Resource and Energy - Undergraduate Programs

Overview

Resource and Energy Engineering BS Degree at UT Arlington

The Bachelor of Science in Resource and Energy Engineering degree program aligns with the University mission to prepare students for full, productive lives and informed and active citizenship. The program is designed to prepare individuals to apply mathematical and scientific principles to the design, development and operational evaluation of energy generation, storage, conversion, and distribution systems. This includes instruction in conventional and alternative/ renewable energy systems, electrical power systems, and electrical system design.

Educational and Professional Career Paths

The Resource and Energy Engineering program prepares engineers to provide interdisciplinary systems level economic and environmental analysis of natural and renewable resources, based on engineering, earth and physical science, and economic principles. The program was developed to address the continued growth in the energy industry for both conventional and renewable sources and the need for a much larger, knowledgeable, and well-trained workforce to support and manage the emerging diversity and complexity in the energy industry.

Texas is the largest energy-producing and energy-consuming state in the nation, and UTA’s location near top economic drivers in the energy sectors of the economy make it a natural home for a program for energy engineers. While the field of Energy Engineering is not formally tracked by the U.S. Bureau of Labor Statistics, studies indicate that the shift in the energy landscape has created new opportunities for energy engineers. There is a growing need for engineers to create efficient ways to generate, transport, and store energy. Engineers who graduate with this degree will work for engineering firms, energy companies, governmental agencies, and national laboratories. They will also be prepared for graduate work in energy and related engineering disciplines.

Students will be specially trained to effectively communicate with both engineers and managers, understanding energy from a systems approach, including the use of modeling and visualization, engineering economics, energy regulation and government policy, project management, and more. Resource and Energy Engineering graduates will be prepared for advanced graduate degrees and a wide range of career paths with energy firms in industry, consulting firms, and governmental agencies.

PROGRAM Educational Objectives

The Program Educational Objectives (PEOs) of the Bachelor of Science in Resource and Energy Engineering are to produce graduates who:

- Advance the mission of their organization by significantly contributing to any of the following engineering disciplines or technologies: energy resources, energy conversion, energy distribution, or energy transmission.
- Demonstrate leadership in one or more significant roles since graduation, as evidenced for example by successful entrepreneurship in a start-up, significant promotions and awards in a company or engineering firm.
- Successfully build on the BSREE degree from UTA by: completing a graduate degree; or taking professional course(s); or earning professional certificate(s).

Student Outcomes of the Undergraduate Program

From these Program Educational Objectives, the Bachelor of Science in Resource and Energy Engineering program is designed to offer its graduates the following student learning outcomes:

- an ability to identify, formulate, and solve complex problems by applying principles of engineering, science, and mathematics
- an ability to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- an ability to communicate effectively with a range of audiences
- an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
- an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- an ability to develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions
- an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Accreditation

The Resource and Energy Engineering Program will seek accreditation by the Engineering Accreditation Commission (EAC) of ABET as soon as it is eligible to do so. ABET, www.abet.org, is recognized by the U. S. Department of Education as the sole agency responsible for accreditation of education programs leading to degrees in engineering. The Resource and Energy Engineering program is housed in the Electrical Engineering Department.

Program Features

The pre-professional program reflects a concentration of preliminary science, mathematics, and engineering courses to prepare the student for the professional engineering program. It consists of core courses in physics, chemistry, and geology, mechanical engineering, electric engineering, and industrial engineering. The professional program consists of core courses in probability and modeling; energy sources, conversion, distribution and storage; systems, project management and governance; and communications. The core curriculum provides the needed foundation for a variety of technical areas in energy engineering. Through careful selection of technical electives, the student may specialize in certain fields of energy engineering. Information on these areas is available in the Resource and Energy Engineering Advising Office in the Electrical Engineering Department. In addition, there may be opportunities to participate in ongoing research projects of the faculty in the College of Engineering.

