Mitigation of climate change: what options ahead?

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RFF CMCC European Institute on Economics and the Environment

European Research Council

Disruptive Digitalization For Decarbonization

UNIVERSITÀ DEGLI STUDI DI BRESCIA

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Outline

- WGIII contribution to the IPCC AR6: *the assessment*
- Climate change: *the basics, the risks, the impacts*
- Challenges and options head: *Latest findings from WGIII contribution to AR6*

WGIII contribution to the IPCC AR6

The assessment

What is the IPCC?

IPCC - Intergovermental Panel on Climate Change

intergovernmental body of the UN dedicated to providing the world with objective, scientific information on

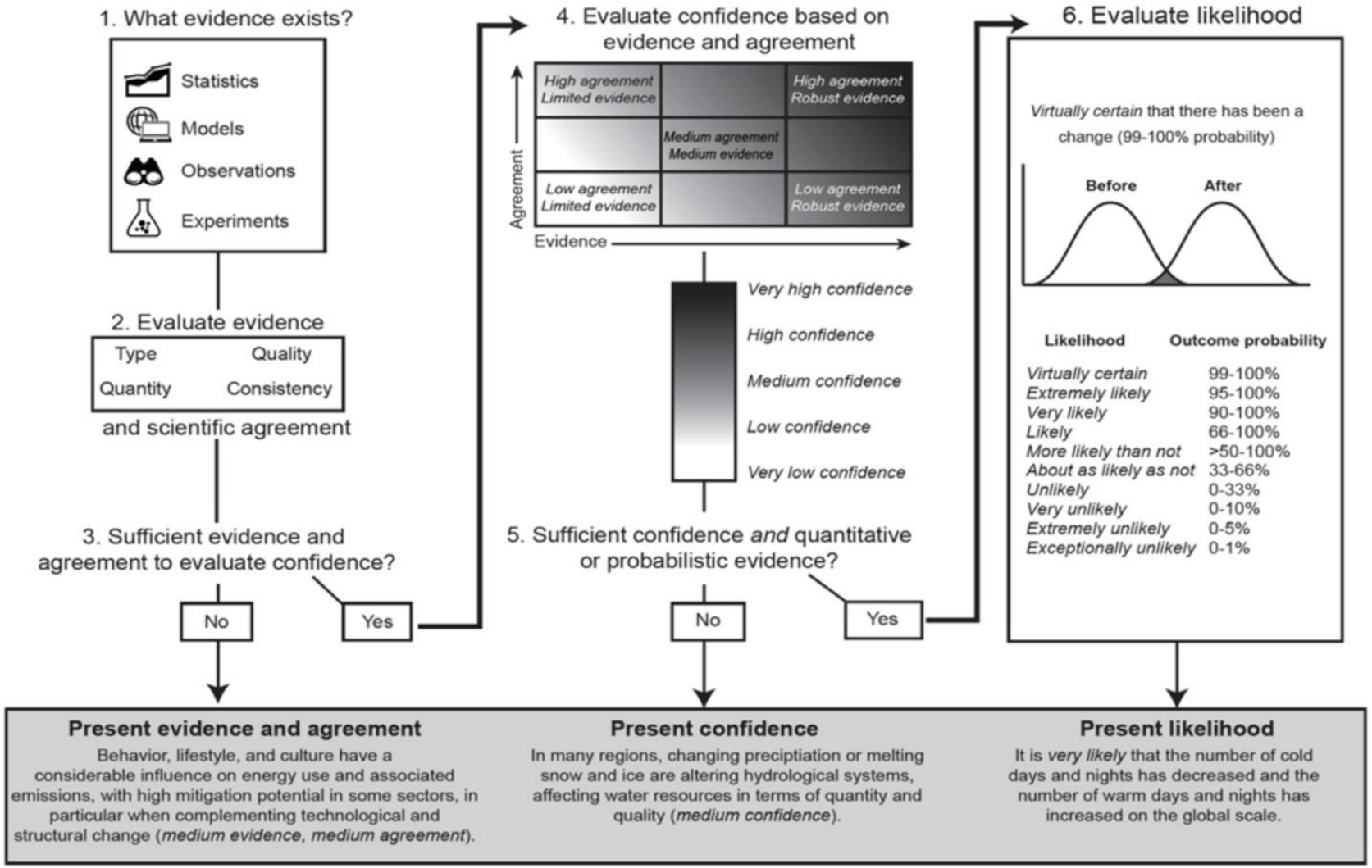
The Physical Science Basis (WGI)
Impacts, Adaptation and Vulnerability (WGII)
Mitigation of Climate Change (WGIII)

The IPCC informs the United Nation Framework Convention on Climate Change.

UNFCCC aim: *"stabilize GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system"*

6 Assessment Reports and several Special Reports (i.e. SR1.5)

What method for assessment?



Who are the WGIII AR6 authors?

278 Authors

65 Countries

41 % Developing countries
59 % Developed countries

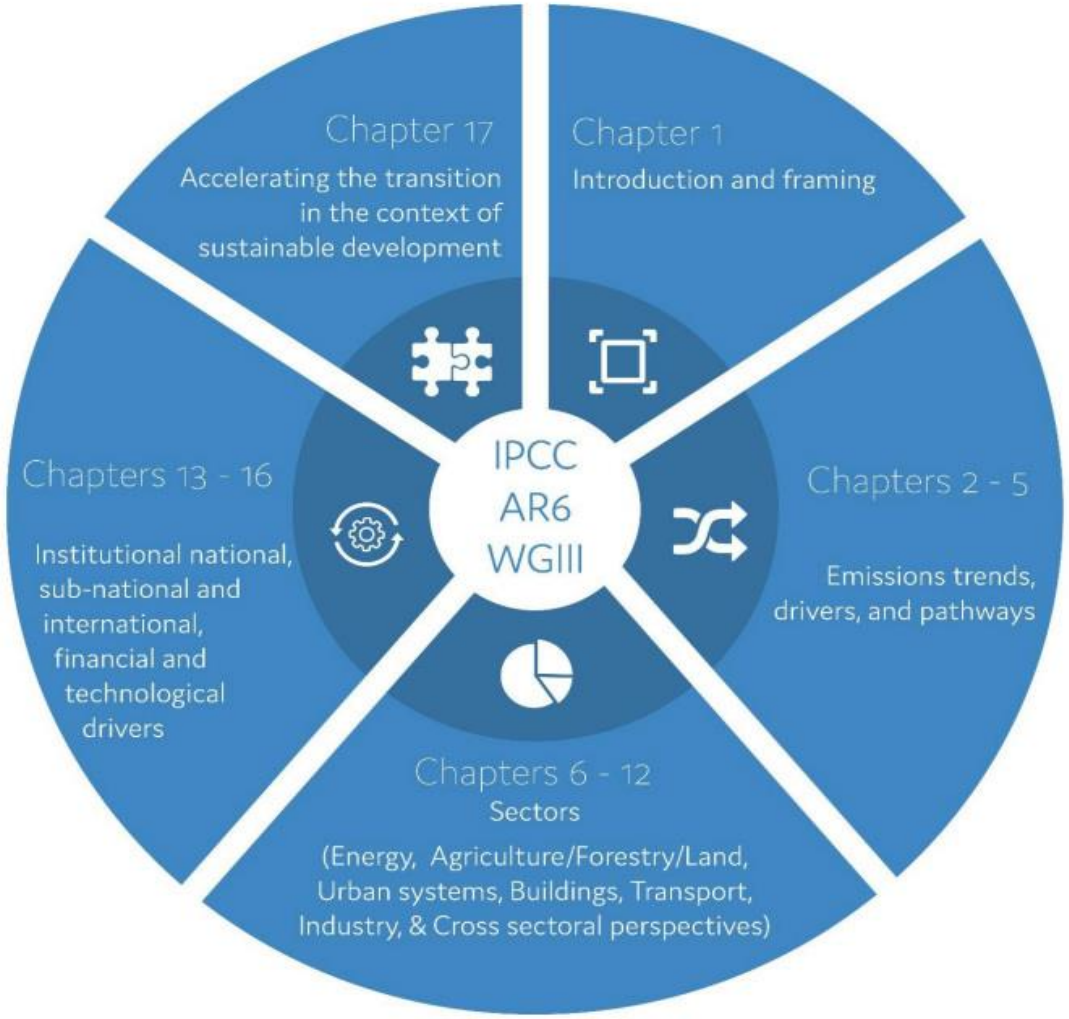
354 Contributing authors

29 % Women / 71 % Men

More than
18,000 scientific papers

59,212 Review comments

How is the WGIII contribution structured?

