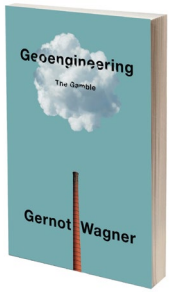
Nuclear power, geoengineering, and climate tipping points



Gernot Wagner
gwagner.com


Andrej Karpathy
@karpathy
I forgot how cool European cities are. More compact, denser, more unique / interesting, cleaner, safer, pedestrian/bike friendly, a lot more pedestrian only plazas with people relaxing / hanging out. A lot more of outside is an outdoor living space, not just transportation space.
8:16 AM · Apr 2, 2022 · Twitter for iPhone
479 Retweets
204 Quote Tweets
8,686 Likes

Gernot Wagner ✓
@GernotWagner

Tesla AI guy goes on European vacation, sees light that is smart urban design

> 
> **Andrej Karpathy** ✓ @karpathy · Apr 2
> I forgot how cool European cities are. More compact, denser, more unique / interesting, cleaner, safer, pedestrian/bike friendly, a lot more pedestrian only plazas with people relaxing / hanging out. A lot more of outside is an outdoor living space, not just transportation space.

$50

~$50 Social Cost of CO_2

Based on 3% constant discount rate, and an average of 3 climate-economy models, including DICE

Table ES-1: Social Cost of CO_2, 2020 – 2050 (in 2020 dollars per metric ton of CO_2)[3]

	Discount Rate and Statistic			
Emissions Year	5% Average	3% Average	2.5% Average	3% 95th Percentile
2020	14	51	76	152
2025	17	56	83	169
2030	19	62	89	187
2035	22	67	96	206
2040	25	73	103	225
2045	28	79	110	242
2050	32	85	116	260

~$50 'interim' Biden SC-$CO_2$, up from $1-7 Trump figure

Source: "Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990" (February 2021).

Eight priorities for calculating the social cost of carbon

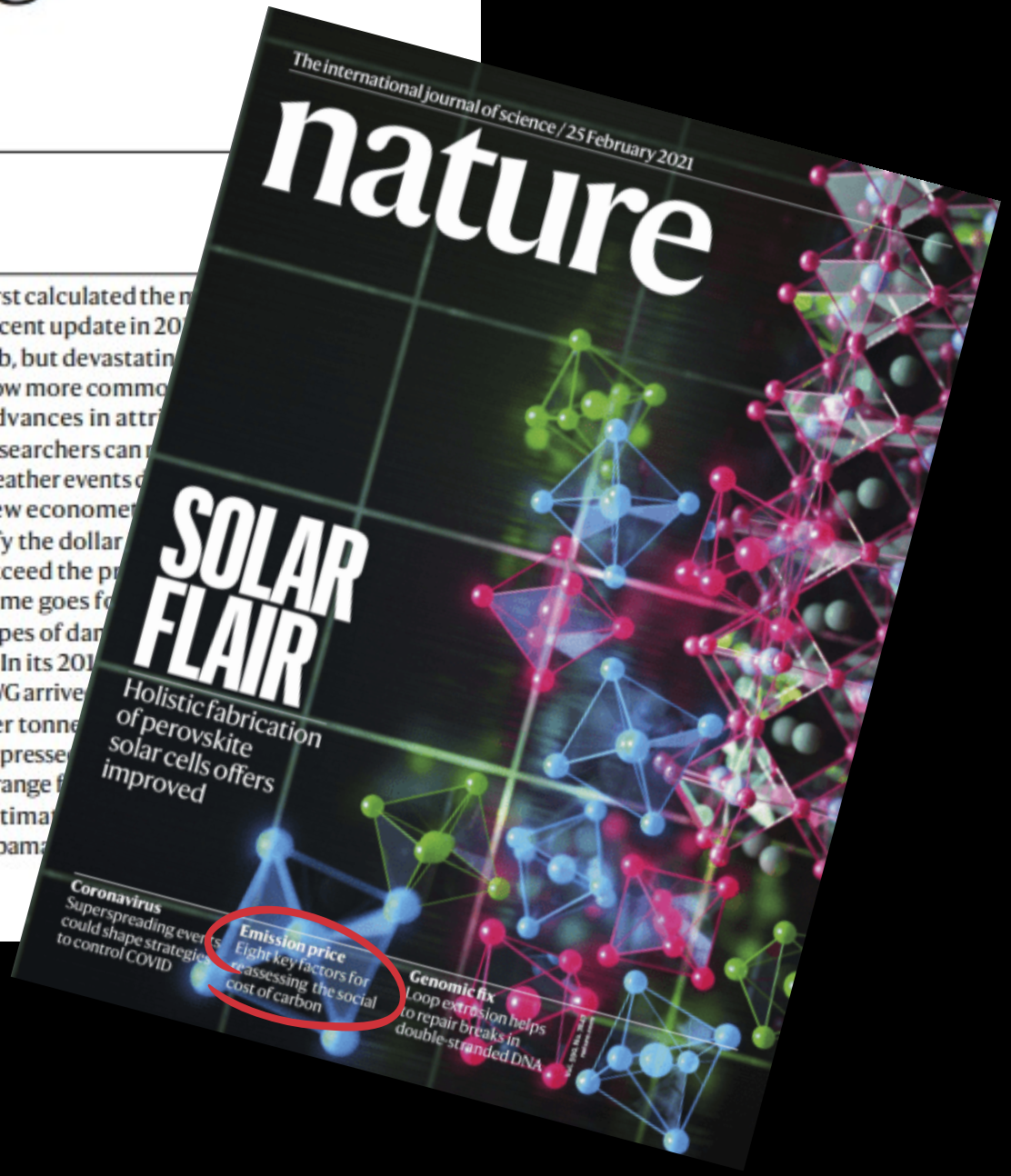
Gernot Wagner, David Anthoff, Maureen Cropper, Simon Dietz, Kenneth T. Gillingham, Ben Groom, J. Paul Kelleher, Frances C. Moore & James H. Stock

Advice to the Biden administration as it seeks to account for mounting losses from storms, wildfires and other climate impacts.

One of the first executive orders US President Joe Biden signed in January began a process to revise the social cost of carbon (SCC). This metric is used in cost–benefit analyses to inform climate policy. It puts a monetary value on the harms of climate change, by tallying all future damages incurred globally from the emission of one tonne of carbon dioxide now.

This month, the Biden administration is publishing an interim value of the SCC, which could be used immediately. Within a year, a newly reconstituted Interagency Working Group (IWG) will issue a review of the latest scientific and economic thinking, to inform what it calls a final number. The IWG will be co-led by the Council of Economic Advisers, the Office of Management and Budget and the Office of Science and Technology Policy. The group will also assess the social costs of methane, nitrous oxide and other greenhouse gases, and will provide recommendations for using and revising the SCC.

