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INTERGOVERNMENTAL PANEL ON climate change

CLIMATE CHANGE 2014

Mitigation of Climate Change

Key Insights from IPCC's AR5 and beyond

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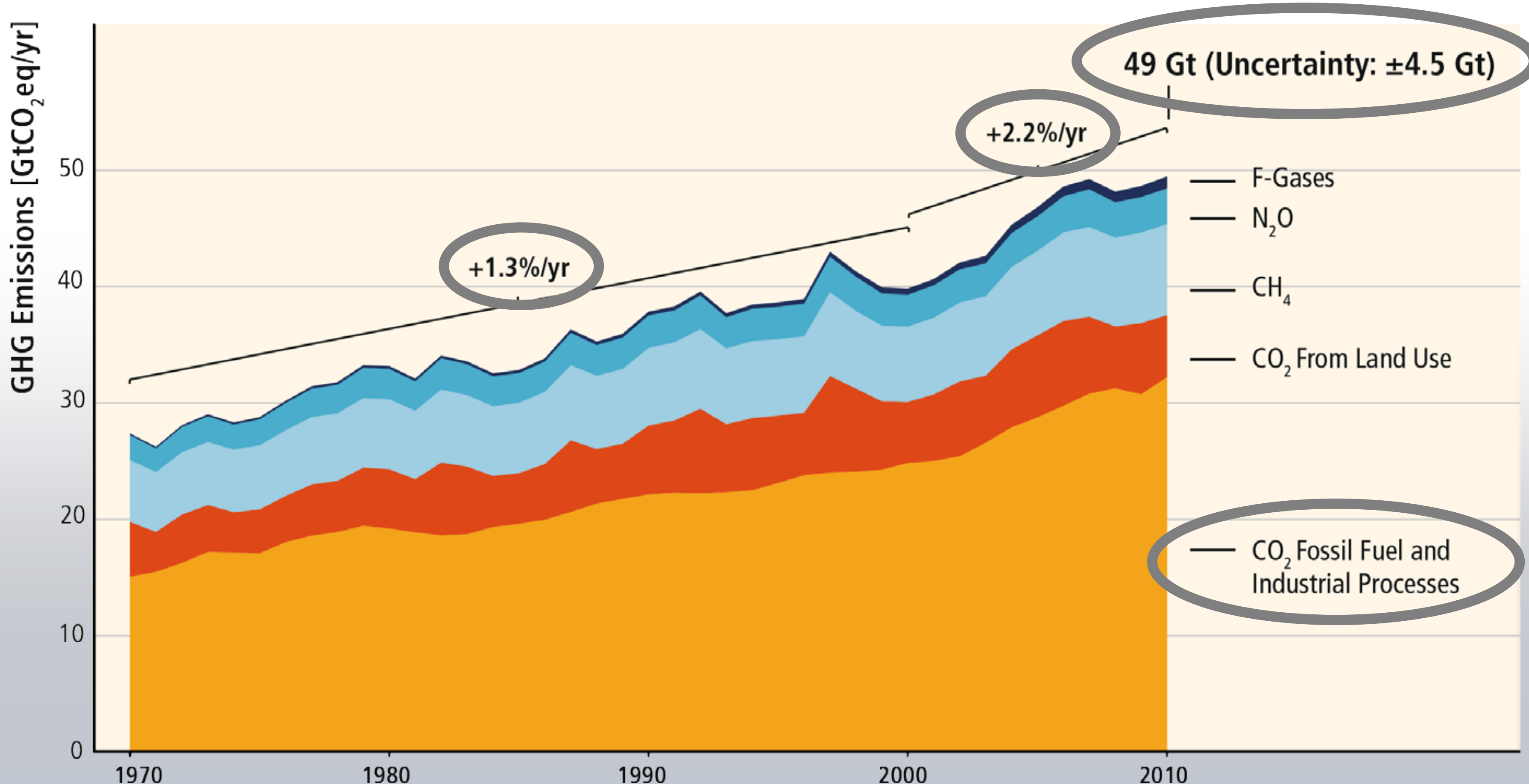
Edinburgh, 26 May 2015

Working Group III contribution to the
IPCC Fifth Assessment Report

Technische Universität Berlin
WMO UNEP

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



Based on Figure 1.3

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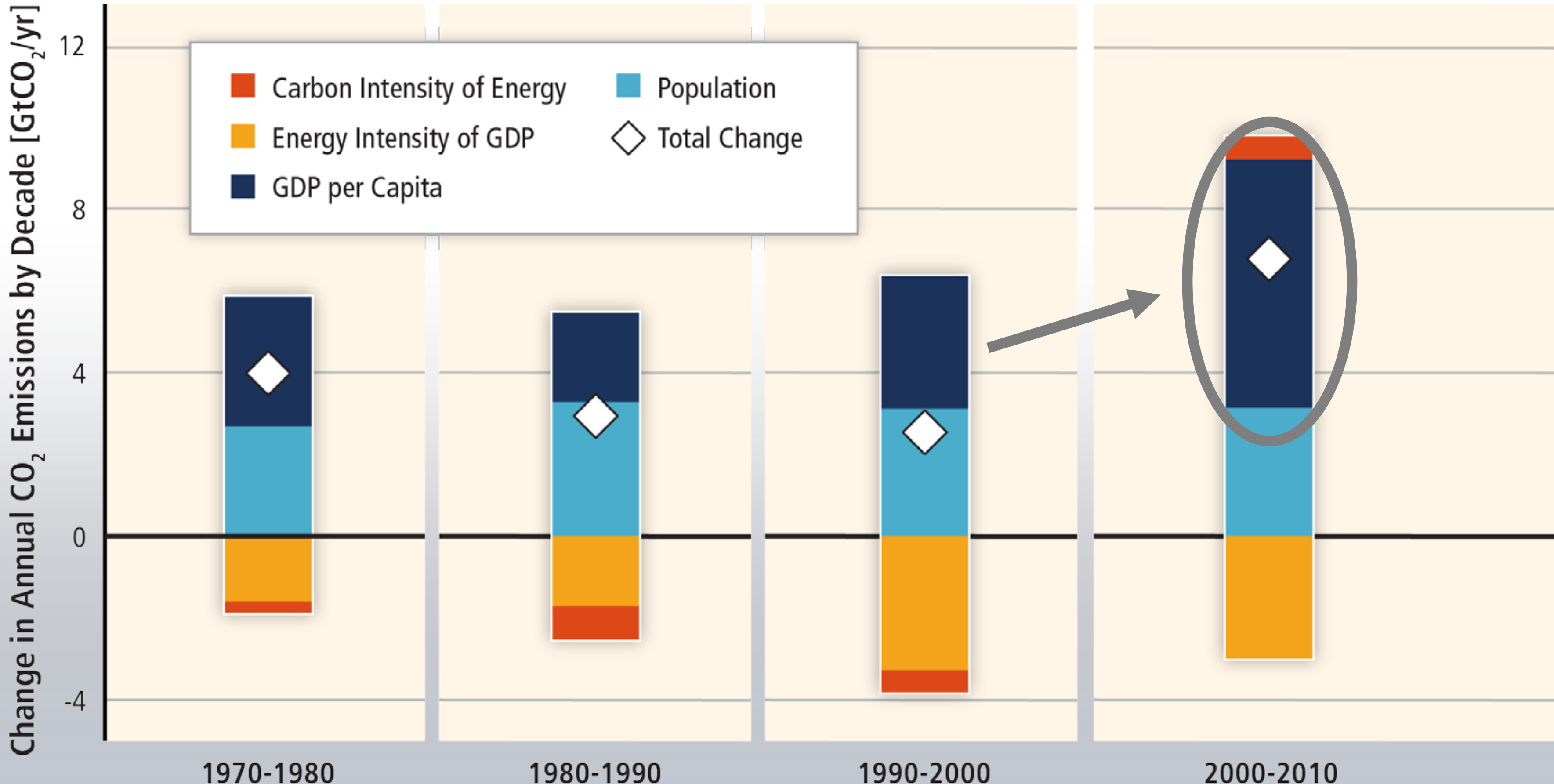
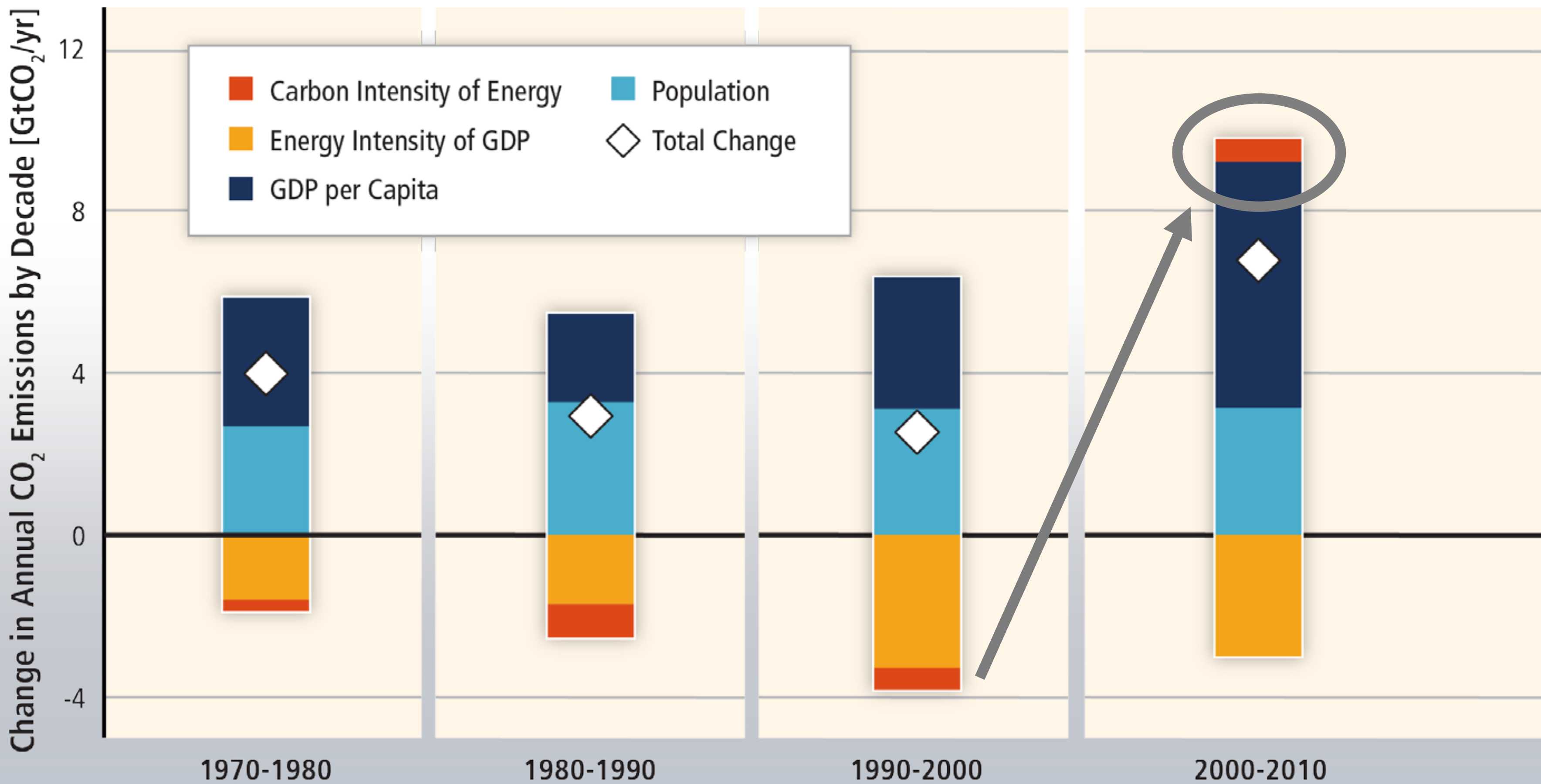
GHG emissions rise with growth in GDP and population.



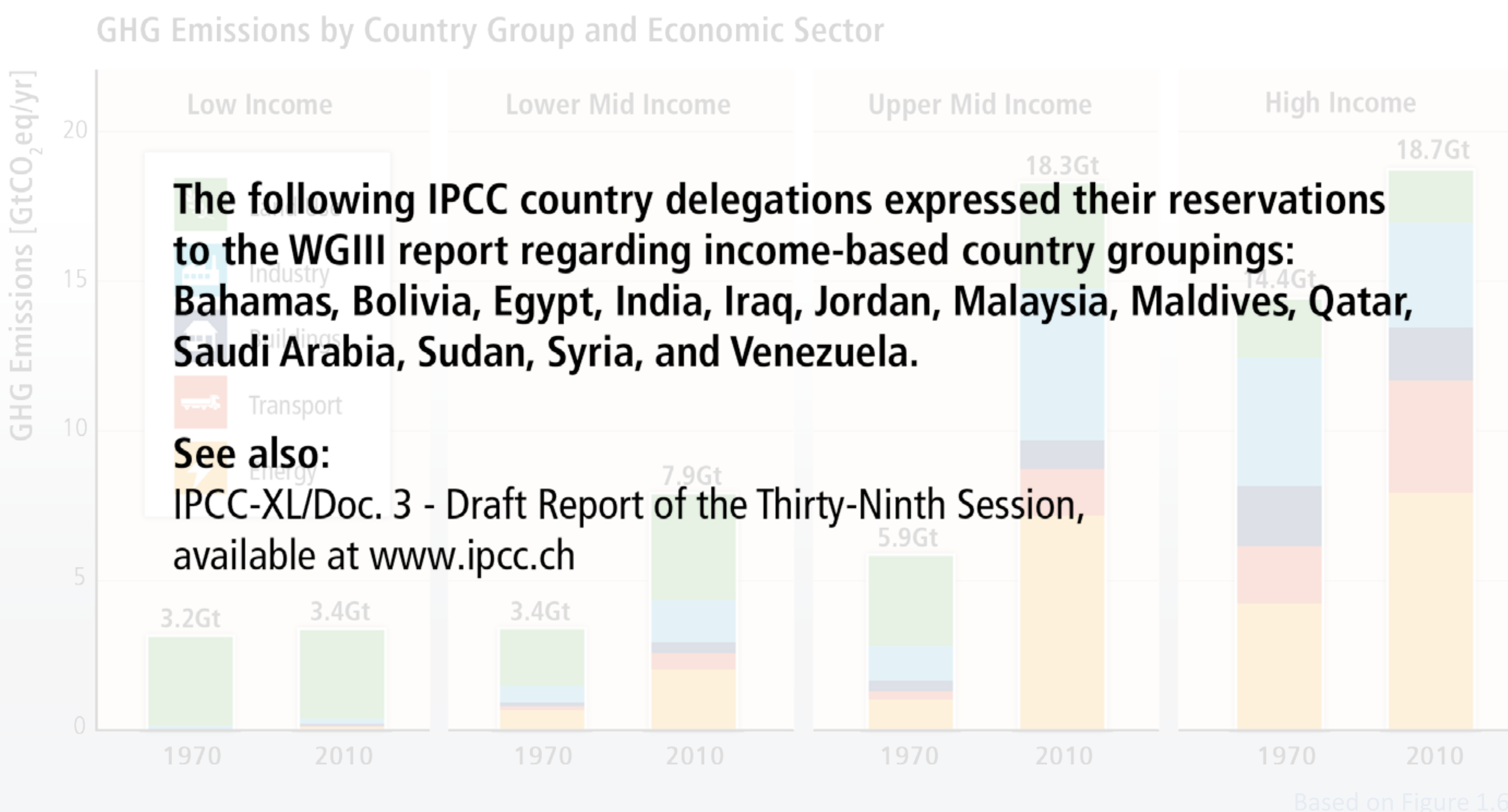
Based on Figure 1.7

The long-standing trend of decarbonization has reversed.