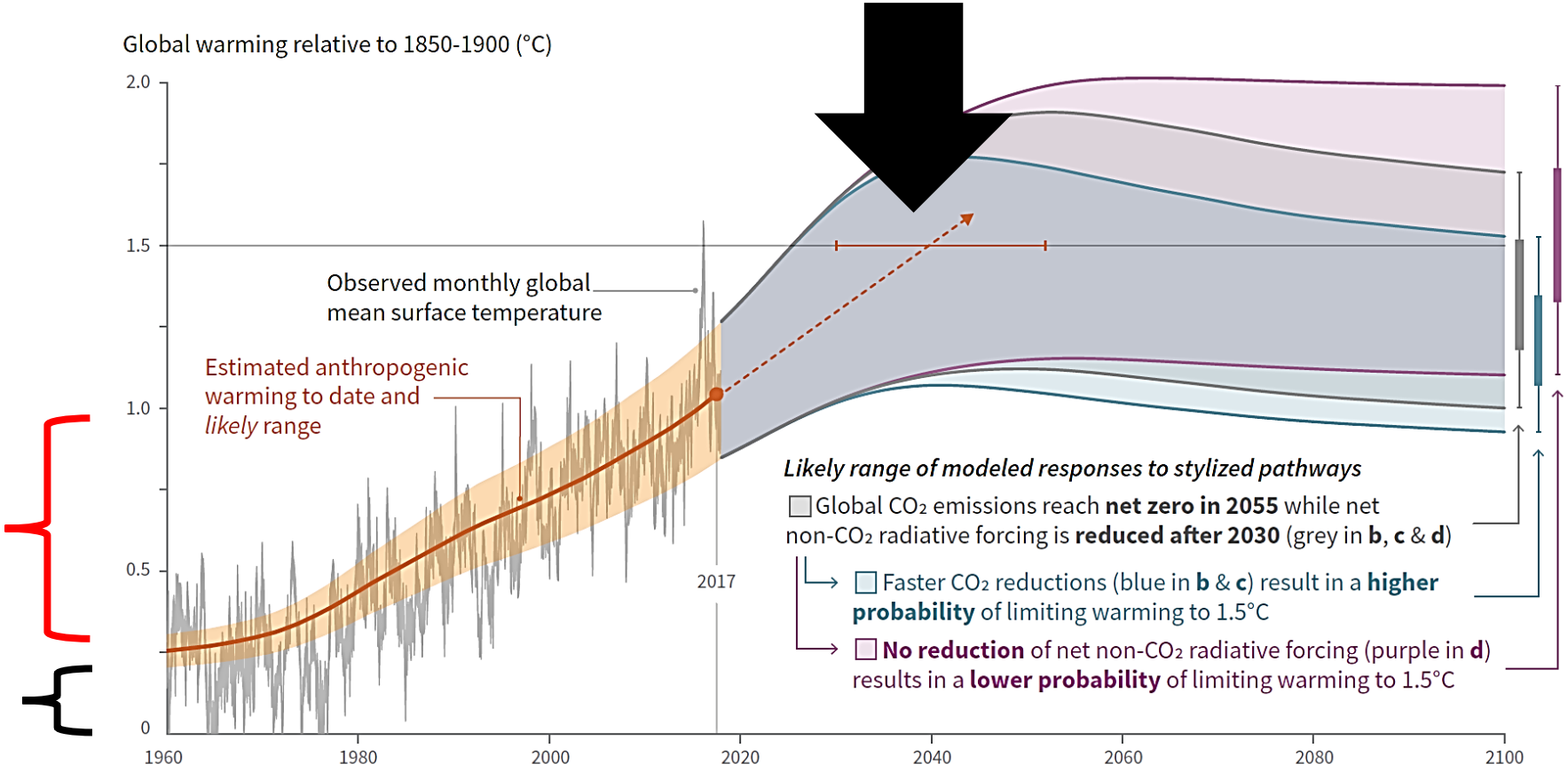


Climate change

The (very) basics, the risks, the impacts

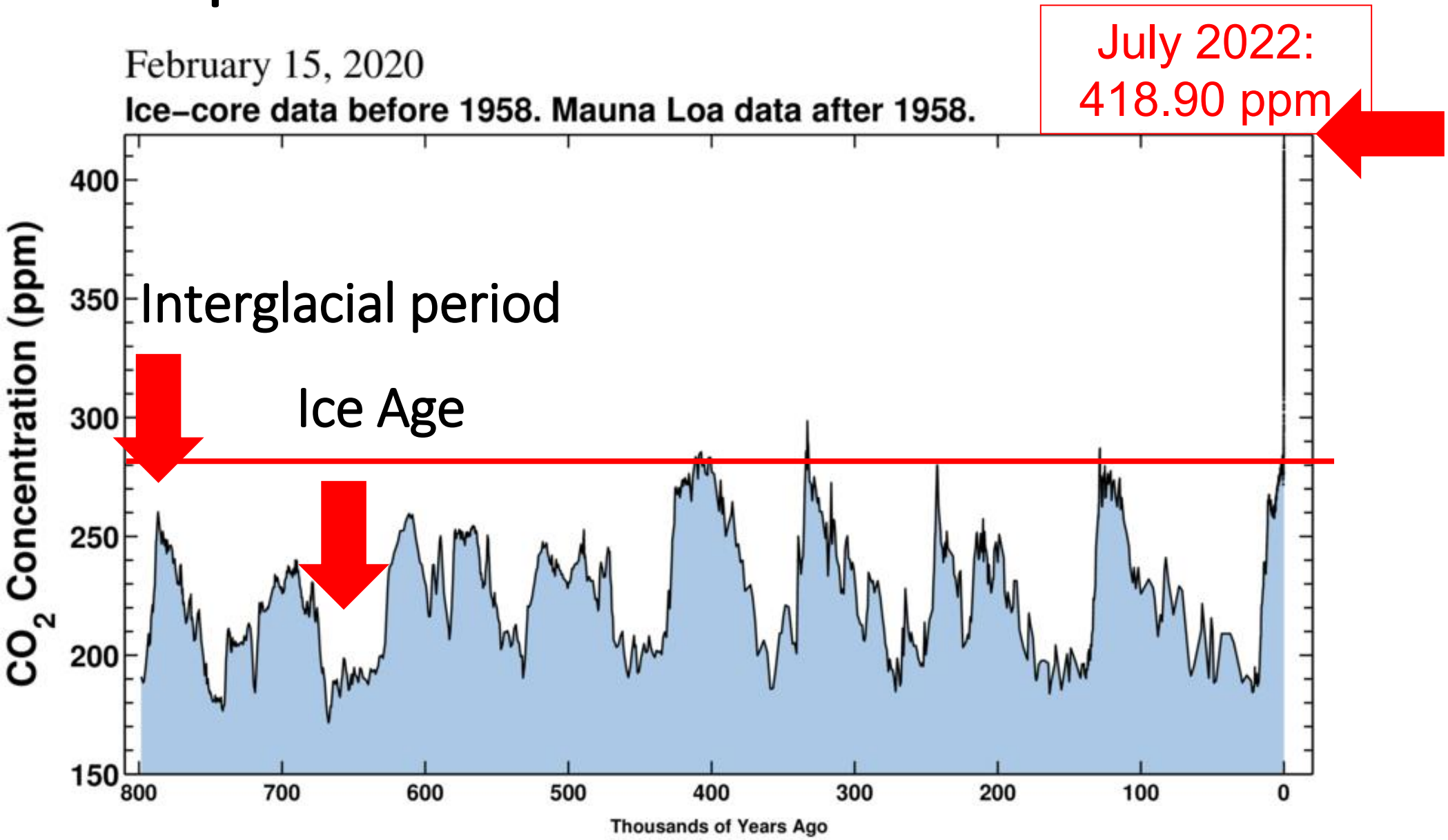
The Physical Science Basis (WGI)
Impacts, Adaptation and Vulnerability (WGII)
Mitigation of Climate Change (WGIII)

Mean surface temperature is increasing very rapidly



1850 – 1960:	1960 – 2017:	~ 2040
+ 0.25°	**+ 0.75°**	**+ 1.50°**

Due to rapid increase in CO2 concentrations

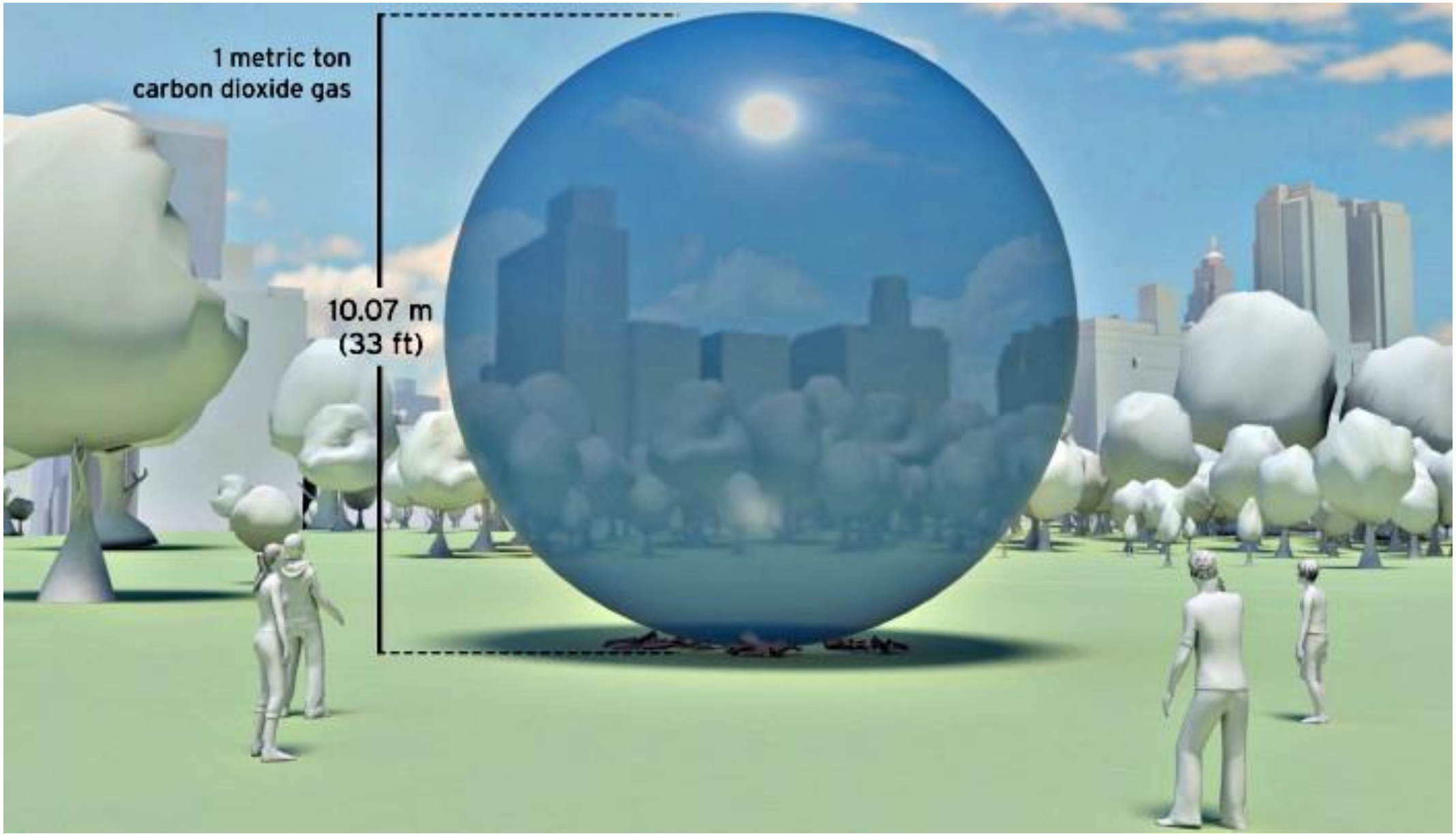


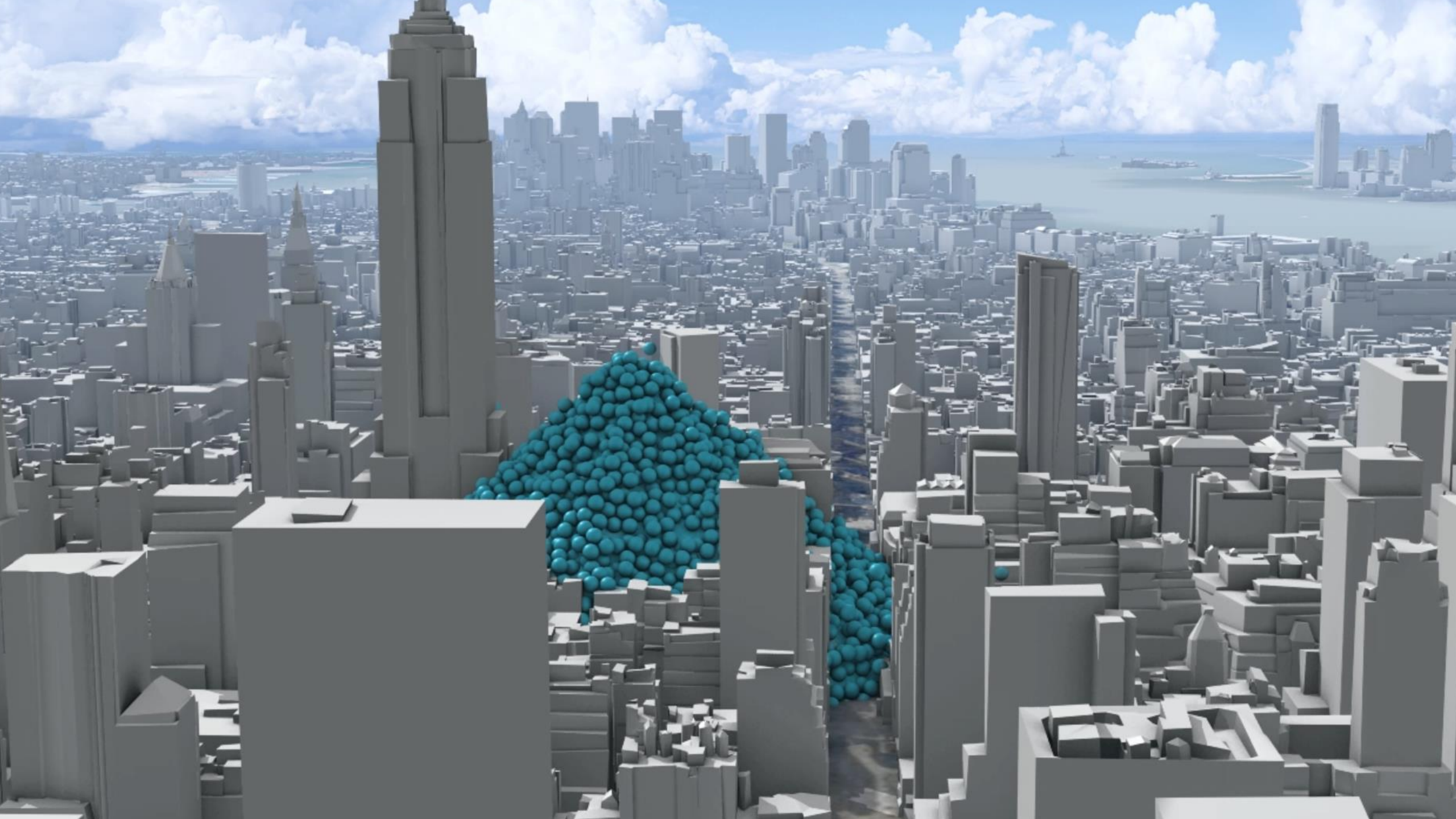
What is the problem? [see WGI :D]

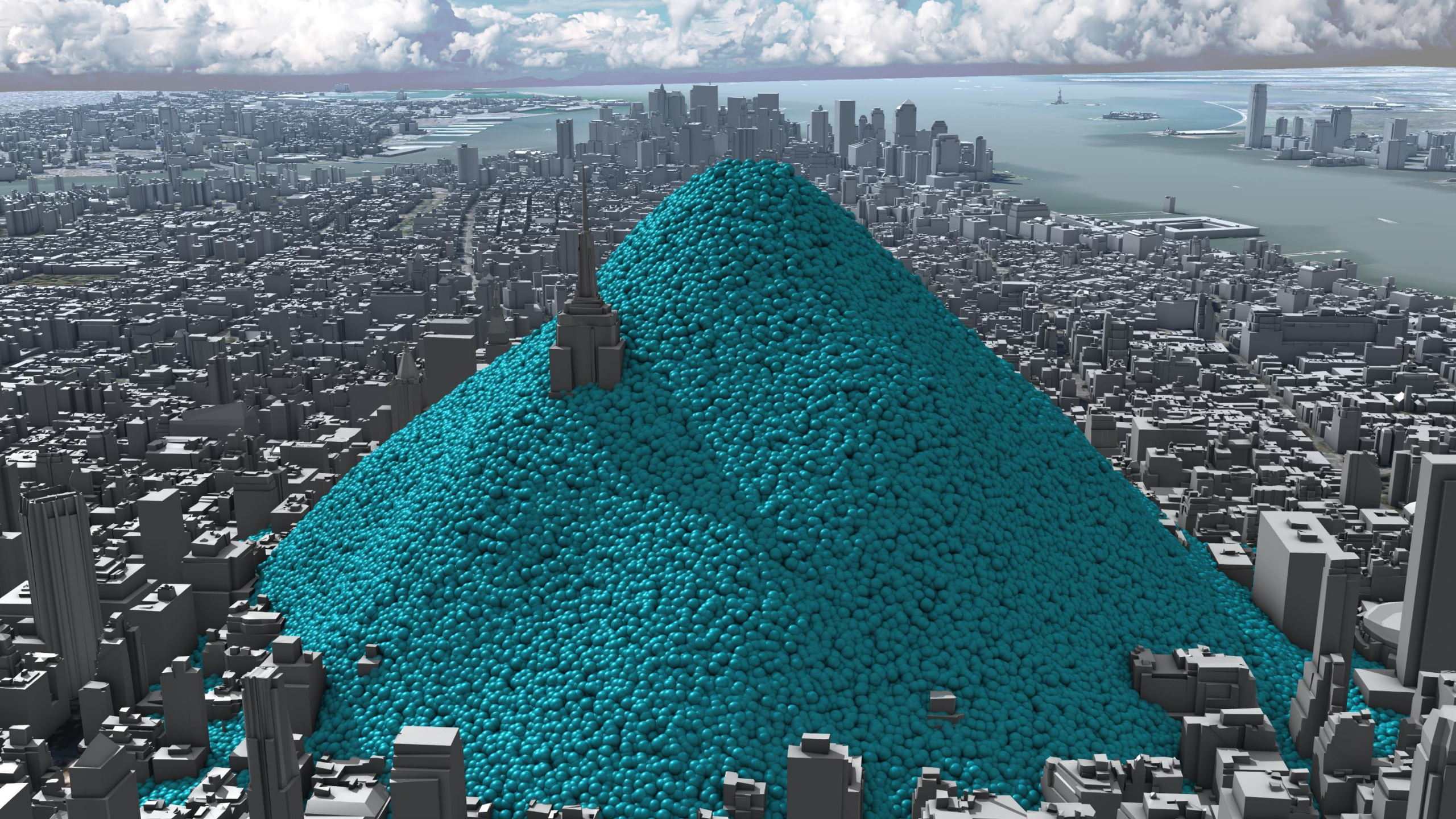
Every year we emit more GHG than the earth can absorb, hence increasing concentrations.

