Washington Township School District

The mission of the Washington Township Public Schools *is to provide a safe, positive, and progressive educational environment that provides opportunity for all students to attain the knowledge and skills specified in the NJ Learning Standards at all grade levels, so as to ensure their full participation in an ever-changing world as responsible, self-directed and civic-minded citizens.*

Course Title:	**College Preparatory Energy in the Environment**
Grade Level(s):	**9th Grade**

Duration:	*Full Year:*	**X**	*Semester:*		*Marking Period:*	

Course Description:

This is an inderdisciplinary course with emphasis on observational, analytical and laboratory safety skills. The course is written to include various energy resources such as hydroelectric, nuclear, electrochemical, fossil fuel, geothermal, solar, and wind energy within the context of impact on the environment. It also discuss environmental concerns and possible solutions towards a sustainable future. Students are required to complete weekly labs and quarterly projects, as the course is inquiry based.

Grading Procedures:

Marking Period Grades		Year End Course Grade	
Tests	35%	Marking Period 1	20%
Quizzes	20%	Marking Period 2	20%
Lab Work	25%	Marking Period 3	20%
Home work	10%	Marking Period 4	20%
Projects	10%	Midterm/Final Exam	10% **EACH**

Primary Resources:

Next Generation Science Standards NGSS

New Jersey Student Learning Standards NJSLS - Science

Text Book : Cengage Environmental Science 2017
Author : Miller and Spoolman

Washington Township Principles for Effective Teaching and Learning

- Implementing a standards-based curriculum
- Facilitating a learner-centered environment
- Using academic target language and providing comprehensible instruction
- Adapting and using age-appropriate authentic materials
- Providing performance-based assessment experiences
- Infusing 21st century skills for College and Career Readiness in a global society

Designed by:	Nivedita Shukla And Lorri Zeiders
Under the Direction of:	Dr. Patricia Hughes

Written: _____

Revised: _____

BOE Approval: _____

Unit 1 : Skills and Mathematics of Lab Work

The unit will identify observational techniques used by scientists in general and basic mathematical skills required for the scientific analysis during the course.Topics included will be accuracy and precision in measurements, interpretation of graphs and maps, data collection and critical analysis. Students will complete several labs requiring application of these skills and addressing these topics. Problem solving and logical reasoning skills are a focus of the unit.

Unit Duration: : 3-4 weeks

Desired Results

Standard(s):

- Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. (**MS- ETS1-3.)**
- Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. **(HS-ETS1-2)**

Indicators:

- There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (**MS- ETS1-3.)**
- Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors.

  Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (tradeoffs) may be needed. **(HS-ETS1-2)**

Understandings:
Students will understand …..

- Observations are the foundations of science and a variety of tools are used to organize data.
- All measurements have uncertainty.
- Uncertainty is used to describe the results of their own lab work.
- Uncertainity can be estimating, described, and expressed in measurements and calculations.
- Identifying types of error, sources of error and how to detect/minimize error are important part of lab work.
- Comparing measured values and determining whether values are the same within stated uncertainty are important for data analysis.
- How to use scientific inquiry to solve a problem.

Essential Questions:

1. What is the difference between Accuracy and Precision?
2. How are accuracy" and "precision" related to measured values?
3. What is the importance of making reliable observations and accurate data collection?
4. How do scientists organize and analyze data ?
5. What information is obtained by reading a graph?
6. How are various types of maps interpreted?
7. How do scientists solve problems?

Assessment Evidence

Performance Tasks:

- Students will organize given data (e.g., via tables, charts, or graphs) from tests intended to determine the effectiveness of three or more alternative solutions to a problem.
- Students will use appropriate analysis techniques (e.g., qualitative or quantitative analysis; basic statistical techniques of data and error analysis) to analyze the data and identify relationships within the data sets, including relationships between the design solutions and the given criteria and constraints.
- Students will use the analyzed data to identify evidence of similarities and differences in features of the solutions.
- Describe the scientific methods and the importance of observation, experimentation,and models.
- Recognize the importance of evidence, hypotheses, theories and laws in science
- Understand the benefits and limitations of science.

Other Evidence:

1. **Homework/Classwork**
   - Worksheets
   - Reading assignments
   - Text questions as assigned

2. **Lab Work** – data collection and analysis, conclusion questions, and lab quizzes.

   Lab # 1- Accuracy and precision in Measurement
   Lab # 2- Graphs of Motion
   Lab# 3- Mass of Pennies

3. **Quizzes**
   Measures of Uncertainity
   Graphing Skills
   Scientific Method
   Map Interpretation

4. **Tests**
   Data interpretation and Observation

Benchmarks: Graphing SGO

Learning Plan

Learning Activities:

Lesson 1 – Uncertainity of Measurements. (3-4 class periods)
(Teacher made hand- outs, powerpoint and worksheets)

- Students will do a warm up activity.
- Introduce the terms Accuracy and Precision in measurements and explain how they relate to measured values.
- Mathematically calculate Error and Deviation and use it to analyze a given set of data.
- Use a variety of lab equipment to take measurements.

Lesson 2- Graphing (4 class periods).
(Teacher made hand- outs, powerpoint and worksheets)

- Students will do a warm up activity.
- Pre-assessment – Graphing.
- Discuss Graphing Skills hand-out .
- Identify the independent and dependent variable on a graph.
- Explain the relationship between the variables.
- Plot a graph from the given data following all the graphing rules
- Use computers and motion sensors to plot and analyze graphs

Lesson 3- Review Mapping (1 class period)
(Teacher made hand- outs, powerpoint and worksheets)

- Review the basics of map reading.
- Locate places on a world map given the coordinates.

- Calculate distance between places .

Lesson 4 – Scientific Inquiry

- Read and outline text chapter 2.1
- Simpson worksheet. Students will use prior knowledge to analyse the problem and discuss the answers in class.
- Chapter Introduction- Pages 42-46
- Powerpoint lecture highlighting key terms and explaining Scientific Method
- Apply the information from powerpoint to the Case study : Experimenting with a forest.
- Reading Graphs and Maps Fig 1.
- PBS Learning Media activity.

Resources:

Miller and Spoolman, Environmental Science, National Geographic Learning, Cengage 2017

Graphing: link to Cengage book supplement: http://www.cengage.com/cgi-wadsworth/course_products_wp.pl?fid=M20bI&product_isbn_issn=9781305637429&token=884E56A165974732BE92622617475F8FA982EC1AD188550A66004163737B7A840F7EF358AE434803B4867C77AD05DB06FB9EE73D811EA0BF3A7BD93FC9A1192A7B745D3980015CBF

https://nj.pbslearningmedia.org/resource/136ef125-5afb-40b7-8c5d-26f400a99c8d/nanoengineer-and-the-scientific-method/#.WZMphaIa4jk

Unit Learning Goals and Scales *(Level 2.0 reflects a minimal level of proficiency)*	
• **Standard(s):** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. **(HS-ETS1-2)**	
4.0	**Students will be able to:** • In addition to score 3.0 performance, the student demonstrates in-depth inferences and applications that go beyond what was taught.
3.0	**Students will be able to:** • Break down criteria into simpler ones that can be approached systematically, and make trade-off decisions about the priority of certain criteria over others.
2.0	**Students will be able to:** • Describe the smaller parts into which a complex problem might be broken.
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**
• **Standard(s):** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. (**MS- ETS1-3.)**	
4.0	**Students will be able to:** • In addition to score 3.0 performance, the student demonstrates the ability to make in-depth inferences and applications that go beyond what was taught.
3.0	**Students will be able to:**

	• Determine which characteristics should be incorporated into a new design or combined to create a solution that is better than any of its predecessors.
2.0	**Students will be able to:** • Describe similarities and differences of design solutions.
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Unit Modifications for Special Population Students	
Advanced Learners	Critical thinking problems and applications of skills presented.
Struggling Learners	Copy notes using fill in notes, collaborative learning activities, utilize all learning styles (visual, audio, kinesthetic etc.)
English Language Learners	Translation of notes in their native language. http://www.state.nj.us/education/modelcurriculum/ela/ELLSupport.pdf
Special Needs Learners	Follow specified instruction in IEP. Copy notes, using fill in notes, collaborative learning activities utilize all learning styles (visual, audio, kinesthetic, etc. http://www.nj.gov/education/udl/
Learners with a 504 Refer to page four in the Parent and Educator Guide to Section 504 to assist in the development of appropriate plans.	

Interdisciplinary Connections

Indicators:
Embedded English Language Arts/Literacy and Mathematics Standards
English Language Arts/Literacy
RST.11-12.1, Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
WHST.9-12.2, Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
WHST.9-12.5, Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
WHST.9-12.7, Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
WHST.11-12.8, Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
WHST.9-12.9, Draw evidence from informational texts to support analysis, reflection, and research.
SL.11-12.5, Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest

Mathematics
MP.2 Reason abstractly and quantitatively.
HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

Integration of 21st Century Skills

Indicators:
Career Ready Practices
CRP2 – Apply appropriate academic and technical skills.
CRP5 – Consider the environmental, social and economic impacts of decisions.
CRP6 – Demonstrate creativity and innovation.
CRP7 – Employ valid and reliable research strategies.
CRP8 – Utilize critical thinking to make sense of problems and persevere in solving them.
CRP10 – Plan education and career paths aligned to personal goals.
CRP11 – Use technology to enhance productivity.
CRP12 – Work productively in teams while using cultural global competence.
9.2 Career Awareness, Exploration, and Preparation
9.2.12.C.1 – Review career goals and determine steps necessary for attainment.
9.2.12.C.3 – Identify transferable career skills and design alternate career plans.

