

**Lesson Plan Title:** A Plan for Energy

**Topic:** Human activity with environment

**Teacher Name:** Example Teacher

**Teacher Grade:** High School Earth Science

**Teacher School:** Example School

**Teacher District:** Example School District

**Standards (Performance, Knowledge and NETS-S):**

Performance

Goal 1. Students will acquire the knowledge and skills to gather, analyze and apply information and ideas.

Goal 2. Students will acquire the knowledge and skills to communicate effectively within and beyond the classroom.

Goal 3. Students will acquire the knowledge and skills to recognize and solve problems.

Science

Strand 1: Properties and Principles of Matter and Energy

2. Energy has a source, can be stored, and can be transferred but is conserved within a system

A. Forms of energy have a source, a means of transfer (work and heat), and a receiver

a. Identify and evaluate advantages/disadvantages of using various sources of energy (e.g., wind, solar, geothermal, hydroelectric, biomass, fossil fuel, electromagnetic radiation) for human activity

Strand 5: Processes and Interactions of the Earth's Systems (Geosphere, Atmosphere, and Hydrosphere)

3. Human activity is dependent upon and affects Earth's resources and systems.

A. Earth's materials are limited natural resources affected by human activity.

- Recognize the limited availability of some energy resources (i.e. solar radiation, wind, fossil fuels) and major mineral deposits in the United States (e.g., lead, petroleum, coal, copper, zinc, iron, gravel, aluminum) and the factors that affect their availability

- Recognize the economic, political, social and ethical constraints associated with obtaining and using natural resources (e.g., mining, and use of different types of Missouri mineral resources such as lead mining, gravel dredging, strip mining, coal burning, production of fertilizers and explosives; use of fossil fuels versus renewable resources)

Social Studies

5. Knowledge of major elements of geographical study and analysis (such as location, place, movement, regions) and their relationship to changes in society and the environment

D. Relationships within places (Human-Environment Interactions) (Movement).

SS5 1.10, 3.7 Identify and evaluate policies and programs related to the use of resources

NETS-S

3. Research and Information Fluency

Students apply digital tools to gather, evaluate, and use information.

4. Critical Thinking, Problem Solving, and Decision Making  
 Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

**What concepts do you want students to understand after completing this lesson?**

- The effect human activity has on the Earth’s limited natural resource supply
- The availability and practicality of current and proposed sources of energy
- The effect political, economic and social issues have on U.S. policies

**Essential Question:**

How is an energy source ensured for future use?

**Criteria for Success (How will you know students have gained the understanding of the concepts?):**

Students will examine current energy policies, research existing and potential energy sources and analyze their use as future sources of energy. They will develop a written document for state and local legislators that outlines recommendations for the national energy plan.

**Resources (What resources will you and your students use?):**

**Statistics**

- Department of Energy – International Energy Information (statistical reports, analysis, summaries and data)  
<http://www.eia.doe.gov/international/>

**Current Policies, Plans**

- U.S. National Energy Policy (video, audio and text)  
<http://www.whitehouse.gov/energy/>  
<http://www.whitehouse.gov/energy/National-Energy-Policy.pdf>

**Ideas, Plans**

- Securing the Energy Future of the United States (text)  
<http://www.ieer.org/reports/energy/bushtoc.html>
- CBS News: Bush Outlines Energy Plan (news report – text/video)  
<http://www.cbsnews.com/stories/2005/04/27/politics/main691160.shtml>
- Links to Energy-related Websites (text)  
<http://www.ieer.org/links.html>
- Department of Interior – Energy (text/audio sources)  
<http://www.doi.gov/initiatives/energy.html>

**Energy Sources**

- Hydrogen Fuel (graphs, text, image)  
[http://www.hyweb.de/Wissen/pdf/Brussels\\_Altmann\\_24SEP2003.pdf](http://www.hyweb.de/Wissen/pdf/Brussels_Altmann_24SEP2003.pdf)
- Department of Energy – Home Page (statistical reports, analysis and summaries)  
<http://eia.doe.gov/>
- Ask a Scientist: Best Replacement for Fossil Fuels (email posting)  
<http://www.newton.dep.anl.gov/askasci/gen99/gen99773.htm>
- Natural and Renewable Energy Sources (text)  
<http://www.clean-energy-ideas.com/>
- Ocean Thermal Energy Conversion (student-created video)  
<http://edcommunity.apple.com/ali/story.php?itemID=197>

