

# Unit 8: Engineering and Power

Content Area: **Applied Technology**

Course(s):

Time Period: **Marking Period 4**

Length: **15**

Status: **Published**

## Summary

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### 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 the how much power a home consumes and strategies to reduce these requirements. Students will investigate different methods of energy production and analyze the pros and cons of each method.

**Revision Date:** July 2020

CS.9-12.8.2.12.ED.2	Create scaled engineering drawings for a new product or system and make modification to increase optimization based on feedback.
CS.9-12.ED	Engineering Design
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.
LA.WHST.11-12	Writing History, Science and Technical Subjects
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.
CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are

excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

CRP.K-12.CRP5

Consider the environmental, social and economic impacts of decisions.

CRP.K-12.CRP5.1

Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.

CRP.K-12.CRP6

Demonstrate creativity and innovation.

CRP.K-12.CRP6.1

Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

SCI.HS.ESS3.A

Natural Resources

SCI.HS.ETS1.B

Developing Possible Solutions

SCI.9-12.HS.ED

Engineering Design

SCI.9-12.HS-ETS1-3

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.

SCI.9-12.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.

SCI.9-12.HS-ETS1-2

Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

SCI.9-12.HS-ETS1-1

Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

SCI.HS-ESS3-4

Evaluate or refine a technological solution that reduces impacts of human activities on climate change and other natural systems.

SCI.HS-ESS3

Earth and Human Activity

SCI.HS-ESS3-2

Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

SCI.HS-ETS1

Engineering Design

SCI.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.

WRK.9.2.12.CAP

Career Awareness and Planning

WRK.9.2.12.CAP.5

Assess and modify a personal plan to support current interests and post-secondary plans.

WRK.9.2.12.CAP.6

Identify transferable skills in career choices and design alternative career plans based on those skills.

WRK.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.8.2.12	Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.
TECH.8.2.12.A	The Nature of Technology: Creativity and Innovation: Technology systems impact every aspect of the world in which we live.
TECH.8.2.12.A.CS1	The characteristics and scope of technology.
TECH.8.2.12.C	Design: The design process is a systematic approach to solving problems.
TECH.8.2.12.C.1	Explain how open source technologies follow the design process.
TECH.8.2.12.C.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
TECH.8.2.12.C.CS1	The attributes of design.
TECH.8.2.12.C.CS2	The application of engineering design.
TECH.9.4.12.CI	Creativity and Innovation
TECH.9.4.12.CT	Critical Thinking and Problem-solving
	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.
	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.
	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.
	Text Types and Purposes
	Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints.
	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).

## **Essential Questions/Enduring Understandings**

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### **Essential Questions:**

What is the role of engineers in the production of power?

What factors effect power distribution?

How does the consumption of power relate to the environment?

## **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**

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### **Students Will Know:**

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

47% of power is used to heat homes.

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 design to protect life and property

unit vocabulary related to power and production: energy, power, fuel, units & volumes-btu; gallon, kilowatt-hour, 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**

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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

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**

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### **Formative Assessment:**

participatio 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:**

Final exam.

## **Materials**

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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.

### **Integrated Accommodation and Modifications...**

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