Based on Figure 1.7

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



The following IPCC country delegations expressed their reservations to the WGIII report regarding income-based country groupings: Bahamas, Bolivia, Egypt, India, Iraq, Jordan, Malaysia, Maldives, Qatar, Saudi Arabia, Sudan, Syria, and Venezuela.

See also:

IPCC-XL/Doc. 3 - Draft Report of the Thirty-Ninth Session, available at www.ipcc.ch

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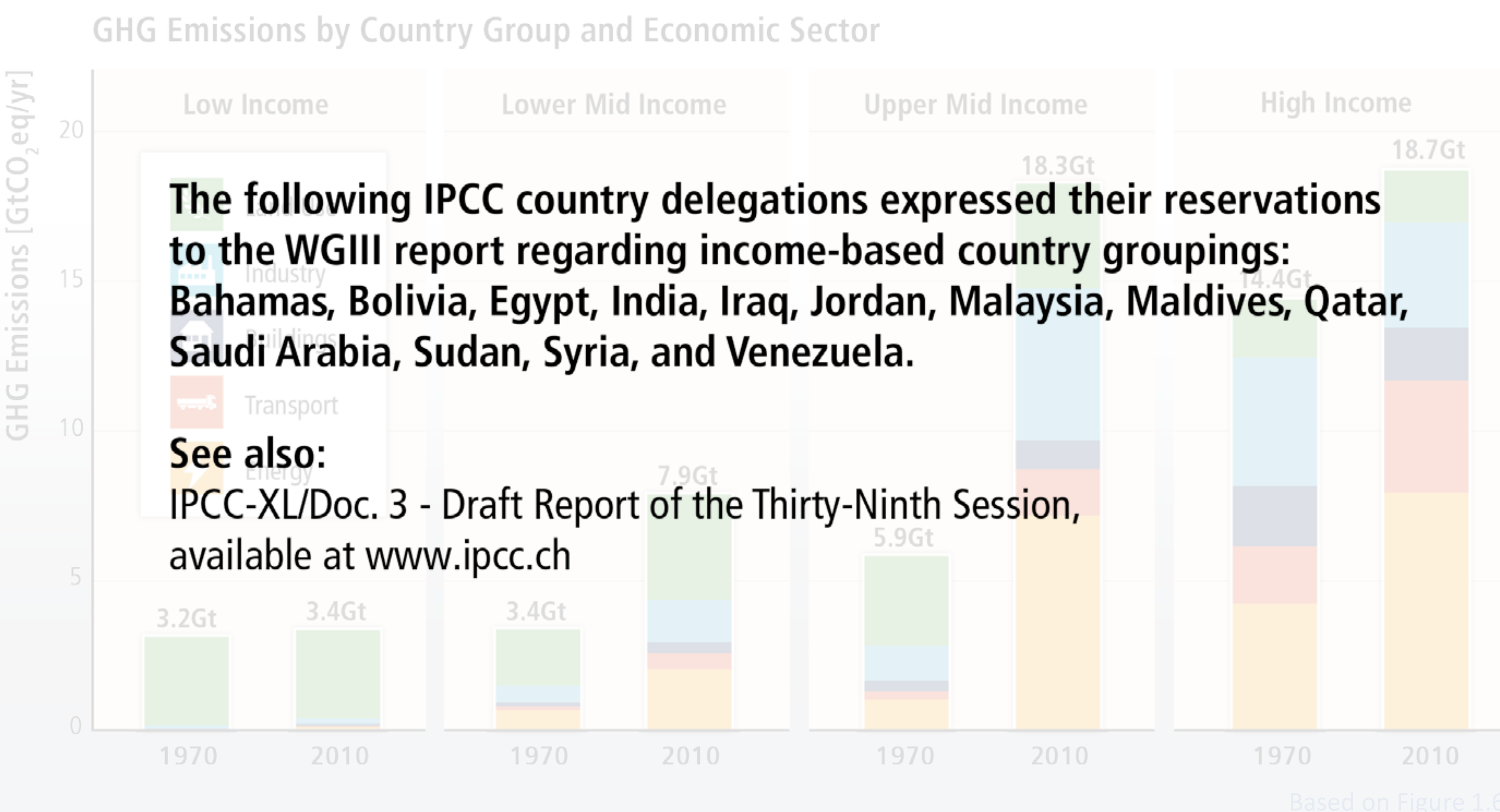

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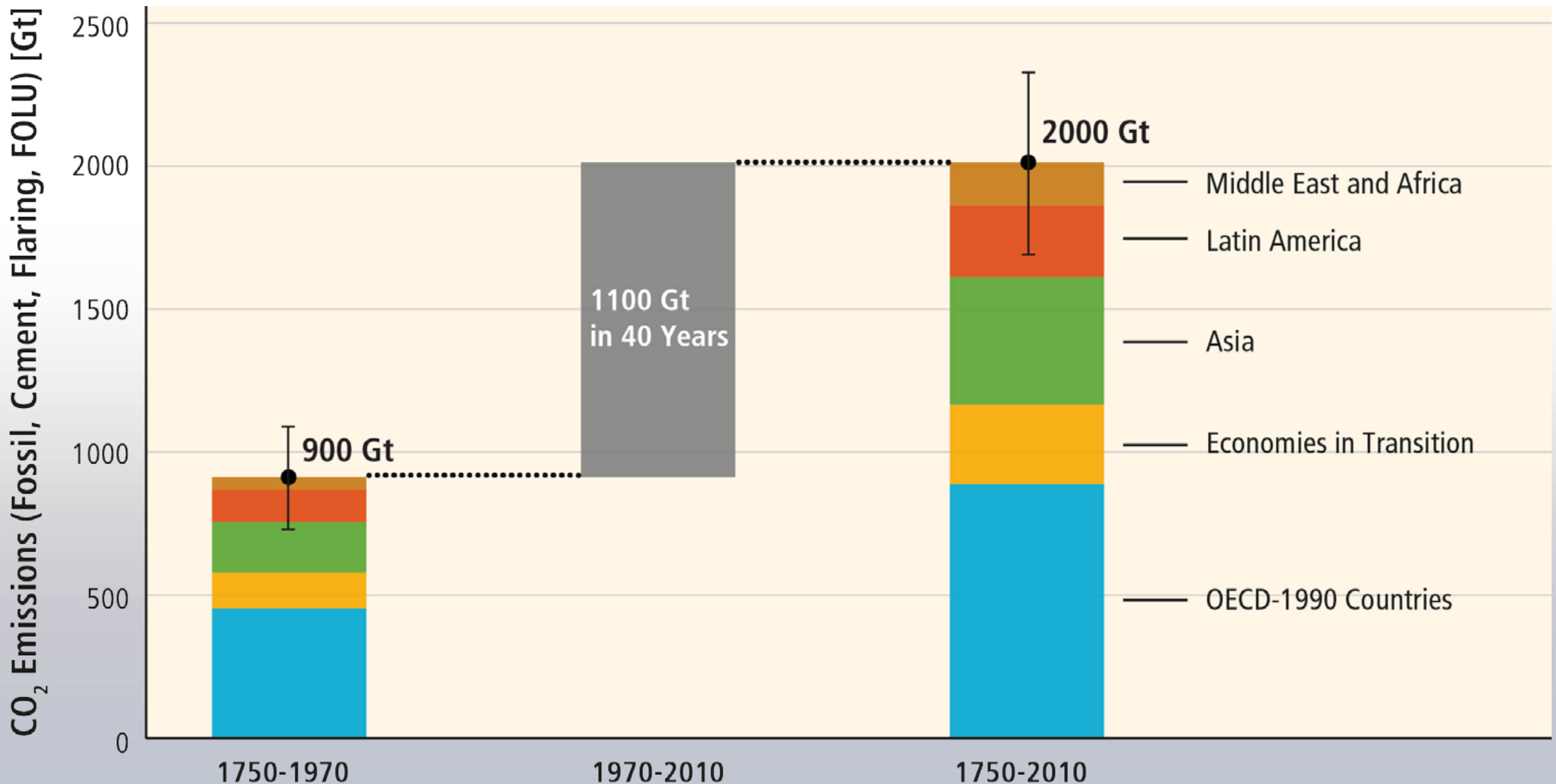
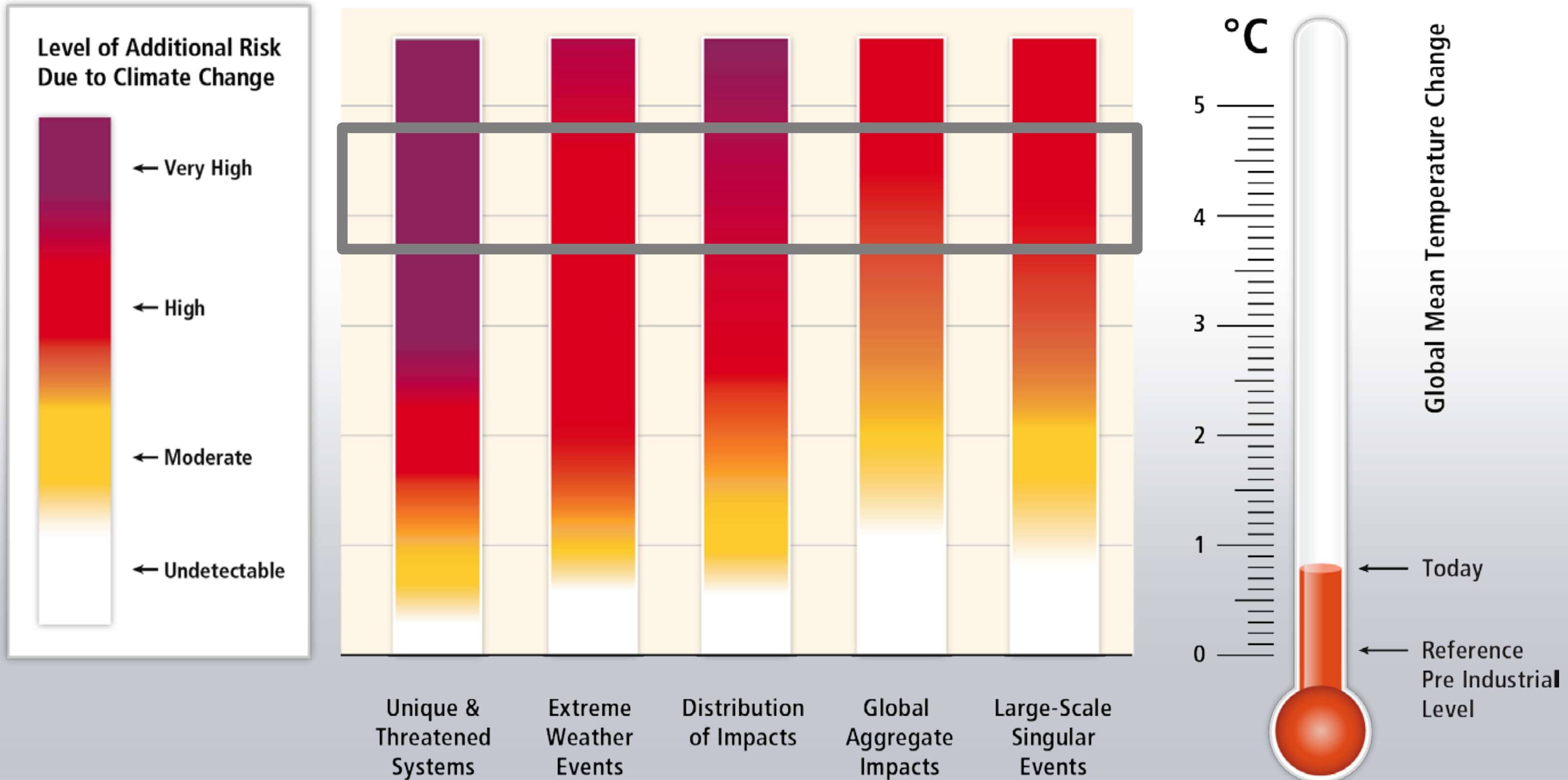
About half of the cumulative anthropogenic CO_2 emissions between 1750 and 2010 have occurred in the last 40 years.



