Maryland
STATE DEPARTMENT OF EDUCATION

Program of Study Guide: Renewable Energy - DRAFT

Comprehensive guidelines and course standards

Office of College and Career Pathways

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Purpose

The Renewable Energy Program of Study (POS) is designed to prepare students for careers in sustainable resource management, renewable energy, and conservation. Because Maryland law requires that all on-site solar, wind or hydro-electric system wiring be reformed by license electrician or registered electrical apprentice, the program emphasizes industry-recognized certifications, and hands-on learning to equip students with the knowledge and skills to transition seamlessly into postsecondary education or employment in energy and environmental fields.

In addition to academic standards, the Maryland State Department of Education (MSDE) 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.

Sources of Standards

The of Study (POS) is designed to prepare students for careers in sustainable resource management, renewable energy, and sustainable conservation. The program emphasizes real-world applications, industry-recognized certifications, and hands-on learning to equip students with the knowledge and skills to transition seamlessly into postsecondary education or employment in energy and environmental fields.

Below is a list of these sources, along with descriptions, their applications in course development, and corresponding web links:

1. **Advance CTE's Career Clusters Framework**
   A. **Description:** The Advance CTE framework provides a nationally recognized structure for organizing career and technical education (CTE) into Career Clusters. Each cluster represents a grouping of occupations and industries, with the Public Service and Safety Career Cluster.
   B. **Use:** The framework serves as a foundational guideline for developing Emergency Services standards, ensuring alignment with industry-specific expectations, and highlighting essential knowledge and skills for each level of study.
   C. **Source:** Advance CTE Career Clusters: https://careertech.org/career-clusters/

2. **Chesapeake Bay Landscape Professional (CBLP) Standards**
   A. **Description:** Provides guidelines for sustainable landscape practices and environmental stewardship.
   B. **Use**: Ensures alignment with best practices for conservation and natural resource management.
   C. **Source**: Chesapeake Bay Landscape Professionals: https://cblpro.org/

3. **ESRI Geographic Information Systems (GIS) Certification Standards**
   A. **Description:** Establishes foundational GIS mapping skills for conservation, land management, and spatial analysis.
   B. **Use**: Integrates GIS certification for real-world environmental applications.
   C. **Source:** ESRI Certification: https://www.esri.com/

4. **Leadership in Energy and Environmental Design (LEED) Green Associate Standards**
   A. **Description:** Defines principles for sustainable building and renewable energy systems.
   B. **Use:** Prepares students for green technology careers in energy and resource conservation.
   C. **Source:** USGBC LEED: https://www.usgbc.org/leed/

5. **AP Environmental Science Integration:**
   A. **Description:** IAQG establishes quality standards and guidelines for the aerospace industry, focusing on continuous improvement and safety.
   B. **Use:** Align course content with AP Environmental Science standards to facilitate credit transfer and advanced placement.
   C. **Source:** College Board AP Environmental Science: https://apstudents.collegeboard.org/courses/ap-environmental-science/

6. **U.S. Environmental Protection Agency (EPA):**
   A. **Description:** Sustainability and Environmental Engineering Resources.
   B. **Use:** Utilize EPA's guidelines and data for course content and research projects.
   C. **Source:** EPA Education Resources https://www.epa.gov/students/

7. **Occupational Safety and Health Administration (OSHA)**
   A. **Description:** OSHA sets and enforces standards to ensure safe and healthful working conditions.
   B. **Use:** Incorporating OSHA standards into the curriculum ensures that students are aware of safety protocols and regulations pertinent to the aerospace industry.
   C. **Source:** Occupational Safety and Health Administration: https://www.osha.gov/

Course Descriptions

Course Level	Course Information	Description
Required Core: Course 1	Renewable Energy I SCED: <XX> Grades: 9-12 Prerequisite: None Credit: 1	Explore how humans interact with and shape our natural world. This course introduces the science behind ecosystems, renewable energy, and sustainable resource management. Students will discover how biodiversity, pollution control, and resource conservation are interconnected, while learning to use cutting-edge GIS mapping tools to solve real-world environmental challenges. Get ready to dive into the exciting world of environmental systems and leave your mark as a future innovator for a greener planet.
Required Core: Course 2	Renewable Energy II SCED: <XX> Grades: 10-12 Prerequisite: Course I Credit: 1	Building on foundational knowledge, this course focuses on conservation techniques, GIS mapping for environmental projects, and renewable energy technologies such as solar and wind power. All installation work discussed in this course is presented for theory only; Maryland requires a licensed electrician or apprentice for field installations.
Optional Flex: Course 1	Renewable Energy III SCED: <XX> Grades: 11-12 Prerequisite: Courses I and II Credit: 1	This course explores the design, performance analysis, and code-compliant maintenance of solar, wind, and hydro-electric systems. Students practice skills that mirror those required of Maryland electrical apprentices conduit bending, wiring methods, grounding/bonding, and NEC article 690 compliance using lab trainers or virtual-reality simulators. Hands-on field installation is limited to demonstrations under a licensed electrician.

