**Lesson 4: Renewable Energy Expert Groups**

**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 identify different types of renewable energy and understand advantages and disadvantages of the different types.

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

**NGSS:**

* 4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
* 4-ESS3-1 Energy and fuels are derived from natural resources and their uses affect the environment.

**CCSS:**

* [CCSS.ELA-LITERACY.RI.4.1](http://www.corestandards.org/ELA-Literacy/RI/4/1/) Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.
* [CCSS.ELA-LITERACY.RI.4.4](http://www.corestandards.org/ELA-Literacy/RI/4/4/) Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a *grade 4 topic or subject area*.
* [CCSS.ELA-LITERACY.RI.4.7](http://www.corestandards.org/ELA-Literacy/RI/4/7/) Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.
* [CCSS.ELA-LITERACY.RI.4.9](http://www.corestandards.org/ELA-Literacy/RI/4/9/) Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.
* 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

**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:**

* Idea: Invite local renewable energy professionals to meet with students and share information.
* 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.

**Prerequisite: students should be taught ahead of this lesson how to use text features to help locate information and how to scan for information in nonfiction text**

**Materials:**

* Chart for team folders to record energy assignments
* Teacher must gather information sources (such as websites, pamphlets) for different types of energy: solar, wind, hydro, biomass, geothermal; see resources at end of lesson plan
* Kid friendly books and/or printed material on solar, wind, hydro, biogas, geothermal on a variety of reading levels
* Note taking grid
* Chart of how a home group and an expert group interact
* Chart of home group assignments
* Map of expert group research locations
* Jeopardy style information review game
* Final exit slip for individuals (optional)

**Lesson preparation:**

**Time required: 4 class sessions, 30 - 40 minutes each**

**Grouping of students for instruction:**

**Students will need to be placed into mixed ability “home” groups with 5 members in each group. If critical, determine which students will research which type of energy to insure heterogenous “expert groups”.**

**What is the instruction?**

**Each student will be responsible for researching and then teaching his/her home group about a different type of energy. To do this:**

1. **Student meet in “home” groups of five members each.**
2. **Students determine which member will research solar, who will do wind, who will do hydro, who will do biomass and who will do geothermal. A teacher can preassign these roles if needed.**
3. **Once roles are assigned/picked, students researching the same type of energy will meet together to gather information using the note taking grid. The research groups are called “expert groups” (the student from each group researching the same type of energy meet together)**
4. **Students meet in expert groups to research. Each student needs to take notes on his/her type of energy.**
5. **Each student returns to his/her home group. Students take turns teaching his/her home group about the what he found out in the expert groups. As the student shares information, the other members record the information on their note taking sheet.**
6. **Once every member has shared their information, the teams compete against each other in a final competition. This can take the form of a “Jeopardy” type game or a teacher drawing cards and quizzing the groups.**

**Session 1**

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| **Teacher** | **Student** |
| Welcome back! You’ve designed a fabulous house in lesson 1. In lesson 2, you found out about all the things that will require energy in your home. And then in lesson 3, you found out the difference between nonrenewable and renewable energy, the type of energy we want to use for our home. With renewable energy, we don’t have to worry about hurting our environment and we can get the power we want. But how are we going to turn that renewable energy into electricity?  In this lesson, you’ll learn:   * The source of the energy, * How the energy is transformed into a form we can use, * Advantages of each type of energy, * Disadvantages of each type of energy.   To do this, you’ll use a procedure called “jigsaw” In jigsaw, you’ll start in groups of 5 called “home” groups. In your home group, each student will be responsible for researching a different type of energy. To research, you’ll be able to join other students from other home groups researching the same type of energy. These are called “expert” groups. When you are done researching in expert groups, you’ll share your learning with your home group. In that way, everyone will have the same information. We’ll even do a group competition at the end to see what teams learned the most. | Examine chart home group/expert group interaction. |
| To start with, you’ll meet in your home groups. | Students:   * move into home group * decide which member will research which type of energy (skip this step if the teacher pre-assigns the expert groups) |
| To make sure we’re ready to go for our next session, I’m going to see which students are researching which type of energy.  If you’re researching solar energy for your home group, please stand. (each group should have one member stand). Repeat for each type of energy. | As each type of energy is called, a team member should stand. |

