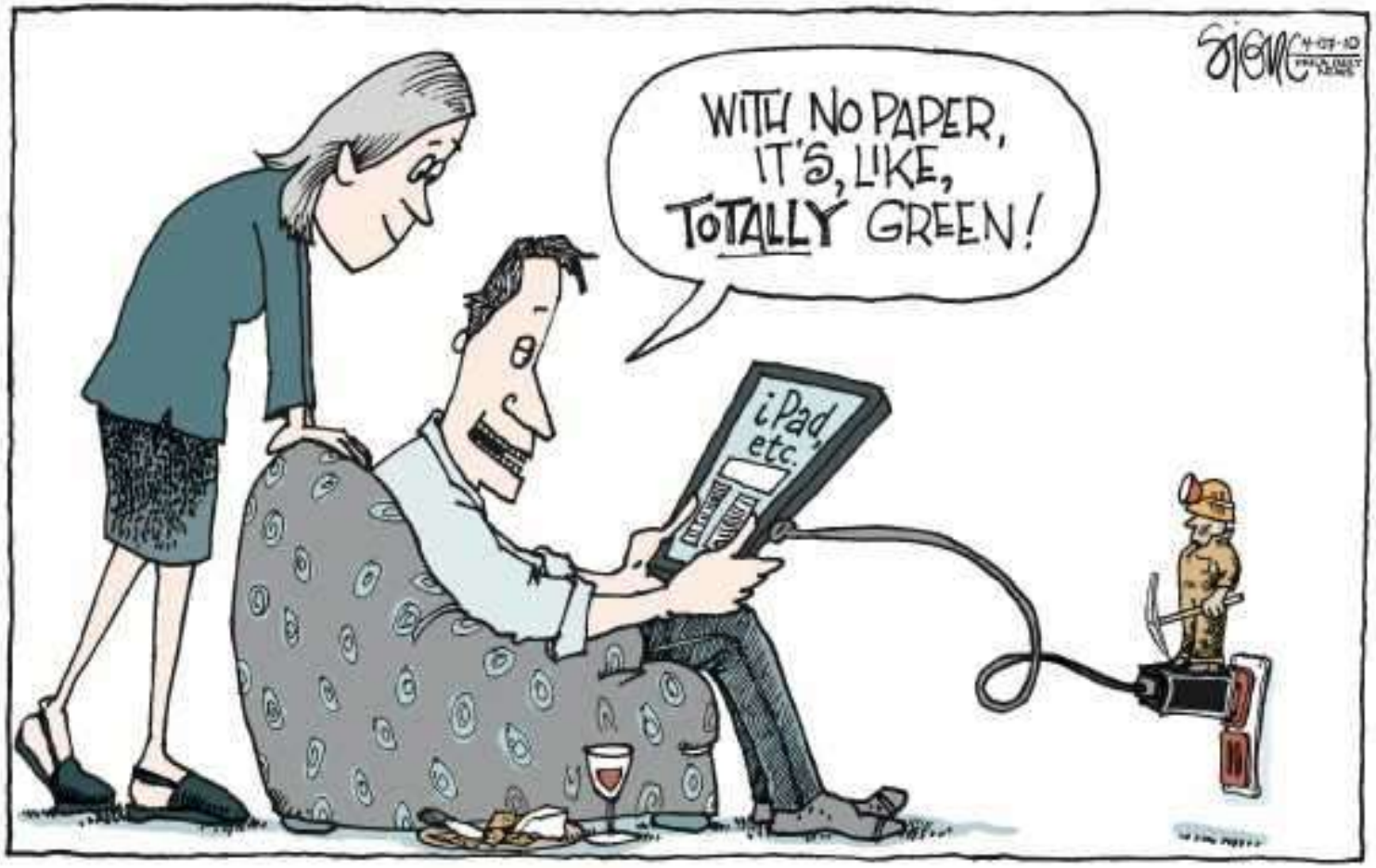
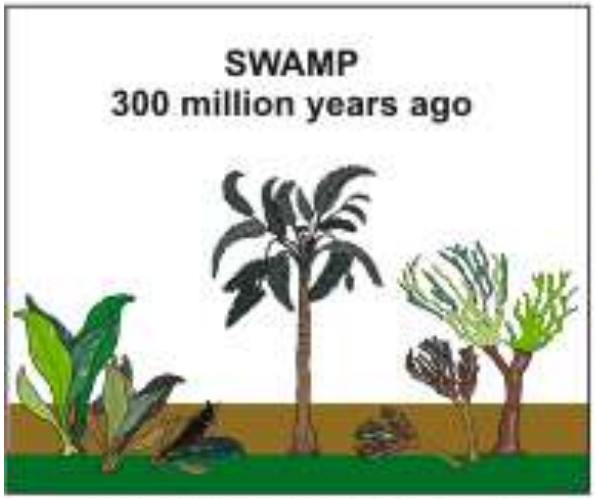
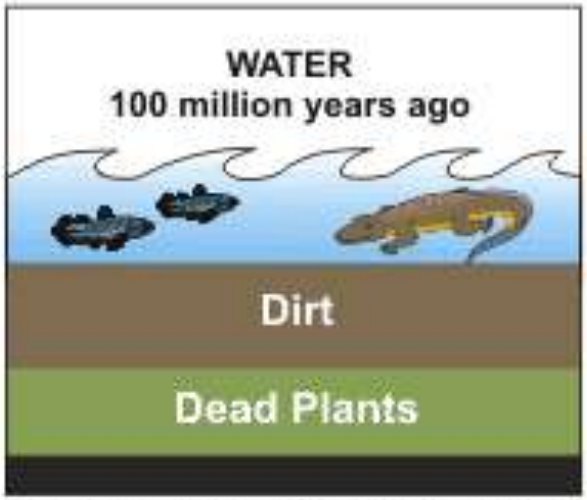
COAL



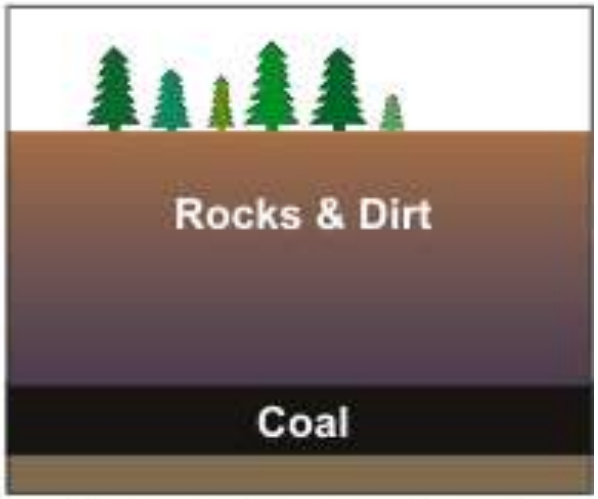
How Coal Was Formed



Before the dinosaurs, many giant plants died in swamps.



Over millions of years, the plants were buried under water and dirt.



Heat and pressure turned the dead plants into coal.

Back then much of the earth was covered in huge swamps. They were filled with giant ferns and plants.

As the plants died they sank to the bottom of the swamps

- Over the years, thick layers of plants were covered by dirt and water.

- The plants were packed down by the weight of the dirt and the water.

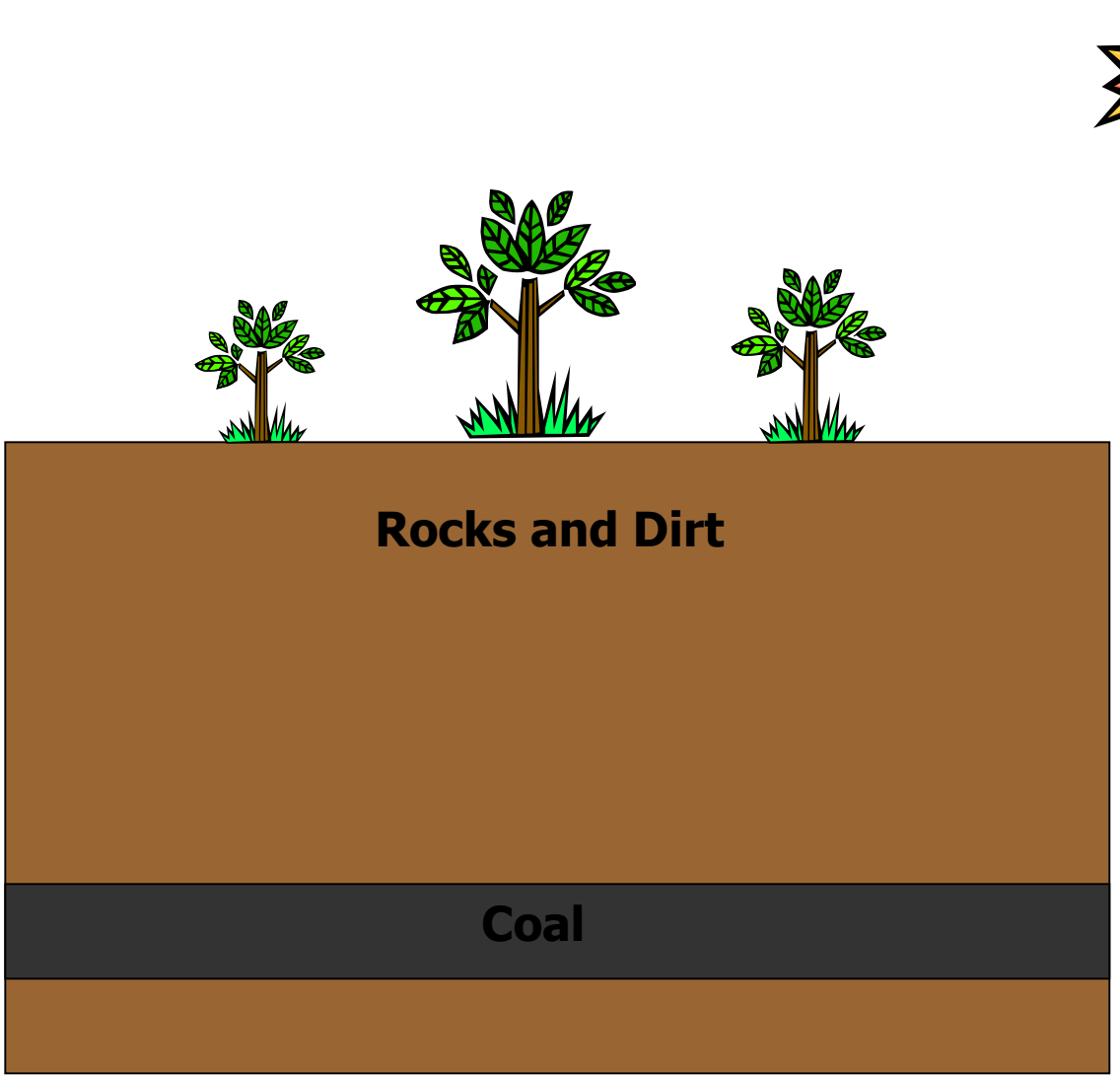
- After a long time, **heat** and **pressure** changed the plants into **coal**.

Coal is a **Fossil Fuel**

- Coal is called a **fossil fuel** because it was made from plants that were once alive.

- The energy in coal came from the **sun**.

Most Coal is Buried Underground.



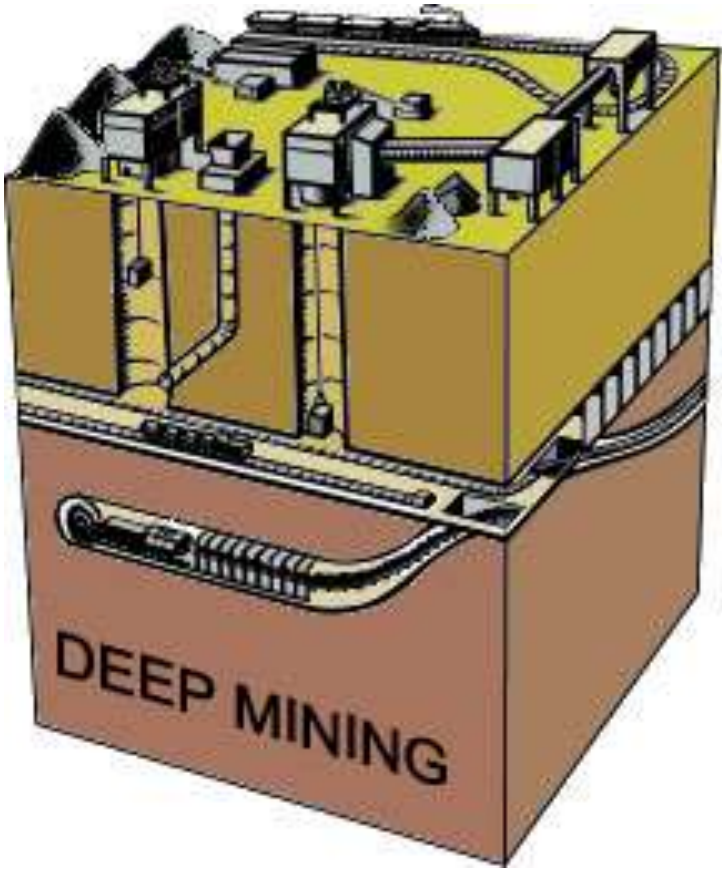
So how do we get coal?

*We **mine** it!*

Underground Mining

Room and Pillar Mining – rooms are cut into the coal bed leaving a series of pillars or columns of coal to help support the mine roof and control the flow of air. The miners advance while cutting out pillars. Once they reach the edge of the mine, they work backwards in what's called "retreat mining."

Long Wall Mining – hydraulic roof supports are used while a cutting head goes back and forth along the coal face. When the cutting head reaches one end of the coal face, it dumps the coal onto a conveyor belt.



Surface Coal Mining

Surface mining occurs at exposed coal seams. It involves drilling above ground and blasting to remove overburden. After the overburden is removed, the mined coal is harvested.

After the Coal is Mined:

The land is made usable again!

The dirt and rocks are put back.

Trees and grass are planted.

This is called **reclamation**.

(Done in Surface mining.)

So how does coal go from

This...

to this...

?

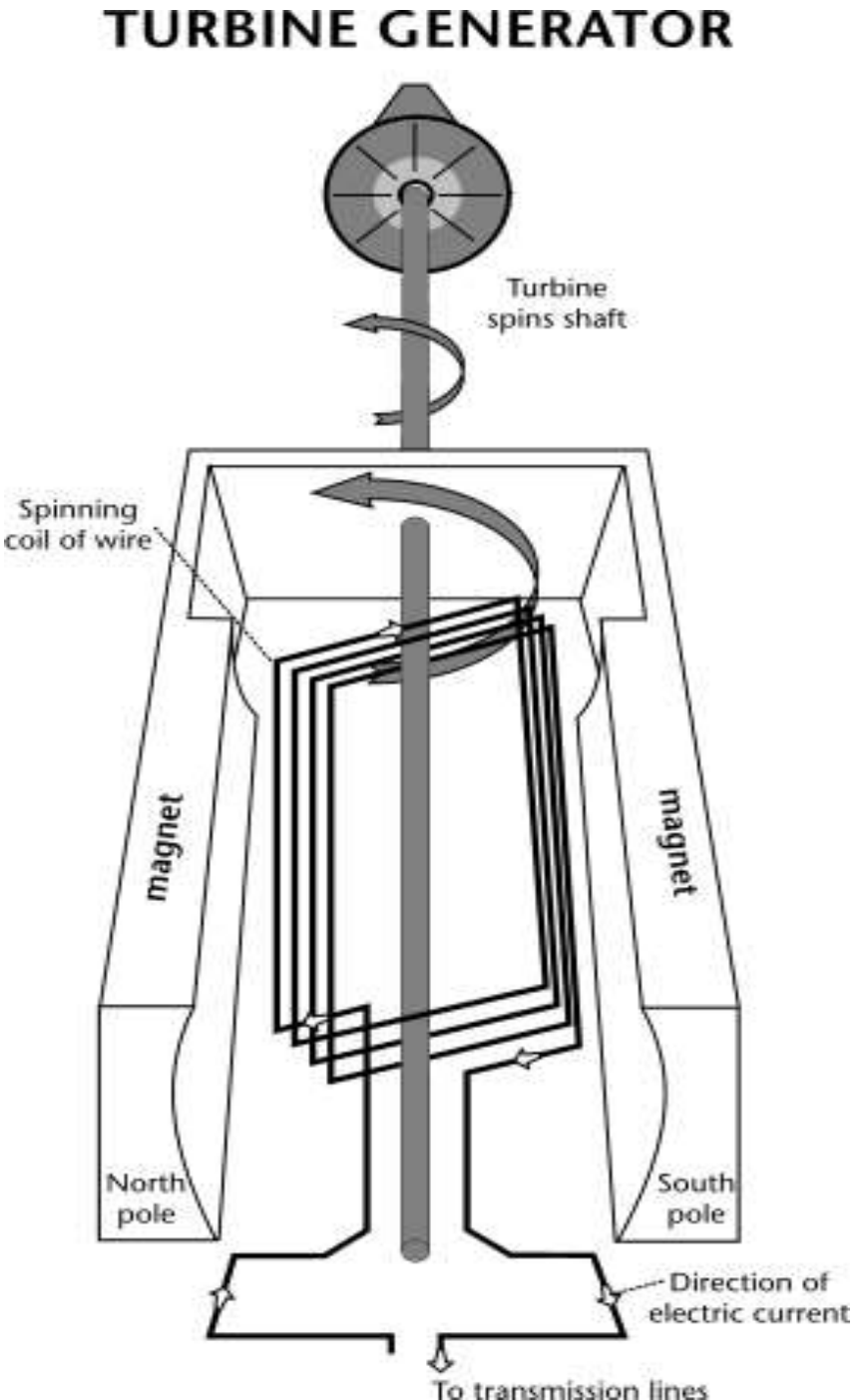
First, coal is transported.

- Most coal is moved by **<u>trains</u>** to power plants and factories.
- The cost of shipping coal can cost more than it costs to mine it!

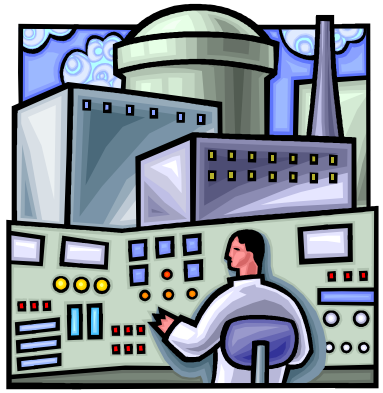
Sometimes it is moved on **barges** along rivers.

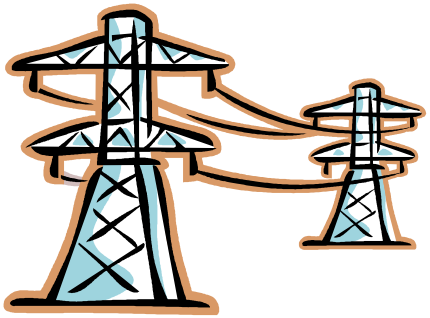
Next, power plants **burn** the coal to make electricity.

- Coal is burned in a large furnace to heat water to make **steam**
- Steam pushes the blades of a **turbine**.
- The turbine is connected to a **generator**, which makes electricity.



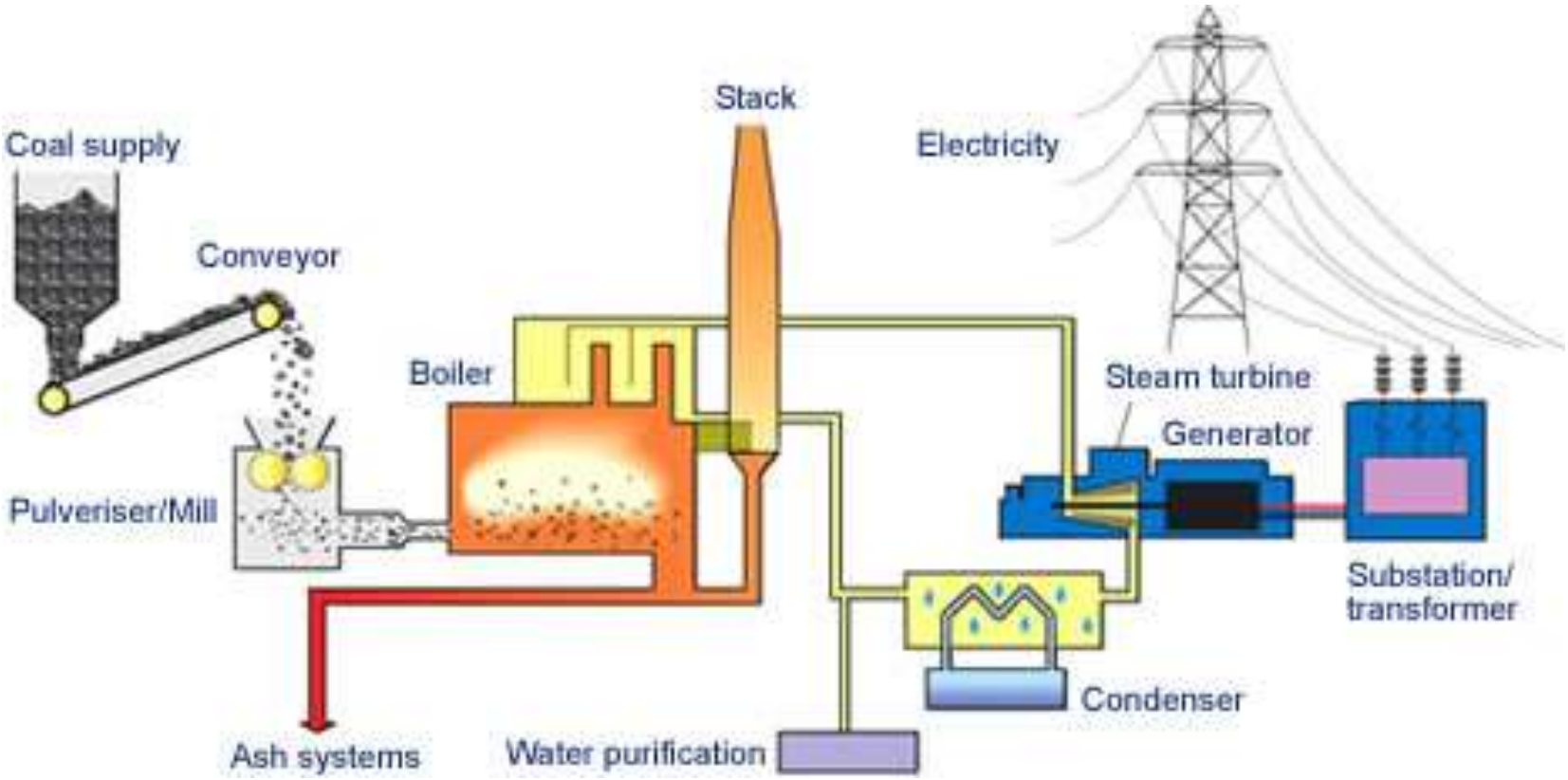
How Coal turns into Electricity





1. Coal is **burned**, which produces **steam**.
2. Steam turns a **turbine**.
3. The turbine generates **electricity**.
4. **Power lines** carry the electricity to our homes.

How Coal turns into Electricity



Coal is also used in **steel** and **iron** production.

64% of steel production worldwide comes from iron made in blast furnaces that use coal!

However, eventually we will run out of coal!

- If we continue to use coal at the rate we use it today, we will have enough coal to last almost 300 years.

Coal is **Non-Renewable**

The coal we use today took millions of years to form.

We can't make more in a short time.

That is why it is called **non-renewable**.

Burning coal can cause **pollution**.

Burning coal produces **emissions** that can pollute the air.

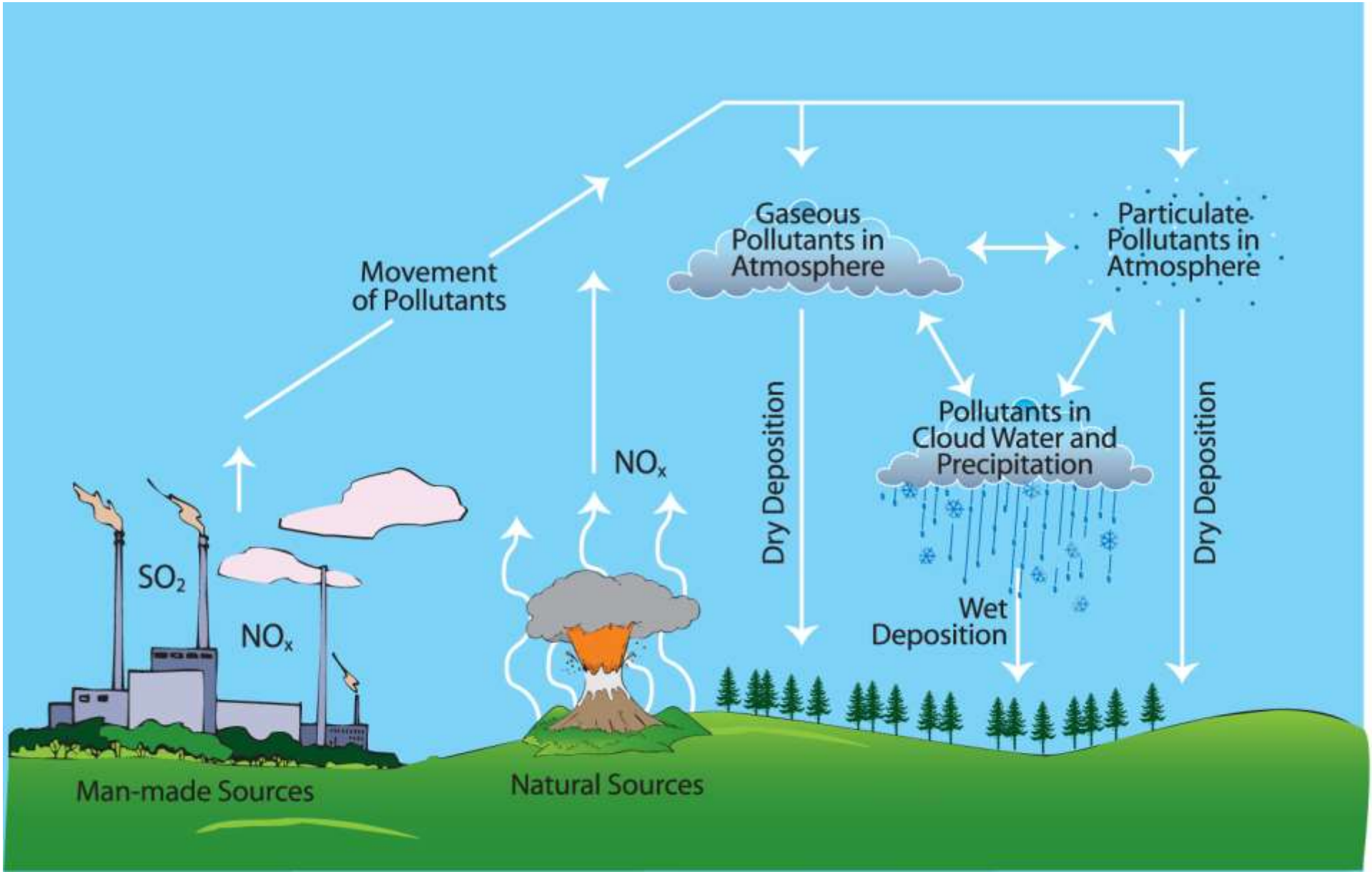
Burning coal can cause **pollution**.

Burning coal also produces carbon dioxide, a **greenhouse gas**.

Burning coal can cause **pollution**.

- When coal is burned, a chemical called **sulfur** may also be released.
- Sulfur mixes with oxygen to form **sulfur dioxide**.
- Sulfur dioxide is a chemical that can affect trees and water when it combines with moisture to produce **acid rain**.

Acid Rain


Movement of Pollutants
Gaseous Pollutants in Atmosphere
Particulate Pollutants in Atmosphere
Dry Deposition
Pollutants in Cloud Water and Precipitation
Dry Deposition
Wet Deposition
SO_2
NO_x
NO_x
Man-made Sources
Natural Sources

ARE THERE SOLUTIONS?

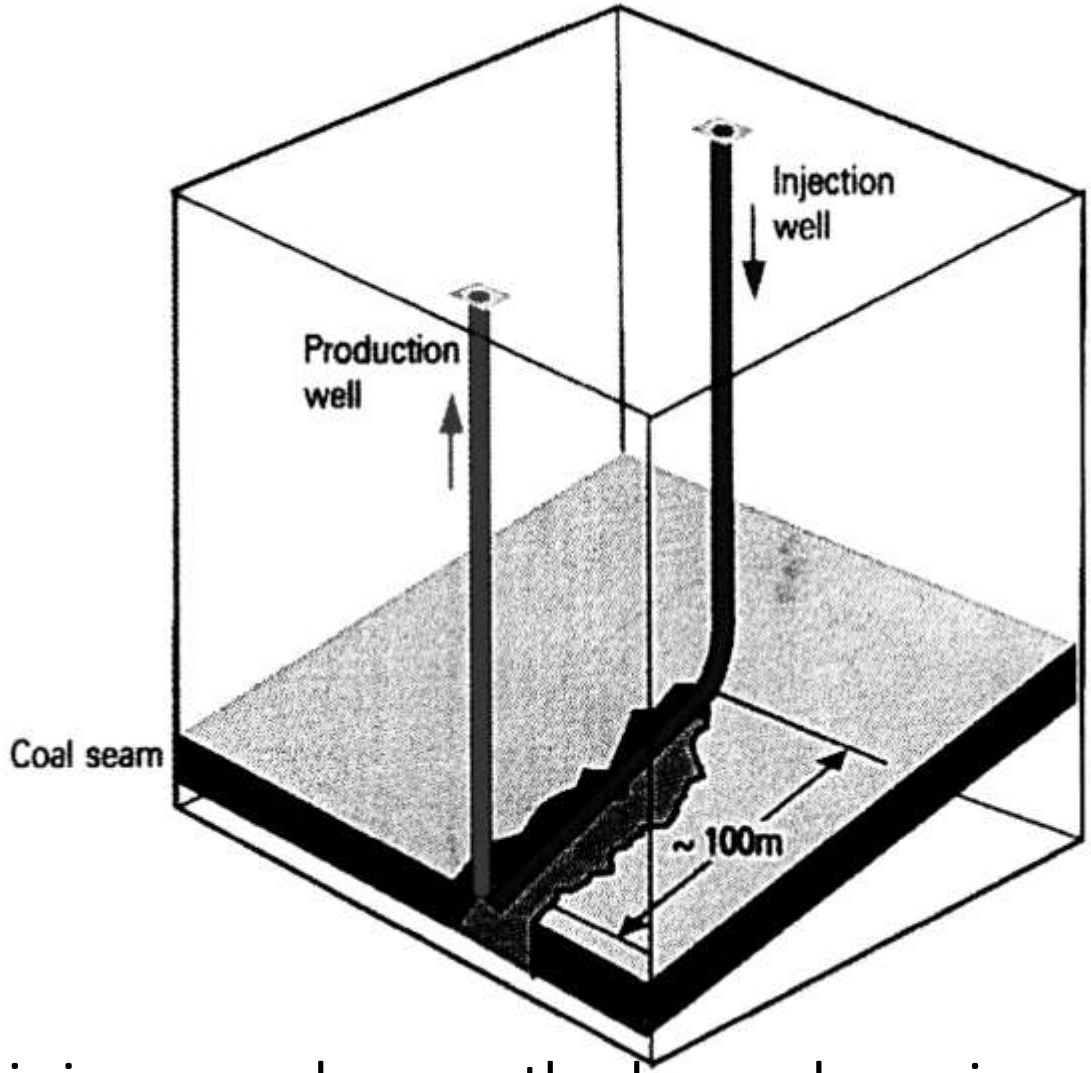
YES WE HAVE

COAL GASIFICATION

Coal gasification reduces greenhouse gas emissions (really low sulfur oxide and nitrogen oxide emission).

Coal gasification is much more efficient than normal coal burning
Efficiencies table
Current normal: 30%
Current gasification: 50%
Future gasification: 70-80%

The UK is developing underground coal gasification (UCG)!



This is a very clean method, as only gas is removed from the ground, leaving all the overburden and ash underground.

One must also remember that gasified coal is not only very clean, but is a far more versatile fuel than regular coal. Think about it: would you rather fuel your car with lumps of coal or gasified coal?

COAL LIQUEFACTION

Here are two of several ways: Direct, and Indirect

Direct liquefaction – involves the introduction of hydrogen gas and catalysts into finely crushed coal to produce synthetic crude oil. Need temperatures of 430-450*C and pressures of 50 to 25 MPA. Hydrogen is needed to remove the oxygen sulfur and nitrogen. The product of direct liquefaction must still be refined to gasoline or diesel.

Indirect liquefaction – first converted to gas through gasification. Then methanol synthesis is used to convert the coal gas into methanol, then the methanol can either be directly converted to gasoline, or it can be used as fuel in and of itself.

Power plants and factories work hard to keep pollution from getting into the air.

- They clean the coal before they burn it.
- They use **scrubbers** to clean the smoke before it goes into the air.


THE END