Environmental and Energy Resources Management, B.S.

Degree Offered
- Bachelor of Science

Nature of the Program
The objective of this major is to examine the interdisciplinary relationships involved in the business of energy production and utilization along with associated environmental management, regulatory and policy issues. This major will provide a strong foundation for students interested in pursuing a career in the growing energy and environmental sectors of the economy, whether in private business, government, consulting, or for entrepreneurial ventures of their own design. The program emphasizes the core components of both business and STEM (science, technology, engineering and math) learning in its curriculum.

Admissions
First-Time Freshman requirements for admission into this major are the same as the general high school credit requirements for admission into the University.

Students transferring from another major within WVU will need at least a 2.00 in order to transfer into the Environmental and Energy Resources Management major. All transfer students will be assigned the Division’s Professional Advisor (Barry Stephens) as their advisor. Students are encouraged to contact Mr. Stephens at barry.stephens@mail.wvu.edu or 304-293-5396 with questions about transferring to this major.

Students transferring from another institution will need to meet admission requirements of the University. All transfer students will be assigned the Division’s Professional Advisor (Barry Stephens) as their advisor. Students are encouraged to contact Mr. Stephens at barry.stephens@mail.wvu.edu or 304-293-5396 with questions about transferring to this major.

ADMISSION REQUIREMENTS 2022-2023
The Admission Requirements above will be the same for the 2022-2023 Academic Year.

Major Code: 0726

Click here to view the Suggested Plan of Study (p. 3)

General Education Foundations
Please use this link to view a list of courses that meet each GEF requirement. (http://registrar.wvu.edu/gef/)

NOTE: Some major requirements will fulfill specific GEF requirements. Please see the curriculum requirements listed below for details on which GEFs you will need to select.

General Education Foundations

<table>
<thead>
<tr>
<th>General Education Foundations</th>
<th>3-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1 - Composition &amp; Rhetoric</td>
<td></td>
</tr>
<tr>
<td>ENGL 101 &amp; ENGL 102 or ENGL 103</td>
<td>Introduction to Composition and Rhetoric and Composition, Rhetoric, and Research Accelerated Academic Writing</td>
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<tr>
<td>F2A/F2B - Science &amp; Technology</td>
<td>4-6</td>
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<tr>
<td>F3 - Math &amp; Quantitative Reasoning</td>
<td>3-4</td>
</tr>
<tr>
<td>F4 - Society &amp; Connections</td>
<td>3</td>
</tr>
<tr>
<td>F5 - Human Inquiry &amp; the Past</td>
<td>3</td>
</tr>
<tr>
<td>F6 - The Arts &amp; Creativity</td>
<td>3</td>
</tr>
<tr>
<td>F7 - Global Studies &amp; Diversity</td>
<td>3</td>
</tr>
<tr>
<td>F8 - Focus (may be satisfied by completion of a minor, double major, or dual degree)</td>
<td>9</td>
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</tbody>
</table>

Total Hours 31-37

Please note that not all of the GEF courses are offered at all campuses. Students should consult with their advisor or academic department regarding the GEF course offerings available at their campus.
# Environmental and Energy Resources Management, B.S.

## Degree Requirements

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>University Requirements</td>
<td>41</td>
</tr>
<tr>
<td>General Requirements</td>
<td>6</td>
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<tr>
<td>Environmental and Energy Resources Management Major Requirements</td>
<td>73</td>
</tr>
<tr>
<td>Total Hours</td>
<td>120</td>
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</tbody>
</table>

### General Requirements

- MATH 150: Applied Calculus (GEF 3) 3 credits
- ARE 150: Introductory Agricultural and Agribusiness Economics (GEF 4) 3 credits
- or ECON 201: Principles of Microeconomics 3 credits

Total Hours: 6 credits

### Environmental and Energy Resources Management Major Requirements

- ARE 187: Energy Resource Economics (GEF 8) 3 credits
- ARE 201: Principles of Resource and Energy 3 credits
- ARE 382: Agricultural and Natural Resources Law 3 credits
- ARE 488: Career Development 1 credit
- ARE 491: Professional Field Experience (Capstone Experience) 3 credits

Select one of the following (GEF 8): 3 credits

- ECON 225: Elementary Business and Economics Statistics
- or STAT 211: Elementary Statistical Inference

- ECON 202: Principles of Macroeconomics (GEF 8) 3 credits
- RESM 440: Foundations of Applied Geographic Information Systems 3 credits
- RESM 480: Environmental Regulation 3 credits