Unit 2: The Environment and Sustainability

Unit Description: This unit introduces students to key factors in sustainability, how ecological footprints affect the Earth, causes of environmental problems in the world today, and the concept of environmentally sustainable societies.

Unit Duration: 2 – 3 weeks

Desired Results

Standard(s): NJ Next Generation Science Standards

- HS-LS2-2: Ecosystems: Interactions, Energy and Dynamics
  Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales

- HS-ESS3: Earth and Human Activity
  Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.

Indicators:

- HS-LS2.A: Interdependent Relationships in Ecosystems
  Ecosystems have carrying capacities, which are limits to the number of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from challenges such as predation, competition, and would have the disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance of species in any given ecosystem.

- HS-ESS3.A: Natural Resources
  Resource availability has guided the development of human society.

Understandings:
Students will understand that...

- Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support.
- The ability of an ecosystem to support a population is limited based on availability of resources.
- Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite.
- Resource availability has guided the development of human society.

Essential Questions:

1. What are some key factors of sustainability?
2. What is Environmental Science and what are its goals?
3. What is the link between ecosystem services and natural resources?
4. How are our ecological footprints affecting the Earth?
5. What causes environmental problems and why do they persist?
6. What is an environmentally sustainable society?
7. What can we do to achieve an environmentally sustainable society?

Assessment Evidence

Performance Tasks:
Students will:

- Define, recall and apply given vocabulary from text sections 1.1, 1.2 and 1.4: *ecology, ecosystem, ecosystem services, environment, environmental science, inexhaustible resource, natural capital, natural resource, nonrenewable resource, renewable resource, sustainability, ecological footprint, environmental degradation.*
- Identify key factors of sustainability.
- Evaluate Case Study and consider how environmentally responsible solutions can be implemented in schools and other businesses.
- Describe the purpose of ecological footprints in terms of sustainability.
- Calculate their environmental footprints and compare them with global footprints.
- Model environmental impacts using IPAT equation (I = P x A x T, where I = Impact, P = Population, A = Affluence and T = Technology).
- Discuss of environmental footprint findings and ways to reduce environmental footprint.

Other Evidence:
Daily informal and formal assessments of student activity, such as:

1. Homework/Classwork
   - Summer Assignment
   - Pre-assessment: The Environment and Sustainability
   - Read text sections 1.1, 1.2 and 1.4; Take Cornell Notes on template and record in OneNote.
   - Complete vocabulary notecards for text sections 1.1, 1.2 and 1.4 and use word pairing activity to demonstrate understanding;
   - Read and discuss Case Study, *Greening of American Schools*
   - EdPuzzle Video: *Growing Appetites, Limited Resources*
   - Black Board Discussion on sustainability topic
   - Current Event on sustainability topic

2. Routine formative assessments:
   - Daily objective questions
   - Warmup activity
   - White board reviews
   - Games (e.g. Kahoot)
   - Class discussion/online discussion boards
   - K-W-L Charts

3. Quiz
   - Ecology and Ecosystems

4. Lab: Watch Your Step Ecological Footprint Online Interactive
   - Objectives: Gain insight into the ways their lifestyle affects the Earth, become aware of limits to available resources, compare their calculated footprint with the average person in various regions of the world; explore ways to reduce our individual footprints

Benchmark: Unit Test: Units 1 and 2 (Tools of the Scientist; The Environment and Sustainability)

Learning Plan

Learning Activities (1 - 2 weeks):
(Note: Each class will begin with daily warm-up.)

Lesson: Introduction to the Environment and Sustainability

1. Online Pre-assessment
2. Students will use K-W-L Chart to state what they know about sustainability;
3. Students will read and discuss case study *The Greening of American Schools*, then complete and submit K-W-L chart.
4. Students will make notecards for vocabulary from text sections 1.1, 1.2 and 1.3. (See "Performance Expectations," above for specific terms).
5. Students will write original sentences identifying the differences between vocabulary work pairs such as: natural capital/natural resource; renewable/nonrenewable resource; students will identify examples of each term.
6. Guided reading of text sections 1.1 – 1.4, using Cornell Notes on OneNote.
7. TED-Ed Video Assignment: *What is Sustainability*?
8. Watch video: *Growing Appetites, Limited Resources*. Answer corresponding discussion questions.
9. Students will determine their ecological footprints to determine whether or not they are living sustainably.
10. Complete IPAT calculations from different geographical locations and compare findings.
11. Complete Ecological Footprint Lab
12. Tying it all together discussion assignment using Unified Classroom
13. The Environment and Sustainability

Resources:

Miller and Spoolman, Environmental Science, National Geographic Learning, Cengage 2017
http://data.footprintnetwork.org/
https://www.populationeducation.org/content/quick-trip-7-billion-exploring-timeline https://www.worldof7billion.org/wp-content/uploads/2014/08/a-report-card-for-the-planet.pdf
http://www.un.org/sustainabledevelopment/sustainable-development-goals/
http://www.nea.org/tools/k-w-l-know-want-to-know-learned.html
https://nj.pbslearningmedia.org/resource/nvel.sci.tech.growapp/growing-appetites-limited-resources/#.WZeoGI-cFPY
https://ed.ted.com/on/NziyiiXK
file:///C:/Users/lzeiders/Downloads/Supp4_ES_CW_49750%20(1).pdf – Environmental Data Analyses
www.footprintnetwork.org
https://education.microsoft.com/Story/SkypeCollaboration?token=I67VR skype/sway Sustainable Development Goal

Unit Learning Goal and Scale
(Level 2.0 reflects a minimal level of proficiency)

Standard(s):
HS-LS2-2: Ecosystems: Interactions, Energy and Dynamics

4.0	**Students will be able to:** • Demonstrate ability to make in-depth references and applications that go beyond what was taught.
3.0	**Students will be able to:** • Examine multiple sets of data pertaining to population, affluence and technology and use data to perform IPAT calculations. • Interpret IPAT calculations to explain environmental impacts with respect to sustainability.
2.0	**Students will be able to:** • Recognize or recall the following vocabulary terms: *ecology, ecosystem, ecosystem services, environment, environmental science, inexhaustible resource, natural capital, natural resource, nonrenewable resource, renewable resource, sustainability, ecological footprint, environmental degradation.* • Describe how ecological footprints can affect the environment.

1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success

Standard(s):

HS-ESS3: Earth and Human Activity

4.0	**Students will be able to:** • In addition to score of 3 , student demonstrate in-depth inferences and applications that go beyond what was taught.
3.0	**Students will be able to:** • Evaluate ecological footprint to develop solutions that reduce impacts of human activities on natural systems (e.g. recycling).
2.0	**Students will be able to:** • Recognize or recall the following vocabulary terms: *ecology, ecosystem, ecosystem services, environment, environmental science, inexhaustible resource, natural capital, natural resource, nonrenewable resource, renewable resource, sustainability, ecological footprint, environmental degradation.* • Summarize a technological solution for reducing the impact of human activities. • Summarize the impact of human activity on natural systems.
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Unit Modifications for Special Population Students	
Advanced Learners	Critical thinking problems and applications of skills presented.
Struggling Learners	Copy notes using fill in notes, collaborative learning activities, utilize all learning styles (visual, audio, kinesthetic etc.)
English Language Learners	Translation of notes in their native language. http://www.state.nj.us/education/modelcurriculum/ela/ELLSupport.pdf
Learners with an IEP	Each special education student has in Individualized Educational Plan (IEP) that details the specific accommodations, modifications, services, and support needed to level the playing field. This will enable that student to access the curriculum to the greatest extent possible in the least restrictive environment. These include: • Variation of time: adapting the time allotted for learning, task completion, or testing • Variation of input: adapting the way instruction is delivered • Variation of output: adapting how a student can respond to instruction • Variation of size: adapting the number of items the student is expected to complete • Modifying the content, process or product

		Additional resources are outlined to facilitate appropriate behavior and increase student engagement. The most frequently used modifications and accommodations can be viewed here. Teachers are encouraged to use the Understanding by Design Learning Guidelines (UDL). These guidelines offer a set of concrete suggestions that can be applied to any discipline to ensure that all learners can access and participate in learning opportunities. The framework can be viewed here www.udlguidelines.cast.org
Learners with a 504	Refer to page four in the Parent and Educator Guide to Section 504 to assist in the development of appropriate plans.	

Interdisciplinary Connections
Indicators: **Embedded English Language Arts/Literacy and Mathematics Standards** **English Language Arts/Literacy** RST.11-12.1, Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. WHST.9-12.2, Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. WHST.9-12.5, Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. WHST.9-12.7, Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. WHST.11-12.8, Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. WHST.9-12.9, Draw evidence from informational texts to support analysis, reflection, and research. SL.11-12.5, Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest **Mathematics** MP.2 Reason abstractly and quantitatively. HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
Integration of 21st Century Skills

Indicators:
Career Ready Practices
CRP2 – Apply appropriate academic and technical skills.
CRP5 – Consider the environmental, social and economic impacts of decisions.
CRP6 – Demonstrate creativity and innovation.
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CRP10 – Plan education and career paths aligned to personal goals.
CRP11 – Use technology to enhance productivity.
CRP12 – Work productively in teams while using cultural global competence.
9.2 Career Awareness, Exploration, and Preparation
9.2.12.C.1 – Review career goals and determine steps necessary for attainment.

9.2.12.C.3 – Identify transferable career skills and design alternate career plans.

Unit 3: Overview of Energy

This unit introduces students to a basic understanding of energy. The unit will include lessons on the relationship between matter and energy, forms of energy (including primary and secondary), and the first and second laws of thermodynamics.

