



Title: Unconventional Energy: A Look at Natural Gas in Arkansas			
Author: Trish Turnbough Cave City Middle School Cave City, AR			
Course: Science, Geography, Arkansas History, Language Arts, Library Media		Duration: One to two 45 minute periods	
Grade Level(s): 6-8			
Objective: To give students an introduction to natural gas in the state of Arkansas.			
Summary of Lesson: This lesson gives an overview of the discovery of natural gas and its development in Arkansas. It also examines the discovery of the Fayetteville Shale.			
Standards: Arkansas State Frameworks			
Subject:	Grade Level(s):	Code:	Standard:
Science	6	6-ESS3-3	Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.* [Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).]
	7	7-ESS3-1	Construct a scientific explanation based on evidence for how the uneven distributions of Earth’s mineral, energy, and groundwater resources are the result of past and current geoscience processes. [Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but



			are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).]
		PS. 7.6.5	Investigate careers, scientists, and historical breakthroughs related to energy forms and conversions
		PS.7.7.1	Identify natural resources used to supply energy.
		PS.7.7.5	Investigate careers, scientists, and historical breakthroughs related to natural resources, alternative resources, electricity, and magnetism.
Geography	7	WST.2.7.2	Compare spatial connections among people, places, and their environments over time.
		WST.2.7.3	Use spatial data to answer questions and resolve problems about patterns reflecting physical and human phenomena.
		HS.7.7.2	Compare advantages and disadvantages of one location over another in the access to factors of production (e.g., human resources, natural resources, capital resources, entrepreneurship).
		HS.8.7.1	Examine physical and human characteristics that influence the division and control of Earth's surface (e.g., resources, land use, ethnicity, national identities).
		ES.9.7.3	Analyze positive and negative consequences of human changes on the physical environment.
		ES.9.7.4	Examine human induced changes in one place or region and its effects on other places or regions (e.g., flood control, deforestation, factories, electric power generation).
		ES.10.7.1	Explain how culture has influenced decisions about the use of resources over time.
		ES.10.7.2	Examine physical and human processes that influence formation and sustainability of resources.
		ES.10.7.3	Evaluate the sustainability of resources achieved through civic actions.
Arkansas History	7-8	G.1.AH.7-8.2	Analyze the availability of resources and their effects on the development of each geographic



			region of the state (e.g., diamonds, bauxite, oil, timber, agricultural, wild game).
		G.1.AH.7-8.3	Evaluate the reciprocal impact of humans and water systems in Arkansas over time (e.g., trade, transportation, recreation, flood control).
		G.2.AH.7-8.2	Analyze relationships between the geography of Arkansas and economic development over time (e.g., tourism, agriculture).
		E.3.AH.7-8.1	Examine the impact of natural resources on the economy of Arkansas (e.g., agriculture, timber, hydroelectricity, mining, tourism).
		E.3.AH.7-8.3	Analyze how various regions of Arkansas developed and changed economically.
		E.4.AH.7-8.2	Analyze the impact of Arkansas businesses and industries on local, national, and global economies (e.g., agriculture, tourism, timber, technology, medical and scientific research, finance).
Language Arts	6-8	RI.6.1 RI.7.1 RI.8.1	Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
		RI.6.2 RI.7.2 RI.7.2	Examine a grade-appropriate informational text. <ul style="list-style-type: none"> ● Provide an objective summary. ● Determine a central idea and how it is conveyed through particular details.
		RI.6.4 RI.7.4 RI.8.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings.
		RI.6.8 RI.7.8 RI.8.8	Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not.
		W.6.1 W.7.1 W.8.1	Write arguments to support claims with clear reasons and relevant evidence.
		W.6.7 W.7.7 W.8.7	Conduct short or more sustained research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.
		W.6.8 W.7.8 W.8.8	Gather relevant information from multiple print and digital sources, using search terms effectively. <ul style="list-style-type: none"> ● Assess the credibility and accuracy of each source. ● Quote or paraphrase the data and conclusions of others while avoiding plagiarism. ● Follow a standard format for citation.



