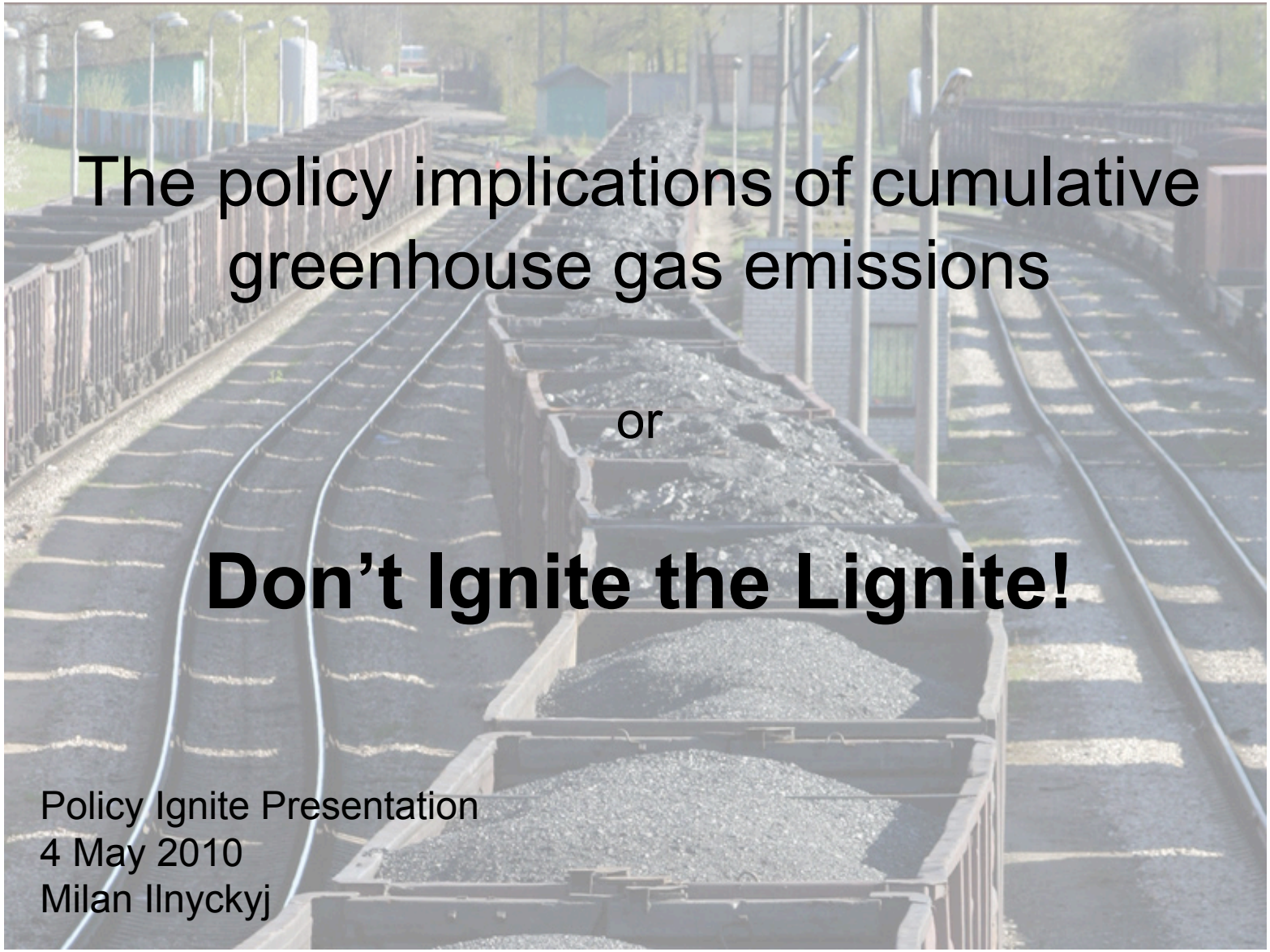


The policy implications of cumulative greenhouse gas emissions

or

Don’t Ignite the Lignite!

