Introduction

Change – to make different; to alter your course or direction; to replace.

Change – an important word for all Americans throughout the previous year. The majority of our country voiced that they were ready for change when they elected Barack Obama the 44th President of the United States.

Change – a term that could be used to describe my professional career this year. After seven years in the science classroom, I asked to be transferred to language arts. I, like many others, was ready for a change. When my new position was announced at the summer retreat, the immediate response from fellow teachers included, "What about our coal unit? Are you still hosting the coal fair?" In only two short years, it had become a tradition in our school. It was important to our administration, to all of us, to carry on this tradition; therefore, it became a focus to create a unit that would transcend subjects – an interdisciplinary unit that would take advantage of our team teaching practices.

In anticipation of the difficulty in finding an appropriate topic that could be researched in all subjects, I approached my students with a variety of ideas. During our discussion forum, they were having none of it! None of my ideas were sparking interest so I decided to turn the power over to the best sources of ideas – the students. At first, their individual ideas weren't igniting the crowd either. "How is coal formed? What type of machinery is used to mine coal? How is coal used to produce electricity?" All good topics, but they lacked that "wow-factor" that was going to get everyone on board. Finally, someone spoke up. "My dad owns a coal mine and I have heard him say he is worried about what will happen to coal now that we have a new president. What kind of changes are we going to see?" There was the magic word – *change.*

"Why would things about coal change just because we have a new president? Doesn't Obama want us to mine coal? If we don't mine coal, how are we going to have electricity? Why does Obama want us to use less coal and more alternative fuels? What is going to happen to our economy if Obama shuts down coal mines and coal plants? What can we do to change his mind?"

The questions were flowing out of their mouths, attempting to answer each other's questions with more questions. This was not just a spark; they had ignited their curiosity that was going to drive us through the unit. The staff was just as eager so the planning of the unit began.

Change – what seems to happen to every well laid out plan. As the time approached to pass out activities and materials, a powerful force swept through eastern Kentucky. This powerful force was Ice Storm 2009, as my students refer to it. After missing over 20 days of instruction, teachers began to bail out of the project. Eventually, I was the only one left planning to carry out the unit, and I knew it would be a stretch to complete the unit and have my students prepared for the state test. I had an important decision to make – stick with the plans or *change*.

As I was weighing my options many personal *changes* occurred in my life – my husband, a respiratory therapist, was laid off and my grandfather passed away. My grandfather was often the topic of conversation during CEDAR meetings and was a big influence of last year's coal study unit. While he was not a coal miner himself, he was the son of a coal miner and valued the natural resource as well as the industry. He took pride in telling us stories of his father working in the coal mines and how he had saved a lot of the paper work and equipment, including social security paper work and a carbide

light with the flask that held the powder. He was always interested in our coal units and loved looking at the pictures of my students' coal fair projects.

With all that was going on, I almost completely abandoned the unit altogether. But I couldn't – I couldn't let down the CEDAR organization, who for two years has been such a support to me, my family, and my students; I couldn't let down my grandfather, who saw value in the coal industry and the people; mostly, I couldn't let down my students…you see, every year that I have participated, I have stories. Stories like the one of a student failing year after year, showing no interest in school, planning to drop out as soon as he was old enough; however, he made a connection to his step-father, a coal truck businessman, during his coal fair project. That student is now thriving in high school, taking advantage of several vocational classes that will assist him in joining his step-father's business. What if there was another student that could be reached with this year's coal unit and coal fair? I was not going to give up!

I e-mailed the teachers and asked if they would still complete a unit with me that was geared more toward content standards and would only take a few days out of their cramped schedules. With some positive replies, I reworked a unit that focused on core content and coal and handed out the materials to participating teachers. We agreed on the following essential questions:

1. How has the coal industry impacted our community?
2. How is coal used to generate electricity?
3. How much coal is required to light our school?
4. How can we conserve this nonrenewable resource so it lasts for years to come?

These essential questions are directly related to core content standards that are used to assess students at the end of the school year:

- SS-08-2.1.1 Students will explain how elements of culture (e.g., economics, language, the arts, customs, beliefs, literature) defined specific groups in the United States

- SC-08-4.6.2 Students will describe or explain energy transfer and energy conservation
- MA-08-5.3.1 Students will model and solve single variable, first-degree real-world and mathematical problems
- WR-07-1.1.3 In Transactive Writing, students will communicate a purpose through informing, persuading or analyzing.

Activities

I decided to create one activity per core subject. I began with social studies. I overheard some of the social studies teachers say that their students often have the hardest time answering questions about their own culture; therefore I wrote an open response that would not only have students thinking about coal, it could be used to better prepare our students for state testing.

I then turned my attention to math. I have always wanted to do the activity "How Much Does It Cost to Light Your School?" so I saw this as the perfect opportunity. Not only would our students gain valuable knowledge about the importance of coal in their every day lives (specifically electricity), they could polish their skills using variables in mathematic equations.

As an extension of the math activity, I thought it would be beneficial for science teachers to explore the path of coal to electricity. They also touched on energy conservation. I provided them with various resources including videos (Coal Into Kilowatt), websites ("United Streaming"), and an interactive webquest ("Electricity Webquest").

Also in relation to the math activity, I provided the language arts teachers with an on-demand writing prompt. Students took the information gained from the math activity and brainstormed ways to cut back on our school's energy costs. Then, students wrote a persuasive letter to our principal informing him of their findings and offered suggestions on how to cut costs. Many students also had some great suggestions on other things they could use that money for.

Summary

After each lesson, students and teachers were given evaluations to complete. All the information collected from these evaluations will of course be used to strengthen next year's unit. At the request of my 7th graders and fellow teachers, we are saving our original coal unit for next year. Even though it would have been a great unit to complete this year, we almost view it as a blessing in disguise - by waiting a year, we will have a clearer picture of President Obama's plans for the coal industry.

