

Frontiers from the Futures of Climate Science



Paul Behrens, Leiden University

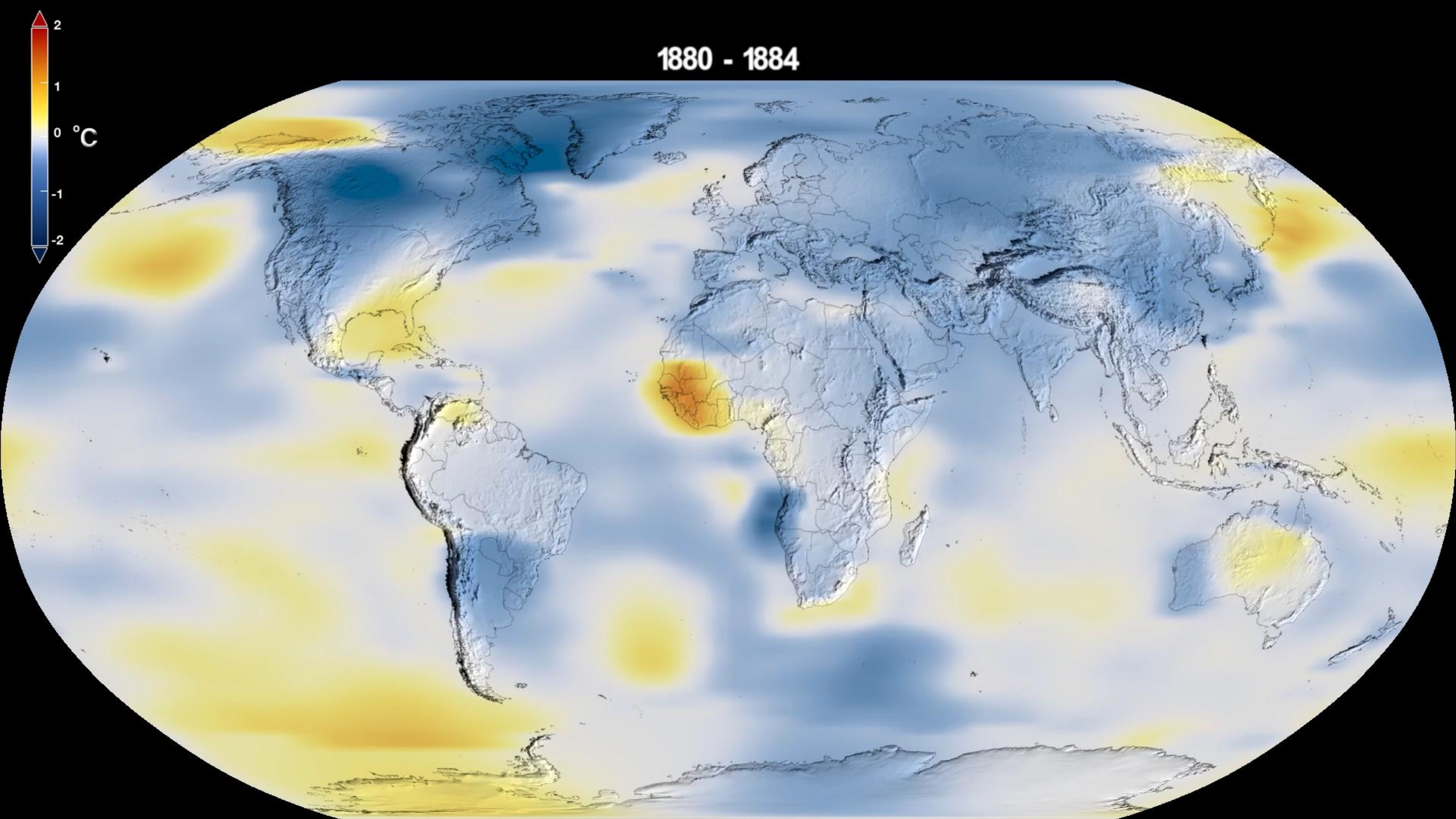
30/11/2022



Universiteit
Leiden



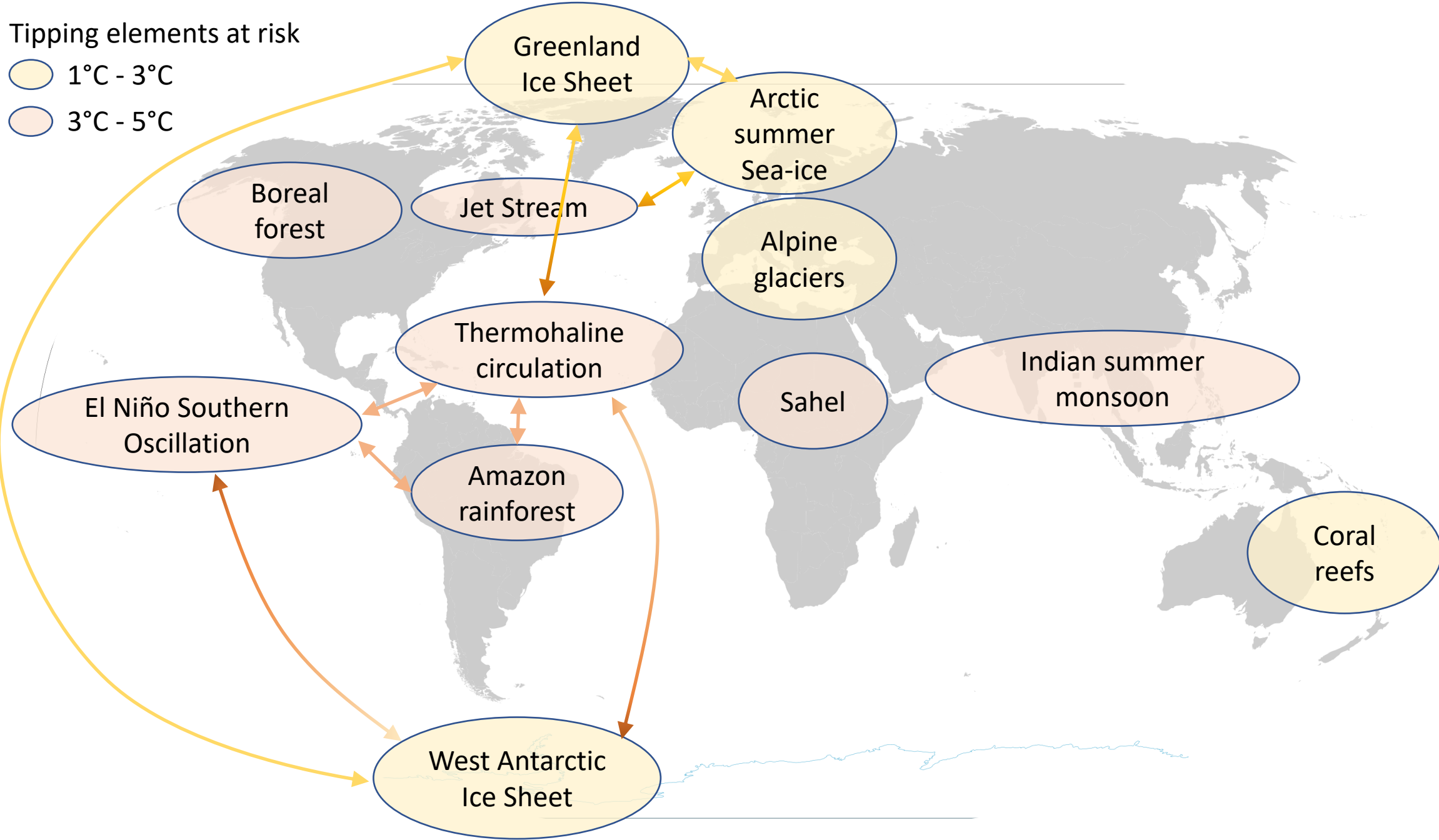
1880 - 1884



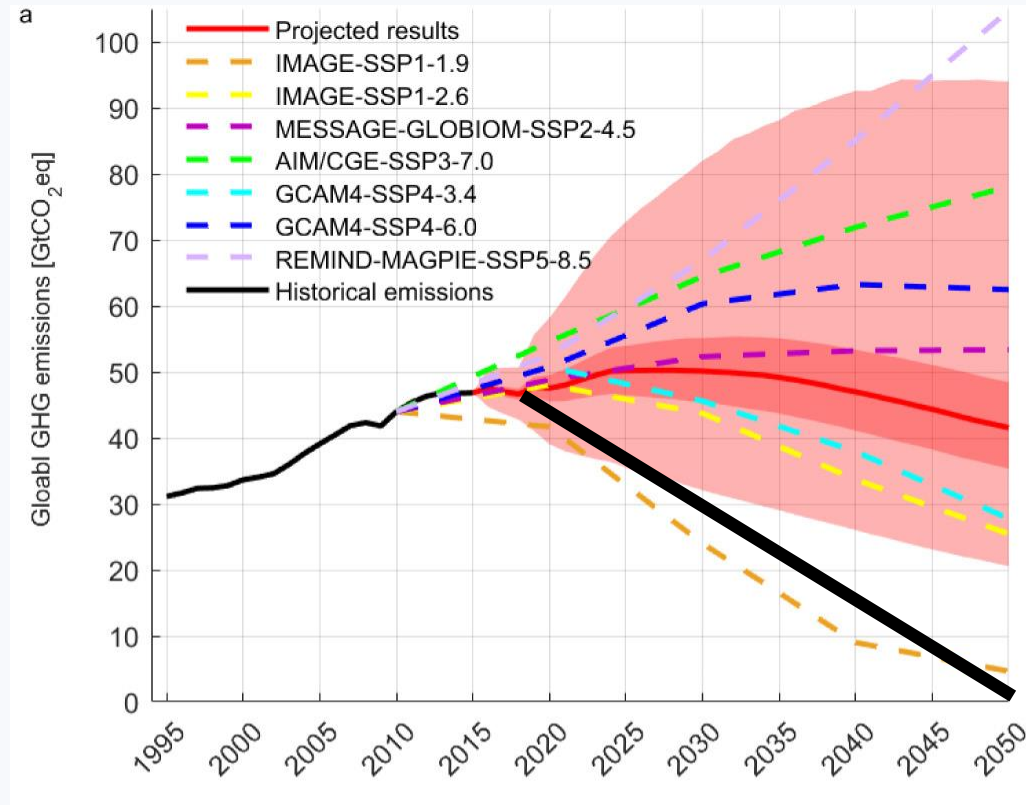
Tipping elements at risk

