

CLIMATE CHANGE 2014

Mitigation of Climate Change

USTH scientific seminar

30/03/2015

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CleanED lab

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

800+ Reviewers

Close to 1500 pages

Close to 10,000 references

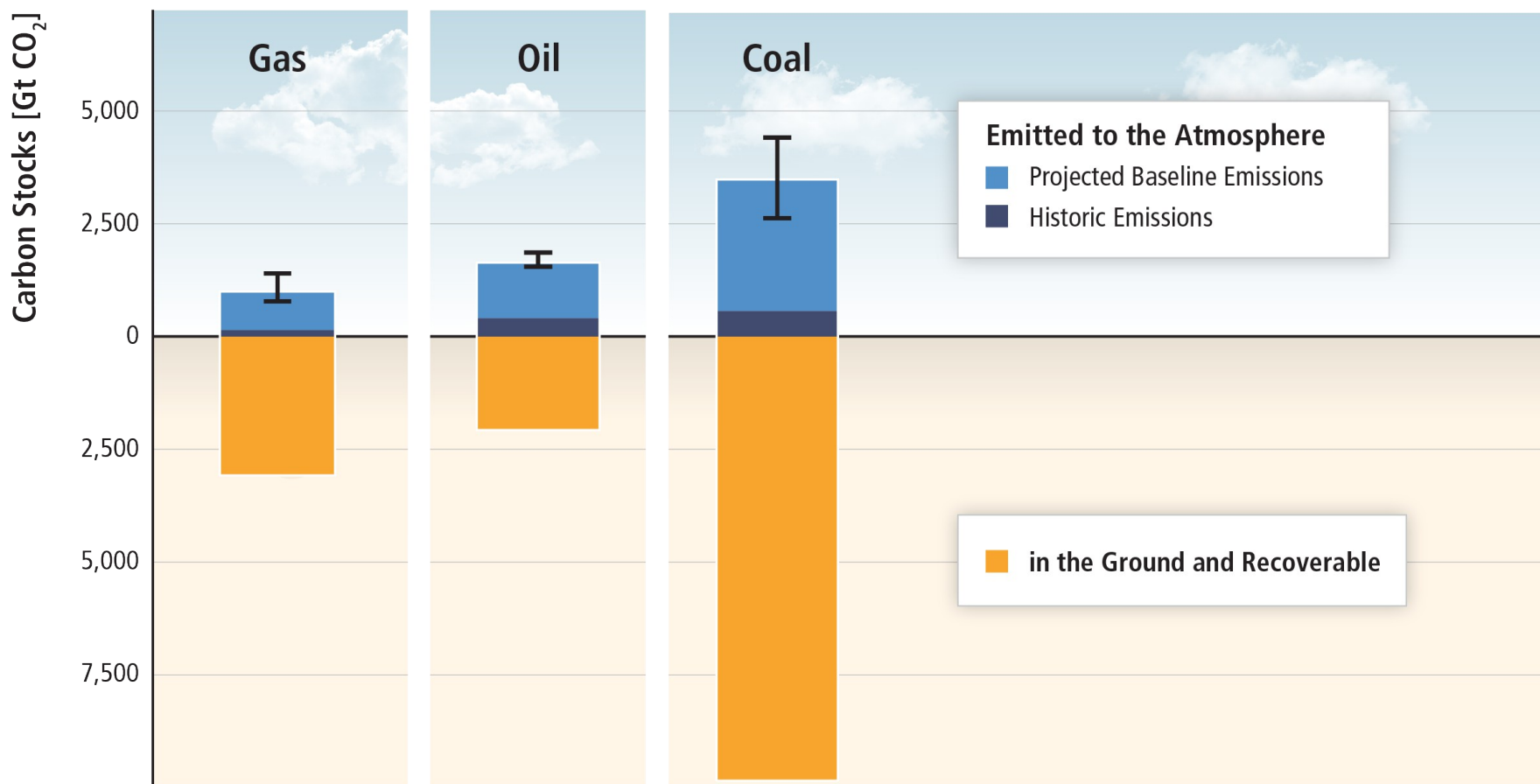
More than 38,000 comments





Climate change is a global commons problem.

