

Energy and Natural Resource Technology



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The purpose of this document is to communicate the required Career and Technical Education (CTE) academic standards for the Energy and Natural Resource Technology Program of Study. The academic standards in this document are theoretical and performance-based. The standards contain content from Colorado, Maryland, Tennessee, and Texas and were validated by D.C. business and industry partners. All content is used with permission.

In addition to academic standards, OSSE has incorporated into this document Labor Market Information (LMI) definitions and explanations for the Program of Study; program aligned Industry Recognized Credentials; and Work-Based Learning resources and requirements by course level.

This document is intended for use by educational administrators and practitioners. A similar document is available for each state-approved CTE Program of Study.



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Course Descriptions: Energy and Natural Resource Technology		
Course Level	Course Information	Description
Level I	Principles of Agriculture, Food, and Natural Resources OSSEID: 18001G1.0014 Grades: 9-12 Prerequisite: None Credit: 1	Principles of Agriculture, Food, and Natural Resources will allow students to develop knowledge and skills regarding career and educational opportunities, personal development, globalization, industry standards, details, practices, and expectations. To prepare for careers in agriculture, food, and natural resources, students must attain academic skills and knowledge in agriculture. To prepare for success, students need opportunities to learn, reinforce, experience, apply, and transfer their knowledge and skills in a variety of settings.
Level II	Energy and Natural Resource Technology OSSEID: 18506G1.0024 Grades: 10-12 Prerequisite: Principles of Agriculture, Food, and Natural Resources Credit: 1	Energy and Natural Resource Technology examines the interrelatedness of environmental issues and production agriculture. Students will evaluate the environmental benefits provided by sustainable resources and green technologies. Instruction is designed to allow for the application of science and technology to measure environmental impacts resulting from production agriculture through field and laboratory experiences. To prepare for careers in environmental service systems, students must attain academic skills and knowledge, acquire advanced technical knowledge and skills related to environmental service systems and the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills, and technologies in various settings.
Level III	Advanced Energy and Natural Resource Technology OSSEID: 18506G1.0034 Grades: 11-12 Prerequisite: Energy and Natural Resource Technology Credit: 1	Advanced Energy and Natural Resource Technology is designed to explore the interdependency of the public and natural resource systems related to energy production. In addition, students will explore renewable, sustainable, and environmentally friendly practices. To prepare for careers in energy and natural resource systems, students must attain academic skills and knowledge, acquire technical knowledge and skills related to energy and natural resources and the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills, and technologies in various settings.



Level IV	Practicum in Agriculture, Food, and Natural Resources OSSEID: 18950G1.0044 Grades: 12 Prerequisite: Advanced Energy and Natural Resource Technology Credit: 1	Practicum in Agriculture, Food, and Natural Resources is designed to give students supervised practical application of knowledge and skills. Practicum experiences can occur in various locations appropriate to the nature and level of experiences such as employment, independent study, internships, assistantships, mentorships, or laboratories. To prepare for careers in agriculture, food, and natural resources, students must attain academic skills and knowledge, acquire technical knowledge and skills related to the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills, and technologies in various settings.
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Industry Certifications

Work-Based Learning Examples and Resources

Level I Course	Level II Course	Level III Course	Level IV Course
Career Exploration Industry Visits Guest Speakers Participate in a CTSO	Career Awareness <i>All of Level I, plus:</i> Postsecondary Visits Program- Specific Site Tours Mock Interviews	Career Preparation <i>All of Level I and II, plus:</i> Job Shadow Paid/Unpaid Internships	Career Preparation Paid/Unpaid Internships Apprenticeships

Several resources are available to help instructors meet the Level I and Level II WBL requirements, including:

Career Coach DC (<http://careercoachdc.emsicc.com>). Online site designed to help students find and connect to a career pathway by providing the most current local data on wages, employment, job postings, and associated education and training. The resource includes a Career Assessment for students.

Nepriis (<https://dc.nepriis.com/>). Connects educators and learners with a network of industry professionals virtually, bringing real-world relevance and career exposure to all students. Nepriis also provides a skills-based volunteering platform for business and industry professionals to extend their educational outreach.

