

GREENPEACE



Carbon Capture and Storage – Response to Climate Change
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Organised by: University of Zagreb
Faculty of Mining, Geology, Petroleum Engineering
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Storing carbon dioxide underground - help for the climate ?

- *Climate change*
- *Emission reductions*
- *CCS concerns*
- *Business as usual*
- *Conclusion*



Climate Change (1)

- **Temperature increase**

in Europe over the last 100 years is about 0.95°C – which is higher than global average (0.8°C). Global average sea surface temperature is also increasing. Part of Mediterranean Sea shows a warming of about 0.5°C over the past 15 years.

- **Change in summer precipitation**

annual precipitation trends over the last 100 years show that southern Europe has become up to 20% drier. The reduction in southern Europe / Mediterranean is expected to have severe effects, e.g. more frequent droughts, with considerable **impacts on agriculture and water resources**.

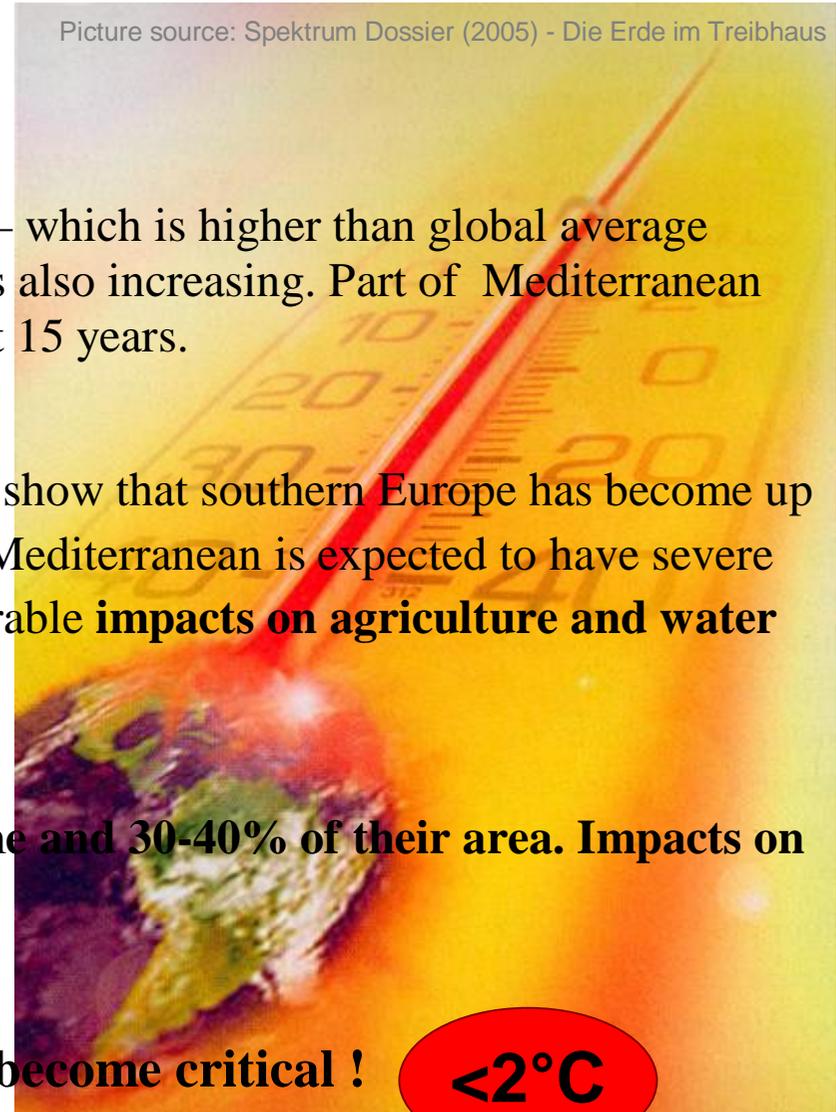
- **Loss of mountain ice / glacier retreat**

European glaciers have lost half of their ice volume and **30-40% of their area**. **Impacts on tourism and water resources**.

0.8°C already – not much more and it will become critical !

