ENERGY SCIENCE MINOR

Description

Website: http://energysciences.unl.edu

The energy science minor is designed to offer an educational component to University of Nebraska students that will prepare them with the knowledge, expertise, and background to successfully compete for positions with companies that are producing or developing renewable energy sources or conventional fossil fuels sources or with organizations that manage energy use or the environmental impacts of energy use. The minor is for students who desire a broad understanding of energy-related issues and an in-depth knowledge of energy in one or more of four elective thematic areas as well as for those seeking employment in agriculture, business/industry, communication, transportation, and government.

Courses of Instruction (ENSC)

Courses suitable for automatic inclusion in one of the four elective thematic areas have been identified and can be viewed at the website https://engineering.unl.edu/energy-science-thematic-tracks/. Any of the ENSC courses can be taken independently as desired by any student.

A student in consultation with an academic advisor will submit a "College-Degree-Major-Advisor Change Form" (CDMA) declaring their intent to complete the minor before the deadline for submitting the application for graduation. The degree audit system of the University Registrar will evaluate whether the appropriate courses have been taken for the completion of the minor. The minor will be recorded on the student's transcript upon graduation.

College Requirements

College Admission

Requirements for admission into the College of Agricultural Sciences and Natural Resources (CASNR) are consistent with general University admission requirements (one unit equals one high school year): 4 units of English, 4 units of mathematics, 3 units of natural sciences, 3 units of social sciences, and 2 units of world language. Students must also meet performance requirements: a 3.0 cumulative high school grade point average OR an ACT composite of 20 or higher, writing portion not required OR a score of 1040 or higher on the SAT Critical Reading and Math sections OR rank in the top one-half of graduating class; transfer students must have a 2.0 (on a 4.0 scale) cumulative grade point average and 2.0 on the most recent term of attendance.

Admission Deficiencies/Removal of Deficiencies

Students who are admitted to CASNR with core course deficiencies must remove these deficiencies within the first 30 credit hours at the University of Nebraska–Lincoln, or within the first calendar year at Nebraska, whichever takes longer, excluding foreign languages. Students have up to 60 credit hours to remove world language deficiencies. College-level coursework taken to remove deficiencies may be used to meet degree requirements in CASNR.

Deficiencies in the required entrance subjects can be removed by the completion of specified courses in the University or by correspondence.

The Office of Admissions, Alexander Building (south entrance), City Campus, provides information to new students on how deficiencies can be removed.

College Degree Requirements

Curriculum Requirements

The curriculum requirements of the College consist of three areas: ACE (Achievement-Centered Education), College of Agricultural Sciences and Natural Resources Core, and Degree Program requirements and electives. All three areas of the College Curriculum Requirements are incorporated within the description of the Major/Degree Program sections of the catalog. The individual major/degree program listings of classes ensures that a student will meet the minimum curriculum requirements of the College.

World Languages/Language Requirement

Two units of a world language are required. This requirement is usually met with two years of high school language.

Experiential Learning

All undergraduates in the College of Agricultural Sciences and Natural Resources must take an Experiential Learning (EL) designated course. This may include 0-credit courses designed to document co-curricular activities recognized as Experiential Learning.

Minimum Hours Required for Graduation

The College grants the bachelors degree in programs associated with agricultural sciences, natural resources, and related programs. Students working toward a degree must earn at least 120 semester hours of credit. A minimum cumulative grade point average of C (2.0 on a 4.0 scale) must be maintained throughout the course of studies and is required for graduation. Some degree programs have a higher cumulative grade point average required for graduation. Please check the degree program on its graduation cumulative grade point average.

Grade Rules

Removal of C-, D, and F Grades

Only the most recent letter grade received in a given course will be used in computing a student's cumulative grade point average if the student has completed the course more than once and previously received a grade or grades below C in that course.

The previous grade (or grades) will not be used in the computation of the cumulative grade point average, but it will remain a part of the academic record and will appear on any transcript.

A student can remove from his/her cumulative average a course grade of C-, D+, D, D-, or F if the student repeats the same course at the University of Nebraska and receives a grade other than P (pass), I (incomplete), N (no pass), W (withdrew), or NR (no report). If a course is no longer being offered, it is not eligible for the revised grade point average computation process.

For complete procedures and regulations, see the Office of the University Registrar website at http://www.unl.edu/regrec/course-repeats (http://www.unl.edu/regrec/course-repeats/).

