

# CLIMATE CHANGE, ENERGY & DEVELOPMENT

presented by Harald Schütt

AMUSHA

Consultancy Services

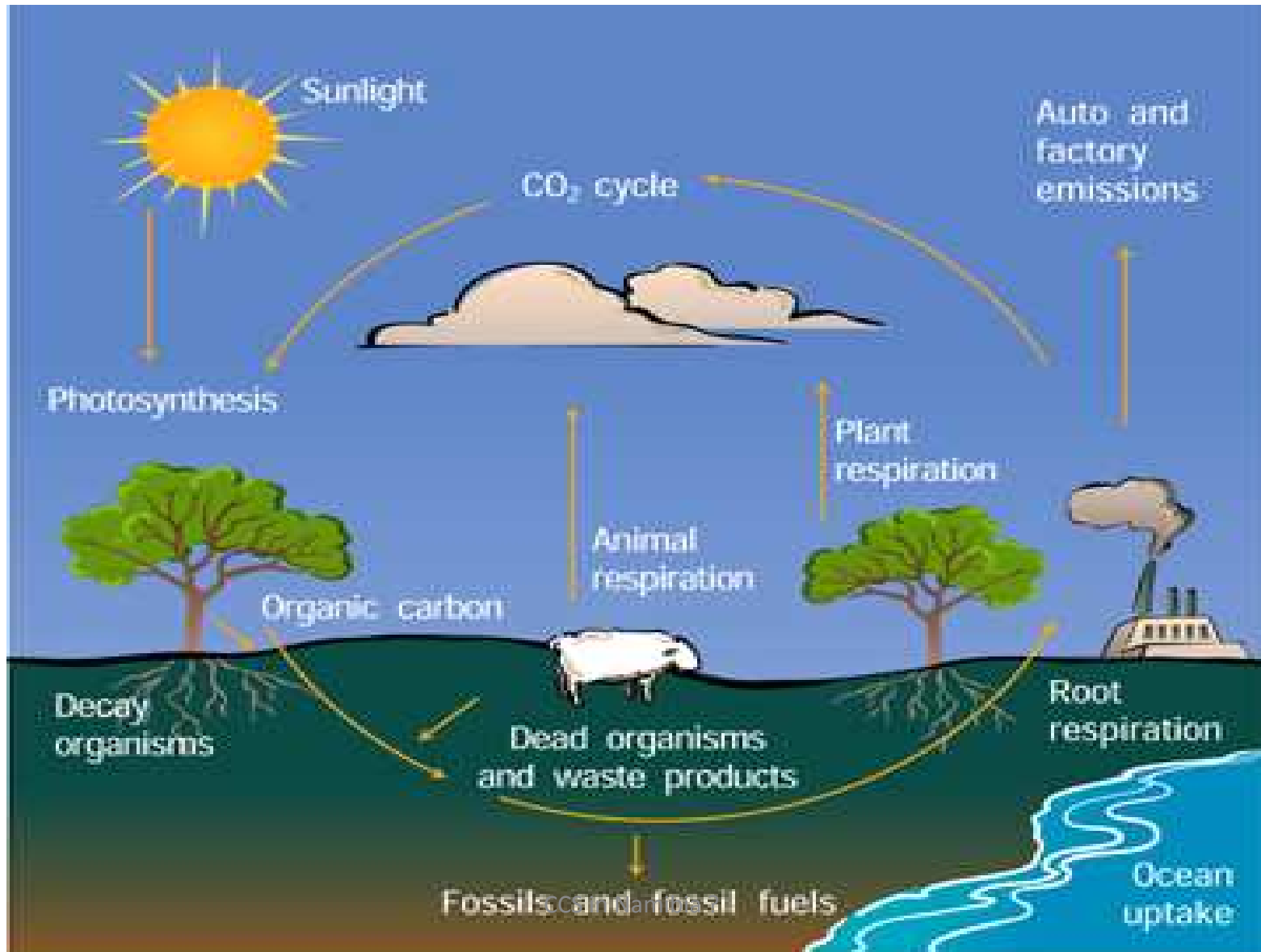
commissioned by

Desert Research Foundation of Namibia

# The Carbon Cycle

- In prehistoric times the atmosphere was full of  $\text{CO}_2$  => no mammals.
- Good conditions for plants = lots of carbon to absorb: after millions of years there were lots of trees and other plants giving away lots of Oxygen ( $\text{O}_2$ )
- Through tectonic movements, geological shifts, heat and pressure and exclusion of Oxygen underground, plants become coal and diamonds, oil & gas (hydrocarbons)

