Foundations of Energy

PEIMS Code: N1300263
Abbreviation: FOUNDEN
Grade Level(s): 9-12
Award of Credit: 1.0

Approved Innovative Course

- Districts must have local board approval to implement innovative courses.
- In accordance with Texas Administrative Code (TAC) §74.27, school districts must provide instruction in all essential knowledge and skills identified in this innovative course.
- Innovative courses may only satisfy elective credit toward graduation requirements.
- Please refer to TAC §74.13 for guidance on endorsements.

Course Description:

*Foundations of Energy* provides students with the fundamentals of Texas energy resources from conventional, unconventional, and renewable sources. Students develop knowledge and skills regarding career and educational opportunities in the production, transmission, and use of energy in Texas, including import and export markets for energy.

Essential Knowledge and Skills:

(a) General Requirements This course is recommended for students in Grades 9-12. Students shall be awarded one credit for successful completion of the course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and success in current or emerging energy professions.

(2) 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.

(3) In *Foundations of Energy*, students will conduct laboratory and field investigations, use scientific practices during investigations, and make informed decisions using critical thinking and scientific problem solving. Various systems will be described in terms of energy. Students will study a variety of topics that include energy transformation, the Law of the Conservation of Energy, energy efficiency, interrelationships among energy resources and society, sources and flow of energy through the production, transmission, processing, and use of energy. Students will apply these concepts and perform investigations and experiments at least 40% of the time using safe practices.
(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and Skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) evaluate the importance of dressing appropriately, speaking politely, and conducting oneself in a manner appropriate for the profession;
(B) cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome;
(C) present written and oral communication in a clear, concise, and effective manner;
(D) demonstrate time-management skills by prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results;
(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed;
(F) discuss and exhibit teamwork and leadership skills necessary for the workplace;
(G) define and demonstrate effective problem-solving skills; and
(H) apply computer-based skills and other technologies relevant to the energy industry.

(2) The student analyzes current and future career opportunities in the energy sector, including oil and gas exploration and production, refining and chemical processing, and renewable energy. The student is expected to:

(A) evaluate energy systems and identify careers within those systems;
(B) examine past market and employment trends in the energy sector;
(C) discuss current issues in energy production and predict future needs and employment opportunities in this field;
(D) identify career development, education, credentialing, and entrepreneurship opportunities in the energy sector; and
(E) apply competencies related to resources, information, and systems of operation in the energy sector.

(3) The student conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:

(A) demonstrate safe practices during laboratory and field investigations;
(B) use a wide variety of additional course apparatuses, equipment, techniques, and procedures as appropriate such as satellite imagery and other remote sensing data, Geographic Information Systems (GIS), Global Positioning System (GPS), scientific probes, microscopes,
(4) The student uses critical thinking and problem solving to make informed decisions within and outside the classroom. The student is expected to:

(A) communicate and present valid conclusions from energy information extracted from various sources such as current events, news reports, published journal articles, and marketing materials;

(B) explain the impacts of energy discoveries by a variety of historical and contemporary scientists and entrepreneurs on current societal attitudes; and

(C) compare advantages and disadvantages in the use of the various energy sources; and

(D) distinguish between scientific decision-making (scientific methods) and ethical and social decisions that involve science (the application of scientific information).

(5) The student presents conclusions, research findings, and designs using a variety of media throughout the course. The student is expected to:

(A) develop written and oral presentation skills related to energy issues and solutions by researching and describing the history of energy production in Texas and contributions of scientists and entrepreneurs; and

(B) develop data retrieval and analysis skills related to energy production and use by researching information about energy sources, including renewable and non-renewable sources, and energy efficiency, and how each source is used to produce electrical energy.

(6) The student examines and explains of concepts and procedures, related to energy. The student is expected to:

(A) identify general purposes for energy, including transportation, light, cooking, heating or cooling, entertainment, and cleaning;

(B) explain and demonstrate transformations among various energy forms, including potential, kinetic, chemical, mechanical, electrical, and light energy;

(C) analyze the role of gravity in transforming energy;

(D) investigate and calculate the relationship between work, potential energy, and kinetic energy;

(E) examine various types of energy transfer mechanisms and determine the original form of energy and what form that energy is being transformed into and use examples to analyze and calculate the relationships among work, kinetic energy, and potential energy;

(F) describe and apply the law of conservation of energy; and
(G) use basic calorimetry to determine the amount of energy stored in substances such as coal.

(7) The student understands fluid mechanics basics related to energy discovery, production, and transportation. The student is expected to:
   (A) identify fluids used as fuels, including liquids and gases;
   (B) identify fluids used in the discovery, production, and transportation of energy sources;
   (C) explain capillary action and relate it to energy production; and
   (D) explain, using formulas, how pressure and temperature affect the behavior of fluids.