Course Level	Course Information	Description
Optional Flex: Course 2	Career Connected Learning I SCED: <XX> Grades: 11-12 Prerequisite: Courses I and II Credit: 1	This flexible, work-based learning course introduces students to real-world applications of classroom knowledge and technical skills through on-the-job experiences and reflective practice. Students engage in career exploration, skill development, and professional networking by participating in youth apprenticeships, registered apprenticeships, pre-apprenticeships, internships, capstone projects, or other approved career-connected opportunities. Variable credit (1–3) accommodates the required on-the-job training hours and related instruction. By integrating industry standards, employability skills, and personalized learning goals, Career Connected Learning I equips students to make informed career decisions, develop a professional portfolio, and build a strong foundation for success in postsecondary education, training, or the workforce.
Optional Flex: Course 3	Career Connected Learning I SCED: Grades: 11-12 Prerequisite: Career Connected Learning 1 Credit: 1	Building on the foundational experiences of Career Connected Learning I, this advanced work-based learning course provides students with deeper on-the-job practice, leadership opportunities, and refined career exploration. Students continue to enhance their technical and professional skills, expanding their industry networks and aligning personal goals with evolving career interests. Variable credit (1–3) remains aligned with the required training hours and related instruction. Through elevated responsibilities and skill application, Career Connected Learning II prepares students to confidently transition into higher-level postsecondary programs, apprenticeships, or the workforce.

Dual Enrollment and Career Connected Learning Experiences Must be Aligned to the CTE Core.

Industry-Recognized Credentials and Work-Based Learning

Industry-Recognized Credentials – The standards in this document are aligned to the following certifications:
By the end of Course I: OSHA 10-Hour General Industry Outreach Training Chesapeake Bay Landscape Professional (CBLP) Certification **By the end of Course II:** ESRI Geographic Information Systems (GIS) Certification **Optional Credentials (via the Flex Course options):** Photovoltaic Associate (knowledge-based) - NOTE: Field installation for PV Professional requires state electrician license or apprenticeship completion in Maryland.

Work-Based Learning Examples and Resources		
Course I: **Career Awareness**	**Course II:** **Career Preparation**	**Flex Courses:** **Career Preparation**
• Industry Visits • Guest Speakers • Participation in Career and Technical Student Organizations • Postsecondary Visits • Specific Site Tours • Mock Interviews	• All of Career Awareness plus the following: • Job Shadow • Paid and Unpaid Internships • Local Renewable Services Facility Visits	• Paid and Unpaid Internships • Apprenticeships • Dual Enrollment Opportunities

Labor Market Information: Definitions and Data

Labor market information (LMI) plays a crucial role in shaping Career and Technical Education (CTE) programs by providing insights into industry demands, employment trends, and skills gaps. This data helps education leaders assess the viability of existing programs and identify opportunities for new offerings. By aligning CTE programs with real-time labor market needs, schools can better prepare students for in-demand careers and ensure that resources are effectively used to support pathways that lead to high-quality, sustainable employment.

Standard Occupational Code (SOC) and Aligned Industry:

Indicator	Definition	Pathway Labor Market Data
High Wage[1]	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 state of Maryland, and/or leads to a position that pays at least the median hourly or annual wage for the DC-VA-MD-WV Metropolitan Statistical Area (MSA). *Note: A 25th percentile hourly wage of $29.90 or greater is required to meet this definition.*	**Standard Occupational Code:** **447-2111 Electricians** Hourly Wage / Annual Salary • 25th Percentile: $29.90 / $62,192 • 50th Percentile: $34.90 / $72,592 • 75th Percentile: $41.78 / $86,902 **47-2231 Solar Photovoltaic Installers** Hourly Wage / Annual Salary • 25th Percentile: $25.79 / $53,643 • 50th Percentile: $28.73 / $59,758 • 75th Percentile: $34.13 / $71,990
High Skill	Those occupations located within the DC-VA-MD-WV Metropolitan Statistical Area (MSA) with the following education or training requirements: completion of an apprenticeship program; completion of an industry-recognized certification or credential; associate's degree, bachelor's degree, or higher.	**Typical Entry-Level Education:** associate degree in environmental engineering technology, applied sciences, or a related field is typically required. Bachelor's degree in environmental science, biology, chemistry, or a related field is required. Some roles may also require coursework in policy, statistics, or environmental law.
In-Demand	Annual growth plus replacement, across all Maryland occupations, is 405 openings between 2024-2029.	**Annual Openings**

