Name _____
Energy and Resource Packet

# Dig A Little Deeper

## How Many Minerals and Metals Does It Take to

# Make A Light Bulb?

**Bulb**
Soft glass is generally used, made from *silica, trona (soda ash), lime, coal, and salt*. Hard glass, made from the same minerals, is used for some lamps to withstand higher temperatures and for protection against breakage.

**Gas**
Usually a mixture of *nitrogen* and *argon* to retard evaporation of the filament.

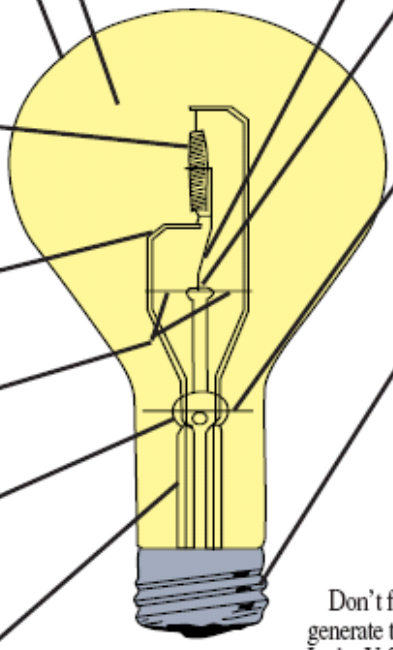
**Filament**
Usually is made of *tungsten*. The filament may be a straight wire, a coil, or a coiled-coil.

**Lead-in-wires**
Made of *copper* and *nickel* to carry the current to and from the filament.

**Tie Wires**
*Molybdenum* wires support lead-in wires.

**Stem Press**
The wires in the glass are made of a combination of *nickel-iron* alloy core and a *copper* sleeve.

**Fuse**
Protects the lamp and circuit if the filament arcs. Made of nickel, manganese, copper and/or silicon alloys.



**Support wires**
*Molybdenum* wires support the filament.

**Button & Button Rod**
Glass, made from the same materials listed for the bulb (plus lead), is used to support and to hold the tie wires placed in it.

**Heat Deflector**
Used in higher wattage bulbs to reduce the circulation of hot gases into the neck of the bulb. It's made of *aluminum*.

**Base**
Made of *brass ( copper and zinc)* or *aluminum*. One lead-in wire is soldered to the center contact and the other soldered to the base.

Don't forget the mineral fuels needed to generate the electricity to light up the bulb. In the U.S., these are the sources of our fuels

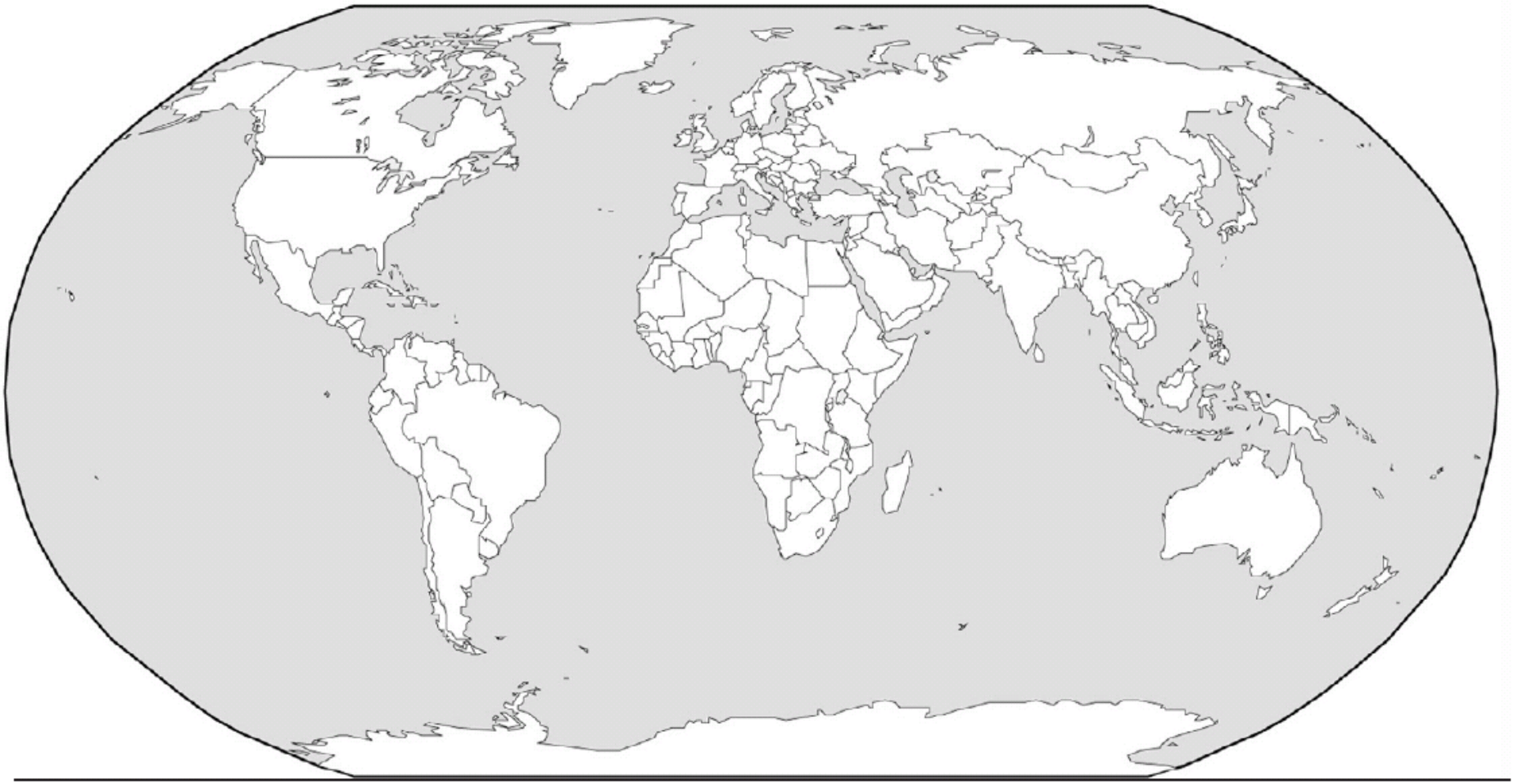
| Coal | Nuclear | Hydro | Natural Gas | Oil | Other |
|---|---|---|---|---|---|
| 52 % | 20 % | 7 % | 16% | 3 % | 2 % |

For information about minerals in society, go to:
**Mineral Information Institute, www.mii.org**

**Science:** *What makes the bulb work?* **Predict:** *Design light bulbs for the future.*

**Math/Art:** *Explore shapes & sizes. Light bulb picture collage.*

**Geography:** *Research & ID the states and countries producing these minerals.*



Make a symbol key or color key for each of the resources listed. Place the symbol or color in the appropriate country producing this resource.

# Where In The World Are The Resources To Make A Light Bulb

| Raw Material | Major Countries Supplying the U.S. |
|---|---|
| *Silica (sand)* | USA— quarries throughout the U.S. |
| *Limestone* | USA— numerous mines in the U.S. |
| *Trona* | USA— soda ash (85% from Wyoming) |
| *Nitrogen* | USA— manufactured from liquid air |
| *Argon* | USA— manufactured from liquid air |
| *Manganese* | Russia; South Africa; Brazil; China |
| *Tungsten* | China; Russia; USA (Calif. & Colo.) |
| *Copper* | Canada; USA; Chile; Russia; Zambia |

| Raw Material | Countries Supplying the U.S. |
|---|---|
| *Molybdenum* | Canada; USA |
| *Aluminum* | Australia; Guinea; Jamaica |
| *Zinc* | Canada; Russia; Australia |
| *Coal* | USA; Russia; China |
| *Salt* | USA; China; Russia |
| *Nickel* | Canada; Australia; Russia |
| *Lead* | USA; Russia; Australia |

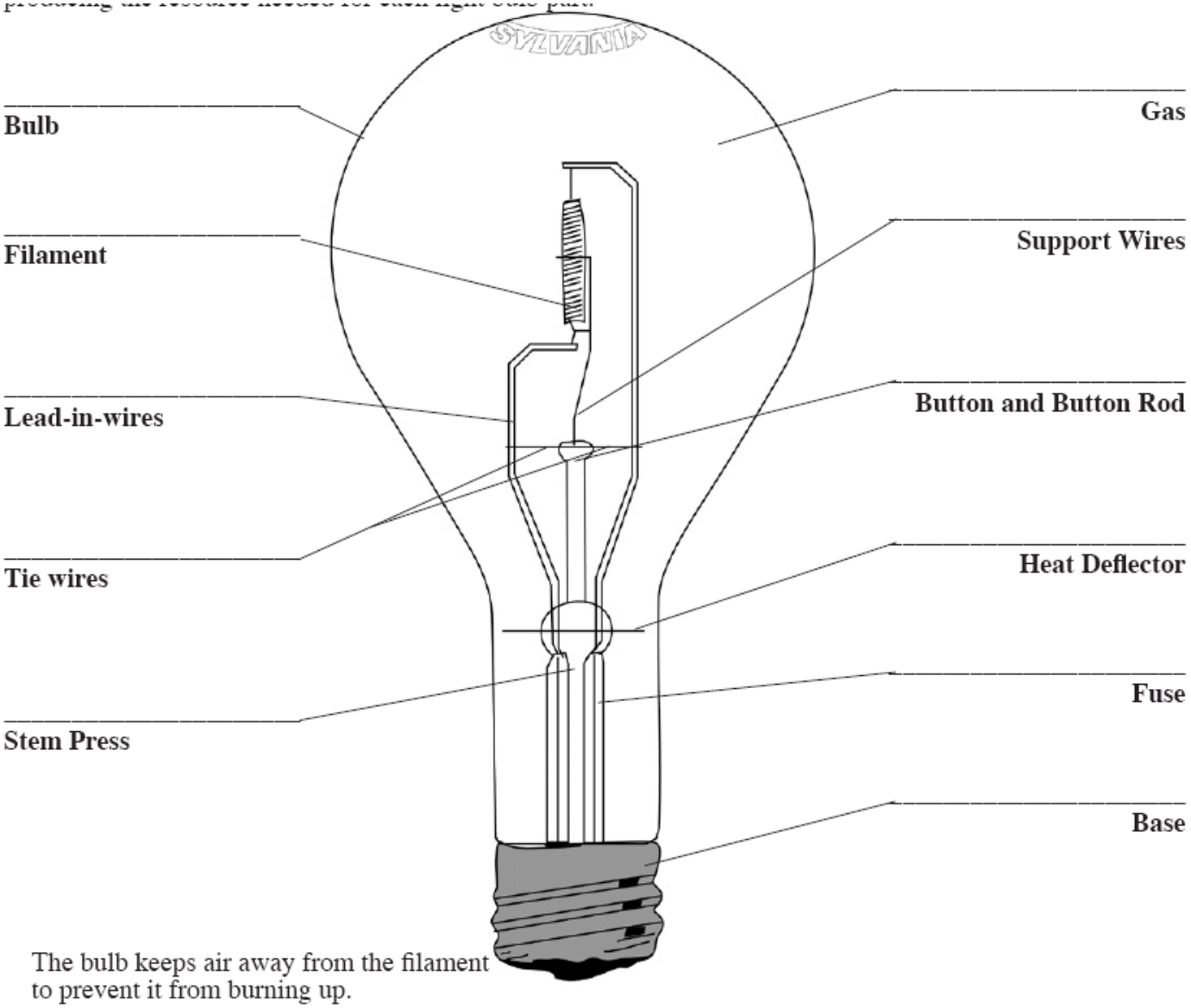
Russia is used for all former Soviet Union countries.

# Parts from all over the world

Using the information from page 1-2, fill in the blanks by the light bulb with the name of the states or countries producing the resource needed for each light bulb part.

What do you think would happen if one of the parts was removed from the bulb?

_____




The bulb keeps air away from the filament to prevent it from burning up.

Tungsten melts at about 6,100˚ F; most rocks melt at about 2,800˚ F.

Molybdenum is an extremely strong metal and has a high melting point.

Bauxite to make aluminum is not mined in North America.

The world supplies of soda ash are practically inexhaustible. Almost all U.S. trona comes from Wyoming.

Copper is an excellent conductor of electricity and heat. Incandescent means *glowing with heat.*

Lithium, a metal, is also used in the glass to keep heat from turning it black.

Electricity doesn't come from the light switch on the wall, it comes from power generating plants. More than half of the electricity that is used in the United States is provided by burning coal.

How much coal does your family need to provide the electricity you use everyday? And where does it come from? One ton (2,000 pounds) of coal can produce 2,500 kilowatts (kwh) of electricity.

Examples of how much coal is used each year by a family of four to produce the electricity needed to operate various appliances.

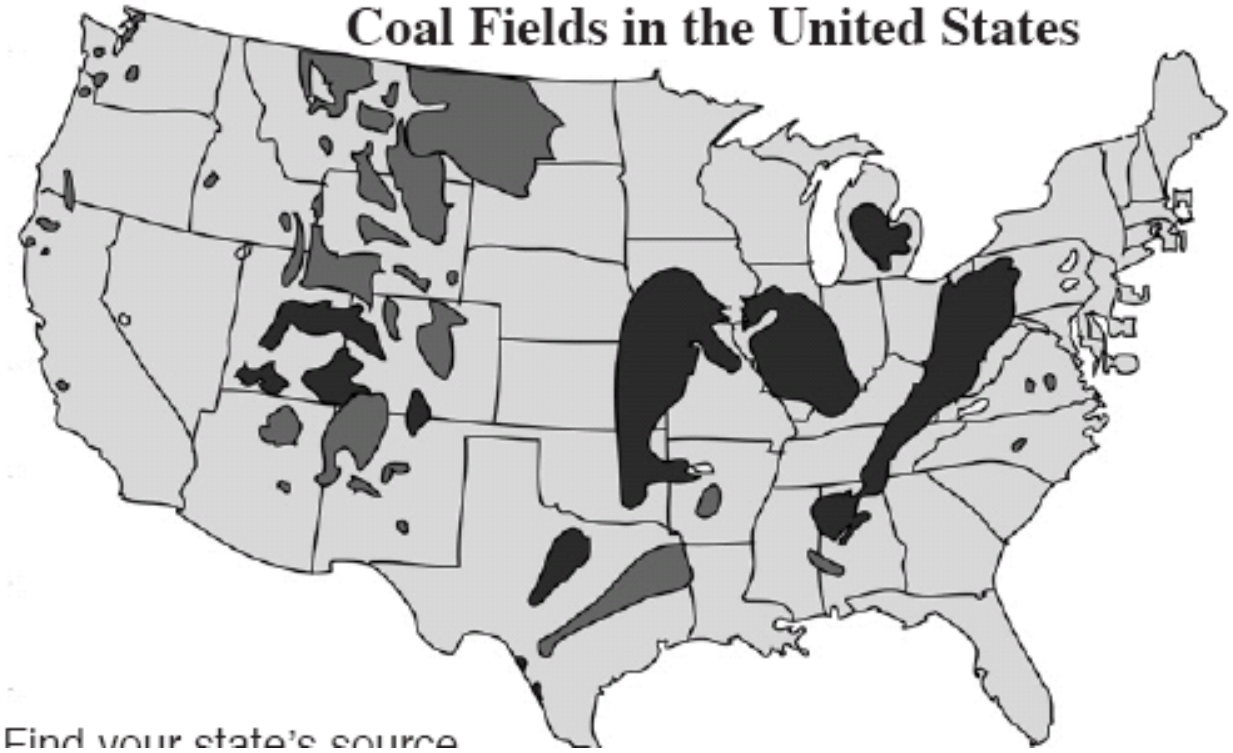
| | | | |
|---|---|---|---|
| Electric water heater | 3,375 pounds | Hairdryer | 20 pounds |
| Electric stove and range | 560 pounds | Vacuum cleaner | 37 pounds |
| Color television | 256 pounds | Clock | 14 pounds |
| Electric iron | 48 pounds | | |

About 7,500 pounds of coal is mined every year for every person in the U.S., most to produce electricity.

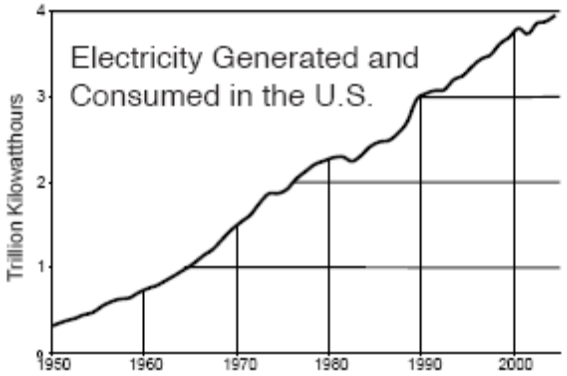
About 7,500 pounds of natural gas is used every year for every person in the U.S. to make electricity or is burned for heating.

About 1/4 of a pound of uranium is used every year for every person in the U.S. to make electricity.

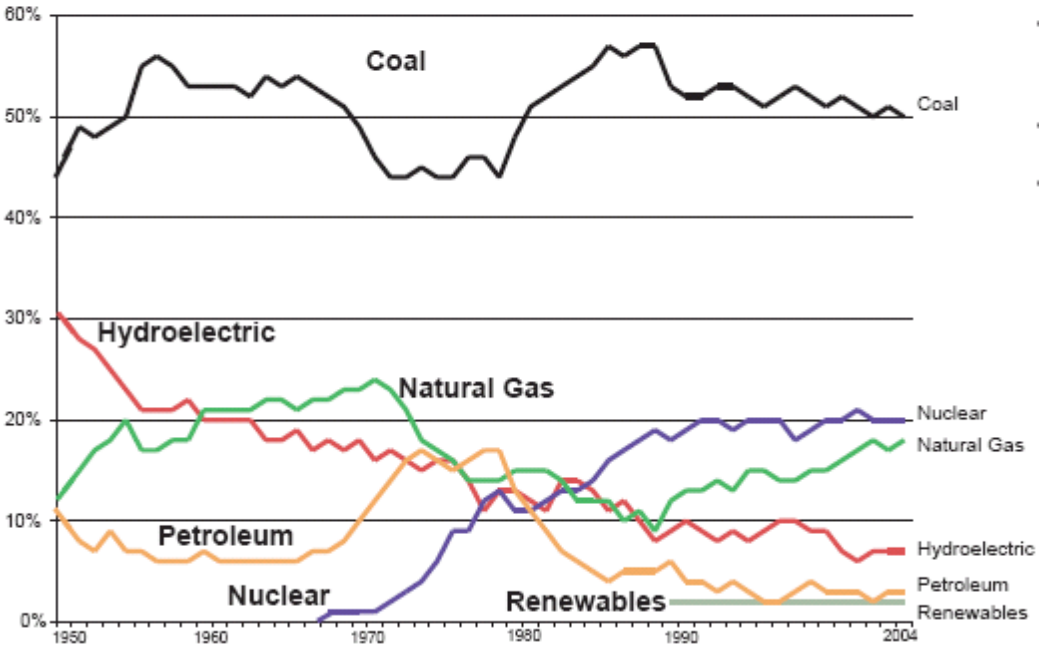
## Coal Fields in the United States



Find your state's source




## Fuels Used to Generate Electricity in the U.S.

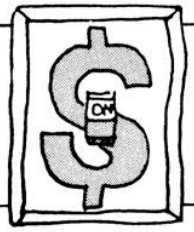



1. What is the major fuel used to generate electricity? _____
2. Which fuel source has increased the most in the last 50 years? Why?

   _____
3. Which has decreased the most? Why?

   _____
4. Why do you think more electricity is being used today than 50 years ago?

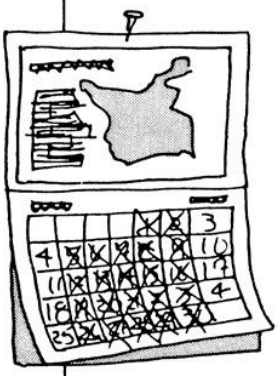
   _____



# How much does it cost to light your school?

## Materials

Pencil and paper
Classroom with fluorescent bulbs
Chalkboard and colored chalks
OR
Newsprint pad and felt-tipped markers



First determine how much electrical energy it takes to light your classroom for 1 hour, then compute the cost. Record this amount on the table below.

| Number of tubes in your classroom | × | 0.3¢* | = | Cost per hour to light your classroom |
|---|---|---|---|---|

Then, compute how much it costs to light your classroom for 1 day. Record below.

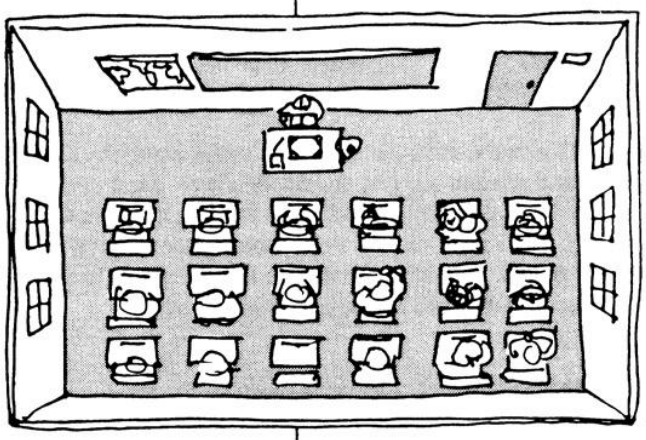
| Cost per hour to light your classroom | × | Hours per day classroom is lit | = | Cost per day |
|---|---|---|---|---|

***Note**

Fluorescent tubes cost about 3/10¢ per hour for the electricity needed to light them. The cost of electricity ranges from 0.013¢ to 0.038¢ per hour, depending on where you live.

How much does it cost to light your classroom for 1 week? 1 month? 1 year? How many kilowatt hours (kwh) of electricity were used?

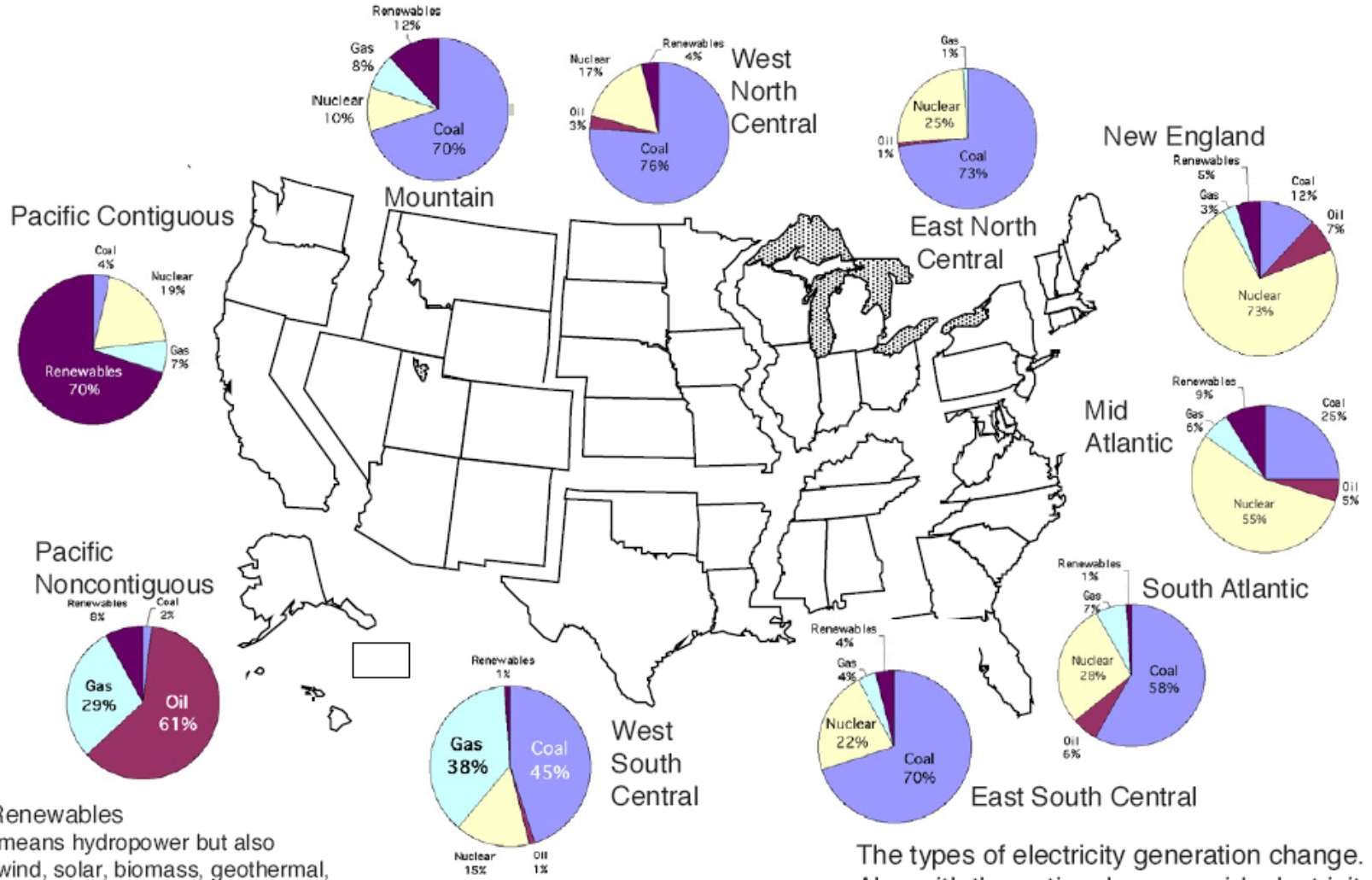
How many fluorescent tubes are there in your school? How many classrooms? How much does it cost to light your entire school for 1 hour? 1 day? 1 week? 1 month? 1 year? How many kwh of electricity were used? Record your calculations below.



| | Classroom | School |
|---|---|---|
| Cost per hour | | |
| Cost per day | | |
| Cost per week | | |
| Cost per month | | |
| Cost per year | | |
| Kilowatt hours used | | |
| Tons of coal used | | |

An average 2500 kwh of electricity are produced by burning 1 ton of coal. How many tons of coal would it take to light your classroom? Your school?

# Different Regions of the Country Rely on Different Generation Mixes for Electricity




Renewables
primarily means hydropower but also includes wind, solar, biomass, geothermal, and others.

The types of electricity generation change. Also with the national power grid, electricity is shared among the regions and even across country borders.

Source of statistics: Energy Information Administration; Electric Power Monthly.
www.eia.doe.gov/emeu/reps/states/maps/

How is your electricity created?

# Sources of Energy in the United States

## Energy History of the United States— 1845 to Today

**Energy statistics are constantly changing**

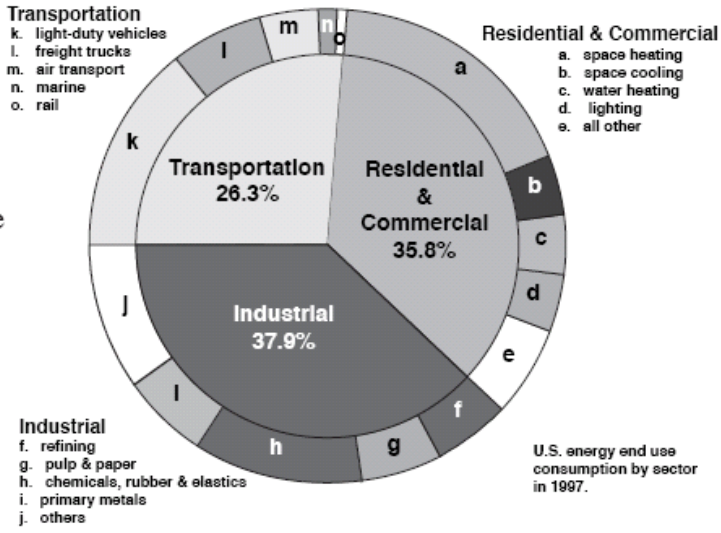
**Today—**

Transportation accounts for 66% of all petroleum consumption.

90% of all coal mined in the U.S. is used to generate electricity; 51% of all elecricity used comes from coal.

Nearly 75% of Hydro is used to generate electricity, yet only five states account for two-thirds of total renewable electricity generated in the U.S.

Nuclear power provides 20% of all electricity.



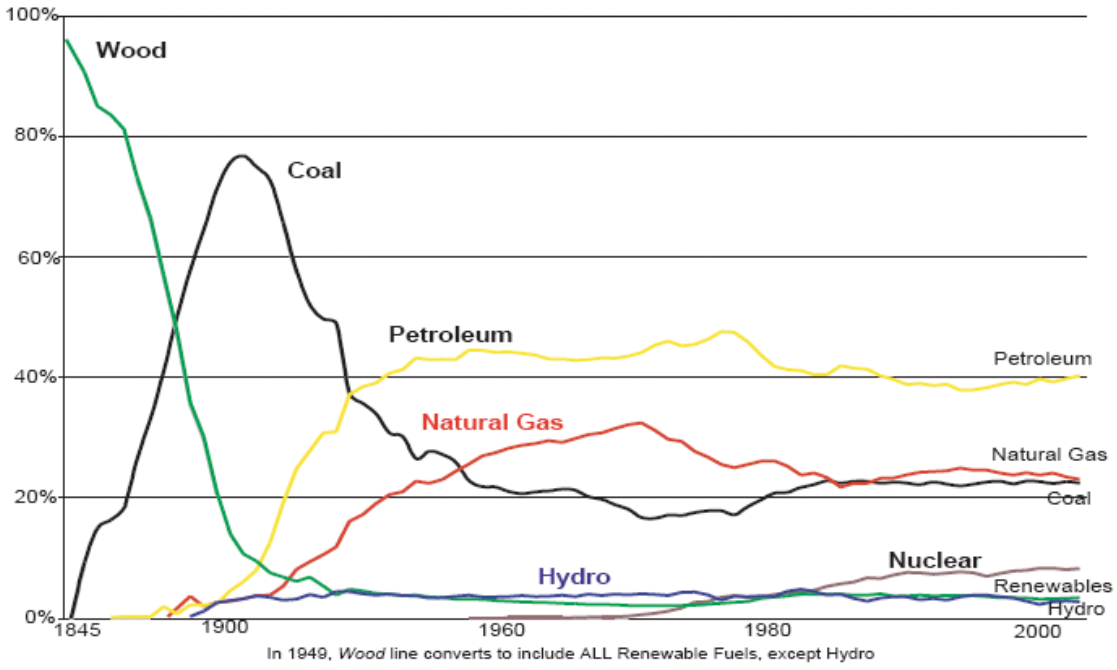

What was the major source of fuel 100 years ago?

What is the biggest residential use of energy?

What is the biggest transportation use of energy?

**U.S. Daily Per Capita Consumption of Energy**
nearly 1 million Btu per day per person

| Type of Energy | Amount/ Type of Unit |
|---|---|
| Petroleum Products | 2.8 gallons |
| Motor Gasoline | 1.2 gallons |
| Natural Gas | 225 cubic feet |
| Coal | 19.6 pounds |
| Hydroelectricity | 3.1 kilowatt hours |
| Nuclear Electricity | 7.0 kilowatt hours |
| Total Electricity | 31.2 kilowatt hours |
| **Total Energy** | **945,000 Btu** |



1. In 1850, the average frontier American house needed 17.4 cords of wood each year for heat and cooking. What would you spend most of your time doing if you lived then? *A cord is a stack of wood 4 ft. high by 8 ft. wide by 4 ft. deep.*

2. Where does your electricity come from in the Mid Atlantic Area?

3. Where does the electricity come from for those states that don't have coal?

4. Where does the electricity come from for those states that don't have oil and gas?

5. What if Pennsylvania coal was only used in Pennsylvania? What would happen to the rest of the New England states?

6. How does the Pacific Northwest produce electricity?

7. Can other states do the same?

8. Why don't more states use nuclear power