1°C - 3°C

3°C - 5°C



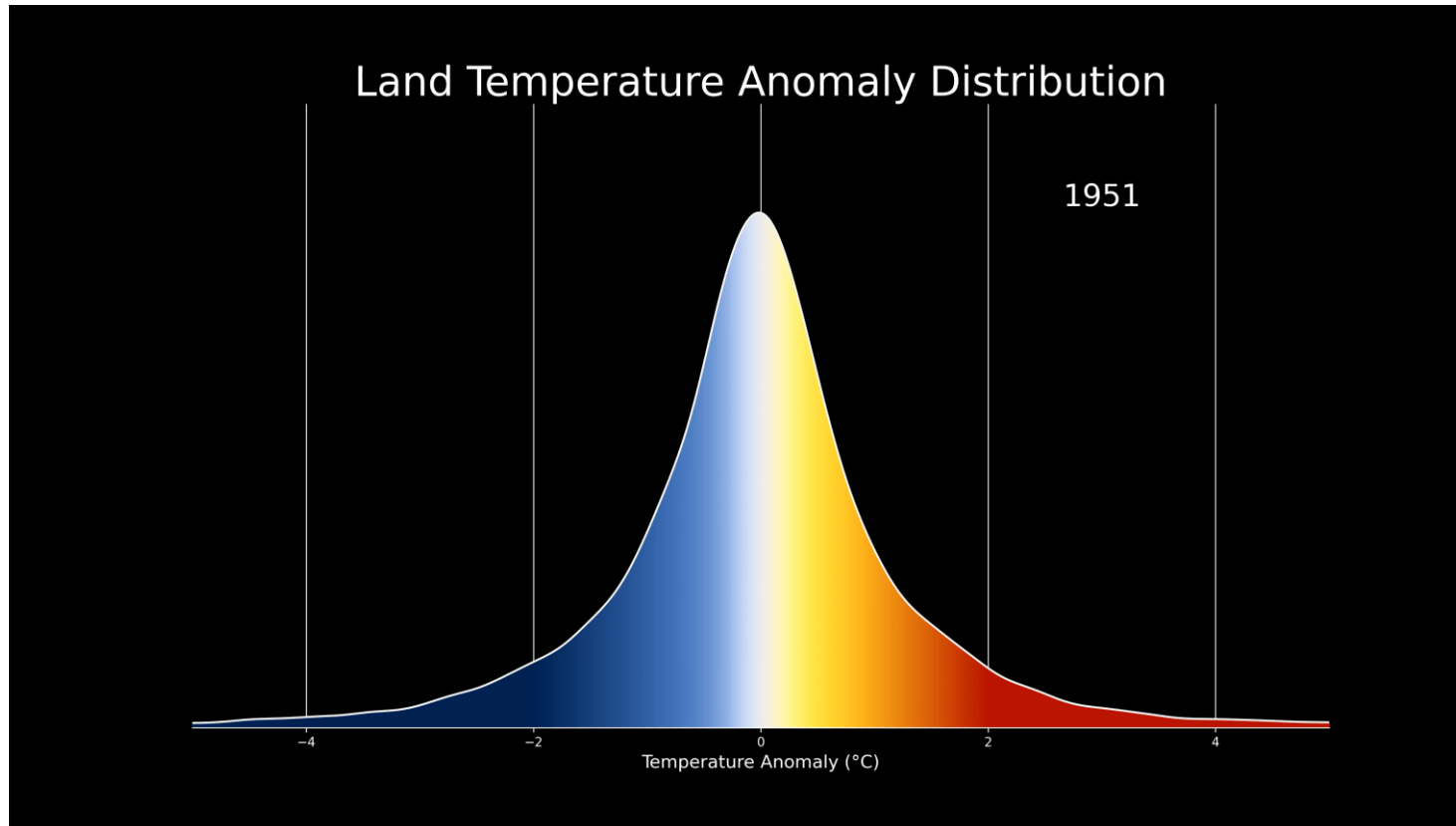
A worst-case avoided?



R. Yuan, J. F. D. Rodrigues, A. Tukker, P. Behrens, The statistical projection of global GHG emissions from a consumption perspective. *Sustain. Prod. Consum.* **34**, 318–329 (2022).