# The Carbon Cycle

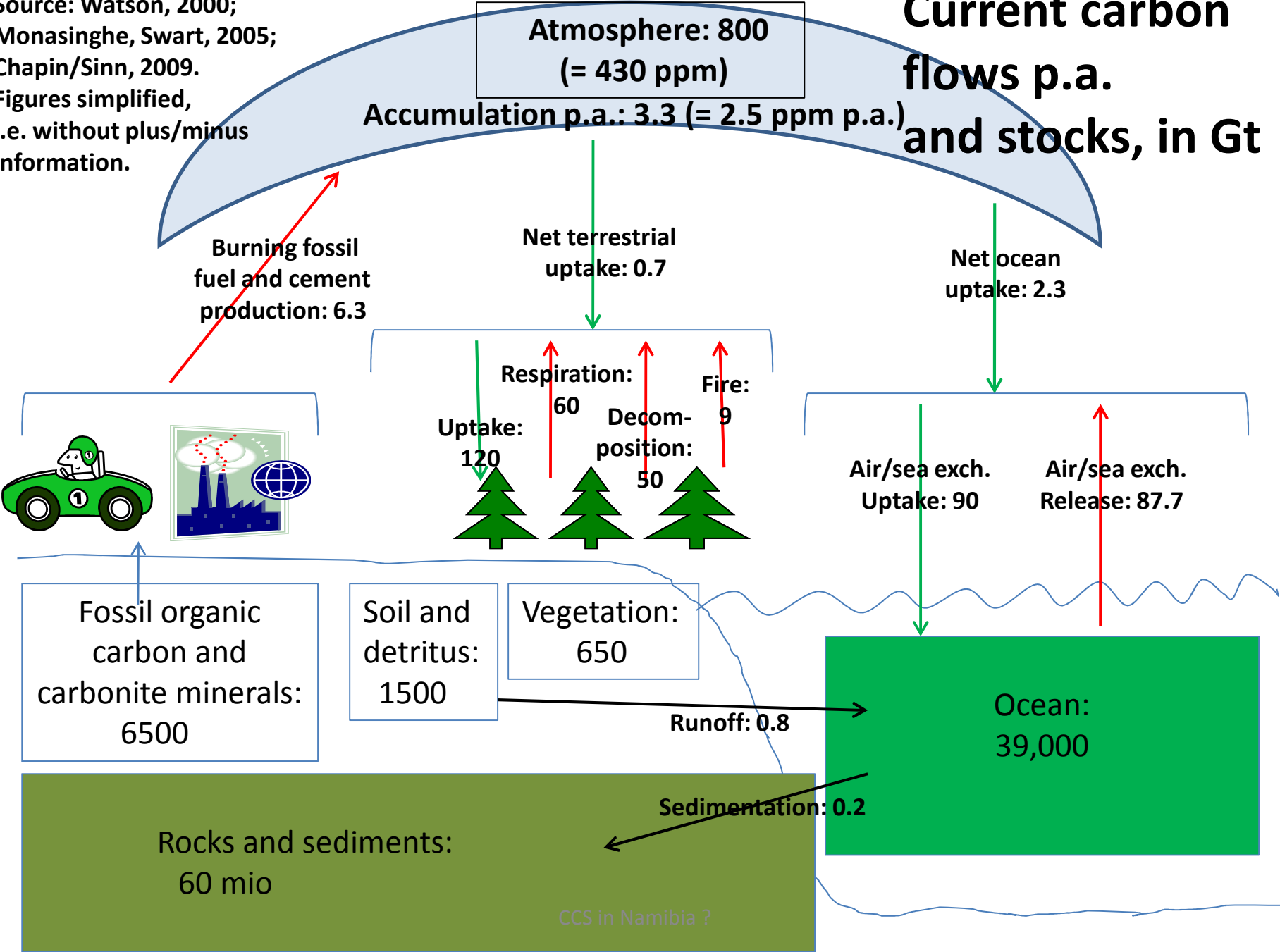


# The Carbon Cycle

- **When humans burn fossil fuels, most of the carbon quickly enters the atmosphere as carbon dioxide.**
- **Carbon dioxide is a greenhouse gas and traps heat in the atmosphere.**
- **Without it and other greenhouse gases, Earth would be a frozen world.**
- **But humans have burned so much fuel that there is about 30% more carbon dioxide in the air today than there was about 150 years ago, and Earth is becoming a warmer place.**
- **Ice cores show us that there is now more carbon dioxide in the atmosphere than there has been in the last 420'000 years.**

# Current carbon flows p.a. and stocks, in Gt

Source: Watson, 2000; Monasinghe, Swart, 2005; Chapin/Sinn, 2009. Figures simplified, i.e. without plus/minus information.



