Developing and Using Science and Engineering Practices (by Lesson)

SEP Element #	Lesson	Elements of Science and Engineering Practice(s)	Rationale
1.3	6	Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables.	Students ask and answer questions to select the independent variable they want to manipulate and the dependent variable they will measure using a simulation. Based on their results, they determine the relationship between independent and dependent variables.
1.4	1	Ask questions to clarify and refine a model, an explanation, or an engineering problem.	Students ask questions to clarify and refine their model of energy production, and to refine an engineering problem about reliable energy that meets the needs of their communities.
1.4	10	Ask questions to clarify and refine a model, an explanation, or an engineering problem.	Students develop an interview protocol for asking questions of community members to identify a wider range of criteria and values that can help inform a plan for improving electricity infrastructure.
1.4	11	Ask questions to clarify and refine a model, an explanation, or an engineering problem.	Students ask questions about peers' design solutions to help them clarify their ideas and refine their proposal.
1.6	7	Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.	Students develop and test a hypothesis using available data to investigate trade-offs inherent in making decisions about energy.
1.8	1	Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical, and/or environmental considerations	Students begin to define the design problem that will drive this unit: how to address global challenges such as increased weather events, a growing population, climate change, and accelerating land use by making informed energy decisions.
1.8	10	Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical, and/or environmental considerations	In Part 1 of the interview protocol handout, students articulate the design problem that has driven this unit: how to address local and global challenges by making informed energy decisions.
1.8	11	Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical, and/or environmental considerations	Students make an argument for why our region's current grid solution has associated costs and risks, in order to define a design problem and propose its solution (Q2 of the Design Challenge).
2.3	1	Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.	Students develop and use a model based on their experience to illustrate how electricity gets to their community, and to predict the relationship between the systems involved.

SEP Element #	Lesson	Elements of Science and Engineering Practice(s)	Rationale
2.3	2	Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.	Students construct a model based on evidence they collected from their investigations to illustrate the relationships between components and their connections in an electrical system (a power strip) on day 1. The class revises that model together on day 2 to explain structures in a building and across a neighborhood.
2.3	3	Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.	Students develop an energy transfer model based on evidence from our investigation in Lesson 2 to illustrate the energy flow between components of the electric grid system.
2.3	5	Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.	Students develop models showing energy transfer between the subsystems within a larger system to generate electricity. This modeling is done on the scale of a power plant and on the scale of a small generator. Some of the evidence for our modeling comes from diagrams of power plants and some from students' experiments with homemade generators. Students conclude from the models that a change in "magnetic energy" creates a change in electrical energy.
2.3	6	Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.	In the transfer task, students give feedback on a model of a motor
2.3	7	Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.	Students develop a model based on evidence from previous lessons showing how insufficient supply entering the system could result in buildings losing power.
2.3	9	Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.	Students will develop and revise an energy transfer model to illustrate the role of a battery system in relation to other systems that are part of the electric grid.
2.3	11	Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.	In the transfer task, students revise and use a model to illustrate and predict the relationships between components of the sand and mirrors system.
2.6	11	Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.	Students use the Energy Grid Calculator (a computational model) to generate data to inform their design solutions.
3.6	2	Manipulate variables and collect data about a complex model of a proposed process or system to identify failure points or improve performance relative to criteria for success or other variables	Students carry out collaborative investigations to dissect a power strip and use it to transfer energy from one source to multiple devices. On day 1, they individually use evidence from the investigations to identify and make an initial model of key components and connections in the power strip. On day 2, they use these power strips to test the effect of short circuits and broken circuits (failure points) across an electrical distribution network in a neighborhood.

