Climate change: a summary for policy-makers

MYLES ALLEN Environmental Change Institute, School of Geography and the Environment & Department of Physics

University of Oxford

Climate change: a summary for policymakers

- How rising atmospheric CO_2 causes global warming
- How global temperatures and sea level respond
- Quantifying human influence on climate and weather
- The fate of CO_2 and other anthropogenic emissions
- Global impact functions and the social cost of carbon
- Mitigation costs and pathways
- Policy options from carbon pricing to geo-engineering
- Capstone activity: design a robust climate policy

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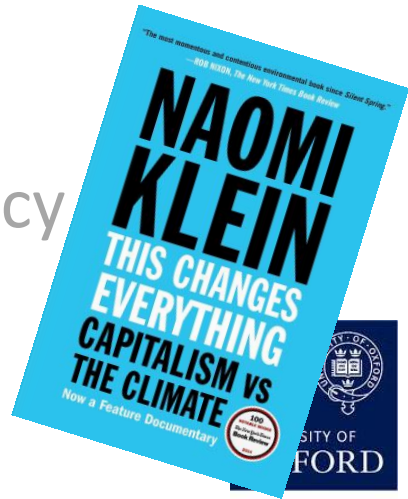
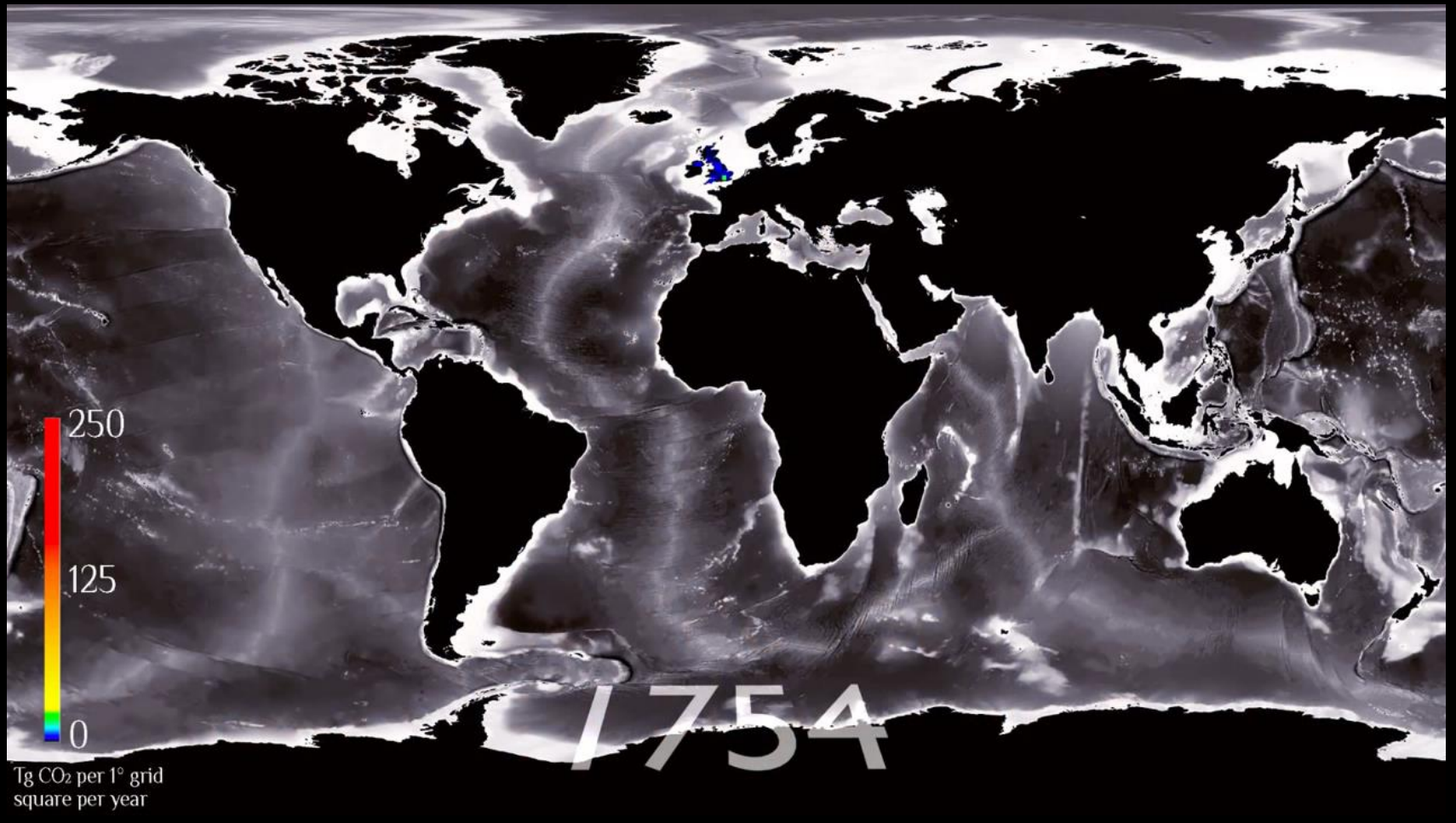
- Does Climate Change Everything?
- Capstone activity: design a robust climate policy




250
125
0
1754
Tg CO2 per 1° grid
square per year


CLIMATE
OR
CAPITALISM
ACAB

Do we need a Green New Deal?

116TH CONGRESS
1ST SESSION

H. RES. 109

Recognizing the duty of the Federal Government to create a Green New Deal.

IN THE HOUSE OF REPRESENTATIVES

FEBRUARY 7, 2019

Ms. OCASIO-CORTEZ (for herself, Mr. HASTINGS, Ms. TLAIB, Mr. SERRANO, Mrs. CAROLYN B. MALONEY of New York, Mr. VARGAS, Mr. ESPAILLAT, Mr. LYNCH, Ms. VELÁZQUEZ, Mr. BLUMENAUER, Mr. BRENDAN F. BOYLE of Pennsylvania, Mr. CASTRO of Texas, Ms. CLARKE of New York, Ms. JAYAPAL, Mr. KHANNA, Mr. TED LIEU of California, Ms. PRESSLEY, Mr. WELCH, Mr. ENGEL, Mr. NEGUSE, Mr. NADLER, Mr. MCGOVERN, Mr. POCAN, Mr. TAKANO, Ms. NORTON, Mr. RASKIN, Mr. CONNOLLY, Mr. LOWENTHAL, Ms. MATSUI, Mr. THOMPSON of California, Mr. LEVIN of California, Ms. PINGREE, Mr. QUIGLEY, Mr. HUFFMAN, Mrs. WATSON COLEMAN, Mr. GARCÍA of Illinois, Mr. HIGGINS of New York, Ms. HAALAND, Ms. MENG, Mr. CARBAJAL, Mr. CICILLINE, Mr. COHEN, Ms. CLARK of Massachusetts, Ms. JUDY CHU of California, Ms. MUCARSEL-POWELL, Mr. MOULTON, Mr. GRIJALVA, Mr. MEEKS, Mr. SABLAN, Ms. LEE of California, Ms. BONAMICI, Mr. SEAN PATRICK MALONEY of New York, Ms. SCHAKOWSKY, Ms. DELAURO, Mr. LEVIN of Michigan, Ms. MCCOLLUM, Mr. DESAULNIER, Mr. COURTNEY, Mr. LARSON of Connecticut, Ms. ESCOBAR, Mr. SCHIFF, Mr. KEATING, Mr. DEFAZIO, Ms. ESHOO, Mrs. TRAHAN, Mr. GOMEZ, Mr. KENNEDY, and Ms. WATERS) submitted the following resolution; which was referred to the Committee on Energy and Commerce, and in addition to the Committees on Science, Space, and Technology, Education and Labor, Transportation and Infrastructure, Agriculture, Natural Resources, Foreign Affairs, Financial Services, the Judiciary, Ways and Means, and Oversight and Reform, for a period to be subsequently determined by the Speaker, in each case for consideration of such provisions as fall within the jurisdiction of the committee concerned

