

## Sustainable Energy Alternatives

*Sustainable Energy Alternatives* is a two semester course that broadens a student’s understanding of environmentally friendly energies. In this course students will use a combination of classroom, laboratory, and field experiences to analyze, critique, and design alternative energy systems. Class content and activities center on renewability and sustainability for our planet. Topics covered in this course include the following types of alternative energies: solar, wind, geothermal, biomass and emerging technologies.

### Course Specifications

- DOE Code: 5229
- Recommended Grade Level: Grade 11-12
- Recommended Prerequisites: Introduction to Agriculture, Food and Natural Resources, Natural Resources
- Credits: 1 credit per semester, maximum of 2 credits
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- Pathway Assessment: Dual credit course final exam
- This course is aligned with postsecondary courses for Dual Credit
  - IVY Tech
    - SUST 100 – Introduction to Renewable Energy Systems

#### Dual Credit

This course provides the opportunity for dual credit for students who meet postsecondary requirements for earning dual credit and successfully complete the dual credit requirements of this course.

#### Application of Content and Multiple Hour Offerings

Intensive laboratory applications are a component of this course and may be either school based or work based or a combination of the two. Work-based learning experiences should be in a closely related industry setting. Instructors shall have a standards-based training plan for students participating in work-based learning experiences. When a course is offered for multiple hours per semester, the amount of laboratory application or work-based learning needs to be increased proportionally.

#### Career and Technical Student Organizations (CTSOs)

Career and Technical Student Organizations are considered a powerful instructional tool when integrated into Career and Technical Education programs. They enhance the knowledge and skills students learn in a course by allowing a student to participate in a unique program of career and leadership development. Students should be encouraged to participate in FFA, the CTSO for this area.

### Content Standards

#### Domain-Renewable Energy

**Core Standard 1** Students apply knowledge of renewable resources to the management of those resources.

**Standards**

- SEA-1.1 Differentiate renewable fuels and renewable energy (IvT – SUST 100)
- SEA-1.2 Differentiate renewable, non-renewable, sustainable, and exhaustible (IvT – SUST 100)
- SEA-1.3 Identify natural sources of kinetic, thermal, and light energy (IvT – SUST 100)
- SEA-1.4 Evaluate the impact of alternative energy sources on the environment.
- SEA-1.5 Explain the “green” movement (IvT – SUST 100)
- SEA-1.6 Compare appropriate energy sources per setting (IvT – SUST 100)
- SEA-1.7 Identify advantages and disadvantages to alternative energy sources
- SEA-1.8 Evaluate the impact of alternative energy sources on the environment
- SEA-1.9 Identify and describe various forms of energy
- SEA-1.10 Explain how converting to green energy would affect the agriculture industry
- SEA-1.11 Explain how converting to green energy would affect costs to producers and consumers

**Domain-Solar Energy**

**Core Standard 2** Students apply concepts of renewable resources to solar energy.

**Standards**

- SEA-2.1 Investigate passive environmental systems (IvT – SUST 100)
- SEA-2.2 Contrast photovoltaic system performances (IvT – SUST 100)
- SEA-2.3 Monitor a photovoltaic system output to effective lumen ratio (IvT – SUST 100)
- SEA-2.4 Demonstrate solar heat systems performance (IvT – SUST 100)
- SEA-2.5 Describe solar energy and how it is harnessed
- SEA-2.6 Explain the difference between passive solar and active solar
- SEA-2.7 Evaluate the advantages and disadvantages of using solar energy
- SEA-2.8 Describe basic solar movement and effect of the Earth’s tilt
- SEA-2.9 Predict solar position using solar path diagrams
- SEA-2.10 Describe how a photovoltaic solar cell works
- SEA-2.11 Identify factors that reduce/enhance solar irradiation

**Domain-Wind Energy**

**Core Standard 3** Students apply concepts of alternative energy resources to wind energy.

**Standards**

- SEA-3.1 Research varying wind energy systems (IvT – SUST 100)
- SEA-3.2 Design small wind blades using common materials (IvT – SUST 100)
- SEA-3.3 Investigate site issues for wind energy systems (IvT – SUST 100)
- SEA-3.4 Describe wind energy and the way it is harnessed
- SEA-3.5 Explain why farmers and ranchers are amenable to wind technology
- SEA-3.6 Evaluate the advantages and disadvantages to wind technology
- SEA-3.7 Compare topography of different quadrangles and geographical features that could affect wind conditions
- SEA-3.8 Evaluate short term weather conditions and their implications on wind turbines

