



UTAH OFFICE OF ENERGY DEVELOPMENT

Energy Grid

Grade/Subject: *Physics*

Strand/Standard: **Physics 2.5 Design a solution** to a major global problem that accounts for societal energy needs and wants. Define the problem, identify criteria and constraints, develop possible solutions using models, analyze data to make improvements from iteratively testing solutions, and optimize a solution. Emphasize problems that require the application of conservation of energy principles through energy transfers and transformations. Examples of devices could include one that uses renewable energy resources to perform functions currently performed by nonrenewable fuels or ones that are more energy efficient to conserve energy. (PS3.A, PS3.B, PS3.D, ETS1.A, ETS1.B, ETS1.C)

Lesson Performance Expectations:

- Students will analyze the electrical grid in the United States and identify the types of systems. They will then play the “Power the Grid” game and identify the type of grid and its features.

Materials:

- One computer per student with internet access
- Student sheet

Time: 50 minutes unless students wish to play again, to win.

Teacher Background Information:

- This activity is based on a video “game” based on energy use. The link below opens the game and allows the student to balance the electrical grid in a city. The energy produced must meet the demand.
- Play the game yourself to make sure you understand how it is set up. There are not many instructions. The students will most likely pick it up fairly easily but you may need to help.
- Background info:

<https://www.epa.gov/green-power-markets/us-electricity-grid-markets>

Student Background Knowledge:

- Students should be aware that electricity is involved in many applications in their daily lives. Many have seen the power lines extending from very tall towers around their city. You may wish to see if they know the difference between electricity and fuel burning as cars and homes are increasingly using both sources of energy.

Teacher Step by Step: A 3-D lesson should insist that students think deeply. Provide time and space for the students to experience the phenomenon and ask questions. The student sheet provided below provides guidance but is only an example of how students might respond.

1. **Introduce Phenomenon:** *Turn off the lights and any other electrical components in your classroom. Ask students how their day would be different without electricity. Ask them where the electricity for the lights in the school comes from?*
2. Share the student sheet with students and provide time to read the website. Ask them to record ideas on the student sheet that are new to them. Review these ideas and make sure students read the whole article.

3. Draw student attention to the questions before they begin. They are based on the article and the game itself.
4. Introduce the “Power the Grid” game at: <https://kbhgames.com/game/power-the-grid>
5. After as much time as you can stand the background music (mute is a good idea), ask students to stop and record their results (using the bar across the top) and answer the questions. Ask students to determine a “winner” based on their results.
6. Students should then answer the questions and, if time allows, play the game from a more knowledgeable perspective.

Assessment of Student Learning.

1. What are parts of a power grid? Choose all that apply:
 - a. Substations *
 - b. Transmission lines*
 - c. Homes*
 - d. Gasoline powered cars
 - e. Power station*
 - f. Energy storage facility*
 - g. Gas furnace or fireplace
 - h. Transformers*
2. What is the advantage of a large network of power sources on a grid?
 - a. If one source becomes unavailable, other sources can fill the gap.*
 - b. There is an unlimited amount of power because of the large network.
 - c. The electricity will be cheaper and more available for everyone.
 - d. The electricity will move more quickly through the grid.
3. How is electricity different from solid or gas fuel sources?
 - a. Electricity does not yet have advanced storage methods.*
 - b. Electricity has more energy per unit mass.
 - c. Electricity can be stored more cheaply.
 - d. Electricity is found in all locations.
4. Which of the following is true of the electrical grid that Utah belongs in? Choose all that apply.
 - a. It is composed of many Western States in the US.*
 - b. Customers have only one choice of who to buy power from*
 - c. Utahns enjoy unlimited power from many different sources.
 - d. There is very little management of the movement of electricity.

Extension of lesson and Career Connections:

Ask a parent or guardian to see a power bill for your home or apartment. What information do you see? When does your living space use the most electricity? Why?