**Session 2**

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| **Teacher** | **Student** |
| “Today you meet in your expert groups. You are responsible for learning about your type of energy and then teaching your home group. Your team is depending upon you!” What you find out will help you decide which type of energy or energies will help you power your home. | Students move into their “expert” groups (all the students researching the same type of energy meet together)  Each student is given a note taking grid and gets a pencil to use for notetaking.  The teacher can dictate how the students research. Students would have access to kid friendly energy books and websites.  One student can read the information outloud to the group. Then, a different student can reread the information stopping when signaled by the group that they believe a piece of information should be placed on their note taking grid.  Each student completes the area of the note taking grid pertaining to their assigned type of energy. |

**Session 3**

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| **Teacher** | **Student** |
| “In our last session, you collected information about your energy source. Now, it's time to share what you learned with your home group.” | Students move to their home group. Each student then shares what he/she learned in the expert group. It can be useful to set a timer giving each student a set amount of time to share. |

**Session 4**

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| **Teacher** | **Student** |
| “Now that you’ve learned about different types of renewable energy, it’s time to use what you learned with a team competition.” We’ll use a game to see to test what you’ve learned.  Teacher brings up the Energy Jeopardy game on an ActivPanel or display board.  Teacher needs to decide:   1. Will students be allowed to use notes during the game? (suggested to encourage note taking) 2. Will you call on random students or allow teams to work together to answer? Allowing teams to confer can result in the expert answering the questions and doesn’t foster co-dependence between team members to learn the material. 3. If a team answers correctly, will you allow teams to continue choosing questions until they answer incorrectly or will you evenly divide the opportunities to pick questions? | Students/team choose renewable energy questions from a Jeopardy style game board to answer and earn points. |
| Distribute a brief exit slip to check for understanding. | Students complete an exit slip about their understanding of renewable energy. |

**Experience: Jigsawed Questions** What in your home is powered by energy? Create a gallery walk, different posters set up to identify different ideas of energy. Set up 2-4 different areas to cover different types of energy and choose categories: stored energy vs live energy, what uses energy in the house, what supplies energy, and

**Discussion:** Give them a chart to fill in or point out what is powered. Leave it open ended, visual as well as lists for several types of learning. Lead discussion to discuss what energy is and record this on a main chart up front to gather ideas and assess current level of understanding.

**Level Load Information/Scaffolding:** Establish a common definition for energy, leave them curious, give them something to look up. Show video again, first part and then show them the new video.

**Accommodations:**

1. Informational materials can be provided on different levels to help all students access the information.
2. Strategic grouping of students in home groups and expert groups can help insure peers are available to help support students with IEPs or other academic needs.

**Extensions:** Field trip to locate energy production sites, invite local energy professionals into the classroom to share their expertise especially on the days expert groups meet

**Assessment:**

Student note taking form

Final opinion writing/exit slip

**References/Resources:**

**Informational websites:**

**Alliant Energy Kids** [**http://www.alliantenergykids.com/EnergyandTheEnvironment/RenewableEnergy/**](http://www.alliantenergykids.com/EnergyandTheEnvironment/RenewableEnergy/)

**Energy Kids (US Energy Information Administration)**

[**https://www.eia.gov/KIDS/energy.cfm?page=about\_home-basics**](https://www.eia.gov/KIDS/energy.cfm?page=about_home-basics)

**eSchoolToday** [**http://www.eschooltoday.com/energy/renewable-energy/what-is-renewable-energy.html**](http://www.eschooltoday.com/energy/renewable-energy/what-is-renewable-energy.html)

**Ducksters,com**

[**http://www.ducksters.com/science/environment/renewable\_energy.php**](http://www.ducksters.com/science/environment/renewable_energy.php)

Solar: <http://rayahsolar.com/blog/solar101/solar-for-kids/>

Biomass: Video - Waste to Watts - <https://www.youtube.com/watch?v=ASoXPy8RWlQ>

**Skype with industry experts**

[**https://www.playfactile.com/**](https://www.playfactile.com/) **- create your own jeopardy**

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