# The Industrial Revolution

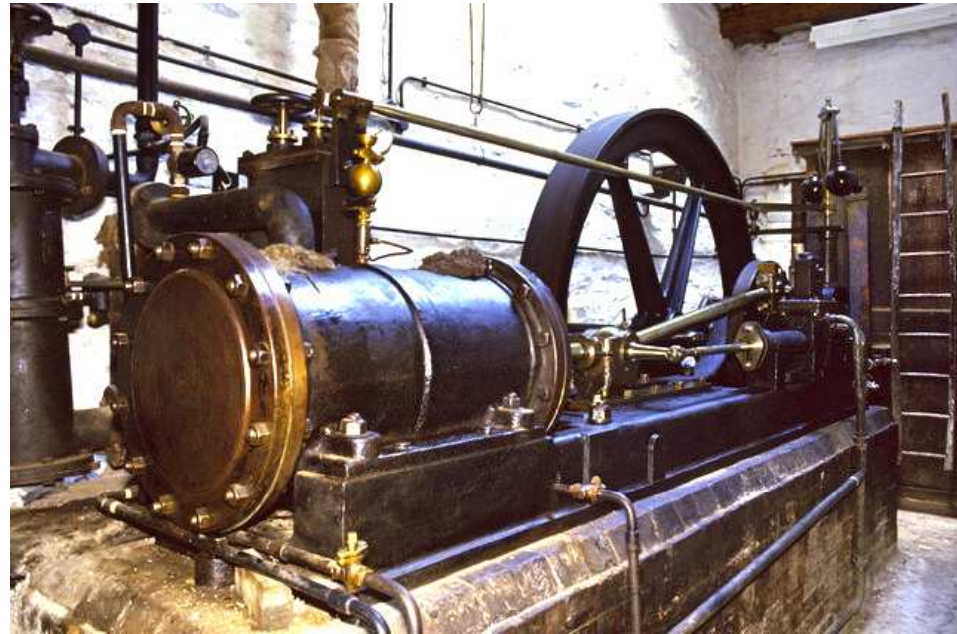
Marks the beginning of the problem:

- 1690 [Denis Papin](#) steam engine
- 1698 [Thomas Savery](#) external combustion engine
- **1760 Commonly taken as the beginning of IR**
- 1781 – 1848 [George Stephenson](#) et al.
- 1850 (and earlier) internal combustion engines of various types
- 1866 The industrial generator of electricity by Werner von Siemens

# The Industrial Revolution

George Stephenson

1800



CCS in Namibia ?

# The Industrial Revolution

- Expansion of modern Empires,
- Colonialism,
- Wars for raw materials, fuels and markets:
  - Triangular Trade
  - Colonial wars
  - World War I
  - World War II
  - Ongoing wars



# European expansion since 1763

Along with the rise of the Industrial Revolution, which economic historians generally trace to the 1760s, and the continuing spread of industrialization in the empire-building countries came a shift in the strategy of trade with the colonial world. Instead of being primarily buyers of colonial products (and frequently under strain to offer sufficient salable goods to balance the exchange), as in the past, **the industrializing nations increasingly became sellers in search of markets for the growing volume of their machine-produced goods.**

Furthermore, over the years there occurred a decided shift in the composition of demand for goods produced in the colonial areas. Spices, sugar, and slaves became relatively less important with the advance of industrialization, concomitant with a rising demand for raw materials like cotton, wool, vegetable oils, jute, dyestuffs and food for the swelling industrial areas like wheat tea, coffee, cocoa, meat, butter, etc. .

source: <http://www.britannica.com/EBchecked/topic/126237/colonialism/25893/Colonial-wars-of-the-first-half-of-the-18th-century>

