Did you hear? There is a new four-letter word. Government officials are trying to ban its use. Communities are ashamed of the men and women who have dealings with the word. Schools downplay its power. Parents do not want their children to learn of the word for fear they might travel down the wrong path in life. It's dirty…it's dark…and it's dangerous. Did you hear? ***Coal*** – the new four letter word.

How has it come to have such a destructive reputation? Can its name be restored to the honor and glory that it once possessed as an important building block of our great nation? **These** are the questions that my students and fellow teachers set out to answer…

Introduction

This unit actually began in the summer of 2009. I nervously sat at the end of a long conference table interviewing for a teaching position. Towards the end of the interview, the principal asked what extra-curricular activities I would be able to assist with. After my list of responses – cheerleading, dance, drama, newspaper, BETA club, etc. – he simply replied, "Our superintendent is very interested in participating in the CEDAR program where a teacher is in charge of organizing a coal study unit and a coal fair. Would you be willing to do that?"

"That sounds like a great opportunity," I agreed and, once hired, I was reminded of my position as the coal study unit and coal fair coordinator. It would be the first time our junior high had participated in the program; the administration was eager to make this program an annual tradition and I was excited to share my knowledge and experience with a new school.

After attending the coal study unit coordinator's meeting, I decided the best thing to do to get the unit rolling was to present the information to the students and allow them

to chart which direction to follow. "Governor Beshear: Intelligent Energy Choices for Kentucky's Future" seemed to be of great importance so I thought that document would be a useful tool to introduce the subject.

During language arts classes, students learned how to annotate by adding personal comments, including critical and explanatory notes, to various types of text. This would be a great opportunity to allow them to practice with a non-fiction, government text. Each student received their own copy of Governor Beshear's plan to annotate and then we shared our notes using the new classroom document camera and Smart Board. One important part of annotating a text is asking questions that arise as you read. Once students were given the opportunity to share, we wrote those questions on the board and determined which questions we most wanted answered during our coal unit. The following are questions the students most wanted to explore:

- What are some of the challenges the coal industry is facing today?
- What steps is the government taking to resolve these challenges?
- How can we be more energy efficient at home and at school?
- How does Kentucky get their energy (renewable/nonrenewable)?
- How is solid coal converted to liquid and gas fuel?
- How does the process of carbon capture/sequestration work?
- Ultimately, how can we make coal "clean and green"?

As stated earlier, our ultimate goal was to figure out why coal has such a destructive reputation **and** how that reputation can be rebuilt to fit the needs of our population and our planet.

Activities

When designing activities to help us answer these essential questions, I tried to focus on student interest and ability levels, since both vary greatly at this level. Students

are very technology savvy and love working with computers, so I tried to incorporate that into each activity as much as possible, usually during research or the presentation of data.

Lesson 1: What are some of the challenges the coal industry is facing today?

Students brainstormed and discussed challenges they were already aware of. Then students were allowed to research various sites in order to add to their list. We created a classroom list that ranged from mine safety to environmental concerns.

Lesson 2: What steps is the government taking to resolve these challenges?

Students immediately recognized that Governor Beshear's "Intelligent Energy Choices for Kentucky's Future" was a huge step in the right direction. They also researched and found various house bills that are being proposed. The one that caused the greatest debate was the Clean Energy Bill (HB 408) proposed by Rep. Moberly in Madison County. Students wrote letters to various representatives voicing their opinions of mandating the use of alternative energy in Kentucky.

Lesson 3: How can we be more energy efficient at home and at school?

Most solutions dealt in some way with energy conservation so the students took on the job of becoming energy ambassadors! After brainstorming how energy is wasted in the home and at school, students thought of ways to reduce the amount of energy being wasted. One way was to use the new compact fluorescent light bulbs (CFLs) instead of the incandescent light bulb. Students followed the scientific method and an experiment from www.energystar.com to determine which bulb used the most energy. Afterwards, each student wrote an editorial about the importance of energy conservation and created a flyer to hang at school and distribute to friends and family in the community. We also discussed how the coal industry could be more energy efficient by making sure all coal

trucks were full and taking the shortest routes. Students completed a math open response to demonstrate how this would help the efficiency of Kentucky's transportation fleet.

Lesson 4: How does Kentucky get their energy?

Students were given the website www.americaspower.com as a primary resource for this activity. This website provided a plethora of information about each state's energy portfolio. At first the assignment was to examine how Kentucky obtains its energy but it turned into a far better activity that allowed students to demonstrate their math and social studies skills. Students, working in groups, chose one bit of information from the website (percentage of electricity produced by coal, retail price of electricity per kilowatt-hour, U.S. raking of electrical costs) and were instructed to display the information in a variety of forms – pie charts, bar graphs, tables, colored maps. When students completed the activity and displayed their findings for the class, students immediately realized the inverse relationship between the amount of coal used for electricity and electrical costs. In other words, states like Kentucky that use a large percentage of coal have small electrical costs; states like Hawaii that use a miniscule amount of coal for electricity have immense electrical costs.

Lesson 5: How is solid coal converted to liquid and gas fuel? How does the process of carbon capture/sequestration work?

For this lesson I combined two of our essential questions since they both dealt with clean coal technologies. We first reviewed that a primary environmental concern of the coal industry is to reduce carbon dioxide emissions. Then students were divided into groups to research new technologies in the coal industry that were doing just that – coal gasification, coal liquefaction, and carbon capture/sequestration. Students determined the

impact of these technologies on public health and safety, efficiency, the environment, and the economy. Students presented their findings in a variety of forms including reports, posters, power points, videos, etc.

Lesson 6: Ultimately, how can we make coal "clean and green"?

For our final lesson students had to take what they had learned and ***DO*** something with it. In other words, you've learned about the challenges and possible solutions so what are you going to do about it? Students created a variety of products to help spread the word that the coal industry is on its way to producing cleaner, greener, and safer coal. Projects ranged from letters to legislators to public service announcements for the local radio station; from editorials for local newspapers to a music video.

The coal study unit culminated with the coal fair, in which our school had better than 92% participation from students! School administrators, board members, teachers, parents, and students (elementary, middle, and high school) toured the coal fair as the participating students stood by explaining their projects. It is estimated that more than 500 people visited the coal fair in the school library!

Overall, at the end of our unit, the students were able to identify the challenges of the coal industry, research the proposals of the coal industry and the government in response to those challenges, analyze and evaluate those proposals in order to form their own opinions, and execute a plan of action to let the people of their community, their state, and their country know that coal is reinventing itself – cleaner and greener!

Summary

What a success! With so many young people learning about the future and possibilities of coal and then in turn educating their fellow classmates, teachers, parents,

and community, how could it not be! In total, 8 teachers and 120 students participated in the planning, implementation, and evaluation of this unit which spanned all content areas. All essential questions were answered and students exceeded our expectations in the products they produced. Throughout the unit, students were evaluated on performance events, writing assignments, and presentations. High-order thinking and meaningful, real-world learning were evident in daily discussions, activities, and assignments.

After the unit's activities and culminating coal fair, everyone involved was given the opportunity to evaluate the unit. Responses were overwhelmingly positive. Administrators enjoyed seeing the students actively learning; teachers appreciated the enthusiasm of the students; parents were eager to assist their children in projects and were proud of their accomplishments; students actively participated in every aspect of the unit and then became educators, ambassadors, and supporters of coal…and perhaps future coal miners, engineers, and government officials that will continue clean coal technologies into the next generation. The favorite activity seemed to depend on the interests of the particular student – some students enjoyed the scientific investigation while other students enjoyed the research and writing aspect of the unit. The main suggestion for next year is to complete the unit earlier in the school year.

Did you hear? There is a new four letter word? Government officials are trying to make it more earth-friendly. Communities are realizing its worth and the value of those associated with it. Schools are teaching entire units about this word. Parents are excited to hear their children use the word, knowing it will be a bright point in their future. It's cleaner…it's greener…it's safer. Did you hear? ***Coal*** – the *positive*, new four letter word!

COAL STUDY UNIT LESSON PLAN 2009-2010

(Given to all cooperating teachers)

Coal Study Unit 2009-2010

Lesson Plan

Objectives: Students will be able to…

1. read and analyze non-fiction text
2. annotate non-fiction text
3. research information using a variety of resources
4. write proficient/distinguished transactive pieces (letter, editorial, article, open response, research paper)
5. follow the scientific method
6. create a variety of visual aids (table, pie chart, bar graph, map) to display information
7. calculate and convert a variety of mathematical expressions (percentages, ratios, fractions, money, etc.)
8. construct a variety of products (research papers, posters, power point presentations, videos, etc.) to demonstrate learning

Students will be assessed on these objectives by a variety of rubrics and observations.

Essential Questions:

1. What are some of the challenges the coal industry is facing today?
2. What steps is the government taking to resolve these challenges?
3. How can we be more energy efficient at home and at school?
4. How does Kentucky get their energy (renewable/nonrenewable)?
5. How is solid coal converted to liquid and gas fuel?
6. How does the process of carbon capture/sequestration work?
7. Ultimately, how can we make coal "clean and green"?

Connections:

Kentucky Learner Goals and Academic Expectations
Goal 1: Students are able to use basic communication and mathematics skills for purposes and situations they will encounter throughout their lives.

1.2 Students make sense of the variety of materials they read.
1.5 - 1.9 Students use mathematical ideas and procedures to communicate, reason, and solve problems.

1.11 Students write using appropriate forms, conventions, and styles to communicate ideas and information to different audiences for different purposes.

1.13 Students make sense of ideas and communicate ideas with the visual arts.

1.16 Students use computers and other types of technology to collect, organize, and communicate information and ideas.

Goal 2: Students shall develop their abilities to apply core concepts and principles from mathematics, the sciences, the arts, the humanities, social studies, practical living studies, and vocational studies to what they will encounter throughout their lives.

2.1 Students understand scientific ways of thinking and working and use those methods to solve real-life problems.
2.2 Students identify, analyze, and use patterns such as cycles and trends to understand past and present events and predict possible future events.
2.8 Students understand various mathematical procedures and use them appropriately and accurately.
2.10 Students understand measurement concepts and use measurements appropriately and accurately.
2.15 Students can accurately describe various forms of government and analyze issues that relate to the rights and responsibilities of citizens in a democracy.
2.18 Students understand economic principles and are able to make economic decisions that have consequences in daily living.
2.22 Students create works of art and make presentations to convey a point of view.

Core Content 4.1

- RD-O8-4.0.2 Students will use evidence from a passage to formulate opinions in response to a reading passage.
- WR-M-1.1.0 Students will establish and maintain a focused purpose to communicate with an authentic audience.
- SC-08-4.7.2 Students will explain the interactions of the components of the Earth system (e.g., solid Earth, oceans, atmosphere, living organisms) and propose solutions to detrimental interactions.
- MA-08-4.1.4 Students will construct data displays (Venn diagrams, tables, line graphs) and explain why the type of display is appropriate for the data.
- SS-HS-1.1.3 Students will evaluate how the U.S. government's response to contemporary issues and societal problems reflects the needs, wants and demands of its citizens.
- PL-08-4.3.2 Students will use a variety of technology tools (e.g., multi-media, Internet, digital camera) to present and communicate information.
- AH-08-4.4.1 Students will create art for specific purposes using the elements of art and principles of design to communicate ideas.

This unit crosses many disciplines in order to give the students a broader understanding of the coal industry and how it affects all aspects of our lives.

Differentiated Instruction:

1. IEP: extended time, reading assistance, shorter assignments, use of calculators, modified grading scale, cooperative learning groups
2. Gifted: independent research, enrichment activities
3. Multiple Intelligences: linguistic, spatial, logical, auditory, kinesthetic, naturalist, existential, interpersonal, intra-personal

Procedures/Resources:

This is only a BASIC outline of procedures. It is up to the individual teacher to decide how to implement the details of each lesson in their classroom. This will allow each teacher to create specific lessons that best suite their individual students.

Pre-activity *(ALREADY COMPLETED)*

1. Read "Governor Beshear: Intelligent Energy Choices for Kentucky's Future"
2. Annotate the text
3. Brainstorm essential questions to be answered throughout the unit

Lesson 1: What are some of the challenges the coal industry is facing today?

1. Brainstorm challenges of the coal industry that students are already aware of
2. Using the Internet, research various web-sites to find more challenges
3. Create a classroom list of challenges that need solutions

Lesson 2: What steps is the government taking to resolve these challenges?