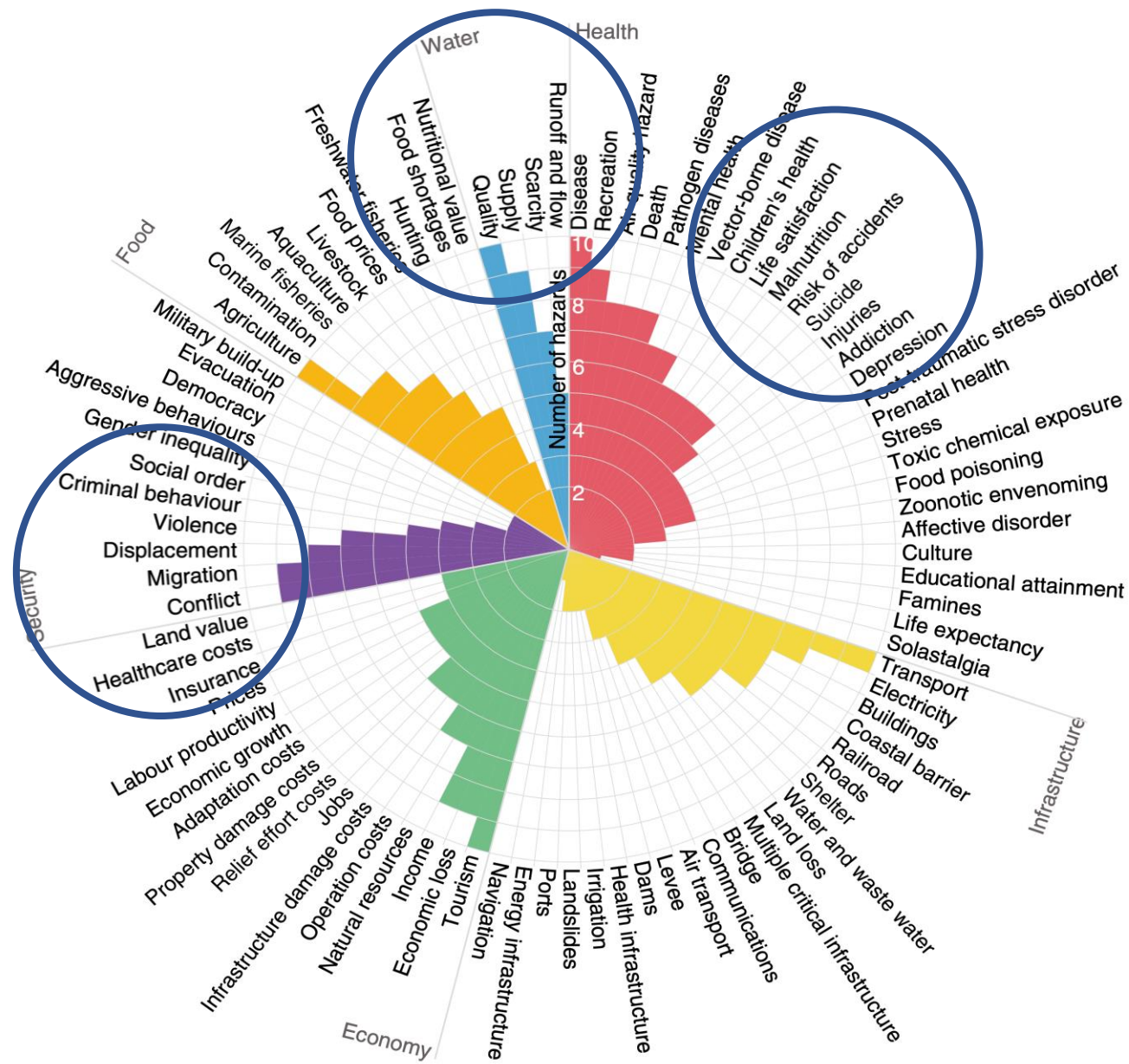
No, we need to go even faster...

Each year will be on average worse



Impacts





“Evidence of observed impacts, projected risks [etc] demonstrate that worldwide climate resilient development action is more urgent than previously assessed in AR5.”



Kent Porter/The Press Democrat



Yasin Akgul/AFP/Getty Images



Bruno Fahy/Belga/AFP/Getty Images



Eric Thayer/Reuters



AFP



Boris Roessler/DPA via AP

Rapid transitions

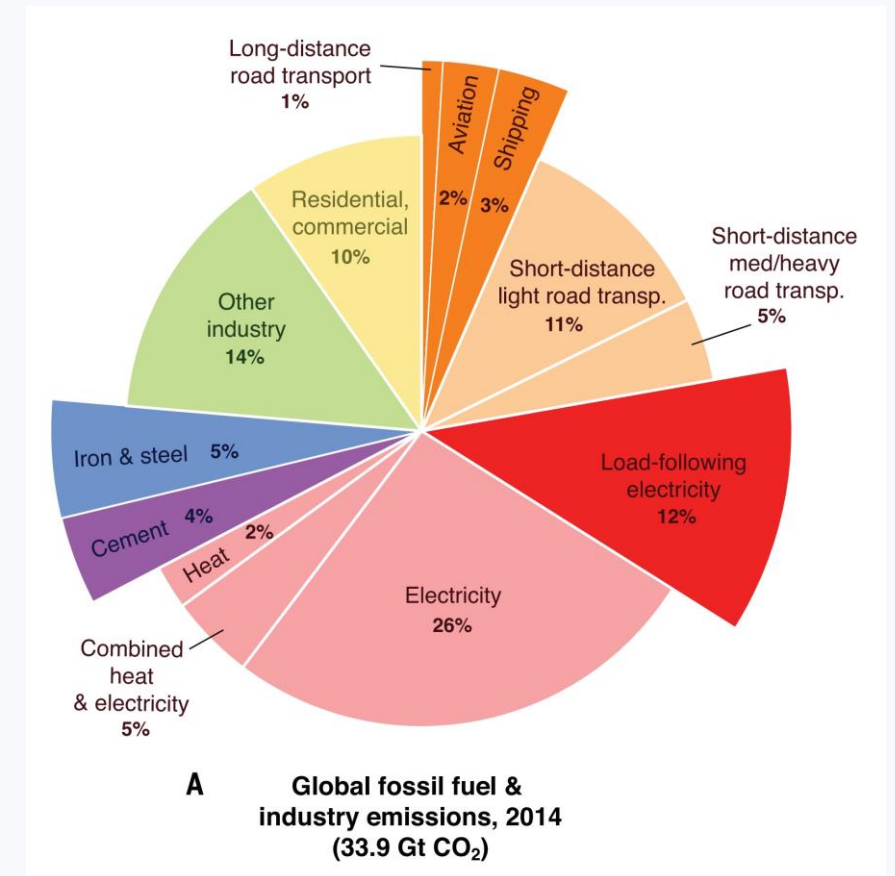
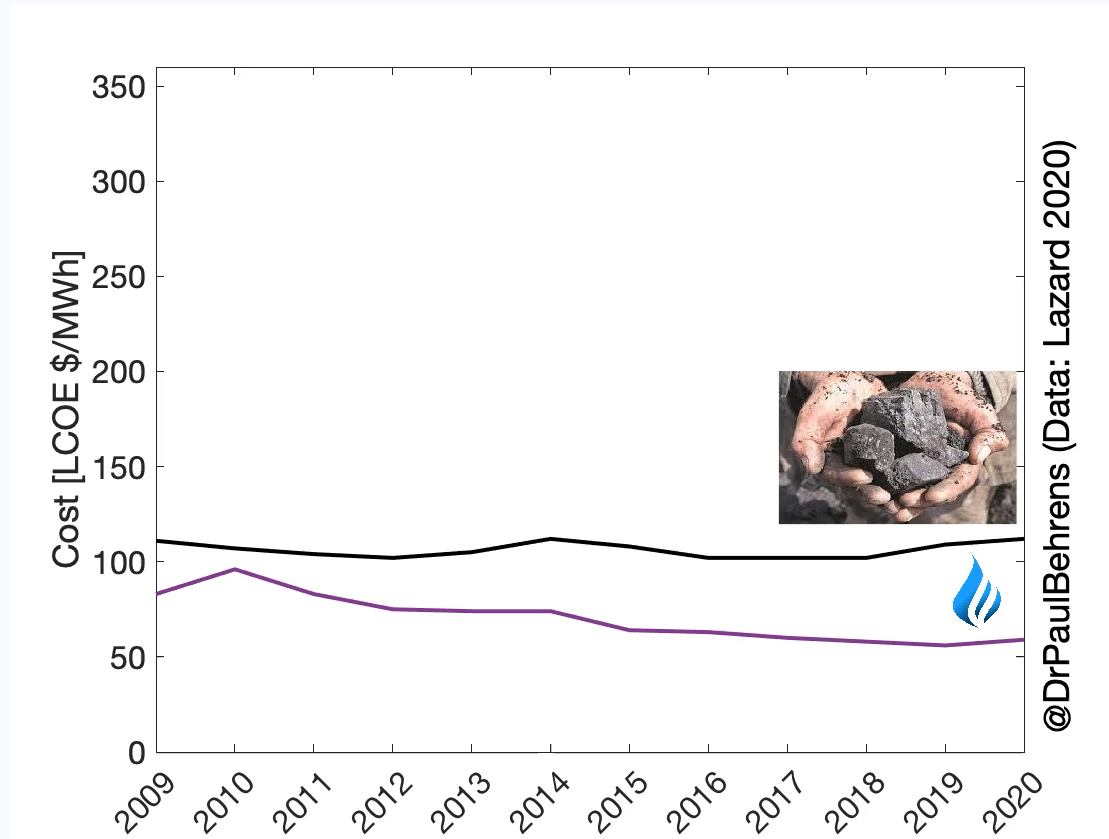
Energy



