

## Web Unit Plan

**Title:** Using Electricity on the Job

**Description:** The City Electricity Company (CEC) wants to collaborate with the class to develop positive publicity materials that promote and educate others about careers involving electricity. Students create presentations, brochures, and Web sites for use with adults and/or children that answer the questions, Why is electricity important? and What jobs use the concepts of electricity in significant ways?

### At a Glance

**Grade Level:** 9–12

**Subject sort (for Web site index):** Science

**Subject:** Physical Science

**Topics:** Earth Science, Electricity, Electromagnetism

**Higher-Order Thinking Skills:** Analysis, Decision Making

**Key Learnings:** Careers in Electricity, Effects on the Environment

**Time Needed:** 3 to 4 weeks, 50 minute lessons daily

### Unit Summary

This project-based learning unit focuses on electronic and magnetic phenomena. Students explore how energy is harnessed and how electricity is produced and used in industry. Students conduct a variety of hands-on laboratory investigations as well as collaborate with the City Electricity Company (CEC) to develop publicity materials. Students choose to create a slideshow presentation, brochure, or Web site format that includes information on how electricity concepts and tools are used in a specific job and demonstrates learning based on state standards and unit objectives.

### Curriculum-Framing Questions

- **Essential Question**

Why care about Earth?

- **Unit Questions**

What is the relationship between electricity and Earth?

How can we harness Earth's power?

Why is electricity important?

What jobs use the concepts of electricity in significant ways?

- **Content Questions**

What is electricity?

What are the parts of an electric circuit?

What is Ohm's Law?

### Assessment Processes

View how a variety of student-centered [assessments](#) are used in the Using Electricity on the Job Unit Plan. These assessments help students and teachers set goals;



monitor student progress; provide feedback; assess thinking, processes, performances, and products; and reflect on learning throughout the learning cycle.

## Instructional Procedures

### Prior to the Unit

Introduce much of the core content through a variety of laboratory experiments that cover static and current electricity, electromagnetism, series and parallel circuits, and Ohm's Law. See the Internet Resources on the Resources page to find Web sites that have hands-on labs to cover these concepts. Take anecdotal notes as you observe students in the hands-on lab activities. Post important questions related to the labs on the board or chart paper for students to respond to in their journals. Collect journals periodically and respond to student entries. If students are having difficulty understanding concepts, take time to work one-on-one or in small groups with students to reteach difficult concepts.

### Introducing the Unit and Covering Core Content

Begin this unit by posing the Essential Question, *Why care about Earth?* to students. Have students record their opinions about the question in journals. Students can use their journals throughout the unit to record thoughts about important questions and take notes during research. After students have time to think about the question, conduct a whole-class discussion.

Ask students the Unit Question, *What is the relationship between electricity and Earth?* Allow students to share their ideas. Throughout the discussion, highlight various natural resources that are used to create electricity. Tell students that they will research the resources later in the unit.

Pose the Unit Question, *Why is electricity important?* Assign students to small groups and ask them to create a concept map to answer the question. Have students post the maps around the classroom and allow time for students to see all the maps. Hold a class discussion analyzing the maps and discussing the question.

Show pictures of waterfalls, ocean waves, windy environments, corn fields, sun, hot springs, and fossil fuels, such as coal. Ask students the Unit Question, *How can we harness Earth's power?* Explain that electricity is generated in a variety of ways, and some ways are more beneficial to the environment than others. Assign student groups to the following categories:

- Biomass
- Coal
- Geothermal
- Hydropower
- Natural gas
- Nuclear
- Oil
- Solar
- Wind

After students are in groups, have each group complete research on how the group's resource is used to produce electricity. Explain that groups need to include the effects on the environment as part of the process. Then, place students into jigsaw



groupings with one representative from each group. Explain that each member of the jigsaw group should describe what they learned about the production of electricity with other group members in a 5-minute presentation. Have students take notes in their journals while their peers are presenting. After every member has shared, tell students to return to their original core groups.

Explain to students that they will research and create slideshow presentations that address the following questions about one form of electricity:

- *How is the selected resource used to generate electricity?*
- *What are the benefits and risks of using the resource to generate electricity?*
- *How does using the resource to generate electricity impact the environment?*
- *How has technology improved the process of generating electricity through the use of the resource?*

Hand out the [checklist](#) and [oral presentation scoring guide](#) and discuss project expectations. Check for understanding and allow ample time for students to work. Arrange [peer conferencing](#) time for groups to give and receive feedback on their presentations before they present to the class. Take time to meet with groups to make sure they are clear on expectations and understanding concepts. Find time to teach concepts not understood by individuals or groups.