1. Research various web-sites to find out what different governments are doing to solve the challenges mentioned in the previous lesson
2. Write a letter to the appropriate government official either supporting or opposing their proposed solutions

Lesson 3: How can we be more energy efficient at home and at school?

1. Brainstorm ways to conserve energy at home and at school
2. Complete "Energy Efficiency Ambassadors" from www.energystar.gov
3. Write an editorial to discuss the importance of energy conservation
4. Create a flyer to encourage others to conserve energy
5. Complete math open response

Lesson 4: How does Kentucky get their energy?

1. Examine www.americaspower.com, specifically the map containing each state's energy portfolio
2. Choose one category of information from the energy portfolio to display in a visual aid

3. Create a visual aid (pie chart, bar graph, table, colored map) to display the information
4. Combine the displays to analyze trends

Lesson 5: How is solid coal converted to liquid and gas fuel? How does the process of carbon capture/sequestration work?

1. Form groups and choose a clean coal technology that students would like to learn more about
2. Use a variety of resources to research how this technology will solve challenges that the coal industry is facing today
3. Present findings in a 10-15 minute presentation

Lesson 6: Ultimately, how can we make coal "clean and green"?

1. Using all information from previous lessons, create a project to spread the word that the coal industry is on its way to producing cleaner and greener coal

Culminating event:

School Coal Fair, Library, April 9th
Please see me for sign-up sheets and category packets

Assessment:

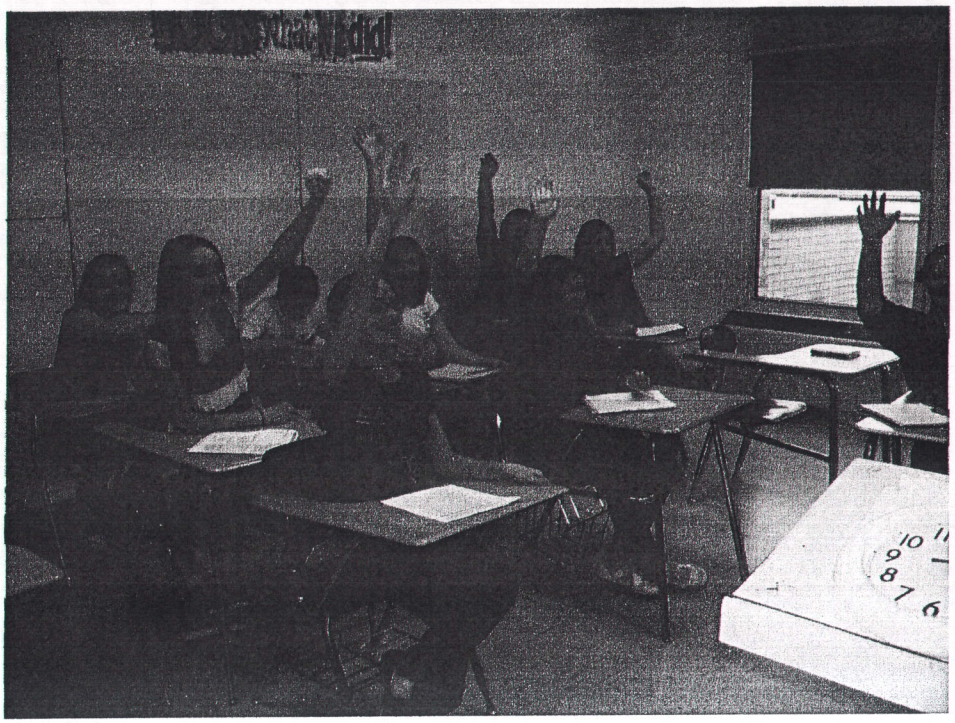
I have attached several rubrics that may be of interest to you in assessing your students. Please turn-in all writing samples to me so they may be placed in their writing folders.

Reflection/Refinement:

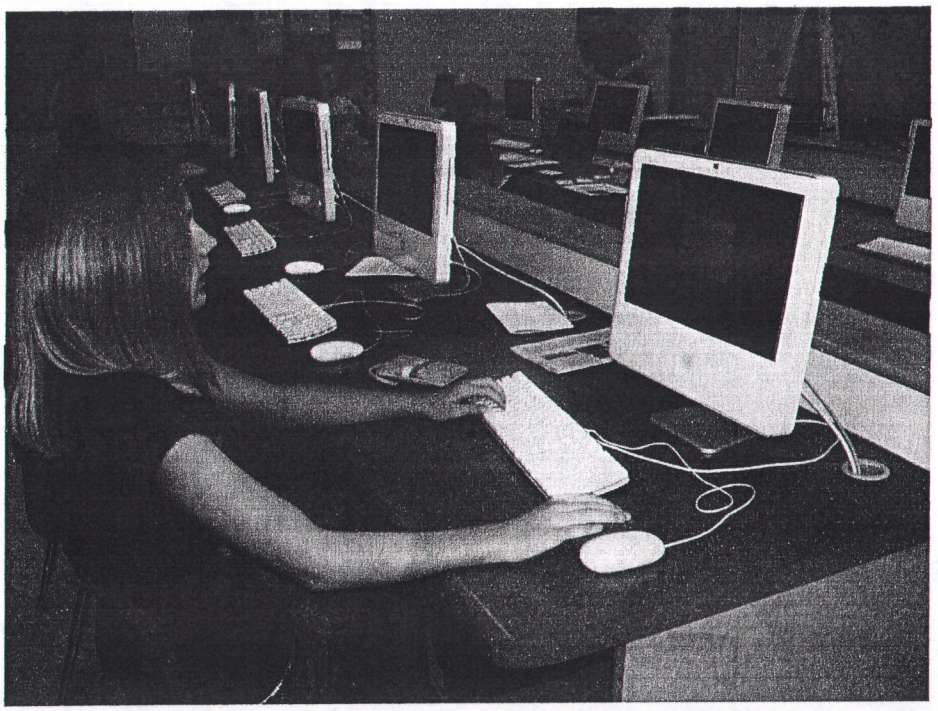
After you complete the unit, take a moment with your students to reflect on the lessons and the overall experience. Please, along with your students, complete the attached unit evaluation forms. Don't forget to include suggestions of changes you would like to see for next year's coal unit as well as what you liked best about the unit. Thank you for your support and participation!

LOOK WHAT WE DID!

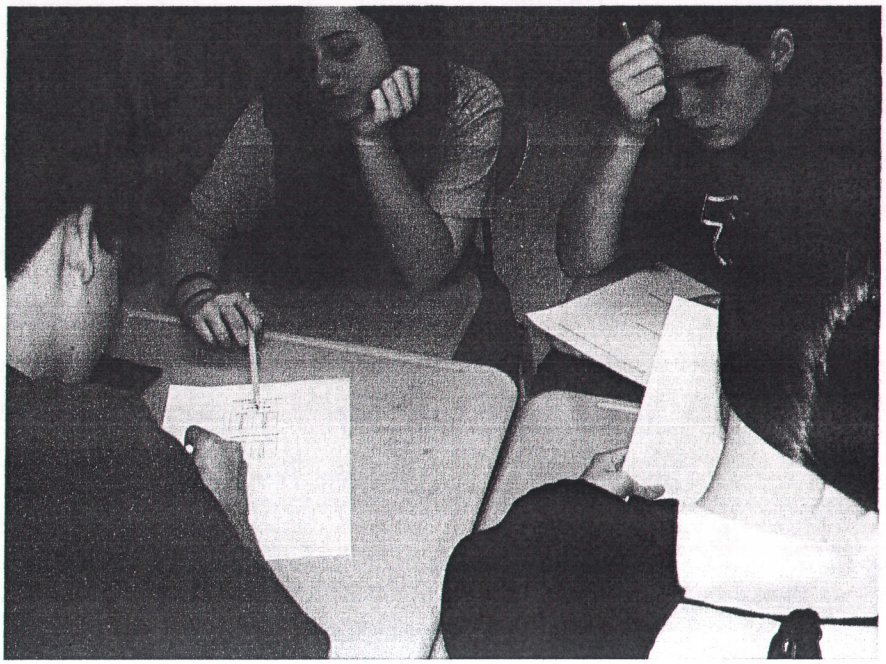
Students individually brainstomed challenges the coal industry is facing. They were eager to share their answers which were written on the classroom list.



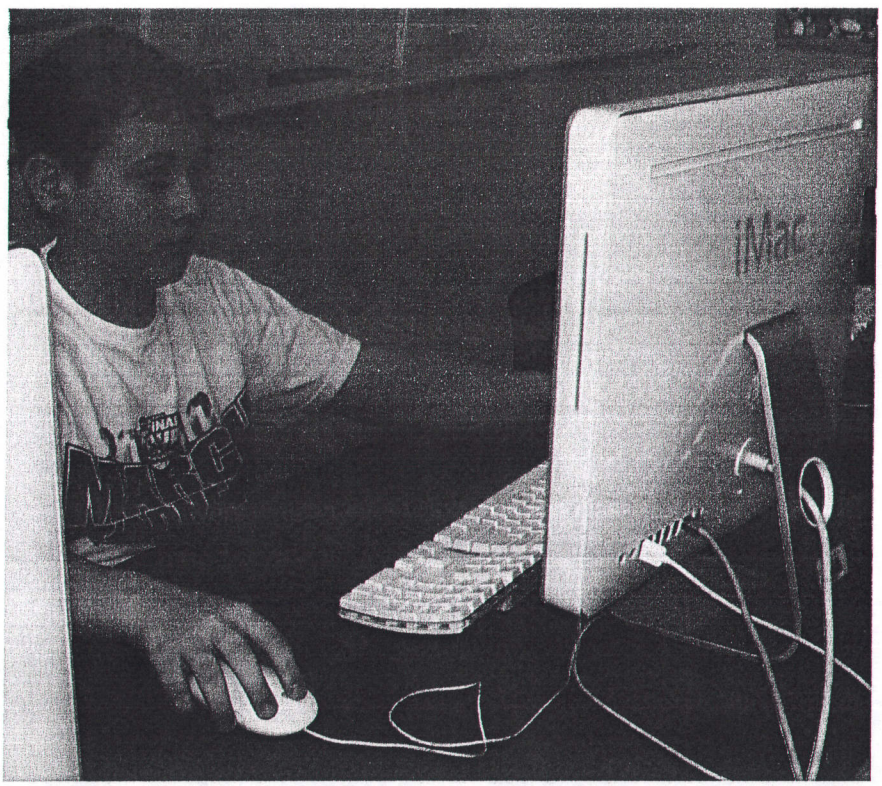
In the computer lab, students researched various websites to find proposed solutions to the challenges from the classroom list.



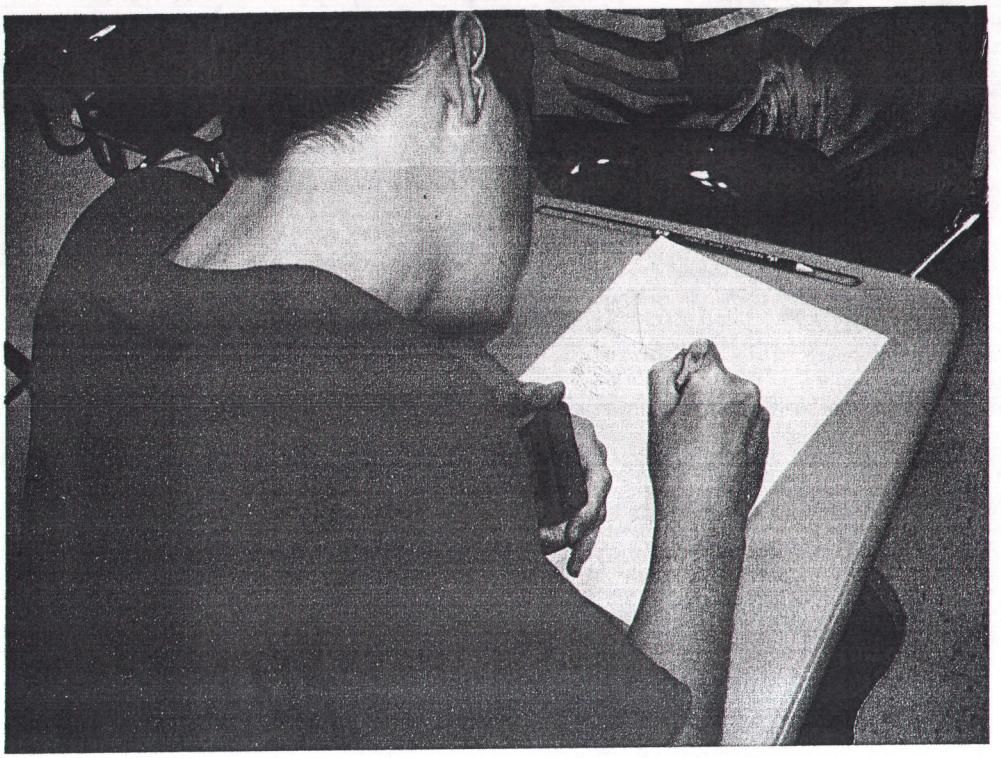
Students act as energy efficiency ambassadors as they analyze the data from their scientific experiement. They then formed conclusions about the efficiency of various light bulbs and discussed ways to use this knowledge to increase energy efficiency at home and at school.

