Into the Outdoors

Educational Partners:

RENEW WISCONSIN

ATC AMERICAN TRANSMISSION COMPANY®

ENERGY ON THE MOVE

8th-10th Grade Discussion Guide

Teacher: Joseph Kanke

GRADE LEVEL: 8-10

TIMEFRAME: 5-7 class periods

MATERIALS: electronic devices for research, computers or classroom supplies to create visual models, printouts of speech bubbles (size of single paper)

KEY WORDS: solar farm, megawatts, high voltage electric transmission system, substation

SCIENCE CATEGORIES: Energy & Sustainable Science

ACTIVITY SUMMARY

Students will activate their prior knowledge about renewable energy by engaging in a short activity called, Word Balloons. They will write about renewable energy and fact in paper, word bubbles and have their picture taken as if speaking the phrase.

In groups students will conduct further research on their understanding of energy transmission focusing on generation, transmission and distribution. They will synthesize understanding by creating a visual representation of the process along with descriptions for each.

Individually, students will choose a career that is connected to energy transmission, conduct research and write a short (one page) paper of their findings. After research, students will participate in a living wax museum where they will develop a poster or trifold with visual representations of the career they chose.

Finally, students will pull together their new learning by participating in the 3,2,1 activity where they will share facts, ask questions and state opinions.

LEARNING OBJECTIVES

- Explain how energy is collected through solar panels and then transported through transmission lines.
- Research a career that is connected to energy transmission and represent findings through writing, a visual and short oral summary.
- Name and provide facts about renewable energy sources.

BACKGROUND INFORMATION:

This episode considers how different sources of energy can be more sustainable than others. One example of more sustainable energy is from solar farms. The solar farm visited in this episode is Badger Hollow solar farm. A solar farm is essentially farming the sun's energy. At full capacity, this solar farm contains enough energy to power around 45,000 homes.

The solar farm depends on a high voltage electric transmission system to move the energy from the field to where it is needed. This begins with a system of poles and wires to transport the energy for long distances.

First the sun is captured by panels. Then the energy moves into the ground through dedicated wires to a collection station. From the station, the energy moves into the high voltage wires to reach a substation. From there it enters the energy grid which powers homes and businesses.

Essentially there are three components to a power system: generation, transmission and distribution. There are many types of generation including solar, gas, wind, coal-fired, hydro and others. The generating system is changing, in part to businesses and cities setting carbon reduction goals. A large part of this transition includes retiring coal power plants and replacing that generation with renewable energies.

Getting energy from its source to where it is needed depends on a team of people. One job highlighted in this clip is a transmission planner. The goal of this position is to analyze the present and future needs of the electrical grid. They also work with other teams to optimize the efficiency and reliability of the transmission system.

If you are interested in getting into the energy workforce, a good place to start is taking STEM courses. STEM stands for Science, Technology, Engineering and Math. There are lots of different career opportunities that collaborate on energy projects including: electrical engineering, civil engineering, environmental science, computer science, legal and other related business degrees.

VOCABULARY:

SOLAR FARM: an installation or area of land in which a large number of solar panels are set up in order to generate electricity.

MEGAWATTS: a unit of power equal to one million watts, especially as a measure of the output of a power station.

HIGH VOLTAGE ELECTRIC TRANSMISSION SYSTEM: deliver electricity over long distances. The high voltage is required to reduce the amount of energy lost during the distance.

SUBSTATION: a set of equipment reducing the high voltage of electrical power transmission to that suitable for supply to consumers.

LEARNING PROCEDURE:

Instructor states, "In the video we focused on the example of solar fields as a type of renewable energy. We're going to see what we already know about other types of renewable energy. You can reference the examples shared in the video, or other examples you may have heard of as well."

In order for students to respond, pose the following question. What is one other type of renewable energy (aside from solar) and what is something you know about it?

Word Balloons

1. Give students a piece of paper to cut into the shape of a bubble.
2. Have them write their type of renewable energy and what they know about it.
3. Have students pose with their word bubbles as if they are uttering the statement and take photos.
4. Compile the photos and think of a way to share them (class website, print and post, etc.)

ACTIVITY 1:

Instructor states, "You will be working in groups of three to demonstrate how energy gets from place-to-place. You will have a lot of choice in determining the manner through which you will display this understanding. Since the video mainly focused on solar energy, that will be your starting place as well. Your final project should visibly represent generation, transmission and distribution along with some type of description of what is occurring in each of these steps."

Instructor should offer the students some examples of how they can complete the visual (a start below) but encourage them to also consider their own representations. It may be helpful to develop or co-develop a rubric for scoring. Also, the instructor should encourage students to deepen their understanding of energy movement by conducting their own research. It may be helpful to offer this website, How Transmission Works , as a starting place.

Options

- Physical 3D model using art supplies
- Graphic design using technology
- Collage using magazine and newspaper images
- Sketching
- Infographic

Upon the completion of the activity, arrange student projects in the room in a way that they are accessible for viewing. Each trio of students should elect one student to represent their project and other students move around the room. At each project, students engaging in the gallery walk should ask the representative creator

questions regarding their project and what they have learned. Following the gallery walk provide trios to regroup. The two students who participated in the gallery walk should share their learning with the student who acted as the project representative.