Pass/No Pass

Students in CASNR may take any course offered on a Pass/No Pass basis within the 24-hour limitation established by the Faculty Senate. However, a department may specify that the Pass/No Pass status of its courses be limited to non-majors or may choose to offer some courses for letter grades only.

GPA Requirements

A minimum cumulative grade point average of C (2.0 on a 4.0 scale) must be maintained throughout the course of studies and is required for graduation. Some degree programs have a higher cumulative grade point average required for graduation. Please check the degree program on its graduation cumulative grade point average.

Transfer Credit Rules

To be considered for admission a transfer student, Nebraska resident or nonresident, must have an accumulated average of C (2.0 on a 4.0 scale) and a minimum C average in the last semester of attendance at another college. Transfer students who have completed less than 12 credit hours of college study must submit either ACT or SAT scores.

Ordinarily, credits earned at an accredited college are accepted by the University. The College, however, will evaluate all hours submitted on an application for transfer and reserves the right to accept or reject any of them. Sixty (60) is the maximum number of hours the University will accept on transfer from a two-year college. Ninety (90) is the maximum number of hours the University will accept from a four-year college. Transfer credit in the degree program must be approved by the degree program advisor on a Request for Substitution Form to meet specific course requirements, group requirements, or course level requirements in the major. At least 9 hours in the major field, including the capstone course, must be completed at the University of Nebraska–Lincoln regardless of the number of hours transferred.

The College will accept no more than 10 semester hours of C-, D+, D, and D- grades from other schools. The C-, D+, D, and D- grades can only be applied to free electives. This policy does not apply to the transfer of grades from UNO or UNK to the University of Nebraska–Lincoln.

Joint Academic Transfer Programs

The College of Agricultural Sciences and Natural Resources has agreements with many institutions to support joint academic programs. The transfer programs include dual degree programs and cooperative degree programs. Dual degree programs offer students the opportunity to receive a degree from a participating institution and also to complete the requirements for a bachelor of science degree in CASNR. Cooperative programs result in a single degree from either the University of Nebraska–Lincoln or the cooperating institution.

Dual Degree Programs

A to B Programs

The A to B Program, a joint academic program offered by the CASNR and participating community colleges, allows students to complete the first two years of a degree program at the participating community college and continue their education and study in a degree program leading toward a bachelor of science degree.

The A to B Program provides a basic knowledge plus specialized coursework. Students transfer into CASNR with junior standing.

Depending on the community college, students enrolled in the A to B Program may complete the requirements for an associate of science at the community college, transfer to the University of Nebraska–Lincoln, and work toward a bachelor of science degree.

Participating community colleges include:

- Central Community College
- Metropolitan Community College
- Mid-Plains Community College
- Nebraska College of Technical Agriculture
- Nebraska Indian Community College
- Northeast Community College
- Southeast Community College
- Western Nebraska Community College

3+2 Programs

Two specialized degree programs in **animal science** and **veterinary science** are offered jointly with an accredited college or school of veterinary medicine. These two programs permit CASNR animal science or veterinary science students to receive a bachelor of science degree from the University of Nebraska–Lincoln with a degree in animal science or veterinary science after successfully completing two years of the professional curriculum in veterinary medicine at an accredited veterinary school. Students who successfully complete the 3+2 Program, must provide transcripts and complete the Application for Degree form via MyRED. Students without MyRED access may apply for graduation in person at Husker Hub in the Canfield Administration Building, or by mail. Students should discuss these degree programs with their academic advisor.

Cooperative Degree Programs

Academic credit from the University and a cooperating institution are applied towards a four-year degree from either the University of Nebraska–Lincoln (University degree-granting program) or the cooperating institution (non-University degree-granting program). All have approved programs of study.

UNL Degree-Granting Programs

A University of Nebraska–Lincoln degree-granting program is designed to provide students the opportunity to complete a two-year program of study at one of the four-year institutions listed below, transfer to CASNR, and complete the requirements for a bachelor of science degree.

Chadron State College. Chadron State College offers a 2+2 program leading to a grassland ecology and management degree program and a transfer program leading to a bachelor of science in agricultural education in the teaching option.

Wayne State College. Wayne State College offers a 3+1 program leading to a bachelor of science in plant biology in the ecology and management option and a 3+1 program leading to a bachelor of science in Applied Science.

University of Nebraska at Kearney. Transfer programs are available for students pursuing degree programs leading to a bachelor of science degree.

University of Nebraska at Omaha. Transfer programs are available for students pursuing degree programs leading to a bachelor of science degree.