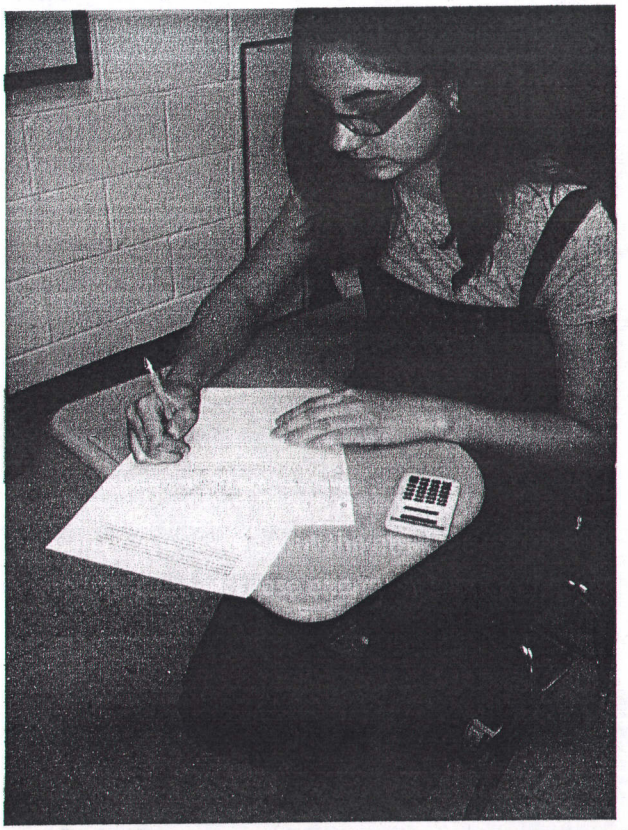


Students visisted the computer lab to examine each state's energy portfolio. They created different types of charts and graphs based on the data they collected and used those graphs to analyze trends.

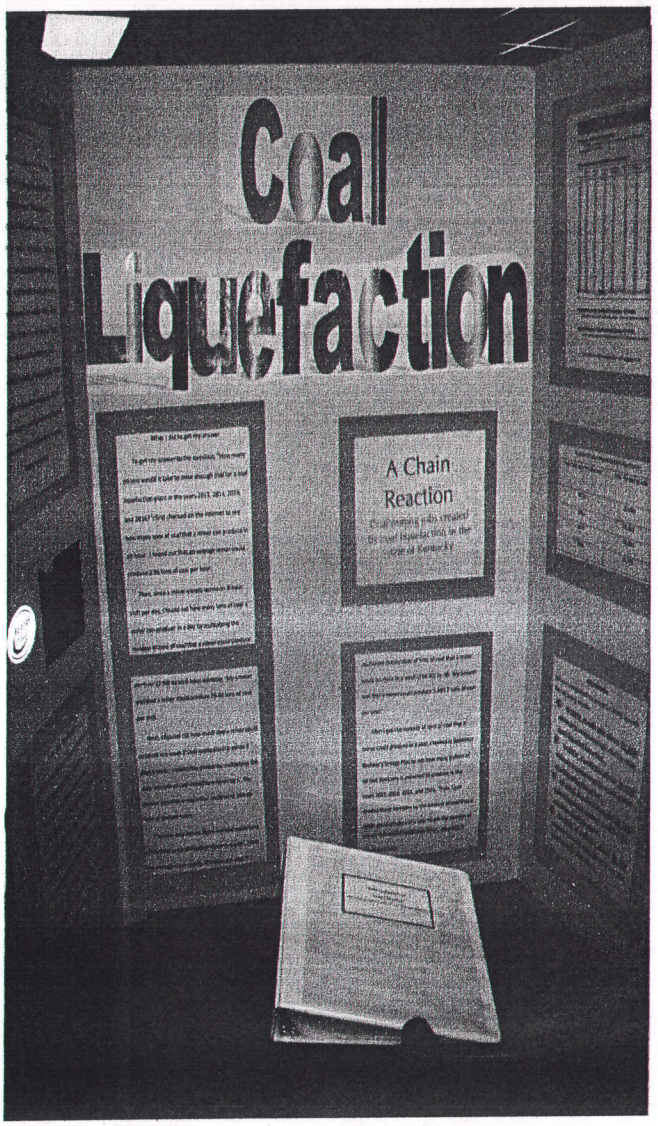


Students use their math knowledge of the Pythagorean theorem to answer an open response question. They had to find the shortest travel distance for coal trucks to use in order to be energy efficient.





Students chose a clean coal technology to research and then present to their class. How the technology affects safety, efficiency, the environment, and the economy were focuses of the projects.



For their final activity, students presented a project that was to be used to spread the word that the coal industry is on its way to being cleaner, greener, and safer. Student projects ranged from editorials for the local newspapers to music videos for the school news.

Dear Parents/Guardians:

I am pleased to announce that [redacted] is participating in the CEDAR (Coal Education Development and Resource) program. CEDAR is "an all-volunteer, not-for-profit corporation, began in July 1993 as a partnership between the Coal Industry, Business Community and Educators." CEDAR targets students grades K-12 in Johnson, Pike, Floyd, Harlan, Knott, Martin, Letcher, Lawrence, and Magoffin counties in an attempt "to form a knowledgeable, unbiased opinion of the coal industry." CEDAR'S motto is as follows: "Securing coal's future today by educating our leaders of tomorrow."

This year, students will be participating in a coal study unit focusing on Governor Beshear's Energy Plan: Intelligent Energy Choices for Kentucky's Future. The goal of the unit is to examine some of the challenges our coal industry is facing – greenhouse gas emissions, increased energy use, decreased coal sales, etc. – and discuss possible solutions.

As part of the CEDAR program, our students will participate in the CEDAR coal fair. Every 7th and 8th grade student[redacted] either an individual or part of a group. Your child and I have gone over this in class and now it is time for you to help your child determine their project category and topic. The topic can be **any aspect of the coal industry**, as long as the main focus of the project is something dealing with coal.

Students can compete in one of the following categories: science, math, language arts, music, technology - multimedia, or social studies. These projects will not only be scored and judged for class but will also be on display at our school's coal fair on April 6, 2010. Selected projects will be invited to compete in the Regional Coal Fair in Pikeville, where 63 cash prizes are awarded to category winners, with nine additional cash prizes being awarded to the overall grade level winners. A Project of the Year award, valued at $2500, is awarded to the student having the over-all best project at the Regional Fair.

Each category has its own guidelines and scoring sheet, which you can view at http://cedarinc.org/coalfairinfo.htm. I will give students a paper copy of the forms if they are unable to view or print them on-line. You can also see photos of previous coal projects on this website.

Remember, the most important things to consider when coming up with your project are originality and relevance to coal. Again, the topic can be anything about coal - the formation of coal, careers in coal, coal reclamation, coal safety, electricity from coal, famous people in coal, types of mining, coal and the environment, calculating coal, mine ventilation, etc. **Be specific, be creative, be original!**

Helping your child is not only allowed, it is encouraged. You may help brainstorm ideas and gather research, as well as assist with the neatness of the display. However, your child must be able to answer questions about his/her project during judging.

If you have any questions or concerns, please feel free to e-mail me and I will assist you as much as possible.

Thank you for your effort and support in this assignment,

[redacted]

[redacted]

From: [redacted]

Sent: Tuesday, April 06, 2010 10:14 AM

To: All [redacted] Prin; All [redacted] Supt; All [redacted] Teachers

Subject: Coal Fair

I would like to invite everyone to visit the library on Friday, April 9th. The middle school students will have their coal fair projects on display throughout the day. Please drop in during your planning to take a look at these great projects. Also, if you have the time, I would appreciate anyone who would like to be a judge in your area of expertise. There are only 6-10 projects in each category (math, science, social studies, language arts, music, art, and technology) so it shouldn't take very long to look over them and give your opinion.

Have a great week! See you in the library!

[redacted]

[redacted]

From: [redacted]

Sent: Thursday, April 08, 2010 10:24 AM

Subject: coal fair tomorrow

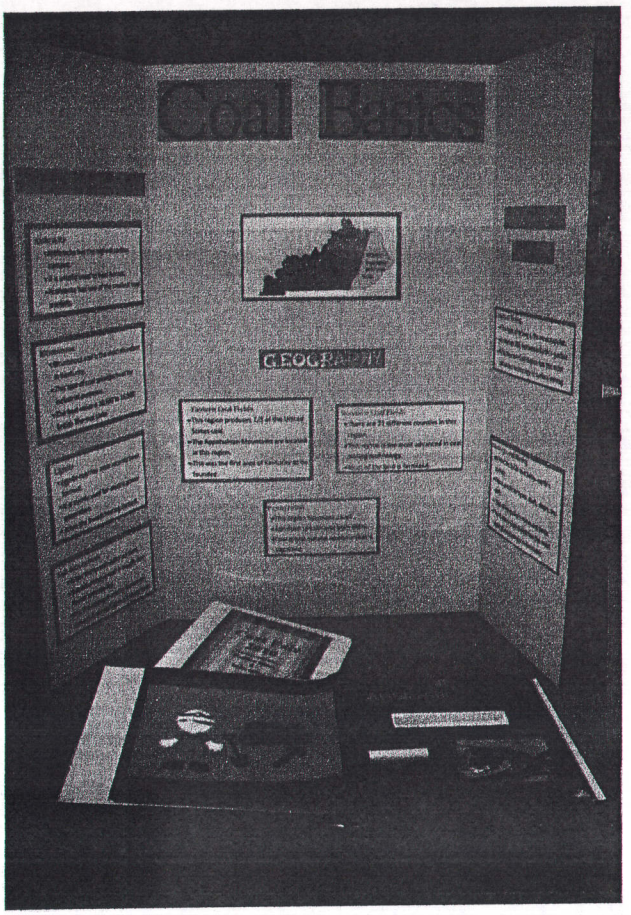
Parents, I would like to invite you to visit the coal fair tomorrow in the high school library. Even if you are only able to stay a few minutes, I know it will mean a lot to your child that you come to visit and view the projects that will be on display. The projects will be set up as students come into school tomorrow. All projects will stay up until approximately 2 P.M. Remember that our school coal fair is simply a preliminary step to the regional coal fair at Pikeville College in May. A certain number of projects will be chosen to advance – CEDAR informs me of the number in each category that can advance and a panel of judges helps me choose the projects. Then, at the regional coal fair, a first, second, and third place winner is designated in each category by CEDAR judges. We will know the results on May 25th and the awards ceremony is May 29th.

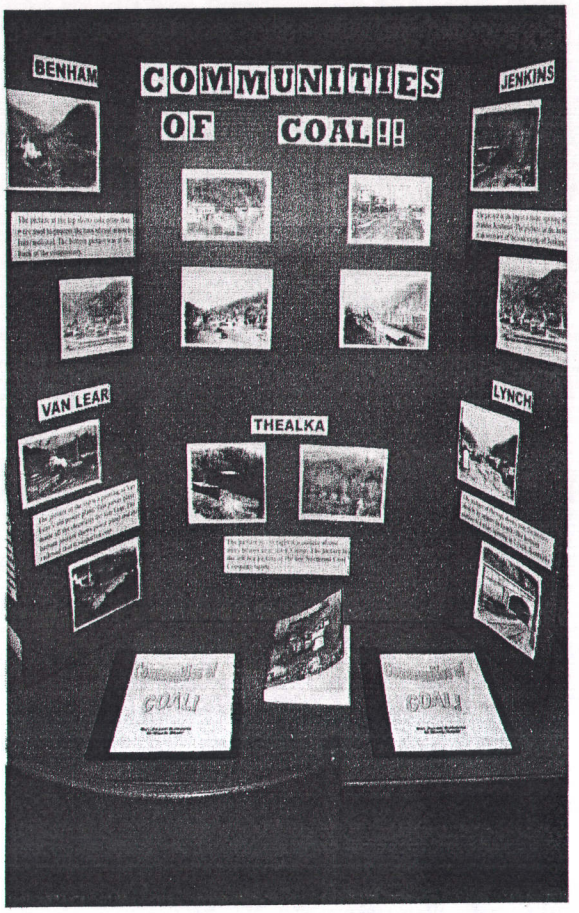
I am ***very*** impressed with the projects that have already come in! I want to thank you for your support given to your child and your school system. Please remember to sign-in with the main office before continuing to the library. Have a great day and I hope to see you tomorrow!

