

Achieving Net Zero: How we will stop global warming

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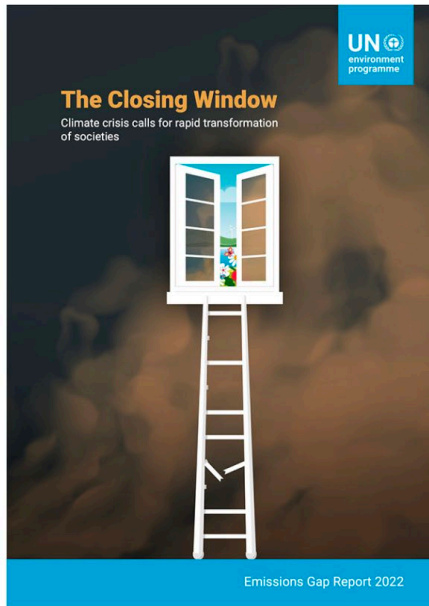
The Oxford Net Zero initiative



27 OCTOBER 2022 | REPORT

Emissions Gap Report 2022

Authors: UNEP

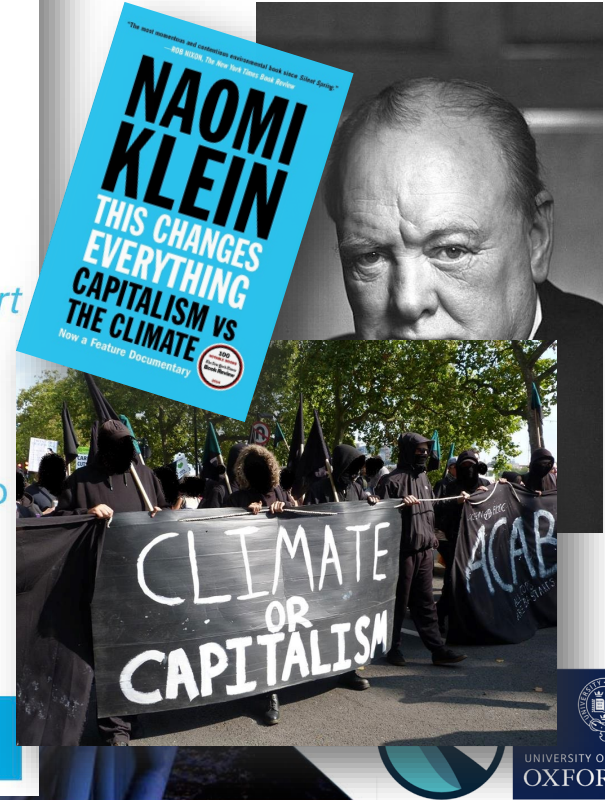


As growing climate change impacts are experienced across the globe, the message that greenhouse gas emissions must fall is unambiguous. Yet the *Emissions Gap Report 2022: The Closing Window – Climate crisis calls for rapid transformation of societies* finds that the international community is falling far short of the Paris goals, with no credible pathway to 1.5°C in place. Only an urgent system-wide transformation can avoid climate disaster.

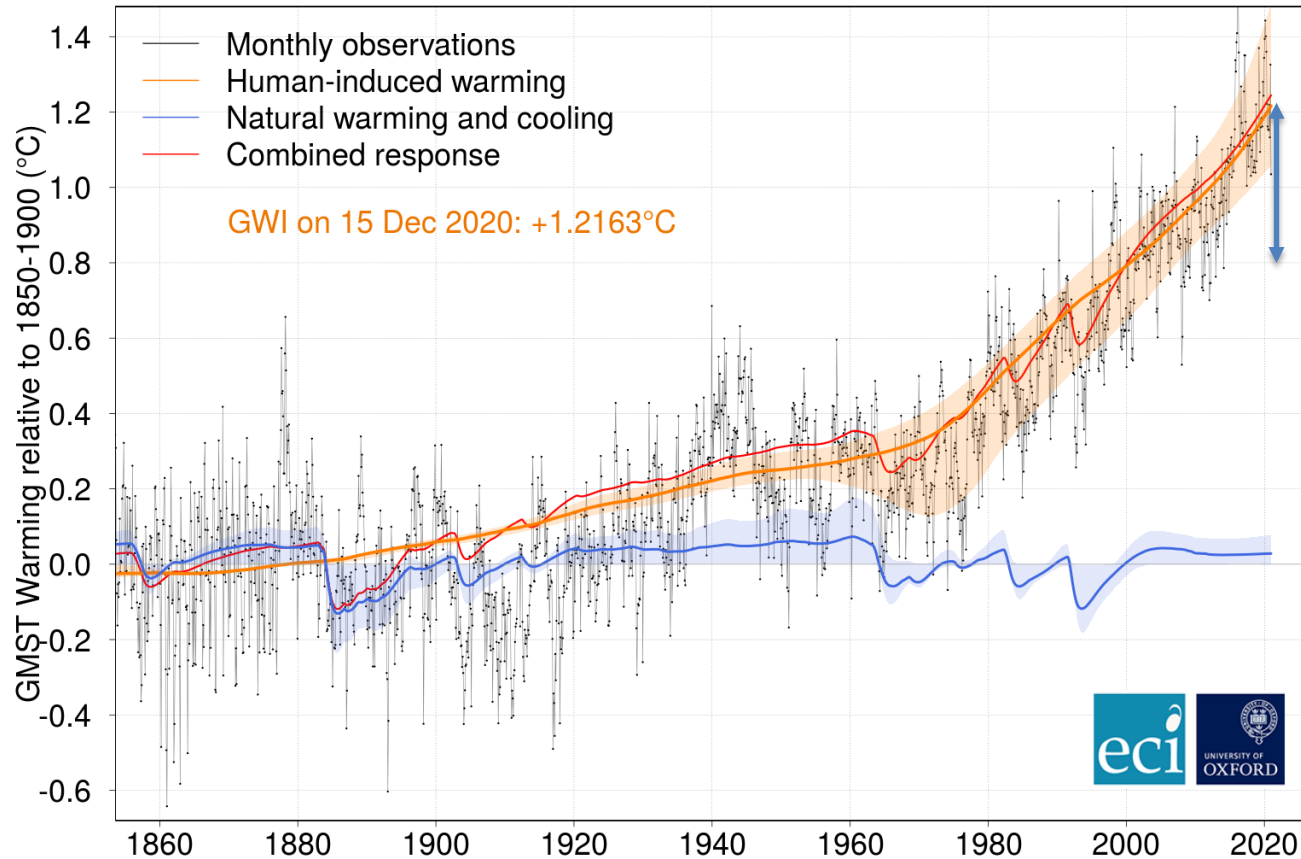
[DOWNLOAD THE FULL REPORT](#)

Achieving Net Zero:

will stop global warming
ried all the alternatives...



How soon do we need to stop global warming?