Non University of Nebraska–Lincoln Degree-Granting Programs

CASNR cooperates with other institutions to provide coursework that is applied towards a degree at the cooperating institution. Pre-professional programs offered by CASNR allow students to complete the first two or three years of a degree program at the University prior to transferring and completing a degree at the cooperating institution.

Chadron State College–Range Science. The 3+1 Program in range science allows Chadron State College students to pursue a range science degree through Chadron State College. Students complete three years of

coursework at Chadron State College and one year of specialized range science coursework (32 credit hours) at CASNR.

Dordt College (Iowa)–Agricultural Education: Teaching Option. This program allows students to pursue an Agricultural Education Teaching Option degree leading toward a bachelor of science in agricultural education. Students at Dordt College will complete 90 credit hours in the Agricultural Education: Teaching Option Transfer Program.

Residency

Students must complete at least 30 of the total hours for their degree using University of Nebraska–Lincoln credits. At least 18 of the 30 credit hours must be in courses offered through CASNR[1] (>299) including the appropriate ACE 10 degree requirement or an approved ACE 10 substitution offered through another Nebraska college and excluding independent study regardless of the number of hours transferred. Credit earned during education abroad may be used toward the residency requirement if students register through the University of Nebraska–Lincoln and participate in prior-approved education abroad programs. The University of Nebraska–Lincoln open enrollment and summer independent study courses count toward residence.

[1] *Includes courses taught by CASNR faculty through interdisciplinary prefixes (e.g., LIFE, MBIO, ENVR, SCIL, EAEP, HRTM, ENSC) and CASNR crosslisted courses taught by non-CASNR faculty.*

Online and Distance Education

There are many opportunities to earn college credit online through the University of Nebraska–Lincoln. Some of these credits may be applicable not only as elective credits but also toward the fulfillment of the College's education requirements. Credits earned online may count toward residency. However, certain offerings may not be counted toward scholarship requirements or academic recognition criteria.

For further information, contact:

Office of Online and Distance Education
University of Nebraska–Lincoln
305 Brace Labs
Lincoln, NE 68588-0109
402-472-4681
http://online.unl.edu/

Independent Study Rules

Students wishing to take part in independent studies must obtain permission; complete and sign a contract form; and furnish copies of the contract to the instructor, advisor, departmental office, and the Dean's Office. The contract should be completed before registration. Forms are available in 103 Agricultural Hall or online at the CASNR website.

Independent study projects include research, literature review or extension of coursework under the supervision and evaluation of a departmental faculty member.

Students may only count 12 hours of independent study toward their degrees and no more than 6 hours can be counted during their last 36 hours earned, excluding senior thesis, internships, and courses taught under an independent study number.

Other College Degree Requirements

Capstone Course Requirement

A capstone course is required for each CASNR degree program. A capstone course is defined as a course in which students are required to integrate diverse bodies of knowledge to solve a problem or formulate a policy of societal importance.

ACE Requirements

All students must fulfill the Achievement Centered Education (ACE) requirements. Information about the ACE program may be viewed at ace.unl.edu (https://ace.unl.edu/).

The minimum requirements of CASNR reflect the common core of courses that apply to students pursuing degrees in the college. Students should work with an advisor to satisfy ACE outcomes 1, 2, 3, 4, 6, and 10 with the college requirements.

Catalog Rule

Students must fulfill the requirements stated in the catalog for the academic year in which they are first admitted to the University of Nebraska–Lincoln or when they were first admitted to a Joint Academic Transfer Program. Students transferring from a community college, but without admission to a Joint Academic Transfer Program, may be eligible to fulfill the requirements as stated in the catalog for an academic year in which they were enrolled at the community college prior to attending the University of Nebraska-Lincoln. This decision should be made in consultation with academic advisors, provided the student a) was enrolled in a community college during the catalog year they are utilizing, b) maintained continuous enrollment at the previous institution for 1 academic year or more, and c) continued enrollment at the University of Nebraska-Lincoln within 1 calendar year from their last term at the previous institution. In consultation with advisors, a student may choose to follow a subsequent catalog for any academic year in which they are admitted to and enrolled as a degree-seeking student at the University of Nebraska–Lincoln in the College of Agricultural Sciences and Natural Resources. Students must complete all degree requirements from a single catalog year. The catalog which a student follows for degree requirements may not be more than 10 years old at the time of graduation.

Requirements for Minor Offered by Department

A minor in energy science (ENSC) will include a minimum of 18 credit hours of energy-related courses including four core courses.