The time is ripe for this update. Climate science and economics have advanced since 2010, when a working group in the administration of former president Barack Obama first calculated the n
recent update in 20
job, but devastatin
now more commo
Advances in attri
researchers can
weather events
new economet
tify the dollar
exceed the pr
same goes f
types of dar
In its 201
IWG arrive
per tonne
expresse
a range
estima
Obam



gwagner.com/SCC-8

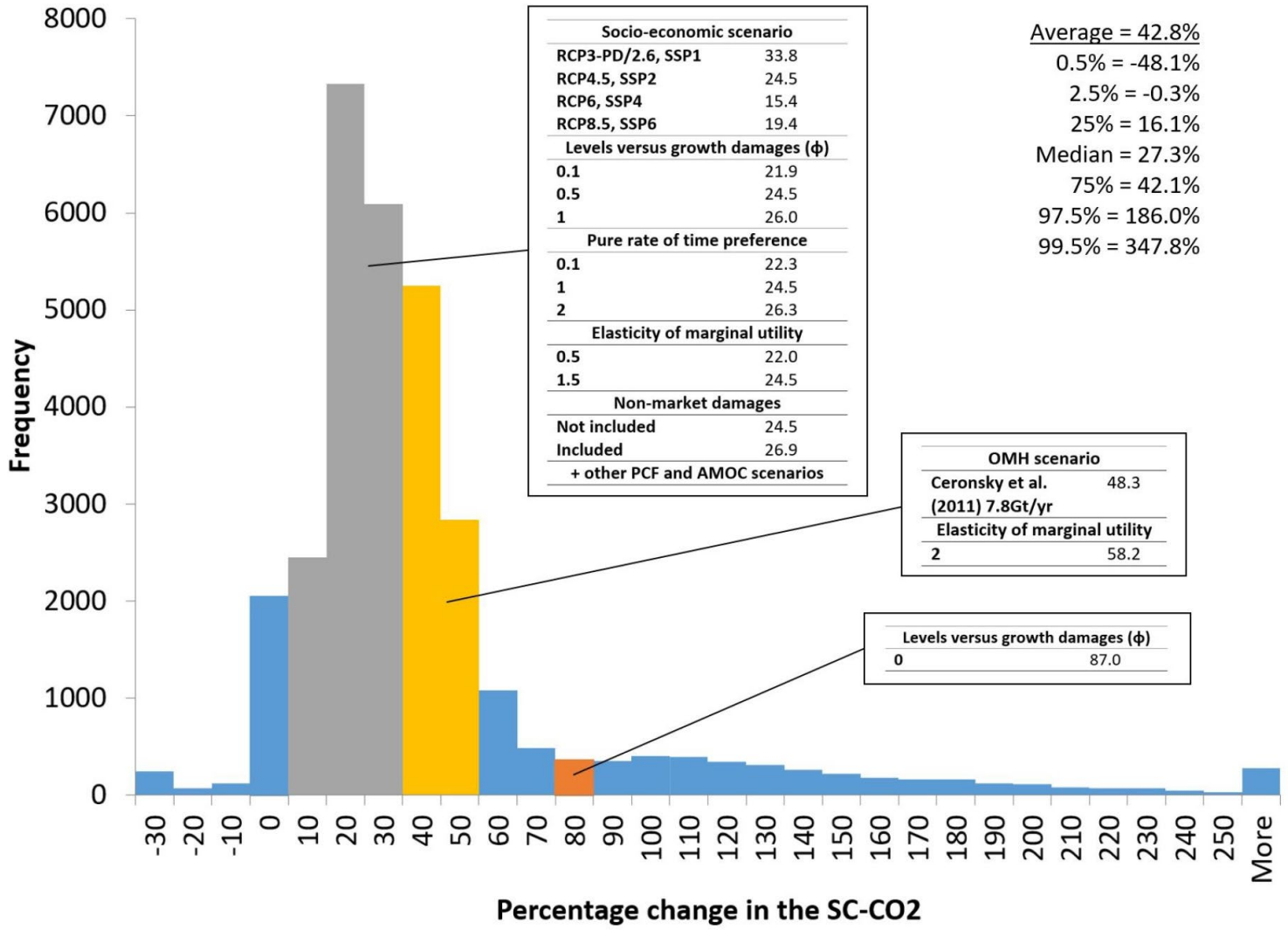
>$100

>$100:

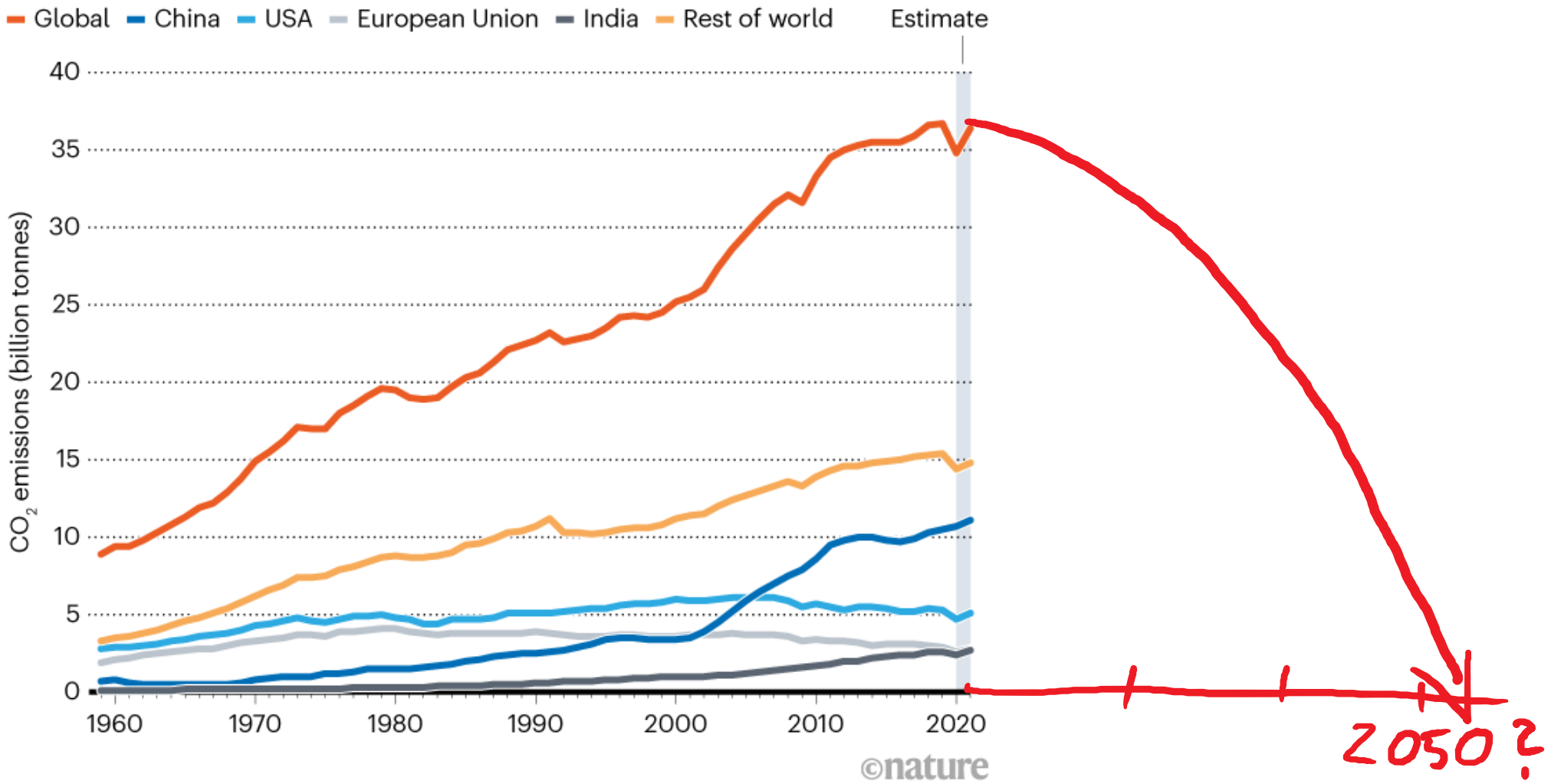
- Climate damage quantification
  - including tipping points
- Tail risks
- Discounting
- Risk calibration, equity, etc.

