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How can Integrated Assessment Better Inform Climate Risk Management?

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*Rapid System Transitions Towards Low GHG Futures Workshop,
Snowmass, Colorado, July 22-25, 2019*



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Different types of climate – related risks

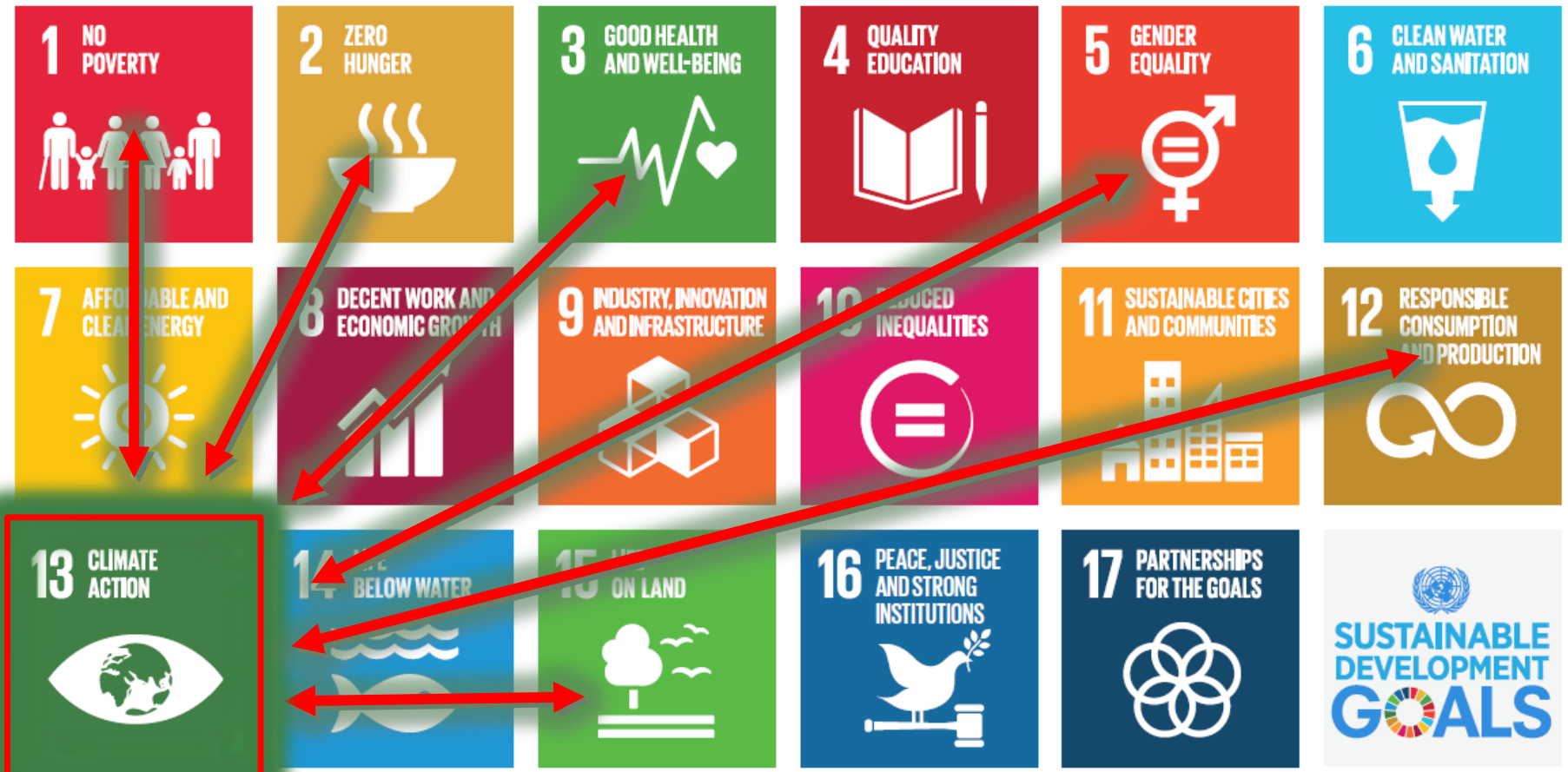
- Transition risks
 - other societal objectives (SDGs)
 - vulnerable (carbon intensive) sectors
 - vulnerable populations (eg, relying on certain services)
- Risks due to climate impacts
- Finance sector risks (due to both transition and impacts)
- Other risks.....

Different types of climate – related risks

- **Transition risks**
 - other societal objectives (SDGs)
 - vulnerable (carbon intensive) sectors
 - Parts of the population (eg, relying on certain services)
- **Range of risks due to climate impacts**
- Finance sector risks (due to both transition and impacts)
- Other risks....



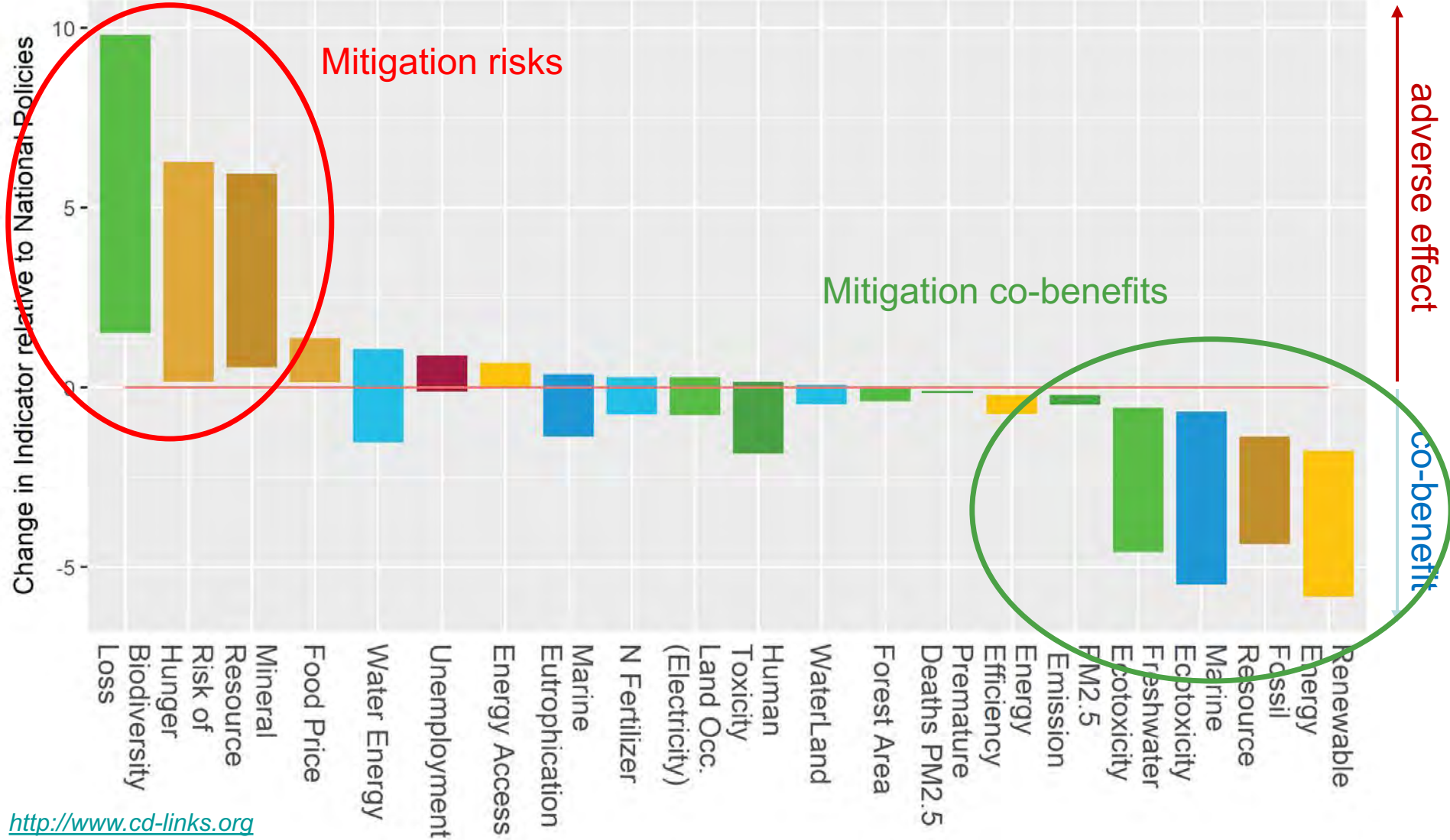
SUSTAINABLE DEVELOPMENT GOALS



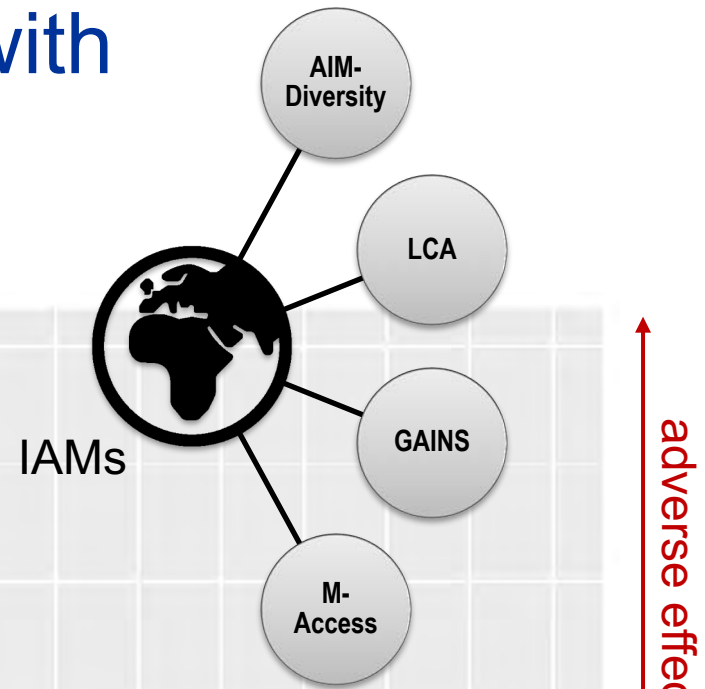
1.5°C: Possible impacts of mitigation actions on the SDGs



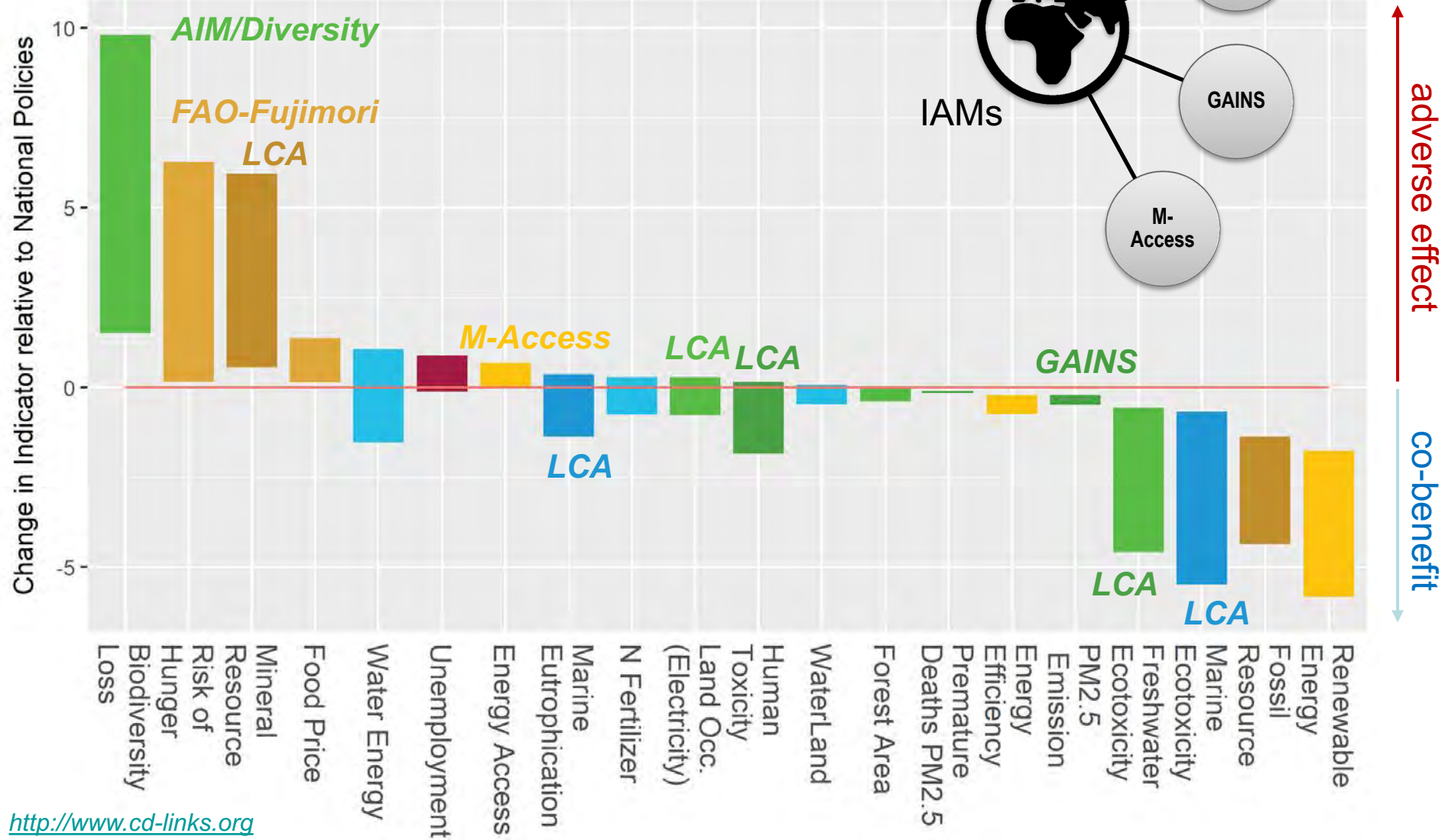
Krey et al. (submitted) – under embargo, do not cite



Integrated IAMs are coupled with a range of disciplinary models



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 (submitted) – under embargo, do not cite

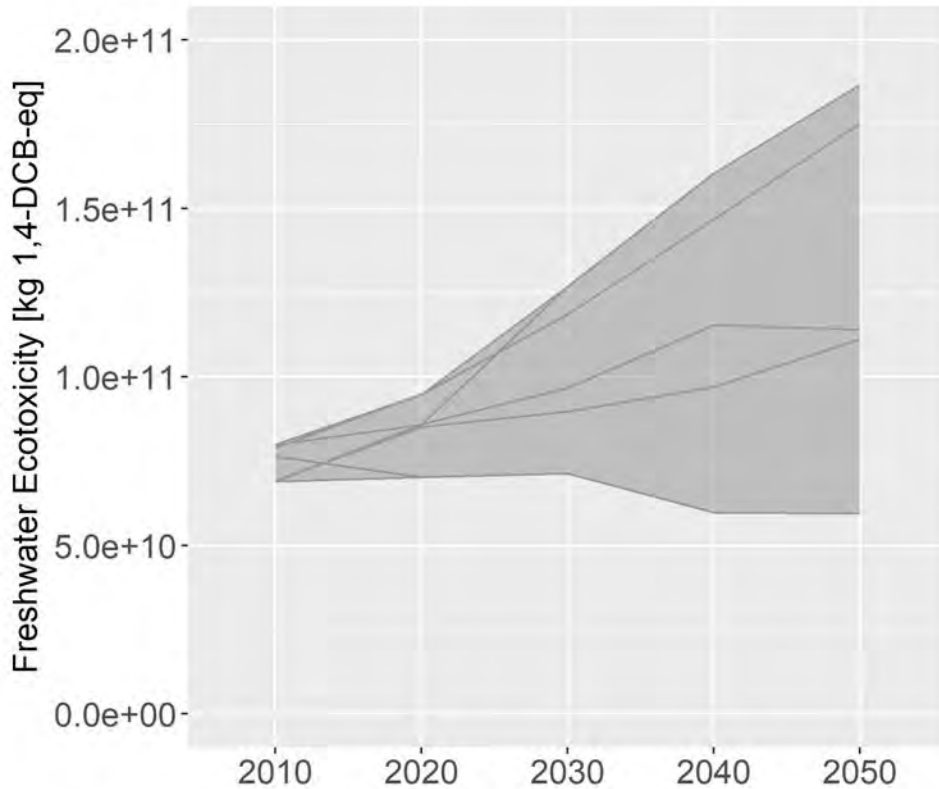


Environmental and Material indicators (LCA)

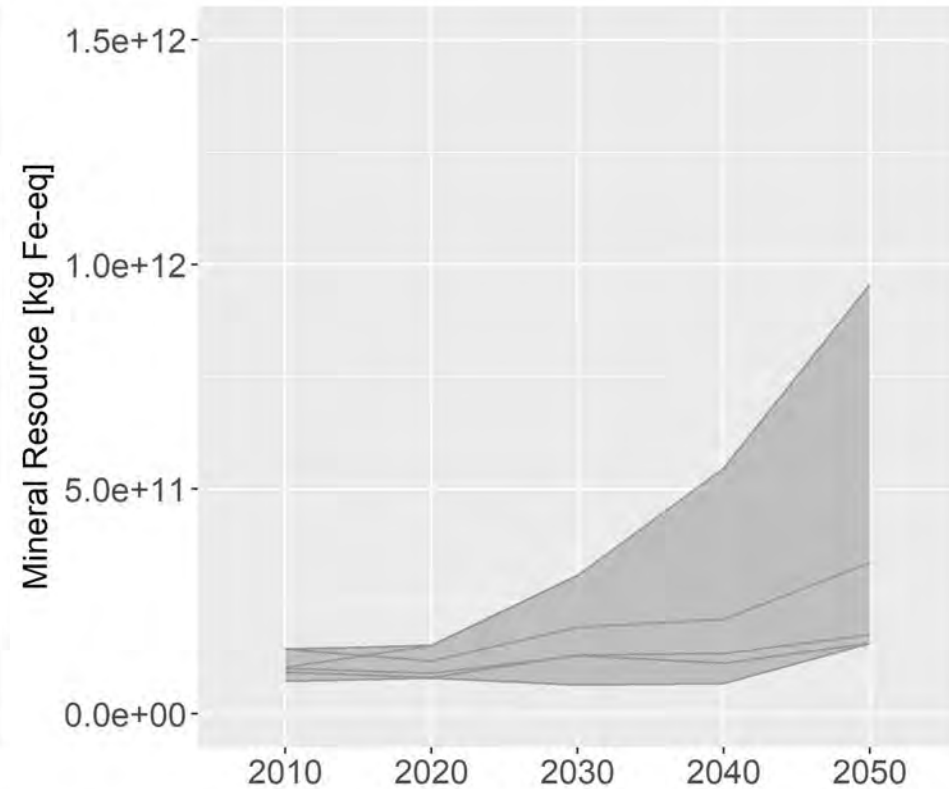


LCA indicators (electricity sector)

Freshwater Ecotoxicity

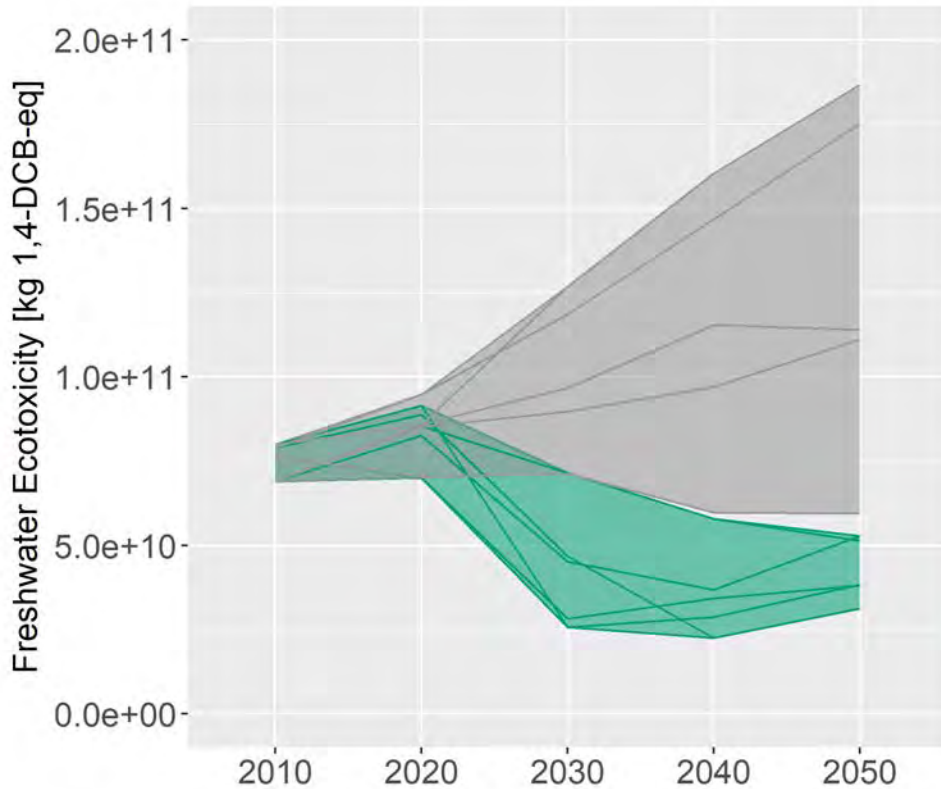


Mineral Resource Depletion

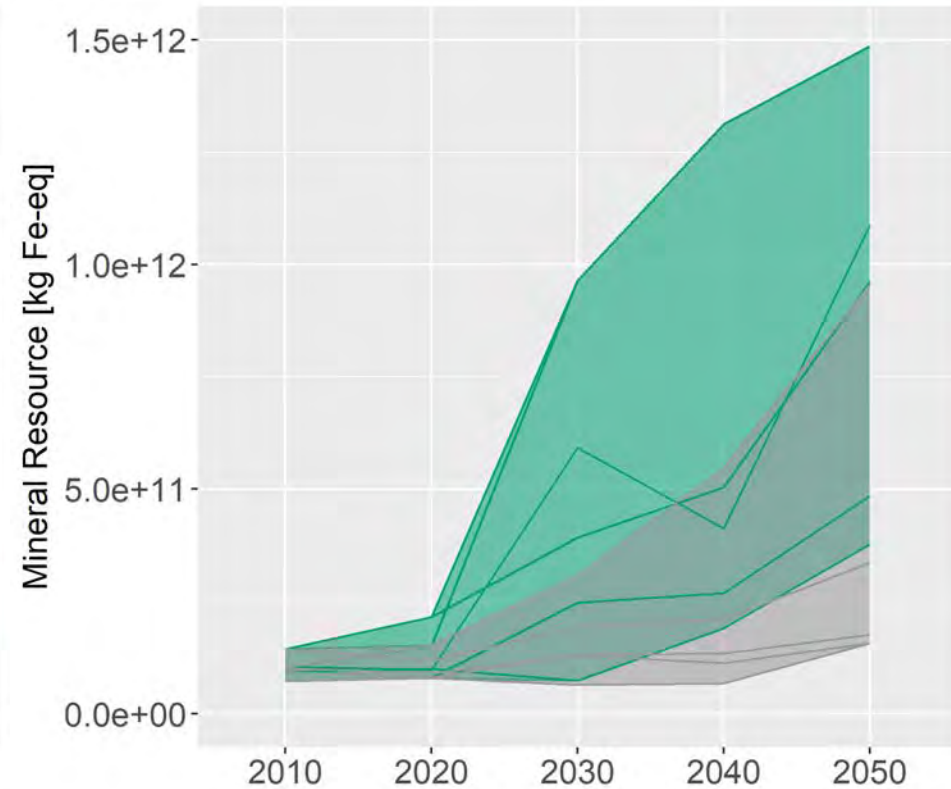


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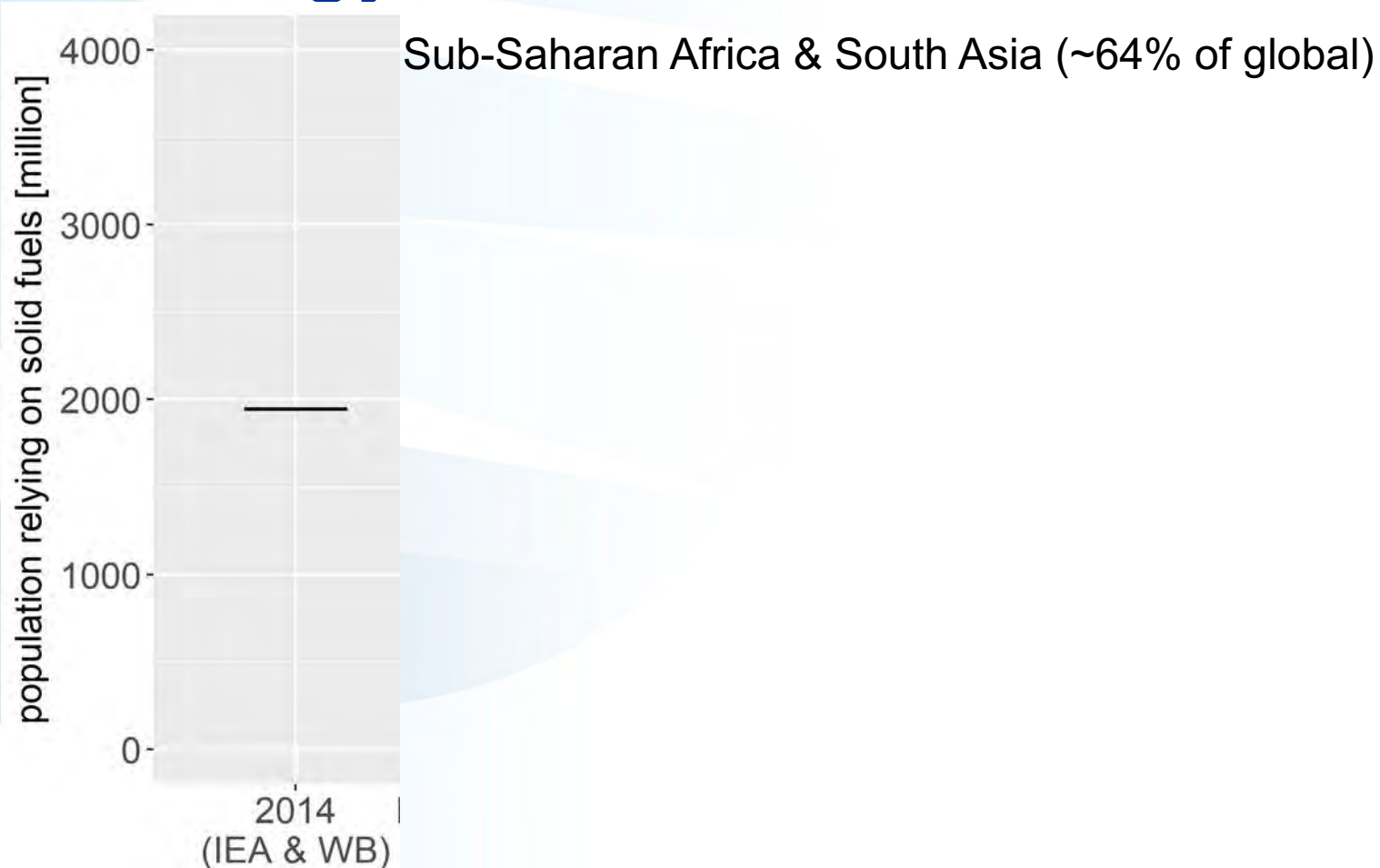