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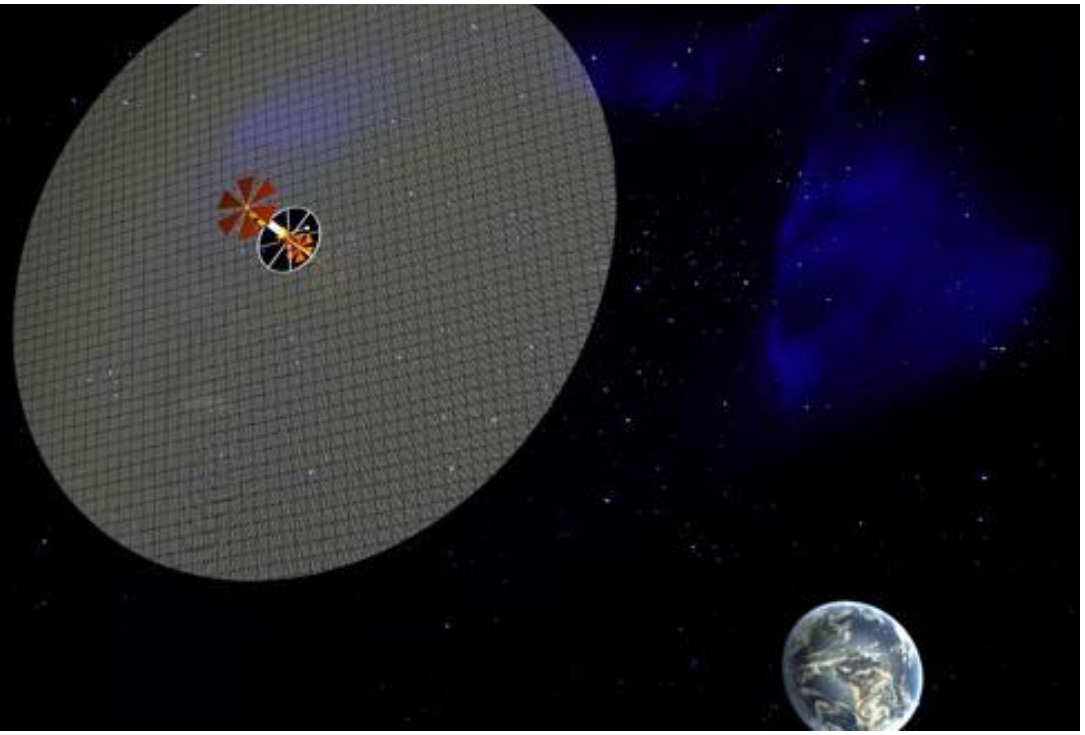
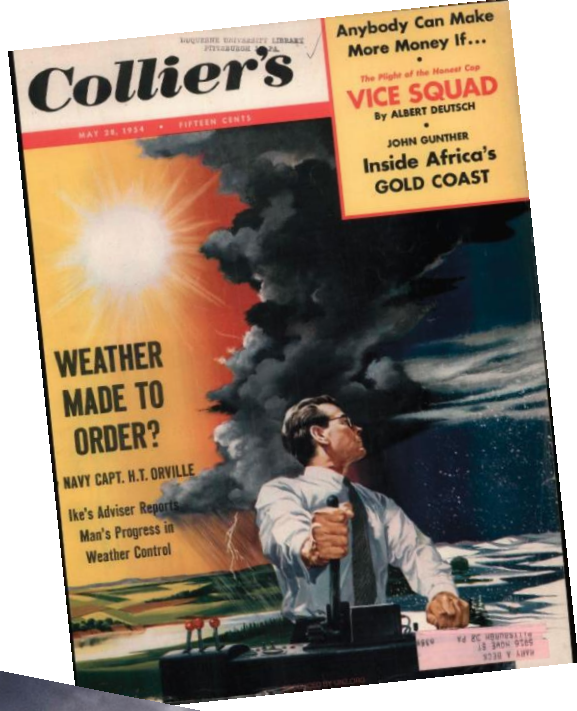
Or just a price on carbon?

The Washington Post
Democracy Dies in Darkness

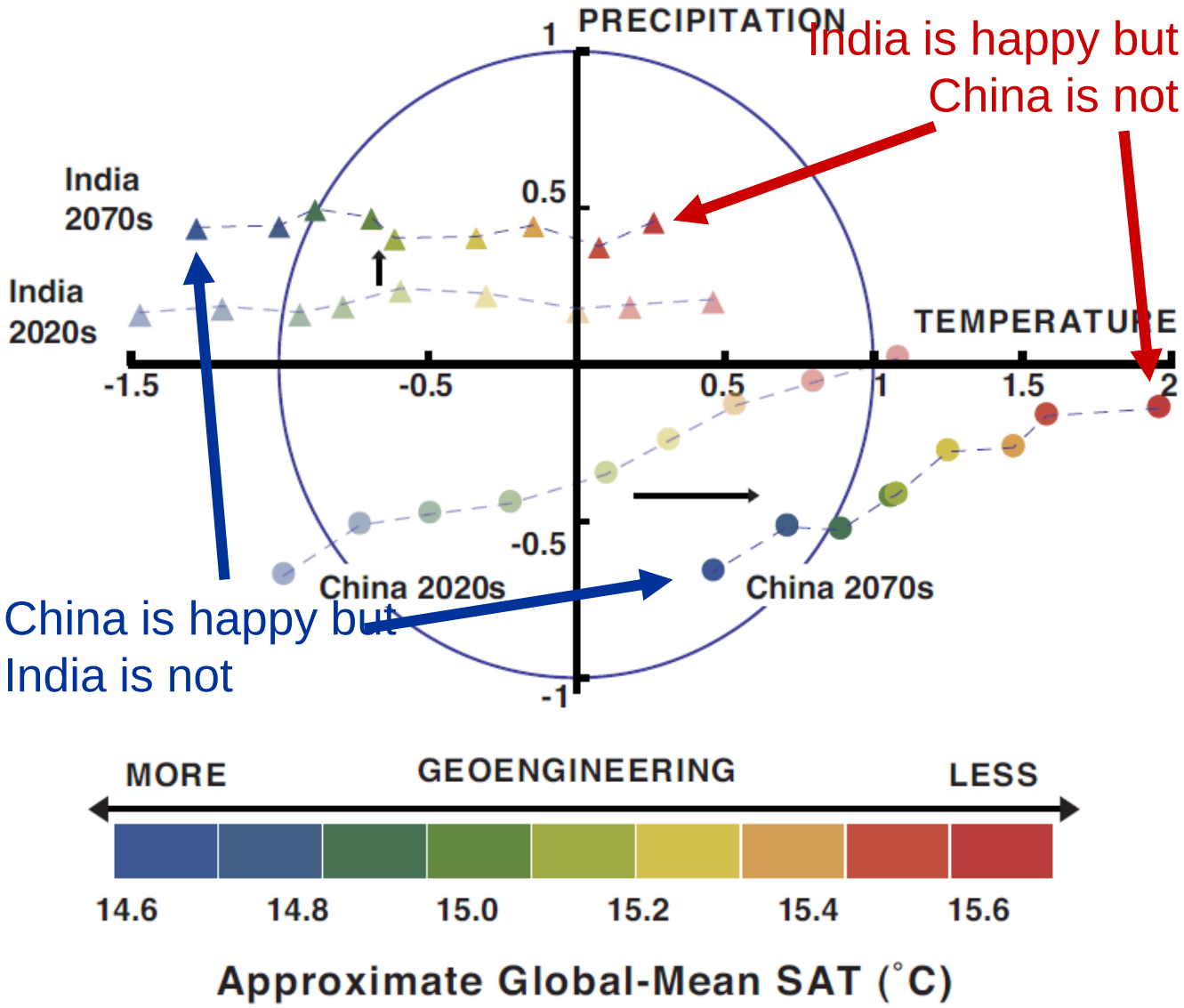
Want a Green New Deal? Here's a better one.

Or something more radical?





What is the “right” level of SRM?