Core Courses		
ENSC 110	Energy in Perspective	3
ENSC 220	Introduction to Energy Systems	3
ENSC 230	Energy and the Environment: Economics and Policy	3
ENSC 300	Energy Science Seminar	1
Credit Hours Subtotal:		10
Total Credit Hours		**10**

The remaining 8 hours of energy-related courses must come from one or more of the following four elective thematic tracks or be approved by the student's academic advisor and the minor coordinator.

Energy and Natural Resources

PLAS 475 / NRES 475 / AGST 475 / CIVE 475 / CRPL 475 / GEOL 475 / NRES 475 / POLS 475 / SOIL 475 / WATS 475	Water Quality Strategy	3
CIVE 422 / BSEN 422	Pollution Prevention: Principles and Practices	3
GEOG 155	Elements of Physical Geography	4
GEOL 100	Introduction to Geology	3
GEOL 101	Dynamic Earth	4
GEOL 109	Oceanography	3
GEOL 125	Frontiers in Antarctic Geosciences	3
GEOL 421	Carbonate Petrology	3
GEOL 424 / BIOS 424	Biogeochemical Cycles	3
GEOL 457 / BIOS 457	Ecosystem Ecology	4
GEOL 485	Fossil Fuel Geology and Exploration	3
METR 100	Weather and Climate	4
METR 140	Severe and Unusual Weather	3
METR 180	Climate Change, Energy, and the Environment	3
NRES 220	Principles of Ecology	3
NRES 424	Forest Ecology	3
NRES 467 / METR 483	Global Climate Change	3

Plant and Animal Bioenergy

ASCI 320	Animal Nutrition and Feeding	3
ASCI 485	Animal Systems Analysis	3
ASTR 113	Selected Topics in Astronomy	3
ASTR 117	Life in the Universe	3
BIOC 401	Elements of Biochemistry	3
BIOS 425	Plant Biotechnology	3
FDST 131 / CHEM 131 / NUTR 131	The Science of Food	3
FDST 363 / AGST 363	Heat and Mass Transfer	3
AGST 364	Agricultural Products Processing and Handling	3
NRES 220	Principles of Ecology	3
PLAS 204	Resource-Efficient Crop Management	3
PLAS 269 / SOIL 269	Principles of Soil Management	3
PLAS 366 / SOIL 366	Soil Nutrient Relationships	4
PLAS 405	Crop Management Strategies	3
PLAS 435 / NRES 435	Agroecology	3
PLAS 439	Organic Farming and Food Systems	3
PLAS 440 / GRAS 440 / NRES 440 / RNGE 440	Great Plains Ecosystem	3
PLAS 452 / AGST 452 / WATS 452	Irrigation Systems Management	3

Energy Engineering

AREN 412	Building Energy II: Primary and Secondary Systems	3
AREN 420	Lighting II: Theory, Design and Application	3
AREN 425	Lighting Design	4
BSEN 244	Thermodynamics of Living Systems	3
BSEN 303 / AGEN 303	Principles of Process Engineering	3
BSEN 325 / AGEN 325	Power Systems Design	3
BSEN 344 / AGEN 344	Biological and Environmental Transport Processes	3
BSEN 444	Biomass and Bioenergy Engineering	3
CHME 202	Mass and Energy Balances	3
CHME 223	Chemical Engineering Thermodynamics I	3
CHME 323	Chemical Engineering Thermodynamics and Kinetics	3
CHME 331	Equilibrium Stage Operations	3
CHME 332	Transport Operations I	3
CHME 333	Transport Operations II	3
CHME 442	Chemical Reactor Engineering and Design	3
CHME 486	Electrochemical Engineering	3
CIVE 419	Flow Systems Design	3
CIVE 422 / BSEN 422	Pollution Prevention: Principles and Practices	3
CNST 306	Electrical Systems	3
ECEN 304	Signals and Systems I	3
ECEN 306	Electromagnetic Field Theory	3
ECEN 316	Electronics and Circuits III	3
ECEN 338	Introduction to Power and Energy Systems	3
ECEN 406	Power Systems Analysis	3
ECEN 407	Power Systems Planning	3
ECEN 428	Power Electronics	3
ECEN 430	Wind Energy	3
ECEN 454	Power Systems Operation and Control	3
ECEN 498	Special Topics in Electrical Engineering IV (Electric Machines)	1-6
ECEN 498	Special Topics in Electrical Engineering IV (Electric Vehicle)	1-6
ECEN 498	Special Topics in Electrical Engineering IV (Renewable Energy Systems)	1-6
ECEN 498	Special Topics in Electrical Engineering IV (Solar Energy)	1-6