Admission Requirements

Admission as a Resource and Energy Engineering (REE) major is subject to the relevant requirements and policies of the University of Texas at Arlington and of the UTA College of Engineering. For unconditional transfer into the department, a student must have a minimum grade point average of 2.50 in all science, mathematics and engineering courses, a minimum 3-GPA calculation of 2.50 in UTA coursework, and a total of no more than 4 unsuccessful attempts in engineering courses. REE majors are only allowed to enroll in pre-professional courses until they meet the requirements for the professional program as outlined below.

Transfer Credit

When a student transfers, a loss of credit can occur that may require change in academic plans. A course, that appears to be similar, may be different in either content or level of difficulty and, as a result, cannot be used for degree credit. Another course may have no equivalent in a particular degree plan. The UTA Electrical Engineering Department encourages students interested in our programs to make early contact with our advisors so that we can help avoid these problems.

A student must earn a grade of C or better for a course to be transferred. Any course that is offered under the Texas Common Course Numbering system is accepted as equivalent to the corresponding UTA course. It is the responsibility of the student to establish the equivalence of any other course or courses to a course required in a program. The student should be prepared to provide a syllabus or similar documents to establish equivalence. To be acceptable as equivalent, at a minimum, a transferred course must have no less credit value than the corresponding course and contain substantially equivalent course content. To be accepted in transfer, junior and senior level courses must be taken at a college or university with the same accreditation as UTA in the area offering the course. For example, an Electrical Engineering course must come from an ABET accredited Electrical Engineering program.

When a student's record or performance indicates weakness in certain areas of study, they may be required to retake courses or to take additional courses. Before enrolling in a course at another institution to transfer for credit toward a program degree, a student should consult with a program advisor to verify that the course can be used in the student's degree plan and to obtain the necessary written permission.

Undergraduate Advising

Academic advisement is required for every undergraduate student before class enrollment each semester. A new student with fewer than 24 hours of transferable credit, including any student entering directly from high school, is advised in the University Advising Center. After one or more semesters and sufficient progress in the degree program, the student is transitioned by the University Advising Center to the program advisors.

Prior to enrollment, a new student with 24 or more hours of transferable credit must make an appointment with the advisor of the program. The advising appointment should be scheduled as soon as possible after admission, but certainly prior to registration.

Academic advising for continuing students will be done during each semester prior to registration. Personal academic advising is available in the office of the Undergraduate Advisor during the semester by appointment. Students can use the course sequence provided by the Academic Advisor to plan their studies. Recommended electives are listed in the advising office.

Academic Rules, Regulations, and Policies

In addition to the rules, regulations, and policies established here and in the individual program section, each student is subject to the rules, regulations, and policies of the University of Texas at Arlington and of the UTA College of Engineering. Each student should become familiar with these. The rules, regulations, and policies of the University of Texas at Arlington and of the UTA College of Engineering are set forth in other sections of this catalog. It is the responsibility of each student to follow the applicable published rules. Failure to follow these rules may be grounds for dismissal from the program.

Admission to the Professional Program

Requirements for admission to the professional program in Resource and Energy Engineering are in accordance with those of the College of Engineering with the following added stipulations:

- Application to the professional program is to be made to the Undergraduate Advisor during the semester that the advancement requirements are being completed.
- No professional engineering courses may be taken until the student is admitted into the professional program or obtains the written consent of the Undergraduate Advisor.
- Each student must have a total of no more than four unsuccessful attempts in engineering courses and complete all pre-professional courses stipulated under "Requirements for a Bachelor of Science Degree in Resource and Energy Engineering" with a minimum grade of C in each course and a minimum GPA of 2.50 in: a) all courses, b) in all required math, science, and engineering courses, and c) in all required engineering courses.
- Upon receipt of the application, a student's record is individually reviewed including grades, academic and personal integrity, record of drops and course withdrawals, the order in which courses have been taken, the number of times a student has attempted a course for credit, and any other aspect of the student's record that may be deemed pertinent to admission.

