Lesson: **Energy Engineering and Collection: Chemical Engineering**

Grade Level: 8-9 – Time Required: 50 minutes – Lesson Dependency: None – Subject Areas:

* History
* Design
* Science and Technology



Summary

This lesson plan and schedule is specifically structured to accommodate a solely online environment. The three most fundamental parts of this lesson include first the lecture, then activity, and finally, an assessment based on both retention of the given information and the intuitive expansion of the knowledge already given. The lecture segment of this lesson is structured to grab attention and maximize attention span by utilizing commonly used online academic retention tactics. The next part of the lesson utilizes activities to both help the reader understand the information just dealt with them and have a way to thoroughly understand it without the pressure of assessment just yet, and also allows the teachers to elaborate on the problems that the class might have in their learning. Finally, to end the lesson, a fair, two-part assessment is given that focuses on one, what was said explicitly, and two, how they could use it in the real-world application of an Energy Engineer.

Engineering Connection

We bring to the student’s attention that every aspect of this particular field of work is governed by the very pillars that construct engineering. It is very important that in this stage we bring to light the intrinsic mechanics of this field, like how solar cells take light particles and turn them into electricity with mechanically superb structures. Or how the study of nuclear engineering by chemical engineers later came to produce a way to harvest the energy released.

Learning Objectives

* Understand energy at the fundamental level
* Identify types of energy sources (Renewable, Non-renewable, and Inexhaustible)
* Be able to distinguish the different modes of modern energy collection (Nuclear, Coal, and Geothermal)
* Students should leave with the knowledge of the benefits and disadvantages of using renewable over non-renewable sources
* Understand at least one Energy Engineering job intrinsically
* Show the shared parts of every energy system

### Educational Standards

* [CTE-AFNR.68.ENVIRO.02.01](https://www.cpalms.org/Public/PreviewStandard/Preview/12113) - Define and identify renewable and nonrenewable natural resources.
* [CTE-AFNR.68.POWER.01.01](https://www.cpalms.org/Public/PreviewStandard/Preview/12315) - Define and use proper terminology associated with the power, structural and technological systems career pathway.
* [CTE-ENGY.68.GNRATN.01](https://www.cpalms.org/Public/PreviewStandard/Preview/12785) - Explain ways of generating electric power.
* [CTE-ENGY.68.GNRATN.02](https://www.cpalms.org/Public/PreviewStandard/Preview/12793) - Explain the conventional electric power generation systems and processes (coal, petroleum, hydroelectric, and nuclear).
* [CTE-ENGY.68.GNRATN.03](https://www.cpalms.org/Public/PreviewStandard/Preview/12796) - Identify the reasons for seeking alternatives to fossil fuels to include economic, environmental, and social impacts.
* [CTE-TECED.68.PWRENG.01](https://www.cpalms.org/Public/PreviewStandard/Preview/14758) - Explain how energy can be used to do work, using many processes.
* [CTE-TECED.68.PWRENG.02](https://www.cpalms.org/Public/PreviewStandard/Preview/14759) - Define power systems used to drive and provide propulsion to other technological products and systems.
* [CTE-TECED.68.PWRENG.03](https://www.cpalms.org/Public/PreviewStandard/Preview/14768) - Identify the technologies that supply or control energy sources.

Worksheets and Attachments

* Energy Engineering Presentation
* How Geothermal Works Video
* Possible Energy Crisis Solutions Video
* Energy Systems Worksheet
* City Energy Optimization Homework Worksheet
* Wonderville Activity
* Power-up Activity

Introduction/Motivation

Remember that the first part of the presentation is lesson-based, so in order to keep the student’s attention bring attention to the photographs. Furthermore, most of the script is on a separate teachers document and not on the page to reduce the strain on the students’ mind, so be sure to accent several key terms as you elaborate on the slide that is in front of them because they will need to remember those later for the after lesson quiz.

The next part of the lesson is activity-based but do not let that stop you from informing them, it is important to keep a stream of steady communication to these kids whilst they are doing the activity. For example: give them pointers, ask them if they find anything interesting, if they like the game or if they are beginning to have a better, more thorough understanding of the reasons for so many different types of energy collection.

It is also important to remember these key points:

1. Modern Energy Engineering is a field inside of Chemical Engineering

2. Energy is found everywhere

3. Renewable energy could be a finite source but as long as it produces quicker than it is consumed it is renewable

4. Inexhaustible energy can never run out as far as we can tell

5. Research the intrinsic mechanics and processes before presenting because they are very intricate

6. The activity is shown because it is a way for students to understand the importance of not only energy optimization but also the importance of international compliance

7. Every slide should have a question to the students

When the Debate occurs, the breakout rooms students should be divided by the last name in chronological order with a reasonable number of students per each room. Each room should be moderated by either a teacher or a co-teacher to reduce aloofness and promote healthy flowing debate.

Lesson Background and Concepts for Teachers

(The script is meant to be an aid to the presenter rather than what they should say verbatim. The goal is for the presenter to put the information in their own words as best they can while still making it easy to understand. Presenters are not recommended to read off the slides.)

**Slide 1 -** What is a Chemical Engineer? What is an Energy Engineer? What are their contributions to society?

**Slide 2 -** Energy is all around us; Energy does not have to be electrical; Examples of Energy in nature; Ask students if they can give an example of a process that uses energy

**Slide 3 -** Famous Energy Engineers; History of the field; It could be considered the oldest engineering field but it’s focus changed along the centuries from purely kinetic and potential to modern-day chemical

**Slide 4 -** Different Types of Energy (Inexhaustible, Renewable, Non-Renewable); Different Energy sources for each of those types (Solar, Biomass, Coal) with pictures, Why do we need so many different modes of a collection?

**Slide 6 -** Inexhaustible energy sources, what are they? What are some examples; Then show the definition and our examples; Describe a specific energy collection process (Geothermal) with a short video

**Slide 7 -** Renewable energy sources, what are they? What are some examples; Then show the definition and our examples; Describe a specific energy collection process (Biomass) with a short video

**Slide 8 -** Non-renewable energy sources, what are they? What are some examples? Then show the definition and our examples; Describe a specific energy collection process (Nuclear) with a short video; Lightly hint the idea of them running out eventually

**Slide 9 -** Activity Slide Wonderville

**Slide 10 -** Benefits and disadvantages of different energy collection systems; Breakout Room Debate on, Renewable Vs Non-Renewable OR Breakout Room Discussion on how they would power a city

**Slide 11 -** Video from TEDx on futurist solutions to the Global Energy Crisis

**Slide 12 -** Describe the relationship between this field of engineering and the others

Associated Activities

[**Wonderville Interactive Activity** (https://wonderville.org/asset/save-the-world](https://wonderville.org/asset/save-the-world)) - The premise of this activity is to show the students not only the effectiveness of the differing prime locations for different modes of energy collection but additionally to show the effects on the global energy crisis if individual countries just started to make the switch to clean energy. Also, the game shows how to maximize spatial efficiency.

[**Power Up Interactive Activity (**https://climatekids.nasa.gov/power-up](https://climatekids.nasa.gov/power-up)) - In this game the students must move the solar panels into the sunny areas so they can capture as much solar energy as possible and the wind turbines must be moved to the windiest altitudes to collect the most wind power, the objective of the game is to efficiently power a small town with the energy produced as quickly as possible. It teaches the students the importance of positioning for efficiency and how that could eventually end up saving countries a lot of money due to the lessened need for more turbines.

**How Geothermal Energy is Collected Video (**<https://www.youtube.com/watch?v=mCRDf7QxjDk>) - To be added into the presentation to give the students an immersive understanding of the particular energy source

**How Biomass Energy is Collected Video (**<https://www.youtube.com/watch?v=IxyvVkeW7Nk>) - To be added into the presentation to give the students an immersive understanding of the particular energy source

**How Coal Energy is Collected Video (**<https://www.youtube.com/watch?v=e_CcrgKLyzc>) - To be added into the presentation to give the students an immersive understanding of the particular energy source

**Possible Energy Crisis Solutions Video (**<https://www.youtube.com/watch?v=TZ169zFgS6Q>) - To be added to the presentation to help students in debating

**Renewable Vs Non-Renewable Debate -** Allow the students to view a list of opposing view to one another by having a breakout room mediator screen share a table of said items

Vocabulary/Definitions

**Energy -** power derived from the utilization of physical or chemical resources, especially to provide light and heat or to work machines.

**Energy Collection -** the process by which energy is derived from external sources (e.g., solar power, thermal energy, wind energy, salinity gradients, and kinetic energy

**Energy Engineering -** Energy engineering or energy systems engineering is a broad field of engineering dealing with energy efficiency, energy services, facility management, plant engineering, environmental compliance, sustainable energy and renewable energy technologies

**Chemical Engineering -** Chemical engineering is a branch of engineering that uses principles of chemistry, physics, mathematics, biology, and economics to efficiently use, produce, design, transport and transform energy and materials

**Renewable Energy Source -** A renewable resource is a natural resource which will replenish to replace the portion depleted by usage and consumption, either through natural reproduction or other recurring processes in a finite amount of time in a human time scale

**Non-Renewable Energy Source -** A non-renewable resource is a natural resource that cannot be readily replaced by natural means at a quick enough pace to keep up with consumption

**Inexhaustible Energy Source -** Resources that are considered to be unlimited in supply and impossible to exhaust, even with humans exploiting them

**Crude Oil –** Unrefined version of the most widely used non-renewable fuel source

**Coal Energy -** Coal is burned and the heat given off is used to convert water into steam, which drives a turbine to produce electricity

**Solar Energy -** Solar energy is radiant light and heat from the Sun that is harnessed using a range of ever-evolving technologies such as solar heating, photovoltaics, solar thermal energy, solar architecture, molten salt power plants and artificial photosynthesis

**Photovoltaic -** Photovoltaics is the conversion of light into electricity using semiconducting materials

**Geothermal Energy -** Geothermal energy is thermal energy generated and stored in the Earth

**Wave Energy -** Wave power is the capture of energy of wind waves to generate electricity

**Biomass Energy –** The use of a living organism like algae to produce energy

Assessment

**Pre-Lesson Assessment**

The pre-lesson assessment is a verbal assessment in which the presenter asks students if they have any prior knowledge about automotive engineering and to explain what it is to the best of their ability.

**Post-Intro Assessment**

Have students ask any questions about the lesson after each slide (if needed) to ensure they are paying attention and retaining the information that is told to them.

**Lesson Summary Assessment**

Following the completion of the Energy Engineering Presentation, students will be given an interactive quiz that will feature five questions about automotive engineering with multiple answer choices and one correct answer:

* What field of engineering does Energy Engineering usually fall under? - Chemical Engineering
* Energy must always be electrical - False
* Which one of the following Engineers created the Solar Panel? - Alexandre-Edmond Becquerel
* Which of the following is an example of a non-renewable energy source? - Oil
* Which of the following renewable sources is NOT inexhaustible? - Biomass
* What energy collection process is depicted in the above picture? (Geothermal Turbine) - Geothermal
* What energy collection process is depicted in the above picture? (Turbine inside of water) - Hydroelectric

The “lesson summary assessment” will be this final quiz, which has 20 questions. The reasoning behind this was to avoid giving the students an exam after each lesson under the unit this lesson is a part of. The quiz itself is kept short so that students are not discouraged or intimidated by it. Additionally, students will be explained why the correct answer is correct and why the other answer choices are wrong after each question. This will allow the students to learn more and retain the information better. The quiz itself is also very interactive and visually appealing, which will keep the students engaged. Finally, each question is worth a certain amount of points, with students gaining points every time they get a question right. In the end, the top three students will receive a prize. The prize will provide the student with the incentive they need to do well on the quiz, but the quiz itself will be revealed at the end.

**Worksheet**

Students must label the different components inside of a given system. Systems can either be universal or assigned according to last name. If it is a classroom of less than 8 students, a different system can be given to each student

**Homework**

Each student will be given the name of a different city/state in the US, on an assigned budget they must include 3 different types of clean energy sources that would accommodate the environmental structure of the surrounding ecosystem and they must create a 3D representation of it. They will also show the remaining money they have or proof that they didn’t go over-budget. Teachers will then judge the assignments grade based off believability, cost-efficiency and aesthetics (lightly).

References

Dictionary.com. Lexico Publishing Group, LLC. Accessed July 28, 2020. (Source of most vocabulary definitions, most of which were done in my own words) <http://www.dictionary.com>

CPALMS Standards Accessed July 28, 2020 (Source of educational standards) <https://www.cpalms.org/Public/search/Standard>

Encyclopedia Britannica Accessed July 28, 2020 (Source for most information on Chemical Engineering and Energy Collection Systems) <https://www.britannica.com/>

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