Post-Paris Policy Analysis in REMIND

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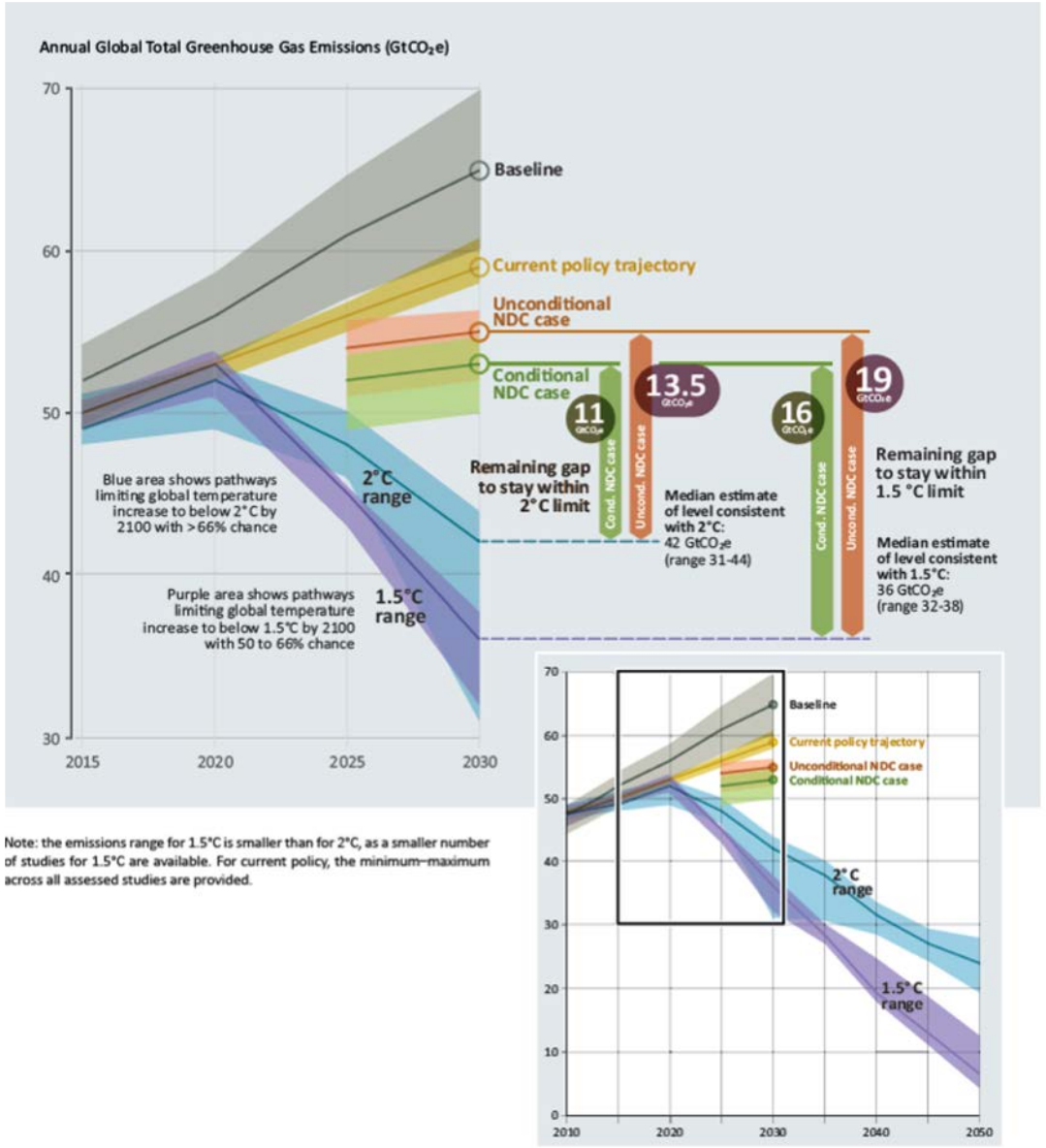
Background and Context

Paris Agreement

- Paris Agreement ratified in 2016. INDCs become NDCs. Climate action post-2020.
- Countries commit to submitting new NDCs every five years with increasing ambition.
- Countries, although not obliged, can submit their first mid-century strategies (MCS) by 2020.
- First Global Stocktake in 2023.

Emissions Gap

Current NDCs not in line with 1.5 or 2 C scenarios



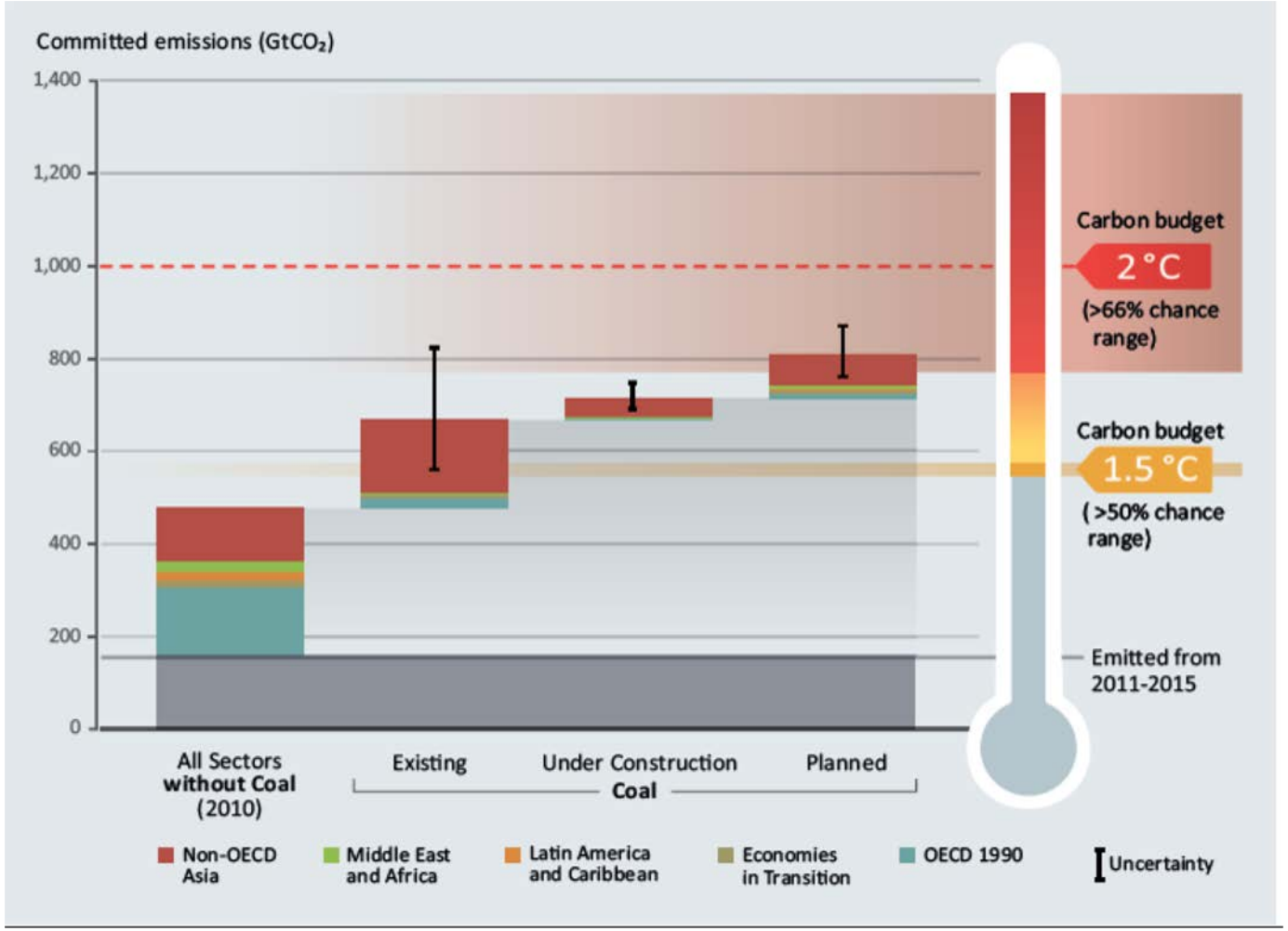
UNEP (2017). The Emissions Gap Report 2017. United Nations Environment Programme (UNEP), Nairobi

Sustainable Development Goals

- Replacement for Millennium Development Goals. Target year 2030.
- Climate action (SDG 13); various other SDGs directly connected to climate action (mitigation and adaptation).
- Mitigation policies have co-benefits and trade-offs with other SDGs.

Carbon Lock-ins

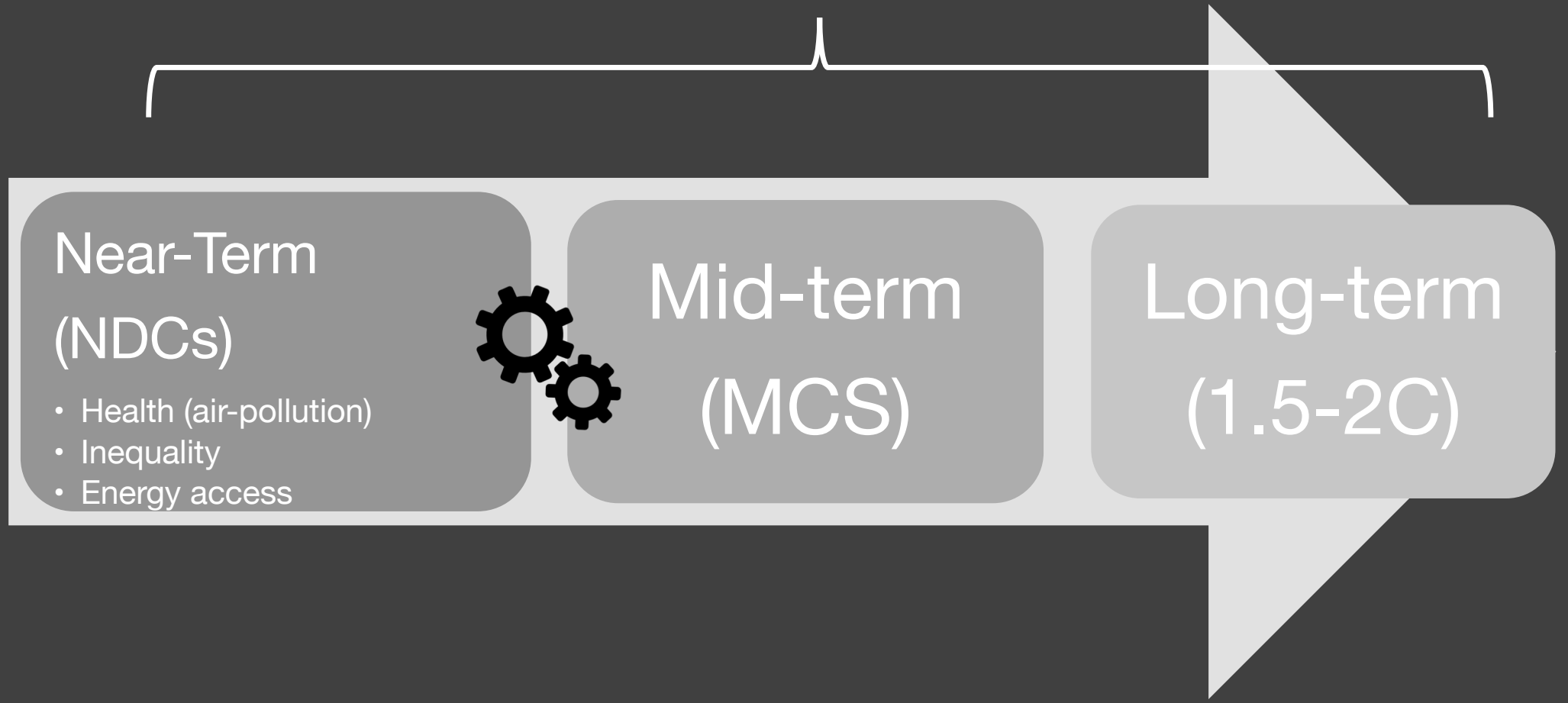
- Existing coal power could use up the 1.5 budget. Added to this, if under construction and planned plants are continued to their life time - 80% of budget for 2C used up.
- Ten countries make up approximately 85 % of the entire coal pipeline: China, India, Turkey, Indonesia, Vietnam, Japan, Egypt, Bangladesh, Pakistan and the Republic of Korea.
- Trade-offs with air pollution, other SDGs



UNEP (2017). The Emissions Gap Report 2017. Figure based on Edenhofer, O., et al. "Reports of coal's terminal decline may be exaggerated." Environmental Research Letters 13.2 (2018)

To sum up…

Carbon-budget/Planetary Boundaries



Research Questions

At a country-level, in which sectors can ambition be increased?

OR What are the bottle-necks for decarbonisation at a country-level?

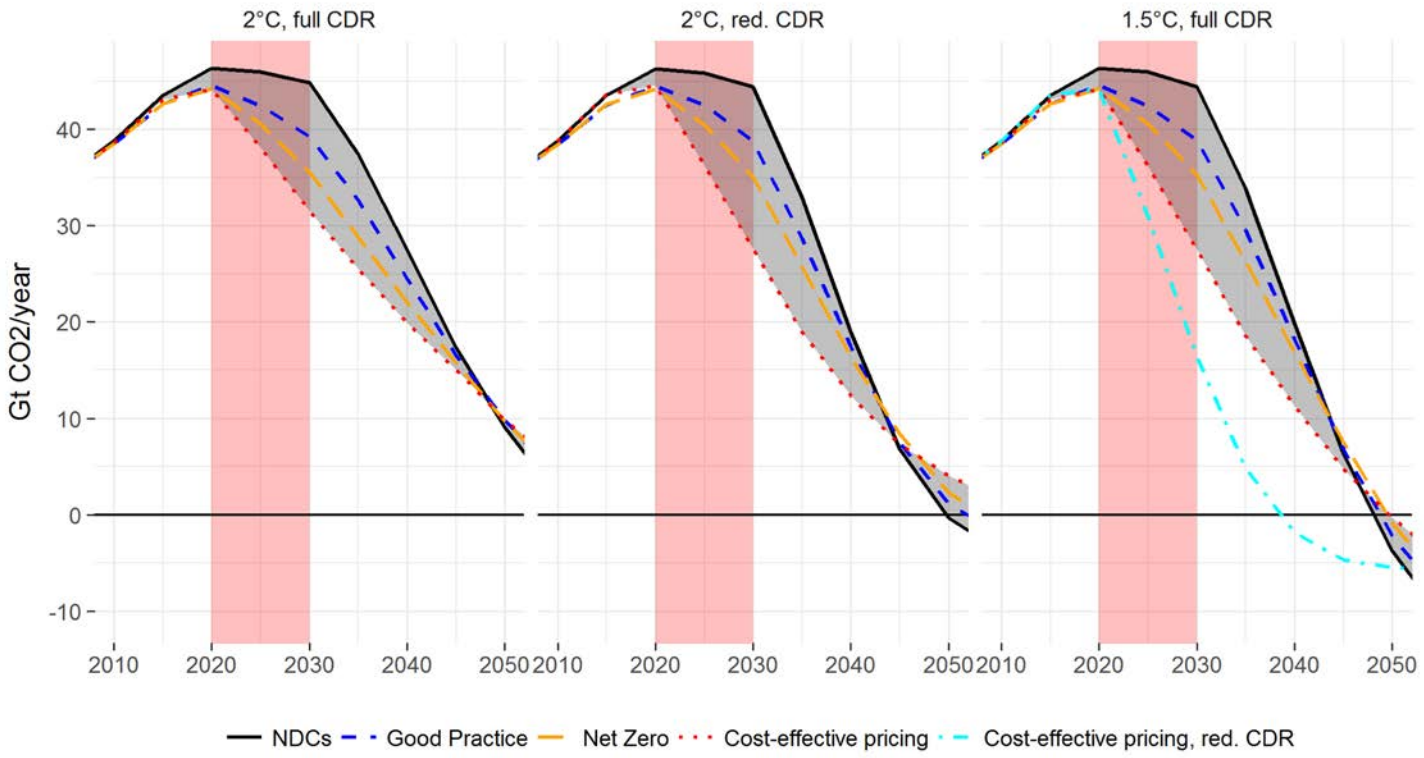
How to avoid carbon lock-ins in the power sector in India and China?

How and why are Mid-Century Strategies important for long term temperature goal?

State-of-the-art research

Bridging 2030 emissions gap

- Increasing near-term ambition to achieve long-term targets.
- Global studies



Kriegler, E., et al. "Short term policies to keep the door open for Paris climate goals", *submitted* (2018)

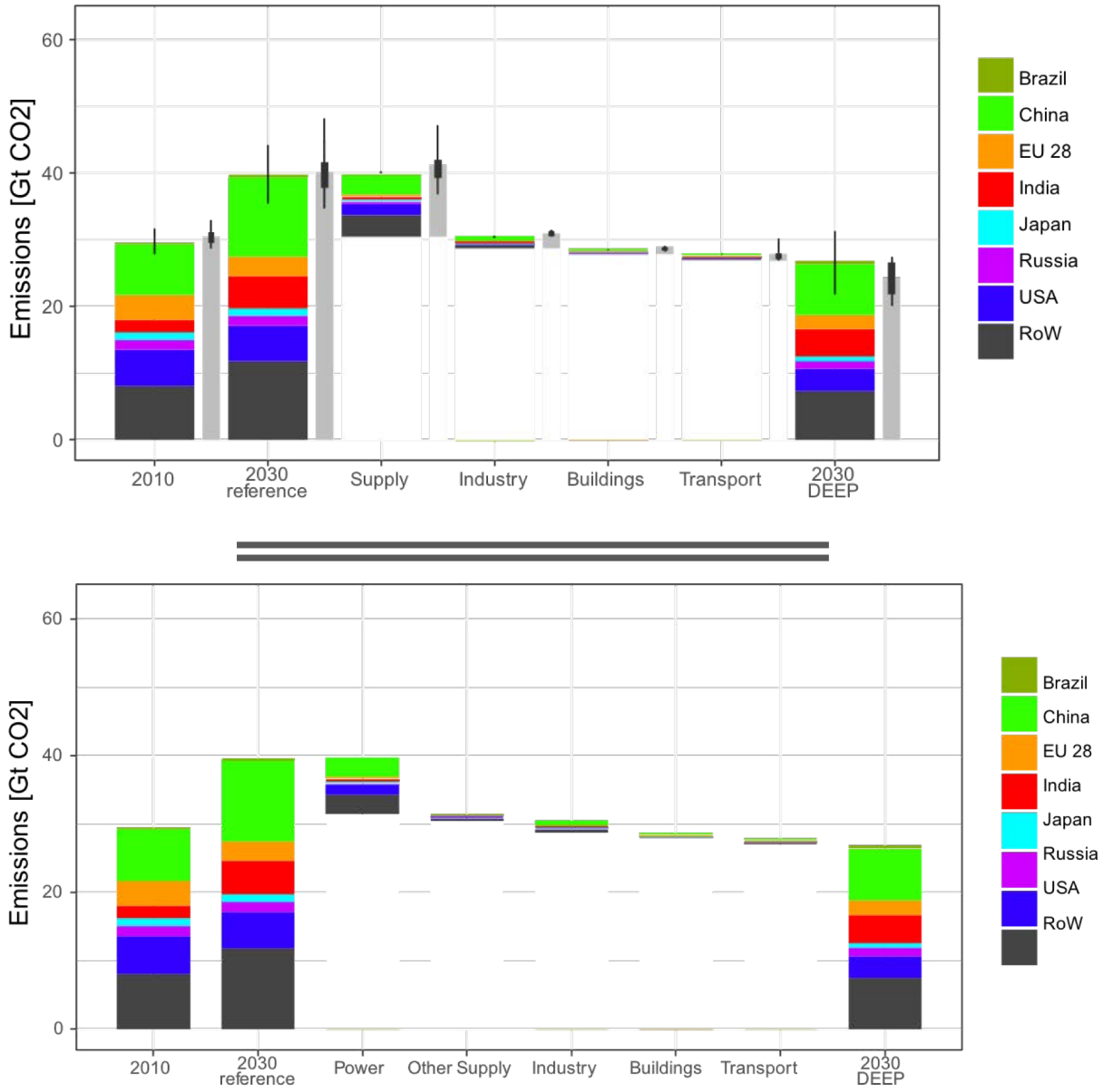
Bridging 2030 emissions gap

Detail of policy advise from REMIND, targeting various sectors

Sector	Current level	Good practice value (-2030)
Energy supply: renewables	0.45 %-point/yr share increase	1.25-1.45 %-point/yr share increase
Energy supply: fossil fuel-fired power	270 GW coal power under construction	No new unabated coal power plants after 2022-2032 (→123 GW 2020-2030 new installations)
Industry	Approx. 1%/yr EE improvement; No full scale commercial CCS	0.5%/yr additional EE improvement (→9% reduction); Approx. 200 $MtCO_2$/yr CCS in industry.
Buildings	1%/yr retrofit; Approx. 1%/yr EE improvement for appliances and lighting	1.5-2.1%/yr retrofit; new buildings on average near zero energy by 2020-30; 0.5%/yr additional EE for appliances and lighting; (→13% reduction)
Passenger transport; freight transport; **International shipping and aviation**	EV share in new sales: <1%; LDV fuel economy: 20 km/l (Japan, 2013, test mode); 1.4%/yr increase in bunker CO_2 emissions	20-30% EV share in new sales; 38 km/l for new LDVs; strengthened new freight vehicle fuel efficiency; Aviation EE improvement up to 2%/yr by 2020, cap emissions at a max of 2020 values for years >2020 (→13% reduction)
Agriculture	Aerobic digester adoption: 10%; N_2 use efficiency: 52%	30% adoption of anaerobic digesters; 10%-point increase of N_2 use efficiency
Forestry and land use	6 million ha/yr net forest loss	End natural forest loss; 10 million ha/yr afforestation
Carbon pricing	Low to moderate carbon pricing in a few regions	at least 5$/t CO2 in 2025, increase at 1$/year (higher for countries with existing carbon pricing) (→average price in 2030 at 22$)

Kriegler, E., et al. "Short term policies to keep the door open for Paris climate goals", *submitted* (2018)

Role of the power sector in decarbonisation



Kriegler, E., et al. "Making ends meet: Collective national mid-century strategies staying well below 2°C", *submitted* (2018)

Opportunities: Project Environment

- CD-LINKS
- COMMIT
- Pep1p5

Partner Institutes

Leveraging connections with national modelling teams

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Methodology/ Tools

Insights into these questions will be provided using the IAM REMIND.

REMIND can analyse impacts of sector-specific policy targets and their timings (e.g., emission or capacity targets) but NOT policy instruments; so for e.g., questions like which policy instrument(s) will best achieve a policy target cannot be answered in REMIND.

However, some policy instruments like a carbon price, subsidies, air-pollution taxes are built into REMIND and their impacts can be studied.

Current Work – I Policy implementation

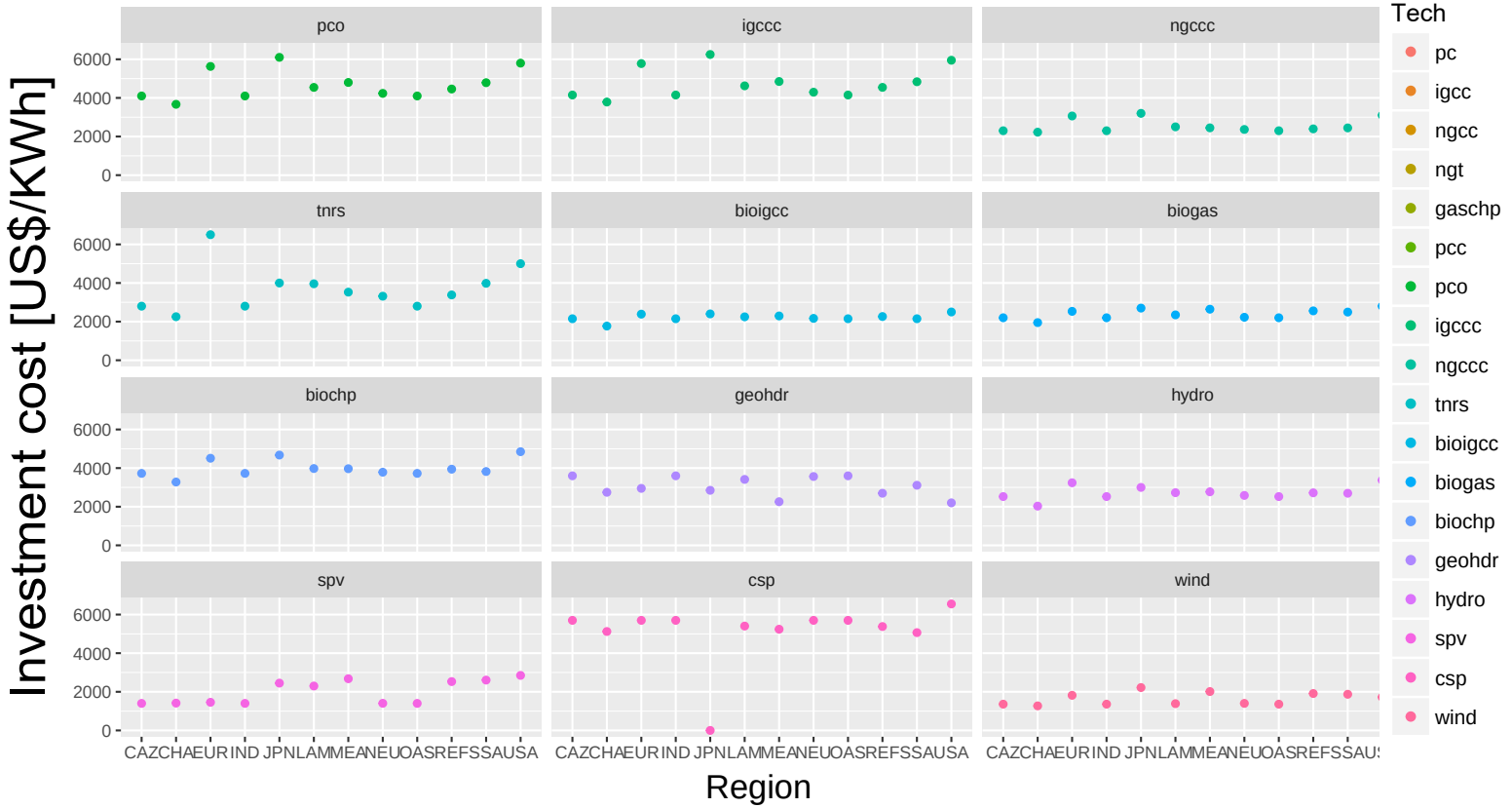
Raw data on policy targets from various policy databases