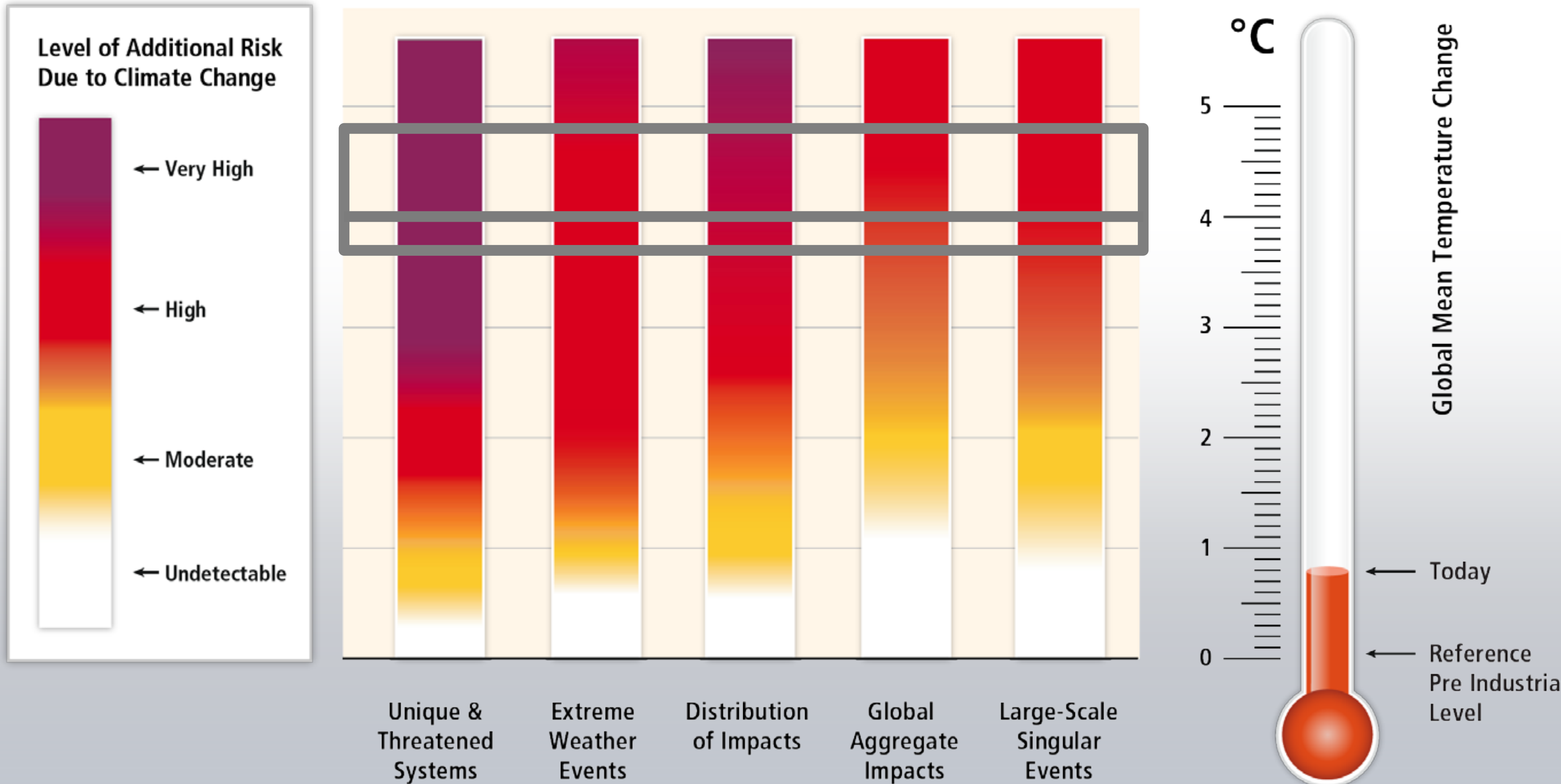
Based on Figure 5.3

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



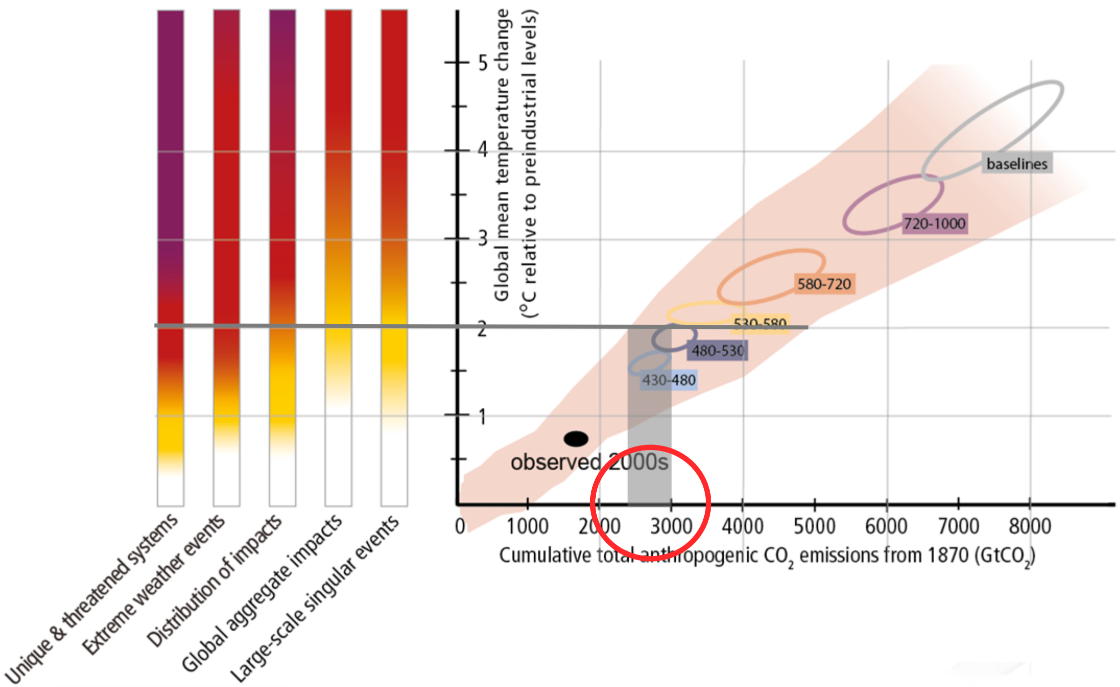
Based on WGII AR5 Figure 19.4

Substantial emissions reductions over the next few decades can reduce climate risks in the 21st century and beyond.



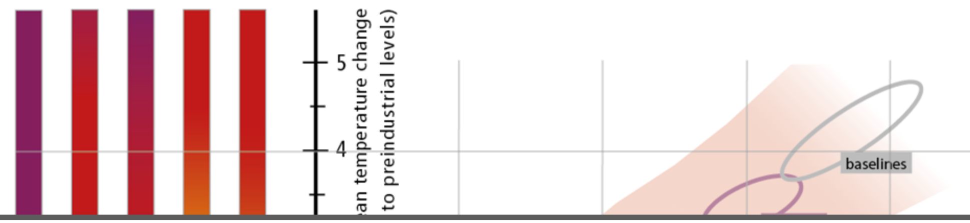
Based on WGII AR5 Figure 19.4

Risks from climate change depend on cumulative CO_2 emissions...

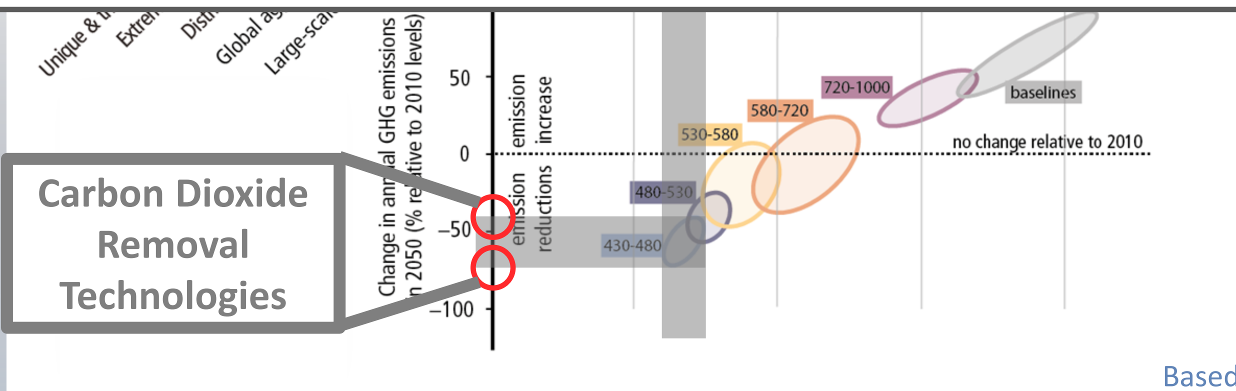


Based on SYR Figure SPM.10

...which in turn depend on annual GHG emissions over the next decades.

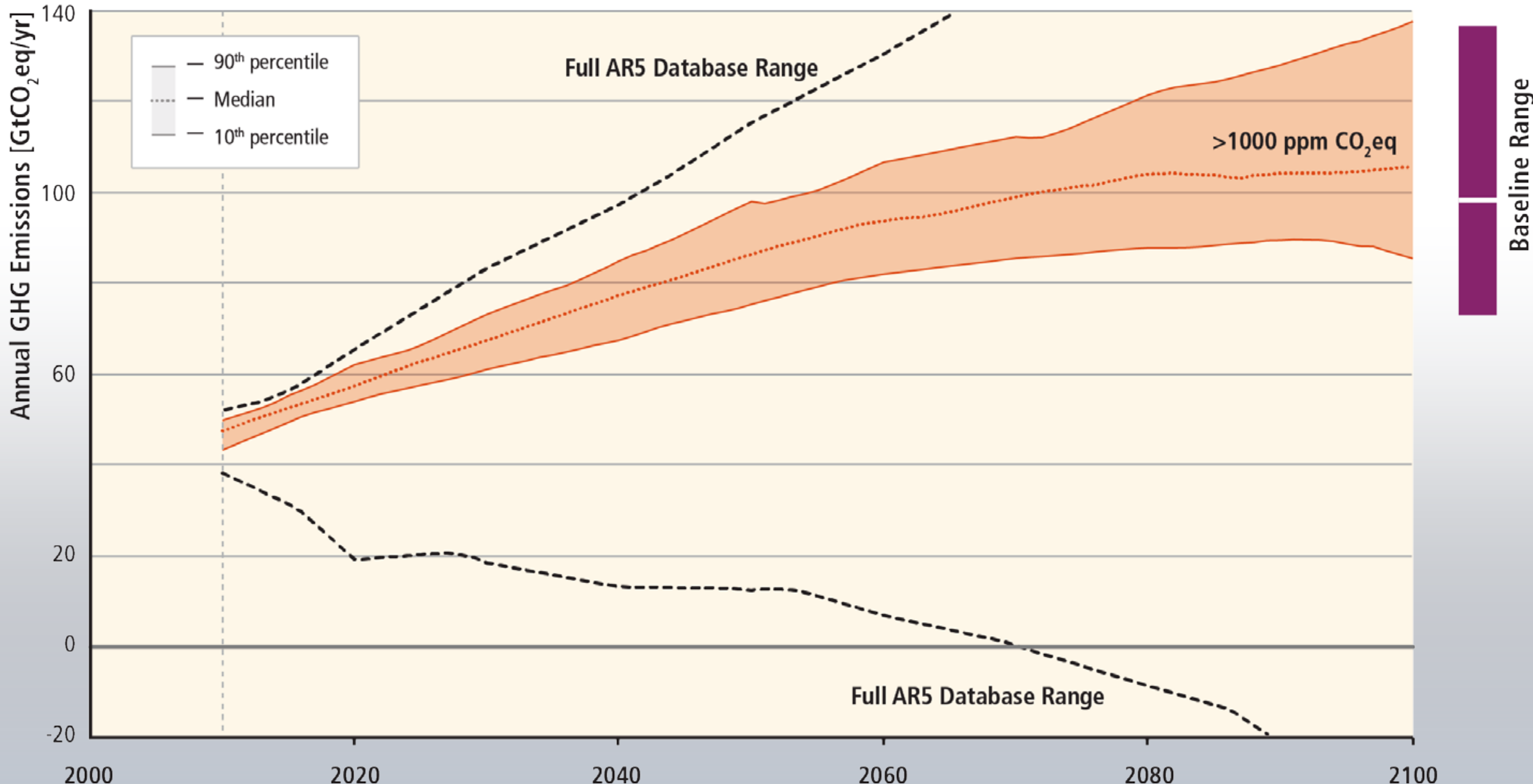


Mitigation involves some level of co-benefits and of risks due to adverse side-effects, but these risks do not involve the same possibility of severe, widespread and irreversible impacts as risks from climate change.



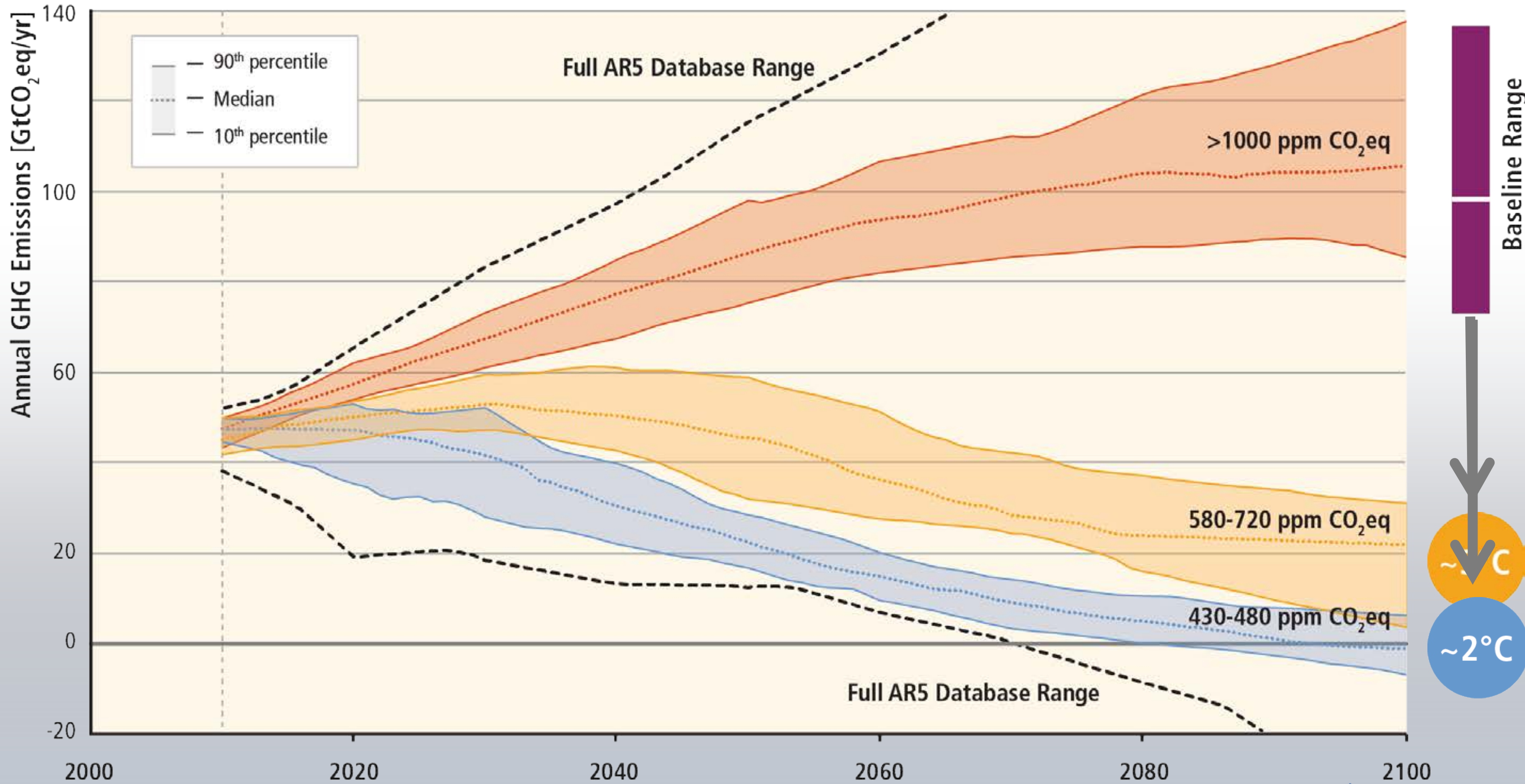
Based on SYR Figure SPM.10

Stabilization of atmospheric GHG concentrations requires moving away from business as usual.



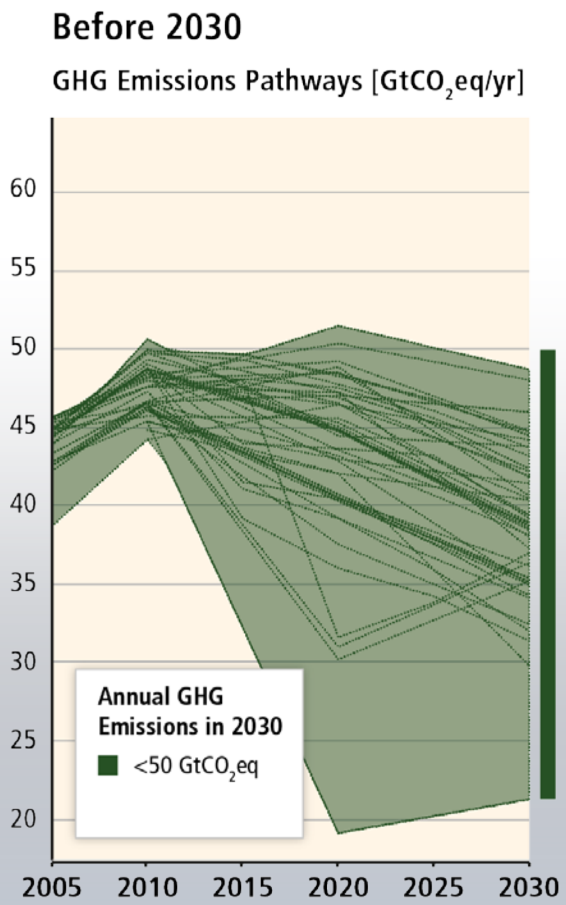
Based on Figure 6.7

Lower ambition mitigation goals require similar reductions of GHG emissions.



