Where did the energy in fossil fuels come from?

- **Solar radiation** hits the plant
- **Photosynthesis** uses that solar energy with CO_2 and H_2O to create oxygen and **glucose (an organic carbon based molecule)**
- When breaking down the compounds of glucose are broken down, it releases the stored energy in a process called **oxidation (called respiration in living stuff)**
    - So the energy entering the biosphere from photosynthesis, gets used at an equal amount from oxidization
- When plant matter gets sedimented and **decomposed (chemically breaking matter into simpler compounds)**, the energy stored in the plant's glucose gets trapped in the now called **fossil fuels**, but that sprouts a question?
    - **Why doesn't the biosphere run out of energy overtime due to some of it being sedimented yearly**
    - Because plants take the energy from the sun, so the energy in the biosphere is always renewed by the sun
- **Fossil fuels** are consumed faster than they form, that's why they are a **non-renewable** source of energy

COAL

It is a combustible rock that is made from carbon through the processes of **compaction** and **hardening** of plant matter along time ago

1. **Sedimentation :** plants are first buried by the sediments, and under it is sediments too, it is just a thin layer between them (shale/mud/sandstone/sand) as carbon layers can go from several centimeters to several meters in thickness, depending on the environment

2. **Compaction :** plants are then compressed by the weight of the sediments on top of them
    - During it, much of the **water** that was in the plant is squeezed out, removing the hydrogen and oxygen from the material
    - And then gasses are forced out like **methane**, leading to even less hydrogen
    - So the percentage of carbon becomes **greater** and **greater, as coal gets more enriched, its ranks** in carbon percentage increases
        1. Peat (least percentage of carbon)
        2. Lignite
        3. Sub-bituminous coal
        4. Bituminous coal
        5. Anthracite coal
        6. Graphite (pure carbon mineral)

NOTES

- The deeper the plant material is buried, the **higher rank coal** it becomes
- Peat is not considered coal, just very dense plant material
- Graphite is not considered coal, just a pure carbon mineral
- The highest ranked coal is **anthracite** and the lowest rank is **lignite**
- The greater the heat put into the fire, the smaller the mass of coal that needs to be burned to produce the needed heat.
- The heat content of coal increases with the rank of the coal. It depends mainly on the carbon content.
- Coal is not good for the environment as some of it will contain sulfur which will combine with H_2O and lead to sulfuric acid found in rains
- The amount of energy in coal is expressed in **British thermal unit** (**BTU) per pound (Lbs)**
- **BTU ->** the amount of heat needed to raise the temperature of 1 pound of water by 1 degree Fahrenheit'
- **The purest coal** has less than 1% of it being ash, but the usable coal contain much higher ash Content
- there are **3 major factors** when determining which coals are economical to mine
    - **Cost of transportation**
    - **Environmental concern** from mining that coal
    - **Quality**
    - **Thickness**
    - **Volume**
    - **Depth**

UNDERGROUND MINING (COAL)
Drift – slope – shaft
SURFACE MINING (COAL)
Mountain top – contour – auger and area mining

Peat

- Used as a source of fuel, but has very low heat content

Lignite (brown coal)

- Is the least buried coal, it is used in electrical generation as it does not produce much heat

Sub-bituminous coal

- Is a desirable heat sources because it is between lignite and bituminous coal, but has low sulfur content

Bituminous coal

- Used for generating electricity and making coke for the steel industry
- **Coke** is a grey, hard, porous coal based fuel with high carbon content, it is made by heating coal in the absence of air

Anthracite

- Used for home heating

Ash

- Some parts of the coal do not burn, this is called ash
- It consist of sand, slit, and clay contents that were deposited with the plant material