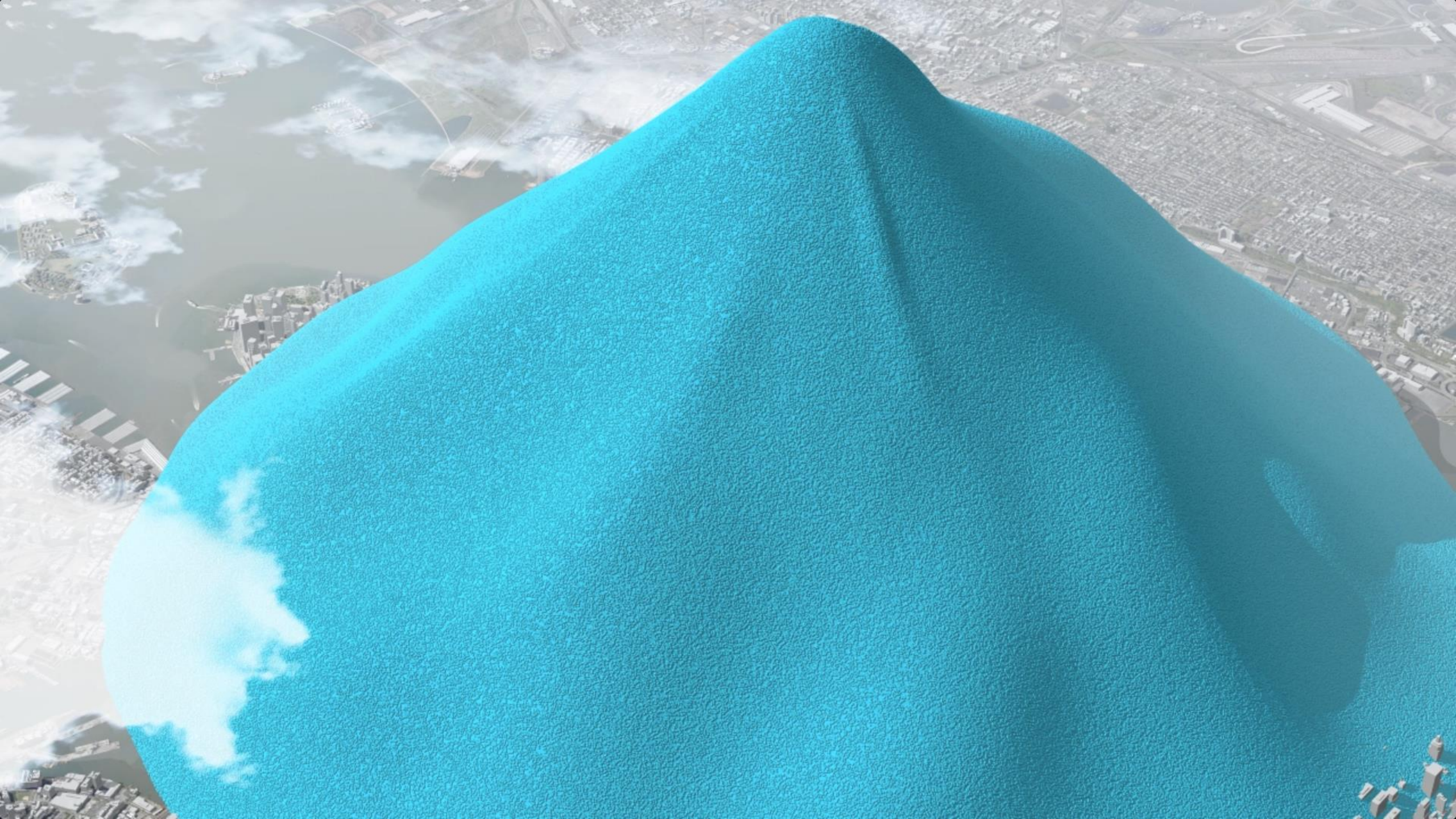
Main GHGs: CO2 (Carbon-dioxide), CH4 (methane – GWP 28), N2O (nitrous oxide – GWP 265), fluorinated gases with high GWP

All economic activities generate anthropogenic emissions

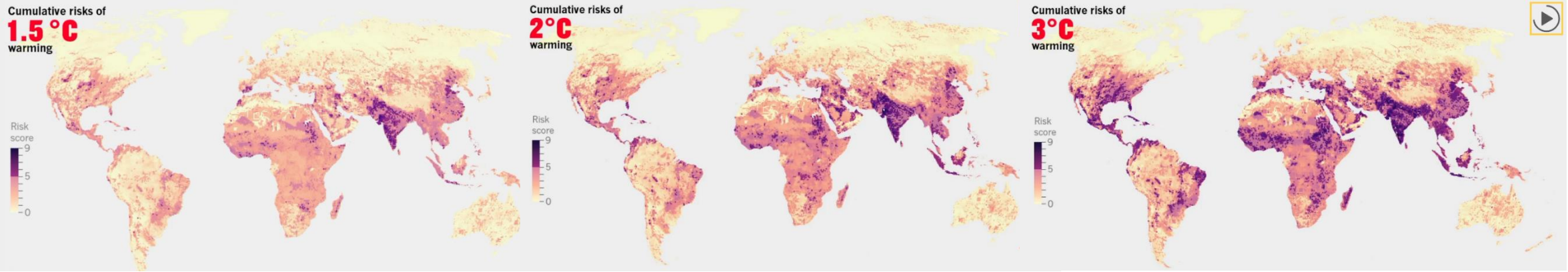

1 metric ton
carbon dioxide gas
10.07 m
(33 ft)





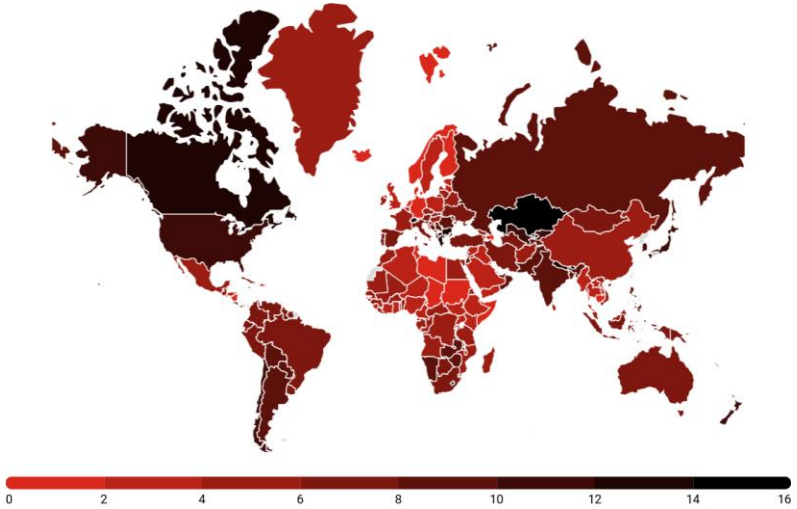


Why is this a problem? [see WGI, WGII :D]



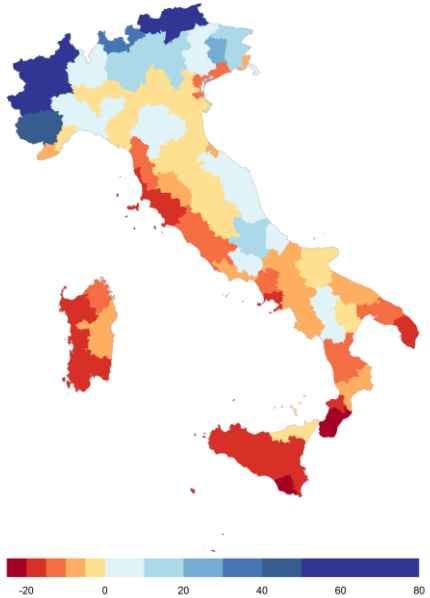
Global warming leads to many risks for natural and economic systems

Risks increase non linearly and are heterogenous



Percentage change in PIL in 2100 without climate policy (RCP 8.5). Kahn et al 2019 NBER

Percentage change in PIL.
Bosello, Dasgupta and Tavoni, 2019

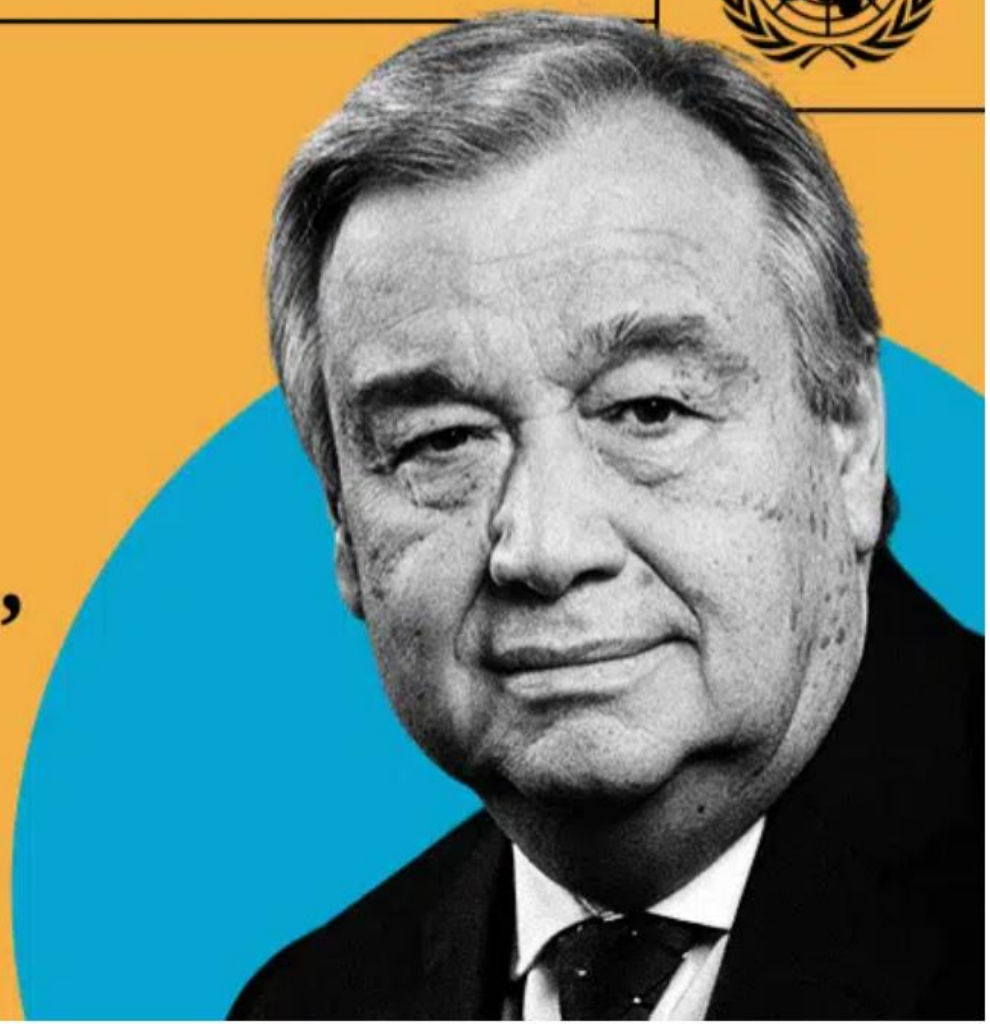


ANTÓNIO GUTERRES | *United Nations Secretary-General*

“

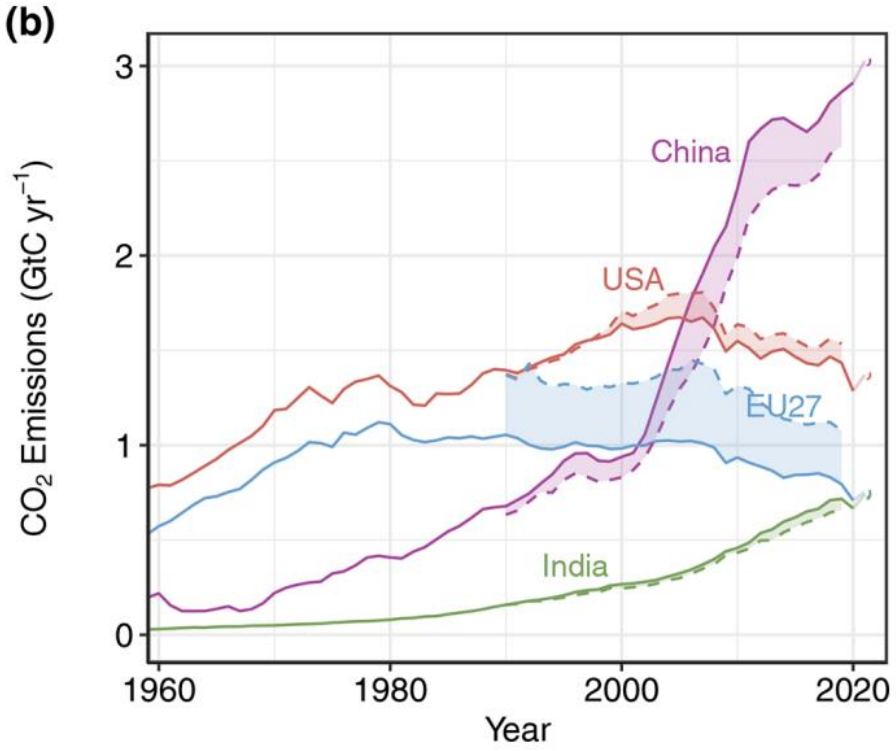
Today’s IPCC Working Group 1 Report is a code red for humanity.”