Virtual Job Shadow (<https://virtualjobshadow.com>). Provides interactive tools which empower students to discover, plan, and pursue their dreams. Rich video library presents a “day in the life of” view for thousands of occupations.



Labor Market Information Definitions and Data

Career and Technical Education programs of study in the District of Columbia must meet at least one of the High Wage, High Skill, and In-Demand definitions below to be considered appropriate for our students and the regional labor market. These definitions were created in collaboration with Career and Technical Education leaders from District of Columbia LEAs, the University of the District of Columbia Community College, and national guidance from Research Triangle International (RTI) and Education Northwest. Additionally, previous work was consulted from researchers at MIT's Labor Wage Index Project and the DC CTE Task Force's 2012 Strategic Plan for the District of Columbia.

Indicator	Definition	Data for the Energy and Natural Resources Program of Study (source: EMSI, August 2022)
<p>High Wage</p>	<p>Those occupations that have a 25th percentile wage equal to or greater than the most recent MIT Living Wage Index for one adult in the District of Columbia, and/or leads to a position that pays at least the median hourly or annual wage for the Washington, DC, metropolitan statistical area.</p> <p><i>Note: A 25th percentile hourly wage of \$23.13 or greater is required to meet this definition.</i></p>	<p>Standard Occupational Code (SOC): 19-204.00 Environmental Scientists and Specialists, Including Health</p> <p>Hourly Wages 25th Percentile: \$38.71 50th Percentile: \$52.19 75th Percentile: \$67.39</p>
<p>High Skill</p>	<p>Those occupations located within the Washington, DC, metropolitan statistical area with the following education or training requirements: completion of an apprenticeship program; completion of an industry-recognized certification or credential; associate's degree, or higher.</p>	<p>Typical Entry-Level Education: Bachelor's degree</p>
<p>In-Demand</p>	<p>Those occupations in the Washington, DC, metropolitan statistical area having more than the median number of total (growth plus replacement) annual openings over a five-year period.</p> <p><i>Note: An occupation is required to have an annual growth plus replacement rate of 105 openings, or greater, between 2021-2026 to meet this definition.</i></p>	<p>Annual Openings: 570</p>



Model Six-Year Plan: Energy and Natural Resource Technology

College: University of the District of Columbia Community College

Program/CIP:

Plan:

Entity: Office of the State Superintendent of Education

Career Cluster: Agriculture, Food, and Natural Resources

Program of Study: Energy and Natural Resource Technology

High School					College			
Subject	9 th Grade	10 th Grade	11 th Grade	12 th Grade	Semester I	Semester II	Semester III	Semester IV
English (4)	English I	English II	English III	English IV				
Math (4)	Algebra I	Geometry	Algebra II	Math				
Science (4)	Biology	Lab Science	Lab Science	Science				
Social Studies (4)	World History and Geography I: Middle Ages	World History and Geography II: Modern World	U.S. History	U.S. Government (.5) and D.C. History (.5)				
Health (.5) and Physical Ed (1)	Health (.5) Physical Ed (.5)	Physical Ed (.5)						
World Languages (2)			World Language I	World Language II				
Art (.5)		Art (.5)						
Music (.5)		Music (.5)						
Elective / Major Courses	Principles of Agriculture, Food, and Natural Resources	Energy and Natural Resource Technology	Advanced Energy and Natural Resource Technology	Practicum in Agriculture, Food, and Natural Resources				
Total possible college credits completed in high school: XX					Credit hours required to complete the AAS program: XX			



Course Standards

Principles of Agriculture, Food, and Natural Resources

1. **General requirements.** This course is recommended for students in Grades 9-12. Students shall be awarded one credit for successful completion of this course.
2. **Introduction.**
 - A. Career and technical education instruction provides students with industry-aligned content, challenging academic standards, and relevant technical knowledge to further their education and succeed in current or emerging professions.
 - B. The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.
 - C. Principles of Agriculture, Food, and Natural Resources will allow students to develop knowledge and skills regarding career and educational opportunities, personal development, globalization, industry standards, details, practices, and expectations. To prepare for careers in agriculture, food, and natural resources, students must attain academic skills and knowledge in agriculture. To prepare for success, students need opportunities to learn, reinforce, experience, apply, and transfer their knowledge and skills in a variety of settings.
 - D. Students will participate in at least two Career Exploration Work-Based Learning experiences in this course, including guest speakers and workplace tours relevant to the program of study.
 - E. Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
3. **Knowledge and skills.**
 - A. **The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:**
 1. identify career development, education, and entrepreneurship opportunities in the field of agriculture, food, and natural resources;
 2. apply competencies related to resources, information, interpersonal skills, problem-solving, critical thinking, and systems of operation in agriculture, food, and natural resources;
 3. demonstrate knowledge of personal and occupational safety, environmental regulations, and first-aid policy in the workplace;
 4. analyze employers' expectations such as appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills; and
 5. identify careers in agriculture, food, and natural resources with required aptitudes in science, technology, engineering, mathematics, language arts, and social studies.



