Sustainable MANUFACTURING

Shaping Global Value Creation

What can we learn from the IPCC?
–
Research and Solutions

Prof. Dr. Ottmar Edenhofer

CRC 1026 – Macroeconomic Sustainability Assessment (A4)

MGK Round Lecture

October 16, 2014

CRC 1026 Sustainable Manufacturing – Shaping Global Value Creation
Funded by German Research Foundation (DFG)

Technische Universität Berlin

IPCC reports are the result of extensive work of many scientists from around the world

1 Summary for Policymakers

1 Technical Summary

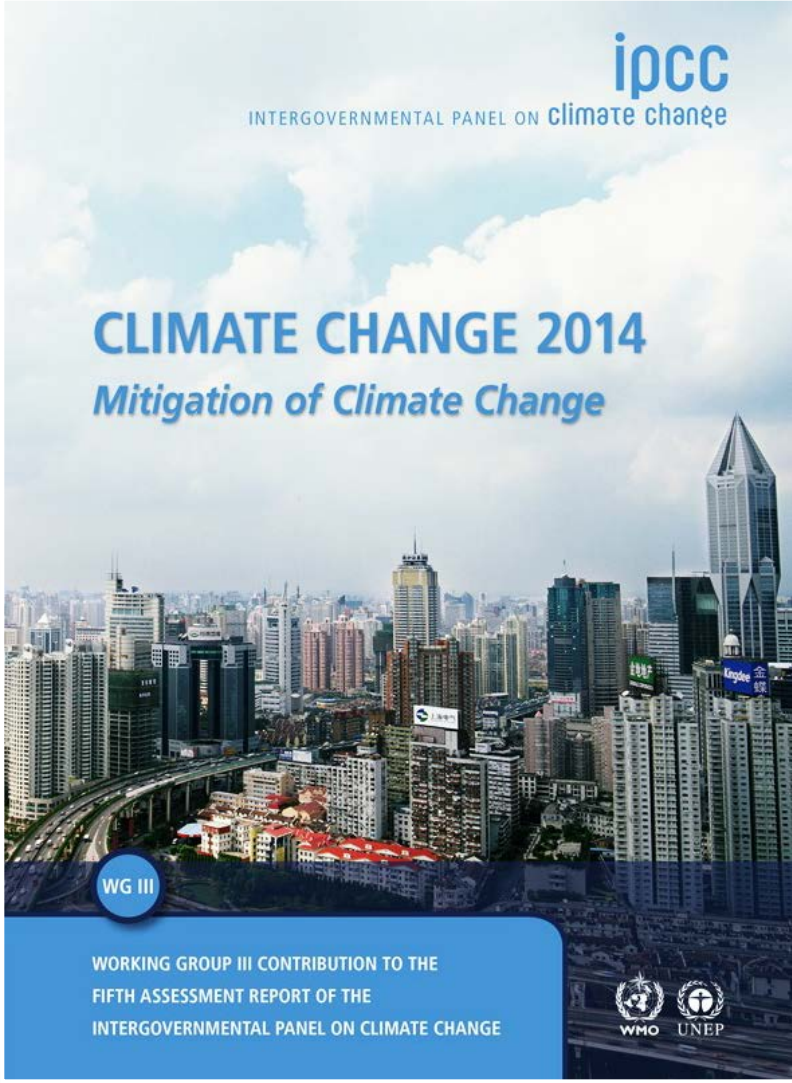
235 Authors

900 Reviewers

More than 2000 pages

Close to 10,000 references

More than 38,000 comments



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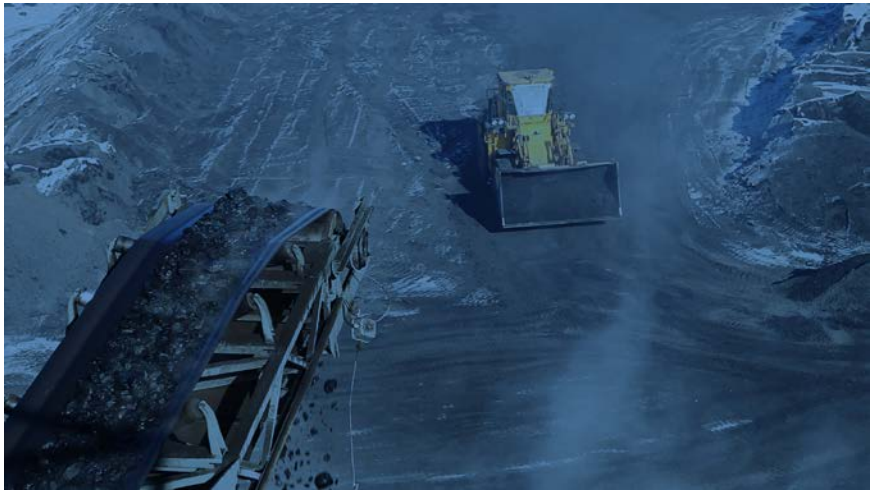
GHG emissions growth has accelerated despite reduction efforts.



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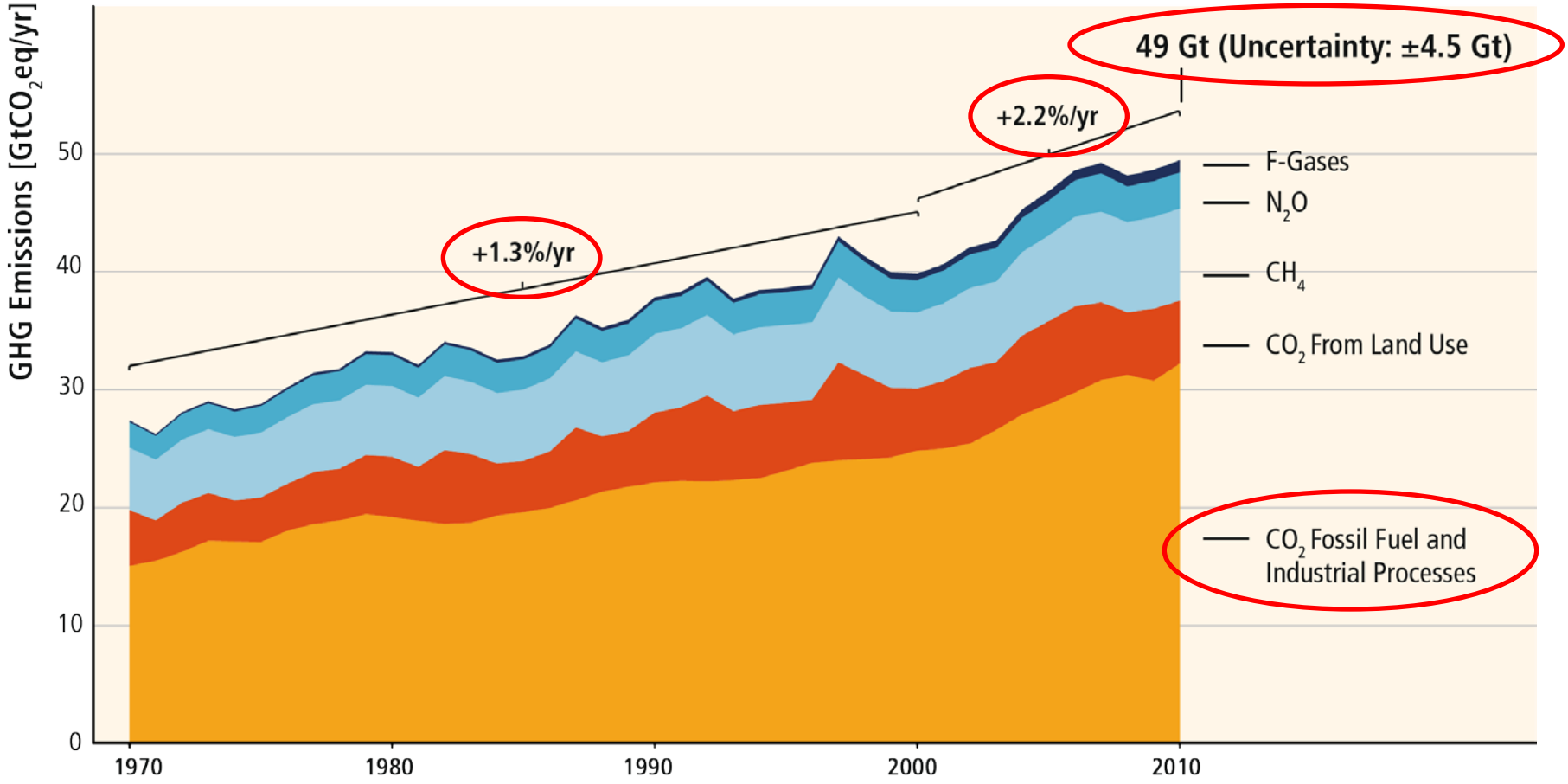
GHG emissions growth between 2000 and 2010 has been larger than in the previous three decades.



Based on IPCC Figure 1.3

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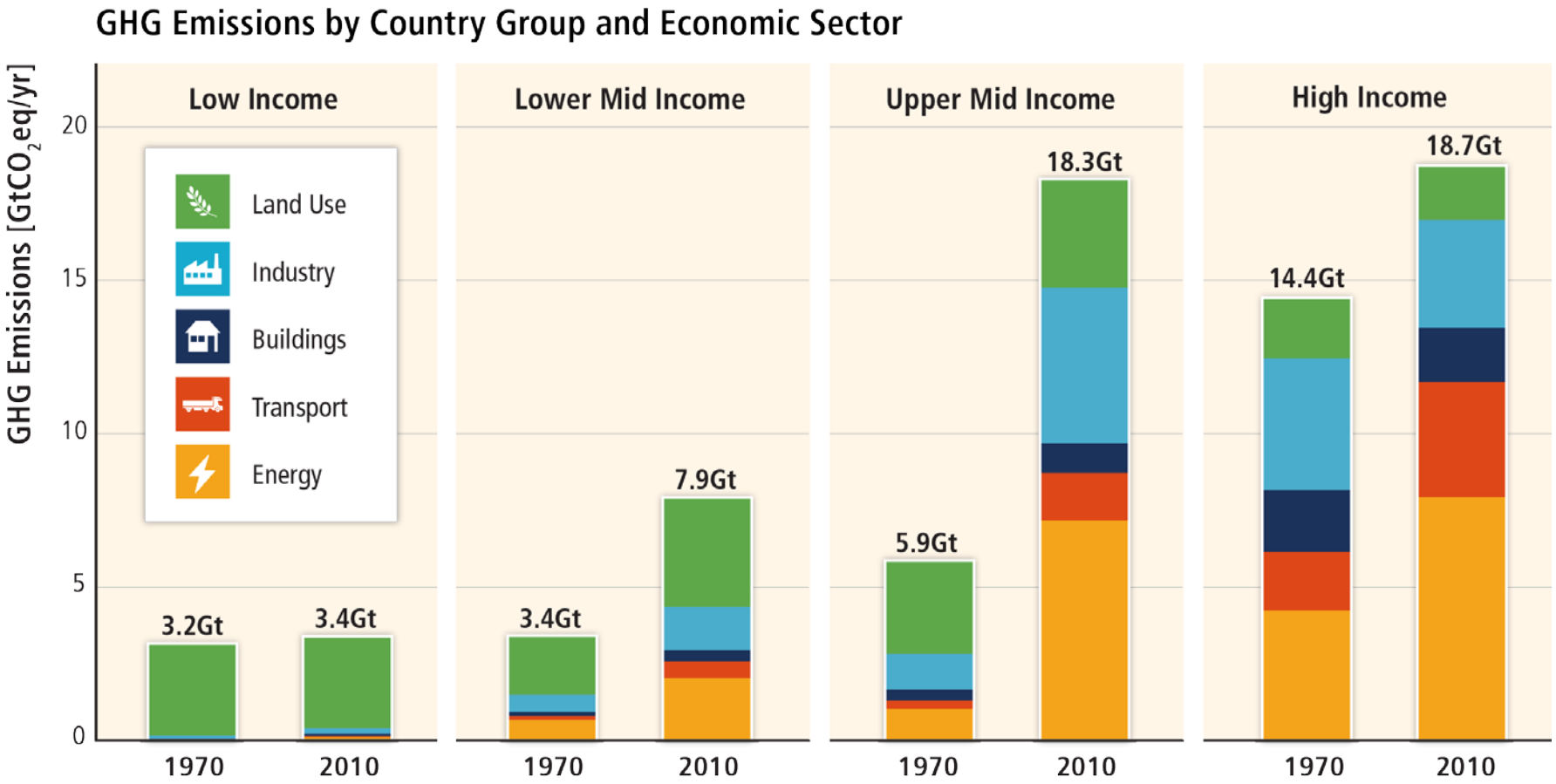
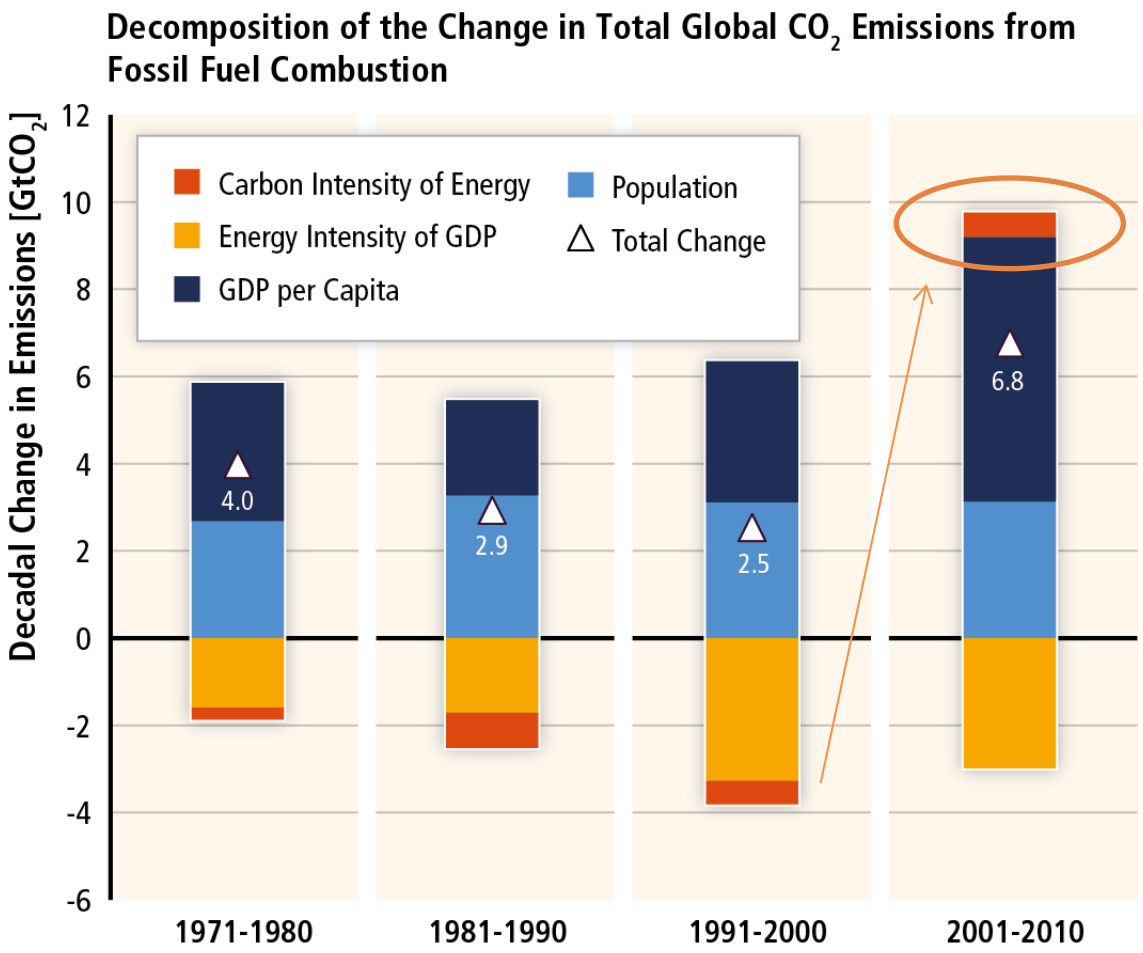
Regional patterns of GHG emissions are shifting along with changes in the world economy.