Economic impacts of tipping points in the climate system

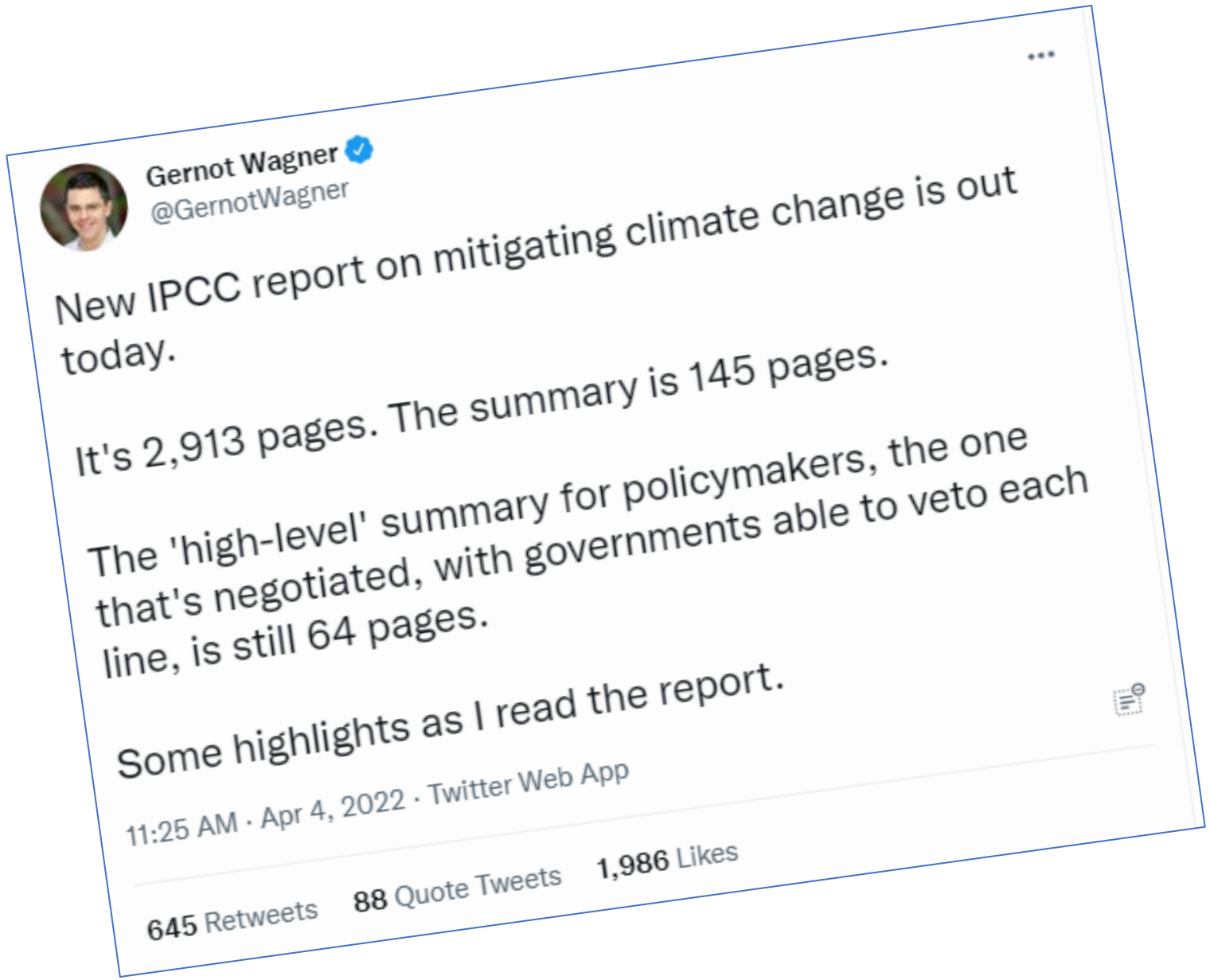
Tipping points increase SCC by between ~27-43%, with large, right-skewed distribution



Source: Dietz, Rising, Stoerk & Wagner (*PNAS* 2021), gwagner.com/tipping-economics



Source: Global Carbon Project + umpteen climate-econ model runs


Gernot Wagner
@GernotWagner
New IPCC report on mitigating climate change is out today.
It's 2,913 pages. The summary is 145 pages.
The 'high-level' summary for policymakers, the one that's negotiated, with governments able to veto each line, is still 64 pages.
Some highlights as I read the report.
11:25 AM · Apr 4, 2022 · Twitter Web App
645 Retweets
88 Quote Tweets
1,986 Likes

Many options available now in all sectors are estimated to offer substantial potential to reduce net emissions by 2030. Relative potentials and costs will vary across countries and in the longer term compared to 2030.