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

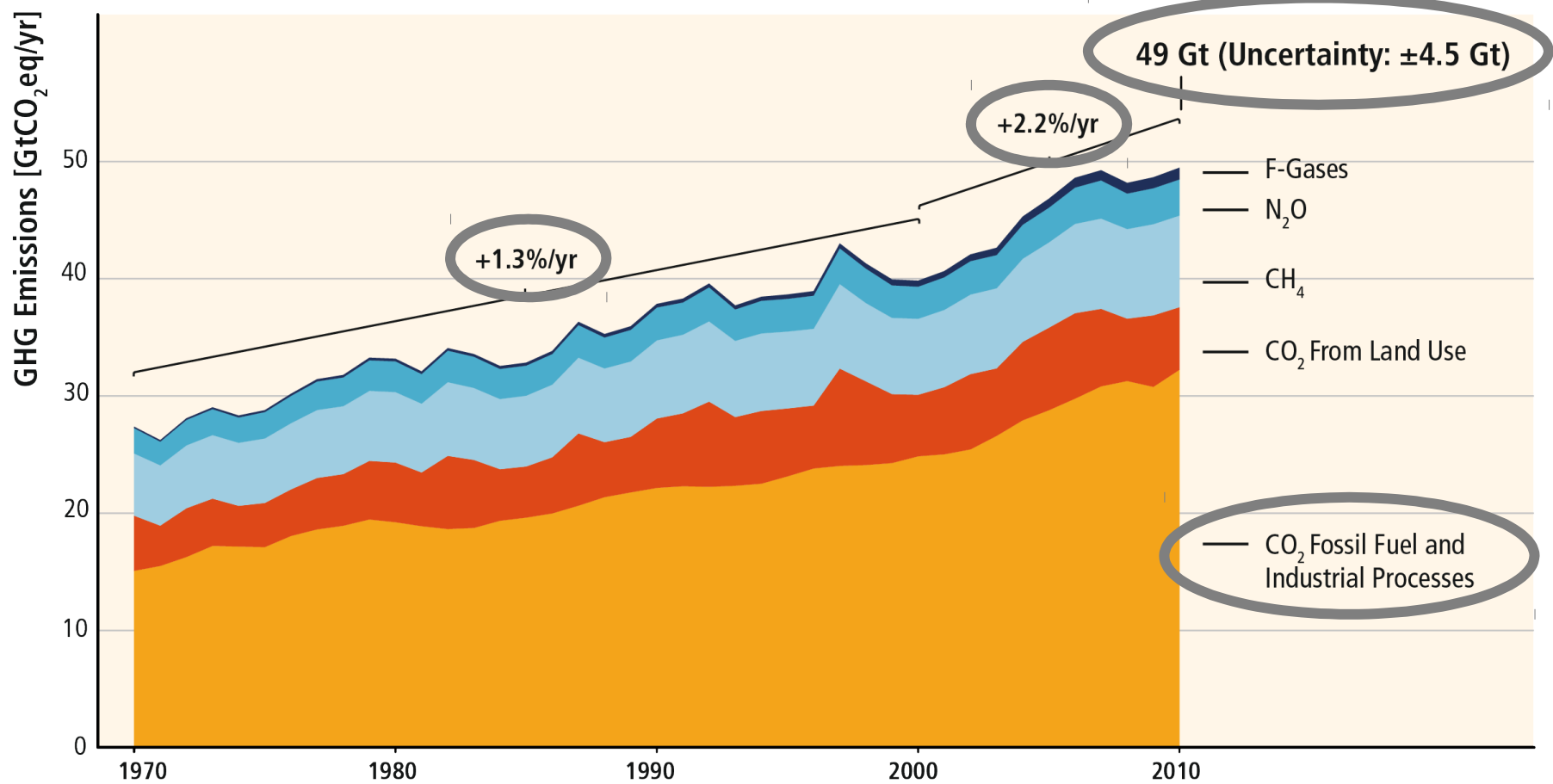


Based on SRREN Figure 1.7

A high-angle, blue-tinted photograph of a large-scale excavation site. In the center-right, a yellow bulldozer is positioned on a dirt path, facing away from the camera. The ground is uneven and shows signs of heavy machinery work. In the foreground, the metal structure of a conveyor belt or similar industrial equipment is visible, extending from the left side towards the center. The overall scene is industrial and depicts a significant earthmoving project.

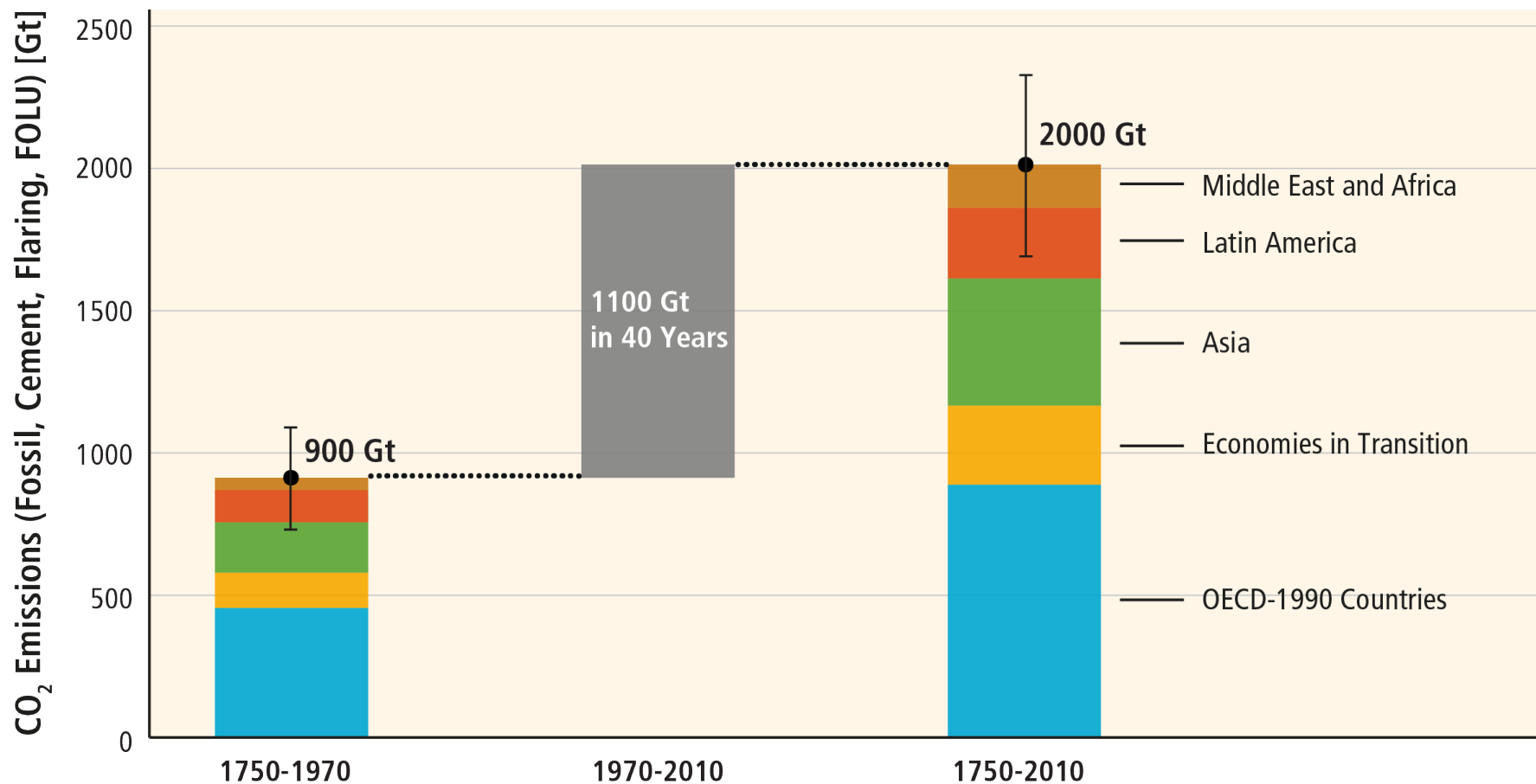
GHG emissions growth has accelerated despite reduction efforts.

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



Based on Figure 1.3

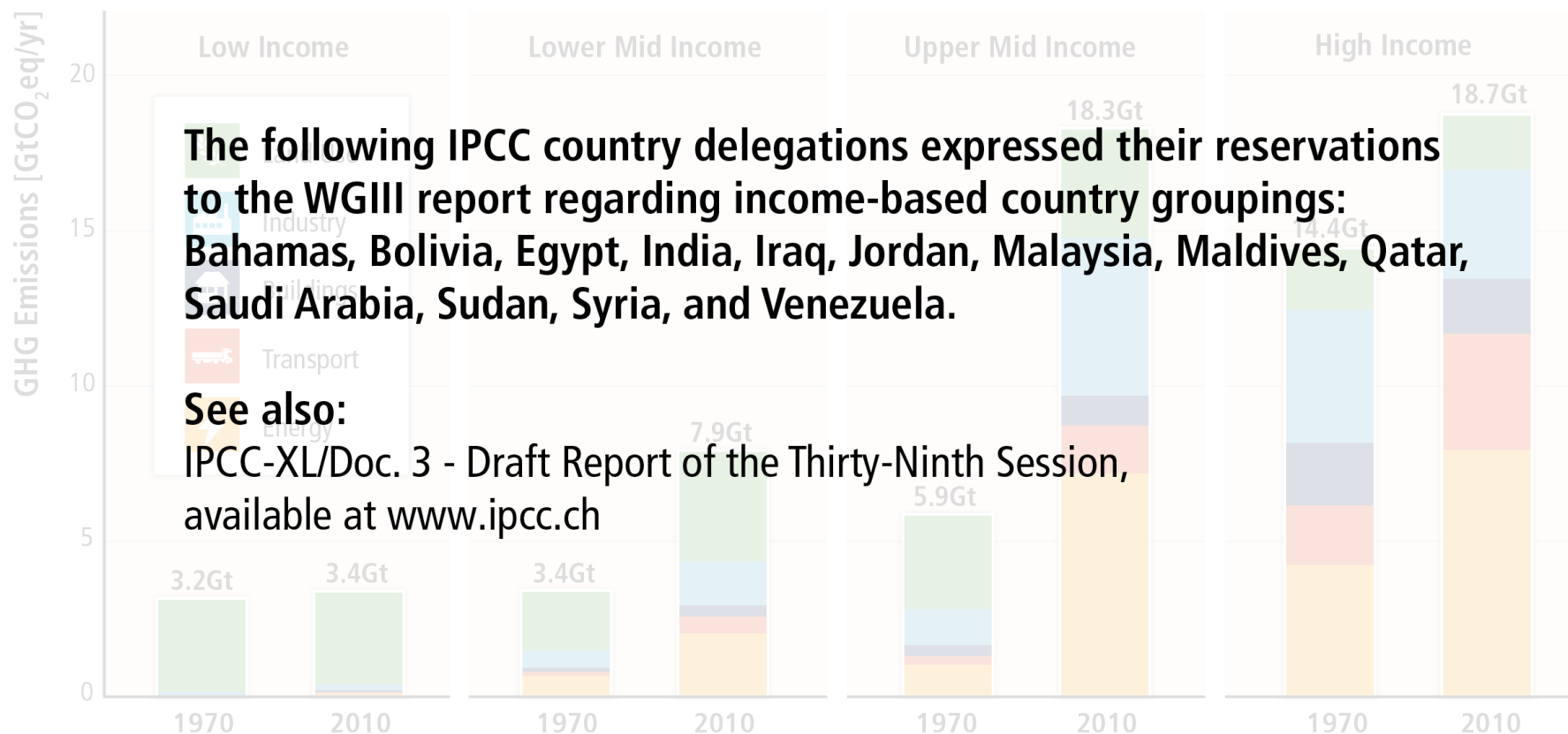
About half of the cumulative anthropogenic CO₂ emissions between 1750 and 2010 have occurred in the last 40 years.



Based on Figure 5.3

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

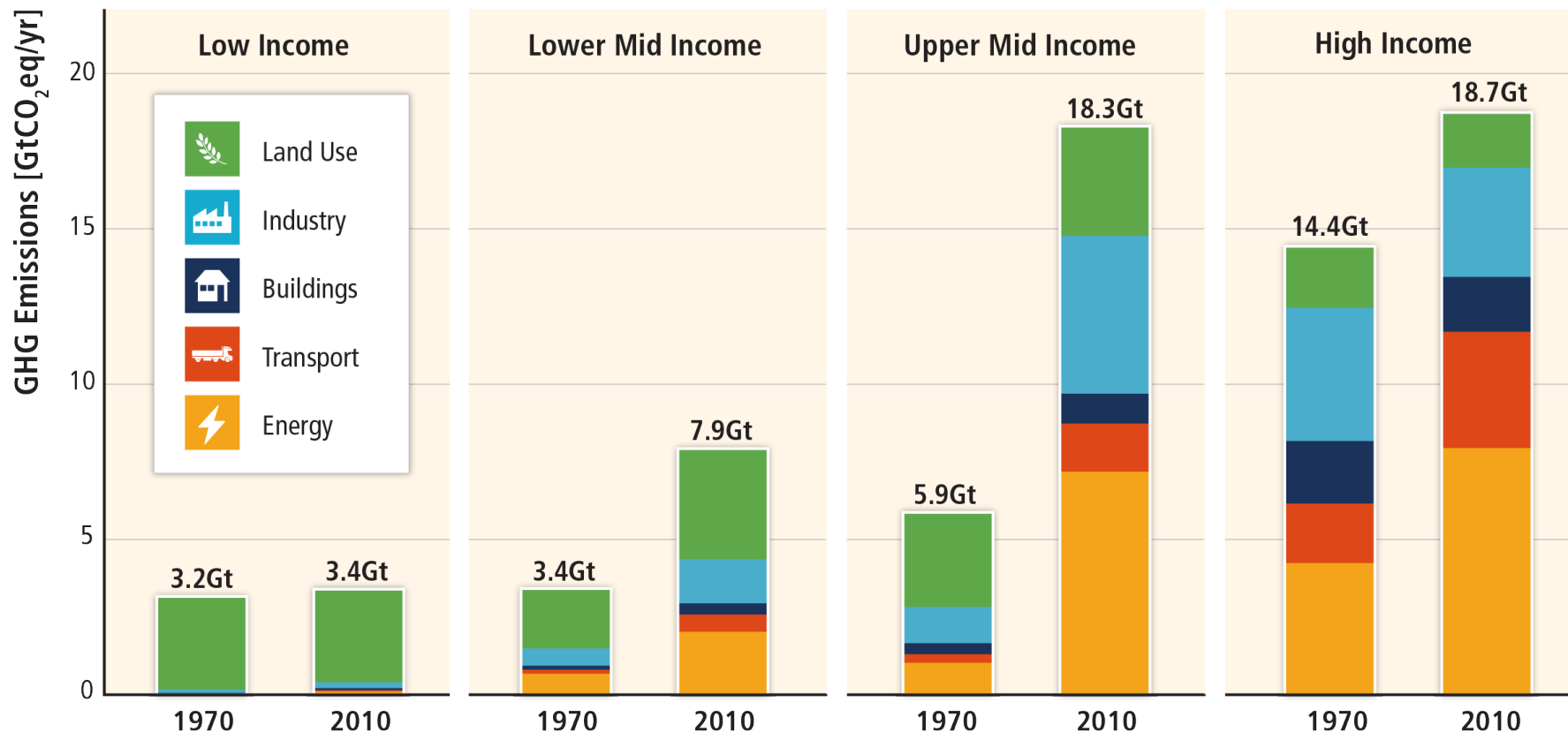
GHG Emissions by Country Group and Economic Sector