Food



Energy Transition

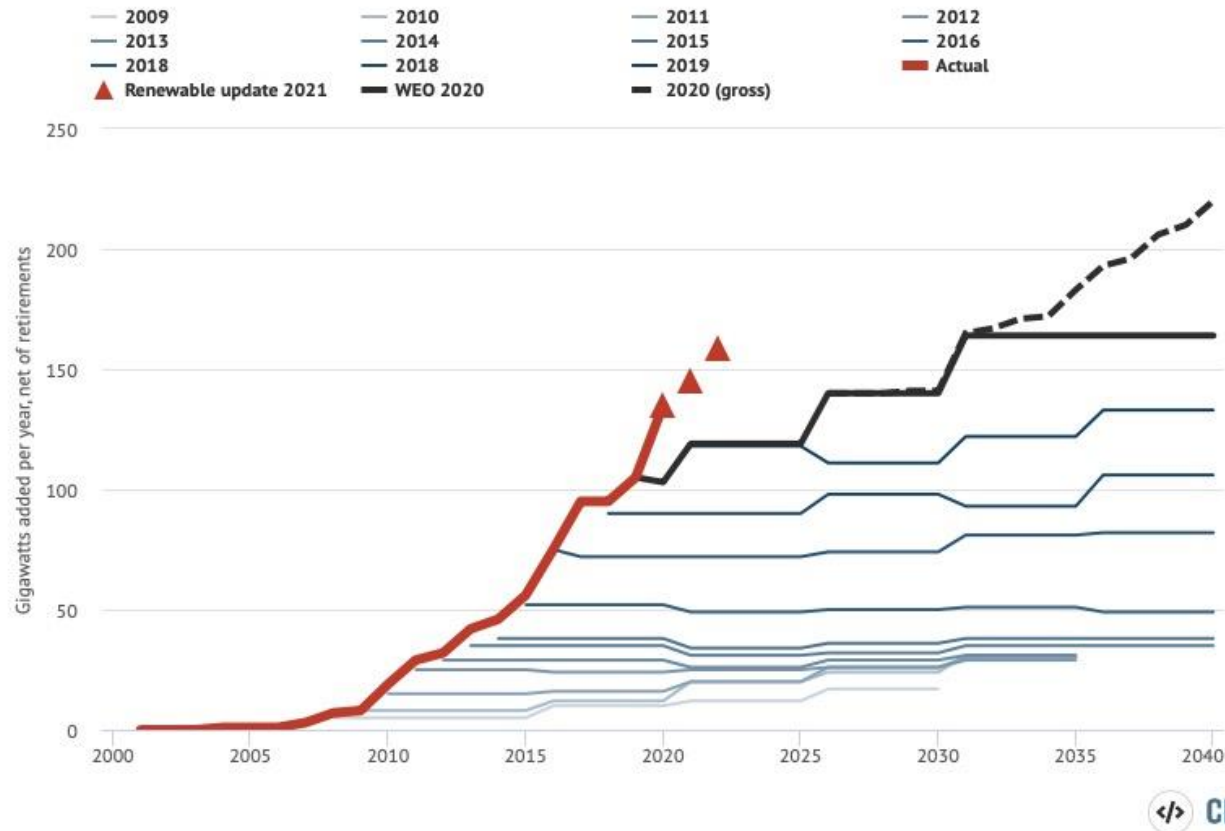


S. J. Davis *et al.*, Net-zero emissions energy systems. *Science* (80-.). **9793** (2018), doi:10.1126/science.aas9793.

Speed

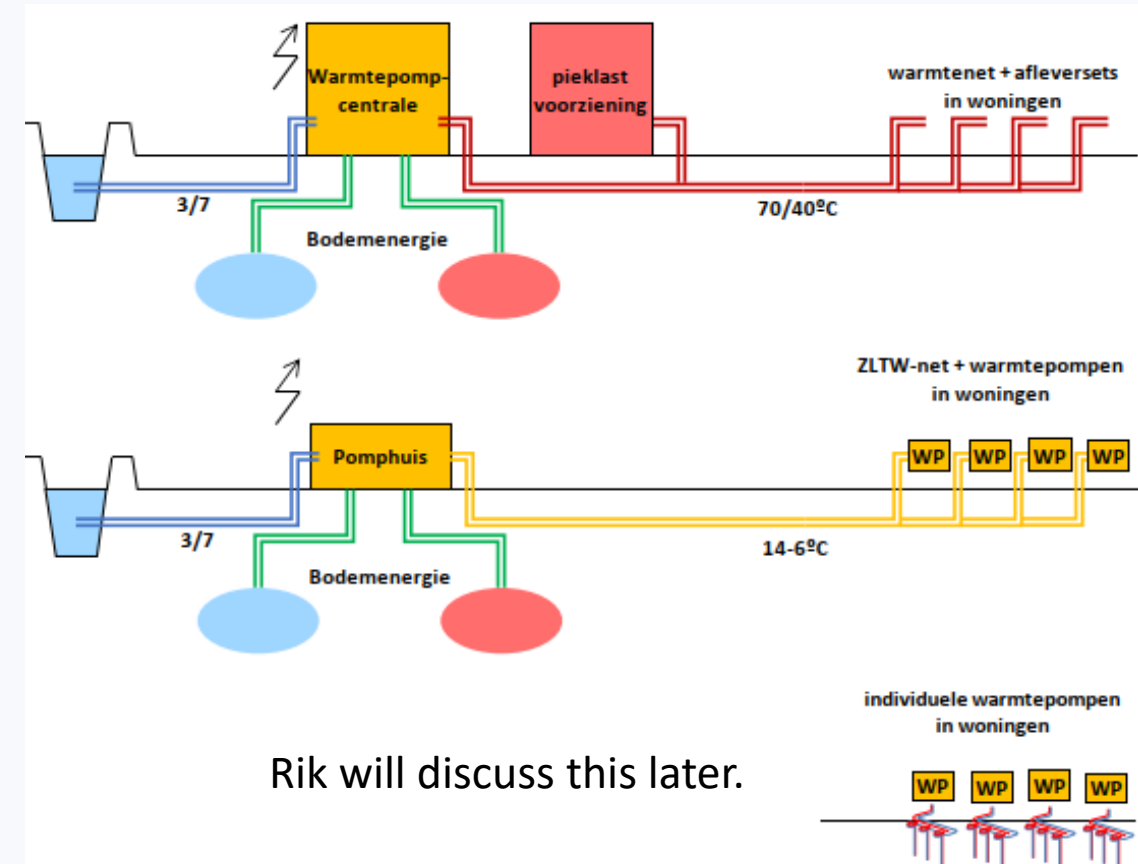
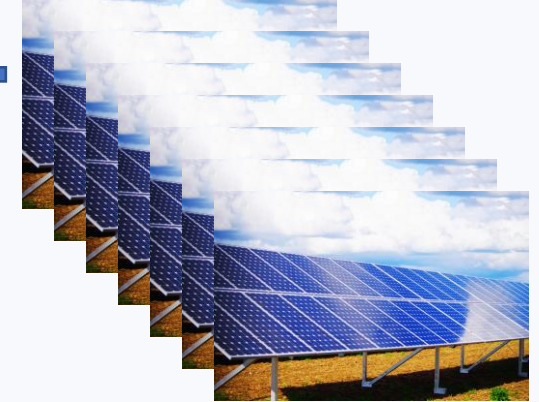
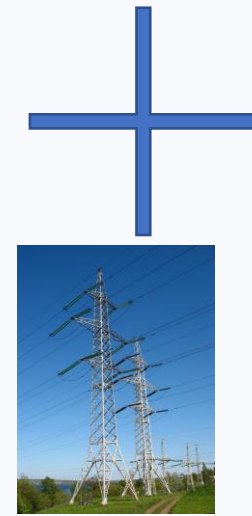
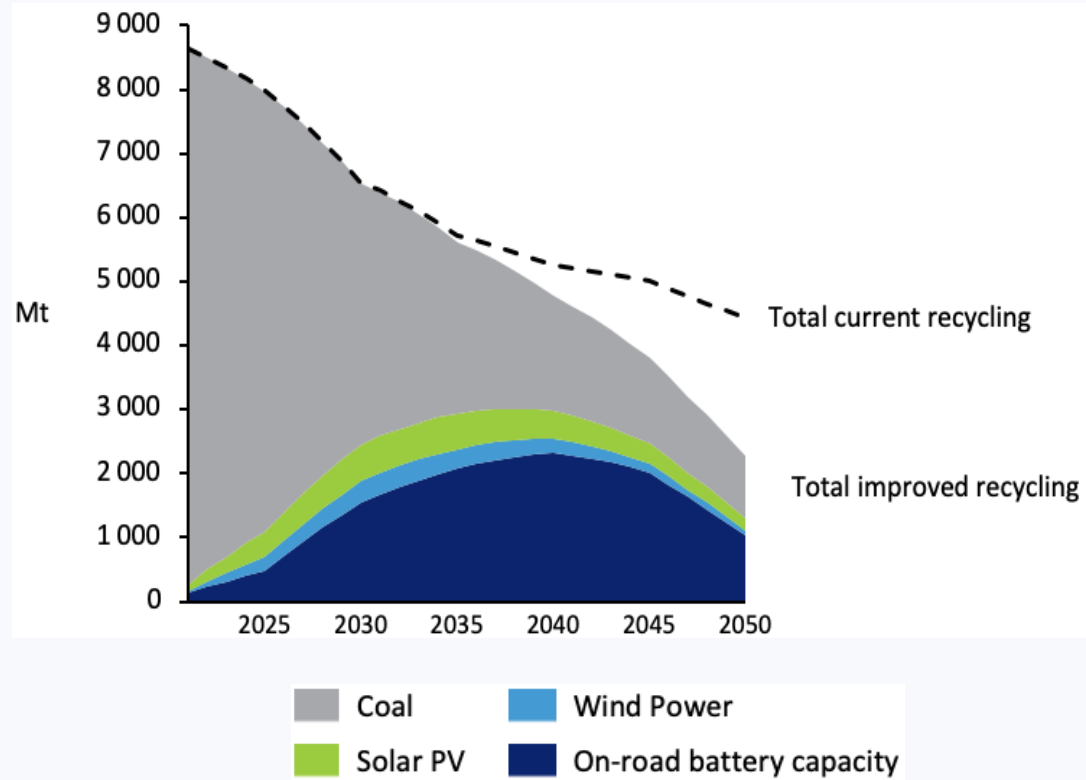
The **new IEA solar forecast** is far more rapid than its **2020 WEO**, published in November