Unit Duration: 3 – 4 weeks

Desired Results

Standard(s): NJ Next Generation Science Standards

- HS-PS1: Matter and Its Interactions
  Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons (HS-PS1-1)

- HS-PS3: Energy
  Create a model to calculate the change in the energy of one component in a system when change in energy of the other component(s) and energy flows in and out of the system are known. (HS-PS3-1)

  Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of the particles or objects. (HS-PS3-2)

  Design, build and refine a device that works within given constraints to convert one form of energy into another form of energy. (HS-PS3-3)

  Plan and investigate to provide evidence that the transfer of thermal energy when two components of different temperatures are combined within a closed-loop system results in a more uniform energy distribution among the components in the system (second law of thermodynamics). (HS-PS3-4)

- HS-ESS2: Earth Systems
  Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth Systems.

Indicators:

- HS-PS1.A: Structure and properties of matter
  Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1)

- HS-PS3A: Definition of Energy
  Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is since a system's total energy conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HS-PS3-1 and HSPS3-2)

  At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HS-PS3-2 and HSPS3-3)

- HS-PS3B: Conservation of Energy and Energy Transfer
  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)

  Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS-PS3-1 and HSPS3-4)

  Mathematical expressions, which quantify how the stored energy in a system depends on its configuration and how kinetic energy depends on mass a d speed, allow the concept of conservation of energy to be used to predict and describe system behavior. (HS-PS3-1)
  Uncontrolled systems always evolve toward more stable states – that is, toward more uniform energy distribution. (HS-PS3-4)**.**

- HS-PS3D: Energy in Chemical Processes
  Although energy cannot be destroyed, it can be converted to less useful forms; for example, to thermal energy in the surrounding environment. (HS-PS3-4)

Understandings:
Students will ...

Lesson 1: What is Matter?

- Define, recall and apply the following vocabulary from text section 2.2: *matter, element, compound, atom, molecules, ions, physical change, chemical change (chemical reaction), Law of Conservation of Matter.*
- Understand that each atom has a charged substructure consisting of a nucleus, which is made of a proton, neutron and electron (HS-PS1-1).
- Understand that elements and compounds can be changed from one physical or chemical form, but atoms are never created or destroyed in the process.

Lesson 2: Energy Introduction

- Define, recall, and apply the following vocabulary terms from text section 2.3: *energy, kinetic energy, potential energy, thermal energy, electromagnetic radiation.*
- Understand the definition of energy and the two basic forms of energy: kinetic and potential. Students will be able to identify the form of energy when given examples.
- Understand that energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy (HS-PS3-1 and 2).

Lesson 3: Thermodynamics

Essential Questions:

Lesson 1

1. Can you define matter and identify its building blocks?
2. Can you explain the law of conservation of matter?
3. What is the difference between physical and chemical changes?

Lesson 2

4. Can you explain the concept of *energy?*
5. Can you explain the difference between kinetic energy and potential energy and provide examples?
6. What are the different forms of energy?

Lesson 3

7. Can you define and explain the first and second laws of thermodynamics and provide examples?
8. What is created when energy is "lost?"

Lesson 4

9. What are the key components of a system?
10. What are the ways in which systems respond to change?
11. What is needed for systems to become sustainable?

- Define, recall and apply the following vocabulary terms from text section 2.3: *heat, conduction, convection, radiation, insulation*, *first law of thermodynamics, second law of thermodynamics.*
- Understand that 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).
- Understand that energy cannot be created or destroyed but it can be transported from one place to another and transferred between systems (HS-PS3-1 and HS-PS3-4).
- Understand that although energy cannot be created or destroyed, it can be converted to less useful forms (HS-PS3-3 and 4).
- Understand that it takes energy to produce energy, and explain the significance of net energy. (HS-PS3-3)

Lesson 4: What Are Systems?

- Define, recall and apply the following vocabulary terms from text section 2.4: system, feedback loop, ecological tipping point.
- Provide examples of how systems are interconnected and predict how changes in one system will affect other systems.

Assessment Evidence

Performance Tasks:

- Draw and label parts of an atom, then explain how atoms build elements, compounds and molecules.
- Develop idea to test the Law of Conservation of Matter.
- Identify at least three examples of kinetic energy and three examples of potential energy.
- Classify different types of energy as potential or kinetic forms of energy.
- Explain why thermal energy is classified as kinetic energy.
- Explain the difference between first and second laws of thermodynamics and provide examples.
- Map energy transformations in everyday life.
- Explain what is necessary for a system to become sustainable and provide examples.
- Predict how changes in one system will affect other systems.
- Perform Home/School Energy Audit

Other Evidence:

Daily informal and formal assessments of student learning, such as:

1. Homework/Classwork
   - Energy Pre-Assessment
   - Guided Reading of Text Sections 2.2, 2.3, and 2.4
   - OneNote Cornell Notes on Energy Power Point
   - Complete vocabulary notecards for text sections 2.2, 2.3, and 2.4 and use work paring activity to demonstrate understanding.
   - Unified Classroom Energy Discussion Assignment
   - EdPuzzle *Nova Energy* Video Assignment
   - Home/School Energy Audit (Marking Period Project)
   - Current Event on Energy Topic

2. Routine formative assessments
   - Daily objective questions
   - Warmup activity
   - White board reviews
   - Games (e.g. Kahoot)
   - Class discussion/online discussion boards
   - K-W-L Charts

3. Quizzes
   - Introduction to Energy and Matter
   - Thermodynamics
   - Systems

	4. Labs • Science of Energy Lab Students are divided groups, with each group responsible for learning and teaching the other groups about the energy experiment in their assigned station • Potential vs Kinetic Energy Marble Lab • Vernier: Energy and Power Lab

Benchmarks: Unit Test and Marking Period Project: Energy Audit

Learning Plan

Learning Activities.

Note: Each class will begin with daily warm-up.

Lesson 1: Introduction to Matter

1. PreAssessment: Quiz
2. HW:
   - Guided reading text section 2.2/Cornell Notes, or similar checkpoints
   - Vocabulary definitions
   - Complete Experimental Design Assignment
   - Complete PHet Assignment: Build an Atom
3. Lab: Science of Energy
4. PowerPoint Presentation: Matter (Definition, Physical and Chemical Changes, Conservation
   - Demo to determine whether air is matter (Annenberg Learner)
5. Discuss physical and chemical changes in matter.
   Provide students with examples of changes in matter and have them identify whether change is chemical or physical and why. (see Interpret *Visuals* in the textbook).
6. Video: Physical Changes and Conservation of Matter (Abbreviated)/Guided Questions
   http://www.learner.org/courses/essential/physicalsci/session3/index.html
7. Video: Chemical Changes and Conservation of Matter (Abbreviated)/Guided Questions
   http://www.learner.org/courses/essential/physicalsci/session4/index.html
8. Assignment: Law of Conservation of Mass
   Students will design an experiment to determine the effect on mass when a substance undergoes either a physical or a chemical change. (Students will need to understand the difference between open and closed systems to do this activity.)
   http://www.cpalms.org/Public/PreviewResourceLesson/Preview/28488
9. Assignment (Optional): PHet Simulation: Build an Atom

Lesson 2: Introduction to Energy

1. Preassessment: Quiz or Energy Poll (SGO? Repeat MP3)
2. HW:
   - Guided reading text sections 2.3/Cornell Notes, or similar checkpoints, and vocabulary
3. Lab: TBD. Options listed above in *Other Assessment Evidence*.
4. Introductory Video:
   - Watch Nova video: Energy Defined and answer following question*: What is energy and why are we on a never-ending search for new energy sources?* (Could add more questions and use this as a homework assignment using EdPuzzle): http://www.pbs.org/video/nova-energy-defined/
5. Presentation on What is Energy? (Kinetic Energy, Potential Energy)
   https://www.teachengineering.org/lessons/view/ucd_energy_lesson01
   https://www.teachengineering.org/lessons/view/ucd_energy_lesson02
6. Activities:
   - Spool Racer Design Competition *or* Pendulum Activity
     https://www.teachengineering.org/activities/view/ucd_energy_lesson01_activity1.
   - Forms of Energy worksheet:
     http://www.need.org/files/curriculum/guides/Secondary%20Infobook%20Activities.pdf

- Energy Calculations (Work and Power) Worksheet
- Taming Energy: Walking vs. Running Up a Flight of Stairs. Calculate work and power, compare results (*Fuel for Thought, Building Energy Awareness in Grades 9 – 12).*

7. Quiz

Lesson 3: Thermodynamics (Energy Transfer)

1. Preassessment: Quiz
2. HW:
3. Lab: To be determined. Options listed above in *Other Assessment Evidence*
4. Presentation: What is Heat (Thermal Energy)?
   https://www.teachengineering.org/content/ucd_/lessons/ucd_heat/ucd_heat_lesson01_presentation_v2_tedl_dwc.pdf.
6. Presentation: Energy Forms, States and Conversions
   https://www.teachengineering.org/lessons/view/cla_lesson4_forms_states_conversions
7. Demonstration: Energy Forms and States
   https://www.teachengineering.org/activities/view/cla_activity1_forms_states
8. Activities:
   - Energy Conversions Activity
     https://www.teachengineering.org/activities/view/cla_activity2_energy_conversion
   - What Works Best in a Radiator? Focus on conduction as it relates to heating a liquid
     https://www.teachengineering.org/activities/view/uoh_magic_lesson01_activity1
   - To Heat or Not to Heat? Student-designed travel mug (use KWL)
     https://www.teachengineering.org/activities/view/wsu_heat_activity
   - Energy Skate Park PHet Simulation: Learn about conservation of energy with a skater dude! Build tracks, ramps and jumps for the skater and view the kinetic energy, potential energy and friction as she moves.
9. Quiz

Lesson 4: What Are Systems?