Human-induced warming has increased by 50% since 2000, with impacts approximately doubling every 20 years

We've understood what's happening for some time

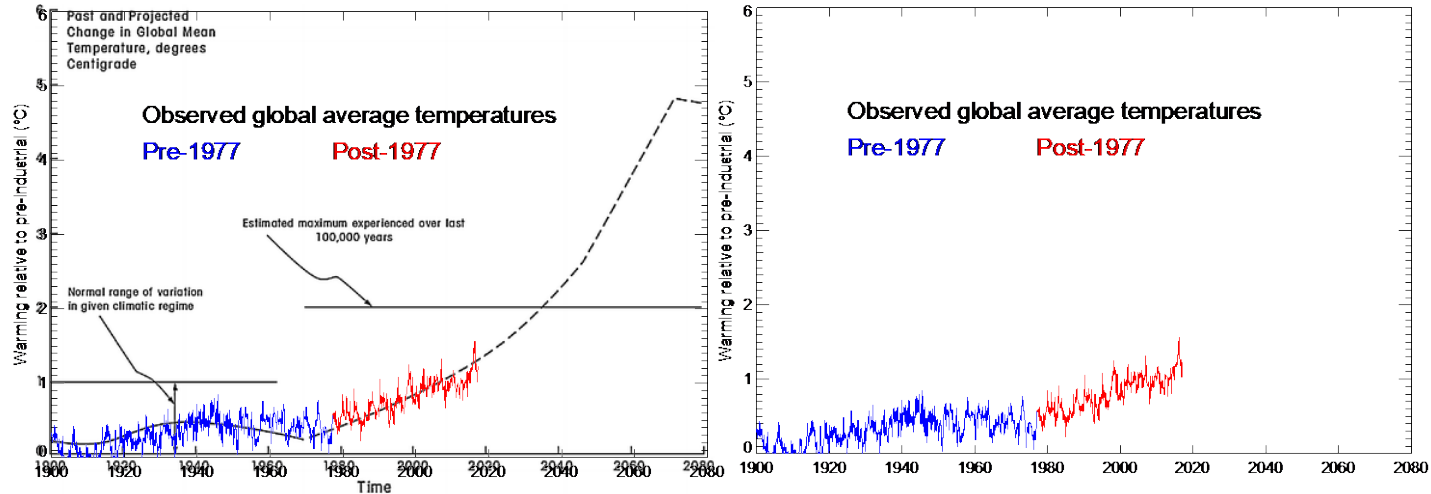


Figure 1 from William D. Nordhaus, “Strategies for Control of Carbon Dioxide”, Cowles Discussion Paper 477, January 6, 1977, using theory developed by, among others, Suyukro Manabe and Klaus Hasselmann in the 1960s and 1970s



More surprises in emerging climate impacts

ENERGY

Dutch court rules oil giant Shell must cut carbon emissions by 45% by 2030 in landmark case

PUBLISHED WED, MAY 26 2021-9:44 AM EDT | UPDATED 35 MIN AGO

Chloe Taylor @CHLOETAYLOR141

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KEY POINTS

- A Dutch court on Wednesday ruled oil giant Royal Dutch Shell must reduce its carbon emissions by 45% by 2030 from 2019 levels.
- That's a much higher reduction than the company's current aim of lowering its emissions by 20% by 2030.
- Shares of Shell were trading 0.3% lower in London. The stock price is up almost 10% year-to-date, having tumbled nearly 40% in 2020.

In this article **RDSA-GB +4.20 (+0.31%)**



A cyclist passes oil silos at the Royal Dutch Shell Pernis refinery in Rotterdam, Netherlands, on Tuesday, April 27, 2021.



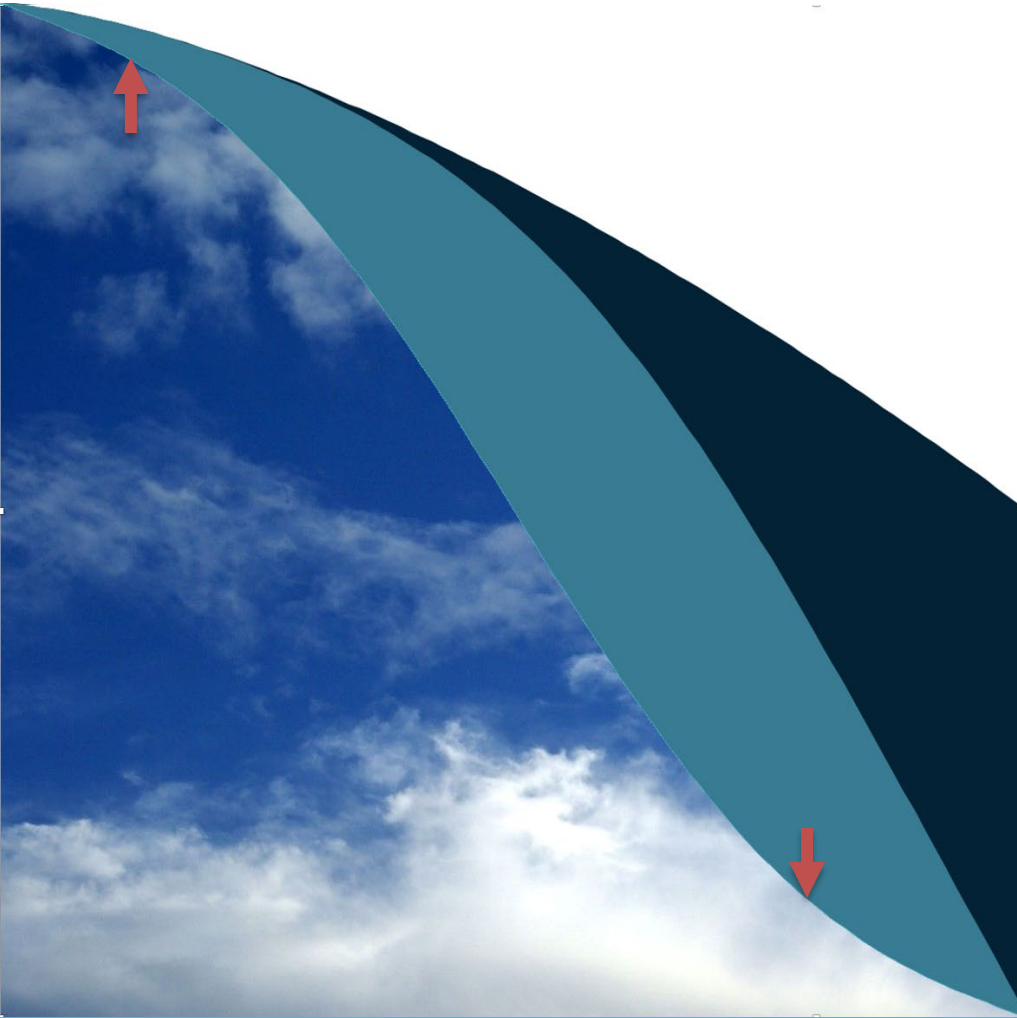
TRENDING NOW

- amazon** Amazon to buy MGM Studios for \$8.45 billion
- Meme stocks** GameStop, AMC are popping again as speculative trading ramps back up
- Bitcoin** Bitcoin crash opens door to a tax loophole for investors
- Millionaire and CEO** shares 5 'quick tests' he always uses at job interviews to decide when to hire