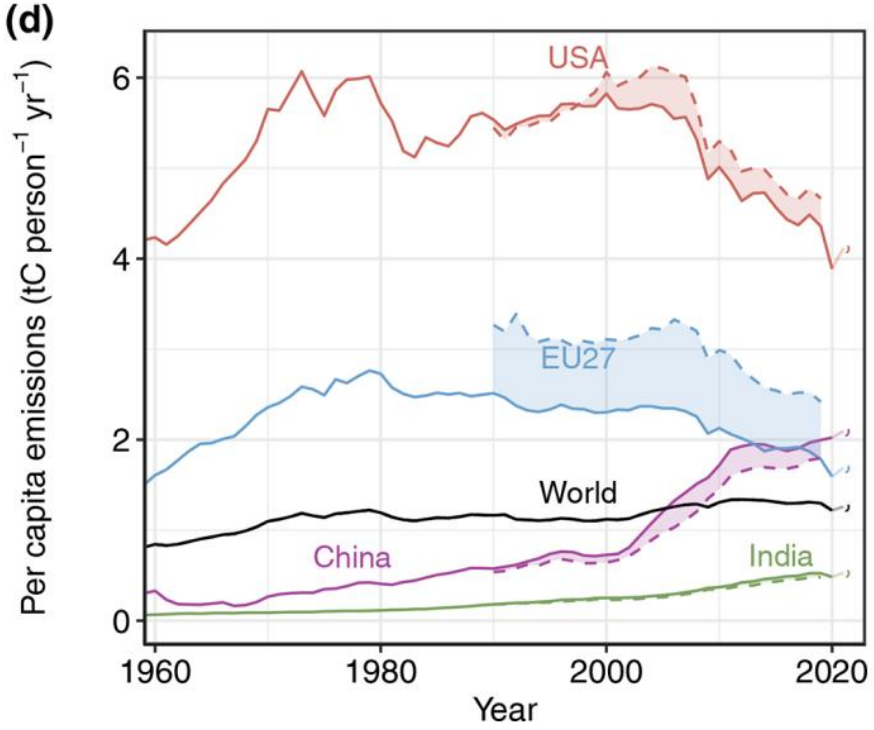
9 AUGUST 2021



What makes it hard to solve the problem?

Emission profiles differ significantly between countries and sectors, and over time



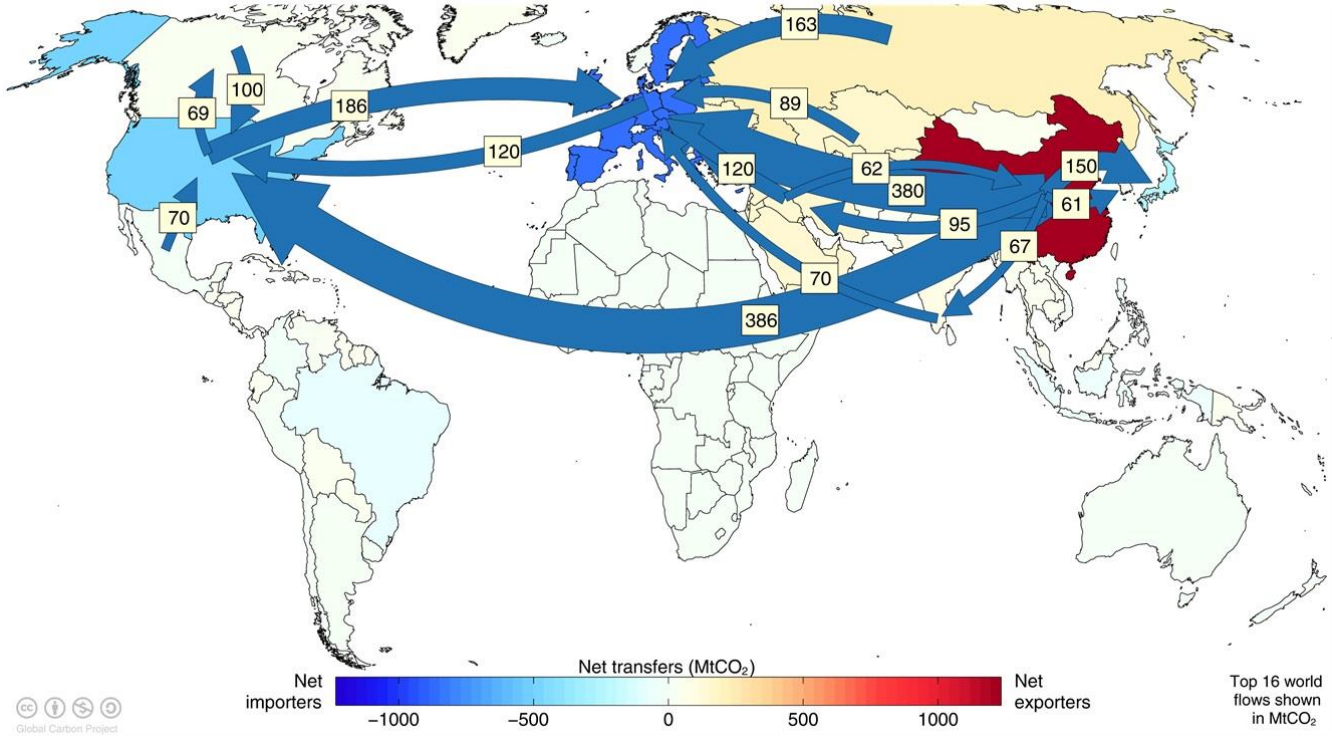


Notes: Gt of carbon. Source: Friedlingstein et al (2022) Global Carbon Budget 2021.

What makes it hard to solve the problem?

International trade means embedded CO2 may be “produced” somewhere but “consumed” somewhere else per capita

Italy: ~6 t (~8 t)



What makes it hard to solve the problem?

We need to reduce GHG emissions
and achieve climate-neutral (net-zero) economies

<u>This entails key changes in our economies, which will not come about unless policy intervention is put into place</u>

Yet, decarbonization policies can have negative impacts on economic growth, competitiveness, and the labor market, and negative distributional outcomes

What makes it hard to solve the problem?

Unfortunately, climate mitigation is not the only challenge humanity faces neither in the short nor in the long run

- *COVID19 pandemic*
- *Geopolitical tensions and wars*
- *Poverty, hunger and inequality*
- *Health and well-being*
- *Justice*

AND THERE ARE TRADE-OFFS!

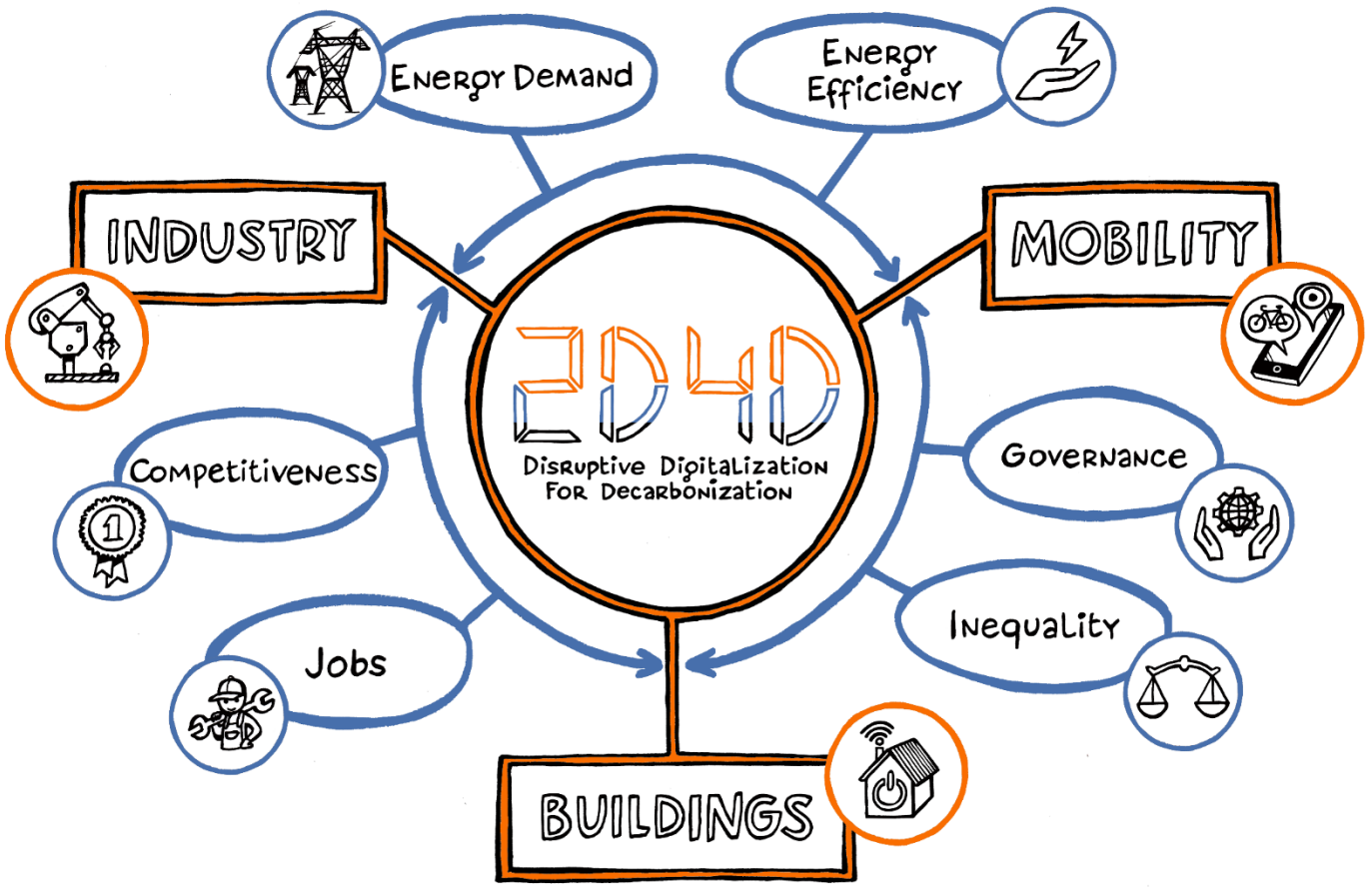
What makes it hard to solve the problem?

Furthermore, climate mitigation does happen in a vacuum

For instance, digitalization

Q1: How does digitalization affect GHG emissions?

Q2: Can we capitalize on digitalization to reduce the burden of climate mitigation?



Twitter: @2D4D_ERC

Challenges and options ahead

Latest findings from WGIII contribution to AR6

Sixth Assessment Report

WORKING GROUP III – MITIGATION OF CLIMATE CHANGE

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INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

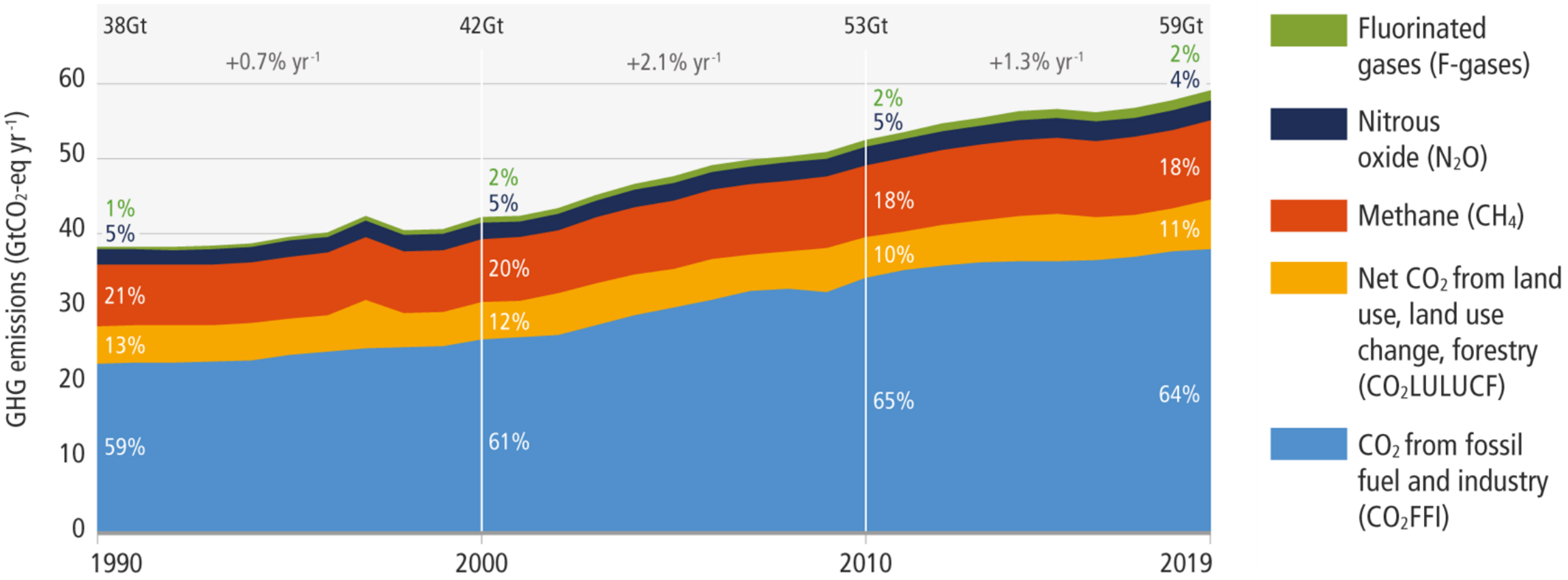
Climate Change 2022

Mitigation of Climate Change

[Matt Bridgestock, Director and Architect at John Gilbert Architects]

