

Climate Change: Past Legacies, Current Choices

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1

Human-Induced Climate Change

- The Earth's climate is changing due to emissions from our energy use
- We use fossil fuel-based energy which releases CO₂, the major heat-trapping gas causing climate change
- We are already seeing and experiencing impacts
- Solutions are wide-ranging, and involve all of us (in our many societal roles)...

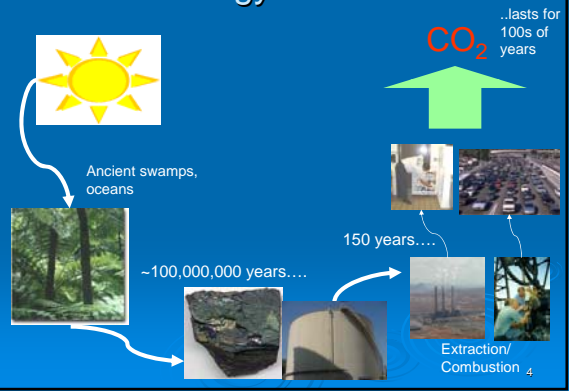
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Home

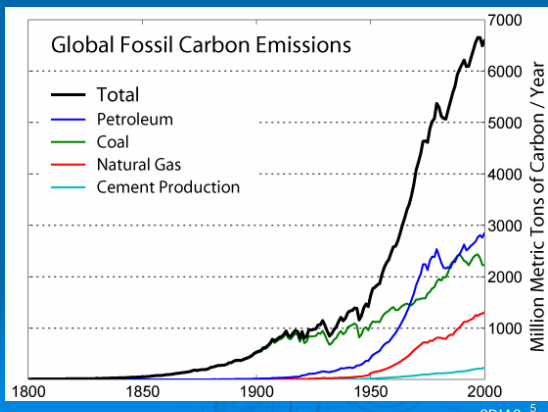


3

The energy/carbon link

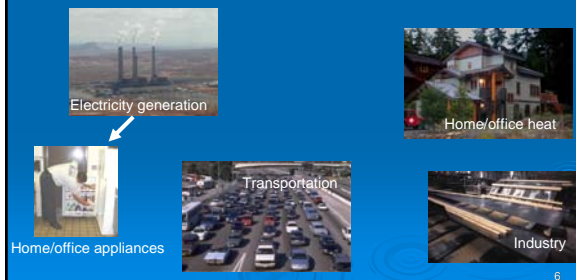


Global Fossil Carbon Emissions



5

86% of our energy in the U.S. comes from fossil fuels which put carbon dioxide (CO₂) into the atmosphere...



6

Carbon dioxide also added by land use change...

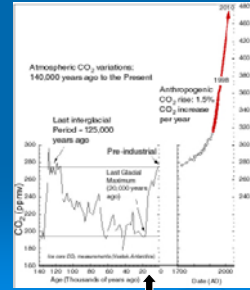


- Deforestation
- Agricultural practices



7

CO₂ concentration of our atmosphere



CO₂ today: 384 ppm

(In my lifetime, it's risen by 62 ppm...)

- Higher today than it has been for 400,000 years, likely 2 million years.

The first human farmers, 12,000 years ago... 8

...And this CO₂ * acts as an increasingly heavy heat-trapping "blanket" around the Earth...

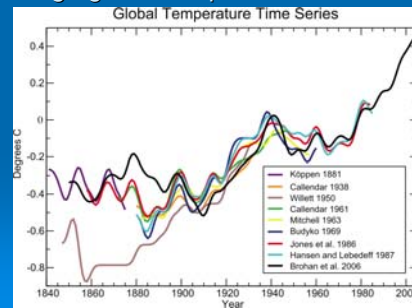


*Along with less abundant gases such as methane, N₂O, and others

9

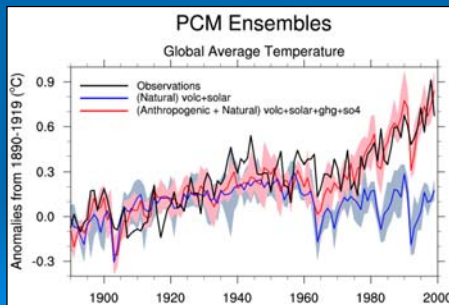
Impacts are here...

- Average global temperature increase



10

...caused by human activity...



11

...with some very rapid increases in northern latitudes and higher elevations



Portions of the ground in Alaska are subsiding



All but a few glaciers will be gone from Glacier National Park by mid-century

12

Other impacts...