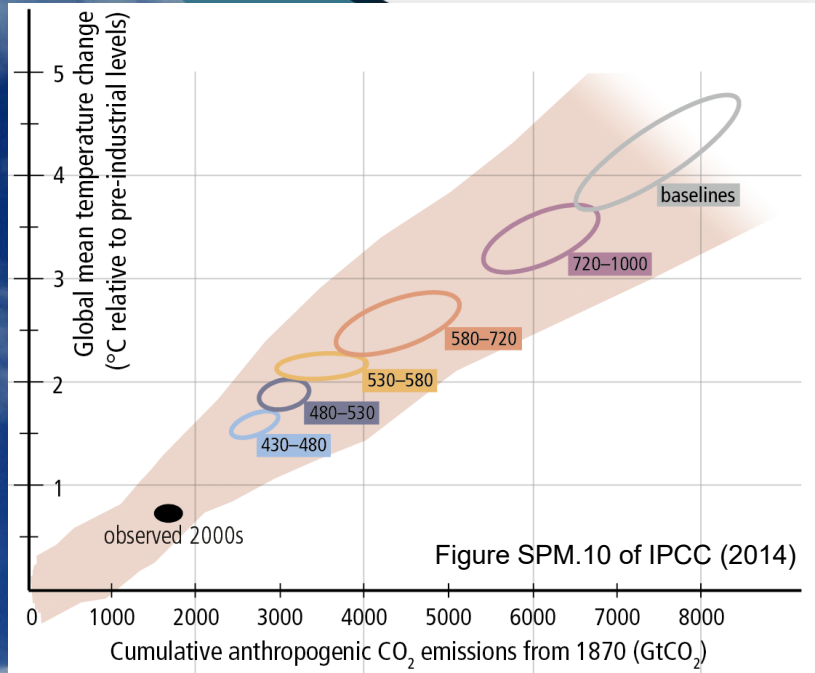
Achieving Net Zero

Cumulative carbon dioxide emissions
to the time of net zero largely
determine peak warming



Achieving Net Zero

Cumulative carbon dioxide emissions to the time of net zero largely determine peak warming



Achieving Net Zero

And weaning the world off fossil fuels is going to take time:
We need to stop fossil fuels from causing global warming before the world stops using fossil fuels



Lignite mining in Anthochori, Greece, 2007



Achieving Net Zero

Near-term emissions reductions complemented with Nature-based Climate Solutions



Achieving Net Zero

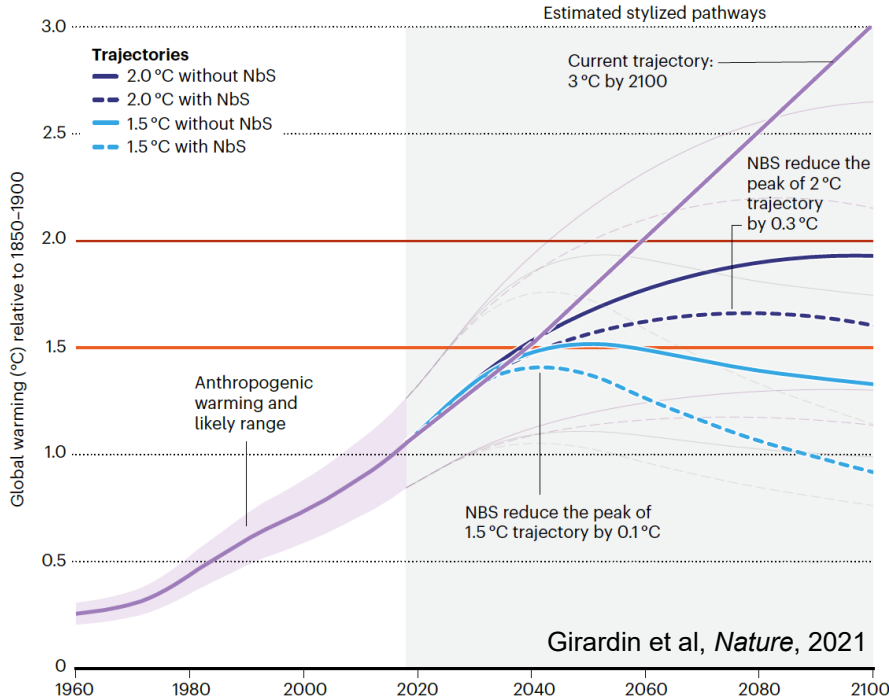
Near-term emissions reductions complemented with Nature-based Climate Solutions



Achieving Net Zero

THE LONG GAME

Nature-based solutions (NBS) could reduce the global peak temperature and suppress warming beyond 2100 — if they are ambitious and designed for longevity.

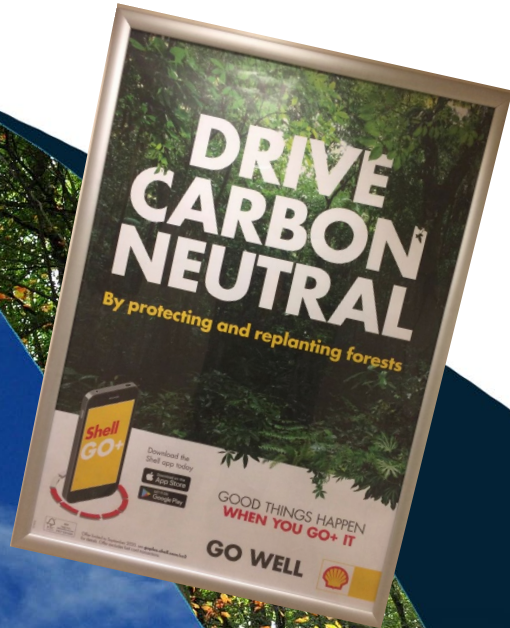


Nature-based Solutions have immediate benefits, but take time to reduce temperatures: limited impact on peak warming if this occurs around mid-century



