

# Coal Products in Your Home

## Sandy Claus

### Wyoming Geographic Alliance

**Overview:** Coal produced in the Powder River Basin is used to produce electricity in coal-fired power plants. Fly ash, bottom ash, and boiler slag are formed when coal is burned. The byproducts of coal fired power generation are used for many common, household items. By creating an awareness of the consumer products made from fly ash, bottom ash, and boiler slag, you will introduce the students to the dependence consumers have on coal, which is a non-renewable resource.

**Teaching Level:** Fourth through Sixth Grade level

**Connection to the Curriculum:** Earth Science, Geography, Social Studies, and Economics

**Connections to the National Geography Standards:**

Standard 1: How to use maps and other Geographic representations, tools and technologies to acquire, process, and report information from a spatial perspective.

Standard 11: The patterns and networks of Economic Interdependence on Earth's surface.

Standard 16: The changes that occur in the meaning, use, distribution and importance of resources.

**Wyoming Social Studies Standards:**

**SS4.3.1** Students describe the importance of major resources, industries, and economic development of the local community and Wyoming.

**SS8.2.2** Students apply the themes of geography to topics being studied.

**SS11.3.3** Students describe the impacts of global economic interdependence.

**Time:** Allow two 1 hour class periods, one for defining, locating coal reserves and predicting. The other hour is for creating a poster, debriefing and discussion.

**Materials:**

- Book-C is for Cowboy: A Wyoming Alphabet; written by Eugene Gagliano and Illustrated by Susan Guy
- **24** Baggies with pieces of coal in each, one to represent each coal mine in Wyoming
- Copies of the Wyoming Coal Mines map from the Wyoming Mining Association web site, printed ahead of the lesson.
- 5 paper bags with these materials distributed equally amongst the bags: abrasives, baking powder, batteries (one for each bag), chalk, concrete (small pieces), fertilizer, golf balls, insulation, linoleum, mothballs, paint, paper clips, perfumes, pens, plastic, rubber bands, shingles, sugar substitute, trays, pine cones (one for each bag), bananas or apples (one for each bag), pencils, paper, CDs (one for each bag), candles (one for each bag), crayons, eye makeup, cover-up makeup  
Some items may be placed in more than one bag to make sure that each bag has at least 12 items.
- Picture cards (at the end of this lesson) of electric appliances labeled "Electricity" for each bag. \*Make sure each bag has at least 12 items
- Markers
- Tape
- 12 feet by 12 feet Wyoming floor map
- Poster Board

**Objectives:** Students will

- Identify and locate Wyoming coal mines.
- Identify by-products of coal
- Create a poster display of products from coal and products that are made from the byproducts of coal fired power generation-fly ash, bottom ash and boiler slag

**Geographic Themes or Skills:**

- Human environment interaction
- Acquiring geographic information
- Organizing geographic information

-Analyzing geographic and geologic information

## SUGGESTED PROCEDURE

### Opening:

Explain that coal provides 43% of the nation's electricity and Wyoming supplies 40% of the nation's supply of coal. Show students there are other products besides electricity that coal fired power generation byproducts are used to create. Define flyash, bottom ash, and boiler slag.

- Fly ash: Exhaust gases leaving the combustion chamber of a power plant entrain particles during the coal combustion process. To prevent fly ash from entering the atmosphere, power plants use various collection devices to remove it from the gases that are leaving the stack. Fly ash is the finest of coal ash particles.
- Bottom ash: With grain sizes ranging from fine sand to fine gravel, bottom ash is coarser than fly ash. Utilities collect bottom ash from the floor of coal burning furnaces used in the generation of steam, the production of electric power, or both. The physical characteristics of the residuals generated depend on the characteristics of the furnace.
- Boiler Slag: Boiler slag consists of molten ash collected at the base of cyclone and pulverized coal boilers. Facilities cool boiler slag with water, which then shatters into black, angular pieces that range in size from coarse sand to fine gravel and have a smooth appearance.