Each evaluation consisted of four open-ended questions about the unit and lesson as a whole, including follow-up activity suggestions that can be completed after testing. Then each specific activity was listed where students could give them a ranking of 1 lump to 4 lumps.

1 lump: Peat – Blowing' smoke, not effective
2 lumps: Lignite – Feelin' some heat, needs more time and planning
3 lumps: Bituminous – Good, improvement possible but not required
4 lumps: Anthracite – Extremely efficient!

The students generated a list of important characteristics that any successful activity would contain. After some discussion and a final vote, our top four characteristics of a successful unit are…

1. Writing component (Does it allow us to write about our learning?)
2. Collaborative (Does it allow for group work?)
3. Real-world (Does this apply to our daily lives?)
4. Engaging (Does it keep our attention?)

If an activity possesses all four characteristics then it gets four lumps; however, if it is only collaborative and real-world, for example, it will receive two lumps. Students quickly made the connection between our coal rankings and the holistic rankings (novice,

apprentice, proficient, distinguished) that are used to score their performances and assessments.

The culminating activity for this year's unit was the coal fair. Students were able to demonstrate their knowledge of the coal industry in their choice of seven categories. Over 35 projects were entered, including the work of over 70 students. 20 of the projects were chosen to compete in the regional coal fair.

Was the unit a success? Success is subjective – different people measure success in different ways. Our revised essential questions and core content were thoroughly explored. In total, 9 teachers, several parents, and approximately 400 students (ranging from our gifted students to our students with special needs) participated in the coal unit and coal fair. We created a unit in which ALL students could participate. And, yes, I have more stories…a parent, a coal miner, who wrote me a thank you note expressing his gratitude for assigning a project that he could help his son with…a student who was able to inspire a school with her voice, despite a physical handicap…a teacher who feels an overwhelming sense of pride and emotion as she types a final reflection with smiles and tears at end of each coal unit, promising to make this a constant in her classroom, pledging to get more people involved each year. So, yes…this unit was a success.

Change – it is inevitable. Things change and we have to be willing to roll with the punches. Our world is changing and so is the coal industry. I decided I would not give up on this unit, I would not give up the opportunity to educate our Kentucky students about our most important natural resource. It is essential that we educate our students, <u>our</u> future, on the future of the coal industry. They are the ones that will carry out these ideas…they are the ones that will lead the *change*.

Social

Studies

The Van Lear Historical Society is in the process of designing a new display to educate visitors on the culture of our area.

A. List 3 items you believe should be included in the new display.

B. Explain why you would include each of the 3 items. What would visitors learn about our culture?

Hint: As you write your response, keep these 20 cultural universals in mind. These are elements that are common to all cultures.

1. Language

2. Clothing

3. Food

4. Housing

5. Religion

6. History

7. Holidays

8. Family

9. Customs

10. Transportation

11. Government

12. Economics

13. Tools

14. Weapons

15. Education

16. Art

17. Literature

18. Music

19. Recreation

20. Medicine

[redacted]

Open Response

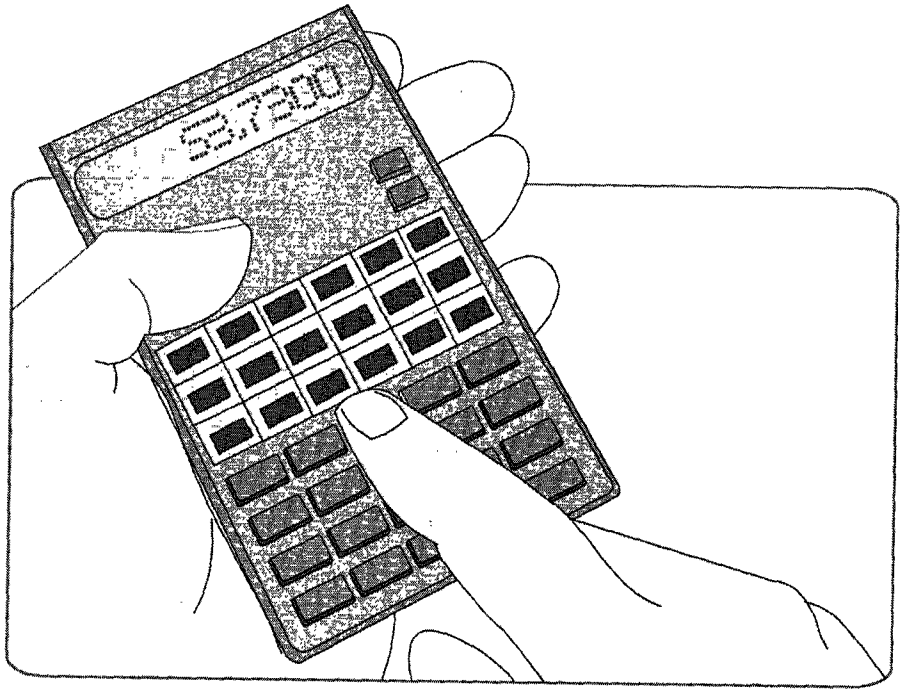
A. If the Van Lear Historical Society made a cultural display, it would need certain things. To educate visitors about the culture of our area, I believe a coal pick or shovel should definitely be included in the display. Maybe this could be an item that was actually used by miners when Van Lear was a coal camp. I also believe that an acoustic guitar, signed by singers such as Loretta Lynn and Crystal Gayle would be a nice piece to add. Finally, I believe that several photographs of our school academic teams and their trophies and awards should be included.