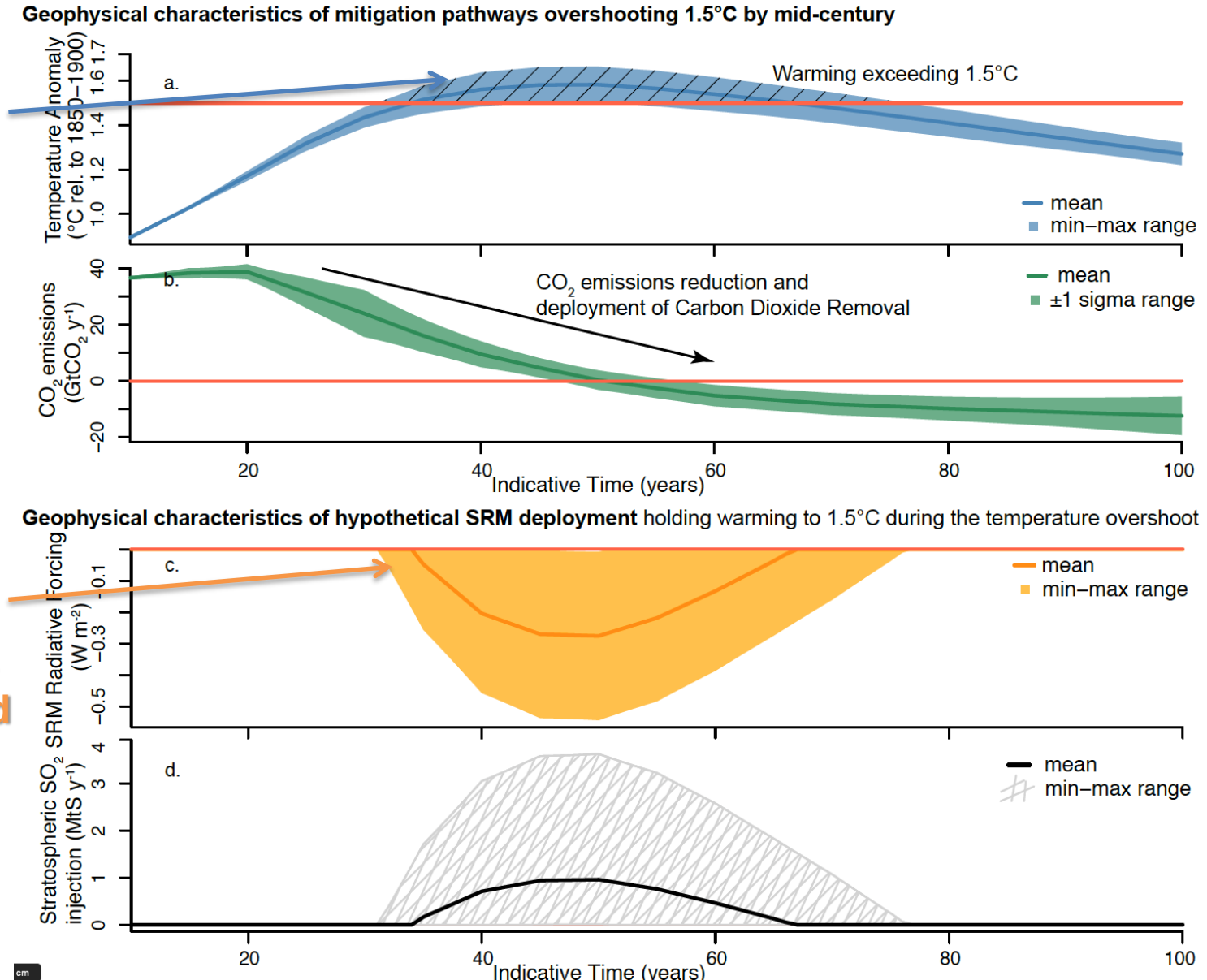


Ricke, Morgan & Allen, 2010

“Peak shaving” proposals for “harmless” SRM

Peak impact comparable to response uncertainty

SRM deployed after emissions already reduced by ~30%



Economists and young people both like carbon pricing

- Stiglitz, Stern et al (2017)
- Key conclusion:
  - \$40-80 /tCO_2 by 2020
  - \$50-100 /tCO_2 by 2030

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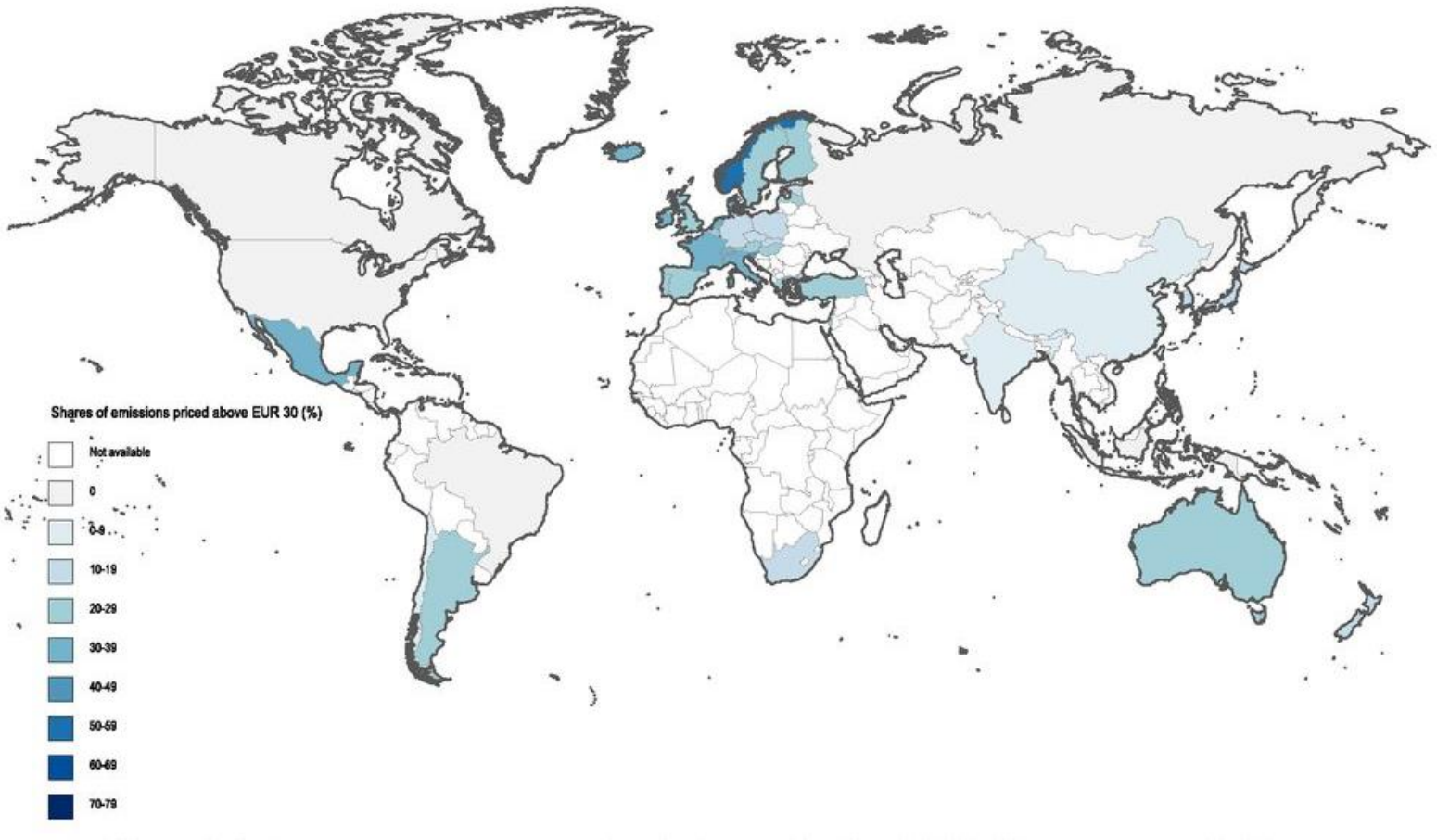
Carbon pricing is starting to happen

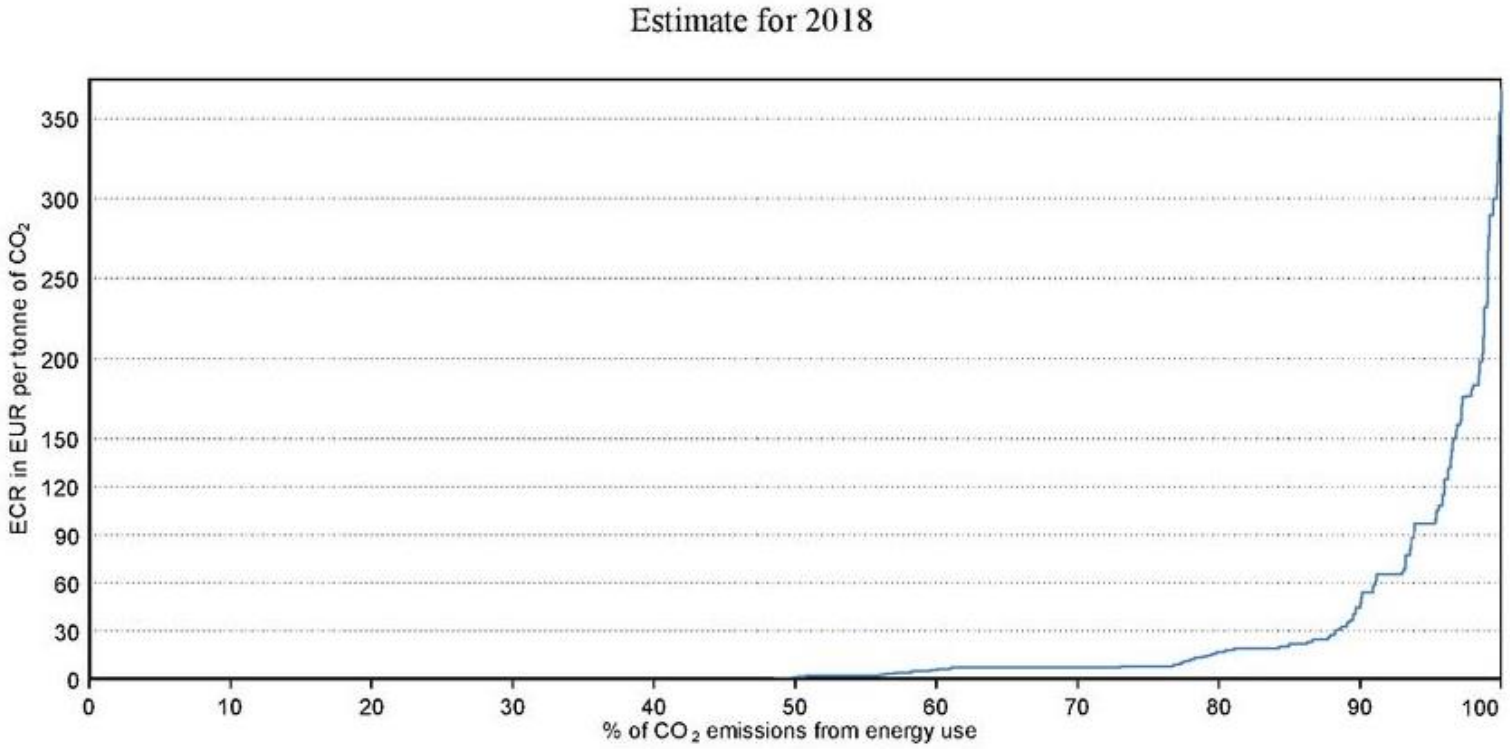
Figure 2.2. Share of emissions from energy use priced above EUR 60 per tonne of CO_2



Effective Carbon Rates 2018 -- OECD

But effective carbon prices vary a lot...