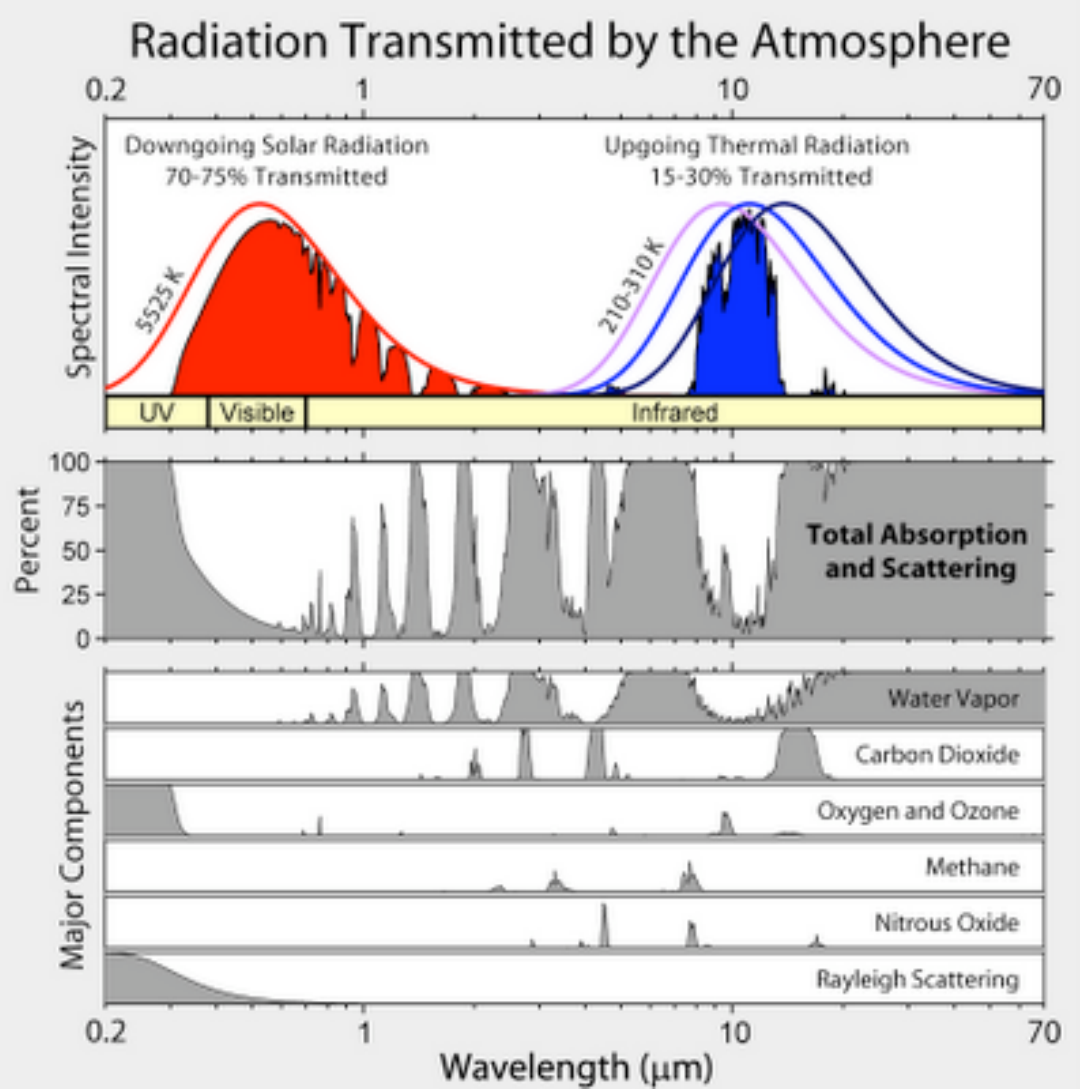
Policy Ignite Presentation
4 May 2010
Milan Ilnyckyj

milan.ilnyckyj@gmail.com

Outline

1. The physics of climate change
2. Evidence the climate is changing
3. How much climate change will we experience?
4. What about carbon capture and storage?
5. Mitigation co-benefits

(1) What goes in, what comes out



Red: incoming from the sun
Blue: outgoing from the Earth

Wavelengths of outgoing radiation absorbed by different greenhouse gases.