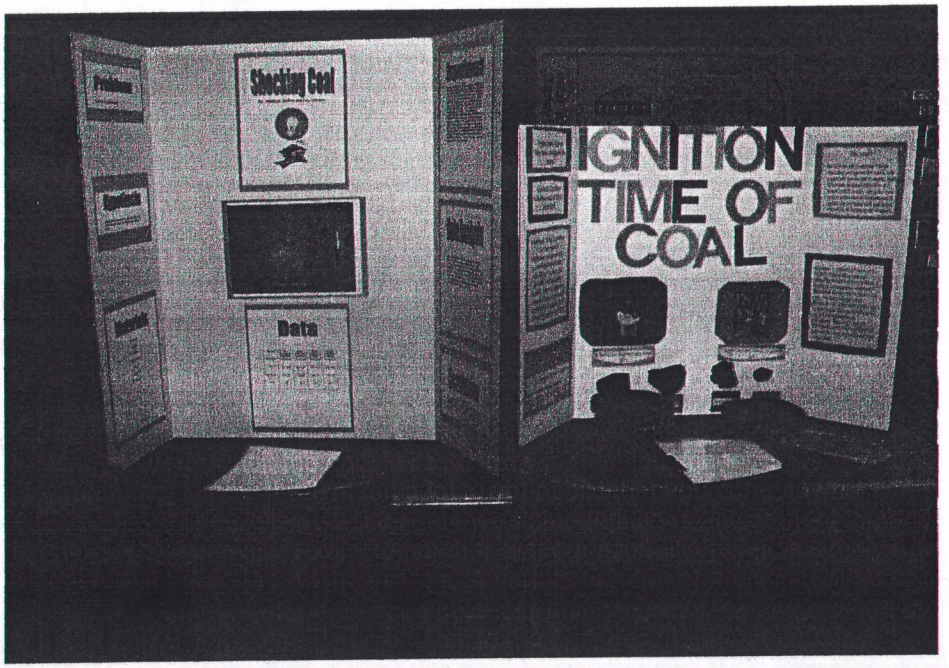
Thanks again,

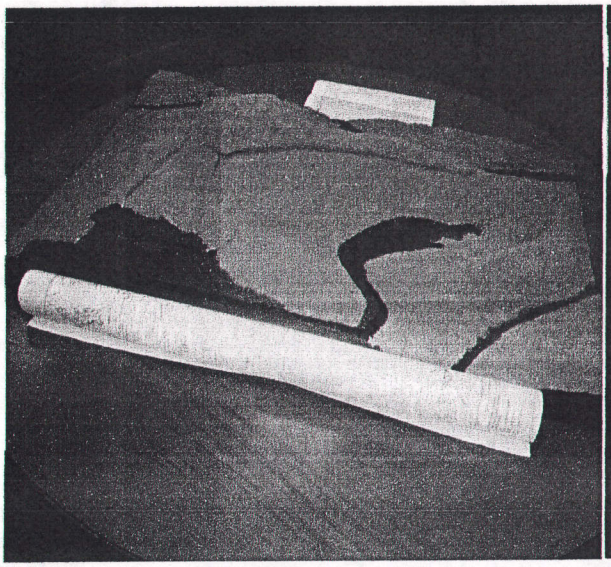
[redacted]

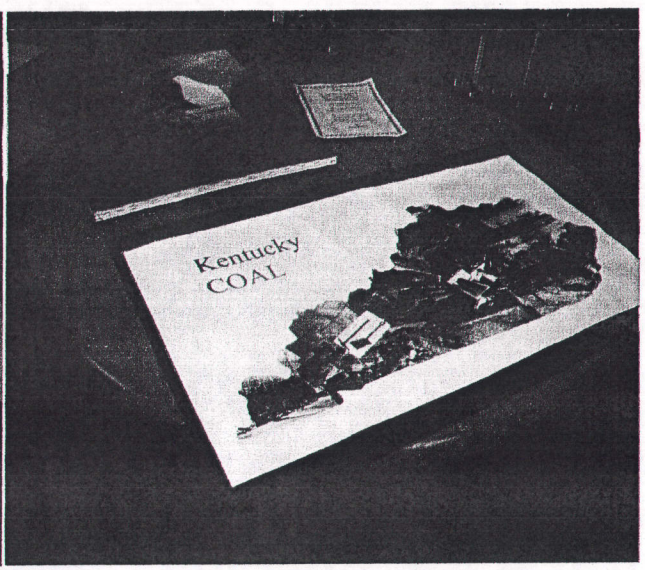
Awesome Coal Fair Projects

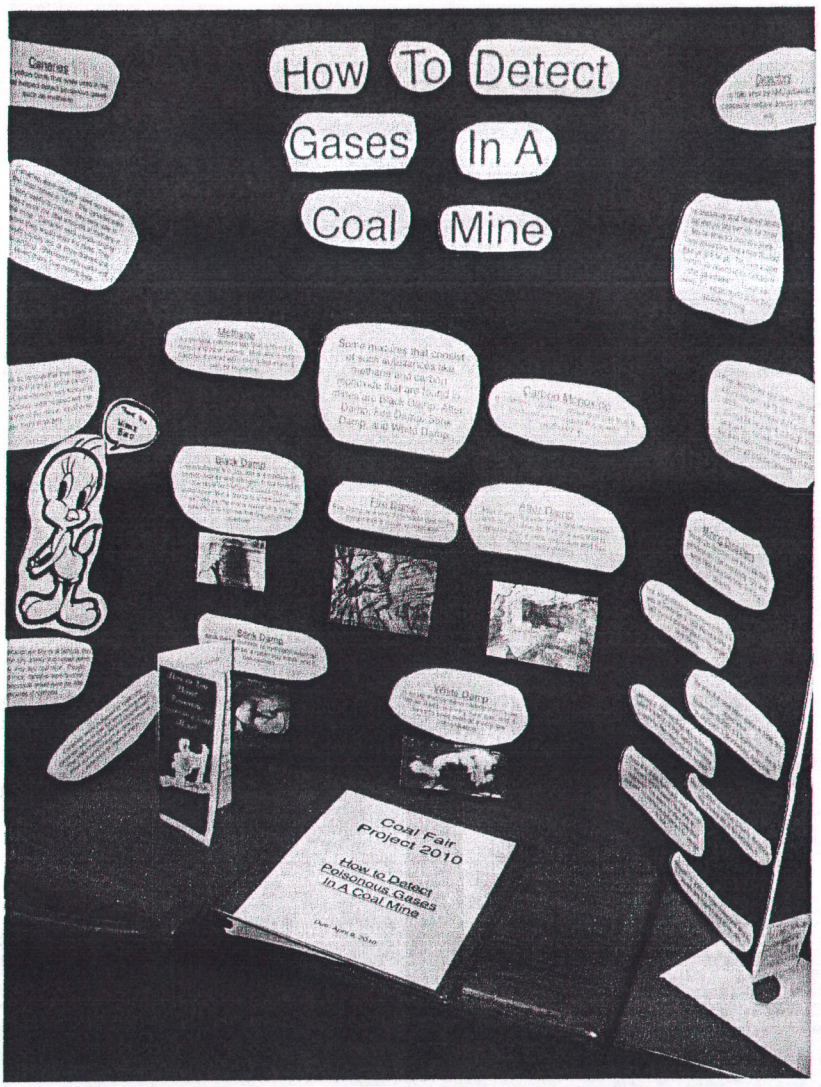









Kentucky
COAL


How To Detect
Gases In A
Coal Mine
Cameras
Methane
Some mixtures that consist of such substances as methane and carbon monoxide that are found in mines as Black Damp, After Damp, Fire Damp, Stink Damp, and White Damp.
Carbon Monoxide
Black Damp
Fire Damp
After Damp
Mine Disasters
Stink Damp
White Damp
Coal Fair
Project 2010
How to Detect
Poisonous Gases
In A Coal Mine

Student Work for Lessons 1-6

[redacted] [redacted] [redacted]

Governor Steve Beshear:
Intelligent Energy Choices for Kentucky's Future

CHALLENGES

Why? Will this create a strain?

- Kentucky's energy use is projected to grow by slightly more than 40 percent between now and 2025.
- Greenhouse gas (GHG) emissions could be more than 40 percent higher in 2025. ↑ Due to more energy being produced
- Coal-fired power generation in the state will not sufficiently support Kentucky's coal industry if other states cease purchase of Kentucky coal. Why will they not buy it?
- The nation's dependence on foreign energy supplies endangers our security.

↳ How can we be independent?

STRATEGIES

Strategy 1: Improve the energy efficiency of Kentucky's homes, buildings, industries and transportation fleet.
Goal: Energy efficiency will offset at least 18 percent of Kentucky's projected 2025 energy demand. Great! How can we be more energy efficient?

Strategy 2: Increase Kentucky's use of renewable energy What type of renewable energy will work best
Goal: By 2025, Kentucky's renewable energy generation will triple to provide the equivalent of 1,000 megawatts of clean energy while continuing to produce safe, abundant and affordable food, feed and fiber. in Kentucky? How will this affect the coal industry?

Strategy 3: Sustainably grow Kentucky's production of biofuels What is a biofuel? Produced from something living? (Bio?)
Goal: By 2025, Kentucky will derive from biofuels 12 percent of its motor fuels demand, while continuing to produce safe, abundant and affordable food, feed and fiber.

Wow! That is a lot!

Strategy 4: Develop a coal-to-liquids industry in Kentucky to replace petroleum-based liquids
Goal: Kentucky will develop a coal-to-liquids industry that will use 50 million tons of coal per year to produce four billion gallons of liquid fuel per year by 2025. How do you turn coal into a liquid?

Strategy 5: Implement a major and comprehensive effort to increase gas supplies, including coal-to-gas in Kentucky
Goal: Kentucky will produce the equivalent of 100 percent of our annual natural gas requirement by 2025 by augmenting in-state natural gas production with synthetic natural gas from coal-to-gas processing. How do you turn coal into a gas?

Strategy 6: Initiate aggressive carbon capture/sequestration projects for coal-generated electricity in Kentucky How do you capture carbon? What do you do with it after you capture it?
Goal: By 2025, Kentucky will have evaluated and deployed technologies for carbon management, with use in 50 percent of our coal-based energy applications.

Strategy 7: Examine the use of nuclear power for electricity generation in Kentucky
Goal: Nuclear power will be an important and growing component of the nation's energy mix and Kentucky must decide whether nuclear power will become a significant part of meeting the state's energy needs by 2025. Isn't nuclear power expensive and dangerous?

Strategies 1, 2 & 3 are designed to help the commonwealth achieve a proposed **Renewable and Efficiency Portfolio Standard**, whereby 25 percent of Kentucky's energy needs in 2025 will be met by reductions through energy efficiency and conservation and through the use of renewable resources.

Strategies 1, 3 & 4 include strategies to help the commonwealth achieve an **Alternative Transportation Fuel Standard** (ATFS) to help transition away from dependence on foreign petroleum, utilizing fuels such as those derived from biomass and coal, plug-in hybrid vehicles and compressed natural gas. I want one!

Lesson 1

[redacted]

Challenges:

1. Mine safety
2. limited supply of coal
3. Burning coal creates air pollution.
4. Mining for coal destroys habitats.

More challenges from research.