1. Read Section 2.4 and answer guided questions.
2. Diagram and describe positive and negative feedback loops.
3. Assignment:
   a. Provide three examples of systems in nature that are not discussed in book.
   b. Explain what can cause a system to become unsustainable.
   c. Analyze classroom (or other example). Draw a model of the system.

Resources:

- Miller and Spoolman, Environmental Science, National Geographic Learning, Cengage 2017
- Interaction between matter and energy explained: https://socratic.org/questions/what-is-the-relationship-between-matter-and-energy
- Nova Energy Lab: https://nj.pbslearningmedia.org/resource/nvel.sci.tech.lpenergy/nova-energy-lab-lesson-plan/#.WZnxpSiGNPY
- PHet Build an Atom activity: https://phet.colorado.edu/sims/html/build-an-atom/latest/build-an-atom_en.html
- PHet Build an Atom activity worksheet: https://phet.colorado.edu/en/contributions/view/4064
- 5th grade lesson plan with activities that can be adapted for high schoolers: http://wiki.gpaea.k12.ia.us/sandbox/groups/scienceliteracy/wiki/68492/attachments/a388f/Conservation%20of%20Mass%20lesson%20plan-%205th%20grade%20with%20Backwards%20design%20and%205%20E%20Cycle.pdf?sessionID=c0e4bd2073d44628dc605baaeb2b27f06474d5cf
- Formative assessment resource book: Uncovering Student Ideas in Science: 25 formative assessment probes; Page Keeley, Francis Eberle, Lynn Farrin
- Subscription to www.CPalms.org
- Energy Icebreakers and games: http://www.need.org//Files/curriculum/guides/GamesandIcebreakers.pdf
- Heat Transfer Demo: Burning a Candle at Both Ends (*Fuel for Thought, Building Energy Awareness in Grades 9 – 12)*

- Taming Energy (*Fuel for Thought, Building Energy Awareness in Grades 9 – 12)*
- Energy Flow Activity: Students learn about forms of energy, how energy is converted from one form to another and how energy flows through systems: http://www.need.org/files/curriculum/guides/Energy%20Flows.pdf
- Energy Skate Park Simulation: https://phet.colorado.edu/en/simulation/legacy/energy-skate-park
- Good introductory Energy Power Point presentation https://www.teachengineering.org/lessons/view/ucd_energy_lesson01
- Energy of Motion Curricular Unit: https://www.teachengineering.org/curricularunits/view/cub_energy_curricularunit
- www.learner.org Physical Science – good questions/ideas on matter
  What is Matter? Video - https://nj.pbslearningmedia.org/resource/psu06-nano.sci.matter/what-is-matter/#.WZyJ0LpFwy8
- Good examples and discussion material*:* Annenberg Learner Physical Science
  http://www.learner.org/courses/essential/physicalsci/session4/closer1.html
- Science of Energy Lab: (http://www.need.org/files/curriculum/guides/Secondary%20Science%20of%20Energy.pdf

Unit Learning Goal and Scale *(Level 2.0 reflects a minimal level of proficiency)*	
• **Standard(s):** HS-PS3: Energy Create a model to calculate the change in the energy of one component in a system when change in energy of the other component(s) and energy flows in and out of the system are known.	
4.0	**Students will be able to:** • In addition to score of 3, student demonstrates the ability to make in-depth inferences and applications that go beyond what was taught
3.0	**Students will be able to:** • Use basic algebraic expressions to calculate the change in the energy.
2.0	• **Students will be able to:** • Research ways in which energy can be converted from one form to another. • Describe how energy results from the motion of the particles.
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success
Standard(s): • HS-PS1: Matter and Its Interactions Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons (HS-PS1-1)	
4.0	**Students will be able to:** • In addition to score of 3, student demonstrates the ability to make in-depth inferences and applications that go beyond what was taught.
3.0	**Students will be able to:** • Use information on the periodic table to predict relative properties.
2.0	**Students will be able to:** • Recognize and recall specific vocabulary (for example atom.atomic mass, atomic nucleus, bond,electron,proton,neutron, periodic table, element,compounds).
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Unit Modifications for Special Population Students	
Advanced Learners	Critical thinking problems and applications of skills presented.
Struggling Learners	Copy notes using fill in notes, collaborative learning activities, utilize all learning styles (visual, audio, kinesthetic etc.)
English Language Learners	Translation of notes in their native language.

	http://www.state.nj.us/education/modelcurriculum/ela/ELLSupport.pdf
Learners with an IEP	Each special education student has in Individualized Educational Plan (IEP) that details the specific accommodations, modifications, services, and support needed to level the playing field. This will enable that student to access the curriculum to the greatest extent possible in the least restrictive environment. These include: • Variation of time: adapting the time allotted for learning, task completion, or testing • Variation of input: adapting the way instruction is delivered • Variation of output: adapting how a student can respond to instruction • Variation of size: adapting the number of items the student is expected to complete • Modifying the content, process or product Additional resources are outlined to facilitate appropriate behavior and increase student engagement. The most frequently used modifications and accommodations can be viewed here. Teachers are encouraged to use the Understanding by Design Learning Guidelines (UDL). These guidelines offer a set of concrete suggestions that can be applied to any discipline to ensure that all learners can access and participate in learning opportunities. The framework can be viewed here www.udlguidelines.cast.org
Learners with a 504 Refer to page four in the Parent and Educator Guide to Section 504 to assist in the development of appropriate plans.	

Interdisciplinary Connections

Indicators:
Embedded English Language Arts/Literacy and Mathematics Standards
English Language Arts/Literacy
RST.11-12.1, Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
WHST.9-12.2, Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
WHST.9-12.5, Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
WHST.9-12.7, Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
WHST.11-12.8, Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
WHST.9-12.9, Draw evidence from informational texts to support analysis, reflection, and research.
SL.11-12.5, Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest

Mathematics

MP.2 Reason abstractly and quantitatively.
HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

Integration of 21st Century Skills

Indicators:
Career Ready Practices
CRP2 – Apply appropriate academic and technical skills.
CRP5 – Consider the environmental, social and economic impacts of decisions.
CRP6 – Demonstrate creativity and innovation.
CRP7 – Employ valid and reliable research strategies.
CRP8 – Utilize critical thinking to make sense of problems and persevere in solving them.
CRP10 – Plan education and career paths aligned to personal goals.
CRP11 – Use technology to enhance productivity.
CRP12 – Work productively in teams while using cultural global competence.
9.2 Career Awareness, Exploration, and Preparation
9.2.12.C.1 – Review career goals and determine steps necessary for attainment.
9.2.12.C.3 – Identify transferable career skills and design alternate career plans.

Unit 4: Geology and Nonrenewable Mineral Resources

Unit Description:

Resources are considered nonrenewable if their quantities are limited or if they cannot be replenished for thousands or even millions of years This unit describes Earth's geology as well as its nonrenewable mineral resources and how people use them.

Unit Duration: 2 weeks

Desired Results

Standard(s):

- Evaluate competing design solutions fordeveloping, managing, and utilizing energy and mineral resources based on cost-benefit ratios**.(HS-ESS3-2).**
- Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. (**HS-ETS1-1).**

Indicators:

- 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.

- All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks aswell as benefits. New technologies and social regulations can change the balance of these factors.

Understandings:
Students will understand …

- Geosphere is divided into three major parts.
- Earth's crust is made up of slowly moving tectonic plates.
- Geological processes within Earth and on its surface produce various mineral resources.
- The supply of mineral resource is limited.
- Various mining practices create environmental and safety problems.
- Mineral resources can be used more sustainably.

Essential Questions:

- How do geological processes relate to society and environment?
- What are Earth's mineral resources and and how long might reserves last?
- What are the effects of mineral resources?
- How can society use mineral resources more sustainably?

Assessment Evidence

Performance Tasks:
Students will be able to :

- Identify three major parts of Earth's Geosphere.
- Describe the movement of tectonic plates.
- Explain the interaction between geologic events,human populations and the environment.
- Define minerals and rocks and describe how they are formed during the rock cycle.
- Discuss the variety of minerals and their uses.
- Explain how market prices affect mineral supplies.
- Describe the major type of mining.
- Discuss the harmful environmental effects of mining.
- Identify new materials that are replacing some common metals.
- Explain how mineral resources can be used more sustainably.

Other Evidence:

Daily informal and formal assessments of student activities, such as:

Homework/Classwork

- Warm up questions
- Worksheets
- Reading assignments
- Text questions as assigned
- On going Lab work.
- Independent/group work

Lab Work

- Analysis and conclusion questions
- Lab Quizzes
  Lab # 1- Mineral identification.
  Lab # 2- Rocks and Minerals webquest.

Quizzes

- Layers of the Earth.
- Plate Tectonics and Boundaries.
- Minerals.

	Tests Chapter 11 assessment. Video presentation where applicable.
Benchmarks: Mid-term exam	

Learning Activities:

Chapter 11- Geology and Nonrenewable mineral resources.

Lesson 1 (1.5 weeks.)

- Powerpoint lecture – Layers of the Earth.
- Layers of the Earth – TED-Ed. Make a model and label it.
- Map and Map analysis Fig. 23-24.
- Powerpoint lecture- Plate tectonics theory.
- Watch “Plate Margins”
- PBS learning media activity:
  Plate Tectonics -an introduction
  Tectonic Plates, earthquakes and volcanoes.
- Volcanic Activity (pg.359)
- Vocabulary terms (pg. 357)
- Predict and confirm (pg. 357)

Lesson 2 (1.5 weeks)

Case study- The importance of Rare Earth Metals.