## **Domain-Geothermal Energy**

**Core Standard 4** Students discover geothermal energy as an alternative energy resource.

### **Standards**

- SEA-4.1 Differentiate geothermal power and geothermal heat (IvT – SUST 100)
- SEA-4.2 Describe geothermal heat set-up parameters (IvT – SUST 100)
- SEA-4.3 Describe geothermal energy and the way it is harnessed
- SEA-4.4 Evaluate the advantages and disadvantages of using geothermal energy
- SEA-4.5 Analyze a diagram of a geothermal power plant

## **Domain-Biomass Systems**

**Core Standard 5** Students evaluate various aspects of biomass systems as alternative energy resources.

### **Standards**

- SEA-5.1 Compare potential biomass feedstock (IvT – SUST 100)
- SEA-5.2 Identify limiting factors of the use of biomass for energy (IvT – SUST 100)
- SEA-5.3 Describe anaerobic digestion (IvT – SUST 100)
- SEA-5.4 Model a small scale Anerobic Digestion closed-loop system (IvT – SUST 100)
- SEA-5.5 Describe the process used in producing alcohol from biomass
- SEA-5.6 Produce alcohol and co-products from biomass
- SEA-5.7 Explain the process of transesterification
- SEA-5.8 Diagram the process used in producing biodiesel from biomass
- SEA-5.9 Explain the process of fermentation
- SEA-5-10 Explain the process of methanogenesis
- SEA-5.11 Illustrate the process used in producing methane from biomass
- SEA-5.12 Produce methane and co-products from biomass
- SEA-5.13 Describe the scientific principles related to composting
- SEA-5.14 Explain biomass and sources of biomass
- SEA-5.15 Assess the characteristics of biomass that make it useful for biofuels production
- SEA-5.16 Evaluate the technologies used to create biofuels from biomass

## **Domain-Emerging Technologies**

**Core Standard 6** Students research emerging renewable energy resource technologies.

### **Standards**

- SEA-6.1 Research other renewable sources of energy (IvT – SUST 100)
- SEA-6.2 Critique viability of other systems (IvT – SUST 100)
- SEA-6.3 Research storage issues and possibilities (IvT – SUST 100)
- SEA-6.4 Describe hydroelectric generaton techniques and procedures
- SEA-6.5 Discuss the feasibility of new and emerging energy resources
- SEA-6.6 Discuss emerging and alternative electric power generation technologies and fuel sources
- SEA-6.7 Diagram biogeochemical cycles and explain the processes

## **Domain - Careers**

**Core Standard 7** Students examine the scope of career opportunities in and the importance of agriculture to the economy.

**Standards**

- SEA-7.1 Define and explore environmental and natural resource agriculture and environmental and natural resource agribusiness and their role in the economy
- SEA-7.2 Evaluate and explore the environmental and natural resource career opportunities in agriculture
- SEA-7.3 Identify how key organizational structures and processes affect organizational performance and the quality of products and services
- SEA-7.4 Demonstrate those qualities, attributes and skills necessary to succeed in, or further prepare for, a chosen career while effectively contributing to society

**Domain - Leadership**

**Core Standard 8** Students validate the necessity of leadership skills development in conjunction with participation in The National FFA Organization (FFA) as a critical component to a well rounded agricultural education.

**Standards**

- SEA-8.1 Acquire and demonstrate communication skills such as writing, public speaking, and listening while refining oral, written, and verbal skills
- SEA-8.2 Recognize and explain the role of the FFA in the development of leadership, education, employability, communications and human relations skills
- SEA-8.3 Examine roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment
- SEA-8.4 Acquire the skills necessary to positively influence others
- SEA-8.5 Develop a skill set to enhance the positive evolution of the whole person

**Domain - Supervised Agriculture Experience**

**Core Standard 9** Students validate the necessity of a Supervised Agricultural Experience (SAE) program as a critical component to a well rounded agricultural education.

**Standards**

- SEA-9.1 Explain the nature of and become familiar with those terms related to an SAE program
- SEA-9.2 Explore the numerous possibilities for an SAE program which a student might develop
- SEA-9.3 Develop an individual SAE program and implement record keeping skills