Based on Figure 1.6

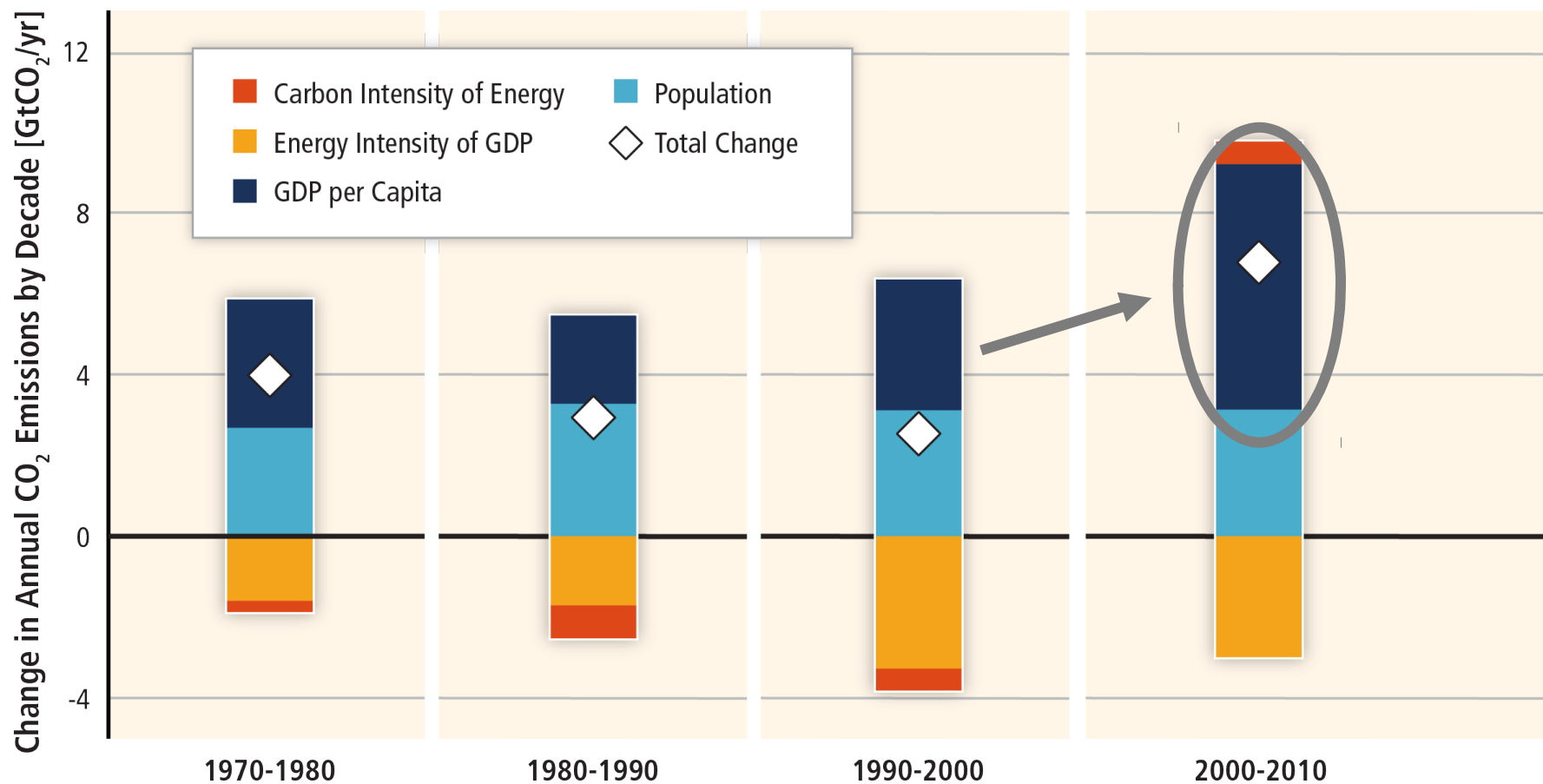
Regional patterns of GHG emissions are shifting along with changes in the world economy.

