

## **Lesson Six: How Do You Build a Better Wind Turbine?**

**Grade Level:** 3<sup>rd</sup> Grade

**Time:** 45 minutes

**Essential Question:** How can we be stewards of Wyoming's mineral and energy resources to benefit current and future generations?

**Objective:** Students will generate possible solutions to a problem.

**Purpose:** Students address the issues that are preventing the greater use of wind farms in Wyoming.

### **Required Materials/Resources:**

- Wyoming Energy Brainstorming sheet (one per student)
- Wyoming Energy Questions sheet (one per student)

### **Suggested Teacher Preparation:**

- Have extra copies of the sheets available if you want students to do extra revisions.

### **Standards:**

Science: 3-5-ETS1-2 (Explicit)

ELA: 3.SL.1, 3.SL.4 (Practiced/Encountered)

### **Vocabulary:**


- **Constraint** - a limitation or restriction

## Instructional Procedure/Steps:

1. Say: **“In our last lesson, we saw that Wyoming would be a great place to build wind farms that would generate electricity. Using more renewable energy is a way to be a steward. However, there are some challenges with using wind as an energy source. Today, we are going to brainstorm and design, like engineers, some solutions to those challenges.”**





In this lesson, students will be engaged in the higher order thinking skills of application, synthesizing, and evaluation as they problem solve to modify and design potential

2.  Post the four questions from the Wyoming Energy Questions sheet. (Students will receive the questions sheet later in the lesson.) Pass out the Wyoming Energy Brainstorming sheets. Read through each problem. Clarify any questions. Say: **“You will choose one of these problems and brainstorm two possible solutions to solve them. Circle the solution you feel is most likely to work best. Draw and write your ideas in each of the boxes below. You will have 10 minutes to create both solutions. Please begin.”**

3. At the end of the brainstorming period, reconvene the class. Say: **“You will now share your solutions with a partner. As your partner is sharing, you will be evaluating their proposed solutions based on how well they meet certain criteria: Does the idea help solve the problem, and is it realistic? You will also look at two constraints. Constraints are limits that must be considered when designing a solution to a problem. The constraints that we will look at are the cost of the solution and the idea that the solution can’t create new challenges that are bigger than the problem we’re trying to solve. Partner A will go first. While partner A shares, partner B will be thinking if the solution answers our four questions. You will**

TEACHER NOTE: If students are working productively at the end of 10 minutes, give them more time, if possible.

**then switch, and partner B will present.”** Put students into pairs and pass out the Wyoming Energy Questions sheets. Students will have 10 minutes to share both sets of solutions. Once 5 minutes have passed, say: **“If partner A has not yet finished, please wrap up, so partner B can begin.”** After both students have shared, give them a few minutes to discuss which of their proposed solutions they think is most likely to solve the challenge.

4.   Reconvene the class. Say: **“Now, work with your partner to determine which of the solutions you just shared with each other, best meet the criteria. Choose that one to think about and redesign together. Make it even better. You could consider using parts of all the other solutions you’ve each come up with to combine them into the new one. Remember, your goal is to continue to refine the idea, so that it can better solve the problem. You will do this on the back of your paper. Use ideas that came out of your discussion with your partner to help you. Don’t forget that your revised solution should still meet the criteria and constraints from our four questions. You will have 10 minutes to do this. Begin.”** *As students are revising, circulate around and find two or three students who have made quality revisions to share with the whole class at the end. These should be exemplars of how students identified areas to improve.*
5. At the end of the 10 minutes, reconvene the class. Call on the students you selected to share their original solution and how they improved it. Collect all students’ sheets as an assessment to check students’ understanding.



In this lesson, students will be engaged in the higher order thinking skills of synthesizing, and evaluation as they problem solve to modify and design potential solutions.

**Assessment:**

Reconvene students to have a whole group final discussion using the questions below:

- **“What are some of the challenges you faced in your work as an engineer?”**
- **“How can the work of engineers help us to be better stewards of our resources?”**
- **“What did you enjoy about the engineering and design process?”**

*Students should recognize that, in engineering, there isn't a “right” answer. The process is about making solutions better in order to be better stewards when solving problems.*

**Credits/Sources:**

1. Poudre Rural Electric Association, Milton Geiger, Alternative Energy Administrator.