

## Advanced Energy and Fuels Management

### GRADUATE SCHOOL, COLLEGES OF AGRICULTURAL SCIENCES, BUSINESS, ENGINEERING, LIBERAL ARTS, AND SCIENCE

#### Advanced Energy and Fuels Management Faculty:

Please see departmental web pages for detailed information on the research activities of individual faculty members. Please see also departmental entries in this catalog.

**Achenbach, Laurie**, *Microbiology*

**Altman, Ira**, *Agribusiness Economics*

**Anderson, Kenneth**, *Geology*

**DeRuntz, Bruce**, *Technology*

**Fraedrich, John**, *Business*

**Haddock, John**, *Microbiology*

**Karau, Steve**, *Business*

**Liang, Yanna**, *Civil Engineering*

**Lightfoot, David**, *Plant, Soil, and Agricultural Systems*

**Mathias, James**, *Mechanical Engineering and Energy Processes*

**Mondal, Kanchan**, *Mechanical Engineering and Energy Processes*

**Odom, Marcus**, *Business*

**Secchi, Silvia**, *Geography and Environmental Resources*

**Talapatra, Saikat**, *Physics*

**Wiltowski, Tomasz**, *Mechanical Engineering and Energy Processes*

The Professional Science Master's (PSM) in Advanced Energy and Fuels Management is a 36-hour post-graduate degree that combines graduate level technical training in energy resources and technology with opportunities for the development of workplace skills. This intensive program is designed to prepare graduates for leadership positions in the energy industry. The program includes nine (9) business-related credit hours, nine (9) science/technology-related credit hours, three (3) credit hours in energy policy studies, nine (9) credit hours of graduate level electives, and a six (6) credit hour capstone internship completed with an industrial partner.

#### Program Description

In the energy sector, increasing global energy demand coupled with a need to reduce the sector's environmental impact are driving unprecedented change. Industry leaders are discovering new ways to create energy from both alternative and traditional resources. At the same time, firms in the energy sector are developing and employing new technologies to reduce the environmental impact of existing energy resources, as well as to improve the manner in which energy and fuels are extracted, refined, generated, stored, and distributed. Rapid growth and change in the energy sector has created a strong demand for personnel in management and leadership roles who are trained in both the technical aspects of the energy industry and who also possess workplace skills. The overarching academic objective of the Professional Science Master's (PSM) in Advanced Energy and Fuels Management is to satisfy this need by providing high quality professional training that ensures graduates have acquired the diverse skill set sought and demanded by industry.

The proposed course of study achieves this objective by providing core technical training in energy resources, energy production technology and energy policy issues coupled with business training in project and personnel management, business leadership skills and fiscal management. In addition to these core requirements, students participating in this program will have the opportunity to take nine (9) credit hours of electives to allow them to gain additional specialized graduate level training related to their own specific interests and career goals.

The PSM program consists of a 36-hour curriculum structured in accord with the PSM model originally developed by the Sloan Foundation. The program is designed to be completed in one academic year (based on full time study), with additional course work to be completed in the preceding summer semester and the capstone internship to be completed in the final summer semester. This intensive program is designed to minimize the time student's need to be away from full-time employment while also maintaining academic rigor.

This program provides the diverse skill set demanded by industry. It includes business, science/technology and policy elements, broken down as follows:

- 9 Business-related credit hours
- 9 Science/technology-related credit hours
- 3 Credit hours of energy policy studies
- 9 Credit hours of electives
- A capstone 6 credit hour internship in industry completed over the summer semester following completion of other requirements

The program is composed of the following courses. All specified courses are required (core) curriculum elements. A list of electives is included, but this list is not all inclusive.

#### Fall Semester (12 hours)

ME 568-3	Alternative Energy and Fuel Resources
ME 446-3	Energy Management
IMAE 450-3	Project Management
BA 510-3	Managerial Accounting & Control Concepts

#### Spring Semester (12 hours)

GEOG 522-3	Environmental and Energy Economics
BA 540-3	Managerial & Organizational Behaviour
Elective (3 hrs)	
Elective (3 hrs)	

#### Summer Session (6 hours)

AEFM 585-6	Internship in Advanced Energy and Fuels Management
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This internship requires the student to complete a specified project for the employer supporting the internship, the nature of which will be approved by PSM faculty in consultation with the employer prior to the initiation of the project. The intern is required to submit both a written and oral project report, to both the employer and PSM faculty.