$<2^{\circ}\text{C}$

Picture source: Spektrum Dossier (2005) - Die Erde im Treibhaus





Climate Change (2)

New IPCC report underlines that

We are the driver of climate change

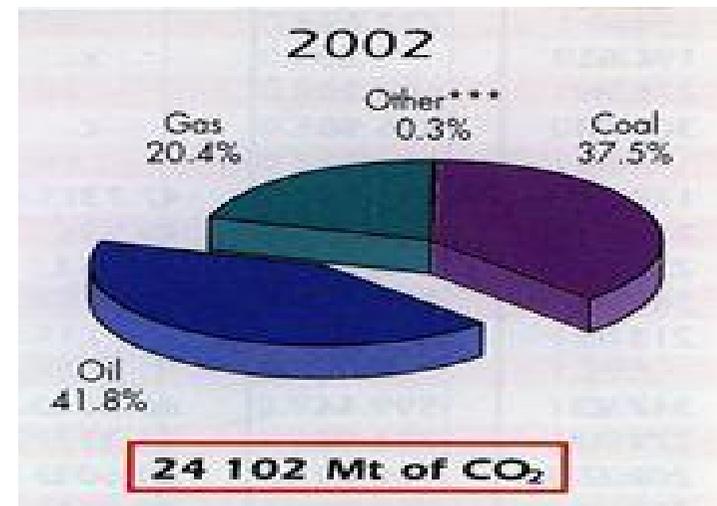
We are releasing masses of GHG and heat our planet.

Anthropogenic emissions are derived mainly through burning of fossil fuels.

This has increased the atmospheric concentration of CO₂ from 278 ppm (pre-industrial levels) to 379 ppm at present (which exceeds the highest concentration in the last 400.000 years by 70 ppm).

We are the cause of the problem

– we must fix it!

