**Lesson 3: Renewable Energy vs Non-Renewable Energy**

**Problem Statement:**

“Dear Diary,

Mom and Dad said that we have to move to the country because we want more space and they want to be someplace quiet. I don’t know where we are planning to move but I know I’m sad that I’m leaving my friends. Mom says I can still chat with them online, and my computer and XBOX will be powered by poop! LOL!!

I’m really wondering how I can power my XBOX with poop. Do I just plug it into a pile of poop? I think living on a farm I’ll have a lot of chores. I wonder what I’ll have to do.

My parents said there will be lots of ways for us to get power for our house. We can use solar panels, wind turbines (whatever those are!) and even something called a “digester” that can break down poop (and some other materials) and use it for power. Wow! We can even use falling water to make power. Mom and Dad says we will be able to get all the power we need without even needing to get electricity from the city. They even said living like this will be better for the environment and we’ll be polluting less. How in the world will we be able to do this?

I’m really excited to learn about how sun, wind, and poop can make power. I also can’t wait to have so many animals! Plus, my parents said I get to actually help design the self-sustaining farm! I guess I’ll give it a try.”

**Learning objectives:** Students will be able to understand differences between renewable energy and nonrenewable energy and identify different types of renewable energy.

**Lesson standards (NGSS, CCSS, CTE):**

**NGSS**

* 4-ESS3-1 - Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

**CCSS**

* CCSS.ELA-LITERACY.SL.4.1.A Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.
* CCSS.ELA-LITERACY.SL.4.1.B Follow agreed-upon rules for discussions and carry out assigned roles.
* CCSS.ELA-LITERACY.SL.4.1.C Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others.
* CCSS.ELA-LITERACY.SL.4.1.D Review the key ideas expressed and explain their own ideas and understanding in light of the discussion.
* CCSS.ELA-LITERACY.W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

**Soft skills:** Collaboration, communication, listening

**Locally and/or personally relevant for students:**

* Personally Relevant: materials used to build a home, knowledge of the standard Western lifestyle
* Locally Relevant: begin to think about different sources of energy; where their own energy may come from; generating interest and knowledge for future job opportunities

**Connections to career and educational pathways:**

* Students are engaging in the engineering and design processes by developing solutions to a problem and testing the theory to refine their designs.
* Students will gain an interest in STEM fields by designing sustainable homes and learning about the benefits of renewable energy versus the way we use energy in our traditional homes.

**Materials:**

* Large chart paper for Renewable/Nonrenewable Energy T-Chart (enough room to write definition and tape a few example pictures)
* Chart marker
* Pictures for Pictures File Sort; enough for each table group to have one set of pictures (provided at end of this Lesson Plan)
* Way for students to view Youtube Video ([**https://www.youtube.com/watch?v=S4O5voOCqAQ**](https://www.youtube.com/watch?v=S4O5voOCqAQ)) **\*\*WARNING: STOP VIDEO AT 2:49 SECONDS FOR EXPLICIT LANGUAGE\*\***

**Lesson preparation:**

**Time required:** 45 minutes

**Grouping of students for instruction:**Group students heterogeneously--consider participation and language needs.

**What is the instruction? Consider the PBL Procedure that is being addressed here:**

**Understanding the Problem**

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| --- | --- |
| **Teacher** | **Student** |
| 1. Review prior learning and ask question from yesterday’s class “How do we turn energy into electricity?” | Students will discuss in their small groups (same groups from the last lessons) to recall what they know about the way that energy is turned into electricity |
| 2. Introduce video:  “I’m going to show you a video of a man powering a toaster, but he’s not an ordinary man. He’s an Olympic cyclist. He’s going to try to produce enough power to toast one piece of bread. As you’re watching, think about what you notice about Robert (the cyclist) as he is powering the toaster.” | Students listen to teacher |
| 3. Play Video: Olympic Cyclist vs. Toaster: Can He Power It? Youtube Video  [**https://www.youtube.com/watch?v=S4O5voOCqAQ**](https://www.youtube.com/watch?v=S4O5voOCqAQ)  **\*\*WARNING: STOP VIDEO AT 2:49 SECONDS FOR EXPLICIT LANGUAGE\*\*** | Students watch video, considering guiding question provided by teacher: What do you notice about Robert as he is powering the toaster? |
| 4. Debrief Video  Ask students, “What did you notice about Robert as he was powering the toaster?”  Guide students towards the conclusion that Robert had to put in a lot of energy to produce a small amount of electricity. | Possible responses:  He was working hard.  He was sweating.  He was breathing heavy. |
| 5. Lead discussion around the following question:  “Then what does that mean about what it takes to power the things in your current home?”  “What about what it would take to power the things you want in your design?” | Students provide responses that lead to conclusion that it would be difficult to sustainably produce enough electricity to power everything in their design without a renewable and reliable energy source. |
| 6. Table/Group Activity: Picture File Sort -- Renewable Energy vs. Nonrenewable Energy  Tell students, “To help us think about different kinds of energy, we’re going to do a Picture File Sort. Your job is to sort the pictures that belong together and explain why those pictures belong together.”  “Be sure to work cooperatively as a team to sort the pictures. Everyone in the group should be able to explain why your team decided to sort pictures together the way you did.”  As students work as teams, circulate and take notes on what students are noticing; pay particular attention to team who are sorting by energy type; be sure to ask those teams to share out during debrief. | Working cooperatively to complete Picture File Sort |
| 7. Debrief Picture File Sort with T-Chart: Identify different types of renewable energy-- Facilitate discussion on renewable energy vs. nonrenewable by pointing out the way they sorted out nonrenewable (or “traditional”) energy homes, buildings, and sources from other pictures.  Create a large, class T-Chart with “Renewable Energy” on one side and “Nonrenewable Energy” on the other side. Have students tape example pictures of each on the large chart under the correct header.  Ask, “How are these two different types of energy different?”  “What type of energy do you think is better and why?”  Add definitions of each to the chart:  Renewable energy: energy from a source that is not depleted or does not run out; sustainable  Nonrenewable energy: energy from a source that will eventually run out and cannot be replaced | Teams share out how they sorted their pictures: most students will have likely sorted by energy type: renewable vs. nonrenewable, then further by renewable energy type (ie., solar, hydro, wind)  Students might be able to conclude that renewable energy is sustainable and comes from a source that does not deplete; if not, define for students. |
| 8. Close Lesson: Next time, we’re going to go deep into different types of renewable energy sources, like the ones we saw in the Picture File Sort today. |  |

**Accommodations:**

Heterogeneous groups and partnerships

**Extensions:** Have students consider, “What is something at home that would be really difficult for Robert the Olympic cyclist to power?”

**Assessment:**

Formative Assessment: Observation of student conversations about Picture File Sort

**References/Resources:**YouTube Video Resource: Olympic Cyclist vs. Toaster: Can He Power It?, https://www.youtube.com/watch?v=S4O5voOCqAQ

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