#### Fall Semester (6 hours)

Elective (3 hrs)	
PHYS 450 (3 hrs)	

### Program Admission and Graduate Requirements

An admission committee, composed of the program director and members of the faculty advisory board, will oversee admission of candidates to the program. Preferred candidates are individuals who hold a baccalaureate degree in natural sciences, physical sciences or engineering. Candidates not holding an appropriate baccalaureate degree may be required to complete necessary prerequisite courses prior to admission to the program. Catalog course descriptions for elective courses indicate the nature of any prerequisites or consent of instructor. Academic exceptions may be granted in specific circumstances for individuals with extensive professional experience or other background that, in the opinion of the admissions committee, qualifies the candidate for admission.

- SIU's graduate school admission requirements are available at: [gradschool.siu.edu/about-us/grad-catalog](http://gradschool.siu.edu/about-us/grad-catalog).
- Graduation requirements are successful completion of all course work and the capstone internship, with an overall GPA  $\geq$  3.0.
- SIU's graduate school graduation requirements are available at: [gradschool.siu.edu/about-us/grad-catalog](http://gradschool.siu.edu/about-us/grad-catalog).

### Core Courses

#### BA 510-3 Managerial Accounting and Control Concepts.

Basic cost concepts, measures, methods and systems of internal accounting useful for managerial planning, implementation, control and performance evaluation. Includes cost analysis relevant for non-routine decision-making. Prerequisite: BA 410 and MBA program "computer ability" foundation requirement met, or equivalent. Restricted to enrollment in College of Business graduate program or consent of department.

**BA 540-3 Managerial and Organization Behavior.** Case analyses of human problems in the business organization. Application of findings of behavioral science research to organization problems. Development of direction and leadership skills. Prerequisite: BA 440 or equivalent. Restricted to enrollment in College of Business graduate program or consent of department.

**IT 450-3 Project Management.** This course is designed to provide students with an overview of the project management process followed by an in-depth examination of the activities needed to successfully initiate, plan, schedule, and control the time and cost factors of the project. Prerequisite: none.

**GEOL 588-3 Global Energy Resources.** Ready access to energy is essential to sustaining modern societies. This course will discuss the nature of the resources that have been, are, or potentially could be used to provide energy in the US and around the globe, including fossil fuels, nuclear energy resources, bioenergy resources and emerging energy resources such as geothermal, wind, tidal, and solar energy.

**ME 446-3 Energy Management.** Fundamentals and various levels of analysis for energy management of commercial buildings and industrial processes and buildings. Use of energy management systems and economic evaluations are required in course projects. Prerequisite: ME 302.

**ME 568-3 Alternative Energy and Fuel Resources.** The course covers the alternatives for energy resources and the impact of the human growth on the energy usage and its environmental consequences. The course describes the fossil fuel era, renewable energy resources, and hydrogen fuel era. The fundamentals of

each of these fuel types, their conversion to usable energy and the potential of each of these fuels for the future is discussed. Prerequisite: ME 300 and 400, or instructor's consent.

### Electives

**ABE 440-3 Natural and Environmental Resource Economics and Policy.** Students will study the application of socioeconomic principles to problems related to natural and environmental resources. The course covers the policy context within which policies related to natural and environmental resources are developed and implemented as well as the range of policy tools available for addressing environmental/natural resource problems. The institutional setting for dealing with natural and environmental resources is presented along with the role of property rights and entitlements. Contemporary resource problems are used as examples. Prerequisite: six hours of agribusiness economics, economics, or geography; graduate status; or consent of instructor.

**ABE 453-3 Agribusiness Planning Techniques.** Application of mathematical programming to agribusiness and farm planning, including enterprise selection, resource allocation, least cost ration formulation, decision making under risk and uncertainty, transportation and location problems. Emphasis placed on modeling problems and interpretation of results. Restricted to: junior standing or consent of instructor.

**BA 503-3 Management of Change.** The methods and processes of planned change are examined. Special emphasis is placed on the design and implementation of continuous improvement systems and related issues of managing constant change. Change models are viewed in the context of international competitiveness and a dynamic global environment. Restricted to enrollment in College of Business graduate program or consent of department.

**BA 530-3 Financial Management.** Provide a broad overview of basic concepts, principles, and recent innovations in financial management. Topics covered will include risk and return, valuation, capital budgeting, capital structure and cost of capital, dividend policy, financial planning, international financial management and corporate restructuring. Prerequisite: BA 510, ECON 240 and 241 or equivalent, FIN 330 with a grade of C or better. Restricted to enrollment in College of Business graduate program or consent of the department. Students who have had FIN 361 or its equivalent or were undergraduate finance majors are not allowed in BA 530 and should take BA 531 instead.