After presentations are finalized, have students present their information to the class. Use the [oral presentation scoring guide](#) to assess student presentations. As a wrap up activity, hold a discussion that revisits the Essential Question, *Why care about Earth?* Have students compare and contrast various forms of generating electrical energy and then record in their journals how each form affects the environment. Ask students to come to a conclusion about which forms of generating electricity should be pursued in the future.

## Rising to the Challenge

Present the following scenario:

*The City Electricity Company (CEC) has asked our class to collaborate with them to develop positive publicity materials that promote and educate others about how specific jobs use electricity as a tool. Your task is to create a presentation, brochure, or Web site for use with adults and/or children that answer the questions, Why is electricity important? and What jobs use the concepts of electricity in significant ways? Each group must decide who their audience will be and what form the publicity piece should take.*

To ensure that students understand all of the project requirements and how they will be assessed, distribute the [Electricity Project Plan and Scoring Guide](#) and discuss all of the criteria in detail.

Next, instruct students to begin the research process by conducting a career background study that will help them to select one profession for which they will develop the publicity materials. Distribute the [Career Study Summary Sheet](#). Explain to students that each team will research a minimum of three careers that use electricity as an important and significant tool on the job. At a minimum, students will:

- Identify or explain in their summary how electricity concepts are used on the job



- Include positive and negative impact
- Explain other skills that each job requires
- Include a recommendation that either encourages or discourages others from entering the profession

After the summary sheets are completed, have teams select the profession for which they will develop materials. Tell students that their next step is to develop a publicity plan and submit it for approval. They then choose to develop a brochure, Web site, or slideshow presentation. Show the [slideshow presentation](#) as an example. Ask students to use the [Electricity Project Plan and Scoring Guide](#) to help them create the project storyboard and publicity plan. Explain each piece in detail and post due dates for both. Then, allow time for students to create a comprehensive plan. Involve students in the assessment process and have them conduct both self- and peer-assessments on the project plans. Remind students that their assessment feedback should include ideas for improvements.

After the plans are approved, allow time for student groups to develop their publicity materials. If possible, invite community members to the class to observe group presentations and see the materials created. Follow up with a whole-class debriefing.

### Wrapping Up the Unit

Pose the Unit Questions again:

- *How can we harness Earth's power?*
- *Why is electricity important?*
- *What jobs use the concepts of electricity in significant ways?*

Instruct students to respond in essay form to the questions and to support their answers with evidence they gathered from their research and science investigations. Use the essay responses to assess student learning of unit objectives.

### Prerequisite Skills

- Basic computer skills
- Using storyboards

### Differentiated Instruction

#### Resource Student

- Provide templates to assist the student with organization and the writing process
- Outline major topics to help the student visually organize information
- Provide a list of vocabulary words and definitions

#### Gifted Student

- Encourage the student to participate in online collaborative projects dealing with electricity
- Give the student the option of inventing a new way a particular profession might use electricity on the job to make the job easier or more productive, and have the student develop publicity materials about this instead of reporting on current uses



## English Language Learner

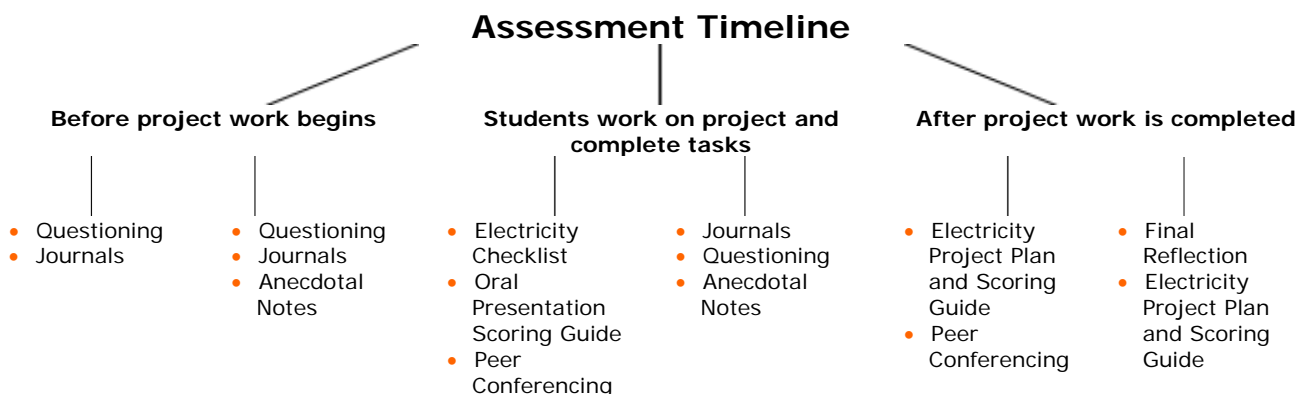
- Support the student with ESOL staff
- Pair the student with a more proficient bilingual student who shares a common first language
- Provide a list of vocabulary words and definitions
- Allow submission of drawings, models, graphs, and charts to demonstrate understanding in lieu of a lot of text

## Credits

Debra Power participated in the Intel® Teach Program, which resulted in this idea for a classroom project. A team of teachers expanded the plan into the example you see here.