The agency has raised its solar outlook repeatedly as costs fall and policy support improves



- Issue is not technology but social
- Issues are now:
 - Transmission
 - Energy Markets (inc. demand side)
- For hard to decarbonize it is:
 - Commercialization of existing technologies
 - Further investment to bring costs down

Materials?



Rik will discuss this later.

A great food transition

1. Dietary change



2. Reduce food waste



3. Improve production



4. All saved land for biodiversity/RE and carbon sequestration

nature food

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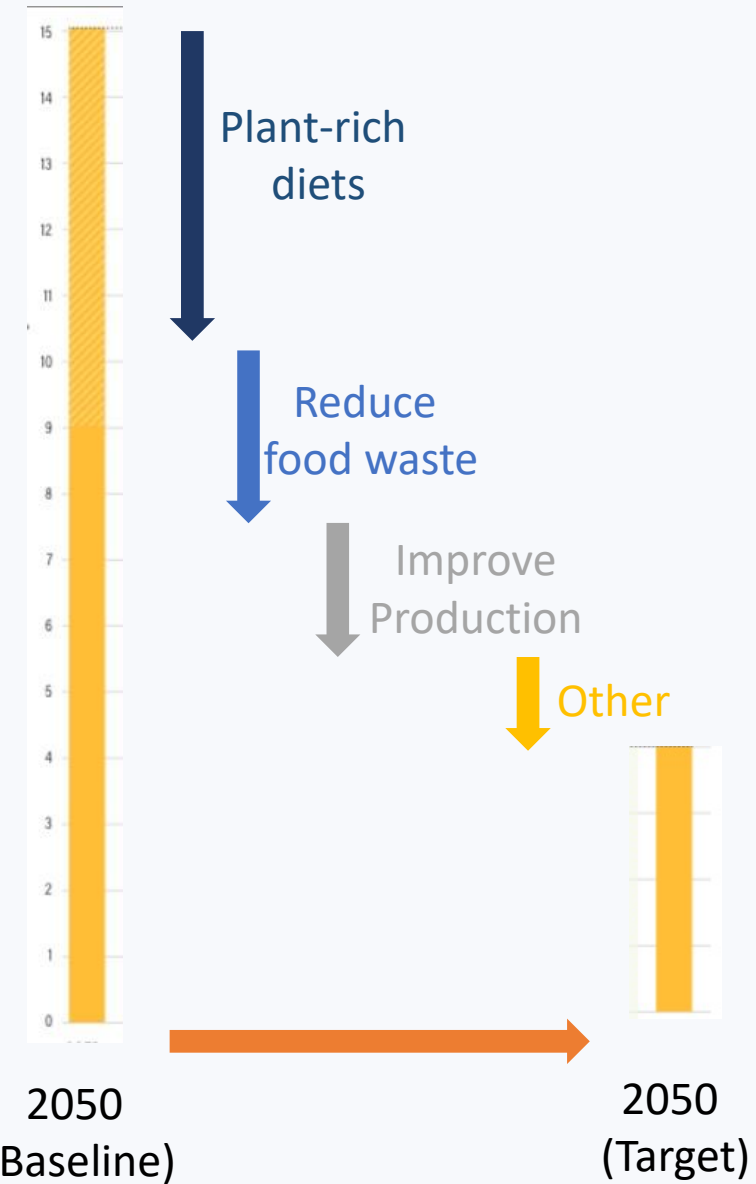
[nature](#) > [nature food](#) > [articles](#) > [article](#)

Article | Published: 10 January 2022

Dietary change in high-income nations alone can lead to substantial double climate dividend

[Zhongxiao Sun](#) ✉, [Laura Scherer](#), [Arnold Tukker](#), [Seth A. Spawn-Lee](#), [Martin Bruckner](#), [Holly K. Gibbs](#) & [Paul Behrens](#)

Agricultural emissions per year in 2050



Data: World Resources Institute, Creating a Sustainable Food Future (2018).

Do people want this change?