[1] Living Wage Calculator: https://livingwage.mit.edu/states/24

Labor Market Information Data Source

Lightcast Q4 2024 Data Set. Lightcast occupation employment data are based on final Lightcast industry data and final Lightcast staffing patterns. Wage estimates are based on Occupational Employment Statistics (QCEW and Non-QCEW Employees classes of worker) and the American Community Survey (Self-Employed and Extended Proprietors). Occupational wage estimates are also affected by county-level Lightcast earnings by industry. Foundational data for the state of Maryland is collected and reported by the Maryland Department of Labor. olar Photovoltaic Installer positions in Maryland are classified under the electrician licence; wage data shown reflect combined demand

Methodology for High Wage Calculations

To combine labor market data across multiple Standard Occupational Classifications (SOCs), a weighted average approach was used to ensure accurate representation of the marketplace. Median wages for each SOC were weighted based on their respective employment levels, reflecting the relative demand for each occupation. This method ensures that occupations with higher employment contribute proportionately to the overall wage calculation. Additionally, job openings from all relevant SOCs were summed to determine the total projected demand. For example, if Mechanical Engineers account for 67% of total employment and Electrical Engineers for 33%, their respective wages are weighted accordingly, and job openings are aggregated to provide a comprehensive view of labor market opportunities. This approach delivers a balanced and accurate representation of both wages and employment demand for the program.

Methodology for In-Demand Calculations

The baseline for annual job openings, considering new positions and replacement positions, was determined by taking the average of all annual job openings between 2024 and 2029 across all 797 career sectors at the 5-digit SOC code level. For the 2024-2029 period, average job openings (growth + replacement) is 405.

Course Standards: Renewable Energy I

1. **GENERAL REQUIREMENTS** This course is recommended for students in Grades 9-10.

2. **INTRODUCTION**
   A. Career and Technical Education (CTE) instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
   B. The Career Cluster focuses on preparing students for foundational careers in environmental science, renewable energy, resource management, and sustainability engineering. This cluster emphasizes the essential skills needed for careers in energy production, environmental conservation, sustainability management, and geospatial technology. Professionals in this field operate in diverse settings, including renewable energy facilities, environmental research labs, and conservation organizations.
   C. The Renewable Energy (POS) offers students foundational knowledge in environmental systems, renewable resources, and sustainability practices. Students will gain hands-on experience through structured coursework and practical applications, enabling them to explore the essential functions of environmental science and sustainability engineering careers.
   D. Introduction to Renewable Energy I introduces students to foundational topics such as the dynamics of ecosystems, fundamentals of renewable energy, principles of sustainable resource management, and the ethical responsibilities in environmental fields. This course lays the groundwork for understanding the critical role of environmental science and resource management in addressing global challenges such as climate change, biodiversity loss, and energy sustainability.
   E. Students will participate in at least two Career-Connected Education and Work-Based Learning experiences in this course, such as attending guest lectures from environmental scientists, field visits to renewable energy facilities, or participation in local conservation projects.
   F. Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.

3. KNOWLEDGE AND SKILLS

A. **The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:**

1. Identify and demonstrate positive work behaviors that enhance employability, including punctuality, professional appearance, and adherence to protocols.
2. Exhibit effective communication and active listening skills when collaborating on environmental science projects, renewable energy initiatives, and sustainability challenges. This includes presenting technical findings and engaging with diverse audiences such as peers, industry professionals, and community members.
3. Solve problems using critical thinking and decision-making skills, particularly when analyzing data, designing renewable energy solutions, or addressing environmental challenges such as resource conservation, pollution management, and climate adaptation operations.
4. Demonstrate leadership and teamwork skills through group activities, project-based learning, and focused exercises. These may include planning and executing conservation projects, renewable energy installations, or geospatial mapping initiatives.
5. Gain an understanding of ethical and legal responsibilities in environmental science and sustainability professions. This includes addressing environmental regulations, adhering to safety standards, and promoting sustainable practices in compliance with local, state, and federal guidelines.