GHG Emissions by Country Group and Economic Sector



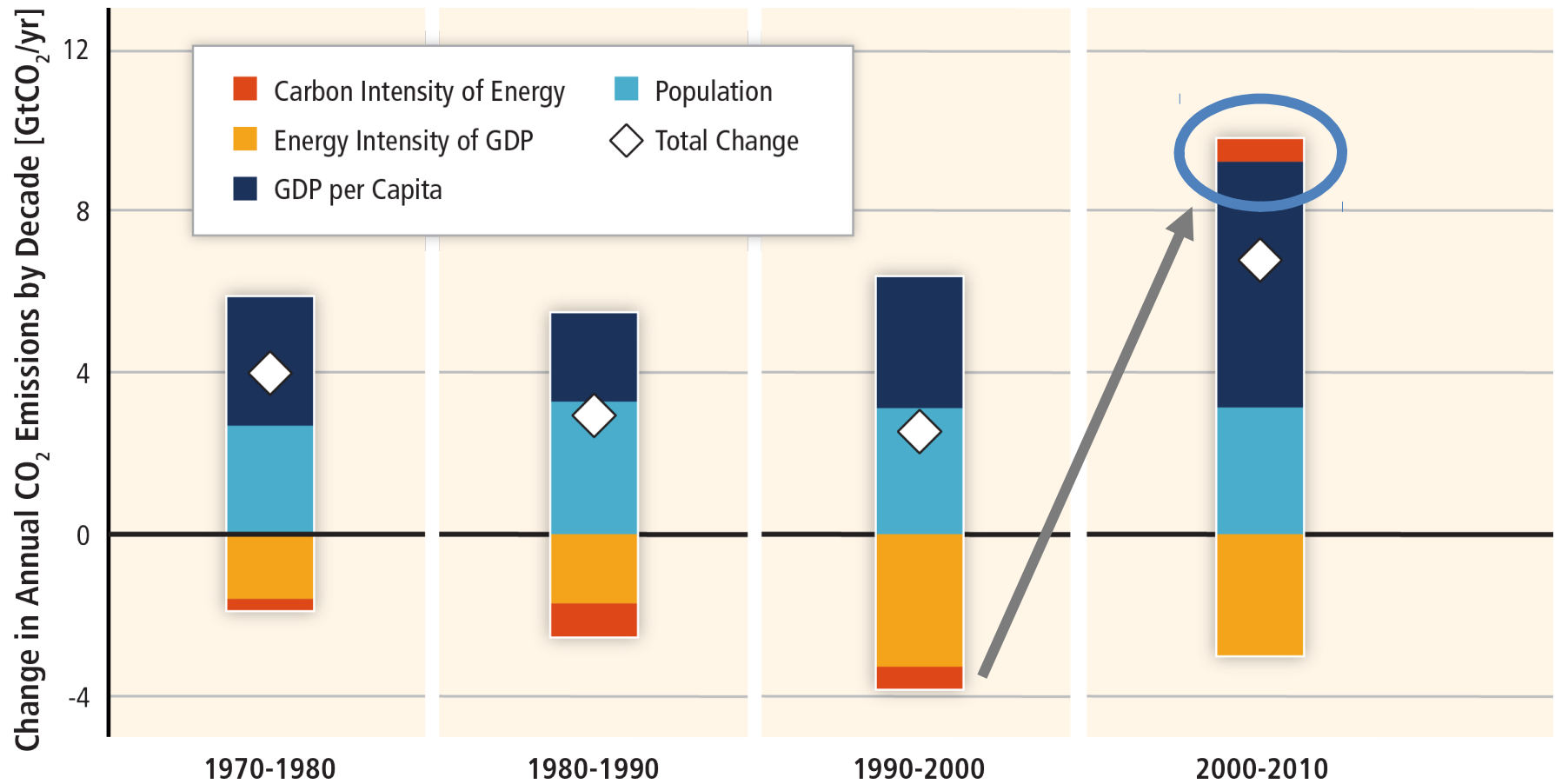
Based on Figure 1.6

GHG emissions rise with growth in GDP and population.



Based on Figure 1.7

The long-standing trend of decarbonization has reversed.

