Climate change models & new data approaches resulting from the Covid-19 pandemic

Climate Change Modelling Information (CCMI) project

3 February 2022

European Commission

Agenda

- Welcome by **Vicky Pollard** (European Commission, DG CLIMA)
- Introduction to the topic by **Katre Kets** (European Commission, DG CLIMA)
- Presentations:
  - **Debbie Rosen** (Leeds University)

    "Simulating climate impacts of the Covid-19 lockdown"
  - **Zhu Liu** (Harvard University and Tsinghua University)*

    "Near-real-time monitoring of global carbon emissions"
  - **Kimon Keramidas** (European Commission, JRC and Université Grenoble Alpes)

    "Integrating short-term and long-term effects of the pandemic into the energy system modelling for the Global Energy and Climate Outlook"
  - **Silvia Pianta** (European University Institute)

    "Incorporating insights from social and political science into climate modelling"
- Q&A moderated by **Matthias Weitzel** (European Commission, JRC)

*Unable to present due to technical issues

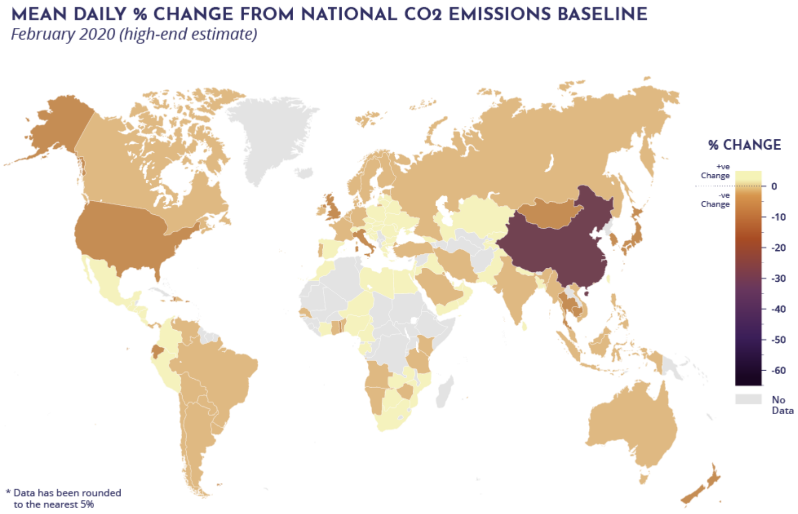
Vicky Pollard, European Commission, DG CLIMA

Katre Kets, European Commission, DG CLIMA

Debbie Rosen, Leeds University

Simulating climate impacts of the COVID-19 lockdown

Dr Debbie Rosen
CONSTRAIN Science and Policy Manager



Forster et al. (2020), Nature Climate Change

CONSTRAIN

CONSTRAINING UNCERTAINTY OF MULTI-DECADAL CLIMATE PROJECTIONS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 820829

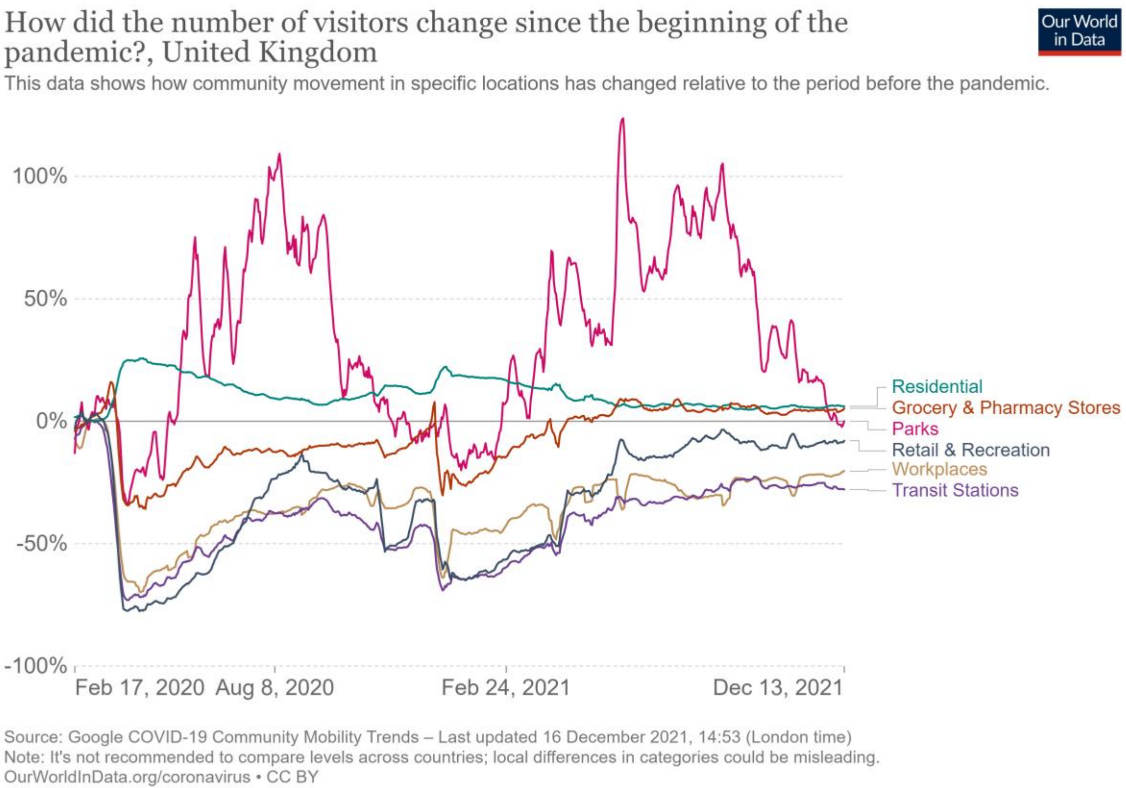
4 year (2019-2023) programme looking at:

- Understanding uncertainties in the climate system
- Improving climate model projections
- Translating this into policy-relevant information

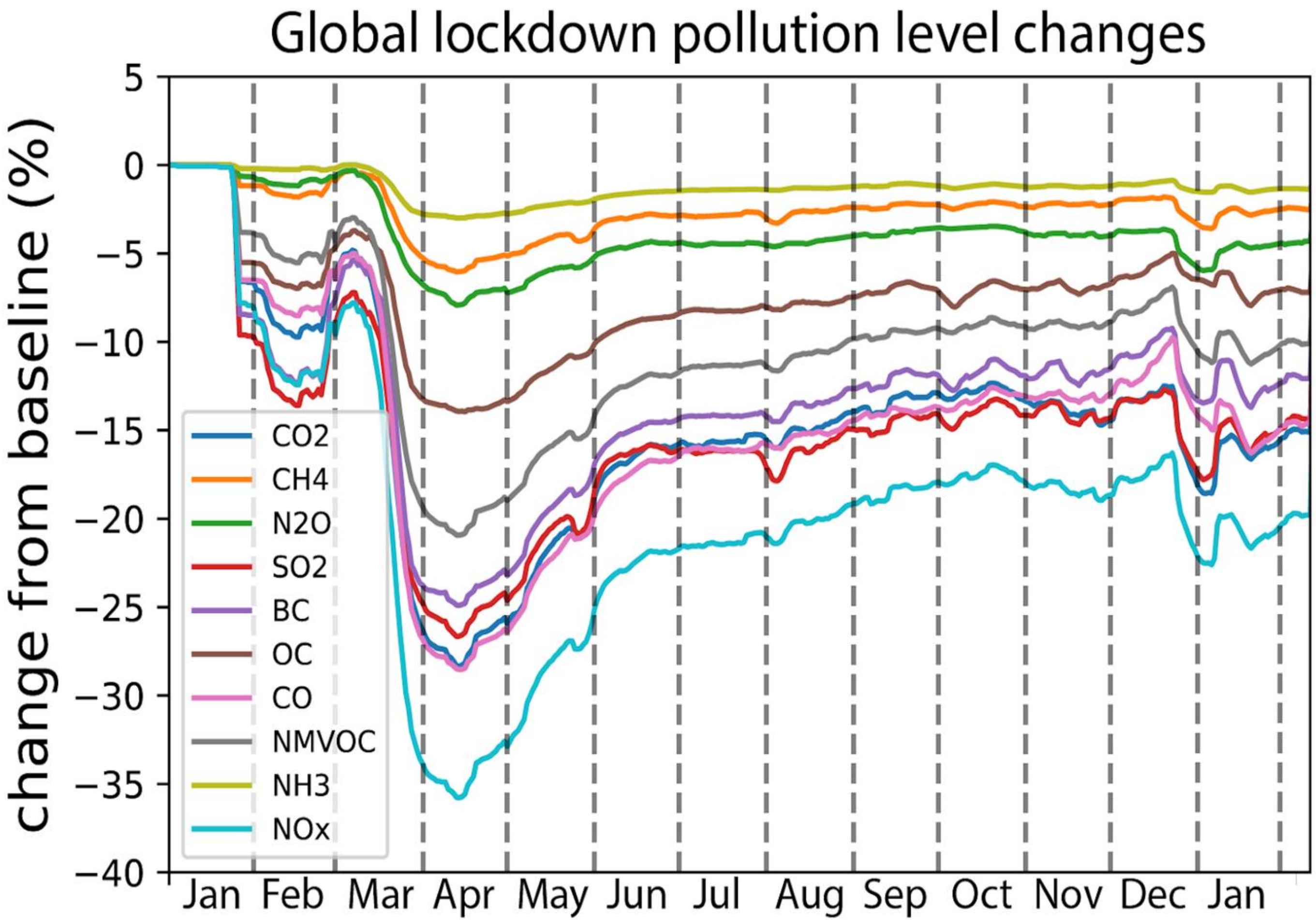
· THE REMAINING CARBON BUDGET
· DECADAL WARMING RATES

A NEW GENERATION OF CLIMATE MODELS, COVID-19 AND THE PARIS AGREEMENT

NEAR-TERM WARMING AND OUR CHANCES OF STAYING WITHIN 1.5°C



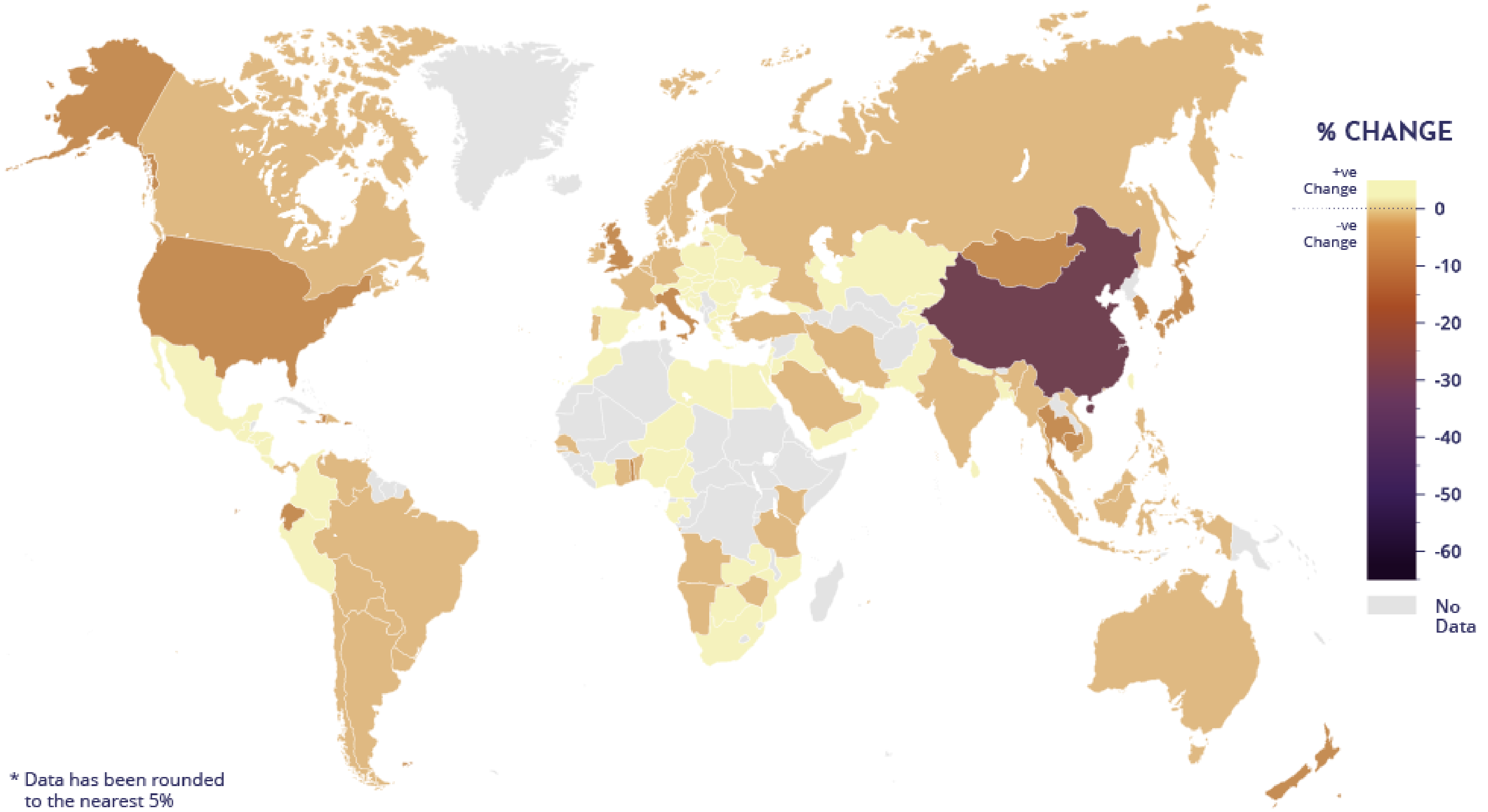
https://ourworldindata.org/covid-google-mobility-trends



Global lockdown pollution level changes
change from baseline (%)
5
0
−5
−10
−15
−20
−25
−30
−35
−40
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
CO2
CH4
N2O
SO2
BC
OC
CO
NMVOC
NH3
NOx

MEAN DAILY % CHANGE FROM NATIONAL CO2 EMISSIONS BASELINE

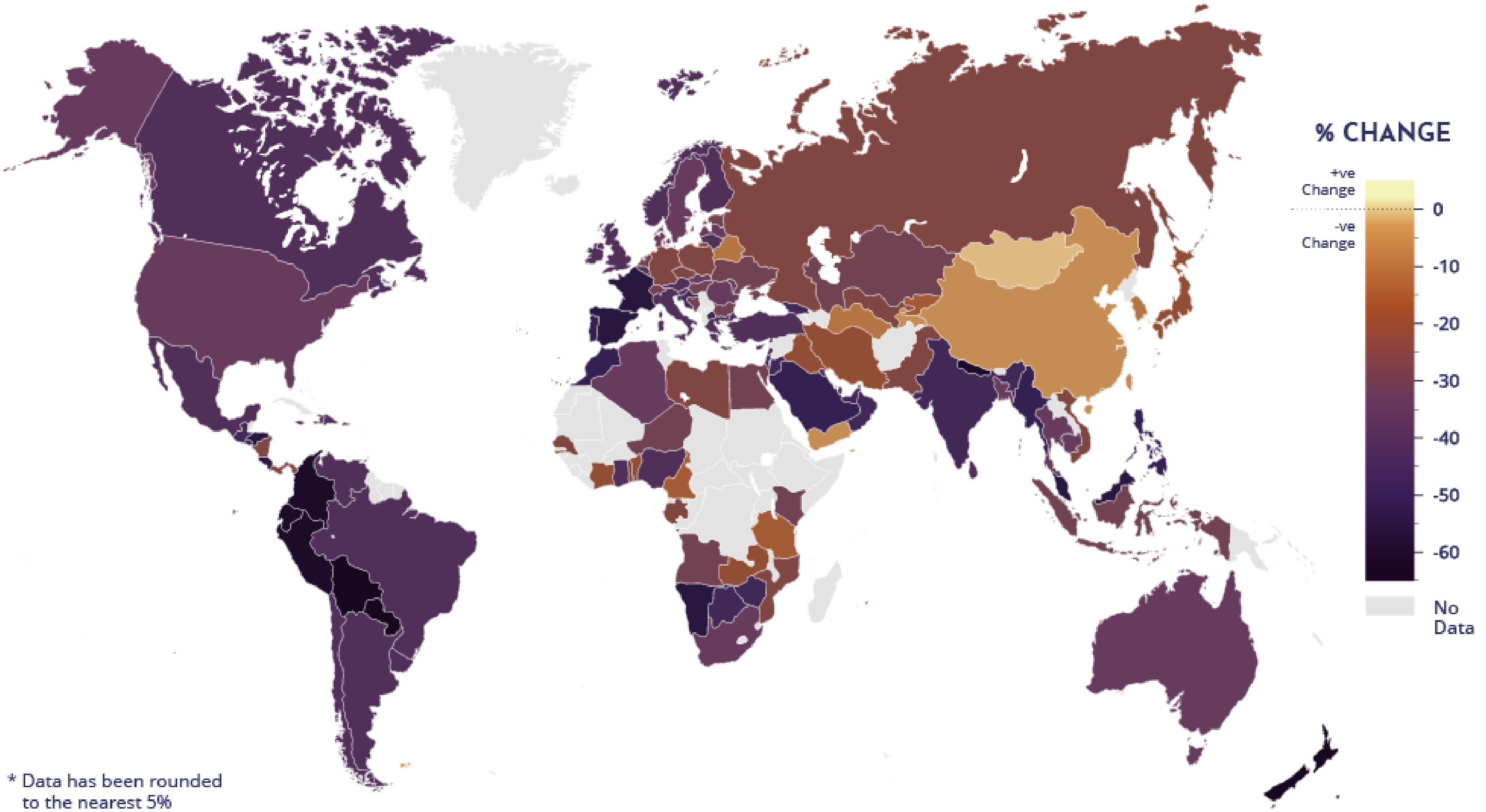
February 2020 (high-end estimate)



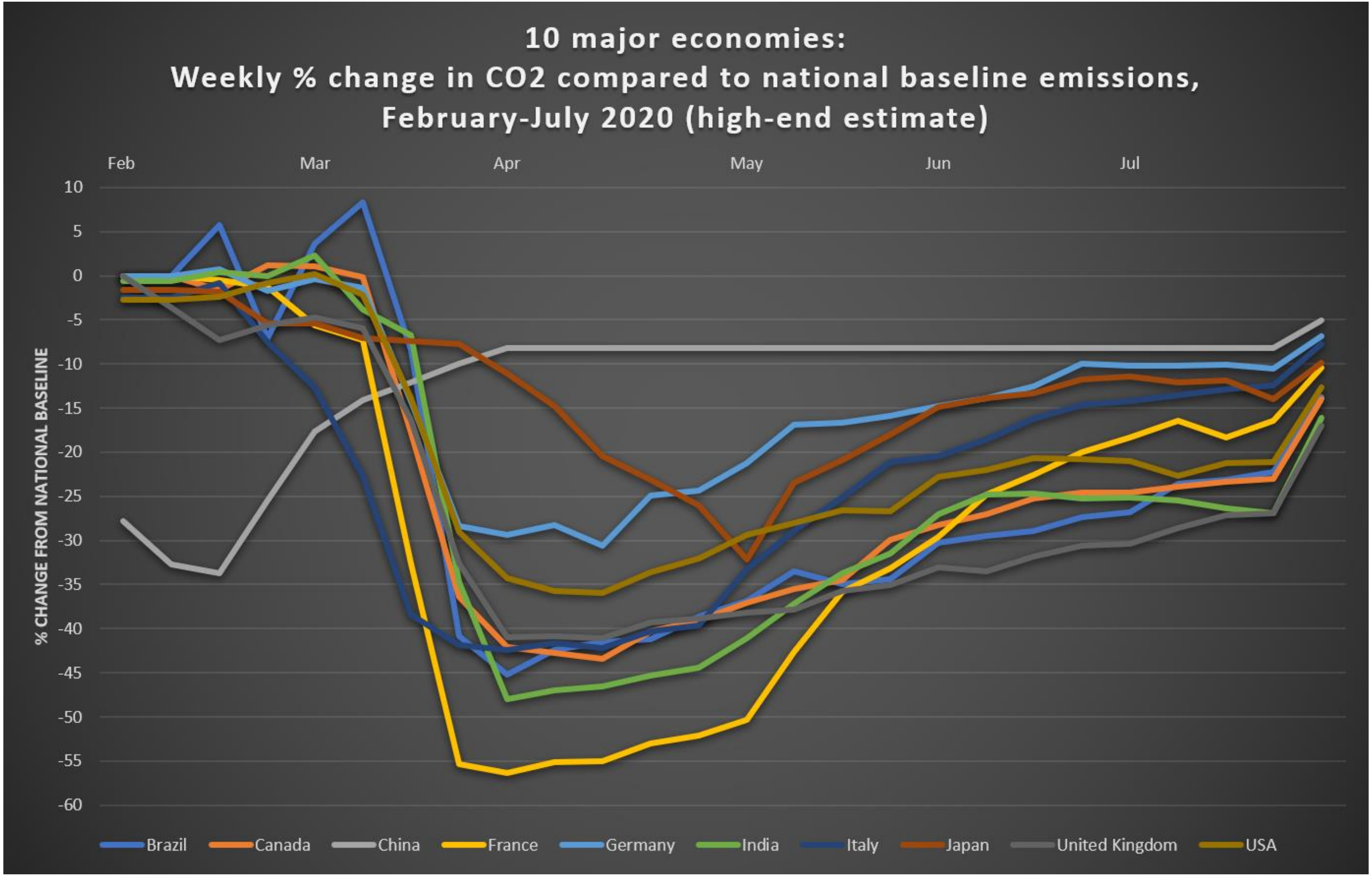
* Data has been rounded to the nearest 5%

MEAN DAILY % CHANGE FROM NATIONAL CO2 EMISSIONS BASELINE

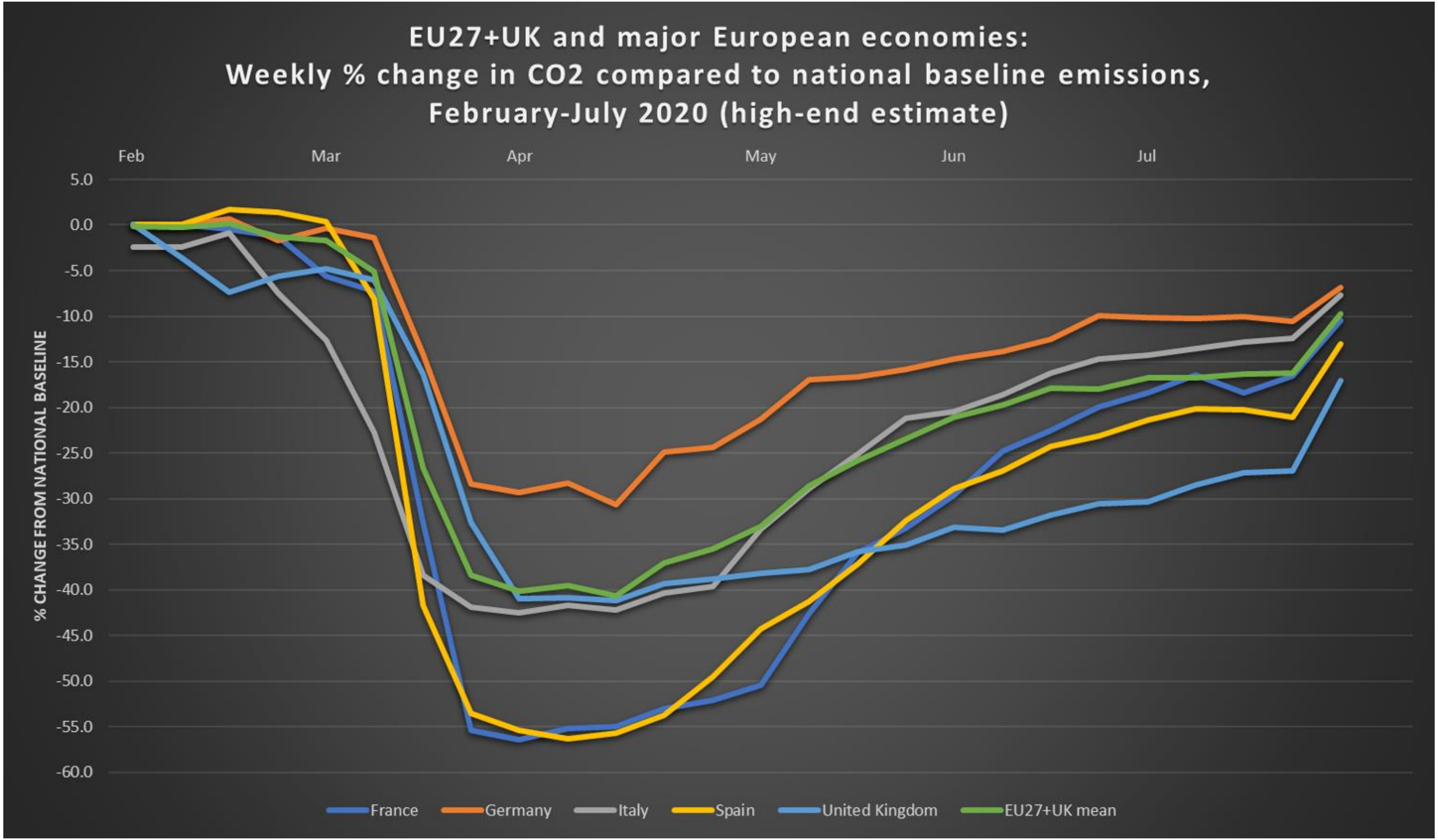
April 2020 (high-end estimate)