- B. The student develops a supervised agriculture experience program. The student is expected to:**
1. plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;
 2. apply proper record-keeping skills as they relate to the supervised agriculture experience;
 3. participate in youth leadership opportunities to create a well-rounded experience program; and
 4. produce and participate in a local program of activities using a strategic planning process.
- C. The student analyzes concepts related to global diversity. The student is expected to:**
1. compare and contrast global agricultural markets, currency, and trends; and
 2. evaluate marketing factors and practices that impact the global markets.
- D. The student explains the historical, current, and future significance of the agriculture, food, and natural resources industry. The student is expected to:**
1. define the scope of agriculture;
 2. analyze the scope of agriculture, food, and natural resources and its effect upon society;
 3. evaluate significant historical and current agriculture, food, and natural resources developments;
 4. identify potential future scenarios for agriculture, food, and natural resources systems, including global impacts;
 5. describe how emerging technologies and globalization impacts agriculture, food, and natural resources; and
 6. compare and contrast issues impacting agriculture, food, and natural resources such as biotechnology, employment, safety, environment, and animal welfare issues.
- E. The student analyzes the structure of agriculture, food, and natural resources leadership in organizations. The student is expected to:**
1. develop and demonstrate leadership skills and collaborate with others to accomplish organizational goals and objectives;
 2. develop and demonstrate personal growth skills and collaborate with others to accomplish organizational goals and objectives; and
 3. demonstrate democratic principles in conducting effective meetings.
- F. The student demonstrates appropriate personal and communication skills. The student is expected to:**
1. demonstrate written and oral communication skills appropriate for formal and informal situations such as prepared and extemporaneous presentations; and
 2. demonstrate effective listening skills appropriate for formal and informal situations.
- G. The student applies appropriate research methods to agriculture, food, and natural resources topics. The student is expected to:**
1. discuss major research and developments in the fields of agriculture, food, and natural resources;
 2. use a variety of resources for research and development; and
 3. describe scientific methods of research.
- H. The student applies problem-solving, mathematical, and organizational skills in order to maintain financial and logistical records. The student is expected to:**
1. develop a formal business plan; and
 2. develop, maintain, and analyze records.



- I. **The student uses information technology tools to access, manage, integrate, and create information related to agriculture, food, and natural resources. The student is expected to:**
1. apply technology applications such as industry-relevant software and Internet applications;
 2. use collaborative, groupware, and virtual meeting software;
 3. analyze the benefits and limitations of emerging technology such as online mapping systems, drones, and robotics; and
 4. explain the benefits of computer-based and mobile application equipment in agriculture, food, and natural resources.
- J. **The student develops technical knowledge and skills related to soil systems. The student is expected to:**
1. identify the components and properties of soils;
 2. identify and describe the process of soil formation; and
 3. conduct experiments related to soil chemistry.
- K. **The student develops technical knowledge and skills related to plant systems. The student is expected to:**
1. describe the structure and functions of plant parts;
 2. discuss and apply plant germination, growth, and development;
 3. describe plant reproduction, genetics, and breeding;
 4. identify plants of importance to agriculture, food, and natural resources; and
 5. use tools, equipment, and personal protective equipment common to plant systems.
- L. **The student develops technical knowledge and skills related to animal systems. The student is expected to:**
1. describe animal growth and development;
 2. identify animal anatomy and physiology;
 3. identify and evaluate breeds and classes of livestock; and
 4. explain animal selection, reproduction, breeding, and genetics.
- M. **The student describes the principles of food products and processing systems. The student is expected to:**
1. evaluate food products and processing systems;
 2. determine trends in world food production;
 3. discuss current issues in food production; and
 4. use tools, equipment, and personal protective equipment common to food products and processing systems.
- N. **The student safely performs basic power, structural, and technical system skills in agricultural applications. The student is expected to:**
1. identify major areas of power, structural, and technical systems;
 2. use safe and appropriate laboratory procedures and policies;
 3. create proposals that include bill of materials, budget, schedule, drawings, and technical skills developed for basic power, structural, and technical system projects or structures;
 4. identify building materials and fasteners; and
 5. use tools, equipment, and personal protective equipment common to power, structural, and technical systems.