B. Each of the above items has a specific purpose in educating visitors about our culture. Firstly, Van Lear used to be a coal camp, and produced the majority of the county's coal in the past. We, today, still take pride in this fact, and we honor the many coalminers who sacrificed even their life for their job and community. Also, [redacted] County is highly known for the many country music stars it has produced. Considering we have a highway and a museum named for this, I believe it is very important. Lastly, [redacted] County is known internationally for its accomplishments in academic competitions. Our dedication and respect that we put into education in [redacted] County is a major part of our culture, and needs to be

made aware to visitors.

If all these things are put into the displays, tourists and visitors will be much more informed about our heritage and what takes priority in [redacted] County. Coal mining, country music, and education are essential parts of our region

Math



Activity: How Much Does It Cost to Light Your School?

(Information courtesy of the American Coal Foundation)

Overview:
Students compute the cost of electricity used to light their classroom and their school for various lengths of time. They then compute the amount of coal needed to produce the electricity used for one hour of light in their classroom.

Objectives:
Students will:

- calculate the cost of providing electricity to light their classroom and school,
- compute the amount of coal needed for one hour of light in their classroom, and
- gain an appreciation for how much coal is needed to generate electricity.

Materials:
Paper and pencil
Classroom and school lit by fluorescent bulbs

Discussion Questions:
How is your classroom lit?
Where does the electricity come from to power the lightbulbs in your classroom?
How much do you think it costs to light your classroom for one hour?

Procedure:
Begin by explaining to students that coal is used to produce more than half of the electricity consumed in the United States. Tell the students that they will use their computation skills to gain an appreciation for how much it costs, and how much coal is used, to light their classroom and school.

Tell the students that the electricity needed for the fluorescent tubes used to light most classrooms costs approximately three-tenths of a cent per hour. Write this fact on the blackboard for use in calculating. (The actual costs range from two-tenths of a cent to four and one-half cents per hour, depending on the locale.) Ask the students if they can figure out how to calculate how much it would cost to light their entire classroom for one hour. Explain that they can count the number of fluorescent tubes in the classroom (N) and multiply that number by .003 (or three-tenths of a cent). The answer is the total dollar cost (C) of lighting the classroom for one hour.

$$N \times .003 = C$$

Students can then compute the daily cost (DC) of lighting the classroom by multiplying C by the number of hours per day the classroom is lit (H):

$$C \times H = DC$$

Complete other calculations for lighting the classroom for the week, month, and year. Then have the students compute how much it costs to light the entire school for the day, week, month, and year. (Students will need to find out how many fluorescent tubes are in the school. They can estimate this by multiplying the number in their own classroom by the number of classrooms in the school.)

Explain to students that it takes approximately 1 ton of coal to produce 2,500 kilowatt-hours (kWh) of electricity (or 1 pound of coal to produce 1.25 kilowatt-hours). Write this fact on the blackboard or display it on the overhead projector. Explain that a kilowatt-hour is the unit of electric power used by 1,000 watts of energy for one hour. Tell them that the average fluorescent tube uses 18 watts per hour or .018 kilowatt-hours of power per bulb. Ask them if they can determine how to calculate the amount of coal needed to light their classroom. Remind them that 1 ton of coal can produce 2,500 kilowatt-hours of electricity, and that 1 pound of coal can produce 1.25 kilowatt-hours of electricity. Ask them to figure out how much coal (n) it takes to produce only .018 kilowatt-hour.

1 ton : 2,500 kWh = n ton : .018 kWh

(or 1 ton is to 2,500 kWh as "n" tons is to .018 kWh)

OR

1 lb. : 1.25 kWh = n lb. : .018 kWh

(or 1 pound is to 1.25 kWh as "n" pounds is to .018 kWh)

n = .0000072 ton or .014 lb.

This is the amount of coal needed to light one fluorescent tube for one hour. Students can now multiply this number by the number of tubes in the classroom (or school) to figure out how many tons of coal are needed to light the classroom (or school) for one hour.

Conduct a class discussion about the calculations. Were the students surprised by how much it costs to light their classroom or school? Were their findings more or less than they thought they would be? Did they have any idea how much coal was needed to provide electricity for fluorescent tubes? Tell them that regular lightbulbs use significantly more electricity (on average .075 kWh/bulb). Even though fluorescent tubes cost more to purchase, they are more economical in the long run, because the electricity needed to light them costs so much less. Encourage students to think about how much coal might be needed to provide light for their whole town.

Our Room

[redacted]

N = # of lights in our room

N X .003 = C

36 X .003 = .108

C X H = DC
(cost) (Hours) (Daily cost)

1 Day	.108 X 8 = .864
Week	.108 X 40 = 4.32
Month	.108 X 160 = 17.28
Year	.108 X 1440 = 155.52

Our School

1 Day	.864 X 24 = 20.736	.864 X 49 = 42.336
Week	4.32 X 24 = 103.68	4.32 X 49 = 211.68
Month	17.28 X 24 = 414.72	17.28 X 49 = 846.72
Year	155.52 X 24 = 3732.48	155.52 X 49 = 7620.48

1. Turn off half lights
2. Put in charge a light monitor
3. Turn off gym & cafeteria lights when not in use

How Much Coal

1 ton : 2,500 KWH = n tons : .018 KWH
1 lb : 1.25 KWH = n lbs : .018 KWH

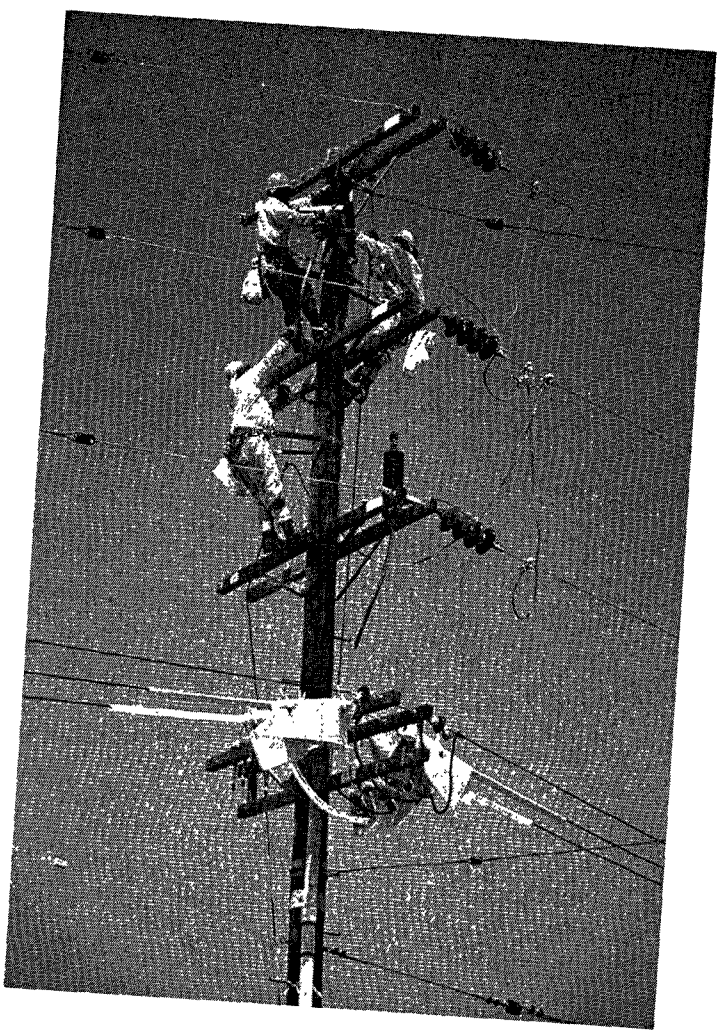
# of lbs of coal to light 1 tube 1 hour

n = .014 lb
.014 X 36 = .504 lbs of coal to light our room per hour
.504 X 8 = 4.032 lbs of coal to light our room all day
4.032 X 24 = 96.768 lbs of coal for 1 day in the school
97 X 180 = 17418.24 lbs of coal

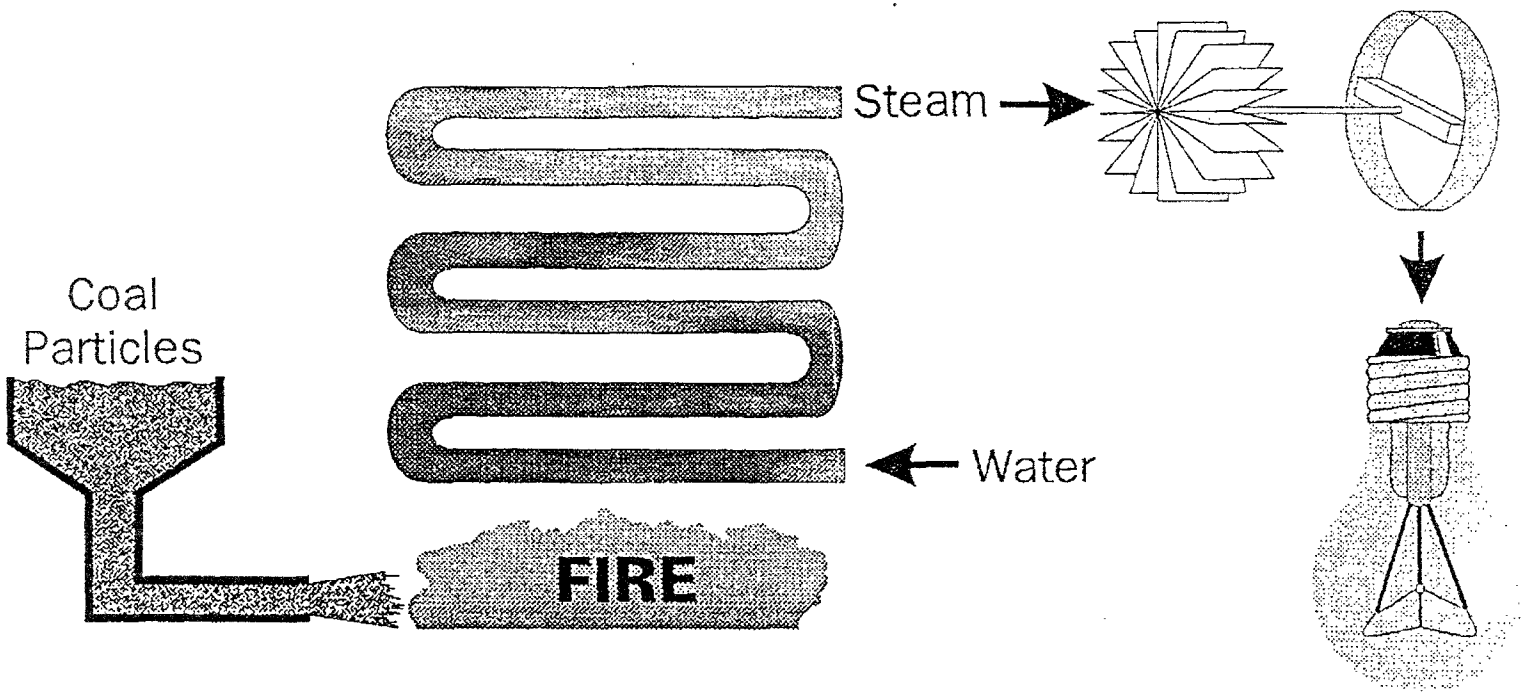
4.032 X 49 = 197.568 lbs of coal per day
197.568 X 49 = 9680.832 lbs of coal per year

35562.24

Science



How Electricity Is Made



1) Coal is pulverized into tiny particles.

2) The coal is burned at temperatures greater than 2,500 degrees.

3) Water is super-heated to make it turn into steam.

4) The steam blows against a series of blades, making the blades and the shaft they are attached to, turn.

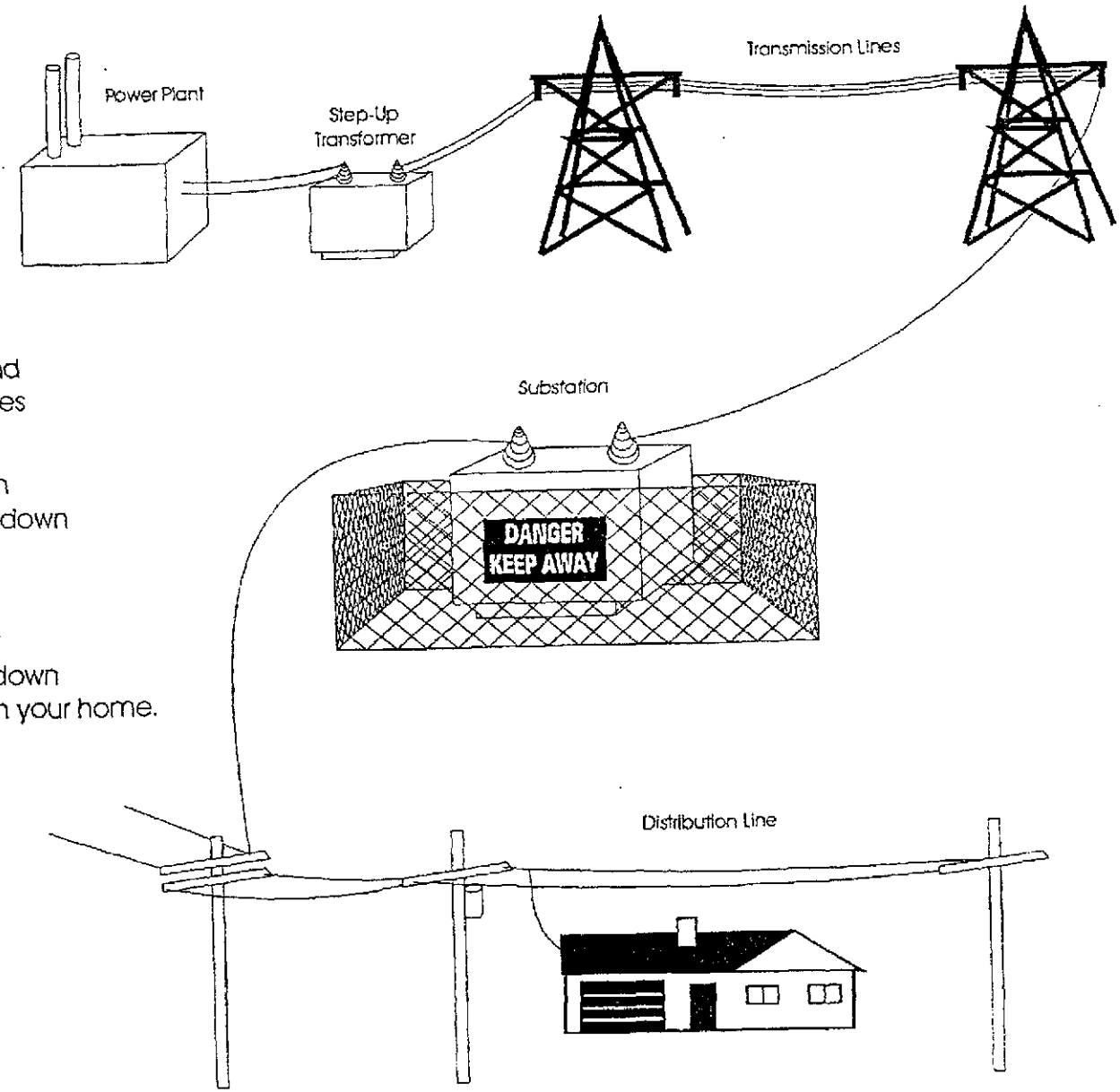
5) A magnet, which is attached to the other end of the shaft, moves at right angles to a coil of wire, producing electricity.

How Electricity Gets From The Power Plant To Your Home

1) Electricity is produced at the power plant and is sent to a step-up transformer that increases the voltage so it can travel long distances.

2) The electricity then travels along transmission lines until it reaches a substation that steps-down the voltage for distribution.

3) The electricity travels along distribution lines, going through another, smaller transformer attached to a distribution pole, that steps-down the voltage even more so it can be used in your home.