Lab Science Requirement 12 credits

Select 12 credits from the following:

- AGRN 202: Principles of Soil Science
- & AGRN 203: and Principles of Soil Science Laboratory
- BIOL 101: General Biology
- & BIOL 103: and General Biology Laboratory
- CHEM 111: Survey of Chemistry 1
- & 111L: and Survey of Chemistry 1 - Laboratory
- GEOL 101: Planet Earth
- & GEOL 102: and Planet Earth Laboratory
- GEOL 103: Earth Through Time
- & GEOL 104: and Earth Through Time Laboratory
- PHYS 101: Introductory Physics
- PLSC 206: Principles of Plant Science

### Restricted Electives*

- Energy, Choose 12 credits. Six credits must be at the 400 level.

- ARE 440: Futures Markets and Commodity Prices
- ARE 445: Energy Economics
- ARE 485: Economics of Water Resources and Energy
- DSGN 340: Design for Energy Efficiency
- DSGN 470: Leadership in Energy and Environmental Design Green Building Systems

Restricted Electives: 36 credits

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*Restricted Electives: 36 credits. Six credits must be at the 400 level.*
ENGR 310  Energy Engineering
GEO 472  Energy Geology
RESM 450  Land Use Planning Law
RESM 460  Energy Project and Program Management
WDS 444  Bio-based Energy Systems

Environment. Choose 12 credits. Six credits must be at the 400 level.
AGRN 455  Reclamation of Disturbed Soils
or ENVP 455  Reclamation of Disturbed Soils
ARE 485  Economics of Water Resources and Energy
ENVP 355  Environmental Sampling and Analysis
ENVP 415  Hazardous Waste Training
ENVP 460  Environmental Impact Assessment
GEOG 205  Climate and Sustainability
GEOG 415  Global Environmental Change
RESM 444  Advanced GIS for Natural Resource Management
WMN 200  Restoration Ecology

Economics and Entrepreneurship. Choose 12 credits. Six credits must be at the 400 level.
AGGE 421  Agricultural and Natural Resource Communications
ARE 204  Agribusiness Management
ARE 220  Introductory Environmental and Resource Economics
ARE 380  Agribusiness Sales and Management
ARE 401  Applied Demand Analysis
or ECON 301  Intermediate Micro-Economic Theory
ARE 410  Environmental and Resource Economics (fulfills Writing and Communication skills requirement)
ARE 422  New Venture Creation
ARE 431  Marketing Agricultural Products
ARE 445  Energy Economics
ARE 450  Agriculture, Environmental and Resource Policy
ARE 461  Agribusiness Finance
ARE 482  Enterprise Operation Law
ARE 484  Agribusiness Strategic Management
ECO 302  Intermediate Macro-Economic Theory

* Selected and approved in consultation with advisor. Must include at least four courses from each of the four restricted elective categories: Economics, Energy, Entrepreneurship, and Environment.

**SUGGESTED PLAN OF STUDY**

**First Year**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>ANRD 191</td>
<td>1</td>
<td>ARE 187 (GEF 8)</td>
<td>3</td>
</tr>
<tr>
<td>ARE 150 (GEF 4)</td>
<td>3</td>
<td>GEOL 101 &amp; GEOL 102</td>
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<tr>
<td>ARE 201</td>
<td>3</td>
<td>MATH 150 (GEF 3)</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 101 (GEF 1)</td>
<td>3</td>
<td>GEF 5, 6, or 7</td>
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<tr>
<td>BIOL 101 &amp; BIOL 103 (GEF 2B)</td>
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<td>Free Elective</td>
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| Total Hours | 14 | 16 |

**Second Year**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
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<tbody>
<tr>
<td>ARE 204 (Entrepreneurship/Economics)</td>
<td>3</td>
<td>AGRN 202 &amp; AGRN 203</td>
<td>4</td>
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</tbody>
</table>
**Environmental and Energy Resources Management, B.S.**

ENGL 102 (GEF 1) 3 ECON 202 (GEF 8) 3
GEOG 205 (Environment) 3 STAT 211 (GEF 8) 3
GEF 5, 6, or 7 3 GEF 5, 6, or 7 3
Free Elective 3 Free Electives 3