# TODAY

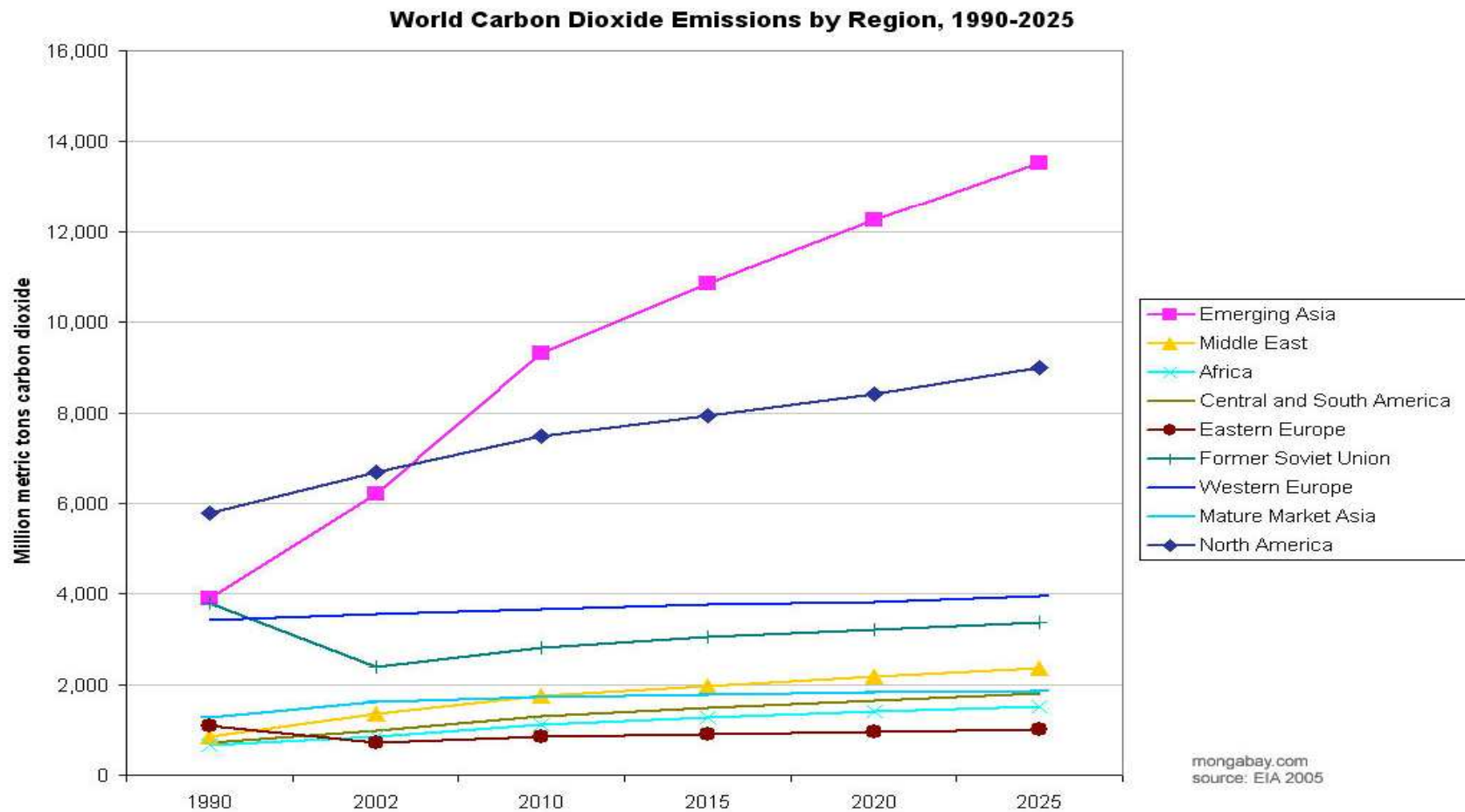
## WE HAVE A MAJOR ENVIRONMENTAL CRISIS



HUMANKIND USES IN ONE YEAR AS MUCH HYDROCARBON MATERIAL AS MOTHER EARTH COULD PRODUCE IN ONE MILLION YEARS.

# TODAY

CO<sub>2</sub> concentration in the atmosphere is going towards the old times when there where no mammals.



# Today

20% of the worlds' population enjoy a lifestyle that consumes 80% of the energy currently available and produces 75% of the toxic waste.

