2023 Energy Technology

Program CIP: 15.0503 — Energy Management and Systems Technology/Technician

Direct inquiries to:

Instructional Design Specialist
Research and Curriculum Unit
P.O. Drawer DX
Mississippi State, MS 39762
662.325.2510
helpdesk@rcu.msstate.edu

Program Supervisor
Office of Career and Technical Education
Mississippi Department of Education
P.O. Box 771
Jackson, MS 39205
601.359.3974

Published by:

Office of Career and Technical Education
Mississippi Department of Education
Jackson, MS 39205

Research and Curriculum Unit
Mississippi State University
Mississippi State, MS 39762

The Research and Curriculum Unit (RCU), located in Starkville, as part of Mississippi State University (MSU), was established to foster educational enhancements and innovations. In keeping with the land-grant mission of MSU, the RCU is dedicated to improving the quality of life for Mississippians. The RCU enhances the intellectual and professional development of Mississippi students and educators while applying knowledge and educational research to the lives of the people of the state. The RCU works within the contexts of curriculum development and revision, research, assessment, professional development, and industrial training.

Table of Contents

Acknowledgments

The Energy Technology curriculum was presented to the Mississippi State Board of Education on April 19, 2023. The following persons were serving on the state board at the time:

Mr. Michael D. Kent, interim state superintendent of education
Mrs. Rosemary G. Aultman, chair
Mr. Glen V. East, vice-chair
Ms. Mary Werner
Dr. Ronnie L. McGehee
Dr. Wendi Barrett
Mr. Matt Miller
Mr. Bill Jacobs
Ms. Micah Hill, student representative
Mr. Charlie Fruge', student representative

The following Mississippi Department of Education (MDE) and RCU managers and specialists assisted in the development of the Energy Technology curriculum:

Wendy Clemons, the associate state superintendent of the MDE Office of Secondary, Professional Development, and Career Technical Education, supported the RCU and teachers throughout the development of the framework and supporting materials.
Josh Stanford, the energy technology program supervisor of the MDE Office of CTE, supported the RCU and teachers throughout the development of the framework and supporting materials.
Betsey Smith, the director of the RCU, supported RCU staff and teachers throughout the development of this framework and supporting materials.
Courtney McCubbins, the curriculum manager of the RCU, supported RCU staff and teachers throughout the development of this framework and supporting materials.
Nathan King, a project manager with the RCU, researched and coauthored this framework.
Rob Fyke, a project manager with the RCU, researched and coauthored this framework.

Special thanks are extended to the educators who contributed to the development and revision of this framework and supporting materials:

James Ross, Hinds Community College — Vicksburg Warren Campus, Vicksburg

Appreciation is expressed to the following professionals who provided guidance and insight throughout the development process:

Dr. Sumesh M. Arora, Program Manager, Diversity & Workforce Strategies, Entergy Corporation
Gary D. Beeland, Central Area Director, Mississippi Construction Education Foundation (MCEF)
Dr. Thomas Brooks, CTE Director, Gulfport High School
Lisa Campbell, Energy Education and Outreach Program Manager — Energy and Natural Resources Division, Mississippi Development Authority
Regmon Chaney, Program Manager, Workforce Development, Entergy Corporation
David Cress, director of Innovative Programs, MDE Office of Career and Technical Education (CTE)
Mark Foster, Utility Foreman, Entergy Mississippi, LLC
Tori Gieger, Communications/Education Facilitator, Cooperative Energy
Ann Holland, Representative, Mississippi Power Company
Randy Miller, Operations and Maintenance Manager — Plant Ratcliffe, Mississippi Power Company
Derek Read, CTE Director and Dean of Workforce Education, College and Career Technical Institute (CCTI), Pascagoula Gautier School District
Walt Skupien, Engineer, Mississippi Power Company
Dr. Apryl Trimble-Washington, Secondary Director, Hinds Community College Vicksburg-CTE Secondary John H. Wilbanks, President, Mississippi Solar, LLC

Standards

Standards and alignment crosswalks are referenced in the appendix. Depending on the curriculum, these crosswalks should identify alignment to the standards mentioned below, as well as possible related academic topics as required in the Subject Area Testing Program in Algebra I, Biology I, English II, and U.S. History from 1877, which could be integrated into the content of the units. Mississippi's CTE energy technology is aligned to the following standards:

International Society for Technology in Education Standards (ISTE)
Reprinted with permission from *ISTE Standards for Students* (2016). All rights reserved. Permission does not constitute an endorsement by ISTE.
iste.org

National Center for Construction Education and Research (NCCER) Core Standards
The NCCER Core standards covers the basic knowledge and skills necessary for students entering the construction and manufacturing field.
nccer.org/workforce-development-programs/disciplines/craft-details/core

Next Generation Science Standards (NGSS)
NGSS Lead States. 2013. *Next Generation Science Standards: For States, By States.* Washington, DC: The National Academies Press. The NGSS were developed by educators, content experts and policymakers, using as a guiding document *A Framework for K-12 Science Education* from the National Research Council. The K-12 academic standards in science were developed by and for educators and school leaders. An alignment crosswalk can be viewed at the end of this document.

National Energy Education Development Project (NEED)
NEED intends to implement comprehensive energy education within our public school systems. It calls attention to the need for a reducing our dependence on fossil fuels and the necessity for increasing the use of renewable energy technologies and energy efficiency. It promotes an energy-conscious and educated society by creating effective networks of students, educators, businesses, government, and community leaders to design and deliver objective, multi-sided energy education programs. NEED works with energy companies, agencies, and organizations to bring balanced energy programs to the nation's schools with a focus on strong teacher professional development, timely and balanced curriculum materials, signature program capabilities and turn-key program management.

College- and Career-Readiness Standards
College- and career-readiness standards emphasize critical thinking, teamwork, and problem-solving skills. Students will learn the skills and abilities demanded by the workforce of today and the future. Mississippi adopted Mississippi College- and Career-Readiness Standards (MCCRS) to provide a consistent, clear understanding of what students are expected to learn and so teachers and parents know what they need to do to help them.
mdek12.org/oae/college-and-career-readiness-standards

Framework for 21st Century Learning

In defining 21st-century learning, the Partnership for 21st Century Skills has embraced key themes and skill areas that represent the essential knowledge for the 21st century: global awareness; financial, economic, business, and entrepreneurial literacy; civic literacy; health literacy; environmental literacy; learning and innovation skills; information, media, and technology skills; and life and career skills.
battelleforkids.org/networks/p21/frameworks-resources

Preface

Secondary CTE programs in Mississippi face many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing applied learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments. This document provides information, tools, and solutions that will aid students, teachers, and schools in creating and implementing applied, interactive, and innovative lessons. Through best practices, alignment with national standards and certifications, community partnerships, and a hands-on, student-centered concept, educators will be able to truly engage students in meaningful and collaborative learning opportunities.