Figure 2.5. Proportion of CO_2 emissions from energy use subject to different levels of effective carbon rates in 42 OECD and G20 countries



Effective Carbon Rates 2018 -- OECD

Effective Carbon Prices and Emissions in the UK by Sector

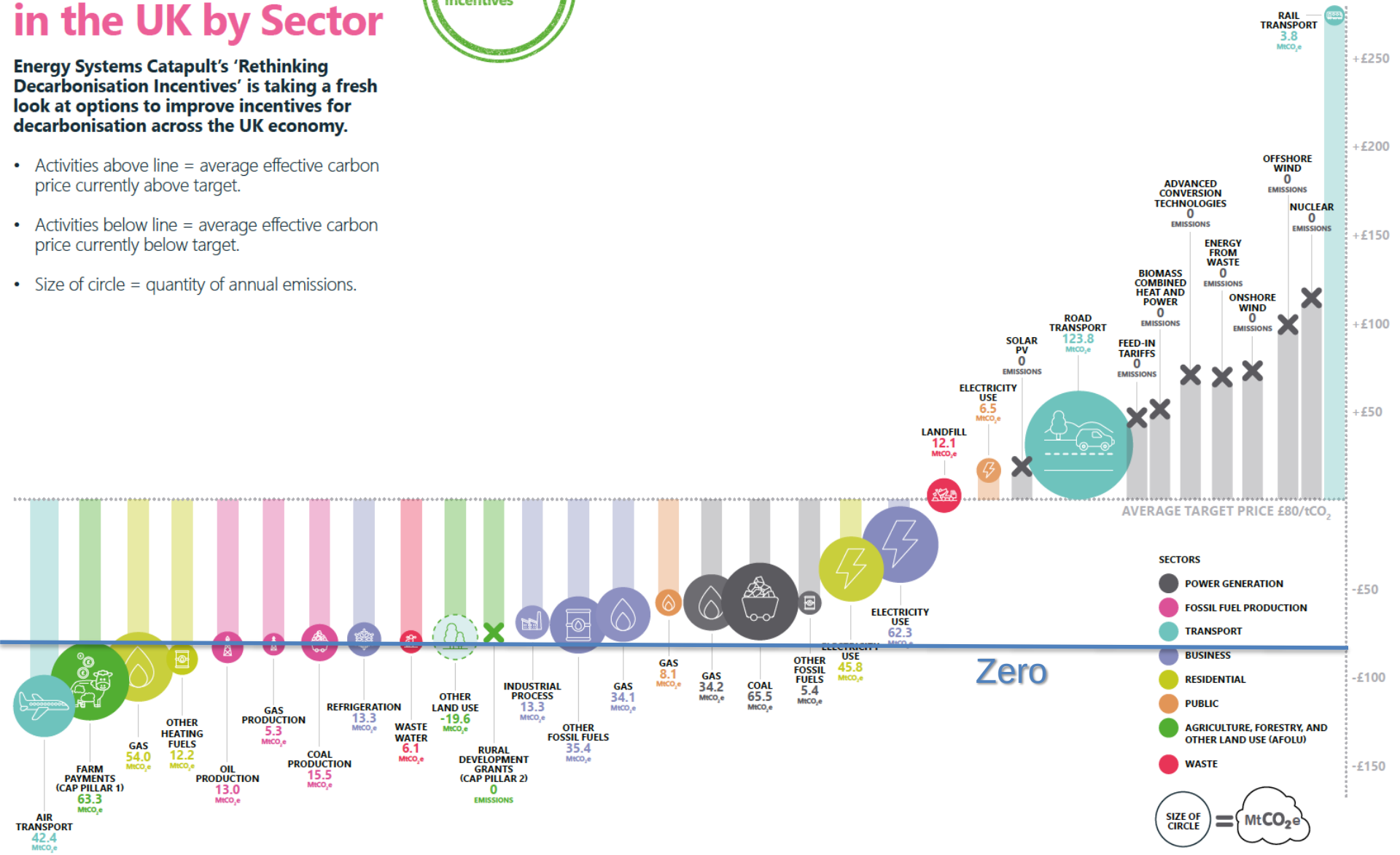
Rethinking Decarbonisation Incentives

energy technologies institute

CATAPULT Energy Systems

Energy Systems Catapult's 'Rethinking Decarbonisation Incentives' is taking a fresh look at options to improve incentives for decarbonisation across the UK economy.

- Activities above line = average effective carbon price currently above target.
- Activities below line = average effective carbon price currently below target.
- Size of circle = quantity of annual emissions.



Catapult Energy Systems, 2018

OXFORD

Conventional mitigation scenarios driven by a global carbon price

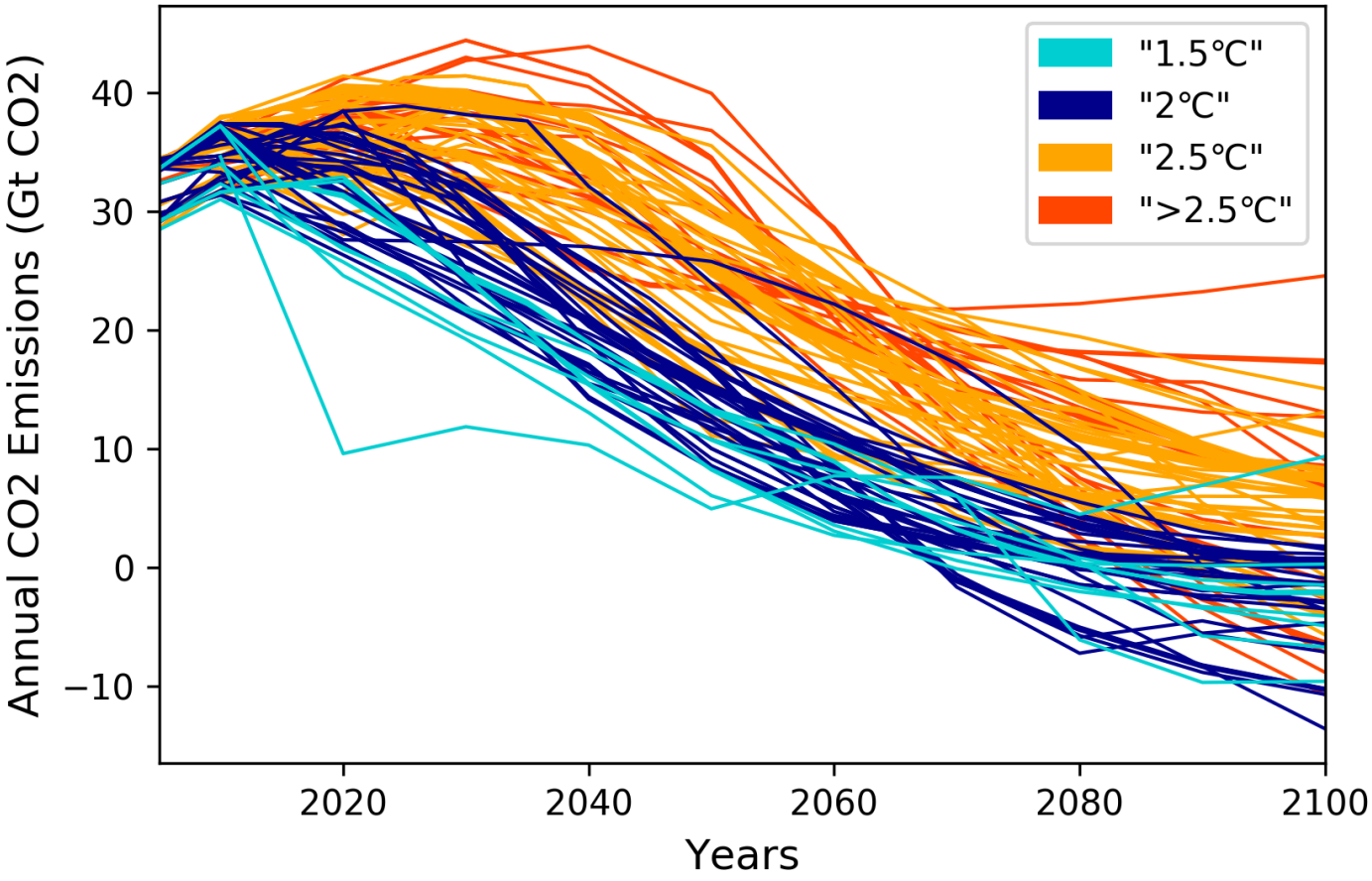
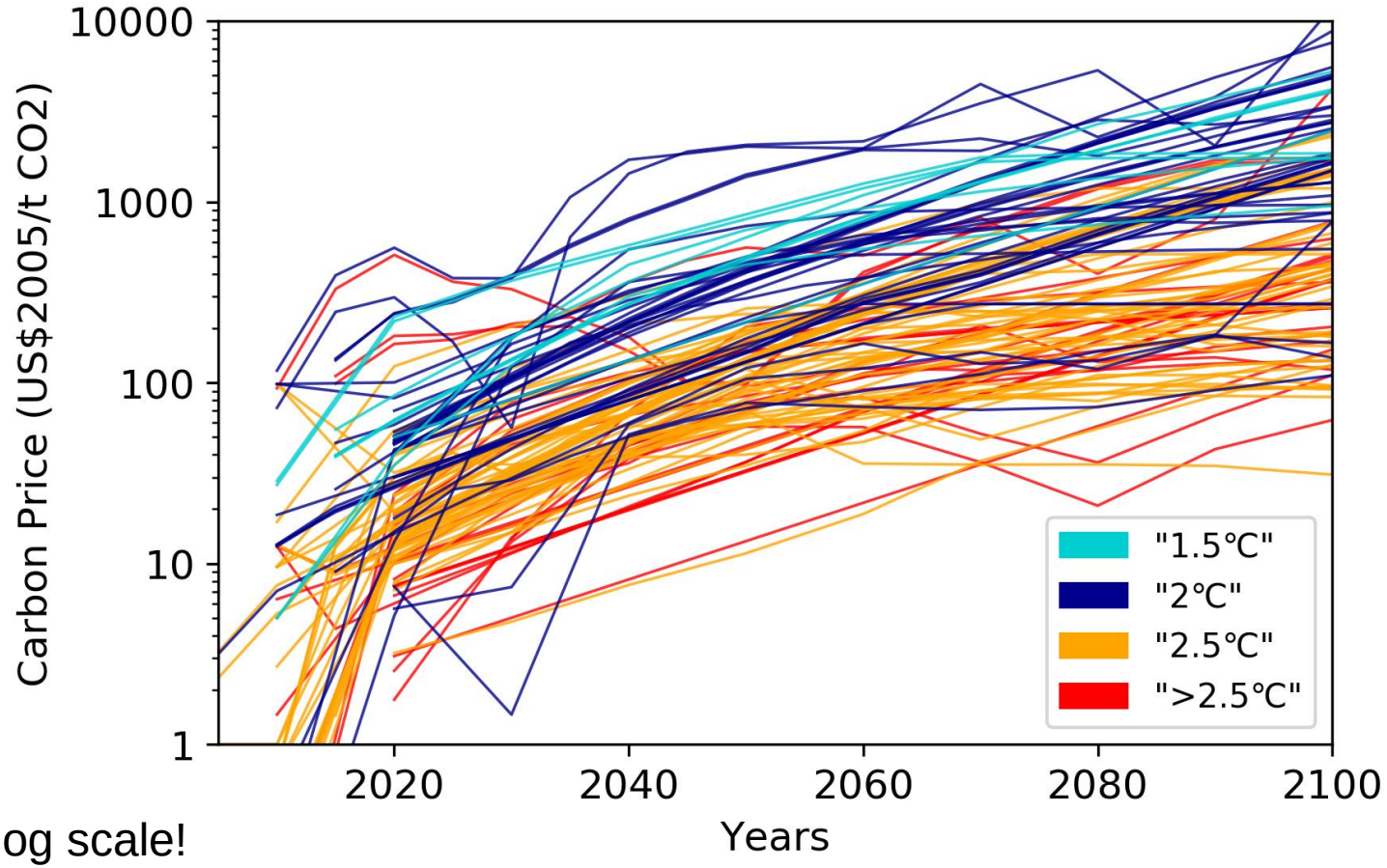