B. **The student identifies various career pathways. The student is expected to:**

1. Design a career plan that includes a clear pathway for advancement within energy, natural resources, and sustainability engineering careers, highlighting continuous education, certifications, and specialization opportunities in fields such as environmental science, renewable energy, and resource management. Examples may include pathways to roles like Environmental Scientist, Renewable Energy Technician, or Sustainability Engineer.
2. Develop a career plan that includes the necessary education, certifications, job skills, and experience for roles in energy and environmental industries. This plan may outline progression from entry-level technician roles to leadership or specialized positions, such as Environmental Policy Analyst, GIS Specialist, or Environmental Engineering Technologist.
3. Demonstrate effective interview skills for roles in environmental science, sustainability, or renewable energy industries, with a focus on entry-level positions. These skills include articulating knowledge of industry-specific challenges, certifications, and practical experience gained through work-based learning opportunities.

C. **The student develops technology and digital literacy skills. The student is expected to:**
   1. Use technology as a tool for environmental data collection, renewable energy modeling, and geospatial analysis. This includes leveraging tools to simulate energy efficiency, track resource usage, and monitor ecosystem changes.
   2. Apply digital tools for creating and managing technical reports, resource management plans, and project presentations. Students will use platforms such as spreadsheet software for data analysis, presentation software for communication, and cloud-based tools for collaboration.
   3. Demonstrate proficiency in using industry-standard software, including GIS mapping tools, renewable energy design platforms, and environmental impact assessment tools. This includes creating geospatial maps, analyzing renewable energy potential, and modeling sustainable systems.
   4. Adhere to ethical and legal considerations for technology use, including environmental regulations, secure data management, and intellectual property laws. Students will demonstrate responsible practices in using data and tools for environmental projects.

D. **The student integrates core academic skills into practices. The student is expected to:**
   1. Demonstrate the use of clear communication techniques, both written and verbal, that are consistent with industry standards in environmental science, renewable energy, and sustainability practices. This includes presenting findings, collaborating on conservation projects, and delivering technical information effectively to various audiences.
   2. Apply English concepts such as writing technical reports, documenting sustainability projects, and articulating resource management plans and environmental goals. This includes creating well-structured, professional documents that align with industry expectations.
   3. Apply scientific principles relevant to environmental science and renewable energy, including ecosystems dynamics, energy transfer, and the physical properties of renewable systems (e.g., solar panels, wind turbines, and hydropower). Students will also explore principles of chemistry and biology as they relate to pollution control, soil health, and biodiversity.
   4. Recognize the roles and responsibilities of government agencies, environmental regulations, and public policies that impact sustainability and resource management. This includes knowledge of environmental laws, ethical considerations, and regulatory compliance in areas such as water quality, emissions standards, and energy use.
   5. Utilize mathematical skills, including measurement, ratios, and data interpretation, for renewable energy calculations, resource allocation, and data analysis. Students will calculate energy efficiency, interpret graphs of environmental trends, and evaluate the economic viability of sustainable solutions.

E. **The student demonstrates knowledge and skills for environmental science and sustainability scenarios. The student is expected to:**
   1. Describe National Electrical Code (NEC) requirements for renewable-energy system wiring (Article 690) and explain why licensed electricians or supervised apprentices must perform all permanent solar/wind/hydro installations in Maryland.
   2. Demonstrate knowledge of personal protective equipment (PPE) and its proper use in environmental science and renewable energy settings. This includes using PPE such as gloves, goggles, harnesses, and respirators during activities like handling hazardous materials, conducting energy system maintenance, and working in natural resource management.
   3. Recognize the importance of mental and physical fitness for roles in environmental science and sustainability, emphasizing the ability to handle physically demanding tasks such as field research, energy system installations, and emergency response scenarios effectively. This includes fostering resilience and preparedness for safety-critical situations.

Course Standards: Renewable Energy II

1. **GENERAL REQUIREMENTS** This course is recommended for students in Grades 10-11.