**Non-Fiction Books**

*Energy Alternatives*, Charles P. Cozic & Matthew Polesetsky, eds.  
*Cape Wind*, Wendy Williams & Robert Whitcomb  
*Energy and American Society*, E. Willard Miller & Ruby M. Miller  
*Alternative Energy Sources*, Sally Morgan  
*Wind Power of the Future*, Betsy Dru Tecco  
*Renewable Energy*, Jennifer Carless  
*What if We Run Out of Fossil Fuels*, Kimerly M. Miller  
*Fuels to Drive our Future*, National Research Council (U.S.)  
*Crisis in the Oil Patch*, Donald Paul Hodel, & Robert Deitz  
*Coming Clean*, Michael Brune  
*Global Resources*, Charles P. Cozic, ed.

**Videos**

*Energy: How Bright is Our Future?* Knowledge Unlimited  
*The Eyes of Nye: Nuclear Energy*, Disney Educational Productions  
*Car of the Future*, WGBH Boston Video

**Management (How will students share technology resources? How will you break up the lesson into segments-the number of hours or days?)**

- Teamwork – students work in teams of four (home team) that jigsaw into four expert areas.
- Expert pairs share one computer to conduct research, organize information and develop a presentation to share with their home team. Experts store presentations on a shared network drive to facilitate access from a different computer during home group presentations.
- Each home group (4 members) has access to two laptops during expert presentations. Group members electing to record notes via a technology tool share the use of the computer with one other person in their group.
- Library resources remain in the library to ensure equitable access by all students. Students acquire a pass to go to the library to access library resources.
- Timeframe: 2 weeks: 10 - 50 minute class periods
  - 1 day – engage and form teams
  - 4 days – research with expert partner
  - 2 days – share with teams and discuss plan recommendations
  - 2 days – class discussion of potential recommendations and start of energy plan and letter
  - Out of class time to finish energy plan and letter as an extended assignment
  - 1 day – presentation of plans and letters
  - A team self-evaluation form (attached) will be completed by groups as needed to monitor progress.
- Expert role presentation development (individual work) – Additional time will be set up in the computer lab as needed so all students will have access to computers to develop their presentation.

**Learner Diversity (What diverse learner needs do you need to consider when selecting resources, grouping students or planning the culminating project? Are there any special considerations such as assistive technologies or second-language learning to take into account?)**

- Scaffolding for the following tasks is provided as needed:
  - Question stems for students that struggle with the development of

- questions to guide exploration so they will generate questions that go beyond basic facts and elicit an investigation that will lead the development of a solution to a problem.
  - Planning and Gathering handout for students that struggle with time management and resource organization.
- Second-language learners
  - Two sets of home teams will combine to form expert pairs. In groups that have more than one second-language learner each expert pair will consist of only one second-language learner.
  - Second-language learners will have the option of going to the resource classroom with their partner for assistance as needed. If possible the resource teacher will come to the classroom during the project to provide assistance.
- Student groups
  - Student groups are pre-determined to ensure mixed ability groups.
  - Students select roles within home groups and jigsaw to form expert pairs. Pair formation is monitored to ensure pair is of mixed abilities.
- Energy plans may be developed as a document (text only or with accompanying images) or a multimedia project.

**Engage:**

Capture the students' attention, stimulate their thinking and help them access prior knowledge.