R: Tidying data and converting to magpie object at country-level resolution.

Implementation and Validation in REMIND

Current Work – II

Differentiated investment costs of technologies



Challenges

REMIND NDC emissions on the higher end compared to other IAMs.

Country-level policies, particularly the share and emission targets, must be aggregated to regions.

Extrapolation of targets when not given in 'model years'

NDCs are evolving documents; framing and values of targets can change.

Implementation has to be compatible with REMIND flexible regions.

Next Steps

Implementation and Validation of capacity, emission, and share targets (from NDCs) in REMIND. Followed by policies outside NDCs.

"Deep-Dive" into carbon lock-ins in India and China. Paper submission expected first-half of 2019 focussing on power sector.

- Power system configuration
- Committed emissions
- Stranded assets/financial indicators

Future Work/Outlook

Implementation of Mid-century targets.

- How can scenarios across countries be compared?

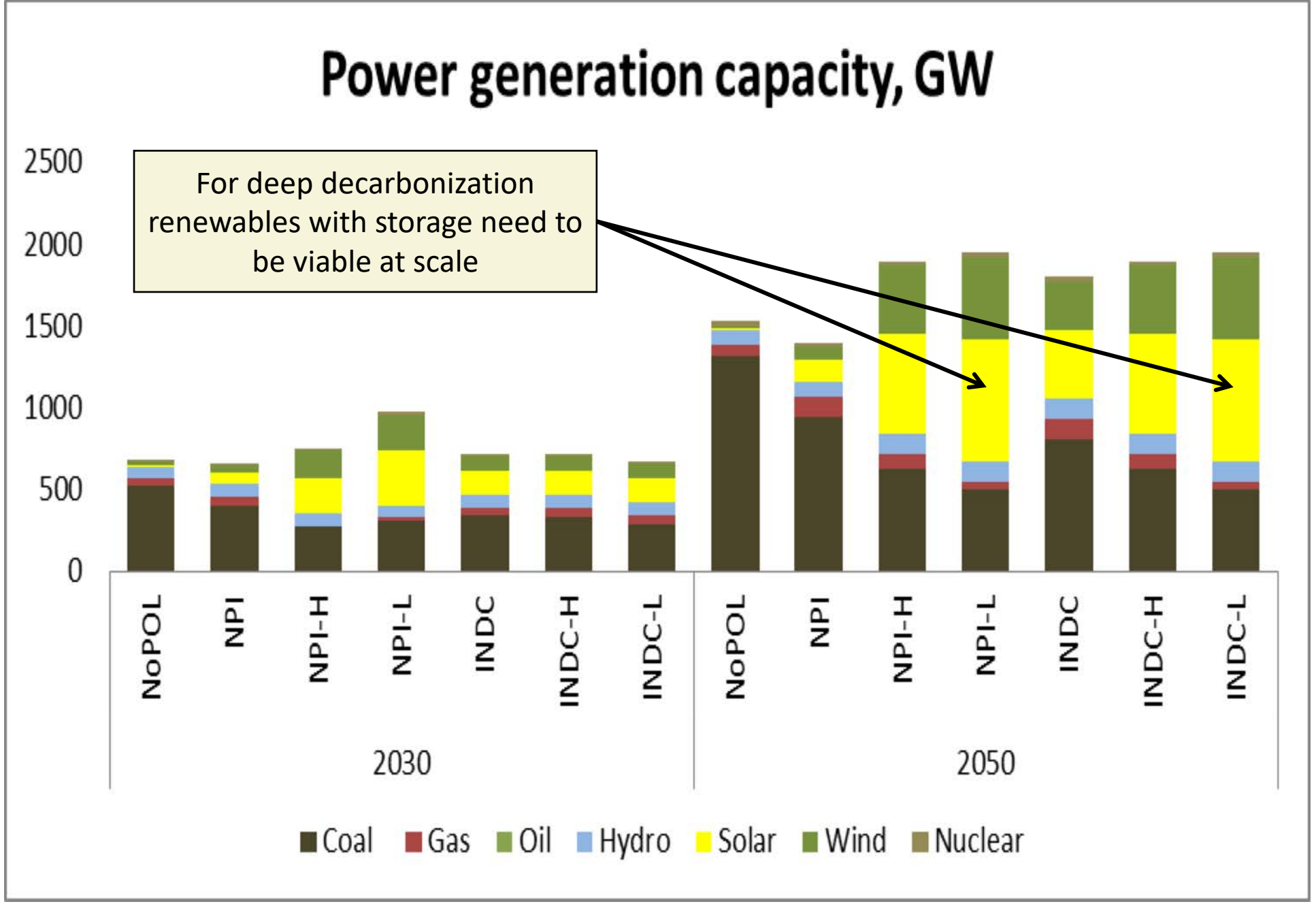
Methodologies to implement collective effort-sharing regimes (Article 6 on market mechanisms).

- What is the influence on domestic action?

Set of indicators to analyse country-level policies (difference between actual sector targets and least-cost targets)

Discussion and Questions

Appendix


Power generation capacity, GW
For deep decarbonization renewables with storage need to be viable at scale
2500
2000
1500
1000
500
0
NoPOL
NPI
NPI-H
NPI-L
INDC
INDC-H
INDC-L
NoPOL
NPI
NPI-H
NPI-L
INDC
INDC-H
INDC-L
2030
2050
Coal
Gas
Oil
Hydro
Solar
Wind
Nuclear

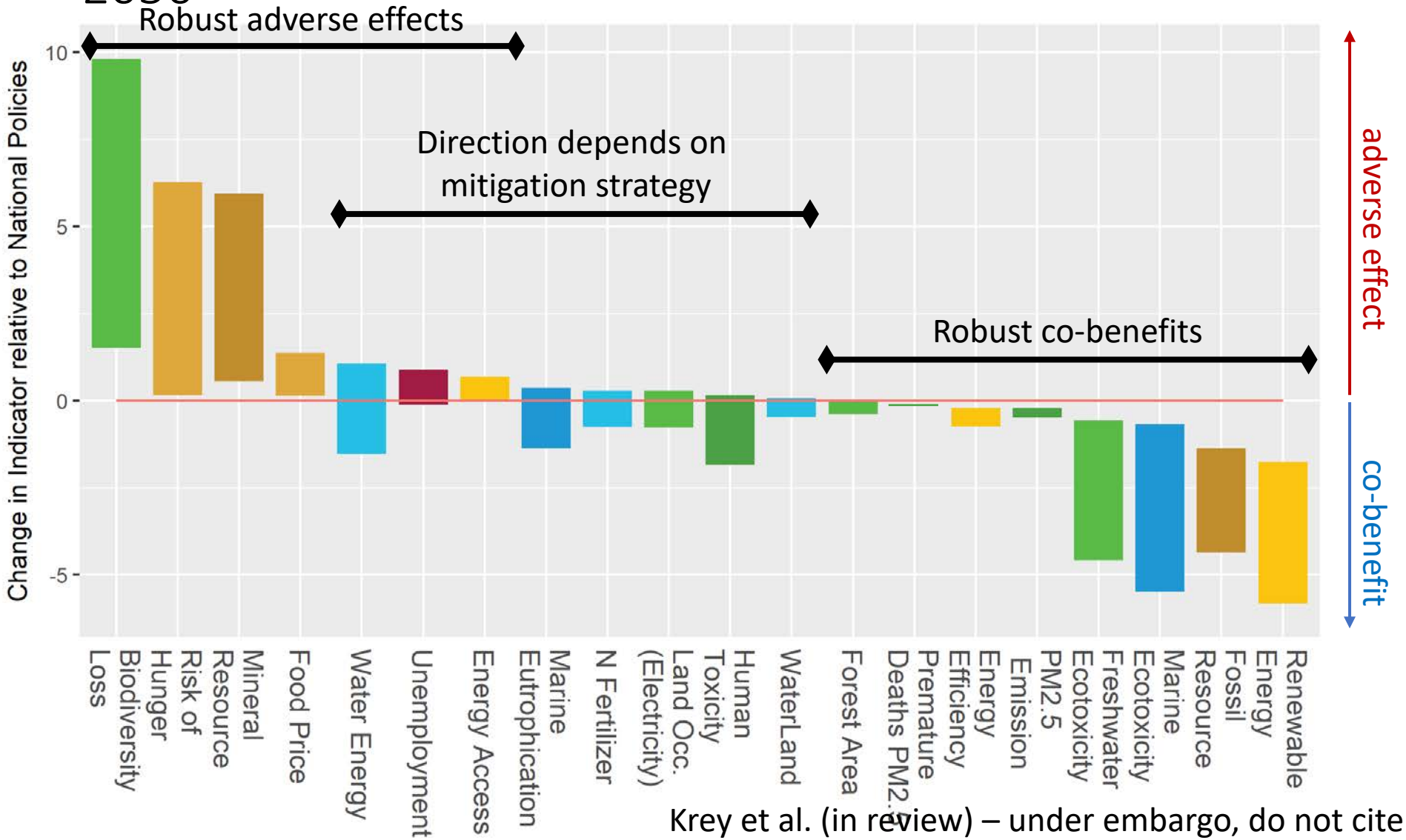
On next steps (Deep-dive)…

- Country-level developments in the power sector is necessary. This means solar and wind techno economics, nuclear expansion plans etc. based on bottom-up data sets and national expertise

Outline

- Background and Context
  - Paris Agreement
  - Emissions Gap
  - Sustainable Development Goals
  - Carbon Lock-ins
  - Summary
- Research Questions
- Past work
- Methodology/Tools
- Opportunities
- Next Steps
- Future Work/Outlook

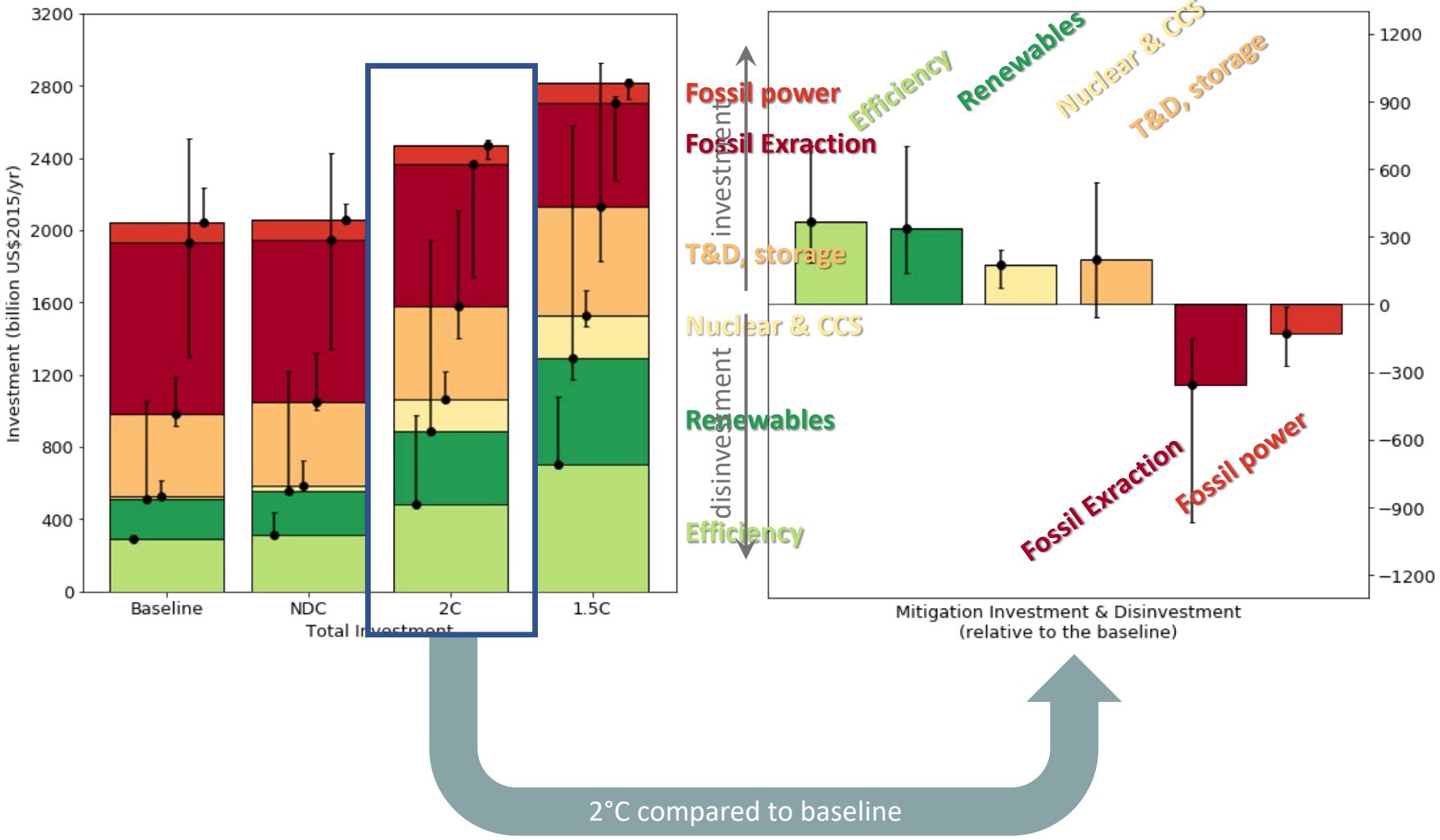
Climate Policy Impact on SDG: 1.5°C 2050



Krey et al. (in review) – under embargo, do not cite

Global Investment Portfolios for 1.5 and 2C

Average annual investments 2010 to 2050



McCollum et al, CD-LINKS (under embargo – do not cite or quote)