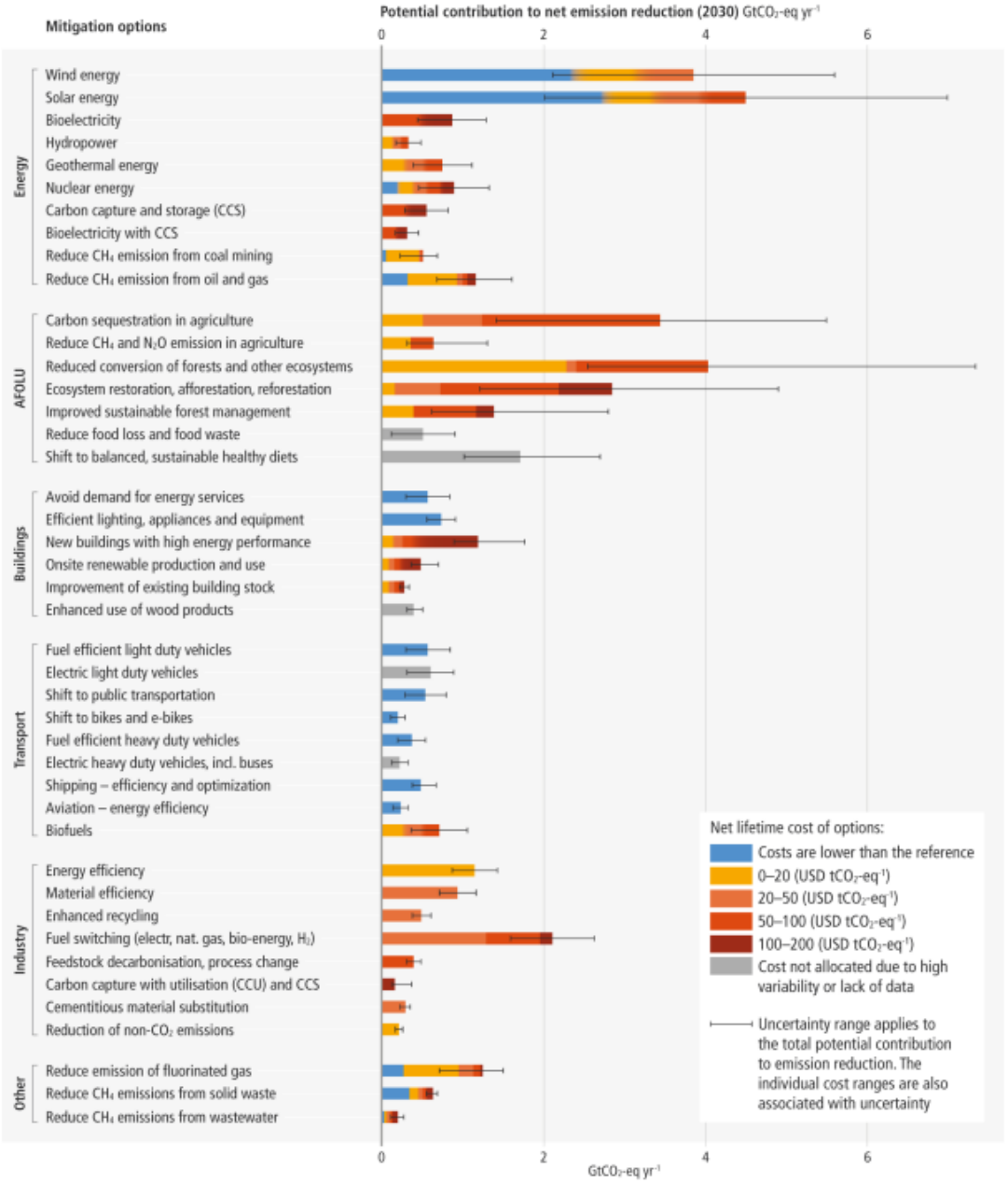
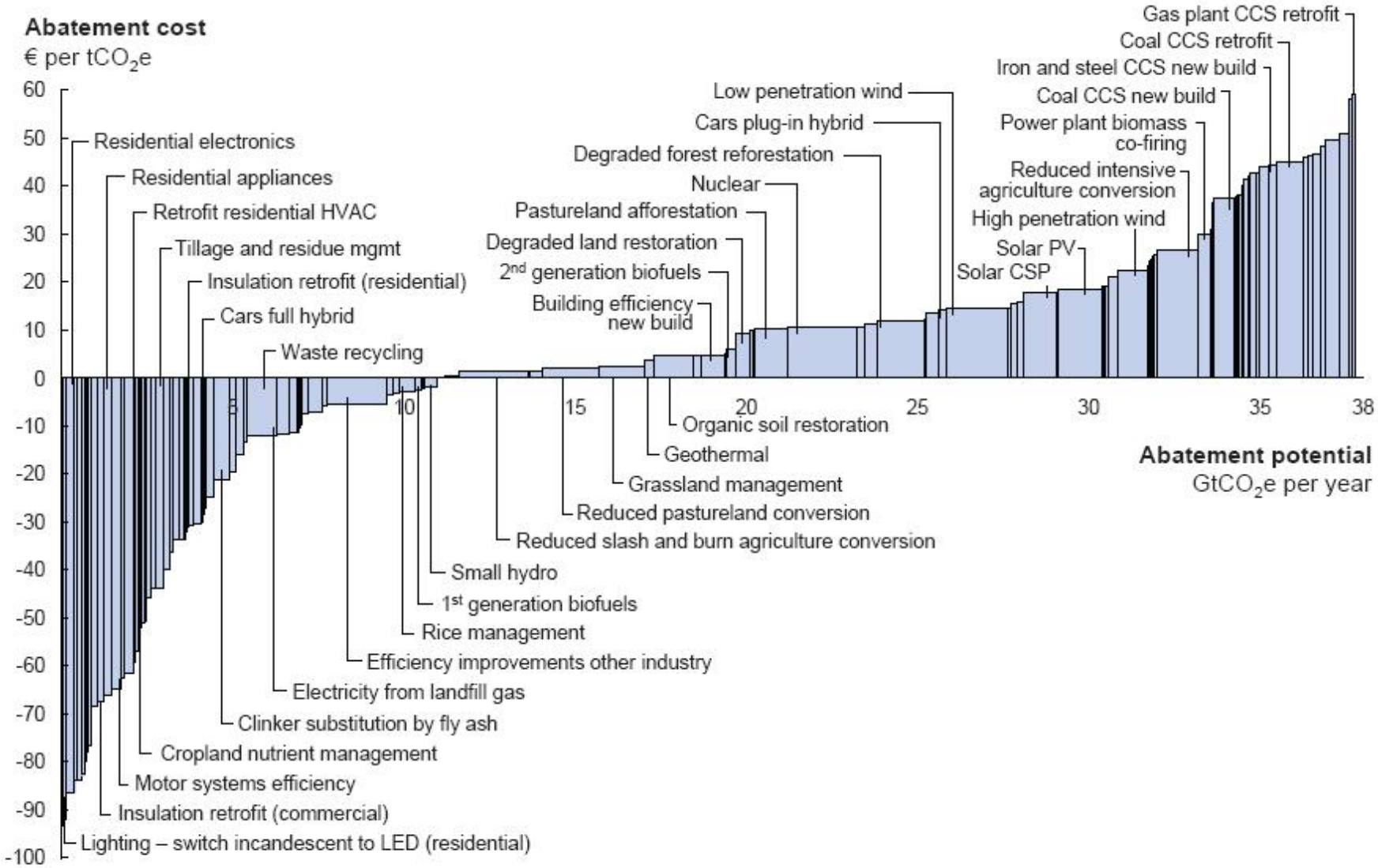


Figure SPM.7: Overview of mitigation options and their estimated ranges of costs and potentials in 2030.

IPCC AR6 WGIII, ipcc.ch/report/ar6/wg3

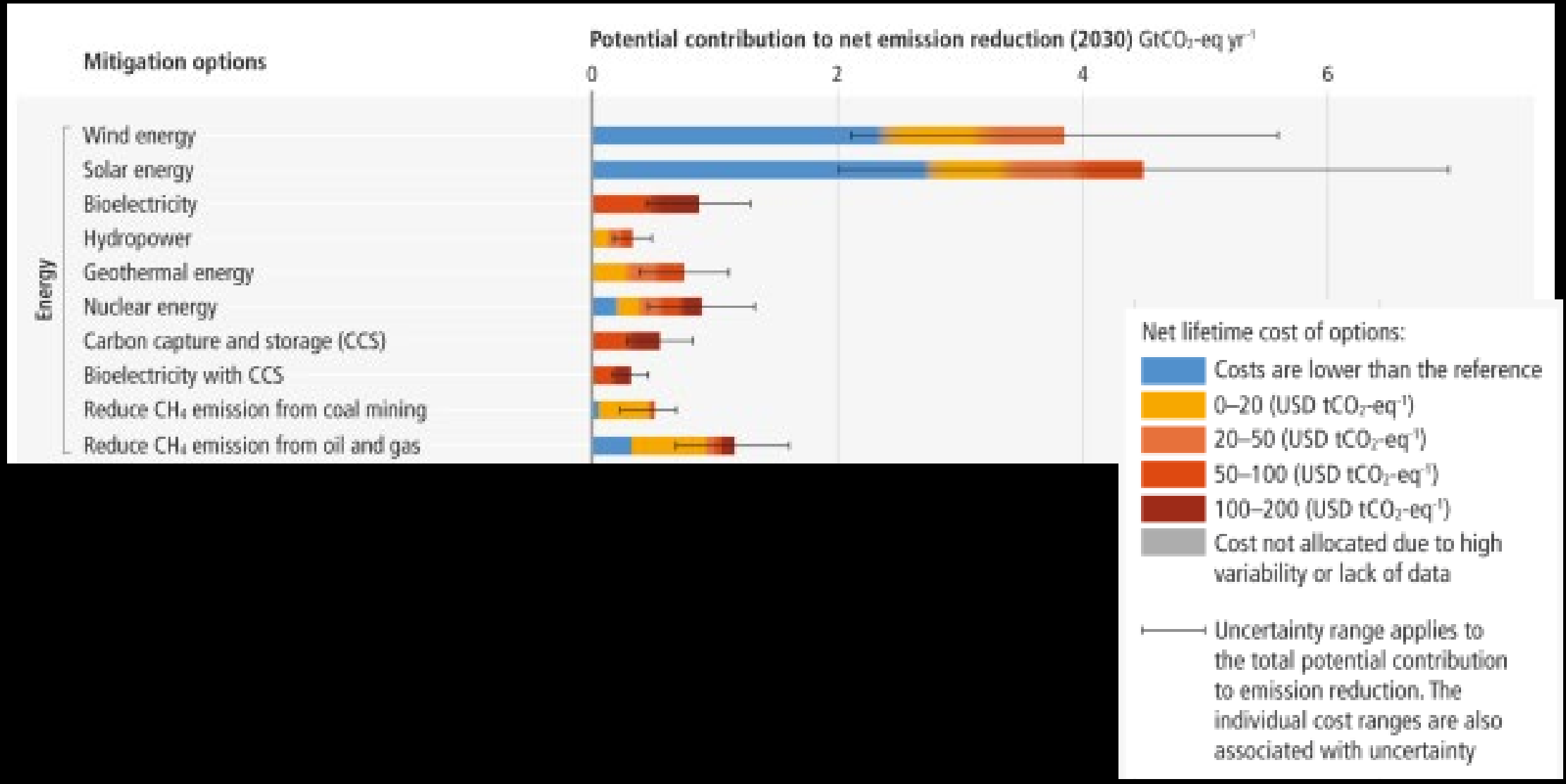
Large abatement opportunities available at low or no cost

McKinsey Global v2.0 effort identified 38 $GtCO_2e$ abatement potential in 2030



Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €60 per tCO_2e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.