Achieving Net Zero

So invest in nature, but don't count on it as a permanent solution



Achieving Net Zero

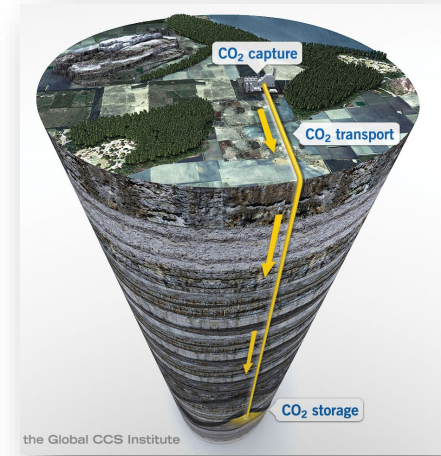
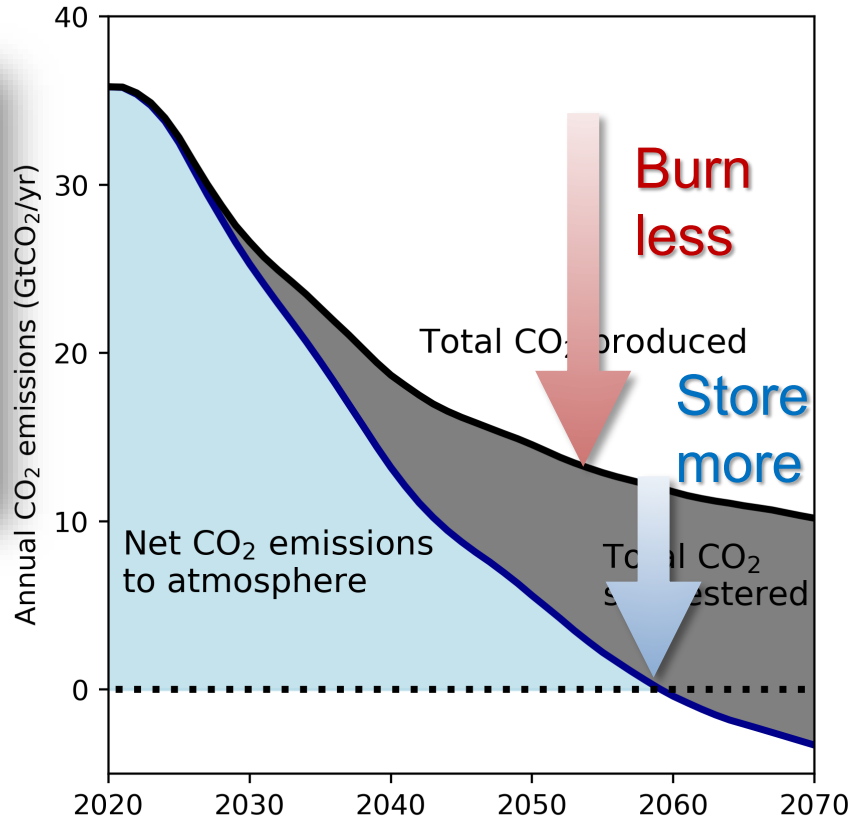
Stopping fossil fuels from causing global warming means scaling up permanent CO₂ storage



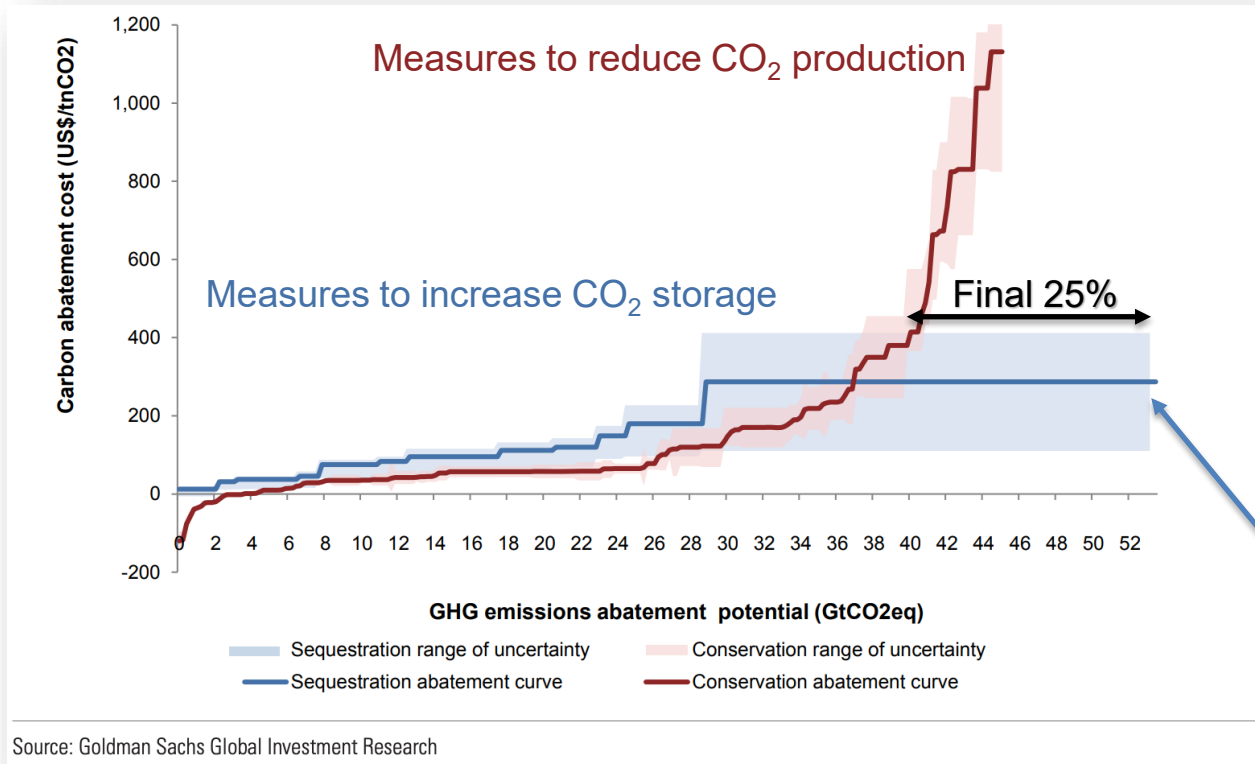
How to stop fossil fuels from causing global warming



Global CO₂ production and storage from energy and industry in average “technology neutral” scenarios that limit warming to about 1.5°C



The challenging economics of CO₂ storage

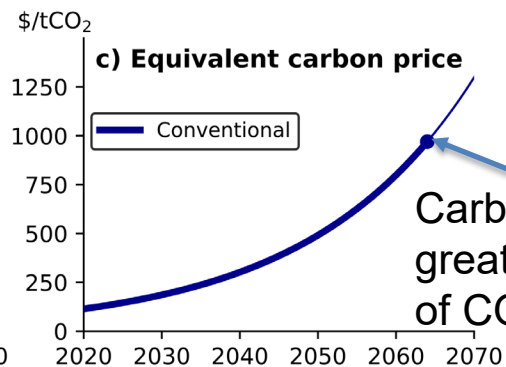
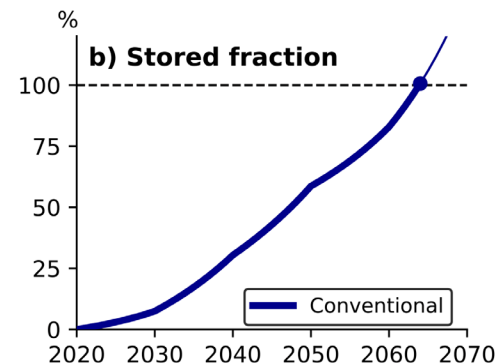
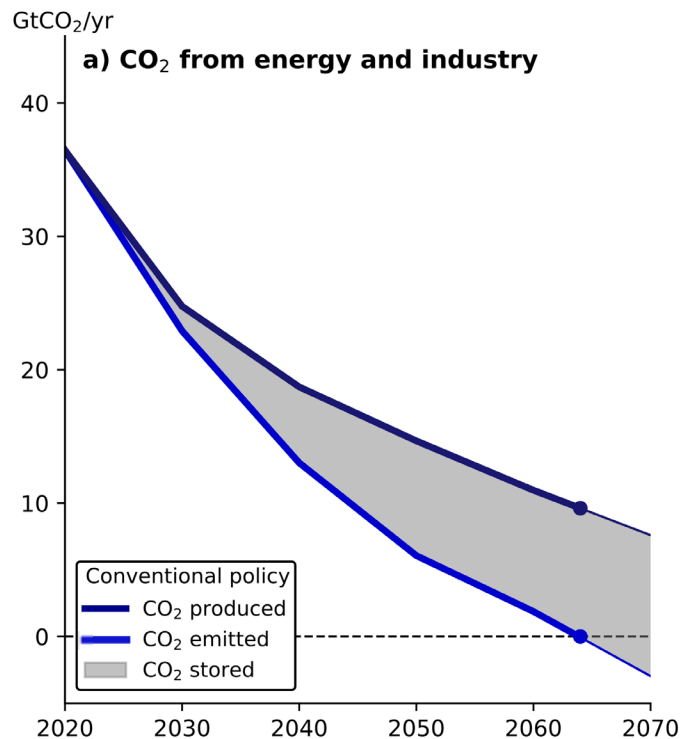