Tyndall (1859)
Arrhenius (1896)

(2) Theoretical evidence

- Burn a set amount of coal, oil, or gas and you get a set amount of CO2 (basic chemistry).
- Greenhouse gases absorb outgoing infrared radiation.
- Planets absorbing more radiation than they emit will warm.

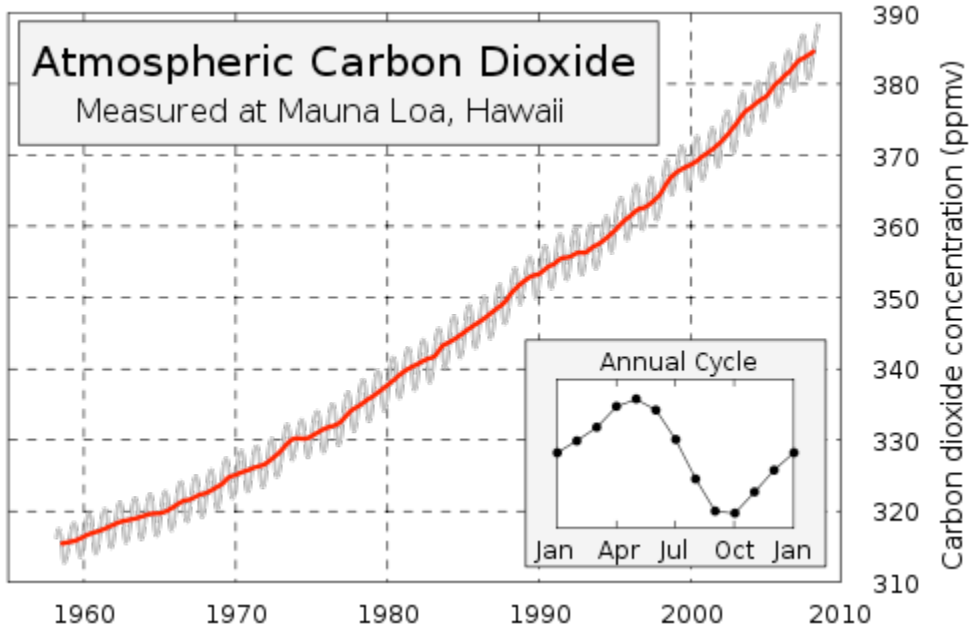
Climate sensitivity

- **Double how much CO2 is in the atmosphere, and how much does the planet warm?**

About 3˚C

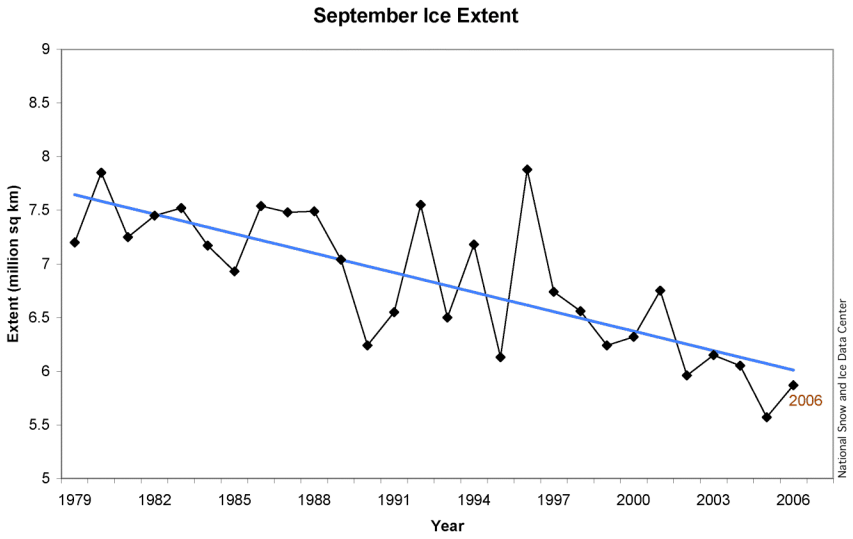
- Based on observational evidence, not computer models
- This estimate applies only for a bounded range – beyond that, runaway feedback