(8) The student understands how and where energy is produced and identifies Texas energy resources. The student is expected to:
   (A) research the location of energy resources and power production plants in Texas;
   (B) compile information on the history of energy production in Texas and describe its past and current importance to the U.S. economy;
   (C) investigate the role of technology in the future development of energy usage;
   (D) identify ways to conserve energy;
   (E) map the major sources of energy used in Texas;
   (F) assess the impact of the various energy sources on the economy in Texas;
   (G) analyze how supply and demand impacts Texas’s economy in relation to energy; and
   (H) compare and contrast impact of energy sources and supply demand in Texas with the national and global data.

(9) The student investigates how energy resources such as water, oil, and natural gas are stored underground in rock formations. The student is expected to:
   (A) assess the properties and geological histories of rocks and rock formations that enable energy storage;
   (B) determine the physical properties of permeability and porosity of rock formations and relate these properties to the amount of water, oil, and natural gas held in these formations;
   (C) explain how aquifers function and locate major aquifers in Texas; and
   (D) investigate how innovations such as hydraulic fracturing (fracking) and high power transmission lines, have made massive energy resources such as oil and gas and wind and electricity, available in Texas.

(10) The student knows differences between renewable and non-renewable resources. The student is expected to:
   (A) identify and describe various renewable and non-renewable resources;
(B) describe and compare the energy efficiency of renewable and non-renewable energy derived from natural and alternative sources such as oil, natural gas, coal, nuclear, solar, geothermal, hydroelectric, and wind;

(C) examine the benefits and hazards of using renewable and non-renewable energy sources;

(D) research methods by which benefits can be increased and hazards reduced in the use of renewable and non-renewable energy sources;

(E) examine different viewpoints of an energy source regarding availability, cost, potential pollution, impact to plant and animal habitat, and sustainability;

(F) analyze an energy source’s relative availability and renewability and discuss how these factors inform decision-making regarding a source’s use; and

(G) analyze changing social perspectives and how they can influence scientific practices.

(11) The student knows how energy impacts the student’s life and the role energy plays in international relations, environment, standard of living, and the economy. The student is expected to:

(A) analyze the impact energy has on the environment;

(B) research and discuss the ethical and social issues surrounding Earth’s energy resources;

(C) analyze the advantages and disadvantages of an energy source’s long-term use;

(D) explain the relationship between energy and quality of life;

(E) research and describe the connection between energy production, transmission, processing, and marketing; and

(F) analyze the impact and effectiveness of the measures taken by the United States and other countries to use energy to reduce greenhouse gases, improve water and air quality, and extend life expectancy.

(12) The student investigates extended learning experiences such as career and technical student organizations and area energy museums and displays. The student is expected to:

(A) identify a minimum of three energy professionals for potential speaking invitations either in person or via the internet;

(B) research and describe an energy-related organization such as a museum or local business; and

(C) compare educational requirements for different energy industry jobs in Texas.

Recommended Resources and Materials:

Textbooks:


Nepris - Connecting Industry to Classrooms https://www.nepris.com for internet-based classroom discussions with industry professionals.

Energy Education Resources: https://www.txng.org/education-resources/. The first tab lists energy curriculum resources; the second tab lists Texas energy museums and other knowledge resources and the third tab lists available energy scholarships.


https://study.com/academy/lesson/what-is-a-renewable-energy-source-definition-example-quiz.html

https://circuitdigest.com/electronics-projects

Equipment:

- General Soldering Equipment
Foundations of Energy

- Personal Protective Equipment - Class E and G Hardhats, steel toe cover, Fluke/Greenlee Multimeter

Supplies:
- Arduino Uno
- Arduino integrated development environment (IDE) - free for download
- Breadboards
- Jumpwires
- LEDs
- Resistors
- Wire cutters
- 9-volt battery pack
- SunFounder RAB 5 in 1 Breadboard Holder Base Plate Circuit Board Screws for Arduino Uno R3 Mega 2560 Raspberry Pi 3 Model B

**Recommended Course Activities:**

Activities will be based on the course standards. At least 60% of the course will be hands-on learning through lab and other engaging activities.

- The student collects data to determine the relationship between height and gravitational potential energy.
- The student participates in a mock town hall meeting. Each student is randomly assigned a part to play. After assigning their parts, the student’s research all sides of the issue, discuss with like-minded citizens of the community what their opinions are, and come up with a statement that expresses their viewpoint.
- The student participates in hands-on activities such as Arduino/Electronic Projects and basic programming.
- The student participates in CareerSafe Occupational Safety and Health Administration in General Industry training and certification.
- The student interacts with invited energy professionals in group and/or one-on-one classroom settings or interactively over the internet.

**Suggested methods for evaluating student outcomes:**

- Presentations, reports, infomercials and foldables
- Written/oral responses to quizzes
- Evaluations of contribution to group assignments by team members

**Teacher qualifications:**

- Secondary Industrial Technology: Grades 6-12
- Technology Education: Grades 6-12
- Trade and Industrial Education: Grades 6-12 with appropriate work approval as identified on the certificate OR Grades 8-12 with appropriate work approval as identified on the certificate
- Vocational Trades and Industry with appropriate work approval as identified on the certificate
- Agriculture, Food, and Natural Resources: Grades 6-12
- Agricultural Science and Technology: Grades 6-12
- Any vocational agriculture certificate

Additional information: