



TOPIC OF STUDY

How Does Electricity Play A Role In My Life?

 3 HOURS

KEY TERMS

Energy
Power
Electricity
Energy Conservation
Energy Efficiency
Multi-Meter
Loads
Teamwork
Fracking
Nuclear
Transmission
Distribution

LESSON

History, How and Why?

OVERVIEW

While the focus of this segment is about energy generation and transmission, this segment is also intended as a way to get to know the students in the class better as well as help assess their current understanding of the role of electricity in their life. This session can also be used to help understand students' current level of reading, writing, and comprehension. Lastly, the activities in this session will help build teamwork and bond students together.

STANDARDS

PA/SDP

3.4.10.A2. Interpret how **systems** thinking applies logic and creativity with appropriate comprises in complex real-life problems.

3.4.10.B2. Demonstrate how humans devise **technologies** to reduce the negative consequences of other **technologies**.

3.4.12.B2. Illustrate how, with the aid of **technology**, various aspects of the environment can be monitored to provide information for decision making.

3.4.12.C2. Apply the concept that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.

INSTRUCTIONAL

TEACHING TOOLS

- **The Random Word Game - Overarching goal: demonstrate that it is difficult to use things you know well in new ways.**
 - Students pair off forming 2 parallel lines facing each other.
 - The rule is to say as many random words to each other as possible. The words cannot relate to each other in any way (so grass and then green are not allowed). For example: one person says "space" the other says "shoe"
 - You cannot repeat words nor can you say anything you see in the room
 - See how long students can go say random words to each other, game should last about a minute or a minute and a half
 - Ask students if it was hard?
 - Let them know that they know thousands of words and they use them everyday, but when asked to use them in a new way it became hard.
 - Did anyone come up with a strategy? Did anyone just ignore what the other person was saying



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INSTRUCTIONAL (CONTINUED)

- The Human Knot Game - overarching goal is teamwork and perspective.
 - Have 6-8 students stand in a circle shoulder to shoulder.
 - Have each student put their hands in the middle of the circle
 - Randomly have students clasp hands so that arms are mixed above and below in the middle of the circle
 - Have students unknot their arms without releasing hands in under 3 minutes
 - Was anyone a leader?
 - Did the leader change throughout?
 - Did the physical perspective change the leader?

TEXT/REFERENCES

<https://theoatmeal.com/comics/tesla>

<https://www.fi.edu/benjamin-franklin/kite-key-experiment>

<https://www.youtube.com/watch?v=fsgqy5FYP2c> (Centralia coal fire)

<https://www.nih.gov/news-events/nih-research-matters/drop-coal-power-plant-emissions-associated-asthma-improvements>

<https://www.ucsusa.org/resources/coal-power-impacts#:~:text=Climate%20change%20is%20coal's%20most,the%20earth%20above%20normal%20limits>

Solar Photovoltaic Basics - Chp. 3 Pg. 36 Electrical Transmission and Distribution Systems & Pg. 39 Figure 3.7 Electrical generation, transmission, and distribution

MATERIALS

No additional materials are needed/required for this exercise.

BACKGROUND/IN ADVANCE (TEACHER)

A strong understanding of teamwork, creative thinking exercises, and electricity generation and distribution is important. Being able to find a shared connection point with the students is helpful (both like the same music, both have been without power, both have some leadership qualities, etc.). It's important to have a strong understanding of electricity generation, transmission, and distribution.

IMPLEMENTATION (LESSON PLAN)

INTRODUCTION - OUR PERSONAL CONNECTION TO ENERGY.

- Introduce the role that energy plays in our everyday lives, like listening to music
- Let everyone name their favorite musician
- Tell everyone your favorite musician
- What device do you listen to music on?
- At its core what does that device need to work? ELECTRICITY!!!!
- Other interests outside of music, how do those relate to energy use?
- Connect current electricity production, particularly coal, to health impacts (asthma)
- What you love to do, listening to music, could be making you and your family sick (asthma), crazy right?!?! How do we solve this?
- Discussion about how we have solved how to generate electricity for most of the US, now we need to solve that problem in a way that does not make us sick. Solving already solved problems in a new way can be very difficult

PLAY RANDOM WORD GAME



IMPLEMENTATION (LESSON PLAN) - CONTINUED

LECTURE & DISCUSSION

How is energy produced, where is it produced, and why?

- Benefits & drawbacks of coal generation
 - Benefits: Relatively inexpensive, well understood, lots of coal in PA, rural jobs.
 - Drawbacks: mining (tell story of Centralia, PA), pollution and health impacts (coal burning's relationship to asthma, coal burning's relationship to global warming), burning coal releases CO₂, no urban jobs.
- Benefits & drawbacks of gas generation
 - Benefits: Relatively inexpensive, Marcellus Shale is abundant in PA, gas power plants are dispatchable, land lease money for farmers, rural fracking is out of site of most people, rural jobs.
 - Drawbacks: Fracking, Methane release from well heads, burning gas releases greenhouse gases (CO₂), gas has become so inexpensive that they are stopping pumping and lease payments are stopped, no urban jobs.
- Benefits & drawbacks of nuclear generation
 - Benefits: Inexpensive, baseload power, long lifetime, zero CO₂ emissions, rural jobs.
 - Drawbacks: No solution for nuclear waste, nuclear fallout from plant failures, no urban jobs.
- Centralized -vs- Distributed generation.
 - Centralized: <https://www.epa.gov/energy/centralized-generation-electricity-and-its-impacts-environment>
 - Distributed: <https://www.epa.gov/energy/distributed-generation-electricity-and-its-environmental-impacts>
- Discussion about global climate change and how our energy systems play a role in it.

PLAY HUMAN KNOT GAME

MEETING INDIVIDUAL NEEDS

STUDENTS WITH LEARNING DIFFICULTIES

The team building and verbal communication exercises typically appeal to a wide variety of learners. Getting students out of their seats and working together can assist students with learning difficulties.

ADVANCED LEARNERS

Advanced learners can use the links provided to dive deep into the different energy sources. There are lots of advanced topics that can be discussed or used for independent learners around fracking, coal, and nuclear energy. Use the links provided and give to students encouraging them to do additional research.

HOMEWORK

Homework 700-1

TECHNOLOGY

The homework will require access to the internet for research.