### Development/Procedure:

- Read page U from the alphabet book, C is for Cowboy, A Wyoming Alphabet Book. Have students examine the map shown on the page of all of the coal reserves that are in Wyoming. If the book is not available, use the attached map of Wyoming coal fields.
- Have each group of students take five mines, find them on the desk maps, and place one of their baggies of coal on the FLOOR map where it would go according to the Wyoming Coal Mines DESK map that has been printed before the lesson. Discuss: Are there mines close to you? How many of your parents either work at a mine or for a mining support industry? Do you think we will ever run out of coal?

- Coal Mines in Wyoming:  
Powder River Basin- Buckskin, Rawhide, Eagle Butte, Dry Fork, Wyoak, KFx, Caballo, Belle Ayr, Cordero Rojo, Coal Creek, Jacob's Ranch, Black Thunder, Antelope Rochelle, North Rochelle, Antelope, Dave Johnston  
Big Horn Basin-Big Horn, Grass Creek  
Hanna Coal Field-Shoshone #1, Medicine Bow, Seminoe #2, Elk Mountain  
Ham's Fork Region-Kemmerer  
Green River Coal Region-Bridger, Black Butte, New Stansbury

<http://www.wma-minelife.com/coal/coalhome.html>

Distribute the bags of materials with 12 items in each paper bag.

Working in groups, each student group will make two piles. They will label one pile, "Products from Coal" (Byproducts of coal-fired Generation Power Plants). The other pile will be labeled "Products from Other Resources".

- Students will take turns in their group removing their items one at a time and discuss if they think the item should be placed with the "Products from Coal" pile, or "Products from Other Resources".
- Once all of the items are placed, they have a minute to re-examine and discuss.
- After the sorting and discussion are completed, each group will check with the teacher, and receive the answer "key" to see if their predictions were correct.
- Items will then be placed on the map by one of the "coal mines" if they belong there. It doesn't matter which mine they chose to place their items at, just have them try to have students place the items at each of the mines on the floor map.
- Have students chose different "Products from Coal" and research how they were made. Instruct the students to make a small poster to illustrate how their coal product was made and how coal played a part in its production. Present those posters to the class when they are completed.

**Closing:**

Discuss the way they classified the items. Were they surprised by what they found out? What will happen to those items when we run out of coal? Are there other ideas of materials that could be used? Do they think they will be looking at the items they look at differently from now on? How can we conserve and use these things more wisely? Do they think it is safe to use some of these items after knowing what was used to make them? How is the economy of the state affected by the products we make from coal? What do you think will happen to some of the towns when we run out of coal?

**Suggested Student Assessment:**

Students will demonstrate successful accomplishment of this lesson by:

Creating a poster that illustrates how coal was used to produce a product. 10 points

Demonstrating an understanding of the effect products made from coal has on our community through a journal entry, discussion and participation. 10 points

Demonstrate awareness of the abundance of, and location of coal resources in Wyoming by locating and labeling mines on a blank map of Wyoming. Locate 7 out of 10 mines correctly. 10 points

**Extending the Lesson:**

Students can investigate other energy resources in Wyoming and products of those resources.

Examine ways to recycle some of the byproducts of coal fired power generation.

Begin to study renewable and non-renewable resources and explore ways to become more independent of non-renewable and more dependant on the renewable.