Additional Requirements for Graduation

- The student must be admitted to the professional program and have an approved degree plan on file in the Registrar's office in order to graduate.
- Graduating seniors should apply to graduate during the next-to-last semester.
- Each student must complete all professional courses stipulated under "Requirements for a Bachelor of Science Degree in Resource and Energy Engineering" with a minimum grade of C in each course.
- The College of Engineering requires that students who do not have two units of high school foreign language take six hours, in the same language, of modern or classical language courses in addition to the "Requirements for a Bachelor of Science Degree in Resource and Energy Engineering."
- Each student must have a minimum UTA cumulative GPA of 2.0, and a minimum major GPA of 2.0. The major GPA includes all engineering courses in the degree plan.

Grounds for Dismissal from the REE Program

A student whom the UTA Office of Student Conduct has found to have violated the UTA Code of Student Conduct a second time is subject to dismissal from the REE program.

REQUIREMENTS FOR A BACHELOR OF SCIENCE DEGREE IN Resource and Energy ENGINEERING

The program is divided into a pre-professional program and a professional engineering program, with the division essentially occurring between the sophomore and junior years.

General Education		**21**
HIST 1331	TECHNOLOGY AND SCIENCE IN AMERICAN SOCIETY, I [1]	
HIST 1332	TECHNOLOGY AND SCIENCE IN AMERICAN SOCIETY, II [1]	
POLS 2311	GOVERNMENT OF THE UNITED STATES	
POLS 2312	STATE AND LOCAL GOVERNMENT	
Language, Philosophy, and Culture elective: any course which satisfies the University Core Curriculum requirements for Language, Philosophy, and Culture is accepted. [2]		
Creative arts elective: any course which satisfies the University Core Curriculum requirements for Creative Arts is accepted. [2]		
Communication:		
COMS 2302	PROFESSIONAL AND TECHNICAL COMMUNICATION FOR SCIENCE AND ENGINEERING	
Pre Professional Requirements that may also satisfy Core requirements [3]		**22**
ENGL 1301	RHETORIC AND COMPOSITION I	
MATH 1426	CALCULUS I [4]	
MATH 2425	CALCULUS II	
PHYS 1443	GENERAL TECHNICAL PHYSICS I	
PHYS 1444	GENERAL TECHNICAL PHYSICS II	
IE 2308	ECONOMICS FOR ENGINEERS	
Total Hours		**22**

Additional Pre-Professional Program Requirements [3]		
UNIV 1131	STUDENT SUCCESS [5]	1
CHEM 1465	CHEMISTRY FOR ENGINEERS [6]	4
EE 1311	COMPUTING SYSTEM AND ALGORITHMIC SOLUTIONS	3
GEOL 3340	GEOLOGY FOR ENGINEERS	3
MAE 1312	ENGINEERING STATICS	3
MAE 2323	DYNAMICS	3
MATH 2326	CALCULUS III	3
MATH 3319	DIFFERENTIAL EQUATIONS & LINEAR ALGEBRA	3
EE 2440	CIRCUIT ANALYSIS WITH LAB	4
REE 1301	INTRODUCTION TO RESOURCE & ENERGY ENGINEERING	3
REE 1306	THE CHEMISTRY OF FUELS	3
REE 2301	THERMAL ENGINEERING	3
Professional Courses		
EE 3317	LINEAR SYSTEMS	3
IE 3301	ENGINEERING PROBABILITY	3
REE 3301	PRINCIPLES OF ENERGY ENGINEERING	3
REE 3302	SUSTAINABLE ENERGY SYSTEMS	3
REE 3303	PETROLEUM & GAS ENGINEERING	3
REE 3310	DATA ANALYTICS AND VISUALIZATION FOR ENERGY SYSTEMS (DATA ANALYTICS AND VISUALIZATION)	3
REE 4301	ENERGY SYSTEMS MODELING	3
REE 4302	SMART GRID	3
REE 4303	MANAGEMENT OF ENERGY PROJECTS	3
REE 4304	ENERGY STORAGE TECHNOLOGIES	3
REE 4305	ENERGY GOVERNANCE	3
REE 4310	CAPSTONE DESIGN	3
Select three Science or Engineering 3000/4000 Elective courses [2]		9
Total Hours [7]		**124**