Source: Goldman Sachs Global Investment Research

We can eliminate 75% of emissions with very little use of CO₂ storage, but we can't get to net zero...

Vital role for CO₂ capture and disposal at about \$250 per tonne

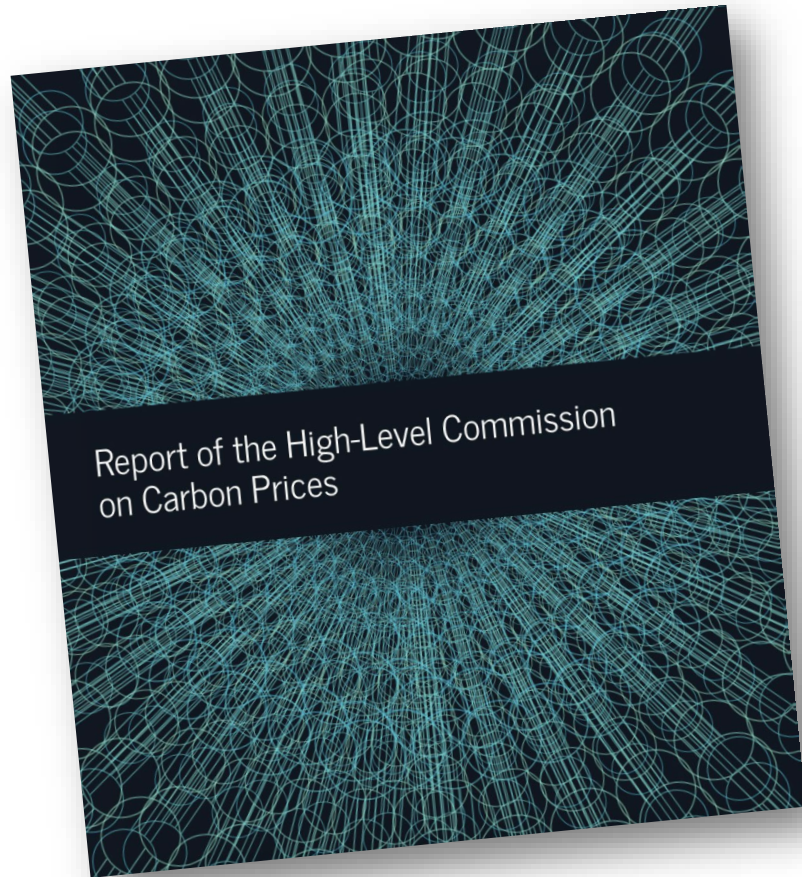
How carbon pricing fails to drive adequate CO₂ disposal capacity in conventional policy scenarios



Carbon prices much greater than the cost of CO₂ disposal



Related confessions of economists



- “Carbon pricing by itself *may* not be sufficient to induce change at the pace and on the scale required for the Paris target to be met...”
 - Stiglitz et al (2017)



Introducing the Carbon Takeback Obligation

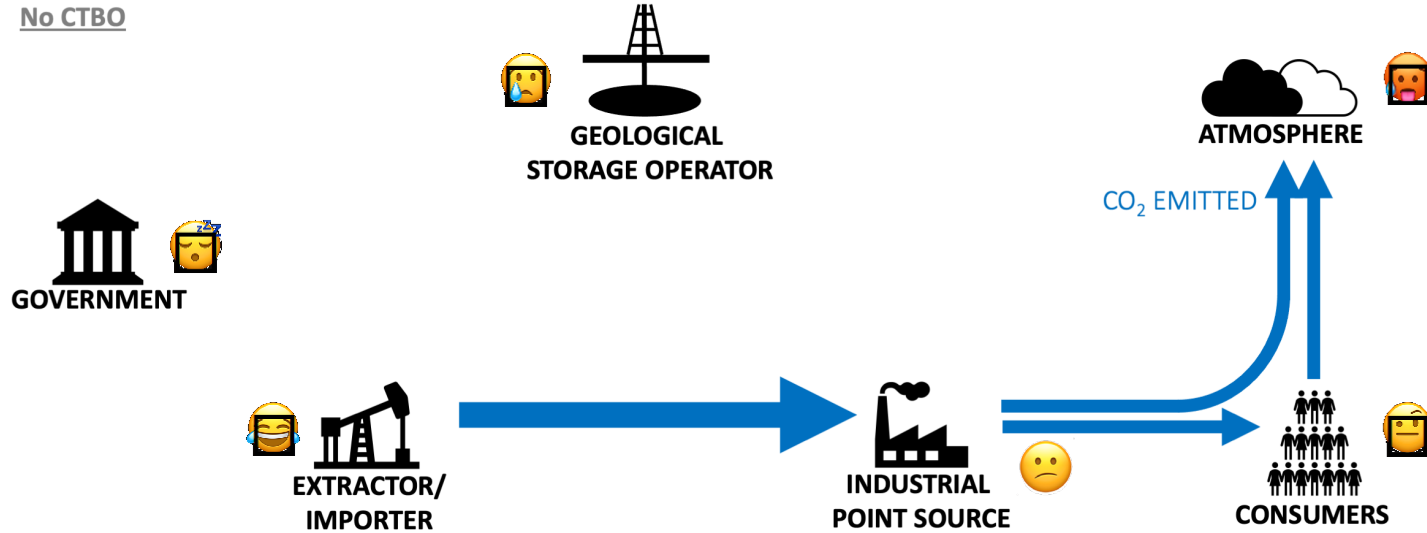
- A group of countries (North Sea Alliance?) imposes a licensing condition that anyone selling fossil fuels must certify that a fraction of the CO₂ generated by those fuels has been geologically sequestered.
- Sequestered CO₂ can be sourced from any CO₂ that would otherwise have ended up in the atmosphere.
 - Companies would initially capture their own (e.g. refinery) emissions, then industrial sources, and eventually free air capture.
- This sequestered fraction S rises, on average, by 3.3% per year, but slower initially: 10% by 2030, 50% by 2040, 100% by 2050.
- Costs passed on to the consumer, encouraging a shift away from fossil fuels, but no need for a ban or punitive carbon tax.