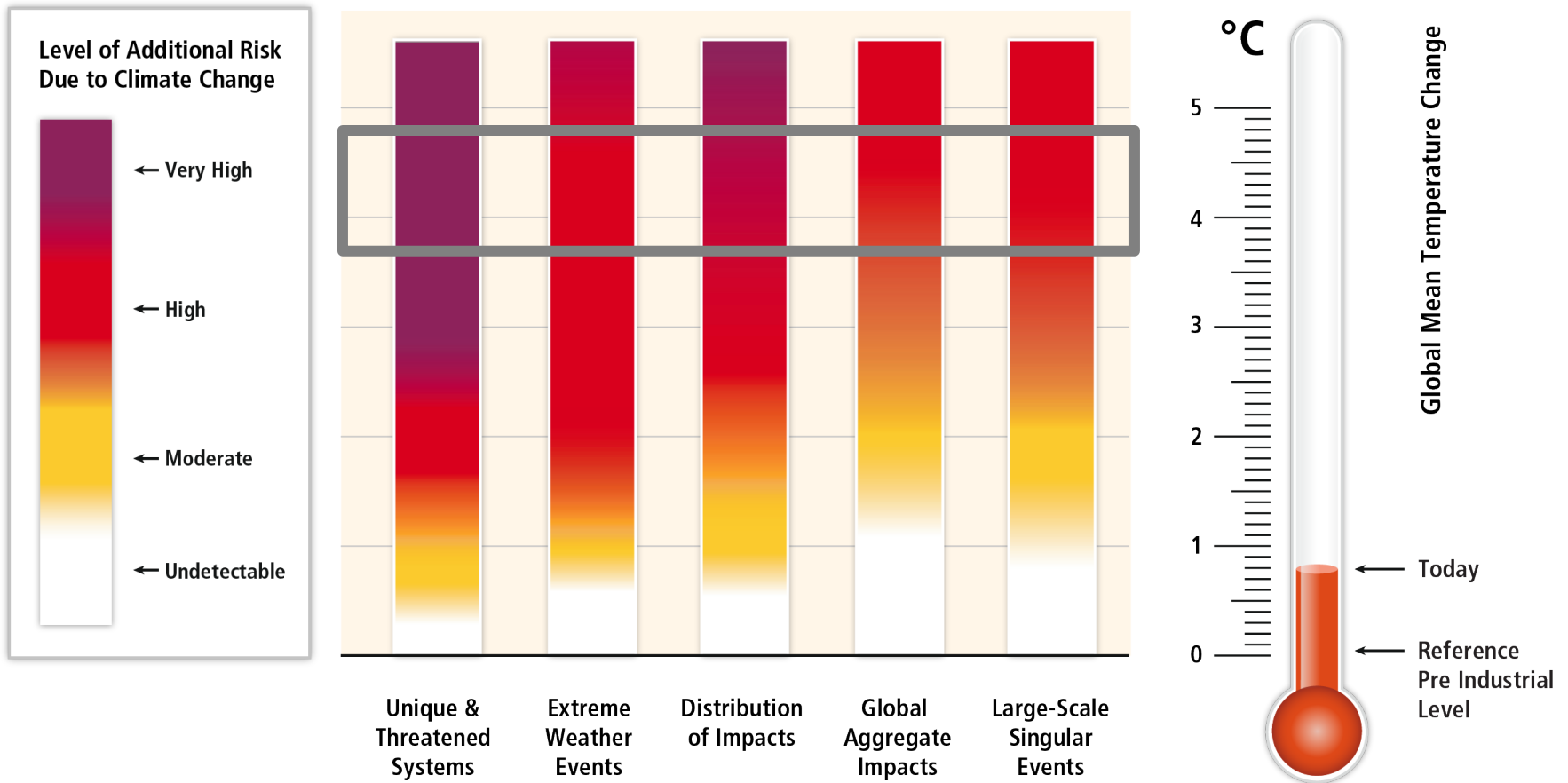


Based on Figure 1.7

**Limiting warming involves substantial technological,
economic and institutional challenges.**

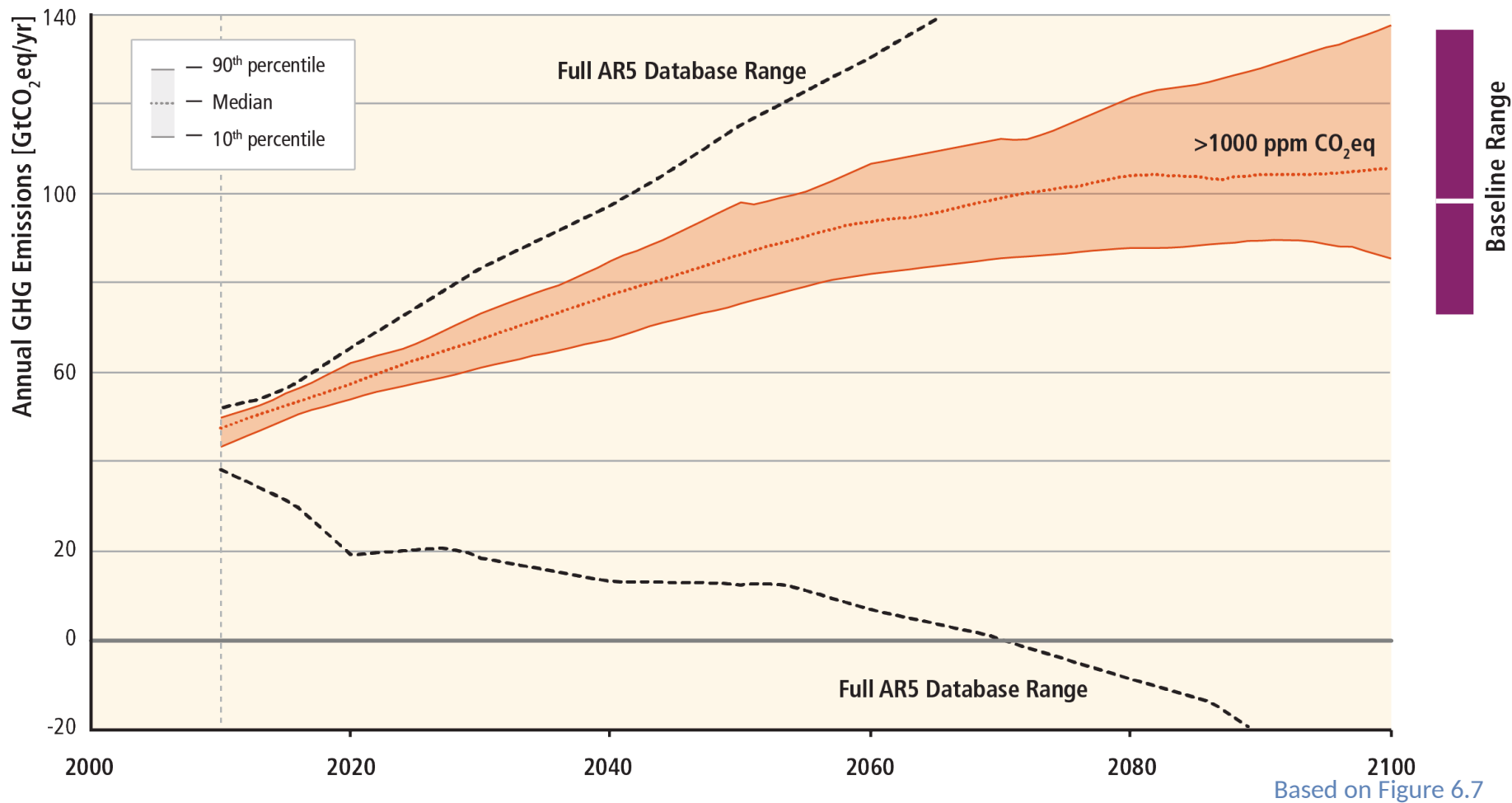


Without additional mitigation, global mean surface temperature is projected to increase by 3.7 to 4.8°C over the 21st century.

