

Problem-Based Learning

Power Possibilities

Middle School

Earth and Space Science

SC11812



Power Possibilities

Standards/Objectives

MS-ESS2-1 MS-ESS2-4
MS-ESS2-2 MS-ESS2-5

Middle School

Overview

Earth and Space Science

You are an electrical engineer, and your firm has just won a bid to build a power plant on the Mississippi River! Students will explore concepts related to Earth's systems.

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PBL Problem Guide

FOR FACILITATOR USE ONLY

Timeframe

This lesson plan will take approximately 2 hours.

Step-by-step guide

- Put students into teams of three to five members.
- Ask for a volunteer to read the STUDENT PROBLEM aloud [pages 6 & 7].
- As a whole group, ask students to list What We Know [FACTS, page 8].
- Have each team create a list of What We Need to Know [NEED TO KNOWS & LEARNING ISSUES, page 9].
- Have each team begin a list of POSSIBLE HYPOTHESES [page 10].
- Allow teams to research LEARNING ISSUES [pages 9 & 11].
- Teams re-evaluate POSSIBLE HYPOTHESES [page 10] and determine one DEFENDABLE SOLUTION for Final Product [page 12].
- Teams create and present DEFENDABLE SOLUTION and individual students write ACTION PLAN [page 12].

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PBL Resources

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Resources provided

Included with this case are:

- OSHA™: Power Generation Plants Website
- ABB™: All Kinds of Plants Website
- Mississippi River Facts Website
- Human Health and Environmental Effects of Emissions from Power Generation Website

Resources to assemble

You may wish to assemble the following resources ahead of time (if you purchased the corresponding materials kit, these items are included):

- **Wind Power by Tea Benduhn**
- **Solar Power by Tea Benduhn**
- **Water Power by Tea Benduhn**
- **Nuclear Power by Tea Benduhn**
- **Oil, Gas and Coal by Tea Benduhn**
- **Ethanol and Other New Fuels by Tea Benduhn**

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Student Problem

FOR STUDENT USE

You are an electrical engineer, and your firm has just won a bid to build a power plant on the Mississippi River!

In accordance with the bid, you must select a site with the least environmental impact. You must also determine the type of plant to be built.

You will present your initial proposal at the next meeting of government officials.

Consider:

- What would you consider a good location for a power plant?
- What types of power plants are there?

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Student Problem

FOR STUDENT USE

Your assistant provides you with a preliminary report:

The Mississippi River is one of the U.S.'s largest rivers, flowing 2,350 miles from its source at Lake Itasca through the center of the continental United States to the Gulf of Mexico.

Wind speeds vary along the river.

Coal is available by train at any place along the river.

Nuclear power could be generated anywhere along the river.

Consider:

- Why do you think your assistant reported on wind speed, coal availability and nuclear power generation?

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Key Facts

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PART ONE

- You are an electrical engineer.
- Your firm has just won a bid to build a power plant on the Mississippi River.
- You must select a site with the least environmental impact.
- You must determine the type of plant to be built.
- You will present your initial proposal at the next meeting of government officials.

PART TWO

- Your assistant provides you with a preliminary report.
- The Mississippi River is one of the largest in the U.S. It flows 2,350 miles from its source at Lake Itasca through the center of the continental United States to the Gulf of Mexico. .
- Wind speeds vary along the river.
- Coal is available by train at any place along the river.
- Nuclear power could be generated anywhere along the river.

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Need-to-knows / Learning Issues

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NEED TO KNOWS

- Can we build anywhere along the river?
- Can we build any type of plant?

NEED TO KNOW ANSWERS

- Yes.
- Yes.

LEARNING ISSUES

- What types of power plants are there?
- What is the most environmentally friendly type of power?
- What is the environmental impact of a power plant?
- How or where can we reduce this impact?

LEARNING ISSUE RESOURCES

- Students will investigate using the Learning Issue Resource Guide, page 11.

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Hypotheses

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- Hypotheses will vary by each team's site selection.
- Hypotheses will vary by the type of plant each team selects.

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Learning Issue Resource Guide

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WEBSITES

OSHA™: Power Generation Plants

www.osha.gov/SLTC/etools/electric_power/illustrated_glossary/power_generation_plant.html

ABB™: All Kinds of Plants

www.abb.com/industries/us/9aaf403278.aspx

Mississippi River Facts

www.nps.gov/miss/riverfacts.htm

Human Health and Environmental Effects of Emissions from Power Generation

www.epa.gov/captrade/documents/power.pdf

TEXT RESOURCES

Wind Power by Tea Benduhn

Solar Power by Tea Benduhn

Water Power by Tea Benduhn

Nuclear Power by Tea Benduhn

Oil, Gas and Coal by Tea Benduhn

Ethanol and Other New Fuels by Tea Benduhn

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Final Product and Writing Guide

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Team

- Each team will create a presentation of its selected site and power plant type to be reviewed by United States officials. This will include a blueprint or model for the plant, cost of construction and environmental impact.

Individual

- Each student will write a narrative report to accompany the presentation. The report will explain why the site and plant type were chosen, and how the team minimized environmental impact.

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Rubric

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AREA	ABOVE AVERAGE Three points each	AVERAGE Two points each	BELOW AVERAGE One point each	NO EVIDENCE Zero points each	POINTS
Final Product	<ul style="list-style-type: none"> All Learning Issues addressed Three or more hypotheses present High quality final product 	<ul style="list-style-type: none"> Most Learning Issues addressed Two hypotheses present Roles somewhat define Fair quality final product 	<ul style="list-style-type: none"> Few learning issues addressed One hypothesis present Low quality final product 	<ul style="list-style-type: none"> No learning issues addressed No hypotheses present No final product 	
Writing Assessment	<ul style="list-style-type: none"> Problem Summary, Learning Issues/New Information Integrated well presented Hypotheses well presented Solution and Defense well presented 	<ul style="list-style-type: none"> Problem Summary, Learning Issues/New Information Integrated presented Hypotheses presented Solution and Defense presented 	<ul style="list-style-type: none"> Problem Summary, Learning Issues/New Information Integrated poorly presented Hypotheses poorly presented Solution and Defense poorly presented 	<ul style="list-style-type: none"> Problem Summary, Learning Issues/New Information Integrated not presented Hypotheses not presented Solution and Defense not presented 	
Collaboration	<ul style="list-style-type: none"> Individual works well with group members Individual communicates well with group members Individual carries out their individual responsibilities 	<ul style="list-style-type: none"> Individual works acceptably with group members Individual communicates acceptably with group Individual mostly carries out their individual responsibilities 	<ul style="list-style-type: none"> Individual does not work well with group members Individual does not communicate well with group members Individual attempts but fails to carry out their individual responsibilities 	<ul style="list-style-type: none"> Individual interferes with group members Individual does not communicate at all Individual does not attempt to carry out their individual responsibilities 	

24 – 27 Points = Above Average

15 – 23 = Average

6 – 14 = Below Average

0 – 6 = Failing

Wake Forest School of Medicine Problem-Based Learning

Wake Forest School of Medicine Problem-Based Learning

provides essential case studies to K–12 teachers across the United States. These cases help support problem-based learning enrichment programs to focus on implementing Common Core State Standards. Access useful and easy-to-implement case studies on Math, English Language and other STEM topics online at www.wakeproblembasedlearning.com.



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