POTSDAM INSTITUTE FOR
CLIMATE IMPACT RESEARCH

What do we know so far about getting to 1.5°C?

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Leibniz Association

The Paris Agreement

Temperature and emissions goals

- Holding global mean temperature well below 2°C
- **Pursuing efforts to limit temperature increase to 1.5°C**
- Aiming to peak global GHG emissions as soon as possible
- Undertaking rapid reductions thereafter to **achieve balance between emissions sources and sinks in the 2nd half of the century**, on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty

Why 1.5 degrees?

- Political glue for the agreement
- 1.5°C warmer world as impact benchmark – adaptation up to 1.5°C is national task, above 1.5°C would be due to failure of collective action
- Lowering the lower end of the long term target pushes research into this direction, increases expectation of stringent emissions reductions, establishes more stringent yardstick and thus may lead to stronger climate action.

Risks:

Increased fragility of the agreement due to loss of credibility

Increased division in scientific and political debate

PIK

Risks for research community and IAM community in particular

Repeat 2°C debate „on steroids“

The (Post-)AR5 2°C debate

AR5 approach: Assess requirements and implications of 2°C pathways and highlight synergies and trade-offs (delay, technology, CDR)

AR5 reception: A distinct story about 2°C. But different audiences perceived different stories (depending on their pre-conceptions):

(a) 2°C pathways robustly achievable ➔ Critique: BECCS not needed, has been introduced to keep fossil fuels in a 2°C world alive

(b) 2°C pathways a large challenge

➔ Critique: BECCS has been invented to keep 2°C alive

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The coming 1.5°C debate?

SR 1.5C approach? Assess requirements and implications of 1.5°C pathways and highlight synergies and trade-offs (NDCs, energy and food demand, transition rates, CDR, SRM?, sustainable development)

Reception? A distinct story about 1.5°C. But different audiences may again perceive different stories (depending on their pre-conceptions):

(a) 1.5°C pathways more opportunity than challenge ➔ Critique: Radical (societal) transformation needed , not large-scale CDR

(b) 1.5°C pathways infeasible ➔ Critique: CDR portfolios have been extended to make 1.5°C feasible for reasons of political expediency.

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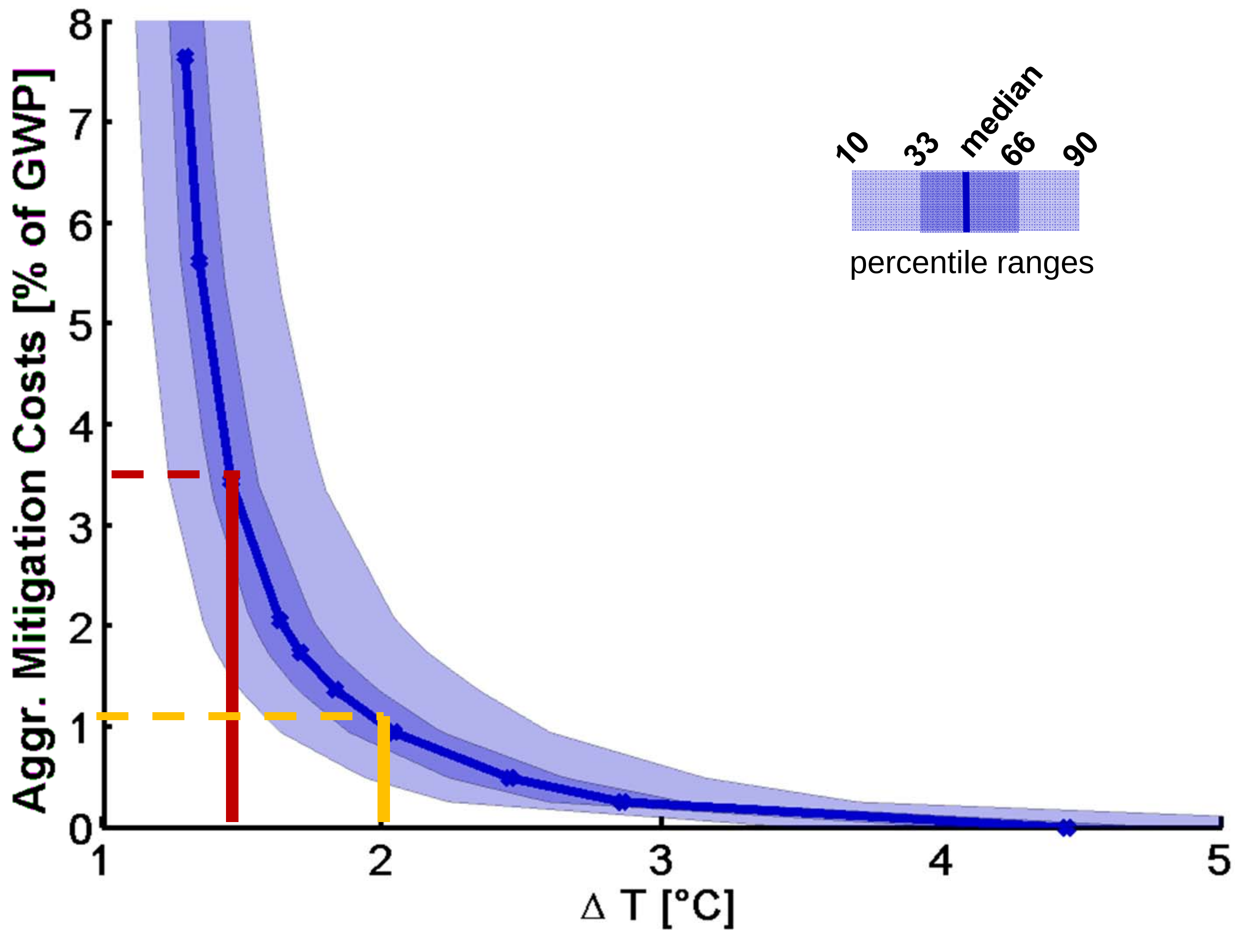
How to characterize 1.5°C challenge?



Luderer, G., Pietzcker, R., Bertram, C., Kriegler, E, Meinshause, M., Edenhofer, O. Economic mitigation challenges: How further delay closes the door for achieving climate targets. *ERL* (2013).

How to interpret the 1.5°C target?

1.5°C consistent emissions budget for 21st century depends on

- Likelihood of limiting warming below 1.5°C
- Degree of admissible overshoot (by when needs the target likelihood of being below 1.5°C be achieved)

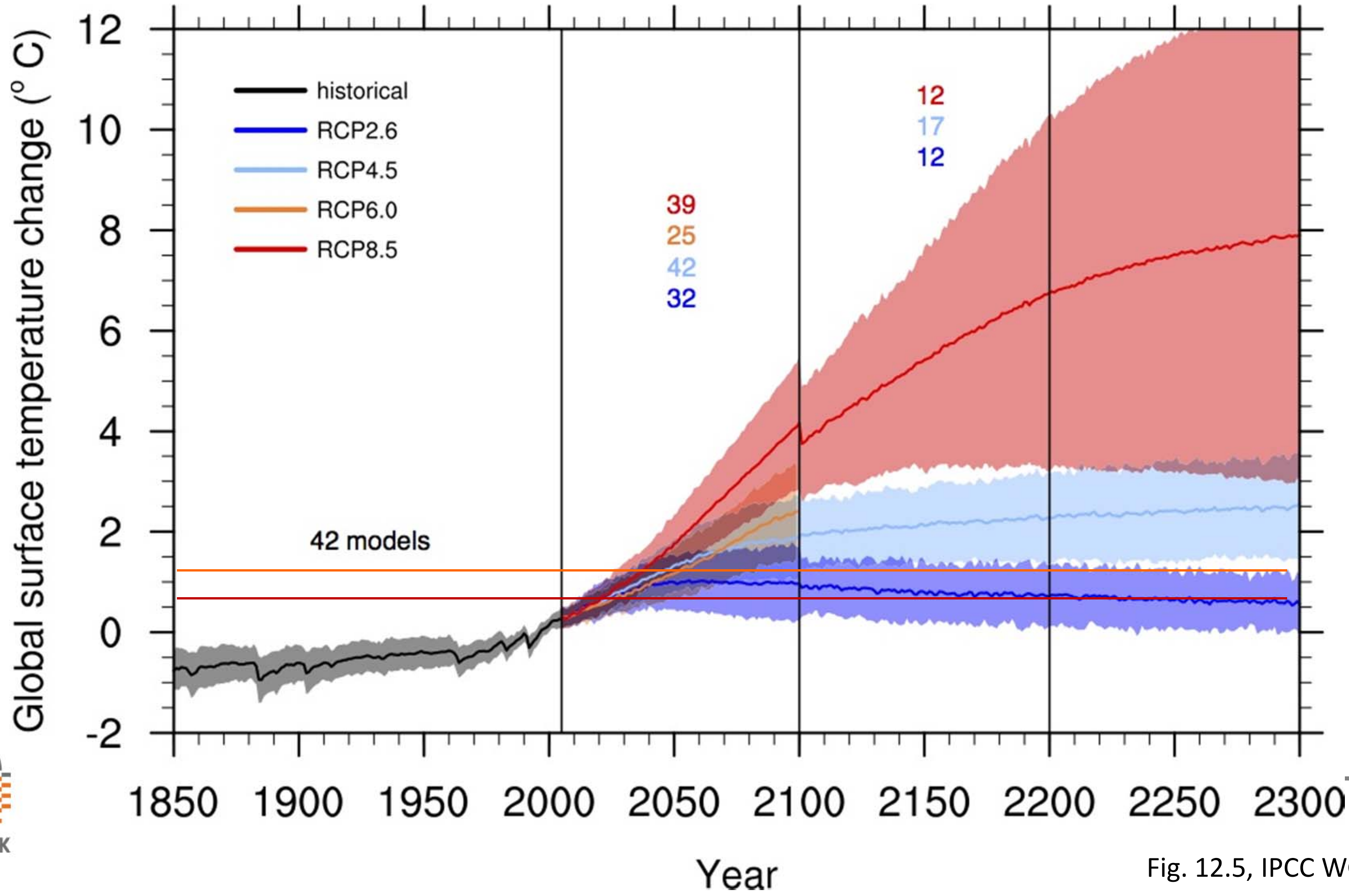


Fig. 12.5, IPCC WG1 AR5 (2013)

What CO_2 budgets are implied by a given target definition?