NEWS

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Science & Environment

Climate change: Tax frequent fliers and get rid of SUVs, government told

By Roger Harrabin
BBC environment analyst

10 September 2020

Our Planet Matters



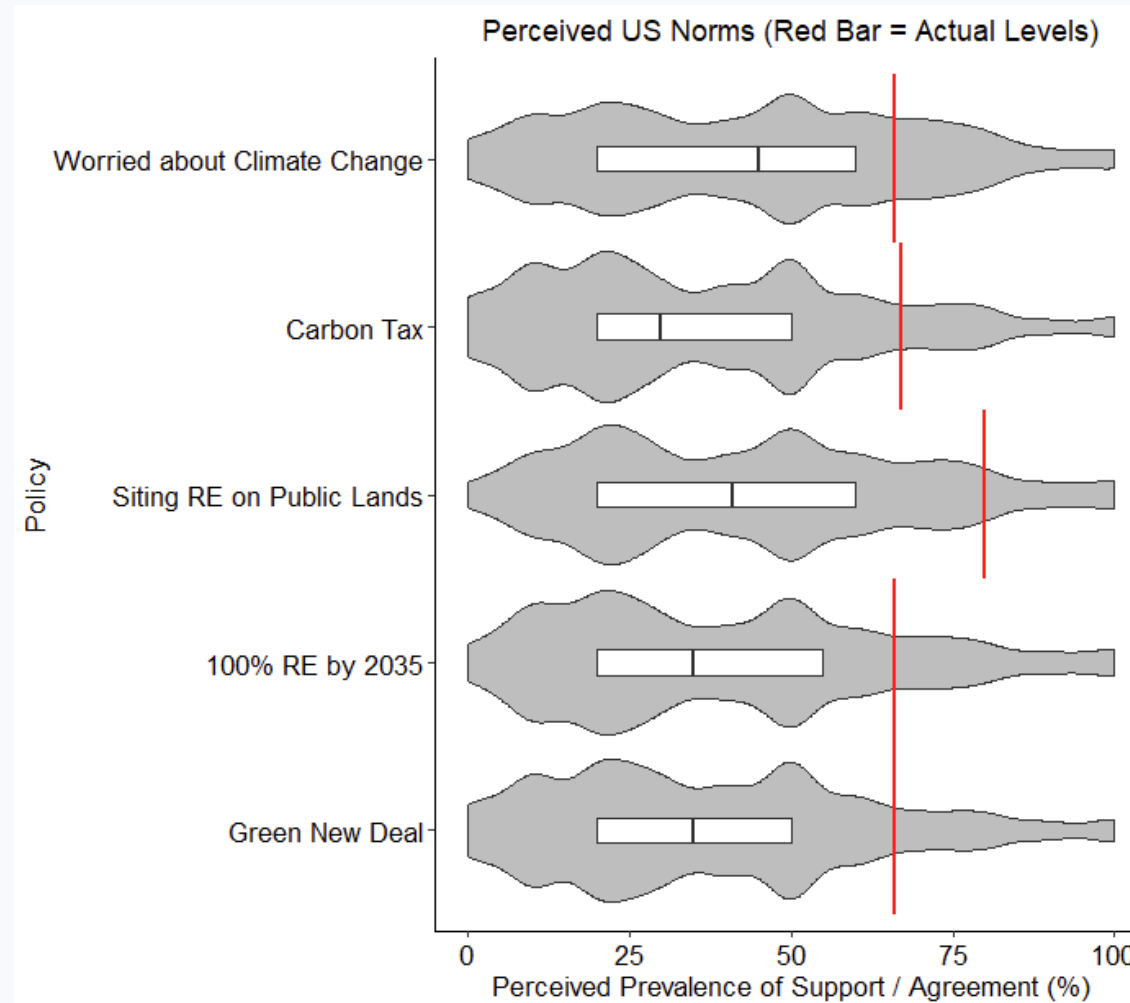
Earlier this year, the BBC's Rebecca Morelle heard the views of four citizens' assembly members

A frequent flyer tax, phasing out polluting SUVs and restricting cars in city centres are among climate change solutions suggested by members of the public.

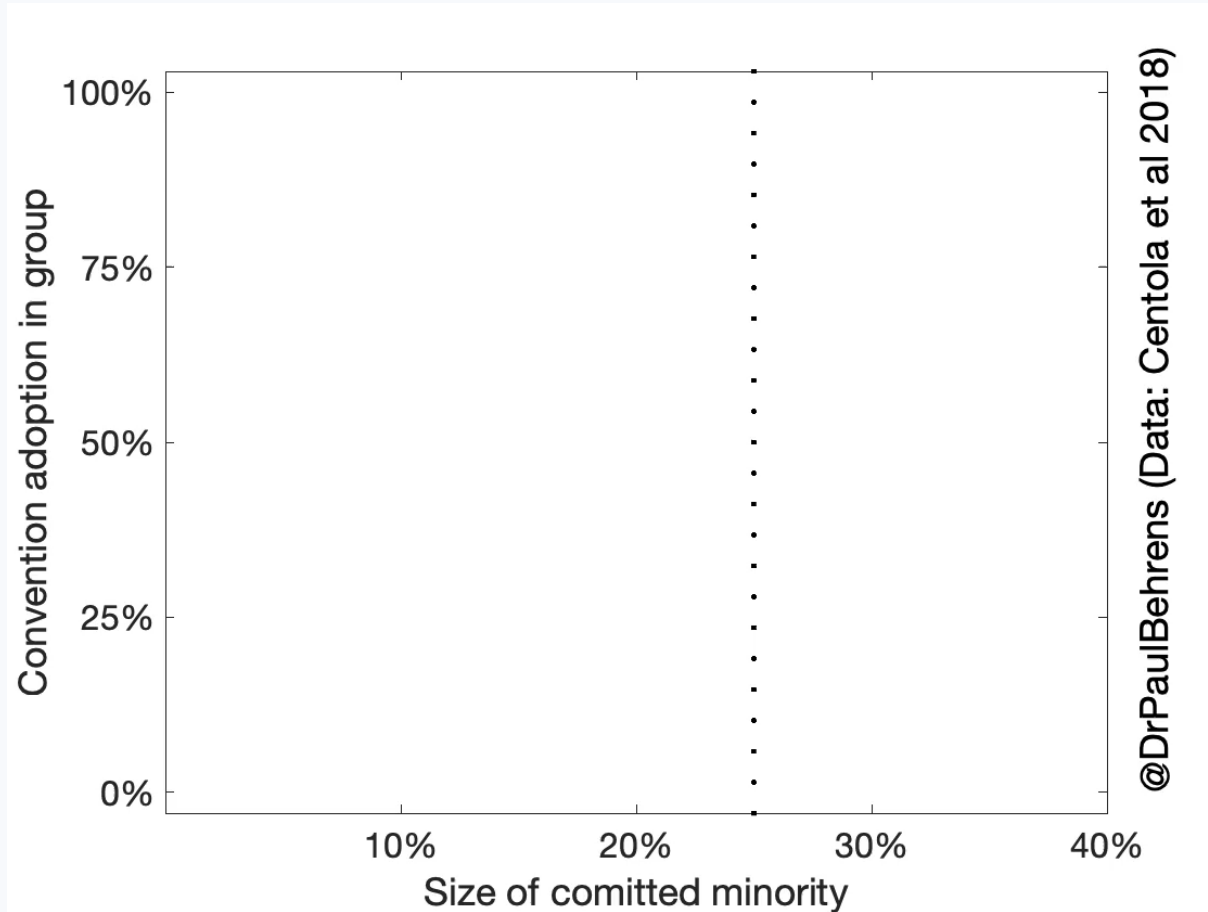
A citizens' assembly of 108 people from all walks of life published its report after weeks of debate.

They proposed curbing road building and using the pandemic to cut emissions.

MPs said the report offered a "unique insight", but activists Extinction Rebellion said it didn't go far enough.



How fast can people change?



Centola et al. Tipping points in social convention. *Science* (80-.). **360**, 1082.4-1082 (2018).

Mark Carney tells global banks they cannot ignore climate change dangers

Financial sector warned it risks losses from extreme weather and its stakes in polluting firms



▲ Mark Carney arriving for IMF and World Bank meetings in Washington earlier this month. Photograph: James Lawler Duggan/Reuters

The biggest things you can do?

Don't sweat the small stuff

Big things



Don't be purist, take small steps and then re-evaluate

Do talk about it! Climate conversations and social contagion = system change!