1. Can be substituted with HIST 1301 & HIST 1302
2. A list of acceptable courses is available in the REE Advising Office
3. All pre-professional courses must be completed before enrolling in professional program courses
4. The Mathematics Department requires passing a placement test provided by the Mathematics Department before enrolling
5. For transfer students, UNIV 1131 can be substituted with ENGR 1101
6. Chem 1465 can be substituted with Chem 1441 and Chem 1442 (8 hours)
7. Total hours will depend upon prior preparation and academic qualifications. Also, students who do not have two units of high school foreign language will be required to take two courses of foreign language in addition to the previously listed requirements

Suggested Course Sequence

A suggested course sequence for the Pre-Professional and Professional Program courses is available in the REE Advising Office.

Prior Preparation and Course Requirements

The undergraduate baccalaureate degree in resource and energy engineering is a four-year program and requirements for the degree are based upon prior high school preparation through either an honors or college track program. Students who have not had the appropriate prior preparation should contact the departmental advising office for a curriculum guide that will assist them in structuring a study plan that will include leveling courses. Students requiring leveling courses may require a period of time greater than four years to complete their undergraduate degree.

Refer to the College of Engineering section of this catalog for information concerning the following topics: Admission into Engineering, Admission into Pre-Engineering, Admission into the Professional Program, Counseling or Advising, Transfer and Change of Major Policies, Honors Program, Academic Regulations, Professional Engineering Registration, Cooperative Education, Academic Probation, Repeating Course Policy, and Academic Dishonesty.

COURSES

REE 1301. INTRODUCTION TO RESOURCE & ENERGY ENGINEERING. 3 Hours.
Provides a review and discussion of the history of energy usage, the relation between energy usage and quality of life, the societal impact of energy use, and the environmental constraints on energy usage. Emphasis is placed on the role that engineering disciplines play in solving energy problems. The full impact that the various energy alternatives have on economic and environmental issues will be reviewed in order to provide a rational basis for energy choices now and in the future. The course also provides foundational experience using units, 2D and 3D coordinate geometry, vector algebra and scientific problem solving in preparation for higher level courses. Prerequisite: C or better in MATH 1426 (or concurrent enrollment).

REE 1306. THE CHEMISTRY OF FUELS. 3 Hours.
The course deals with formation of natural resources as well as formation of alternative fuels. The chemical composition and physical and chemical properties of the principal fossil hydrocarbons (coal, petroleum, natural gas), and their refining, upgrading, and conversion chemistry will be explored. The chemistry of different types of fuel cells and the use of hydrogen as a fuel will be investigated, including advantages and disadvantages of alternative technologies. The lab component covers fuel production processes and analytical methods for assessing fuel properties. Prerequisite: CHEM 1465.

REE 2301. THERMAL ENGINEERING. 3 Hours.
Basic concepts and definitions, properties of pure substances, work and heat, first law of thermodynamics, second law of thermodynamics, entropy, and introduction to conductive, convective, and radiative transfer. Prerequisite: CHEM 1465 (or concurrent enrollment) or CHEM 1441 and CHEM 1442 (or concurrent enrollment); MATH 2425 (or HONR-SC 2425) and PHYS 1444; or student group.

REE 3301. PRINCIPLES OF ENERGY ENGINEERING. 3 Hours.
Design of energy systems including generation, delivery, conversion and efficiency. Topics include efficiencies of both new and established energy generation and conversion methods; electricity generation by fossil fuels, nuclear, solar, wind and hydropower; and alternative energy technologies. Energy systems are evaluated quantitatively by modeling and by introducing the principles of fluid mechanics, thermodynamics and heat transfer. Prerequisite: REE 2301 or equivalent.