- O. **The student explains the relationship between agriculture, food, and natural resources and the environment.**
The student is expected to:
1. use technology as a tool to research, organize, evaluate, and communicate information;
 2. use digital technologies (computers, PDAs, media players, GPSs, etc.); communication/networking tools, and social networks appropriately to access, manage, integrate, evaluate, and create information to function in a knowledge economy successfully;
 3. demonstrate using current and new technologies specific to the program of study, course, and/or industry;
and
 4. apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies.



Energy and Natural Resource Technology

1. **General requirements.** This course is recommended for students in Grades 10-12. Prerequisite: Principles of Agriculture, Food, and Natural Resources. Students shall be awarded one credit for successful completion of this course.
2. **Introduction.**
 - A. Career and technical education instruction provides students with industry-aligned content, challenging academic standards, and relevant technical knowledge to further their education and succeed in current or emerging professions.
 - B. The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.
 - C. Energy and Natural Resource Technology examines the interrelatedness of environmental issues and production agriculture. Students will evaluate the environmental benefits provided by sustainable resources and green technologies. Instruction is designed to allow for the application of science and technology to measure environmental impacts resulting from production agriculture through field and laboratory experiences. To prepare for careers in environmental service systems, students must attain academic skills and knowledge, acquire advanced technical knowledge and skills related to environmental service systems and the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills, and technologies in various settings.
 - D. Students will participate in at least two Career Awareness Work-Based Learning experiences in this course, which might include informational interviews or job shadowing relevant to the program of study.
 - E. Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
3. **Knowledge and skills.**
 - A. **The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:**
 1. identify career development, education, and entrepreneurship opportunities in the field of energy and natural resources;
 2. apply competencies related to resources, information, interpersonal skills, and systems of operation in energy and natural resources;
 3. demonstrate knowledge of personal and occupational safety, environmental regulations, and first-aid policy in the workplace; and
 4. analyze employers' expectations such as appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills.



- B. The student develops a supervised agriculture experience program. The student is expected to:**
1. plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;
 2. apply proper record-keeping skills as they relate to the supervised agriculture experience;
 3. participate in youth leadership opportunities to create a well-rounded experience program; and
 4. produce and participate in a local program of activities using a strategic planning process.
- C. The student uses the instructional time to conduct field and laboratory investigations using safe, environmentally appropriate, and ethical practices in a supervised agriculture experience. The student is expected to:**
1. demonstrate safe practices during field and laboratory investigations in a supervised agriculture experience; and
 2. use accepted procedures for the use and conservation of resources and for the secure handling of materials.
- D. The student discusses the importance and scope of natural resources. The student is expected to:**
1. identify various types of natural resources;
 2. discuss renewable and non-renewable energy resources and their impact on the environment;
 3. analyze the impacts of natural resources and their effects on the agricultural economy; and
 4. map the geographic and demographic uses of natural resources.
- E. The student identifies water use and management in agricultural settings. The student is expected to:**
1. identify the distribution and properties of water in the hydrologic cycle;
 2. identify agricultural uses of water such as recycling;
 3. discuss how agricultural uses may impact water resources;
 4. define point source and non-point source pollution;
 5. identify sources of point source and non-point source pollution associated with agriculture;
 6. evaluate how the different agricultural water uses may impact water availability; and
 7. research water use legislation.
- F. The student describes air quality associated with agricultural production. The student is expected to:**
1. describe the components of the atmosphere and the atmospheric cycle;
 2. define air pollution;
 3. analyze air quality legislation;
 4. identify sources and effects of air pollution from agricultural production;
 5. discuss different emission management strategies; and
 6. identify common air pollution controls used in agricultural production.
- G. The student examines soil erosion as related to agricultural production. The student is expected to:**
1. identify agricultural production practices that can contribute to soil erosion;
 2. analyze effects of soil erosion;
 3. discuss the legal aspects of soil erosion; and
 4. identify soil erosion control methods and programs.