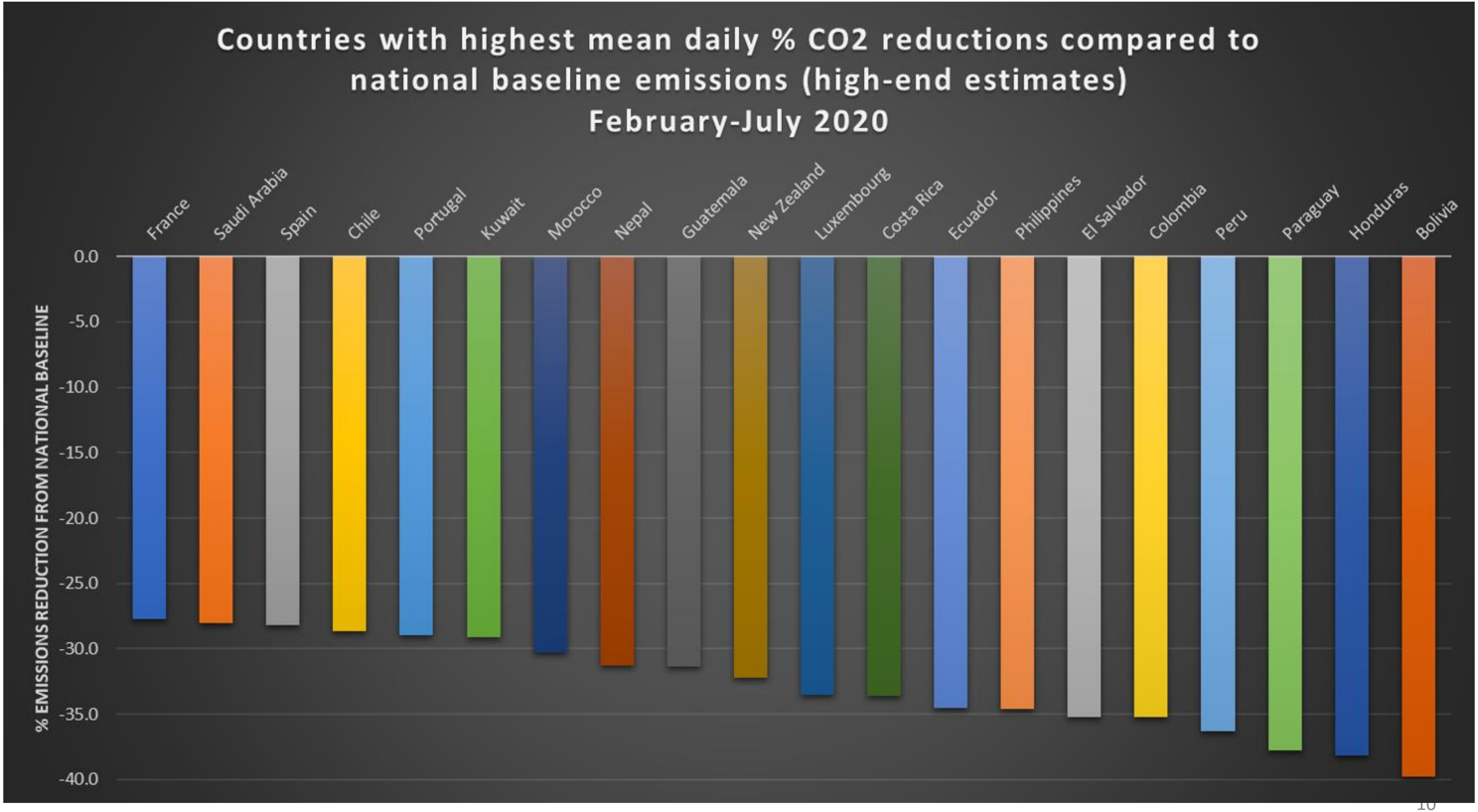


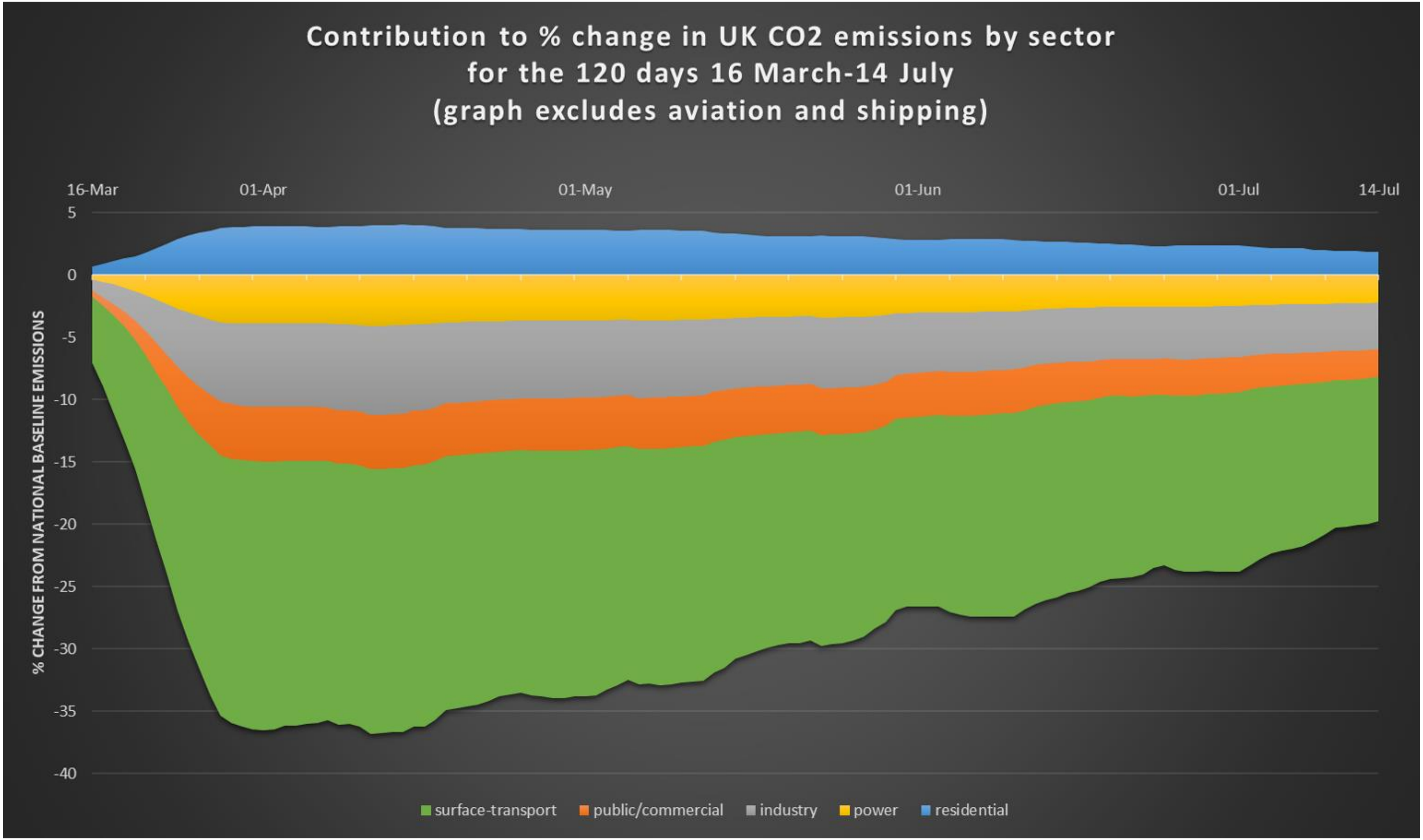
* Data has been rounded
to the nearest 5%



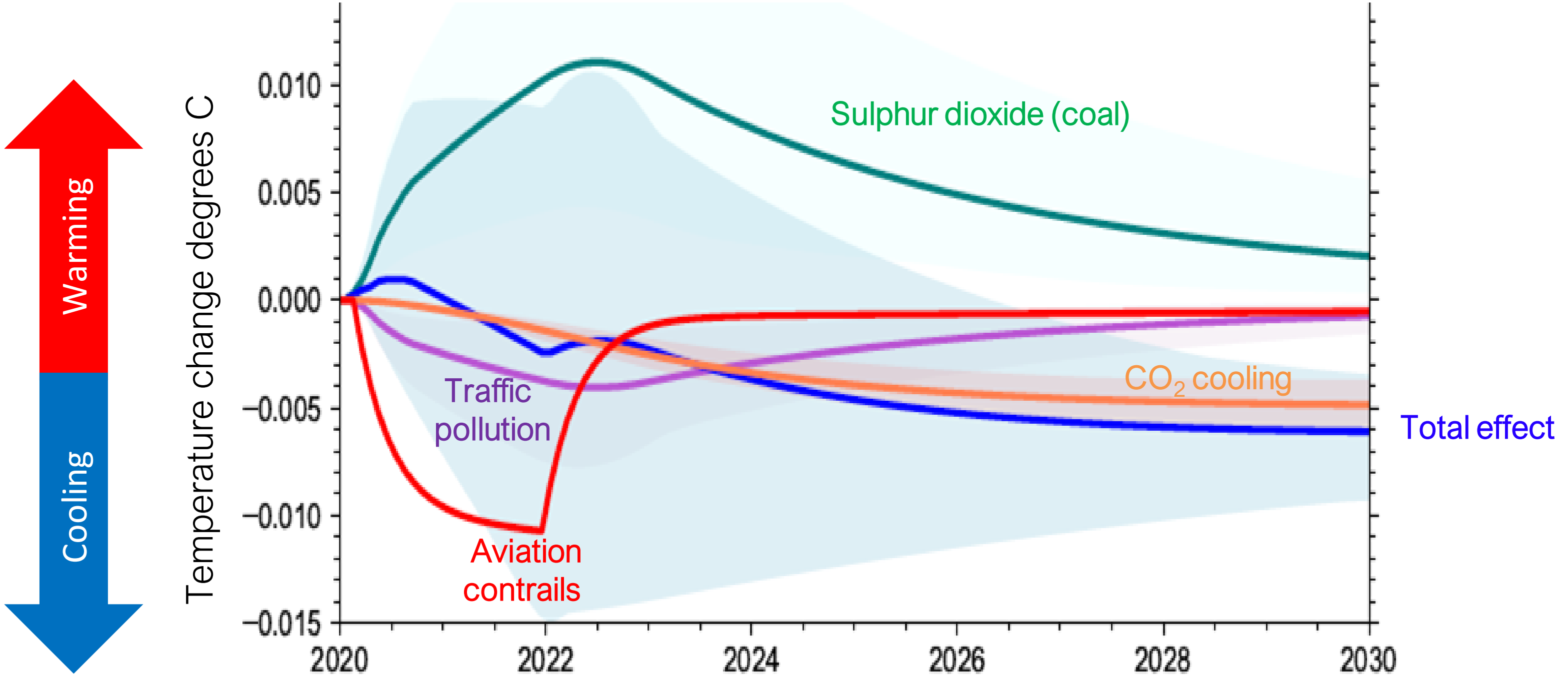
10 major economies:
Weekly % change in CO2 compared to national baseline emissions, February-July 2020 (high-end estimate)
Feb
Mar
Apr
May
Jun
Jul
% CHANGE FROM NATIONAL BASELINE
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
Brazil
Canada
China
France
Germany
India
Italy
Japan
United Kingdom
USA


EU27+UK and major European economies:
Weekly % change in CO2 compared to national baseline emissions,
February-July 2020 (high-end estimate)
Feb
Mar
Apr
May
Jun
Jul
5.0
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
-55.0
-60.0
% CHANGE FROM NATIONAL BASELINE
France
Germany
Italy
Spain
United Kingdom
EU27+UK mean

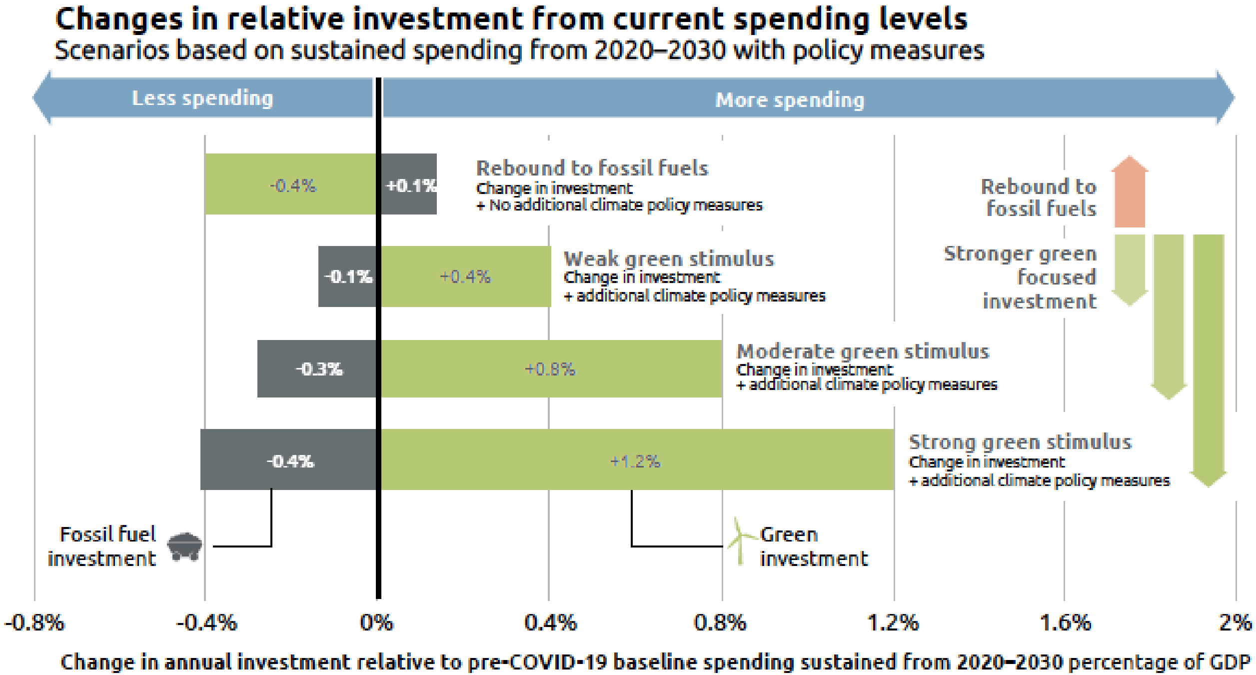

Countries with highest mean daily % CO2 reductions compared to national baseline emissions (high-end estimates)
February-July 2020
% EMISSIONS REDUCTION FROM NATIONAL BASELINE
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
France
Saudi Arabia
Spain
Chile
Portugal
Kuwait
Morocco
Nepal
Guatemala
New Zealand
Luxembourg
Costa Rica
Ecuador
Philippines
El Salvador
Colombia
Peru
Paraguay
Honduras
Bolivia


Contribution to % change in UK CO2 emissions by sector
for the 120 days 16 March-14 July
(graph excludes aviation and shipping)
16-Mar
01-Apr
01-May
01-Jun
01-Jul
14-Jul
5
0
-5
-10
-15
-20
-25
-30
-35
-40
% CHANGE FROM NATIONAL BASELINE EMISSIONS
surface-transport
public/commercial
industry
power
residential

Short-term change in emissions created a small long-term cooling effect by 2030 (less than 100th of a degree)



We explored possible future pathways with some simple economic modelling from Climate Action Tracker

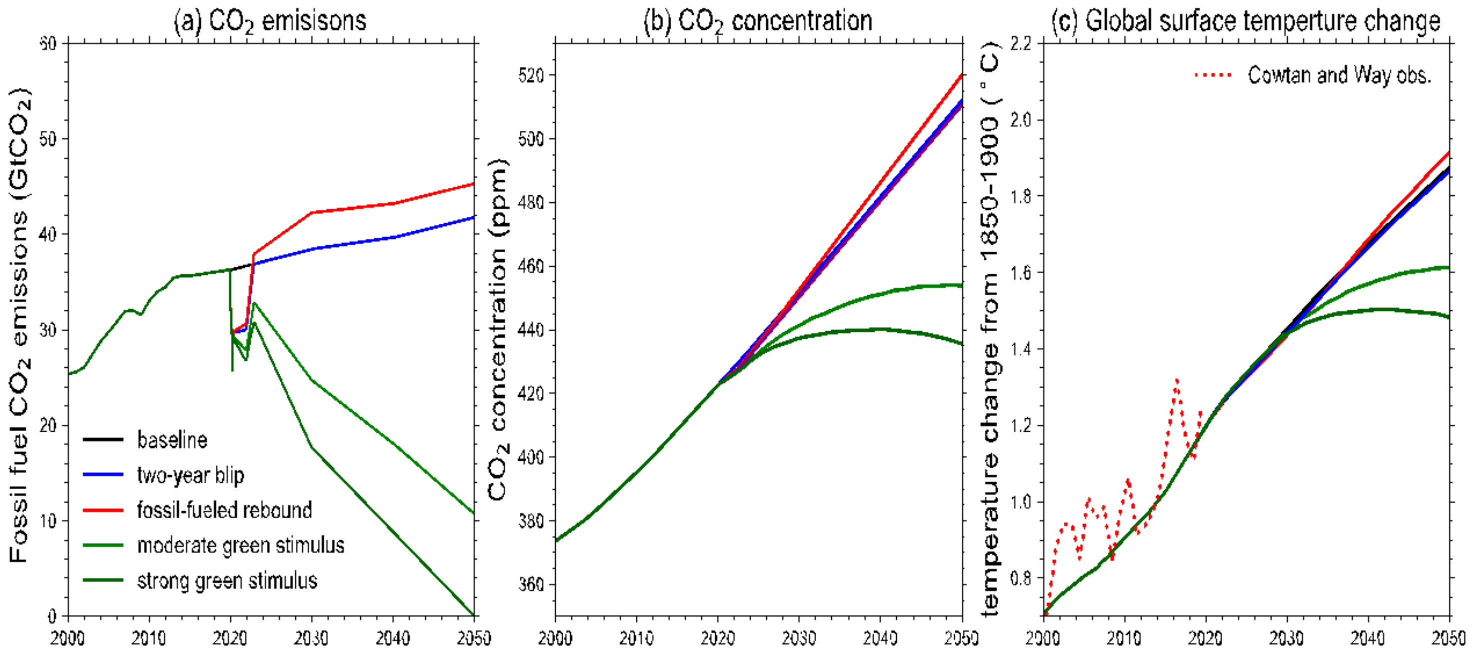


Strong green stimulus = 1.2% GDP spending on green policies plus limiting investment in fossil fuels

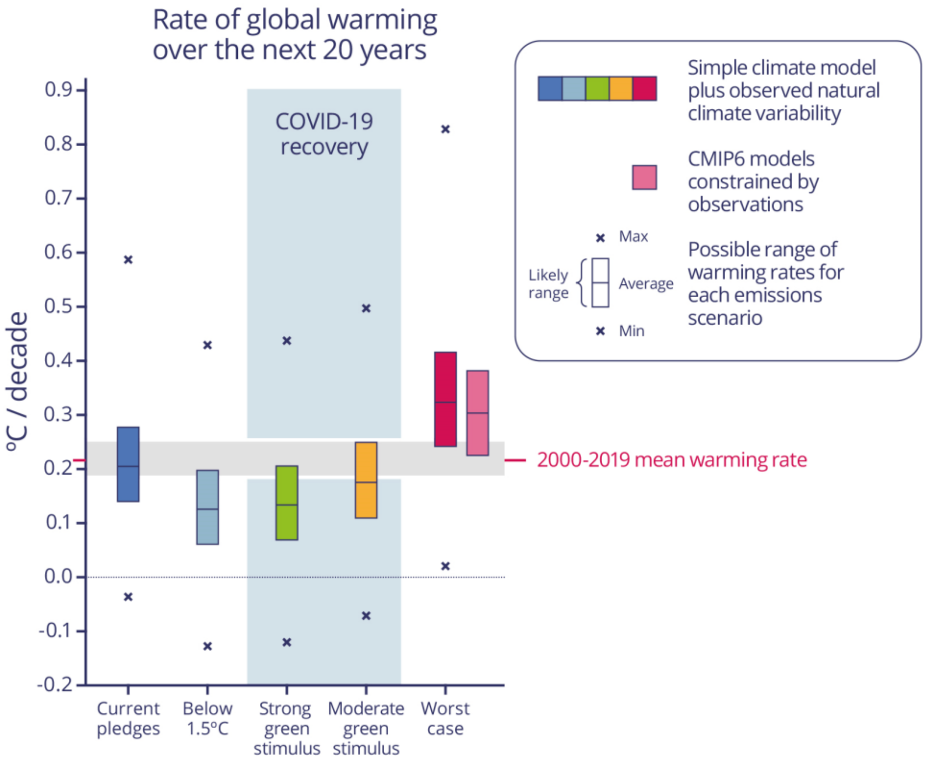
Figure 3: Stylised scenarios for post COVID-19 investment structures that can be initiated by a climate-focused recovery from COVID-19.

https://climateactiontracker.org/publications/addressing-the-climate-and-post-covid-19-economic-crises/

How we recover could have a real effect by 2050 and potentially keep us on track to meet the Paris Long-Term Temperature Goal

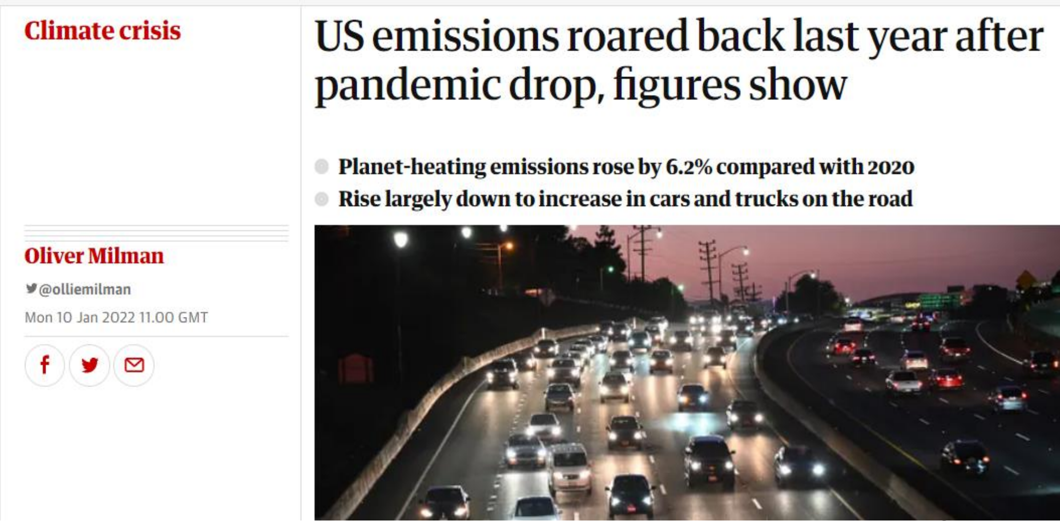


A strong green economic recovery could also cut the rate of warming by up to half in coming decades, giving us vital time and space to adapt



Urgent and targeted investment could really change the direction of travel. But…

UNEP Emissions Gap Report


Climate crisis

US emissions roared back last year after pandemic drop, figures show

- Planet-heating emissions rose by 6.2% compared with 2020
- Rise largely down to increase in cars and trucks on the road

Oliver Milman
@olliemilman
Mon 10 Jan 2022 11.00 GMT

Guardian 10.01.2022

CONSTRAIN

CONSTRAINING UNCERTAINTY OF MULTI-DECADAL CLIMATE PROJECTIONS

www.constrain-eu.org

@constrain_eu

CONSTRAIN EU

Kimon Keramidas, JRC and Université Grenoble Alps

The European Commission's science and knowledge service

Joint Research Centre

European Commission

Integrating short-term and long-term effects of the pandemic into the energy system modelling for the Global Energy and Climate Outlook

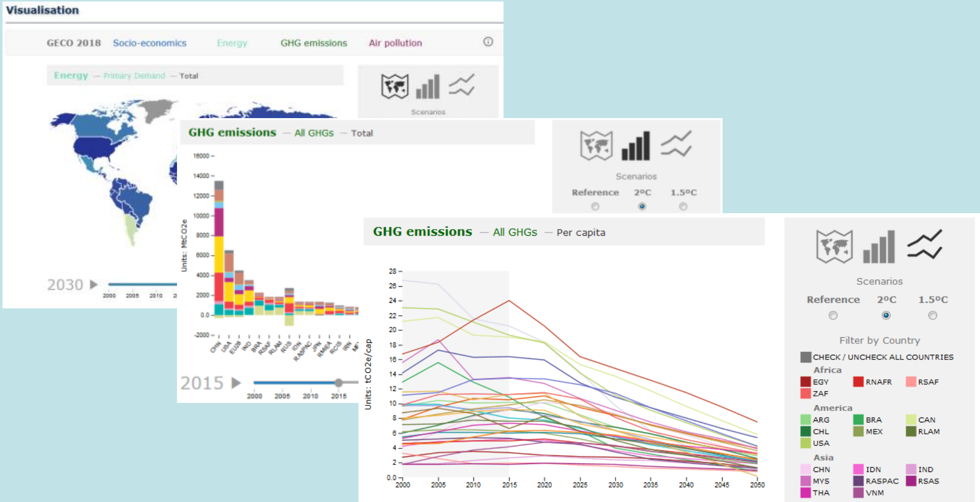
Kimon Keramidas, JRC.C.6 / Université Grenoble-Alpes

Online workshop - Seville, 03/02/2022

European Commission

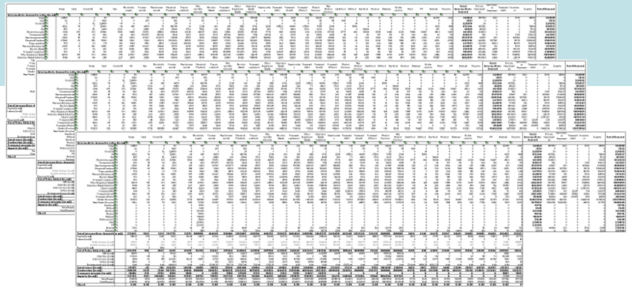
Global Energy and Climate Outlooks (GECO)

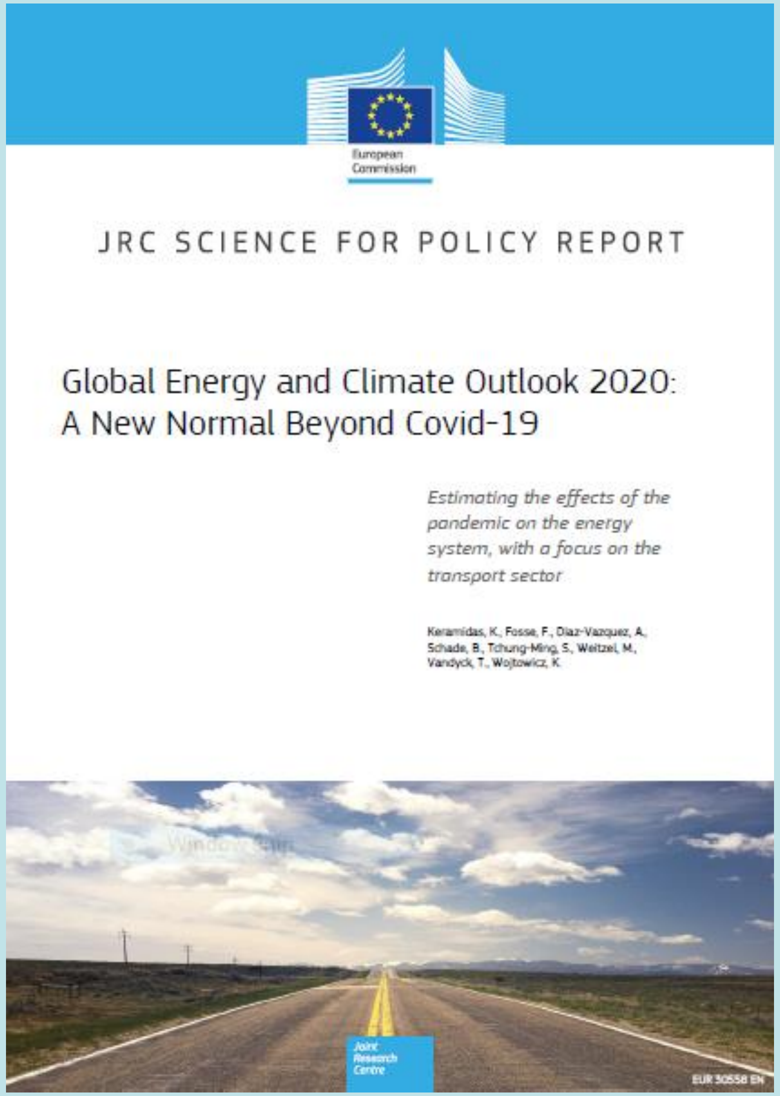
Scenarios of global energy-climate-economy futures



- POLES-JRC & JRC-GEM-E3
- Publication of country-level Energy & GHG balances + Macroeconomic Baseline
- Work used in EU long-term strategy, 2030 target impact assessment

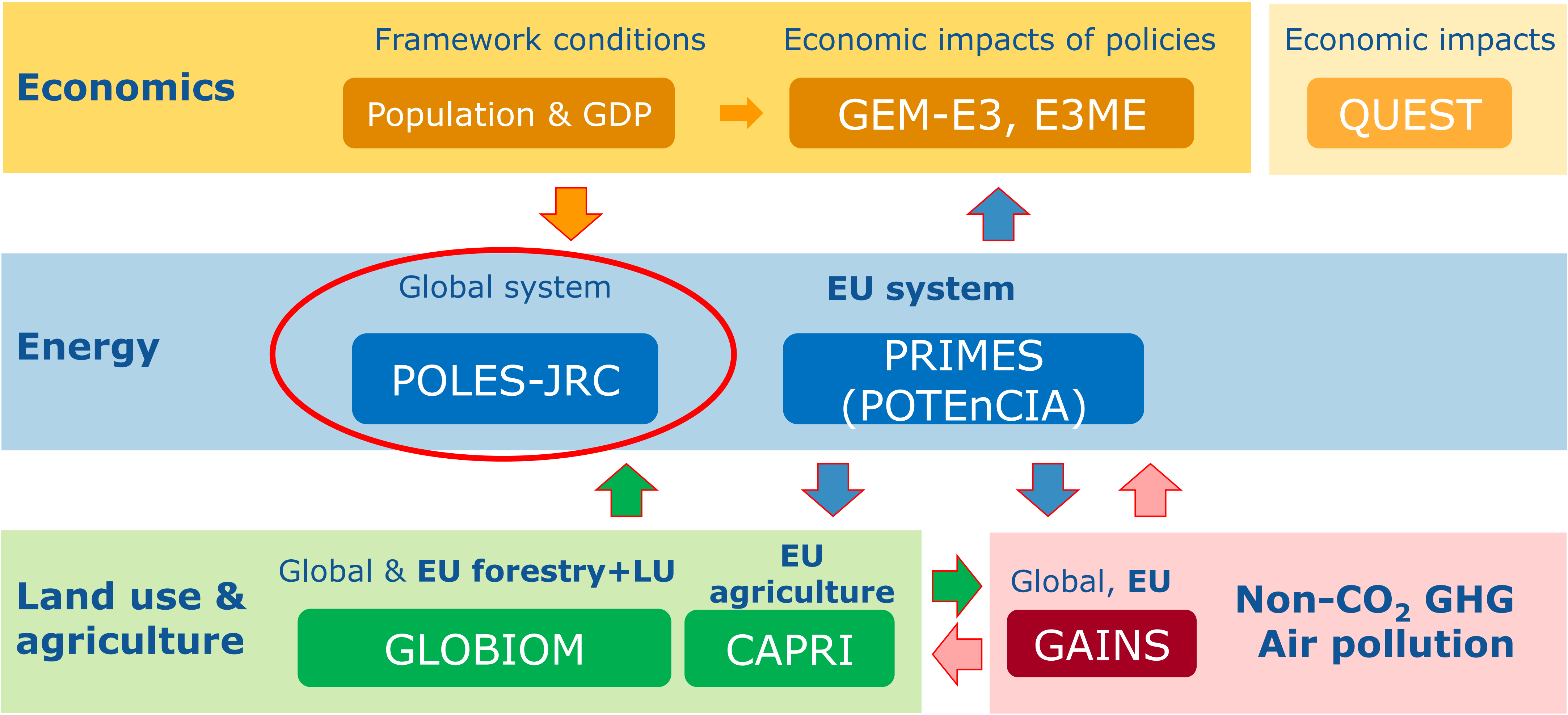
Taking into account the effect of Covid-19: GECO 2020 (continued in GECO 2021)





European Commission

Modelling toolbox in EU energy-climate policymaking



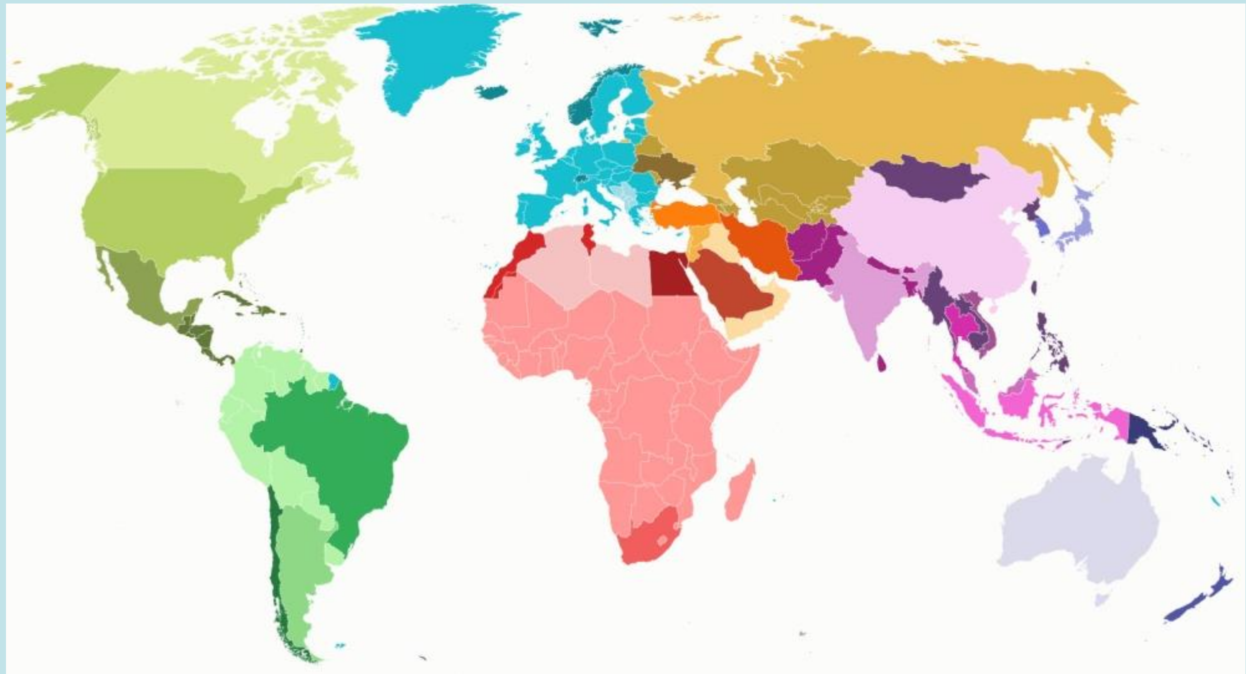
POLES-JRC: Prospective Outlook on Long-term Energy Systems

Simulating the evolution of the world energy system

- Annual steps until 2050-2100
- EU + 39 countries / regions (OECD, G20)

Output

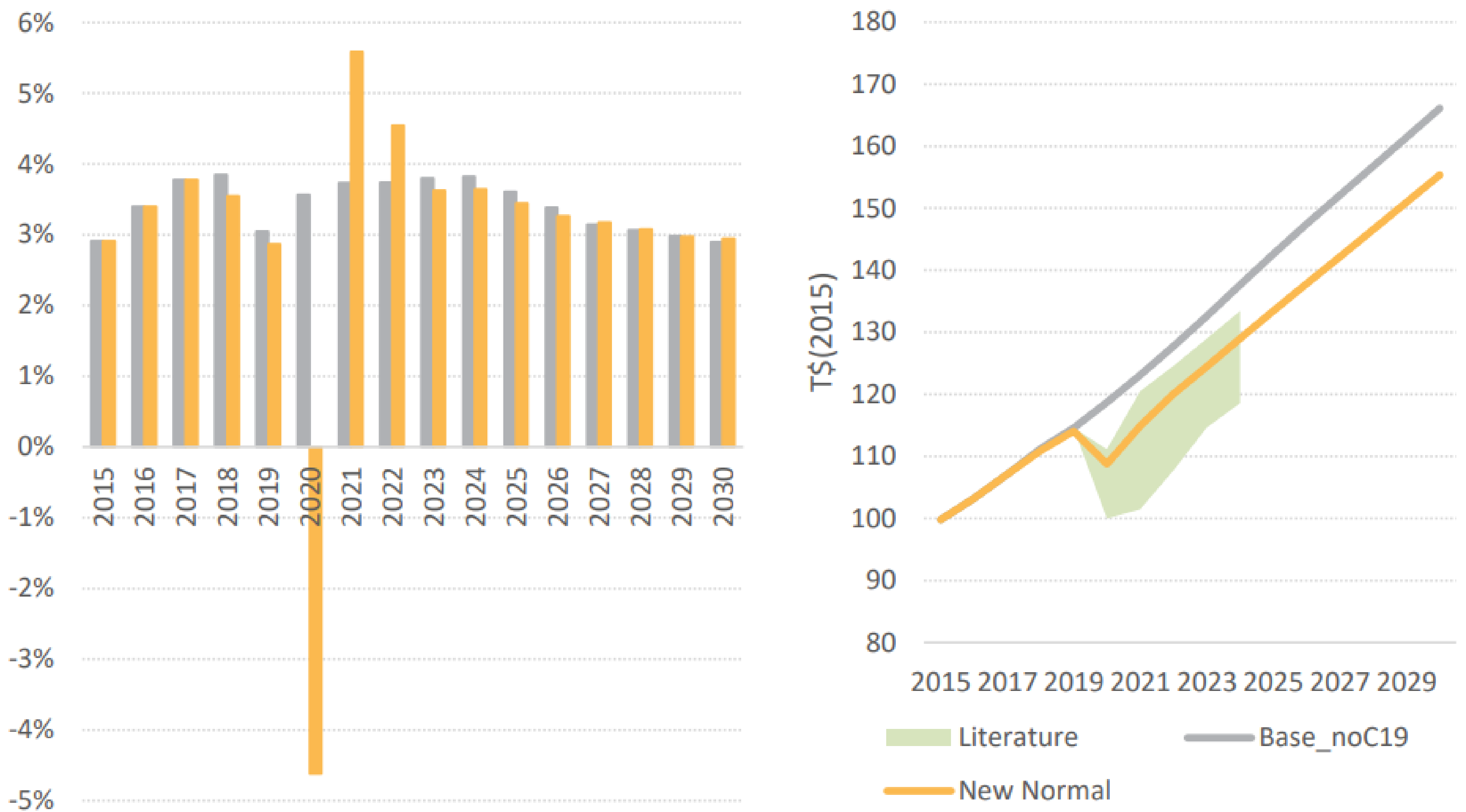
- International energy prices & trade
- All energy sources and vectors
- All GHG emissions (linkage with specialist tools for non-energy)



Resources & production → Trade → Transformation → Consumption → GHGs & other externalities

Creating a post-Covid-19 "New Normal"
1. Adapting macroeconomic parameters

Global GDP



Source: derived from IMF, OECD, DG ECFIN

Projected loss of global GDP: -6.3% in 2030

Uncertainties – even more than usual!

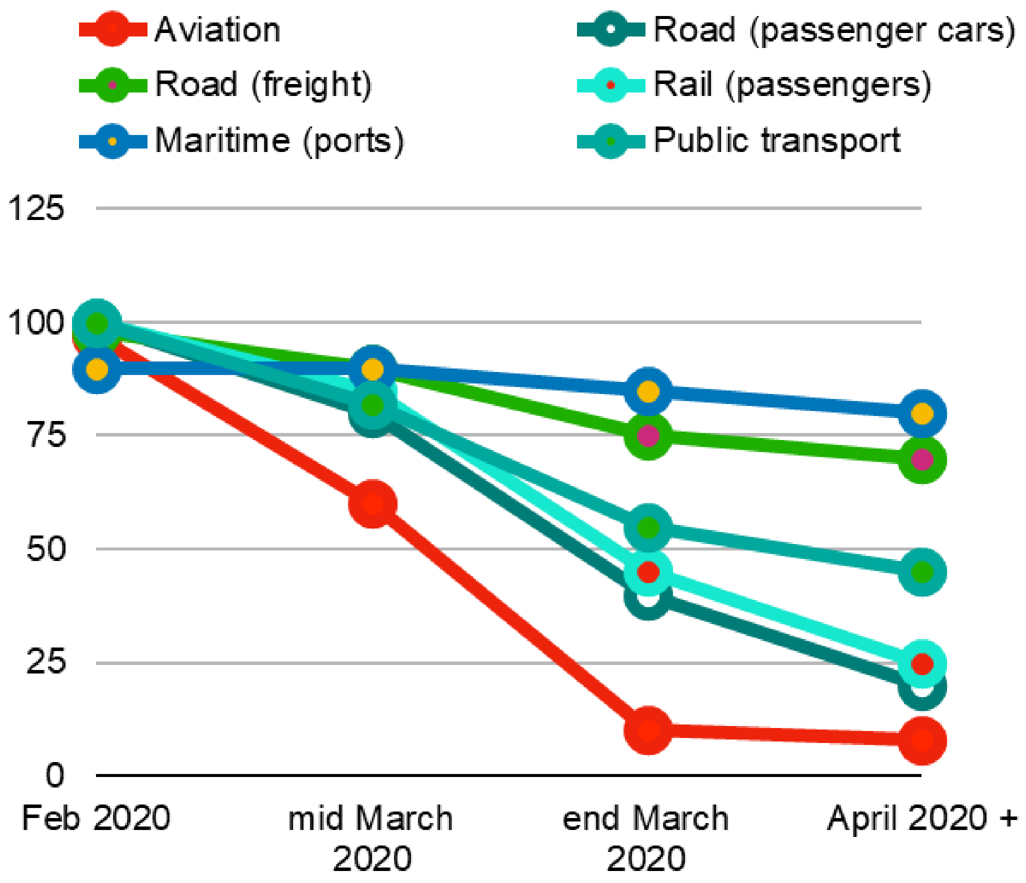
European Commission

Creating a post-Covid-19 “New Normal”
2. Estimating immediate changes in transport

Pandemic did not hit all sectors of the economy uniformly: particular focus on transport

Activity per transport mode adjusted:
- OECD ITF, Google, Apple land traffic data
- IATA aviation traffic data
- OECF ITF maritime traffic data
- Enerdata energy data for land transport
- IEA energy data per fuel

From regions to all worlds countries:
- Energy/GDP elasticity, Emissions/GDP elasticity
- Lockdown effect on traffic vs GDP

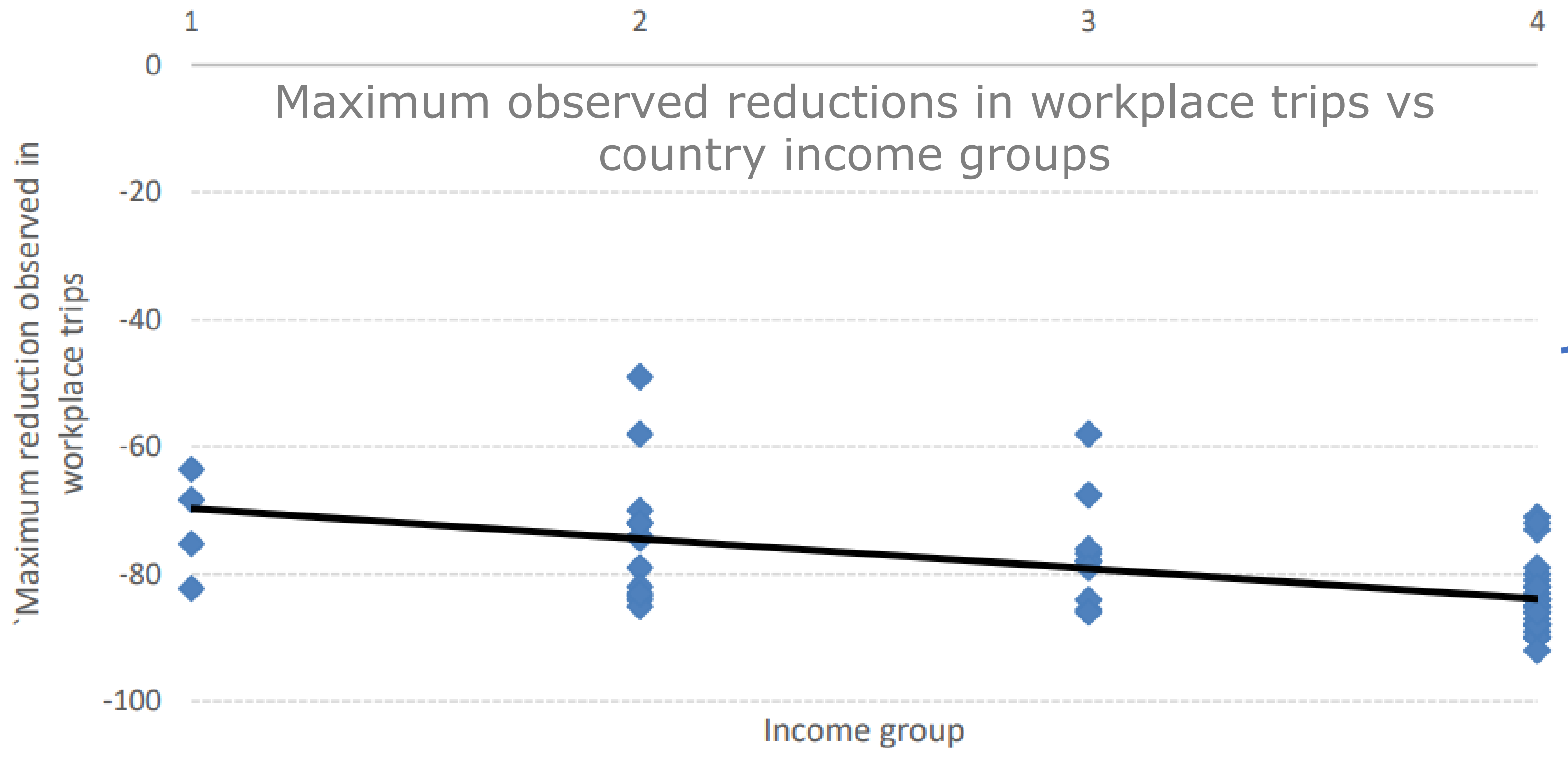


Source: JRC based on EUROCONTROL, Google, Apple

Creating a post-Covid-19 "New Normal"
3. Estimating lasting changes in transport

Observed mobility during pandemic: short-term trend (?)

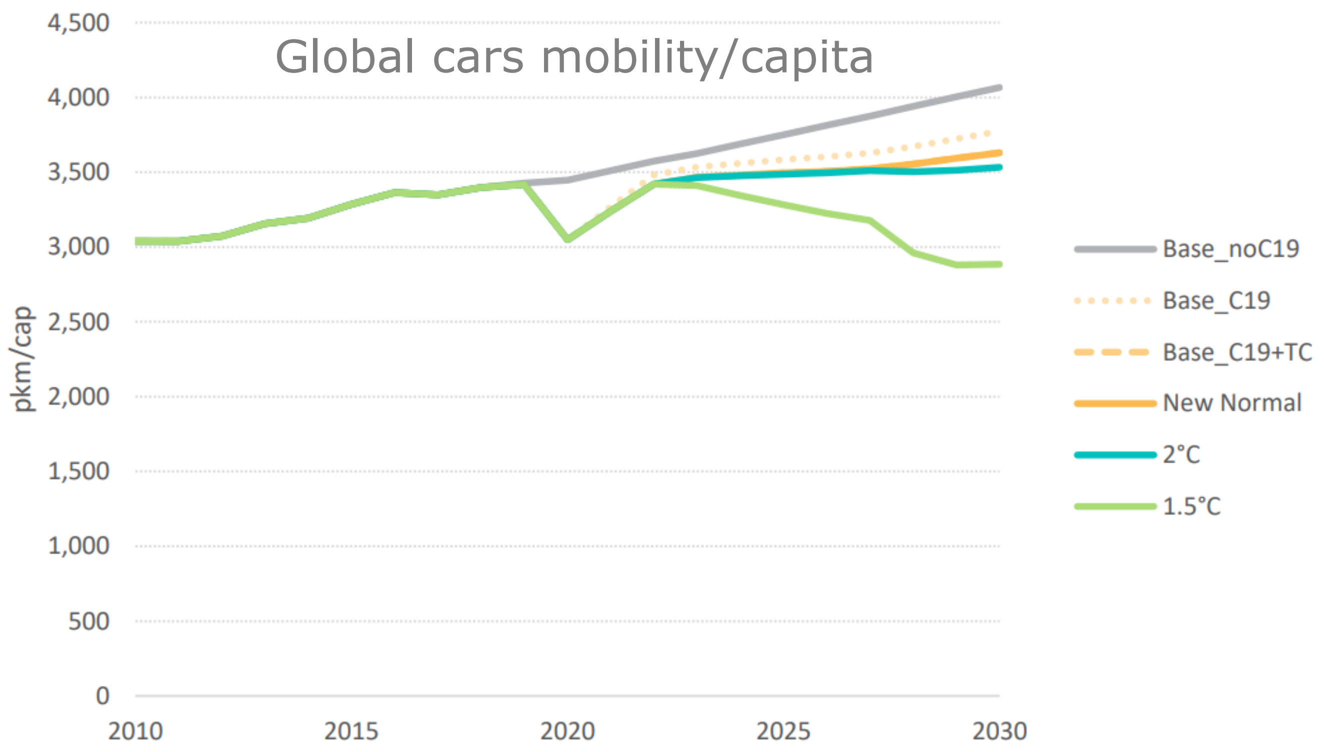
- **Digitalization trend**: impact on teleworking & videoconferencing
- **Mobility as a service trend**: impact on car ownership
- **Urban organization**: more soft modes & public transport
- **Lifestyle choices**: shorter distance travelling?



Source: GECO 2020 based on Google

Pandemic: transient changes vs accelerator?
Country differentiation: methodology?

→ Up to 11% loss of private cars mobility in 2030
→ Up to 21% loss in aviation mobility in 2030



Source: GECO 2020

European Commission

Creating a post-Covid-19 "New Normal"
4. Policies to drive the recovery: how "green"?

Unprecedented public monies advanced to help economic recovery ($12 trillion by 20 September 2020) – **but only 1% explicitly "green"/low-carbon**

2020: resilient investment in renewables (90% of power investments)

Announcements that could snowball into global policy norms

- Phase-out inefficient coal power
- Phase-out ICE road vehicles, assist EVs & FCVs deployment & infrastructure
- Assist green hydrogen production
- Energy/carbon taxation of international transport
- Long-term net-zero emissions commitments

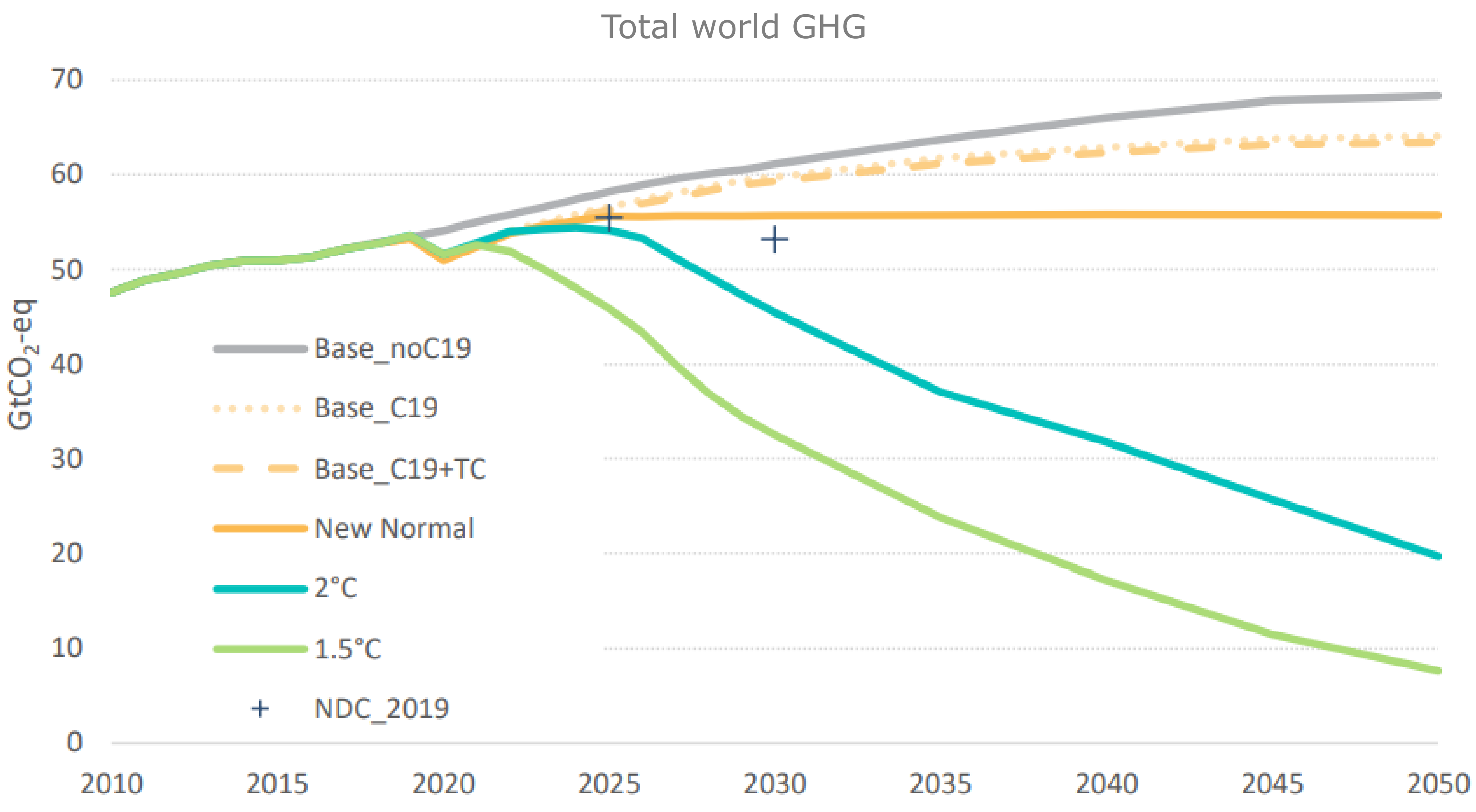
Perception of inertia: our expectations of fossil-fuelled BAU are out of date?

vs

Anticipating a disruption: information collection biased towards a low-carbon future?