**Resources:**

Wikipedia

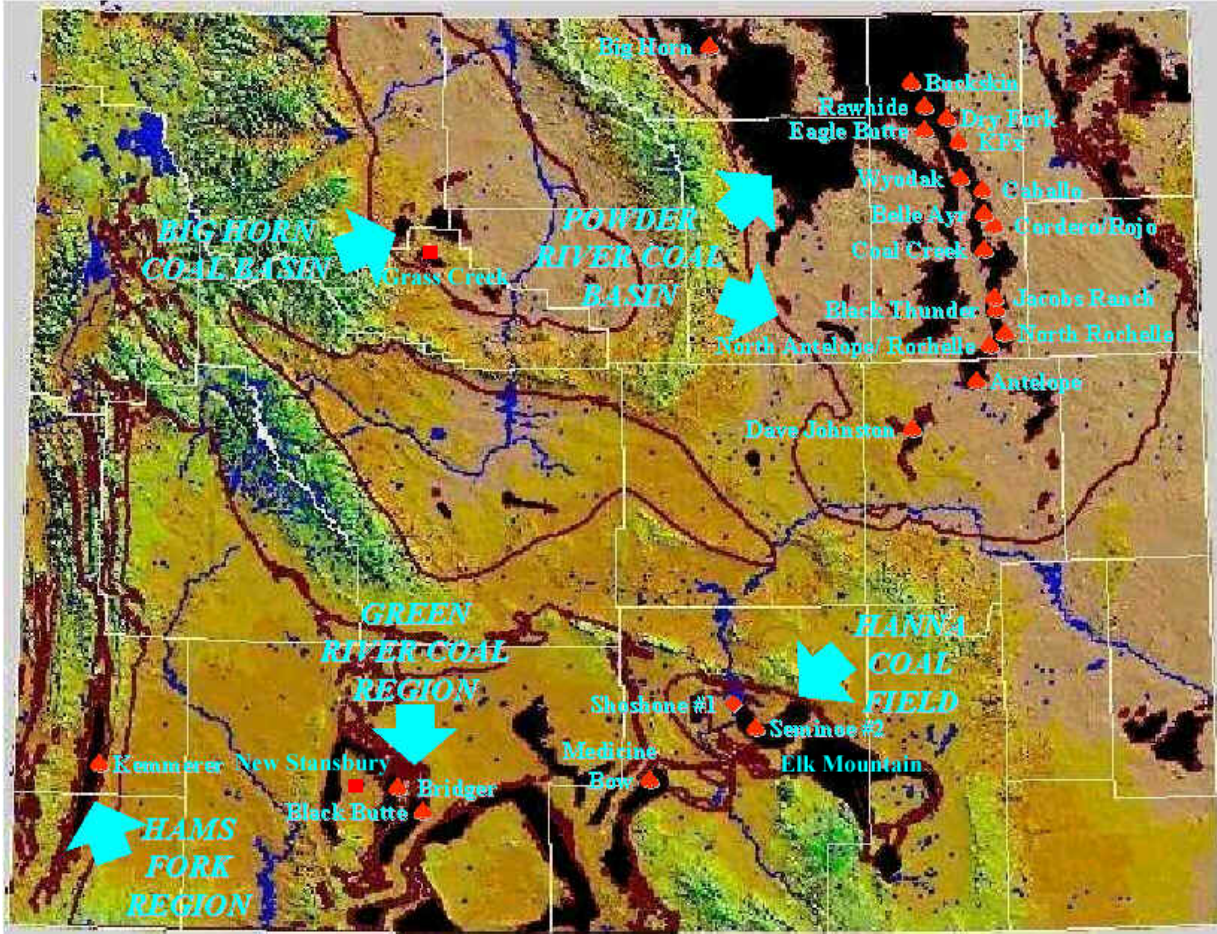
Gagliano, Eugene; C is for Cowboy; A Wyoming Alphabet Book

<http://www.teachcoal.org/teacherstore/documents/CoalActElem.pdf>

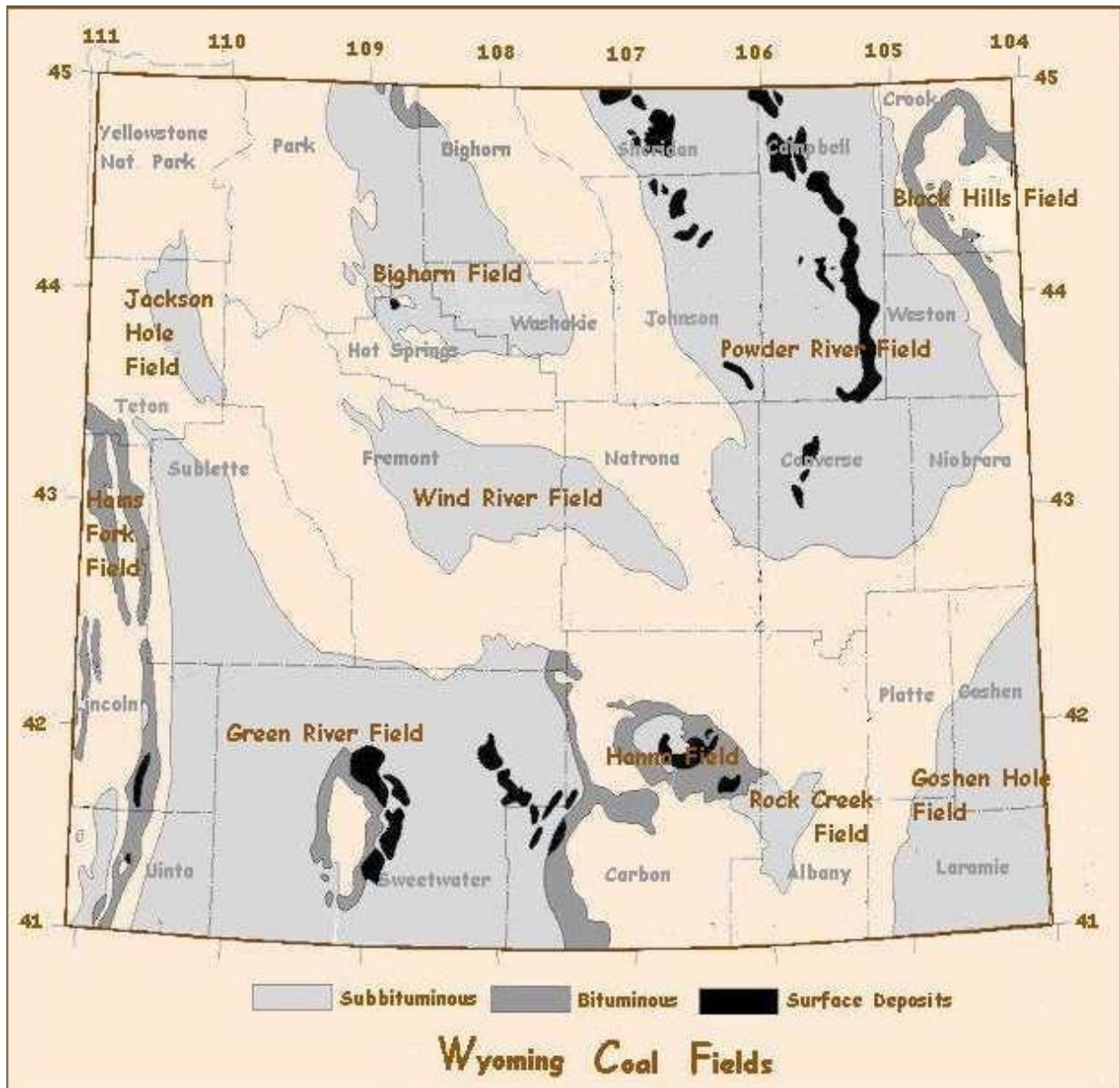
<http://www.wma-minelife.com/coal/coalhome.html>

[http://www.coaleducation.org/lessons/primary/uses/find\\_coal.htm](http://www.coaleducation.org/lessons/primary/uses/find_coal.htm)