Source: Global GHG Abatement Cost Curve v2.0



IPCC AR6 WGIII, ipcc.ch/report/ar6/wg3

Plan A

Cut CO_2, methane et al.

Adapt

Carbon removal

→ “net-zero” emissions

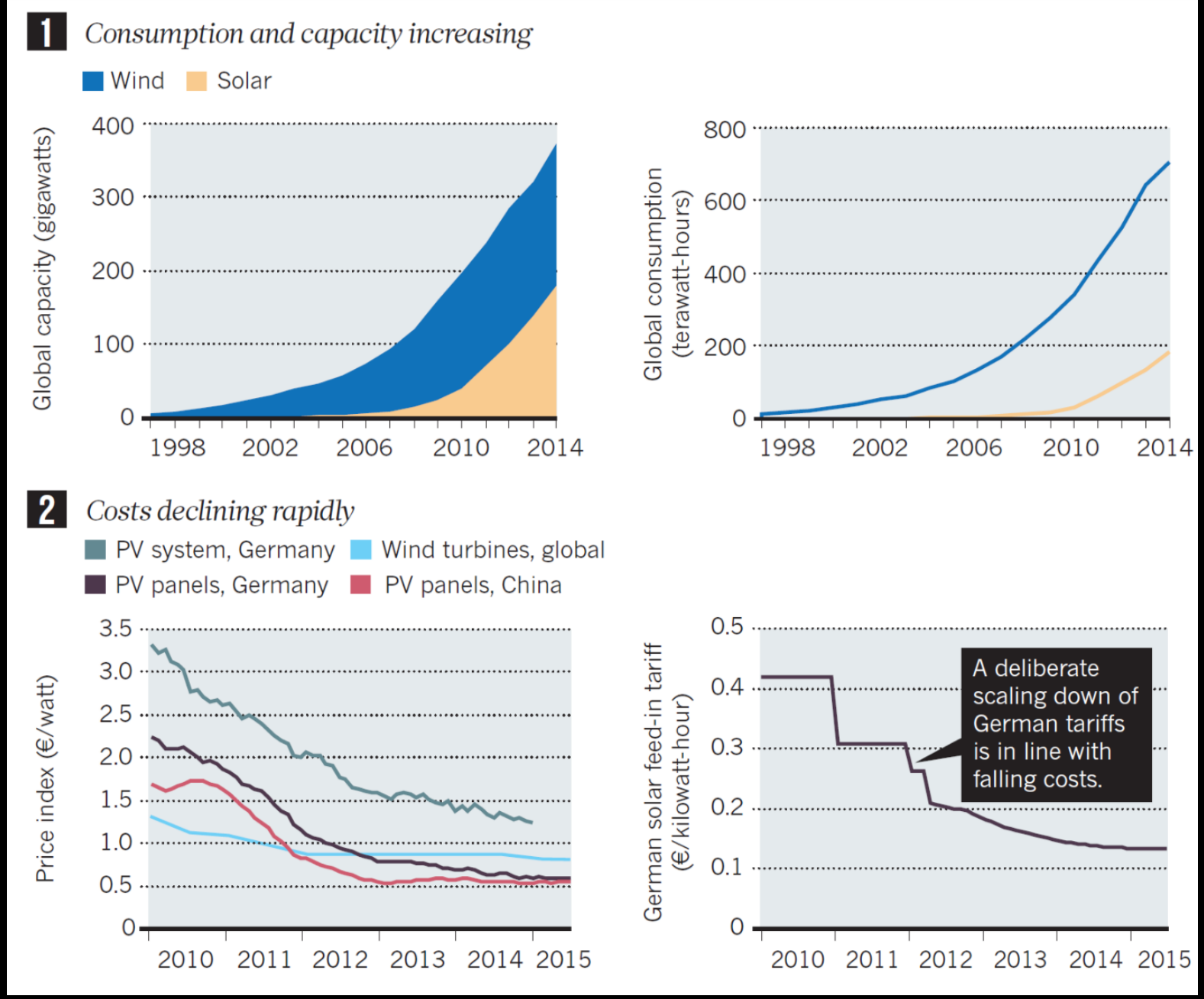
450 ppm CO_2e "unachievable" (circa 2009)

"Full" participation scenario assumes maximum global $1,000/ton CO_2 tax starting 2012; delay assumes *only* Annex I