H. The student explains the effects of natural resource use. The student is expected to:

1. identify the progression of use of natural resources leading to environmental degradation;
2. explain the impact of human population dynamics on the environment;
3. discuss the abuse of natural resources; and
4. communicate the environmental consequences of natural resource use such as the impact on living organisms.

I. The student develops technology skills. The student is expected to:

1. use technology as a tool to research, organize, evaluate, and communicate information;
2. use digital technologies (computers, PDAs, media players, GPSs, etc.); communication/networking tools, and social networks appropriately to access, manage, integrate, evaluate, and create information to function in a knowledge economy successfully;
3. demonstrate using current and new technologies specific to the program of study, course, and/or industry; and
4. apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies.



Advanced Energy and Natural Resource Technology

1. **General requirements.** This course is recommended for students in Grades 11 and 12. Prerequisite: Energy and Natural Resource Technology. Students shall be awarded one credit for successful completion of this course.
2. **Introduction.**
 - A. Career and technical education instruction provides students with industry-aligned content, challenging academic standards, and relevant technical knowledge to further their education and succeed in current or emerging professions.
 - B. The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.
 - C. Advanced Energy and Natural Resource Technology is designed to explore the interdependency of the public and natural resource systems related to energy production. In addition, renewable, sustainable, and environmentally friendly practices will be explored. To prepare for careers in the field of energy and natural resource systems, students must attain academic skills and knowledge, acquire technical knowledge and skills related to energy and natural resources and the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills, and technologies in various settings.
 - D. Students will participate in a Career Preparation Work-Based Learning experience in this course, which might include paid or unpaid internship experiences relevant to the program of study.
 - E. Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
3. **Knowledge and skills.**
 - A. **The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:**
 1. identify career development, education, and entrepreneurship opportunities in the field of energy and natural resources;
 2. apply competencies related to resources, information, interpersonal skills, and systems of operation in energy and natural resources;
 3. demonstrate knowledge of personal and occupational safety, environmental regulations, and first aid policy in the workplace; and
 4. analyze employers' expectations such as appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills.
 - B. **The student develops a supervised agriculture experience program. The student is expected to:**
 1. plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;
 2. apply proper record-keeping skills as they relate to the supervised agriculture experience;



3. participate in youth leadership opportunities to create a well-rounded experience program; and
 4. produce and participate in a local program of activities using a strategic planning process.
- C. **The student uses the instructional time to conduct field and laboratory investigations using safe, environmentally appropriate, and ethical practices in a supervised agriculture experience. The student is expected to:**
1. demonstrate safe practices during field and laboratory investigations in a supervised agriculture experience; and
 2. apply accepted procedures for the use and conservation of resources and for the safe handling of materials.
- D. **The student determines and evaluates the importance and scope of energy and natural resources. The student is expected to:**
1. identify various types of natural resources;
 2. identify renewable, non-renewable, and sustainable energy resources and determine their availability;
 3. evaluate the impacts of energy production on natural resources and the agricultural economy; and
 4. analyze the geographic and demographic uses of natural resources.
- E. **The student analyzes ethical issues related to natural resource management and energy production. The student is expected to:**
1. compile examples of different lease agreements used for leasing minerals and natural resources;
 2. interpret legal documents related to natural resource management and energy production; and
 3. compare and contrast public and industry interest in natural resource management.
- F. **The student understands the role of natural resource management and energy production policies at the local, state, and national levels. The student is expected to:**
1. identify policy affecting the use of natural resources;
 2. identify policy affecting energy production;
 3. research controls that protect Earth's natural resources;
 4. identify state and federal agencies that have natural resource management and energy production responsibilities; and
 5. define the roles of government, society, and property owners in the development of natural resource management and energy production policy.
- G. **The student recognizes the purpose of land use planning for natural resource management and energy production. The student is expected to:**
1. discuss advantages and disadvantages of land use planning for natural resource management and energy production; and
 2. compare and contrast land use policy trends within the state.
- H. **The student identifies water use and wastewater management. The student is expected to:**
1. identify municipal, industrial, and agricultural uses of water;
 2. explore and develop water recycling opportunities;
 3. evaluate sources of point and non-point source pollution associated with municipal, industrial, and agricultural uses;
 4. describe effective management practices commonly used to abate point and non-point sources of pollution;