Name _____

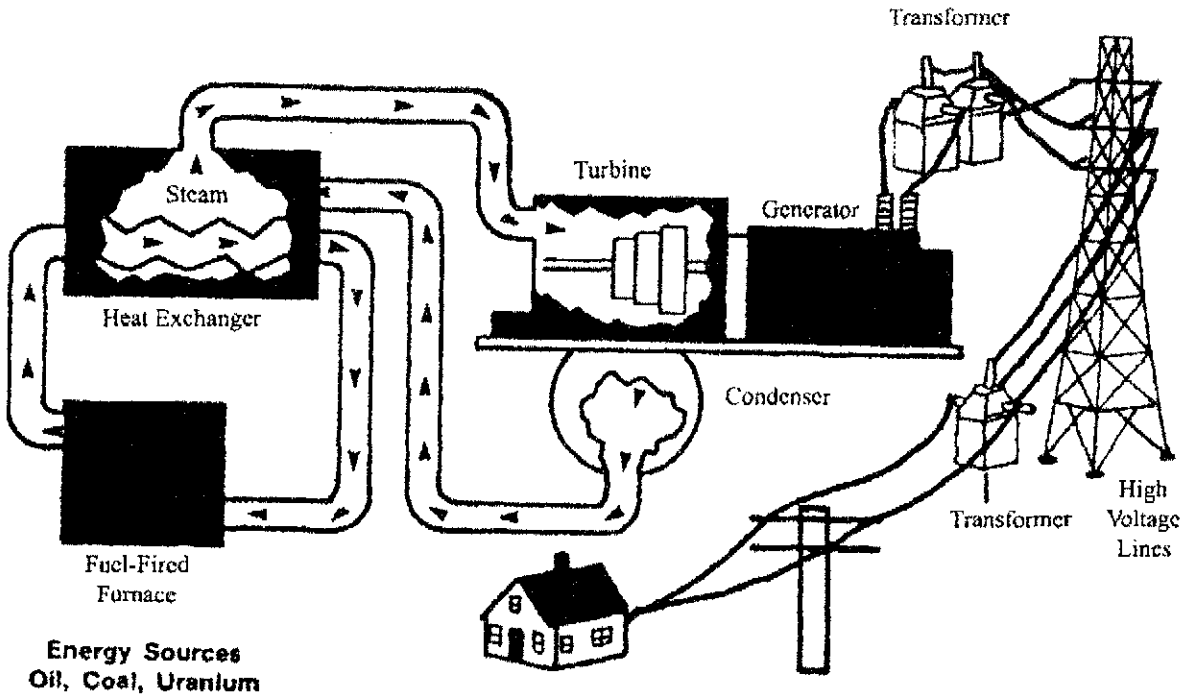
4

GENERATING ELECTRICITY
from the series Electricity and Magnetism

POWER PLANT

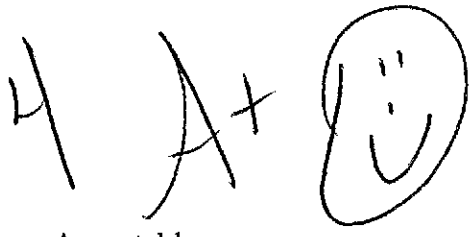
Here is a illustration showing the steps involved in developing electricity.

Explain the process, starting with the fuel-fired furnace and ending with electricity in the home.



[redacted]

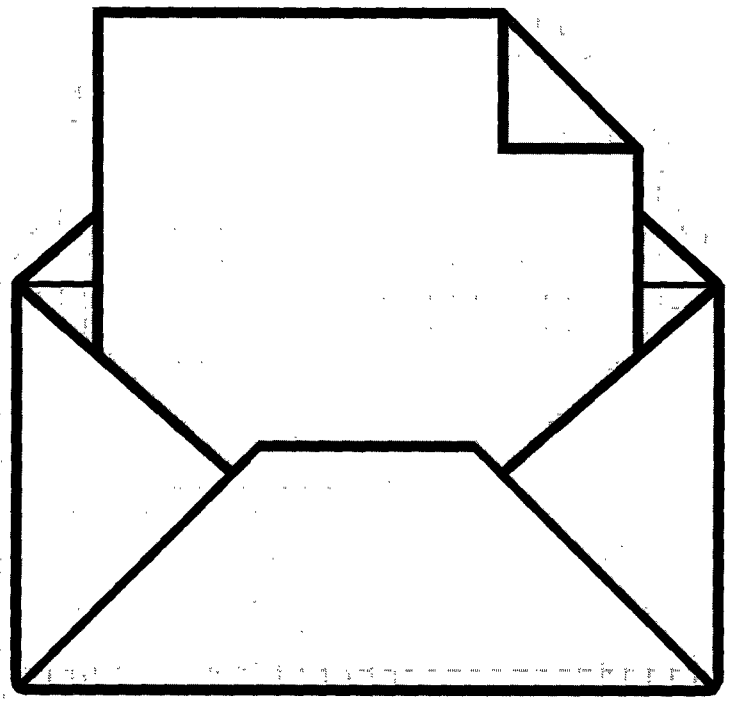
A. The Process of getting electricity in a home starts at the Power Plant. It begins when the Power Plant burns coal. As the coal is burind it heats water into steam. This steam is used to spin a turbine that makes a giant magnet spin. This magnet is spun in a area surrounded by metal coils. The creates an electrical current. The current (flow of electrons) goes through the metal to something called a step-up transformer that increases the voltage of the current. This current travels to a step-down transformer that lowers the voltage to a safe level for use in the Home. The water and heat used in this process is reused to make it more efficent in order to Produce more electricity. Next time I flip on my lights, turn on my Tv, or take a hot shower, I will know how the electricity reached my home- it all began with coal!



Open Response Rubric

	Unacceptable		Acceptable	
	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
Higher-order thinking	Little to no evidence of elaboration, extension, higher-order thinking, or relevant prior knowledge	Limited evidence of elaboration, extension, higher-order thinking or relevant prior knowledge	Some evidence of elaboration, extension, higher-order thinking, and relevant prior knowledge	Contains elaboration, extension, and/or evidence of higher-order thinking and 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
Scientific vocabulary	Inappropriate vocabulary	Simplistic vocabulary; few scientific words defined	Acceptable vocabulary; majority of scientific terms defined	Strong use of scientific 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
Grammar	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

Language



Arts

Assignment: How Much Does It Cost to Light Our School?