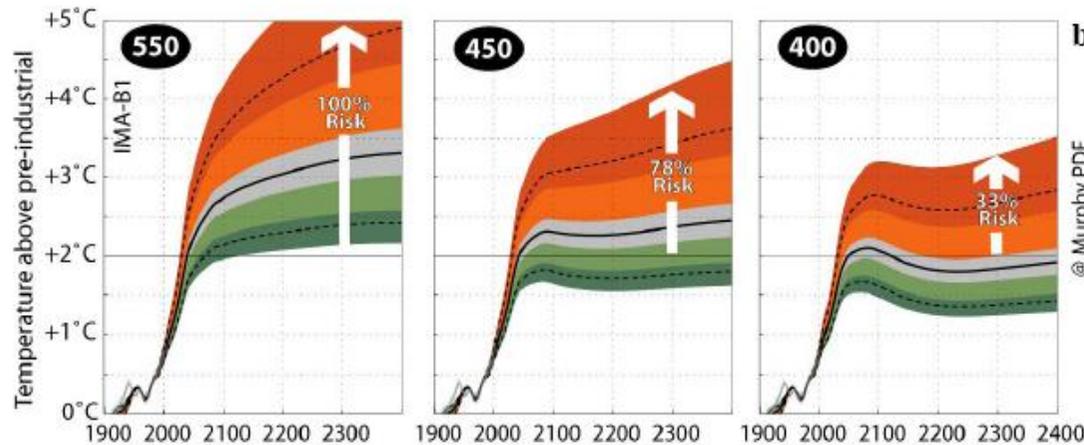


Source: IEA Key World Statistics 2004

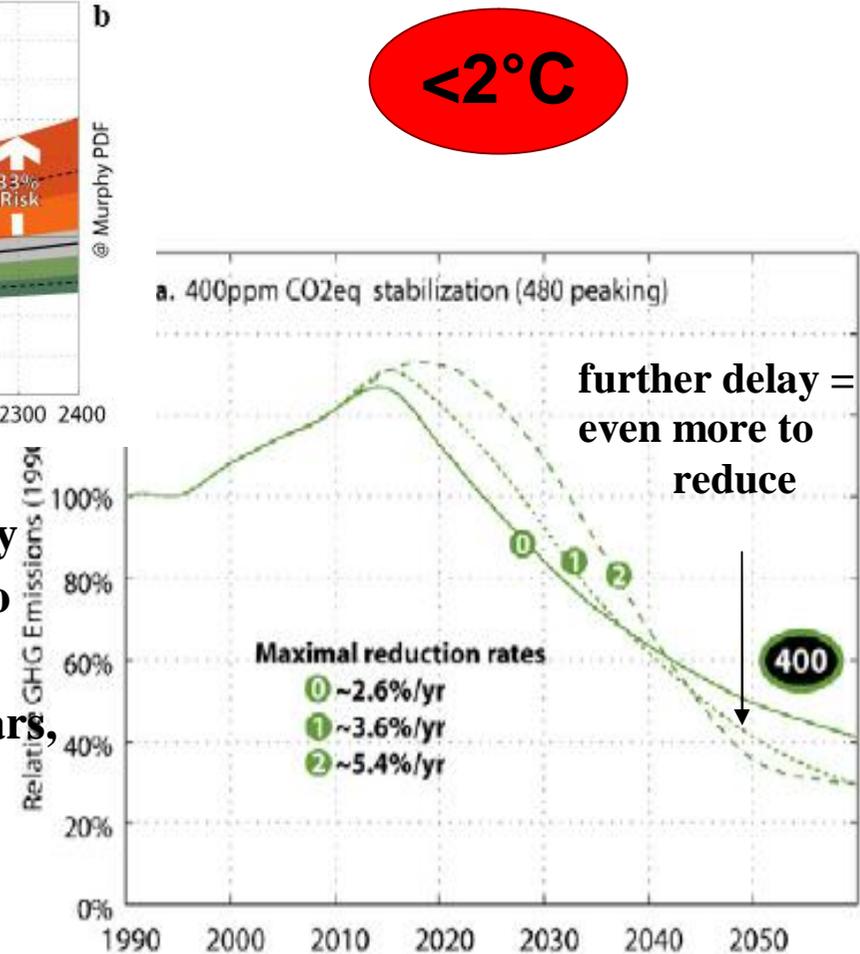


Climate Change (3)

Source: Elzen & Meinshausen (2005): Meeting the EU 2°C climate target: global and regional emission implications. NEAA



For achieving the $<2^{\circ}\text{C}$ target with a probability of more than 65%, GHG concentrations need to be stabilized at **400 ppm** CO₂equ. This requires global emissions to peak in the next 10 to 15 years, followed by substantial reductions in the order of 50% by 2050!





How to achieve reductions?

- Reduce GHG emissions at their source -
- The goal: new renewable energies provide clean energy, energy efficiency reduces demand
- Today: New, more efficient coal power plants need less coal and emit less CO₂ than old power plants - but there is still too much land destroyed and water polluted due to mining and too much CO₂ emitted.

... what about CCS?



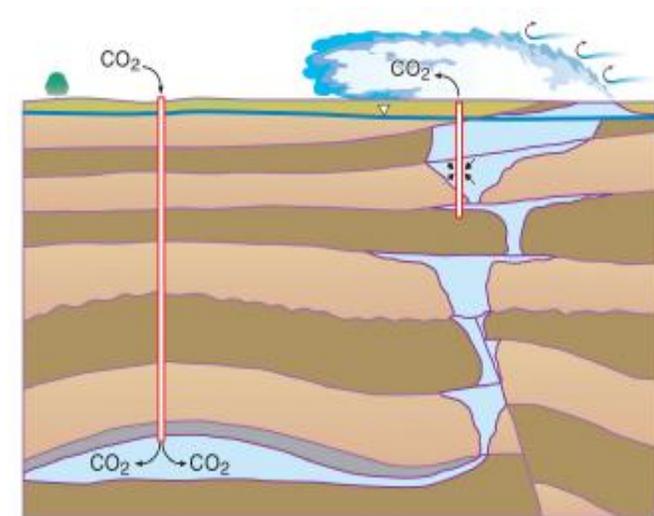
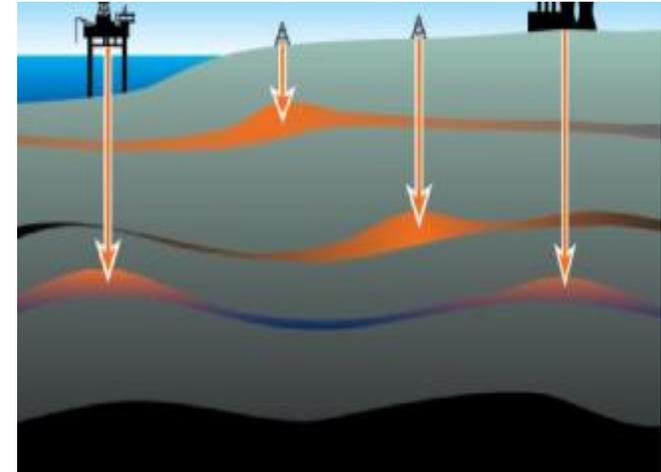