		W.6.9 W.7.9 W.8.9	Draw evidence from literary and/or informational texts to support analysis, reflection, and research.
		SL.6.1 SL.7.1 SL.8.1	Engage effectively in a range of collaborative discussions <ul style="list-style-type: none"> ● one-on-one ● in groups ● teacher-led with diverse partners on Grade 6-8 topics, texts, and issues, building on others' ideas and expressing their own clearly.
		SL.6.4 SL.7.4 SL.8.4	Present claims and findings, emphasizing primary points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.
		SL.6.5 SL.7.5 SL.8.5	Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize the primary points.
Library Media	6-8	PG.8.6.1 PG.8.7.1 PG.8.8.1	Demonstrate knowledge gained from reading self-selected informational texts.

Teacher Excellence and Support System:

1c: Setting instructional outcomes, 1d: Demonstrating knowledge of resources, 1e: Designing coherent instruction, 1f: Designing student assessments, 3b: Using questioning/prompts and discussion, 3c: Engaging students in learning

Instructional Strategies and Practices:

Discussion, Independent Research, Peer Partner Learning, Research Project, Didactic Questioning, Assigned Questions, Oral Presentations, Analyzing Resources

Bloom's Level: *(Highest Level Only)*

Evaluation: What do you think about natural gas development in Arkansas?

Materials and Resources:

- Projection equipment
- Computers with internet access
- Map of Arkansas

Formative Assessment:

- Teacher made rubric for presentation from <http://rubistar.4teachers.org/> or search the internet for a more current web site
- Write new lyrics to Beverly Hillbillies theme song

Teaching Notes:

Bell ringer: Project photo. "Rougnocks photographed following July 1, 1922 discovery of the Smackover field" www.aoghs.org



Have students analyze photo using the National Archives handout found at: http://archives.gov/education/lessons/worksheets/photo_analysis_worksheet.pdf or search key phrase: National Archives and Records Administration: Analyze a Photograph

Student Activity:

Introduction:

1. Explain that natural gas is a fossil fuel burned for energy. Ask students if they know what fuel is used to heat their homes, their bathwater and the food on their stoves. If needed, you might briefly discuss how natural gas was formed and where it is found.
2. Have students read: Encyclopedia of Arkansas: Natural Gas <http://www.encyclopediaofarkansas.net/encyclopedia/entry-detail.aspx?entryID=4251> or search the internet with key phrase Encyclopedia of Arkansas: Natural Gas and Fayetteville Shale <http://www.encyclopediaofarkansas.net/encyclopedia/entry-detail.aspx?entryID=6011> or search the internet with key phrase Encyclopedia of Arkansas: Fayetteville Shale
3. After reading each article, answer the following questions.
For discussion and to check comprehension:
 - What is natural gas? What is it used for?
 - Where is natural gas found in Arkansas?



- Explain to the person sitting next to you what is meant by “unconventional” gas.
- What benefits are created from natural gas development?
- Are there any negative impacts associated with natural gas development?
- What questions do you have about natural gas development in Arkansas?

Activity:

- Natural gas extraction has far-reaching effects on rural communities. In this activity, group students to research and prepare a brief presentation on the following:
 - Economy: Students in this group should identify the economic opportunities, including job creation, and challenges that arise from natural gas development.
 - Land: Students in this group should explain the amount of land required for natural gas development. They should be able to illustrate how gas extraction might change the use of land and roads in the community.
 - Water: Students in this group should describe the amount of water required for hydraulic fracturing and where the water comes from. This group could also examine protecting against drinking water contamination.

Assessment:

- Students will be assessed with a teacher created rubric. <http://rubistar.4teachers.org/>

Extensions:

- Show students YouTube video of Beverly Hillbillies theme song, (<http://www.youtube.com/watch?v=YD22a4APsCg>) If this web site is no longer available search the internet for Beverly Hillbillies them song.
- Have students write new lyrics based on natural gas in Arkansas and have them perform their original lyrics for the class.

See Student Handout at:

http://archives.gov/education/lessons/worksheets/photo_analysis_worksheet.pdf or search key phrase: National Archives and Records Administration: Analyze a Photograph