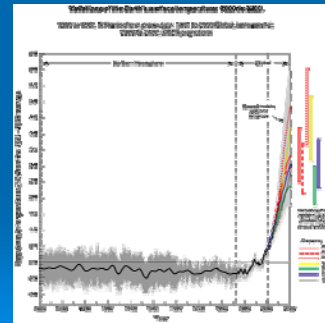
- Sea level rise
- Disruptions in our "expected" climate— more frequent floods, droughts, heat waves
- Changing in timing of freshwater resources, e.g. snowpack

- Surprises such as abrupt change
- Species habitat loss/changes outpacing evolution



13

The future?



14

So why is this not perceived as urgent?

15

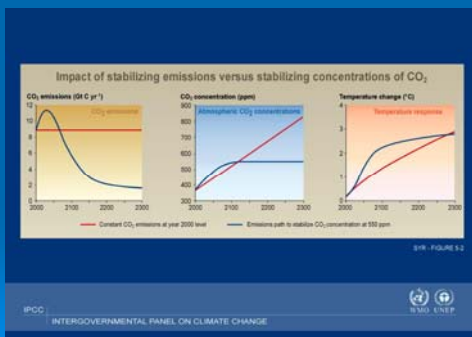
Lack of Urgency: Multiple strikes...

- Climate change is a "creeping problem"
 - Long term
 - Slow onset
 - Incremental changes that result in large problem
 - When recognized, problem may be too severe to be reversed



16

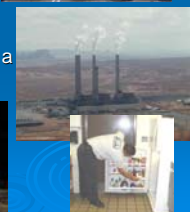
System lags and lack of immediacy



17

But not just in the climate system...

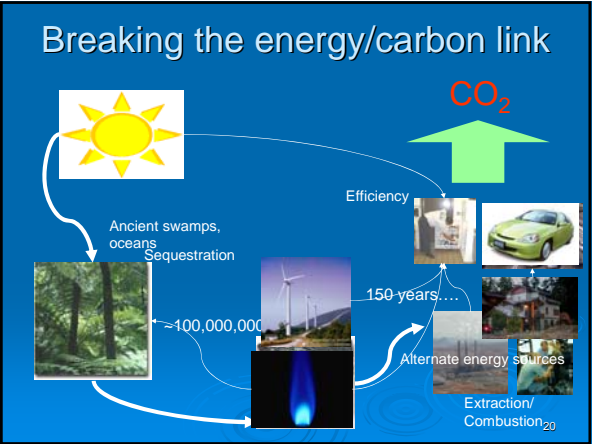
- Appliances 5-10 years
- Automobiles 10-15+ years
- Buildings 10s+ years
- Power plants 30-50 years
- Transportation system - decades
- In other words, human infrastructure brings with it decades of commitment to a particular pathway



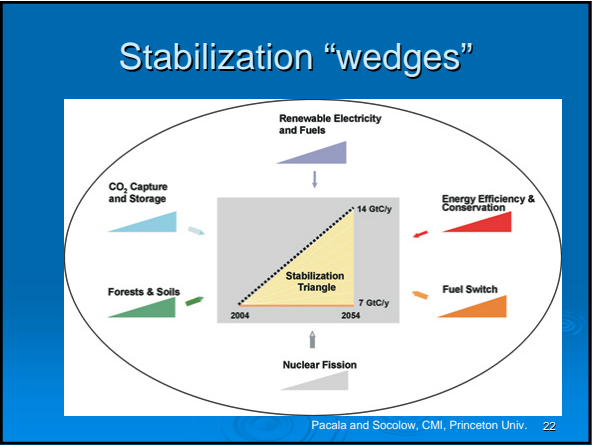
18

We have some choices...

19



- ### Solutions
- Decreasing the CO₂ we emit:
 - Boils down to “Using energy without emitting heat-trapping gases”
 - Using less energy based on fossil fuel
 - Using energy that produces less carbon
 - Sequestering carbon so it doesn’t stay in the atmosphere
 - Adapting to the climate change that is already here and will continue...
- 21



- ### Using less: Efficiency
- Transportation
 - Fuel-efficient cars, trucks (e.g. hybrids), carpooling, biking, public transport
 - Home energy
 - Insulation, energy efficient appliances
 - Energy production
 - More efficient transmission systems
- 23

- ### Emitting Less
- Substitute less carbon-intensive fuels...
 - Coal gives out the most CO₂ per unit energy, followed by petroleum and natural gas
 - Wind, solar, hydro and nuclear energy don’t give off CO₂ emissions
 - Biomass energy– “shorter time scale” carbon
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- 24

Carbon sequestration and offsets

- Putting the CO₂ away from the atmosphere (for a certain length of time)
 - Forestry
 - Agricultural practices, e.g. no-till, which stores more carbon in the soil
 - Geologic sequestration, placing CO₂ underground in abandoned oil wells, formations, etc.
 - Ocean sequestration?