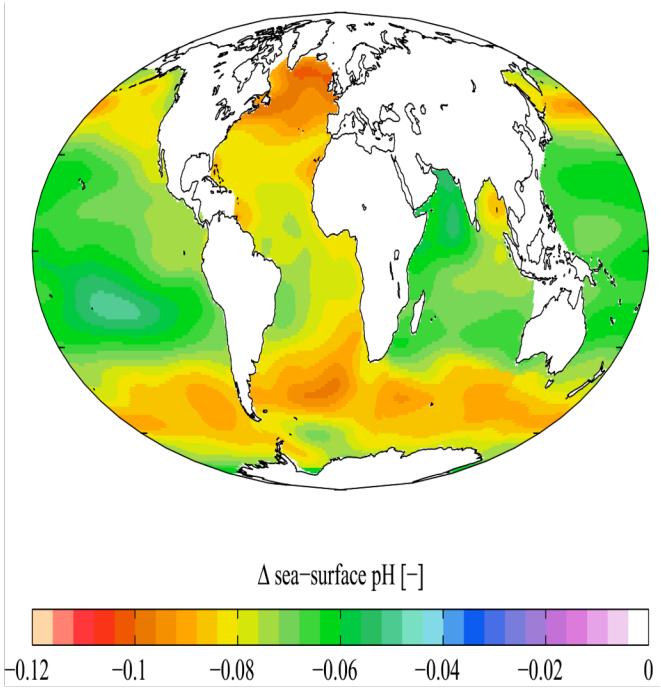
Empirical evidence: atmosphere



- This aligns with data from ALERT in Canada.
- Isotopic ratios prove the CO_2 is primarily from fossil fuels.