- Lead a class discussion about current gasoline prices. Why do students feel gas prices have increased? Will this increase continue in the future? Has the change in prices affected their driving habits?
- Share articles about U.S. National Energy Plan which are both complementary and critical of the plan.
- The availability of energy will be one of the most influential aspects of lives of students in the 21<sup>st</sup> century. Brainstorm with students: If there were an energy crisis in the future in what ways might this impact your life?
- Present students with the following scenario; This is your opportunity to make a recommendation to our state and local legislators about what you think should be included in the U.S. energy plan. You will work with a team of four to complete research and submit your ideas for an energy plan to at least one legislator.
- Guide students into developing questions about energy sources, consumption and current policies. The option used for generating student questions is dependent upon the needs and skill level of students in the class and include the following:
  - T-chart (used with classes in which students are skilled in generating questions that are factual as well as those that require higher-level thinking skills). Post a T-chart in SMART Notebook. List what students currently know about energy sources, consumption and policies on one side of the chart and questions on the other.
  - Question stems (used with classes in which students need scaffolding to generate questions that elicit both factual answers and require high-level thinking skills). After students are placed in teams of four (as noted below). Each group will select one recorder that will type group generated questions into a word processing document (i.e. Word, online collaborative document). Provide each group a set of

question stems. Have each expert group develop a list of questions using a set of question stems as prompts.

- Explain to students that when experts begin their research they may add additional questions to the chart or document as they work.

### **Explore:**

Give students time to think, plan, investigate and organize collected information.

- Place students in teams of four. Each team member will be given one of the four research roles:
  - Policy expert: Research current and past U.S. national energy policies
  - Availability expert: Research current energy sources – availability, consumption rates, future supplies, environmental concerns
  - Futures expert: Research potential energy sources – feasibility, cost, research required, renewable or nonrenewable, environmental concerns
  - Conservation expert: Research current conservation practices in place and ideas for future conservation opportunities
- Have two groups of four combine to plan their exploration. Each combined group of 8 will determine which questions or information, based on the questions that were generated by the class, experts will research. In addition, the groups will develop an activity completion timeline based on the schedule constraints listed below. Provide scaffolding options, such as the attached Planning and Gathering document in Word or a graphic organizer, such as a concept map in SMART Ideas to plan the exploration.
  - 4 days – research with expert partner
  - 2 days – share with teams and discuss plan recommendations
  - 2 days – class discussion of potential recommendations and start of energy plan document and letter
  - 1 day – presentation of plans and letters
- Jigsaw students from the combined groups of 8 so that each student is researching with a partner in their same expert area.
- Encourage students to check the question T-chart or document with student-generated questions (posted on the SMART Board) each day while conducting research for additional questions they may want to address in their area of expertise.
- Upon completion of expert pair research have each pair organize the information they gathered into logical categories. Information may be organized using one of several options; concept map in SMART Ideas, matrix in Word, Excel or online tool, outline in Word or online tool, etc.
- Brainstorm with the class a list of elements that should be included in the presentation. Develop a scoring guide that includes gradations of the elements identified by the students. Provide the scoring guide to students prior to presentation development.
- Have each expert develop a presentation to share the information they have researched with their group. A technology presentation tool might be chosen for this task.
- Provide a blog for student discussion as they research. Students can post ideas and resources they locate during the research phase. If possible an expert can be invited to comment on blog posts.

<p><b>Explain:</b> Involve students in an analysis of their explorations. Use reflective activities to clarify and modify their understanding.</p>
<ul style="list-style-type: none"> <li>• Students return to their home group and share their expert information. Each group member is responsible for recording notes or developing a graphic organizer to summarize the information presented using a tool of their choice. Technology tools students might elect to use include SMART Ideas, Word, Excel, or an online version of the software.</li> <li>• Students individually review the information they acquired from their home team presentations and write a reflective journal entry (paper form or electronic) or blog post in which they explain their understanding of energy sources, consumption needs, effects on the environment, policies and what they think should be done.</li> <li>• After each expert in the home group has completed their presentation, the group will form two pairs. Each pair will conduct a peer review that consists of completing the presentation scoring guide followed by discussion.</li> <li>• Student teams discuss ideas for recommendations for state and local legislators. If desired, aspects of an effective energy plan can be debated.</li> </ul>
<p><b>Elaborate:</b> Give students the opportunity to expand and solidify their understanding of the concept and/or apply it to a real-world situation.</p>
<ul style="list-style-type: none"> <li>• Brainstorm with the class different aspects that should be included in the plan. For example, research for alternative energy sources, expansion of current sources such as nuclear energy, conservation practices, etc.</li> <li>• Provide students copies of the letter and energy plan scoring guides. Discuss the criteria in the scoring guide with students. Make changes to the scoring as needed and as are appropriate based on the discussion with students.</li> <li>• Each home team reaches consensus on an energy plan and develops a product that consists of two items. Home teams will develop a U.S. energy plan (document with text and if desired images, or multimedia project) and compose an accompanying letter with recommendations to at least one state or local legislator. To ensure all students contribute to the plan and letter conduct informal observations of students as they work in their groups.</li> </ul>
<p><b>Evaluate:</b> Evaluate throughout the lesson. Present students with a scoring guide at the beginning. Scoring tools developed by teachers (sometimes with student involvement) target what students must know and do. Consistent use of scoring tools can improve learning.</p>
<ul style="list-style-type: none"> <li>• Monitor and respond to student blog posts.</li> <li>• Checklist to evaluate the thoroughness and usefulness of student pair's research plan.</li> <li>• Self-evaluation form provided to teams as needed to monitor progress.</li> <li>• Scoring guide for student presentations of research information to be used for peer review. Criteria in the scoring guide are developed from a student-generated list of elements that should be included in the presentations.</li> <li>• Scoring guide (attached below) for student letter and energy plan used by teacher and by team members for peer review.</li> </ul>