In Germany, we have >80 million people and 40 million cars, which pollute the air and create a lot of other problems, but we read on the newspapers that it is a big “success” when the auto industry sells an increasing number of them

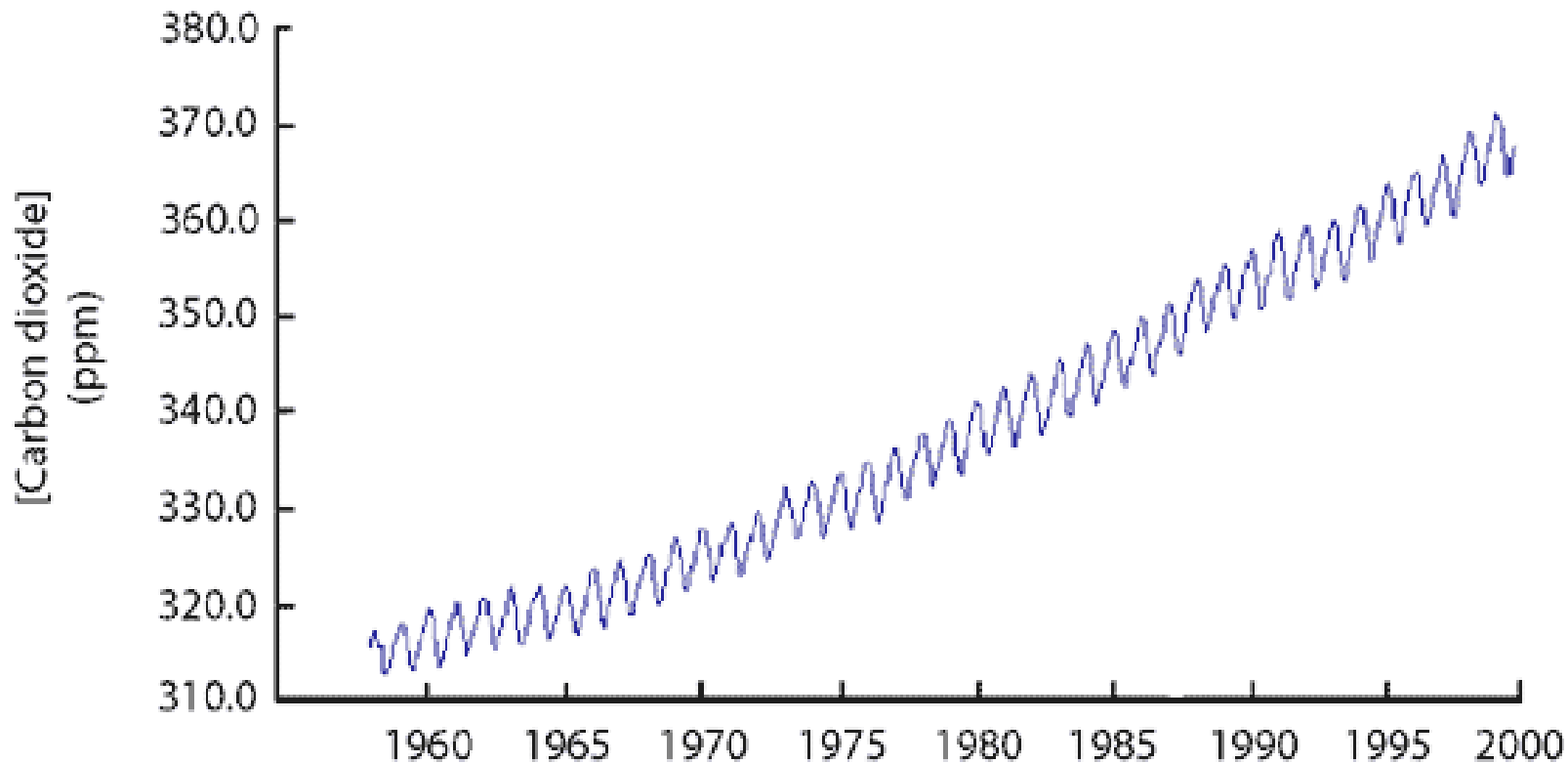


CCS in Namibia ?

# TODAY

We have a problem of a life threatening CO<sub>2</sub> concentration NOW and we better deal with it

Keeling Curve of Atmospheric Carbon Dioxide from Mauna Loa, Hawaii



# The real problem TODAY

- CO<sub>2</sub> concentration in the atmosphere is a **symptom** that indicates a much bigger disease:
- **Industrial constipation**
  - Too many products
  - No new markets
  - Too much CO<sub>2</sub>
- **SAME MENTALITY SINCE INDUSTRIAL REVOLUTION**

# Solutions TODAY

- **We could start solving the cause of the problem**
- **Stop producing CO<sub>2</sub> instead of storing it ? ! ?**
- The Industrial Revolution is over ! It has proven unsustainable and disastrous in its present form and is **not replicable** => **we need to change the way we live** if we want to survive as humankind.
- We need to think out of the box to find new solutions !