2. **INTRODUCTION**
   A. Career and Technical Education (CTE) instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
   B. The Career Cluster focuses on preparing students for foundational careers in environmental science, renewable energy, resource management, and sustainability engineering. This cluster emphasizes the essential skills needed for careers in energy production, environmental conservation, sustainability management, and geospatial technology. Professionals in this field operate in diverse settings, including renewable energy facilities, environmental research labs, and conservation organizations.
   C. The Renewable Energy Program of Study (POS) offers students foundational knowledge in environmental systems, renewable resources, and sustainability practices. Students will gain hands-on experience through structured coursework and practical applications, enabling them to explore the essential functions of environmental science and sustainability engineering careers.
   D. Renewable Energy II expands upon foundational concepts by deepening students' understanding of ecosystem dynamics, advanced renewable energy systems, and sustainable resource management practices. The course emphasizes the application of scientific principles to real-world challenges, such as mitigating climate change, conserving biodiversity, and advancing energy sustainability. Students will explore ethical responsibilities in environmental fields, analyze case studies of global resource issues, and develop innovative solutions for environmental conservation and renewable energy implementation. This course equips students with the advanced knowledge and skills needed to address pressing environmental challenges and drive sustainable development.
   E. Students will participate in at least two Career-Connected Education and Work-Based Learning experiences in this course, such as attending guest lectures from environmental scientists, field visits to renewable energy facilities, or participation in local conservation projects.
   F. Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.

3. **KNOWLEDGE AND SKILLS**
   A. **The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:**
      1. Identify and demonstrate positive work behaviors that enhance employability, including punctuality, professional appearance, and adherence to protocols.
      2. Exhibit effective communication and active listening skills when collaborating in aviation and aerospace projects or responding to industry-specific scenarios.
      3. Solve problems using critical thinking and decision-making skills, particularly during time-sensitive or high-pressure situations in aviation or aerospace operations.
      4. Demonstrate leadership and teamwork skills through group activities, project based learning, and focused exercises.
      5. Demonstrate an understanding of ethical and legal responsibilities in emergency response professions.

   B. **The student identifies career pathways. The student is expected to:**
      1. Design a career plan that includes a clear pathway for advancement within environmental science, renewable energy, and sustainability engineering fields, highlighting opportunities for continuous education, industry certifications, and specialization in roles such as Electrician (Renewable-Energy Specialist) / Electrical Apprentice (*Maryland does not issue a separate 'renewable energy technician' license*.)
      2. Develop a career plan that outlines the necessary education, certifications, job skills, and experience for roles in environmental and energy industries. Explain how a solar-photovoltaic system is installed under the supervision of a licensed electrician, including permitting, NEC compliance, and inspection
      3. Demonstrate effective interview skills for roles in environmental science, renewable energy, or sustainability, with a focus on entry-level positions. These skills include articulating technical knowledge, showcasing work-based learning experiences, and understanding the expectations of industry professionals.

   C. **The student develops technology and digital literacy skills. The student is expected to:**
      1. Use technology as a tool for environmental data collection, renewable energy modeling, and geospatial analysis. This includes leveraging tools to simulate energy efficiency, track resource usage, and monitor ecosystem changes.
      2. Apply digital tools for creating and managing technical reports, resource management plans, and project presentations. Students will use platforms such as spreadsheet software for data analysis, presentation software for communication, and cloud-based tools for collaboration.
      3. Demonstrate proficiency in using industry-standard software, including GIS mapping tools, renewable energy design platforms, and environmental impact assessment tools. This includes creating geospatial maps, analyzing renewable energy potential, and modeling sustainable systems.
      4. Adhere to ethical and legal considerations for technology use, including environmental regulations, secure data management, and intellectual property laws. Students will demonstrate responsible practices in using data and tools for environmental projects.

D. **The student integrates core academic skills. The student is expected to:**
   1. Demonstrate the use of clear communication techniques, both written and verbal, that are consistent with industry standards in environmental science, renewable energy, and sustainability practices. This includes presenting findings, collaborating on conservation projects, and delivering technical information effectively to various audiences.
   2. Apply English concepts such as writing technical reports, documenting sustainability projects, and articulating resource management plans and environmental goals. This includes creating well-structured, professional documents that align with industry expectations.
   3. Apply scientific principles relevant to environmental science and renewable energy, including ecosystems dynamics, energy transfer, and the physical properties of renewable systems (e.g., solar panels, wind turbines, and hydropower). Students will also explore principles of chemistry and biology as they relate to pollution control, soil health, and biodiversity.
   4. Recognize the roles and responsibilities of government agencies, environmental regulations, and public policies that impact sustainability and resource management. This includes knowledge of environmental laws, ethical considerations, and regulatory compliance in areas such as water quality, emissions standards, and energy use.
   5. Use mathematical skills, including measurement, ratios, and data interpretation, for renewable energy calculations, resource allocation, and data analysis. Students will calculate energy efficiency, interpret graphs of environmental trends, and evaluate the economic viability of sustainable solutions.