5. analyze how water use impacts water availability;
 6. research water use legislation;
 7. discuss water quality policy and how it affects the decisions made in agricultural production; and
 8. discuss the interaction of energy production and water resources.
- I. **The student describes air quality associated with natural resource management and energy production. The student is expected to:**
1. research air quality legislation;
 2. identify sources and effects of air pollution;
 3. discuss different emission management strategies; and
 4. identify air pollution controls used in energy production.
- J. **The student examines soil erosion as related to natural resource management and energy production. The student is expected to:**
1. examine the effects of natural resource management and energy production on soil erosion;
 2. analyze the components and functions of soils;
 3. appraise soil and water conservation programs; and
 4. compare soil erosion control methods.
- K. **The student analyzes the identification, handling, storing, and disposing of waste and hazardous materials. The student is expected to:**
1. classify types of waste and hazardous materials;
 2. research legislation related to waste and hazardous materials;
 3. select appropriate entities responsible for waste and hazardous material management; and
 4. describe safe handling, storing, and disposal of waste materials such as composting and recycling.
- L. **The student learns the processes for producing energy and green products from agricultural, biomass, fossil fuel, wind, solar, and geothermal sources. The student is expected to:**
1. identify agricultural and silvicultural crops and bio-products suitable for renewable production;
 2. discuss production processes for agricultural and silvicultural-based bio-products;
 3. describe the fundamentals for non-renewable resource recovery;
 4. analyze the effects of non-renewable resource recovery methods and the environmental considerations associated with each method such as environmentally friendly alternatives;
 5. analyze the advantages and disadvantages of wind-generated energy;
 6. identify public policy considerations related to transmission line construction to transport wind-generated energy;
 7. locate areas in the state that have geothermal energy production potential;
 8. explain the benefits of geothermal energy;
 9. identify solar energy systems and describe the function of each; and
 10. identify the environmental considerations associated with biofuels.



M. The student develops technology skills. The student is expected to:

1. use technology as a tool to research, organize, evaluate, and communicate information;
2. use digital technologies (computers, PDAs, media players, GPSs, etc.); communication/networking tools, and social networks appropriately to access, manage, integrate, evaluate, and create information to function in a knowledge economy successfully;
3. demonstrate using current and new technologies specific to the program of study, course, and/or industry;
and
4. apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies.



Practicum in Agriculture, Food, and Natural Resources

1. **General requirements.** This course is recommended for students in Grades 12. The practicum course is a paid or unpaid capstone experience for students participating in a coherent sequence of career and technical education courses in Agriculture, Food, and Natural Resources Career Cluster. Prerequisite: Advanced Energy and Natural Resources (Energy and Natural Resource Technology POS) or Greenhouse Operation and Management (Horticulture Science POS).
2. **Introduction.**
 - A. Career and technical education instruction provides students with industry-aligned content, challenging academic standards, and relevant technical knowledge to further their education and succeed in current or emerging professions.
 - B. The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.
 - C. Practicum in Agriculture, Food, and Natural Resources is designed to give students supervised practical application of knowledge and skills. Practicum experiences can occur in various locations appropriate to the nature and level of experiences such as employment, independent study, internships, assistantships, mentorships, or laboratories. To prepare for careers in agriculture, food, and natural resources, students must attain academic skills and knowledge, acquire technical knowledge and skills related to the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills, and technologies in various settings.
 - D. Students will participate in a Career Preparation Work-Based Learning experience in this course, which includes paid or unpaid internship, pre-apprenticeship, or apprenticeship experiences relevant to the program of study.
 - E. Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.
3. **Knowledge and skills.**
 - A. **The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:**
 1. adhere to policies and procedures;
 2. demonstrate positive work behaviors and attitudes, including punctuality, time management, initiative, and cooperation;
 3. apply constructive criticism and critical feedback from supervisor and peers;
 4. apply ethical reasoning to a variety of situations to make ethical decisions;
 5. complete tasks with high standards to ensure quality products and services;
 6. model professional appearance, including using appropriate dress, grooming, and personal protective equipment; and
 7. comply with practicum setting safety rules and regulations to maintain safe and healthful working conditions and environments.