# Solutions TODAY

We came here to discuss **Carbondioxide Capture and Storage (CCS)**.

CCS applied to a modern conventional power plant could reduce CO<sub>2</sub> emissions to the atmosphere by approximately 80-90% compared to a plant without CCS.

The IPCC estimates that the economic potential of CCS could be between 10% and 55% of the total carbon mitigation effort until the year 2100 (section 8.3.3 of IPCC report)

Capturing and compressing CO<sub>2</sub> requires much energy and would increase the fuel needs of a coal-fired plant with CCS by 25%-40% and thus the price per kWh.

These and other system costs are estimated to increase the cost of energy from a new power plant with CCS by 21-91%

# Solutions TODAY

Besides biological and natural ways there are according to my knowledge three main methods to do that:

1. Inject CO<sub>2</sub> in geological formations that can keep it for a long time – (HOW long time ?)
2. Dissolve CO<sub>2</sub> in the ocean (what will happen to it ? Aciditation ?)
3. Bind it chemically to create Carbonates (CaCO<sub>3</sub>, MgCO<sub>3</sub>, Na<sub>2</sub>CO<sub>3</sub>, FeCO<sub>3</sub>, K<sub>2</sub>CO<sub>3</sub>)

See this little experiment.

# Solutions TODAY

Experts say that it would be best to press the CO<sub>2</sub> in geological formations that did contain carbohydrates like oil or gas before. This is also the relatively cheapest solution. It has already been practiced since many years to increase the pressure of depleting oilfields.

There is some discussion about what will happen in the real **long term** with this CO<sub>2</sub> gas.

The biggest anticipated danger is **leakage**, which poses and immediate threat to the people around and a long term threat to the environment in general should leakage happen, the rise of CO<sub>2</sub> in the atmosphere will increase dramatically in the short period of time.

# Solutions TODAY

What could Namibia possibly contribute ?



We have a big country with lots of space.

CCS in Namibia ?

# Solutions TODAY

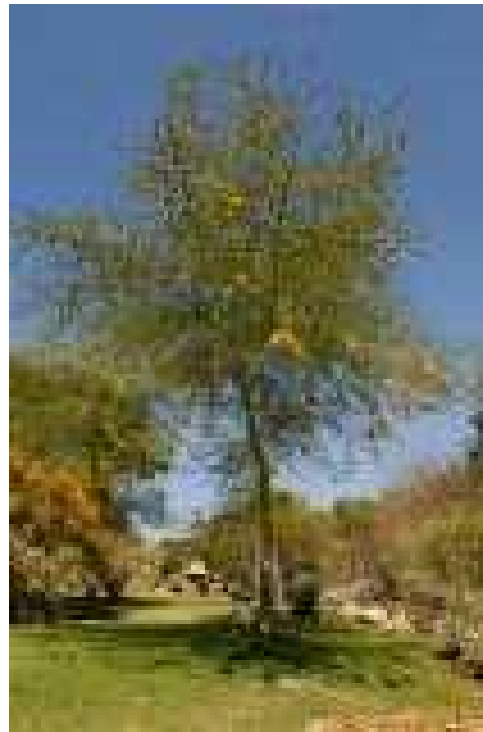


But, do we have geological formations that are suitable for CCS ?

CCS in Namibia ?

# Solutions TODAY

We can offer our trees to take up the CO<sub>2</sub> with time



CCS in Namibia ?

# Conclusion TODAY

Will Namibians will be in a position to help with CCS ?

Should we leave this task to countries with geological formations that hold natural gas, oil or coal like Algeria, Botswana, Central Africa, Egypt, Libya, Mozambique, South Africa and others who are much better suited for this ?

# Solutions TODAY



CCS in Namibia ?

We must always remember that we only borrowed the earth from our children – we did not inherit her from our ancestors



# Thank you

**PLEASE LET ME HEAR YOUR QUESTIONS AND COMMENTS  
LET'S TALK**

**HARALD SCHÜTT**

**AMUSHA**

Consultancy Services

[amusha@iway.na](mailto:amusha@iway.na)

[www.teamnamibia.com/amusha](http://www.teamnamibia.com/amusha)