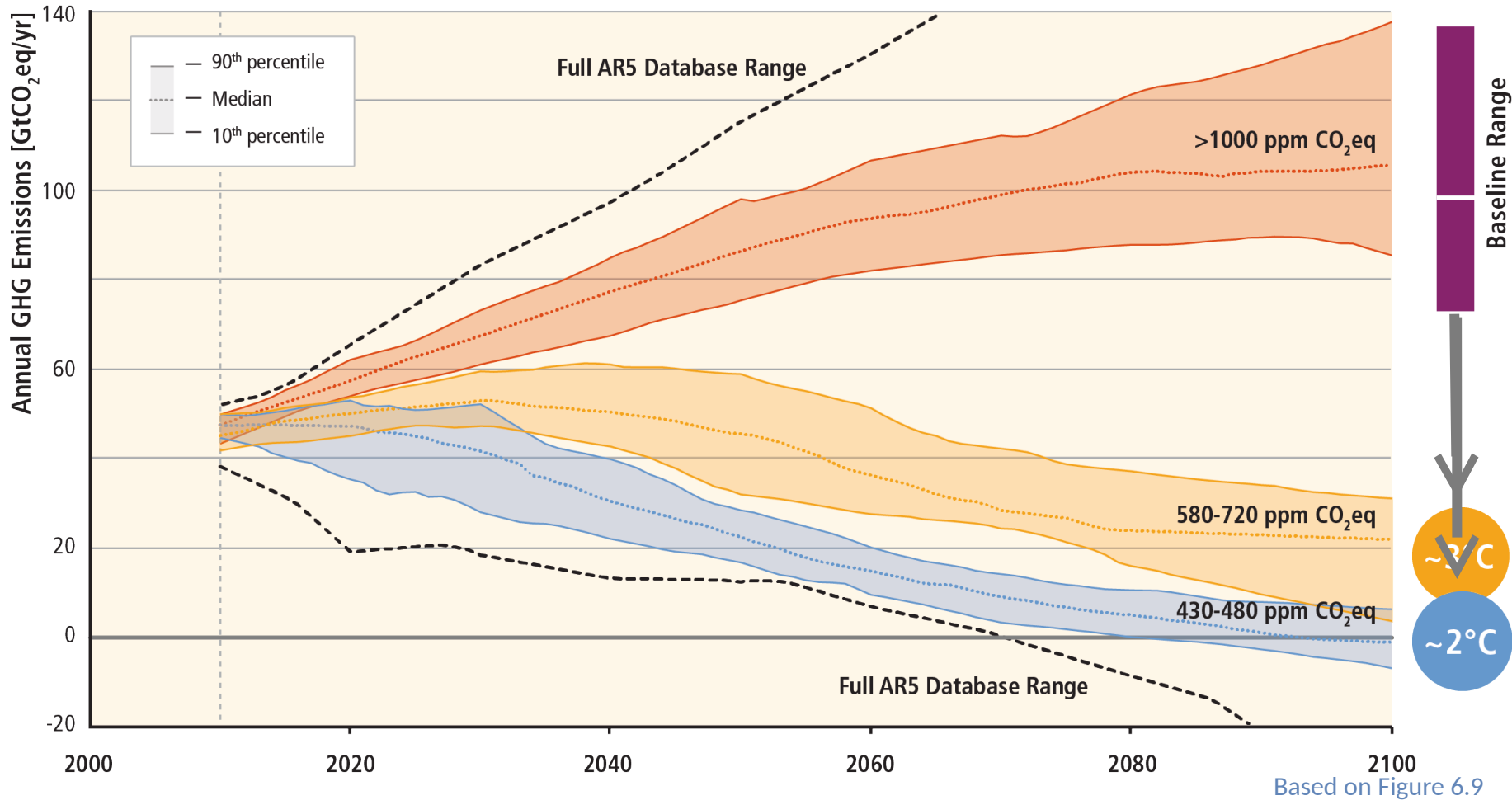


Based on WGII AR5 Figure 19.4

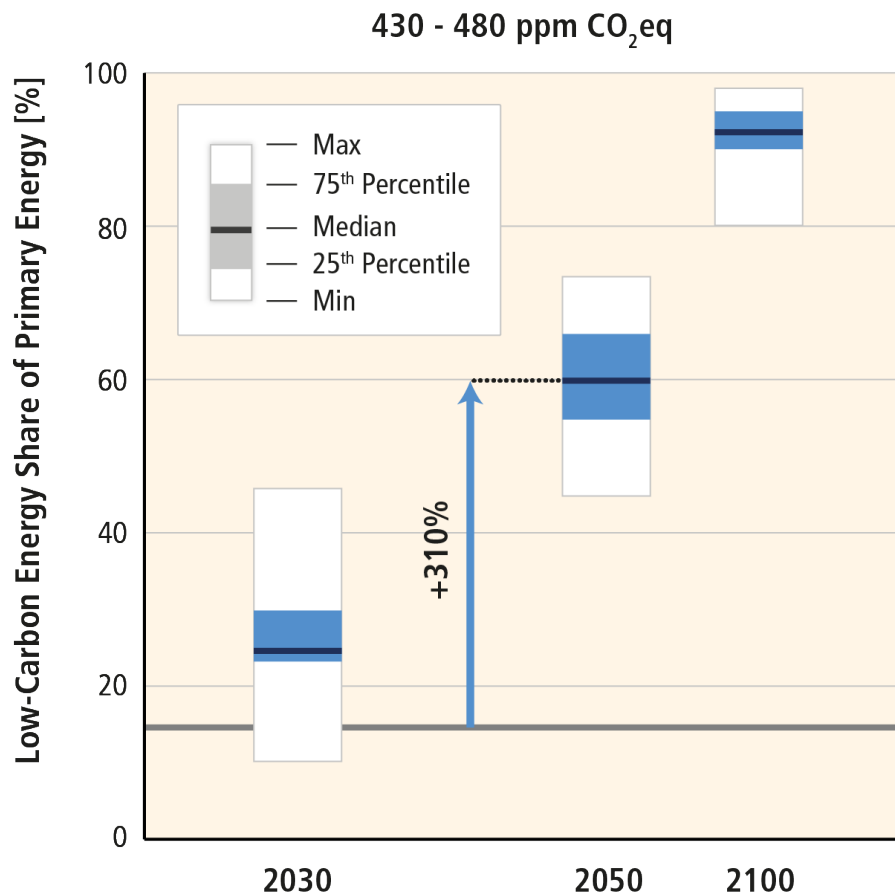
Stabilization of atmospheric GHG concentrations requires moving away from business as usual.



Lower ambition mitigation goals require similar reductions of GHG emissions.