**Third Year**

<table>
<thead>
<tr>
<th>Fall Hours</th>
<th>Spring Hours</th>
<th>Summer Hours</th>
<th>Hours</th>
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<tbody>
<tr>
<td>ARE 220 (Entrepreneurship/Economics) 3 ARE 482 (Economics and Entrepreneurship) 3 ARE 491 3</td>
<td></td>
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<tr>
<td>ARE 488 1 ENVP 415 (Environment) 3</td>
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<tr>
<td>ENGR 310 (Energy) 3 RESM 450 (Energy) 3</td>
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<tr>
<td>RESM 440 3 RESM 480 3</td>
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<tr>
<td>Free Elective 3 Free Elective 3</td>
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**Fourth Year**

<table>
<thead>
<tr>
<th>Fall Hours</th>
<th>Spring Hours</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>ARE 382 3 AGRN 455 (Environment) 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSGN 340 (Energy) 3 ARE 431 (Entrepreneurship/Economics) 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environment 3 RESM 460 (Energy) 3</td>
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<tr>
<td>Free Electives 6 Free Electives 4</td>
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</table>

**Total credit hours: 120**

**Major Learning Outcomes**

**ENVIRONMENTAL AND ENERGY RESOURCE MANAGEMENT**

After completing this major students will be able to:

1. Demonstrate an understanding of major concepts in energy and environmental resource economics, legal issues related to natural resource and environmental management, and enterprise creation and demonstrate critical thinking skills and problem solving abilities related to these areas.

2. Utilize relevant software for data analysis in energy and environmental applications and general business settings.

3. Communicate effectively in a business or professional setting (written and oral).

4. Work cooperatively within a business or professional setting.

**ARE 110. Agribusiness Accounting. 3 Hours.**
Introduction to accounting for agricultural, rural, and small business managers. Emphasis on the accounting cycle, analysis and interpretation of financial statements, income taxes, and managerial accounting. (Students having prior college credit in accounting are not eligible for this course.).

**ARE 150. Introductory Agricultural and Agribusiness Economics. 3 Hours.**
Introduction to basic agricultural economics and agribusiness concepts, and the application of these concepts to agricultural and agribusinesses issues.

**ARE 187. Energy Resource Economics. 3 Hours.**
Dilemmas posed for developing and modern societies by rising energy demands amid concerns for the world's environment. Economics of fuel sources and technologies, and historical and new concerns over resource scarcities.

**ARE 191. First-Year Seminar. 1-3 Hours.**
Engages students in active learning strategies that enable effective transition to college life at WVU. Students will explore school, college and university programs, policies and services relevant to academic success. Provides active learning activities that enable effective transition to the academic environment. Students examine school, college and university programs, policies and services.

**ARE 199. Orientation to Agriculture and Resource Economics. 1,2 Hour.**
Orientation to degree programs and requirements, departmental resources, curriculum options, student responsibilities and opportunities.
ARE 201. Principles of Resource and Energy. 3 Hours.
PR: Third-year standing. Analyzes problems important or peculiar to mineral industry economics; exhaustion, externalities, risks, production cycle, industry structure, pricing, role of minerals in development and trade, resource planning. Energy, metals, industrial minerals. (3 hr. lec.).

ARE 204. Agribusiness Management. 3 Hours.
Overview of the agribusiness decision-making process, and the functions of agribusiness management; analysis of financial statements and budgeting for evaluating profitability of alternative enterprises and practices.

ARE 220. Introductory Environmental and Resource Economics. 3 Hours.
Economic analysis of environmental pollution, natural resource conservation and management, outdoor recreation, public land use, wildlife resources, water use, property rights, and benefit-cost issues.

ARE 293. Special Topics. 1-6 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

ARE 298. Honors. 1-3 Hours.
PR: Students in Honors Program and consent by the honors director. Independent reading, study, or research.

ARE 360. Current Issues In Agriculture. 3 Hours.
Course focusing on the current scientific, ethical, legal, economic and political issues relating to agriculture. Students conduct group and individual research, discuss topics in an informal debate format and summarize positions in a written form.

ARE 380. Agribusiness Sales and Management. 3 Hours.
This course is designed to provide students with essential spreadsheet and sales skills they can apply regardless of their chosen profession. The course will cover spreadsheet basics and students will apply that knowledge to problems related to agricultural and resource economics.

ARE 382. Agricultural and Natural Resources Law. 3 Hours.
Introduction to legal concepts, principles and practices related to environmental, natural resource, and agricultural issues; in the context of the legal system within which statutes are enacted, administered and enforced.