E. **The student demonstrates knowledge and skills for environmental science and sustainability scenarios. The student is expected to:**
   1. Understand and implement safety protocols to minimize risks during environmental fieldwork, renewable energy installations, and laboratory operations. This includes identifying potential hazards, ensuring proper site assessments, and maintaining safety during conservation and sustainability projects.
   2. Demonstrate knowledge of personal protective equipment (PPE) and its proper use in environmental science and renewable energy settings. This includes using PPE such as gloves, goggles, harnesses, and respirators during activities like handling hazardous materials, conducting energy system maintenance, and working in natural resource management.
   3. Recognize the importance of mental and physical fitness for roles in environmental science and sustainability, emphasizing the ability to handle physically demanding tasks such as field research, energy system installations, and emergency response scenarios effectively. This includes fostering resilience and preparedness for safety-critical situations.

Course Standards: Renewable Energy III

1. **GENERAL REQUIREMENTS** This course is recommended for students in Grades 11-12.

2. **INTRODUCTION**
   A. Career and Technical Education (CTE) instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
   B. The Career Cluster focuses on preparing students for foundational careers in environmental science, renewable energy, resource management, and sustainability engineering. This cluster emphasizes the essential skills needed for careers in energy production, environmental conservation, sustainability management, and geospatial technology. Professionals in this field operate in diverse settings, including renewable energy facilities, environmental research labs, and conservation organizations.
   C. The Renewable Energy Program of Study (POS) offers students foundational knowledge in environmental systems, renewable resources, and sustainability practices. Students will gain hands-on experience through structured coursework and practical applications, enabling them to explore the essential functions of environmental science and sustainability engineering careers.
   D. Renewable Energy III builds on prior coursework by advancing students' expertise in ecosystem dynamics, cutting-edge renewable energy systems, and innovative resource management strategies. This course focuses on solving complex, real-world environmental challenges such as reducing carbon emissions, protecting endangered species, and integrating renewable energy into existing infrastructures. Students will critically evaluate case studies of global sustainability efforts, refine their understanding of ethical and legal responsibilities in environmental practices, and design forward-thinking solutions for conservation and energy efficiency. Through hands-on projects and advanced technical training, this course prepares students to lead initiatives in sustainable development and environmental stewardship.
   E. Students will participate in at least two Career-Connected Education and Work-Based Learning experiences in this course, such as attending guest lectures from environmental scientists, field visits to renewable energy facilities, or participation in local conservation projects.
   F. Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.

3. **KNOWLEDGE AND SKILLS**
   A. **The student demonstrates advanced skills in environmental science, renewable energy, and sustainability practices. The student is expected to:**
      1. Analyze ecosystem dynamics and interpret environmental data to address sustainability challenges, such as biodiversity conservation, water quality, and pollution mitigation.
      2. Perform advanced renewable energy tasks, including designing, simulating, and optimizing solar, wind, and hydroelectric energy systems using industry-standard tools and software.
      3. Operate environmental monitoring equipment and geospatial tools in both simulated and real-world scenarios to collect, analyze, and interpret environmental data for resource management and conservation efforts.
      4. Demonstrate knowledge of renewable energy systems, maintenance practices, and troubleshooting procedures for technologies such as photovoltaic panels, wind turbines, and energy storage systems.

   B. **The student identifies career pathways. The student is expected to:**
      1. Design a career plan that includes a clear pathway for advancement within environmental science, renewable energy, and sustainability engineering fields, highlighting opportunities for continuous education, industry certifications, and specialization roles.
      2. Develop a career plan that outlines the necessary education, certifications, job skills, and experience for roles in environmental and energy industries. This plan may include certifications like GIS, LEED, or Solar System Installation, as well as hands-on experience through internships or work-based learning opportunities.
      3. Demonstrate effective interview skills for roles in environmental science, renewable energy, or sustainability, with a focus on entry-level positions. These skills include articulating technical knowledge, showcasing work-based learning experiences, and understanding the expectations of industry professionals.