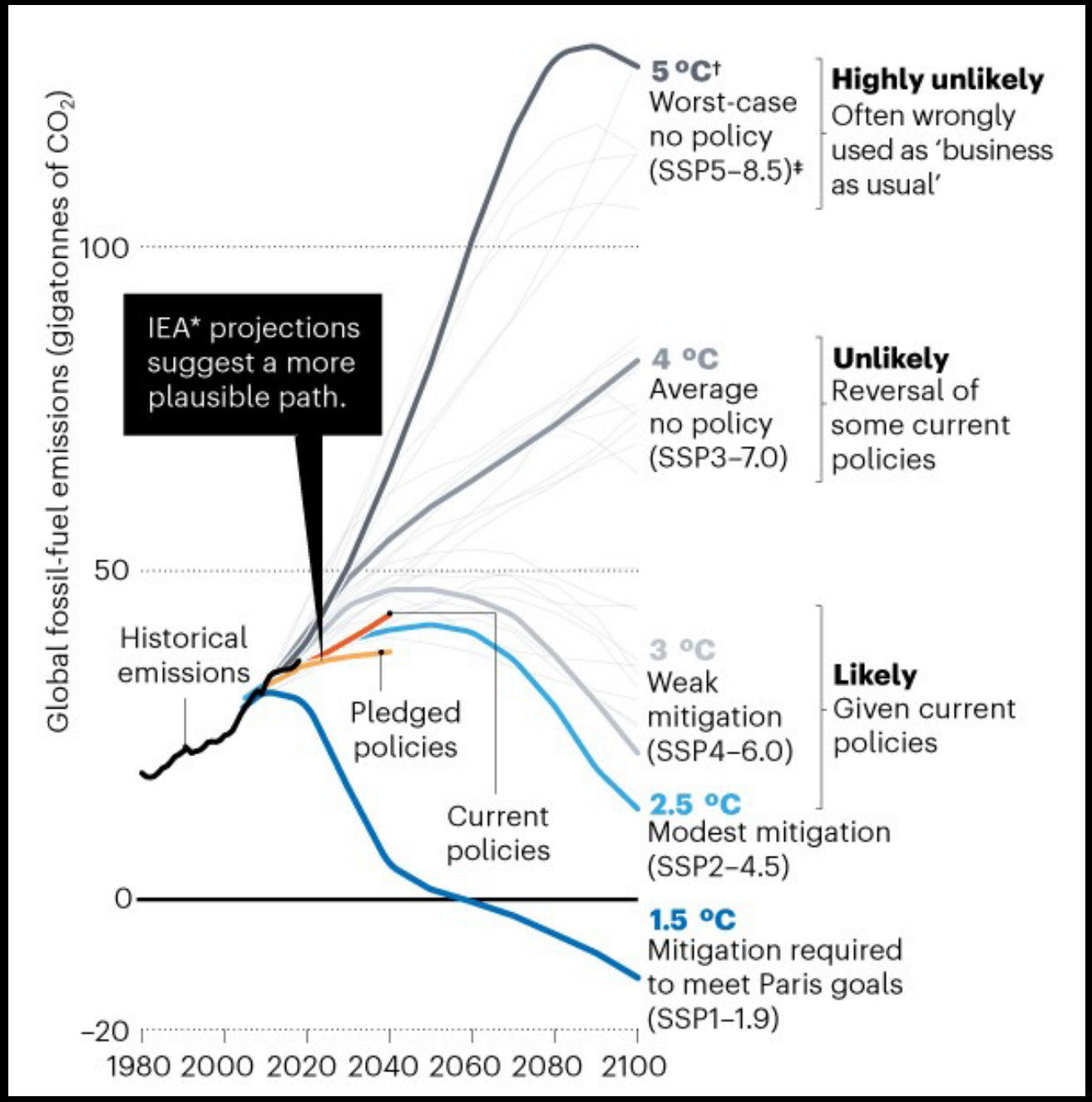
	Model	650 CO2-e		550 CO2-e				450 CO2-e			
		Full	Delay	Full		Delay		Full		Delay	
		Not-to-Exceed	Not-to-Exceed	Overshoot	Not-to Exceed	Overshoot	Not-To-Exceed	Overshoot	Not-to Exceed	Overshoot	Not-To-Exceed
1	ETSAP-TIAM	+	+	+	+	+	+	+	+	+	XX
2	FUND	+	+	+	+	+	+	+	XX	XX	XX
3	GTEM	+	+	+	+	+	XX	+	XX	XX	XX
4	IMAGE	+	+	+	+	+	+	XX	XX	XX	XX
	IMAGE-BC	-N/A-	-N/A-	-N/A-	-N/A-	-N/A-	-N/A-	+	XX	XX	XX
5	MERGE Optimistic	+	+	+	+	XX	XX	XX	XX	XX	XX
	MERGE Pessimistic	+	+	+	+	+	+	XX	XX	XX	XX
6	MESSAGE	+	+	+	+	+	XX	+	XX	XX	XX
	MESSAGE - NOBECS	+	-N/A-	+	+	-N/A-	-N/A-	+	XX	XX	XX
7	MiniCAM Base	+	+	+	+	+	XX	+	+	+	XX
	MiniCAM LoTech	+	+	+	+	+	XX	+	XX	XX	XX
8	POLES	+	+	+	+	+	XX	XX	XX	XX	XX
9	SGM	+	+	+	+	+	+	XX	XX	XX	XX
10	WITCH	+	+	+	+	+	+	XX	XX	XX	XX

No 450 ppm/2°C with mitigation alone, without massive negative emissions

Clark et al (2009), Stanford Energy Modeling Forum 22



Wagner et al., *Nature* (2015)



Source: Hausfather & Peters, *Nature* (2020)

Plan A

Cut CO_2, methane et al.

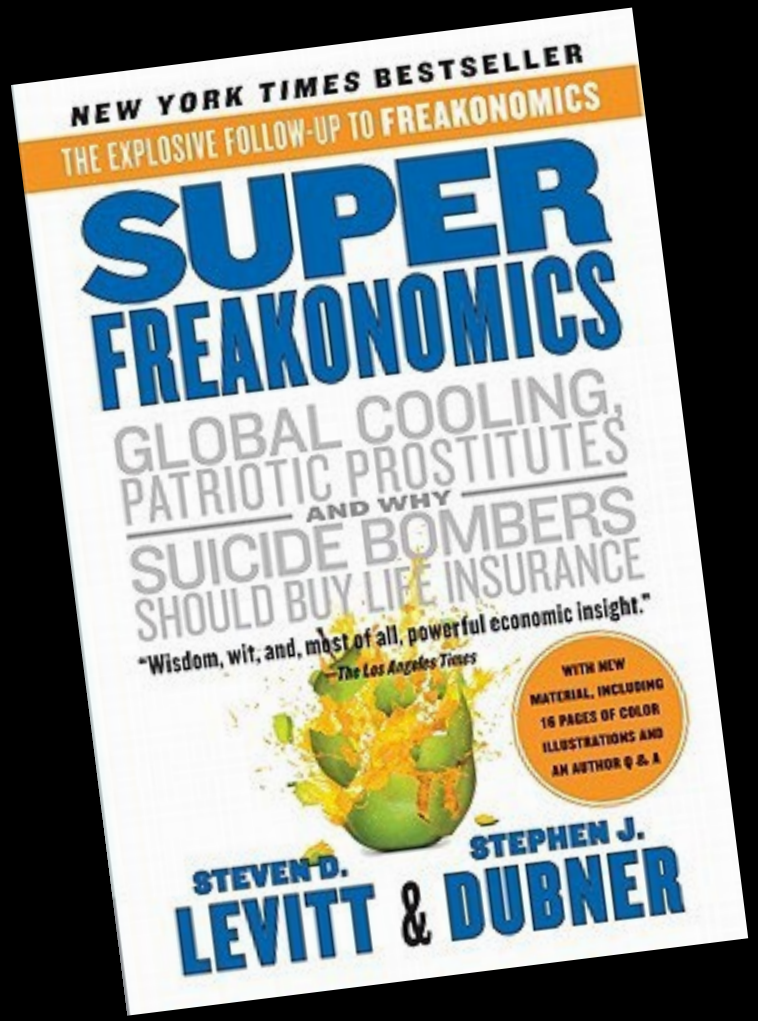
Adapt

Carbon removal

→ “net-zero” emissions

Suffer

There is no Plan B



"Geo-engineering holds forth the promise of addressing global warming concerns for just a few billion dollars a year," said Newt Gingrich, former speaker of the US House of Representatives, in 2008. "We would have an option to address global warming by rewarding scientific innovation. Bring on American ingenuity. Stop the green pig."