Access to Clean Cooking Fuels



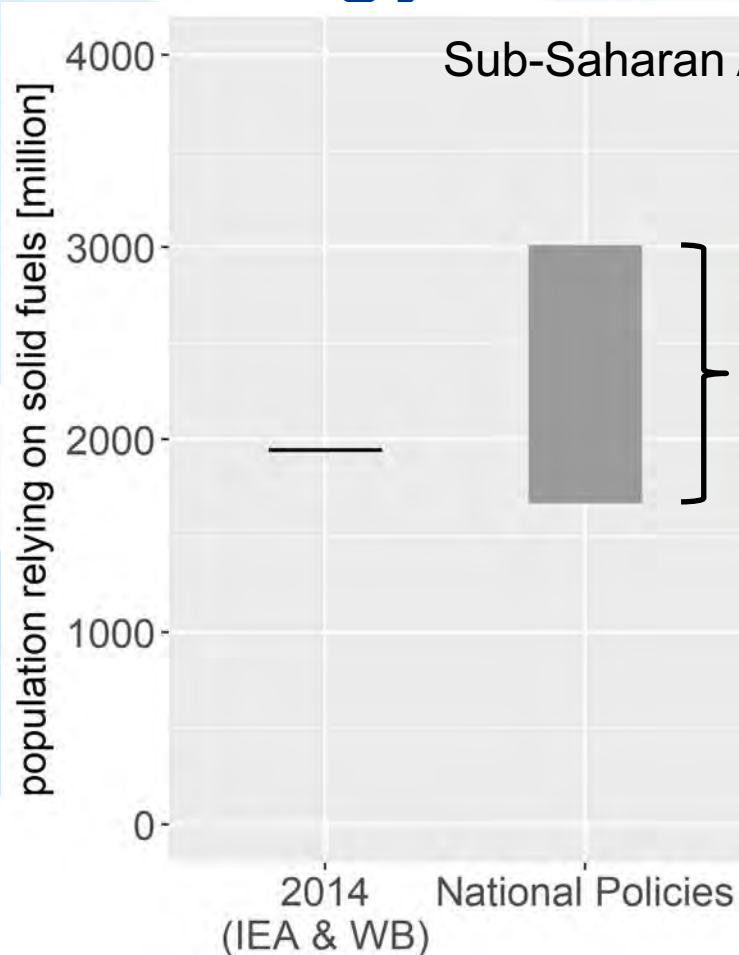


Energy Access – 2050



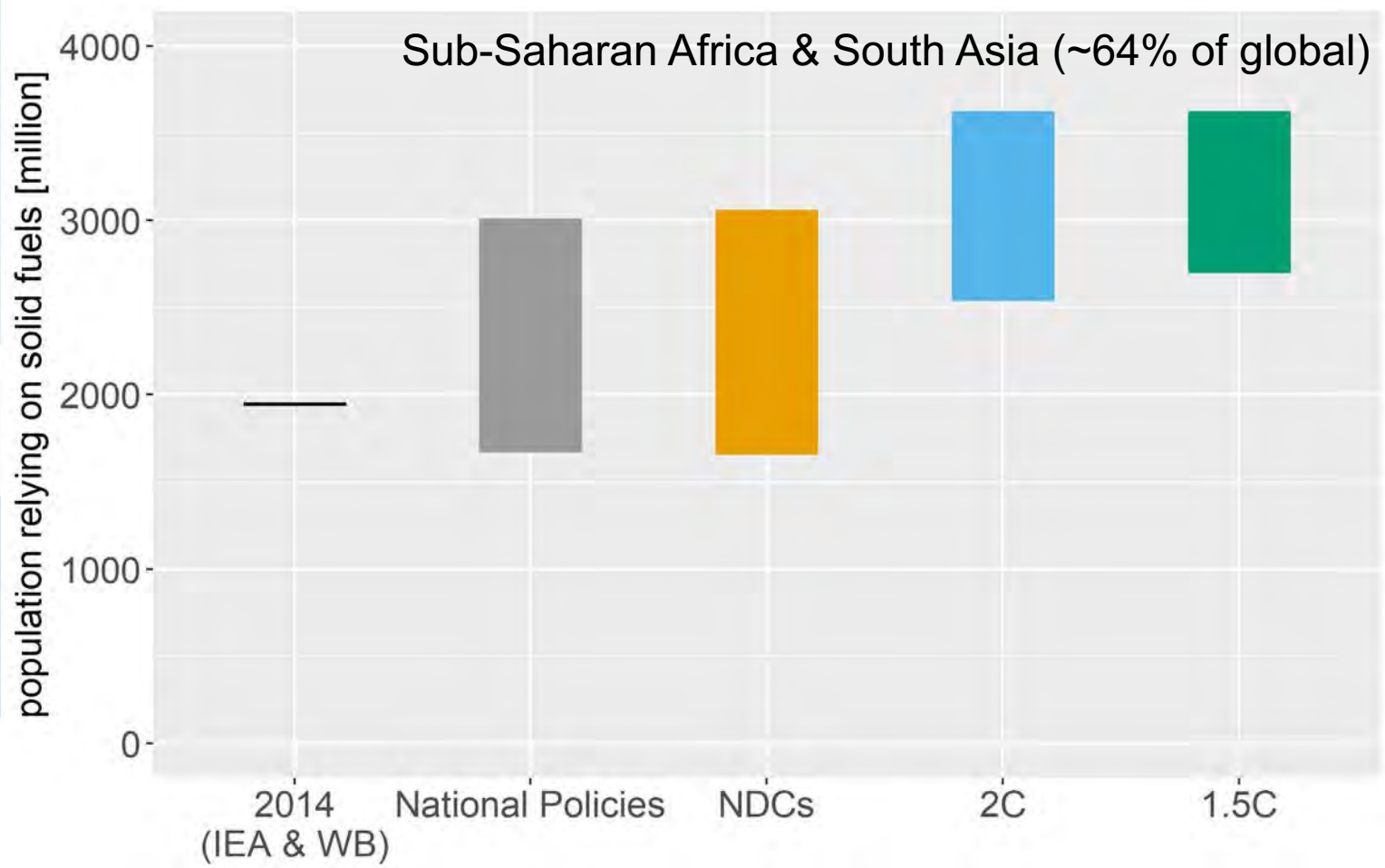


Energy Access – 2050

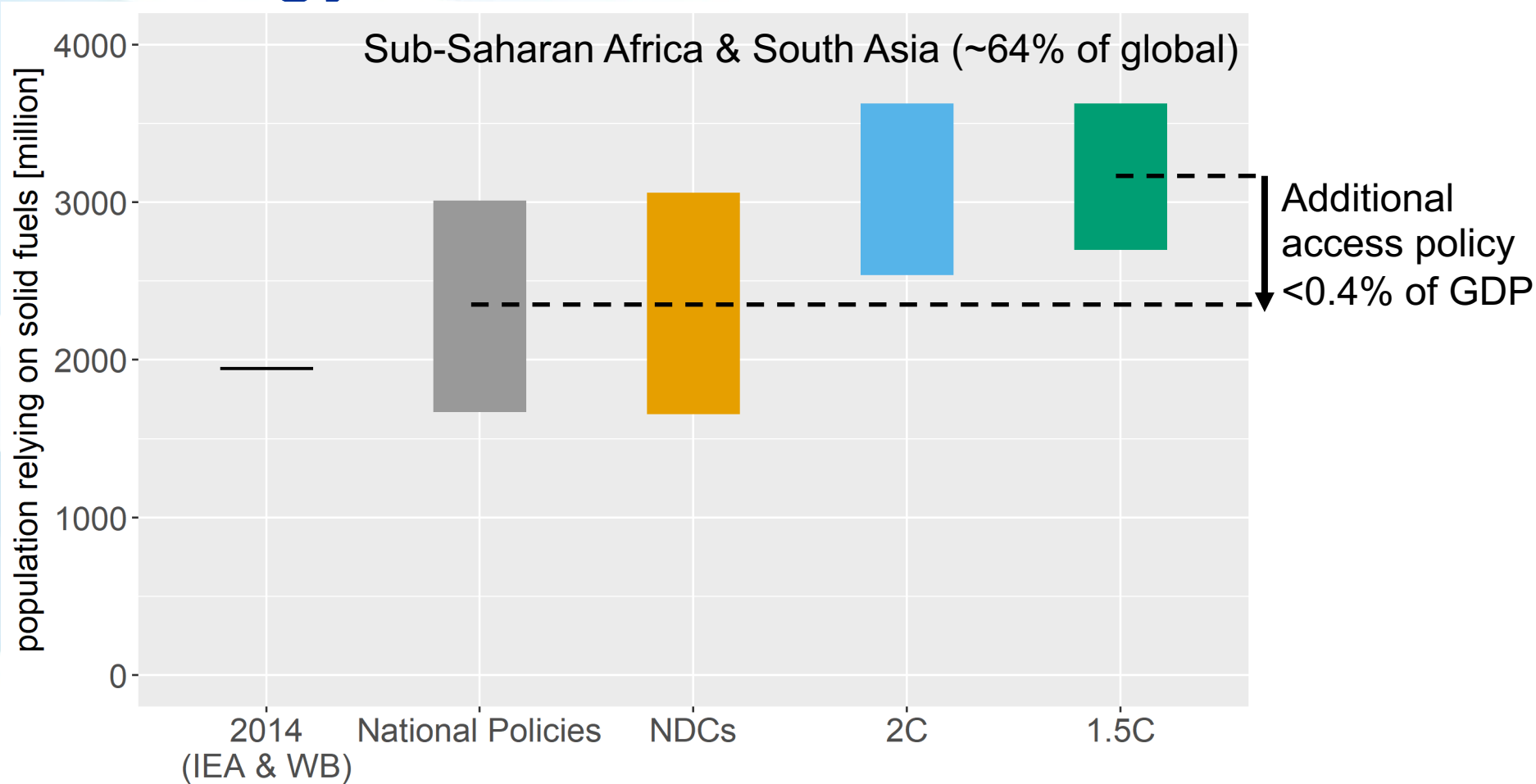


Uncertainty due to fossil fuel price development in National Policies scenario

Energy Access – 2050



Energy Access – 2050



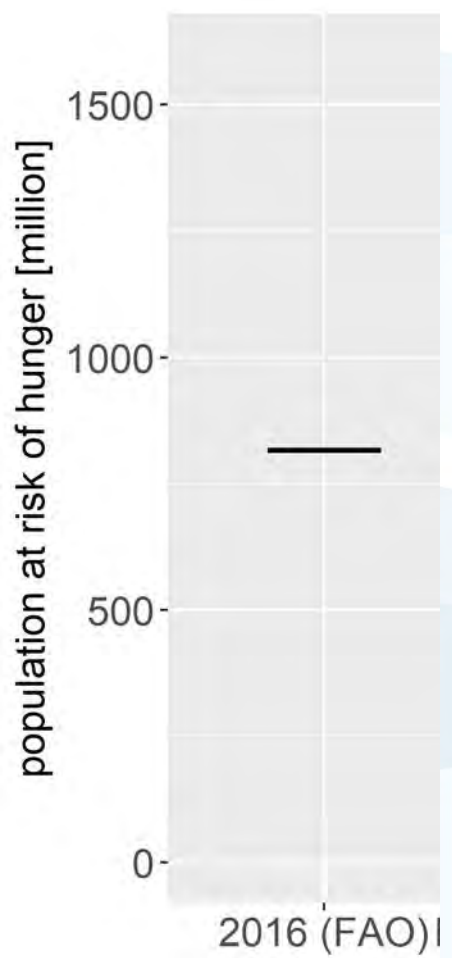
Inclusive development & climate policies are key to improve energy access for simultaneous achievement of SDG7 (energy) and SDG13 (climate).