What about CCS?

CCS is a radical departure from the path of renewable energy and efficiency – its intent is not to avoid the production of harmful emissions but instead to bury them.

Storing of CO₂ raises environmental concerns:

- Much more mining / energy is required (efficiency loss by 8-14% points due to capture)
- Liability, regulatory, accounting, monitoring
- Risk of leakage (physical risk)
- Shift of efforts and money away from sustainable renewable energies / high costs (however, doing nothing would cost even more) (economical risk)
- CCS is not available before 2020 (political risk)





Risk of leakage

- Local risk: If CO₂ leaks out of a storage formation, or a well, local impacts may exist for humans, ecosystems and groundwater. The risk increases if the injected CO₂ stream contains toxic impurities.
- Global risk: Release of CO₂ may contribute significantly to climate change if some fraction leaks from the storage formation to the atmosphere. Continuous leakage could, at least in part, offset the climate benefits.

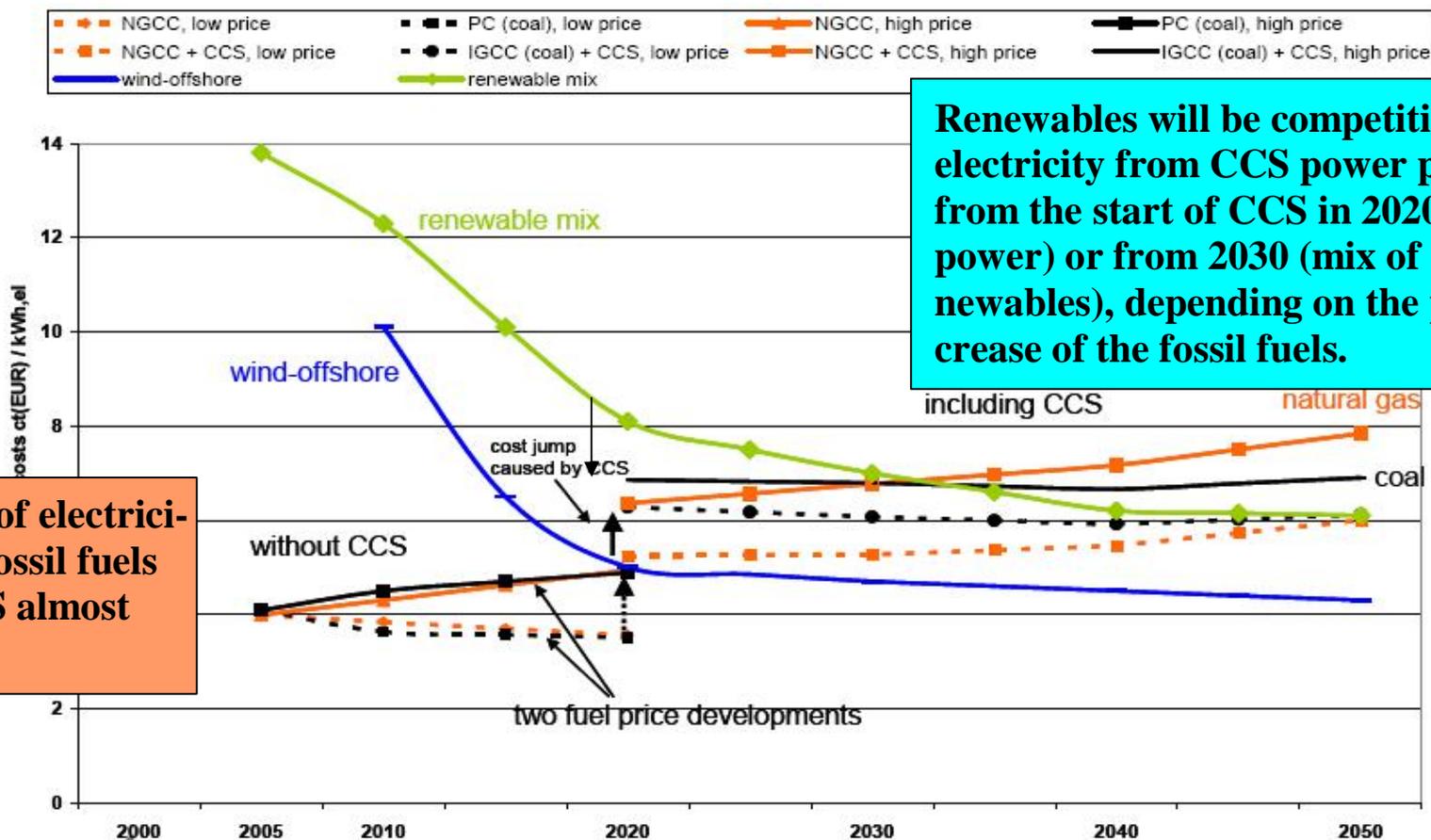


How to move forward? Need international regulatory framework, comprehensive geological site-characterization, EIA, monitoring, reporting, liability system (insurance, bond, reduced amounts of credits, fund as incentive for best practise)

The IPCC report classifies two types of leakage scenarios: (1) abrupt leakage, through injection well failure or leakage up abandoned wells, (2) gradual leakage, through undetected faults, fractures or wells.



Renewable energies / costs of CCS



Renewables will be competitive with electricity from CCS power plants from the start of CCS in 2020 (wind power) or from 2030 (mix of all renewables), depending on the price increase of the fossil fuels.

The cost of electricity from fossil fuels with CCS almost doubles.

From: Viebahn P. et al. (2006): Comparison of carbon capture and storage with renewable energy technologies regarding structural, economical, and ecological aspects. GHGT-8



CCS is not available before 2020

Before 2020: Not available on large scale / commercially / economically. We do have an increasing number of pilote projects that need to be financed / subsidized.

