

## ENERGY TECHNOLOGY

### Department of Applied Computing and Electronics Associate of Applied Science (A.A.S.) Degree Program

#### Program Description:

The Energy Technology Program introduces students to the full suite of energy systems and technologies—traditional and renewable—and prepares them for careers in the rapidly expanding energy industry. Graduates of the program are general practitioners skilled in design, installation, maintenance, and operation of energy systems; site identification and assessment; structural audits for energy efficiency and conservation; project management; regulatory compliance; and basic economic, environmental and social impact assessments. These specialized skills are built upon a strong education in math, science, communications, computing, and business.

#### Student Outcomes:

Upon completion students will:

- Understand the basics of energy production, delivery, consumption, and waste disposal
- Comprehend traditional, alternative, and sustainable energy production technologies
- Evaluate energy production sites
- Identify factors affecting energy efficiency and conservation
- Assist in the design, installation, maintenance, and management of energy systems
- Assess societal, economic, environmental, ethical, and legal impacts of energy systems
- Identify and practice safe workplace habits
- Develop and practice professional standards of communication and management skills

#### Special Features of Program:

- Broad-based curriculum enables graduates to seek employment in different sectors of the energy industry in Montana as these emerge and grow
- Industry and professional participation in curriculum building, internship sites, and practicum sites provides students with early and frequent contact with potential employers
- Graduates trained as mid-level project and personnel managers as well as general practitioners able to practice and work in a wide variety of positions in the energy sector

#### Related Job Titles:

- Energy efficiency auditors
- Field energy analysts
- Project technicians
- Energy technicians
- Project managers
- Equipment suppliers
- Environmental assessment technicians
- Renewable energy site assessment technicians
- Construction workers
- Grid and pipeline operators/technicians
- Wind technicians
- Solar photovoltaic and solar thermal installers
- Biofuel-plant operators/technicians
- Geothermal technicians

#### Program Delivery:

- This is an online program. Campus residency is currently required for completion of EET 112 Basic Electronics Lab and NRG 191 Practicum. These courses are delivered using an intensive hybrid delivery to provide program accessibility for distance students. This curriculum requirement provides students with 5 credits (approximately 150 hours) of lab-based training.
- For those students preferring the classroom, the majority of courses are offered in a traditional classroom setting. The list below identifies those courses which are only offered online.
  - CAR 235 Building Energy Conservation - 3 cr.
  - CRT 209T Project Management - 3 cr.
  - NRG 213 Power Systems Technology - 3 cr.
  - NRG 295 Energy Storage and Distribution Systems - 3 cr.
  - and Energy-Related Directed Electives (15 cr.)

### Partnerships:

Curriculum articulations are in place with other institutions in the Montana University Systems. All students are required to complete 51% of their courses through the University of Montana, Missoula. The program is interested in partnering with students and other institutions in creating articulations for the delivery of this program. Currently articulated partnerships exist with:

- Flathead Valley Community College - Kalispell
- Miles Community College – Miles City

### Program Curriculum Sequence\*:

Course	First Year	Autumn	Spring	Summer
BUS 160S	Issues in Sustainability	3	-	
CAR 235	Building Energy Conservation	-	3	
CRT 172	Introduction to Computer Modeling	3	-	
EET 111	Basic Electronics	-	4	
EET 112	Basic Electronics Lab	-	3	
M 121	College Algebra	-	3	
NRG 101	Introduction to Energy Systems I	3	-	
NRG 102	Introduction to Energy Systems II	-	3	
SCN 175N	Integrated Physical Sciences	3	-	
WRIT 101	College Writing I	3	-	
<b>Total</b>		<b>15</b>	<b>16</b>	
	<b>Summer</b>			
NRG 191	Energy Practicum (60 hours)			2
Course	Second Year	Autumn	Spring	
BUS 103S	Principles of Business	-	3	
CRT 209T	Project Management	3	-	
EVST 101	Environmental Science	3		
M 122	College Trigonometry	3	-	
NRG 213	Power Systems Technology	3		
NRG 290	Energy Internship	-	2	
NRG 295	Energy Storage and Distribution Systems	-	3	
	Select 5 Energy Electives** (See list below)	6	9	
<b>Total</b>		<b>18</b>	<b>17</b>	

\*This curriculum is subject to change depending on course availability.

Energy Elective Requirement: Students must select a total of 5 energy-related electives or 4 energy-related electives and 1 general elective.