Food Security

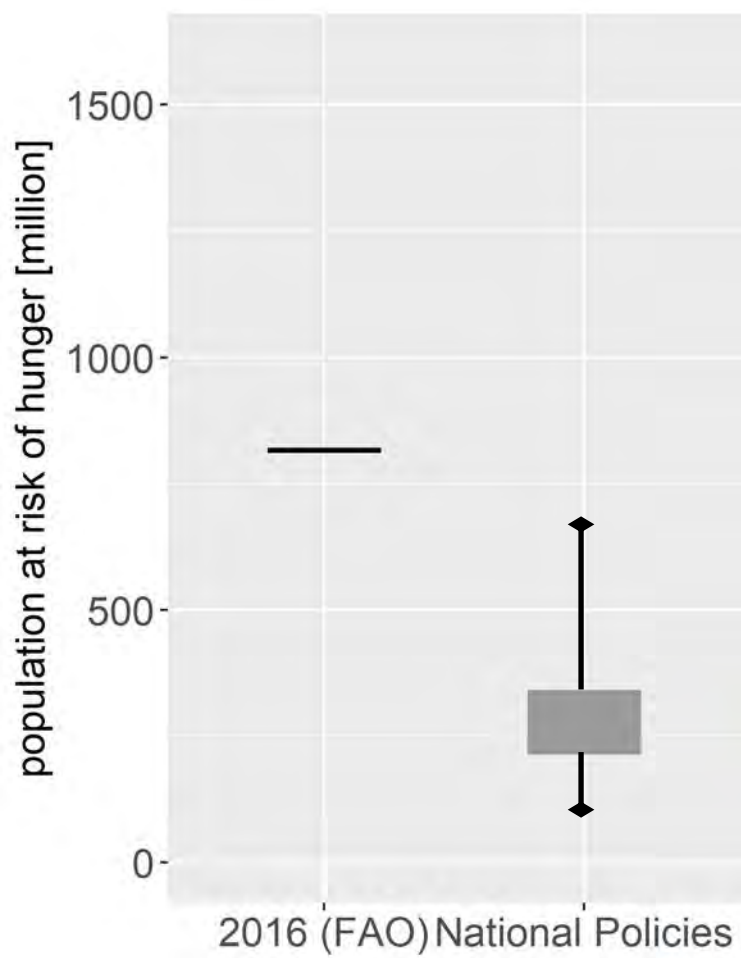




Food Security

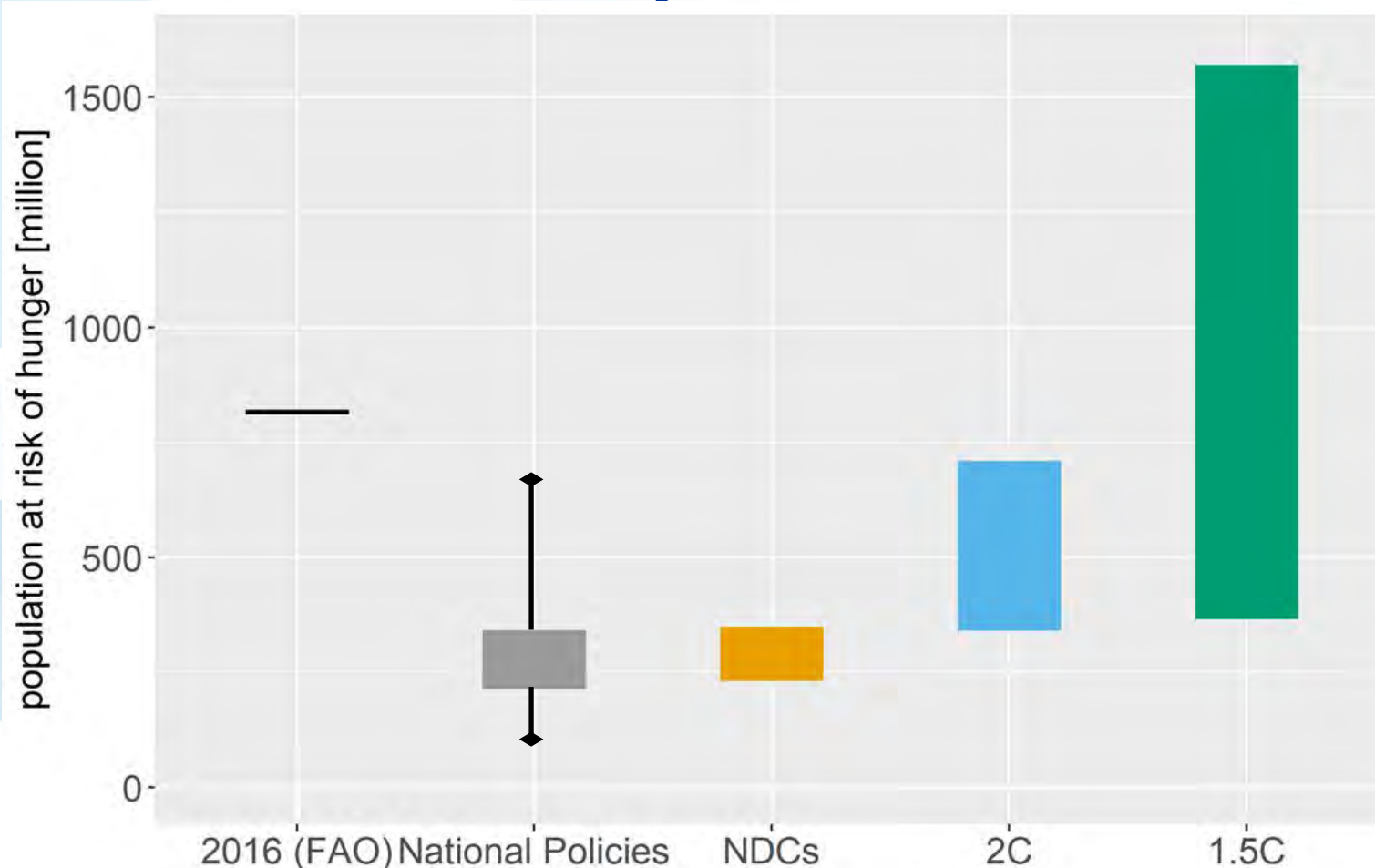


Food Security – 2050





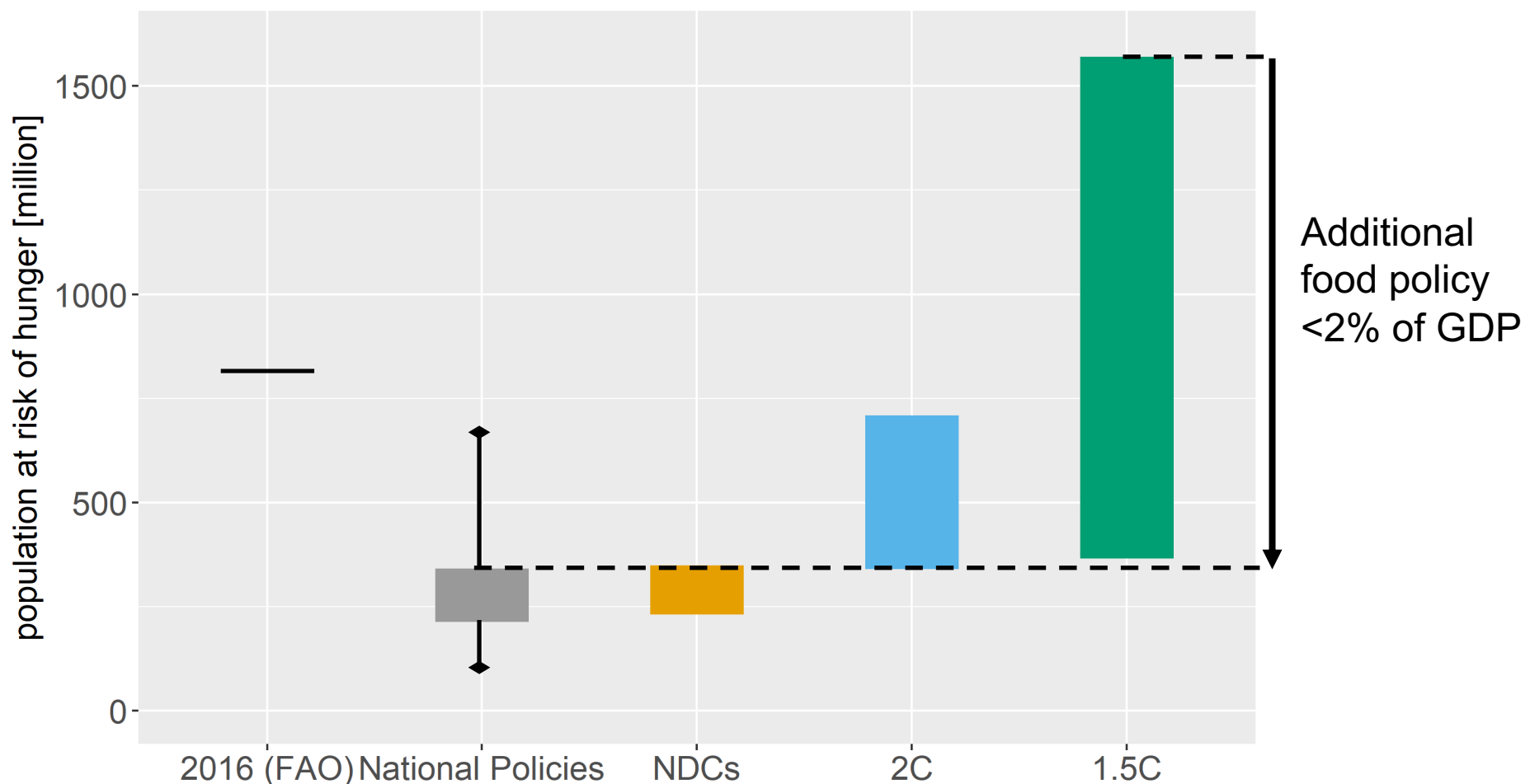
Food Security – 2050



Inclusive development & climate policies are key to reduce risk of hunger for simultaneous achievement of SDG2 (hunger) and SDG13 (climate).

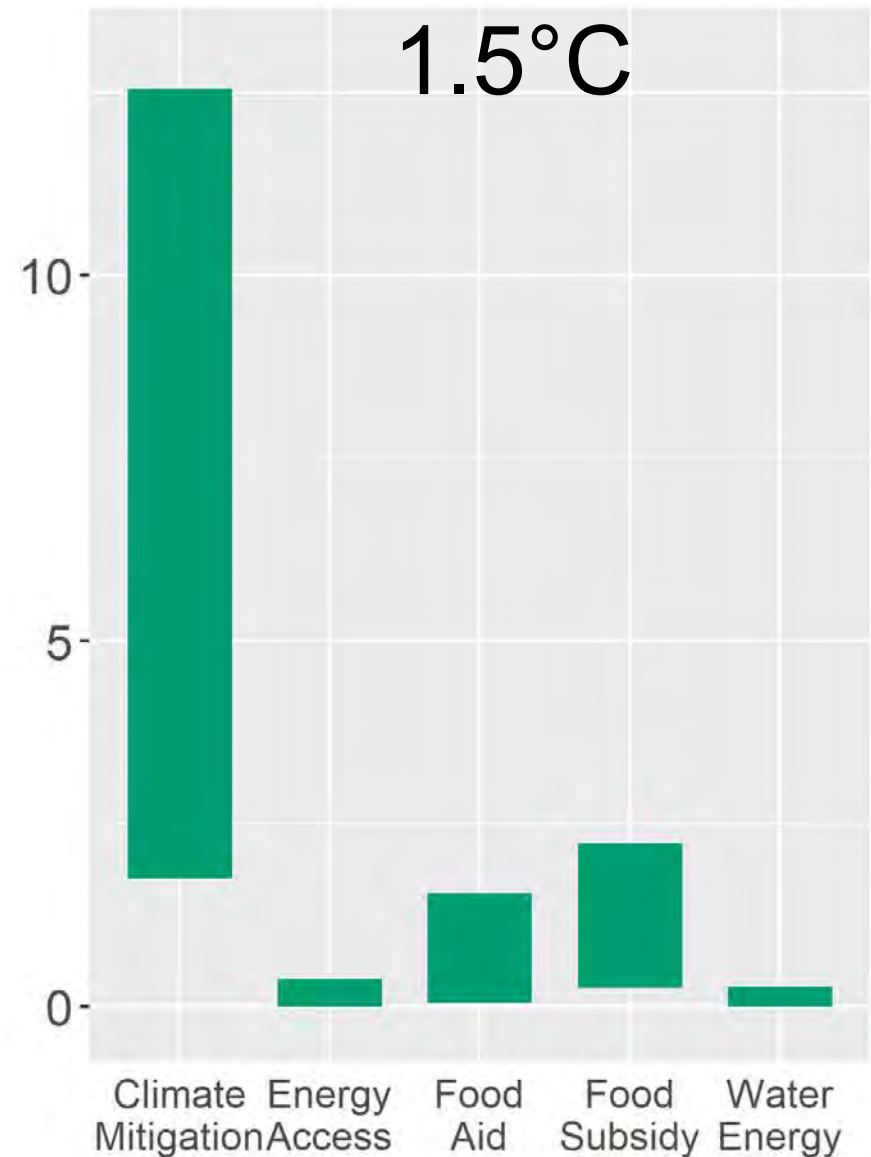
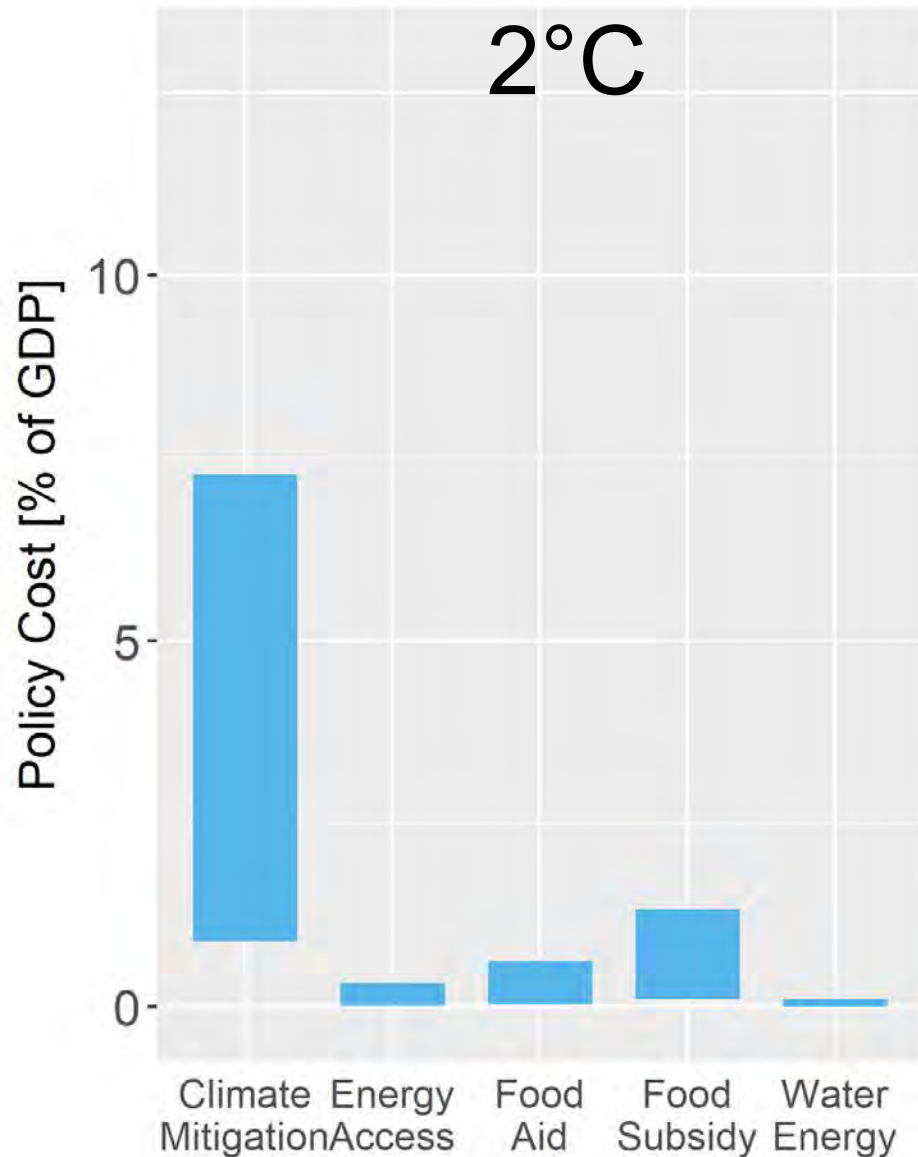


Food Security – 2050



Inclusive development & climate policies are key to reduce risk of hunger for simultaneous achievement of SDG2 (hunger) and SDG13 (climate).