5. Burning coal can lead to acid rain (www.fossil-fuel.com)
6. Clean coal technology can be expensive and time consuming. (www.fossil-fuel.com)
7. Transforming coal can be dangerous expensive and its time consuming (www.fossil-fuel.com)
8. Abandoned mines are dangerous. (www.childrensuniversity.com)
9. Coal miners can suffer from a variety of health problems. (www.childrensuniversity.com)

[redacted]

Independent Research Rubric

4	3	2	1
You research the entire time	You research the majority of the time	You research some of the time	You are looking around the room
You carefully select appropriate books and websites	You tend to select appropriate books and/or websites	You were not careful in selecting appropriate books and/or websites	You did not select appropriate books and websites
You respect the researchers around you	You tend to respect the researchers around you	You are often off-task	You are distracting to the researchers around you
You know when you come across good information and take notes	You select some good information to include in your notes	You scan too quickly and miss important information	You did not include important information in your notes
You document all resources appropriately	You document all resources	You document the majority of your research	You did not document your research

20/20 :)

[redacted]

Dear Representative Moberly:

As part of a coal study unit, my fellow classmates of Paintsville Jr. High and I have studied the many challenges our coal industry is facing. We also examined the solutions that the coal industry and the state government are implementing in order to fix these challenges. During my research, I came across the Clean Energy Bill (HB 408) which you are heading. At first glance, I was opposed to this bill. But as I read deeper, I began to see the positive aspects of this solution.

I did not realize at first that Kentucky's energy requirements are expected to rise 40% in the next several years. I began to think, will we have a great enough supply of coal to handle this demand? I agree that the coal industry needs help in meeting this demand. I do want to stress, however, that I believe alternative energy should only supplement coal, not replace it. Coal must remain our top resource if our economy has any chance of surviving and thriving.

What types of alternative energy do you expect Kentucky to employ? In my past classes, I have heard how difficult it would be to use alternative energies in our area due to costs, wastes, dangers, and our mountainous region. If we are going to use a new energy source in Kentucky to help coal generate energy, I think it should be cheap, clean, safe, and not disturb our beautiful lakes and mountains.

Thank you for your time,

[redacted]

Lesson 3

[redacted]

Ways to Conserve energy

- turn of the lights when you leave a room
- turn your thermostat up in the summer so your AC doesn't kick on as often.
- only wash full loads of laundry and dishes.
- buy energy-efficient appliances
- buy better windows
- unplug coffee pot/toaster when not in use
- take shorter and cooler showers

CHANGE FOR THE BETTER WITH ENERGY STAR

Products that earn the ENERGY STAR® prevent greenhouse gas emissions by meeting strict energy efficiency guidelines set by the U.S. Environmental Protection Agency and the U.S. Department of Energy. www.energystar.gov

Energy Efficiency Ambassadors

The below activities for teachers to use with their students are based on the Alliance to Save Energy's Green Schools Program activities. The activity also incorporates materials from the "Comparing Light Bulbs" activity produced by the National Energy Education Development (NEED) Project.

- *For information about the Alliance to Save Energy, go to www.ase.org, or www.greenschools.com*
- *For information about NEED's educational materials, go to www.NEED.org.*

Subject: Science, Mathematics, English, and Technology

Grades: 6-8

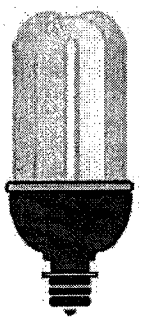
Brief Description:
Too many greenhouse gas emissions are collecting in our earth's atmosphere and are causing our climate to change. People at any age can help by using less energy. In these activities, students will compare two products that provide the same function (in this case, providing light) but require different amounts of energy to do their job. Students will research and demonstrate energy efficiency in action and learn how it applies to different technologies.

After the activities, students should be able to discuss the following:

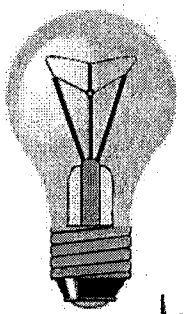
- How does using less energy help our environment?
- What are the primary differences between compact fluorescent light bulbs and incandescent light bulbs?
- What are other examples of energy-efficient technologies or energy-saving practices?

Background:
We have all heard about global climate change and know that it is a challenge facing our world. Most people don't know that the average home is responsible for twice as many greenhouse gas emissions as the average car. Most of the electricity we use at home comes from burning fossil fuels like coal and oil, which releases greenhouse gas emissions into our earth's atmosphere. What this means is that we can each play a role in reducing these emissions by using energy more efficiently.

One of the easiest ways to learn about energy efficiency and put it into practice at home is through the light bulb. The most common light bulb today is the incandescent light bulb, invented by Thomas Edison 125 years ago. New compact fluorescent light bulbs (CFLs) use 1/3 the energy of Edison's bulb and last as much as 10 times longer. In fact, only 10% of the electricity required by an incandescent bulb is used for light, and the other 90% escapes as heat. CFLs create the same amount of light, but generate a lot less heat – about 70 percent less. CFLs are more energy-efficient than incandescent lights because fluorescent technology does not require a metal filament to



CFL



incandescent

create light, but instead uses contained gases which require less electricity to create the same amount of light. To save the most energy and do the most good for the environment, it makes sense to use CFLs in frequently used areas of the home.

There are many other appliances and technologies where energy efficiency comes into play. For example, two different refrigerators may keep food cool equally well, but the amount of energy they use to do so may vary significantly. Or, two different houses of similar size may both have indoor air temperatures of 75 degrees Fahrenheit, but depending on how well each house is insulated, the amount of energy used to heat or cool that house could mean a difference of $100 dollars or more a month in electricity and gas bills, signaling a large amount of wasted energy. Appliances and other technologies are considered energy efficient when they provide as good or better performance as other technologies but use less energy to do the job.

While a few kilowatt hours of energy wasted here or there may not seem like a large enough amount of energy to worry about, they add up quickly in the form of greenhouse gas emissions in our atmosphere. Consider that using a CFL instead of an incandescent light bulb can prevent 750 pounds of coal from being burned, and that lighting accounts for about 20 percent of total residential energy use. The potential savings is enormous, and that's just with one technology.

Objectives:

1. Students will learn the connection between energy use and global climate change
2. Students will learn that different appliances and technologies with similar output vary in the amount of energy they consume
3. Students will identify and list technologies and other practical ways to be more energy efficient in a home
4. Students will build or display an apparatus or energy-efficient device that demonstrates its practical application for energy efficiency
5. Students will compare the relative value of an energy-efficient product or practice versus an equivalent product or practice that uses energy less efficiently, and use specific data, facts, and ideas to support their findings
6. Students will convey information and ideas from primary and secondary sources accurately and coherently
7. Students will report information and convey ideas logically and correctly

Lesson Plan:

1. Brainstorm with students how energy is wasted in homes and how they might help stop the waste. Students will do Internet research on current methods recommended for home energy efficiency. Students may also contact local energy specialists in the community and interview them about methods and/or technologies that would reduce energy waste, save money and prevent greenhouse gas emissions. These specialists may also provide testing equipment for the project.

2. Conduct the following demonstration project in class using a thermometer and lamp (or watt meter comparator), and one each of a CFL and incandescent bulb that produce equivalent lumens (light levels). A 60 watt incandescent bulb and a 13 watt CFL will generally produce equivalent light levels.

Have an adult place the CFL bulb in the lamp (or watt meter) and turn it on. Observe the light that is produced. Then, hold a thermometer six inches above the bulb for one minute and record the temperature. Turn off the lamp and let the bulb cool. Have an adult remove the CFL bulb, place the incandescent bulb in the lamp and turn it on. Observe the light that is produced. Again, hold a thermometer six inches above the bulb for one minute and record the temperature. Ask the students if they could tell any difference in how much light the two bulbs produced, which bulb produced more heat than the other, and which bulb is more energy efficient.

3. Have the class compute the actual electricity consumption of the two bulbs for varying time periods of use; have the students approximate how long they leave lights on (i.e. one hour of use, how many times a week, how much over the year). Have the students compare the amount of electricity used for the two bulbs for similar amounts of time. Compare the life cycle costs of the two bulbs based on the cost of electricity consumed and the purchase price of the bulb. Have the students compare the amount of amount of greenhouse gases produced based on the electricity consumed.

   Electricity used (kWh) = hours of use x (wattage of bulb divided by 1000)

   Cost = kWh x electric rate — $0.058

   Lifecycle costs = bulb price + lifetime electricity costs
   = bulb price + (electric rate x bulb lifetime x wattage of bulb / 1000)
   *CFL lifetime is 6,000 hours
   *Incandescent bulb life time is 750 hours, so it takes 8 incandescents for every 1 CFL

   Greenhouse Gas Emissions (pounds of pollution) = kWh x 1.58 pounds/kWh

Extension/Alternate Activities

For a social sciences or language arts class:

Have the students do the same research as described above, but instead of or in addition to doing the mathematical comparison above, have the students write a persuasive essay promoting the importance of using energy efficiently at home. Or, students could take the material they learned in the research phase and create a children's book that explains what energy efficiency is, why it is important, and how individuals taking energy-saving steps can help.

For a science or technology class:

Form small groups of students (2-3 per group). Each group selects a method or apparatus to display and demonstrate energy efficiency (like the demonstration lighting project done

above). The project should have a display showing how the energy efficiency was tested and a poster chart showing the projected energy and greenhouse gas savings over a set period of time. The chart can be created using a spreadsheet program and enlarged to poster size. The students should also submit a journal detailing the project that includes a statement of the research question they sought to answer, documented research, data collection, analysis, and results. The group should create a script from which each member is able to explain the project, how it works, and the significance of the results with regard to energy efficiency.

For a science or environmental club:

Encourage club members to prepare a presentation for a lower grade level class about the importance of using energy efficiently and our environment, using the CFL to demonstrate. Students can do the math to calculate the difference it would make in energy and environmental benefits if everyone in their class changed one light at home to a CFL, if everyone in their school did the same, and then everyone in their city followed suit.

> Electricity saved (kWh) = bulb lifetime hours x (wattage difference of bulbs divided by 1000) x number of bulbs
>
> Greenhouse Gas Emissions Prevented (pounds of pollution) = kWh x 1.58 pounds/kWh
>
> Emissions equivalency in trees planted (acres of trees) = emissions prevented ÷ 8,066

90/100 A :)

[redacted]

Energy Efficiency Ambassadors
Data Sheet

Incandescent Bulb

Seconds	Temperature
0	73
15	73
30	75
45	78
60	81

✓

what scale did you use?

Compact Fluorescent Light Bulb

Seconds	Temperature
0	74
15	74
30	74
45	75
60	75

✓

✓ **Which bulb produced the most heat?**
The incandescent bulb uses the most heat

✓ **Which bulb is most energy efficient?**
The compact fluorescent bulb is the most energy efficient.

Mathematical Calculations:

Electricity Used = hours × (wattage / 1000)
4 → 13
4 → 60

Cost = kwh × electric rate

Lifecycle Costs = bulb price + (electric rate × lifetime × wattage / 1,000)
6,000 hours (CFL)
(I) 750 hours
13
60

Greenhouse Gas Emissions = kwh × 1.58 pounds/kWh

Hi! :)

Electricity Used

CFL

hours = 4
Wattage = 13

EU = 4 x (13/1000)
EU = .052 kWh (one day) ✓

Incandescent

hours = 4
wattage = 60 ✓

EU = 4 x (60/1000)
EU = 0.24 kWh (one day)

CFL (one week)
hours = 28 (4 x 7) ✓
wattage = 13

EU = 28 x (13/1000) ✓
EU = 0.364 kWh

Incandescent (one week)
hours = 28 (4 x 7)
wattage = 60

EU = 28 x (60/1000) ✓
EU = 1.68 kWh

CFL (30 day month)
hours = 120 (4 x 30) ✓
wattage = 13

Lifecycle Cost = price+(rate x lifetime x watts/1000)

CFL

price = .09¢ lifetime = 6,000 hours
rate = .058¢ wattage = 13 kWh

LC = .09+(.058 x 6,000 x 13/1000) ✓
LC = 4.614

Incandescent

price = .42¢ lifetime = 750
rate = .058¢ wattage = 60

LC = .42+(.058 x 750 x 60/1000) ✓
LC = 3.03

Greenhouse Gas Emmissions

GGE = kWh x 1.58 per kWh

CFL

kWh = 1.56

GGE = 1.56 x 1.58
GGE = 2.4648 pounds/kWh ✓

Incandescent

kWh = 7.2

GGE = 7.2 x 1.58
GGE = 11.232 pounds/kWh ✓

What are the differences between compact fluorescent light bulbs and incandescent light bulbs?

The incandescent bulb requires a metal filament, where as, the compact fluorescent light bulb doesn't require it. Because of this, the compact fluorescent light bulb is more energy-efficient that the incandescent light bulb. The compact fluorescent light bulb last 10 times longer than the incandescent light bulb. The incandescent bulb uses 90% of its energy for heat, where as the compact fluorescent light bulb uses 20% less heat than the incandescent bulb.

