

## Activity Eight: When the Wind Doesn't Blow

### Adopted/ Revised From

N/A

### Grade Level

6-12

### Objectives

- Brainstorm options for meeting electricity needs without sufficient wind to power a turbine
- Research costs and benefits of the different options
- Present a given option as a group
- Vote on the options presented to come to class consensus

### Overview

Students conduct a web quest to learn about energy efficiency and conservation, storage, and renewable and non-renewable forms of energy. They then create mock budgets to promote various solutions to bridge our demand for electricity with the intermittent supply of wind and solar.

### Materials (per group)

- Internet access
- Stickers (2 per student)

### Estimated Cost of Materials

\$5

### Computer Required?

Yes

### Duration

2 class periods (assuming web quest is conducted as homework)

**Primer References:** Wind and Other Electrical Generation in Colorado

### Engagement

This activity is ideally conducted after “What Speed Do We Need” since in that lesson students should have learned that the school wind turbine is insufficient to provide the school’s electricity needs and won’t generate any electricity at all if the wind doesn’t blow.

1. What powers the classroom when the wind isn’t blowing?
2. What are some options for making sure school electricity demand is met when the wind isn’t blowing?
3. What are some options for making sure the U.S. electricity demand is met when the wind isn’t blowing?

The third question should result in a list of options named by the students, to include the following:

1. **Reduce our electricity demand** through energy conservation and efficiency
2. **Use other sources of energy** to generate backup electricity
3. **Store electricity** from wind and solar in batteries or otherwise for later use
4. **Expand the grid** to incorporate more renewable energy systems from across the country
5. **Charge more** for electricity produced by sources other than wind and solar
6. **Ration electricity** based on intermittent supply of wind and solar

## Investigation

Now we're going to learn how to conduct unbiased research in order to understand the advantages and disadvantages of different energy sources:

1. Divide the students into groups, assigning each group to one of the options listed above.
2. Read the students each of the following paragraphs and ask them to detect bias:

“A new solar photovoltaic array was constructed in Colorado yesterday. The panels were an expensive local solution to global warming, which itself has not been proven. It remains to be seen how much electricity is actually generated by the panels and whether the neighbors object to the “new look” of their community.”

“A new solar photovoltaic array was constructed in Colorado yesterday. The panels were tastefully installed to match the surrounding environment and will reduce energy costs for participating customers. “This technology benefits everyone – the customers, the environment, the economy, and the community”, said Joe Schmidt, a local solar installer.

3. Explain to the students that their research should be unbiased and that they should cite a minimum of four unbiased websites in their presentations.
4. Hand out the lesson's List of Suggested Websites to all students to use in their research. This table is a mere starting point for research and is not intended to be comprehensive.
5. Each group should prepare a 5-10 minute PowerPoint presentation to present to the class that includes the following (charts, graphs, and other visuals encouraged); citations should be placed on each slide as applicable:
  - a. What is the current status of your approach – is it used widely or is it still being researched?
  - b. What are the advantages and disadvantages of your approach, including factors such as feasibility, cost, and environmental impact?
  - c. What are the main barriers to implementing your approach?
  - d. What stakeholder groups would favor your approach? Who would oppose it?
  - e. Could your approach work independently of any other approaches or would it need to be supplemented by other approaches?
  - f. What does your approach need to become more widespread?

## Class Review

Now we're going to compare the advantages and disadvantages of different approaches to meeting electricity demand in the face of intermittent renewable resources in order to come up with a shared vision for our energy future:

1. Each group should make their presentation.
2. After all the presentations are made, list the various approaches and ask the students to put stickers next to their top two choices. A student can put both of his/her stickers next to the same choice if so desired.
3. Tally the votes and discuss as a class.

## Elaboration

Students should at least read [“Colorado Boosts its RPS to 30% by 2020”](#) and [“A Plan to Power 100 Percent of the Planet with Renewables”](#).

1. Is a 30% Renewable Portfolio Standard too high, too low, or just right.
2. Do you think we can power the plant with 100% renewables? Why or why not?

## Instructor Notes

- Reports do not have to be done in PowerPoint – they can also be done as oral reports, with posters, etc. If using a poster, voting stickers can be stuck directly to them.

**Extensions and Variations**

- Debate the advantages and disadvantages of the different approaches to meeting electricity demand.

**References/For More Information**

- See below.

## When The Wind Doesn't Blow: List of Suggested Websites

Source	Website	Topic	Description
U.S. Energy Information Administration	<a href="http://www.eia.doe.gov/kids/">http://www.eia.doe.gov/kids/</a>	All	Comprehensive overviews of each energy source
U.S. Energy Information Administration	<a href="http://www.eia.gov/cfapps/state/state_energy_profiles.cfm?sid=CO">http://www.eia.gov/cfapps/state/state_energy_profiles.cfm?sid=CO</a>	All	Colorado energy production, consumption, cost data
U.S. Department of Energy	<a href="http://apps1.eere.energy.gov/states/state_specific_information.cfm/state=CO">http://apps1.eere.energy.gov/states/state_specific_information.cfm/state=CO</a>	All	Colorado-specific energy information under “Energy Summary” and “Energy Statistics”
U.S. Energy Information Administration	<a href="http://www.eia.gov/todayinenergy/detail.cfm?id=4310">http://www.eia.gov/todayinenergy/detail.cfm?id=4310</a>	Energy Storage	Overview of various technologies – advanced information
California Energy Commission	<a href="http://energyquest.ca.gov/story/index.html">http://energyquest.ca.gov/story/index.html</a>	All	Student-friendly overviews of each energy source
Sandia National Labs	<a href="http://www.sandia.gov/ess/tech_batteries.html">http://www.sandia.gov/ess/tech_batteries.html</a>	Energy Storage	Overview of various technologies – advanced information
Scientific American	<a href="http://www.scientificamerican.com/article.cfm?id=solution-to-renewable-energy-more-renewable-energy">http://www.scientificamerican.com/article.cfm?id=solution-to-renewable-energy-more-renewable-energy</a>	Intermittency of renewable energy	Article on the potential for a mix of renewable energy sources to provide reliable electricity
Washington State University Extension	<a href="http://energyexperts.org/EnergySolutionsDatabase/ResourceDetail.aspx?id=912">http://energyexperts.org/EnergySolutionsDatabase/ResourceDetail.aspx?id=912</a>	Backup power	An Ask an Expert question with detailed response describing backup power options for renewable energy
U.S. Energy Information Administration	<a href="http://www.eia.doe.gov/oiaf/ieo/index.html">http://www.eia.doe.gov/oiaf/ieo/index.html</a>	Non-renewables	Energy reserve data for non-renewable resources
Midwest Energy News	<a href="http://www.midwestenergynews.com/2013/02/05/midwest-grid-operator-expands-south-to-last-frontier-for-renewables/">http://www.midwestenergynews.com/2013/02/05/midwest-grid-operator-expands-south-to-last-frontier-for-renewables/</a>	Expanding the grid	A news article covering costs and benefits of expanding transmission
NY Times	<a href="http://www.nytimes.com/2009/10/20/science/earth/20fossil.html?_r=0">http://www.nytimes.com/2009/10/20/science/earth/20fossil.html?_r=0</a>	External cost of fossil fuels	Describes health care and environmental costs of fossil fuels not accounted for in electric rates