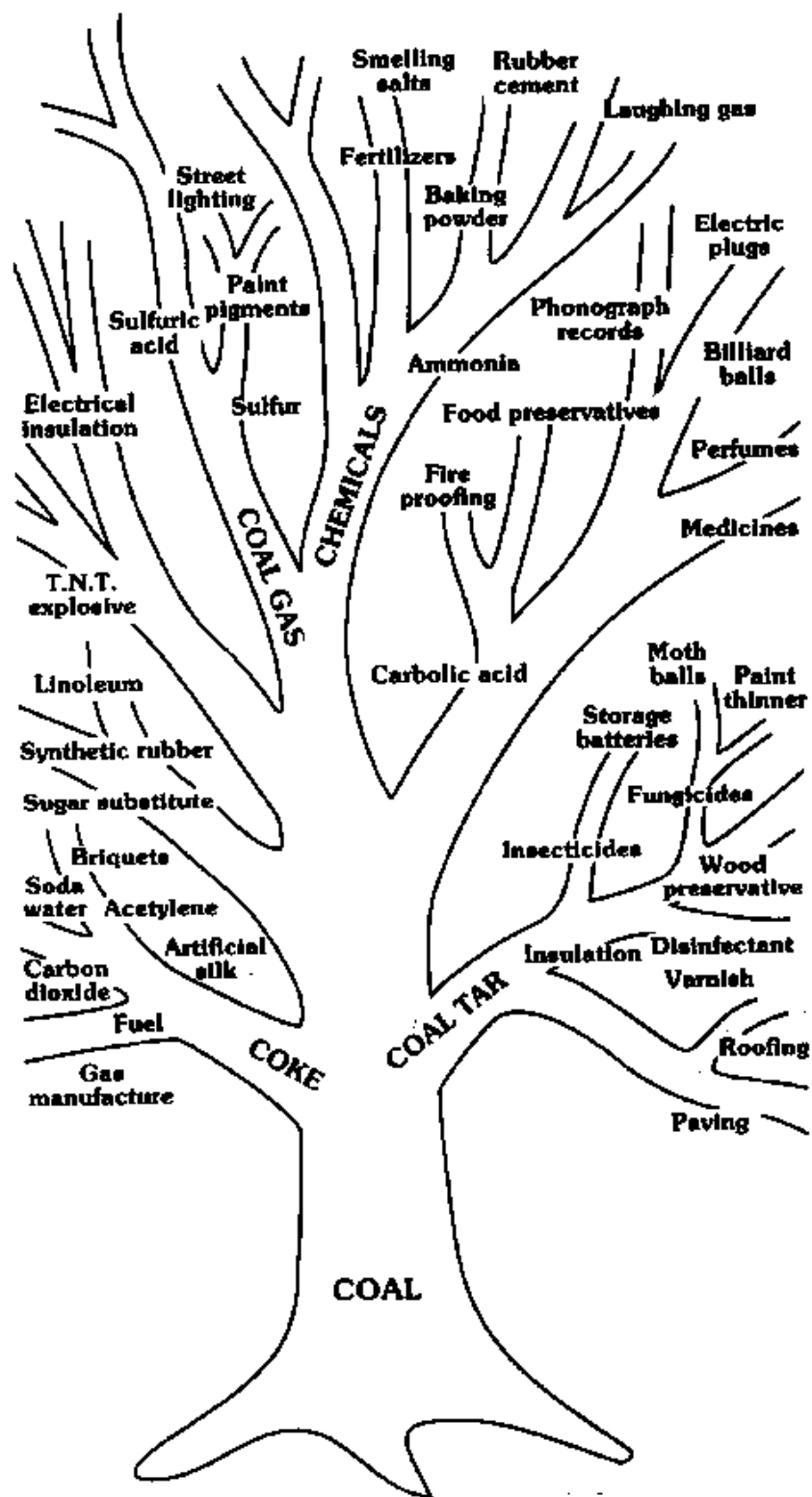
<http://www.epa.gov/wastes/nonhaz/define/pdfs/coal-combust-final.pdf>



<http://www.wma-minelife.com/coal/coalhome.html>













Answer Key:

Products made from coal by products:

Abrasives

Baking Powder

Batteries

Chalk

Concrete

Fertilizer

Golf Balls

Insulation

Linoleum

Mothballs

Paint

Paper clips

Perfume

Pens

Plastic

Rubber bands

Shingles

Sugar Substitute

Tray

Crayons

Eye makeup

Cover-up makeup

Electricity for appliances

Products from other Sources

Paper

Pine cones

Bananas, apples or oranges

candles