SEP Element #	Lesson	Elements of Science and Engineering Practice(s)	Rationale
3.6	5	Manipulate variables and collect data about a complex model of a proposed process or system to identify failure points or improve performance relative to criteria for success or other variables	Students agree as a class on specific design criteria for a homemade generator, then work in groups to build and test these generators. Through Design Challenges focused on specific aspects or "failure points" of their generator design, they collect qualitative data about how well their generator meets design criteria.
4.2	7	Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.	Students fit a least squares line to data using digital tools (CODAP) and use the r^2 value (correlation coefficient) to test the strength of the correlation.
4.3	7	Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.	Students consider limitations on their analysis to motivate seeking information about patterns at a smaller grain size.
4.5	3	Evaluate the impact of new data on a working explanation and/or model of a proposed process or system.	Students evaluate the impact of electrical energy supply and demand in Texas during 2020 and 2021 on a working explanation of energy loss from the system as a possible cause of the crisis.
4.6	4	Analyze data to identify design features or characteristics of the components of a proposed process or system to optimize it relative to criteria for success.	Students analyze multiple types of data to identify characteristics of energy sources that increase the reliability of the energy grid (a criterion for success).
4.6	10	Analyze data to identify design features or characteristics of the components of a proposed process or system to optimize it relative to criteria for success.	Students will analyze data from their interviews of interested parties to identify criteria for success that can inform the development of a plant to improve electricity infrastructure in their community.
4.6	11	Analyze data to identify design features or characteristics of the components of a proposed process or system to optimize it relative to criteria for success.	In the transfer task, students analyze data that they derive using computation to determine if a proposed design solution will be successful.
5.2	9	Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.	Students will apply ratios and unit conversions in the context of energy, costs, area, and efficiency problems involving quantities with compound units.
5.5	11	Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3 , acre-feet, etc.).	In the transfer task, students apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units to determine how much energy is available for Bahrain.
6.5	3	Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.	Students use empirical data about energy supply and demand to revise the design solutions we are building in this unit about how to build a more reliable electrical system.
6.5	6	Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.	In the transfer task, students will consider design decisions for building a motor, and then refine its design based on performance.

SEP Element #	Lesson	Elements of Science and Engineering Practice(s)	Rationale
6.5	11	Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.	Students design a solution, evaluate peers' solutions, and refine their solution for improving electrical grid reliability in their community based on results from a computational model, scientific knowledge we have figured out over the unit, weighted criteria, and tradeoff considerations informed by interviews with interested parties.
8.2	6	Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.	Students do a close reading about fields and particle interactions involving electrical energy. They integrate information from this reading into models they generate themselves and then compare these models to a computer simulation model.
8.2	8	Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.	Students integrate audio/text information from the podcast with graphs and images to define some of the challenges and tradeoffs associated with a drop in energy supply.

Developing and Using Crosscutting Concepts (by Lesson)

CCC Elements #	Lesson	Elements of Crosscutting Concept(s)	Rationale
1.3	6	Patterns of performance of designed systems can be analyzed and interpreted to reengineer and improve the system.	After identifying and analyzing patterns in the performance of an electrical system in a computer simulation model, students interpret these patterns to make suggestions to reengineer and improve our own electrical grid.
1.3	11	Patterns of performance of designed systems can be analyzed and interpreted to reengineer and improve the system.	Students analyze patterns of data generated through a computational model. They use these patterns to test various ways to improve the local grid system and to determine which best meets priorities related to global challenges that have manifestations in local communities.
1.5	3	Empirical evidence is needed to identify patterns	Students identify patterns in energy supply and demand data to suggest some of the causes of the mismatch between energy production and demand in Texas during February 2021.
2.1	7	Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.	Students choose a variable to consider based on a potential causal mechanism, but then develop and test a correlational hypothesis, recognizing that they will not be able to make causal claims.
2.2	6	Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system.	Students investigate the influence of several variables on the transfer of electrical energy through a wire to examine how the loss of energy could have caused the Texas blackout in February 2021.