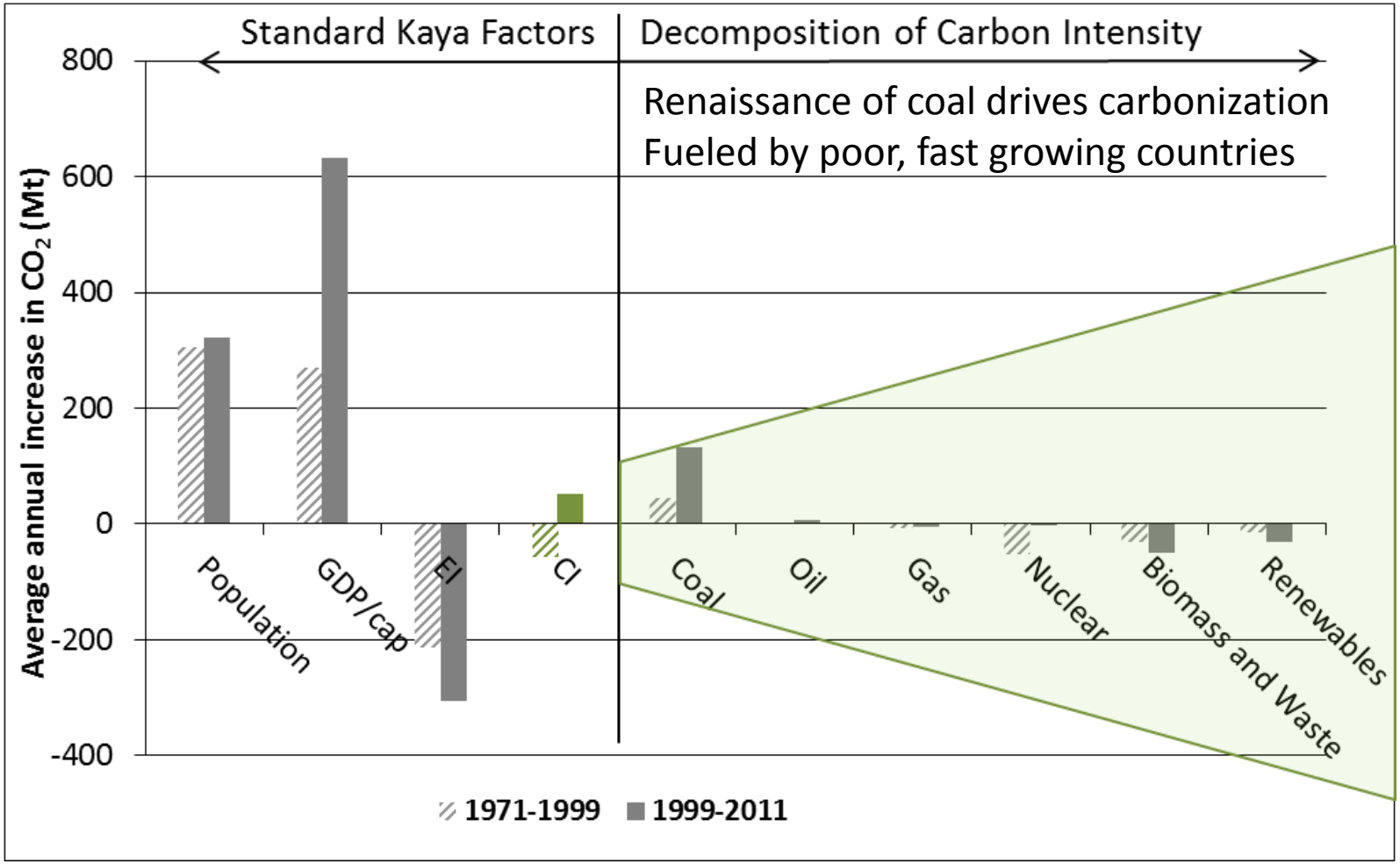
Based on Figure 1.6

GHG emissions rise with growth in GDP and population; long-standing trend of decarbonisation of energy reversed.



IPCC 2014

No Leapfrogging of energy carriers: Evidence for a renaissance of coal



Steckel, Edehofer, Jakob, submitted to PNAS

No leapfrogging of economic structures: The product space

Radebach et al

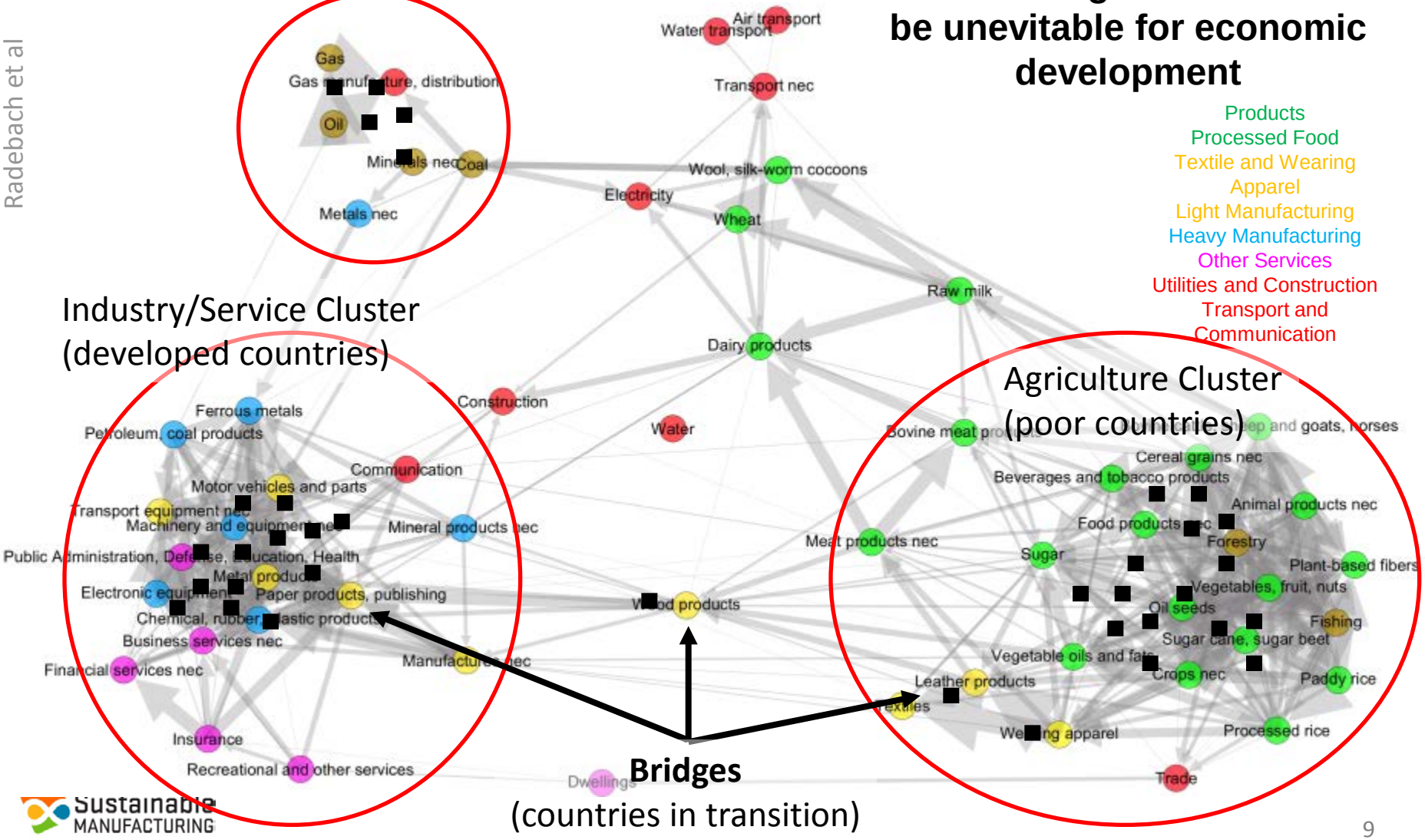
Resource Cluster

Manufacturing sectors seem to be unevitable for economic development

Products
Processed Food
Textile and Wearing Apparel
Light Manufacturing
Heavy Manufacturing
Other Services
Utilities and Construction
Transport and Communication

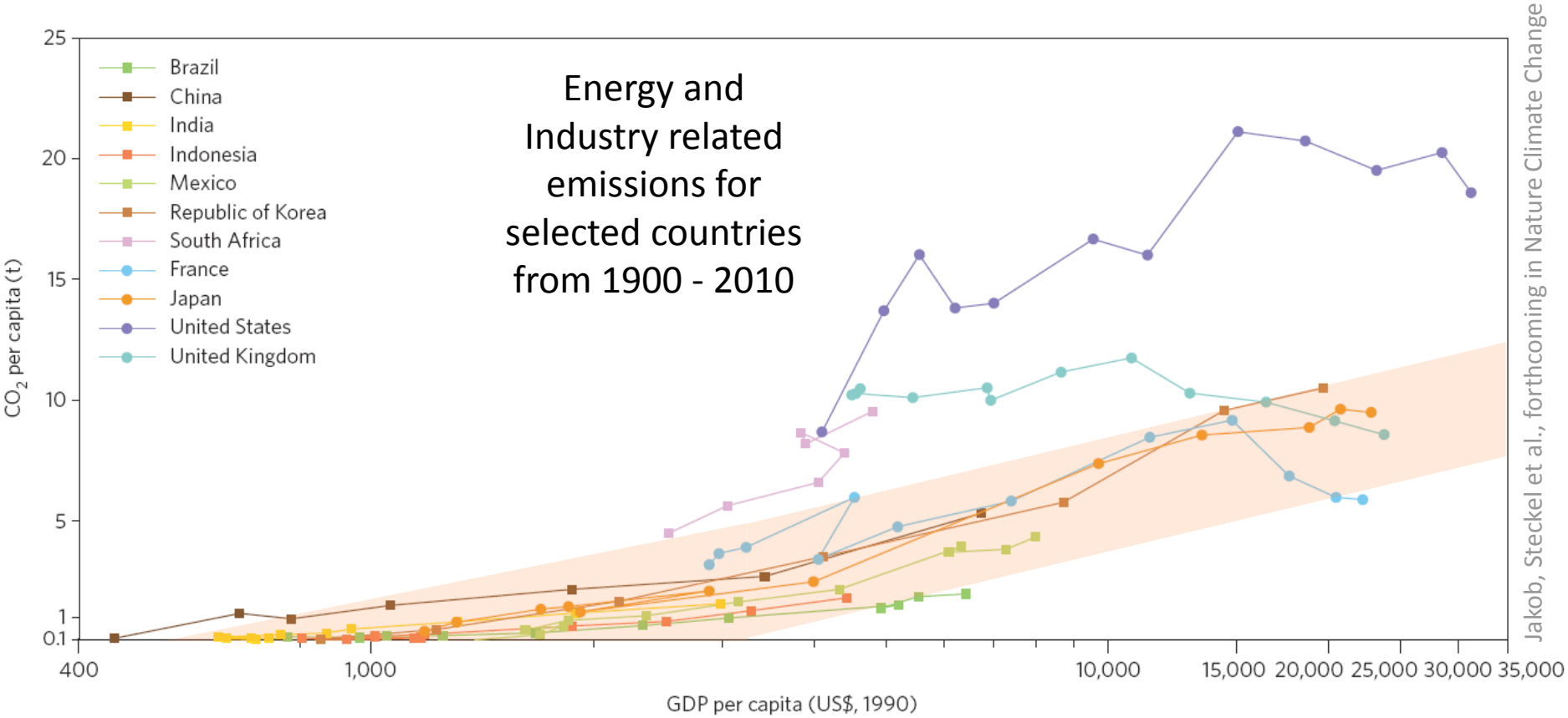
Industry/Service Cluster (developed countries)

Agriculture Cluster (poor countries)



Bridges
(countries in transition)

Poor countries follow emission pathways of rich countries



Historic patterns of CO_2 per capita emissions and GDP per capita seem to be replicated by today's developing countries.

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Limiting warming to 2°C involves substantial technological, economic and institutional challenges.

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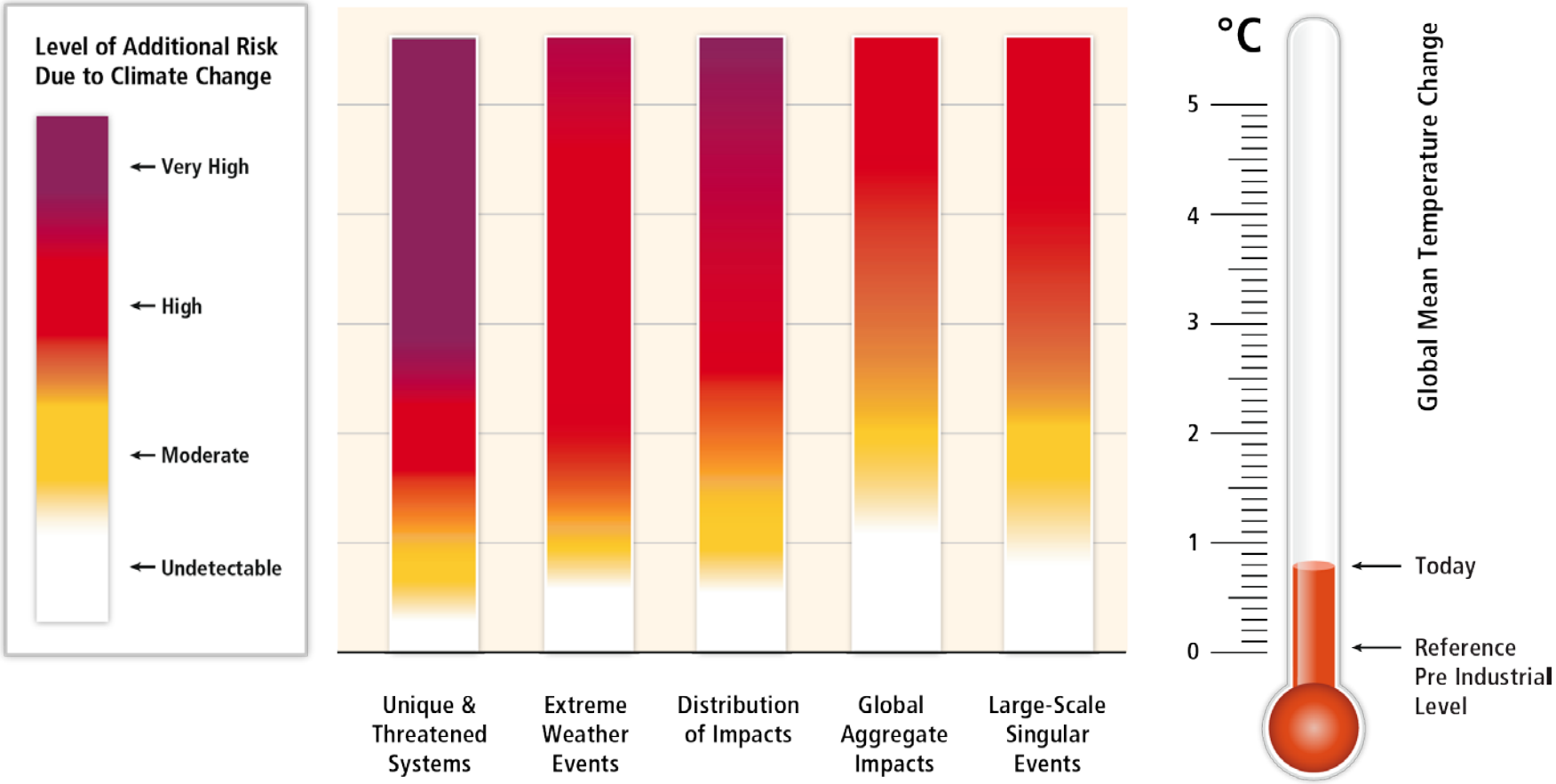
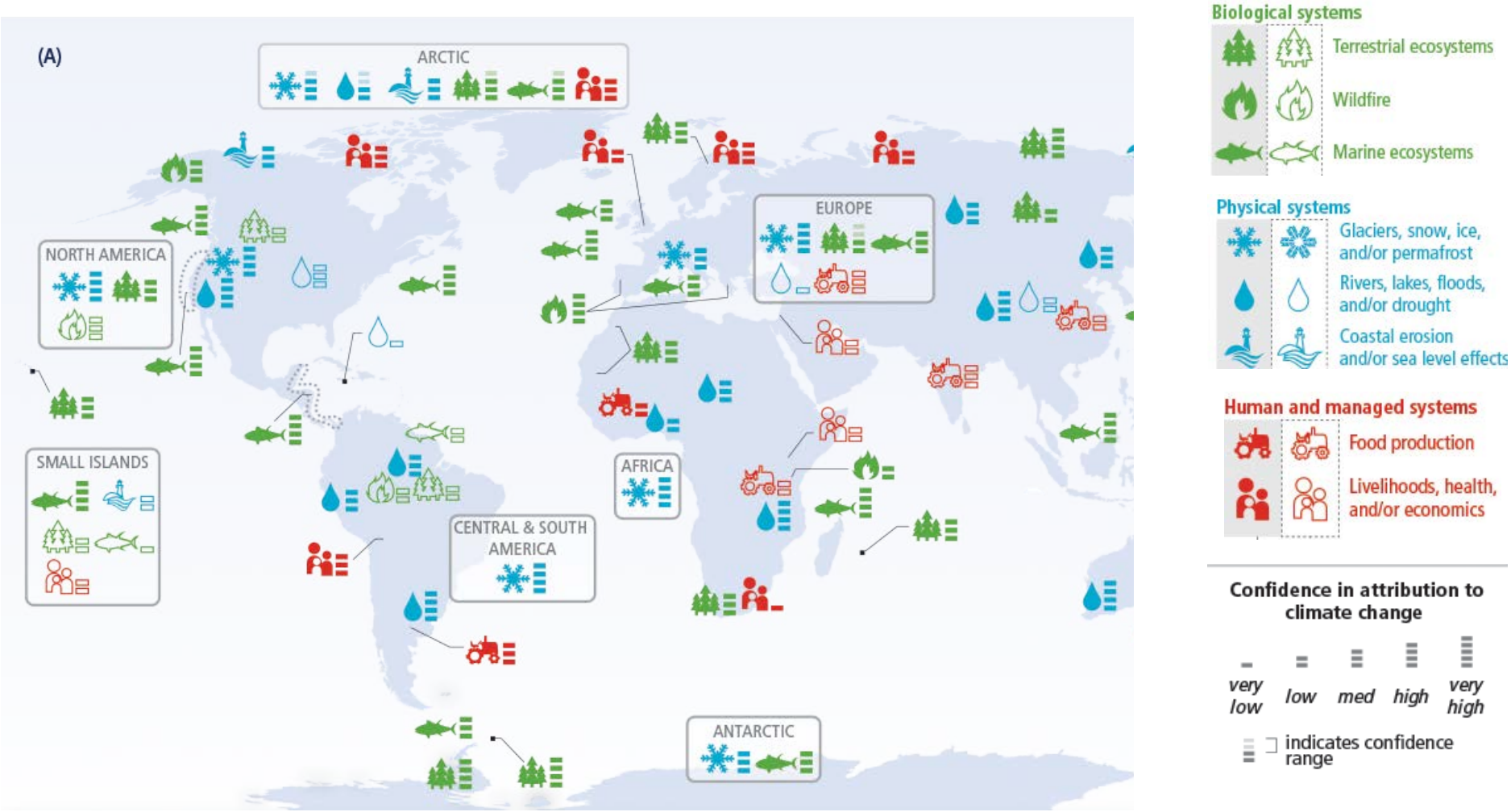
Without additional mitigation, global mean surface temperature is projected to increase by 3.7 to 4.8°C over the 21st century.

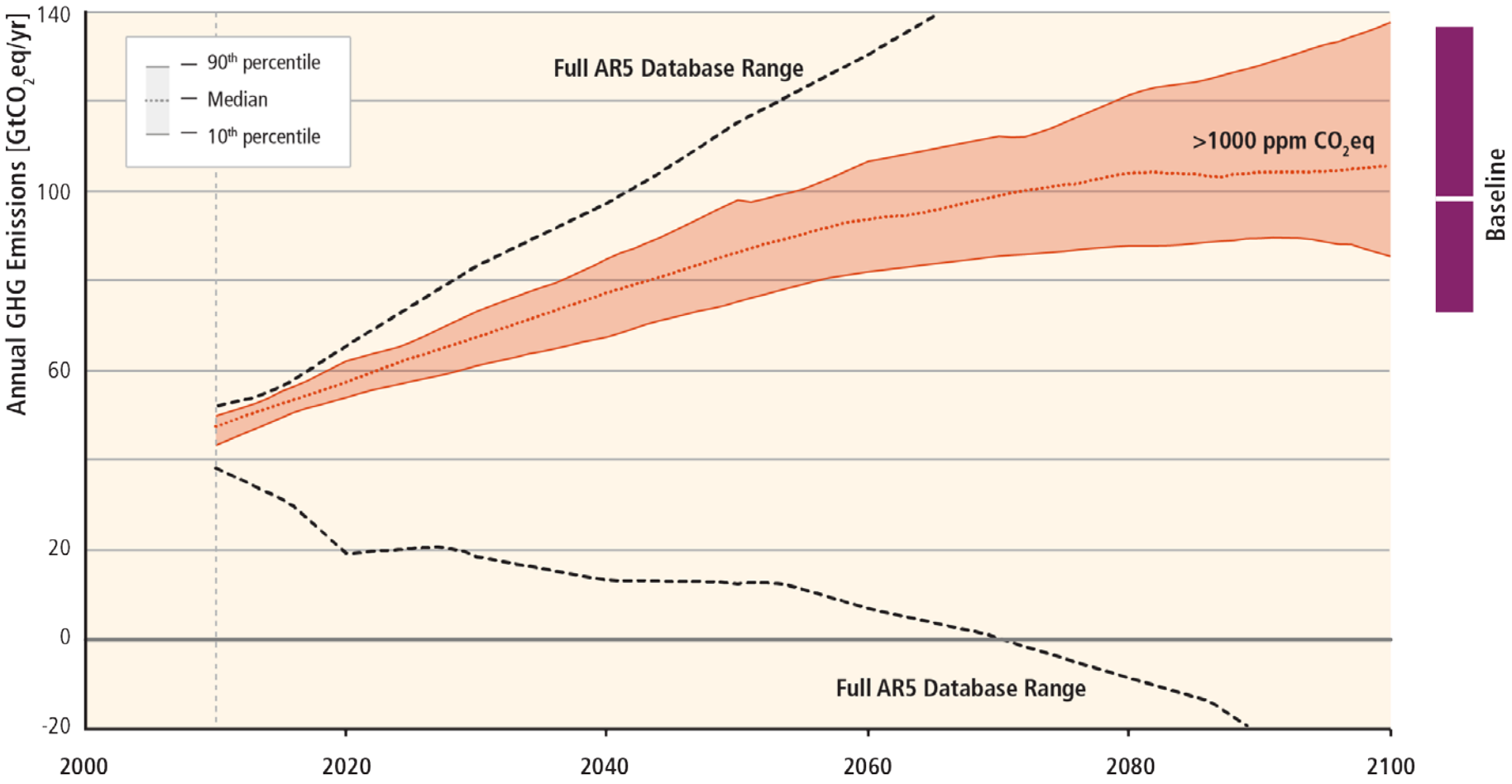


Based on WGII AR5 Figure 19.4

Observed impacts of climate change are widespread and consequential.



Stabilization of atmospheric GHG concentrations requires moving away from the baseline, regardless of the mitigation goal.



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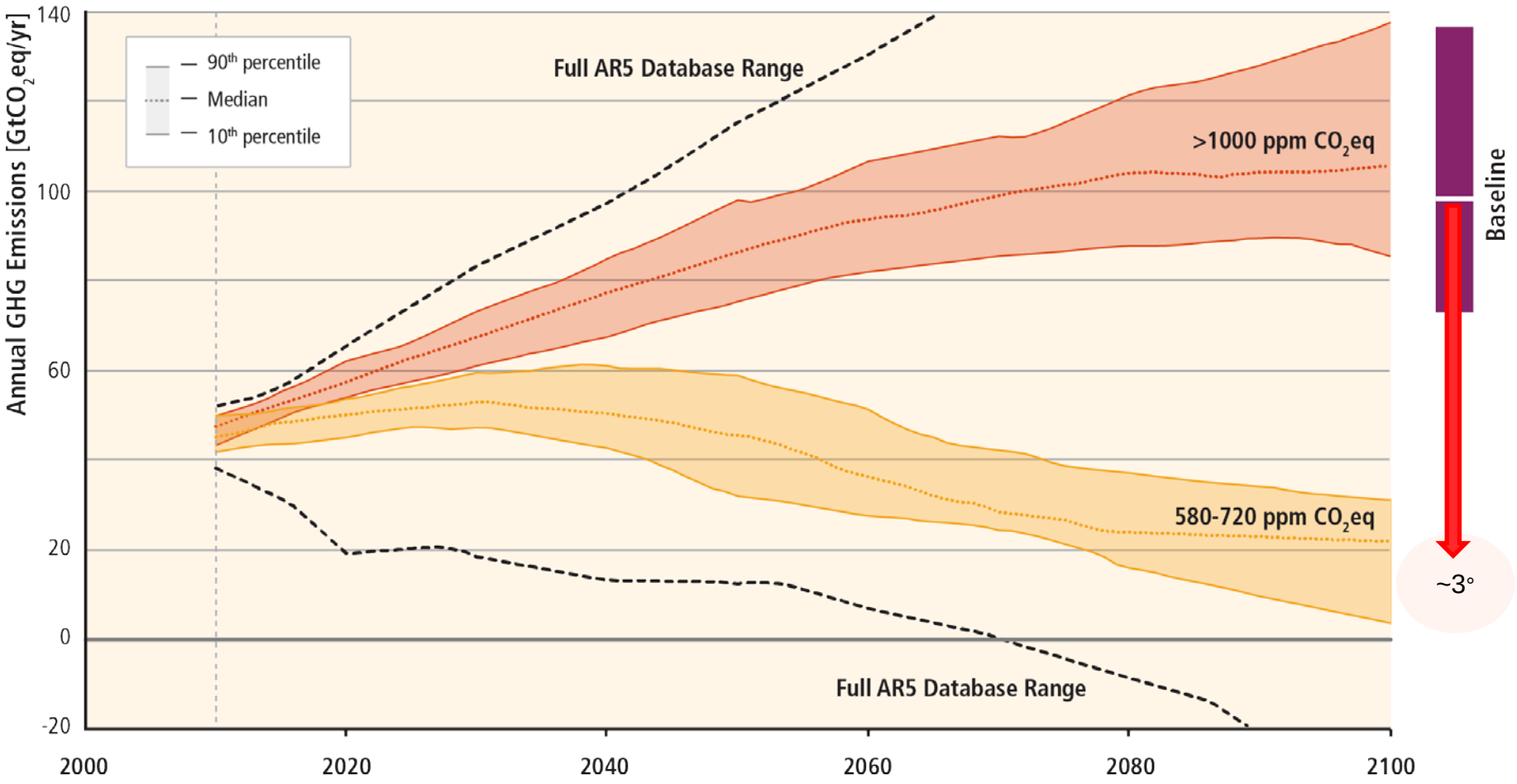

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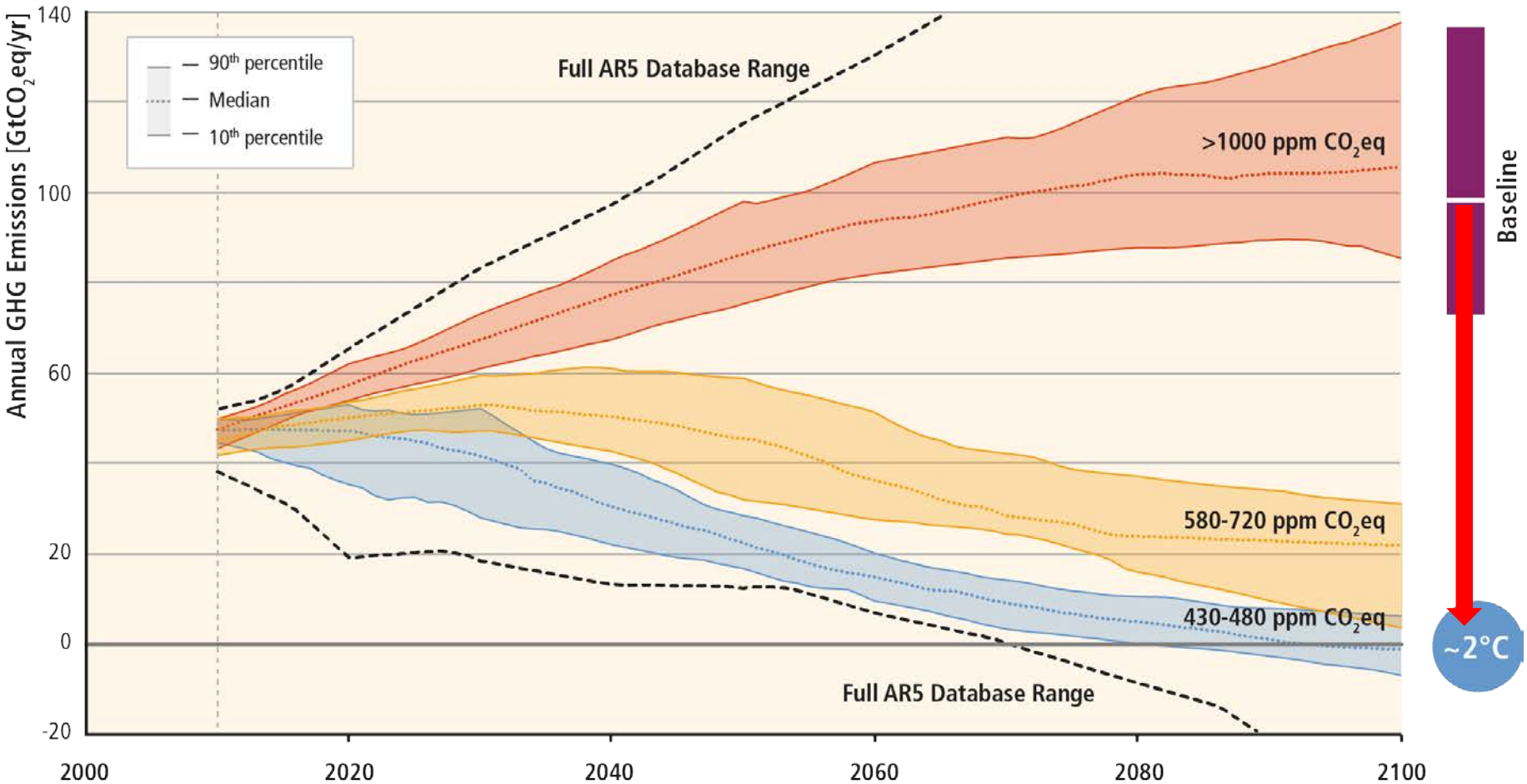

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Global costs to stabilize the climate are comparably moderate

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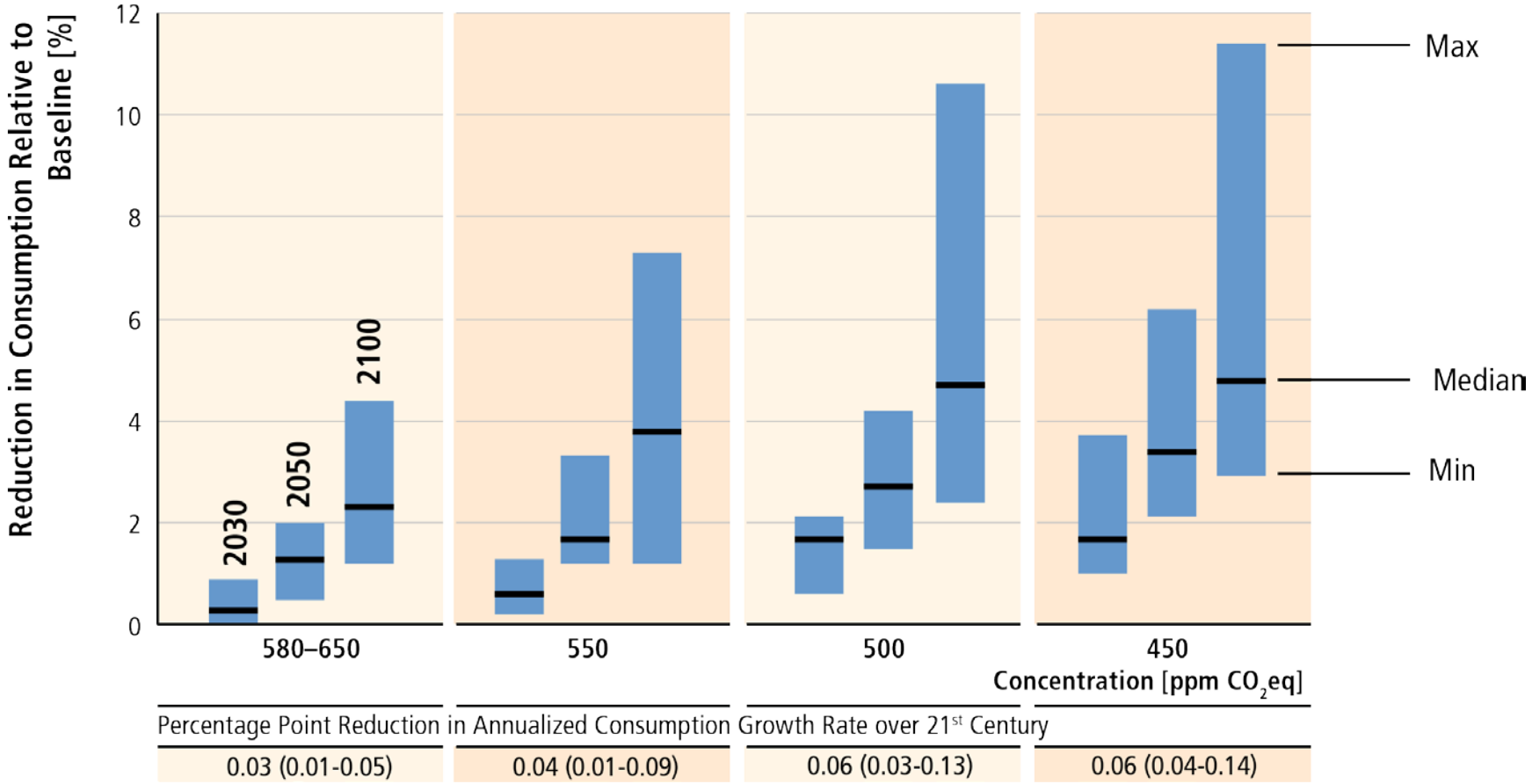
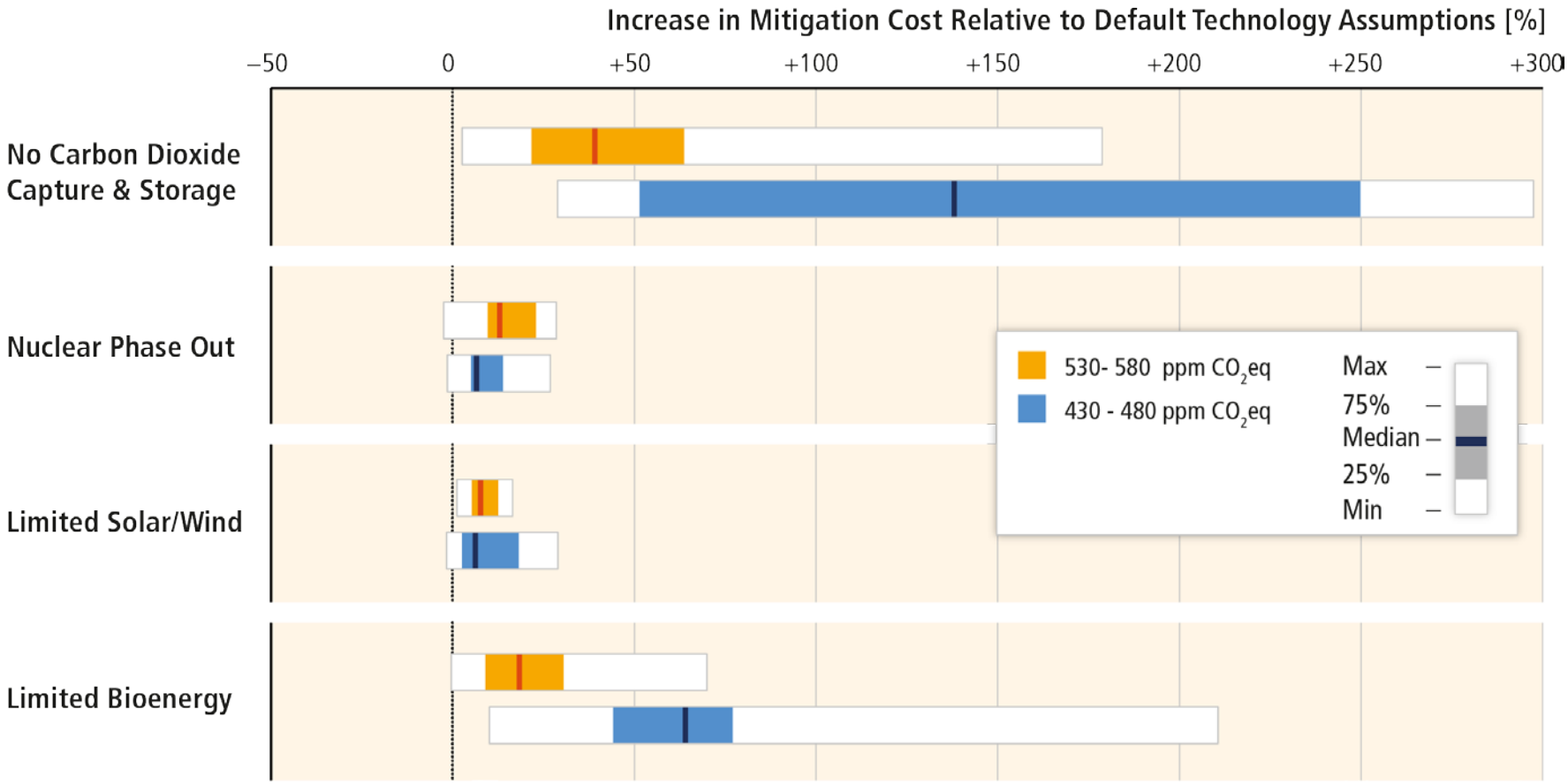
Global costs rise with the ambition of the mitigation goal.



Based on Table SPM.2

Availability of technology can greatly influence mitigation costs.



Based on Figure 6.24

Low stabilization scenarios are dependent upon a full decarbonization of energy supply in the long term.

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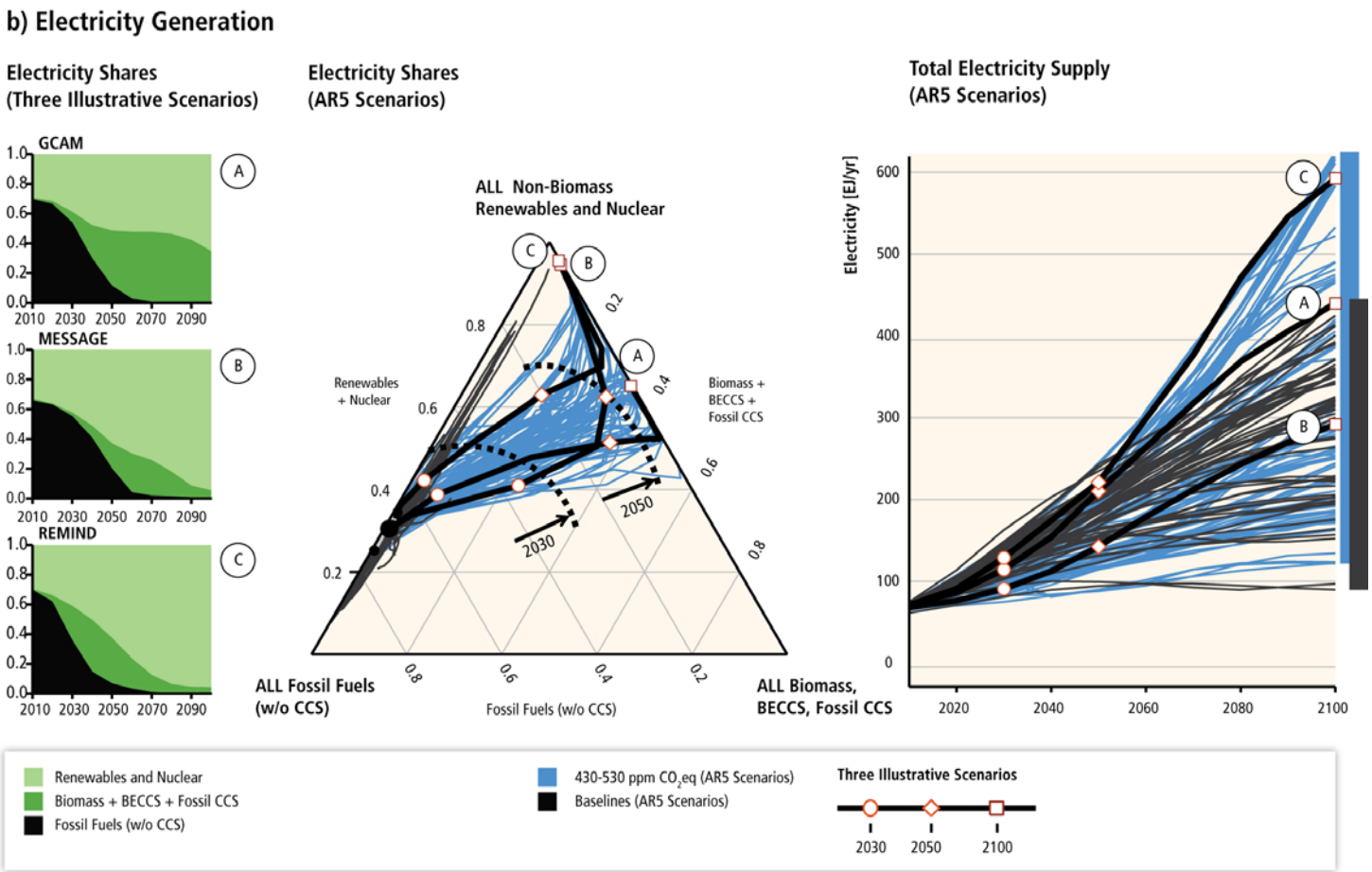
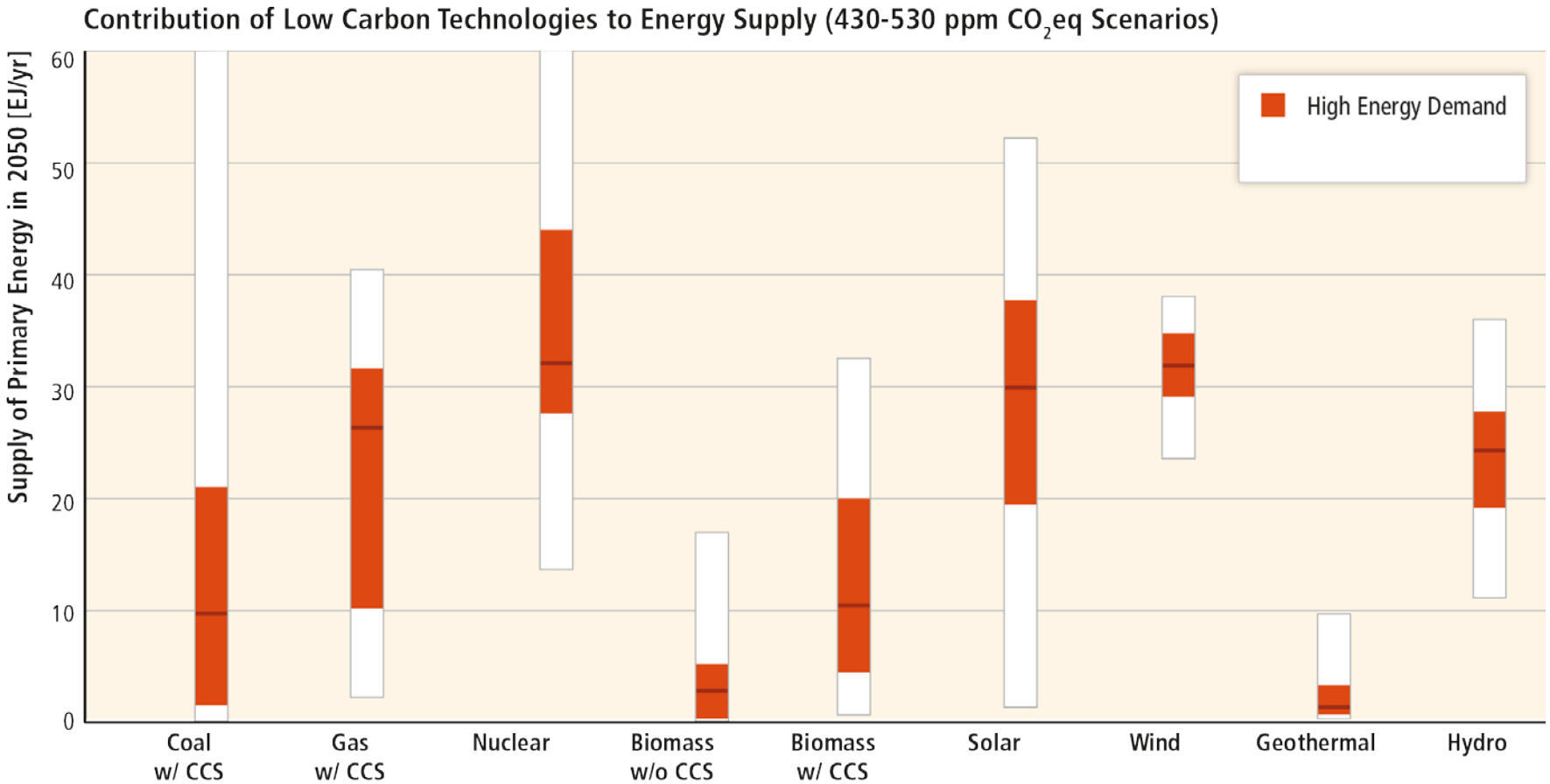
In low CO_2 concentration stabilization scenarios, fossil fuel use without CCS is phased out in the long-term.



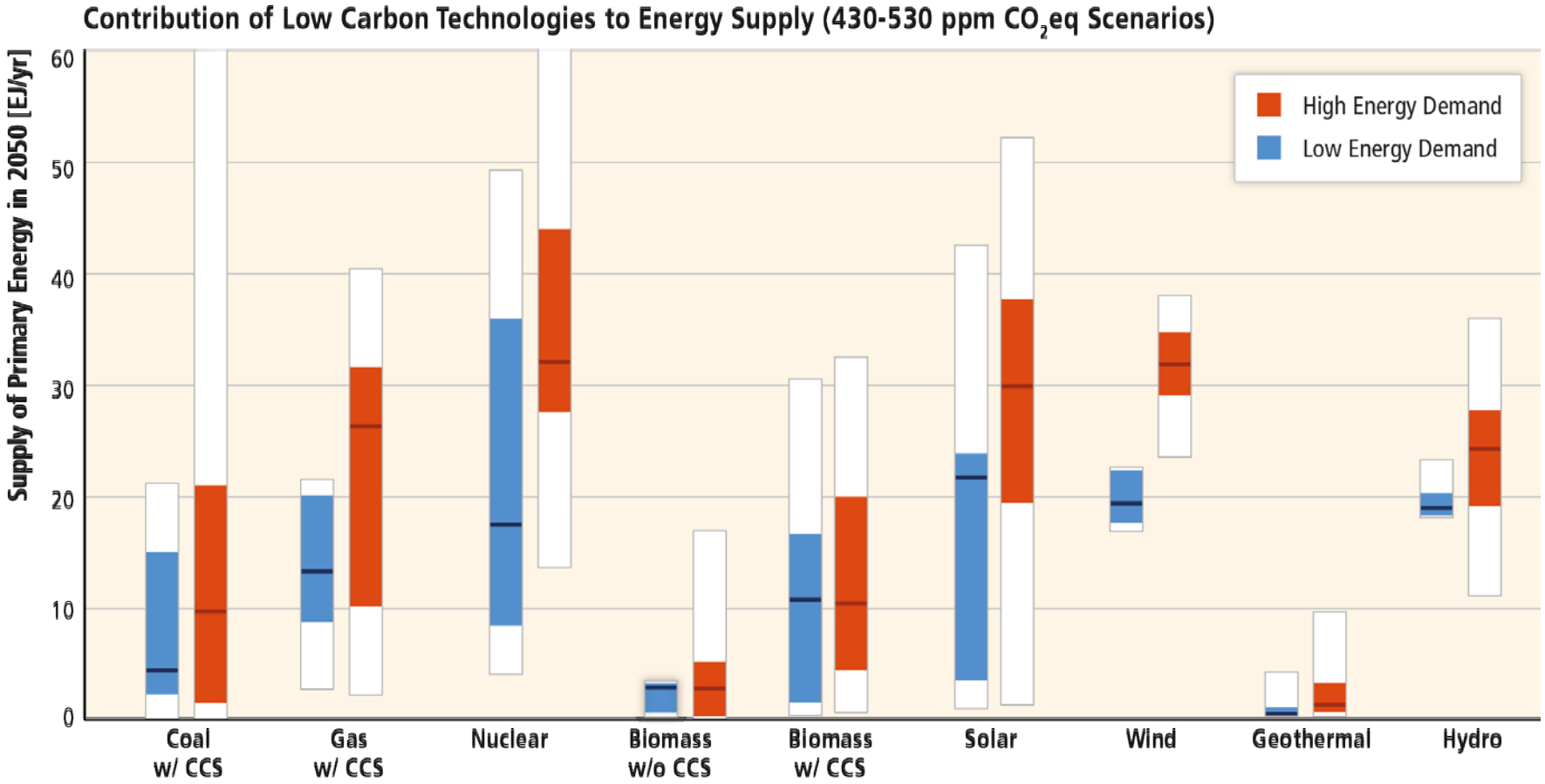
Based on Figure 7.15b

Decarbonization of energy supply is a key requirement for limiting warming to 2°C.