European Commission

Creating a post-Covid-19 "New Normal" Emissions projections (1)



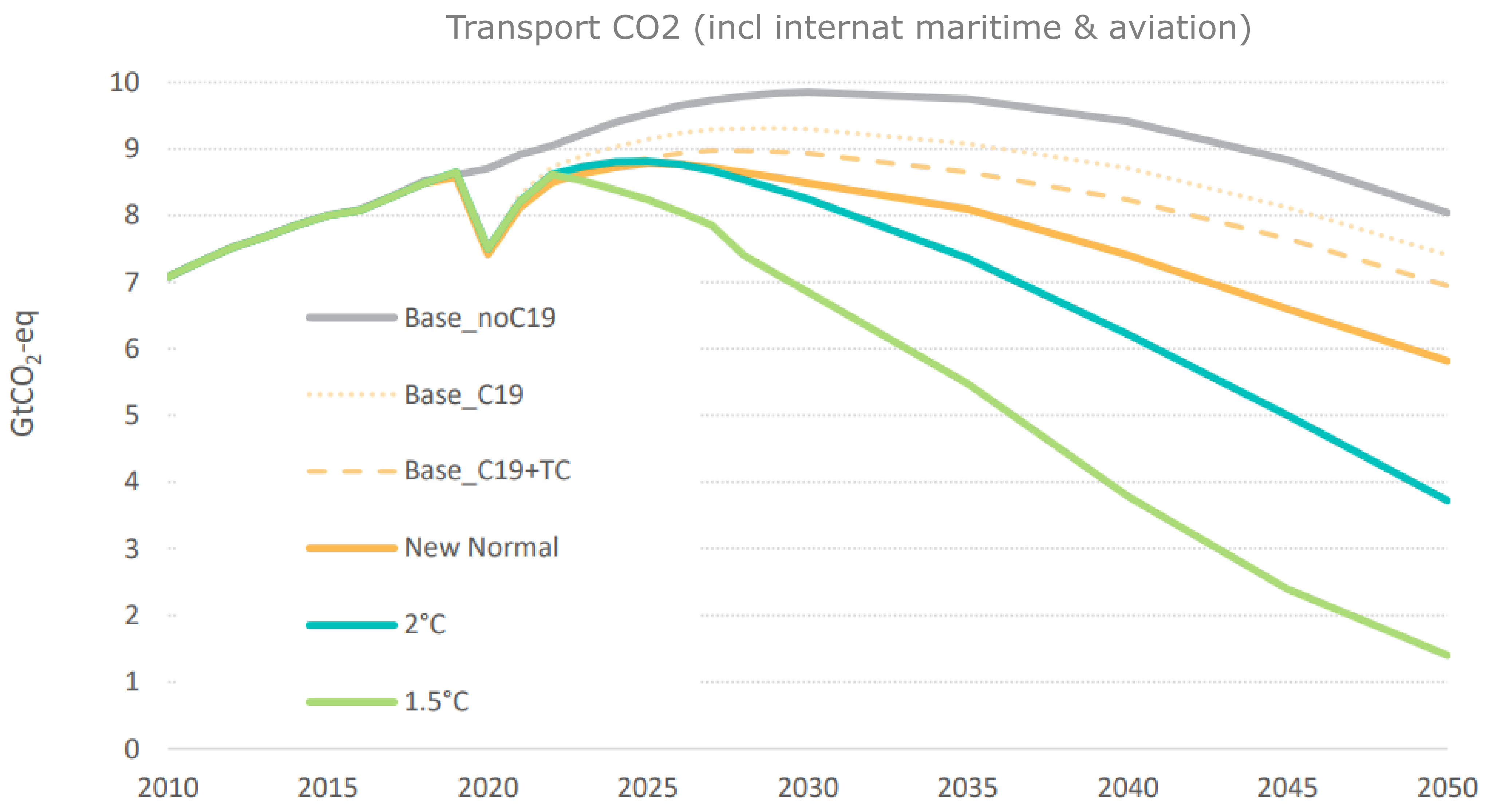
Source: GECO 2020

2030 emissions: [2-9]% lower vs pre-Covid Baseline, even taking into account decelerated investment & demand rebound

Covid gets world close(r) to NDC emissions globally

Additional policies needed to usher absolute peak in emissions

Creating a post-Covid-19 "New Normal" Emissions projections (2)

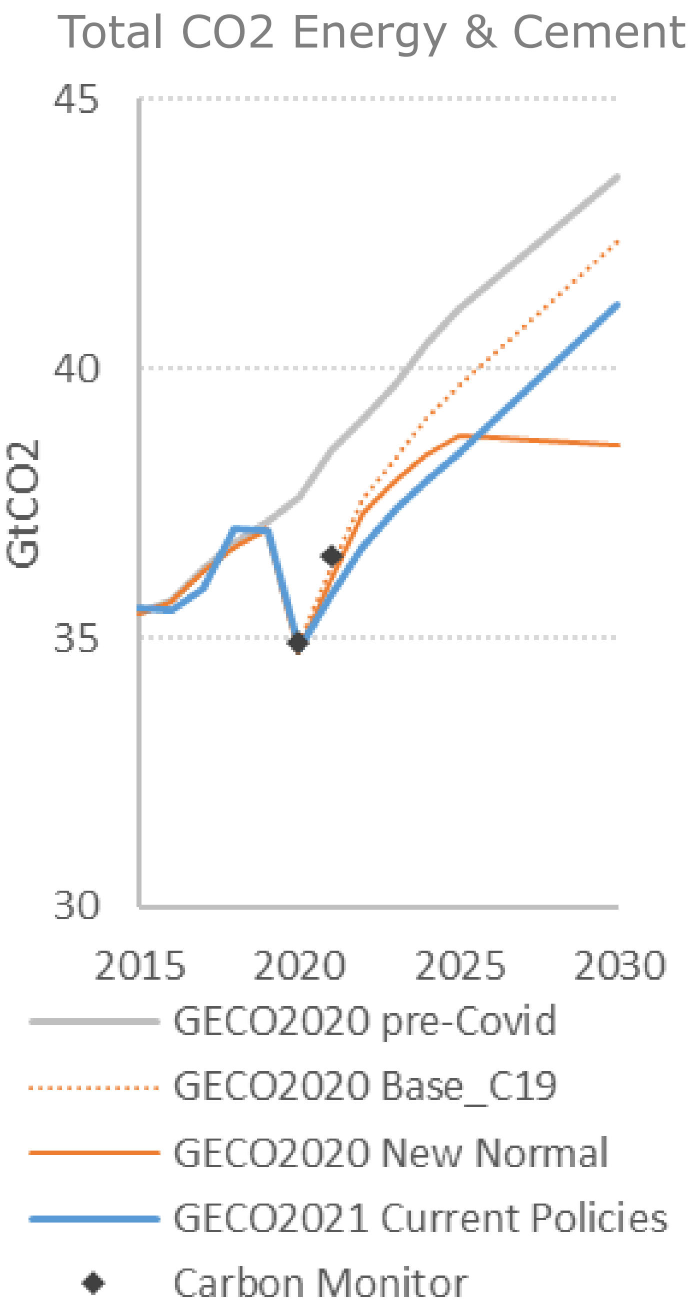


Source: GECO 2020

2030 emissions: [6-14]% lower vs pre-Covid Baseline

Transport sector severely impacted – perhaps even past peak

GECO 2021: living with the pandemic



GECO 2020 vs 2021 vs Carbon Monitor

		2019/20	2020/21	2030 vs pre-Covid
CO_2 Energy & Cement	GECO2020 CP	[-5.9,-6.2]%	[4.1,4.3]%	[-2.8,-11.5]%
	GECO2021 CP	**-6.0%**	**2.9%**	-5.5%
	Carbon Monitor	-5.7%	4.6%	
CO_2 Transport	GECO2020 CP	[-12.2,-13.5]%	[9.6,10.2]%	[-5.6,-13.9]%
	GECO2021 CP	**-12.7%**	**6.8%**	-10.8%
	Carbon Monitor	-15.7%	8.9%	

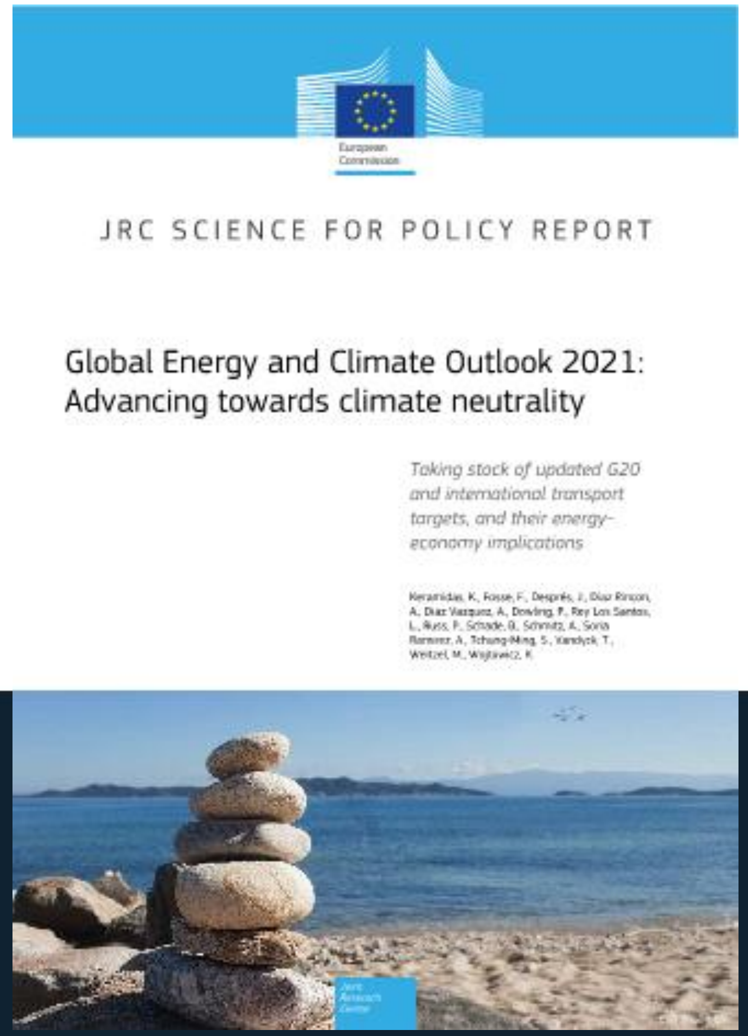
Exercise repeated for Current Policies scenario of GECO 2021 (published Dec-2021)

Annual data update (y-2) + estimation of most recent data (y-1, y) + estimation of recovery (y+3)

Recovery more fossil-fuelled than projected

European Commission

GECO 2021: Advancing towards climate neutrality



Jacques Després
Andrea Diaz Rincon
Ana Díaz Vazquez
Paul Dowling
Florian Fosse
Kimon Keramidas
Peter Russ
Burkhard Schade
Andreas Schmitz
Antonio Soria
Stéphane Tchung-Ming
Rafael Garaffa
Luis Rey Los Santos
Toon Vandyck
Matthias Weitzel
Krzysztof Wojtowicz