Encourage others to get involved

Feedbacks everywhere

Technology:

- The faster investments pour in
- The faster the costs come down
- The faster better technologies outcompete



Society/behaviour:

- The faster we make small steps
- Further steps become easier
- The faster change becomes



Civil action:

- More lawsuits and more actions
- Discovery of documents and comfort with protest
- The faster change becomes

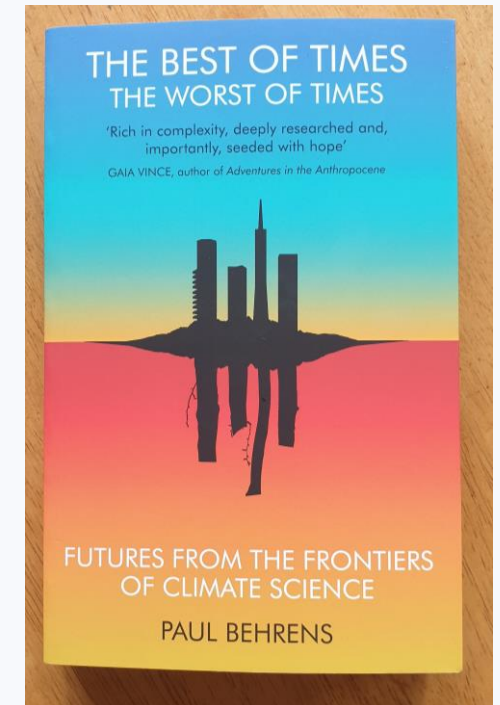
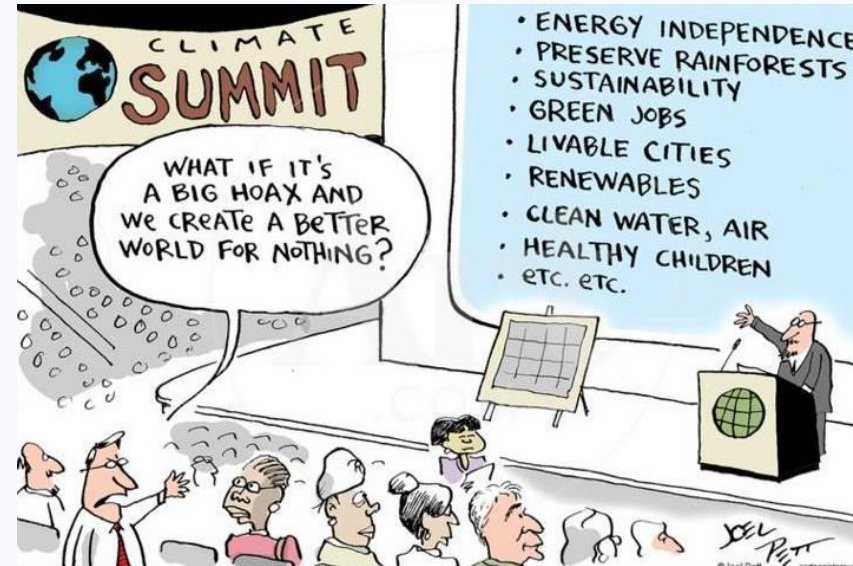


Communication at this unique time in history

Be honest, alarm people, give solutions, act, build hope



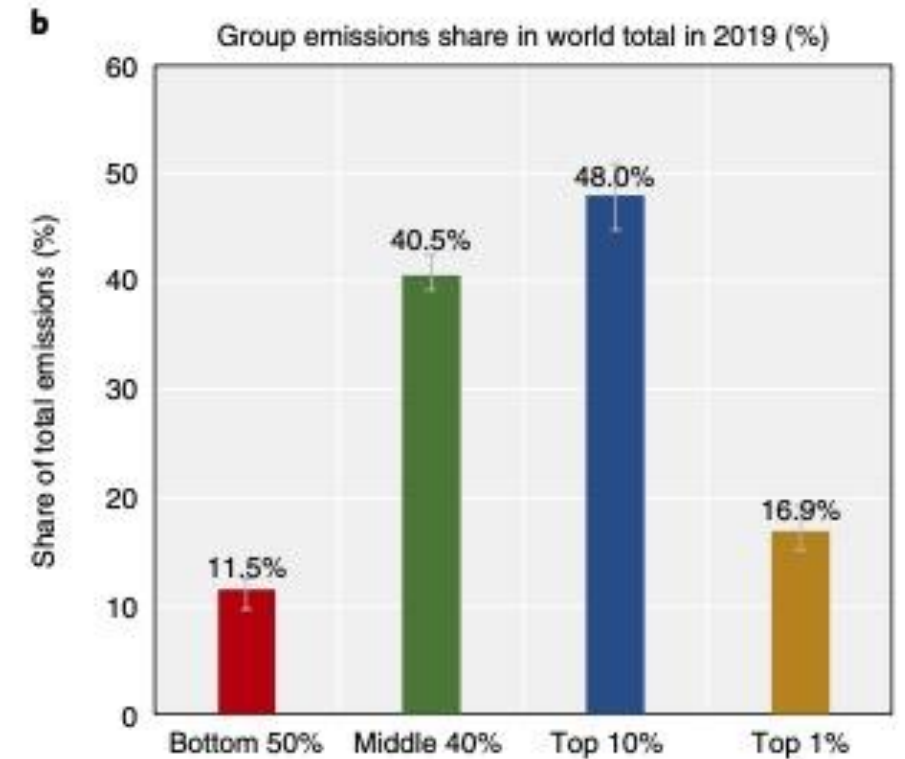
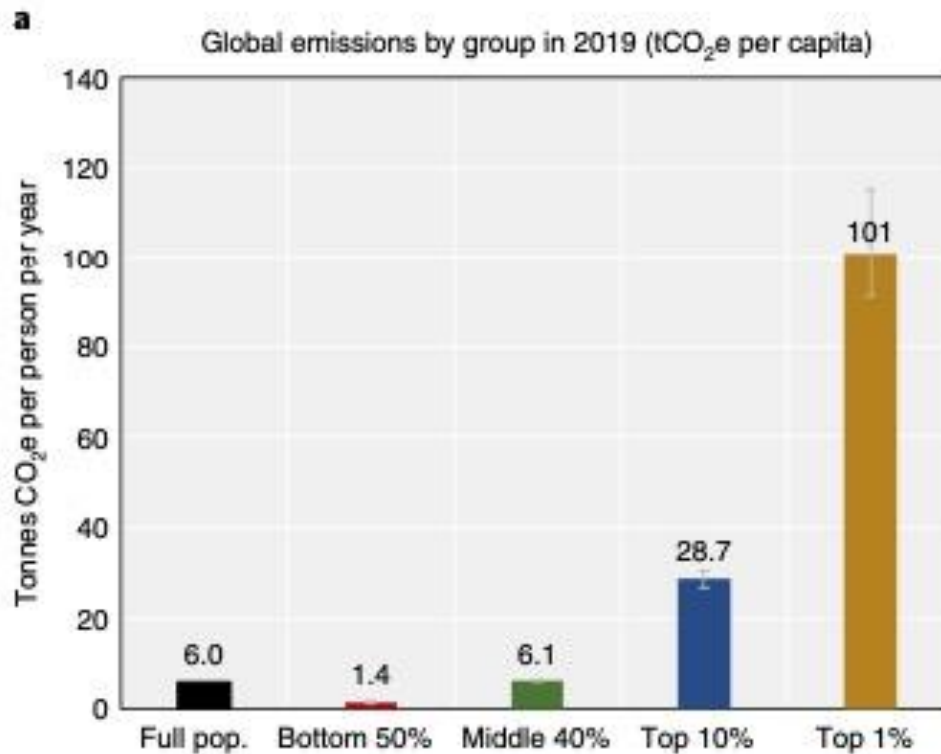
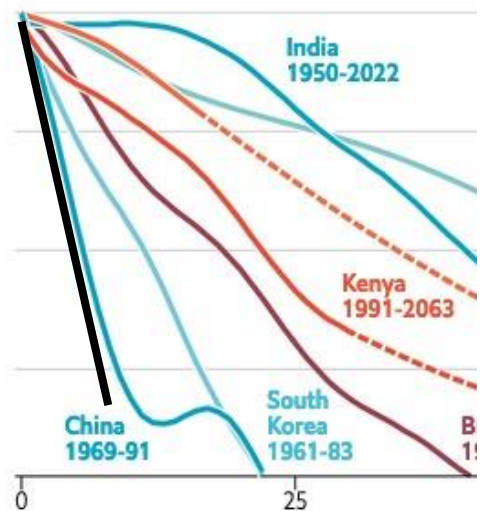
EVERY **ACTION** MATTERS
EVERY **BIT OF WARMING** MATTERS
EVERY **YEAR** MATTERS
EVERY **CHOICE** MATTERS



To consider as we pass 8 billion...