Plan A+

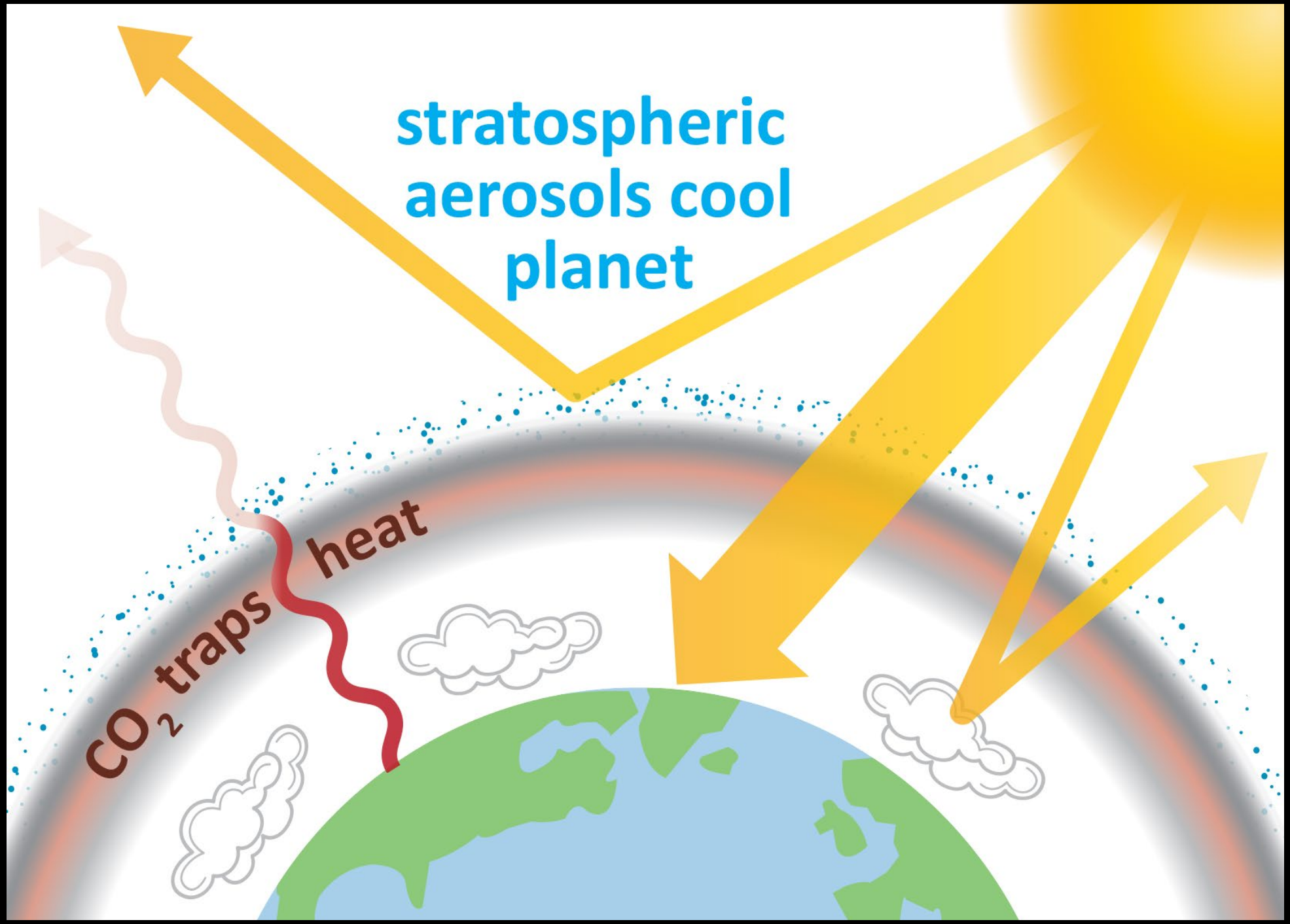
Cut CO_2, methane et al.

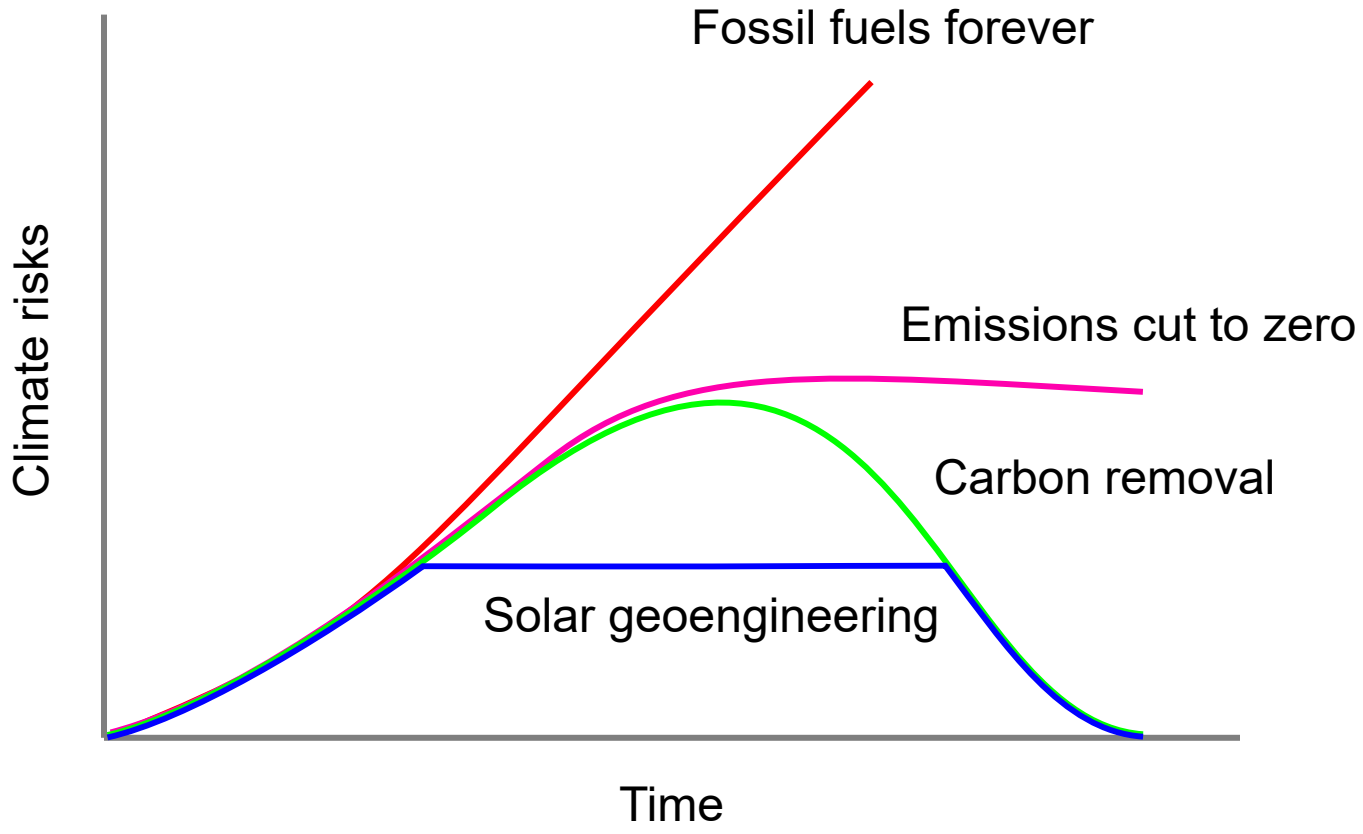
Adapt

Carbon removal

→ “net-zero” emissions

Solar Geoengineering(?)


stratospheric
aerosols cool
planet
CO_2 traps heat



Source: John Shepherd's "napkin diagram" at 2010 Asilomar conference; this version: SGRP

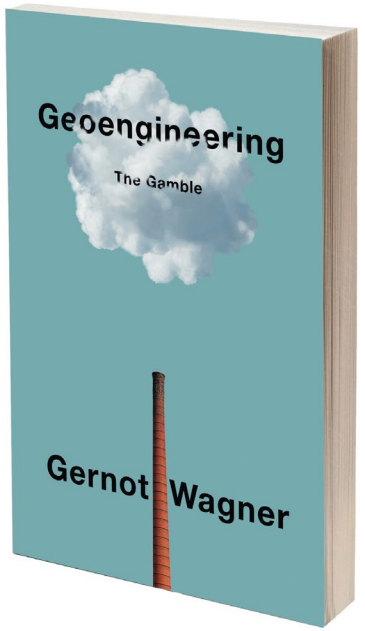
Green
Risky Climate

Fear of Geoengineering Is Really Anxiety About Cutting Carbon

Research into unproven technofixes isn't a replacement for eliminating emissions, even if the debate over geoengineering is stuck on that concern.