Form: Persuasive letter

Audience: Principal

Purpose: To convince them to reduce the amount of energy/electricity used to light our school

****Use your research and information from math and science class!**

[redacted]

Dear Mr. [redacted]

Did you know it costs about $42.34 to light our school for one day? It takes about 197.60 lbs of coal to light our school for one day!

I think there are plenty of ways to reduce both of these things.

It's fairly easy to come up with this. The cost of lighting one room for one hour is $0.11. If you times that by eight (the number of school hours in a day) you get $0.86. That would be how much to light one room for the day! Times that by 49 (about the number of classrooms) and you get $42.34. Thats how much it is to light the school for one day.

I want to cut down the lighting bill for the school. I love [redacted]!

There are lots of ways to go about doing this. One way is to turn off half of the lights in classrooms. You can still see just as good as it would be with both sets of lights on.

Another way is turning off lights when there not used! We all know the gyms light take forever to turn back on! Those few minutes of inconvience are worth it though!

[redacted]

One other way to [redacted] energy and coal is to put the students in charge of monetthy the lights in their team. like maybe two per team? They could monitor and turn off the lights when necesary.

Of cowse, I understand you may have diffrat opinons than I do. However the "light monitors" i told you about could inforce all of these ways with no problems! So there is really no reason why not to do these things!

There are may way, other than the ones i listed to save enogy and coal! You can turn off unnesceSury lights and have student "light monitors" inforce it! Remember it [redacted] 197.60 lbs of coal to light ow School for one day. If we don't do this then coal will keep being wasted when theres hardly any coal left! We need to save enogy and help the earth!

Sincearly,
yow student

Student/Teacher Evaluation

Name: [redacted]

Lesson: How much does it Cost to light your School

1. What did you like best about this lesson?

Finding Out that the price to light our School, and know that It takes MTons of Coal to light our School For a year.

2. What would you change to make this lesson better?

what I would change to make this lesson better would be to turn off half the lights in each Classroom than look at the difference and how much Coal we saved.

3. What could we do as a follow-up activity to this lesson?

we Could tell people about how much money and Coal we use and than havea School progam telling teachers and Students to turnoff the lights and show them how much Coal were using.

4. What did you learn from this lesson? How can you use this information in your daily life?

I learned that it takes MTons of Coal per year to light our School. I Could turn out my lights whenever Im not in my room, Oranother room in my house. I Could talk to the teachers and principals that it would Save us Coal and money.

Please rank the lesson based on writing component, collaboration, real-world connection, and level of engagement.

1 lump (peat)	2 lumps (lignite)	3 lumps (bituminous)	4 lumps (anthracite)




Student/Teacher Evaluation

Name: [redacted]

Lesson: From Coal to Electricity

1. What did you like best about this lesson?

Students liked the interactive webquest. Also, video had good visuals with "easy to understand" direction

2. What would you change to make this lesson better?

If given time, students could demonstrate their knowledge of the process through art, writing, song, etc.

3. What could we do as a follow-up activity to this lesson?

Field trip to a coal burning power plant

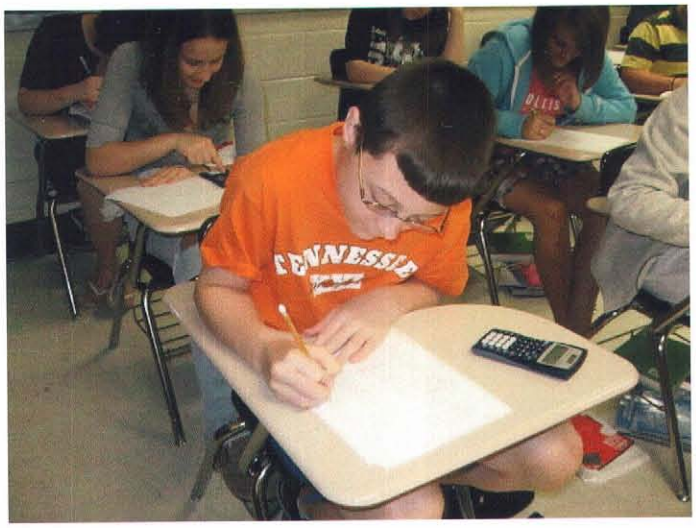
4. What did you learn from this lesson? How can you use this information in your daily life?

I learned that students did not have a grasp of how coal was used to generate electricity. After the lessons, over 93% of the students scored proficient and/or distinguished on the open response.

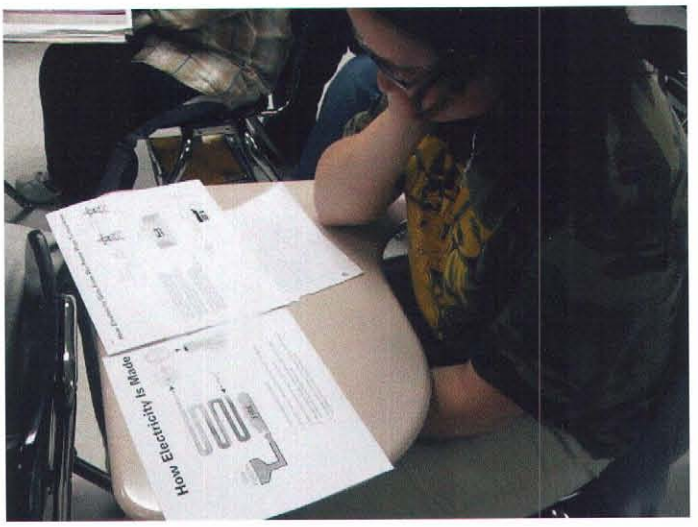
Please rank the lesson based on writing component, collaboration, real-world connection, and level of engagement.