Figure courtesy of Euan Graham based on IPCC WG3 scenarios

Carbon prices in conventional mitigation scenarios



Note log scale!

The New York Times

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New U.N. Climate Report Says Put a High Price on Carbon

THE HILL

Gas at $240 per gallon? IPCC report lays out high cost of carbon taxes

BY VANCE GINN AND ELLIOTT RAIA, OPINION CONTRIBUTORS — 11/12/18 04:30 PM EST
THE VIEWS EXPRESSED BY CONTRIBUTORS ARE THEIR OWN AND NOT THE VIEW OF THE HILL

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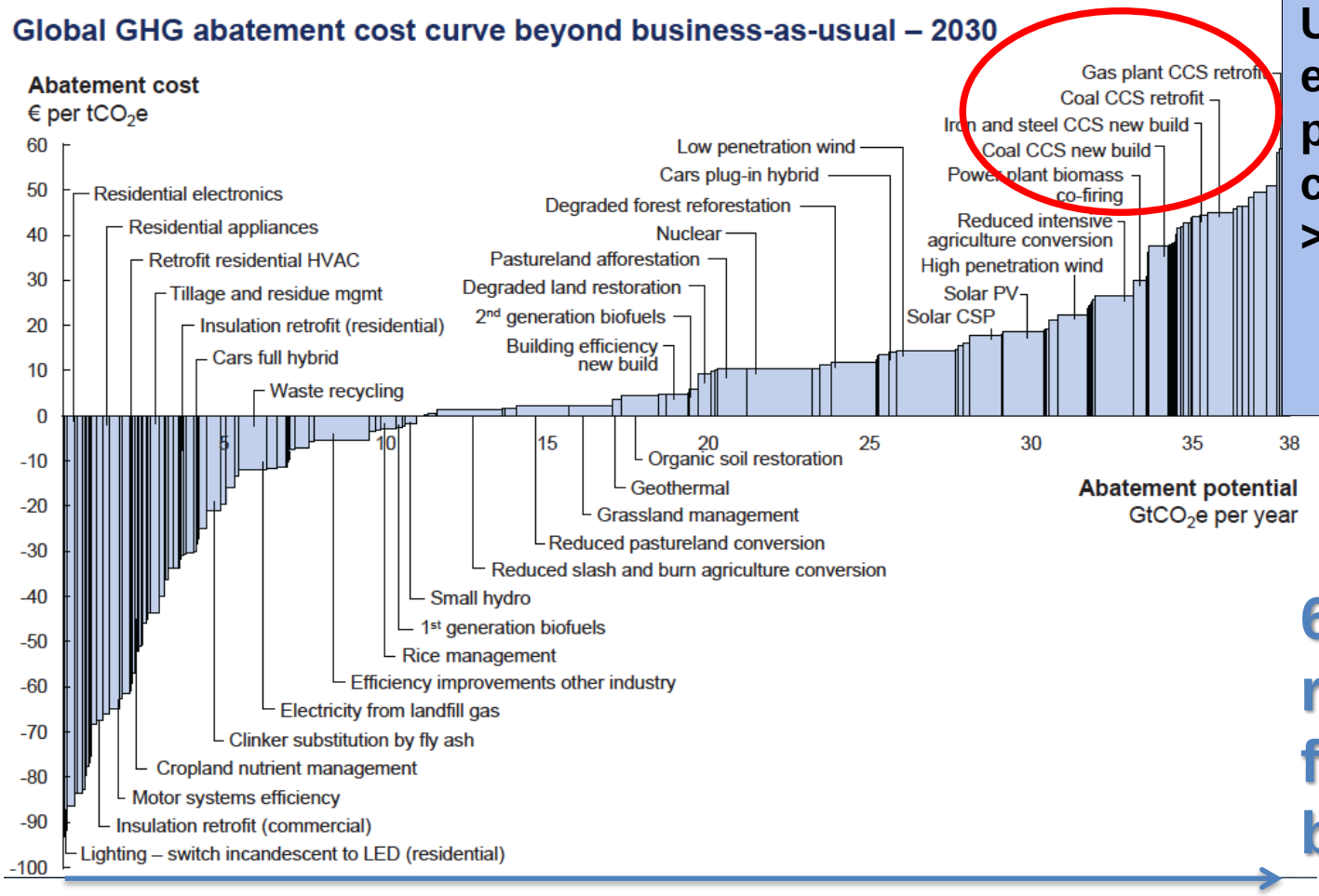
Why do carbon prices go that high?