The geoengineering debate is caught in false choice between cutting emissions, like those from cars, and researching the dire possibility of resorting to technofixes such as reflecting back a portion of sunlight. *Photographer: Samuel Corum/Bloomberg*

By Gernot Wagner
June 25, 2021, 6:00 AM EDT



Nuclear

Green
Risky Climate

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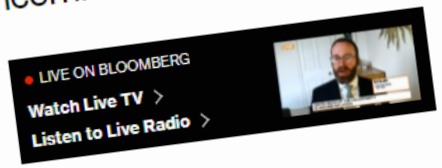
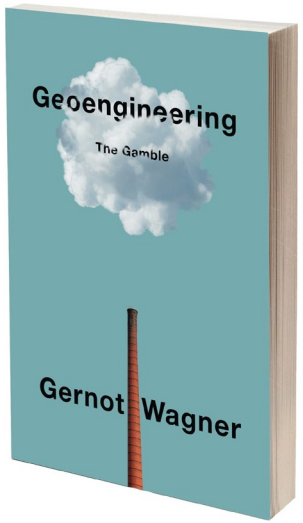




Sources: Wagner (*Bloomberg,* 2021), Wagner & Zizzamia (*Ethics, Policy & Environment* 2021), Wagner *Geoengineering: the Gamble* (2021)

THE SATURDAY ESSAY

Is Nuclear Power Part of the Climate Solution?

Investing in the next generation of nuclear reactors could give the world an important tool for reducing carbon emissions.

gwagner.com/WSJ-nuclear

Columbia Business School

Nuclear pros and cons

Long history of misperceptions

Pros

+ Low-CO_2
+ Dense
+ Stable

Cons

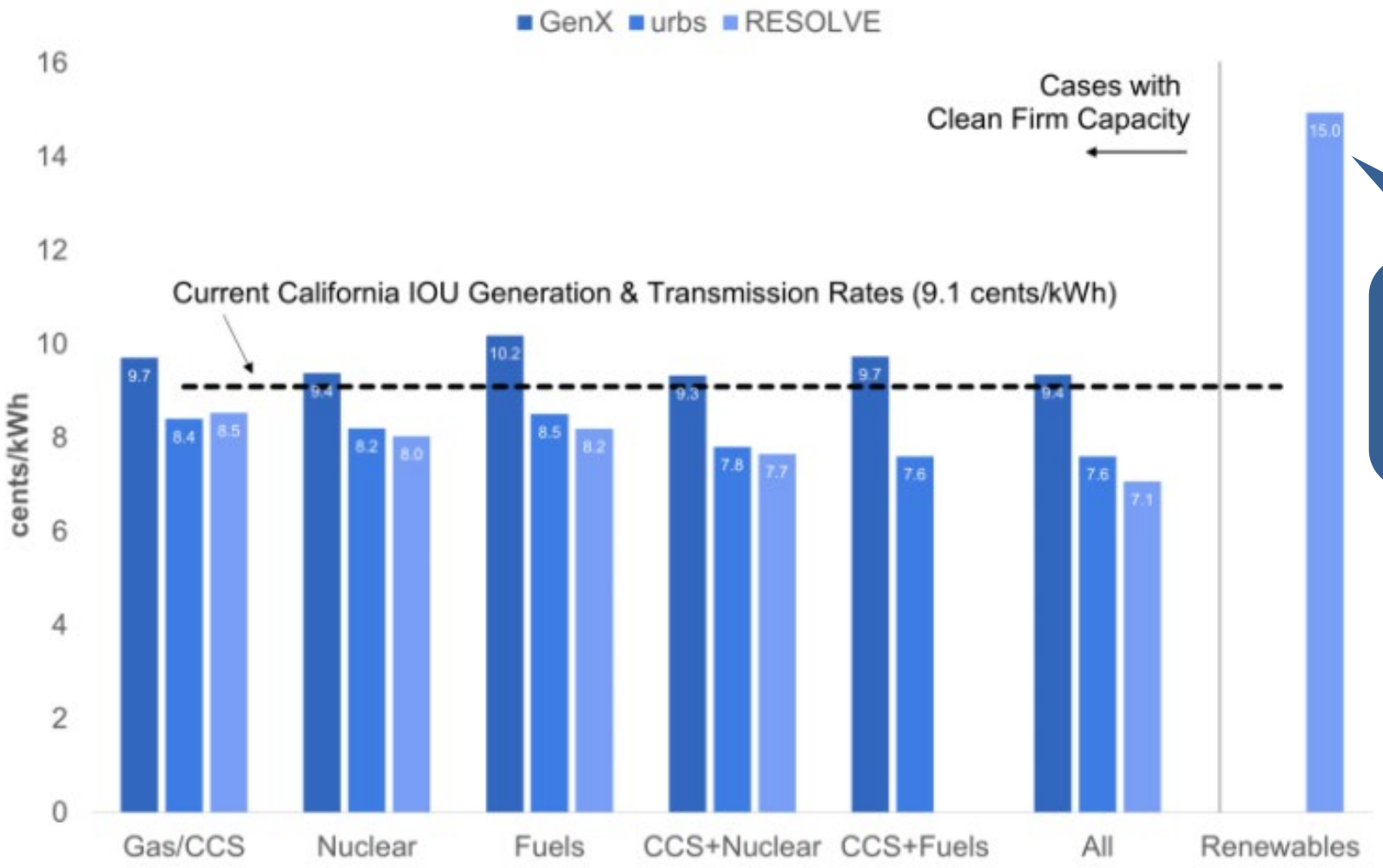
– Costs
– Risks (perceived and real)
– Perception

"Correct" framework:
Risk-risk tradeoffs

Source: Wagner (*WSJ*, 2022)

“Clean firm” capacity lowers system costs

LCOE wrong (or at least limited) lens



Includes storage & large capacity overbuild

Source: Cohen *et al* (*Issues*, 2021); GenX, URBS & Resolve are 3 models from Princeton, Stanford, and E3 teams, respectively

Nuclear pros and cons

Long history of misperceptions

Pros

+ Low-CO_2
+ Dense
+ Stable
+ *System* costs

Cons

– *Project* costs (including SMRs)

– Risks (perceived and real)

– Perception

"Correct" framework:
Risk-risk tradeoffs

Source: Wagner (*WSJ*, 2022)

Most any ‘technofix’

Green
Risky Climate

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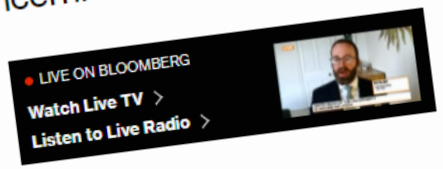

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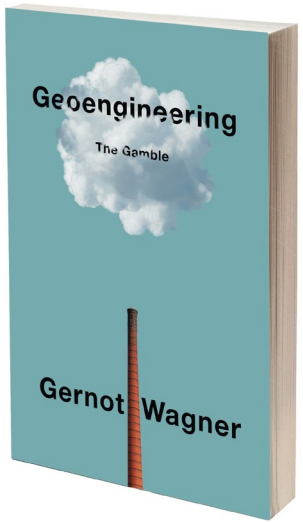

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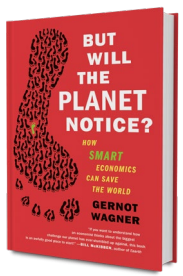

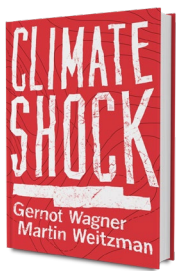

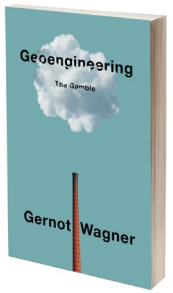

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