Empirical evidence: ice, oceans, and living things

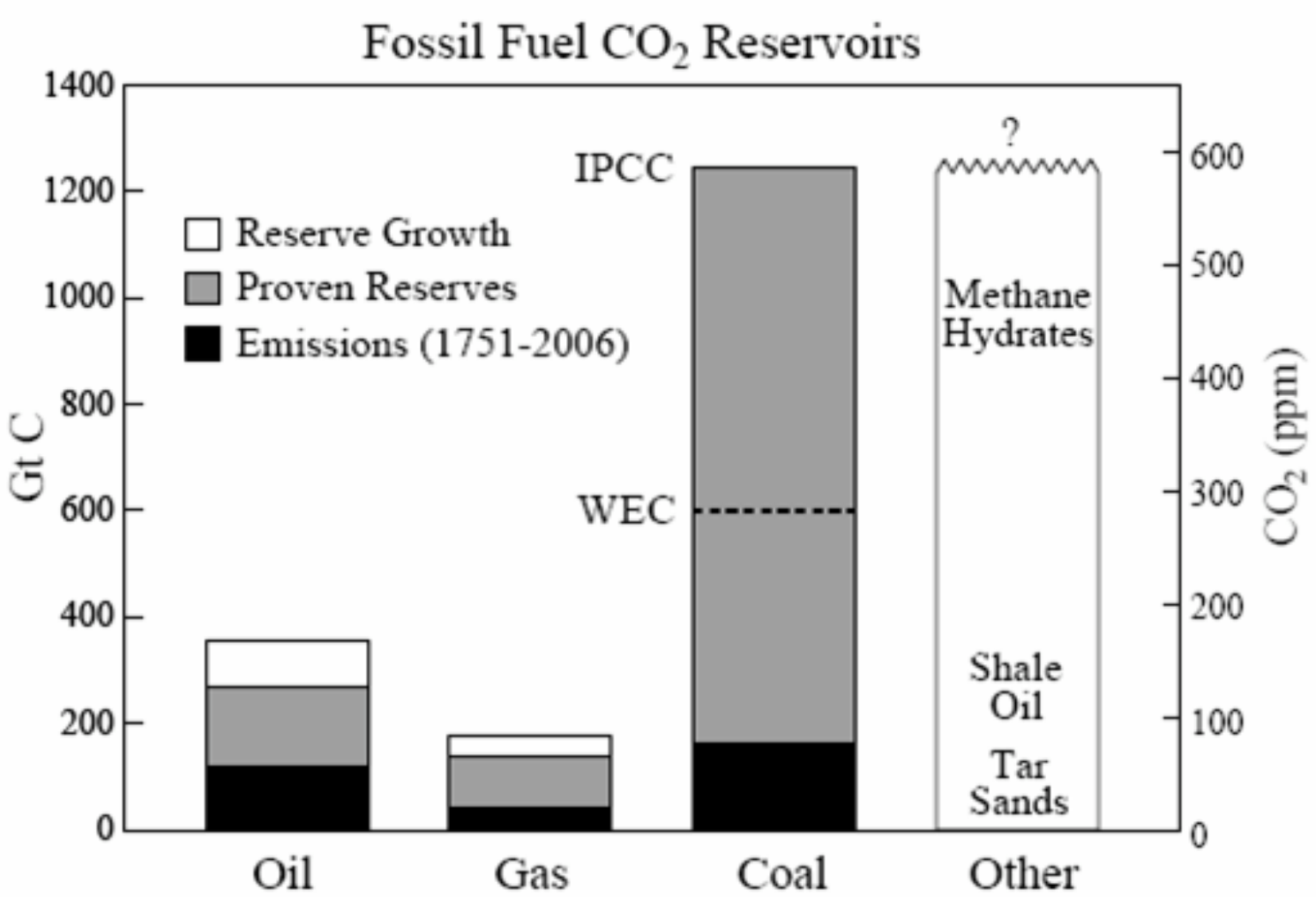




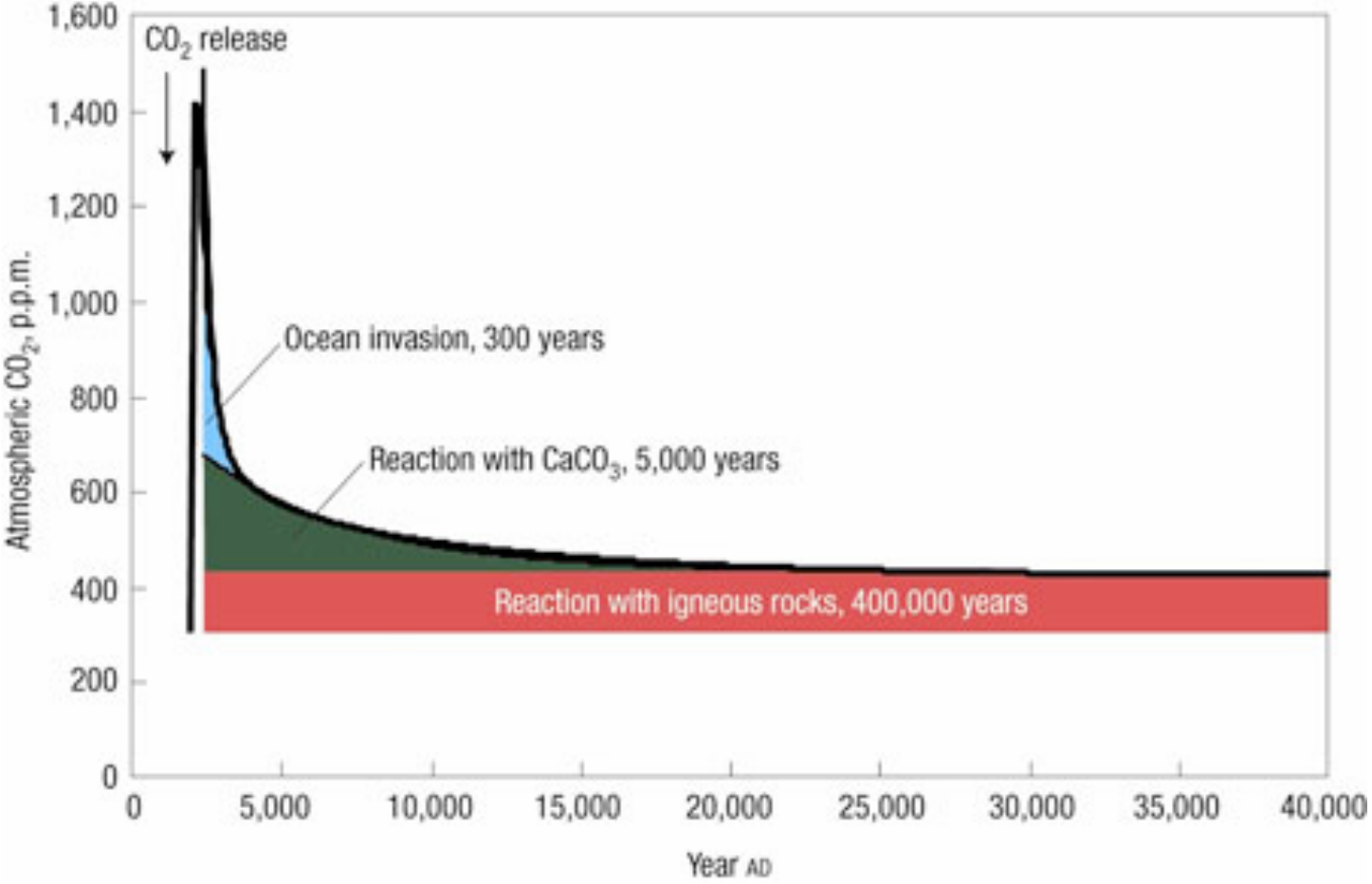
Also:

- Relocating species (50-75km per year)
- Changes in seasonal timing
- Direct observation of outgoing radiation

(3) What you burn determines how much you warm



CO2 endures in the air



- Our choices will affect many future generations.

Where is the danger?

- **Coal**
  - Huge reserves, especially in the U.S. and China
- **Unconventional oil and gas**
  - The oil sands alone could increase CO2 by 50ppm.
- **Positive feedback effects**
  - Enormous quantities of **methane in the Arctic** could be released as a consequence of warming.
  - The same is true for forests, peatlands, etc.

Where we're headed

- If global emissions keep rising as they are now, temperature increase is likely to be over 5˚C by 2100- with more to come afterwards.

- The consequences of that are likely to be severe:
  - Many metres of sea level rise (eventually 14m +)
  - Major changes in precipitation
  - Risk of runaway warming