Underlying economic productivity of carbon > €1000/tCO_2e

60% reduction from baseline

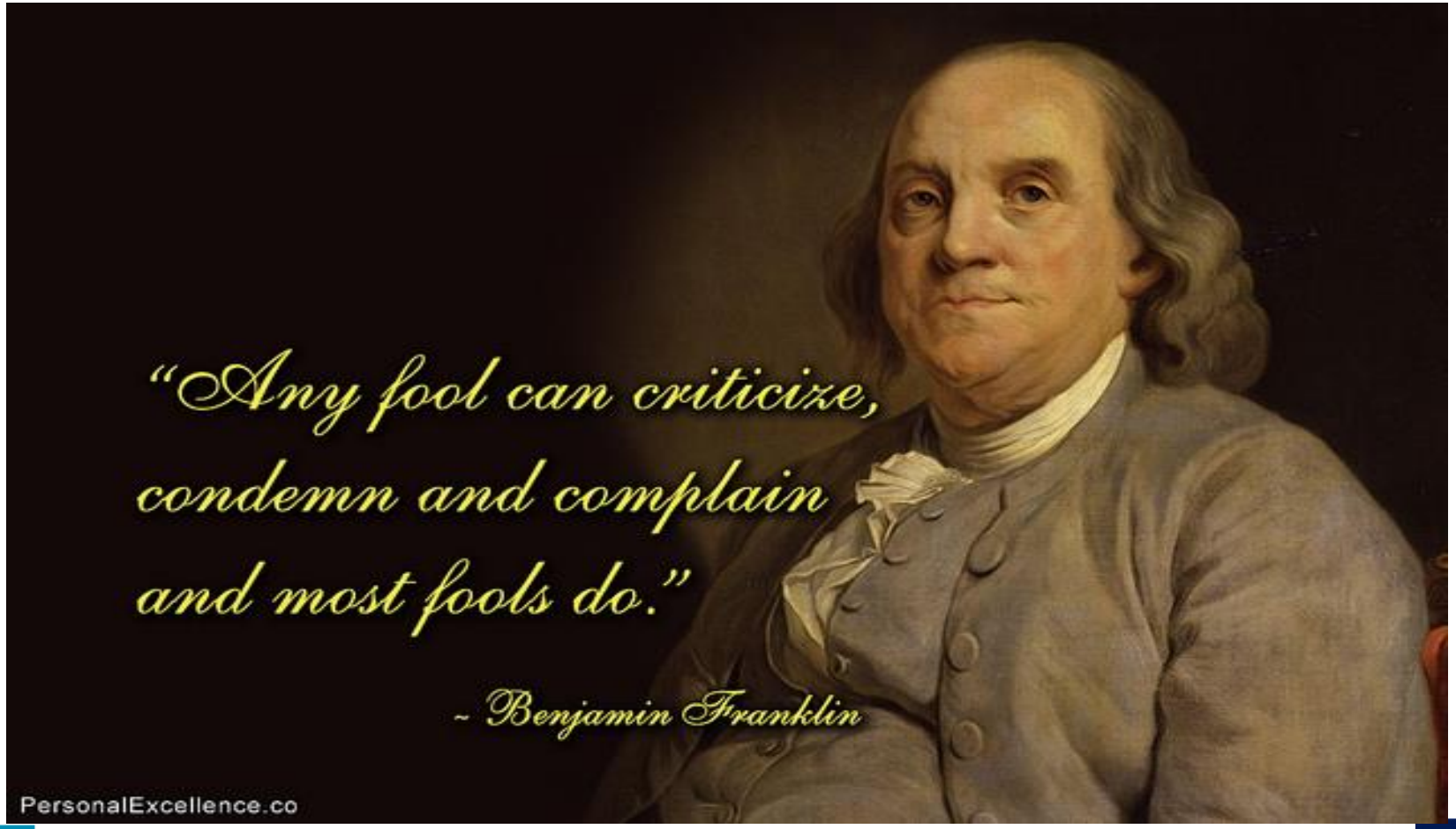
So relying on carbon pricing means…

- We put off deploying the most expensive, but also the most crucial, mitigation options until the last minute.
- Which increases the risks they won't work, or are more expensive than expected, so we either
  - Reduce emissions by reducing consumption or…
  - Relax the climate target.
- It also means actual expenditure on mitigation (as opposed to redistribution) is pushed as far as possible onto the next generation.

Belated 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…"

So, have I got a better idea?



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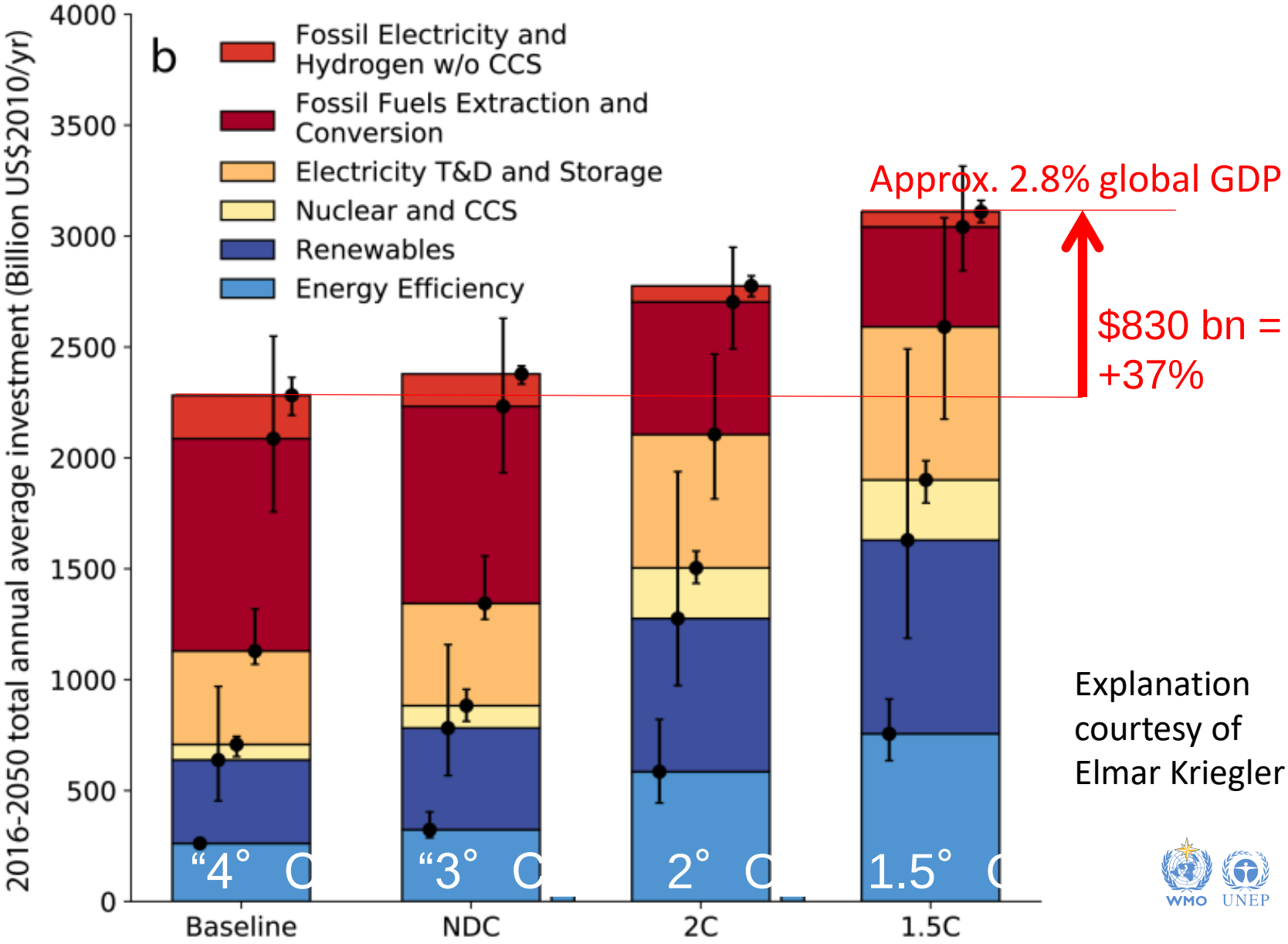
Annual average energy-related investments over the period 2016-2050 in 4 scenario categories (Fig 2.27 underlying report)

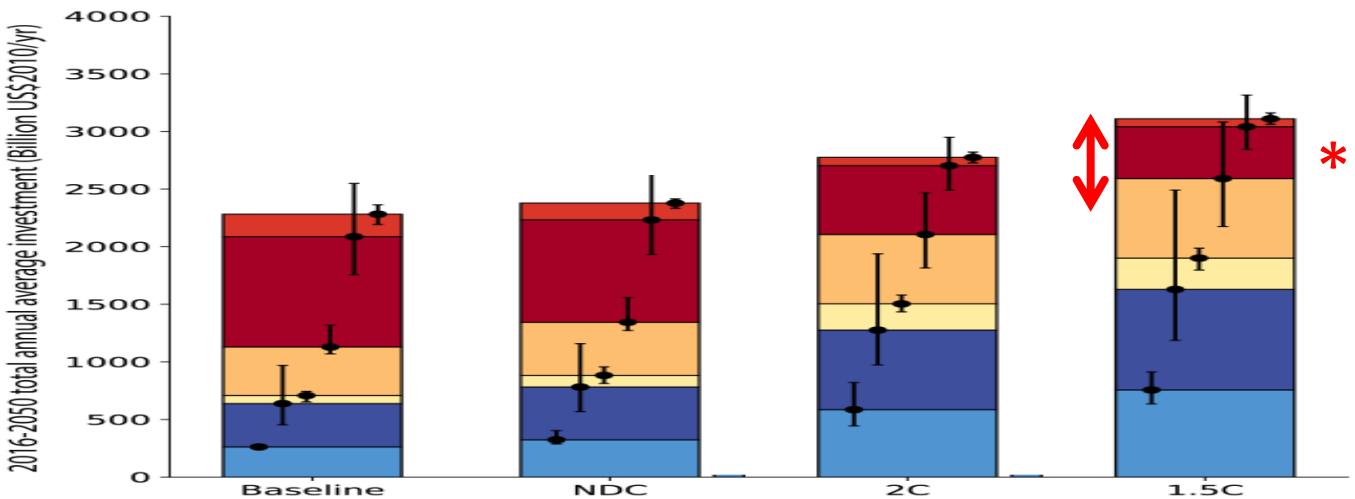


Explanation courtesy of Elmar Kriegler

Context: annual average energy-related investments relative to energy-related expenditure (assuming this follows GDP)

"1.5° C to cost 2.5% of GDP"

Additional energy-related investment for 1.5°C is <1% of global GDP, or <10% of projected spending on energy if that remains at ~10% of global GDP