ECEN 498	Special Topics in Electrical Engineering IV (Wind Energy)	1-6
ENGR 300	Principles of Nuclear Engineering	1
ENGR 302	Introduction to Nuclear and Radiation Engineering Concepts	1
ENGR 310	Utilization of Nuclear Technologies in Society	3
ENGR 402	Energy Systems and Resources	3
ENGR 411	Nuclear Reactor Theory	3
ENGR 412	Nuclear Reactor Analysis	3
ENGR 420	Nuclear Reactor Engineering	3
MECH 200	Engineering Thermodynamics	3
MECH 300	Thermal Systems and Design	3
MECH 403	Internal Combustion Engines	3
MECH 404	Theory of Combustion	3
MECH 406	Air Conditioning Systems Design	3
MECH 407	Power Plant Systems Design	3
MECH 408	Heat Exchanger Design	3
MECH 420	Heat Transfer	3
MECH 425	Solar Energy Engineering	3
AGST 245	Fundamentals of Electrical Systems	3

Energy Economics, Policy, and Human Dimensions

AECN 265 / NREE 265	Resource and Environmental Economics I	3
AECN 357 / NREE 357	Natural Resource and Environmental Law	3
AECN 396	Independent Study in Agricultural Economics (Energy Law)	1-5
AECN 445 / NREE 445	Agricultural and Natural Resource Policy Analysis	3
AECN 456 / NREE 456	Environmental Law	3
AECN 465 / NREE 465 / WATS 465	Resource and Environmental Economics II	3
ANTH 430 / NUTR 430	Nutritional Anthropology	3
ANTH 473	Ecological Anthropology	3
ENVR 249 / NRES 249	Individual and Cultural Perspectives on the Environment	3
HIST 469	Global Environmental History	3
JOMC 444 / ALEC 444	Science Writing	3
METR 450 / NRES 452 / GEOG 450 / PLAS 450	Climate and Society	3
NRES 323	Natural Resources Policy	3
PHIL 225	Environmental Ethics	3
SOCI 346	Environmental Sociology	3

Additionally, optional courses for elective credit include:

ENSC 311	Energy Science Study Tour	1
ENSC 496	Independent Study in Energy Science	1-3
ENSC 499H	Honors Thesis	3-6

At least 6 credit hours must be at the 300 or 400 level and up to 3 hours of energy-related independent study coursework or Honors thesis may be included (ENSC 311, ENSC 496, and ENSC 499H).

ENSC 110 Energy in Perspective
Description: Scientific principles and historical interpretation to place energy use in the context of pressing societal, environmental and climate issues.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: ENSC 311; ENSC 395; SCIL 300
ACE: ACE 9 Global/Diversity

ENSC 220 Introduction to Energy Systems
Description: Overview of energy stystems, sources, transformations, efficiency, and storage. Fossil fuels, biomass, wind, solar, nuclear, and hydrogen. Sustainability and environmental trade-offs of different energy systems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: ENSC 311; SCIL 300

ENSC 230 Energy and the Environment: Economics and Policy
Description: Introduction to the economics of energy. How the economic system determines production and consumption. The linkages between economic and environmental outcomes. How future energy use can be influenced by economic, environmental, trade, and research policy.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Prerequisite for: ENSC 311; SCIL 300

ENSC 300 Energy Science Seminar
Description: Overview and evaluation of existing energy problems and solutions, covering technological, environmental, economic, business, and political issues.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option

ENSC 311 Energy Science Study Tour
Prerequisites: ENSC 110, ENSC 220, and ENSC 230
Description: Identification of energy related enterprises that represent the breath of the industry and prioritizing these as candidates for inclusion in the tour.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option

ENSC 395 Internship in Energy Science
Prerequisites: Sophomore standing; ENSC 110; and permission.
Description: Structured practical experience under the supervision of an energy science professional.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 5
Grading Option: Graded with Option

ENSC 496 Independent Study in Energy Science
Prerequisites: Sophomore standing and permission.
Description: Individual or group project in research, literature review, or extension of course work.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 6
Grading Option: Graded with Option

ENSC 499H Honors Thesis
Prerequisites: Good standing in the University Honors Program and permission. AGRI 299H recommended.
Notes: Requires conducting a scholarly research project and writing a University Honors Program or undergraduate thesis. Letter Grade Only
Credit Hours: 3-6
Min credits per semester: 3
Max credits per semester: 6
Max credits per degree: 6
Grading Option: Graded