

CLIMATE CHANGE 2014

Mitigation of Climate Change

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Exploring the solution space



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

1 Summary for Policymakers

1 Technical Summary

16 Chapters

235 Authors

900 Reviewers

More than 2000 pages

Close to 10,000 references

More than 38,000 comments



An aerial photograph of a dense urban landscape, likely Hong Kong, featuring a complex network of highways and numerous skyscrapers under a blue sky with light clouds. A large blue circle is superimposed in the upper center of the image.

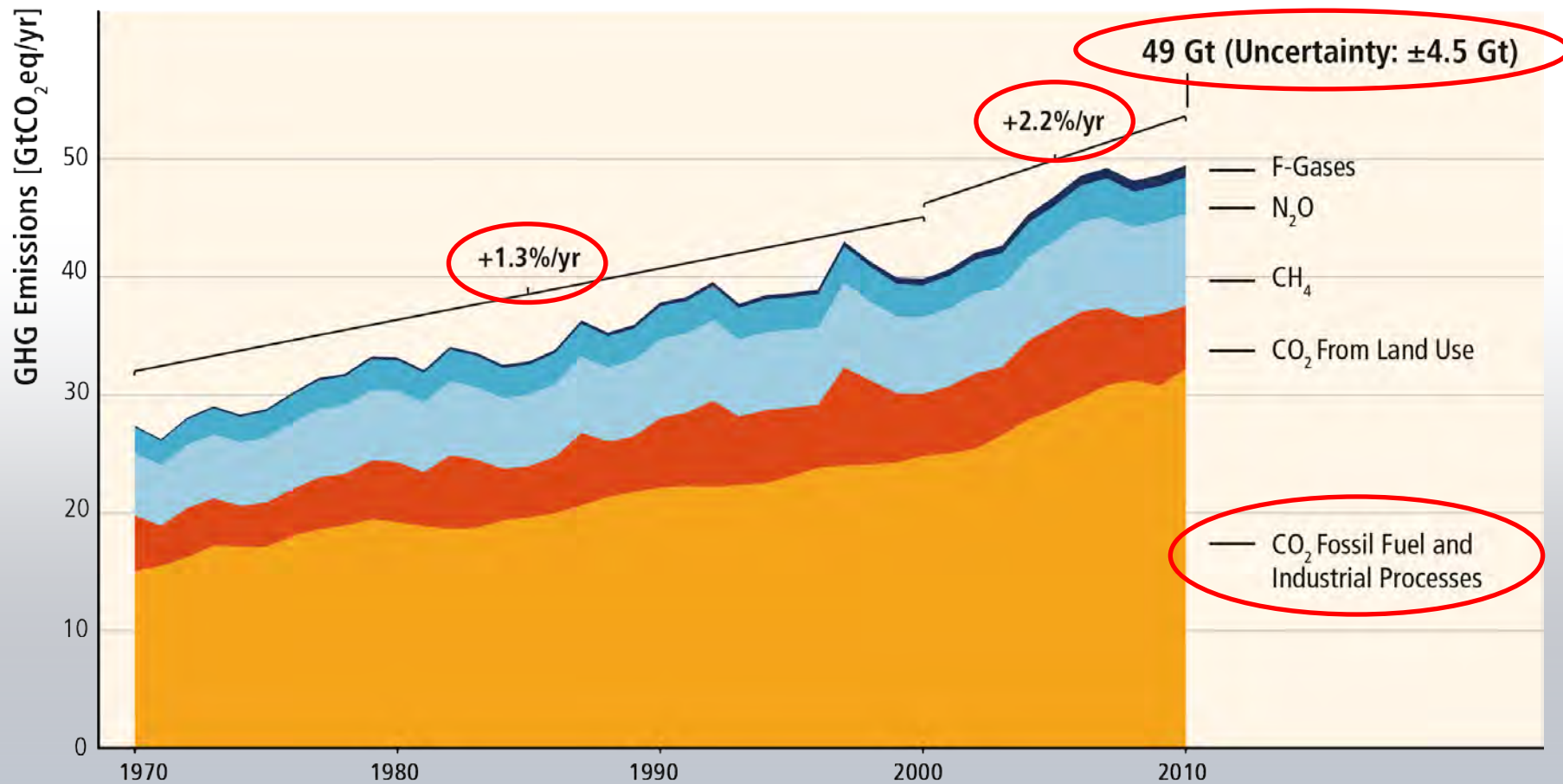
#1

What are the trends in stocks and flows of GHG emissions?

A yellow bulldozer is shown from a high angle, working on a large pile of dark, granular material, likely coal or ore. The bulldozer is positioned on the right side of the frame, with its blade lowered and pushing the material. The background is a vast, dark expanse of the same material, creating a sense of scale and industrial activity. The overall lighting is dim, with a blueish tint, emphasizing the industrial and somewhat somber nature of the scene.

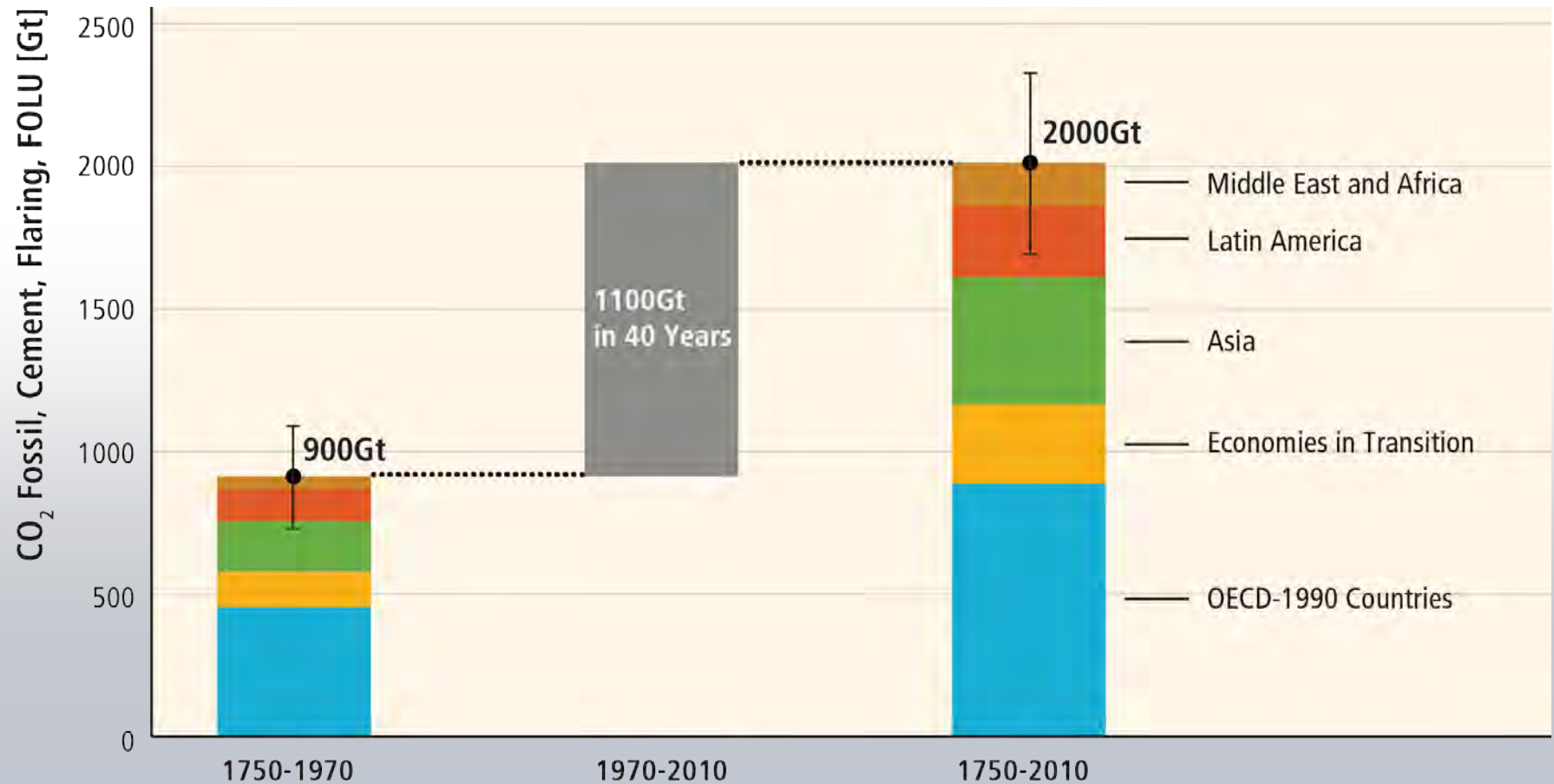
**GHG emissions growth has accelerated
despite reduction efforts.**

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



Based on Figure 1.3

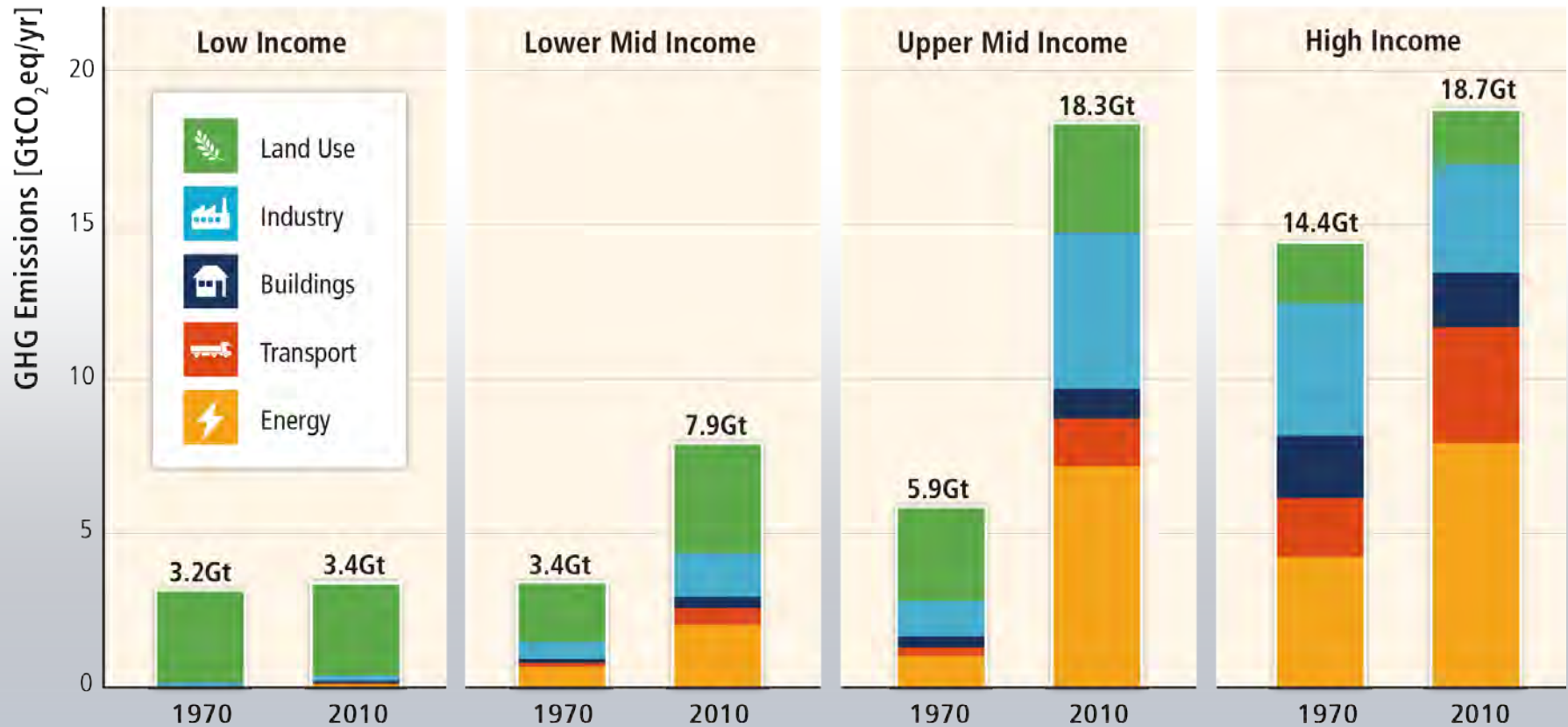
About half of cumulative anthropogenic CO₂ emissions between 1750 and 2010 have occurred in the last 40 years.