The courses in this document reflect the statutory requirements as found in Section 37-3-49, *Mississippi Code of 1972*, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, Ch. 487, §14; Laws, 1991, Ch. 423, §1; Laws, 1992, Ch. 519, §4 eff. from and after July 1, 1992; Strengthening Career and Technical Education for the 21st Century Act, 2019 [Perkins V]; and Every Student Succeeds Act, 2015).

Mississippi Teacher Professional Resources

The following are resources for Mississippi teachers:

Curriculum, Assessment, Professional Learning
: Program resources can be found at the RCU's website, rcu.msstate.edu.

Learning Management System: An Online Resource
: Learning management system information can be found at the RCU's website, under Professional Learning.

Should you need additional instructions, contact the RCU at 662.325.2510 or helpdesk@rcu.msstate.edu.

Executive Summary

Pathway Description
Energy Technology is a pathway in the Science, Technology, Engineering, and Mathematics (STEM) cluster. This course covers how to obtain employment in energy-related occupations regarding electrical leadership, power generation, transmission, and distribution operations. Upon completion of this course, the students will explain the flow of energy from generation through distribution to the customer. They will discover emerging technologies designed to automate and to incorporate into a Smart Grid system. The curriculum framework for this program was developed in partnership with the Mississippi Construction Education Foundation (MCEF). MCEF is the accredited sponsor for NCCER. An NCCER Core certification and a Center for Energy Workforce Development (CEWD) Energy Industry Fundamentals (EIF) certification can be achieved while enrolled in this course.

College, Career, and Certifications
The energy technology industry can be found throughout Mississippi. There are numerous community colleges and universities that offer educational programs to prepare students for higher-wage occupations in the energy technology industrial sector. The fundamental goal for this course is to prepare students for an entry-level position in many of the energy technology-related occupations across the state. If the student considers pursuing further education, then they enter the second half of the energy technology pathway equipped with an NCCER Core certification and a CEWD issued EIF certification.

Grade Level and Class Size Recommendations
It is recommended that students enter this program as freshmen, sophomores, or juniors. Exceptions to this are a district-level decision based on class size, enrollment numbers, student maturity, and CTE delivery method. This is a hands-on, lab- or shop-based course. Therefore, a maximum of 15 students recommended per class, with only one class with the teacher at a time.

Student Prerequisites

For students to experience success in the program, the following student prerequisites are suggested:

1. C or higher in English (the previous year)
2. C or higher in high school-level math (last course taken or the instructor can specify the level of math instruction needed)
3. Instructor approval and Test of Adult Basic Education (TABE) reading score (eighth grade or higher)

or

1. TABE reading and math score (eighth grade or higher)
2. Instructor approval

or

1. Instructor approval

Assessment
The latest assessment blueprint for the curriculum can be found at rcu.msstate.edu/curriculum/curriculumdownload.

Applied Academic Credit
The latest academic credit information can be found at mdek12.org/ese/approved-course-for-the-secondary-schools.

Teacher Licensure
The latest teacher licensure information can be found at mdek12.org/oel/apply-for-an-educator-license.

Professional Learning
If you have specific questions about the content of any training sessions provided, please contact the RCU at 662.325.2510 or helpdesk@rcu.msstate.edu.

Course Outlines

Option 1 — Two 1-Carnegie Unit Courses

This curriculum consists of two 1-credit courses that should be completed in the following sequence:

1. **Energy Technology Core—Course Code: 994202**
2. **Fundamentals of Energy Technology—Course Code: 994203**

Course Description: Energy Technology Core
Energy Technology Core inspires students to match their interests to obtaining a life-long leadership career in the energy industry that is fulfilling. It covers employability skills, fundamentals of student organizations, communication skills, basic safety, construction math, hand and power tools, construction and engineering drawings, reading blueprints, materials handling, and rigging while guiding the students toward receiving an NCCER Core certification. Job shadowing, apprenticeship programs, and on-the-job training are the initial focus of this course.

Course Description: Fundamentals of Energy Technology
Fundamentals of Energy Technology introduces the students to power generation, transmission, and distribution systems that are used to support the global energy infrastructure. Students enrolled in this course could potentially to receive a CEWD EIF certificate. This course covers the history and organization of the energy technology industry, workplace procedural safety and first aid response, electric power generation, electric power transmission, electric power distribution, energy careers, and efficiency in conservation. It introduces OSHA regulations and utility company procedures, as well as explains electric power generation equipment/systems, alternative technologies, and renewable energy (RE) fuel sources (i.e., solar, wind, geothermal, biomass, ocean wave).

Energy Technology Core—Course Code: 994202

Unit	Unit Title	Hours
1	Orientation	4
2	Employability Skills	8
3	Fundamentals of Student Organizations	4
4	Communication Skills	8
5	General Safety	35
6	Introduction to Construction Math	15
7	Hand and Power Tools	22
8	Introduction to Construction and Engineering Drawings	15
9	Introduction to Materials Handling	8
10	Introduction to Rigging	21
Total		**140**

Fundamentals of Energy Technology—Course Code: 994203

Unit	Unit Title	Hours
11	History and Organization of the Energy Technology Industry	34
12	Workplace Procedural Safety and First Aid Response	46
13	Electric Power Generation	26
14	Electric Power Transmission	12
15	Electric Power Distribution	14
16	Energy Careers	4
17	Efficiency in Conservation	4
Total		**140**

Option 2 — One 2-Carnegie Unit Course

This curriculum consists of one 2-credit course that should be completed in the following sequence:

Energy Technician I—Course Code: 994200

Course Description: Energy Technician I
The Energy Technician I course inspires students to match their interests to obtaining a life-long leadership career in the energy industry that is fulfilling. It covers employability skills, fundamentals of student organizations, communication skills, basic safety, construction math, hand and power tools, construction and engineering drawings, reading blueprints, materials handling, and rigging while guiding the students toward receiving an NCCER Core certification. Job shadowing, apprenticeship programs, and on-the-job training are the initial focus of this course. Safety rules for working in a shop/lab and how those rules relate to the energy industry workplace environment will be introduced. This Energy Technician I course introduces the students to power generation, transmission, and distribution systems that are used to support the global energy infrastructure. Students enrolled in this course could potentially receive a CEWD EIF certificate. This course covers the history and organization of the energy technology industry, workplace procedural safety and first aid response, electric power generation, electric power transmission, electric power distribution, energy careers, and efficiency in conservation. It introduces OSHA regulations and utility company procedures, as well as explaining electric power generation equipment/systems, alternative technologies, and renewable energy (RE) fuel sources (i.e., solar, wind, geothermal, biomass, ocean wave).

Energy Technician I—Course Code: 994200

Unit	Unit Title	Hours
1	Orientation	4
2	Employability Skills	8
3	Fundamentals of Student Organizations	4
4	Communication Skills	8
5	General Safety	35
6	Introduction to Construction Math	15
7	Hand and Power Tools	22

8	Introduction to Construction and Engineering Drawings	15
9	Introduction to Materials Handling	8
10	Introduction to Rigging	21
11	History and Organization of the Energy Technology Industry	34
12	Workplace Procedural Safety and First Aid Response	46
13	Electric Power Generation	26
14	Electric Power Transmission	12
15	Electric Power Distribution	14
16	Energy Careers	4
17	Efficiency in Conservation	4
Total		**280**

Career Pathway Outlook

Overview

The science, technology, engineering & mathematics career cluster covers a broad range of occupations related to the distribution, transmission, and generation of energy. According to the U.S. Department of Energy, all industries within the energy technology sector experienced net-positive job growth in 2021. The Annual U.S. Energy and Employment Report (USEER), based on surveys of approximately 33,000 private energy businesses combined with public labor data to produce estimates of employment and workforce characteristics, shows that the energy jobs sector experienced positive job growth increasing by 4.0% from 2020 to 2021. This outpaced overall U.S. employment, which climbed 2.8% in the same period. Overall, the total number of energy jobs increased to more than 7.8 million in 2021, after a steep decline in 2020. Solar energy jobs increased by 5.4%, adding 17,212 new jobs. Wind energy jobs increased by 2.9%, adding 3,347 new jobs. Energy efficiency jobs increased by 2.7%, adding 57,741 new jobs. Energy transmission, distribution, and storage jobs increased by 1.9%, adding 22,779 new jobs. To date, the U.S. Bureau of Labor Statistics indicates that currently nationwide there are approximately 124,000 electrical power-line installers and repairers. Also, they forecast that solar photovoltaic installers will be one of the top five fastest-growing occupations through 2030 and are expected to grow by 52% and pay nearly $48,000 per year.

The NCCER Core and CEWD EIF certifications attained through this course will prepare students for careers at the professional and technical levels in energy technology. Students enrolled in these courses should be better prepared to pursue degrees at the community college and four-year college levels.

Needs of the Future Workforce

Data for this synopsis were compiled from the Mississippi Department of Employment Security (2022). Employment opportunities for each of the occupations are listed below:

Table 1.1: Current and Projected Occupation Report

Description	Jobs, 2018	Projected Jobs, 2028	Change (Number)	Change (Percent)	Average Hourly Earnings, 2022
Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	230	230	0	0%	$35.08
Electrical Power-Line Installers and Repairers	2,050	2,140	90	4.4%	$31.09
Telecommunications Line Installers and Repairers	920	1,140	220	23.9%	$23.06
First-Line Supervisors of Mechanics, Installers, and Repairers	4,490	4,630	140	3.1%	$31.67
Electrical Engineers	1,120	1,140	20	1.8%	$43.65

Electrical and Electronics Engineering Technicians	1,040	1,060	20	1.9%	$28.29
Electricians	5,470	5,990	520	9.5%	$26.08
Helpers—Electricians	800	850	50	6.3%	$16.14
Helpers—Pipelayers, Plumbers, Pipefitters, and Steamfitters	430	490	60	14%	$15.12
Electrical, Electronic, and Electromechanical Assemblers, Except Coil Winders, Tapers, and Finishers	2,260	2,260	0	0%	$18.57

Source: Mississippi Department of Employment Security; mdes.ms.gov (2022).

Perkins V Requirements and Academic Infusion

The Energy Technology curriculum meets Perkins V requirements of introducing students to and preparing them for high-skill, high-wage occupations in energy technology fields. It also offers students a program of study, including secondary, postsecondary, and institutions of higher learning courses, that will further prepare them for energy technology careers. Additionally, this curriculum is integrated with academic college- and career-readiness standards. Lastly, it focuses on ongoing and meaningful professional development for teachers as well as relationships with industry.

Transition to Postsecondary Education

The latest articulation information for secondary to postsecondary can be found at the Mississippi Community College Board website, mccb.edu.

Best Practices

Innovative Instructional Technologies
Classrooms should be equipped with tools that will teach today's digital learners through applicable and modern practices. The energy technology educator's goal should be to include teaching strategies that incorporate current technology. To make use of the latest online communication tools—wikis, blogs, podcasts, and social media platforms, for example—the classroom teacher is encouraged to use a learning management system that introduces students to education in an online environment and places more of the responsibility of learning on the student.

Differentiated Instruction
Students learn in a variety of ways, and numerous factors—students' background, emotional health, and circumstances, for example—create unique learners. By providing various teaching and assessment strategies, students with various learning preferences can have more opportunities to succeed.

CTE Student Organizations
Teachers should investigate opportunities to sponsor a student organization. There are several here in Mississippi that will foster the types of learning expected from the Energy Technology curriculum. SkillsUSA and Technology Student Association (TSA) are examples of student organizations with many outlets for energy technology. Student organizations provide participants and members with growth opportunities and competitive events. They also open the doors to the world of energy technology careers and scholarship opportunities.

Cooperative Learning
Cooperative learning can help students understand topics when independent learning cannot. Therefore, you will see several opportunities in the Energy Technology curriculum for group work. To function in today's workforce, students need to be able to work collaboratively with others and solve problems without excessive conflict. The Energy Technology curriculum provides opportunities for students to work together and help each other complete complex tasks. There are many field experiences within the energy technology curriculum that will allow and encourage collaboration with professionals currently in the energy technology field.

Work-Based Learning
Work-based learning is an extension of understanding competencies taught in the energy technology classroom. This curriculum is designed in a way that necessitates active involvement by the students in the community around them and the global environment. These real-world connections and applications link all types of students to knowledge, skills, and professional dispositions. Work-based learning should encompass ongoing and increasingly more complex involvement with local companies and energy technology professionals. Thus, supervised collaboration and immersion into the energy technology industry around the students are keys to students' success, knowledge, and skills development.

Professional Organizations

American Society of Certified Engineering Technicians (ASCET)
ascet.org

Association of Energy Engineers (AEE)
aeecenter.org/certified-renewable-energy-professional

Center for Energy Workforce Development (CEWD)
cewd.org

Electronics Technicians Association International (ETAI)
etai.org

Energy Management Association (EMA)
energymgmt.org

Institute of Electrical and Electronics Engineers (IEEE)
ieee.org

International Brotherhood of Electrical Workers (IBEW)
ibew.org

National Center for Construction Education & Research (NCCER)
nccer.org

North American Board of Certified Energy Practitioners (NABCEP)
nabcep.org

Office of Energy Efficiency and Renewable Energy (EERE)
energy.gov/eere/office-energy-efficiency-renewable-energy

The American Clean Power Association (ACP)
cleanpower.org

The Energy Professionals Association (TEPA)
tepausa.org

The National Energy Education Development Project (NEED)
need.org

Using This Document

Competencies and Suggested Objectives
A competency represents a general concept or performance that students are expected to master as a requirement for satisfactorily completing a unit. Students will be expected to receive instruction on all competencies. The suggested objectives represent the enabling and supporting knowledge and performances that will indicate mastery of the competency at the course level.

Teacher Resources
All teachers should request to be added to the Canvas Resource Guide for their course. For questions or to be added to the guide, send a Help Desk ticket to the RCU by emailing helpdesk@rcu.msstate.edu.

Perkins V Quality Indicators and Enrichment Material
Some of the units may include an enrichment section at the end. This material will greatly enhance the learning experiences of students. If the Energy Technology program is using a national certification, work-based learning, or another measure of accountability that aligns with Perkins V as a quality indicator, this material could very well be assessed on that quality indicator. It is the responsibility of the teacher to ensure all competencies for the selected quality indicator are covered throughout the year.

Unit 1: Orientation

Competencies and Suggested Objectives
1. Describe local program and center expectations, policies, and procedures. DOK 1, 2 a. Describe local program and career center policies and procedures, including dress code, attendance, academic requirements, discipline, shop/lab rules and regulations, and transportation regulations. b. Give a brief overview of the course. c. Explain to students what energy technology is, why it is important, and how it will be delivered. d. Compare and contrast local program and school policies with expectations of employers. e. Preview course objectives, program policy, and industry standards.
2. Explore energy career opportunities related to program areas. DOK 2, 3 a. Explore the opportunities available through the program areas: • Job shadowing • Apprenticeship programs • On-the-job training • Other opportunities available through the program areas

Unit 2: Employability Skills

Competencies and Suggested Objectives
1. Describe employment opportunities in the energy industry. DOK 1, 2 a. Describe employment opportunities, including potential earnings, employee benefits, job availability, working conditions, educational requirements, required technology skills, and continuing education/training. b. Discuss the guidelines for developing a proper résumé. c. Demonstrate completing job applications.
2. Examine the Mississippi Department of Employment Security website and its applications relating to employment opportunities. DOK 2, 3 a. Perform various searches through the MDES website, such as: • Number of jobs available for a specific area of expertise • Hourly wage • Percent of jobs in the county • Percent of jobs in the state
3. Demonstrate appropriate interview skills. DOK 3 a. Identify interview skills, such as speaking, dress, professionalism, and punctuality. b. Simulate a job interview.
4. Describe basic employee responsibilities and appropriate work ethics. DOK 2 a. Compare and contrast employment responsibilities and expectations to local school and program policies and expectations. b. Define effective relationship skills and workplace issues, including but not limited to sexual harassment, stress, and substance abuse.

Unit 3: Fundamentals of Student Organizations

Competencies and Suggested Objectives
1. Discuss the history, mission, and purpose of student organizations, including SkillsUSA. DOK 1 a. Trace the history of the program area student organization. b. Identify the mission, purpose, and/or goals of the program area's student organization.
2. Explore the advantages of membership in a student organization. DOK 2 a. Discuss the membership process for the program area's student organization. b. Explain the activities related to the local chapter and the state and national organizations.
3. Discuss the organization's brand resources. DOK 1 a. Identify the motto, creed, and/or pledge and discuss their meanings. b. Recognize related brand resources, such as: • Emblem • Colors • Official attire • Logos • Graphic standards
4. Describe the importance of effective communication skills. DOK 2 a. Demonstrate verbal and nonverbal communication skills. b. Apply appropriate speaking and listening skills to class- and work-related situations.
5. Apply leadership skills to class- and work-related situations and 21st Century Skills. DOK 2 a. Define leadership. b. Discuss the attributes of a leader. c. Identify the roles a leader can assume.
6. Utilize team-building skills in class- and work-related situations. DOK 2 a. Define team building. b. Discuss the attributes of a team. c. Identify the roles included in a team.
7. Discuss the various competitions offered through the program area's student organization. DOK 2, 3 a. Describe each of the competitions and the skills needed to accomplish the tasks. b. Perform the tasks needed to complete an assigned requirement for a competition.

Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 4: Communication Skills

Competencies and Suggested Objectives
1. Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations. DOK 2 a. Follow basic written and verbal instructions. b. Effectively communicate in on-the-job situations using verbal, written, or electronic communication.
2. Discuss the importance of good listening skills in on-the-job situations. DOK 2 a. Apply the tips for developing good listening skills.
3. Discuss the importance of electronic communication. DOK 2 a. Social media etiquette b. Email etiquette c. Electronic messaging etiquette d. Appropriate use of company technology
4. Discuss the importance of physical and cyber security. DOK 2 a. Phishing attacks b. Malicious software c. Security protocols

Unit 5: General Safety

Competencies and Suggested Objectives
1. Describe, define, and illustrate general safety rules for working in a shop/lab and how they relate to the energy industry. DOK 2 a. Describe how to avoid on-site accidents. b. Explain the relationship between housekeeping and safety. c. Explain the importance of following all safety rules and company safety policies according to OSHA standards. d. Explain the importance of reporting all on-the-job injuries, accidents, and near misses. e. Explain the need for evacuation policies and the importance of following them. f. Explain causes of accidents and the impact of accident costs. g. Compare and contrast shop/lab safety rules to industry safety rules.
2. Identify and apply safety around welding operations. DOK 1, 2 a. Use proper safety practices when welding or working around welding operations. b. Use proper safety practices when welding in or near trenches and excavations. c. Explain the term "proximity work."
3. Display appropriate safety precautions to take around common jobsite hazards. DOK 2, 4 a. Explain the safety requirements for working in confined areas. b. Explain the different barriers and barricades and how they are used. c. Discuss the importance of energy job safety briefings.
4. Demonstrate the appropriate use and care of personal protective equipment (PPE). DOK 2, 3 a. Identify commonly used PPE items. b. Understand proper use of PPE. c. Demonstrate appropriate care for PPE.
5. Explain fall protection, ladder, stair, and scaffold procedures and requirements. DOK 2 a. Explain the use of proper fall protection. b. Inspect and safely work with various ladders, stairs, and scaffolds.
6. Explain the safety data sheet (SDS). DOK 2 a. Explain the function of the SDS. b. Interpret the requirements of the SDS. c. Discuss hazardous material exposures.
7. Display appropriate safety procedures related to fires. DOK 2, 3 a. Explain the process by which fires start. b. Explain fire prevention of various flammable liquids. c. Explain the classes of fire and the types of extinguishers. d. Illustrate the proper steps to follow when using a fire extinguisher. e. Demonstrate the proper techniques for putting out a fire.
8. Explain safety in and around electrical situations. DOK 2 a. Explain injuries that can result when electrical contact occurs. b. Explain safety around electrical hazards. c. Explain the actions that you should take when an electrical shock occurs. d. Explain the actions that you should take when an arc flash occurs.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.
Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 6: Introduction to Construction Math

Competencies and Suggested Objectives
1. Apply the four basic math skills using whole numbers, fractions, decimals, and percentages, both with and without a calculator. DOK 2, 4 a. Define basic geometric shapes used in the energy industry. b. Add, subtract, multiply, and divide whole numbers, decimals, and fractions with and without a calculator. c. Convert whole numbers to fractions and convert fractions to whole numbers. d. Convert decimals to percentages and convert percentages to decimals. e. Convert fractions to decimals. f. Convert fractions to percentages. g. Demonstrate reading a standard and metric ruler and tape measure. h. Recognize and use metric units of length, weight, volume, and temperature.

Unit 7: Hand and Power Tools

Competencies and Suggested Objectives
1. Demonstrate the use and maintenance of hand and power tools. DOK 2, 3 a. Identify, visually inspect, and discuss the safe use of common hand and power tools. b. Discuss rules of safety. c. Select and demonstrate the use of tools. d. Explain the procedures for maintenance.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.
Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 8: Introduction to Construction and Engineering Drawings

Competencies and Suggested Objectives
1. Read, analyze, and understand basic components of a blueprint. DOK 2, 3 a. Recognize and identify terms, components, and symbols commonly used on blueprints. b. Relate information on construction drawings to actual locations on the print. c. Recognize different type of drawings. d. Interpret and use drawing dimensions.

Unit 9: Introduction to Materials Handling

Competencies and Suggested Objectives
1. Safely handle and store materials. DOK 2, 3 a. Define a load. b. Establish a pre-task plan prior to moving a load. c. Demonstrate proper materials-handling techniques. d. Choose appropriate materials-handling equipment for the task. e. Recognize hazards and follow safety procedures required for materials handling. f. Identify and demonstrate commonly used knots.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.
Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 10: Introduction to Rigging

Competencies and Suggested Objectives

1. Discover and apply basic inspection techniques, hitch configurations, and load-handling safety practices, as well as how to use American Society of Mechanical Engineers hand signals. DOK 2, 3
   a. Identify and describe the use of slings and common rigging hardware.
   b. Describe basic inspection techniques and rejection criteria used for slings and hardware.
   c. Describe basic hitch configurations and their proper connections.
   d. Describe basic load-handling safety practices.
   e. Demonstrate proper use of American Society of Mechanical Engineers (ASME) hand signals.
   f. Select and inspect appropriate slings for a lift.
      - Weight and dimensions
   g. Given various loads, determine the proper hitch to be used.
   h. Select and inspect appropriate hardware and/or lifting equipment.
   i. Demonstrate and/or simulate the proper techniques for connecting hitches.
   j. Demonstrate the proper use of all hand signals according to ASME B30.2 and B30.5.
   k. Describe or demonstrate pre-lift safety checks.
   l. Demonstrate and/or simulate how to lift the load level.
   m. Describe and/or demonstrate safety precautions for attaching and disconnecting a load.
2. Determine and explain how to inspect and use common rigging hardware, slings, and tag lines; how to select, inspect, use, and maintain special rigging equipment. DOK 2, 3
   a. Identify and describe the uses of common rigging hardware and equipment.
   b. Perform a safety inspection on hooks, slings, and other rigging equipment.
   c. Describe common slings and determine sling capacities and angles.
   d. Select, inspect, use, and maintain special rigging equipment, including:
      - Block and tackle (bull rigging)
      - Chain hoists
      - Ratchet-lever hoists
      - Jacks
      - Base-mounted drum hoists (tuggers)
   e. Inspect heavy rigging hardware.
   f. Tie knots used in rigging.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.

Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.

Unit 11: History and Organization of the Energy Technology Industry

Competencies and Suggested Objectives
1. Demonstrate knowledge of the basic concepts and explain the emerging principles that impact the energy technology industry. DOK 2
2. Analyze and explain the flow of energy from power generation through distribution to the customer. DOK 2, 4
3. Investigate and discuss the history of the United States energy industry/infrastructure. DOK 2 a. Research the accomplishments of the Energy Information Administration (eia.gov).
4. Identify and justify the role and function of generation, transmission, and distribution organizations. DOK 1, 3
5. Explain the role of regulatory bodies in the energy industry. DOK 2, 3 a. Investigate the role and responsibilities of the Federal Energy Regulatory Commission (ferc.gov).
6. Discuss and critique environmental laws and regulations that impact the energy industry (local, state, and federal) and explain the importance of proper documentation to ensure compliance. DOK 2, 4
7. Explain the different structures of energy companies. DOK 2 a. Investor-owned utilities b. Municipalities (and associated utility practices such as water/wastewater) c. Electric cooperatives d. Independent power producers
8. Compare and contrast the different business sectors related to energy technology. DOK 2 a. Electric b. Gas c. Other business sectors related to energy technology
9. Describe the process of electric metering and billing for energy consumption. DOK 2
10. Analyze and discuss the importance and role of unions in the energy technology industry. DOK 2, 4

Note: This section of the Energy Technology course content focuses on:

- Understanding the various types of energy
- Converting various types of energy to useable energy such as electrical power.
- Understanding how generated electrical power is transmitted and distributed to the point of use.

Note: The material for the Energy Industry Fundamentals (EIF) unit can be located here: getintoenergy.org/wp-content/uploads/Curriculum/EIFModule1-Student-Rev2018.pdf?_t=1633014056

Unit 12: Workplace Procedural Safety and First Aid Response

Competencies and Suggested Objectives
1. Discuss the importance of and demonstrate compliance with procedures necessary to ensure a safe and healthy workplace environment. DOK 1, 2
2. Review the role of the U.S. Department of Labor/Occupational Safety and Health Administration (OSHA) in workplace safety. DOK 1, 2
3. Identify and formulate a plan of action to prevent and reduce some occurrences of potential hazards and various types of accident scenarios in the energy technology workplace environment. DOK 1, 3
4. Investigate and demonstrate established safety procedures regarding OSHA regulations and utility company procedures. DOK 3
5. Evaluate changes in the environment with respect to their impact on safety of self and others. DOK 4
6. Promote and justify effective local, state, and national security operations for the protection of people, data, property, and institutions. DOK 1, 3
7. Communicate various reasons why we must comply with energy industry safety procedures and proper ways to perform energy technology-related work. DOK 1, 3
8. Identify and communicate ways to combat potential threats caused by deviating from safety procedures and improperly using tools/equipment. DOK 1, 3
9. Use safety equipment as specified by user manuals and safety training. DOK 2
10. Use personal protective equipment (PPE) to ensure personal safety within the workplace. DOK 2 a. Safety glasses b. Hearing protection c. Gloves d. Work boots e. Hard hats f. Other energy industry required PPE
11. Demonstrate how to keep personal safety equipment in good working order. DOK 2
12. Demonstrate the use of energy technology-related tools and equipment in compliance with user manuals and training. DOK 2
13. Identify potential and actual hazardous conditions involving the energy technology workplace. DOK 1
14. Instruct others on proper ways to alert coworkers and supervisory personnel to hazardous conditions and discuss situational issues that necessitate a deviation from safety procedures in a timely manner. DOK 3
15. Maintain appropriate certification and gain experience in first aid applications or first response procedures. DOK 1, 3
16. Demonstrate an understanding and knowledge of lock/tagout practices in the workplace. DOK 2
17. Demonstrate proper procedures regarding when and how to notify the person in charge and/or coworkers of unsafe conditions within the workplace. DOK 2

18. Demonstrate proper procedures regarding when and how to stop the job if there are unsafe conditions within the workplace. DOK 2

Enrichment
1. Discuss the Code of Federal Regulations (CFR) regarding electric power generation, transmission, and distribution. a. These regulations can be viewed at ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-R/section-1910.269. 2. Discuss OSHA regulations regarding electrical protective equipment (PPE). a. These regulations can be viewed at osha.gov/laws-regs/federalregister/1994-01-31.

Note: Safety is to be taught as an ongoing part of the program. Students are required to complete a written safety test with 100% accuracy before entering the shop for lab simulations and projects. This test should be documented in each student's file.
Note: This unit will be ongoing throughout the year. Time allotted for this unit will be distributed over the entire year.
Note: Center for Energy Workforce Development — Get into Energy (Online Portal): getintoenergy.org/curriculum/eif-modules/ The material for the Energy Industry Fundamentals (EIF) unit can be located here: getintoenergy.org/wp-content/uploads/Curriculum/EIFModule2-Student-Rev2018.pdf

Unit 13: Electric Power Generation

Competencies and Suggested Objectives
1. Define and discuss the concept of electric power generation. DOK 1
2. Explain how conventional electric power generation systems are used and make observations about their processes. DOK 2 a. Coal b. Gas c. Hydroelectric d. Nuclear e. Other conventional electric power generation systems
3. Identify electric power generation equipment and systems. DOK 1
4. Research and discuss the costs, efficiency concerns, and environmental issues associated with various conventional electric power generation fuel sources. DOK 1, 2
5. Explain how each conventional source of energy was innovated, how countries/locations use each source, and then list the advantages and disadvantages of using each of these sources of energy. DOK 2 a. Oil b. Coal c. Natural gas d. Uranium (nuclear power) e. Water (hydroelectric power)
6. Research and critique emerging technologies, alternative electric power generation technologies, and alternative fuel sources. DOK 3, 4 a. Solar (photovoltaic systems) b. Solar (steam power) c. Wind d. Geothermal e. Biomass f. Ocean Wave
7. Discuss pros and cons of various energy-producing technologies and fuels in the electrical infrastructure. DOK 2 a. Fossil fuels b. Nuclear c. Emerging alternative energy systems
8. Review and explain how electric power generation solves a multitude of societal problems. DOK 3

Note: Center for Energy Workforce Development — Get into Energy (Online Portal): getintoenergy.org/curriculum/eif-modules/
The material for the Energy Industry Fundamentals (EIF) unit can be located here: getintoenergy.org/wp-content/uploads/Curriculum/EIFModule3-Student-Rev2018.pdf

Unit 14: Electric Power Transmission

Competencies and Suggested Objectives
1. Define and discuss the concept of electric power transmission. DOK 1
2. Explain the electric power transmission process. DOK 2
3. Discuss the application of different electric power transmission principles, including alternating current (AC) versus direct current (DC). DOK 2 a. Identify some types of electric power transmission equipment and systems.
4. Discuss the emerging technologies in electric power transmission, including Smart Grid systems. DOK 2
5. Explain ownership and governance of the electric transmission system. DOK 2

Note: Center for Energy Workforce Development — Get into Energy (Online Portal): getintoenergy.org/curriculum/eif-modules/
The material for the Energy Industry Fundamentals (EIF) unit can be located here: getintoenergy.org/wp-content/uploads/Curriculum/EIFModule4-Student-Rev2018.pdf

Unit 15: Electric Power Distribution

Competencies and Suggested Objectives
1. Define and discuss the concept of distribution regarding electric power and natural gas. DOK 2
2. Explain the electric power distribution process. DOK 2
3. Discuss the need for electric distribution systems and how they are designed to operate. DOK 2 a. Identify electric power distribution system equipment and what each component is used for.
4. Discuss the emerging technologies connected to electric power distribution, including distribution automation and Smart Grid systems. DOK 2
5. Explain the fundamental concepts and uses of natural gas and liquid propane. DOK 2
6. Identify the components and workings of the gas transmission and distribution network, including metering and regulating stations. DOK 2

Note: Center for Energy Workforce Development — Get into Energy (Online Portal): getintoenergy.org/curriculum/eif-modules/
The material for the Energy Industry Fundamentals (EIF) unit can be located here: getintoenergy.org/wp-content/uploads/Curriculum/EIFModule5-Student-Rev2018.pdf

Unit 16: Energy Careers

Competencies and Suggested Objectives
1. Identify and describe energy technology-related careers and each of their entry-level requirements. DOK 1
2. Research entry-level careers available in each of the phases of the energy flow from energy generation to transmission and then to distribution. DOK 3, 4 a. Investigate the educational requirements for entry into those positions. b. Investigate the experience requirements for entry into those positions. c. Assess career development and advancement opportunities for each of those positions.
3. Research entry-level careers available in energy technology-related business leadership and corporate level support functions. DOK 3, 4 a. Investigate the educational requirements for entry into those positions. b. Investigate the experience requirements for entry into those positions. c. Assess career development and advancement opportunities for each of those positions. d. Describe general wage/salary, benefits, and other advantages of these careers in the energy industry.
4. Explain the educational pathways available that are necessary for entry into energy technology careers at the secondary and postsecondary levels. DOK 2 a. Utilize the Create Energy Education Portal (createenergy.org).

Note: Center for Energy Workforce Development — Get into Energy (Online Portal): getintoenergy.org/curriculum/eif-modules/
The material for the Energy Industry Fundamentals (EIF) online unit can be located here: cordonline.net/cewd/module6section1.php#

Unit 17: Efficiency in Conservation

Competencies and Suggested Objectives
1. Evaluate and analyze energy "hot topics." DOK 2
2. Research energy technology current topics, using news sources and peer-reviewed research papers. DOK 2 a. Utilize peer-reviewed research sources (e.g., sciencedirect.com).
3. Describe energy efficiency and energy conservation. DOK 2 a. Investigate how alternative energy sources such as wind, solar, biomass, and geothermal help to supplement or to replace conventional energy power systems.
4. Discover and describe emerging technologies that have been or will likely be incorporated within the energy industry. DOK 2 a. Wave b. Algae c. Integrated gasification combined cycle (IGCC) d. Clean coal e. Other emerging technologies
5. Investigate and describe Smart Home and Time of Use technologies. DOK 2, 3
6. Describe and discuss key energy regulatory topics. DOK 2 a. Federal Energy Regulatory Commission (FERC) b. North American Electric Reliability Corporation (NERC) c. Cap and trade system d. Environmental Protection Agency (EPA) — Radiation risks and realities (nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P10033BH.txt) e. Efficiency f. Cost g. Other key energy regulatory topics

Note: Center for Energy Workforce Development — Get into Energy (Online Portal): getintoenergy.org/curriculum/eif-modules/ The material for the Energy Industry Fundamentals (EIF) online unit can be located here: cordonline.net/cewd/module7section1.php

Student Competency Profile

Student's Name: _____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student, and it can serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Orientation		
	1.	Describe local program and center expectations, policies, and procedures.
	2.	Explore energy career opportunities related to program areas.
Unit 2: Employability Skills		
	1.	Describe employment opportunities in the energy industry.
	2.	Examine the Mississippi Department of Employment Security website and its applications relating to employment opportunities.
	3.	Demonstrate appropriate interview skills.
	4.	Describe basic employee responsibilities and appropriate work ethics.
Unit 3: Fundamentals of Student Organizations		
	1.	Discuss the history, mission, and purpose of student organizations, including SkillsUSA.
	2.	Explore the advantages of membership in a student organization.
	3.	Discuss the organization's brand resources.
	4.	Describe the importance of effective communication skills.
	5.	Apply leadership skills to class- and work-related situations and 21st Century Skills.
	6.	Utilize team-building skills in class- and work-related situations.
	7.	Discuss the various competitions offered through the program area's student organization.
Unit 4: Communication Skills		
	1.	Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations.
	2.	Discuss the importance of good listening skills in on-the-job situations.
	3.	Discuss the importance of electronic communication.
	4.	Discuss the importance of physical and cyber security.
Unit 5: General Safety		
	1.	Describe, define, and illustrate general safety rules for working in a shop/lab and how they relate to the energy industry.

	2.	Identify and apply safety around welding operations.
	3.	Display appropriate safety precautions to take around common jobsite hazards.
	4.	Demonstrate the appropriate use and care of personal protective equipment (PPE).
	5.	Explain fall protection, ladder, stair, and scaffold procedures and requirements.
	6.	Explain the safety data sheet (SDS).
	7.	Display appropriate safety procedures related to fires.
	8.	Explain safety in and around electrical situations.
Unit 6: Introduction to Construction Math		
	1.	Apply the four basic math skills using whole numbers, fractions, decimals, and percentages, both with and without a calculator.
Unit 7: Hand and Power Tools		
	1.	Demonstrate the use and maintenance of hand and power tools.
Unit 8: Introduction to Construction and Engineering Drawings		
	1.	Read, analyze, and understand basic components of a blueprint.
Unit 9: Introduction to Materials Handling		
	1.	Safely handle and store materials.
Unit 10: Introduction to Rigging		
	1.	Discover and apply basic inspection techniques, hitch configurations, and load-handling safety practices, as well as how to use American Society of Mechanical Engineers hand signals.
	2.	Determine and explain how to inspect and use common rigging hardware, slings, and tag lines; how to select, inspect, use, and maintain special rigging equipment.
Unit 11: History and Organization of the Energy Technology Industry		
	1.	Demonstrate knowledge of the basic concepts and explain the emerging principles that impact the energy technology industry.
	2.	Analyze and explain the flow of energy from power generation through distribution to the customer.
	3.	Investigate and discuss the history of the United States energy industry/infrastructure.
	4.	Identify and justify the role and function of generation, transmission, and distribution organizations.
	5.	Explain the role of regulatory bodies in the energy industry.
	6.	Discuss and critique environmental laws and regulations that impact the energy industry (local, state, and federal) and explain the importance of proper documentation to ensure compliance.
	7.	Explain the different structures of energy companies.
	8.	Compare and contrast the different business sectors related to energy technology.