- Powerpoint lecture -minerals and rocks.
- Webquest – minerals and rocks.
- Activity – mineral research.
- Lab: Mineral identification.
- KWL chart (pg.362)
- Depletion Curves (pg. 365)
- Local Mineral Resources.
- Watch “ Crystals “.
- Vocabulary (pg.362)
- 11.2 assessment.

Lesson 3 (2 class periods)

- Discuss The major types of mining.
- Watch “Processing Ore to Make Gold”.
- Make a chart on the harmful effects of mining.
- Vocabulary terms.

Resources:

https://ed.ted.com/on/88t2sB4g

https://nj.pbslearningmedia.org/resource/ess05.sci.ess.earthsys.plateintro/plate-tectonics-an-introduction/#.WZuG16LNzRw

Unit Learning Goal and Scale

(Level 2.0 reflects a minimal level of proficiency)

Standard(s): **(HS-ESS3-2).**	
4.0	**Students will be able to:** • Demonstrate the ability to make in-depth references and applications that go beyond what was taught.
3.0	**Students will be able to:** • Evaluate competing design solutions, and develop best practices for agricultural soil use, coal,tar sand and oil shale mining.
2.0	**Students will be able to:** • Describe the process of using cost-benefit ratios to evaluate design solutions. • Summarize competing design solutions for developing, managing and utilizing energy and mineral resources.
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Standard(s): (**HS-ETS1-1**).	
4.0	**Students will be able to:** • Demonstrate the ability to make in-depth inferences and applications that go beyond what was taught.
3.0	**Students will be able to:** • Analyze a major global challenge that can be addressed through engineering, such as the need of clean water and food or for energy sources that minimize pollution.
2.0	**Students will be able to:** • Summarize a major global challenge or problem. • Summarize societal needs and wants related to the challenge or problem.
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Unit Modifications for Special Population Students	
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	• Modifying the content, process or product Additional resources are outlined to facilitate appropriate behavior and increase student engagement. The most frequently used modifications and accommodations can be viewed here. Teachers are encouraged to use the Understanding by Design Learning Guidelines (UDL). These guidelines offer a set of concrete suggestions that can be applied to any discipline to ensure that all learners can access and participate in learning opportunities. The framework can be viewed here www.udlguidelines.cast.org
Learners with a 504	Refer to page four in the Parent and Educator Resource Guide to Section 504 to assist in the development of appropriate plans.

Unit 5: Electricity

In this unit, students will explore how current flows through a circuit and label a simple circuit diagram. Students will measure the voltage across a battery, light bulb, and resistor. They will apply Ohm's Law to determine current, resistance, or voltage. Students will observe how electrical energy is generated and transformed into other types of energy.

Unit Duration: 2 weeks

Desired Results

Standard(s): NJ Next Generation Science Standards

- HS-PS2-6
  Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
- HS-PS3-1
  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.
- HS-PS3-3:
  Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

Indicators:

- HS-PS3A: Definition of Energy
  "Electrical Energy" may mean energy stored in a battery or energy transmitted by electrical currents.
- HS-PS3B: Conservation of Energy and Energy Transfer
  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)
- HS-PS3D: Energy in Chemical Processes
  Although energy cannot be destroyed, it can be converted to less useful forms; for example, to thermal energy in the surrounding environment. (HS-PS3-4)

Understandings:

Students will ...

- Define, recall and apply the following vocabulary from the NEED Secondary Energy Infobook: *secondary source of energy, turbine, generator, magnet, electric current, voltage, transformer, transmission lines, distribution lines, substation, power station.*
- Know that electricity represents a flow of electrons.
- Describe electricity, including how it is generated
- from various energy sources and distributed.
- Research where local electricity is generated and resources used to generate this electricity.
- Explain how current flows through a circuit.
- Use Ohm's Law to determine current, resistance and voltage.
- Measure voltage across a battery, light bulb and resistor

Essential Questions:

- What type of resources are used to generate most electricity in the United States and the World?
- How does electricity get from the power plant, where it is generated, to the customer?
- What is the difference between series and parallel circuits?
- How is electricity measured?
- What happens to electrical energy during transmission? (What is electrical envery converted into during transmission?)

- Understand that it takes energy to produce energy, and understand that explain the significance of net energy. (HS-PS3-3)

Assessment Evidence

Performance Tasks:

- Conduct an investigation to provide evidence that an electric current can produce a magnetic field and that changes in that field can produce an electric current.

- Student presentations on focused topics pertaining to electricity, such as economics of electricity, deregulation and competition, future demand and smart grids.

Other Evidence:
Daily informal and formal assessments of student learning, such as:

1. Homework/Classwork
   - Nearpod Interactive PowerPoint
   - Discussion board responses to guided questions pertaining to electricity.

2. Quizzes
   - Vocabulary
   - Electricity

3. Labs
   - PHet Electricity Online Simulation (or physical circuit design lab, pending availability of circuit boards).

Benchmarks: Unit Test, Circuit Construction Performance

Learning Plan

Learning Activities.

Lesson 1: Nature of Electricity

- History of Electricity: Documentary – The Electricity War
- BBC Bitesize introduction to Electricity: Electric Current and Potential Difference
- Electricity Power Point and Guided Notes
- Electricity Focus: Students will be divided into groups, with each group focusing on a specific topic pertaining to electricity as described in the NEED.org Secondary Energy Infobook (p. 55 – 61)

Lesson 2: Making and Moving Electricity

- Students will explore movement and characteristics of electricity and magnetism by designing series and parallel circuits during lab activity.
- Interactive: How Does Electricity Get to Your Home?
- Activity: How Much Electricity is Lost in Transmission?
- Research resources used to generate electricity that is ultimately used in Washington Township.

Lesson 3: Smart Grid/Vehicle to Grid (V2G) Technology

- Compare and Contrast Conventional Power Grid to Smart Grids
- Smart Grid Activity (https://www.studentenergy.org/topics/smart-grid) - Students will explore implementation of Smart Grids in detail and complete associated assignment.
- Students will watch video on cutting edge Vehicle to Grid Technology and express thoughts on Discussion Board

Resources:

- Miller and Spoolman, Environmental Science, National Geographic Learning, Cengage 2017
- www.need.org resources
- Virtual Energy Labs: https://www.youngscientistlab.com/sites/youngscientistlab.com/files/interactives/VirtualLabs/iOS6_Fixes/VirtualLabs/index.htm?Title=Getting%20Connected%20&Path=Circuits&Lang=en
  https://phet.colorado.edu/sims/html/circuit-construction-kit-dc/latest/circuit-construction-kit-dc_en.html
- Power Points:

http://www.need.org/electricityandmagnetism and https://www.energy.gov/ne/information-resources/stem-resources
(The Harnessed Atom)

- BBC Bitesize introduction to Electricity: Electric Current and Potential Difference: https://www.bbc.com/bitesize/guides/zsfgr82/revision/3
- Electricity Wars - https://topdocumentaryfilms.com/electricity-war/
- https://www.khanacademy.org/science/physics/electric-charge-electric-force-and-voltage/electric-potential-voltage/v/electric-potential-energy
- www.need.org/files/curriculum/guides/Secondary%20Energy%20Infobook.pdf
- How Does Electricity Get to Your Home Activity - https://ww2.kqed.org/quest/2014/11/14/how-does-electricity-get-to-your-home/
- How much electricity is lost in transmission activity - http://insideenergy.org/2015/11/06/lost-in-transmission-how-much-electricity-disappears-between-a-power-plant-and-your-plug/
- https://www.pbs.org/wgbh/nova/video/smart-grid and V2G Technology
- https://www.studentenergy.org/topics/smart-grid

Unit Learning Goal and Scale *(Level 2.0 reflects a minimal level of proficiency)*	
• **Standard(s): HS-PS3-1, HS-PS3-3**	
4.0	**Students will be able to:** • In addition to Score 3.0 performance success, the student demonstrates the ability to make in depth inferences and applications that go beyond what was taught.
3.0	**Students will be able to:** • Students will be able to compute relationships between electricity, voltage and current then demonstrate how changes in one of these variables impacts the others.
2.0	**Students will be able to:** • Use basic algebraic expressions for calculating Ohm's Law. • Recognize/recall specific vocabulary including electric current, generation, transmission, voltage, distribution. • Trace electricity flow from its generation to distribution to consumer.
1.0	With help, partial success at level 2.0 content and level 3.0 content:
0.0	Even with help, no success
Standard(s): HS-PS2-6	
4.0	**Students will be able to:** • In addition to Score 3.0 performance success, the student demonstrates the ability to make in depth inferences and applications that go beyond what was taught.
3.0	**Students will be able to:** • Conduct an investigation using a circuit board to create an electric current and demonstrate how changes in the circuit components can change amount of energy transfer. • Explain how an electric current is created using a battery and the significance of protons and electrons with respect to electric current direction and flow.
2.0	**Students will be able to:** • Recall select vocabulary including electron, proton, electric circuit, voltage, resister, conductor, insulator
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Unit Modifications for Special Population Students

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WHST.11-12.8, Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and

audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
WHST.9-12.9, Draw evidence from informational texts to support analysis, reflection, and research.
SL.11-12.5, Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest

Mathematics
MP.2 Reason abstractly and quantitatively.
HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

Integration of 21st Century Skills

Indicators:
Career Ready Practices
CRP2 – Apply appropriate academic and technical skills.
CRP5 – Consider the environmental, social and economic impacts of decisions.
CRP6 – Demonstrate creativity and innovation.
CRP7 – Employ valid and reliable research strategies.
CRP8 – Utilize critical thinking to make sense of problems and persevere in solving them.
CRP10 – Plan education and career paths aligned to personal goals.
CRP11 – Use technology to enhance productivity.
CRP12 – Work productively in teams while using cultural global competence.
9.2 Career Awareness, Exploration, and Preparation
9.2.12.C.1 – Review career goals and determine steps necessary for attainment.
9.2.12.C.3 – Identify transferable career skills and design alternate career plans.