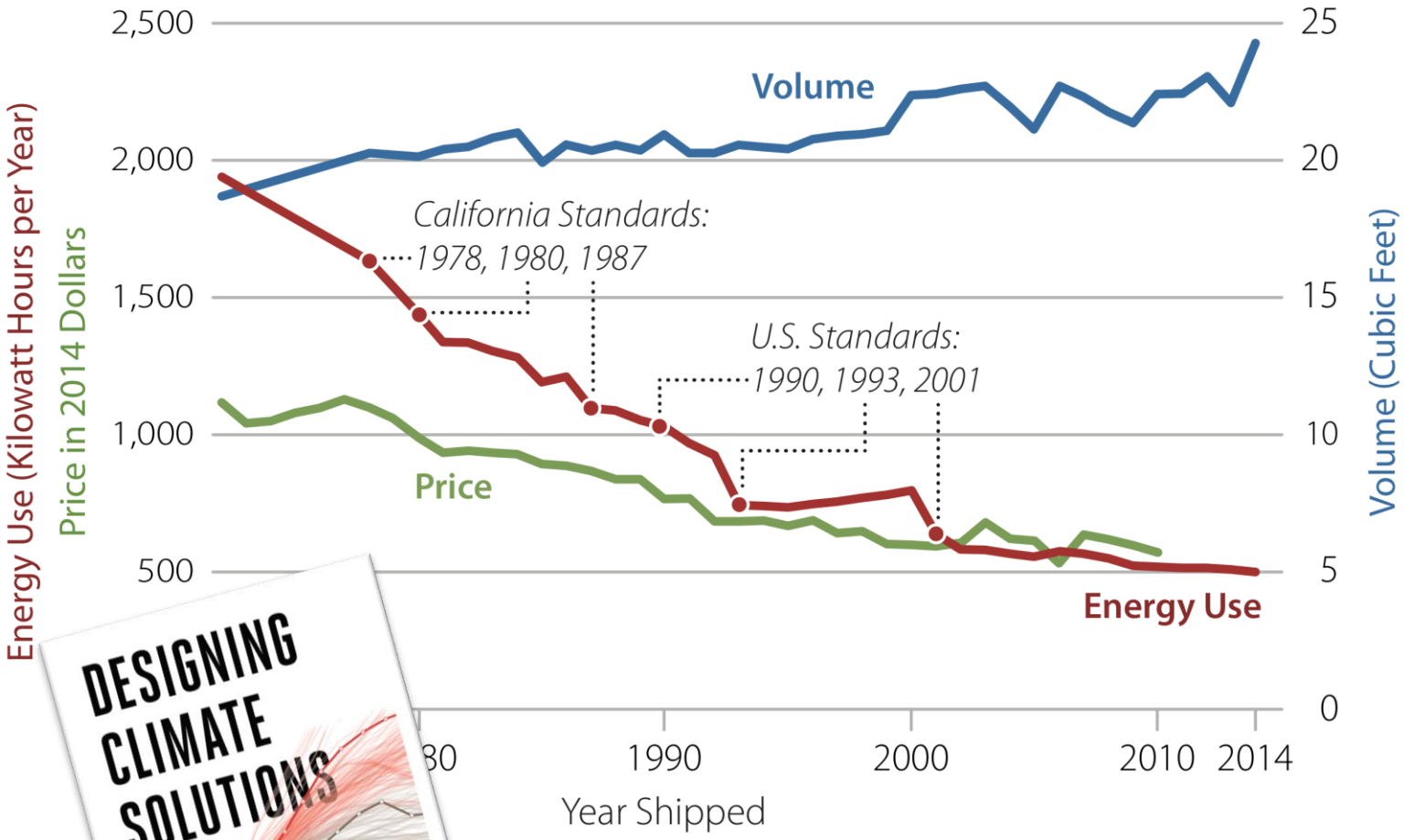
Spending on energy

UNEP

Follow the money...

- Most of the money we currently spend on fossil fuels is rent, going to whoever owns fossil carbon as it comes out of the ground.
- Carbon pricing directly competes with rent-holders, giving them every incentive to opposed or undermine it.
- Under these circumstances, “second best” regulatory approaches may be more effective.

One climate policy that does work: performance standards

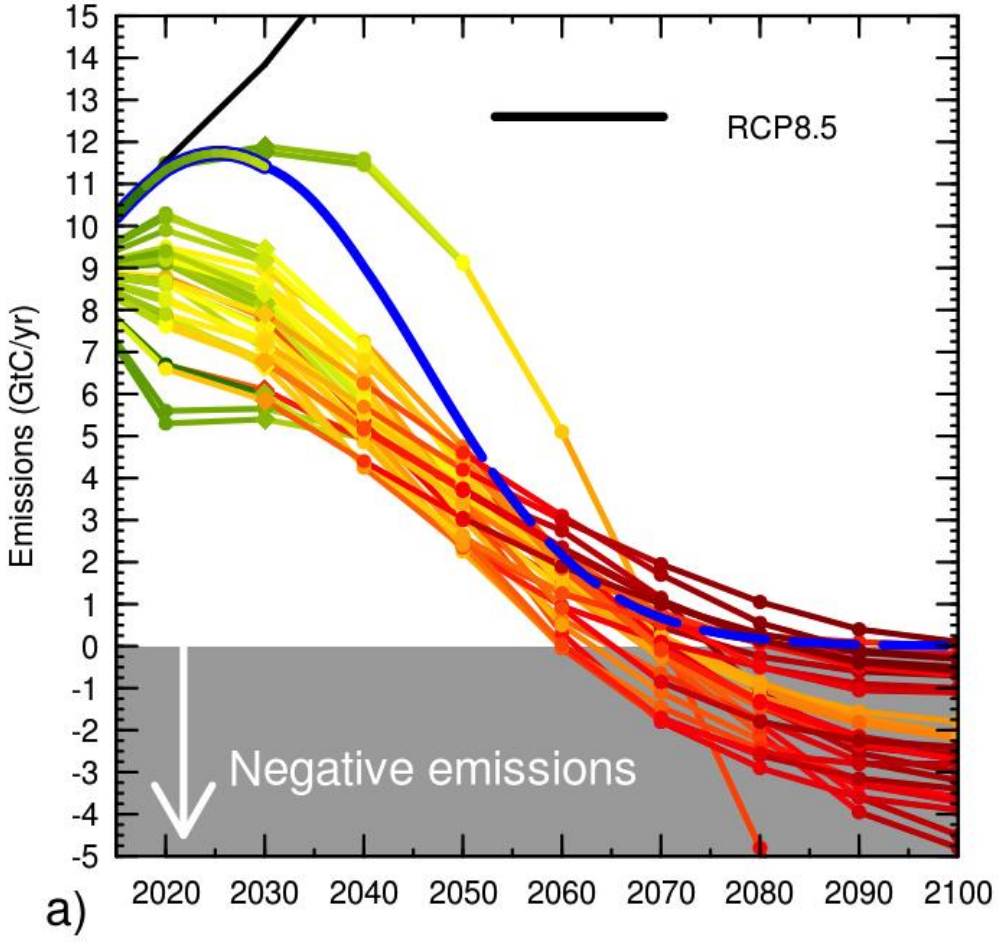


Performance of US fridges

What is a climate performance standard for the fossil fuel industry?

Emissions and mitigation costs in “well-below 2° C” scenarios

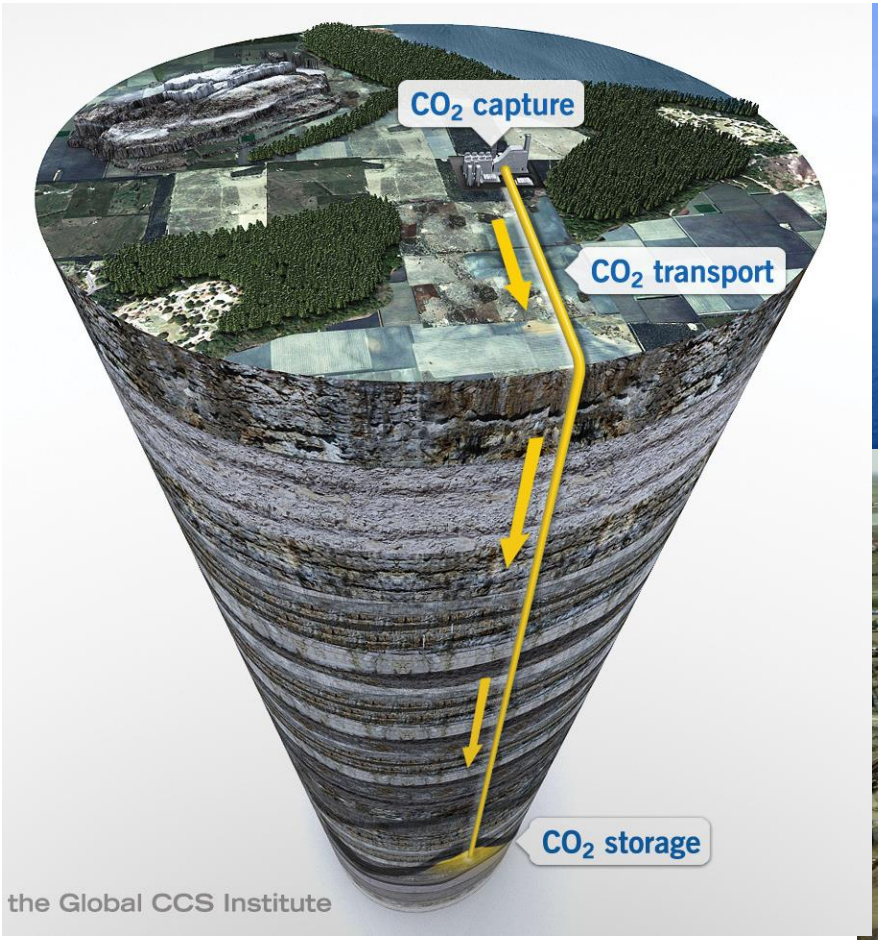
Total emissions in scenarios in IPCC WGIII “430-480ppm” (lowest) scenario category



Colours show total policy cost in US$$_{2005}$$

Figures courtesy of Richard Millar based on IIASA database

Simplest route to “negative emissions”: carbon capture and sequestration (CCS)



But this not popular – and also not happening. Why not?