ARE 393. Special Topics. 1-6 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

ARE 401. Applied Demand Analysis. 3 Hours.
Consumer demand economics applied to environmental, natural resource, and agricultural issues; analysis of factors that influence demand and determine prices; special applications to non-market, environmental, and natural resource amenities.

ARE 406. Applied Quantitative Methods. 3 Hours.
PR: ARE 150. Application of basic quantitative concepts and methods applied to agribusiness and natural resources. Topics include applied economics, statistics, mathematics, and financial concepts and decision-making tools for determining optimum allocation of resources for production processes.

ARE 410. Environmental and Resource Economics. 3 Hours.
PR: ARE 220. Economic analysis of natural resource and environmental problems; management of renewable and non-renewable resources and environmental amenities; market failure, externalities, benefit-cost and risk analysis; property rights and the taking issues.

ARE 411. Rural Economic Development. 3 Hours.
Economic trends, development policies, and analysis of rural economies in the United States. Rural diversity, development concepts, rural planning, public programs and policies, and community analysis methods.

ARE 420. Adaptation and Mitigation Strategies for Addressing Climate Change. 3 Hours.
PR: Junior or Senior standing. This course identifies mechanisms that may be used to offset or reduce the effects of a changing climate. It addresses options that can help to protect agriculture and food production, protect human health, improve water resources and ecosystems services, and provide for the energy needed for continued economic activity. Students cannot receive credit for both ARE 420 and ARE 620.

ARE 422. New Venture Creation. 3 Hours.
In this course, students will learn the process of starting a new venture. The student will gain an in depth understanding of the framework and process by practicing the techniques on a startup of the student’s choice.

ARE 431. Marketing Agricultural Products. 3 Hours.
Organization, functions, and analysis of the agricultural marketing system. Food consumption, exports, price analysis, marketing costs, market power, commodities futures market, food safety, and government regulations.

ARE 435. Marketing Livestock Products. 3 Hours.
Livestock marketing practices and policies. Supply and demand, livestock price cycles, grading, marketing alternatives, processing and retailing. Economic analysis of alternatives, current issues, and trends.

ARE 440. Futures Markets and Commodity Prices. 3 Hours.
Analysis of price-making forces which operate in the market place; emphasis on major agricultural and mineral commodity and futures markets.

ARE 445. Energy Economics. 3 Hours.
Analysis of the energy sector and its relationship to the rest of the economy; energy security, deregulation, full cost pricing, substitutability among energy sources, transmission, new technologies, environmental considerations.
ARE 450. Agriculture, Environmental and Resource Policy. 3 Hours.
PR: ARE 150 or ECON 201 or consent. Economic analysis of agricultural, natural resource and environmental policies; problems of externalities and market failure, and alternative policies for addressing such problems; benefits and cost of alternative policies.

ARE 461. Agribusiness Finance. 3 Hours.
An overview of financial analysis and the application of financial principles to small, rural and agricultural businesses. Includes applications of financial analysis computer software.

ARE 462. Records and Analysis for Sustainable Agribusinesses. 3 Hours.
PR: ARE 110 or ACCT 201 or BUSA 202. Managerial and record-keeping concepts and tools needed to run a successful agribusiness. Course materials and lab activities focus on collection and use of information to assist in whole-farm/agribusiness planning, decision-making, performance evaluation, sensitivity analysis, and management. Course stresses the impact of record-keeping and performance evaluation on the ability of an agribusiness to achieve its strategic goals.

ARE 482. Enterprise Operation Law. 3 Hours.
Course focusing on laws applicable to businesses and the management of risks associated with operating a business. Students will learn to read and interpret laws and apply them to real-life business scenarios.

ARE 484. Agribusiness Strategic Management. 3 Hours.
PR: Senior standing. This course is designed to enhance understanding of business strategy formulation and implementation. The course provides a balance between theoretical concepts, principles, and practice of agribusiness management. Case studies are used to illustrate the crafting, implementation, and execution of optimal strategies.

ARE 485. Economics of Water Resources and Energy. 3 Hours.
PR: Calculus with a grade of B- or better or consent, introductory micro economics with a C- or consent. Allocation under scarcity, water institutions and management, risk, pricing, marketing, demand and supply estimation, interdependence between energy and water resources (Credit cannot be received for both ARE 485 and ARE 585).

ARE 488. Career Development. 1 Hour.
PR: For Resource Economics and Management majors only. Development of career goals and job search skills. Investigation of topics that advance students in their career goals.

ARE 490. Teaching Practicum. 1-3 Hours.
PR: Consent. Teaching practice as a tutor or assistant.