Unit 6: Non-renewable Energy Resources.

Unit Description: Nonrenewable resources are used worldwide to create electricity, heat homes, power vehicles and manufacture goods. Resources are considered nonrenewable if their quantities are limited or if they cannot be replenished for thousands or even millions of years. Most sources of non-renewable energy are fossil fuels.

This unit discusses various nonrenewable energy sources and examines the benefits and drawbacks of producing energy from fossil fuels and nuclear reactions.
Topics discussed in this section include atomic structure, periodic table, atomic mass, half-life, radiation, fission, nuclear reactors, electricity generation, and nuclear accidents.

Unit Duration: 4-5 weeks

Desired Results

Standard(s):

- Evaluate competing design solutions fordeveloping, managing, and utilizing energy and mineral resources based on cost-benefit ratios**.(HS-ESS3-2).**
- Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. (**HS-ETS1-1).**
- 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-PS1-8)**

Indicators:

- 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.

- All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks aswell as benefits. New technologies and social regulations can change the balance of these factors.

- Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process.

Understandings:
Students will understand …

- The concept of commercial energy and identify the types of non-renewable energy sources.
- That it takes energy to produce energy and the significance of net energy.
- That the energy resources with a low net energy require government subsidies.
- The use of oil, natural gas and coal as commercial energy sources.
- That the use of nonrenewable resources provides immediate benefits, but results in pollution and biodiversity losses.
- Energy reserves from nonrenewable energy resources are finite.
- The nucleus of an atom is made of protons, and neutrons.
- Some naturally occurring materials have differing levels of instability, causing radioactive decay.
- How a nuclear fission reaction works and describe the nuclear fuel cycle.
- The advantages and disadvantages of using nuclear power.
- The future of nucler power.

Essential Questions:

- What is Net Energy and why is it important?
- What are the advantages and disadvantages of using fossil fuels?
- What is radiation and radioactive decay?
- What are the major components of a nuclear reactor?
- What are the advantages and disadvantages of using Nuclear Power?

Assessment Evidence

Performance Tasks:
Students will:

- Define commercial energy.
- Research various nonrenewable energy resources.
- Contrast between nonrenewable and renewable energy resources.
- Analyze and interpret data from various nonrenewable energy resources.
- Apply the concept of net energy to the technological improvements for producing a given energy resource.
- Compare the main energy sources in New Jersey with that of the United States.

Other Evidence:

Daily informal and formal assessments of student activities, such as:

Homework/Classwork

- Warm up questions
- Worksheets
- Reading assignments
- Text questions as assigned
- On going Lab work.
- Independent/group work

Labs:

• Make a KWL chart on Fracking. • Interpret Maps and Graphs, Fig.5 • Discuss the advantages and disadvantages of using fossil fuel energy. • Explain the componenets of an atom. • Use the periodic table to determine atomic number and the specific componenets of a given atom. • Graph the half-life of a radioactive material. • Locate all the parts of a nuclear reactor and explain how each part works to generate electricity. • Explain the difference between fission and fusion. • Research and explain historic problems with nuclear reactors. • Debate the benefits and safety concerns of using nuclear power. • Investigate ideas for new approaches to nuclear power.	• Vernier lab- What is Energy. • Half-Life of Pennies. • Nova on line lab. • Energy Audit. **Quiz** • Non-renewable Energy. • Atoms, Radiation and Half- life. • Chapter 12 -post assessment. **Tests** • Fossil fuels • Radioactivity, Half- life and Nuclear reactors

Benchmarks: Unit Test

Learning Plan

Learning Activities:
Chapter 12- Nonrenewable Energy Resources.

Week 1 :

- Chapter Introduction: pages 382-386
- Read Explores at work – hunting for Methane Leaks with Kathy Walter Anthony
- Students will discuss and answer the follow-up questions.
- Locate power plant on NJ state map.
- Case Study : Fraking of Oil and Gas
- Powerpoint lecture.
- Define commercial energy and identify the types of nonrenewable energy sources.
- Review key terms -commercial energy, net energy.
- Explain energy production and the significance of net energy.
- Explain why energy resources with a low net energy need government subsidies.
- Discuss Map and Graphs Fig. 5
- Environmental data and data analysis Fig. 1-2
- Review terms- Key concept summaries and Review worksheet

Week 2 / 3

- Power point lecture/notes- Non renewable energy resources.
- PBS learning- Fossil fuels.
- Discuss oil,natural gas and coal as commercial energy sources
- Explain the advantages and disadvantages of using fossil fuels for energy.
- Write down the key terms.
- Write an opinion on – To Frack or not
- Map and map analysis – Figs 25-27
- Environmental Data and Data analysis Fig,3-4
- Use key concept summaries to review.
- Vernier Lab : “ What is Energy “

Week 4/ 5.

- Plant radiated and non-radiated germanium seeds. Check daily and label differences between seed growth over the next 3 weeks.
- Explain how a nuclear fission reaction works and describe the nuclear fuel cycle.
- Discuss parts of an atom
- Describe Half-Life and analyze Half-life curves.
- Do graphing activity in Excel.
- EdPuzzle: What is radiation?
- Lab activity- Half-life of Pennies
- Discuss the advantages and disadvantages of using nuclear power.
- Discuss the future of nuclear power.
- Online Activity- Nuclear Fission (PHET)

Resources:

- The NEED Project link to a pdf contains sheets and activities described above (http://www.need.org/files/curriculum/guides/ExploringNuclearEnergy.pdf). Specifically: The Nuclear Energy Expo, Radiation Dose Chart, Examining Nuclear Energy worksheet, Uranium In The Round vocabulary game, Milling Simulation.
- University of Colorado Phet Simulation webpage contains online labs for alpha and beta decay, and one for nuclear fission. These can likely be made into lab activities.
- Radiated seeds to watch over are available from Ward's Science: https://www.wardsci.com/store/catalog/product.jsp?catalog_number=6730926
- Miller and Spoolman, "Environmental Science", National Geographic Learning, Cengage 2017
- http://printableworksheets.in/?dq=Fossil%20Fuels
- https://nj.pbslearningmedia.org/resource/whats-the-deal-with-fossil-fuels/flipside-science-exploring-energy-video/#
- http://www.pbs.org/wgbh/nova/labs/lab/energy/1/1/
- "PhET Interactive Simulations." PhET. University of Colorado, 2017. https://phet.colorado.edu
- National Energy Education Development Project, Exploring Nuclear Energy 2016 - 2017 http://www.need.org/files/curriculum/guides/ExploringNuclearEnergy.pdf
- Center for Nuclear Science and Technology Information, http://www.nuclearconnect.org/
- http://www.need.org/Files/curriculum/Energy%20At%20A%20Glance/CoalAtAGlance_8.5x11.pdf
- http://printableworksheets.in/?dq=Fossil%20Fuels
- https://nj.pbslearningmedia.org/resource/whats-the-deal-with-fossil-fuels/flipside-science-exploring-energy-video/#
- http://www.pbs.org/wgbh/nova/labs/lab/energy/1/1/

Unit Learning Goal and Scale *(Level 2.0 reflects a minimal level of proficiency)*	
• Evaluate competing design solutions fordeveloping, managing, and utilizing energy and mineral resources based on cost-benefit ratios**.(HS-ESS3-2).**	
4.0	**Students will be able to:** In addition to score of 3 , student demonstrates the ability to make in-depth inferences and applications that go beyond what was taught
3.0	**Students will be able to:** • Analyze the use of fossil fuels as a major global problem. In their analysis, students describe the challenge with a rationale for why it is considered a major global challenge • Describe qualitatively and quantitatively, the extent and depth of the problem and its major consequences to society and/or the natural world. • Document background research on the problem from two or more sources. • Specify qualitative and quantitative criteria and constraints for acceptable solutions to the problem.
2.0	**Students will be able to:** • Analyze the use of fossil fuels as a major global problem. In their analysis, students describe the challenge with a rationale for why it is considered a major global challenge • Suggest some acceptable solutions to the problem.
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Unit Modifications for Special Population Students	
Advanced Learners	Critical thinking problems and applications of skills presented.
Struggling Learners	Copy notes using fill in notes, collaborative learning activities, utilize all learning styles (visual, audio, kinesthetic etc.)
English Language Learners	Translation of notes in their native language. http://www.state.nj.us/education/modelcurriculum/ela/ELLSupport.pdf
Learners with an IEP	Each special education student has in Individualized Educational Plan (IEP) that details the specific accommodations, modifications, services, and support needed to level the playing field. This will enable that student to access the curriculum to the greatest extent possible in the least restrictive environment. These include: • Variation of time: adapting the time allotted for learning, task completion, or testing • Variation of input: adapting the way instruction is delivered • Variation of output: adapting how a student can respond to instruction • Variation of size: adapting the number of items the student is expected to complete • Modifying the content, process or product Additional resources are outlined to facilitate appropriate behavior and increase student engagement. The most frequently used modifications and accommodations can be viewed here.

		Teachers are encouraged to use the Understanding by Design Learning Guidelines (UDL). These guidelines offer a set of concrete suggestions that can be applied to any discipline to ensure that all learners can access and participate in learning opportunities. The framework can be viewed here www.udlguidelines.cast.org
Learners with a 504	Refer to page four in the Parent and Educator Guide to Section 504 to assist in the development of appropriate plans.	