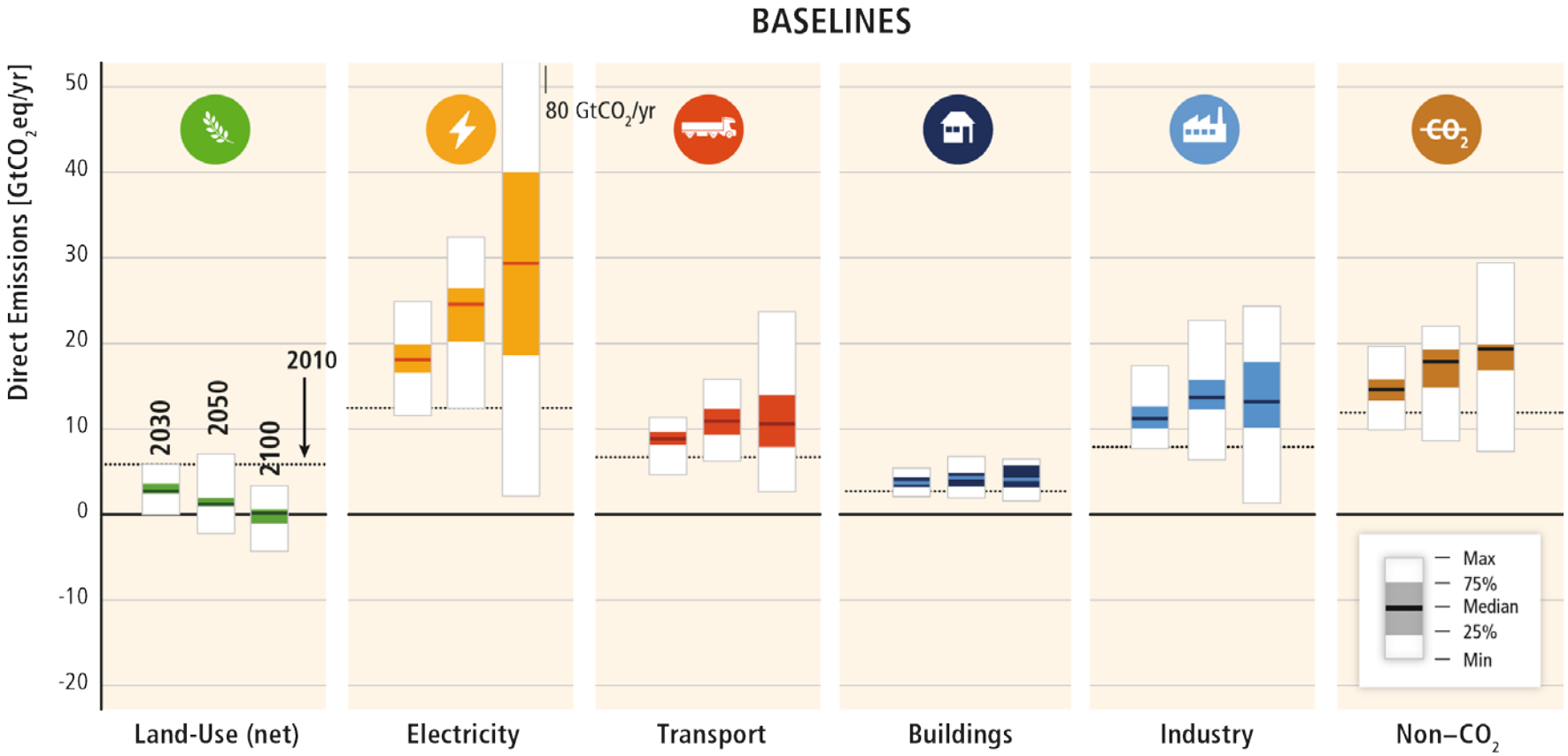
Based on Figure 7.11

Energy demand reductions can provide flexibility, hedge against risks, avoid lock-in and provide co-benefits.



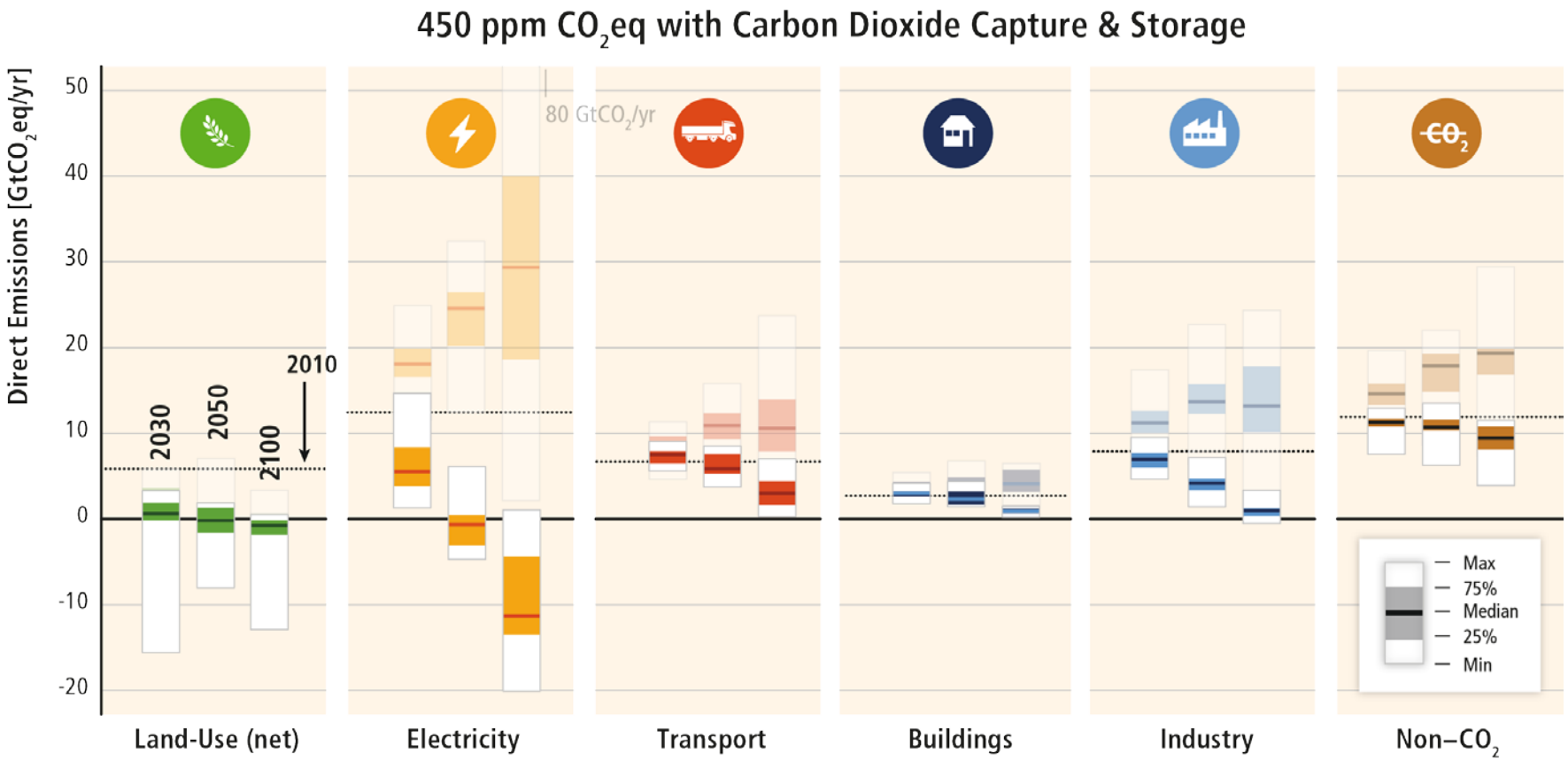
Based on Figure 7.11

Baseline scenarios suggest rising GHG emissions in all sectors, except for CO_2 emissions in the land use sector.



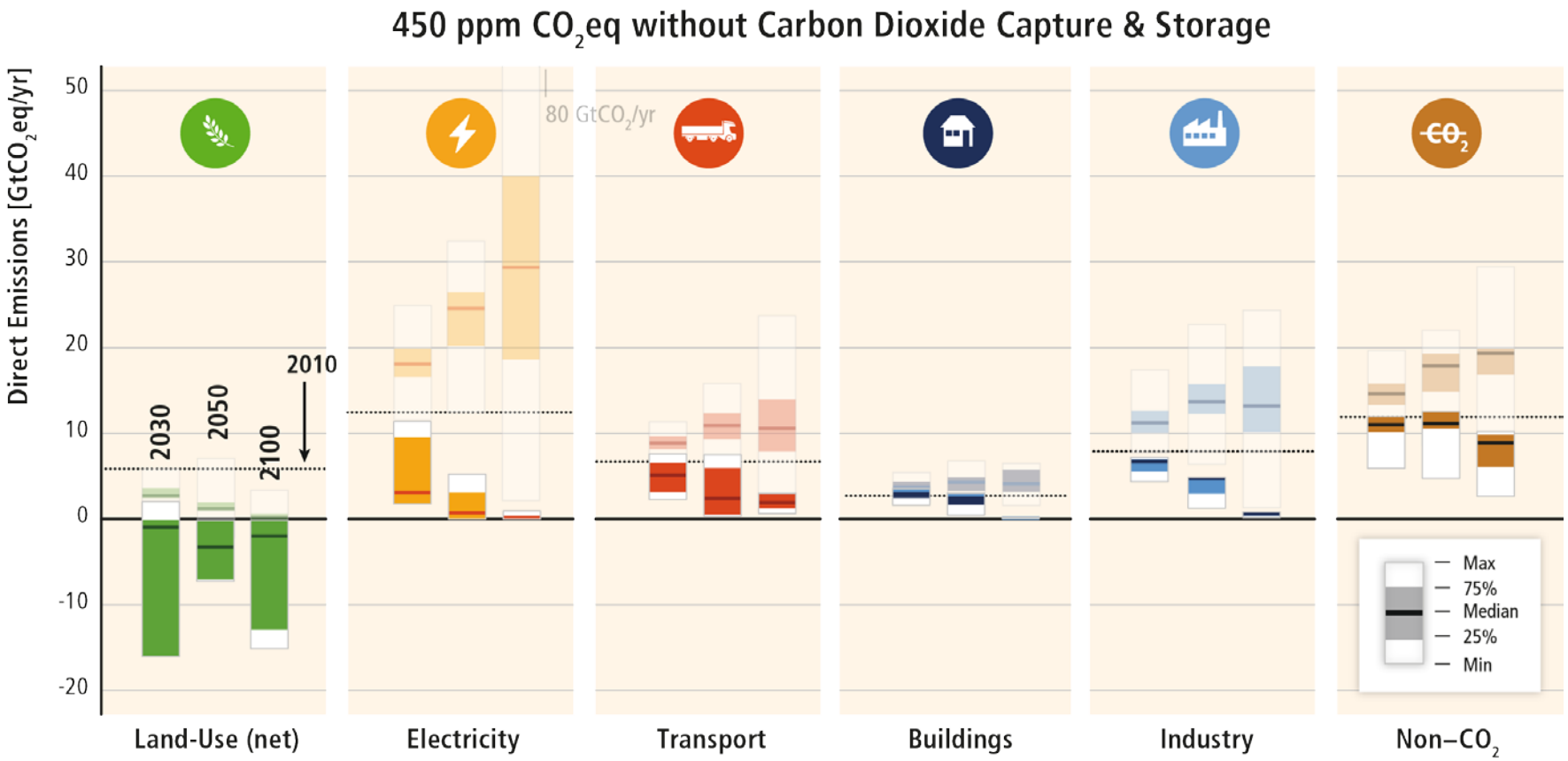
Based on Figure TS.17

Mitigation requires changes throughout the economy. Systemic approaches are expected to be most effective.



Based on Figure TS.17

Mitigation efforts in one sector determine efforts in others.



Based on Figure TS.17

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Effective mitigation will not be achieved if individual agents advance their own interests independently.

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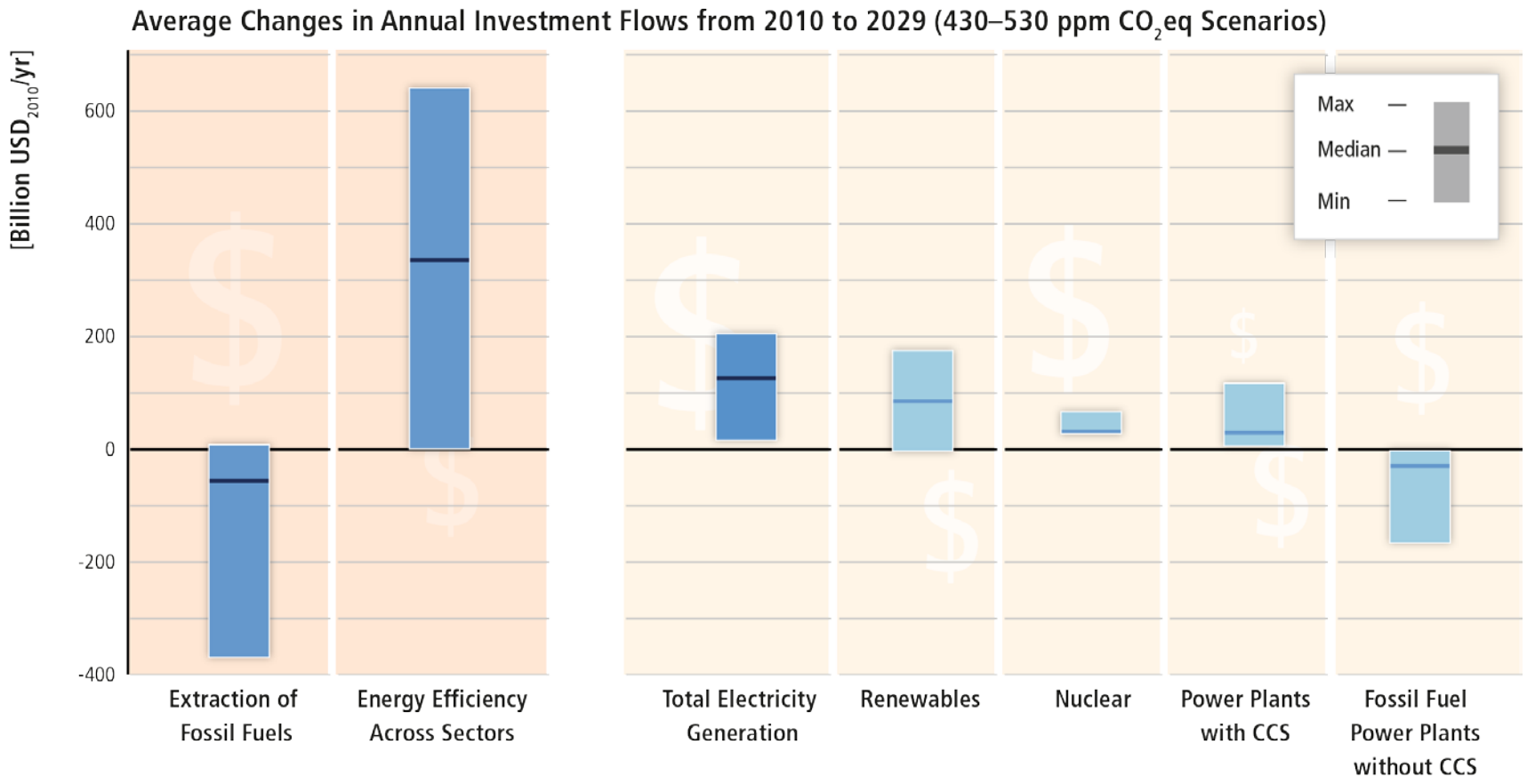
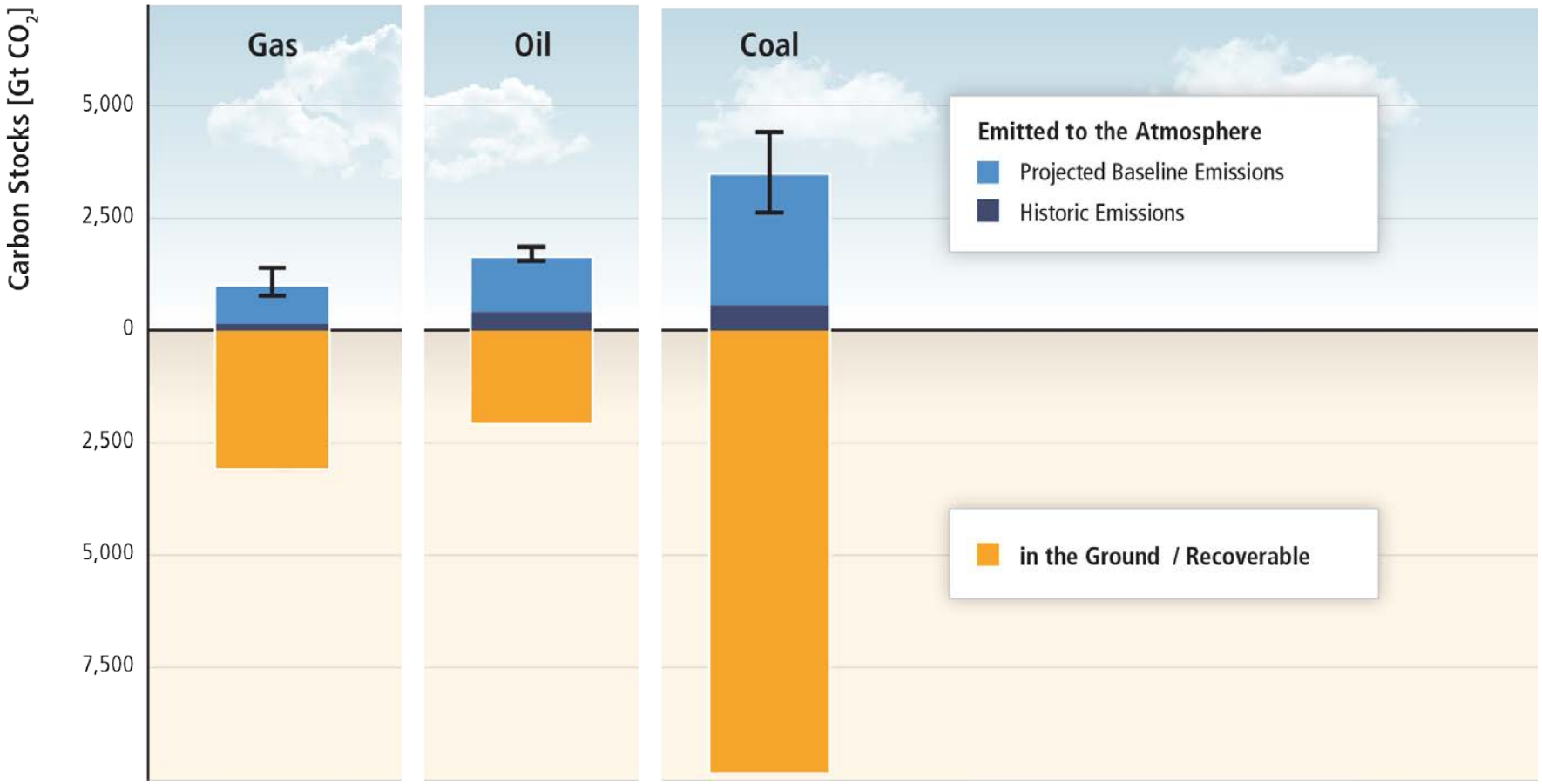
Substantial reductions in emissions would require large changes in investment patterns and appropriate policies.



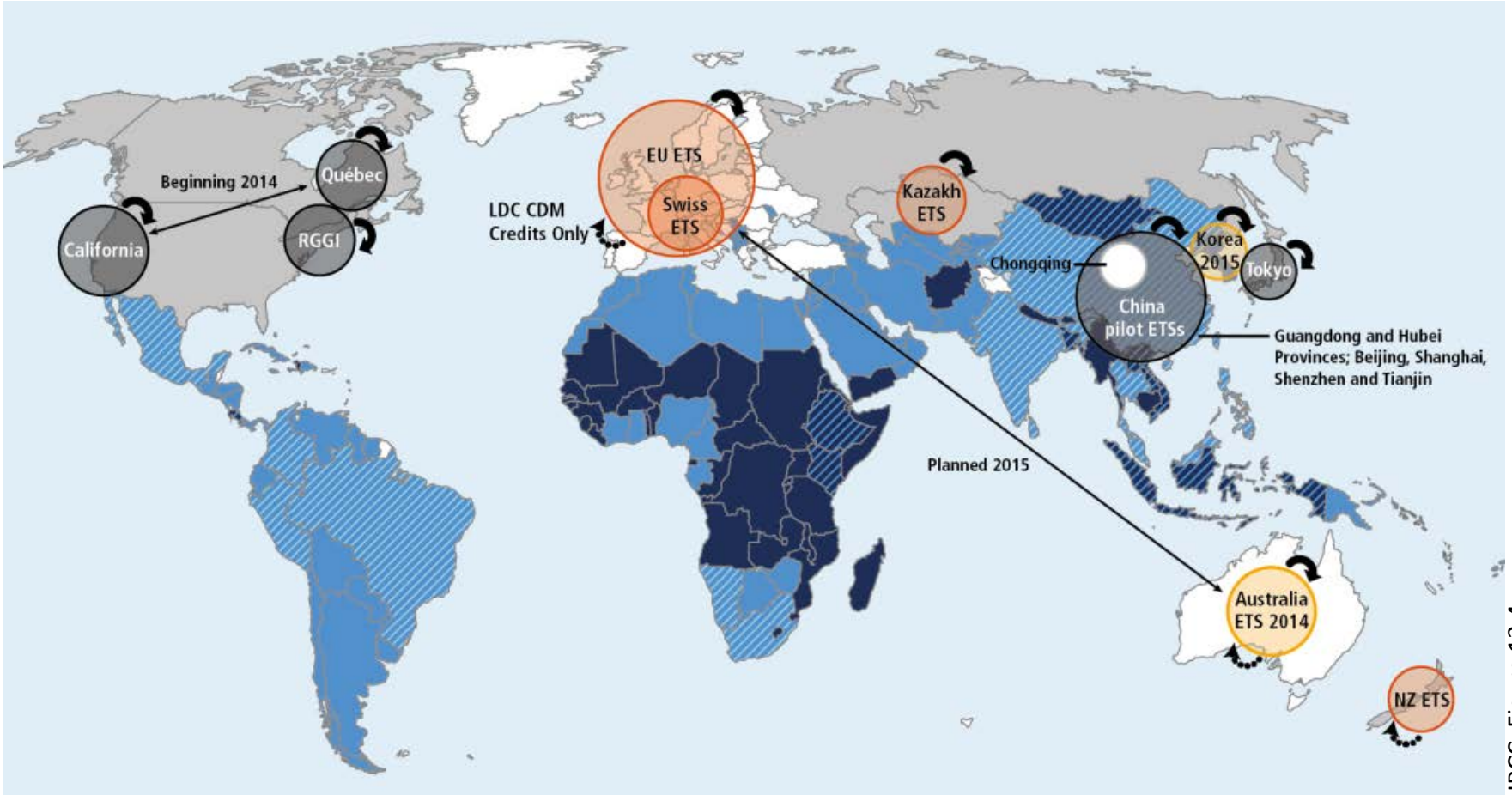
Based on IPCC Figure 16.3

There is far more carbon in the ground than emitted in any baseline scenario.



Based on SRREN Figure 1.7

The emerging schemes of global carbon pricing

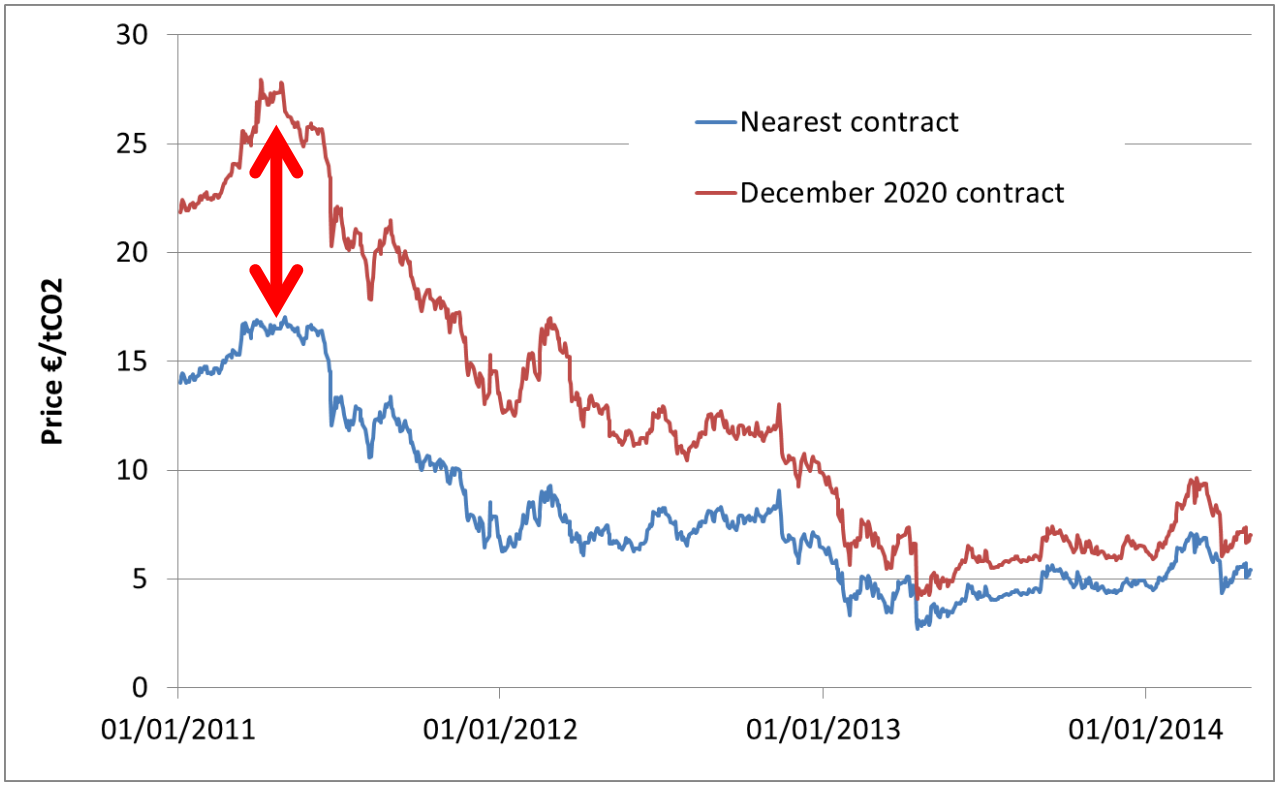


IPCC, Figure 13.4

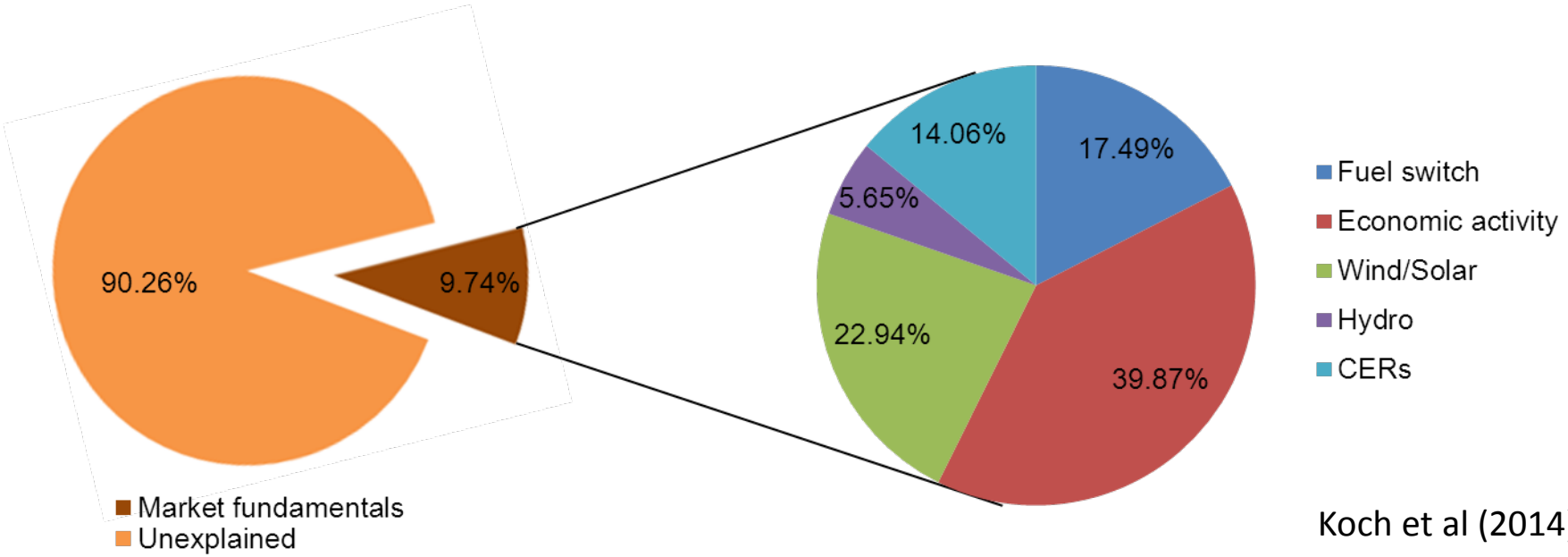
- **Globally uniform emission price optimal to address global externality**
- **This would require global cooperation; hampered by free-riding**
- **Nevertheless, some recent regional advances to carbon pricing**

Dynamic cost-effectiveness of ETS is lacking

- Declining CO_2 price
- Currently , no substantial price increase expected for 2020 (only little spread between nearest contract and future contract for 2020)



Empirical evaluation of price drivers of EU emission allowances



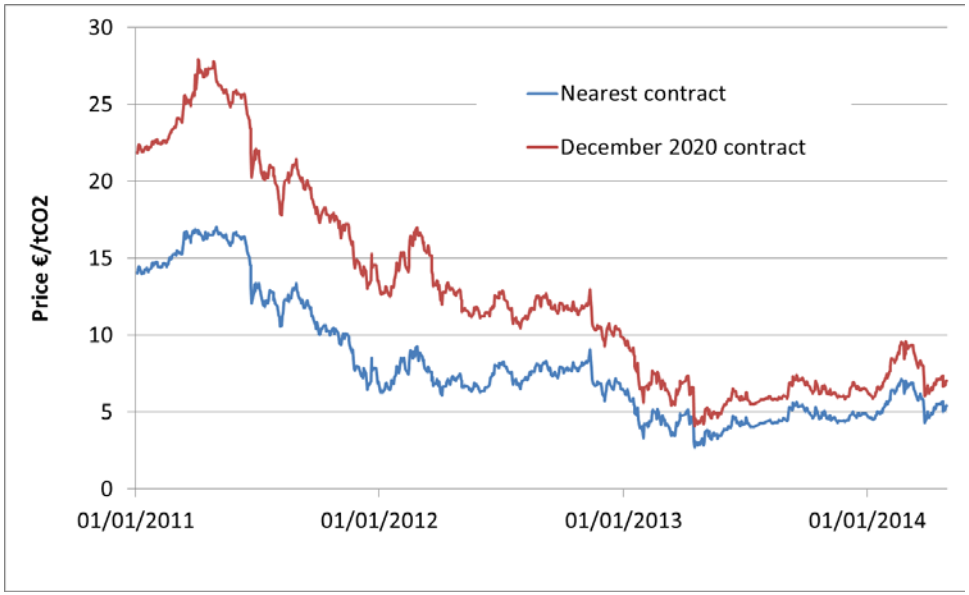
Koch et al (2014)

- **Only 10% of price formation can be explained by market fundamentals (renewable deployment, economic crisis, CDM, …)**
- **But when taking into consideration policy events dummies (e.g. backloading vote) explanatory power jumps from 10% to 44%.**
- **In the situtation with the non-binding cap, the standard price formation does not work**

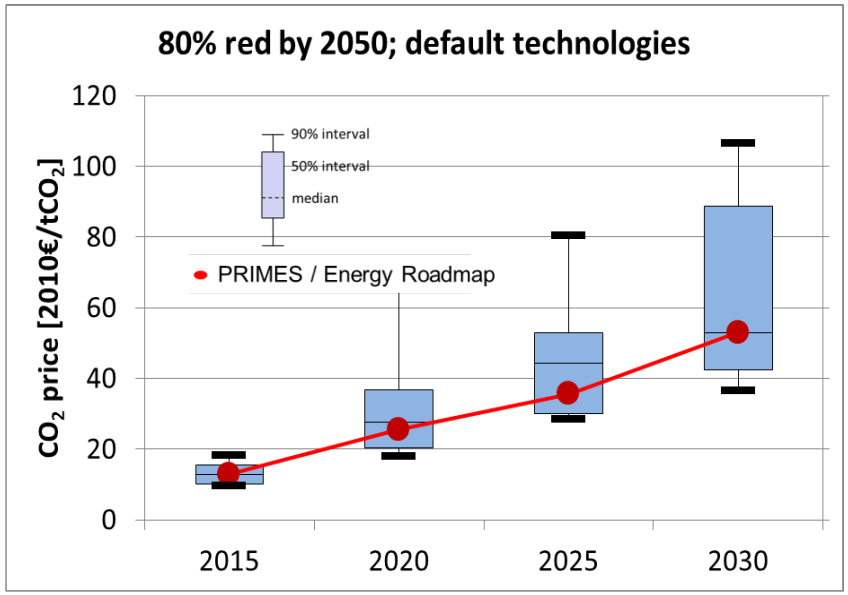
Dynamic cost-effectiveness of ETS is lacking

- Consider the price in 2020 as a benchmark for evaluating dynamic cost-effectiveness of the ETS
- There is a gap between expectations and models that suggest a cost-effective price higher than 20€ / tCO_2 in 2020

EUA nearest contract and Futures 2020



Cost-effective CO_2 price from modeling



Knopf et al. (2013)

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Using climate policy to realize co-benefits for broader sustainability goals

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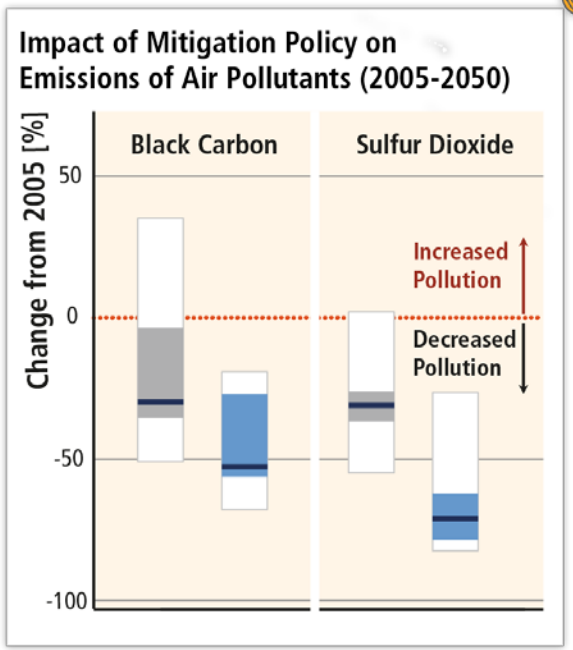
Massive infrastructure investments are needed globally.

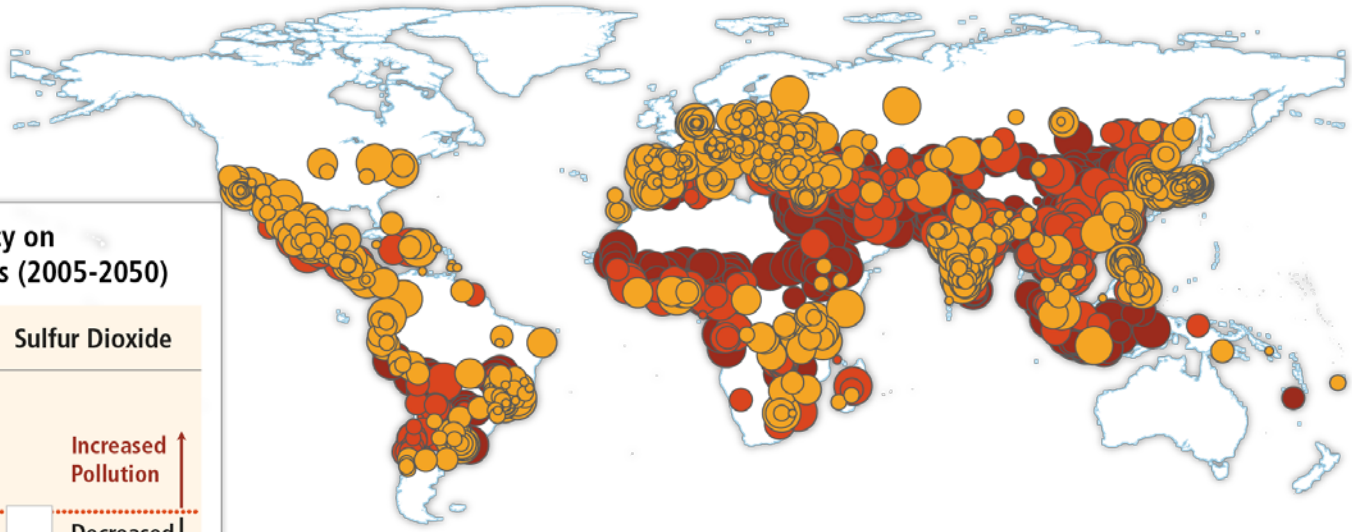
- Telecommunication

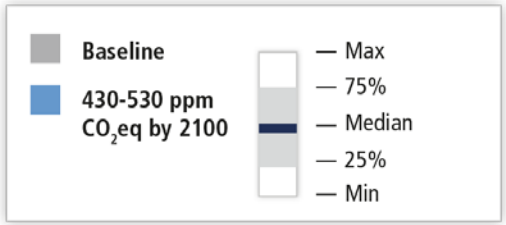
- Access to electricity

- Water availability

Mitigation can result in large co-benefits for human health and other societal goals.

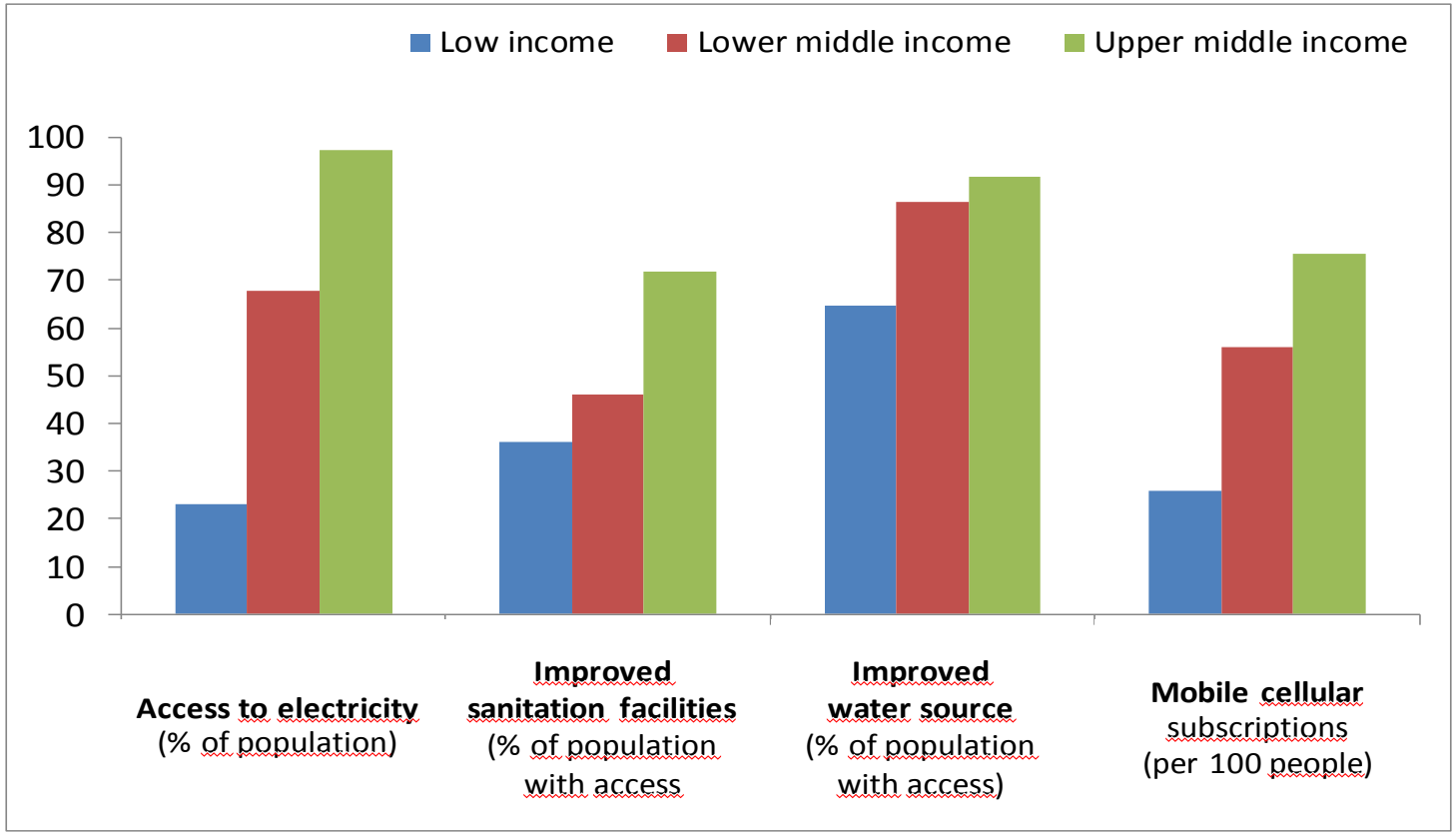






Based on IPCC Figures 6.33 and 12.23

Infrastructure investment

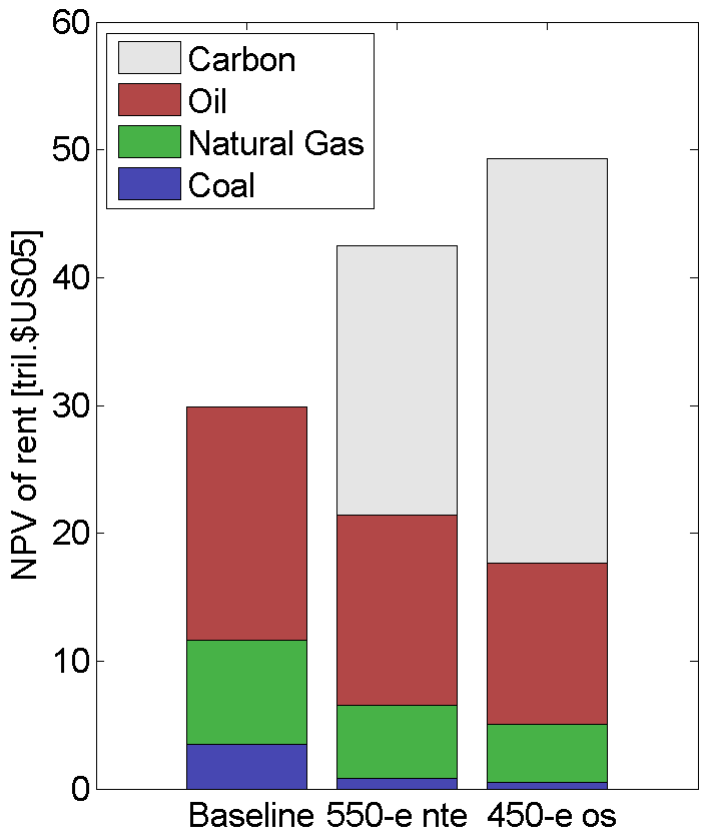


Jakob and Edenhofer, submitted

- Achieve universal energy access by 2030: US$ 36-41 bln per year (Riahi et al. 2012)
- "Great convergence" of global health standards by 2035: about US$ 40 bln per year (Jameson et al. 2013)

data from 2009, Source: WDI online

The carbon rent: Emission pricing revenues could overcompensate profit losses of fossil fuel owners.



Bauer et al. (2013)

- Fossil resource rents decrease with climate policy ambition
- For a globally optimal carbon price, over-compensation by carbon rent (=permit price or tax * emissions)
- Carbon rent appropriated domestically via auctioned permits or tax
- Receipts from a CO_2-tax or auctioning could be used to lower taxes, for investments in infrastructure or to reduce debts

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Thank you

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Additional slides

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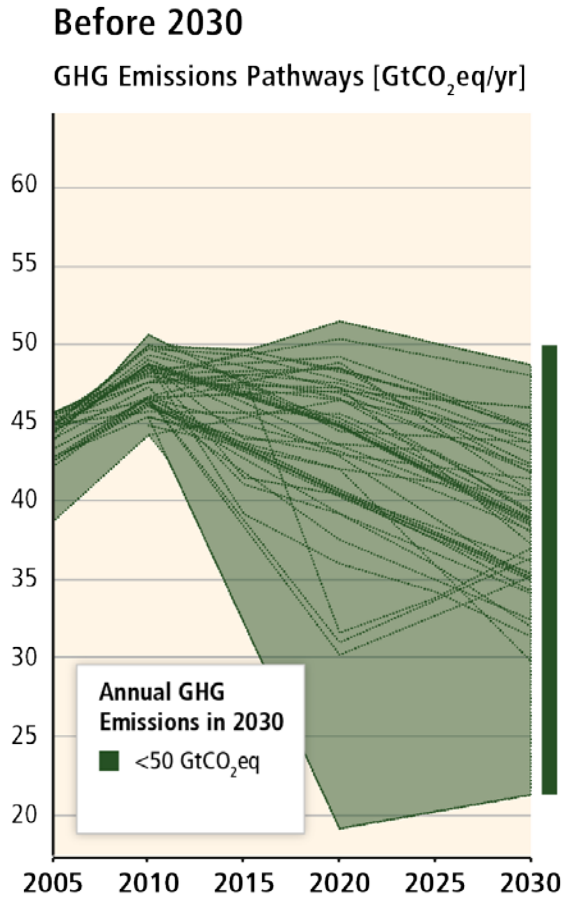
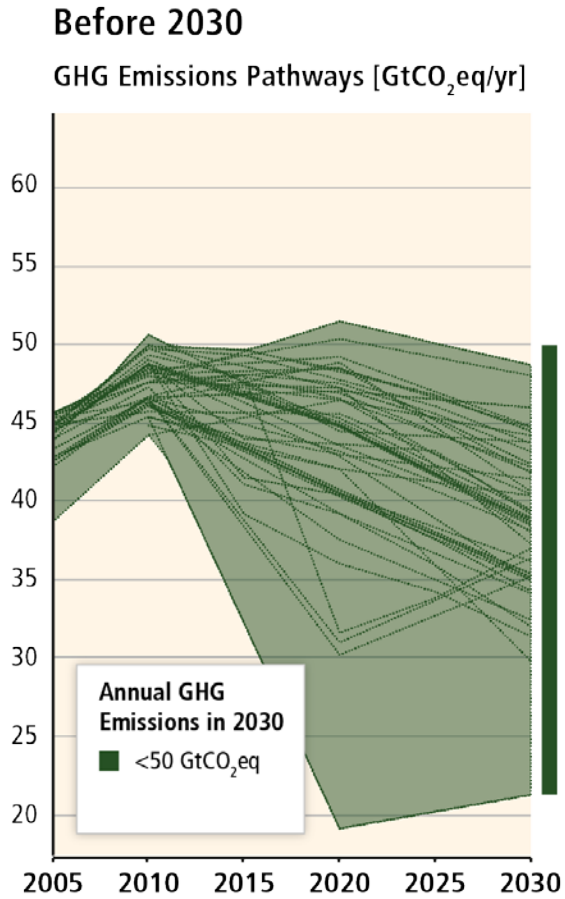
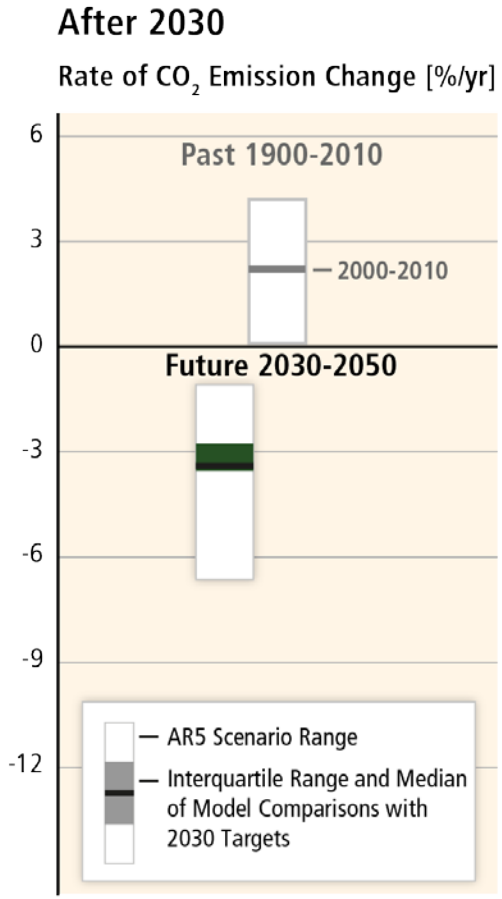
Delaying mitigation increases the difficulty and narrows the options for limiting warming to 2°C.



“Immediate action“

Delaying mitigation increases the difficulty and narrows the options for limiting warming to 2°C.





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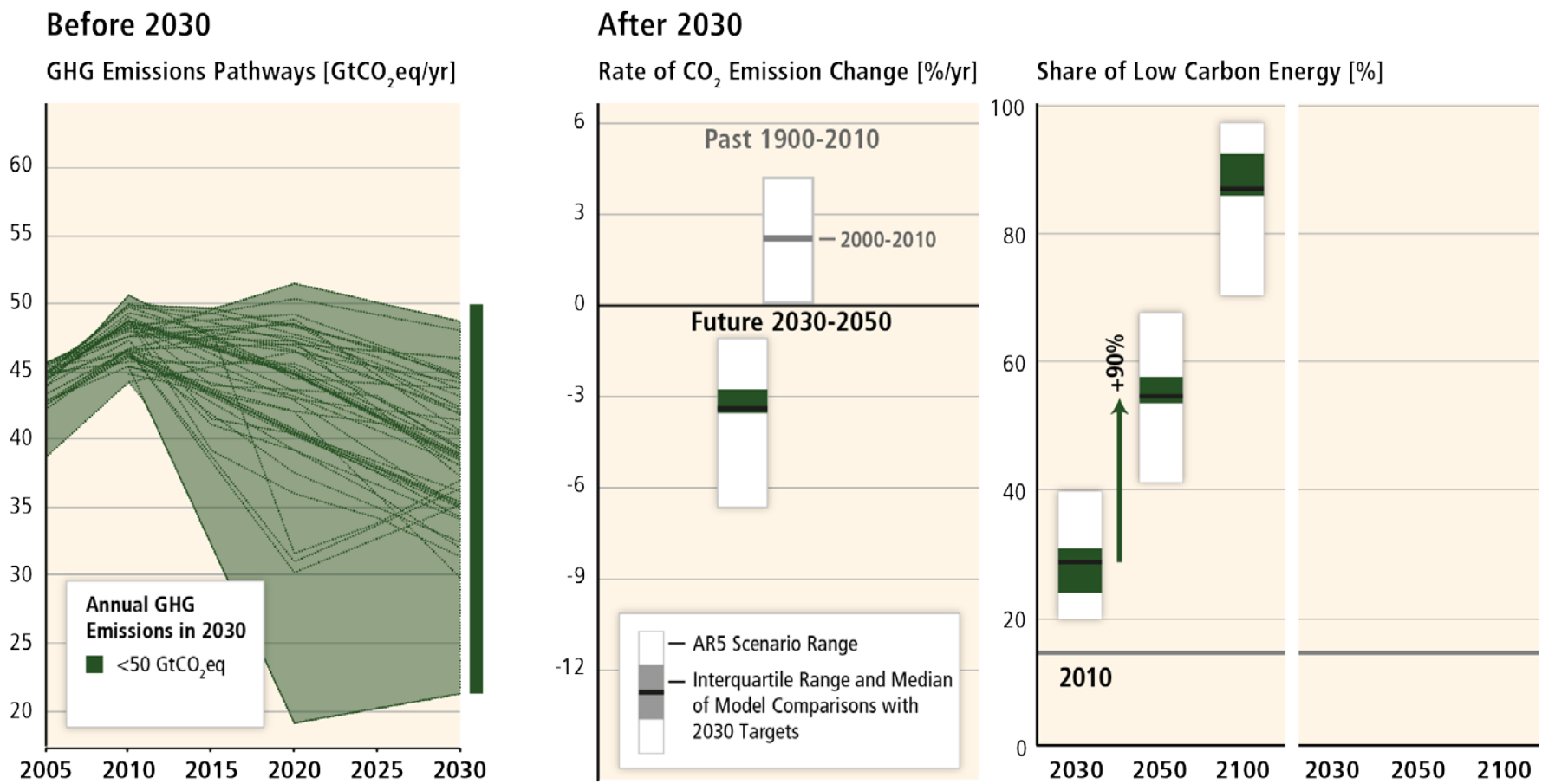
Delaying mitigation increases the difficulty and narrows the options for limiting warming to 2°C.



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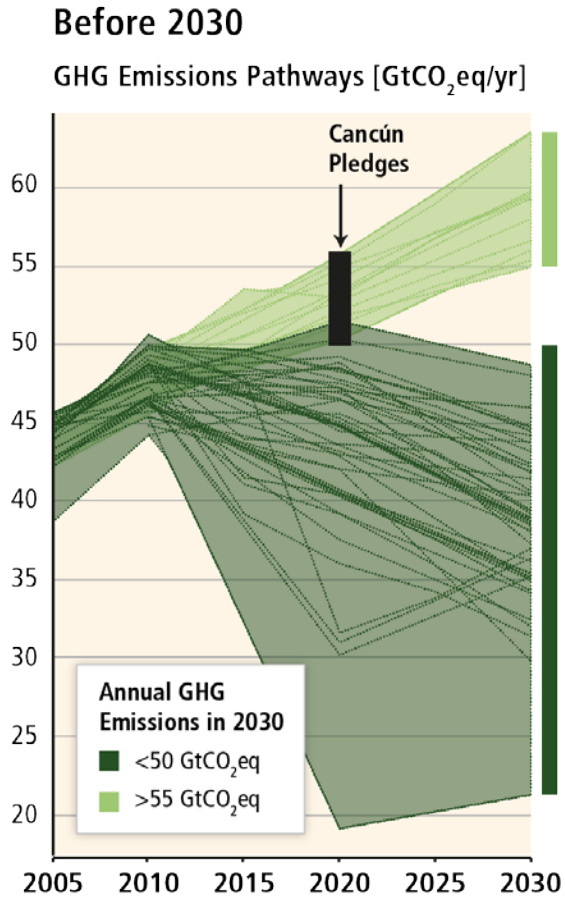
Delaying mitigation is estimated to increase the difficulty and narrow the options for limiting warming to 2°C.



“Delayed mitigation“

“Immediate action“

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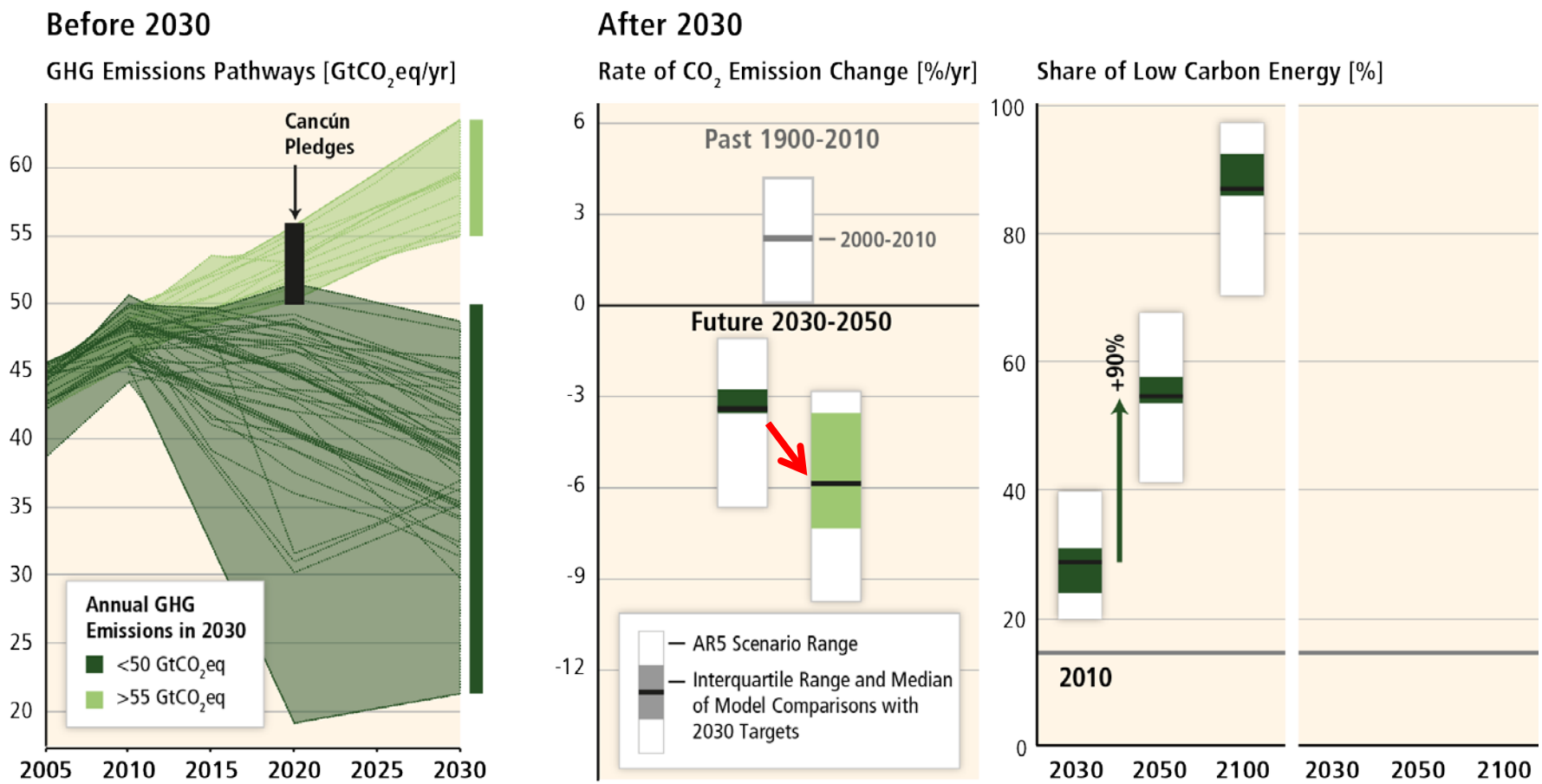

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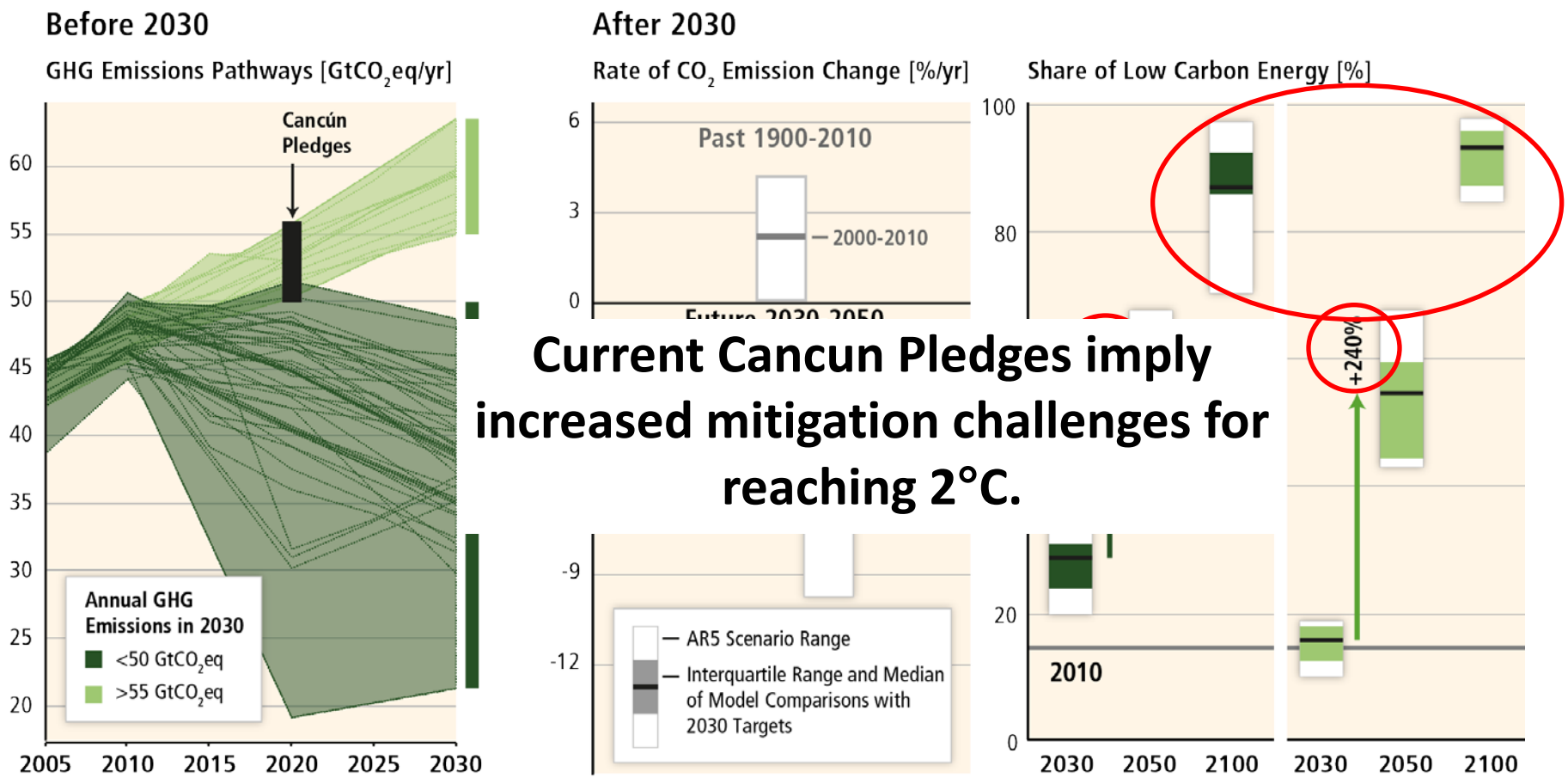

Current Cancun Pledges imply increased mitigation challenges for reaching 2°C.

Based on Figures 6.32 and 7.16

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