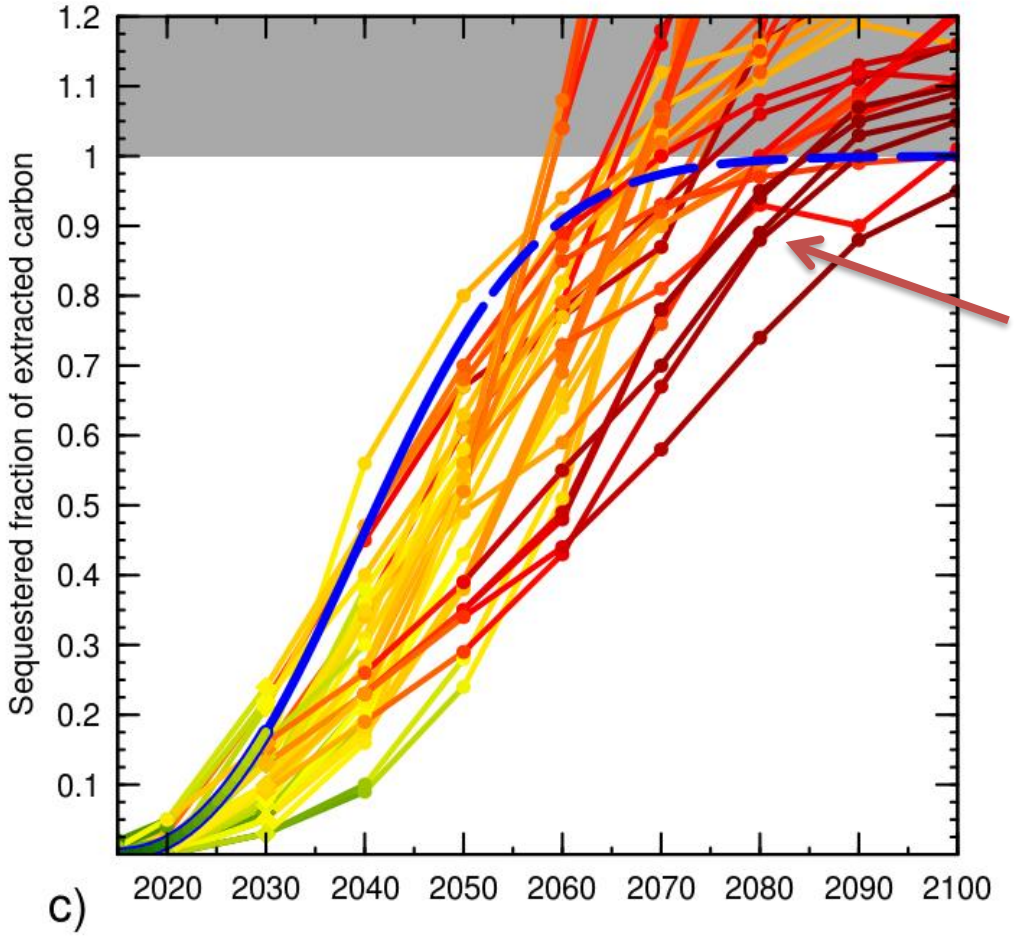
Why environmentalists are right to opposed most current CCS projects – but not CCS itself

- Who is the main beneficiary of successful CCS development?
  - The owners of fossil fuel assets
  - Assuming fossil energy is priced at whatever the market will bear (not what it costs to extract), the marginal benefits of increased consumption go to the rent-ho

Why should her taxes be used to develop a technology to allow him to keep selling his product?

Another way of looking "well below 2°C" scenarios

Net fraction of extracted carbon that is re-injected through CCS, Bioenergy with CCS (BECCS) or Direct Air Capture (DAC)



Delayed deployment of CO_2 disposal is associated with mitigation costs >\$60 $T\$_{2005}$/year

Figures courtesy of Richard Millar based on IIASA database

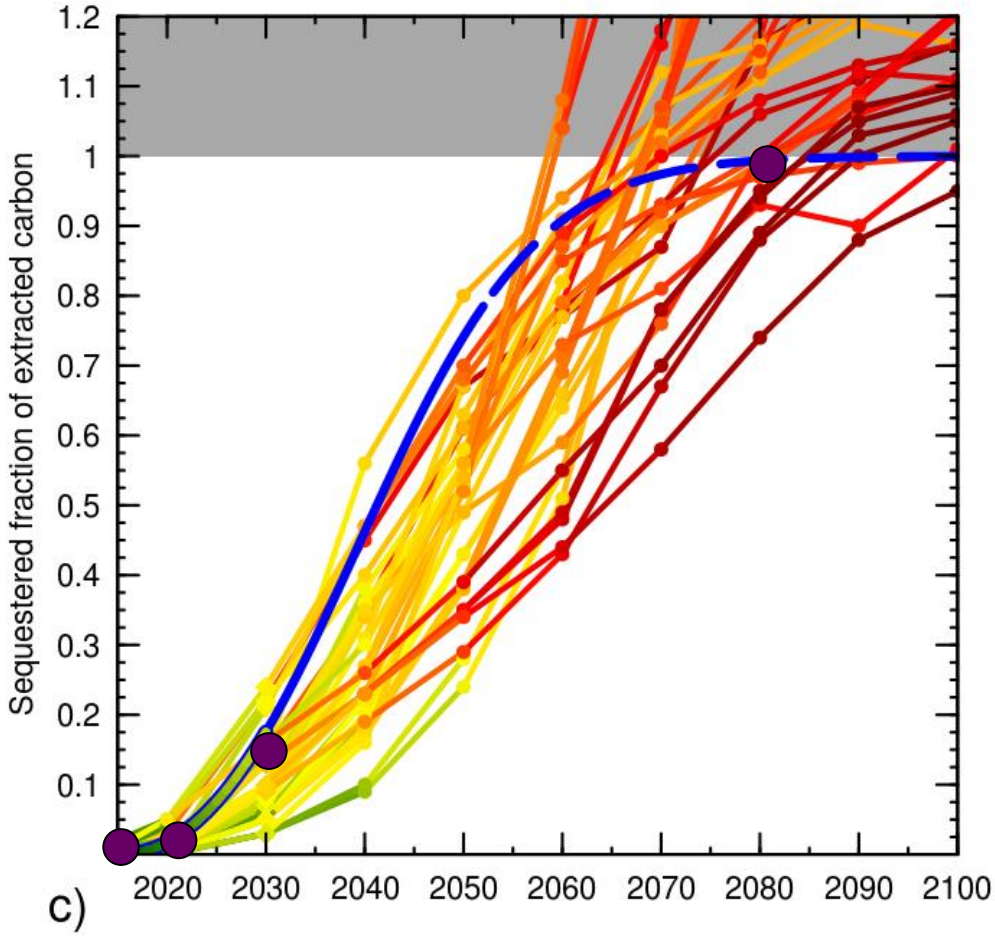
A scenario for progressive CCS deployment

Net fraction of carbon extracted that is re-injected through CCS:

1% by 2020

15% by 2030

100% by the time temperatures reach 2°C



Colours show total policy cost in US$$_{2005}$$

The remarkable economics of mandatory sequestration

- Suppose CO_2 disposal initially costs \$50/tCO_2 *sequestered* (enhanced oil recovery, use pure CO_2 sources), rising to \$250/tCO_2 at net zero (combined CCS, BECCS & DAC).
- Cost per tCO_2 fossil carbon *sold*: $S(50+200S)$ where S is sequestered fraction.
- This is equivalent to a carbon price of:
  - \$ 0.52 /tCO_2 at S=1% (mid-2020s)
  - \$12.00 /tCO_2 at S=15% (mid-2030s)
  - \$250 /tCO_2 at S=100% (before 2100)

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Mandatory sequestration works

Gorgon gas project, Western Australia

So the choice is very simple

- How do we get to 15% sequestration in the 2030s?
  - Definitely not through carbon pricing.
  - The only feasible option is a certificate system, making sequestration a licensing requirement of fossil fuel extraction and import.
- If we get to 15% by the time warming reaches 1.2°C, the industry will be able to reach 100% well below 2°C.
- So either we introduce mandatory sequestration now, or we won't meet the goals of the Paris Climate Agreement.

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We were so close…

- “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, tabled by Lord Oxburgh, September, 2015)
- http://www.publications.parliament.uk/pa/ld201516/ldhansrd/text/150909-0001.htm#15090934000396

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A challenge to you all

- There is one institution in the world with the capital and the expertise to solve the climate change problem:
  - The 6 $Tn/year global fossil fuel industry
- But no single country or company has any incentive to invest seriously in CCS, even though the industry as a whole needs it to survive in a net zero world.
- How can we get the environmental movement to embrace mandatory sequestration as a key part of the solution to climate change?

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