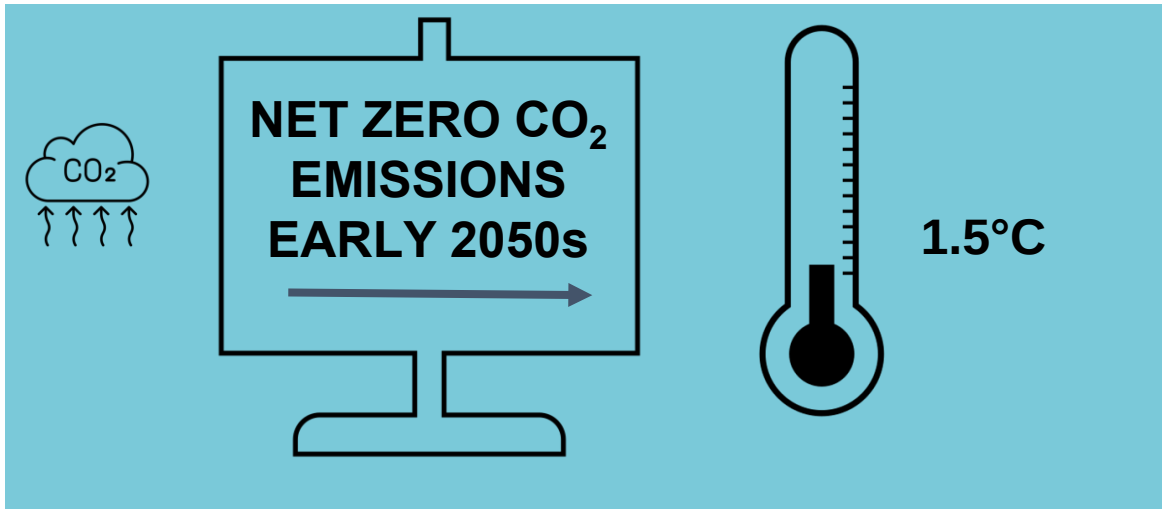
Exhibit 1: limited progress

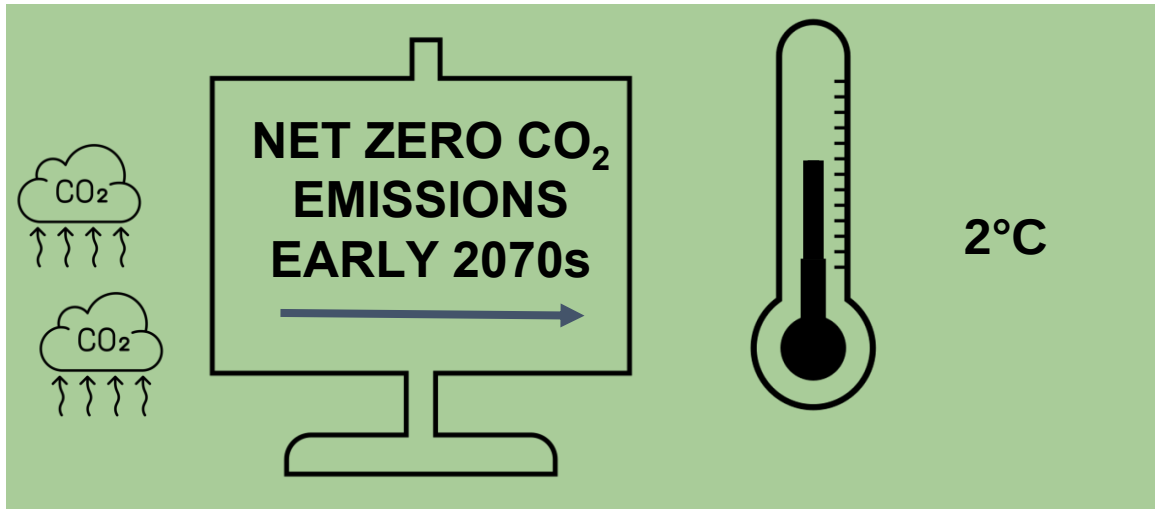
Rising emissions, not on track to limit warming to 1.5°C.



The silver lining - 1

The temperature will **stabilize** when we reach net zero carbon dioxide emissions





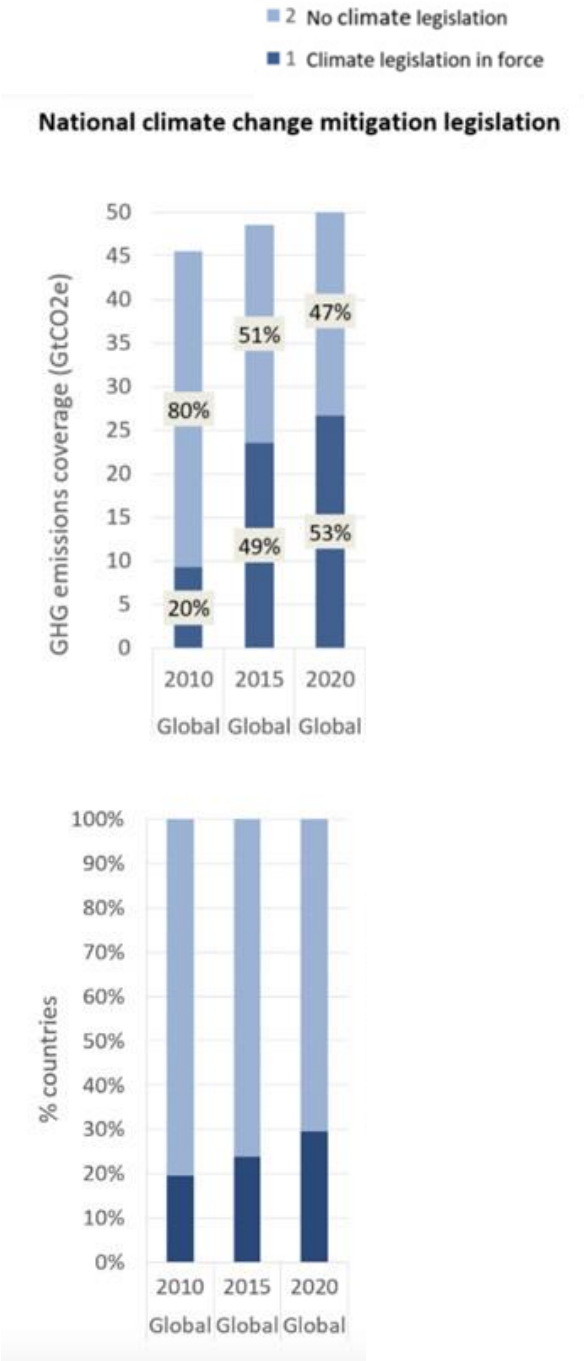
(based on IPCC-assessed scenarios)

The silver lining - 2

Increased evidence of climate action

Some countries have achieved a **steady decrease** in emissions **consistent** with limiting warming to **2°C.**

Zero emissions targets have been adopted by at least **826 cities and 103 regions**

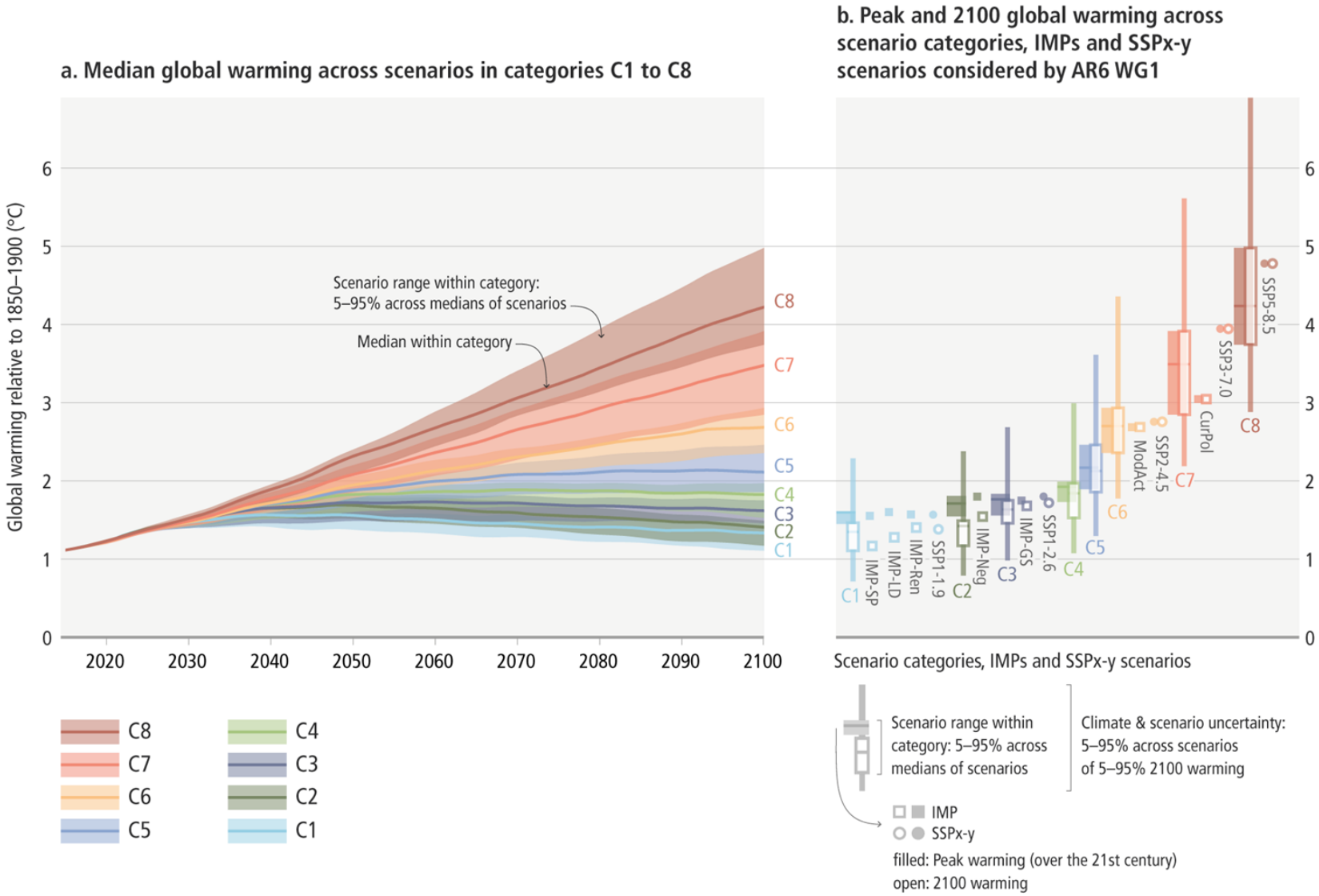


The silver lining – 3

The global economic benefits of limiting warming to 2°C are reported to exceed the cost of mitigation in most of the assessed literature.