Meeting the 2°C target

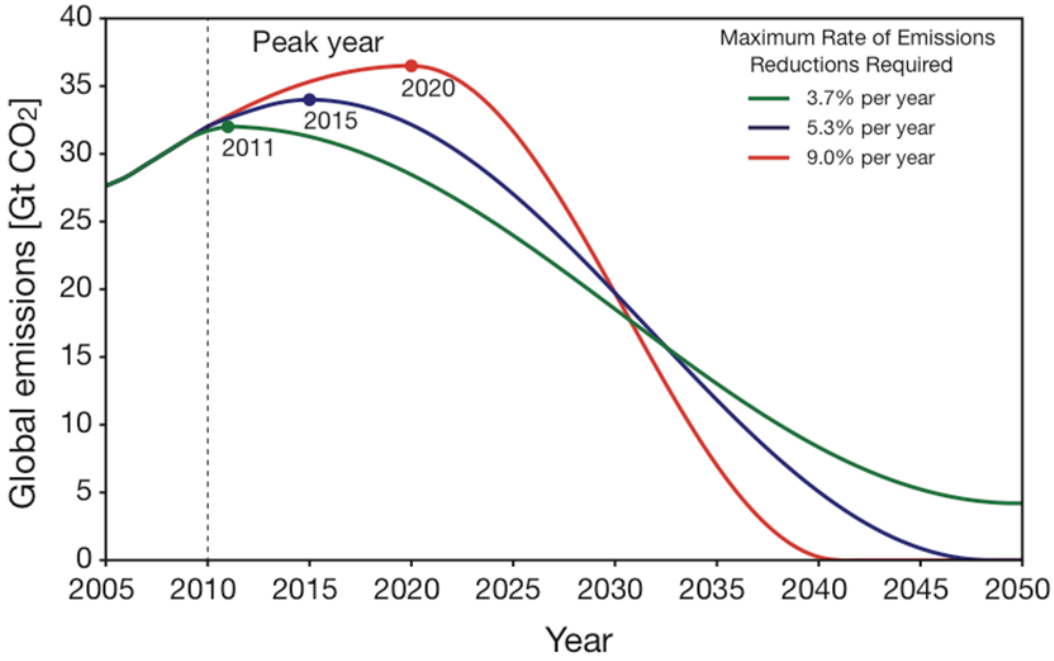


Figure 22: Emissions pathways to give 75% chance of limiting global warming to 2ºC

The Copenhagen Diagnosis
Updating the World on the Latest Climate Science

http://www.copenhagendiagnosis.com/

- Note the importance of **when we peak**
- Given this, we certainly should not be building new coal plants.

(4) Is carbon capture and storage (CCS) a way out?

- The basic idea: extract the energy from fossil fuels, while leaving the carbon underground

- Barriers:
  - Effectiveness
  - Safety
  - Useless for mobile sources, like vehicles
  - Cost and deployment rate

- Effectiveness
  - How long will the CO2 remain underground?
  - How much space is there really?
- Safety
  - Are leaks a concern?
  - Contamination of ground water?
- Useless for mobile sources of emissions

Economics are the real barrier

- Every year, we emit about 30 billion tonnes of CO2.
- By comparison, we extract about 1 billion tonnes worth of oil.
- Solving the whole climate change problem with CCS would require about **thirty times as much capital equipment as the global oil industry uses**
- What would that cost?
- How fast could it be rolled out?

CCS is one tool among many

- Efficiency and conservation
  - Canada is half as efficient as the Scandinavian countries
- Nuclear fission
  - Not renewable, but an important transition technology
- Solar, wind, tidal, geothermal, etc
- Protecting and enhancing soils and forests

(5) Bonuses from the transition

- Decreased air and water pollution
- Reduced oil spills, coal mining accidents
  - In China, 3000 people a year die in coal mines
- Reduced geopolitical vulnerability
- Reduced habitat destruction
- Increased expertise in the energy technologies of the future