1 lump (peat)	2 lumps (lignite)	3 lumps (bituminous)	4 lumps (anthracite)

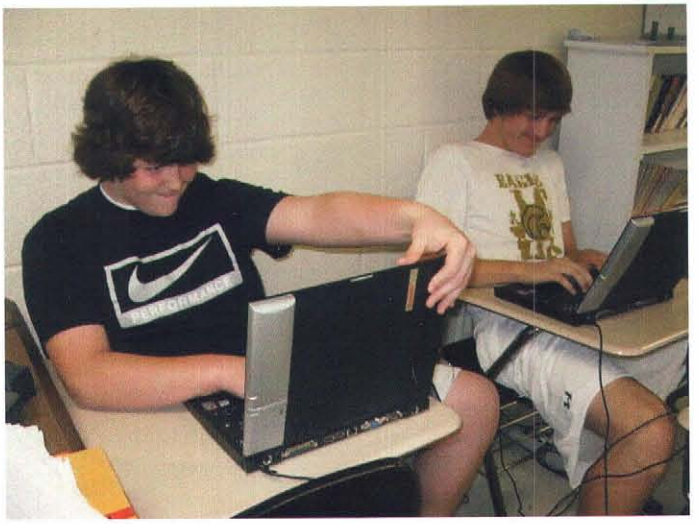
After studying the elements of culture, students completed open responses describing how the coal industry has influenced our culture.



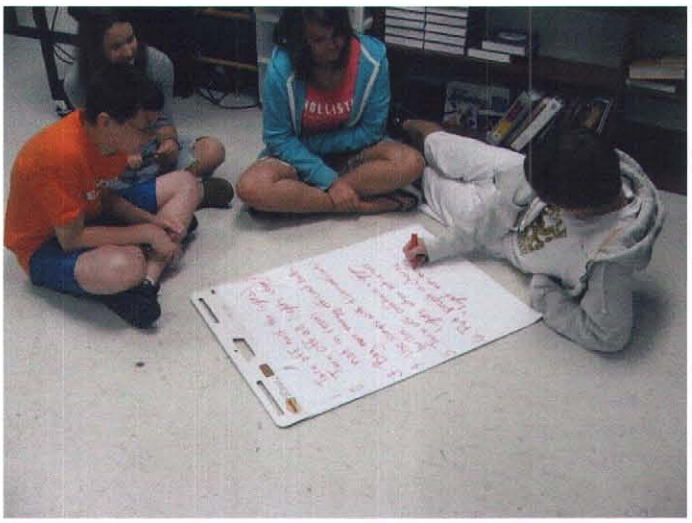
During math class, students calculated how much it costs to light our school. They couldn't believe the numbers!



Students studied a diagram of how electricity is generated and were then asked to explain the process as part of an open response.

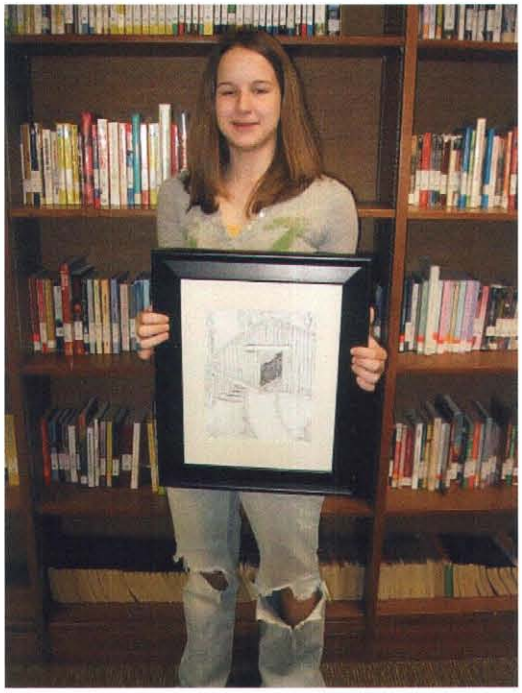


Students researched electricity through a webquest. They explored how coal generates electricity, how electricity reaches your home, and how we can conserve electricity.

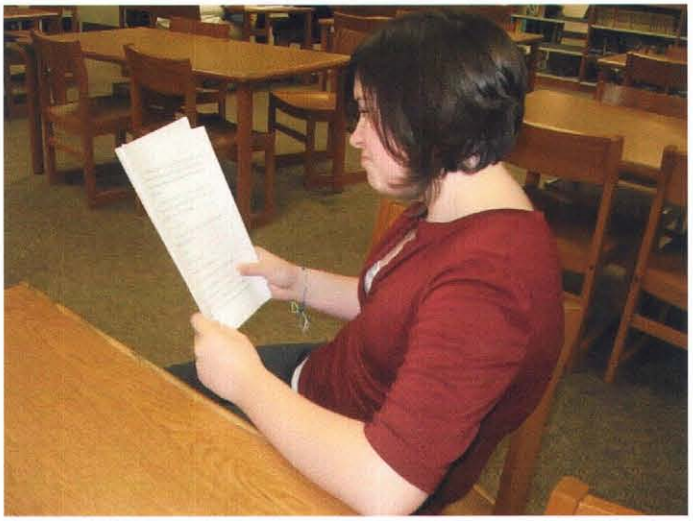


Students worked in collaborative groups to brainstorm ways our school could save money on our lighting bill. They were very creative!

During language arts, students wrote persuasive letters to the principals encouraging them to cut back on energy use, specially lighting.



Students proudly presented their coal fair projects to teachers, parents, and fellow students.



Many students read aloud their English coal fair projects to the judges.

Students not only gained valuable knowledge about the coal industry, they were able to demonstrate their proficiency in creativity, writing, and public speaking.