Birth rates have fallen everywh

Total fertility rate, children per woman
Years from high fertility (around 6) to repl



Science, activism and politics?

WETENSCHAP

19 ZATERDAG 5 NOVEMBER 2022

REDACTIE: Tine Hilde (chef), Marja Bakker, Kees Buijs, Joop Hermans, Michiel van der Geest, George van Halbeek, Maarten Koolmans, Margriet Oudeveen, Peter Sabbe, Laurens Verhagen & Ilse de Vries



Klimaatwetenschap Demonstren

Academicus voert actie. Mag dat?

Verenigd in **Scientist Rebellion**, verwant aan Extinction Rebellion, gaan wetenschappers de straat op voor het klimaat. Hoe verhoudt idealisme zich tot het wetenschappelijke werk?

Door Stan van Pelt

W'Wat gaan jullie naartoe?' De stout wetenschappers in station Den Haag Centraal nog niet goed en wel uit, of hij trekt al de aandacht van twee publieksgangers in de Prins Willem-Alexanderhof. Met hun witte laboortrommelen springen de vijftien onderzoekers in het oog, alsof ze verwaald op zoek zijn naar een universiteitsgebouw. Dat is niet het geval, hun bestemming is het ministerie van Economische Zaken en Klimaat (EZK) aan de Besaandenhoeve, waar ze gaan protesteren voor een beter milieu en klimaat, onder de vlag van Scientist Rebellion. 'Onze demonstratie is aangeroerd', vertellen ze de agenten. 'We weten ervan, antwoorden die. 'We willen even checken met hoeveel jullie zijn. De groep mag verder. Met hun demonstratie deze opzettermiddag hopen de activisten voor te komen dat het



Barcelona

Barcelona students to take mandatory climate crisis module from 2024

Course thought to be world first agreed after university bowed to pressure from seven-day End Fossil protest



The decision came as a political leader in Madrid claimed climate activists' claims were part of a communist plot. Photograph: SOPA Images/LightRocket/Getty Images

All students at the University of **Barcelona** will have to take a mandatory course on the climate crisis after the establishment agreed to meet the demands of fossil-fuel production.

Stephen Burgen in
Barcelona

Sat 12 Nov 2022 08:00 GMT



The announcement came after a seven-day occupation by a group from the anti-fossil fuel organisation End Fossil Barcelona.

“To recognise that we all have to study this marks a change in the paradigm of university education,” said Federico Demaria, an economics professor at the university and one of 200 who backed the students’ demands.

“The trigger was the student occupation but it shows a general cultural change. Ten or 15 years ago the university would have sent in the police. But now you can’t kick them out because you know they’re right and society supports them.”

Student and activist Lorenzo Velotti said he was disappointed that the university refused to accede to the group’s other main demand, that it reject funding from the oil company Repsol and other businesses that profit from fossil fuels.

COP27

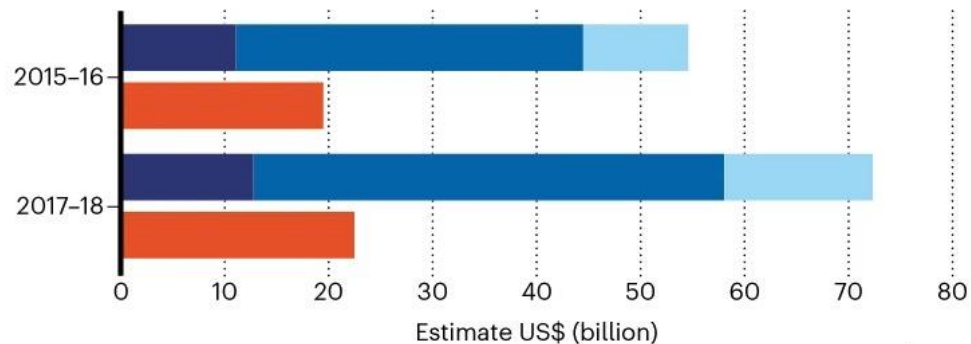
Three options:

- Mitigation (failed miserably to support)
- Adaptation (moving on towards)
- Suffering (damage & loss)

INFLATED FIGURES?

Charities such as Oxfam say that climate aid is worth much less than its face value, in part because a lot of it comes as loans, not grants.

OECD*: ■ Grants ■ Loans and equity ■ Private finance
Oxfam: ■ Upper bound of estimate



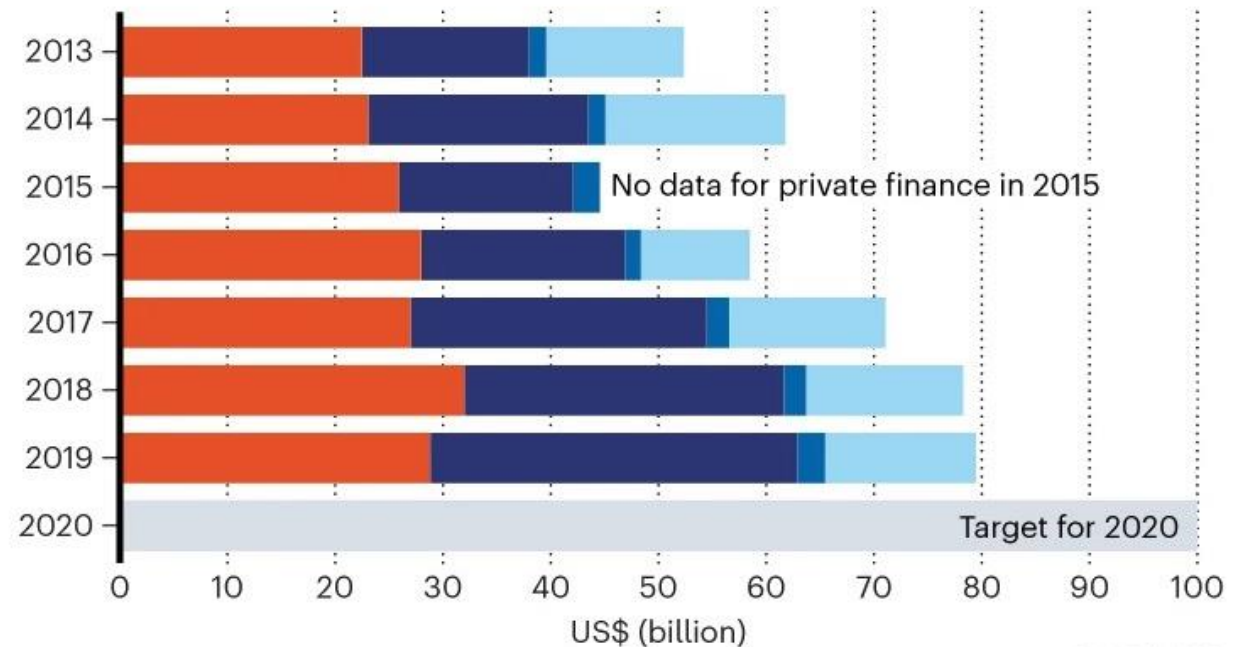
*Organisation for Economic Co-operation and Development

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MISSED TARGET

Rich countries promised developing nations US\$100 billion a year in climate finance by 2020.

■ Bilateral finance ■ Multilateral finance* ■ Export credits ■ Private finance



*Including financing through multilateral development banks.

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COP26