Think about it backwards

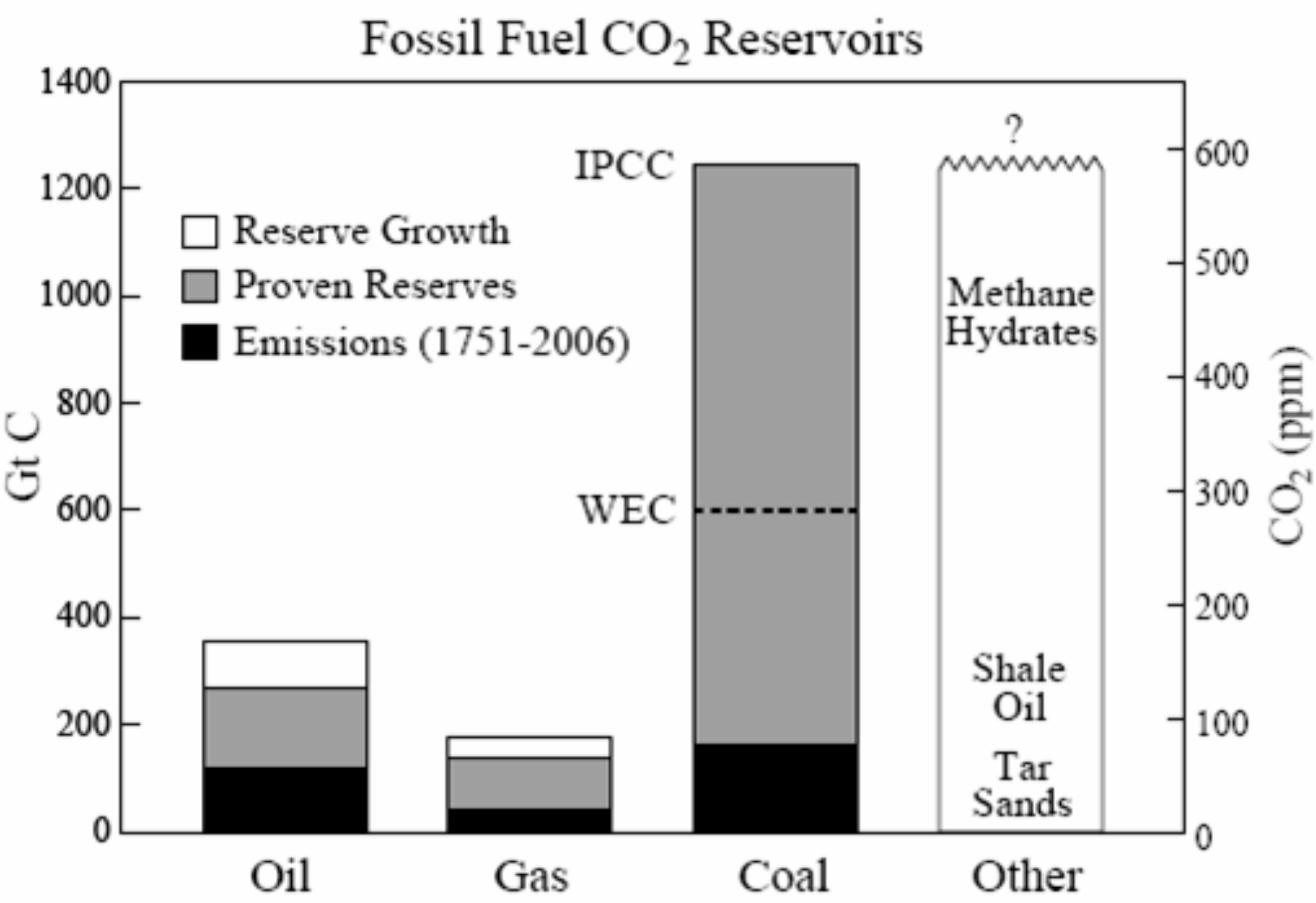
- Economic analyses (Stern, etc) conclude that stopping climate change would cost about 2% of GDP

- If we already had a carbon neutral society, powered by clean energy, would we trade it away for 2% more GDP?

The transition is inevitable

- What is the opportunity cost?
  - Fossil fuels will eventually be exhausted, if we don't stop using them
  - This is a question of moving that date forward, in exchange for reduced climate change

- The cheapest way to respond is slowly and steadily, starting immediately


Fossil Fuel CO_2 Reservoirs
1400
1200
1000
800
600
400
200
0
Gt C
600
500
400
300
200
100
0
CO_2 (ppm)
Reserve Growth
Proven Reserves
Emissions (1751-2006)
IPCC
WEC
?
Methane Hydrates
Shale Oil
Tar Sands
Oil
Gas
Coal
Other