How a Carbon Takeback Obligation works

Current situation

No CTBO



- Actual or embedded CO₂
- Regulation and compliance
- CTBO compliance costs
- Payments for GCS

Weight of arrow reflects relative size of cost and CO₂ flow.

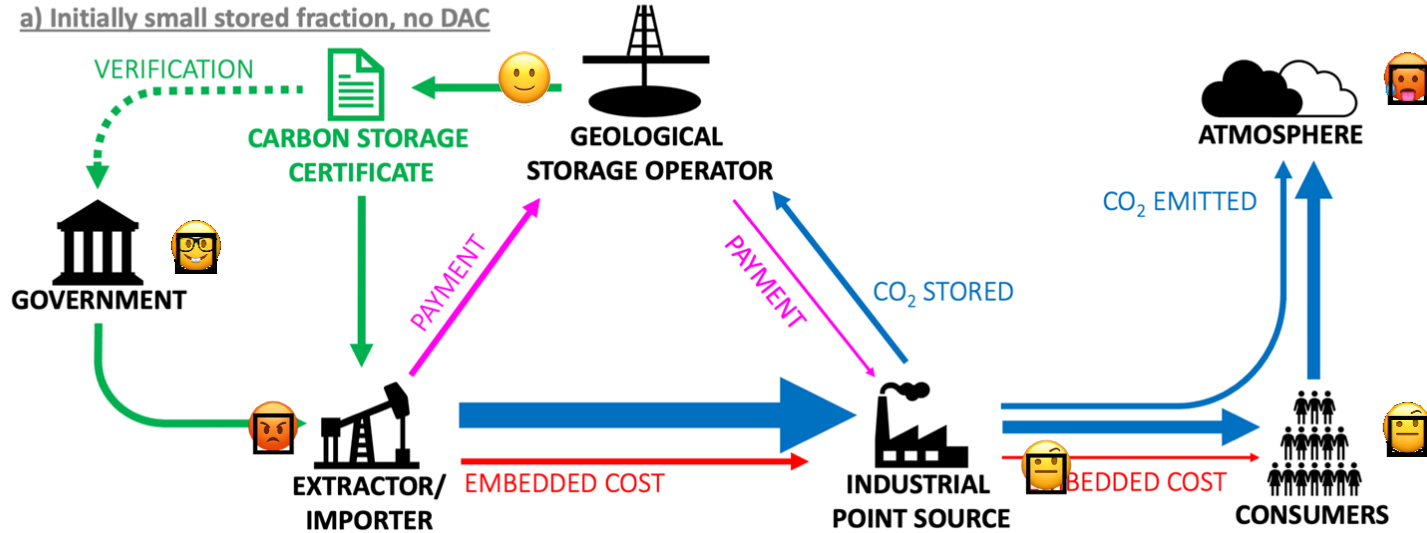
The relative size of CO₂ flows depends on many factors, including the CTBO's stored fraction, availability of industrial point source CCS and availability of DAC technologies.