This is all true... but what differences did you notice based on your calculations - cost, electricity used, emissions, etc.

How does using less energy help our environment?

Because we use so much energy, greenhouse gas emissions collect in Earth's atmosphere. The greenhouse gass emissions cause the Earth's climate to change. If we use less energy, less greenhouse gas emissions would collect in Earth's atmosphere.

What are other examples of energy-efficient technologies or energy-saving practices?

An example is... Two houses have the same temperature of 75° Fahrenheit, but one of the houses might be wasting a big amount of energy. It depends on how well each house is insulated. Another example is.... Two refrigerators keep food equally cool, but one refrigerator is wasting energy. Appliances are considered energy-efficient when their performance is just like any other appliance, but the appliance saves energy

Remember, you should always give 3 examples unless instructed otherwise.

EDITORIAL

Outline for a Persuasive Editorial

I. Introduction
Hook
Opinion

II. Background
Context for the Reader
What has happened that caused you to care about this issue?

III. First Argument
State why you are right or what needs to be done
Provide supports
Anticipate the needs of the reader - what information can you share to convince the reader that you are right.

IV. Second Argument
State why you are right or what needs to be done
Provide supports
Anticipate the needs of the reader - what information can you share to convince the reader that you are right.

V. Third Argument
State why you are right or what needs to be done
Provide supports
Anticipate the needs of the reader - what information can you share to convince the reader that you are right.

VI. More arguments in you can think of them.

VII. Recognize the opposite side.
Use a transition to contrast
List the counterarguments in one sentence if possible
Rebut each argument in another sentence
Example: "Of course, I understand you may think/believe....., but....."

VII. Conclusion
Restate your opinion
If you can, connect back to the hook you used
Summarize your arguments
Make a threat or promise (If we don't do this or change this or whatever, then what will happen)

[redacted]

Global Warming:

It's Getting Hot in Here

Imagine you're walking through the woods, warm splashes of color dance around you. In the distance you can hear the soft sound of water lapping over the smoothened rocks in the stream. It's the same stream that you fished for minnows in when you were five or waded all summer in when you were six. You see the first tree you ever climbed, shorter, but still as majestic. All your childhood memories come rushing back in a flurry of happiness, sadness and recognition. You know that when your kids are teenagers like you, they won't have this beautiful place that has been a refuge to you for so many years. Because of the harshness of nature and the carelessness of man, global warming will snatch this beautiful getaway from you and your family.

So, what is this business of global warming anyway? If you think it's just a bunch of scientific information that means nothing to you, than you're quite wrong. Global warming is an important matter that could affect even the smallest of the communities, even those all the way in Eastern Kentucky. Global warming is when carbon dioxide and other greenhouse gases, such as methane and nitrous oxide trap the sun's heat in atmosphere, rising Earth's temperature. Have you ever heard the song "It's Getting Hot in Here?"

That's exactly what's happening and fast. Upon studying the greenhouse effect I have discovered that even though this process is good because the heat keeps us alive, the increase in carbon-dioxide (CO2) in the atmosphere can be devastating to life on Earth.

As my class has researched several articles on the climate change as a result of global warming, we have found that climate variability is the differences in climate over short periods of time, such as suffering from drought one summer and flooding the next. Climate change refers to differences that will continue for a long period of time. Robert Ferguson defined climate variability as "year to year, decade to decade," and climate change as "any long term trend." Both these terms can affect how people feel about the importance of global warming. Climate variability is often thought as a natural process, and does not need attention as it is only a short term problem Climate change often poses serious threats that may not be too far in the future. What a scary thought some of these problems can be.

First, according to the National Geographic Society, "Glaciers all around the world are melting, causing sea levels to rise. Sea level could rise between 7 and 23 inches by century's end." Though we're nowhere near an ocean, Kentucky's still affected. Are you a little confused? Well it's not hard to understand. As melting and destabilization of glaciers and ice caps occurs,

that water begins a slow, menacing creep onto our lands, conquering our helpless grains of sand. If we do not attempt to stop global warming, and the ice caps keep melting, Manhattan, San Francisco Bay, Sheng-Haiu, China, and Bangladesh India will be underwater. Over a hundred million people will be out of a home. You're probably thinking, "That's sad, but it doesn't bother me, so why should I worry about?" When these millions of people lose their homes they will begin to move away from the ocean. Many people, especially those people in Florida and Louisiana will move northward to Kentucky. What was once a relaxed, rural area may become an urban city. In some scenarios, forests and beautiful scenery will be destroyed to make room for more people. Remember that enchanting forest scene, no more. I think that this is a horrible situation and a major dilemma in on a list of many.

The rise in sea level isn't the only thing affecting us and wildlife. According to James Kanter, "An extinction crisis is on it way with one in four mammals in danger of disappearing because of habitat loss, hunting, and climate change." When I first read this, I couldn't believe ¼ of mammals would be gone. This is a really scary thought considering humans depend on animals for a lot of basic needs like food and clothing. Wait a minute! Aren't humans mammals too? Could human existence be on the

brink of extinction? How bad are we going to allow this to get? Even if humans do survive, Kentucky's economy depends on wildlife. $1.8 billion are spent each year in Kentucky on wildlife activities such as hunting and fishing. Even though we can't control nature, we must do what we can to stop global warming before it is too late.

Finally, one of the biggest and least expected problems with global warming is the possible return of an ice age. You're probably thinking, "What, an ice age? An ice age with wooly mammoths and saber tooth tigers? I thought the ice was melting into water, not all the water freezing into ice." Well, it could happen, maybe without the mammoths and saber-tooth tigers, but it could happen. According to Current Science, if the North Atlantic continues to be diluted with freshwater from melting ice due to global warming, its water could become less dense and less able to sink. That could prevent Gulf Stream water from flowing north. The Gulf Stream is a warm ocean current that flows upward from the equator, heating eastern United States and Western Europe. Without this heat an ice age could begin just as it has done in the past when the Gulf Stream stopped flowing. Completely forget that scene in the forest altogether. Forget your city park, the beach. Forget it all. All you would see is ice- bright, blinding ice. Imagine walking

to school. You wouldn't have to go to Wendy's® to get a frosty, and that's no joke, just like the issue of global warming.

So, everyone says that humans need to do what they can to reduce the amount of CO2 in the air, therefore preventing global warming. In fact, according to ABC news, 62% of Americans say we can help solve the problem. How are a couple of measly teenagers supposed to solve a global issue that's stumping event the most clever and experienced scientists? We can't solve the problem, but we can help by doing things as simple as recycling. Did you know that if you just save ½ of the waste usually thrown away in your home, 2400 less pounds of CO2 would be put into the atmosphere? Imagine how many pounds that would be if you saved ½ of your school's waste. It may seem simple, but it's usually the simple things that make the most difference. So, encourage your parents, teachers, and others in your community to recycle, and see the change with your own eyes.

Another easy, but effective solution to reducing CO2 is turning off electronics when you're not using them. Sorry to say this, but when you're parents tell you to turn off your computer or DVD player, it's actually not a bad idea. Wasted energy form idle electronics emits thousands of pounds of CO2 into the atmosphere, thousand of pounds that you could be saving.

Don't feel bad though. While your parents may yell at you to turn off your video games, how many times have they left a room and left the light on? Schools are especially guilty of this task. Lights in classroom, gymnasiums, and cafeterias are often left on even when no one is using them. Next time you leave a room that is going to be used, turn off the light. That'll show your teachers and parents that you can help the environment just as much as they can.

While both these contributions can ultimately change the amount of CO2 in the atmosphere, do our government leaders expect teenagers to handle this problem alone? Not quite. Scientists are working hard to develop new technologies and strategies that will decrease the greenhouse gases we put into the atmosphere. Vehicles that are more fuel efficient as well as more energy efficient appliances are among the list. Alternative energy sources including advanced wind turbines and solar photovoltaics, which use the wind, and the sun for energy instead of fossil fuels, which release greenhouse gases are also included in their solutions. The government isn't just trying to sound advanced and intelligent. They have some simple solutions too, like communities making it easier for bike and walk. Together these solutions can improve the issue of global warming in an unbelievable capacity.

Of course I understand that you may believe that you may believe that we humans, through carelessness and the lust for greater technology and industry, are destroying our precious planet, but how do you explain the facts? Even though human activity has linked to greenhouse gas emissions, CO2 levels have spiked dramatically (from 180ppm to 280ppm) before the Industrial Revolution and before humans could have been a factor. Humans and nature have obviously teamed up together to create this problem. Be careful what you wish for would have been a helpful warning when man had wished for an industrialized world, and now Mother Nature is ruining herself.

According to the National Geographic Society, "the 20th century's last 10 years were the hottest in 400 years and possibly the warmest in several millennia." Global warming is undoubtedly a major issue. Because of it, major cities will flood, wildlife will die, and we actually might see an ice age return. In the midst of all this trouble, there is hope. There is hope that we can begin to solve this problem by things as simple as recycling or turning off unneeded electronics. The leaders of countries all across the world are turning to energy efficient appliances and vehicles, as well as alternative sources of energy to stop this crisis. Whether it's the forest we played in as a child or a favorite vacation spot, it is our duty to protect it for

future generations. So, remember that even as teenagers in Eastern Kentucky, we have power. We have the power to make a difference in a warming world. All we have to do is stand up and share that power with citizens around the globe.

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Current Science, January 6, 2008, pg.9

"It's Getting Hot in Here" 93/100 A :) [redacted]

What is Good Writing? Graphic Organizer

Ideas

LOVE your introduction!

✓ **An important main idea.** What's the one most important thing the author wants the audience to know? Why is it important to the author? Why is it important to the audience?

✓ **Interesting details.** Which details are the most interesting? How do they help the audience understand the main idea?

✓ **"Showing," not just telling.** Where does the author use "showing" details? How does the "showing" help to improve the audience's understanding?

awesome research

✓ **A clear and meaningful purpose.** Why did the writer write this? Why is this a good reason to write something? What does the author want the audience to think and/or do?

✓ **Something surprising or unusual that works.** What is surprising or unusual about the writing? How does this differ from other things you've read?

Organization

great connection

✓ **Catches the audience's attention at the start; makes them want to read more.** How does the beginning catch the audience's attention? Why would the audience want to read more?

✓ **Feels finished at the end; makes the audience think.** How does the ending make the piece feel finished? What does it make the audience think about?

✓ **Parts arranged in the best order.** Can you easily identify the different parts of the piece? Does each part follow logically from the next? Is the sequencing effective and entertaining?

✓ **Spends the right amount of time on each part.** Why does the author spend more time in some parts than in others? Are there places where the author moves ahead too quickly or hangs on too long?

good transitions

✓ **Easy to follow from part to part.** How does the author move from part to part? How do these transitions work?

Voice

✓ **The author cares about the topic.** How can you tell that the author cares about the topic? Where can you find evidence of strong opinions?

✓ **Strong feelings; honest statements.** Where are the author's strongest statements? How can you tell that the author is saying what he or she really thinks?

This has "your" written all over it :)

✓ **Individual, authentic, and original.** Does this writing feel as though it could only have been written by one person? Does the writing sound like it was written by a real person? How original is it?

✓ **Displays a definite and well developed personality.** How would you describe the author's personality in this writing? What examples from the text tell you you're right?

✓ **Appropriate tone for purpose and audience.** Is the writer using an appropriate tone for this situation? How can you tell? Which parts, if any, seem inappropriate?

Word Choice

___ **Strong verbs that tell how actions are performed.** Where has the author used strong verbs? What makes them effective?

___ **Adjectives and adverbs that make things more specific.** Where has the author used adjectives and adverbs to make the writing more specific? How does using these adjectives and adverbs improve the reader's understanding?

___ **Words and phrases you can remember long after you've finished reading.** Which words and phrases do you remember? Why are they so memorable?

___ **Language that is appropriate to purpose and audience.** Are the words the author has used appropriate for the writer's purpose and audience? Are there any words or phrases that are too casual, too formal, too hard to understand, or possibly offensive?

Sentence Fluency

Great!

___ **Variety in sentence beginnings.** What are some of the different ways the author begins sentences? Do you notice any patterns? Does the author ever begin two or three consecutive sentences in the same way?

___ **Variety in sentence length and structure.** Does the author vary the length and structure of his or her sentences? Do you notice any patterns? Does the author use the same length or structure in two or three consecutive sentences? What sentence structures does the author use most often?