What matters is how we manage the transition

Exhibit 2: a world of possibilities



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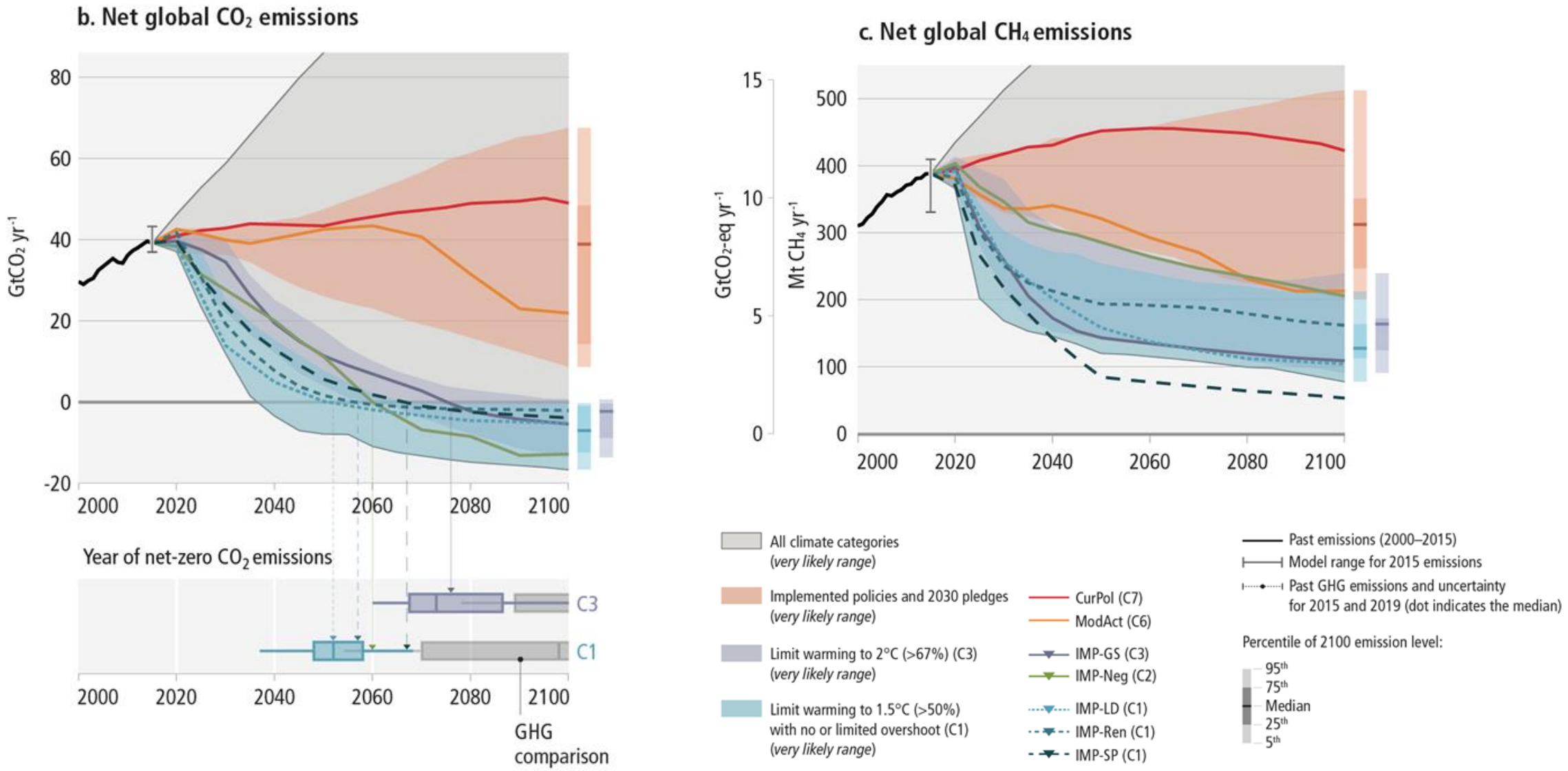
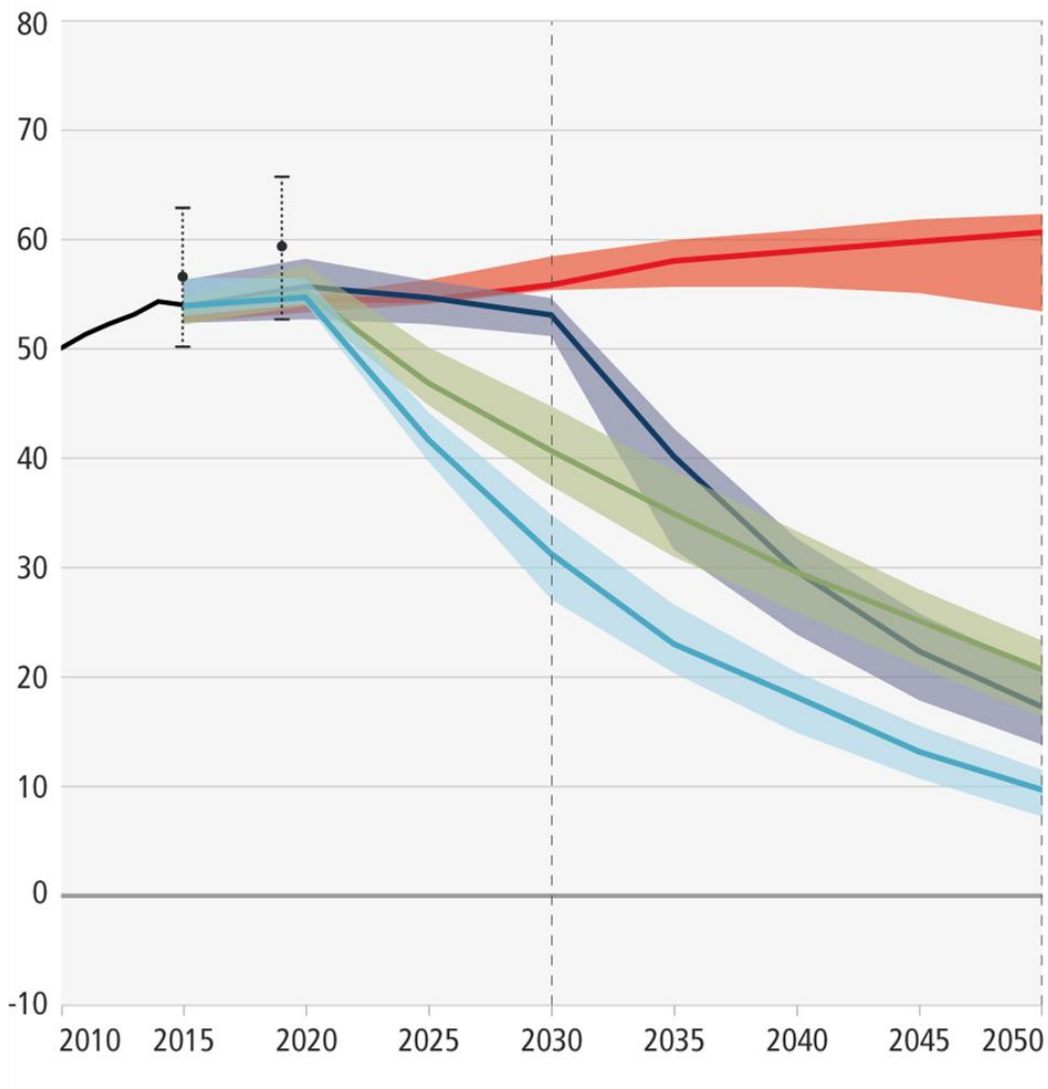


Exhibit 3: IMPs



Limiting warming to 1.5 °C

- Global GHG emissions peak before 2025, reduced by 43% by 2030.
- Methane reduced by 34% by 2030

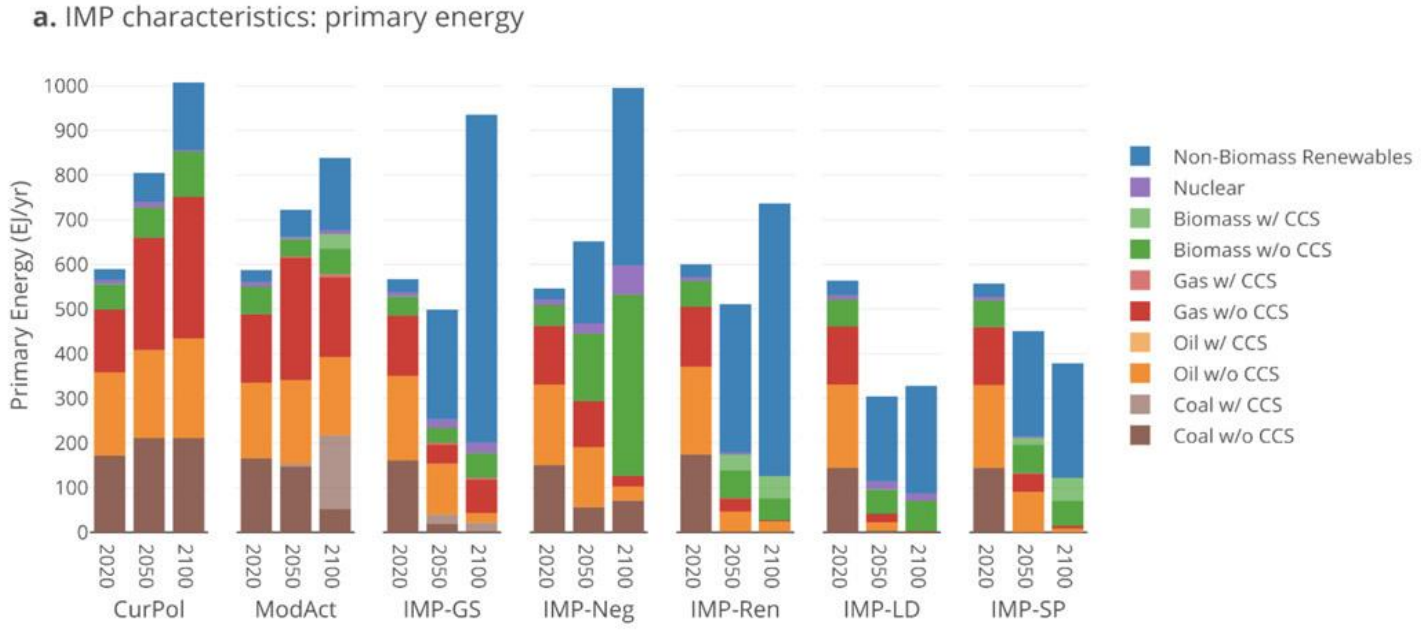
Limiting warming to around 2°C

- Global GHG emissions peak before 2025, reduced by 27% by 2030.

(Based on IPCC-assessed scenarios)

Exhibit 3: IMPs

Different energy systems compatible with climate stabilization



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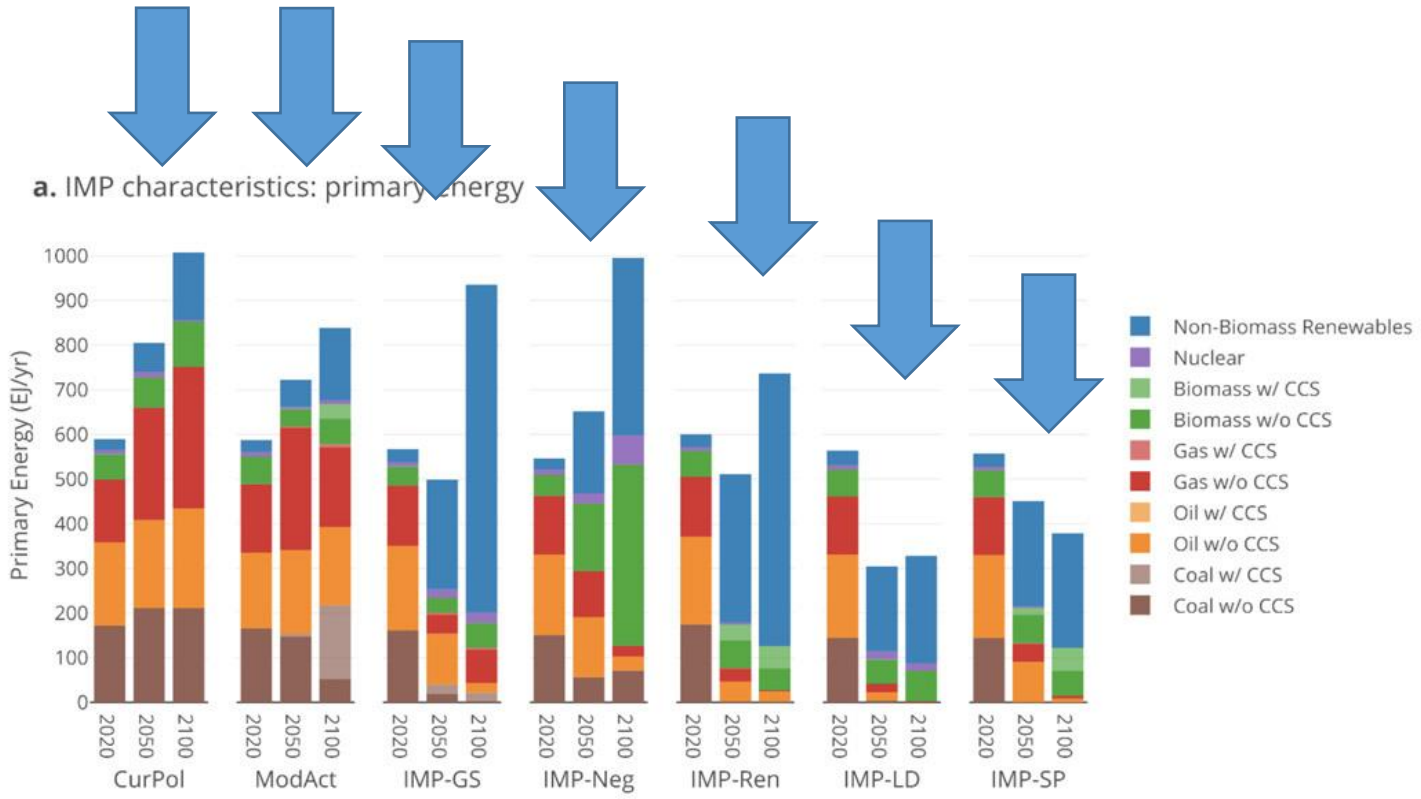
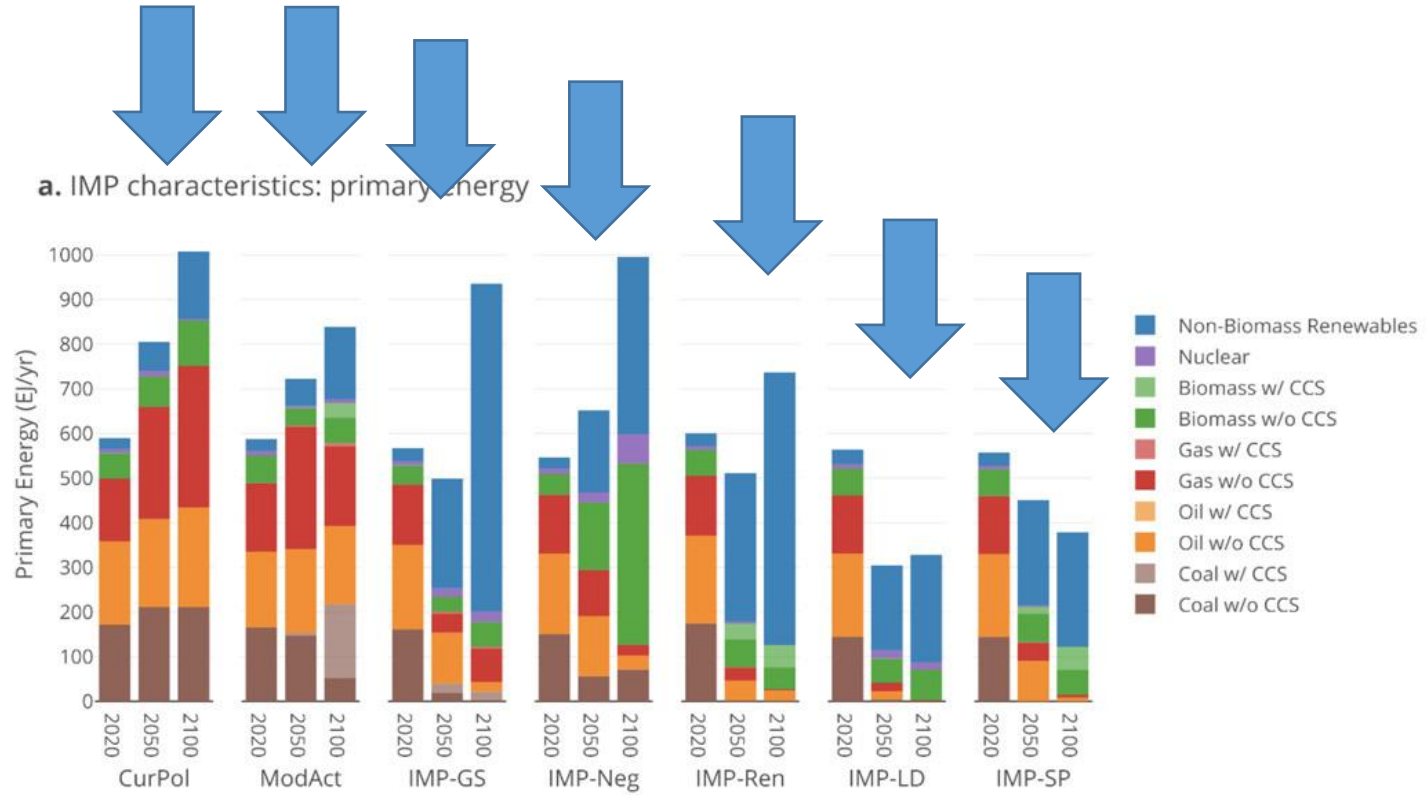