How a Carbon Takeback Obligation works

CTBO introduced

a) Initially small stored fraction, no DAC

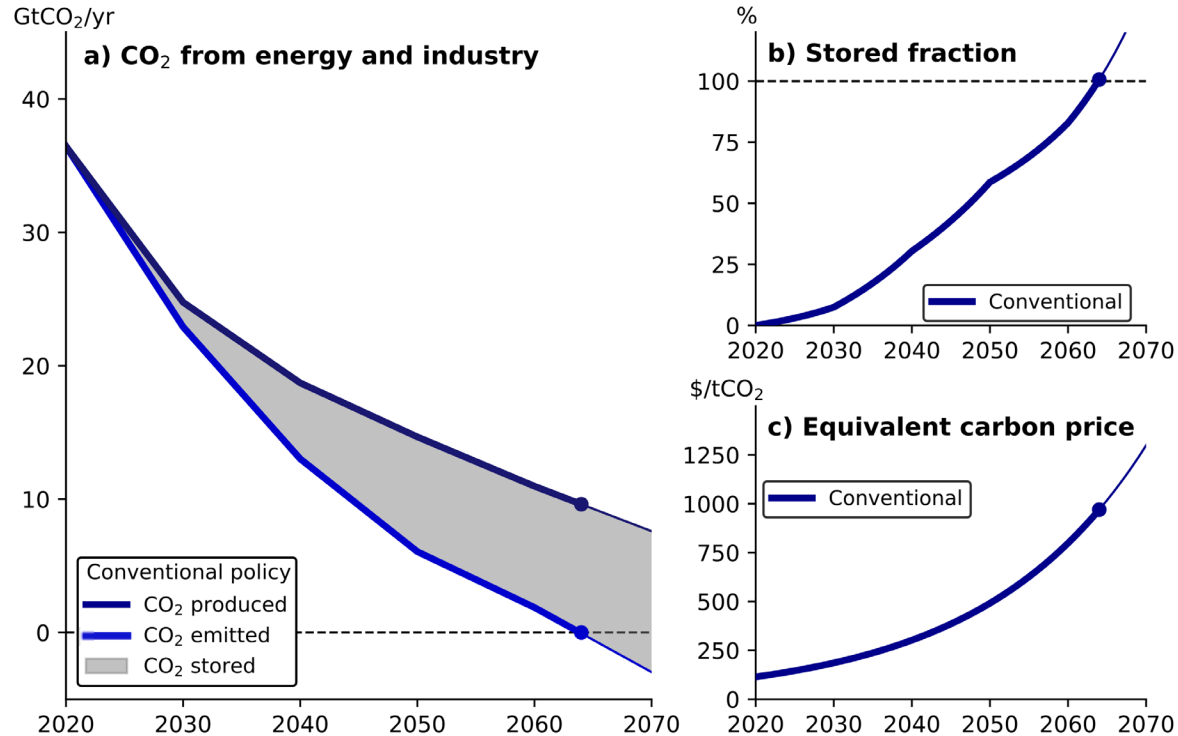


- Actual or embedded CO₂
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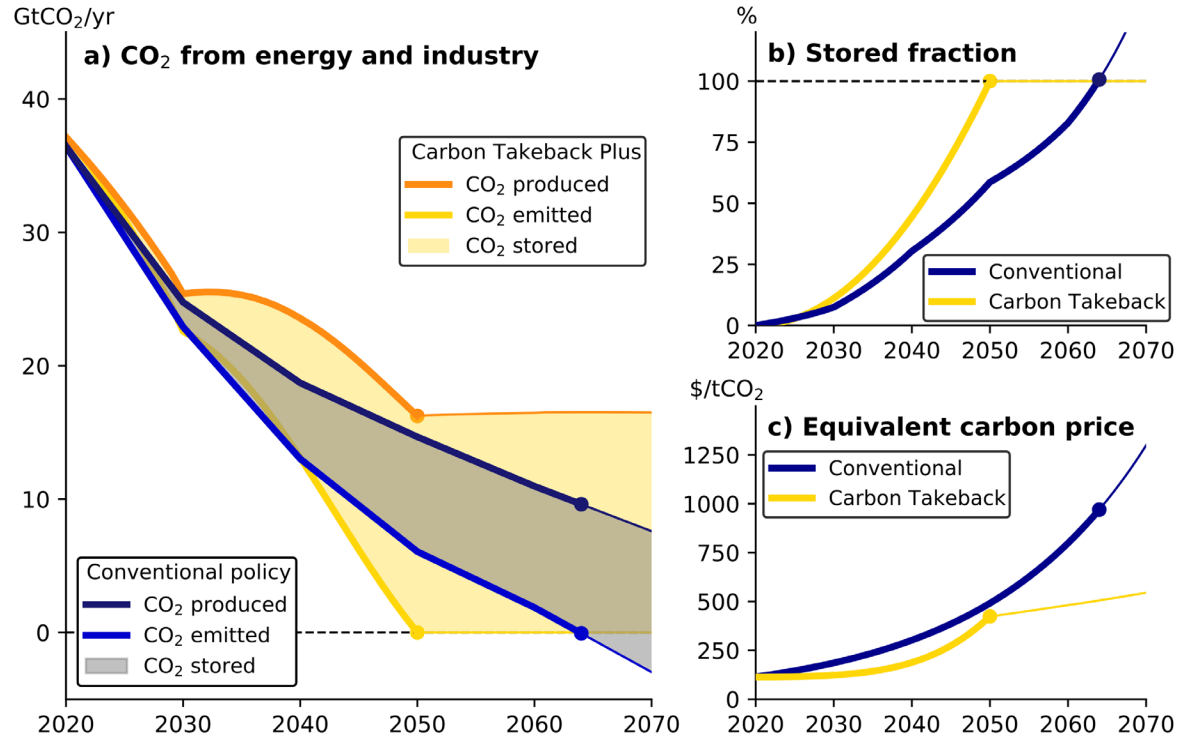
Weight of arrow reflects relative size of cost and CO₂ flow.
The relative size of CO₂ flows depends on many factors, including the CTBO's stored fraction, availability of industrial point source CCS and availability of DAC technologies.



A conventional ambitious mitigation scenario



A Carbon Takeback Obligation supplemented with modest demand management



The surprising economics of Carbon Takeback

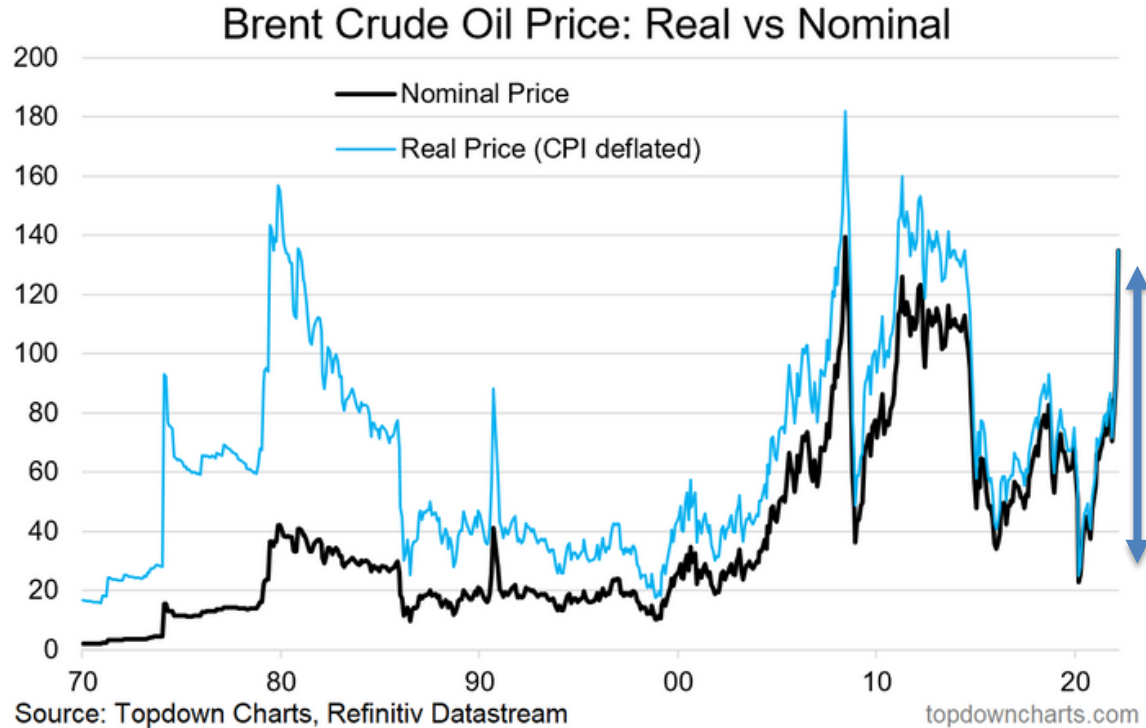
- Suppose CO₂ disposal costs
 - \$50/tCO₂ *sequestered* initially (CO₂ captured at source),
 - \$250/tCO₂ at net zero (point sources + direct air capture).
- Cost per tCO₂ of fossil carbon *sold* = $S(50+200S)$ where S is sequestered fraction.
- This is equivalent to a carbon price of:
 - \$ 0.52 /tCO₂ at $S=1\%$ (early 2020s)
 - \$12.00 /tCO₂ at $S=15\%$ (early 2030s)
 - \$250 /tCO₂ at $S=100\%$ (2050s)



What does a \$250 per tonne cost of disposing of carbon dioxide mean?