___ **Easy to read expressively; sounds great when read aloud.** What are the most expressive parts? What is it about how they sound that makes them so much fun to read out loud?

___ **Uses rhythm, rhyme, alliteration, and other "sound" effects.** Where has the author used rhythm, rhyme, alliteration or other effects to make the writing sound interesting? How does this improve the piece? This is an area that would take your writing to the next level!

___ **Sentences are structured so they're easy to understand.** How does the author use connecting words and punctuation marks to make sentences easy to understand? How does the order of sentence parts make the writing easy to understand?

Conventions

Beware of careless errors

work on comma usage!

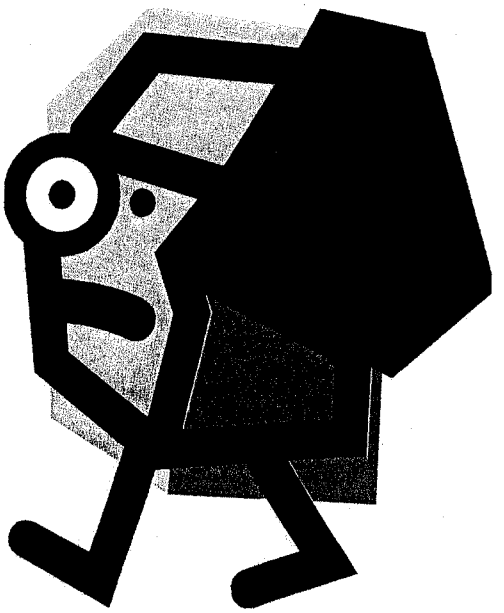
___ **Punctuation.** Has the author used periods, question marks, and exclamation marks in ways that make sense to the audience? Does the author's use of commas, colons, dashes, parentheses, and semicolons make sense to the audience?

___ **Capitalization.** Has the author used capital letters in ways that make sense to the audience? Is it easy to tell where new ideas begin? Has the author capitalized the word "I", as well as names, places, and things that are one of a kind?

___ **Paragraphing.** Has the author grouped related sentences into paragraphs in ways that make sense to the audience? Has the author started a new paragraph each time a new person starts speaking? Has the author indented or skipped a line to show where new paragraphs start?

___ **Spelling.** If the writing has spelling mistakes, do these errors make the piece difficult to read and understand? How does the author's spelling affect the way the audience feels about the writing and the person who wrote it?

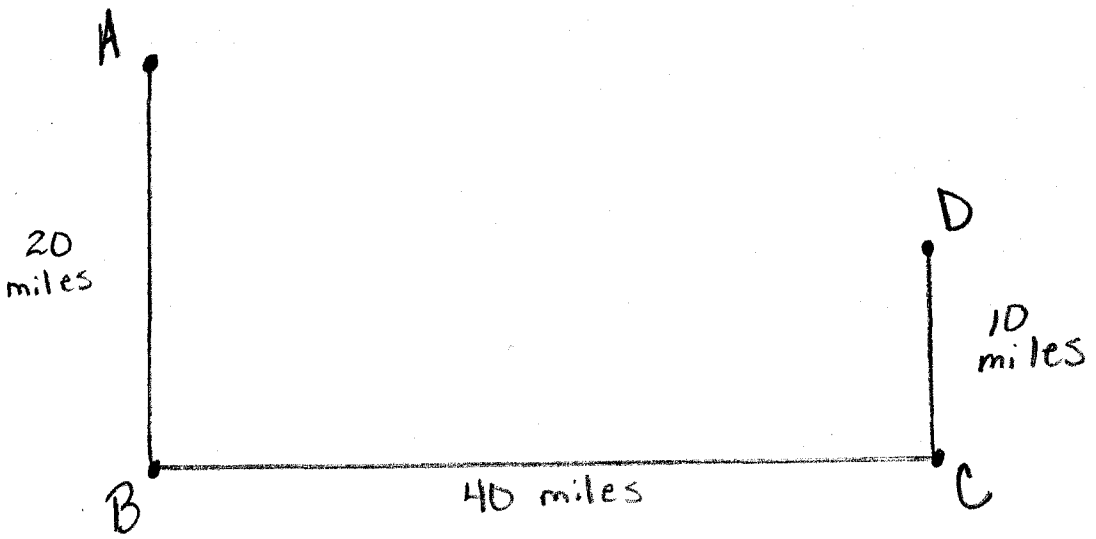
SAVE ENERGY, SAVE COAL!



Open Response

One solution in Governor Beshear's "Intelligent Energy Choices for Kentucky's Future" is to improve the energy efficiency of Kentucky's transportation fleet. By finding the quickest route for coal trucks, the coal industry could save millions of dollars a year.

The coal truck must get from point A to point D but must make a pit stop somewhere between points B and C along the way to weigh in. What is the shortest length of such a journey that satisfies these conditions?



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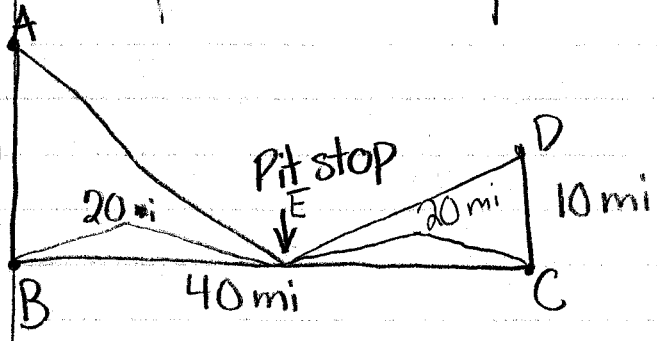
4th Period

Open Response



On this path the truck makes a pit stop in the middle of B and C.

The path forms 2 triangles which we need to find the hypotenuse. We would use the pythagorean theorum ($a^2+b^2=c^2$).

A → E (pit stop)

$20^2+20^2=c^2$

$400+400=800^2$

$\sqrt{800}=28.28$ mi

E (pit stop) → D

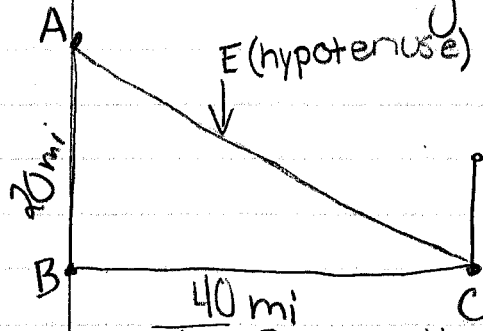
$20^2+100^2=c^2$

$400+100=500^2$

$\sqrt{500}=22.36$ mi

$28.28+22.36=50.64$ miles

The total distance traveled is 50.64 miles to the weigh in.



On this path the truck stops at point C and travels 10 miles to D. We need the length of E to determine the mileage.

To find the hypotenuse use $a^2+b^2=c^2$ (pythagorean theorum).

$20^2+40^2=c^2$

$400+1600=2,000^2$

$E=44.72+10=54.72$mi

C → D

The distance traveled for $\overline{ACD}$ is 54.72 miles.

The best choice is the first because it is 4.08 miles shorter than the second option. The first option would save gas and money for Kentucky's coal industry.

✓

Are these the only two paths the truck driver could take?

Remember, on the test, all OR answers must fit on one page.

[redacted]

Open Response Rubric

22/24 92% A

	1 - Novice	2 – Apprentice	3 – Proficient	4 - Distinguished
Correctness	Demonstrates a minimal understanding in discussion of concepts	Demonstrates a limited awareness of concepts	Demonstrates a general awareness of concepts	Demonstrates a thorough understanding of the subject matter
High-order thinking	Little to no evidence of elaboration, extension, high-order thinking, or relevant prior knowledge	Limited evidence of elaboration, extension, high-order thinking or relevant prior knowledge	Some evidence of elaboration, extension, high-order thinking or relevant prior knowledge	Contains elaboration, extension, high-order thinking or relevant prior knowledge
Idea development	Unfocused details	Poor development of topic; few supporting details	Adequate development of topic using appropriate details	Well-developed topic including pertinent details
Content vocabulary	Inappropriate vocabulary	Simplistic vocabulary; few content words defined	Acceptable vocabulary; majority of content terms defined	Strong use of terminology; defined terms
Organization	Weak to no organization; lapses interfere with comprehension	Weak organization; lapses do not interfere with comprehension	Appropriate organization; no lapses	Strong, subtle organization; no lapses
Conventions	Errors in English conventions interfere with communication	Errors in English conventions are disproportionate to length and interferes with communication	Minor errors with English conventions have little to no effect on communication	Strong control of English conventions

include more options

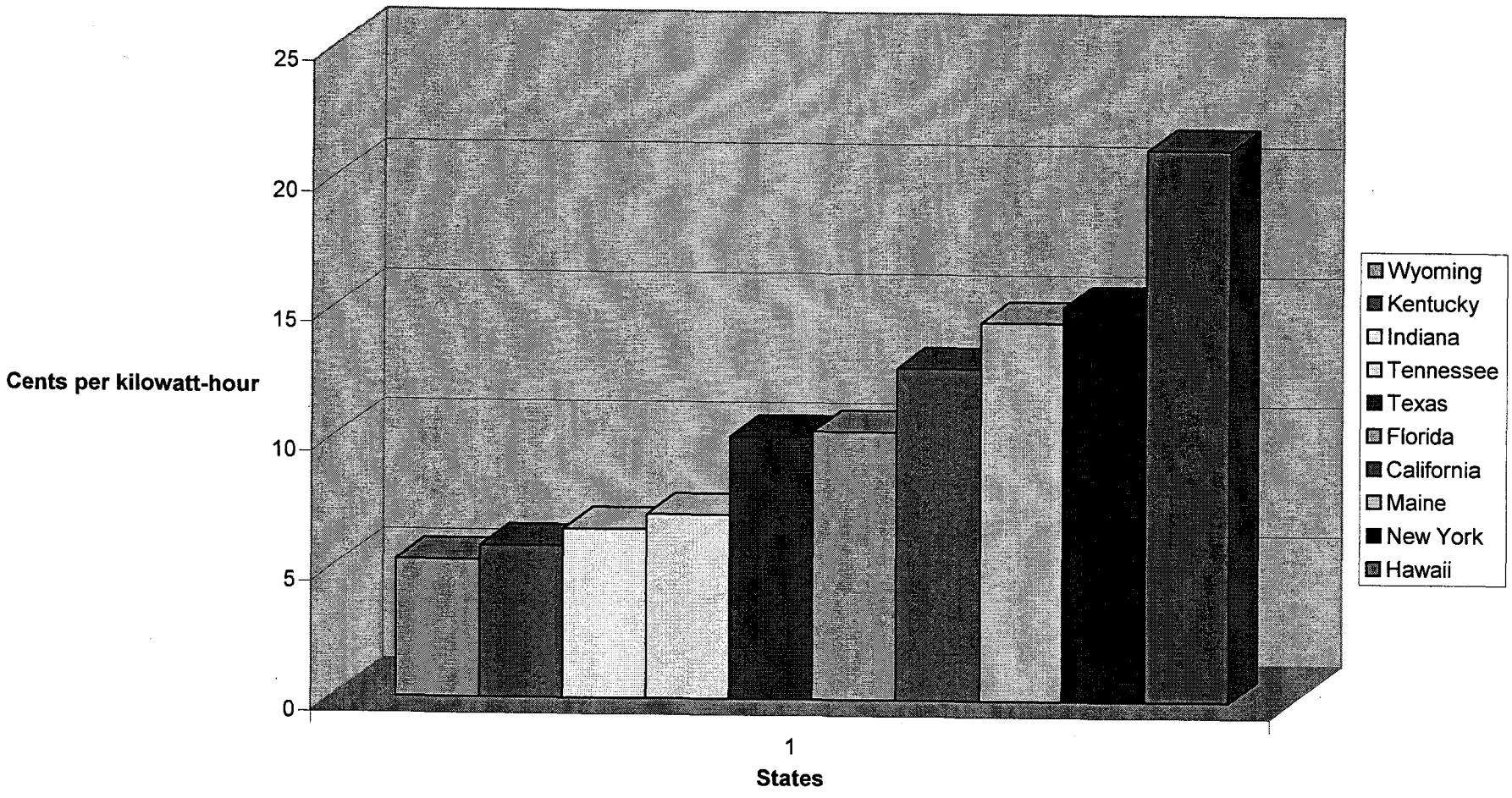
[redacted] [redacted]