**BA 550-3 Marketing Management.** A managerial approach to the study of marketing. Emphasis is on the nature and scope of the marketing manager's responsibilities and on marketing decision-making. Prerequisite: BA 450 or equivalent. Restricted to enrollment in College of Business graduate program or consent of department.

**ECE 486-3 Clean Electric Energy.** History and Future of the Energy Resources and their use as a component of Electrical Systems. Energy Resources (Fossil, Nuclear, Hydro, Fuel Cell, Wind, Solar, Tidal, Waste, Bio-Energy, Oceanic, Renewable, etc). Environmental and Economical Impacts of Various Energy Sources. Electric Energy Generating Plants. Renewable energy. Prerequisites: Consent of Instructor.

**ERP 502-3 Environmental Decision Making.** (Same as ABE 502) The objective of the course is twofold. The first part of the class will be devoted to case studies of environmental decision

making which use a variety of approaches to environmental policy. Topics to be covered include market-based environmental management versus regulatory approaches, climate change, conservation and floodplain management policy. The second part of the class will focus on the challenges of interdisciplinary communication and collaboration, methodological research issues and the role of integrated modeling. We will consider different issues such as qualitative and quantitative evidence, validation, and the role of values and objectivity in the scientific process.

**GEOL 420-3 Petroleum Geology.** The geological occurrences of petroleum including origin, migration and accumulation; a survey of exploration methods, and production problems and techniques. Laboratory study applies geological knowledge to the search for and production of petroleum and natural gas. Prerequisite: GEOL 221, 224.

**GEOL 421-3 Organic Geochemistry.** The nature, origin and fate of natural and artificial organic materials in rocks and sediments. Topics include characterization of fossil fuels using biological marker compounds, petroleum source rock evaluation, and organic pollutants in the environment. Prerequisite: GEOL 325 or consent of instructor.

**MBMB 421-3 Biotechnology.** (Same as MICR 421) Topics covered will include the genetic basis of the revolution in biotechnology, medical applications including genetic screening and therapeutic agents, industrial biotechnology and fermentation, and agricultural applications. Three hours lecture. Fall semester. Prerequisite: MICR 302, or consent of instructor.

**ME 408-3 Energy Conversion Systems.** Principles of advanced energy conversion systems: nuclear power plants, combined cycles, magnetohydrodynamics, cogeneration (electricity and process steam), and heat pumps. Constraints on design and use of energy conversion systems; energy resources, environmental effects, and economics. Prerequisite: ME 400.

**ME 435-3 Design of Mass Transfer Processes.** Design principles of mass transfer processes. The rate mechanism of molecular, convective and interphase mass diffusion. The design of selected industrial mass transport process operations such as absorption, humidification, water-cooling, drying and distillation. Prerequisite: ME 302.

**ME 539-3 Catalysis in Energy Processes.** This course spans the full range from fundamentals of kinetics and heterogeneous catalysis via modern experimental and theoretical results of model studies to their equivalent large-scale energy processes. Several processes are discussed including hydrogen production, fuel cells, liquid fuel synthesis. Prerequisite: ME 410 or consent of instructor.

**PSAS 433-4 Introduction to Agricultural Biotechnology.** (Same as ANS 433) (Same as CSEM 433) (Same as PLB 433) This course will cover the basic principles of plant and animal biotechnology using current examples; gene mapping in breeding, transgenic approaches to improve crop plants and transgenic approaches to improve animals will be considered. Technology transfer from laboratory to marketplace will be considered. An understanding of gene mapping, cloning, transfer and expression will be derived. Special approval needed from the department.

## Advanced Energy and Fuels Management Courses (AEFM)

**AEFM 580-3 to 6 Readings.** Readings in specialized topics under the direction of an approved graduate faculty member. Graded S/U only.

**AEFM 585-6 Internship.** Significant experiential learning to complement and bolster the in-class learning of technical and managerial tools in order to assist in the transition from scholarship to a professional career. It represents an educational strategy that provides the student an opportunity to apply classroom learning in a real world/practical setting aligned with their specific interests in the field of energy and fuels management with the help of the course instructor and site supervisor. The experience also helps students to gain a clearer sense of what they still need to learn and provides an opportunity to build professional networks. Through direct involvement in projects, evaluation of outcomes and reflection of the work completed are expected of the students such that they can relate academic learning to their future contributions in the field of energy. Prerequisite: 2 semesters in the AEFM PSM program.

**AEFM 601-1 (per semester) Continuing Enrollment.** For those graduate students who have not finished their degree programs and who are in the process of working on and completing their internship reports. The student must have completed a minimum of 30 hours of course work before being eligible to register for this course. Concurrent enrollment in any other course is not permitted. Graded S/U or DEF only.