CCC Elements #	Lesson	Elements of Crosscutting Concept(s)	Rationale
3.1	9	The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs.	Students will evaluate the feasibility of existing energy storage design solutions based on the scale of the costs and area used involved with these technologies.
3.3	7	Patterns observable at one scale may not be observable or exist at other scales.	Students consider limitations on this analysis to motivate seeking information about patterns at a smaller grain size, because many patterns are not visible at the county-level.
4.1	1	Systems can be designed to do specific tasks.	Students consider how the electrical system in Texas and in their community was designed and could be redesigned to provide a reliable and equitable source of power.
4.1	5	Systems can be designed to do specific tasks.	Students design their generator to perform a specific task: light up multiple LEDs or light up an LED for a longer period of time. Students make changes to their design to accomplish the specific task by trying to get the generator shaft spinning either faster or more gradually.
4.3	2	Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.	On day 1, students observe how a switch on a power strip can open or close circuits to change energy transfer in the system. Not only is the power strip directly relevant to students' investigation of energy transfer to multiple devices, it serves as a physical model of similar structures at different scales. In the reading for home learning, students see how switches can exist at larger scales, including automatic switches built for safety. On day 2, students use the power strips to build a physical model of a larger community including multiple buildings in order to model events that can change energy flow, such as a broken circuit and a short circuit.
4.3	3	Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.	Students develop energy transfer models to simulate the flow of energy across the three systems identified in Lesson 1: energy source, transportation/distribution, and destination. This model will be the basis to consider energy and matter interactions between various parts of these systems at differing scales in subsequent lessons.
5.2	5	Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.	At multiple scales, students model energy transfer into, within, and out of various systems, including a wind turbine, natural gas power plant, and homemade generator. For each system, students consider changes in matter (or motion of matter) as evidence of where and how energy might be transferring, and note this on their model. However, we take care to make a distinction that energy transfer is not identical to matter transfer.
5.2	6	Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.	In the transfer task, students model and describe how energy transfers in the motor using language about energy flowing in and out of systems and subsystems.

CCC Elements #	Lesson	Elements of Crosscutting Concept(s)	Rationale
5.2	7	Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.	Students show how insufficient supply entering the system could lead to reduced energy transfer into certain communities in Texas when the temperatures dropped, resulting in buildings losing power.
5.2	8	Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.	Students define challenges and tradeoffs associated with a drop in energy supply driven by cold weather, describing changes in terms of energy flows into and out of the system.
5.2	11	Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.	In the transfer task, students show how energy is conserved in the sand and mirror system.
5.3	7	Energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems.	Students model energy moving between systems to show how insufficient supply entering the system could lead to reduced energy transfer into certain communities in Texas.
5.3	8	Energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems.	Students apply their ideas about energy flow from system to system to put the pieces together and explain what happened in Texas in February 2021.
5.3	11	Energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems.	In the transfer task, students model and describe energy flows in and out of subsystems in the sand and mirrors system.
6.1	2	Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem.	Students analyze the shapes, composition, and relationships of a battery, the wires and junction leads for multiple outlets, the ground wire, and the metal connections in a toggle switch to determine how each part functions in the system, and they represent these functions in an individual system model on day 1. On day 2, they identify analogous structures in an electrical system in a building and across a neighborhood.
7.1	1	Much of science deals with constructing explanations of how things change and how they remain stable.	Students make two models of the electrical system: one that shows the system when it is stable, and one that shows the system when something has changed that might cause a blackout.
7.4	4	Systems can be designed for greater or lesser stability.	Students identify characteristics of energy sources that increase the reliability of the energy grid (designing for stability), given that for the system to remain stable, it must be designed for energy supply to meet energy demand.
7.4	9	Systems can be designed for greater or lesser stability.	Students consider the conditions that can make a system more stable by modeling how a battery can affect the behavior of a grid during a supply drop to make the system more reliable.

CCC Elements #	Lesson	Elements of Crosscutting Concept(s)	Rationale
7.4	10	Systems can be designed for greater or lesser stability.	Students develop and carry out an interview protocol to identify criteria that can help design more reliable electric infrastructure while taking into account other design criteria, such as social, cultural, and environmental impacts associated with some forms of energy production that are relevant to members of their community.
7.4	11	Systems can be designed for greater or lesser stability.	Students need to make tradeoffs in the systems they design between reliability (stability) and other criteria such as environmental impacts, cost, and renewability.

Disciplinary Core Ideas (by Lesson)

DCI Elements #	Lesson	Elements of Disciplinary Core Idea(s)	Rationale
PS3.D.1	3	Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment. (HS-PS3-3),(HS-PS3-4)	Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment. (HS-PS3-3) (HS-PS3-4)
ETS1.B.1	3	When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)	When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)
PS3.D.1	6	Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment. (HS-PS3-3),(HS-PS3-4)	Although energy cannot be destroyed, it can be converted to less useful forms--for example, to thermal energy in the surrounding environment. (HS-PS3-3),(HS-PS3-4)
ETS1.B.1	7	When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)	When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)
ETS1.B.1	8	When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)	When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)
PS3.B.1	9	Conservation of energy means that the total change of energy inany system is always equal to the total energy transferred into or out of the system. (HS-PS3-1)	Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. (HS-PS3-1)
PS3.D.1	9	Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment. (HS-PS3-3),(HS-PS3-4)	Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment. (HS-PS3-3),(HS-PS3-4)

