Lesson 3.6
Design Arguments About Converters
Lesson Overview

In this lesson, students consider new possible solutions for adding more energy to the Ergstown electrical system. The class gets a new message from the Ergstown City Planner with two proposed solutions for Ergstown’s blackout problem—adding solar panels or adding wind turbines—as well as new design criteria. The class considers new evidence from the Ergstown Climate Report, the *Energy Conversions* Sim, and the reference book to weigh the impact of both proposed solutions. Students discuss the advantages and limitations of each proposed design solution in a Roundtable Discussion. They choose the best solution and then write their own argument for it, considering audience as they write. The lesson allows students to apply their growing understanding of designing solutions to meet criteria.

**Anchor Phenomenon:** Ergstown has frequent blackouts.
**Design Problem:** Reduce the number of blackouts in Ergstown.

**Students learn:**

- It is often not possible to meet all of the criteria for a given design solution or to meet all of the criteria equally well.
- Engineers must consider both the advantages and the limitations of each solution.
- Scientists and engineers write arguments with an audience in mind.
Gathering Evidence

The class observes as the teacher runs tests in the Sim. Students consult *It’s All Energy* for more information about the advantages and limitations of solar and wind power.

Instructional Guide

1. **Establish the need for more evidence.**

   - When engineers make arguments about solutions, they use evidence from more than one source. This makes the argument more convincing. We have a little bit of evidence about solar panels and wind turbines, but we need more evidence before we can write an argument for Mayor Joules.

   - Let’s use the *Energy Conversions* Simulation to try out a system with these types of converters and see what happens.

2. **Project the *Energy Conversions* Simulation from the Student Apps Page.**

   - Build a system with the following configuration: sun → solar panel → music player.
   - Press RUN, set the energy input to 100, and press GO.
   - Once the simulation has stopped, record the amount of sound energy transferred out (in the Energy Transferred Out graph) on the board.
   - Repeat the second and third step above with the following configuration: wind → flywheel → generator → music player.

3. **Reflect on the evidence from the Sim.**

   - Point to the amounts of sound energy transferred out by the system with the solar panel and the system with the wind converter. Ask students to turn to a partner and discuss what the numbers mean. Have students tell their partners which solution (installing solar panels or wind converters) this evidence supports.
   - Call on a student to share which solution this evidence supports, and how they know. [It supports both solutions—the amount of sound energy transferred out was nearly the same in both systems.]
4. **Record evidence from the Sim on the chart.** Write “Increases the amount of energy in the system” in both columns on the Evidence for Solar and Wind Power chart.

5. **Search for more evidence in It’s All Energy.** Say that, as they suggested earlier, students should now read more about wind turbines and solar panels in the reference book. Distribute one copy of the book to each pair of students and have them read the sections on these two energy converters. Remind students that they can use the table of contents and index to find information quickly.

6. **Conclude the activity.** When students have had a few minutes to read, regain attention. Explain that they will get a chance to consider all of this new the evidence in a Roundtable Discussion.

**Teacher Support**

**Instructional Suggestion**

**Providing More Experience: Using the Energy Conversions Simulation as Evidence**

You may wish to give students additional time to gather evidence from the Energy Conversions Simulation, exploring the difference in sound output energy for systems with the sun or the wind as energy sources for the music device. Giving students additional time to synthesize and apply what they have learned from previous investigations can help them select the solution that best meets the criteria. Focus students’ attention on comparing the efficiency of different sources by asking them to explain how they know which system has more sound output energy.
Gathering Evidence

The class observes as the teacher runs tests in the Sim. Students consult It’s All Energy for more information about the advantages and limitations of solar and wind power.

Instructional Guide

1. Establish the need for more evidence.

   Cuando los ingenieros hacen argumentos sobre soluciones, usan evidencia de más de una fuente. Esto hace que el argumento sea más convincente. Tenemos un poquito de evidencia sobre los paneles solares y las turbinas de viento, pero necesitamos más evidencia antes de que podamos escribir un argumento para la Alcaldesa Joules.

   Usemos la Simulación Conversiones de energía para probar un sistema con estos tipos de convertidores y ver qué sucede.

2. Project the Energy Conversions Simulation from the Student Apps Page.

   - Build a system with the following configuration: sun → solar panel → music player.
   - Press RUN, set the energy input to 100, and press GO.
   - Once the simulation has stopped, record the amount of sound energy transferred out (in the Energy Transferred Out graph) on the board.
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3. Reflect on the evidence from the Sim.

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   - Call on a student to share which solution this evidence supports, and how they know. [It supports both solutions—the amount of sound energy transferred out was nearly the same in both systems.]
4. Record evidence from the Sim on the chart. Write “Increases the amount of energy in the system” in both columns on the Evidence for Solar and Wind Power chart.

5. Search for more evidence in It’s All Energy. Say that, as they suggested earlier, students should now read more about wind turbines and solar panels in the reference book. Distribute one copy of the book to each pair of students and have them read the sections on these two energy converters. Remind students that they can use the table of contents and index to find information quickly.

6. Conclude the activity. When students have had a few minutes to read, regain attention. Explain that they will get a chance to consider all of this new the evidence in a Roundtable Discussion.

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