ARE 491. Professional Field Experience. 1-18 Hours.
PR: Consent. (May be repeated up to a maximum of 18 hours.) Prearranged experiential learning program, to be planned, supervised, and evaluated for credit by faculty and field supervisors. Involves temporary placement with public or private enterprise for professional competence development.

ARE 492. Directed Study. 1-3 Hours.
Directed study, reading, and/or research.

ARE 493. Special Topics. 1-6 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

ARE 494. Seminar. 1-3 Hours.
PR: Consent. Presentation and discussion of topics of mutual concern to students and faculty.

ARE 495. Independent Study. 1-6 Hours.
Faculty supervised study of topics not available through regular course offerings.

ARE 496. Senior Thesis. 1-3 Hours.
PR: Consent.

ARE 497. Research. 1-6 Hours.
Independent research projects.

ARE 498. Honors. 1-3 Hours.
PR: Students in honors program and consent by the honors director. Independent reading, study or research.

RESM 140. Sustainable Living. 3 Hours.
Explores the personal, social, economic and environmental aspects of making sustainable choices. Sustainability principles and practices are discussed along with assessments of consumption and lifestyle decisions. Also listed as DSGN 140 and PLSC 140.

RESM 293. Special Topics. 1-6 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 390. Teaching Practicum. 1-3 Hours.
PR: Consent. Teaching practice as a tutor or assistant.

RESM 405. Drones in Resource Management. 3 Hours.
PR: An interest in aeronautical principals, spatial data collection and analysis, and natural resource applications is preferred. Provides training in the use of drones to collect and analyze spatial data in natural resource applications.
RESM 440. Foundations of Applied Geographic Information Systems. 3 Hours.
An introductory course designed to provide the necessary background and techniques to use GIS technology to analyze and solve spatial problems. An emphasis is placed on acquisition, management, and manipulation of spatial data.

RESM 443. Intro GIS for Trail Planners. 2 Hours.
Introduce technical skills to support site analysis and mapping geographic constraints for trail planning, focusing on technological tools available to new GIS users. The goal of this course is to introduce Geographic Information Systems (GIS) and build foundations in its use to allow students to solve spatial problems. Specifically, the course will teach students necessary spatial and quantitative analysis methods.

RESM 444. Advanced GIS for Natural Resource Management. 3 Hours.
PR or CONC: RESM 440 with a minimum grade of C- or consent. Provides advanced training using geographic information systems to address the spatial issues of managing natural resources.

RESM 445. Spatial Hydrology and Watershed Analysis. 3 Hours.
PR: RESM 440 or consent. Introduction to applied spatial hydrology using GIS; integrates statistical modeling and terrain analysis; provides insights into water quality and quantity analysis for local and regional watershed scales. (Credit cannot be received for both RESM 445 and RESM 545.)

RESM 450. Land Use Planning Law. 3 Hours.
Focus is on identification and understanding of legal issues related to planning and land use. This involves understanding rights, regulations, and responsibilities associated with land use, planning, and related activities.

RESM 455. Practice of Land Use Planning. 3 Hours.
Examines comprehensive land use planning including planning's origin and evolution plus the processes used to create and implement a plan. Focus is on land use and how it relates to other issues.

RESM 460. Energy Project and Program Management. 3 Hours.
PR: Junior or Senior Standing. The concepts and best practices of modern project management as applied to manage activities that meet the requirements of energy and environmental resource industry related programs and projects.

RESM 480. Environmental Regulation. 3 Hours.
Course focusing on laws and policies applicable to the environment. Students will learn to read and interpret statutes, regulations and cases that impact water, air, toxic substances, land and endangered species.

RESM 491. Professional Field Experience. 1-18 Hours.
PR: Consent (may be repeated up to a maximum of 18 hours.) Prearranged experiential learning program, to be planned, supervised, and evaluated by faculty and field supervisors. Involves temporary placement with public or private enterprise for professional competence development.

RESM 493. Special Topics. 1-6 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

RESM 494. Seminar. 1-3 Hours.
PR: Consent. Presentation and discussion of topics of mutual concern to students and faculty.

RESM 495. Independent Study. 1-6 Hours.
Faculty supervised study of topics not available through regular course offerings.

RESM 496. Senior Thesis. 1-3 Hours.
PR: Consent.

RESM 498. Honors. 1-3 Hours.
PR: Students in Honors Program and consent by the honors director. Independent reading, study or research.