   C. **The student develops technology and digital literacy skills. The student is expected to:**
      1. Use technology as a tool for environmental data collection, renewable energy modeling, and geospatial analysis. This includes leveraging tools to simulate energy efficiency, track resource usage, and monitor ecosystem changes.
      2. Apply digital tools for creating and managing technical reports, resource management plans, and project presentations. Students will use platforms such as spreadsheet software for data analysis, presentation software for communication, and cloud-based tools for collaboration.
      3. Demonstrate proficiency in using industry-standard software, including GIS mapping tools, renewable energy design platforms, and environmental impact assessment tools. This includes creating geospatial maps, analyzing renewable energy potential, and modeling sustainable systems.
      4. Adhere to ethical and legal considerations for technology use, including environmental regulations, secure data management, and intellectual property laws. Students will demonstrate responsible practices in using data and tools for environmental projects.

D. **The student integrates core academic skills. The student is expected to:**
   1. Demonstrate the use of clear communication techniques, both written and verbal, that are consistent with industry standards in environmental science, renewable energy, and sustainability practices. This includes presenting findings, collaborating on conservation projects, and delivering technical information effectively to various audiences.
   2. Apply English concepts such as writing technical reports, documenting sustainability projects, and articulating resource management plans and environmental goals. This includes creating well-structured, professional documents that align with industry expectations.
   3. Apply scientific principles relevant to environmental science and renewable energy, including ecosystems dynamics, energy transfer, and the physical properties of renewable systems (e.g., solar panels, wind turbines, and hydropower). Students will also explore principles of chemistry and biology as they relate to pollution control, soil health, and biodiversity.
   4. Recognize the roles and responsibilities of government agencies, environmental regulations, and public policies that impact sustainability and resource management. This includes knowledge of environmental laws, ethical considerations, and regulatory compliance in areas such as water quality, emissions standards, and energy use.
   5. Utilize mathematical skills, including measurement, ratios, and data interpretation, for renewable energy calculations, resource allocation, and data analysis. Students will calculate energy efficiency, interpret graphs of environmental trends, and evaluate the economic viability of sustainable solutions

E. **The student demonstrates knowledge and skills for environmental science and sustainability scenarios. The student is expected to:**
   1. Understand and implement safety protocols to minimize risks during environmental fieldwork, renewable energy installations, and laboratory operations. This includes identifying potential hazards, ensuring proper site assessments, and maintaining safety during conservation and sustainability projects.
   2. Demonstrate knowledge of personal protective equipment (PPE) and its proper use in environmental science and renewable energy settings. This includes using PPE such as gloves, goggles, harnesses, and respirators during activities like handling hazardous materials, conducting energy system maintenance, and working in natural resource management.
   3. Recognize the importance of mental and physical fitness for roles in environmental science and sustainability, emphasizing the ability to handle physically demanding tasks such as field research, energy system installations, and emergency response scenarios effectively. This includes fostering resilience and preparedness for safety-critical situations.

F. **The student prepares for a work-based learning experience by demonstrating professional skills. The student is expected to:**
   1. Develop a professional resume, portfolio, or skills showcase highlighting technical competencies, certifications, and industry-aligned projects in environmental science, renewable energy, and sustainability engineering.
   2. Review and prepare for industry-recognized certifications, such as GIS Certification, Solar System Installation Certification, or Chesapeake Bay Landscape Professional Certification, demonstrating readiness for real-world application.
   3. Practice interview skills and demonstrate knowledge of workplace expectations in environmental and sustainability-focused industries, including renewable energy firms, conservation organizations, and sustainability consulting.
   4. Set career-related goals for a work-based learning experience, identifying specific technical and soft skills to develop and refine for future roles in environmental science, renewable energy, and sustainability engineering.

Course Standards: Career Connected Learning I and II

Career connected learning is an educational approach that integrates classroom instruction with real-world experiences, enabling high school students to explore potential careers and develop relevant skills before graduation. By participating in work-based learning opportunities—such as apprenticeships, internships, capstone projects, and school-based enterprises—students apply academic concepts in authentic settings, gain practical industry knowledge, and build professional networks. This hands-on engagement helps students connect their studies to future career paths, strengthens their problem-solving and communication skills, and supports a smoother transition into college, vocational programs, or the workforce.

All Career and Technical Education Programs of Study include aspects of work-based learning, and almost all the programs include two Career Connected Learning (CCL) courses. Below are the course descriptions for CCL I and CCL II. The CCL standards can be found via this link: