Unit 8: Engineering and Power

Content Area: **Applied Technology**
Course(s):
Time Period: **Marking Period 4**
Length: **2-3 weeks**
Status: **Published**

Summary

Introduction:

Students will explore how electrical power is produced and how it is distributed in a house. Students will review an electrical code and create using CAD, plans indicating the location of different outlets, switches and lights. Students will analyze the current of circuits, identify GFI circuits, and dedicated circuits. Students will also identify how much power a home consumes and strategies to reduce consumption. Climate Change and energy consumption will be explored. Students will investigate different methods of energy production and analyze the pros and cons of each method.

Revision Date: July 2025

Essential Questions/Enduring Understandings

Essential Questions:

How do engineers apply scientific principles and technology to efficiently and safely generate, transform, and manage power for a variety of needs?

What critical factors, such as distance, transmission losses, and grid stability, must engineers consider when designing systems to reliably distribute power?

How do engineers balance the societal demand for power with the environmental impact of its generation and consumption, and what role do sustainable technologies play in this balance?

Essential Understandings:

engineers of different disciplines are involved in the production and distribution of energy.

power production is an economically significant part of the economy.

power production is effected by significant multiple factors such as environment, society and technology that are in constant change.

Power distribution is determined by material specifications and electrical codes.

Objectives

Students Will Know:

approximately 7% of GDP (Gross Domestic Product) is spent on energy.

47% of power is used to heat homes.

the role of home energy consumption in global warming.

that four companies involved in power production rank in the top 10 largest companies in the U.S.

the role of chemical engineers in the production of power.

the role of nuclear engineers in the production of power.

the role of civil engineers in the production of power.

the role of electrical engineers in the production and distribution of power.

the importance of the invention of alternating current in the distribution of energy (Tesla).

that technology is always changing.

life cycle analysis.

conversions and unit cost for energy.

Codes provide guidance in locating where electrical outlets, lights, and switches, as well as other electrical devices, may be placed in residences.

Codes are designed to protect life and property

unit vocabulary related to power and production: energy, power, fuel, units & volumes-btu; gallon, kilowatt-our, ton, cord, ccf (standard measurement of water or natural gas volume), therm, alternating current, direct current, battery, service, circuit, circuit breaker, GFI, home run, ground, 120V, 240V, neutral.

Student Will Be Skilled At:

Making electrical plans using CAD indicating the location of electrical components of a house, including bathrooms, kitchens, and bedrooms.

Using conventions that are trade-specific to communicate their plans.

Learning Plan

Preview the essential questions and connect to learning throughout the unit.

Formative assessments will be conducted throughout the process using class discussion, student writing, and

practice quizzes.

Formative assessments will be conducted to determine knowledge of physics, chemistry, and engineering disciplines.

Formative assessments will be conducted throughout the design process. Problem-based learning: provided with a sample electrical code and a house plan in CAD, create an electrical floor plan.

Current Events: identify trends in power production and explain how they relate to engineering and society. Identify trends in environmentally friendly energy production and explain how they relate to societal needs.

Societal issues: perform research and write a paper on an energy topic with societal concerns, i.e. fracturing (fracking), and nuclear energy.

Societal issues: Climate change and the impact of housing on global warming, Mitigation strategies.

Summative assessments will be conducted throughout to evaluate skills acquisition.

Design logs will be maintained to document the application of the design loop.

Summative assessment will be conducted by the student and teacher using a rubric specific to the design problem.

Complete unit test and/or quiz.

Complete writing prompt.

Assessment

Formative Assessment:

participation in discussions on engineering and power

teacher feedback on design log

exit tickets

proper use of vocabulary

Summative Assessment:

perform a problem-based learning activity focusing on the implementation of power technologies. The project will be graded with a rubric.

identify current event articles related to new power technologies. Summarize and explain their relevance. The articles will be graded using a rubric.

identify a power production method with societal concerns. Identify different conflicting views regarding the

technology. Choose a position and defend it. The paper will be graded using a rubric.

complete writing prompts o Technology and energy production is always changing. An example of this change is…and may have the impact… o Choose an engineering discipline and explain its role in the production of energy.

unit quizzes and test.

answer the essential questions.

Alternate Assessment:

Presentation on fracking and its effect on power and engineering

Benchmark assessment:

Mid Term/ Final exam

Materials

CAD and other software programs

Teacher e-board. The e-board contains descriptions and research information about the first surgeries in the series.

Phones with camera with still and motion ability.

Students will use WEB 2.0 applications like Google Docs to collaborate on projects.

Robotics computer lab with NXT software, presentation software.

Email and e-board

Web sites

SmartBoard use for teacher presentation and interactive lessons

SmartBoard use for student presentations.

Standards

9.2.12.CAP	Career Awareness and Planning
L	Language
9.4.12.CI	Creativity and Innovation
L.SS.9–10.1	Demonstrate command of the system and structure of the English language when writing

	or speaking.
9.4.12.CT	Critical Thinking and Problem-solving
9.2.12.CAP.5	Assess and modify a personal plan to support current interests and post-secondary plans.
9.2.12.CAP.6	Identify transferable skills in career choices and design alternative career plans based on those skills.
9.2.12.CAP.7	Use online resources to examine licensing, certification, and credentialing requirements at the local, state, and national levels to maintain compliance with industry requirements in areas of career interest.
TECH.K-12.1.4	Innovative Designer
LA.RST.11-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
	Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions.
TECH.K-12.1.4.b	select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.
TECH.K-12.1.4.c	develop, test and refine prototypes as part of a cyclical design process.
TECH.K-12.1.4.d	exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems.
TECH.K-12.1.5	Computational Thinker
	Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.
LA.WHST.11-12	Writing History, Science and Technical Subjects
	Text Types and Purposes
LA.WHST.11-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
LA.WHST.11-12.2.D	Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.
ED	Engineering Design
	Engineering design is a complex process in which creativity, content knowledge, research, and analysis are used to address local and global problems. Decisions on trade-offs involve systematic comparisons of all costs and benefits, and final steps that may involve redesigning for optimization.
8.2.12.ED.2	Create scaled engineering drawings for a new product or system and make modification to increase optimization based on feedback.
	Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints.
HS-ESS3	Earth and Human Activity
HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
ESS3.A	Natural Resources
	All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors.

HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on climate change and other natural systems. Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, or areal changes in land surface use (such as for urban development, agriculture and livestock, or surface mining). Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions (such as altering global temperatures by making large changes to the atmosphere or ocean).
HS-ETS1	Engineering Design
HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
ETS1.B	Developing Possible Solutions Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs.

Integrated Accommodation and Modifications...

Integrated Accommodation and Modifications, Special Education students, English Language Learners, At-Risk students, Gifted and Talented students, Career Education and those with 504s