State's Electricity Portfolio
Average Retail Price of Electricity

State	Average retail price of electricity (cents per kilowatt-hour)
Wyoming	5.29
Kentucky	5.84
Indiana	6.50
Tennessee	7.07
Texas	10.11
Florida	10.33
California	12.80
Maine	14.59
New York	15.22
Hawaii	21.29

[redacted]

Average Retail Price of Electricity



americaspower.org/The-Facts

This is a list of the United States and its Territories in alphabetical order:

- Alabama 7.57
- Alaska 13.28
- ~~American Samoa~~
- Arizona 8.64
- Arkansas 6.96
- California 12.8
- Colorado 7.76
- Connecticut 16.45
- Delaware 11.35
- District of Columbia 11.79
- Florida 10.33
- Georgia 7.86
- ~~Guam~~
- Hawaii 21.29
- Idaho 5.07
- Illinois 8.46
- Indiana 6.5
- Iowa 6.83
- Kansas 6.84
- Kentucky 5.84
- Louisiana 8.39
- Maine 14.59
- Maryland 11.5
- Massachusetts 15.16
- Michigan 8.53
- Minnesota 7.44
- Mississippi 8.03
- Missouri 6.56
- Montana 7.13
- Nebraska 6.28
- Nevada 9.99
- New Hampshire 13.98
- New Jersey 13.01
- New Mexico 7.44
- New York 15.22
- North Carolina 7.83
- North Dakota 6.43
- ~~Northern Marianas Islands~~
- Ohio 7.91
- Oklahoma 7.29
- Oregon 7.02
- Pennsylvania 9.08
- ~~Puerto Rico~~
- Rhode Island 13.12
- South Carolina 7.18
- South Dakota 6.89
- Tennessee 7.07
- Texas 10.11

List of US States in alphabetical order

- Utah 6.41
- Vermont 12.04
- Virginia 7.12
- ~~Virgin Islands~~
- Washington 6.37
- West Virginia 5.34
- Wisconsin 8.48
- Wyoming 5.29

Key

<6 cents	green
6.0 - 8.9	blue
9.0 - 11.9	yellow
12.0 - 14.9	orange
>15 cents	red

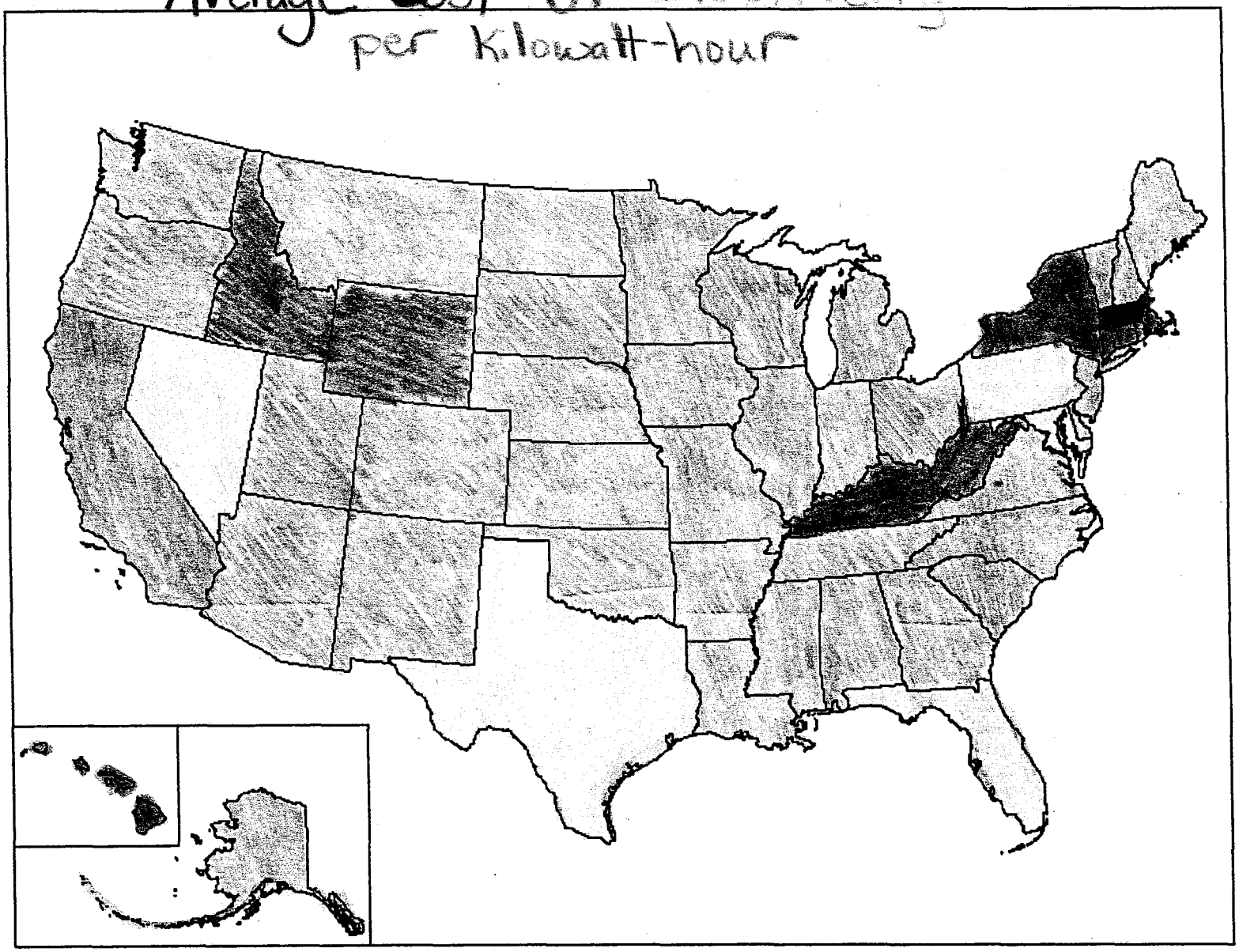
Average Cost of Electricity per Kilowatt-hour

< 6.0 cents

6.0-8.9 cents

12.0-14.9 cents

>15 cents



Lesson 5

[redacted]

Liquid Coal to Jobs

Coal liquefaction is the process of coal being converted into synthetic liquid fuels such as gasoline or diesel by different processes.

Coal is liquefied in two different ways- direct and indirect liquefaction. Direct liquefaction is when coal is crushed and mixed with oil to form synthetic crude oil. Indirect liquefaction is when coal is put under high heat and pressure to form a synthetic gas that can then be used to power engines.

Governor Steven L. Beshear's Intelligent Energy Choices for Kentucky's Future outlines coal liquefaction projections in strategy 4. He outlines plans to develop a Coal-to-Liquid (CTL) industry in Kentucky to replace petroleum-based liquids. The goal states, "Kentucky will develop a CTL industry that will use 50 million tons of coal per year to produce four billion gallons of liquid fuel per year by 2025."

The mid-term action is to bring on line two new 500 million gallon per year (approximately 35,000 barrels per day) CTL facilities in both 2013 and 2014.

For my project, I am calculating the possible new jobs that can be created from one of these new coal liquefaction plants.

The first production of jobs would be miners. The *2007-2008 Kentucky Coal Facts Pocket Guide* states that in 2006, an average Kentucky miner is able to produce 2.98 tons of coal per hour. By my calculations, a miner is able to produce an average of 5683.2 tons of coal per year.

By Governor Beshear's energy plan goals of 2013, personnel must be available to produce levels of 138 million tons of coal. In 2014, personnel will be needed to produce 150 million tons of coal. In 2015, personnel will be needed to produce 163 million tons of coal. Finally, in 2016, personnel will be needed to produce 175 million tons of coal.

That would mean that in 2013, it would take approximately 25,854 miners, in 2014 it would take 28,102 miners, and in 2016 it would take 32,786 miners to produce the planned amounts of coal.

In my project, I used several materials. They are:

- ***A Texas Instrument 7500 calculator***
- ***Several sheets of scratch paper***
- ***Kentucky Coal Facts Pocket Guide 2007-2008***

I also had help from different people. They are:

- ***Sharon Branham***
- ***Ted McGinnis***
- ***Connie Prater***

Coal liquefaction is going to be a very important source of income in Kentucky's future, which is why I picked this project. Coal liquefaction will create many jobs for Kentuckians that were hurt from the recession of 2008 and cannot find a job.

What I did to get my answer

To get my answer to the question, "How many miners would it take to mine enough coal for a coal liquefaction plant in the years 2013, 2014, 2015, and 2016?"I first checked on the internet to see how many tons of coal that a miner can produce in an hour. I found out that an average miner could produce 2.96 tons of coal per hour.

Then, since a miner usually works an 8-hour shift per day, I found out how many tons of coal a miner can produce in a day by multiplying the number of tons of coal that a miner could produce per hour (2.96) by an 8-hour workday. My answer was that a miner could produce 23.68 tons of coal per shift.

Next, I figured out how much coal a miner could produce in a week if they worked in the mines 5 days a week. I found this answer by multiplying the daily amount of coal mined by a miner by 5. My answer was that a coal miner could mine 118.40 tons of coal per week.

The next step was to figure out how many tons of coal that a miner could produce in a year. Since the average miner works 48 weeks per year, I multiplied the number of tons of coal that a miner could produce in a week (118.40) by 48. My answer was that a miner could produce 5,683.2 tons of coal per year.

After I got the number of tons of coal that a miner could produce in a year, I looked in Governor Beshear's Energy Plan to see how many gallons of oil that Kentucky is expected to produce in the years 2013, 2014, 2015, and 2016. Then, I just divided these numbers by the amount of coal that a miner could produce in a year to get the number of miners that would need to be hired. After this, I had my answers.

My Answers

In 2013, I figured out that it will take approximately 25,854 miners to mine enough coal for the coal liquefaction plant.

In 2014, it will take 28,102 miners.

In 2015, it will take 30,538 miners.

In 2016, it will take 32,786 miners.

Coal liquefaction will be a major part of our economy in future years. It will bring many jobs to our area, as shown in the math problem that I did.

Coal Song By [redacted] and [redacted]

Mining on the mountaintops

Using coal, won't stop

Using all the resources that keep our country running

Shortie, our resources they be stunnin'!

Coal not found in other places;

The mountains that it come from got a million faces

Keepin up society, demanding a variety;

Haters be hating, but all we doing is stating

That coal is creating and defining our nation!

Chorus

Coal, Found in Eastern Kentucky

A mix of strategy and miners getting lucky

Risking lives,

Taking strides,

You can't deny,

You gotta mine,

So get in line,

Get with the times

Start using coal and bust a rhyme!

Lights on! (ding!)

Who you think responsible?

Coal in our country becoming unstoppable!

You'd think without coal life would be possible,

But no, (no!)

Coal shouldn't be optional!

Coal is electricity,

Making life simplicity

Don't got enough publicity,

Take out the waste toxicity

(Chorus)

[redacted]

Coal Study Unit 2009-2010

[redacted] Teacher

1. What was the most important piece of information that you learned from this year's coal unit? How can you use this information in the future?

The coal industry really is trying to be more "environmentally-friendly". They need our support and there are many small things we can do to make big differences.

2. What was your favorite activity from the unit? Why?

The student writings, they were very involved and enthusiastic about the topic. Great writing pieces!

3. What was your least favorite activity from the unit? Why?

Honestly, I cannot think of an activity that did not serve a purpose and add to the unit.

4. On a scale of 1 to 10 (10 being the best), how would you rank this unit?

8+

5. What would you change in order to make this unit better?

We need an exact timeline to ensure that all teachers complete their part of the unit so that lessons fall in the correct order.

Let's do this earlier next year!

6. What coal topics would you like to learn more about, perhaps for next year's unit?

Coal-burning power plants
Mine safety

[redacted]

Coal Study Unit 2009-2010

[redacted]

1. What was the most important piece of information that you learned from this year's coal unit? How can you use this information in the future?

One of the best ways to help solve many of the problems the coal industry is facing is to be energy efficent. I am going to make my home more energy efficient.

2. What was your favorite activity from the unit? Why?

learning to create graphs on microsoft Excel and being able to draw pictures about coal.

3. What was your least favorite activity from the unit? Why?

There was a lot of writing.

4. On a scale of 1 to 10 (10 being the best), how would you rank this unit?

9

5. What would you change in order to make this unit better?

Maybe a little less writing. I would have liked to read more books about coal.

6. What coal topics would you like to learn more about, perhaps for next year's unit?

mining equipment