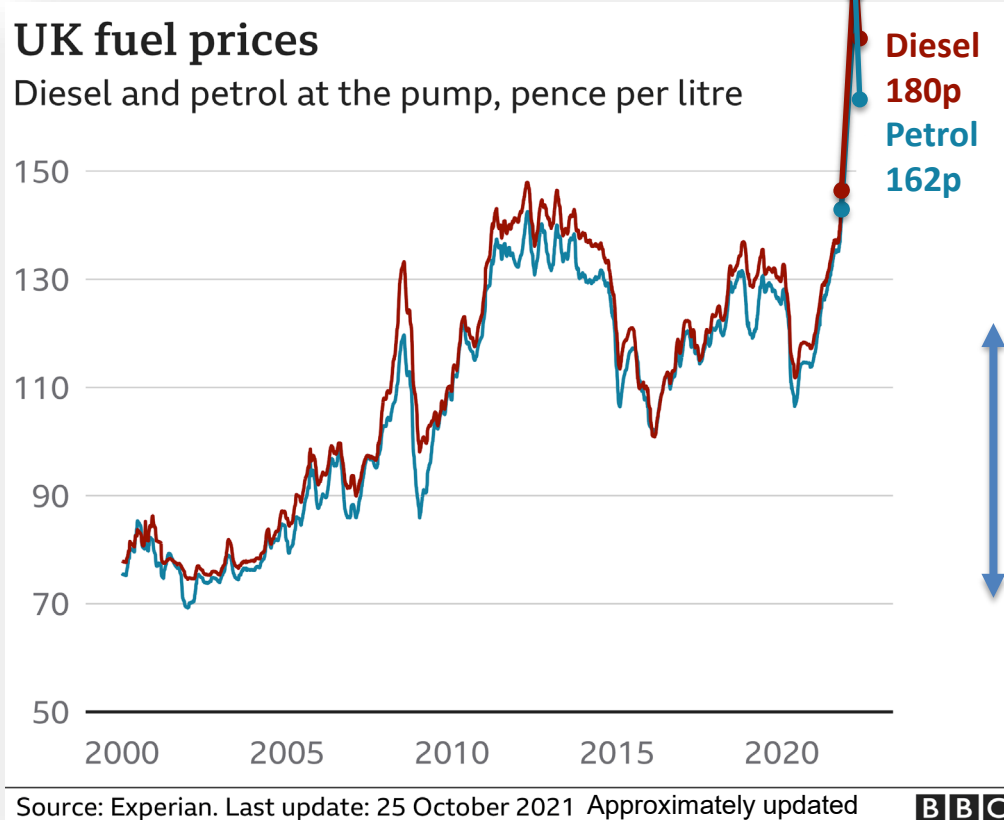
What does a \$250 per tonne cost of disposing of carbon dioxide mean?



\$100 per barrel
of oil



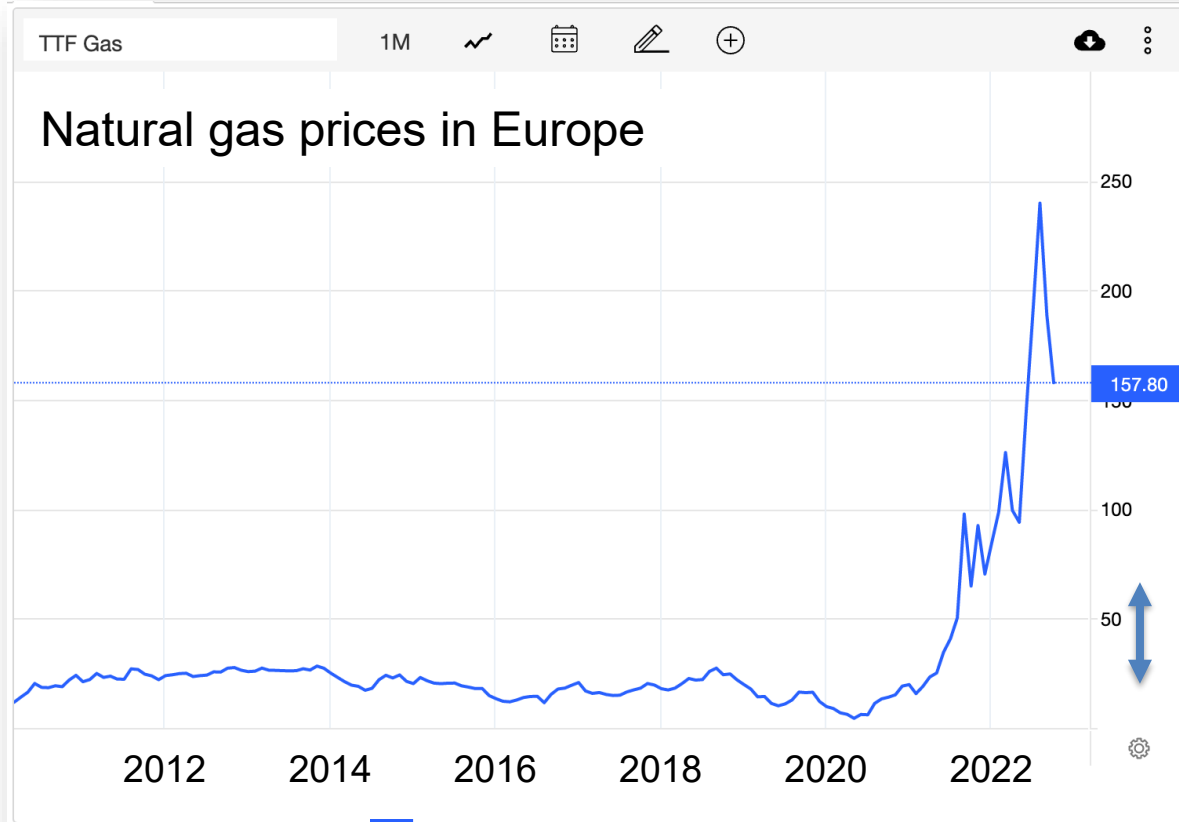
What does a \$250 per tonne cost of disposing of carbon dioxide mean?



50p per litre of petrol



What does a \$250 per tonne cost of disposing of carbon dioxide mean?



4p per kWh of natural gas



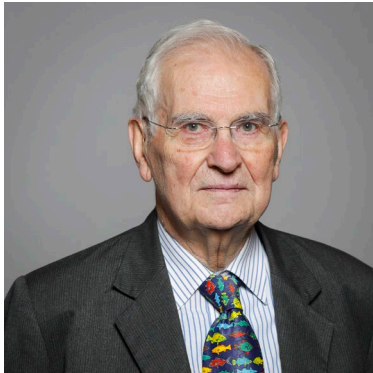
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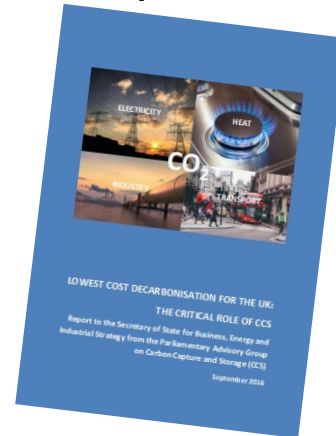
It means the royalties and profits in what we pay for gas are enough to capture every single molecule of CO₂ that gas generates back out of the atmosphere and pump it back under the North Sea. Twice over.

How the UK nearly solved the climate change problem – and no-one noticed

- “Within one year of this Act coming into force, the Secretary of State shall undertake a consultation on the measures requiring extractors and importers of petroleum to contribute to the development of carbon capture and storage.”
 - Amendment 34a of the Energy Bill, September, 2015



Ron Oxburgh



We need Net Zero Stuff

- By decarbonizing 4 products, we solve the climate problem:
 - coal, gas, oil & cement.
- In each case, the cost of decarbonization would be less than wholesale price variations over the past ~~20 years~~ 8 months.
 - 50p/litre for petrol or 4p/kWh for natural gas
- You need regulation to invest in and insure fossil fuel assets.
- A point to remember:
 - we didn't save the ozone layer by rationing deodorant.



Questions?

<https://netzeroclimate.org>

<https://carbontakeback.org>

<https://go.ted.com/mylesallen>