#### Energy-Related Electives

GEO 191 Special Topics: Fossil Fuels  
NRG 241 Alternative Fuels  
NRG 242 Solar and Wind Energy Systems  
NRG 295 Special Topics: Fuel Cells  
NRG 295 Special Topics: Bioenergy  
NRG 295 Special Topics: Fundamentals of Photovoltaic Design and Installation  
NRG 295 Special Topics: Introduction to Geothermal Energy Systems

#### General Electives

BUS 135T Business Law  
BUS250T Entrepreneurship  
CAR236T Building for Solar Energy  
CAR240T Alternative Construction Materials  
COM 150S Interpersonal Communications  
COM 160A Oral Communications  
CRT111 Fluency in Information Technology  
CRT 182 Computer Aided Design and Drafting  
EET234T Automatic Controls  
EET241T Instrumentation  
NRG 295 Special Topics: Energy Choices and Sustainability  
PSYX 162 Organizational Psychology  
SCN120T Technical Physics I \*  
SCN121T Technical Physics II \*

\*completion of both can be considered in lieu of SCN175N

## COURSE DESCRIPTIONS:

**BUS 103S Principles of Business 3 cr.** Introduction to the world of business. Examines capitalism, the economic environment, the types of business organizations, management, marketing, production, labor, financing, and business/government relations. Credit not allowed for both BUS 103S and BADM 100S.

**BUS 160S Issues in Sustainability 3 cr.** This literature-intensive course is intended to expose the student to a variety of essays addressing the balance of economic development with the principles of sustainability and social equity. The student is offered an introduction to sustainability concepts, natural systems/cycles and environmental economics. Natural capitalism and triple bottom line maximization is explored, along with the role of corporations and small businesses in sustainable development. A survey of issues surrounding corporate social responsibility and sustainability-driven innovation will be conducted.

**CAR 235T Building Energy Conservation 3 cr.** Study of the analysis techniques used for reduction of energy consumption and energy management, including energy accounting and energy auditing. Residential and commercial building energy efficiency opportunities will be covered. Other topics addressed include motors, pumps, green building, and purchasing energy supplies. Career opportunities in energy efficiency will be discussed.

**CRT 172 Introduction to Computer Modeling 3 cr.** Offered autumn and spring. Prerequisite MAT 100 or demonstrated computing experience. Problem solving and data modeling using computer productivity software. Emphasis using spreadsheets and databases for data analysis. Formal presentation of results. Credit not allowed for both CRT 172 and CS 172.

**CRT 209T Project Management 3 cr.** Offered fall. Prerequisite CRT 172. Investigation of topics in project management including scope, definition, risk, procurement and the RFP. Management of time, cost, quality, and human resources. Concepts are reinforced with PM software.

**EET 111 Basic Electronics 4 cr.** Introduction to the concepts of electricity, current flow, direct current (DC) and alternating current (AC) electrical circuits. The course covers passive components; scientific notation and metric conversions; voltage, current, and resistance units of electrical measurement; Ohm's Law; analysis of series, parallel, and series-parallel circuits; the use of electrical circuit theorems; electromagnetism; capacitance; inductance; transformers; and motors.

**EET112 Electronics Lab I 3 cr.** Coreq., EET 111. The use of basic electronic test instruments and troubleshooting. Building circuits using resistive, capacitive and inductive components.

**EVST 101N Environmental Science 3 cr.** Offered autumn. An introduction to the scientific principles that underpin environmental science and discussion of how these shape national and local environmental laws and policies. Features local approaches to solving environmental problems.

**GEO 191 Special Topics: Introduction to Fossil Fuels 3 cr.** Offered autumn. A broad introduction to the basic principles and concepts related to the composition of, the exploration for, and the utilization of fossil fuels (coal, coal bed methane, natural gas, and oil). In addition, environmental issues related to fossil fuel development and utilization will be addressed.

**M 121 College Algebra 3 cr.** Offered autumn and spring. Prereq., M 095 (MATH 100D) or appropriate placement score. Intended to strengthen algebra skills. The study of functions and their inverses: polynomial, rational, exponential, and logarithmic functions.

**M 122 College Trigonometry 3 cr.** Offered autumn and spring. Prereq., M 121 (MATH 111) or appropriate placement score. Preparation for calculus based on college algebra. Review of functions and their inverses, exponential and logarithmic functions. Trigonometric functions and identities, polar coordinates and an optional topic such as conic sections or parametric functions.

**NRG 101 Introduction to Energy Systems I 3 cr.** Autumn only. A survey of traditional energy systems and technologies. Introduces conventional primary energy sources--coal, oil, gas, nuclear--and examines the technologies used to capture, convert, distribute, store, and utilize these energy sources. Consideration is given to physical and engineering aspects, as well as economic, social environmental, and political factors that determine the sustainability of these sources.