Integrated Policy Costs – 2050

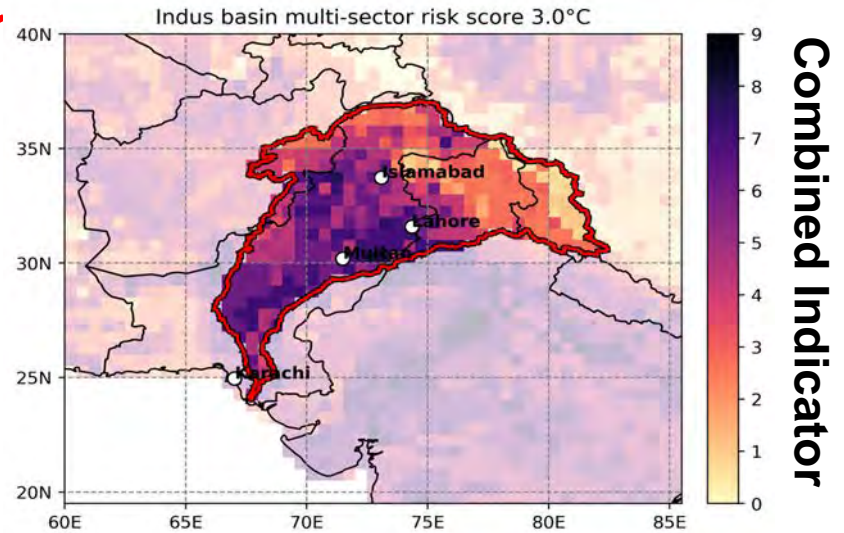
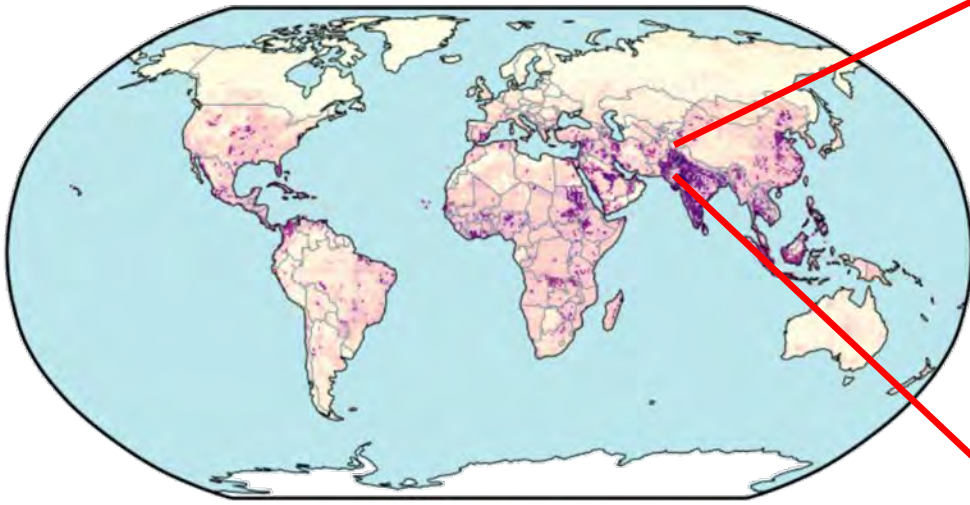


Krey et al. (submitted) – under embargo, do not cite

Some Implications for IAMs

- Policy design matters
- Better representation of social heterogeneity
- Most SDGs are local - how to bridge spatial heterogeneity (water, pollution, food)
- Small overall economic implications, but huge benefits for welfare
- Provision of sustainable services and basic needs (Demand-side transformation vs supply-side focus of many IAMs)

Risks due to multi-sector climate extremes & hotspots



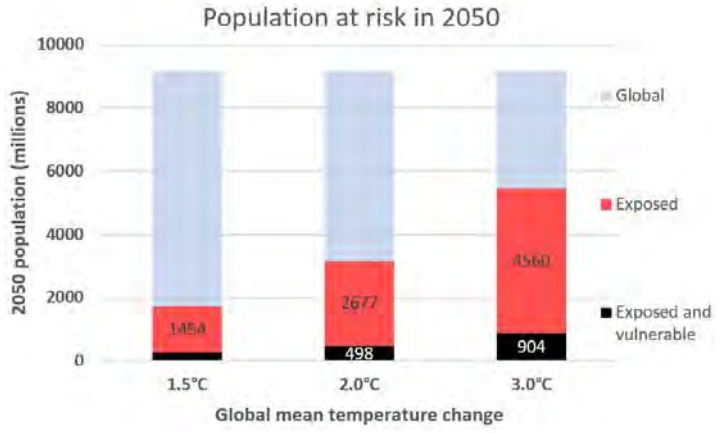
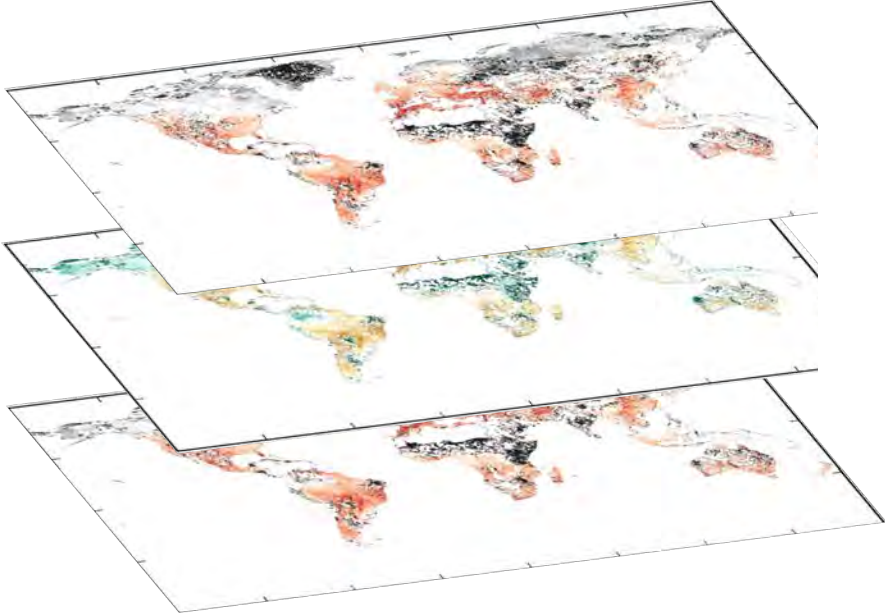
Water	Energy	Land	Socioeconomics
Water stress index	Clean cooking access	Crop yield change	Population density
Non-renewable GW abstraction	Heat event exposure	Environmental flow exploitation	Income levels
Drought intensity	Cooling demand growth	Habitat degradation	
Peak flows risk	Hydroclimate risk to power	Nitrogen leaching	
Seasonality			
Inter-annual variability			



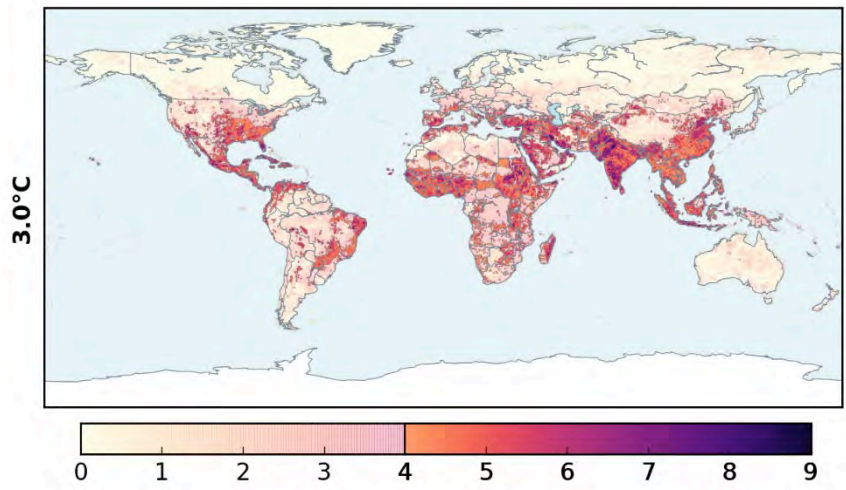
Risks due to multi-sector climate extremes & hotspots

Byers et al. 2018
Gidden et al. 2018

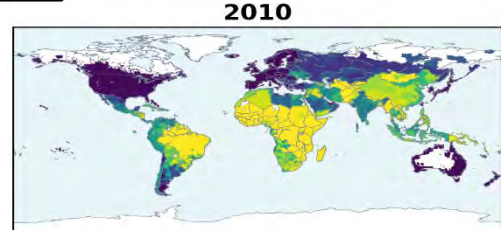
Hotspots of significant nexus vulnerabilities and impacts



3.0 °C
combined indicators

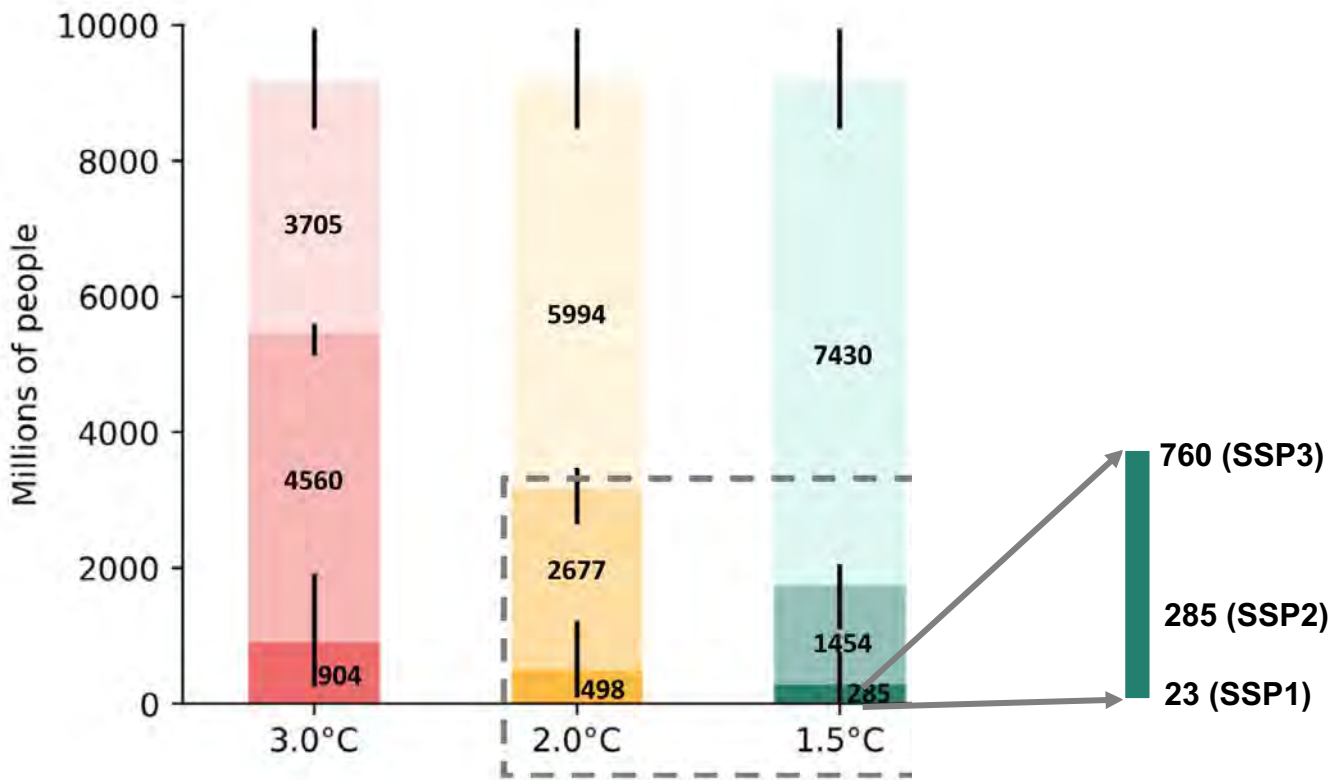


SSP1-3
Spatial equity & poverty projections
Rao et al & Gidden et al

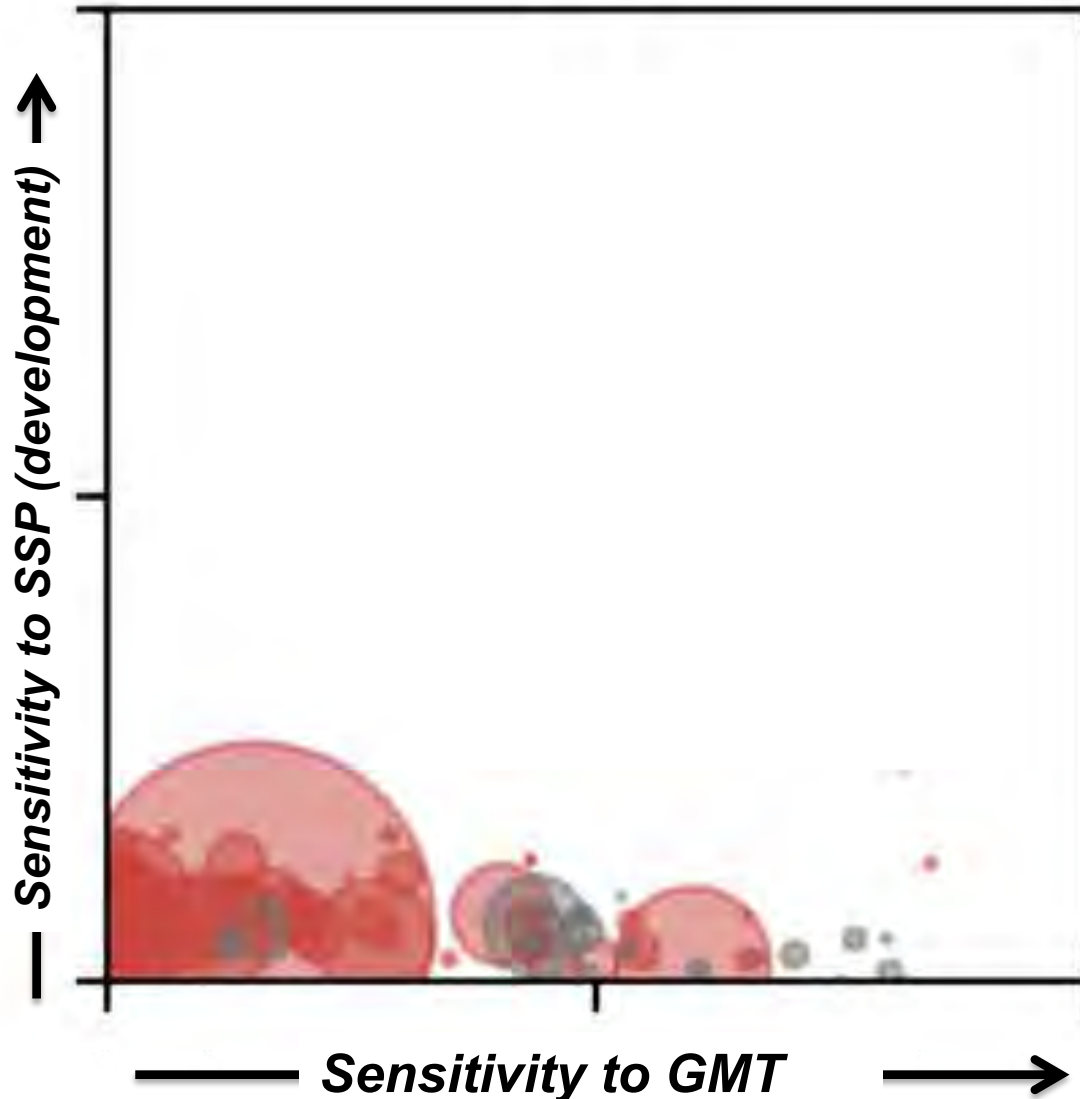


Major difference between 1.5 and 2C

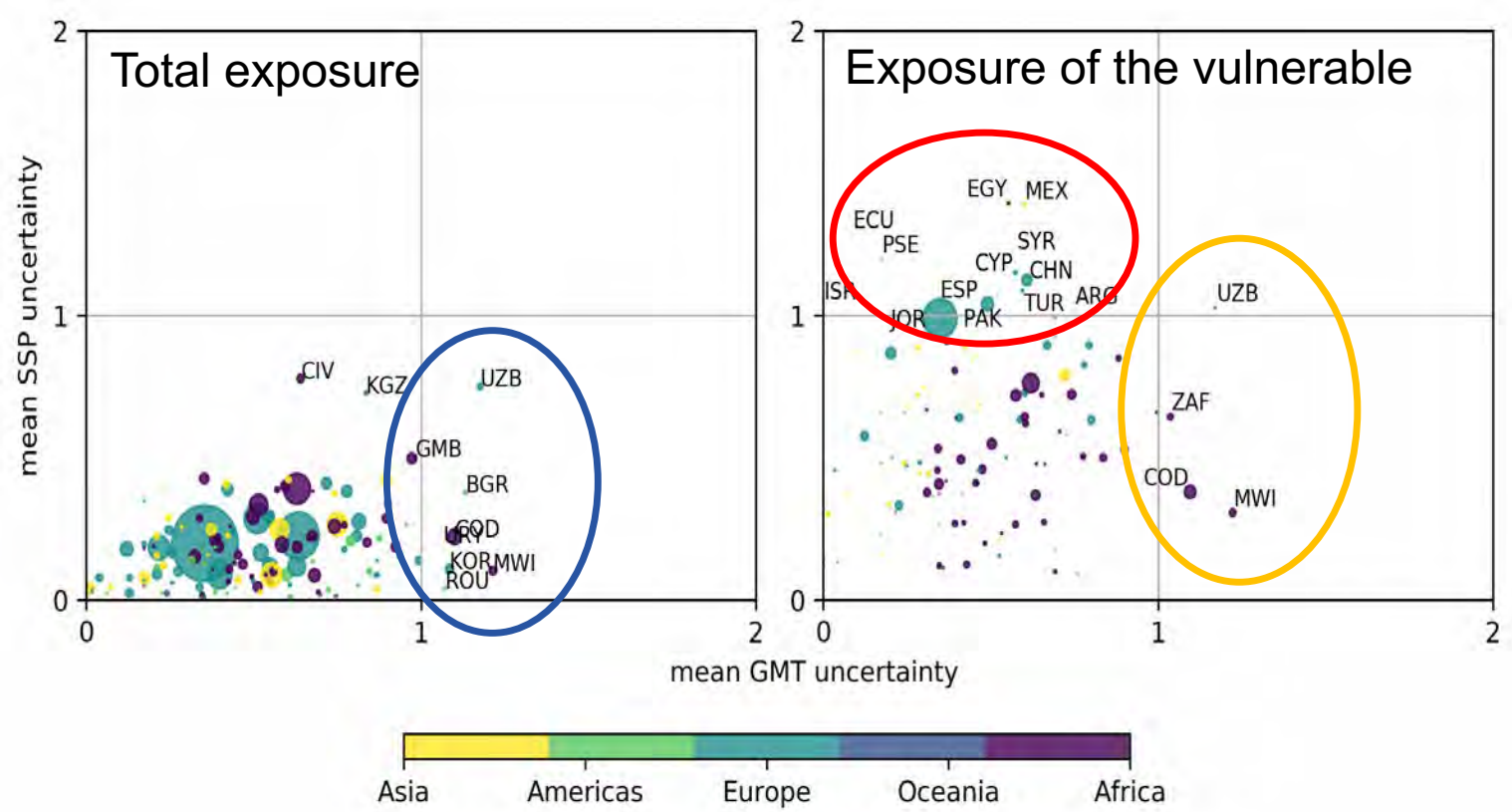
(Development policies key to reduce exposure of the most vulnerable)



Understanding sensitivity of national results climate vs development



Country Sensitivity to Climate Change vs Socioeconomic Development



Exposed & vulnerable

SSP sensitivity is high (vulnerability reduction makes a big difference!)
 • GMT sensitivity high compared to SSP

- Uzbekistan
- Gambia
- Bulgaria
- DR Congo
- Malawi

SSP-sensitive

- Mexico
- Romania
- Egypt
- South Korea
- Jordan
- Uruguay
- China
- Pakistan

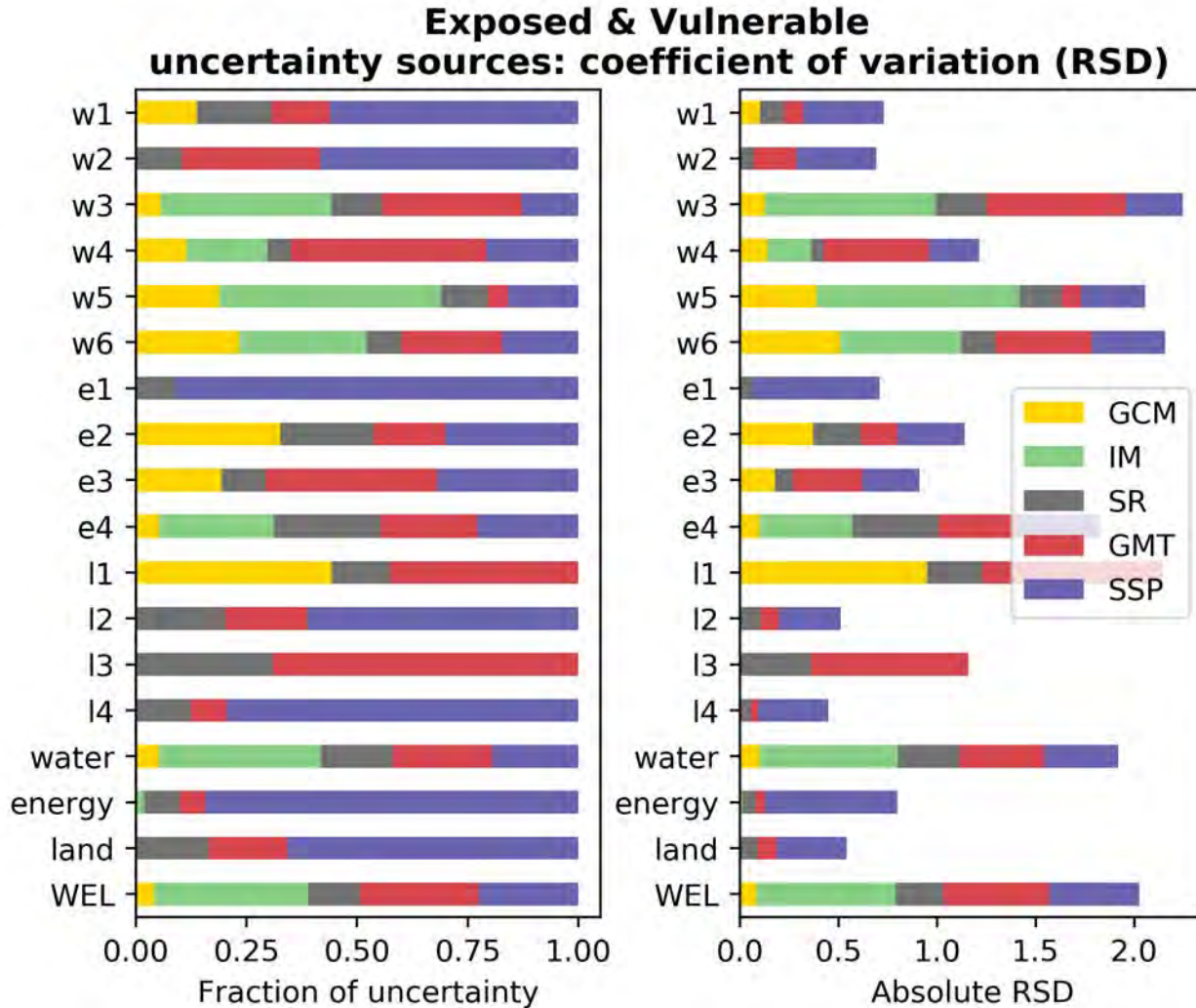
GMT-sensitive

- Spain
- Syria
- Palestine
- Ecuador
- Cyprus
- Turkey

GMT-sensitive

- Uzbekistan
- DR Congo
- Malawi
- South Africa

Uncertainty analysis



For **populated and high-vulnerability locations** – socioeconomic scenarios are the key driver.

Main lesson for IAMs: **Need to represent adaptation options of the poorest**



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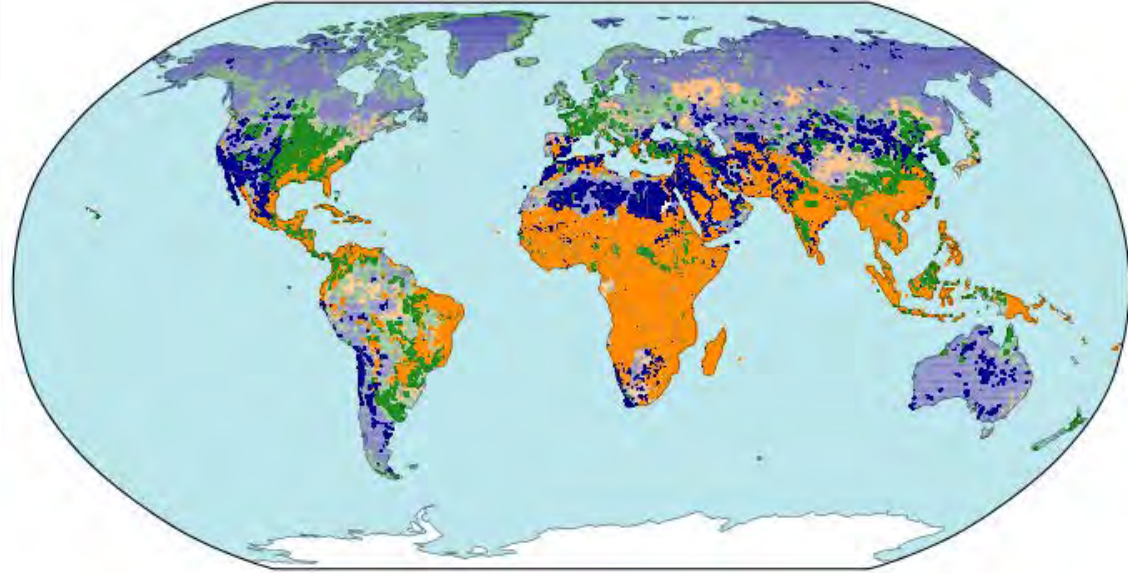
Thank you
riahi@iiasa.ac.at



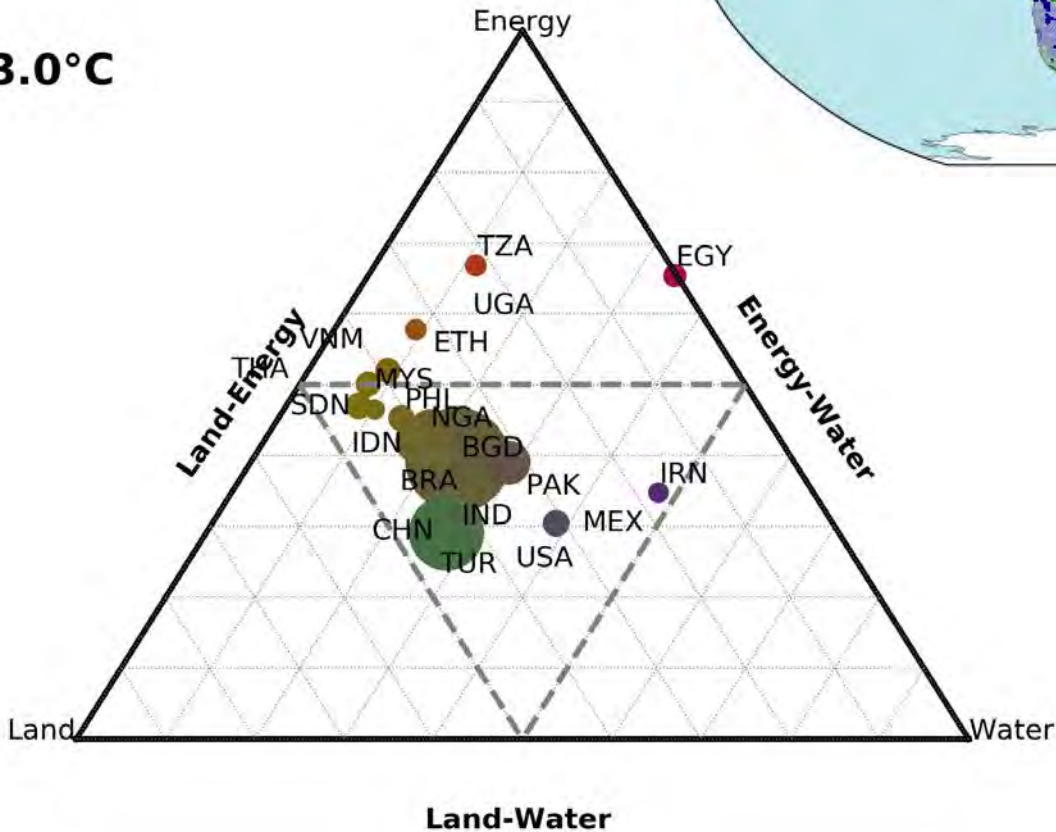
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Sectoral country-level analysis

3.0 C



3.0°C



Score

>2

<2



Land

Energy

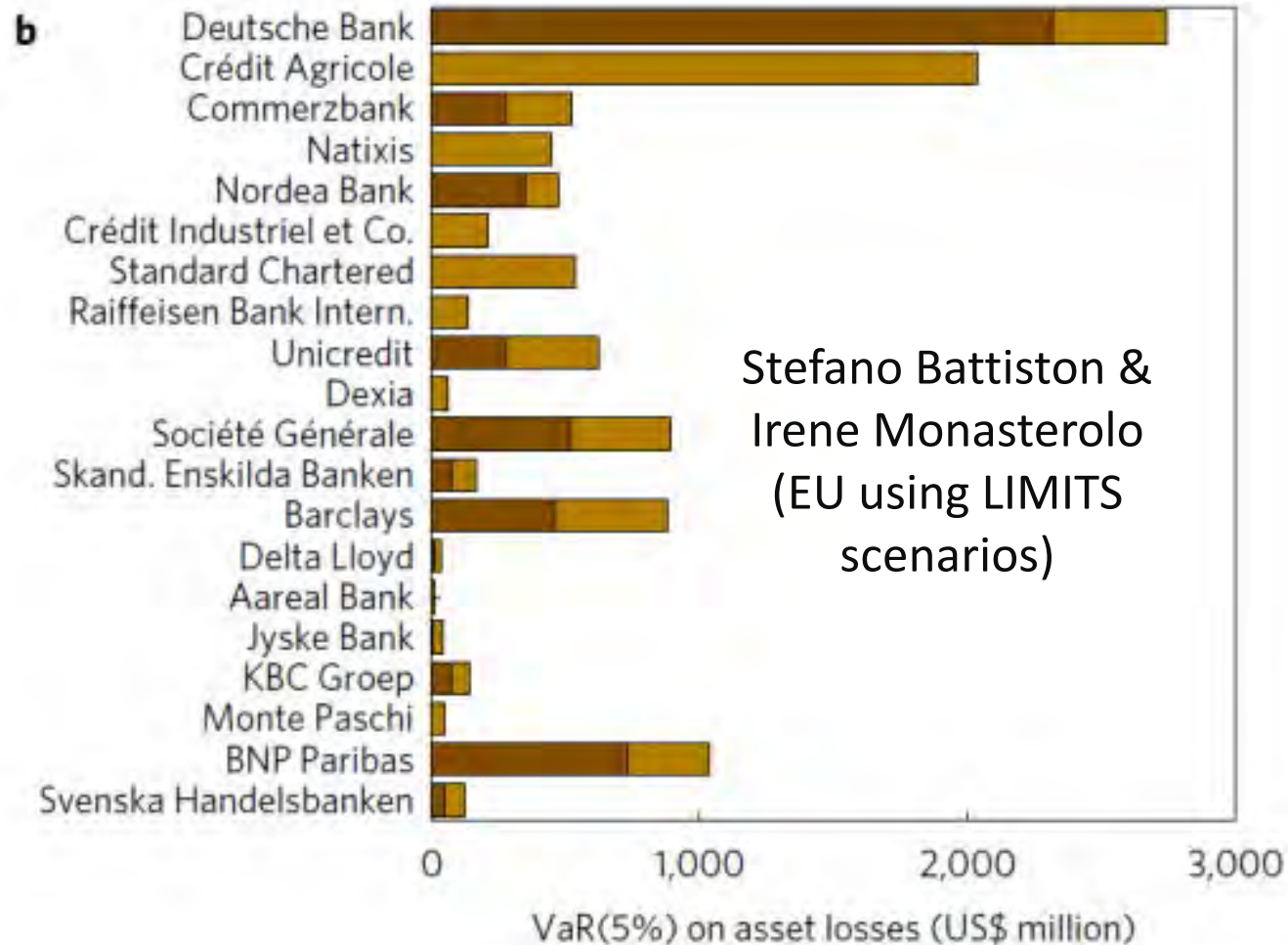
Water

Transition risks and finance

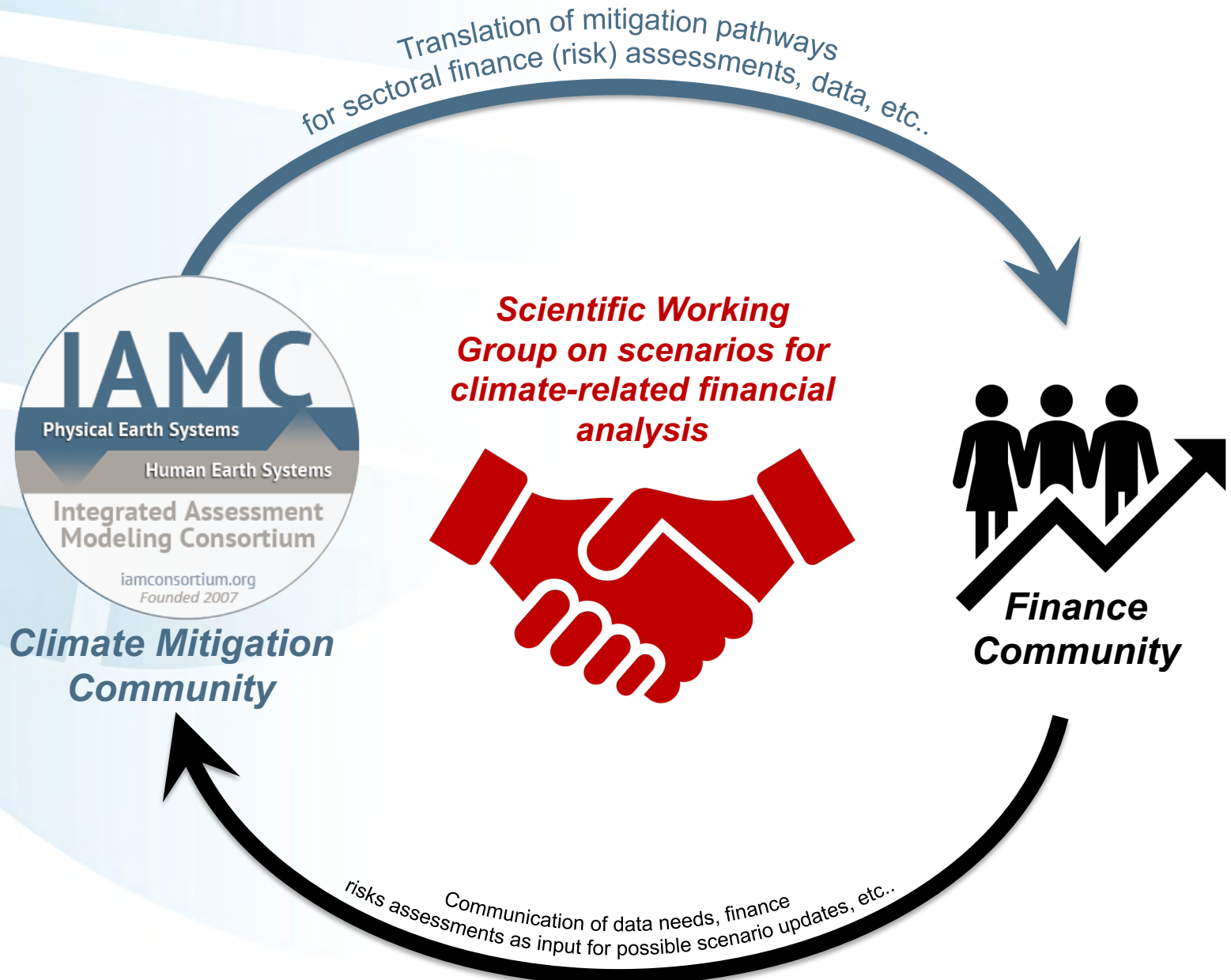
- A range of different instruments available
- Climate-related Financial (Risk) Disclosure
- Initial piloting study by UNEP-FI together with Wyman, Mercer, IIASA & PIK
- Four risk factor pathways (RFP)
 - Direct emissions costs
 - Indirect emission costs
 - Low-carbon capital expenditure
 - Revenue effects



Translating IAM scenarios into standard financial risk metrics (eg, VaR and climate stress test)



New Community effort to bridge the gap between the climate mitigation and finance community



Impact on investments for other SDGs

If the energy system remains largely the same

Energy access



50 (50 to 85)



If the energy system is transformed



200 (125 to 320)

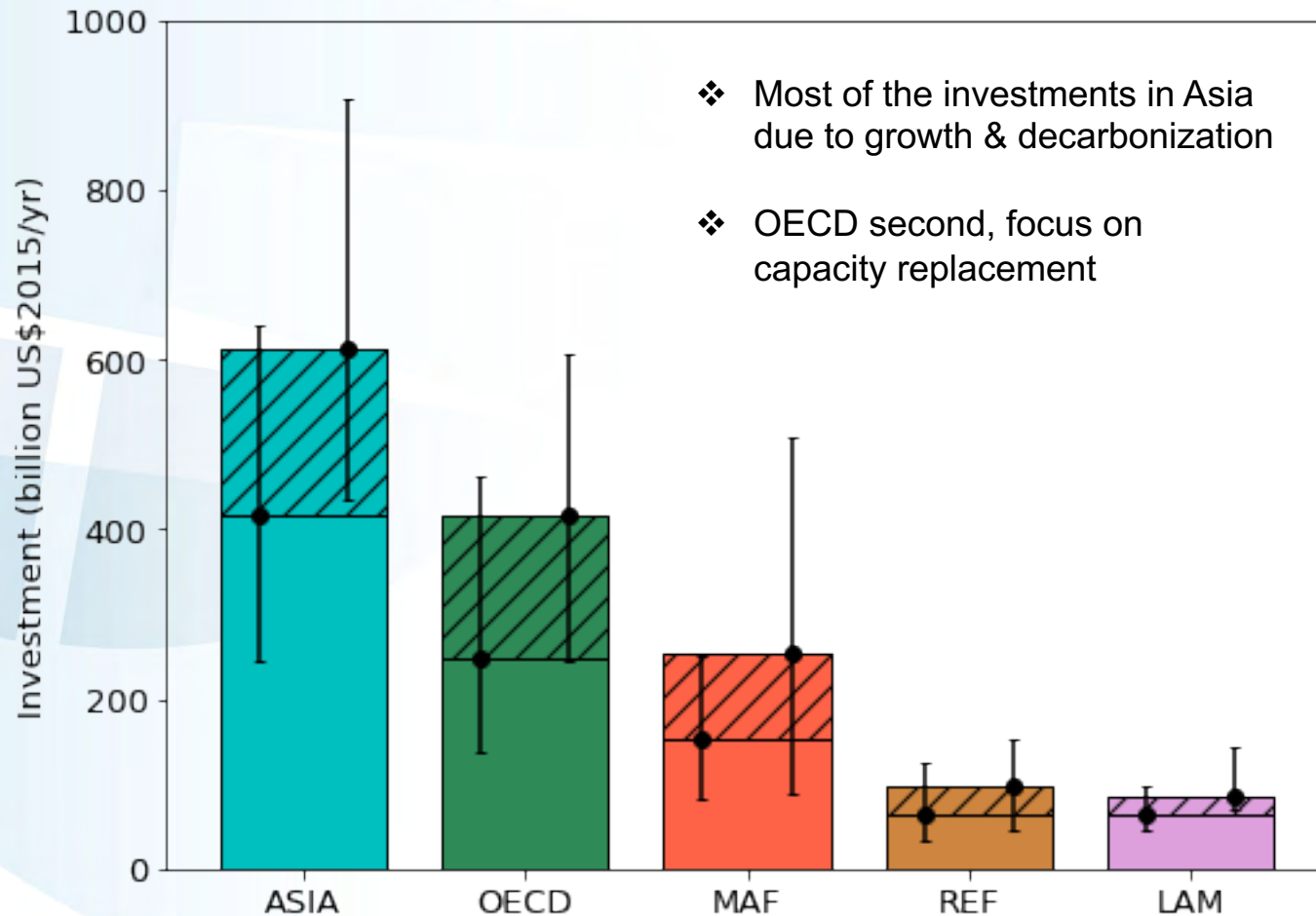
Target 7.1:

Ensure universal access to affordable, reliable and modern energy services

Policy costs to achieve 100% clean fuel adoption throughout the world via subsidies for cookstoves and fuels.

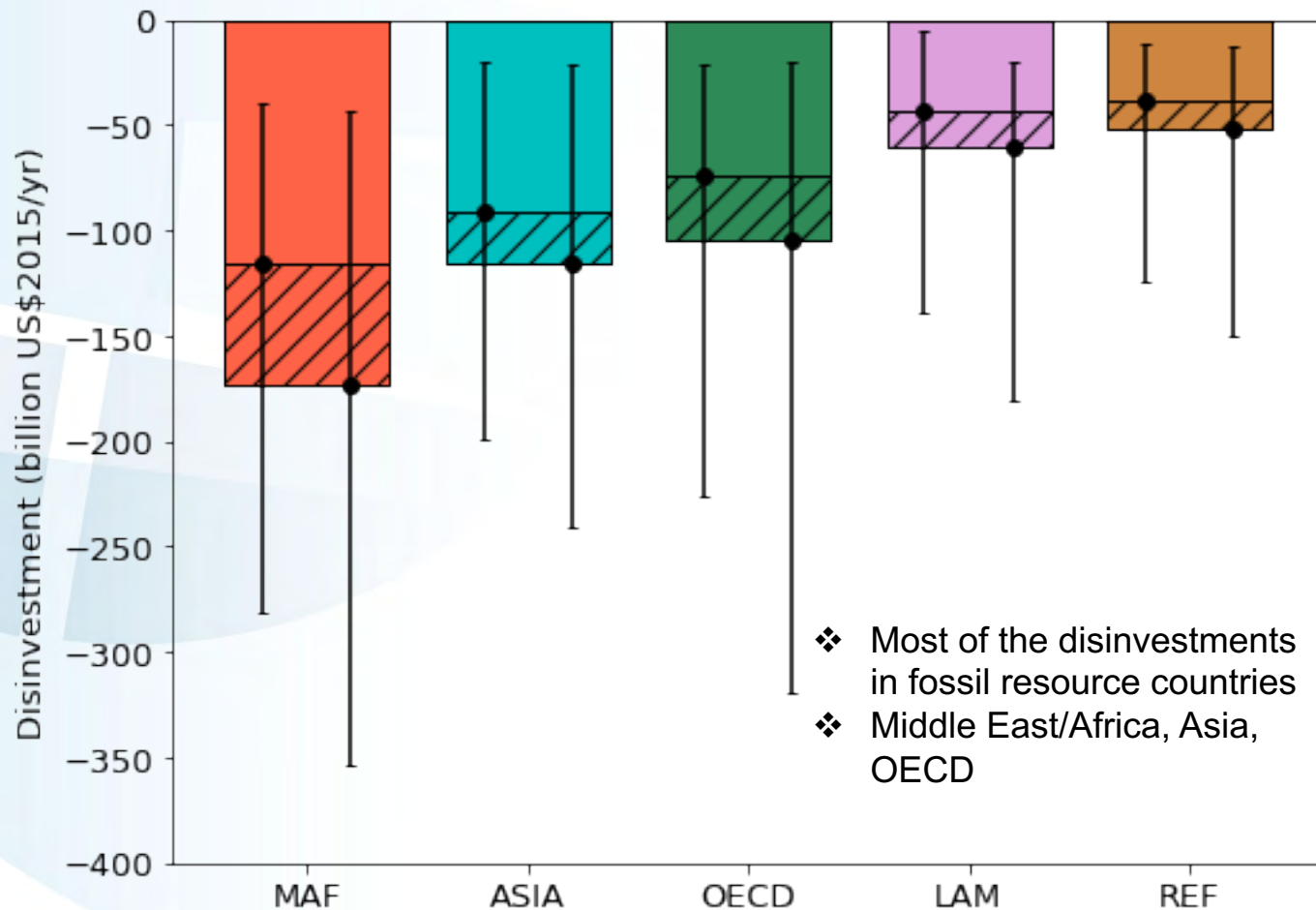
Regional Investments (1.5 vs 2C)

2015-2050, compared to baseline



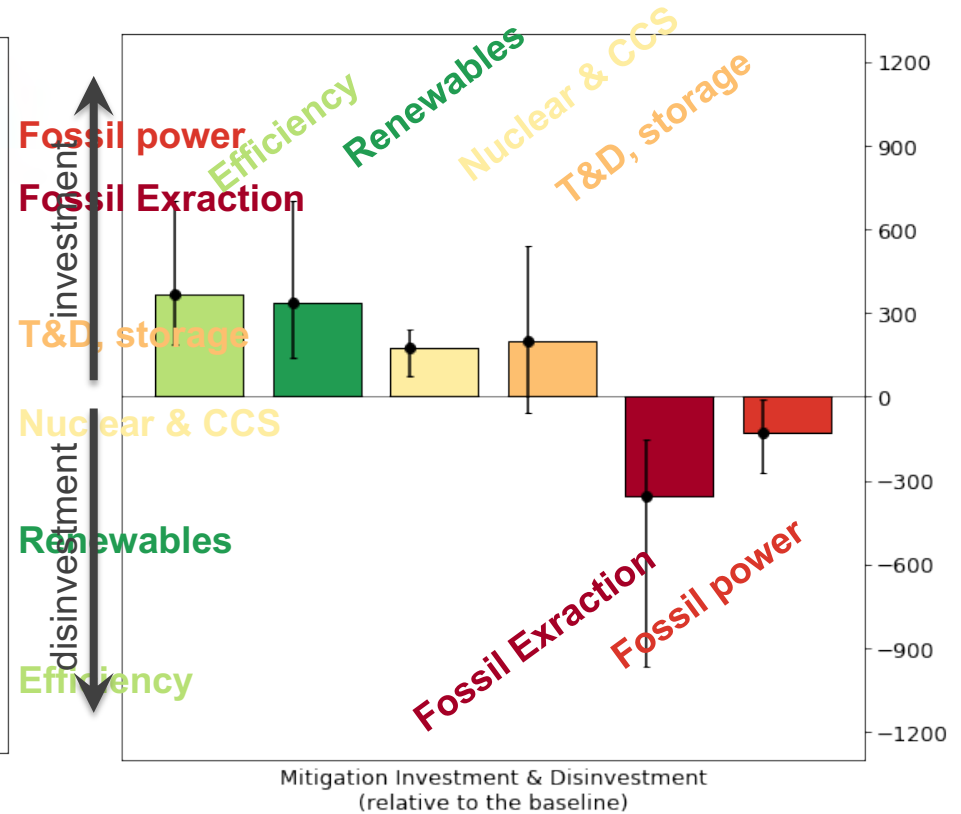
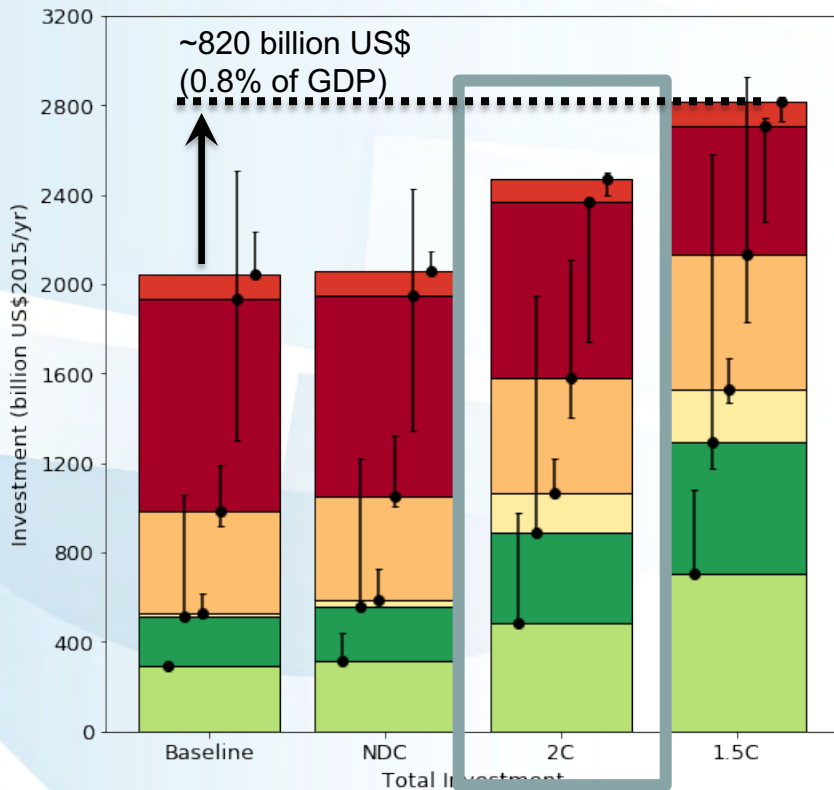
Regional Disinvestments (1.5C vs 2C)

2015-2050, compared to baseline



Global Investment Portfolios for 1.5 and 2C

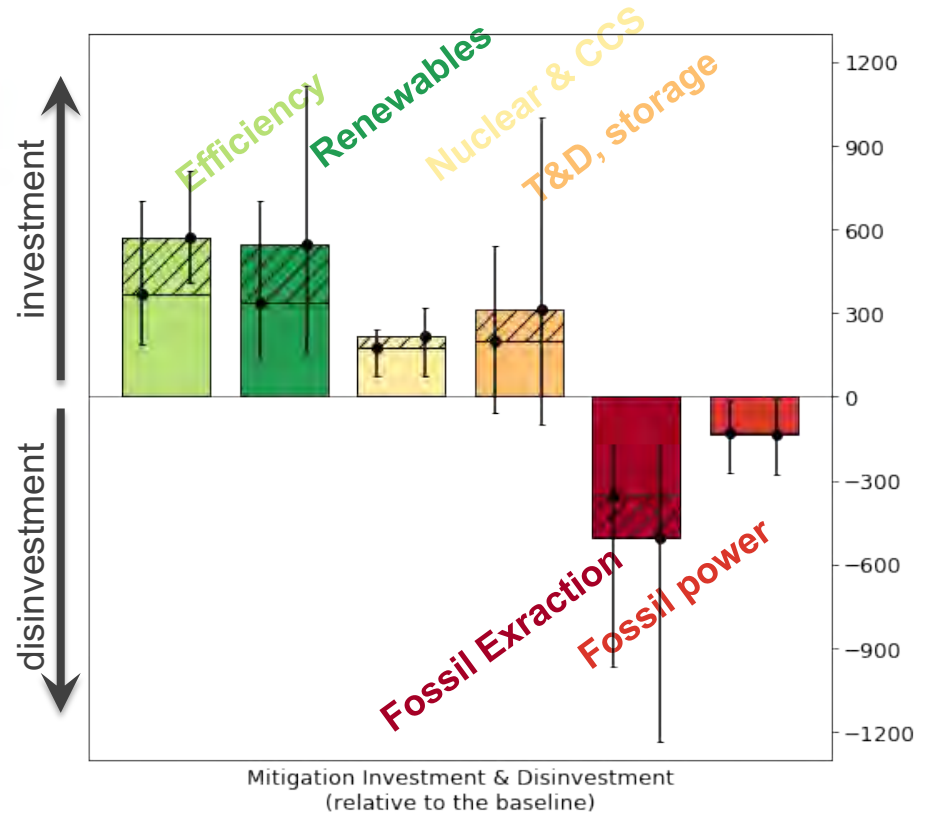
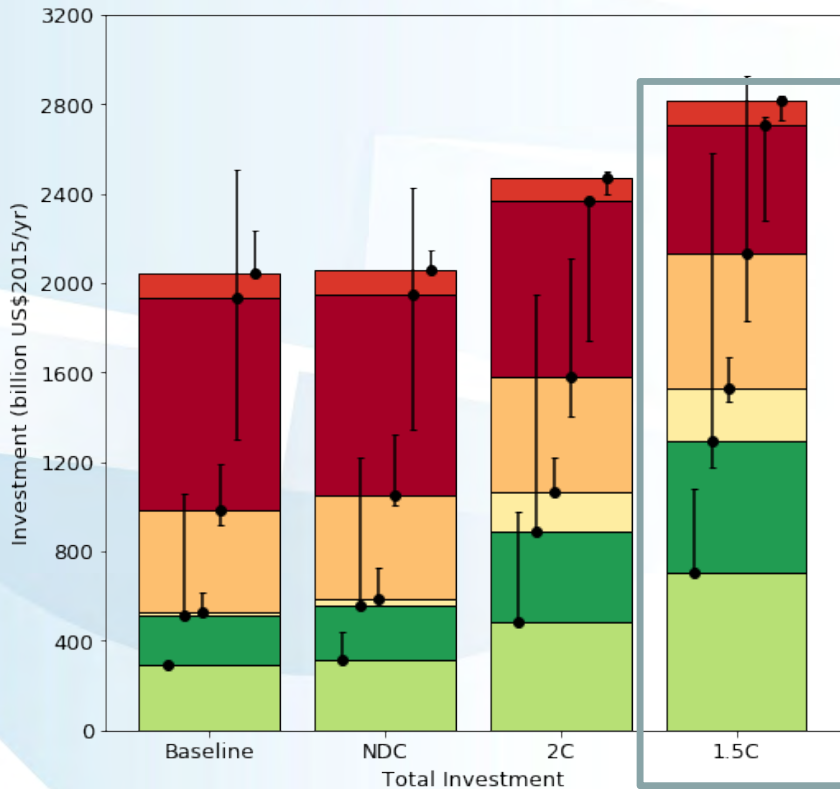
Average annual investments 2010 to 2050



2°C compared to baseline

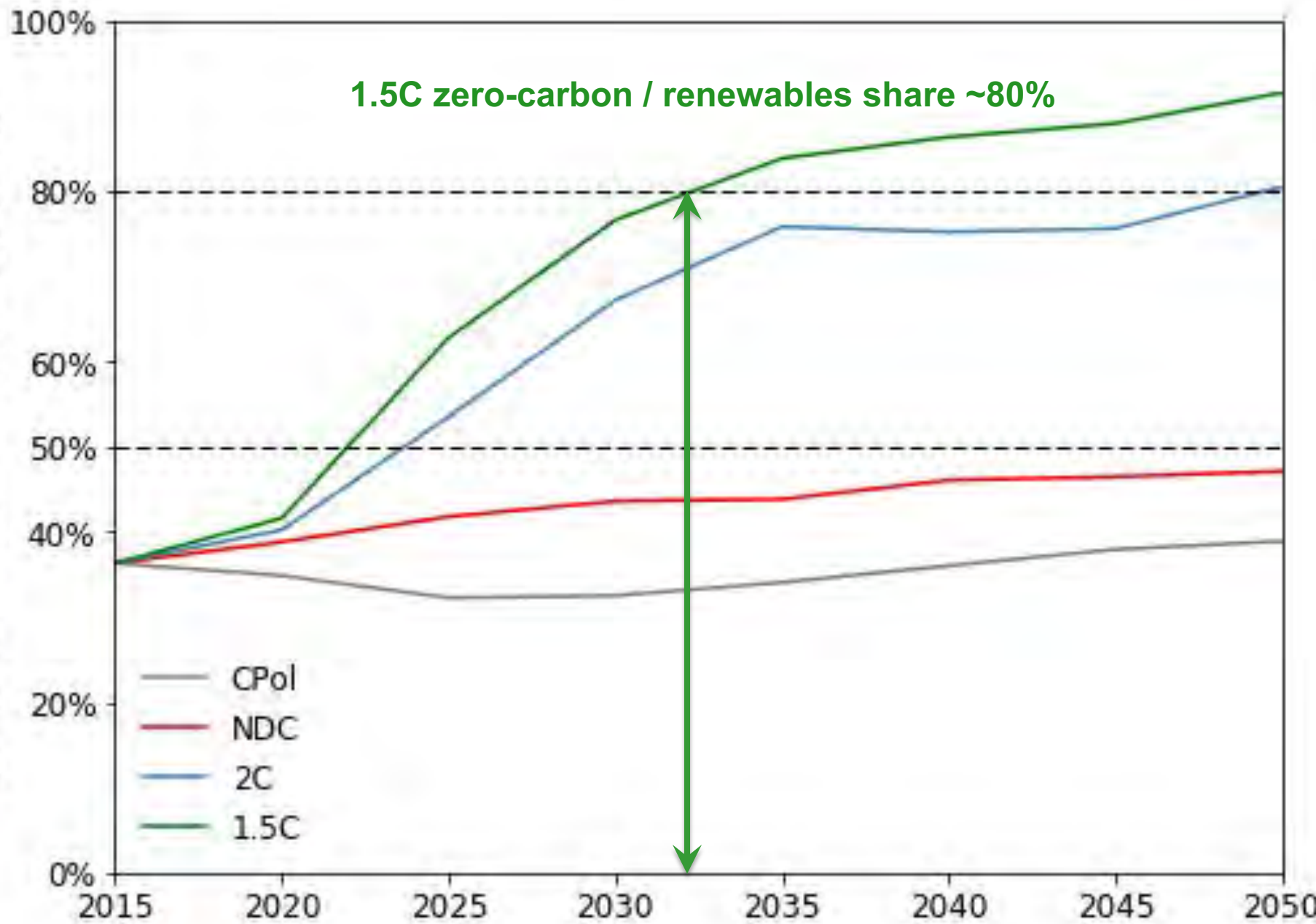
Global Investment Portfolios for 1.5 and 2C

Average annual investments 2010 to 2050



1.5°C compared to baseline

Low-carbon investment share (supply side)



1.5C zero-carbon / renewables share ~80%

- CPol
- NDC
- 2C
- 1.5C

1.5C and 2C imply zero investment into coal-based electricity globally (except some small CCS investments)