The Kyoto target and Post-Kyoto 2020 target (reduction need 30%) must be achieved without CCS.

To prevent catastrophic climate change, the “U-turn” must have been done by 2020. The change of our energy system / our consumption behaviour begins **NOW**. Instead, new coal power plants are built everywhere as if climate change doesn't exist. The decisions taken today have great impact on our future energy and emissions structure (and the need / no need to store CO₂).

Building those power plants “capture-ready” is also just an empty word. Capture-ready does not exist (no plan about the storage site, no plan what type of plant will become economical). Retrofitting those plants later is not economical.



The danger of “business as usual”

Keeping on the “business as usual” track will create a lock-in situation where we have no other choice than to store the CO₂ from coal power plants underground (even if the future would show that CCS remains e.g. expensive).

Running for coal (with CCS) – investment decision - means, we are postponing the transition towards a sustainable low carbon energy world and could **risk losing our climate goal (<2°C)**. [physical barriers, cost barriers, public barriers]

Do we really want to continue spending efforts and money to coal where the only way in which fossil fuel generation can be maintained will be with CCS?

Do we really want to store millions of tons of CO₂ underground while other clean options are available? [a single 1.000MW lignite plant emits ca. 8 MtCO₂/a]

Future generations will pay the price: they have no fossil resources left but huge storage sites to take care of.



Whatever way we choose – Renewables and CCS

Price of energy / electricity will not be cheap any more
The energy infrastructure will be changed dramatically

However, one big difference remains:

Renewable Energies do not create environmental damages like those from mining activities.

Renewable Energies do not create huge underground waste deposits that need to be monitored and overseen.

Renewable Energies do not exploit resources until nothing's left.

Let's go for them!



The less CO₂ to be stored the better

If we really want
world can make it
without substituting
one problem by another.

Thanks