	9.	Describe the process of electric metering and billing for energy consumption.
	10.	Analyze and discuss the importance and role of unions in the energy technology industry.
Unit 12: Workplace Procedural Safety and First Aid Response		
	1.	Discuss the importance of and demonstrate compliance with procedures necessary to ensure a safe and healthy workplace environment.
	2.	Review the role of the U.S. Department of Labor/Occupational Safety and Health Administration (OSHA) in workplace safety.
	3.	Identify and formulate a plan of action to prevent and reduce some occurrences of potential hazards and various types of accident scenarios in the energy technology workplace environment.
	4.	Investigate and demonstrate established safety procedures regarding OSHA regulations and utility company procedures.
	5.	Evaluate changes in the environment with respect to their impact on safety of self and others.
	6.	Promote and justify effective local, state, and national security operations for the protection of people, data, property, and institutions.
	7.	Communicate various reasons why we must comply with energy industry safety procedures and proper ways to perform energy technology-related work.
	8.	Identify and communicate ways to combat potential threats caused by deviating from safety procedures and improperly using tools/equipment.
	9.	Use safety equipment as specified by user manuals and safety training.
	10.	Use personal protective equipment (PPE) to ensure personal safety within the workplace.
	11.	Demonstrate how to keep personal safety equipment in good working order.
	12.	Demonstrate the use of energy technology-related tools and equipment in compliance with user manuals and training.
	13.	Identify potential and actual hazardous conditions involving the energy technology workplace.
	14.	Instruct others on proper ways to alert coworkers and supervisory personnel to hazardous conditions and discuss situational issues that necessitate a deviation from safety procedures in a timely manner.
	15.	Maintain appropriate certification and gain experience in first aid applications or first response procedures.
	16.	Demonstrate an understanding and knowledge of lock/tagout practices in the workplace.
	17.	Demonstrate proper procedures regarding when and how to notify the person in charge and/or coworkers of unsafe conditions within the workplace.
	18.	Demonstrate proper procedures regarding when and how to stop the job if there are unsafe conditions within the workplace.
Unit 13: Electric Power Generation		
	1.	Define and discuss the concept of electric power generation.
	2.	Explain how conventional electric power generation systems are used and make observations about their processes.

	3.	Identify electric power generation equipment and systems.
	4.	Research and discuss the costs, efficiency concerns, and environmental issues associated with various conventional electric power generation fuel sources.
	5.	Explain how each conventional source of energy was innovated, how countries/locations use each source, and then list the advantages and disadvantages of using each of these sources of energy.
	6.	Research and critique emerging technologies, alternative electric power generation technologies, and alternative fuel sources.
	7.	Discuss pros and cons of various energy-producing technologies and fuels in the electrical infrastructure.
	8.	Review and explain how electric power generation solves a multitude of societal problems.
Unit 14: Electric Power Transmission		
	1.	Define and discuss the concept of electric power transmission.
	2.	Explain the electric power transmission process.
	3.	Discuss the application of different electric power transmission principles, including alternating current (AC) versus direct current (DC).
	4.	Discuss the emerging technologies in electric power transmission, including Smart Grid systems.
	5.	Explain ownership and governance of the electric transmission system.
Unit 15: Electric Power Distribution		
	1.	Define and discuss the concept of distribution regarding electric power and natural gas.
	2.	Explain the electric power distribution process.
	3.	Discuss the need for electric distribution systems and how they are designed to operate.
	4.	Discuss the emerging technologies connected to electric power distribution, including distribution automation and Smart Grid systems.
	5.	Explain the fundamental concepts and uses of natural gas and liquid propane.
	6.	Identify the components and workings of the gas transmission and distribution network, including metering and regulating stations.
Unit 16: Energy Careers		
	1.	Identify and describe energy technology-related careers and each of their entry-level requirements.
	2.	Research entry-level careers available in each of the phases of the energy flow from energy generation to transmission and then to distribution.
	3.	Research entry-level careers available in energy technology-related business leadership and corporate level support functions.
	4.	Explain the educational pathways available that are necessary for entry into energy technology careers at the secondary and postsecondary levels.
Unit 17: Efficiency in Conservation		
	1.	Evaluate and analyze energy “hot topics.”

	2.	Research energy technology current topics, using news sources and peer-reviewed research papers.
	3.	Describe energy efficiency and energy conservation.
	4.	Discover and describe emerging technologies that have been or will likely be incorporated within the energy industry.
	5.	Investigate and describe Smart Home and Time of Use technologies.
	6.	Describe and discuss key energy regulatory topics.

Appendix A: Next Generation Science Standards – National Energy Education Development Curriculum Correlation

	Units	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Standards																		
HS-PS1-1						X						X		X	X	X	X	X
HS-PS1-2														X	X	X		X
HS-PS1-3														X				
HS-PS1-4														X	X			
HS-PS1-5															X			
HS-PS1-6														X				
HS-PS1-7														X	X	X		X
HS-PS1-8						X								X				
HS-PS2-1															X			X
HS-PS2-5															X			
HS-PS3-1		X				X						X		X	X	X	X	X
HS-PS3-2		X										X		X			X	X
HS-PS3-3				X			X					X		X	X	X		X
HS-PS3-4														X			X	
HS-PS3-5													X	X	X	X		
HS-PS4-3																		X
HS-PS4-4																		X
HS-LS1-5														X				X
HS-LS2-2																	X	X
HS-LS2-3												X						X
HS-LS2-4												X						X
HS-LS2-5																		X
HS-LS2-6																		X
HS-LS2-7																		X
HS-LS4-6																		X
HS-ESS1-1												X		X			X	X
HS-ESS1-5																		
HS-ESS2-1																		
HS-ESS2-2																		X
HS-ESS2-3														X				X
HS-ESS2-4												X						
HS-ESS2-5												X		X				X
HS-ESS2-6																		X
HS-ESS3-1																		X
HS-ESS3-2														X				X
HS-ESS3-4												X						X
HS-ESS3-5																		X

HS-ESS3-6																		X
HS-ETS1-1														X			X	X
HS-ETS1-2														X			X	X
HS-ETS1-3						X						X		X			X	X

NGSS - A Framework for K-12 Science Education

HS-PS1 Matter and its Interactions

1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
3. Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
8. Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

HS-PS2 Motion and Stability: Forces and Interactions

1. Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
5. Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.

HS-PS3 Energy

1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
2. Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motion of particles (objects) and energy associated with the relative position of particles (objects).
3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined

within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).

5. Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

HS-PS4 Waves and their Applications in Technologies for Information Transfer

3. Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.
4. Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

HS-LS1 From Molecules to Organisms: Structures and Processes

5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

HS-LS2 Ecosystems: Interactions, Energy, and Dynamics

2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem
7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity

HS-LS4 Biological Evolution: Unity and Diversity

6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

HS-ESS1 Earth's Place in the Universe

1. Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun’s core to release energy that eventually reaches Earth in the form of radiation.
5. Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.

HS-ESS2 Earth's Systems

1. Develop a model to illustrate how Earth’s internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.

2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.
3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.
4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

HS-ESS3 Earth and Human Activity

1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
5. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

HS-ETS1 Engineering Design

1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.