http://ec.europa.eu/jrc/geco

Silvia Pianta, European University Institute

Incorporating insights from social and political science into climate modelling

Silvia Pianta

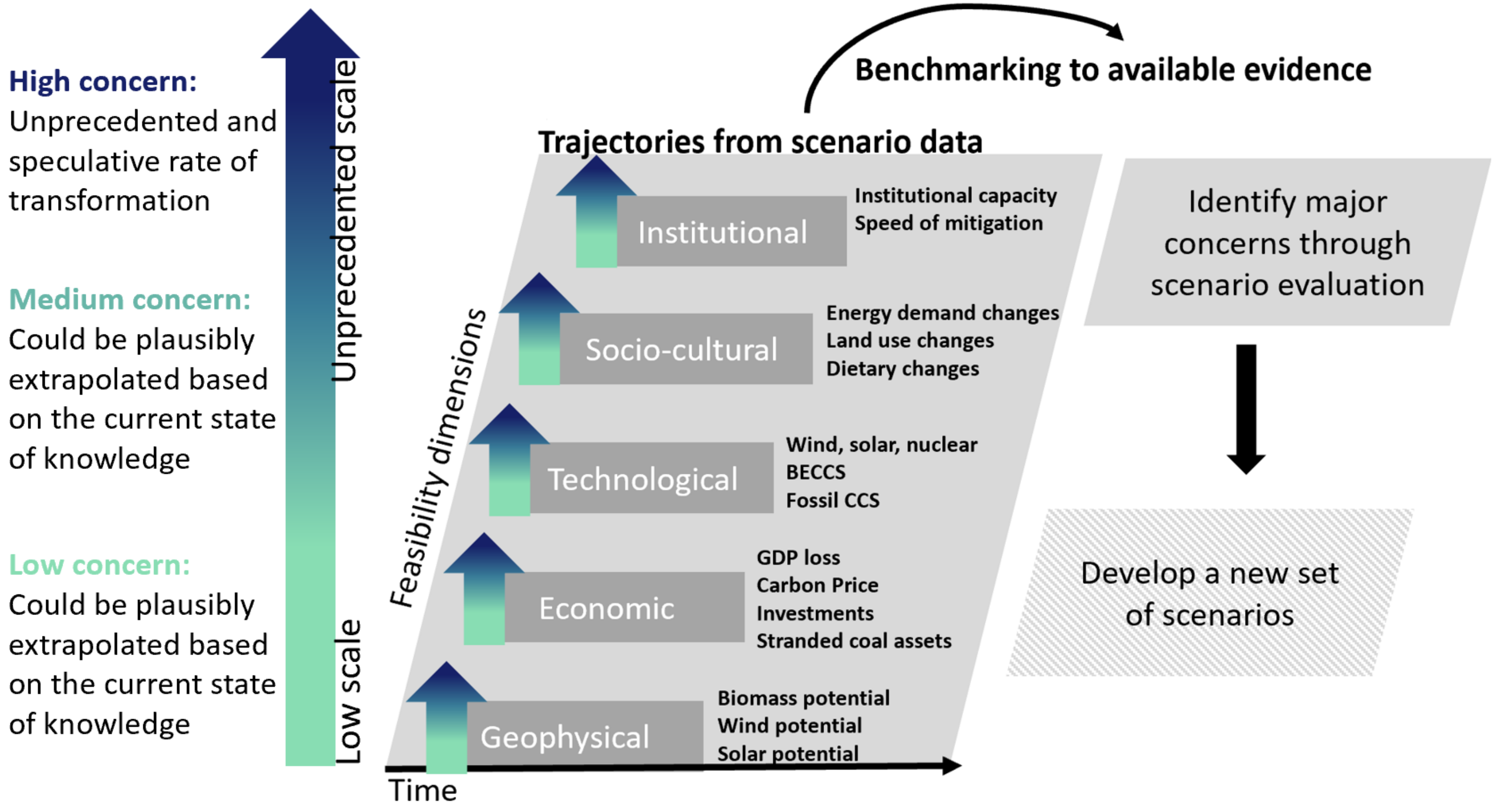
European University Institute
RFF-CMCC European Institute on Economics and the Environment

ENGAGE
FEASIBILITY OF CLIMATE PATHWAYS

Joint work with Elina Brutschin (IIASA) & other colleagues at CMCC & IIASA

Multidimensional feasibility of IAMs mitigation scenarios

- IPCC feasibility dimensions (IPCC 2018)
- Effort to benchmark IAMs scenarios to available empirical evidence
- To identify challenges and enablers of mitigation pathways
- Brutschin et al. 2021 *ERL*



Social and political feasibility of mitigation scenarios

- Social and political factors fundamentally shape the feasibility to implement climate policies consistent with the goal of the Paris Agreement

- Little incorporation into models so far (but see Peng 2021 & Shen 2021)

- Key political aspects shaping climate policy ambition

  - Institutional capacity → institutional enablers
  - Public opinion → socio-cultural enablers

IAMS narratives

- IAMs are very sophisticated in geophysical, economic and technological aspects
- Narrative examples: emissions converge in 2050 / carbon price levels / technology prices converging in 2050

- Social science can provide insights for more grounded narratives
- Based on empirical data
- Insights on under which conditions climate action is more or less likely

- Often this implies higher effort more feasible in developed countries

Public opinion & climate policy

- Robust relationship between public opinion and policy – political science literature on democratic representation (Burnstein 2003, Wleizen and Soroka 2012)

- Public opinion shapes parties' and politicians' incentives and has been shown to impact policy through the election of candidates reflecting citizen preferences or through officials' adaptation to public opinion.

- Public support for climate policies in democracies create important incentives for policymakers to implement ambitious climate action.

✓ **In democracies, the higher public support for climate policies the higher the likelihood of implementing ambitious climate policies.**

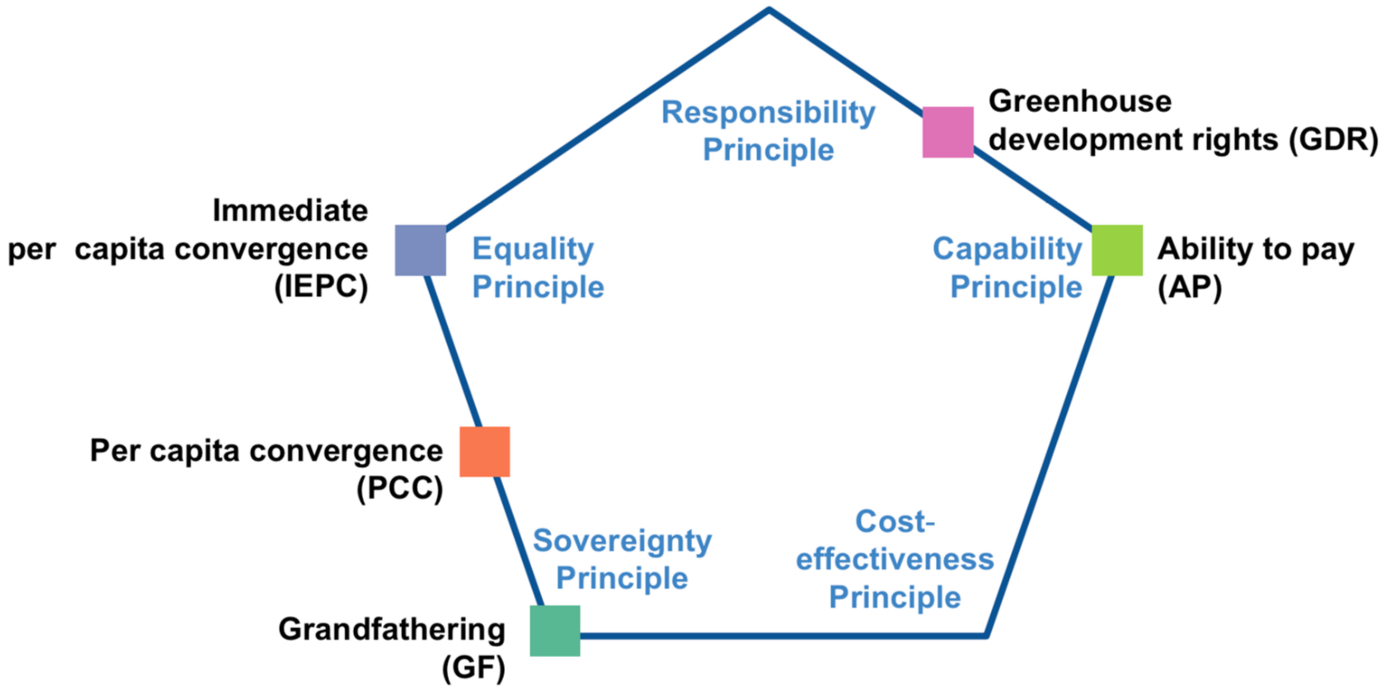
Survey data

- Public opinion data
  - Data on public support for climate action / climate policies
  - ✓ Challenges: Geographical coverage - few & expensive global surveys, original data collection with representative samples for many countries is challenging

- Surveys of elite populations
  - Experts – most often surveyed but possibly biased responses towards own research
  - Policy makers – difficult to get access, hard to access some country representatives
  - Stakeholders
  - ✓ Challenges: low response rate, low representativeness

Elite population survey – an example

- Survey eliciting preferences for different climate mitigation effort sharing mechanisms
- Population: Experts, policymakers, and stakeholders
- Survey data employed to inform IAMs scenarios where each region's mitigation effort reflects the preferred mechanism within thar region



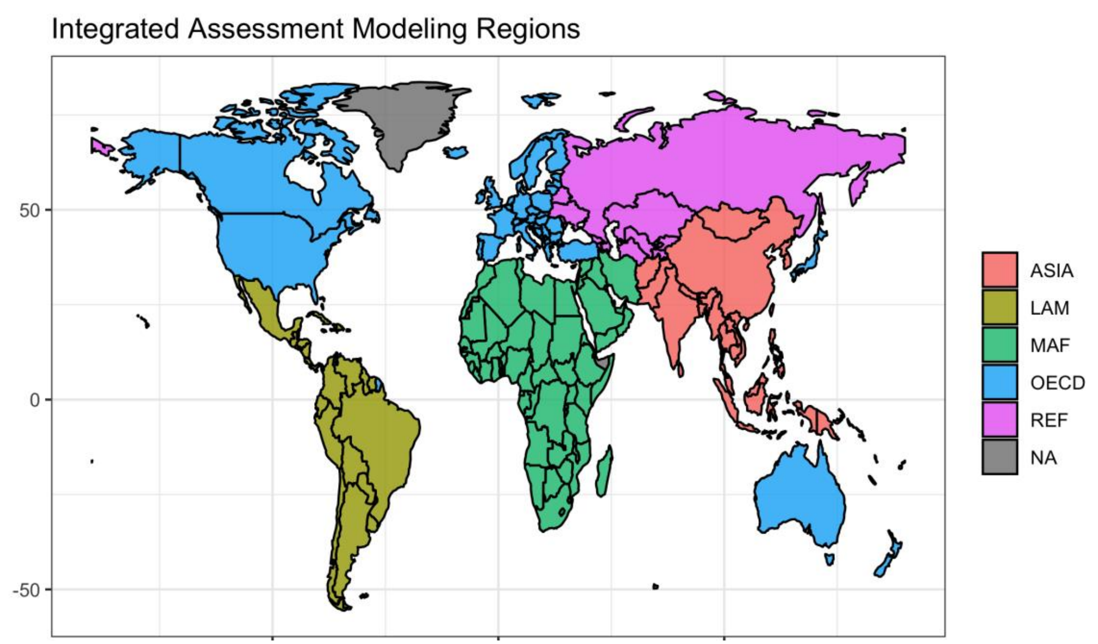
Public opinion data – an example

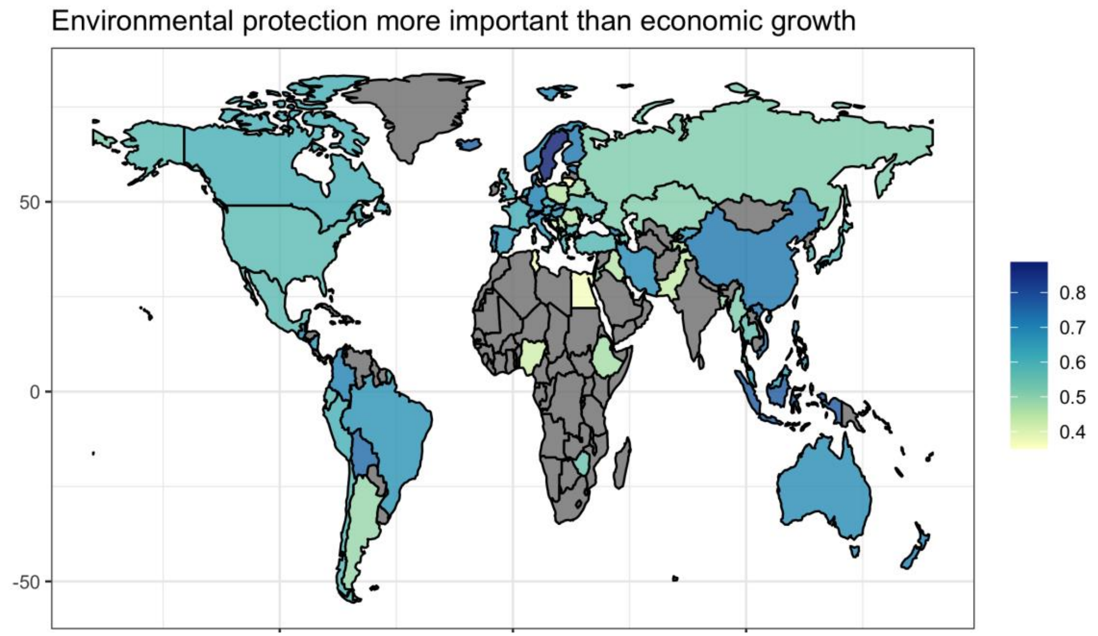
- Link survey data on environmental attitudes to output variables in models (e.g., emission reduction)

✓ Challenge: linking country-level surveys - global IAMs

✓ Need assumptions on link with survey variables

Public support for climate action	Maximum per capita emissions reduction in a decade
Low	20%
Medium	40%
High	70%





Conclusion & Next steps

- Value of interdisciplinary cross-fertilization
- Political and social science can provide important insights to increase resemblance of IAMs scenarios to real-world conditions

- Currently experimenting with exogenous constraints
- Possibly endogenization exercise in the future

Thank you!

References

- Brutschin, E., Pianta, S., Tavoni, M., Riahi, K., Bosetti, V., Marangoni, G., & van Ruijven, B. J. (2021). A multidimensional feasibility evaluation of low-carbon scenarios. Environmental Research Letters, 16(6), 064069.
- Pianta, S., Brutschin, E. (2022) Emissions lock-in, capacity, and public opinion: How social and political science can inform climate modelling efforts (In preparation)

Q&A

Climate change models & new data approaches resulting from the Covid-19 pandemic

Climate Change Modelling Information (CCMI) project

Thank you!

Fill in the survey for the next CCMI Quarterly report:
[EUSurvey - Survey (europa.eu)]

3 February 2022