The eMINTS staff has adapted this form from materials available at this website: <http://www.mdk12.org/instruction/curriculum/science/5emodel.html>.

# Planning and Gathering

## Questions:

Information Needed	Information Location	Notes

## Timeline

Completion Date	Activity

## Self-Evaluation

What did you complete today?

What do you need to do next?

**What questions or concerns do you have about the project?**

# Letter Scoring Guide

	<b>Exemplar</b>	<b>Moderate</b>	<b>Low</b>	<b>Incomplete</b>
Summarization	The energy plan summary is concise and communicates the goals of the plan.	The energy plan summary is lengthy or overly concise but the goals of the plan are still clear.	The energy plan summary does not clearly communicate the goals of the plan.	The letter does not include a summary of the energy plan.
Recommendation	A recommendation is clearly stated with at least three supporting details.	A recommendation is stated with at least two supporting details.	A recommendation is stated without supporting details.	A recommendation is omitted from the letter.
Organization	The letter is organized (i.e. headings, well written paragraphs, etc.) for clarity and understanding.	The letter has some organizational features (i.e. headings, well written paragraphs, etc.)	The letter has very few organizational features (i.e. heading, well written paragraphs, etc.)	The letter has no organizational features.

# Energy Plan Scoring Guide

	<b>Exemplar</b>	<b>Moderate</b>	<b>Low</b>	<b>Incomplete</b>
Earth's Resource Supply	The plan takes into account earth's limited supply of natural resources and clearly outlines a strategy that enables long-term energy consumption.	The plan acknowledges earth's limited supply of natural resources and it attempts to outline a strategy that enables long-term energy consumption.	The plan does not address the earth's limited supply of natural resources or does not provide a strategy that enables long-term energy consumption.	The plan does not include information about the earth's limited supply of natural resources and omits a strategy for long-term consumption.
Energy Options	The plan considers the availability of energy sources and provides at least two options that are realistic.	The plan identifies energy source options that are somewhat available but would be difficult to access.	The plan identifies options that are not readily available and/or are not realistic.	The plan does not include energy source options.
Stakeholder and Economic needs	Stakeholder (consumer, service provider, etc.) needs are addressed with practical (affordable, realistic, etc.) solutions.	Stakeholder (consumer, service provider, etc.) needs are addressed with a solution that is somewhat practical (affordable,	Stakeholder (consumer, service provider, etc.) needs are addressed with a solution that is not practical (affordable, realistic, etc.)	Stakeholder (consumer, service provider, etc.) needs are not addressed with a solution.

		realistic, etc.).		
Environmental Affects	Actions that produce minimal adverse affects to the environment are outlined in the plan.	Actions in the plan produce some adverse affects to the environment.	Actions in the plan do not consider adverse affects to the environment.	Environmental considerations are not included in the plan.
Organization	The plan is organized with clear goals, supported with details and strategies for meeting each goal.	The plan includes goals but with limited details and strategies for meeting the goals.	The plan includes goals or details but it is not clear how the plan will be carried out.	The plan is unorganized.