## THINGS YOU NEED (highlight box)

### Assessment Plan



The use of formal and informal questioning is used throughout the unit. Journals are used throughout the unit to document students' understanding of concepts during labs, allow students to respond to questions, and provide a place for students to take notes during research. Collect journals periodically throughout the unit to assess student understanding and reteach or discuss concepts as needed.

The [electricity checklist](#) is used by students as a guide in the creation of their presentations. The [oral presentation scoring guide](#) is used to assess students' presentations. [Peer conferencing](#) takes place throughout the unit to give and receive feedback on projects. Students use the feedback to improve products before they are assessed.

The [Electricity Project Plan and Scoring Guide](#) is used by students in the creation of their final projects. The project plan and scoring guide handout guides students while they work on their projects and allows them the opportunity to go above and beyond required expectations.

A final reflection gives students the opportunity to reflect on the unit and document examples from their research.



## Targeted Content Standards and Benchmarks

### CA State Science Standard: Physics, Electric and Magnetic Phenomena

5. Electric and magnetic phenomena are related and have many practical applications. As a basis for understanding this concept:
- Students know* how to predict the voltage or current in simple direct current (DC) electric circuits constructed from batteries, wires, resistors, and capacitors.
  - Students know* how to solve problems involving Ohm's Law.

### Student Objectives

Students will be able to:

- Define electricity and explain why it is important
- Draw, label, and describe the four parts of an electric circuit
- Take part in electrical investigations
- Analyze electricity-generating sources
- Explain how various jobs use electricity concepts in significant ways

## Resources

### Supplies

- Materials vary depending on the hands-on labs

### Internet Resources

- Electricity Unit  
<http://wow.osu.edu/experiments/electricity/eleclist.html>\*  
A variety of hands-on electrical experiments
- Smile Program Physics Index  
[www.iit.edu/~smile/physinde.html](http://www.iit.edu/~smile/physinde.html)\*  
A database with over 30 lesson plans (keep in mind that a wide number of authors contribute to the database, so the detail and quality of the lesson plans varies)
- Virtual Labs and Simulations  
[www.hazelwood.k12.mo.us/~grichert/sciweb/electric.htm](http://www.hazelwood.k12.mo.us/~grichert/sciweb/electric.htm)\*  
Collection of links to sites on the Web that have computerized simulations of physics principles that allow students to see a visual demonstration of a scientific concept, often in animated form
- Pasco Castle Kit  
[http://store.pasco.com/pascostore/showdetl.cfm?DID=9&Detail=1&Product\\_ID=51804](http://store.pasco.com/pascostore/showdetl.cfm?DID=9&Detail=1&Product_ID=51804)\*  
CASTLE (Capacitor-Aided System for Teaching and Learning Electricity), a high school electricity curriculum that leads students from initial naive ideas to an increasingly expert understanding of electrical phenomena
- Environmental Defense—Where Does Electricity Come From?  
[www.environmentaldefense.org/article.cfm?contentid=774](http://www.environmentaldefense.org/article.cfm?contentid=774)\*



Discussion about where electricity comes from and how the sources affect Earth

- Electricity Conservation

[www.chrisp.com/conservation/electricity.html](http://www.chrisp.com/conservation/electricity.html)\*

Discussion about the six categories from which electricity is derived

- Electro-Fishing, EPA New England Regional Laboratory

[www.epa.gov/region1/lab/ecology/efishing.html](http://www.epa.gov/region1/lab/ecology/efishing.html)\*

Detailed information about electro-fishing

- Electro-Fishing on the North Branch

[www.boquetrivier.org/newselfish.html](http://www.boquetrivier.org/newselfish.html)\*

Explanation of electro-fishing

### **Other Resources**

- Have experts in careers that use electricity visit the class

### **Technology—Hardware**

- Computers for conducting research and creating presentations
- Internet connection for using computers and communicating through e-mail
- Printer for printing publicity materials
- Projection system for showing presentations

### **Technology—Software**

- Database or spreadsheet for creating content for publicity materials
- Internet web browser for conducting research
- Multimedia, web development, or desktop publishing software for creating publicity materials and presentations