Based on Figure 5.3

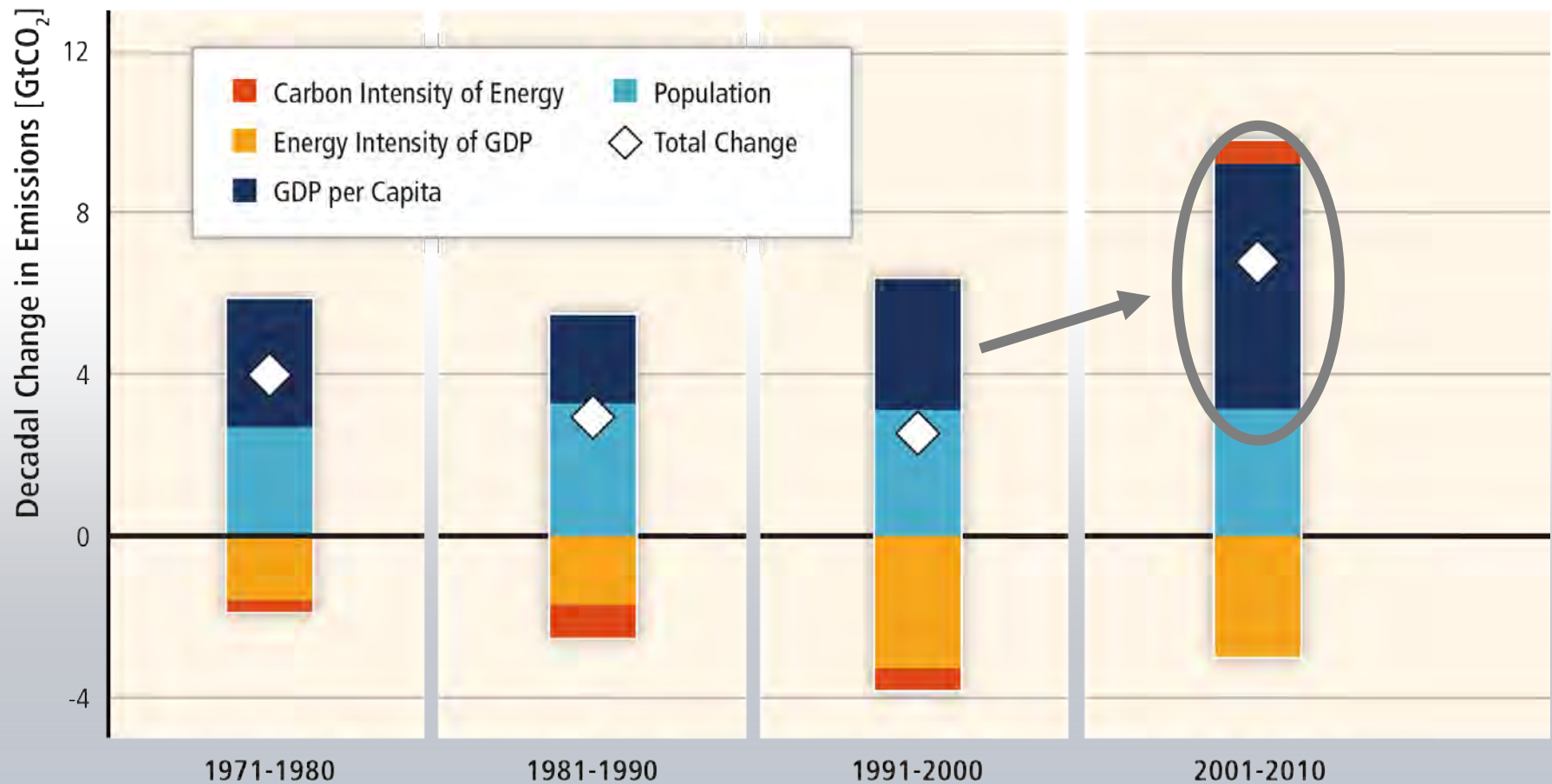
Regional patterns of GHG emissions are shifting along with changes in the world economy.

GHG Emissions by Country Group and Economic Sector



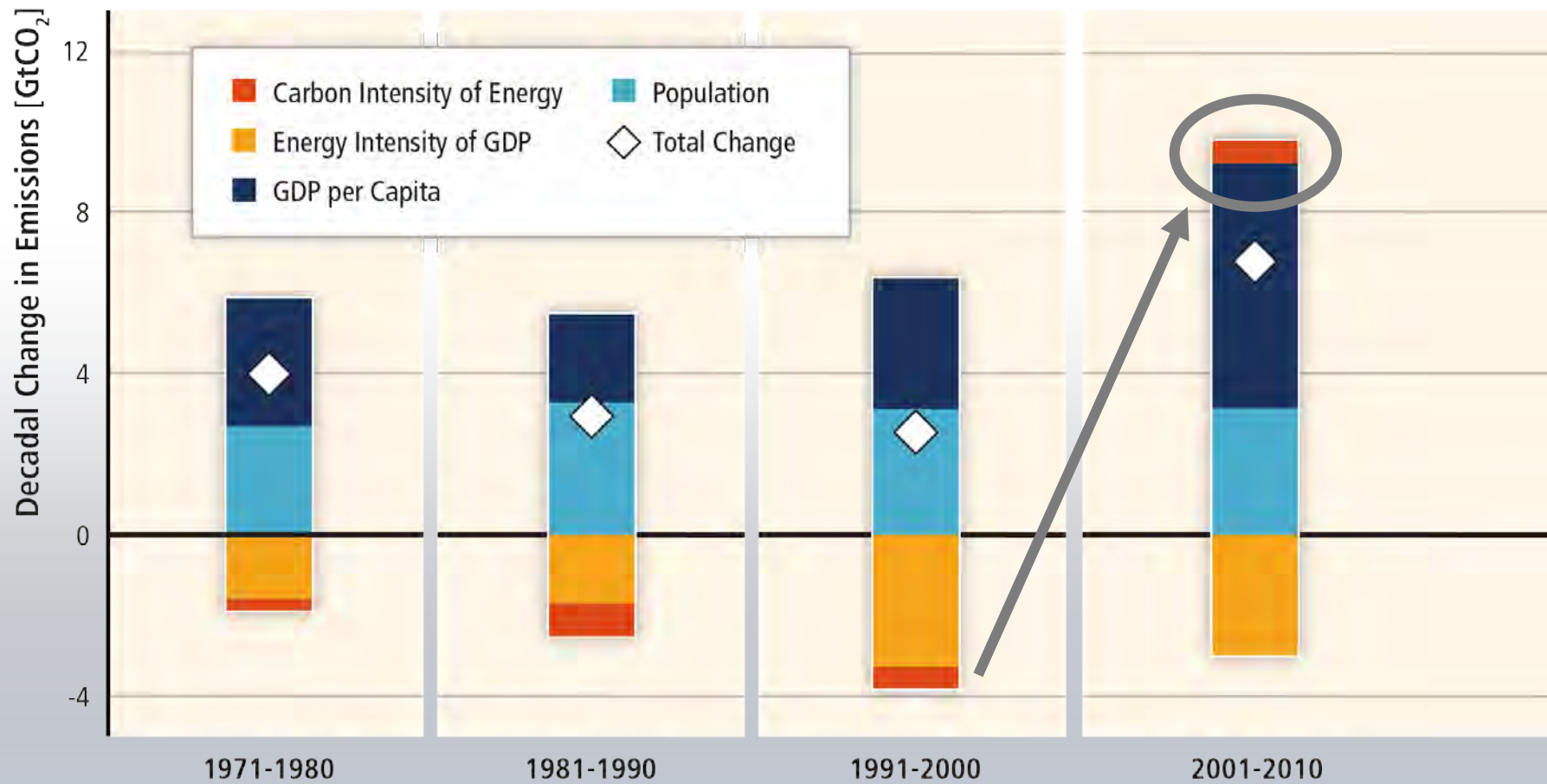
Based on Figure 1.6

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



Based on Figure 1.7

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



Based on Figure 1.7

An aerial photograph of a dense urban landscape, likely Hong Kong, featuring numerous skyscrapers and a complex network of elevated highways. A large, semi-transparent blue circle is centered in the upper half of the image, containing the white text "#2".

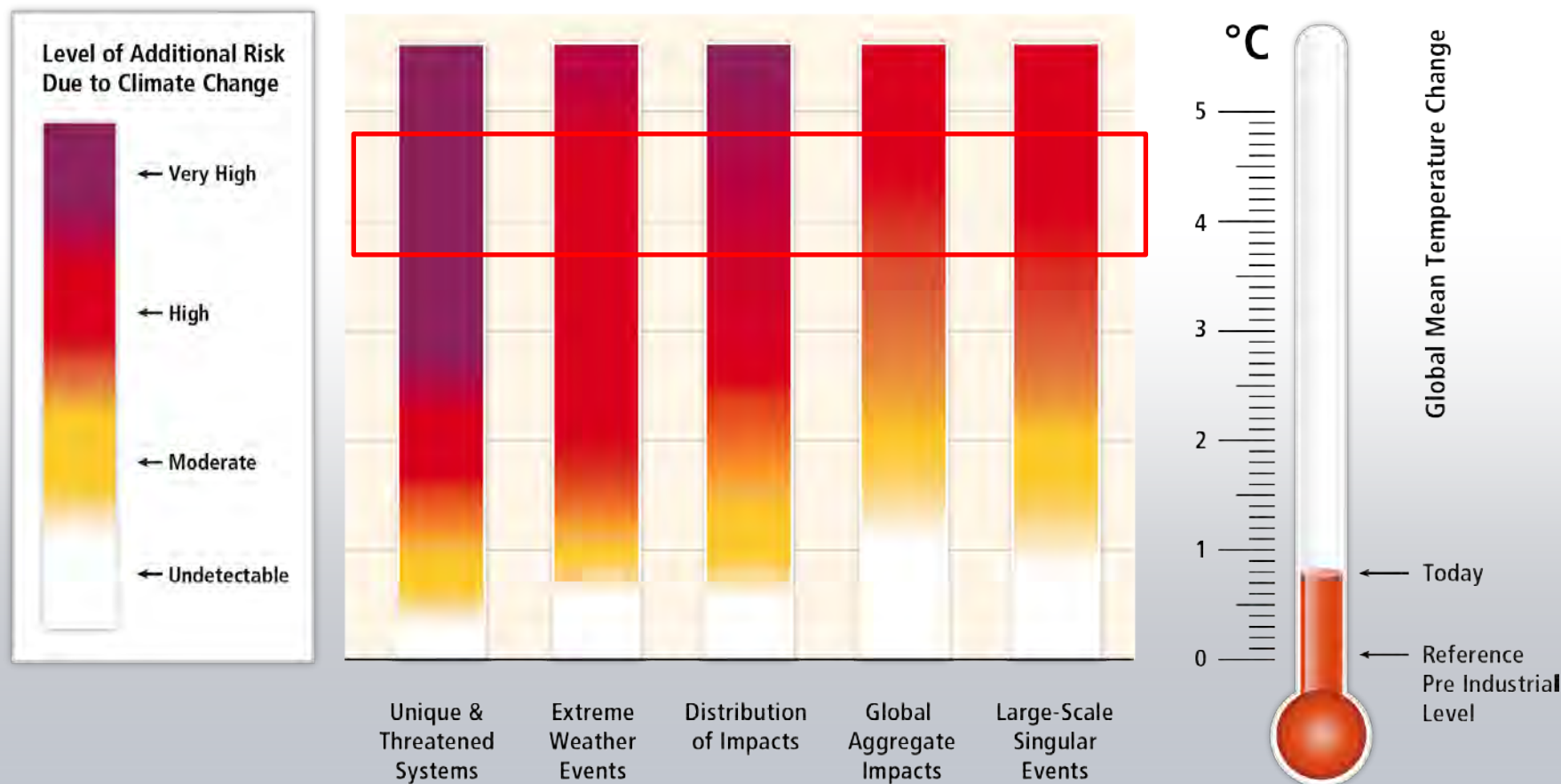
#2

What does the WGIII AR5 tell us about mitigation action required to limit global warming to 2°C and 1.5°C?

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

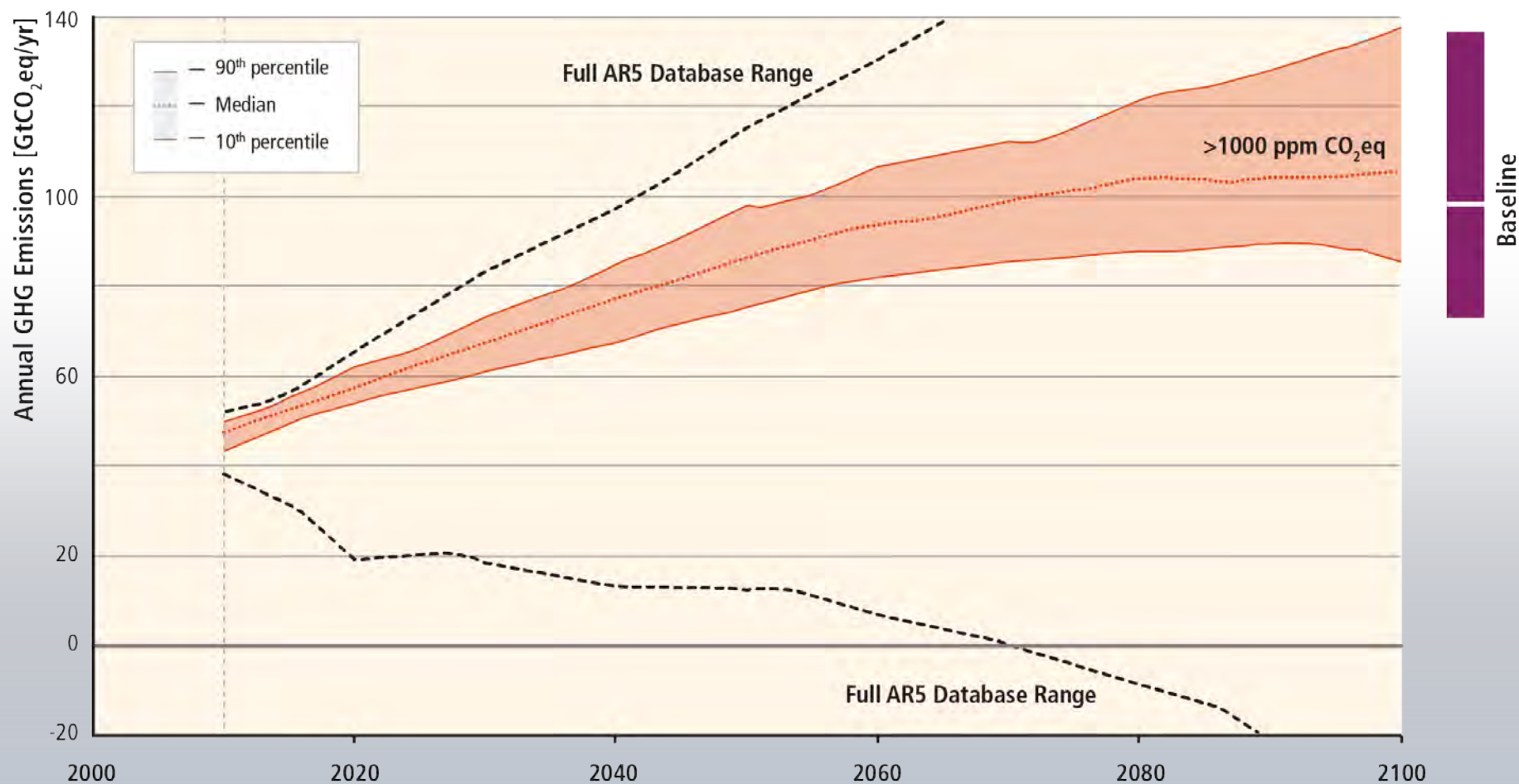


Without additional mitigation, global mean surface temperature is projected to increase by 3.7 to 4.8°C (2.5 to 7.8°C) over the 21st century.

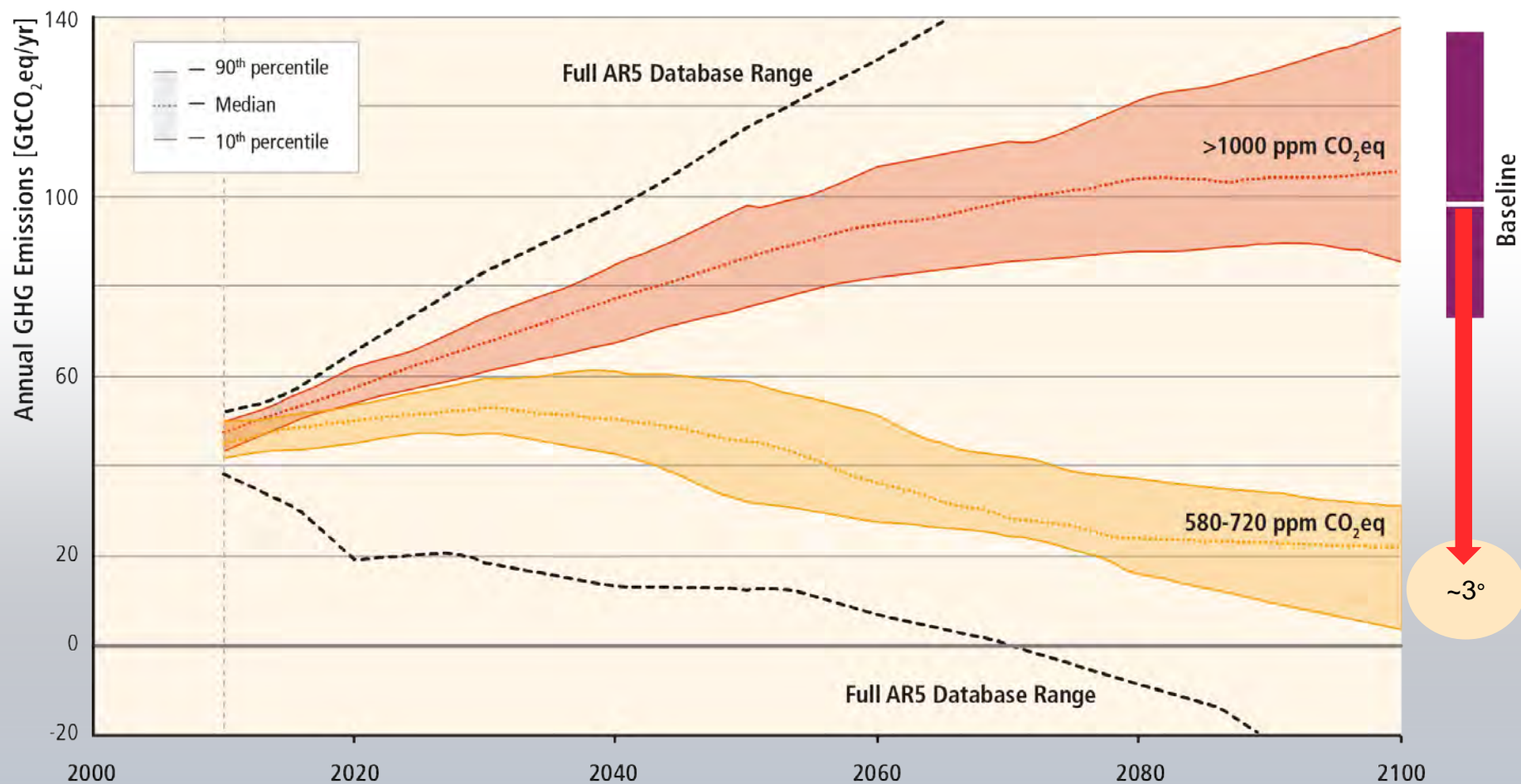


Based on WGII AR5 Figure 19.4

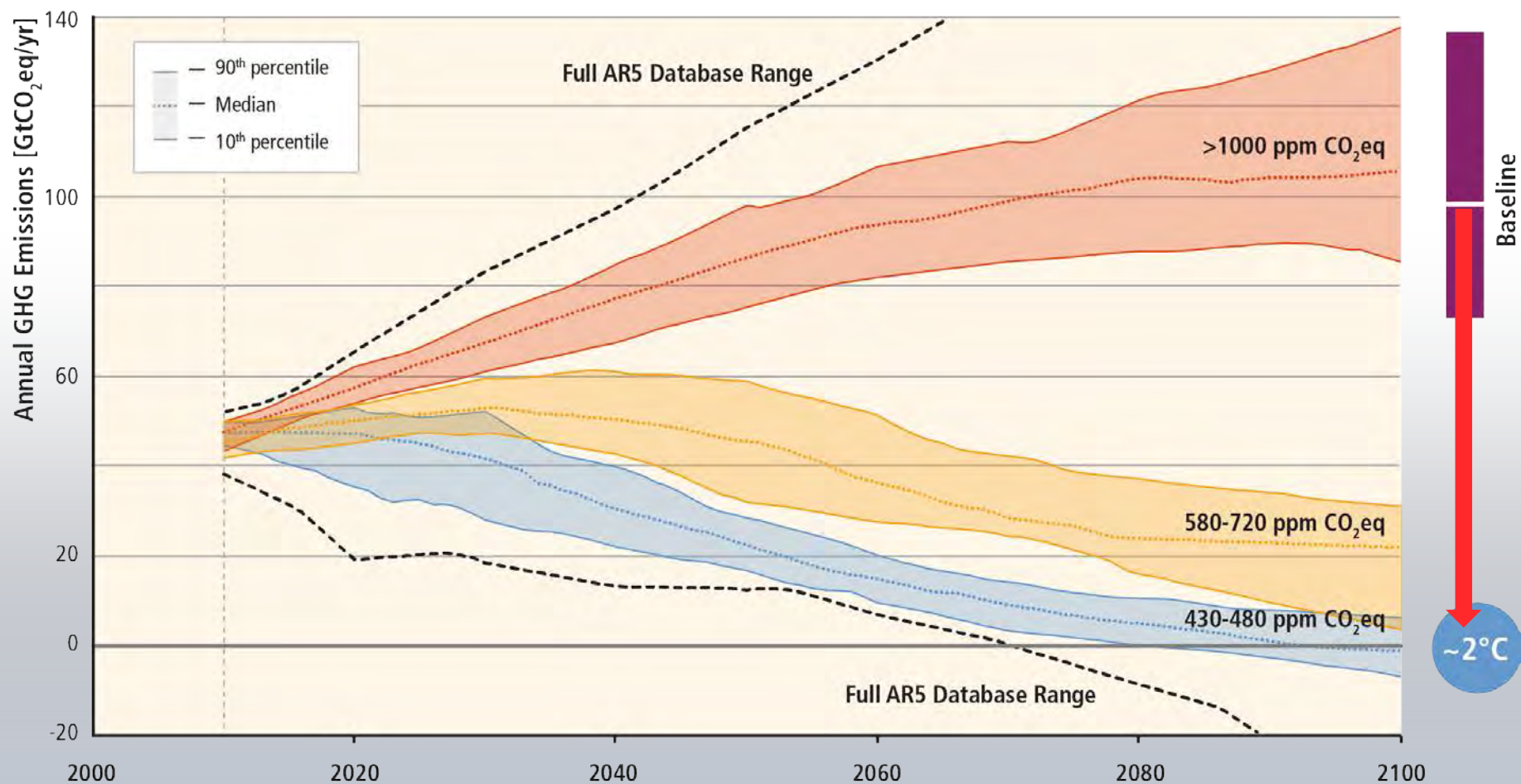
Stabilization of atmospheric GHG concentrations requires moving away from the baseline, regardless of the mitigation goal.



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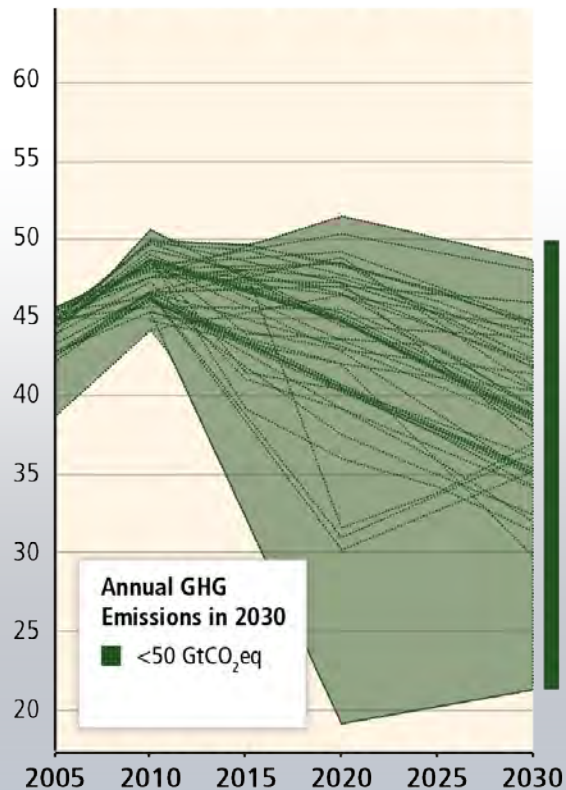
Stabilization of atmospheric GHG concentrations requires moving away from the baseline, regardless of the mitigation goal.



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

Before 2030

GHG Emissions Pathways [GtCO₂eq/yr]

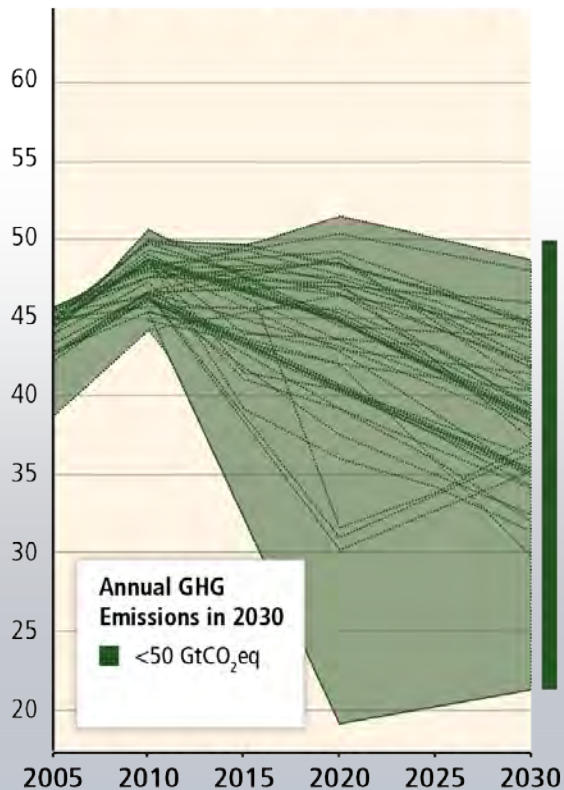


„immediate action“

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

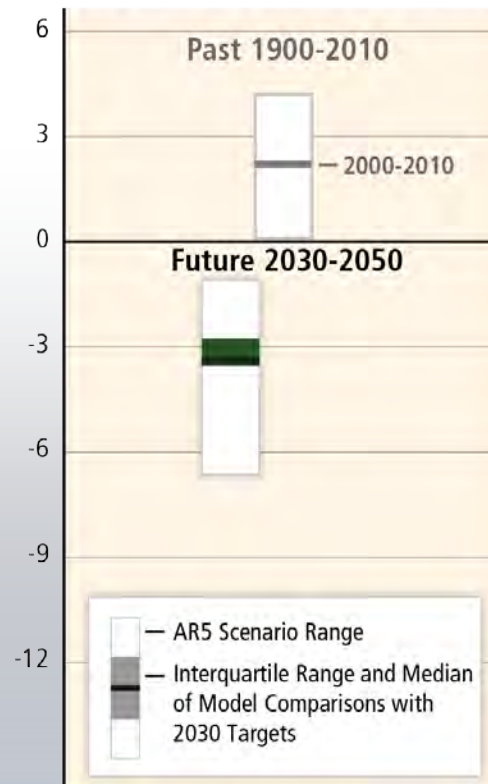
Before 2030

GHG Emissions Pathways [GtCO₂eq/yr]



After 2030

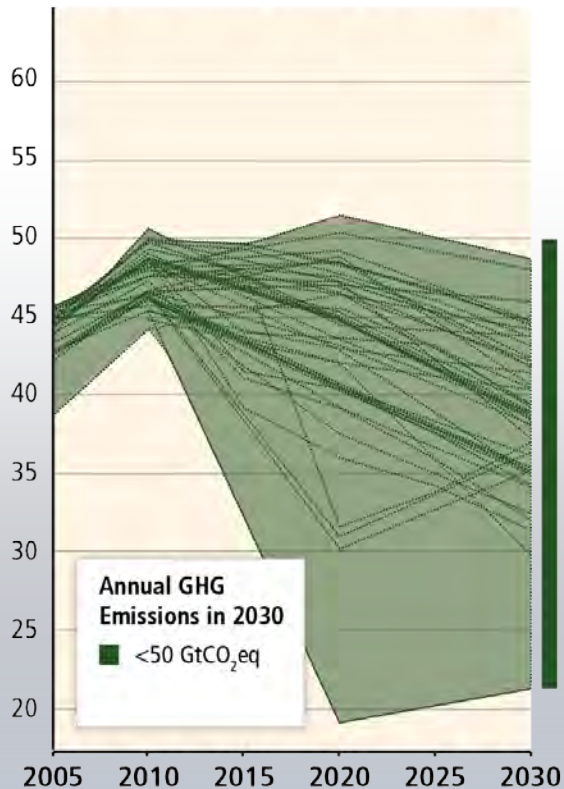
Rate of CO₂ Emission Change [%/yr]



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

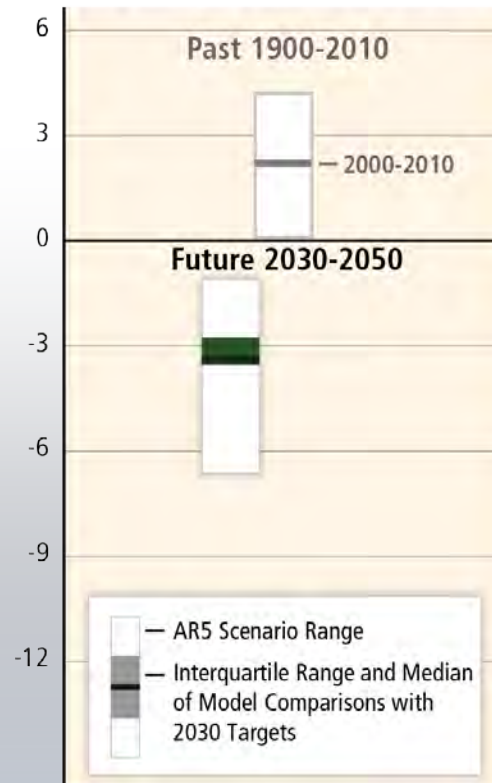
Before 2030

GHG Emissions Pathways [GtCO₂eq/yr]

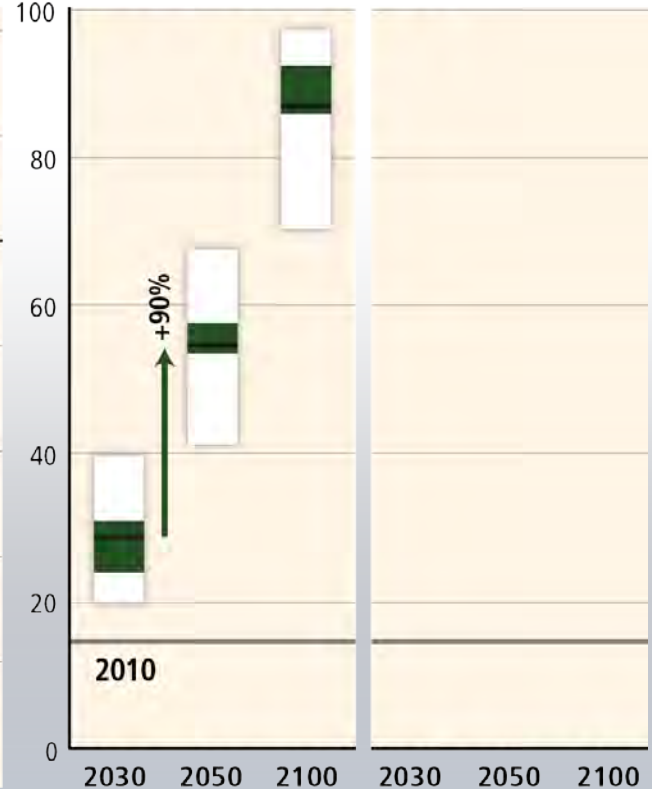


After 2030

Rate of CO₂ Emission Change [%/yr]



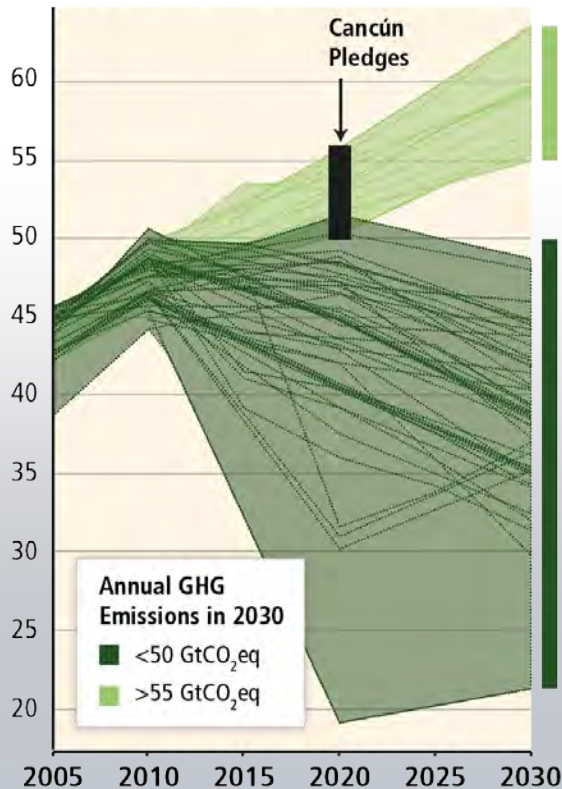
Share of Low Carbon Energy [%]



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

Before 2030

GHG Emissions Pathways [GtCO₂eq/yr]



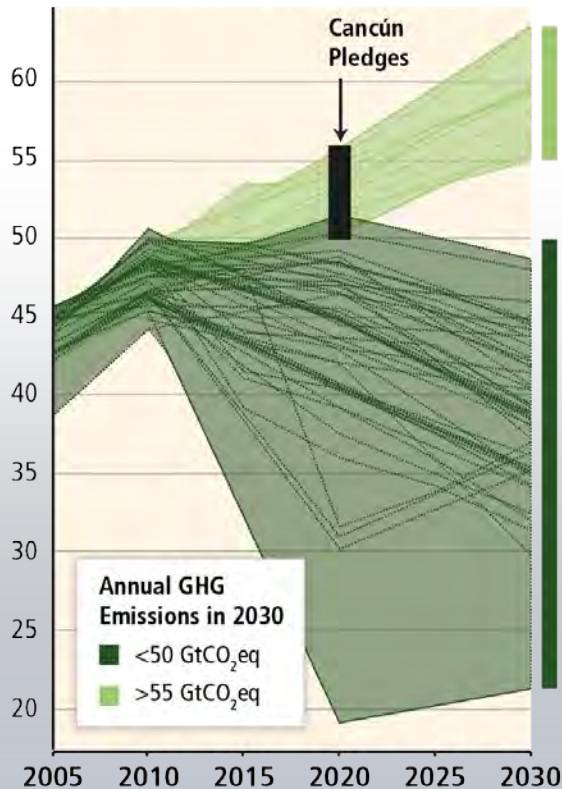
„delayed mitigation“

„immediate action“

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

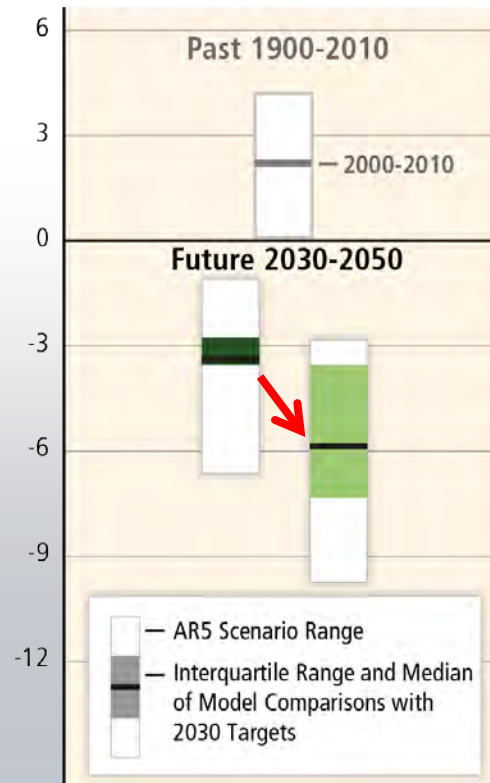
Before 2030

GHG Emissions Pathways [GtCO₂eq/yr]

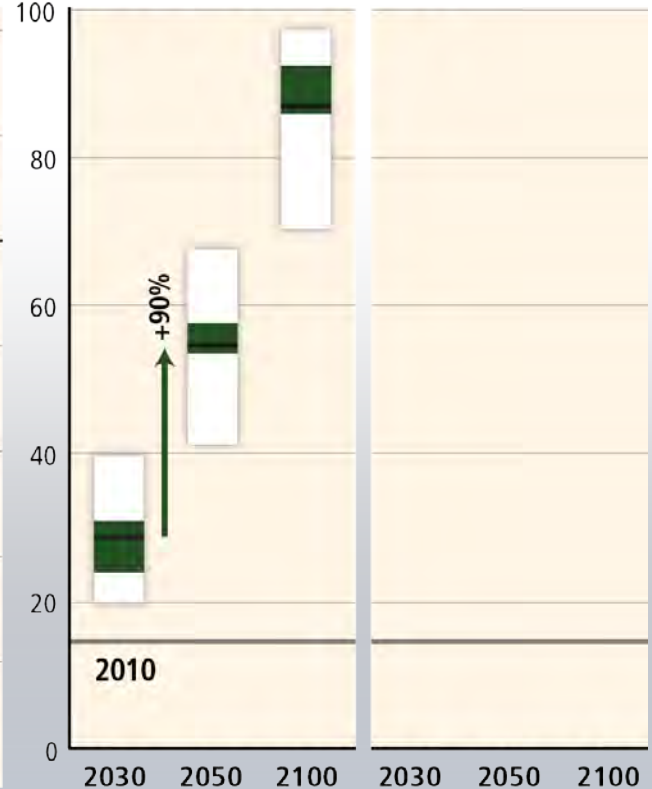


After 2030

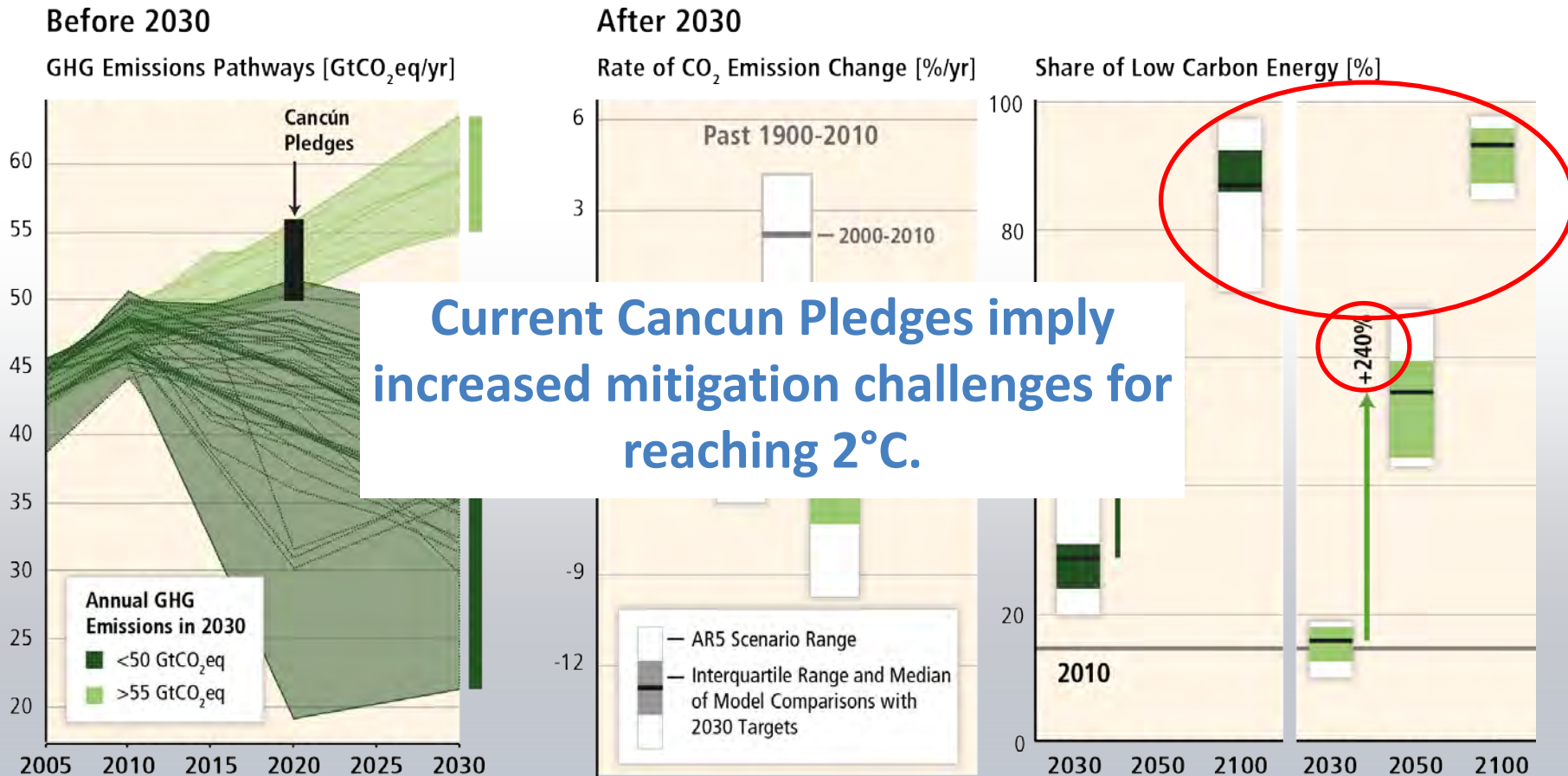
Rate of CO₂ Emission Change [%/yr]



Share of Low Carbon Energy [%]



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



Based on Figures 6.32 and 7.16

Scientific evidence on the 1.5°C goal remains limited.

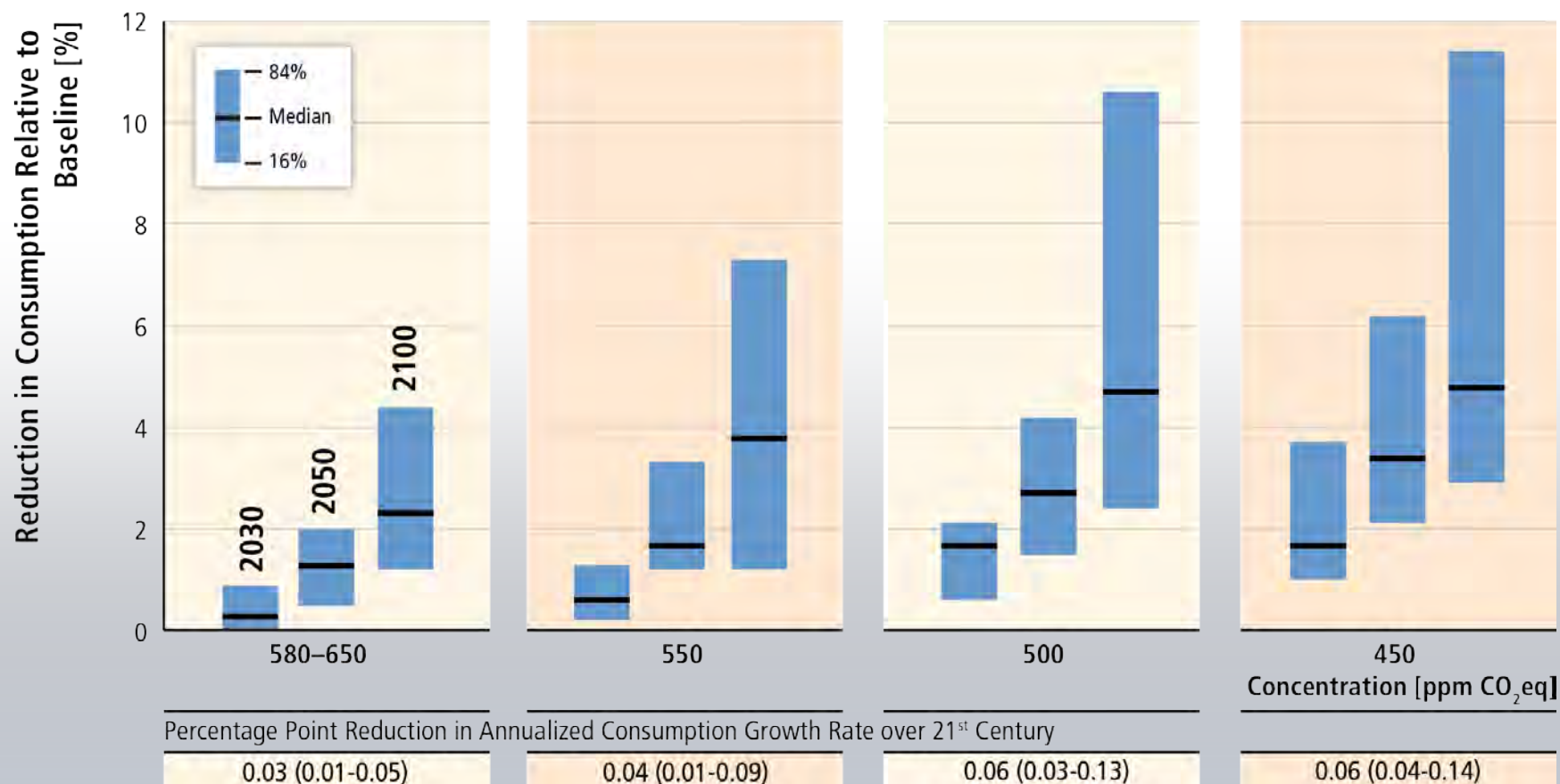
A comprehensive assessment is difficult in the absence of multi-model comparison studies and the limited number of studies focusing on the 1.5°C goal. Existing studies indicate:

- Temperature overshoot and large scale application of carbon dioxide removal technologies
- Immediate mitigation action
- Rapid upscaling of the *full* set of technologies
- Development along a low energy demand pathway

A large container ship is shown from an aerial perspective, sailing on a dark blue ocean. The ship is white with a red hull and is heavily loaded with colorful shipping containers (blue, red, yellow, and white) stacked high on its deck. The ship is moving towards the bottom left, leaving a white wake behind it. The text "Mitigation cost estimates vary, but do not strongly affect global GDP growth." is overlaid in white, bold, sans-serif font across the center of the image.

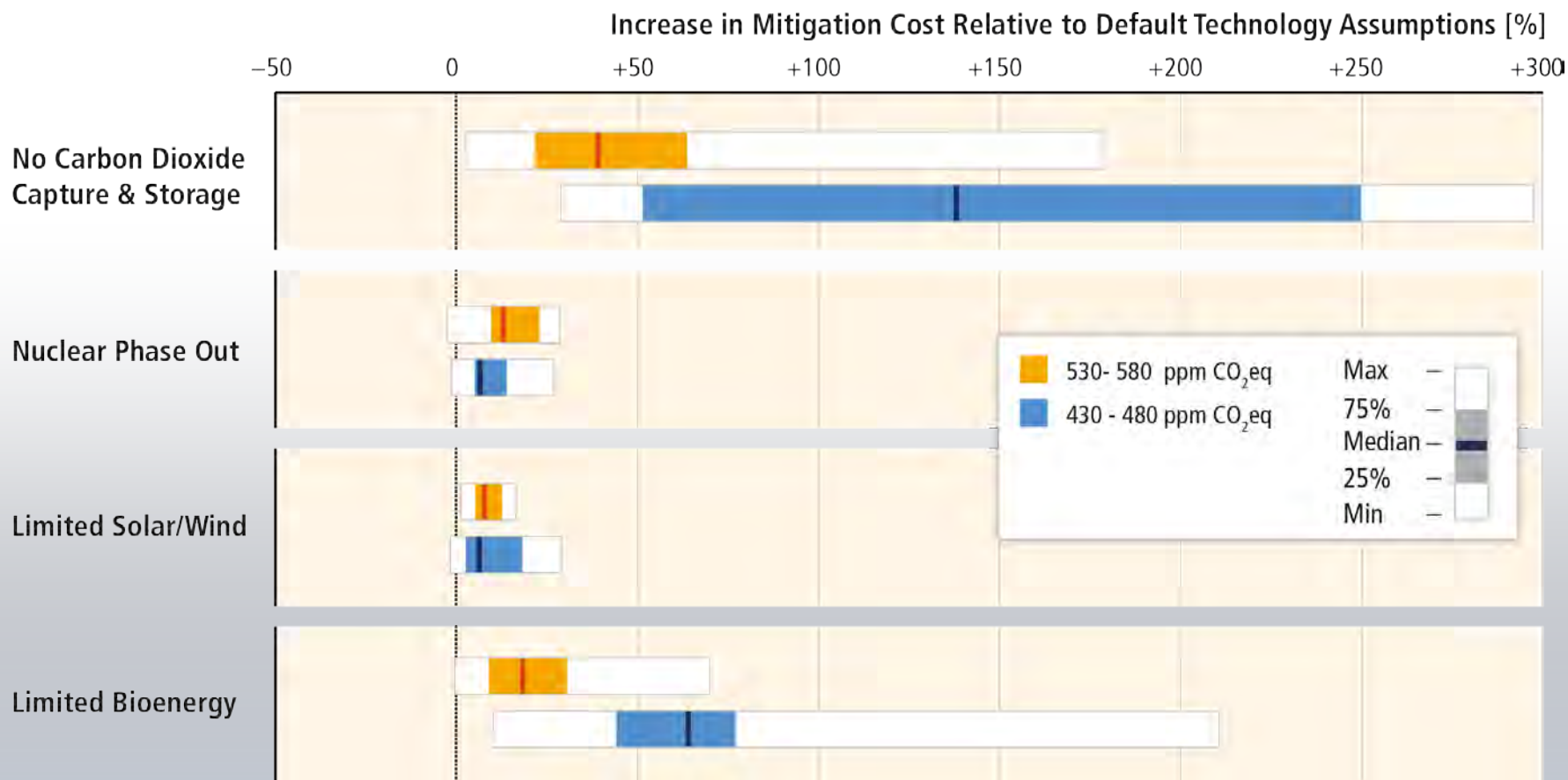
Mitigation cost estimates vary, but do not strongly affect global GDP growth.

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

An aerial photograph of a dense urban landscape, likely Hong Kong, featuring a complex network of highways and numerous skyscrapers. A large, semi-transparent blue circle is centered in the upper half of the image, containing the white text "#3".

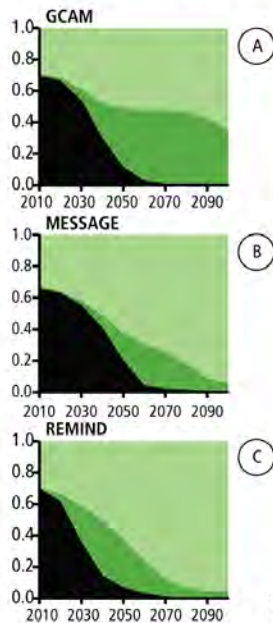
#3

What are the sectoral and technological options for reducing GHG emissions?

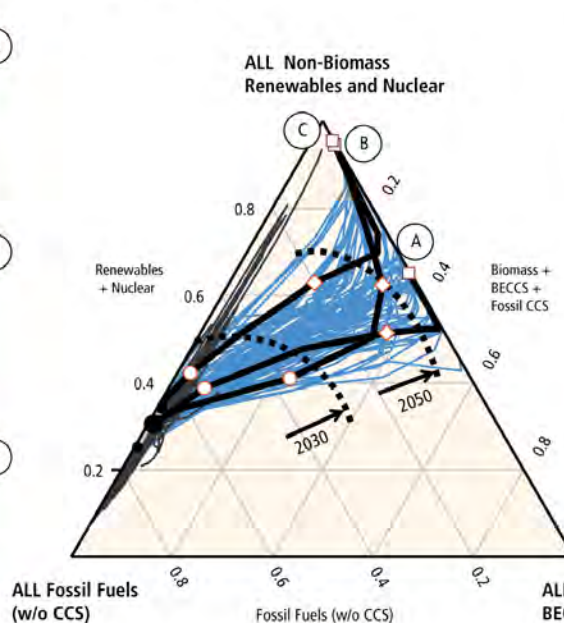
In low CO₂ concentration stabilization scenarios, fossil fuel use without CCS is phased out in the long-term.

b) Electricity Generation

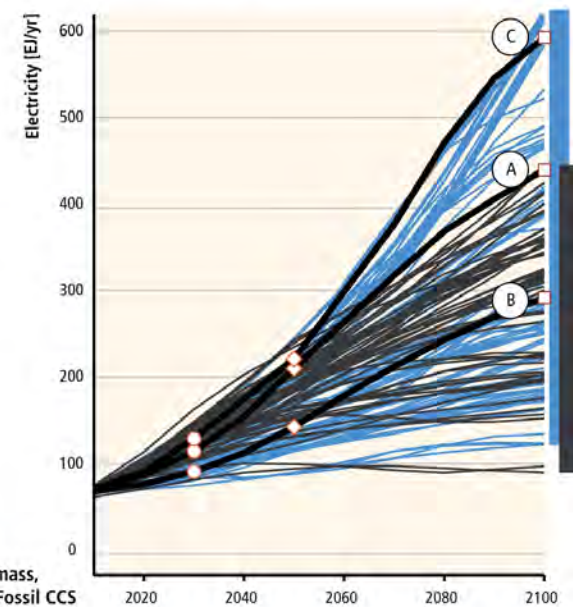
Electricity Shares
(Three Illustrative Scenarios)



Electricity Shares
(AR5 Scenarios)



Total Electricity Supply
(AR5 Scenarios)



■ Renewables and Nuclear
■ Biomass + BECCS + Fossil CCS
■ Fossil Fuels (w/o CCS)

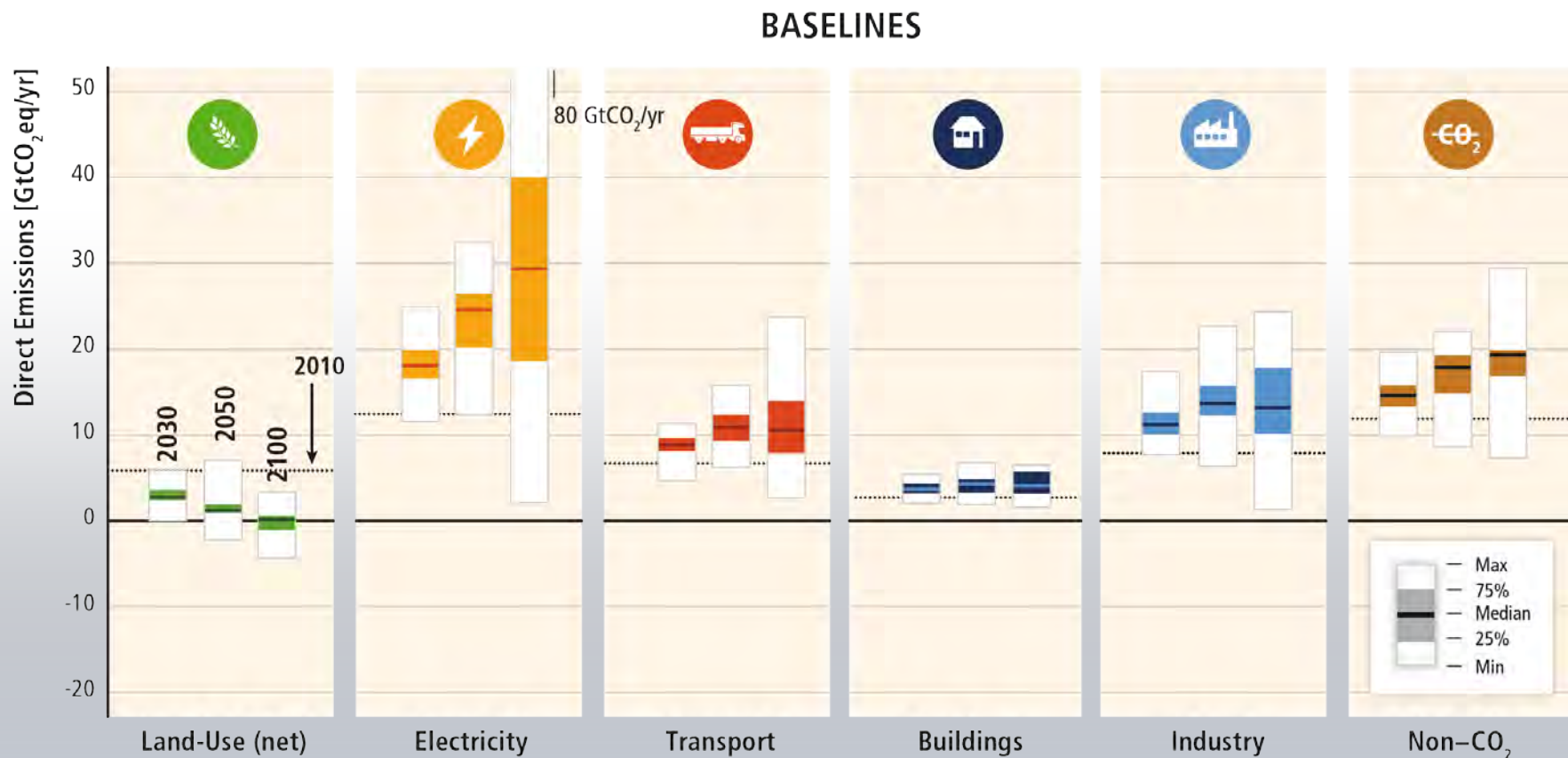
■ 430-530 ppm CO₂,eq (AR5 Scenarios)
■ Baselines (AR5 Scenarios)

Three Illustrative Scenarios



Based on Figure 7.15b

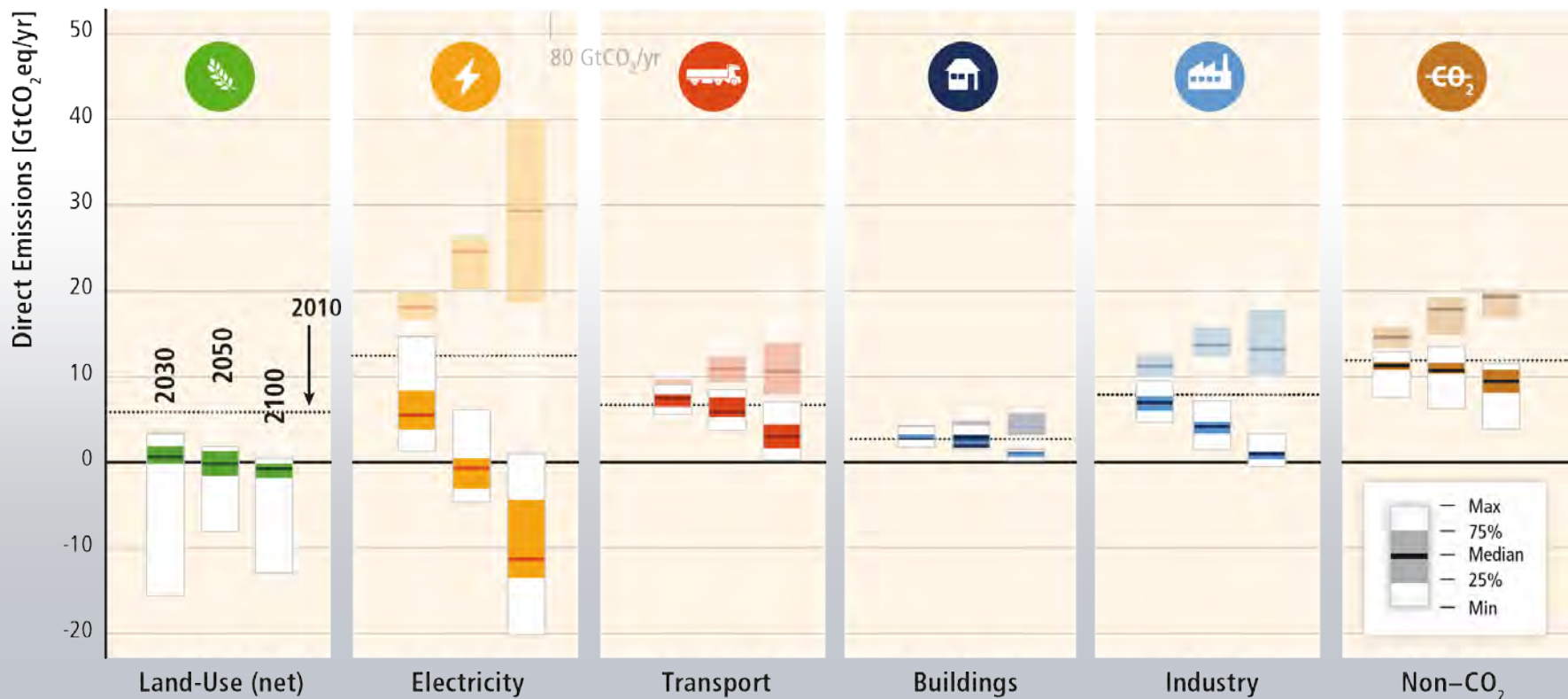
Baseline scenarios suggest rising GHG emissions in all sectors, except for CO₂ emissions in the land-use sector.



Based on Figure TS.17

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

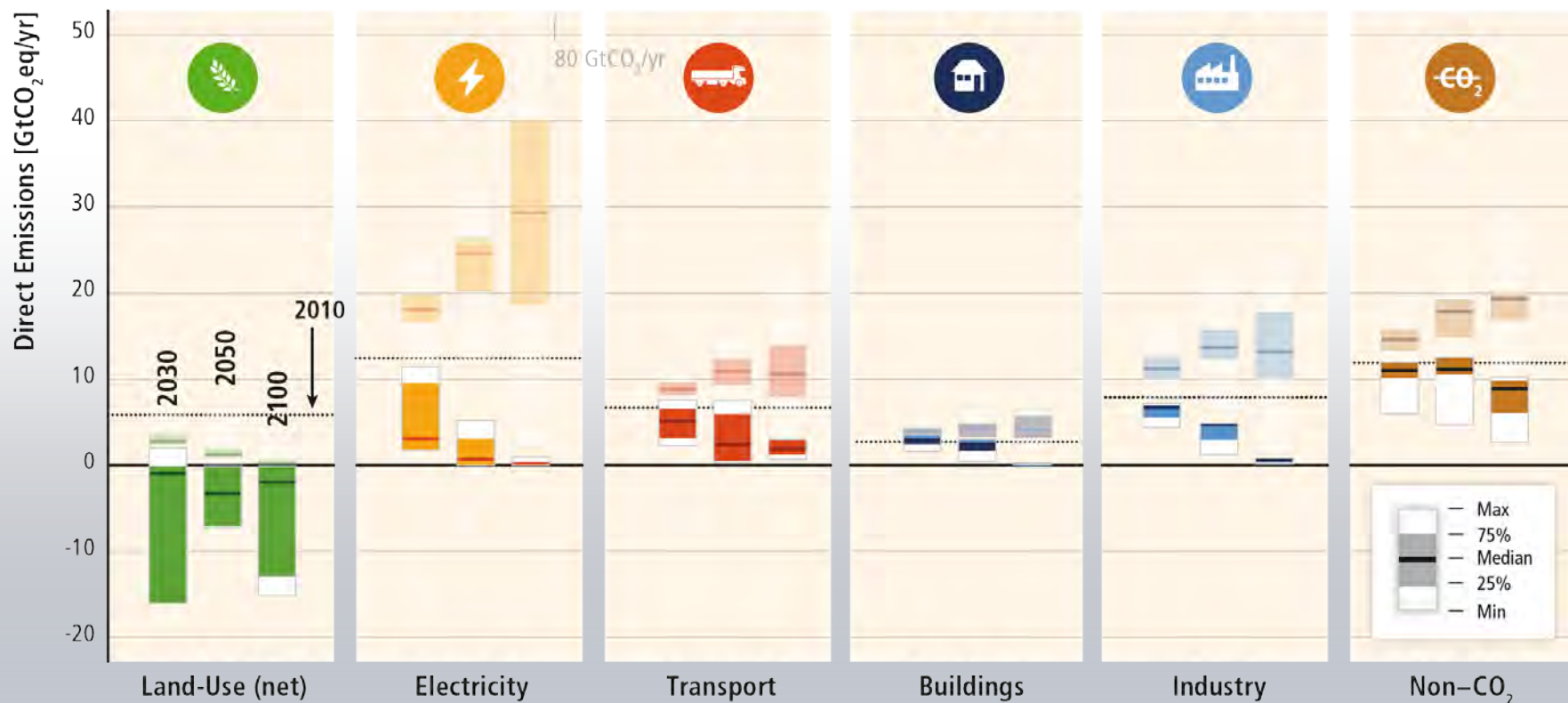
450 ppm CO₂eq with Carbon Dioxide Capture & Storage



Based on Figure TS.17

Mitigation efforts in one sector determine efforts in others.

450 ppm CO₂eq without Carbon Dioxide Capture & Storage




Based on Figure TS.17

An aerial photograph of a dense urban landscape, likely Hong Kong, featuring a complex network of elevated highways and numerous skyscrapers. A large, semi-transparent blue circle is centered in the upper half of the image, containing the white text "#4".

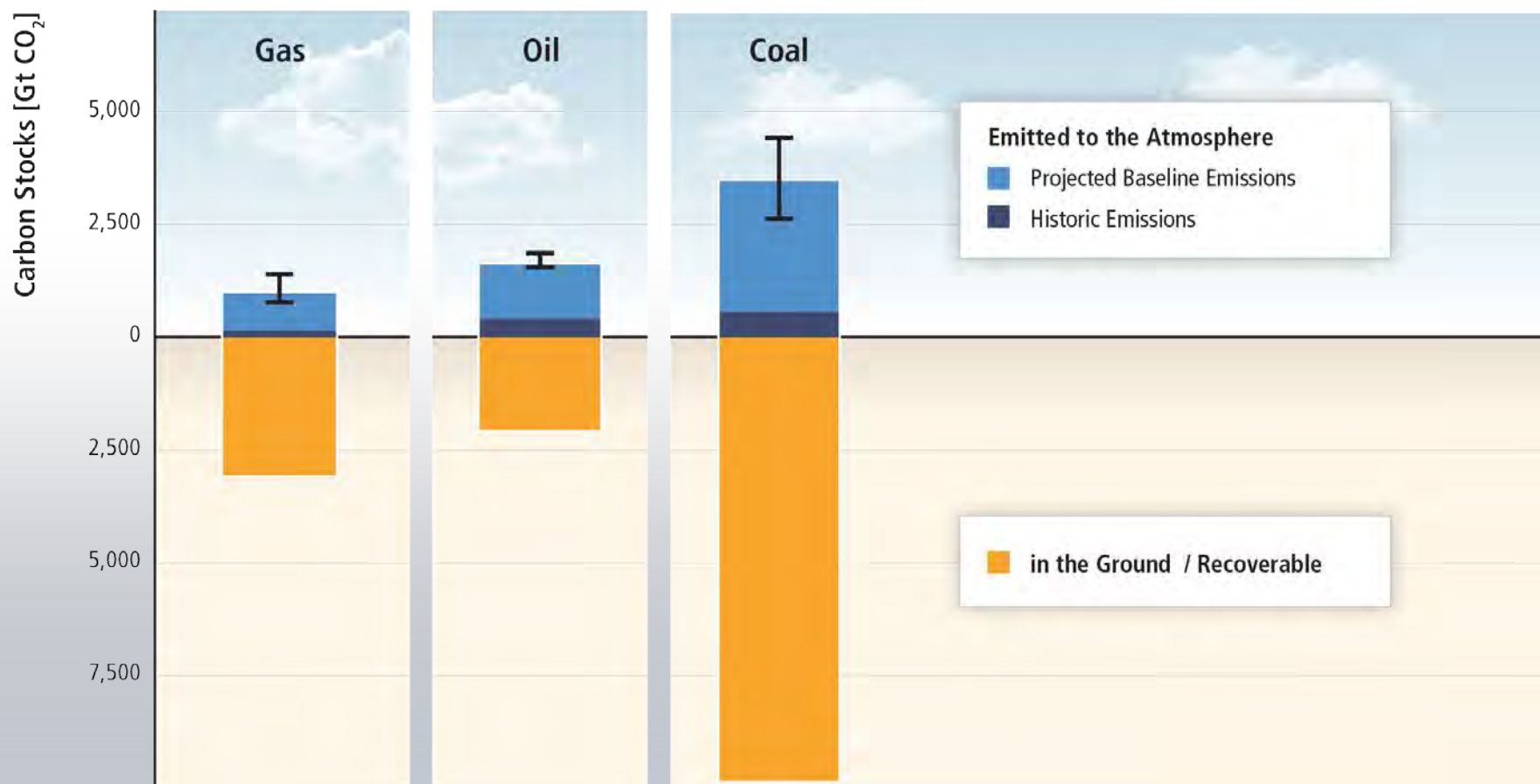
#4

What is the role of international cooperation and national policies in reaching mitigation goals?



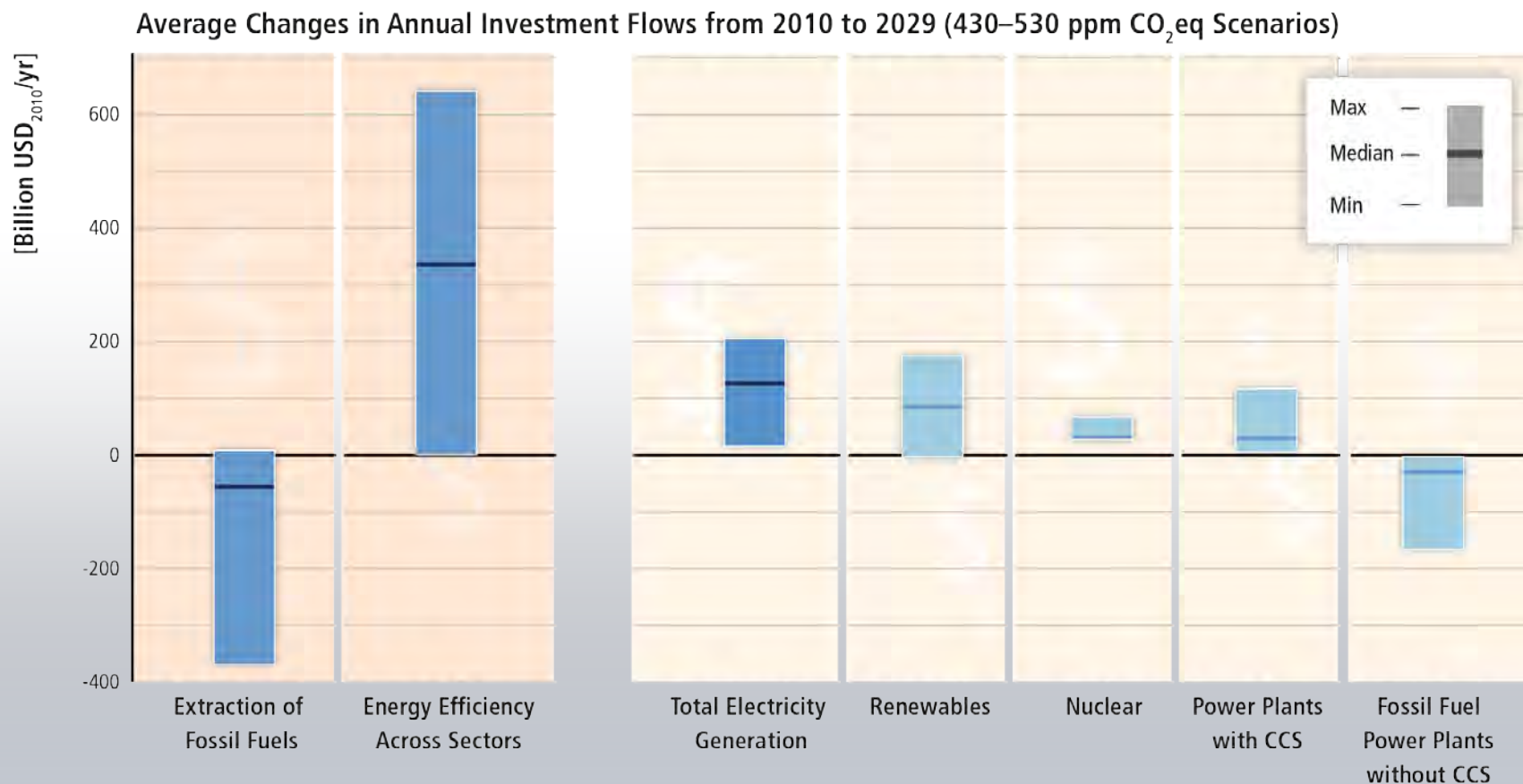
Climate change is a global commons problem that requires international cooperation and coordination across scales.

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



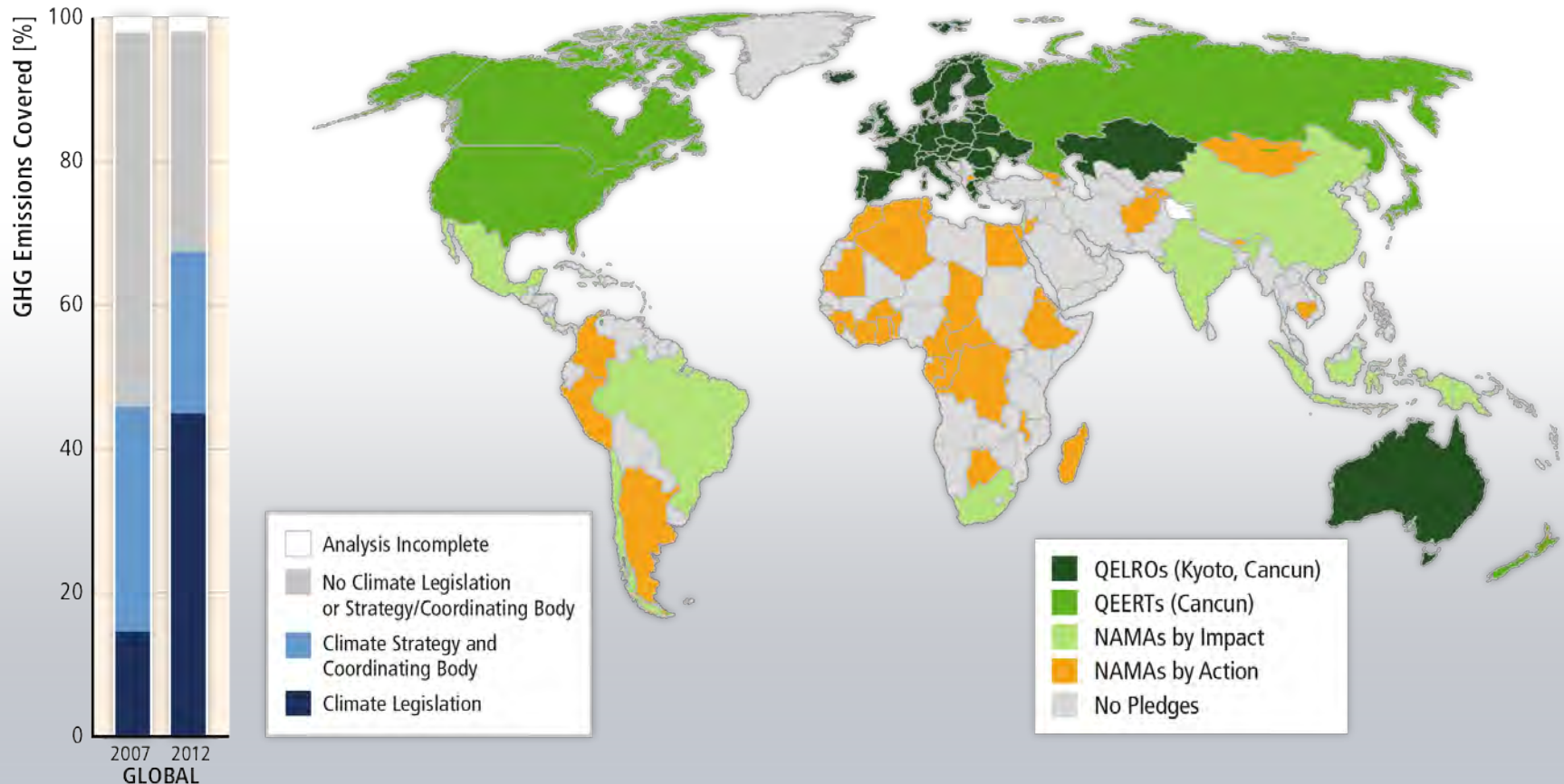
Based on SRREN Figure 1.7

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



Based on Figure 16.3

There has been a considerable increase in national and sub-national mitigation policies since AR4.

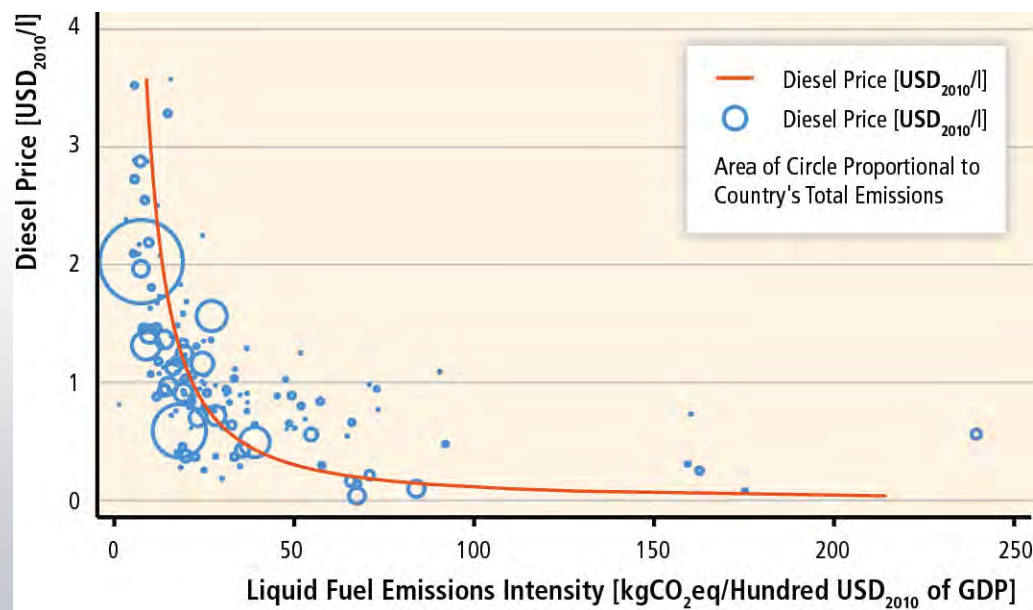


Based on Figures 15.1 and 13.3

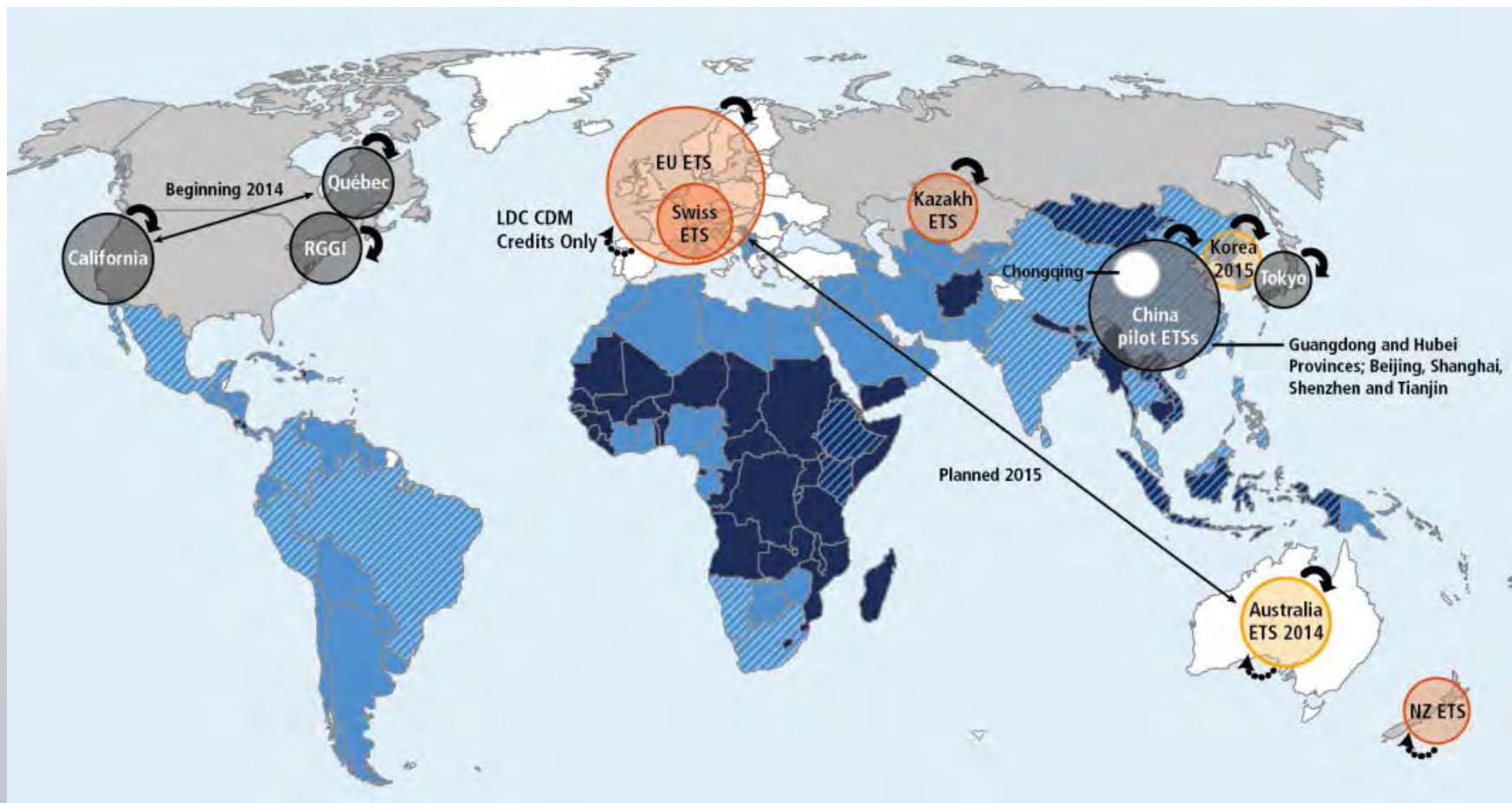
Examples of the performance of emission taxes

Fuel taxes

- In the long run 10% higher fuel prices will lead to a roughly 7% reduction in fuel use and emissions
- OECD could have decreased fuel use by more than 35% if all member countries had chosen taxes as high as in the UK



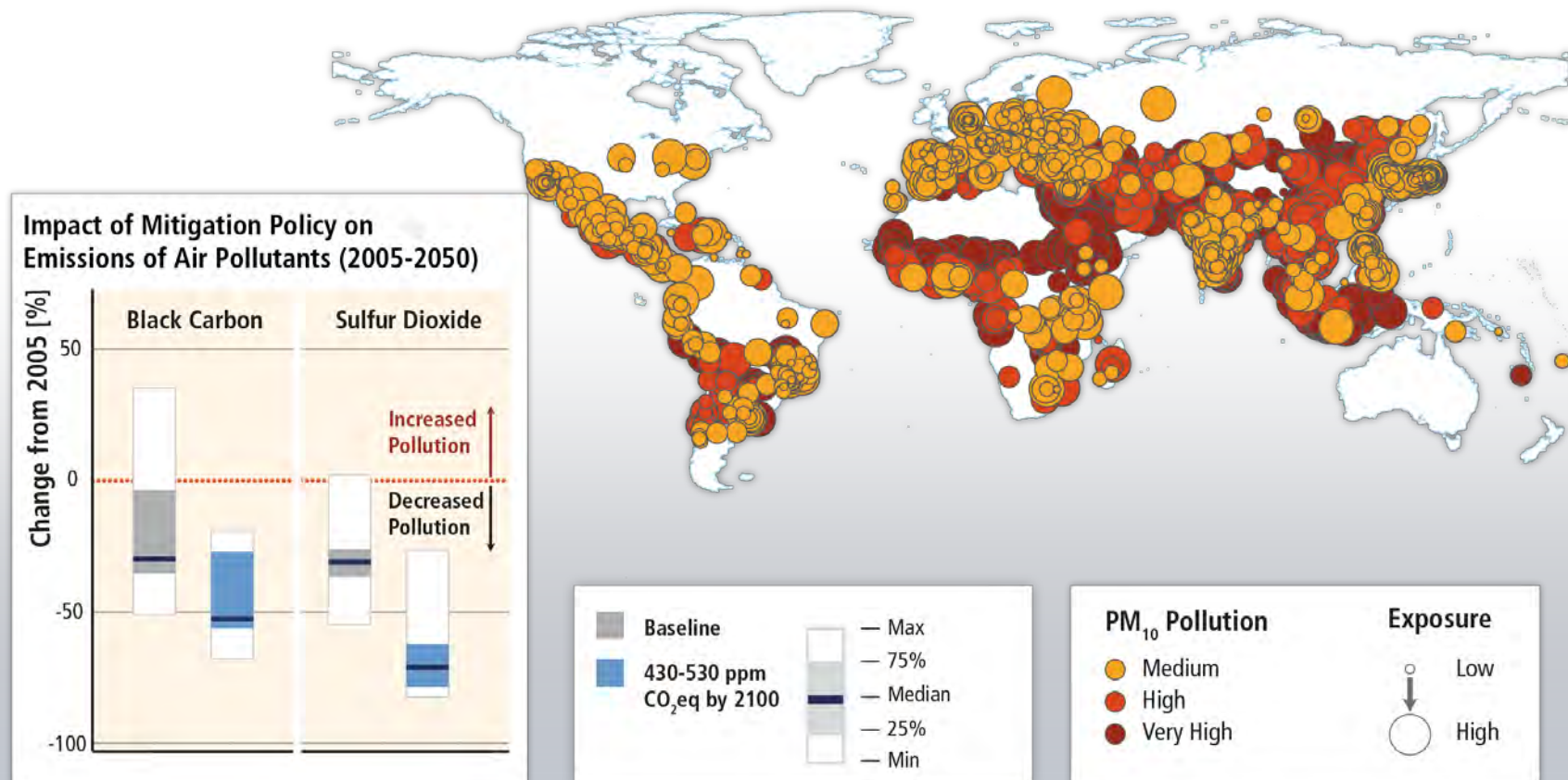
Regions are starting to cooperate.



International climate policy is only slowly taking shape.

- The UNFCCC regime is the only platform with broad legitimacy.
- Cooperation outside the UNFCCC has increased but except for the Montreal Protocol did not lead to significant emissions reduction.
- The Kyoto Protocol was less successful than envisaged.
 - The emissions commitments were reached, benefitting from economic changes in countries in transition.
 - The market mechanisms have mobilized low-cost mitigation, whose additionality is however debated.

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



Based on Figures 6.33 and 12.23

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