DCI Elements #	Lesson	Elements of Disciplinary Core Idea(s)	Rationale
ETS1.B.1	9	When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)	When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)
ETS1.B.1	10	When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)	When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)
ETS1.B.1	11	When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)	When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)
PS3.A.2	1	At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HSPS3-2) (HS-PS3-3)	At the macroscopic scale, energy manifests itself in multiple ways, such as in ~~motion, sound~~, light~~, and thermal energy~~. (HSPS3-2) (HS-PS3-3)
PS3.B.2	1	Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS-PS3-1),(HS-PS3-4)	Energy ~~cannot be created or destroyed, but it~~ can be transported from one place to another and transferred between systems. (HS-PS3-1) (HS-PS3-4)
ETS1.A.2	1	Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1)	Humanity faces major global challenges today, ~~such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering~~. These global challenges also may have manifestations in local communities. (HS-ETS1-1)
PS3.B.2	2	Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS-PS3-1),(HS-PS3-4)	Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems.
ESS3.A.2	4	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-ESS3-2)	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-ESS3-2)
PS3.A.2	5	At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HSPS3-2) (HS-PS3-3)	At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HS-PS3-2) (HS-PS3-3)
PS3.A.2	6	At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HSPS3-2) (HS-PS3-3)	At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HSPS3.A)
ETS1.A.2	8	Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1)	Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1)

DCI Elements #	Lesson	Elements of Disciplinary Core Idea(s)	Rationale
PS3.D.2	10	Solar cells are human-made devices that likewise capture the sun's energy and produce electrical energy. (secondary to HS-PS4-5)	Solar cells are human-made devices that likewise capture the sun's energy and produce electrical energy. (secondary to HS-PS4-5)
ESS3.A.2	11	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-ESS3-2)	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-ESS3-2)
ETS1.A.2	11	Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1)	Humanity faces major global challenges today, such as the need for supplies of ~~clean water and food or for~~ energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1)
ETS1.B.2	11	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. (HS-ETS1-4)	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. (HS-ETS1-4)
PS3.A.3	5	"Electrical energy" may mean energy stored in a battery or energy transmitted by electric currents. (secondary to HS-PS2-5)	These relationships are better understood at the microscopic scale, at which all the different manifestations of energy can be modeled as either motions of particles or energy stored in fields (which mediate interactions between particles). ~~This last concept includes *radiation*, a phenomenon in which energy stored in fields moves across space.~~ (HS-PS3-2)
PS3.A.3	6	"Electrical energy" may mean energy stored in a battery or energy transmitted by electric currents. (secondary to HS-PS2-5)	"Electrical energy" may mean energy stored in a battery or energy transmitted by electric currents. (secondary to HS-PS2-5)
PS3.B.4	1	The availability of energy limits what can occur in any system. (HS-PS3-1)	The availability of energy limits what can occur in any system. (HS-PS3-1)
PS3.A.4	2	These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as either motions of particles or energy stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space. (HS-PS3-2)	"Electrical energy" may mean energy stored in a battery or energy transmitted ~~by electric currents~~.
PS3.B.4	3	The availability of energy limits what can occur in any system. (HS-PS3-1)	The availability of energy limits what can occur in any system. (HS-PS3-1)
PS3.B.4	4	The availability of energy limits what can occur in any system. (HS-PS3-1)	The availability of energy limits what can occur in any system. (HS-PS3-1)

DCI Elements #	Lesson	Elements of Disciplinary Core Idea(s)	Rationale
PS3.A.4	6	These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as either motions of particles or energy stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space. (HS-PS3-2)	These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as either motions of particles or energy stored in fields (which mediate interactions between particles)~~. This last concept includes radiation, a phenomenon in which energy stored in fields moves across space.~~ (HS-PS3-2)
PS3.B.4	7	The availability of energy limits what can occur in any system. (HS-PS3-1)	The availability of energy limits what can occur in any system. (HS-PS3-1)
PS3.B.4	9	The availability of energy limits what can occur in any system. (HS-PS3-1)	The availability of energy limits what can occur in any system. (HS-PS3-1)