Interdisciplinary Connections

Indicators:
Embedded English Language Arts/Literacy and Mathematics Standards
English Language Arts/Literacy
RST.11-12.1, Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
WHST.9-12.2, Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
WHST.9-12.5, Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
WHST.9-12.7, Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
WHST.11-12.8, Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
WHST.9-12.9, Draw evidence from informational texts to support analysis, reflection, and research.
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MP.2 Reason abstractly and quantitatively.
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Integration of 21st Century Skills

Indicators:
Career Ready Practices
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CRP6 – Demonstrate creativity and innovation.
CRP7 – Employ valid and reliable research strategies.
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CRP10 – Plan education and career paths aligned to personal goals.
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CRP12 – Work productively in teams while using cultural global competence.
9.2 Career Awareness, Exploration, and Preparation
9.2.12.C.1 – Review career goals and determine steps necessary for attainment.
9.2.12.C.3 – Identify transferable career skills and design alternate career plans.

Unit 7: Renewable Resources

Unit Description: This unit focuses on the transition to more environmentally and economically sustainable future. Renewable energy resources will be evaluated in the context of net energy, available supply, environmental impacts and health impacts.

The resources examined during this unit include solar energy, wind energy, flowing water, biofuels and geothermal energy.

Unit Duration: 5 - 6 Weeks

Desired Results

Standard(s):

- **HS-ESS3-2** - Evaluate competing design solutions for developing, managing, and using energy resources based on cost-benefit analyses.
- **HS-ESS3-4** - Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.
- **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.
- **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.

- **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.
- **HS-PS3-3 -** Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

Indicators:

- **HS-ETS1.A-2**
  - Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them (HS-ETS1).
  - Humanity faces major global challenges today, including energy sources that minimize pollution, which can be addressed through engineering (HS-ETS1).
- **HS-ETS1.B**
  - When evaluating solutions, it is important to consider a range of constraints including cost, safety, reliability, and aesthetics and to consider social, cultural, and environmental impacts (HS-ETS1-3).
- **HS-PS3.A-2**
  - At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy (HS-PS3).
- **HS-ETS1.A**
  - Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them **(**HS-ETS1).
- **HS-ESS3.A-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).

- **HS-ESS3.C-2**
  - Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation(HS-ESS3).

Understandings

Students will….

- Defnine energy efficiency and explain what makes a device energy efficient.
- Identify ways in which energy is used inefficiently.
- Describe ways to improve energy efficiency with regard to industry, transportation, and home building.
- Explain why renewable energy resources have not been more widely adopted.
- Identify sources of renewable energy and their applications.
- Understand the advantages and disadvantages of each source of renewable energy.
- Identify the challenges associated with transitioning to a more sustainable energy future.
- Describe paths society can take to transition to more sustainable energy use.

Essential Questions:

- Why is energy efficiency an important energy resource?
- What are sources of renewable energy?
- How can society transition to a more sustainable energy future?

Assessment Evidence

Performance Tasks:

Students will:

Other Evidence:

• define and recall the following vocabulary terms: *energy efficiency, cogeneration, hydrogen fuel, cell, passive solar heating system, active solar heating system, solar thermal system, photovoltaic cell, hydropower, biomass, biofuel, geothermal energy, decarbonization, district heating.* • read text and and answer guided questions. • research ways in which energy is being used inefficiently and describe ways to improve energy efficiency with respect to energy, transportation and home building. • explore and debate energy efficiency vs conservation and explain some of the tradeoffs. • reseach reasons that renewable energy resources have not been more widely adopted. • brainstorm sources of renewable energy then research sources and their applications. • research and report the advantages and disadvantages of each source of renewable energy. • consider challenges and limitations associated with transitioning to sustainable energy. • research and describe ways that society can transition to more sustainable energy use. • perform collaborate research on various renewable energy sources then present to class.	**Homework/Classwork** • Guided Reading of Text Sections13.1, 13.2 and 13.3 • Power Point Notes • EdPuzzle Video Assignents • Daily objective questions • Warmup activity • White board reviews • Games (e.g. Kahoot) • Class discussion/ • Online discussion boards · • K-W-L Charts • Unified Classroom Self-assessments • PBSlearning media (and similar) interactives **Labs** • Exploring Solar Panels Vernier Lab (Experiment 17) • Affect of Load on Solar Panel Output Vernier Lab (Experiment 18) • Variables that Affect Solar Panel Output (Experiment 19) • Wind Energy Vernier Lab **Quizzes** • Energy Efficiency as a Resource • Renewable Energy Sources • Efficient Energy Transition **Test** • Renewable Energy Sources, Efficiency,and Future of Sustainability
Benchmarks: Unit Test	

Learning Plan

Learning Activities:

Lesson 1: Energy Efficiency is an Important Energy Resources (1 week)

Students watch short Mindtap video: *Going Green on Rooftops*

- Students will read chapter 13.1 and answer corresponding questions. Students will then make a two-column table with the column headings *Sources of Energy Waste/Loss* and *Ways to Increase Efficiency.* Students will then anwer and discuss the following questions:
  - Why is improving energy efficiency and reducing energy waste an important energy goal?
  - How does cogeneration improve energy efficiency?
  - How will a smart grid save consumers money?
  - Why is the true price of gasoline higher than the price paid at the pump?
  - What is a net zero energy building and how is this achieved?
- Students will break in to groups, research, collaborate then share findings on following topics via PowerPoint or simialr presentation:
  - Hidden costs in fuel prices
  - Electric/Hybrid cars vs. traditional cars. Are electric/hybrid cars really more energy efficient?
  - People-Powered Machines: what are they and how can they provide new opportunities for those with limited means or who live with limited access to electricity.
- Debate (time permitting) – Should laws be put into place for homes and buildings to meet minimum energy standards?
- Power Point review

Lesson 2: Sources of Renewable Energy (2 – 4 weeks)

- Students will read chapter 13.2 (*What Are Sources of Renewable Energy?*) and answer corresponding questions, including:
  - What are misconceptions that people have about renewable energy?
  - How does a passive solar heating system work, and what are pros and cons of solar cells?
  - How is hydropower produced/used and what are pros and cons of hydropower?
  - Why are offshore windfarms so promising and what are pros and cons of wind energy?
  - How are biofuels and biomass produced/used and what are pros and cons of these types of fuel?
  - Why does corn-based ethanol have a low net energy?
  - Why isn't geothermal energy more widely used and what are pros and cons of geothermal energy?
  - How is hydrogen for fuel cells obtained and what are pros and cons of hydrogen fuel?
- TedEd Assignment: *Can 100% Renewable Energy Power the World?*
- TedEd Assignment: *How do Solar Panels Work?*
- Evaulate applications/pros and cons of Active/Passive Solar Heating Systems, Solar Thermal Systems, and Solar Cells
- Evaluate applications/pros and cons of hydropower, wind power, bimass, biofuels, geothermal, and hydrogen fuel.
- Students will break into groups, research and report on renewable energy uses and policies in various countries or cities around the world.
- Evaluate renewable energy usage in New Jersey using interactive map (www.eia.gov)
- Power Point review

Lesson 3: How Can Society Transition ot a More Sustainable Energy Future? (1-2 weeks)

- Students will read chapter 13.3 (*How can Society Transition to a More Sustainable Energy Future?*) and answer corresponding questions, including:
  - How do subsidies for fossil-fuel-based energy compare to subsidies for renewable energy?
  - How might the transition to a more sustainable future be achieved and what are some challenges?
  - What technological advantages may contribute to a more sustainable future?
- Watch and disuss MindTap videos *Us Falling Behind China in Green Energy* and *The Greening of Iceland*.
- Read Text Engineering Focus 13.1: *Green City.* Consider why Iceland, an island nation, was motivated to end its dependence on fossil fuel energy sources.
- Research and discuss stratgegies for transitioning to a more sustainable energy future for the next 50 years. Explore the challenges and technology advancements that may hinder or aid in the transition, respectfully.

Resources:

- http://www.earth-policy.org/datacenter/pdf/book_tgt_overview_all.pdf - good information on energy use for various countries - good chart
- https://www.teachengineering.org/lessons/view/cub_housing_lesson04 Renewable Resource Lesson Plans

- https://www.eia.gov/state/?sid=NJ – interactive map of energy usage in NJ
- https://ed.ted.com/lessons/can-100-renewable-energy-power-the-world-federico-rosei-and-renzo-rosei - TedEd assignmet on renewable energy
- https://ed.ted.com/lessons/how-do-solar-panels-work-richard-komp - TedEd assignment on how solar panels work
- https://nj.pbslearningmedia.org/resource/a81bbb0d-fb61-47c3-af1a-48b23d558fea/burlington-is-first-us-city-to-hit-100-percent-renewable-energy/#.WqLPAejwZPY – Wind Energy – Burlington, VT 100% renewable energy used to run town
- http://scienceline.ucsb.edu/links/links.php - good unit on electricity

Unit Learning Goal and Scale
(Level 2.0 reflects a minimal level of proficiency)

- **Standard(s):** **HS-ESS3-2** - Evaluate competing design solutions for developing, managing, and using energy resources based on cost-benefit analyses.