Exhibit 3: IMPs

Different energy systems compatible with climate stabilization

Role of CO2 removal (a.k.a.“CDR”) in a stylised pathway of ambitious climate action



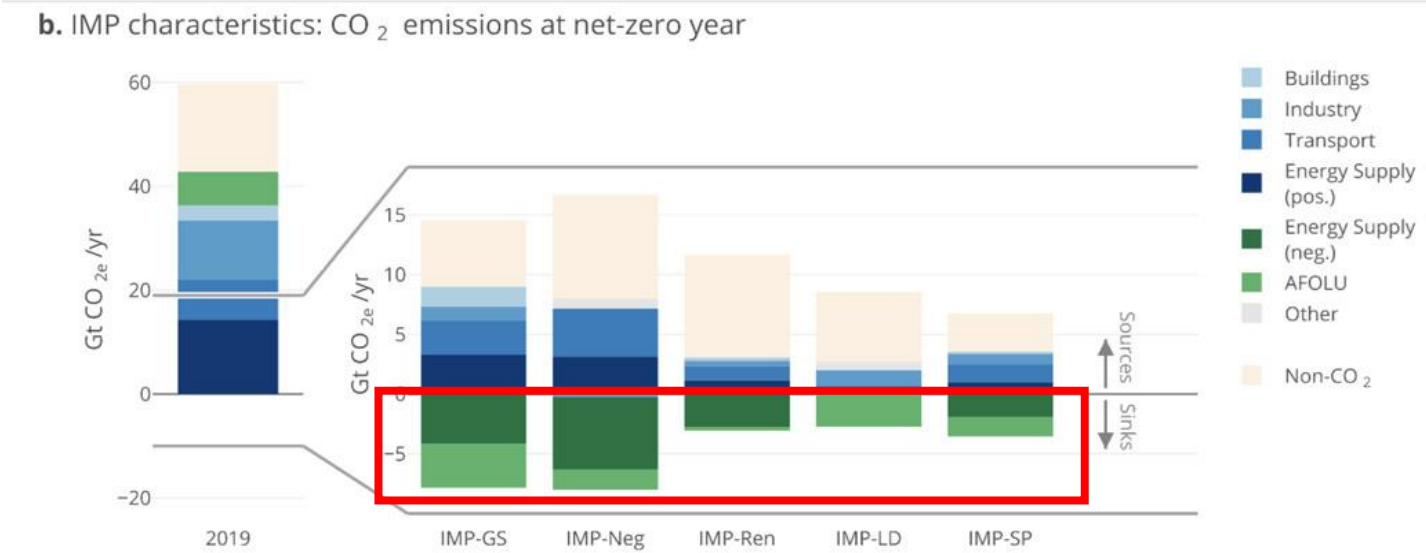


Exhibit 4: costs

Mitigation cost potential from different options:

half of the emission reductions needed by 2030 below 100$/tCO2

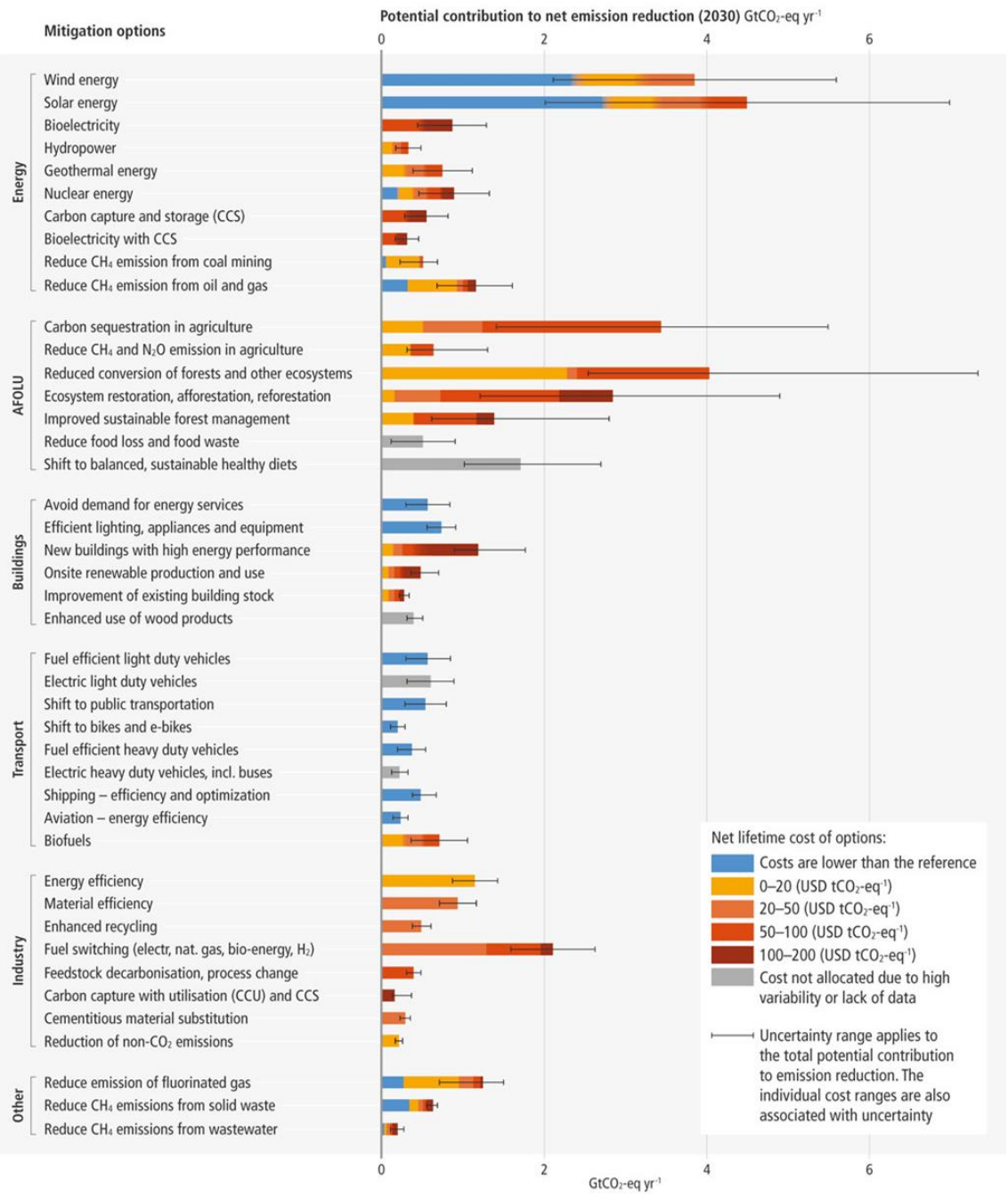


Exhibit 5: investment gaps

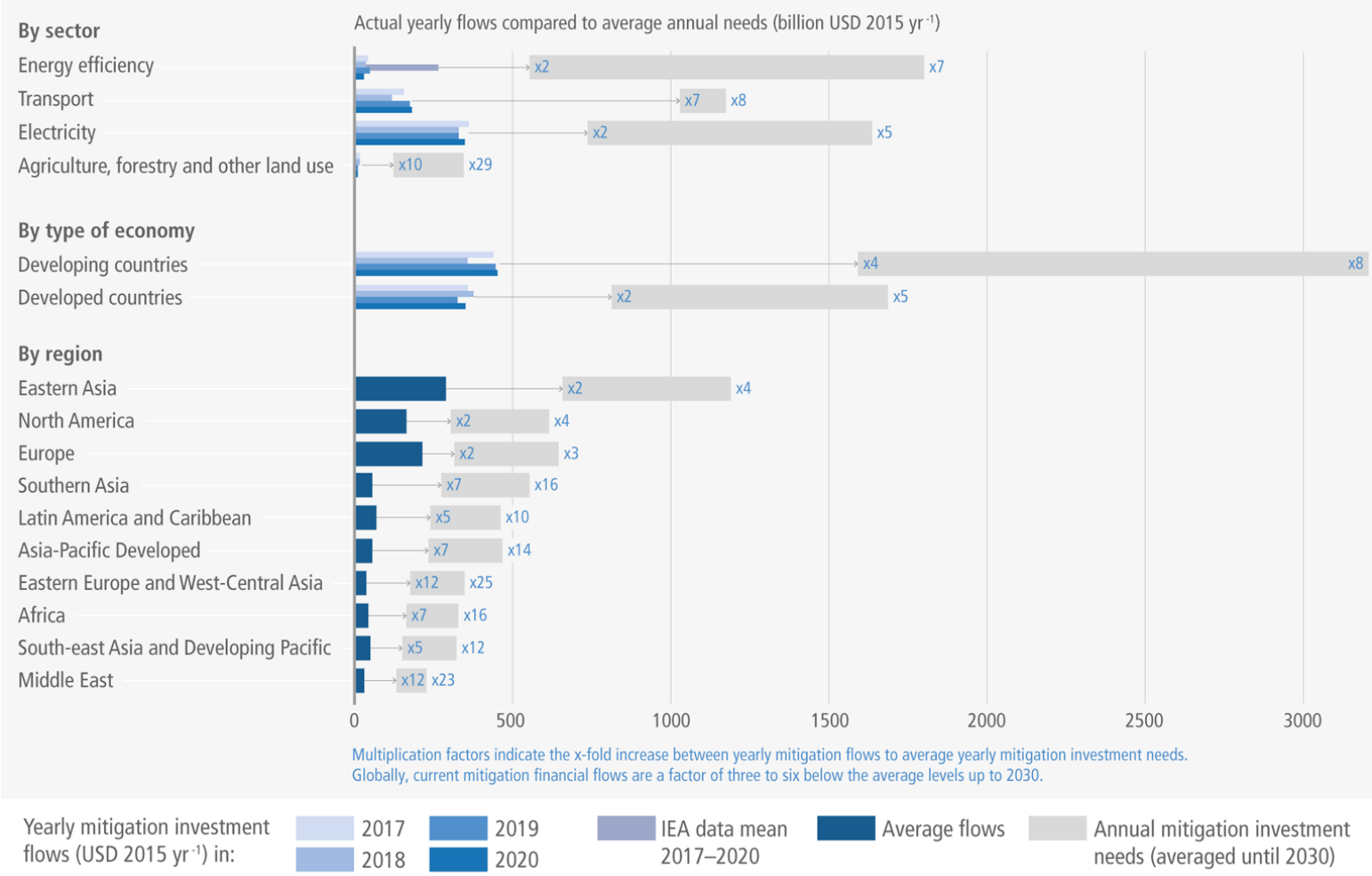
<u>Investment gaps need to be closed.</u>

Current financial flows are <u>3-6x lower</u> than levels needed by 2030 to limit warming to below 1.5°C or 2°C

There is <u>sufficient global capital</u> and liquidity to close investment gaps

Challenge of closing gaps is widest for <u>developing countries</u>

<u>Divestment</u> is as important as green investing



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There are options available **now** in every sector that can at least **halve** emissions by 2030

Demand and services

Energy

Land use

Industry

Urban

Buildings

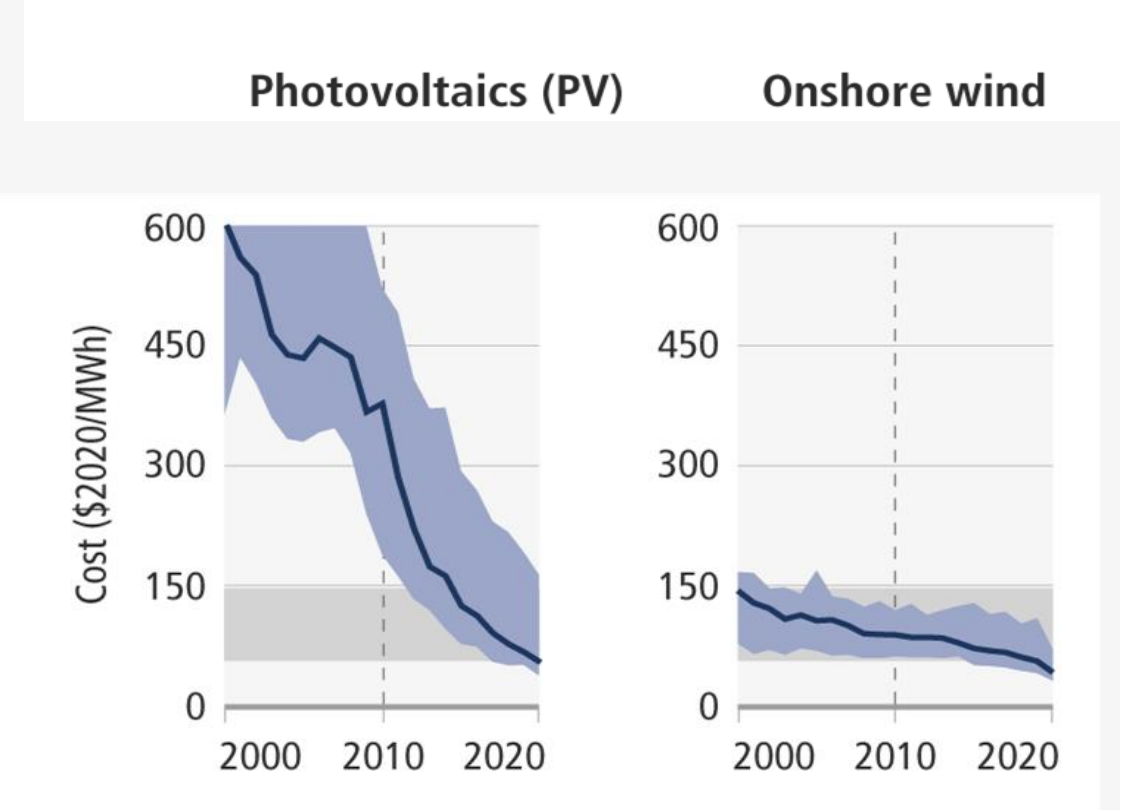
Transport

Energy

Great progress is the last two decades

Energy

Great progress is the last two decades



Energy

Great progress is the last two decades

No regret options (a.k.a. “No brainers”)