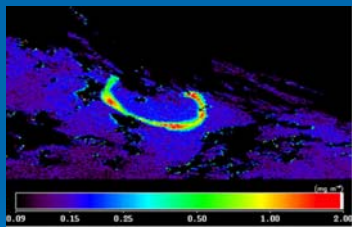
25

Terrestrial Sequestration: Forestry and Agriculture Practices



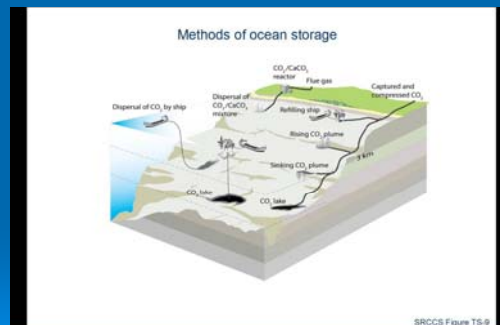
26

Ocean Fertilization experiments



27

Deep ocean injection



SRCCS Figure TS-9

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3

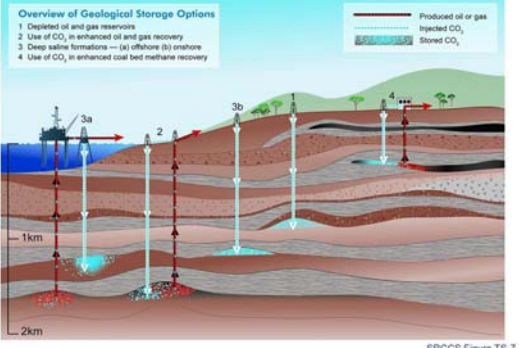
Deep ocean injection experiments



MBARI, Peter Brewer et al.

29

Methods for storing CO2 in deep underground geological formations



SRCCS Figure TS-7

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...and looking beyond energy

- Not just a technology fix
- Fundamental issues of justice and equity
- Issues of sustainability: hunger, poverty, environment, consumption, population
- Adaptation to what is already committed
- Much larger context...sustainability?

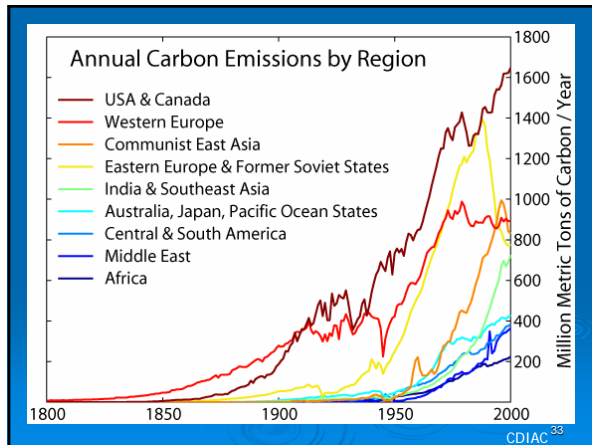
31

Where must action/policy come from?

All levels and sectors of society...

- Local, state, national governments
- Industry
- Business
- NGOs
- Individuals

32



International Policy

- UN FCCC
- Kyoto Protocol in force (thru 2012)
- EU now has cap and trade among heavy industry, mandatory

34

US Congressional Action (past 5 years)

- 106th Congress: Almost 30 legislative proposals introduced
- 107th Congress: 70
- 108th Congress: 100
- 109th Congress: 106
- 110th Congress: 125 as of mid-July

35

Voluntary Policies, local scale

Private Sector Examples:

- The Climate Trust, Oregon
 - Non profit broker of offset projects, both energy and sequestration
- Chicago Climate Exchange
 - Market-based emission reduction and trading program
- World Bank Prototype Carbon Fund
 - Experimental, pilot production of Emission Reductions within the framework of Joint Implementation (JI) and the Clean Development Mechanism (CDM) – a global trading program.
- Many individual projects done as agreements between parties

36

Questions

- Value of mandatory vs. voluntary actions?
- Is 2 degrees C an appropriate target? Who decides?
- Who will bear the cost of mitigation and adaptation?
- Is there a heavier burden on historically larger emitters to solve this problem?
- What is our responsibility to future generations?
- What is our responsibility to current generations still living in poverty?

37

Summary

- CO₂ is the major human-caused heat trapping gas, released by fossil fuel use
- Causing changes in our climate
- Builds up quickly in our atmosphere, is only removed slowly
- Both reducing emissions and addressing unavoidable changes are necessary
- Solutions are required at all levels

38