4.0	**Students will be able to:** • In addition to score of 3 , student demonstrates ability to make in-depth inferences and applications that go beyond what was taught
3.0	**Students will be able to:** • Use cost-benefit ratios to evaluate competing design solutions,and develop best practices for petroleum and natural gas extractionin order to maximize the conservation, recycling and reuse of resources.
2.0	**Students will be able to:** • Summarize competing design solutions for developing, managing, and utilizing energy and mineral resources.
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Unit Modifications for Special Population Students

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English Language Learners	Translation of notes in their native language. http://www.state.nj.us/education/modelcurriculum/ela/ELLSupport.pdf
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		enable that student to access the curriculum to the greatest extent possible in the least restrictive environment. These include: • Variation of time: adapting the time allotted for learning, task completion, or testing • Variation of input: adapting the way instruction is delivered • Variation of output: adapting how a student can respond to instruction • Variation of size: adapting the number of items the student is expected to complete • Modifying the content, process or product Additional resources are outlined to facilitate appropriate behavior and increase student engagement. The most frequently used modifications and accommodations can be viewed here. Teachers are encouraged to use the Understanding by Design Learning Guidelines (UDL). These guidelines offer a set of concrete suggestions that can be applied to any discipline to ensure that all learners can access and participate in learning opportunities. The framework can be viewed here www.udlguidelines.cast.org
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Unit 8: Environmental Challenges – Chapter 14, 15, 16 and 17

Unit Description: This unit highlights the environmental concerns and the solutions associated with human population growth and the risks associated with environmental and technological changes. Major environmental issues related to air pollution, climate change and ozone depletion are discussed along with the environmental challenges involved with producing, handling and disposing of society's waste.

Unit Duration: 3-4 weeks

Desired Results

Standard(s):

- Evaluate or refine a technological solution that reduces impactsof human activities on natural systems. (**HS-ESS3-4**)
- Create a computational simulation to illustrate the relationships among management of natural resources,the sustainability of human populations,and biodiversity. (**HS-ESS3-3**).
- Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. (**HS-ETS1-1).**
- 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-PS1-8)**

Indicators:

- 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.
- All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks aswell as benefits. New technologies and social regulations can change the balance of these factors.
- The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.

Understandings:	**Essential Questions:**
Students will understand … • The three trends in urbanization and the effects of urban sprawl.	• What are the effects of urbanization on the environment ? • How can cities become more sustainable ?

- The concept of eco-city.
- The types of health risks people encounter.
- How chemicals in the environment can harm the human body.
- How diseases can be reduced or prevented.
- The evidence that indicates climate change
- The cause and effect of ozone depletion.
- What happens to solid waste after its disposal.
- The approach to dealing with waste.

- How do biological and chemical hazards threaten human health?
- What are the effects of climate change?
- How can we slow climate change?
- What are problems related to solid and hazardous waste?
- How can society transition to a low waste economy?

Assessment Evidence

Performance Tasks:
Students will:

- Identify trends in human population growth.
- Calculate population change.
- Discuss ways to slow human population growth.
- Analyze figure 14-14 and evaluate the shape of the given rapid-transition scheme.
- Compare the processes of risk assessment and risk management.
- Explain what happens to solid waste after its disposal.
- Describe the process of landfilling waste,as well as its advantages and disadvantages.

Other Evidence:

Daily informal and formal assessments of student activities, such as:

Homework/Classwork

- Warm up questions
- Worksheets
- Reading assignments
- Text questions as assigned
- On going Lab work.
- Independent/group work

Labs: Interactive Demographic Lab Activity.

- EPA air pollution and asthma online lab activity.
- Land fill and Recycling Lab

Quiz

- 14.1 -14.2 quiz
- 14.3 and 15.1 quiz
- 17.1-17.2 quiz.
- 17.3 quiz.

Tests

- Human population and major health hazards.
- Solid and hazardous wastes

Benchmarks: Unit Test

Learning Plan

Learning Activities:
Chapter 14- Human Population and Urbanization

Week 1 :

- Case Study Chapter 14 : Population 7.3 billion
- Guided reading 14.1
- Students will discuss and answer the follow-up questions.
- Maps and Map Analysis Fig. 3 and 4.
- Environmental data and data analysis Fig 12.
- Calculations: Population change.
- Interactive Demographic lab: https://www.learner.org/courses/envsci/interactives/demographics/demo_transition_1.php
- Guided reading 14.3-14.4
- Review terms- Key concept summaries and Review worksheet

Week 2

- Case Study : Mercury's Toxic Effects
- PBS Learning Media Activity- How does your environment affect your health.
- Discuss the types of risk people encounter – 15.1.
- Compare and process the risk assessment and risk management. -Fig 15.2
- Quiz; Chapter 14 and 15

Week 3-4 : Chapter 17 – Solid and Hazardous Wastes

- Case Study: E-Waste – An Exploding Problem.
- Guided reading 17.1-17.2.
- Vocabulary terms ; solid waste,industrial solid waste,municipal solid waste, hazardous wastes, bio remediation, phyto remediation,deep well disposal,surface impoundment and bio mimicry.
- Video presentation : Plastic pollution in ocean
- Guided reading 17.3
- Read the National Geographic article -Planet or plastic? Summarize the article and suggest solutions to manage plastic waste.
  Plastic Pollution: Sources and Solutions: Students will identify non-point source pollution sources

Resources:

Miller and Spoolman, Environmental Science, National Geographic Learning, Cengage 2017
https://climate.nasa.gov/
https://www.epa.gov/hw/criteria-definition-solid-waste-and-solid-and-hazardous-waste-exclusions
https://www.cdc.gov/nceh/ehhe/
https://nj.pbslearningmedia.org/resource/tdc02.sci.life.eco.graphairgas/1900-air-pollution/#
https://www.youtube.com/watch?v=txH30r0NRf0
https://nj.pbslearningmedia.org/resource/envh10.health.spls58/how-does-your-environment-affect-your-health/#.WqK92-dG02w
https://www.youtube.com/watch?v=4Nac_nIBD64
http://www.glencoe.com/sites/common_assets/science/virtual_labs/ES19/ES19.html
https://www.nationalgeographic.com/magazine/2018/06/plastic-planet-waste-pollution-trash-crisis/
https://seagrant.psu.edu/sites/default/files/Lessons%20for%20NIE%202%20and%203%205GyresALLACTIVITIESPlasticPollutionCurriculum.pdf - solid waste activity resource

Unit Learning Goal and Scale *(Level 2.0 reflects a minimal level of proficiency)*	
Standard(s): Evaluate or refine a technological solution that reduces impactsof human activities on natural systems. (**HS-ESS3-4**)	
4.0	**Students will be able to:** • In addition to score of 3, student demonstrates ability to make in-depth inferences and applications that go beyond what was taught

3.0	**Students will be able to:** • Costruct an explaination based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
2.0	**Students will be able to:** • Summarize the impact of human activity on natural systems. • Summarize a technological solution for reducing the impact of human activities
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Standard(s): Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. (**HS-ETS1-1).**

4.0	**Students will be able to:** • In addition to score of 3, student demonstrates the ability to make in-depth inferences and applications that go beyond what was taught
3.0	**Students will be able to:** • Consider a major global challenge that can be addressed through engineering,such as need for clean water and food or for energy sources that minimize pollution,and specify quantifiable and measurable criteria and constraints for a solution.
2.0	**Students will be able to:** • Summarize a major global challenge or problem. • Summarize societal needs and wants related to the change or problem.
1.0	**With help, partial success at level 2.0 content and level 3.0 content:**
0.0	**Even with help, no success**

Unit Modifications for Special Population Students	
Advanced Learners	Critical thinking problems and applications of skills presented.
Struggling Learners	Copy notes using fill in notes, collaborative learning activities, utilize all learning styles (visual, audio, kinesthetic etc.)
English Language Learners	Translation of notes in their native language. http://www.state.nj.us/education/modelcurriculum/ela/ELLSupport.pdf
Learners with an IEP	Each special education student has in Individualized Educational Plan (IEP) that details the specific accommodations, modifications, services, and support needed to level the playing field. This will enable that student to access the curriculum to the greatest extent possible in the least restrictive environment. These include: • Variation of time: adapting the time allotted for learning, task completion, or testing • Variation of input: adapting the way instruction is delivered • Variation of output: adapting how a student can respond to instruction • Variation of size: adapting the number of items the student is expected to complete • Modifying the content, process or product Additional resources are outlined to facilitate appropriate behavior and increase student engagement. The most frequently used modifications and accommodations can be viewed here.

	Teachers are encouraged to use the Understanding by Design Learning Guidelines (UDL). These guidelines offer a set of concrete suggestions that can be applied to any discipline to ensure that all learners can access and participate in learning opportunities. The framework can be viewed here www.udlguidelines.cast.org
Learners with a 504	Refer to page four in the Parent and Educator Resource Guide to Section 504 to assist in the development of appropriate plans.

Interdisciplinary Connections

Indicators:

Embedded English Language Arts/Literacy and Mathematics Standards

English Language Arts/Literacy

RST.11-12.1, Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

WHST.9-12.2, Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

WHST.9-12.5, Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

WHST.9-12.7, Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

WHST.11-12.8, Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

WHST.9-12.9, Draw evidence from informational texts to support analysis, reflection, and research.

SL.11-12.5, Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest

Mathematics

MP.2 Reason abstractly and quantitatively.

HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

Integration of 21st Century Skills

Indicators:

Career Ready Practices

CRP2 – Apply appropriate academic and technical skills.

CRP5 – Consider the environmental, social and economic impacts of decisions.

CRP6 – Demonstrate creativity and innovation.

CRP7 – Employ valid and reliable research strategies.

CRP8 – Utilize critical thinking to make sense of problems and persevere in solving them.

CRP10 – Plan education and career paths aligned to personal goals.

CRP11 – Use technology to enhance productivity.

CRP12 – Work productively in teams while using cultural global competence.

9.2 Career Awareness, Exploration, and Preparation

9.2.12.C.1 – Review career goals and determine steps necessary for attainment.

9.2.12.C.3 – Identify transferable career skills and design alternate career plans.