Based on Figure 6.9

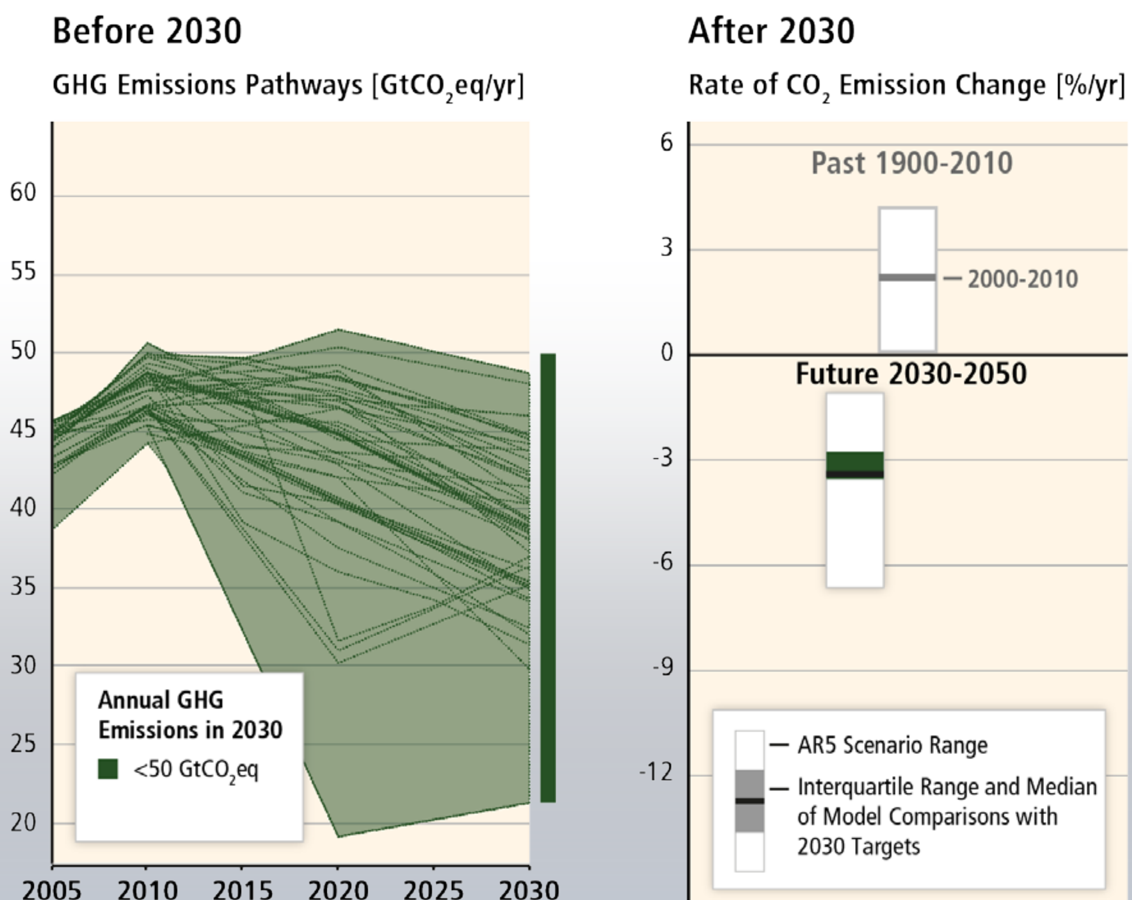
Many scenarios make it at least *about as likely as not* that warming will remain below 2°C relative to pre-industrial levels.



"Immediate Action"

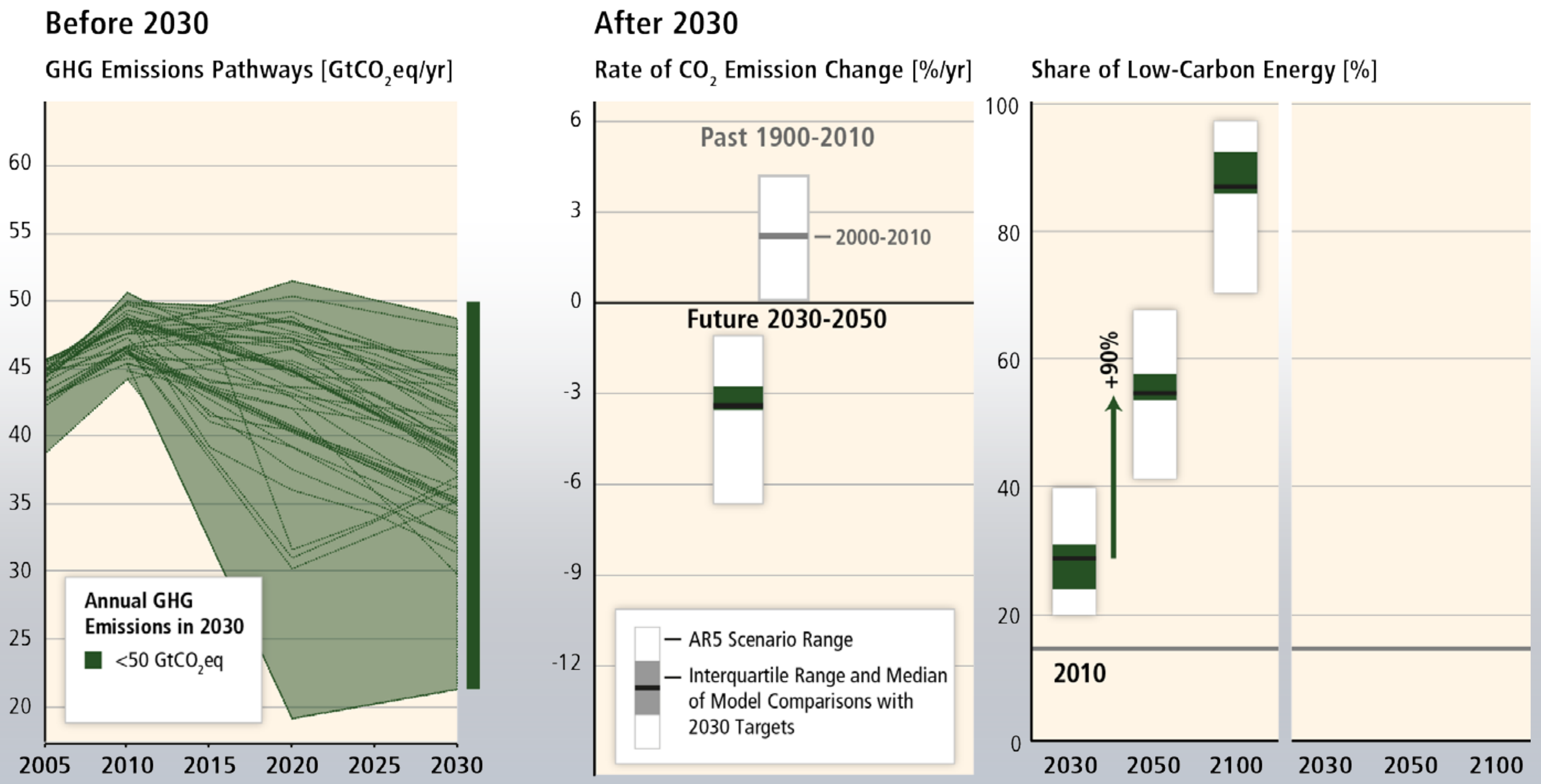
Based on Figures 6.32 and 7.16

Still, between 2030 and 2050, emissions would have to be reduced at an unprecedented rate...



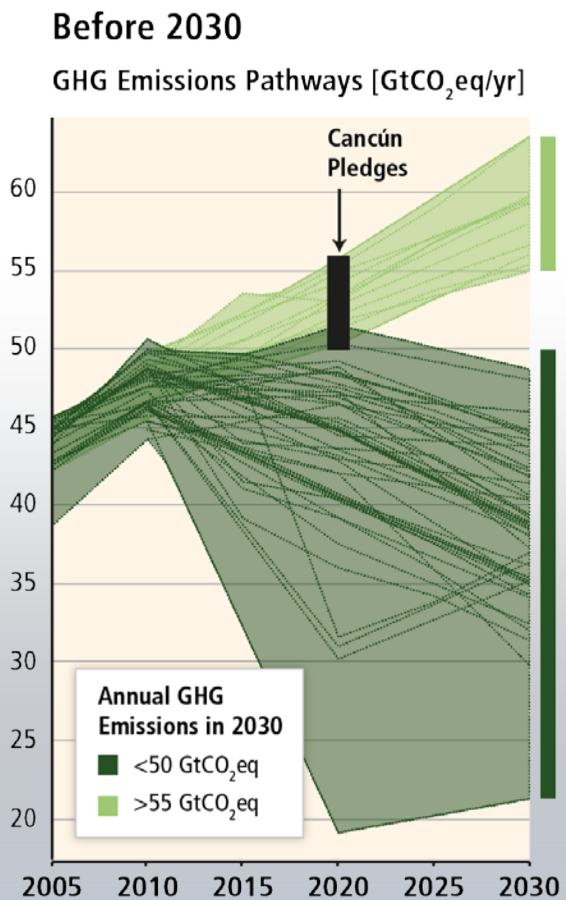
Based on Figures 6.32 and 7.16

...implying a rapid scale-up of low-carbon energy.



Based on Figures 6.32 and 7.16

Delaying emissions reductions increases the difficulty and narrows the options for mitigation.



"Delayed Mitigation"

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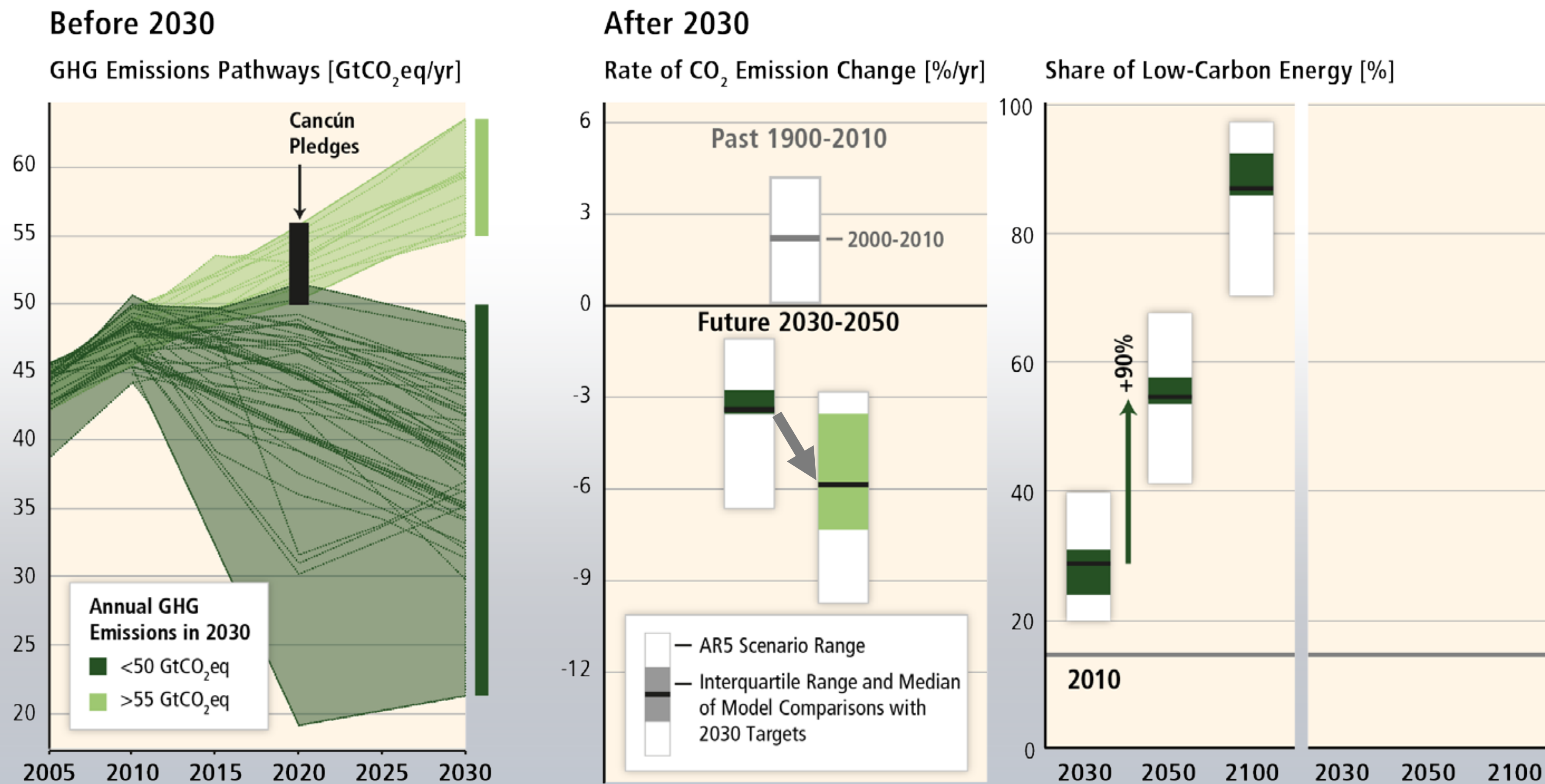

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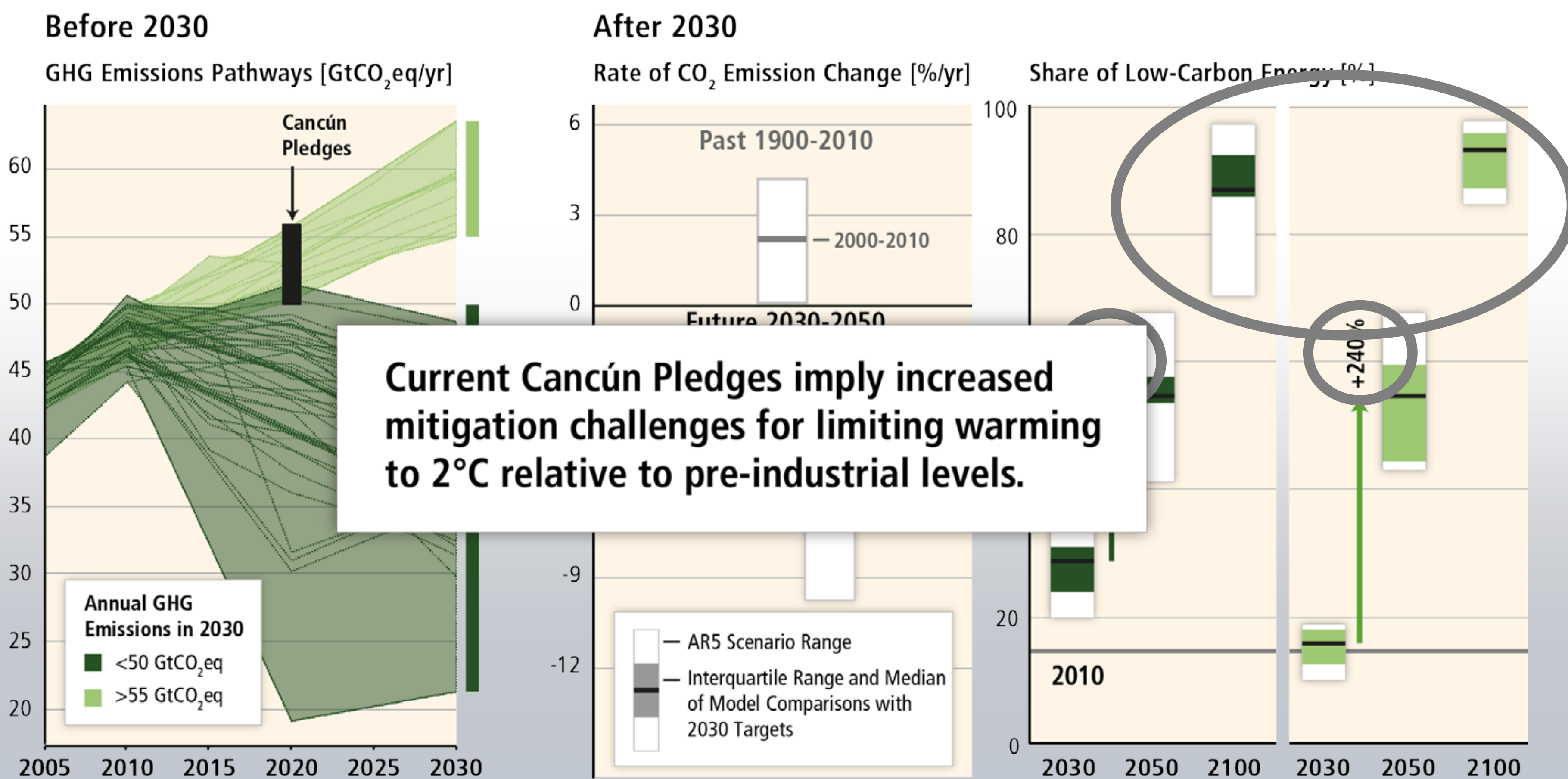
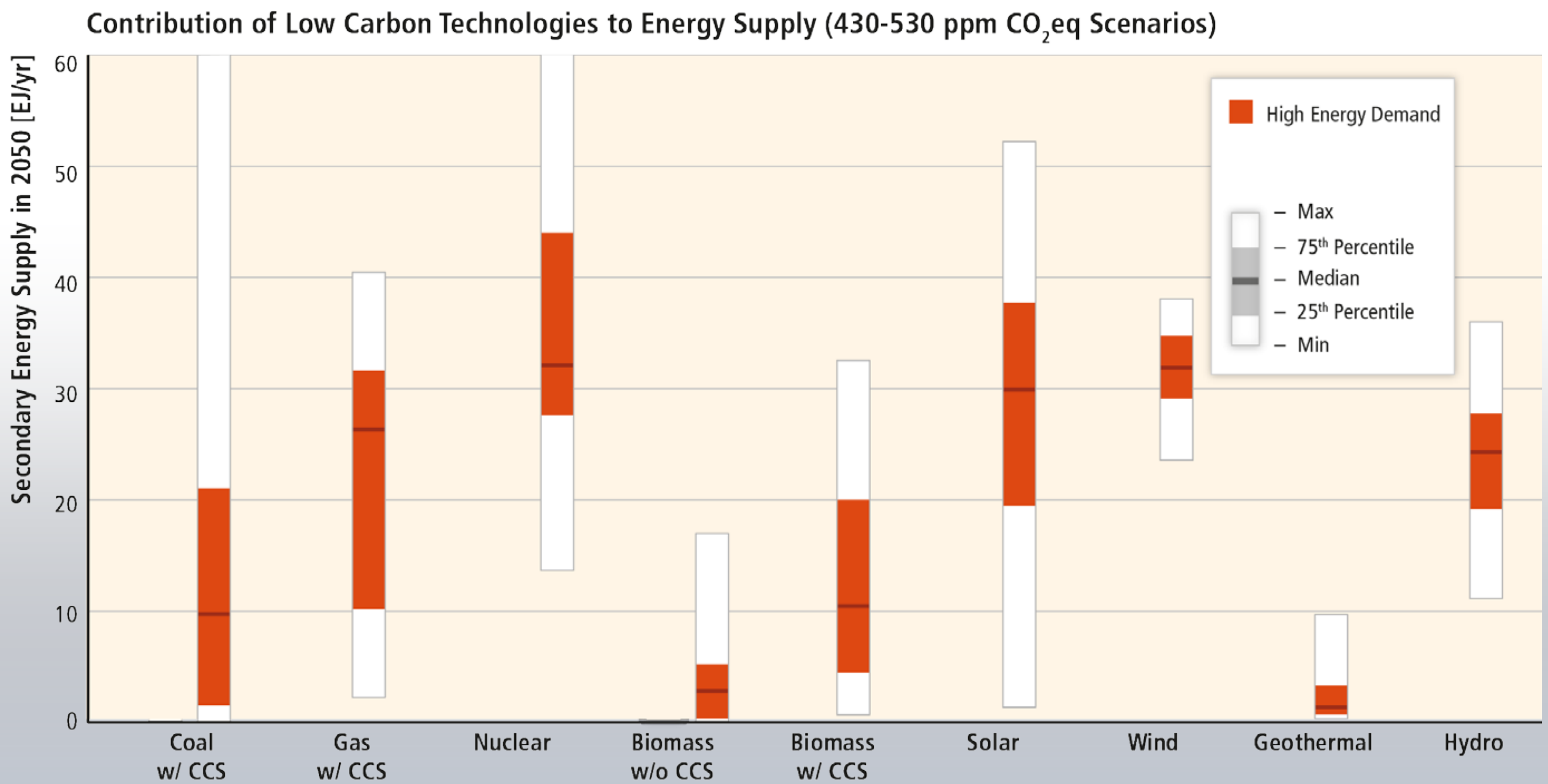


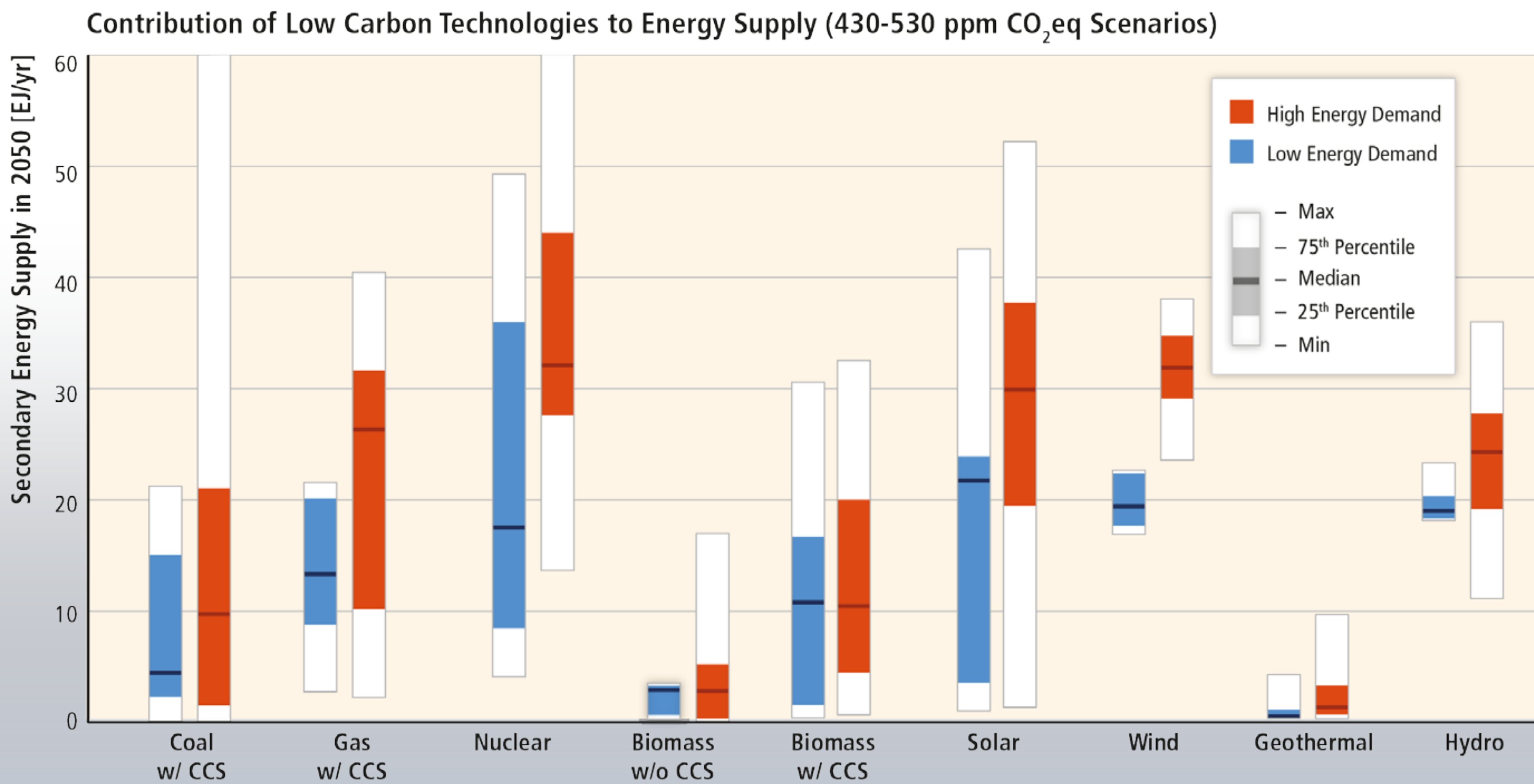
Based on Figures 6.32 and 7.16

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



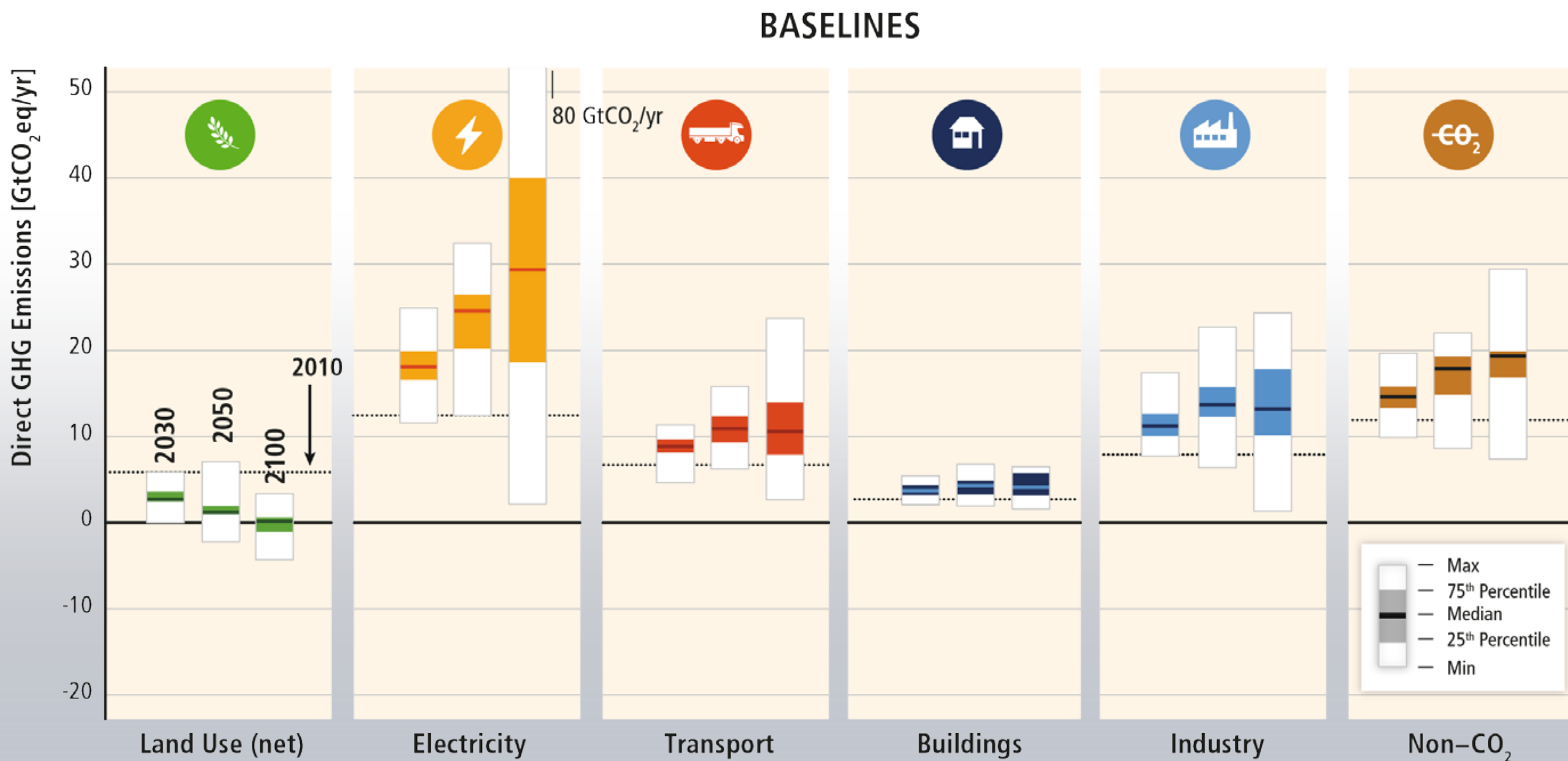
Based on Figure 7.11

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



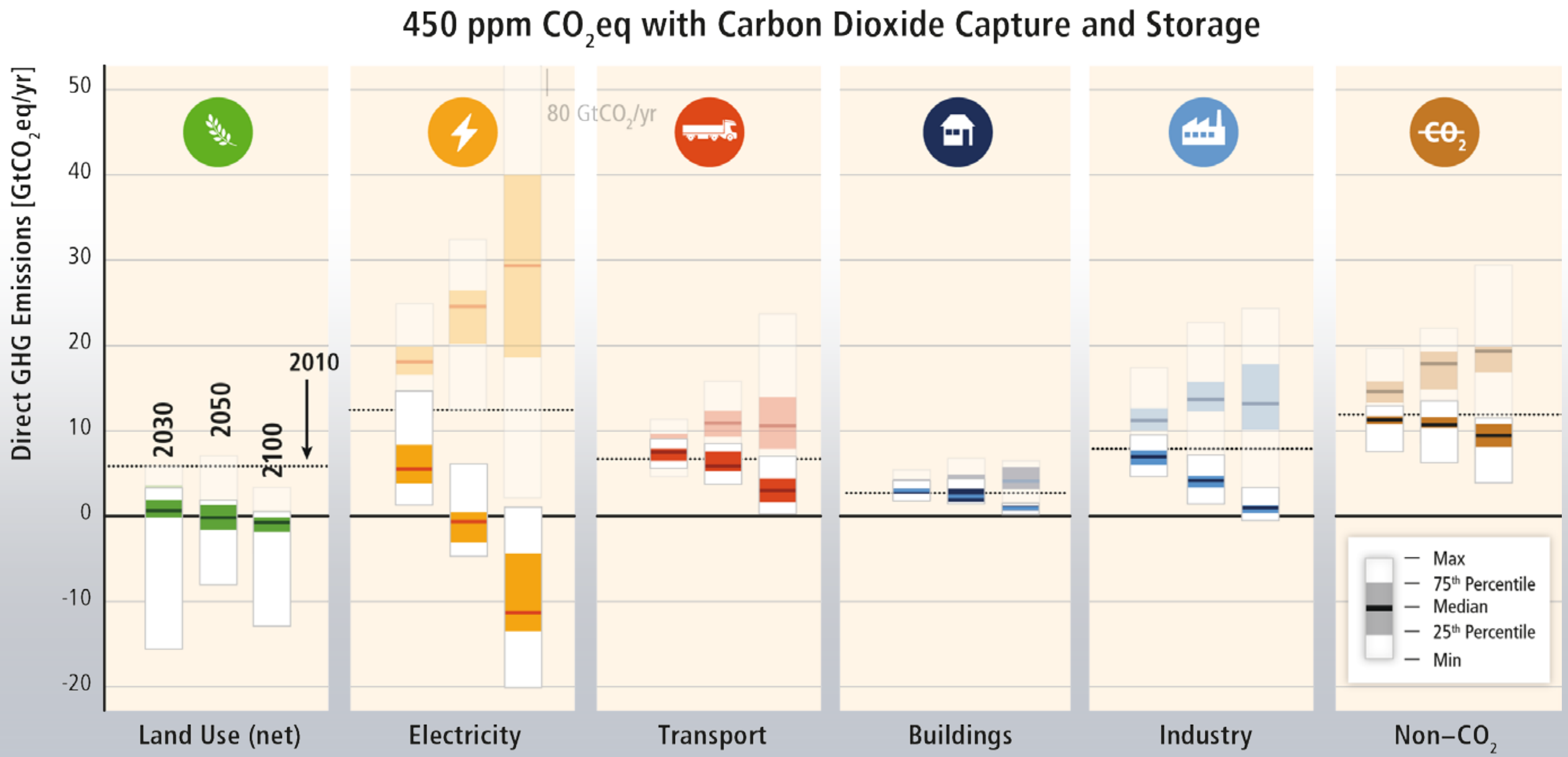
Based on Figure 7.11

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



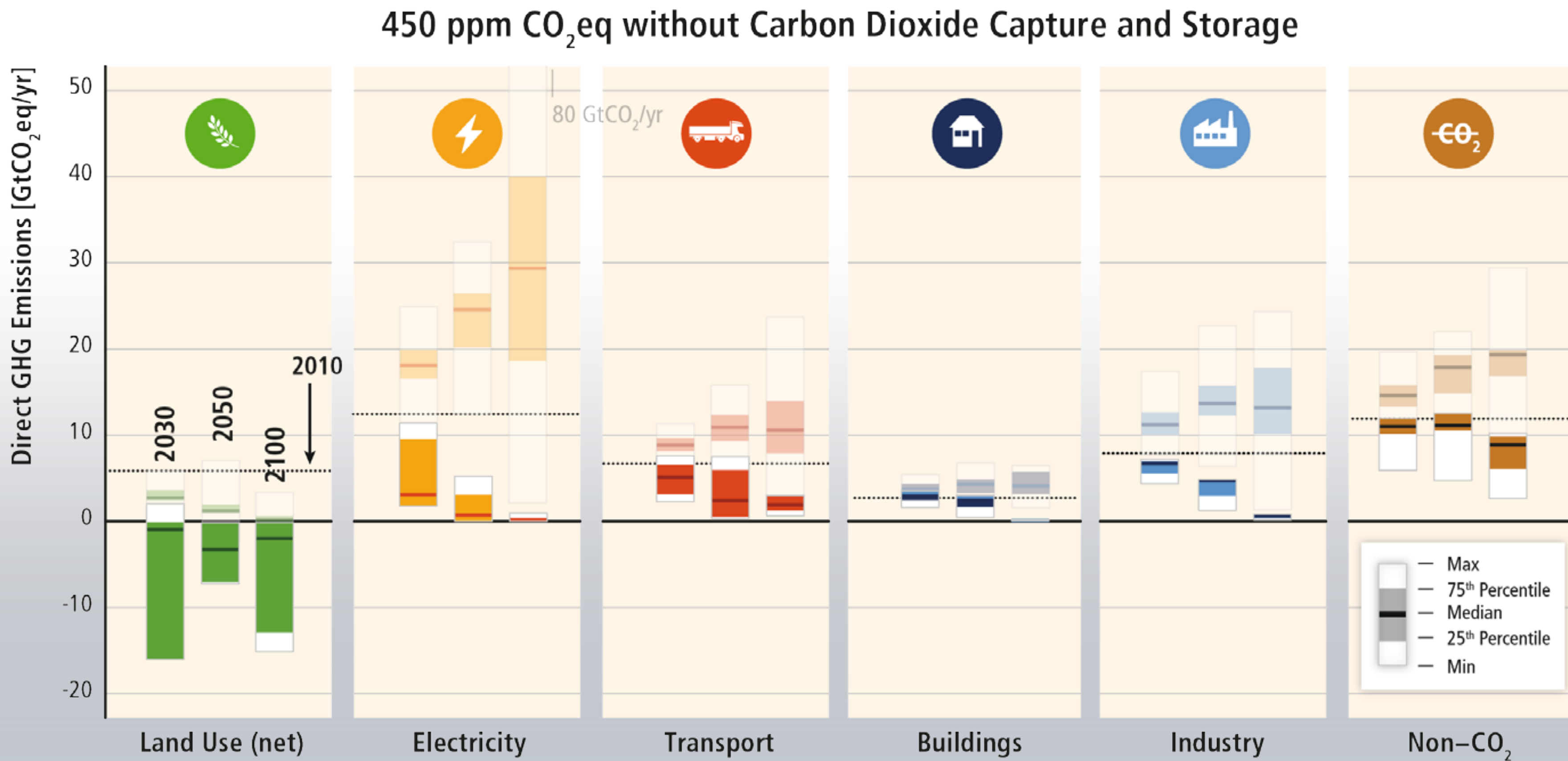
Based on Figure TS.15

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



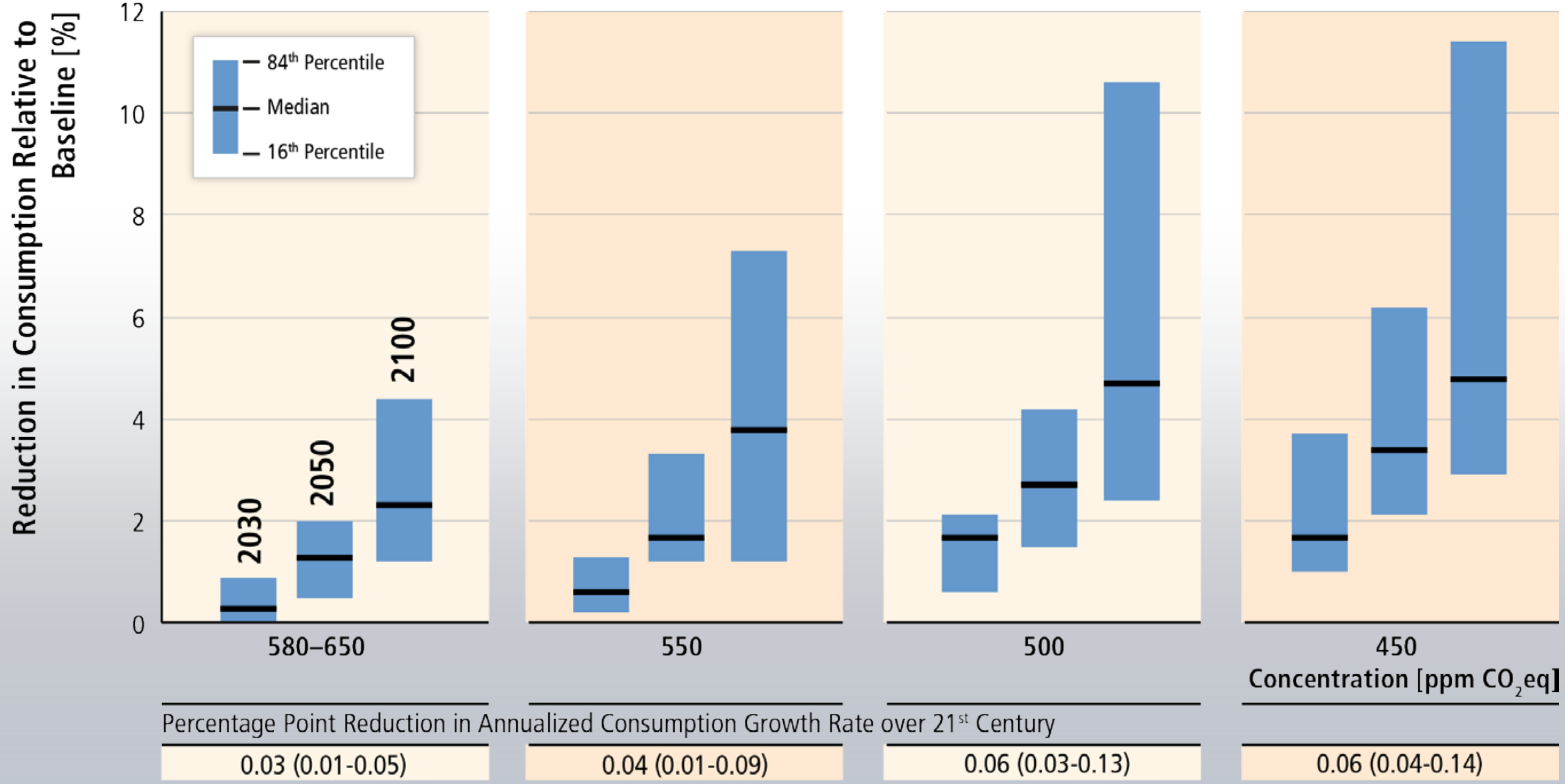
Based on Figure TS.17

Mitigation efforts in one sector determine efforts in others.



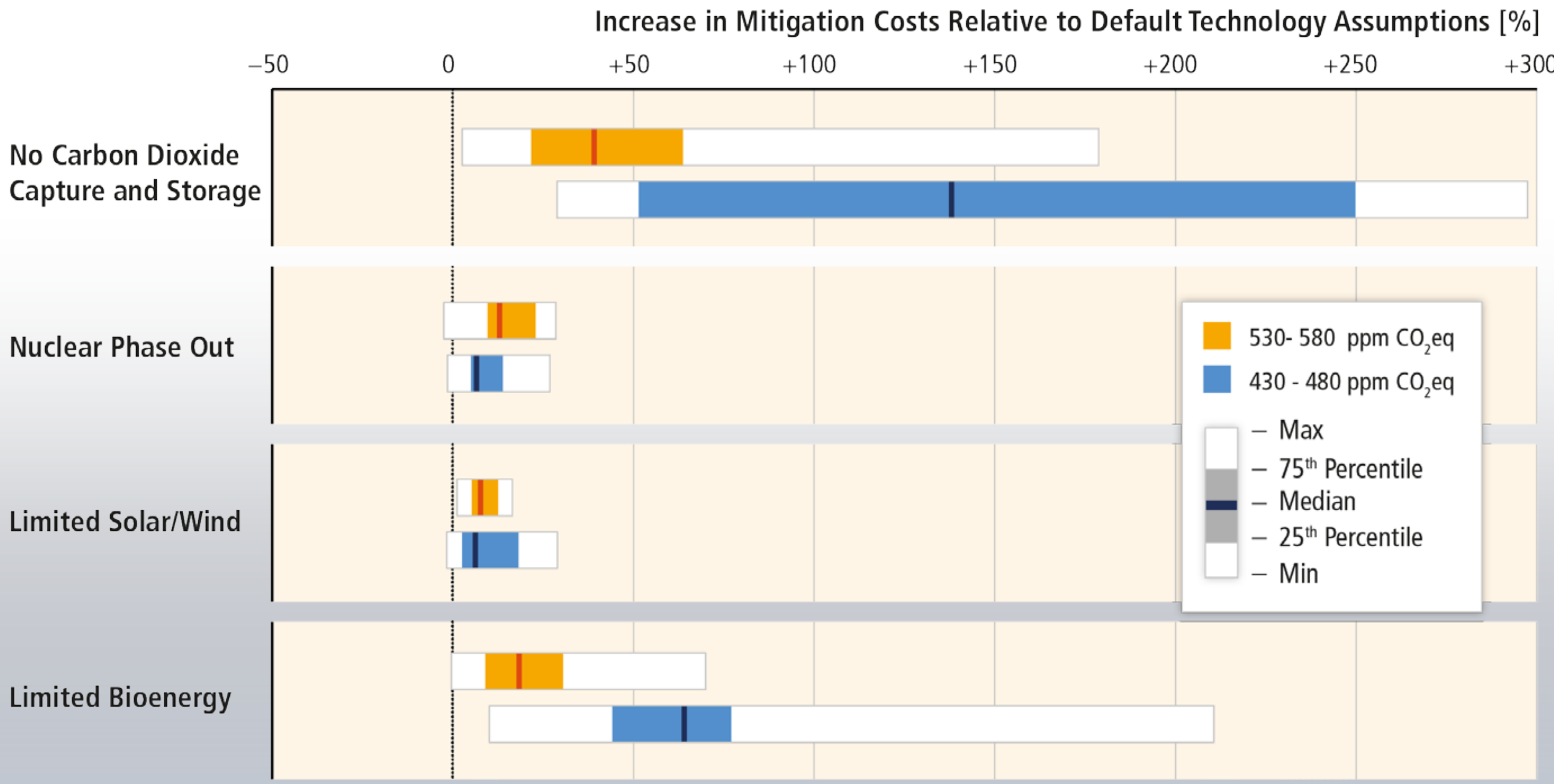
Based on Figure TS.17

Global costs rise with the ambition of the mitigation goal.



Based on Table SPM.2

Technological limitations can increase mitigation costs.

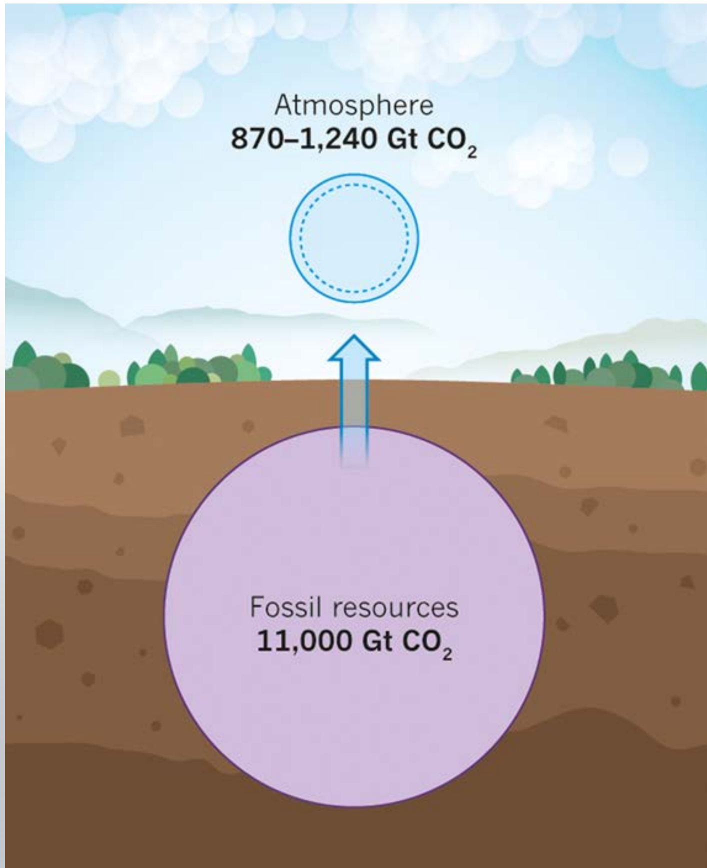


Based on Figure 6.24

What are the consequences for international energy and climate policy?

A few personal thoughts:

The climate problem at a glance



Resources and reserves to remain underground

Until 2100	With CCS [%]	No CCS [%]
Coal	70	89
Oil	35	63
Gas	32	64

Source: Bauer et al. (2014); Jakob, Hilaire (2015)

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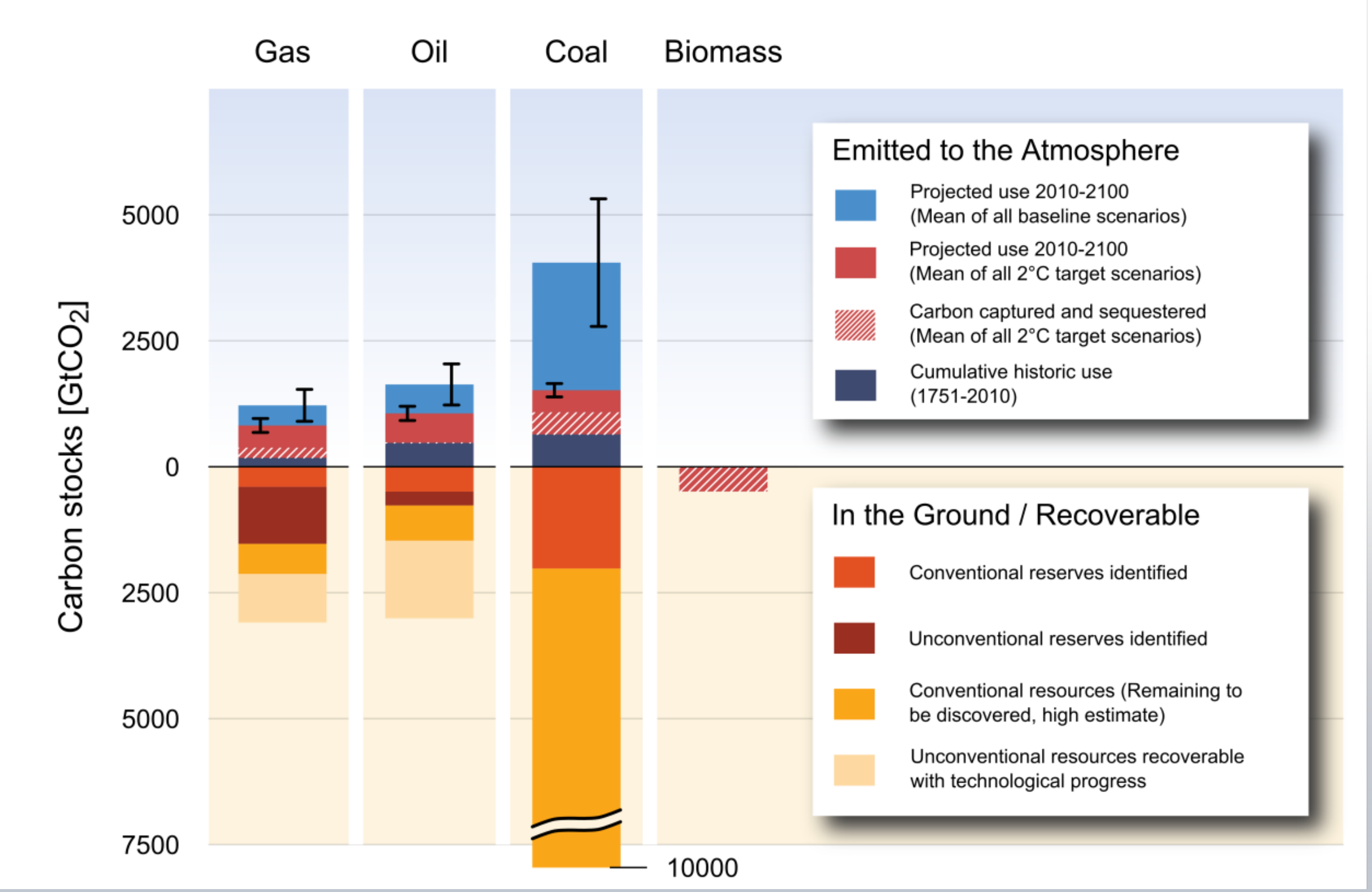
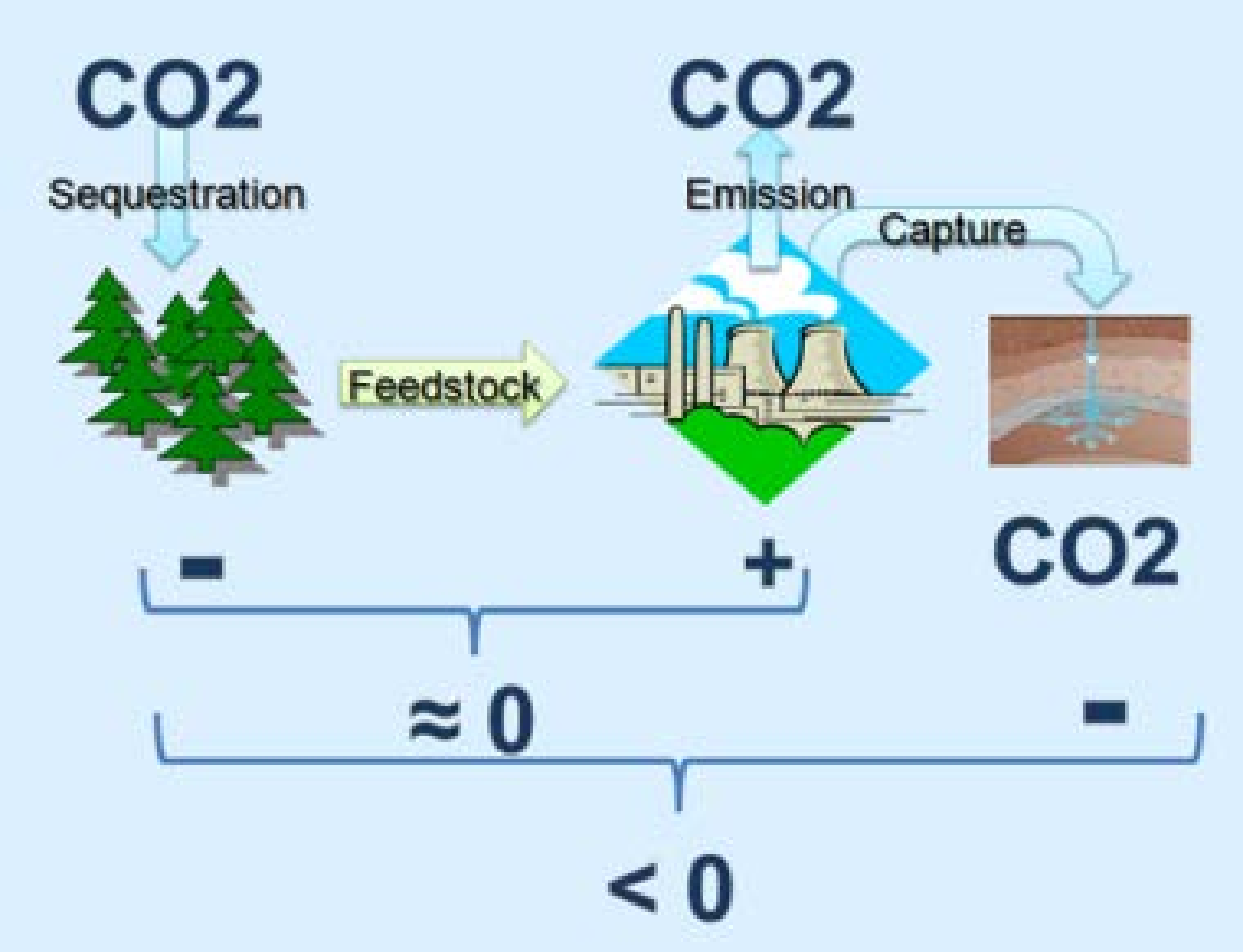
There is far more carbon in the ground than emitted in any baseline scenario.



Source: Edenhofer, Hilaire, Bauer

85 percent of the IPCC scenarios in line with the 2° target venture into the unknown territory of negative emissions.



Quelle: Applied Energy Handbook, Wiley.

85 percent of the IPCC scenarios in line with the 2° target venture into the unknown territory of negative emissions.

Negative emissions options	2020-2100 Low to high potential ($GtCO_2$)
BECCS	178 – 453
Biochar	143
Agricultural soil carbon sequestration	104 – 130
CO_2 air capture	108 – 260*
Ocean alkalinity enhancement	84 – 260*
Afforestation & forestry	80 – 100
Total	~700 – ~1,300*

Further Negative emissions options:

- Afforestation (limited representation in AR5 scenarios)
- Not represented in AR5 scenarios:
  - CO_2 air capture
  - Carbon sequestration in soils (biochar…)
  - Ocean fertilization and alkalinity enhancement
  - Enhanced weathering

Quelle: aus Tabelle 5; Stranded Carbon Assets and NETs (2015), Arbeitspapier SSEE, Univ. of Oxford (*at least)

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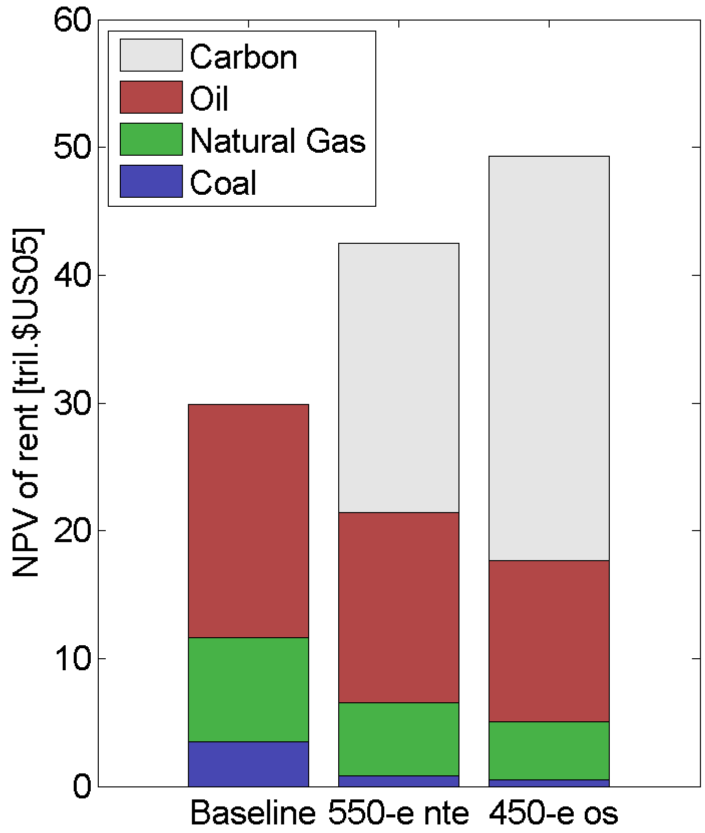
The scarcity rent of CO_2 emissions



- Fossil fuel rents decrease with the ambition of climate policy
- If the optimal CO_2 price is implemented globally, this loss is **over-compensated** by the carbon rent
- The **revenues** of the carbon tax or auctioning of emission permits can be used to finance **tax reductions**, **infrastructure investments** or **debt reduction**

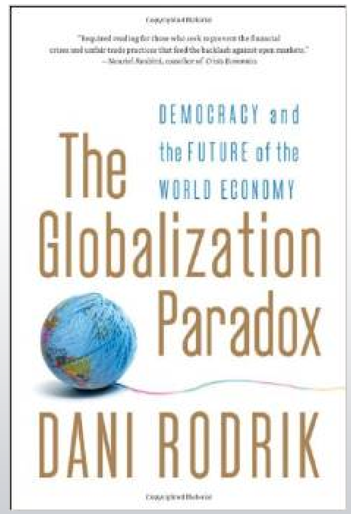
Bauer et al. (2013)

The Globalization Paradox: a trilemma

Gilded cage

Hyper-Globalization

National Sovereignty



Global Federalism

Compromise of Bretton-Woods

Democracy

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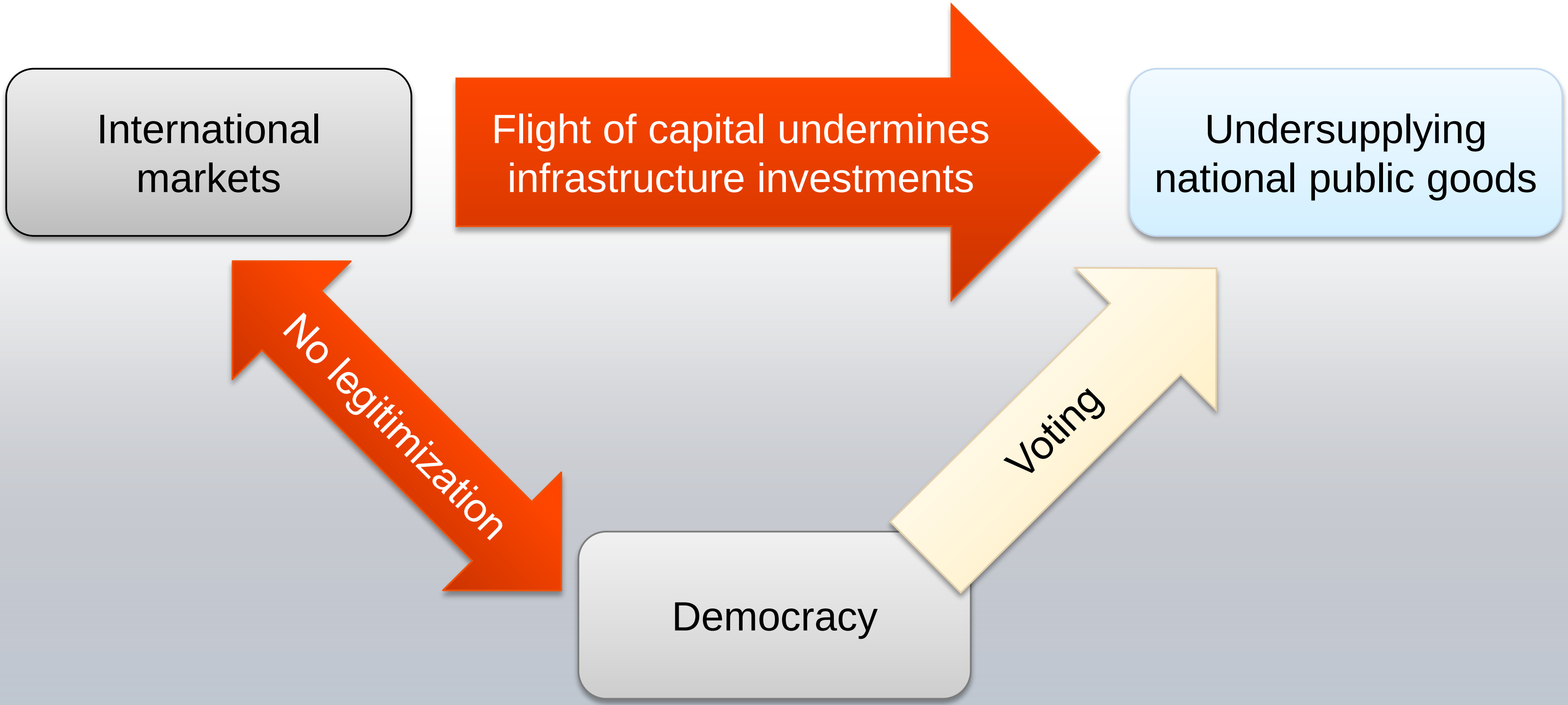
Tax evasion limits national room for maneuver

Mobility of capital



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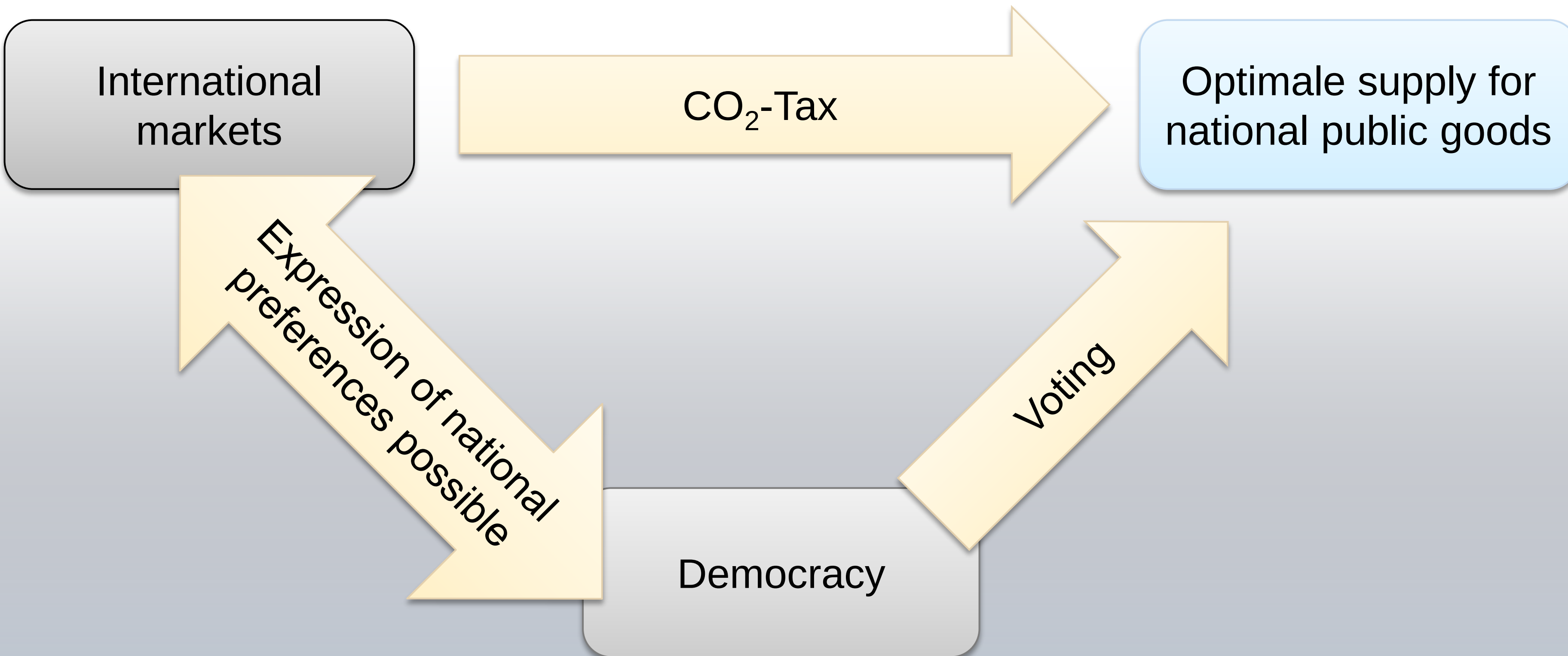
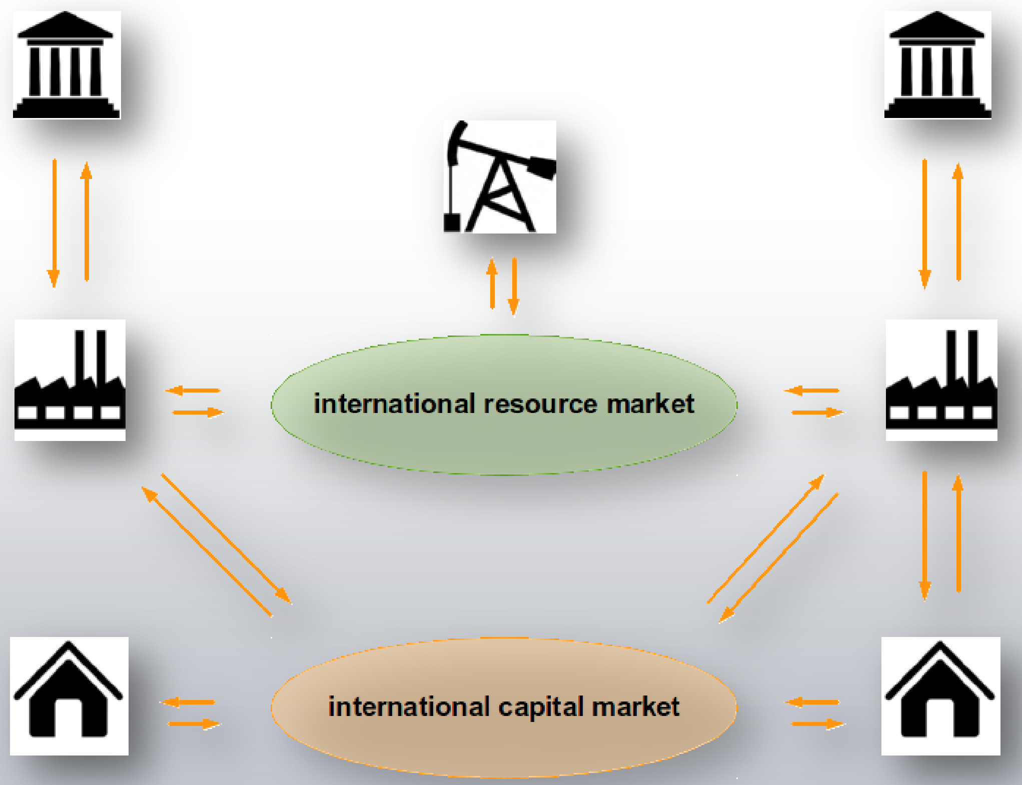
CO_2-taxes free economic potential

Mobility of capital and
trade of resources



A modelling study illustrates the economic potential of CO_2-taxes.



Franks et al. (2015)

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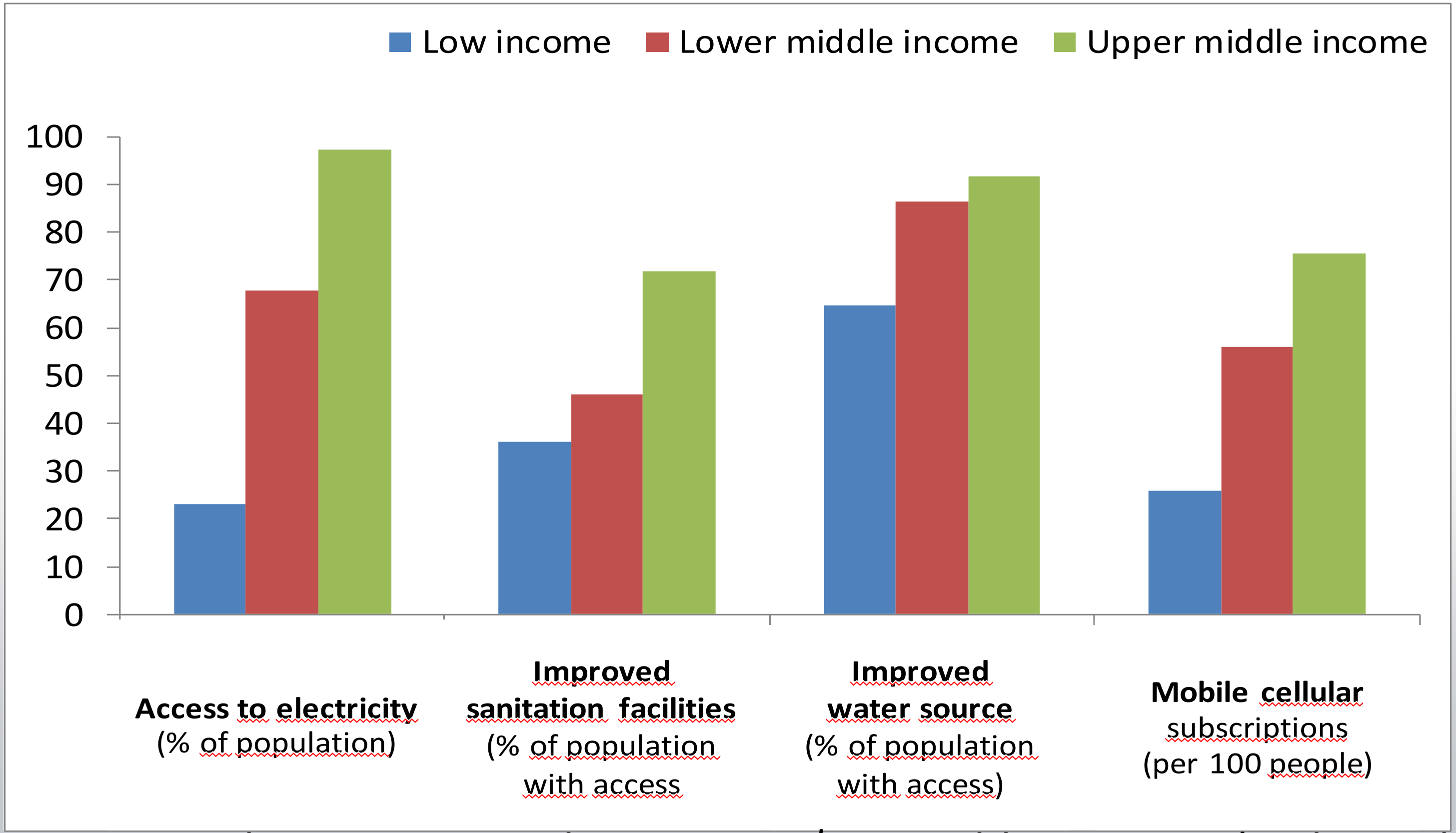
Massive infrastructure investments are needed globally.

- Telecommunication

- Access to electricity

- Water availability

Infrastructure investments



Jakob and Edenhofer (2014)

- 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

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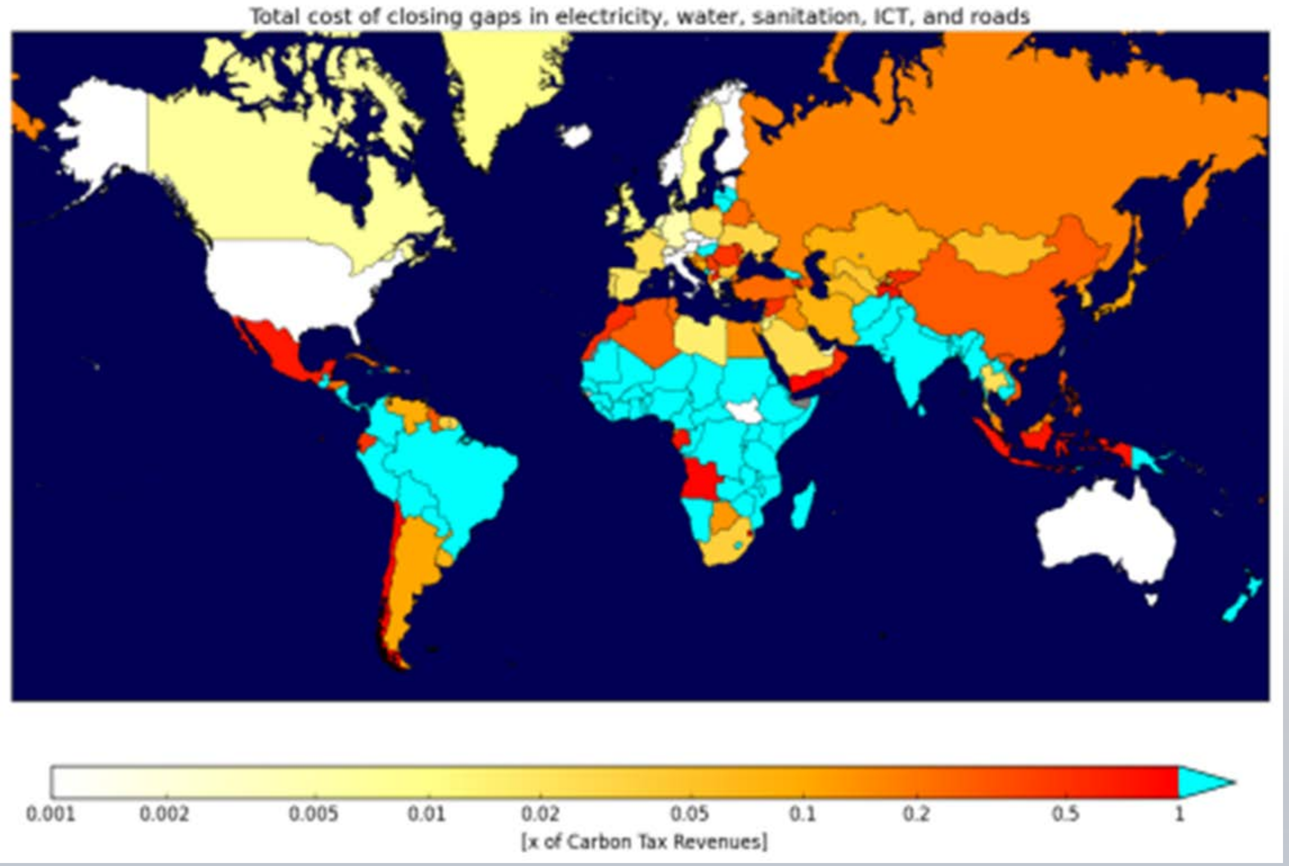
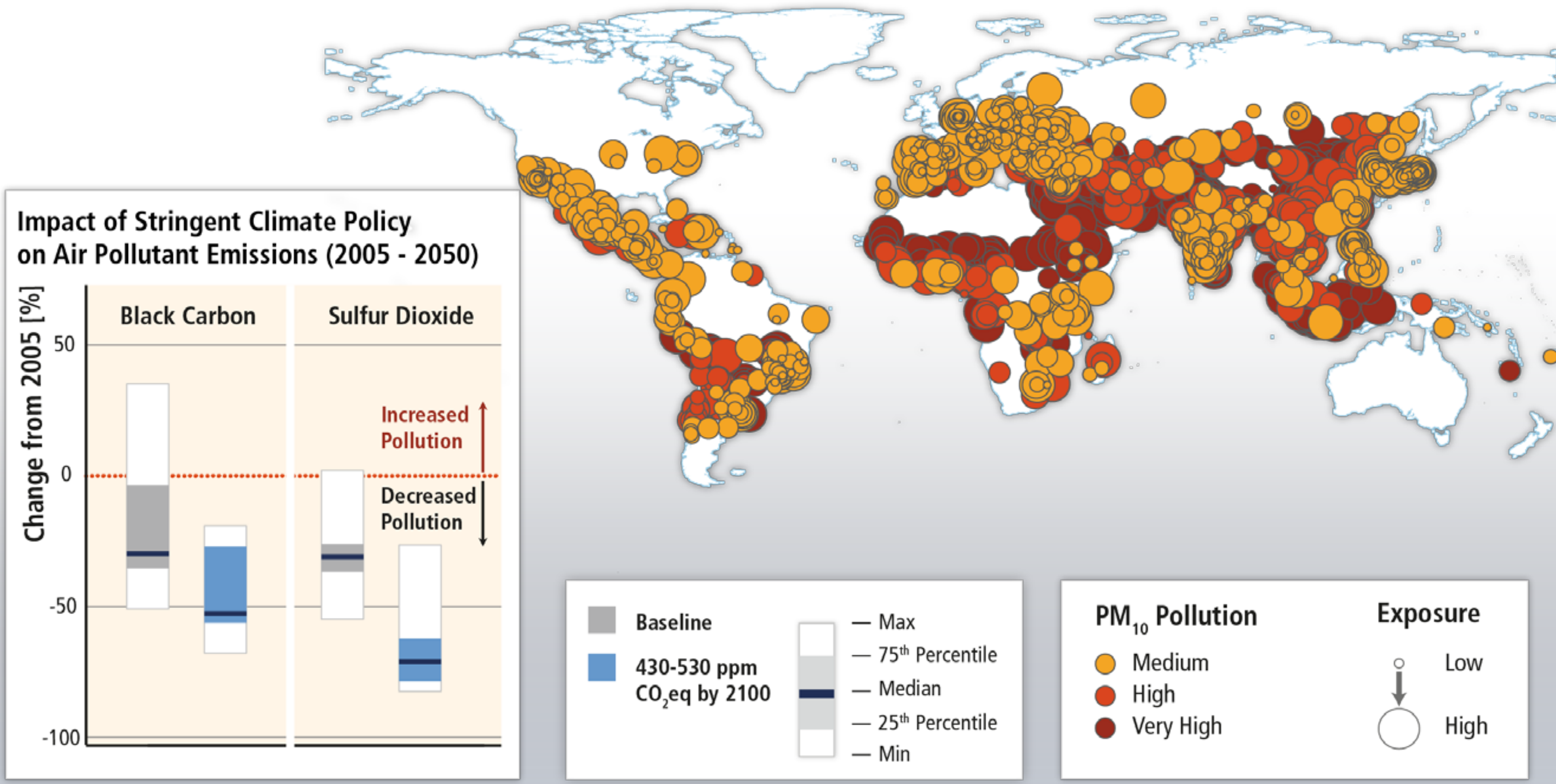
CO_2-tax and infrastructure



Quelle: Jakob et al., 2015

Climate change mitigation can result in co-benefits for human health and other societal goals.



Based on Figures 6.33 and 12.23

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