ACTIVITY 2:

Students will work individually to research one of the many careers (or others found through research) that are connected to the field of energy transmission. Students should research their career and produce a written report of their findings. Things to consider in the research findings may include: education requirements and direct connections to the energy transmission field. Remind students of the careers mentioned in the video:

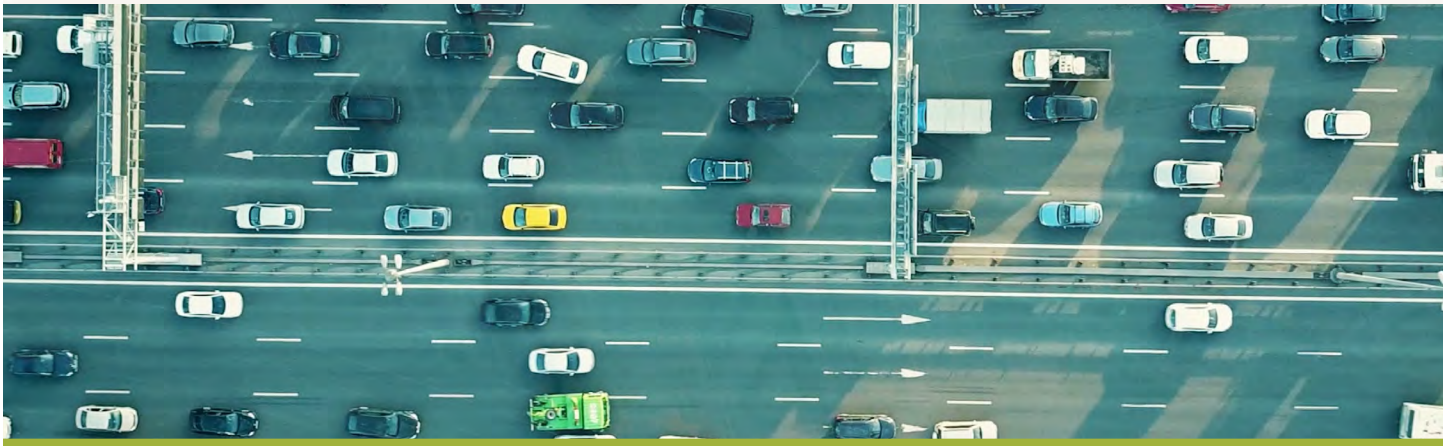
- electrical engineering
- civil engineering
- environmental science
- computer science
- legal
- business

Living Wax Museum

Following the research portion, inform students that they will be participating in a living wax museum. Based on their research they should create an attractive trifold display for their figure, prepare a speech for their chosen career figure, and be prepared to visually represent their career choice through dress or props.

For the day of the presentation consider inviting other staff, classes or even families.

During presentations students should be prepared to become statues of their historical figure and will come to life when an imaginary button is activated. Students will stand in front of their historical figure tri fold or poster display and give a short speech (approximately 1-2 minutes) about the career they have chosen.



CONCLUSION:

3-2-1

As a closing to the lesson series, explain that students will reflect on their learning using the 3-2-1 activity. Based on everything they have learned in the activities student should respond by doing the following:

First, have your students write three facts they learned from something they read or learned in class about energy transmission.

Next, have students write two questions about the topic that wasn't covered or discussed in class.

Finally, have your students write one opinion they have about the lesson.

EXTENDING THE LESSON

- Research other forms of renewable energy and how they move from generation to transmission. Write a compare/contrast summary for your chosen type of energy and solar fields.
- Deeply investigate another form of renewable energy and give students the choice of how they will present their findings.
- Schedule an interview of someone who has a career in the energy transmission field. Prepare your inter view questions ahead of time.
- Develop a timeline on the history of energy transmission from its inception to present day.
- Create a multi-circle Venn diagram comparing and contrasting three types of renewable energy.

RELATED LINKS

How energy works (with helpful graphic and video)

Department of Energy: Renewable Energy

Renewable Energy Explained

Transmission Planning

Educational Standards

ELA Standards

8th Grade

CCSS.ELA-LITERACY.RI.8.1	Cite the textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.
CCSS.ELA-LITERACY.RI.8.2	Determine a central idea of a text and analyze its development over the course of the text, including its relationship to supporting ideas; provide an objective sum mary of the text.
CCSS.ELA-LITERACY.W.8.2	Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
CCSS.ELA-LITERACY.W.8.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
8.7	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and fol lowing a standard format for citation.
CCSS.ELA-LITERACY.SL.8.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.
CCSS.ELA-LITERACY.SL.8.1.A	Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.
CCSS.ELA-LITERACY.SL.8.1.B	Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed.
CCSS.ELA-LITERACY.SL.8.1.	Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas.
CCSS.ELA-LITERACY.SL.8.1.D	Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented.

8.4 4.	Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.
CCSS.ELA-LITERACY.SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

9-10th Grades

CCSS.ELA-LITERACY.RI.9-10.1	Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
CCSS.ELA-LITERACY.RI.9-10.2	Determine a central idea of a text and analyze its development over the course of the text, including how it emerges and is shaped and refined by specific details; provide an objective summary of the text.
CCSS.ELA-LITERACY.W.9-10.2	Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
CCSS.ELA-LITERACY.W.9-10.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
9-10.7	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, demonstrat ing understanding of the subject under investigation.
9-10.8 8.	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in an swering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
CCSS.ELA-LITERACY.SL.9-10.1	Initiate and participate effectively in a range of collaborative discussions (one-on -one, in groups, and teacher-led) with diverse partners on grades 9-10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persua sively.
CCSS.ELA-LITERACY.SL.9-10.1.A	Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.

CCSS.ELA-LITERACY.SL.9-10.1.B	Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.
CCSS.ELA-LITERACY.SL.9-10.1.C	Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.
CCSS.ELA-LITERACY.SL.9-10.1.D	Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.
CCSS.ELA-LITERACY.SL.9-10.2	Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.
9-10.4	Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
CCSS.ELA-LITERACY.SL.9-10.5	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.