**NRG 102 Introduction to Energy Systems II 3 cr.** Prereq., NRG 101 or consent of instructor. Spring only. Same as CCS 102. A survey of renewable energy systems and technologies. Addresses physical and technical aspects of wind, solar, geothermal, hydro, tidal, biological, and wave energy systems. Consideration is given to engineering, economic,

social, environmental, and political factors that determine implementation and sustainability. Credit not allowed for both NRG 102 and CCS 102.

**NRG 191 Practicum 2 cr.** Offered summer only. Prereq., consent of instructor. Same as CCS 191. The practicum provides students with a supervised field experience. Students will gain hands-on experience with energy specific technologies. This opportunity increases students' occupational awareness and professionalism.

**NRG 213 Power Systems Technology 3 cr.** Autumn only. A review of the principles of electricity, magnetism, and transformer action; the application of these principles in the operation of single-phase and three-phase ac/dc motors, alternators, and generators; and the control methods for these electrical devices.

**NRG 241 Alternative Fuels 3 cr.** Autumn only. Identifies alternative fuel sources; explores fuel characteristics; identifies and evaluates the infrastructure required to produce, store, distribute, and use them; discusses emission and conversion efficiencies; assesses social, environmental, and economic impacts.

**NRG 242 Solar and Wind Systems 3 cr.** Spring only. Same as CCS 242. Introduction to the fundamentals of solar and wind energy for the design and installation of solar and wind systems. Includes an overview of the physics and chemistry of the resource and the technology, and will prepare students for a career in renewable energy or for installing a renewable energy system on their own home. Credit not given for NRG 242 and CCS 242.

**NRG 290 Internship 2 cr.** Offered spring. Consent of instructor required. Same as CCS 290. Students complete a field experience at an energy-related site or in an energy-related industry. A series of career development seminars and activities related to the field experience are completed in parallel.

**NRG 295 Special Topics: Bioenergy 3 cr.** Offered autumn. Solar energy is stored within plants and can be captured and used to fuel mankind's industrial machines. As biomass is ubiquitous and renewable, it has tremendous potential to help supply the world's energy needs. This class broadly exams the issues surrounding biorenewable resources and the technologies currently being utilized to tap into this vast resource.

**NRG 295 Special Topics: Energy Storage and Distribution Systems 3 cr.** Offered spring. Examines methods of storage, transportation, and transfer for different types of traditional and renewable energy. Explores emergent technologies and mechanisms designed to enhance efficiency; provides tools for assessing the relative social, economic, and environmental merits of each type of energy system in terms of its storage and distribution. Emphasis on the electrical grid system

**NRG 295 Special Topics: Fuel Cells 3 cr.** Offered spring. An introduction to the different types of fuel cells (hydrogen, biological, metal/air, proton exchange membrane, etc.) accompanied by a critical examination of their applications, operation, efficiencies, advantages and disadvantages.

**NRG 295 Introduction to Geothermal Energy Systems 3 cr.** An introduction to the physical and technical aspects of geothermal energy systems. Topics covered include the fundamental principles of geology and hydrology, heat flow mechanisms, and a consideration of heat exchange systems including: dry steam, flash, binary systems, heat pumps, passive systems. The course also surveys political, economic, ecological, and social aspects of geothermal energy development. Prereqs. M095; SCN175 or NRG101, or consent of instructor.

**NRG 295 Fundamentals of Photovoltaic Design and Installation 3 cr.** An introduction to the fundamental principles and technologies of solar photovoltaic energy systems. Emphasis on system design and installation, including site and resource assessment, load analysis, trouble shooting, and cost analysis. The material covered prepares students for a career in renewable energy or for installing a renewable energy system on their own home. Prereq./coreq. EET 112 Basic Electronics Lab

**NRG 295 Special Topics: Energy Choices and Sustainability 3 cr.** Elective. Offered spring. Explores, within a cultural context, the issues of energy supply, sustainability, security, economic development, transition, and environmental protection, as they relate to traditional, alternative, and emerging energy technologies.

**SCN 175N Introduction to Physical Science 3 cr.** Offered every term. Prereq., or coreq., M 090 (MAT005D) (M095 (MATH 100) suggested). An introduction to the basic principles of physics, chemistry, environmental and earth sciences with emphasis on the scientific method and process. (Suitable for students with little science background).

**WRIT 101 College Writing I 3 cr.** Offered every term. Prereq., WRIT 095 or passing score on placement test. Instruction and practice in both the expository writing and research process. Emphasis on the use of specific techniques of writing to develop style, unity, clarity, and force of ideas, and structure. Students are expected to write without major errors in sentence structure or mechanics. Grading A-F, or NC.