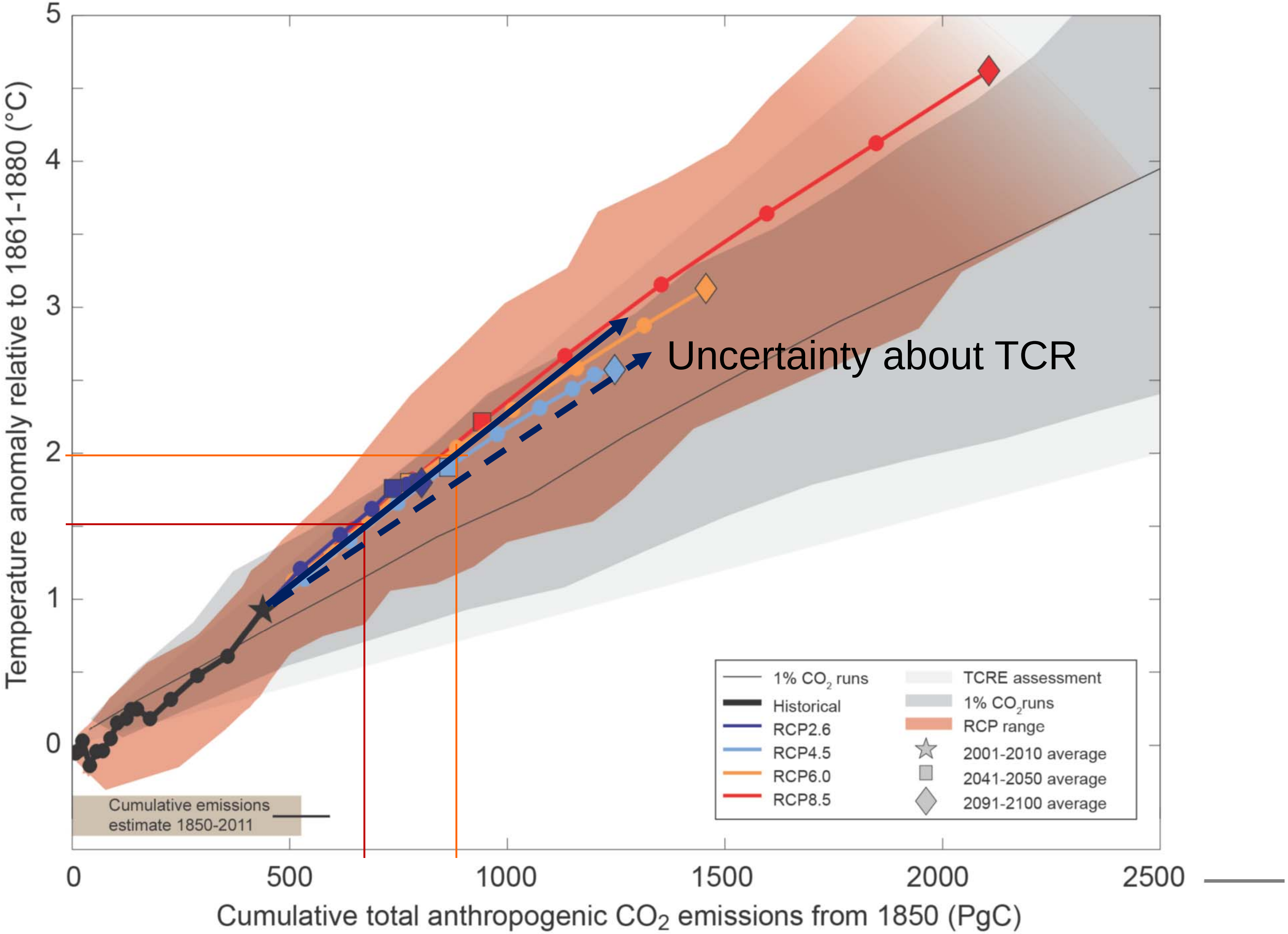


Fig. SPM.9, IPCC WG1 AR5 (2013)

What do we know about 1.5°C pathways?

nature climate change

PERSPECTIVE

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Energy system transformations for limiting end-of-century warming to below 1.5 °C

Joeri Rogelj[1,2*], Gunnar Luderer[3*], Robert C. Pietzcker[3], Elmar Kriegler[3], Michiel Schaeffer[4,5], Volker Krey[1] and Keywan Riahi[1,6]

Many impacts projected for a global warming level of 2 °C relative to pre-industrial levels may exceed the coping capacities of particularly vulnerable countries. Therefore, many countries advocate limiting warming to below 1.5 °C. Here we analyse integrated energy-economy-environment scenarios that keep warming to below 1.5 °C by 2100. We find that in such scenarios, energy-system transformations are in many aspects similar to 2 °C-consistent scenarios, but show a faster scale-up of mitigation action in most sectors, leading to observable differences in emission reductions in 2030 and 2050. The move from a 2 °C- to a 1.5 °C-consistent world will be achieved mainly through additional reductions of CO_2. This implies an earlier transition to net zero carbon emissions worldwide, to be achieved between 2045 and 2060. Energy efficiency and stringent early reductions are key to retain a possibility for limiting warming to below 1.5 °C by 2100. The window for achieving this goal is small and rapidly closing.

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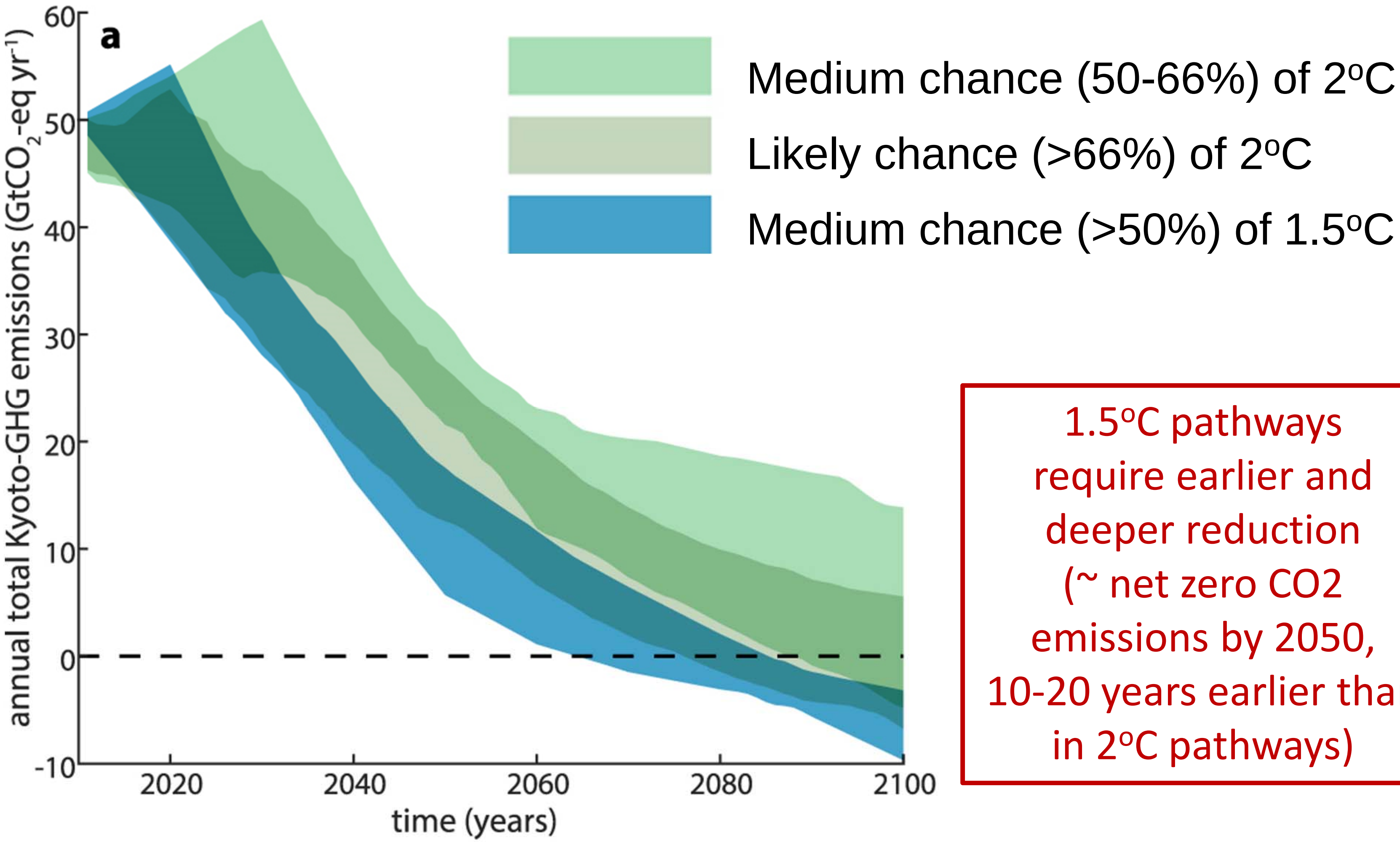
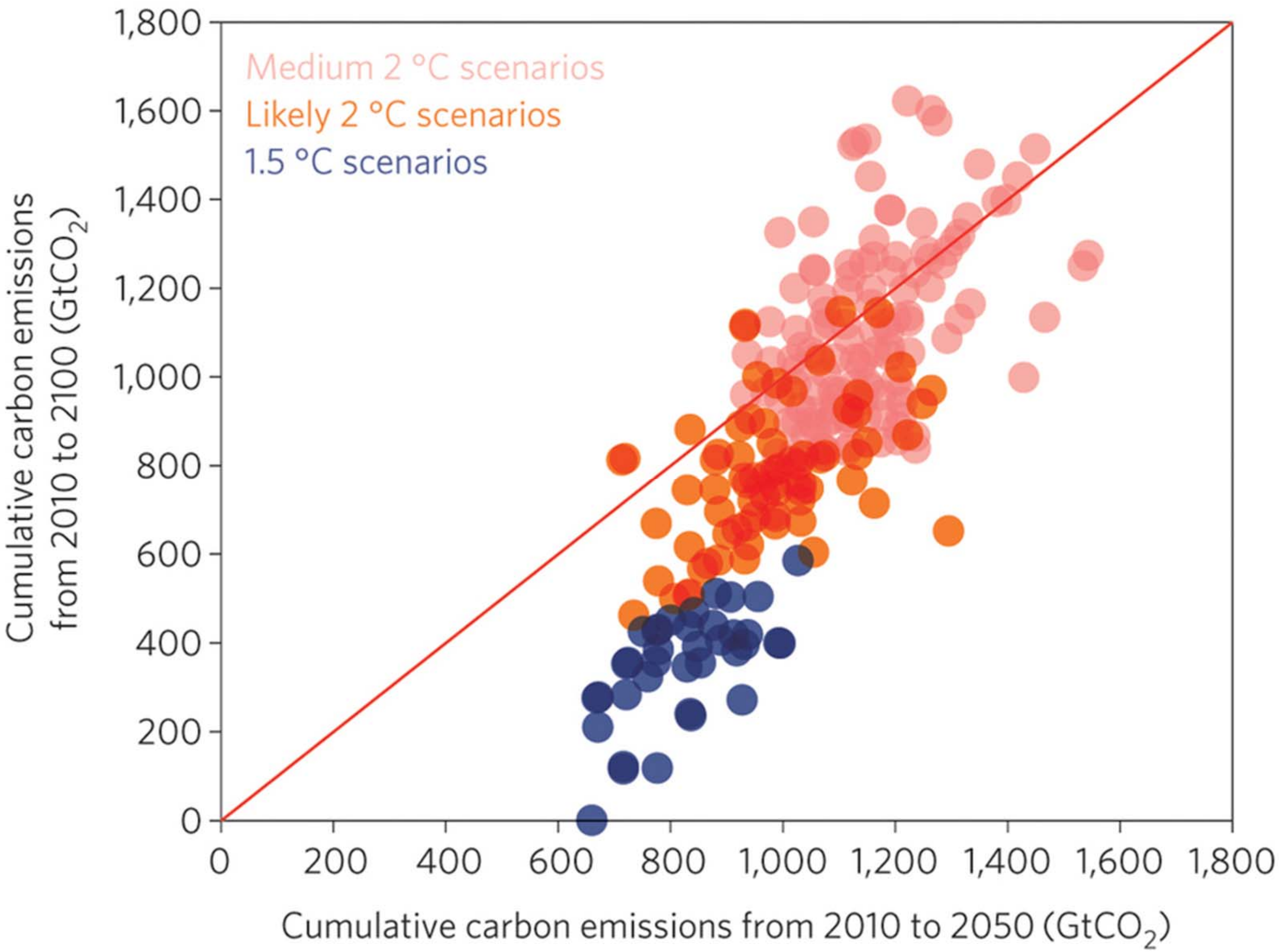
Emission pathways to 2°C and 1.5°C



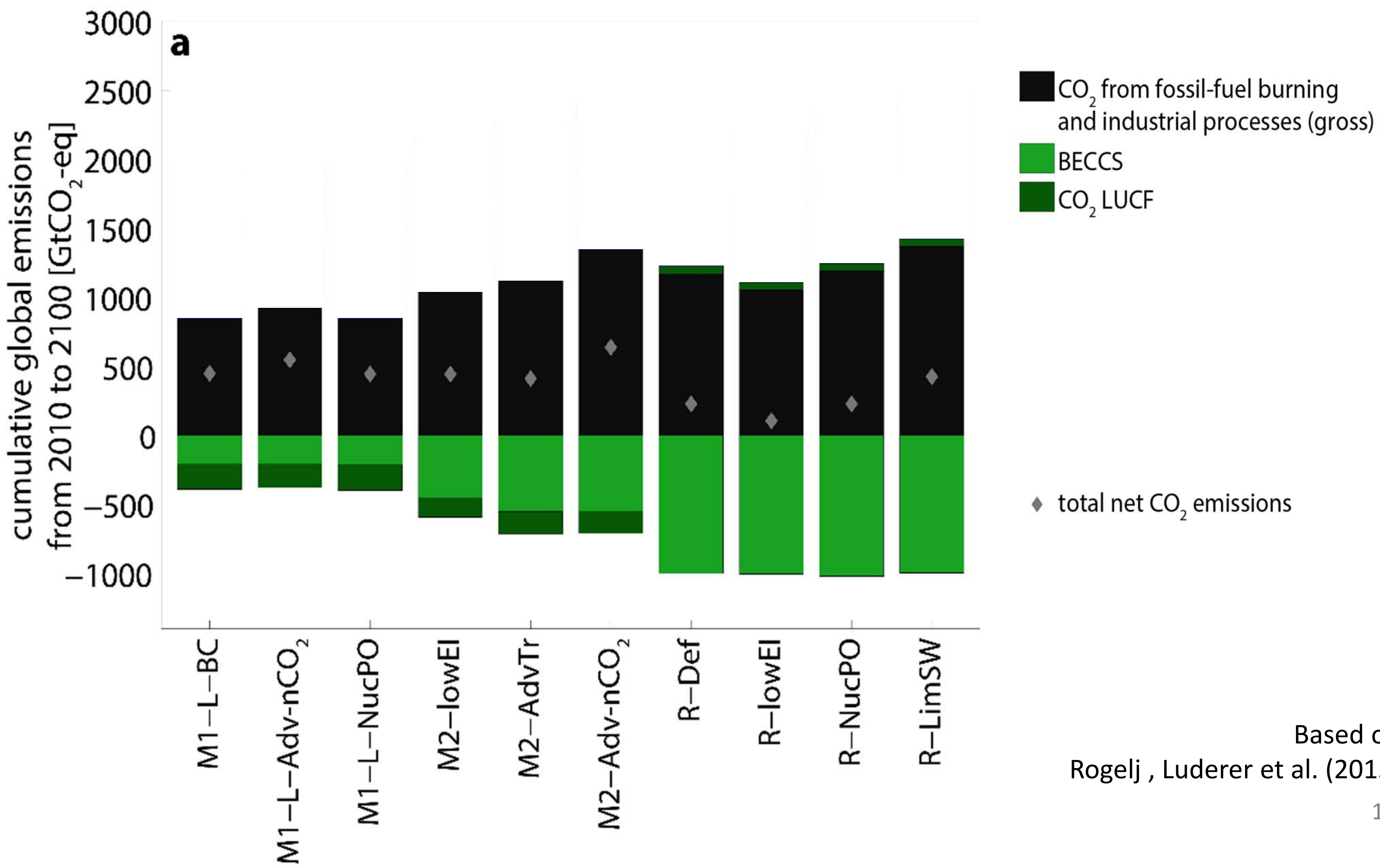
1.5°C pathways require earlier and deeper reduction (~ net zero CO2 emissions by 2050, 10-20 years earlier than in 2°C pathways)

Rogelj , Luderer et al. (2015)

Emissions budgets



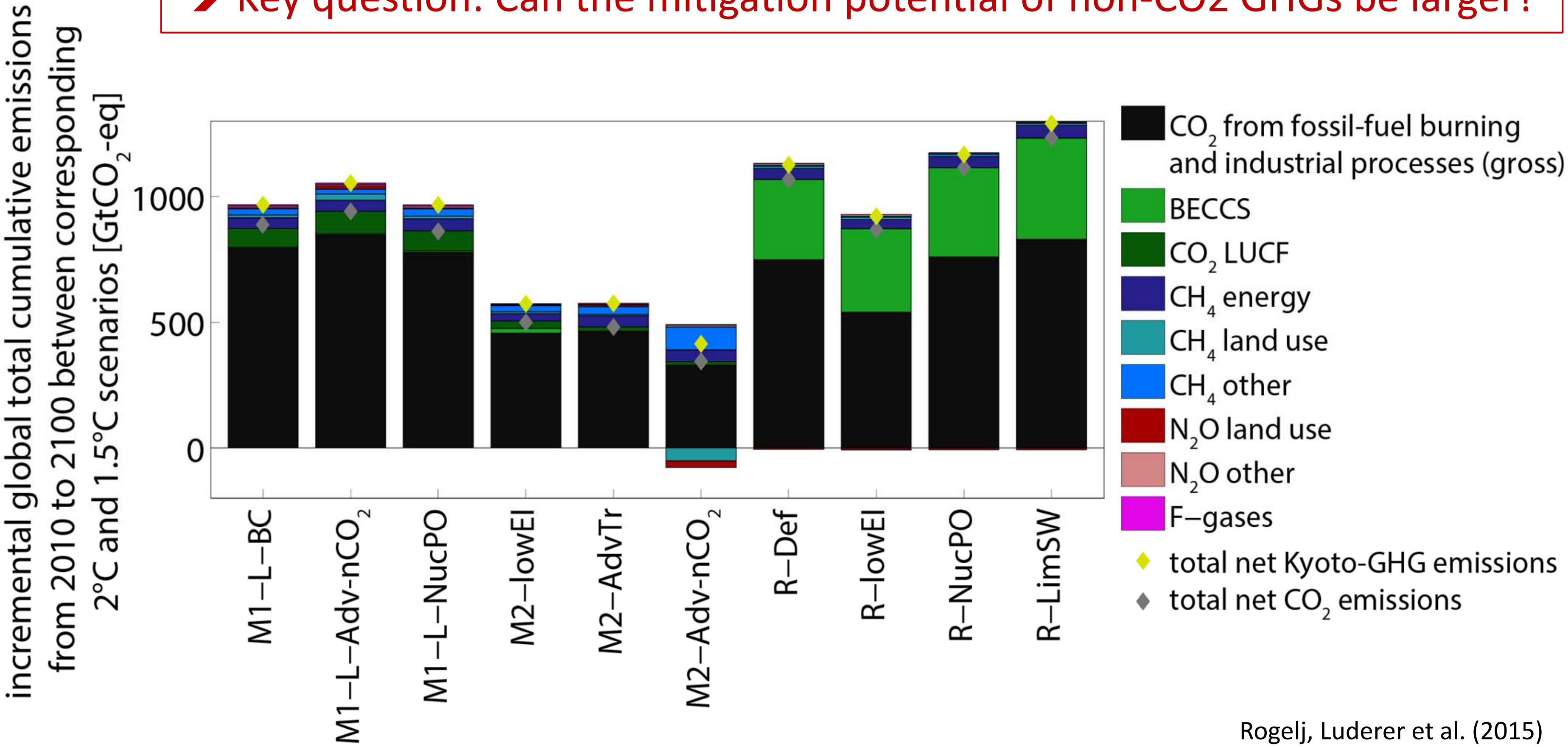
Residual emissions in 1.5°C scenarios



Based on
Rogelj , Luderer et al. (2015)

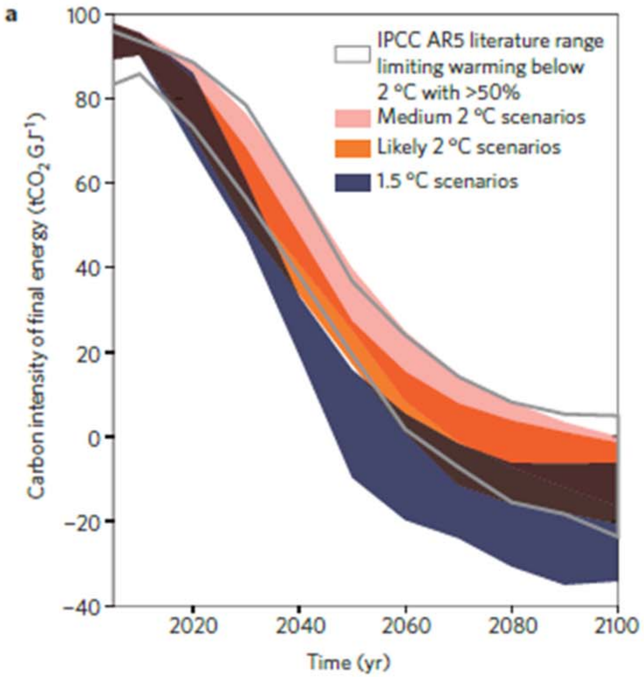
Incremental emissions reductions from 2°C to 1.5°C

Mitigation potential of non-CO2 GHGs often already exhausted in 2°C scenarios, incremental reductions mostly from CO2.
➔ Key question: Can the mitigation potential of non-CO2 GHGs be larger?



Rogelj, Luderer et al. (2015)

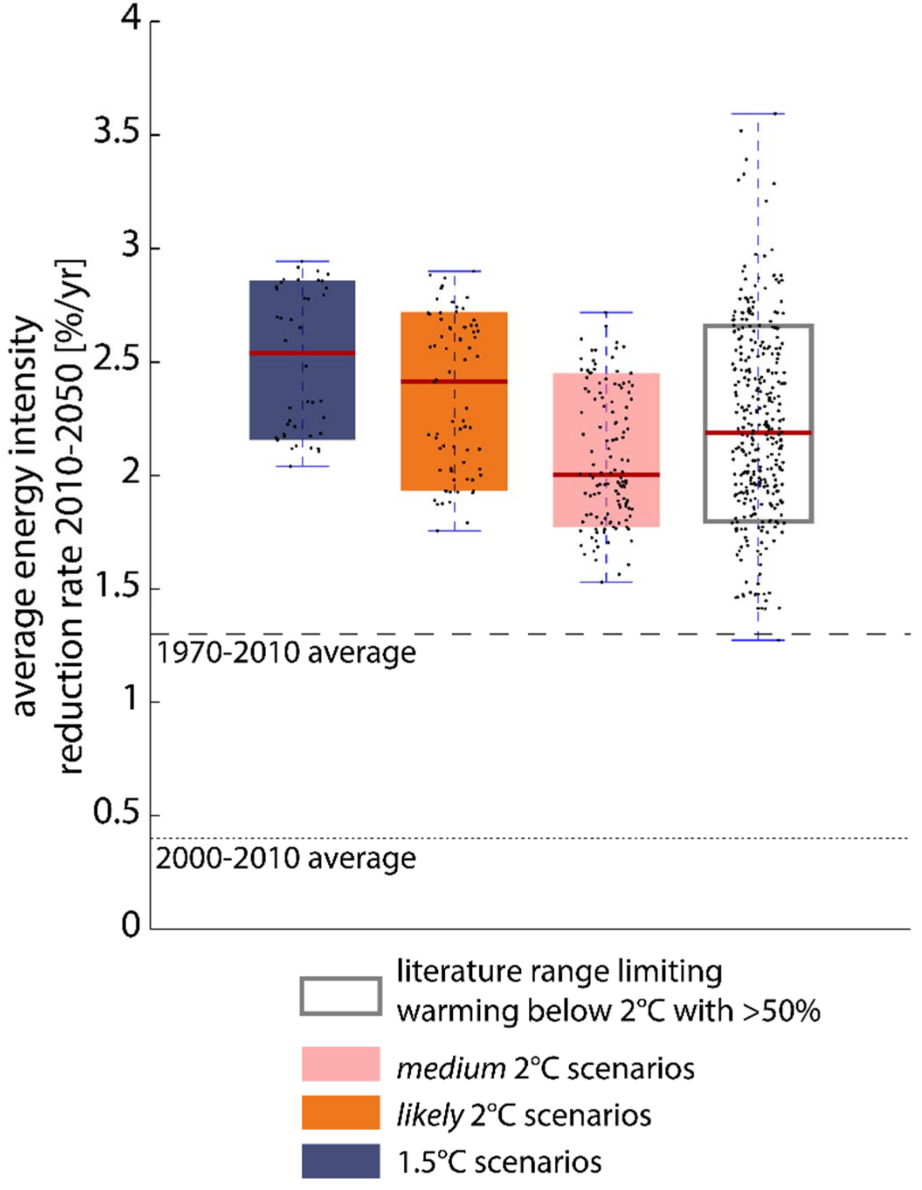
Energy system characteristics



- More rapid near-term decarbonization of electricity sector
- Greater mitigation efforts in the industry, buildings, transportation sectors by mid century

Rogelj, Luderer et al. (2015)

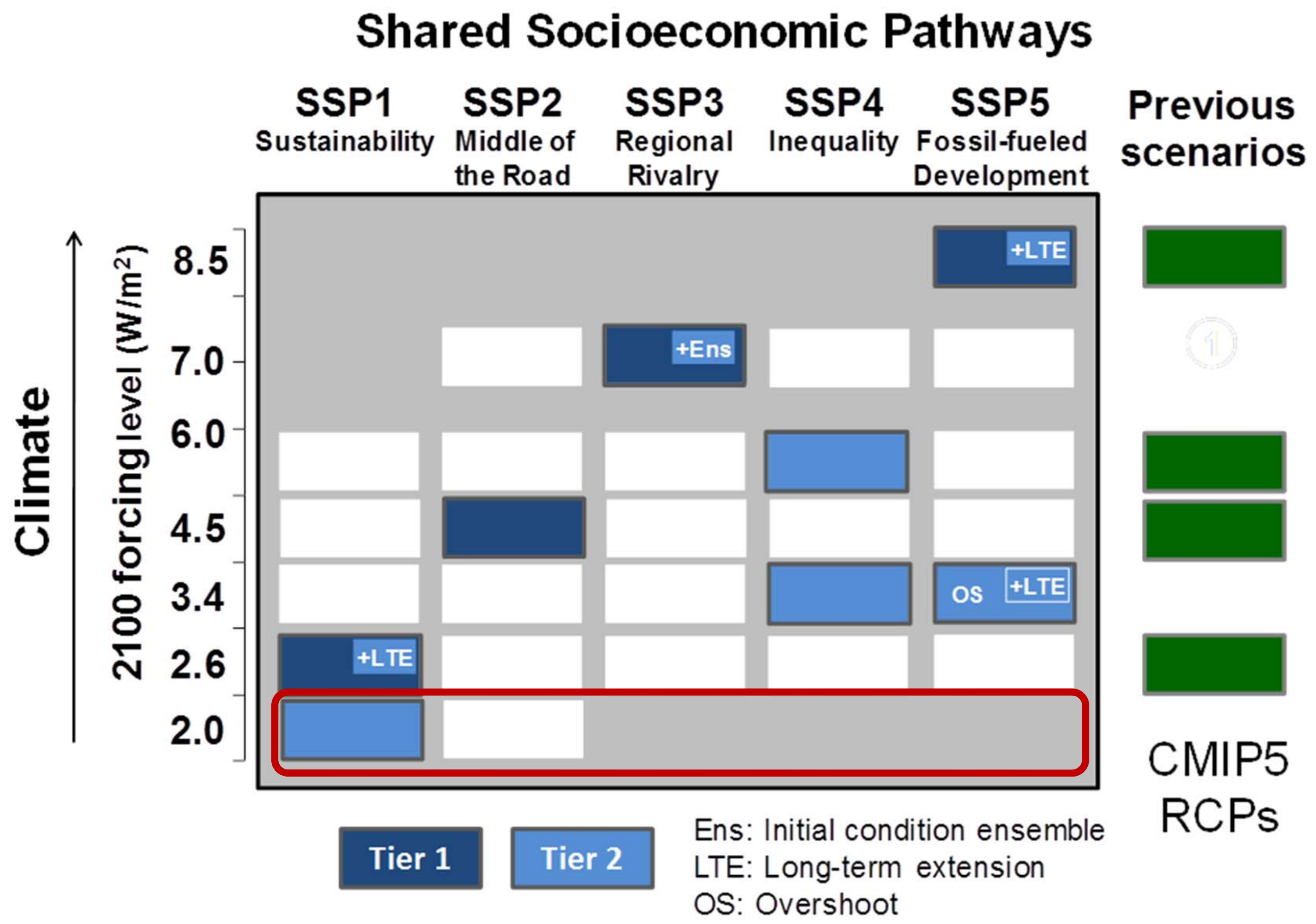
Energy demand



Energy efficiency improvements a crucial enabling factor for 1.5°C

Rogelj, Luderer et al. (2015)

Ongoing work on 1.5°C pathways: SSP-based 1.9 W/m² scenarios



ScenarioMIP design, O'Neill et al. (2016)

ADVANCE Mitigation Pathway Study

Policy dimension		Long-term CO2 budget (2011-2100 cumulated)			
	None	1800	1600	1000	400
Reference	REF				
INDCforever	INDC				
INDC2030		INDC2030_1800	INDC2030_1600	INDC2030_1000	
INDC2020		INDC2020_1800	INDC2020_1600	INDC2020_1000	INDC2020_400

So far, three models ran the INDC 2020_400: MESSAGE, POLES, REMIND

Analysis in progress

This project is funded by the European Union.

ADVANCE mitigation pathway analysis coordinated with CD-Links

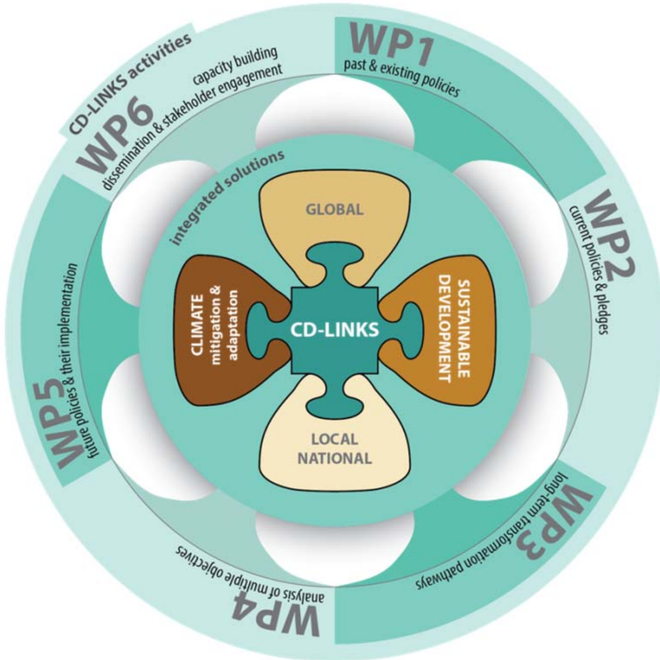
CD-Links consortium includes national modeling teams from

- Brazil (COPPE)
- China (Tsinghua, ERI)
- EU (ICCS)
- India (TERI, IIM)
- Japan (NIES, RITE)
- US (PNNL)
- Russia

CD-Links will explore regional and sustainable development dimension of 1.5°C pathways

CD-Links project

www.cd-links.org



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This project is funded by the European Union.

Key challenges for the 1.5°C report

- Framing, Framing, Framing

➔ How to assess and effectively communicate requirements, implications, trade-offs and synergies of 1.5°C pathways

- 1.5°C budgets (WG1)

- 1.5°C impacts (WG2)

- Characterization of 1.5°C pathways in context (WG3)

Discussion