- **Electrification**
- **Energy efficiency**

The challenges:

- **Alternative fuels**, e.g. hydrogen and sustainable biofuels

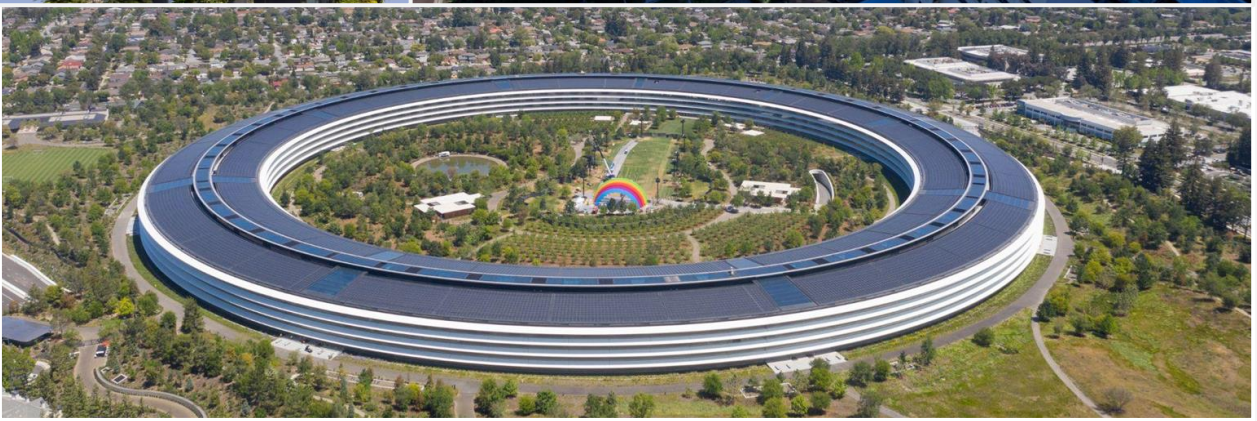
Transport

- **reducing demand** and **low-carbon** technologies are key to reducing emissions
- **electric vehicles**: greatest potential
- **battery technology**: advances could assist electric rail, trucks
- **aviation** and **shipping**: alternative fuels (low-emission **hydrogen** and **biofuels**) needed
- Overall, substantial potential but depends on **decarbonising the power sector**.

Industry

- using materials more **efficiently**, **reusing**, **recycling**, **minimising waste**; currently **under-used** in policies and practice
- **basic materials**: low- to zero-greenhouse gas production processes at **pilot** to **near-commercial** stage
- achieving **net zero** is challenging

[Ahsanization/Unsplash, IMF Focus | Industry and Manufacturing CC BY-NC-ND 2.0, Rwanda Green Fund CC BY-ND 2.0, ILO/M. Fossat CC BY-NC-ND 2.0, Stephen Cornwell Pxhere.com]



Buildings, Cities and urban areas

- buildings: possible to reach net zero emissions in 2050: action in this decade is critical to fully capture this potential
- retrofitting existing buildings and effective mitigation techniques in new buildings
- sustainable production and consumption of goods and services
- enhancing **carbon uptake and storage** (e.g. green spaces, ponds, trees)

Demand and services

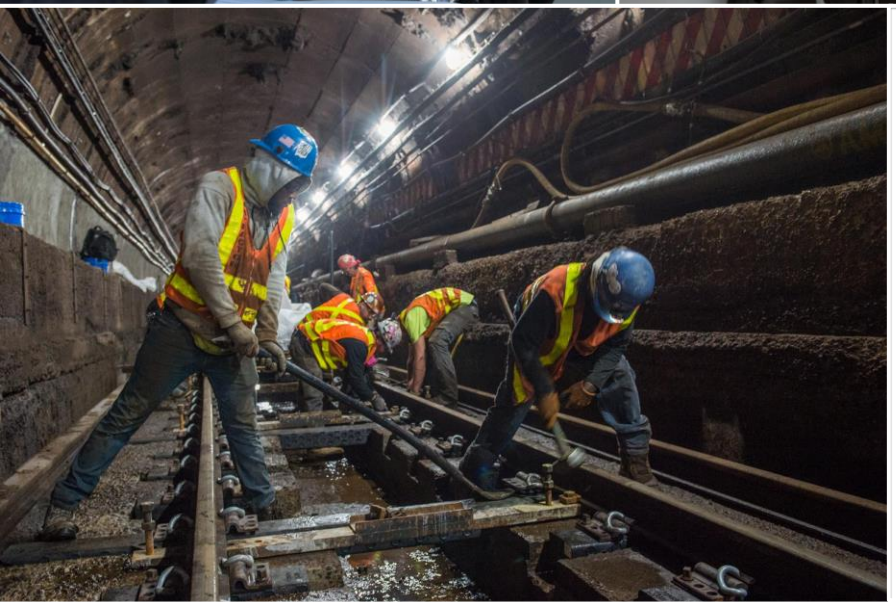
- potential to **significantly bring down** global **emissions** by 2050
- walking and cycling, electrified transport, reducing air travel, and adapting houses make large contributions
- **lifestyle changes** require **systemic changes** across all of society
- **some** people require additional **capacity**, **energy** and **resources** for human wellbeing

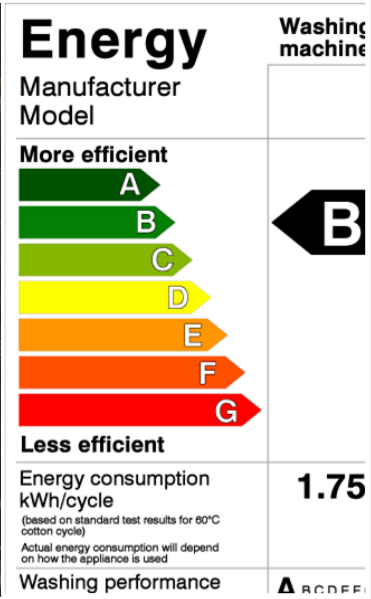
[Bosch, Unsplash/Yoav Aziz, Adam Bartoszewicz, Victor Hernandez]

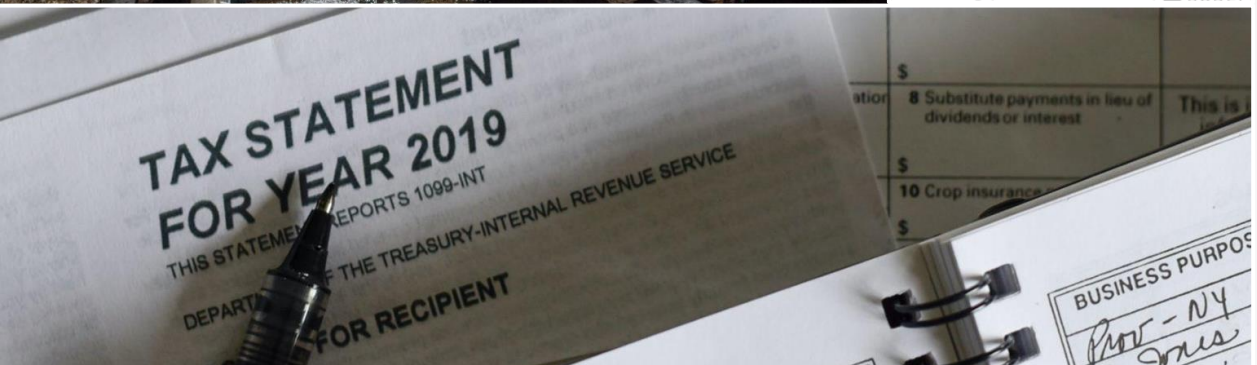
Technology and Innovation

- investment and policies **push forward low emissions** technological **innovation**
- **effective decision making** requires assessing potential benefits, barriers and risks
- **some options** are technically **viable**, rapidly becoming **cost-effective**, and have relatively **high public support**. Other options face barriers

Adoption of low-emission technologies is slower in most developing countries, particularly the least developed ones.







Policies, regulatory and economic instruments

- regulatory and economic instruments have **already proven effective** in reducing emissions
- **policy packages** and **economy-wide packages** are able to achieve **systemic change**
- ambitious and effective mitigation requires **coordination across government** and society

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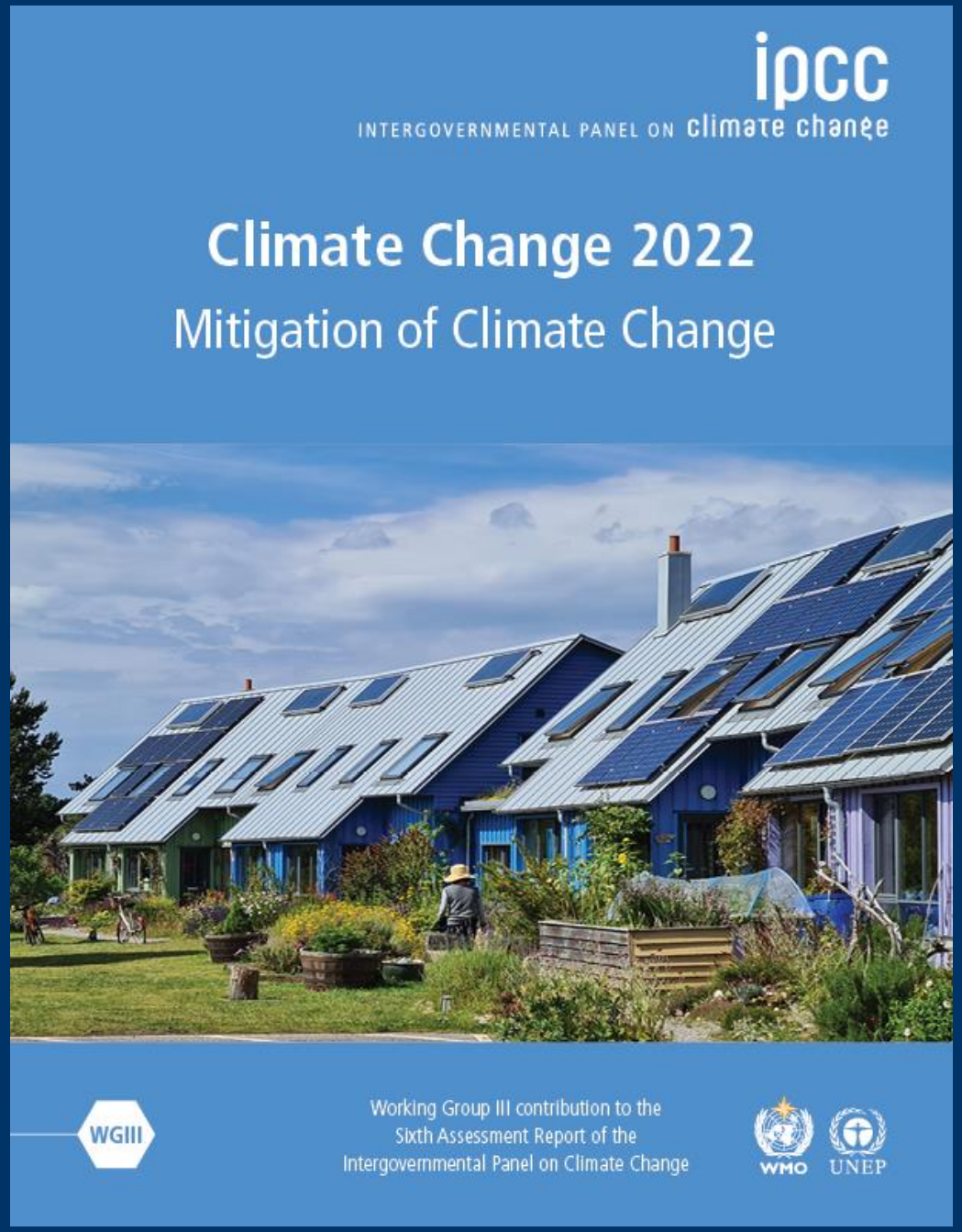
Sixth Assessment Report
WORKING GROUP III – MITIGATION OF CLIMATE CHANGE

“The evidence is clear:
The time for action is now



[Matt Bridgestock, Director and Architect at John Gilbert Architects]

Thank you.
Questions welcome!

Elena Verdolini, PhD. *elena.verdolini@unibs.it*

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erc European Research Council

2D4D Disruptive Digitalization For Decarbonization

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