REE 3302. SUSTAINABLE ENERGY SYSTEMS. 3 Hours.
This course presents the production and consumption of energy from a systems perspective. Sustainability is examined by studying global and regional environmental impacts, economics, energy efficiency, consumption patterns and energy policy. First, the physics of energy and energy accounting methods are introduced. Next, the current energy system that encompasses resource extraction, conversion processes and end-uses are covered. Responses to current challenges such as declining fossil fuels and climate change are then explored. Prerequisite: REE 2301 or equivalent.

REE 3303. PETROLEUM & GAS ENGINEERING. 3 Hours.
The course provides the student with a basic knowledge and understanding of the oil and gas engineering and industry, including its history, technical aspects, business model, and impact on society and the environment. The primary emphasis is on operations in exploration, production, transportation, refining, and marketing. At the end of the course, the student should be able to speak in a general way on all aspects of the industry and be familiar with common industry terminology. Prerequisite: GEOL 3340, REE 3301.

REE 3310. DATA ANALYTICS AND VISUALIZATION FOR ENERGY SYSTEMS. 3 Hours.
This course focuses on the applications of data science for energy systems operations and control. Fundamental elements of data storytelling are explored to analyze energy data. These elements include data curation, dataset cleaning and manipulation, and data visualization as a tool for identifying qualities necessary to answer questions. Students will learn to ask questions of data, to draw insights from data and use them to solve problems, and to create and present visualizations that effectively communicate data-driven findings and decisions. Prerequisite: IE 3301 and REE 3301.

REE 4301. ENERGY SYSTEMS MODELING. 3 Hours.
In this course, mathematical methods are introduced for effective modeling, optimization, control, and management of dynamical energy systems. Topics include basics of energy systems engineering, concepts in probability and statistics, spatial statistics (geo-statistics and machine learning), Monte Carlo simulations, global and local sensitivity analyses, surrogate models, and computational alternatives to Monte Carlo simulates. Prerequisite: IE 3301 and EE 3317.

REE 4302. SMART GRID. 3 Hours.
Fundamentals of smart electric power grid including definition, design criteria, and technology. Application of data collection, processing, and communications to the power grid. Seeks to motivate development of the smart grid, evaluating options for adding sensing, communications, computation, intelligence, control, and automation to various parts of the electric system. Topics include automation in existing power systems; generation; transmission; distribution; and smart grid definition. Prerequisite: EE 2440 and REE 2301.

REE 4303. MANAGEMENT OF ENERGY PROJECTS. 3 Hours.
This project course is intended to provide students with an industry-relevant experience. Students will apply their engineering knowledge and skills to solve problems in the production, processing, storage, distribution, and utilization of energy. A faculty member will follow the progress and serve as an advisor to the project. Each project must have a clearly defined problem or need; must show a solution methodology; and must be value-added to the sponsor. Prerequisite: Must be a senior in the REE Professional Program.

REE 4304. ENERGY STORAGE TECHNOLOGIES. 3 Hours.
Explores the various energy storage technologies, their working, and their practical applications. Focuses on the state-of-the-art review of current and most recent technologies. Offers students an opportunity to explore various innovations in the field of energy storage that can be helpful for fulfilling our current energy storage needs. Covers many different energy storage systems such as mechanical, chemical, electrochemical, thermal, and thermochemical. Prerequisite: REE 2301, EE 2440.

REE 4305. ENERGY GOVERNANCE. 3 Hours.
Introduces contemporary energy markets, government policies, and regulations. Explores energy as a strategic resource influenced by economics, market conditions and environmental constraints. Explores the relationship between nonrenewable and renewable energy sources and how different regions adapt and address local needs and concerns. Evaluates the impact of government policies on energy usage and alternative energy development efforts. Prerequisite: IE 2308 and REE 3302.

REE 4310. CAPSTONE DESIGN. 3 Hours.
Students will apply knowledge gained in the program to an application oriented capstone project. Activities will demonstrate technical skills in energy system knowledge, identifying opportunities, analysis for quantifiable savings, engineering economics, report writing, and presentation. Prerequisite: Must be a senior in the REE Professional Program.