**Sun, Wind, and Poop**

Target Grade Level(s): 4th Grade

Subject(s): Math, Science, and Engineering

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**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.

**Unit Overview and Table of Contents**

From this unit, students will gain an understanding of different types of renewable energy and the benefits of renewable energy versus nonrenewable energy, using what they learn to prioritize household needs and work within an energy budget to design a self-sustaining home.

Before this unit, students should have some experience with working in small groups and whole class cooperatively. Knowledge of renewable energy is not entirely necessary as it will be developed through this unit.

Step 1. Identify the problem: During this unit students will design a farm supported by renewable energy sources.

Step 2. Gather Information: Students will identify energy needs within a household as well as what renewable energy is and different types of renewable energy.

Step 3. Develop a Plan: Students will work within an energy and land budget to design a farm.

Step 4. Build and Test: Students will use a provided table to prioritize and calculate energy usage vs. energy produced.

Step 5. Redesign: Students will revise based on wants vs. needs and availability of resources.

Step 6. Build and Test Again: Make adjustments based on the data they gathered and analyzed during the redesign phase.

Step 7. Reflect: Students will reflect on the feasibility of using rural renewable energy compared to the urban electrical system. They will also weigh the pros and cons of renewable vs. nonrenewable energy.

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| **Lessons** | **Learning Outcomes** |
| Lesson 1: Project Introduction  \*Lessons 1 and 2 are meant to scaffold students’ background knowledge in preparation for Lessons 3 and on. | Students will understand the differences between sustainable living and traditional living. |
| Lesson 2: Diving into Poop | Students will understand that everything that uses electricity requires energy. |
| Lesson 3: Renewable vs. Nonrenewable Energy | Students will determine the differences between renewable energy and nonrenewable energy and identify and explore different types of renewable energy.  (Suggestion: Skype with Wildhorse) |
| Lesson 4: Renewable Energy Expert Groups  (2-3 sessions) | Students have previously learned what the different types of energy are, now they will learn how the different types of renewable energy work.  Source, How Power is Produced, Advantages, Disadvantages  Renewable Energy Sources Games: <https://climatekids.nasa.gov/power-up/> |
| Lesson 5: Design Your Own Farm  (Include parameters for farm design) | Students will choose the energy type(s) that they would like to use on their farms. They will also explain their energy selection by listing the pros and cons of their choice. |
| Lesson 6: Evaluate Your Farm Design | Students will determine if their chosen renewable energies can power their farm design.  (Use data tables) |
| Lesson 7: Revise Your Design | Success Criteria: Chosen renewable energies can power your farm design. |

**Standards (NGSS, CCSS, CTE):**

NGSS:

4-PS3-1 - Use evidence to construct an explanation relating the speed of an object to the energy of that object.

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

3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

K-2- ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

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:**

Listening, Troubleshooting, Working independently, Collaboration, Transferring information and applying it, Communication (written and oral), Creativity, Innovation

**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.

Optional Resources:

Alliantenergykids.com Fun and Games for kids to play

Skype in the Classroom: Connects classrooms with STEM Professionals