- B. The student develops a supervised agriculture experience program. The student is expected to:**
1. plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;
 2. apply proper record-keeping skills as they relate to the supervised agriculture experience;
 3. participate in youth leadership opportunities to create a well-rounded experience program; and
 4. produce and participate in a local program of activities using a strategic planning process.
- C. The student applies concepts of critical thinking and problem-solving. The student is expected to:**
1. analyze elements of a problem to develop creative and innovative solutions;
 2. analyze information to determine value to the problem-solving task;
 3. compare and contrast alternatives using a variety of problem-solving and critical-thinking skills; and
 4. conduct technical research to gather information necessary for decision-making.
- D. The student demonstrates leadership and teamwork skills to accomplish goals and objectives. The student is expected to:**
1. analyze leadership characteristics in relation to trust, positive attitude, integrity, and willingness to accept key responsibilities in a work situation;
 2. demonstrate teamwork skills through working cooperatively with others to achieve tasks;
 3. demonstrate teamwork processes that promote team-building, consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution;
 4. demonstrate responsibility for shared group and individual work tasks;
 5. establish and maintain effective working relationships in order to accomplish objectives and tasks;
 6. demonstrate effective working relationships using interpersonal skills to accomplish objectives and tasks;
 7. negotiate and work cooperatively with others using positive interpersonal skills; and
 8. demonstrate respect for individuals, including those from different cultures, genders, and backgrounds, and value for diversity.
- E. The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:**
1. apply appropriate content knowledge, technical concepts, and vocabulary when analyzing information and following directions;
 2. employ verbal skills when obtaining and conveying information;
 3. review, use, and apply informational texts, Internet sites, or technical materials for occupational tasks;
 4. evaluate the reliability of information from informational texts, Internet sites, or technical materials and resources;
 5. interpret verbal and nonverbal cues and behaviors to enhance communication;
 6. apply active listening skills to obtain and clarify information; and
 7. facilitate effective written and oral communication using academic skills.
- F. The student develops management skills for agricultural resources. The student is expected to:**
1. discuss the importance of agricultural and natural resources to individuals and society;
 2. develop long-range land, water, and air quality management plans;
 3. practice equipment maintenance procedures;
 4. analyze the cost and maintenance of tools, equipment, and structures used in agriculture;
 5. describe and develop marketing strategies for agricultural and natural resources;



6. decide between replacement, maintenance, repair, and reconditioning of agricultural vehicles and machinery; and
 7. describe and perform hazard analysis and follow safety laws.
- G. The student demonstrates technical knowledge and skills required to pursue a career in the Agriculture, Food, and Natural Resources Career Cluster. The student is expected to:**
1. develop advanced technical knowledge and skills related to the personal, occupational objective;
 2. evaluate strengths and weaknesses in technical skill proficiency;
 3. explain the principles of safe operation of tools and equipment related to the practicum; and
 4. pursue opportunities for licensure or certification related to chosen career path.
- H. The student documents technical knowledge and skills. The student is expected to:**
1. create a professional portfolio to include information such as:
 - a. attainment of technical skill competencies;
 - b. licensures or certifications;
 - c. recognitions, awards, and scholarships;
 - d. extended learning experiences such as community service and active participation in career and technical student organizations and professional organizations;
 - e. abstract of key points of the practicum;
 - f. resume;
 - g. samples of work; and
 - h. evaluation from the practicum supervisor; and
 2. present the portfolio to interested stakeholders.
- I. The student develops technology skills. The student is expected to:**
1. use technology as a tool to research, organize, evaluate, and communicate information;
 2. use digital technologies (computers, PDAs, media players, GPSs, etc.); communication/networking tools, and social networks appropriately to access, manage, integrate, evaluate, and create information to function in a knowledge economy successfully;
 3. demonstrate using current and new technologies specific to the program of study, course, and/or industry; and
 4. apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies.