FOSSIL FUELS ARE THEY DINOSAURS?

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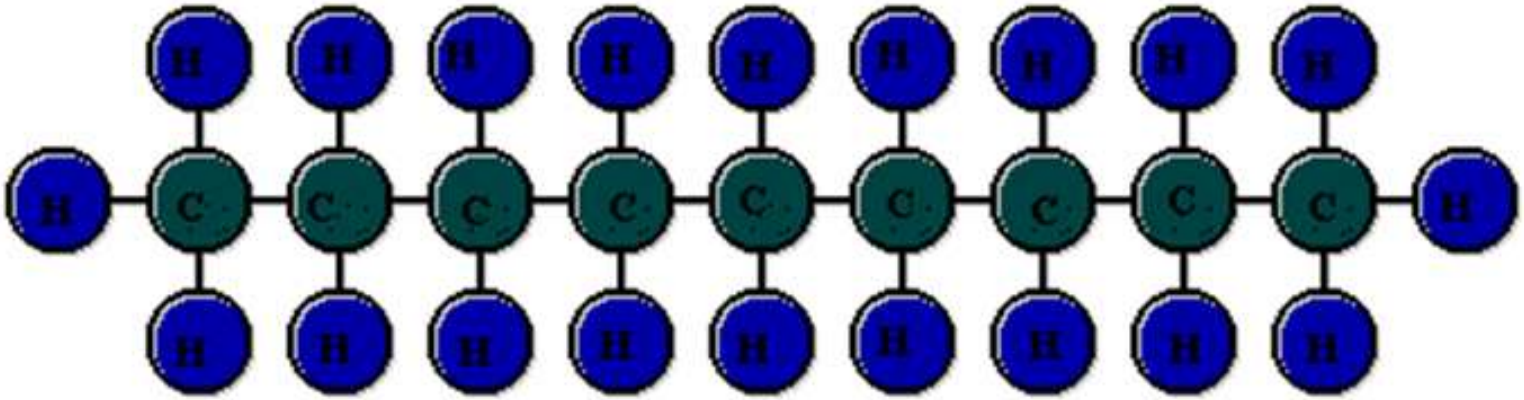
COMBUSTION

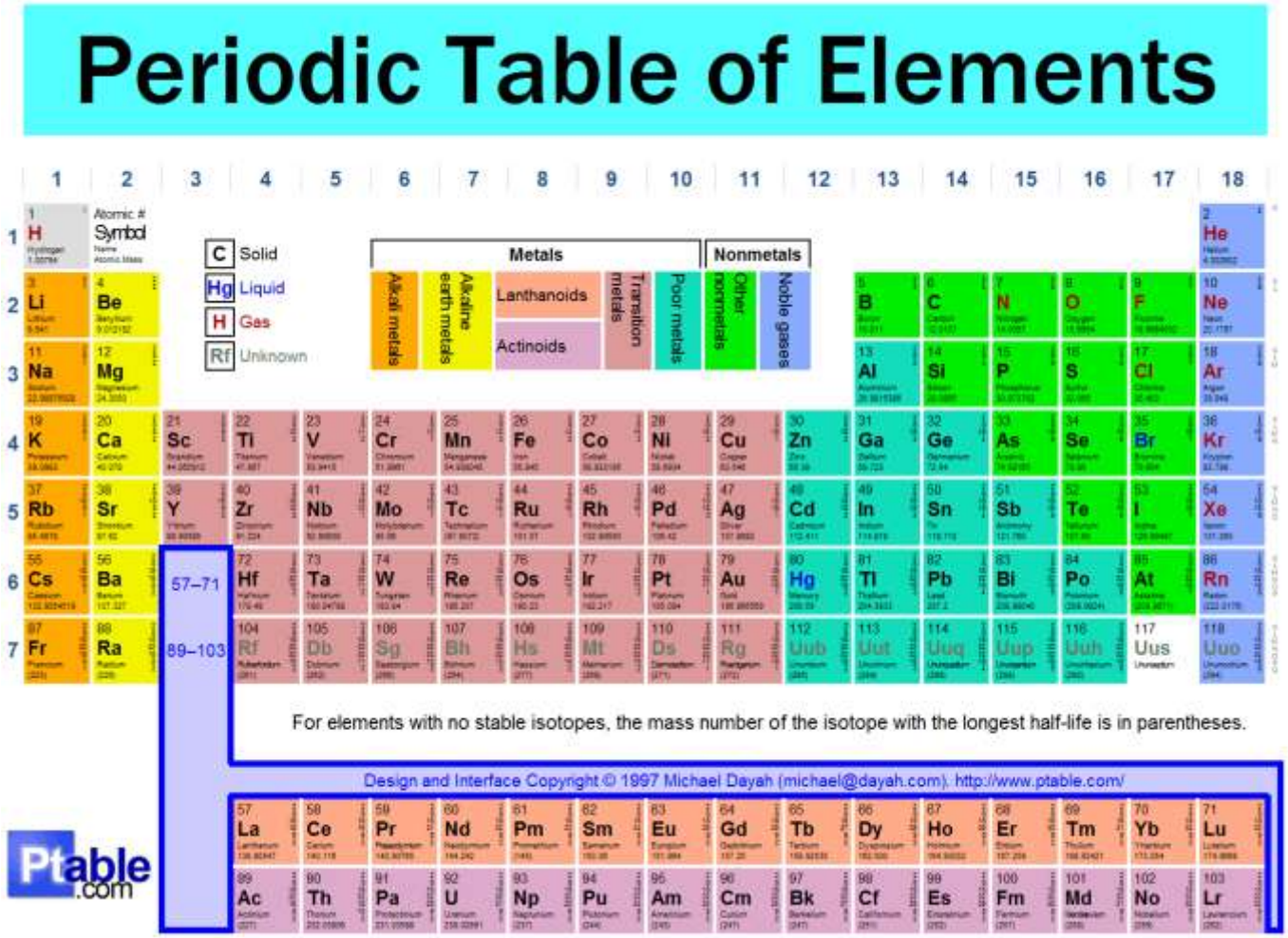
- $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

HYDROCARBONS

- Mainly Carbon and Hydrogen
- Also others like Oxygen and Sulphur



HYDROCARBONS



HYDROGEN


ZEPPELIN NT
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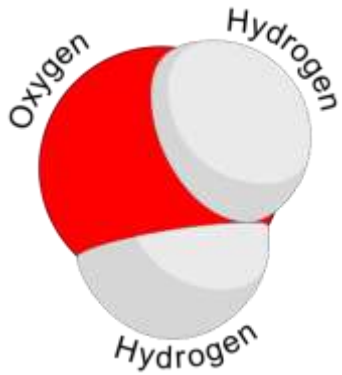

Oxygen
Hydrogen
Hydrogen

HINDENDBURG

CARBON

IDENTIFY THE HYDROCARBONS

- A Used engine oil
- B New engine oil
- C Peat
- D Tar
- E Charcoal
- F Coke
- G Anthracite
- H Coal

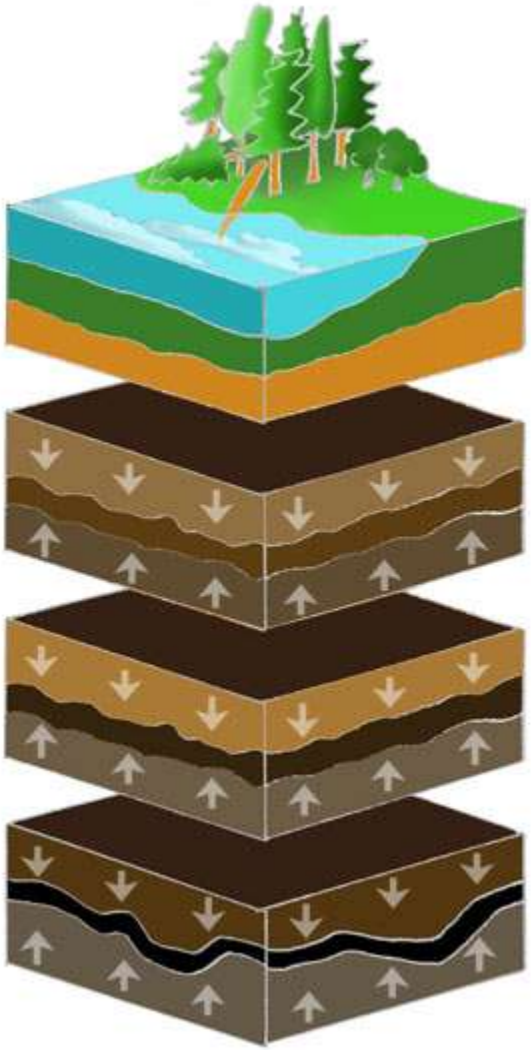
EXAMPLES ARE!

Coal

Natural Gas

Oil

FORMATION OF COAL

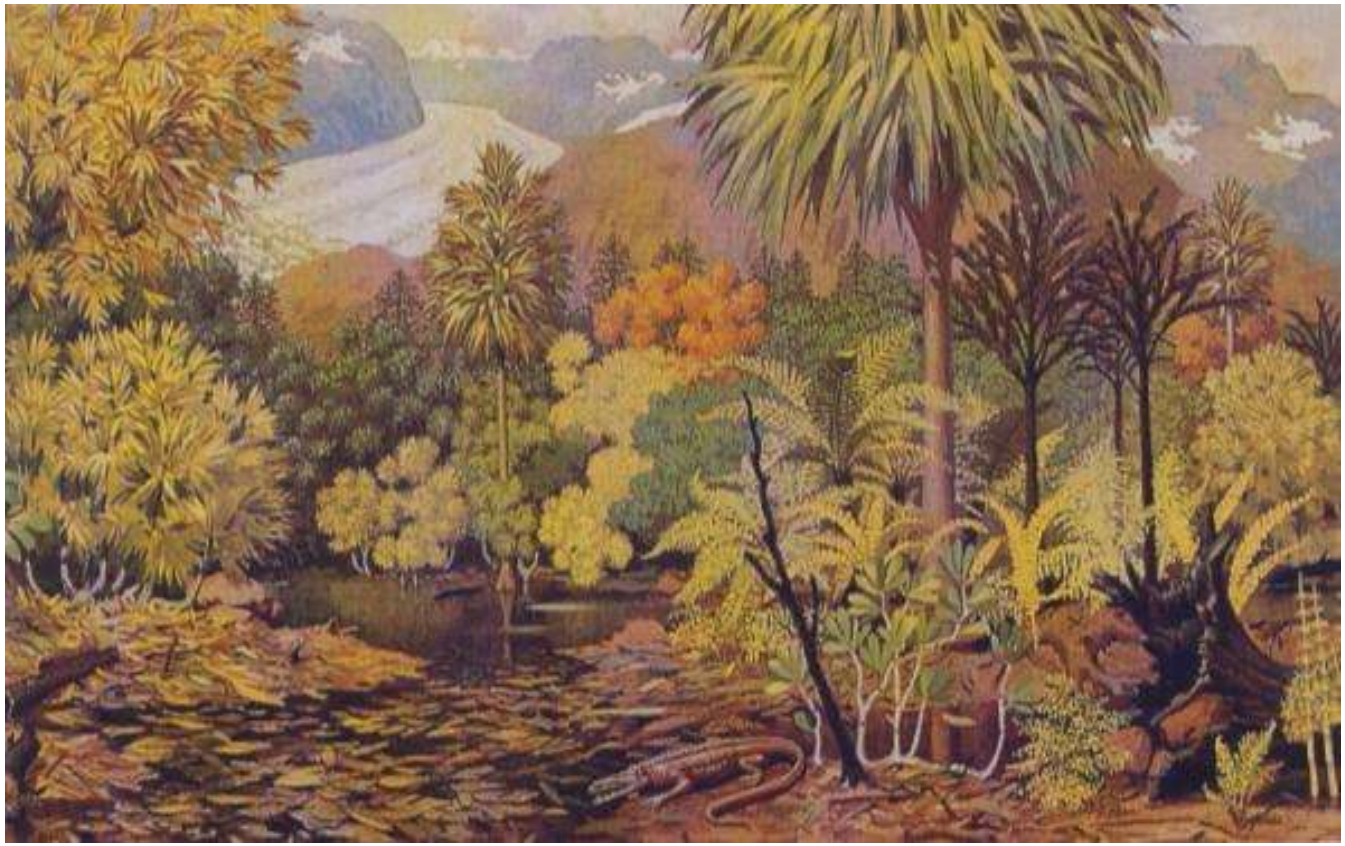


FOSSIL FUEL FACTS

- Rotting plant material becomes peat.
- Peat is buried and subject to high pressures and temperatures.
- Peat becomes lignite.
- Lignite becomes bituminous coal.
- Bituminous coal becomes anthracite.

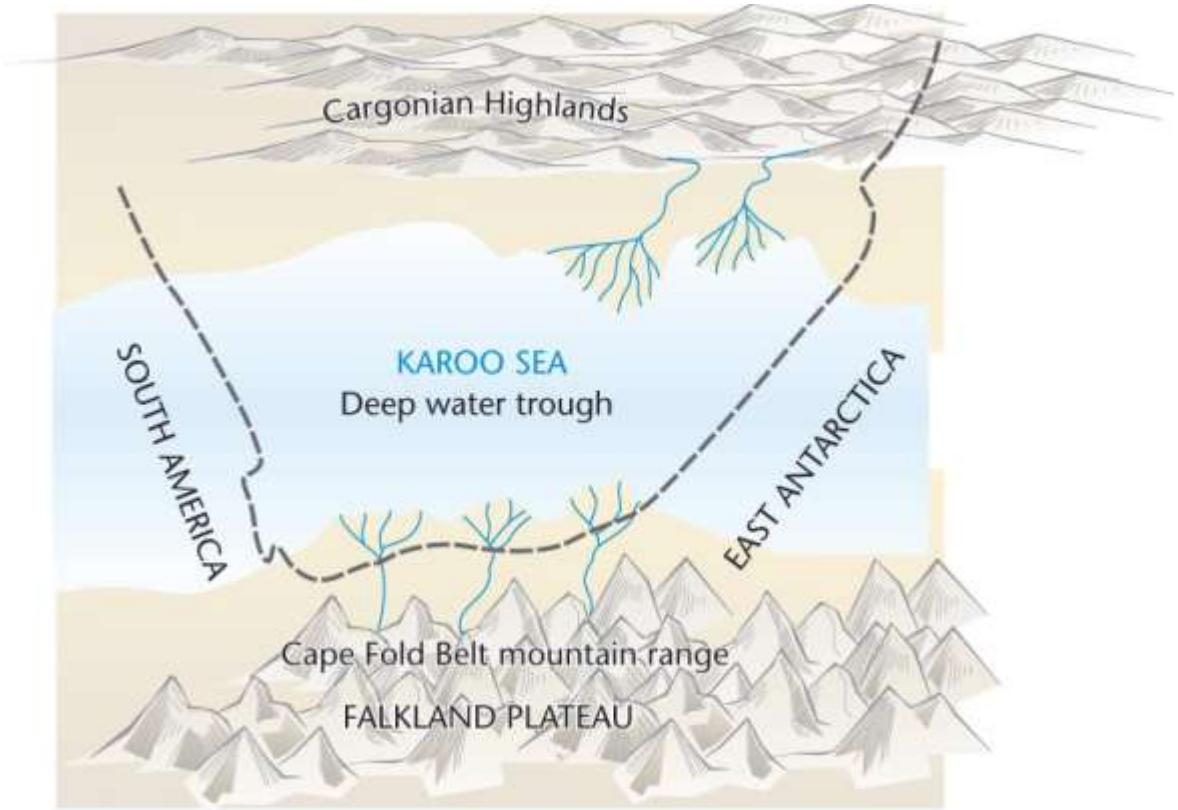
HOW IS COAL FORMED

260 million years ago South Africa was covered with vast swamps



MODERN SWAMPS

WHERE WERE THEY FOUND?



PRESERVED AS FOSSILS

Ferns

Glossopteris

Horse tails

PEAT

Swamp

Peat bog

Peat piled for burning

FOSSIL FUEL FACTS

- Over millions of years plants in the coal swamps died and were buried underwater with no oxygen.
- The dead plant material did not decompose forming peat.
- Burial of the peat created heat and pressure resulting in the peat being turned into coal.
- In South Africa peat is found in wetlands where it is protected.
- In the Northern Hemisphere peat is more common.
- Peat is can be burned or used as a potting soil, it is also used to grow mushrooms

LIGNITE

Lignite

Lignite Burning Power Station

FOSSIL FUEL FACTS

- Lignite or brown coal forms when peat s altered by relatively low temperatures and pressures over a long period of time.
- Lignite may still contain unaltered plant material.
- Fresh Lignite has a high moisture content (up to 66%) content and a relatively low carbon content (20 – 35 %).
- Lignite contains many substances (volatiles) which turn into gas or smoke when burnt.
- We do not burn lignite in South .Africa, but in other parts of the world it is burned in power stations.

BITUMINOUS COAL

Bituminous coal

Arnot Power Station

FOSSIL FUEL FACTS

- Bituminous coal is formed when lignite is subject to high pressures and temperatures.
- Bitumen is a type a sticky black tar-like substance.
- Bituminous coal is 60% to 80% carbon, together with substances like water, hydrogen and sulphur.
- Bituminous coal is the most common type of coal in South Africa. It is used for heating, cooking and in power stations.
- The high sulphur content of this coal can cause acid rain. Power stations need to “scrub” their waste gases to get rid of the sulphur.

ANTHRACITE

Anthracite

Clean burning

FOSSIL FUEL FACTS

- Anthracite is formed when bituminous coal is subject to temperatures of between 150^{o}C and 200^{o}C .
- Anthracite is a type of metamorphic rock.
- It is harder and shinier than ordinary coal.
- Anthracite contains between 92 and 98% carbon. It produces hardly any smoke and can burn for days (unlike ordinary coal which burns out in hours).
- Anthracite is too expensive for power stations and is preferred for domestic heating and cooking because it is clean burning.

COKE (FUEL)

Coke

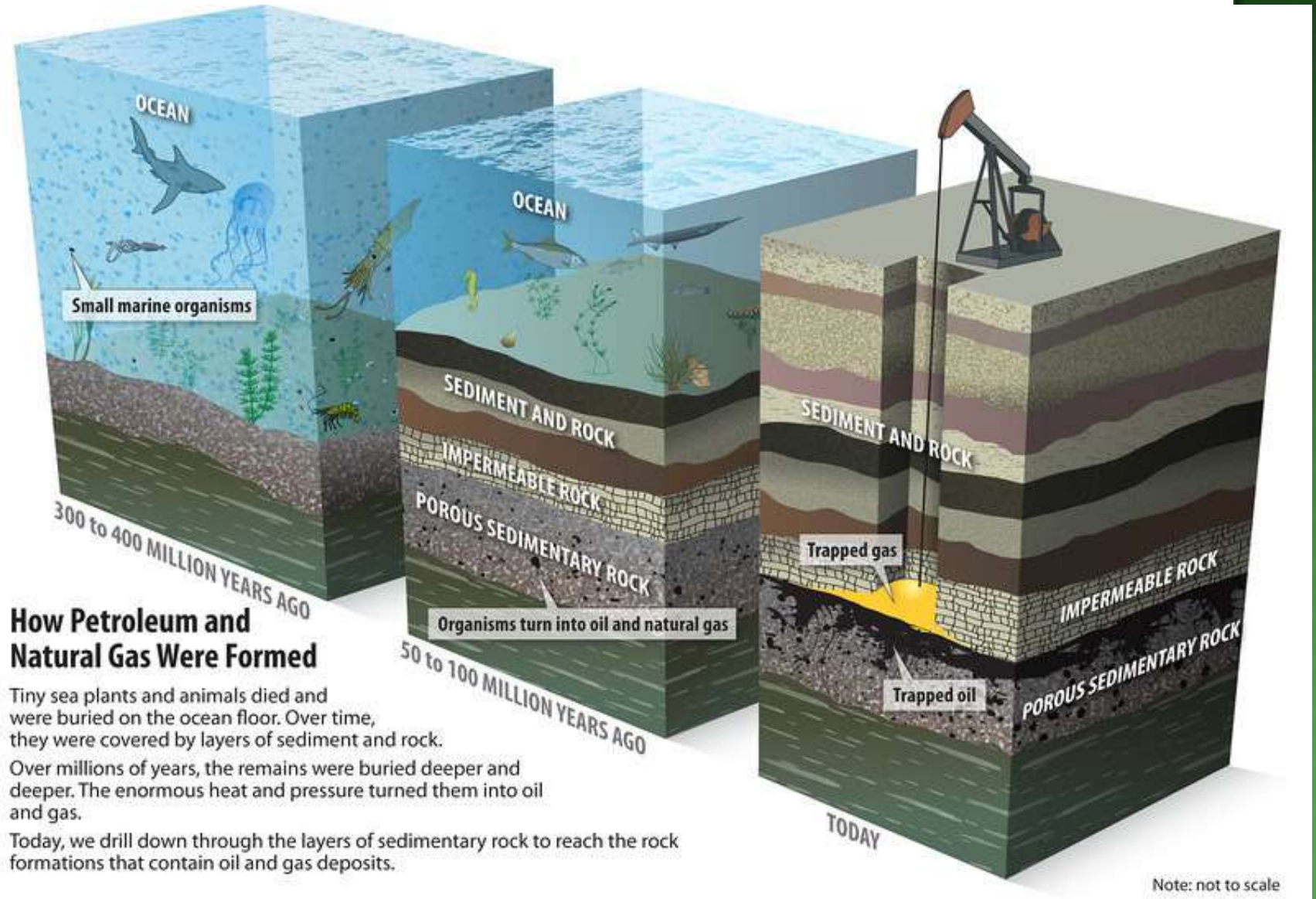
Iron Smelting

FOSSIL FUEL FACTS

- Coke is formed by heating low Sulphur bituminous coal in the absence of air at a temperature as high as 2000^{o}C
- Coke burns cleanly at high temperatures
- Coke is specially useful in furnaces in the iron industry where it is used to reduce iron ore (Fe_2O_3) into iron.

- $2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$

OIL AND GAS FORMATION



How Petroleum and Natural Gas Were Formed

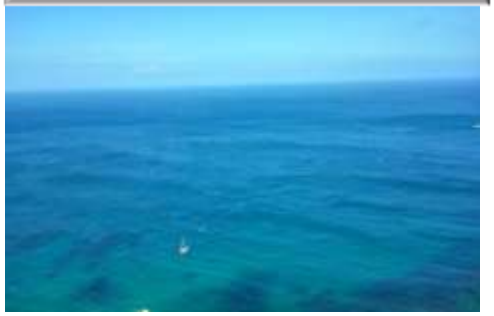
Tiny sea plants and animals died and were buried on the ocean floor. Over time, they were covered by layers of sediment and rock.

Over millions of years, the remains were buried deeper and deeper. The enormous heat and pressure turned them into oil and gas.

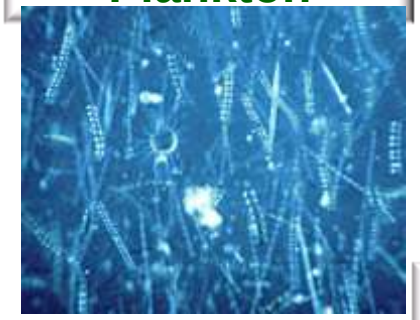
Today, we drill down through the layers of sedimentary rock to reach the rock formations that contain oil and gas deposits.

OIL AND GAS

The Ocean



Plankton



Diatoms

FOSSIL FUEL FACTS

- Oil is formed from fossilized plankton.
- A drop of Ocean water contain thousands upon thousands of tiny creatures called plankton which include:
  - Protists (e.g. copepods and algae including diatoms).
  - Larvae of jellyfish, starfish, sea-cucumbers and other animals.
- These tiny creatures die and form a thick sludge on the bottom of the ocean.
- Diatoms- can form a thick clay called diatomite which is used in toothpaste.
- The dead plankton sludge is buried and heated to form oil and gas.

DRILLING FOR OIL AND GAS

Drilling on land

Oil pump

A floating oil platform

FOSSIL FUEL FACTS

- Huge drilling rigs that can drill through thousands of metres of sediments are needed to drill for oil.
- The drill rigs can be found on land or on floating platforms at sea.
- Once the drillers have found oil they pump it out with special pumps

CRUDE OIL

An oil gusher

FOSSIL FUEL FACTS

- Oil pumped straight out of the ground is called **crude oil.**
- Crude oil is a smelly mixture of tar, oil, benzene and other substances including sulphur.
- When an oil drill stirkes oil the crude oil may come gushing out, this is called a blowout and can be very dangerous.

NATURAL GAS

METHANE

OIL REFINERY

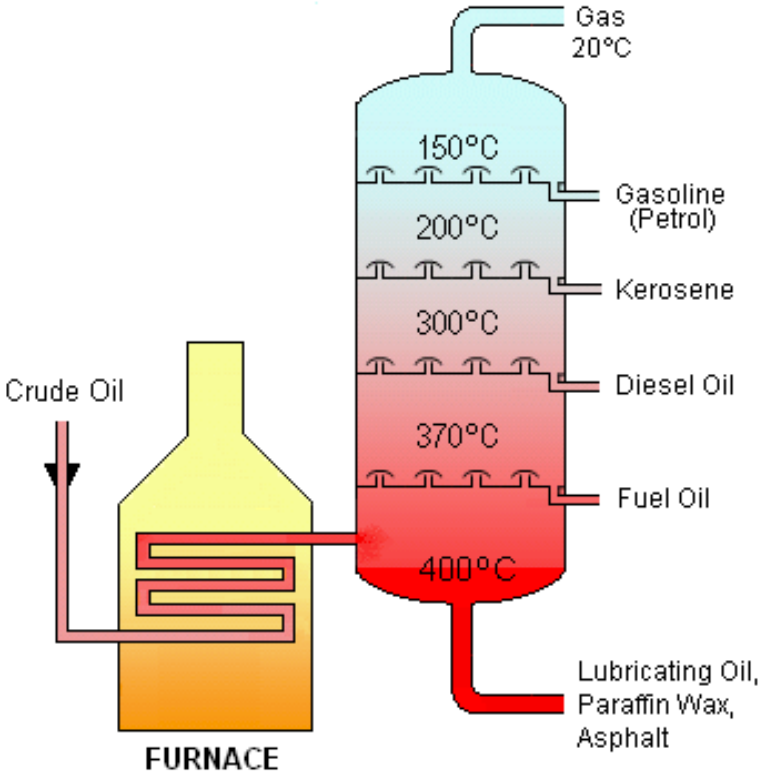
Oil refinery

FOSSIL FUEL FACTS

- A n oil refinery is a huge factory where crude oil is converted into other products like:
  - Tar (Bitumen)
  - Wax
  - Diesel
  - Petrol
  - Motor car oil
  - Gas
- The crude oil here comes from the Engen refinery in Durban

OIL REFINERY

Fractional Distillation

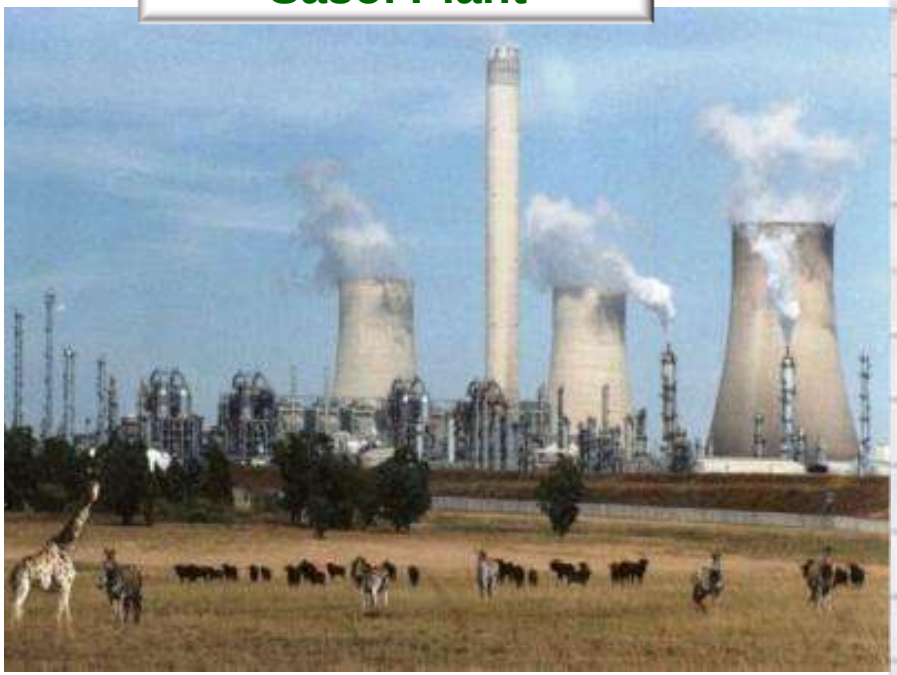


FOSSIL FUEL FACTS

- In an oil refinery a huge fractional distillation column is used to separate the crude oil into different parts:
  - At lower temperatures (20°C) gas (LPG) separates.
  - At 150°C petrol forms.
  - Next at 200°C paraffin (kerosene) separates.
  - At 300°C Diesel forms.
  - At 370°C motor car oil separates.
  - At 400°C Wax and road tar separate out.
  - The products of crude oil can be turned in many types of chemicals and plastics.

SASOL

Sasol Plant



FOSSIL FUEL FACTS

- Since 1955 Sasol has had a factory that can turn coal into oil.
- Coal is heated with oxygen and steam under pressure to make carbon monoxide, hydrogen and methane ga
- The gases are passed over an iron based catalyst to create:
  - LPG (Liquid Petroleum Gas), petrol, diesel, paraffin, motor car oil, waxes, alcohol and acetone
- Sasol can also turn natural gas into fuels.
- Using natural gas and coal as a starting point Sasol produces over 30 types of chemical and
- many types of plastic.

IDENTIFY THE HYDROCARBONS

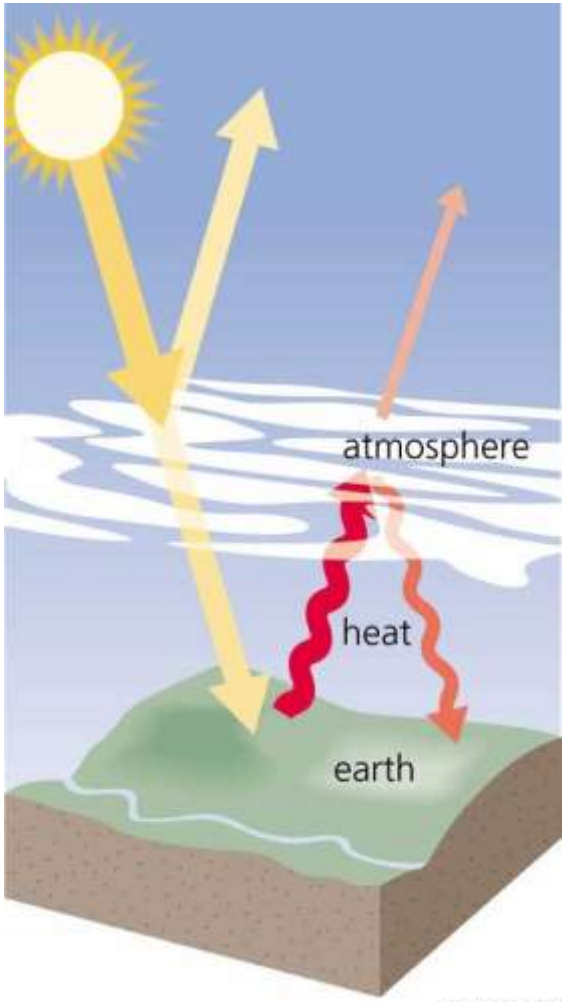
- A
- B
- C
- D
- E
- F
- G
- H

NON-RENEWABLE RESOURCES

FOSSIL FUEL FACTS

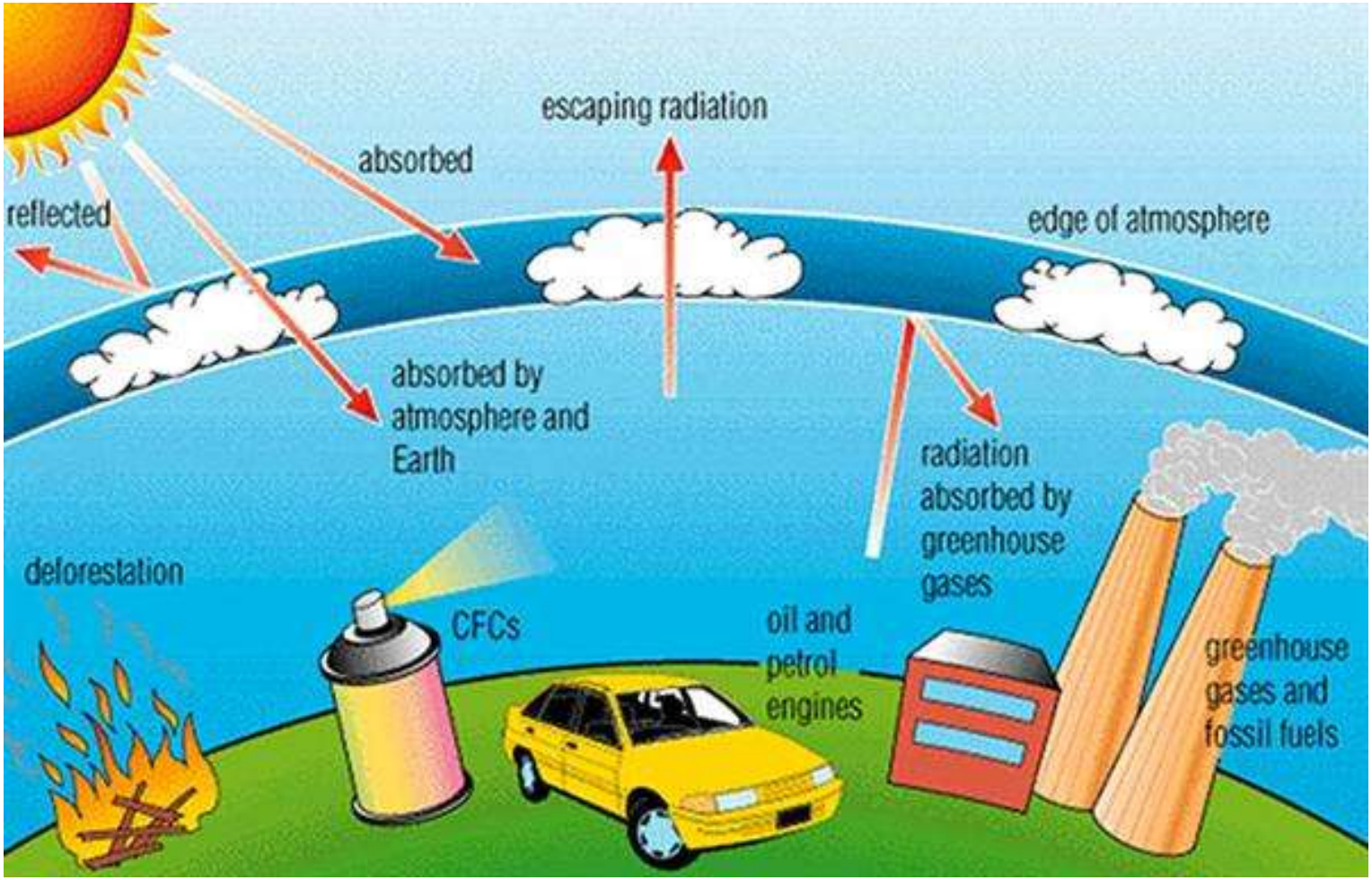
- Fossil fuels are non-renewable resources.
- They took millions of years to form and once we have used them up they will be gone.
- It has been estimated that we have 35 years of oil left, 37 years of gas left and 105 years of coal.
- Calculating how long it will take to use up reserves of fossil fuel is complex because new reserves are being found as are new ways of extracting it

THE GREENHOUSE EFFECT

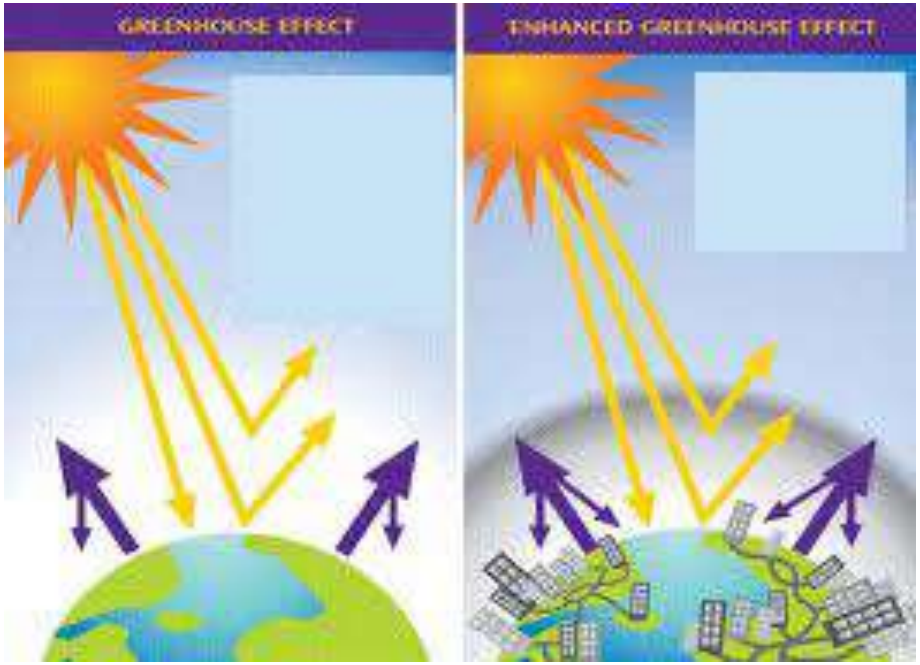


THE MOON

EFFECT OF METHANE AND CO_2



FOSSIL FUELS AND THE ENVIRONMENT



FOSSIL FUEL FACTS

- In 2006 humans produced **29,195.42** million metric tons of carbon dioxide from use of fossil fuels.
- It took millions of years for nature to take carbon dioxide out of the air and to store it in the Earth in the form of fossil fuels.
- Humans are releasing it back into the air in only a few hundred years.
- Increased concentrations of carbon dioxide together with other gases like methane are responsible for enhancing global warming.
- Burning of fossil fuels produces many other pollutants.

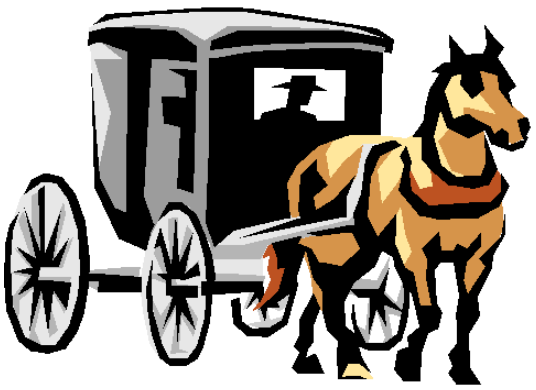
BEFORE GLOBAL WARMING

CO_2 CO_2

$15.5\ ^{o}C$ CO_2 Cool

CO_2 CO_2

CO_2



WITH GLOBAL WARMING

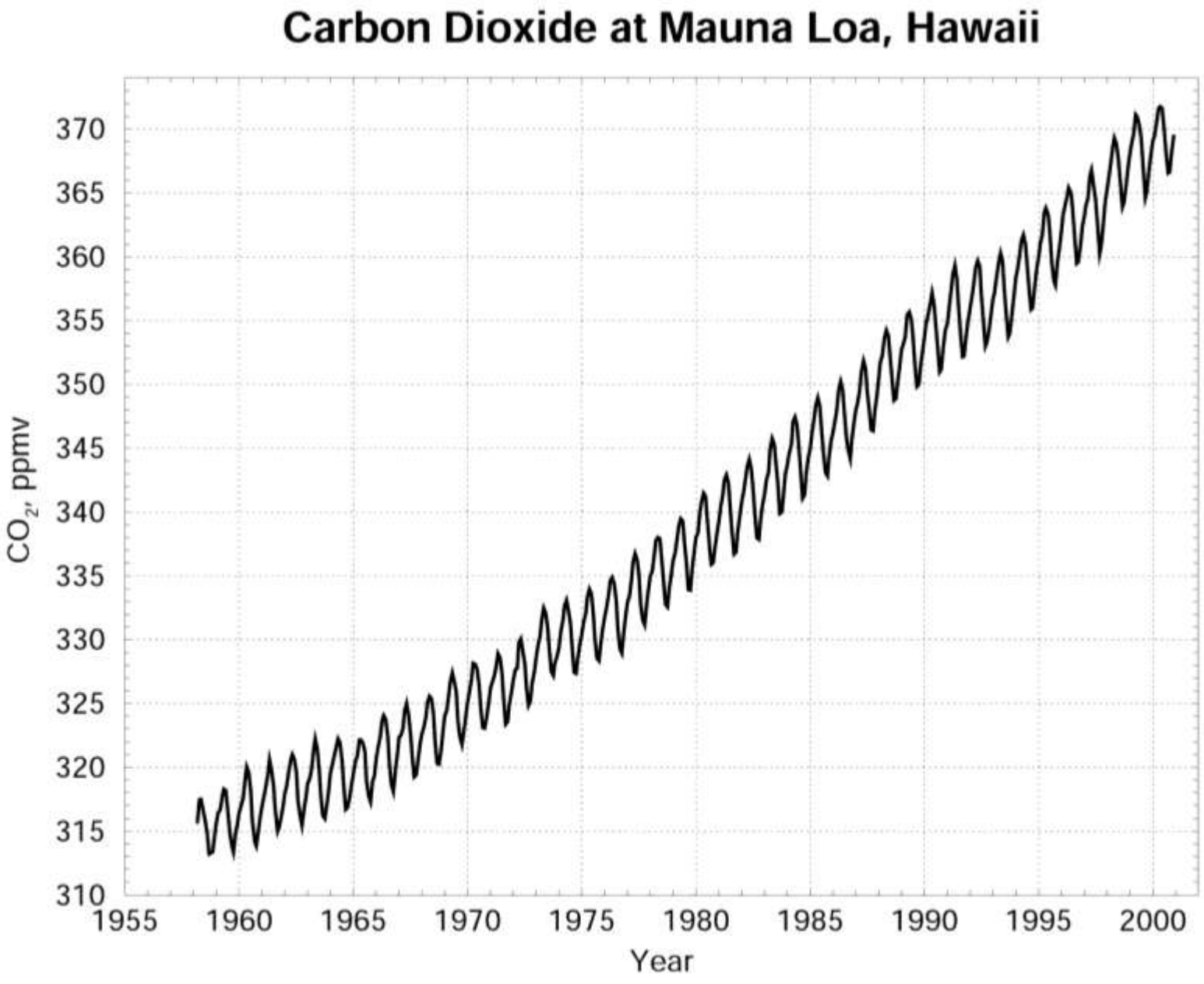
CO_2 CO_2 CO_2 CO_2 CO_2

CO_2 CO_2 CO_2 CO_2 CO_2

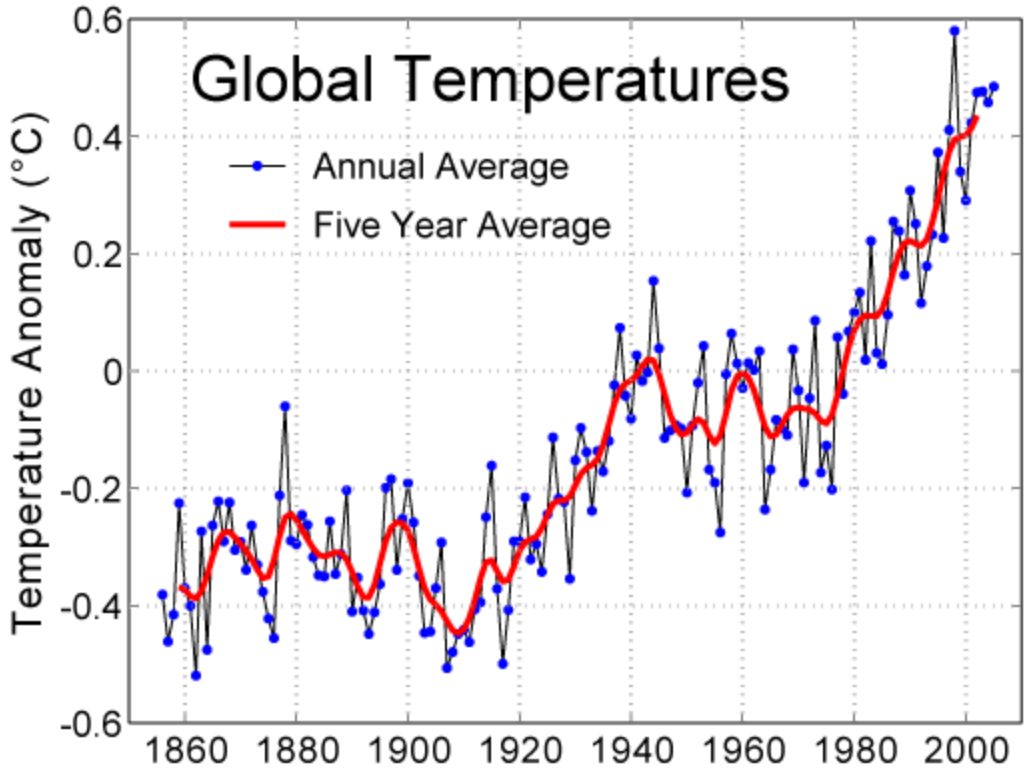
$16.5\ ^{o}C$ CO_2 Warm

CO_2 CO_2 CO_2 CO_2 CO_2

CO_2


Carbon Dioxide at Mauna Loa, Hawaii
370
365
360
355
350
345
340
335
330
325
320
315
310
CO2, ppmv
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
Year

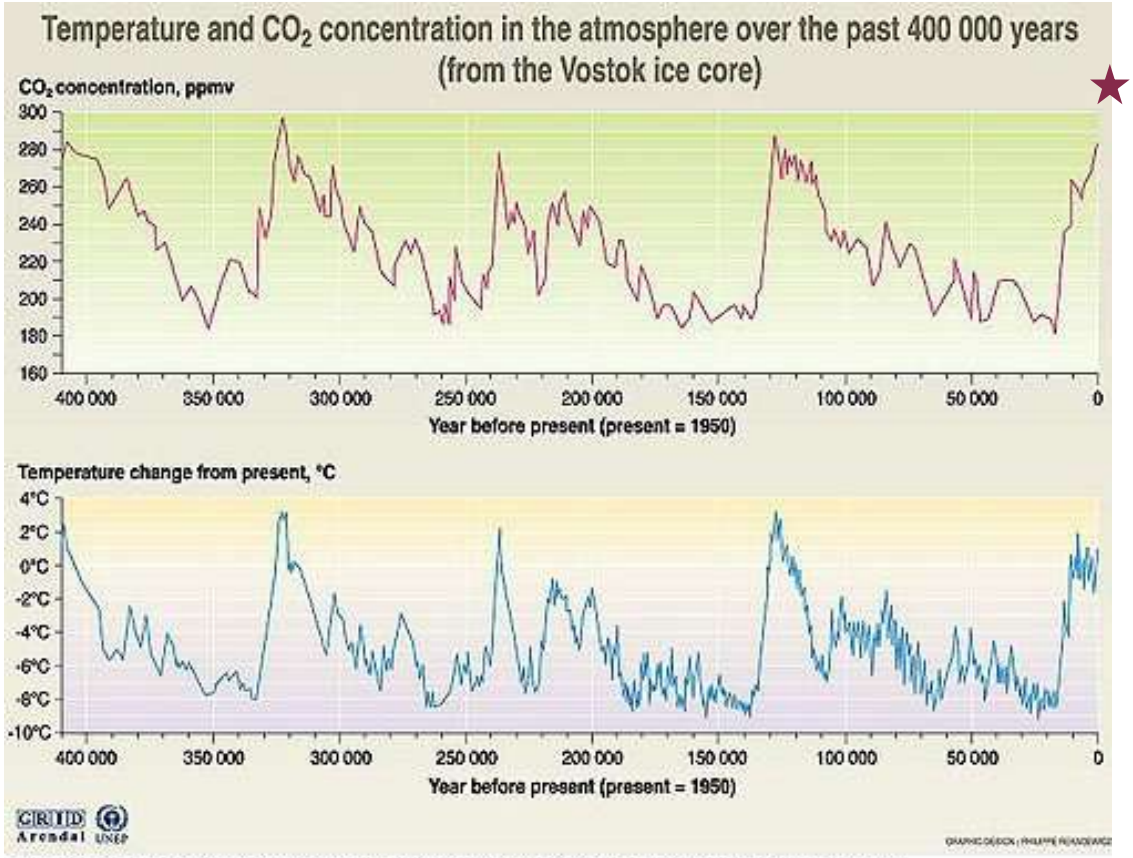
INCREASE IN TEMPERATURE



DRILLING IN THE ICE

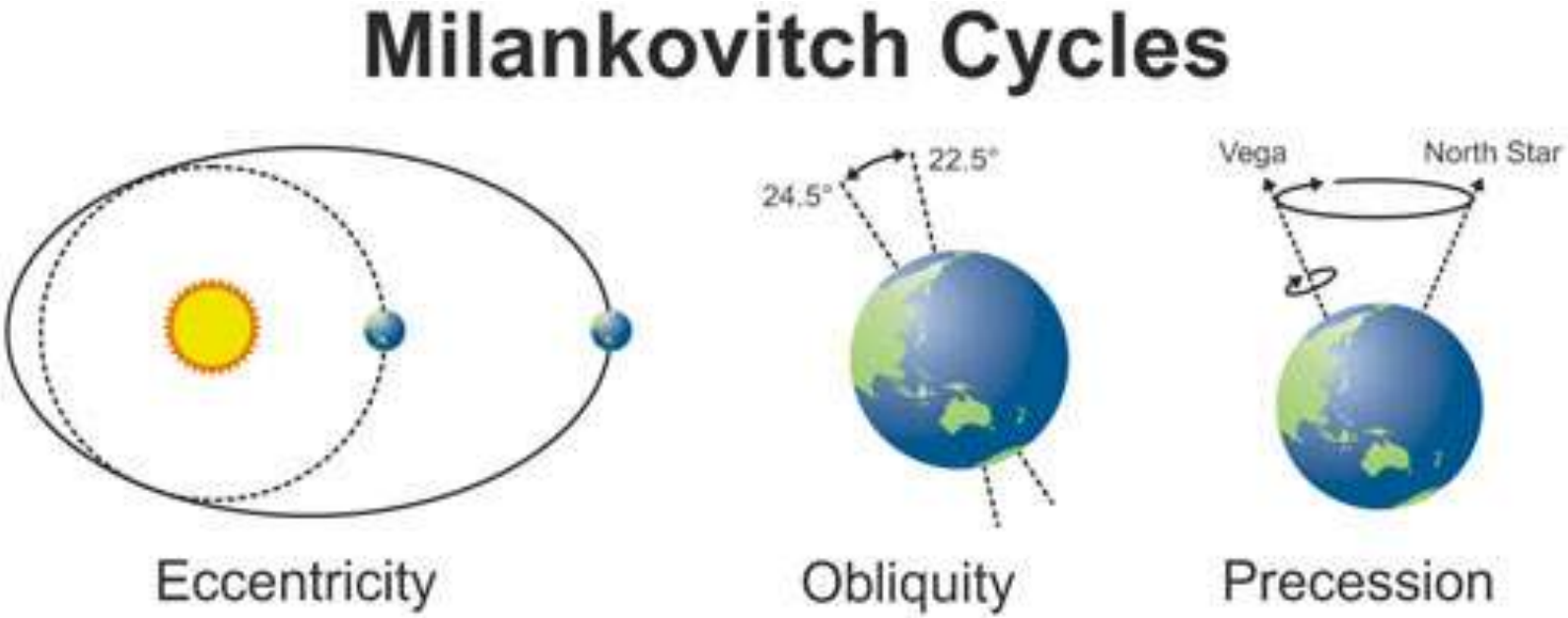
VOSTOK ICE CORE

CO2 AND TEMP 400 000 YEARS

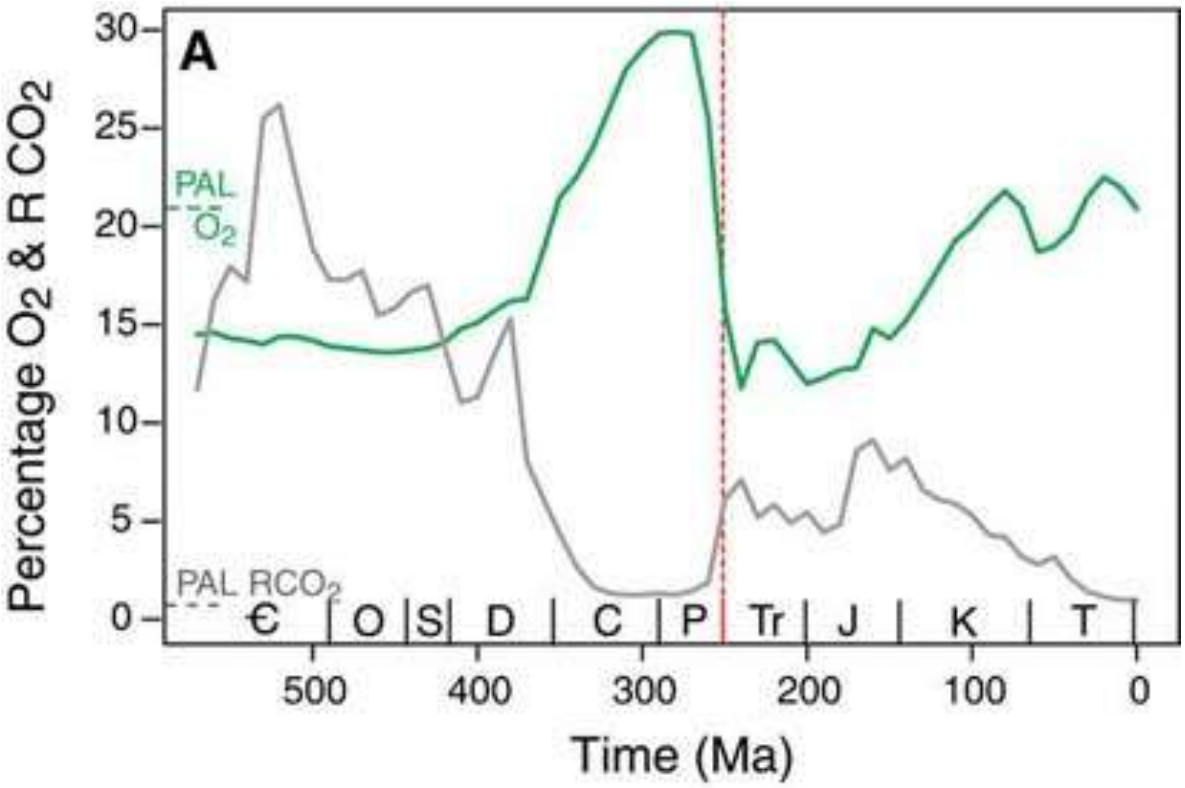


Source: J.R. Petit, J. Jouzel, et al. Climate and atmospheric history of the past 420 000 years from the Vostok ice core in Antarctica, Nature 399 (3 June), pp 429-436, 1999.

MELANKOVITCH CYCLES



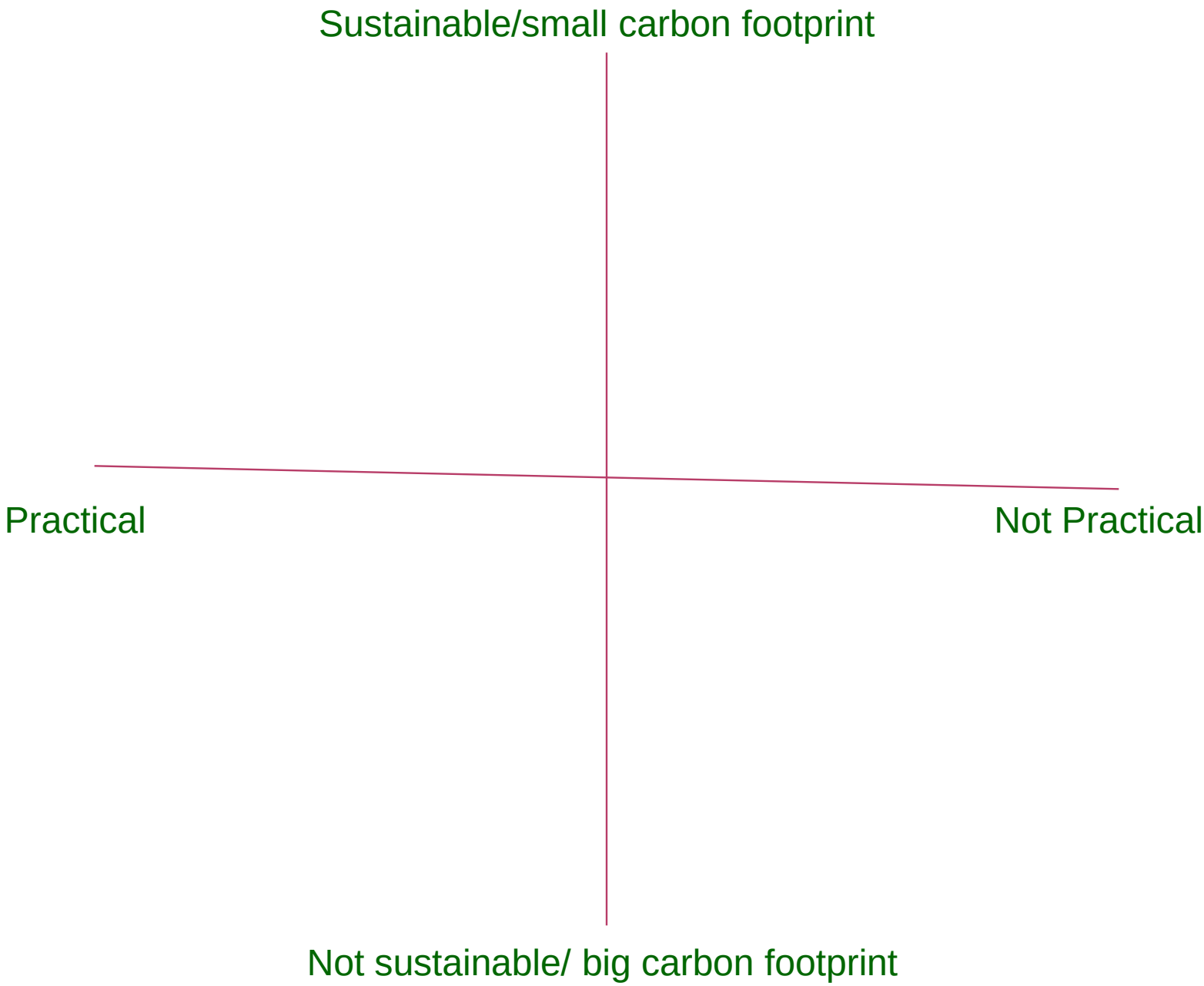
% OF O_2 AND CO_2 OVER TIME



EFFECTS OF CLIMATE CHANGE

Melting Ice Caps
High Sea levels
More extreme weather:

- Hurricanes
- Droughts
- Storms


Sustainable/small carbon footprint
Practical
Not Practical
Not sustainable/ big carbon footprint


anward
WARM YOUR LIFE


Giant
Giant


Doritos


Pick n Pay


fanta
Coca-Cola


zero

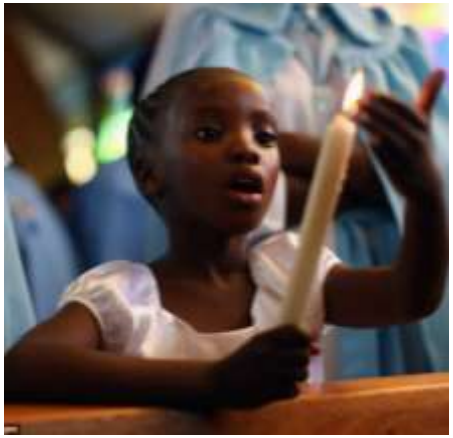

TESLA
394

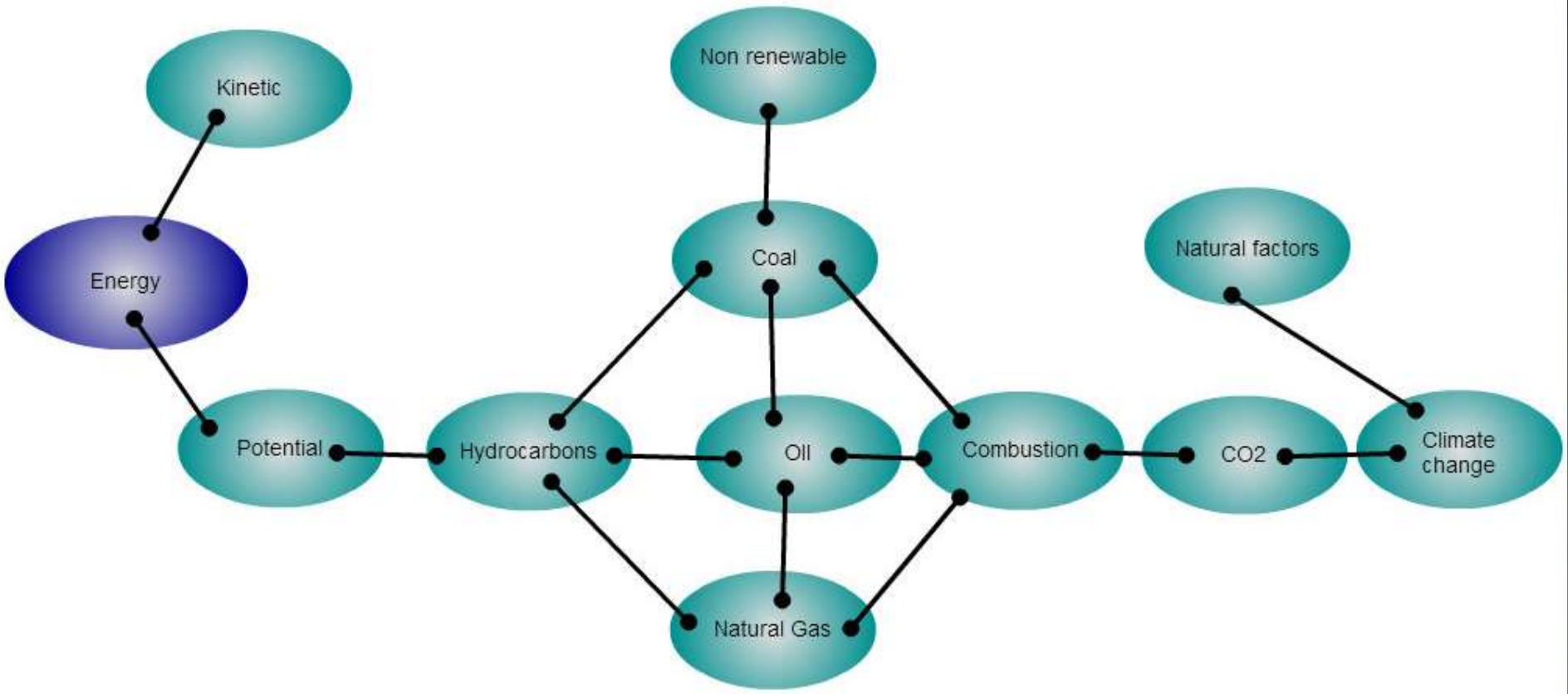

VUN 126


MICRA


METROBUS
Johannesburg, RSA. may-2002
Keith Rapley


SOUTH AFRICAN




Kinetic
Energy
Potential
Non renewable
Coal
Hydrocarbons
Oil
Natural Gas
Combustion
Natural factors
CO2
Climate change