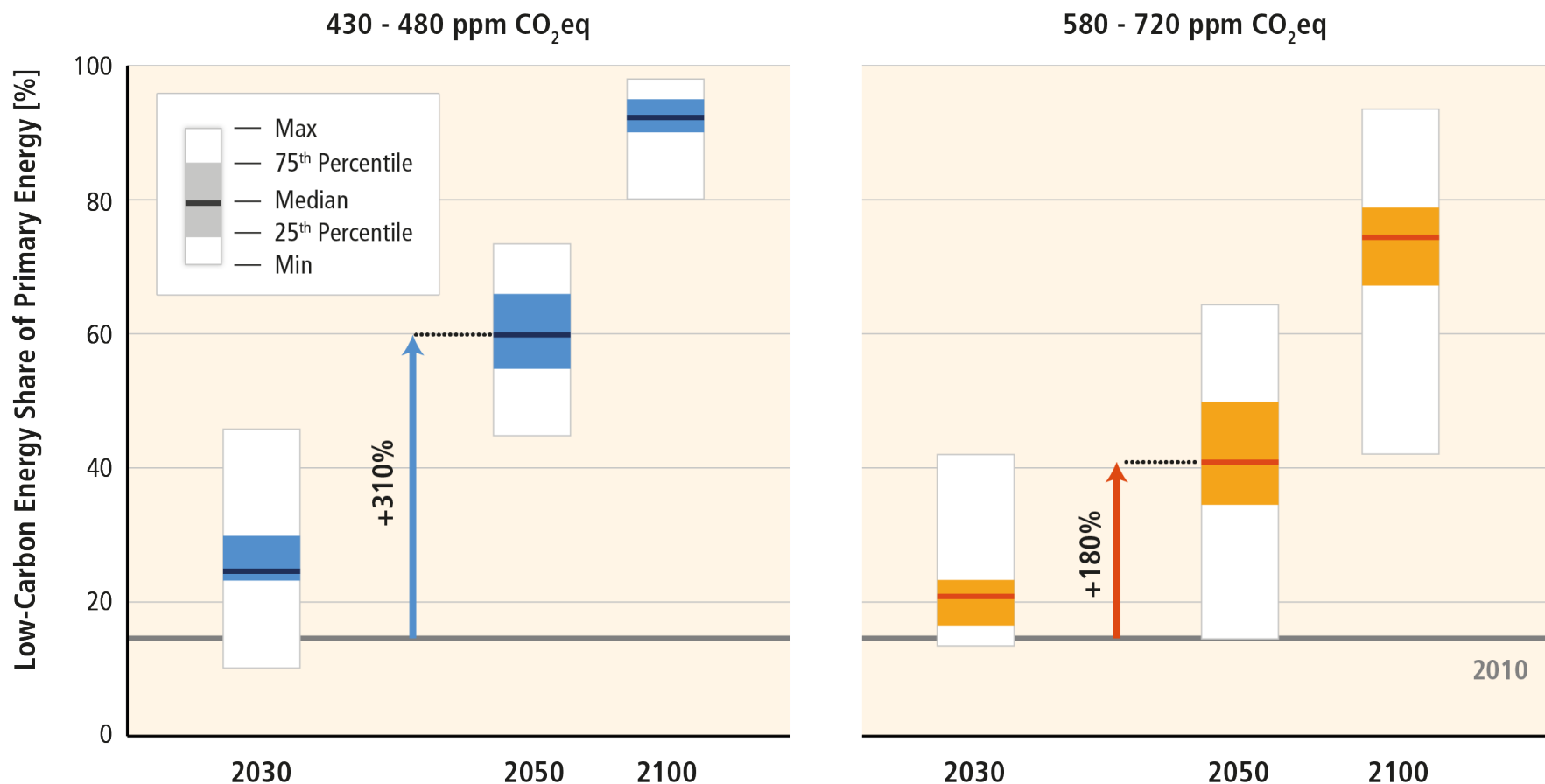


Mitigation involves substantial upscaling of low-carbon energy.



Based on Figure 7.16

Mitigation involves substantial upscaling of low-carbon energy.

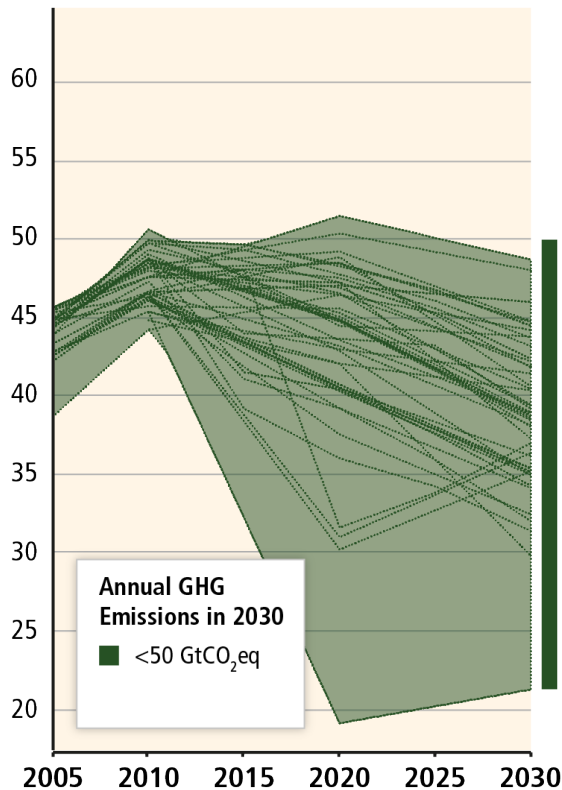


Based on Figure 7.16

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

Before 2030

GHG Emissions Pathways [GtCO₂eq/yr]



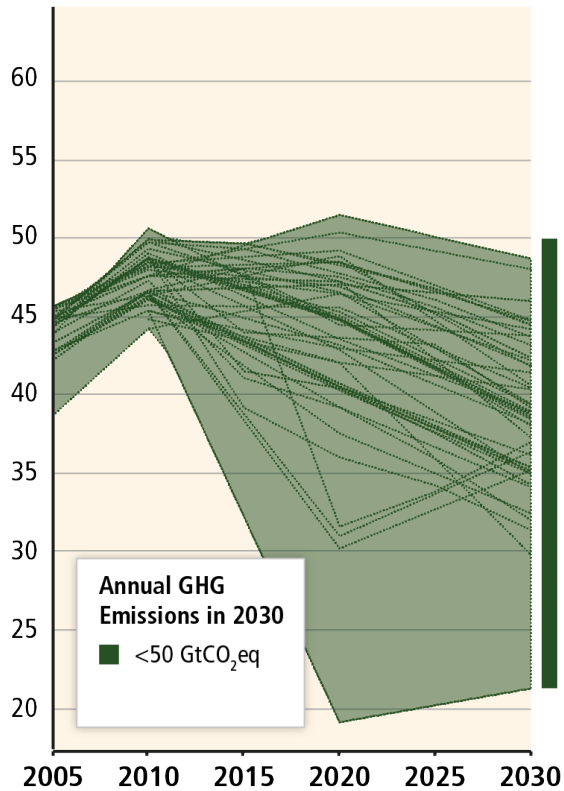
“Immediate Action”

Based on Figures 6.32 and 7.16

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

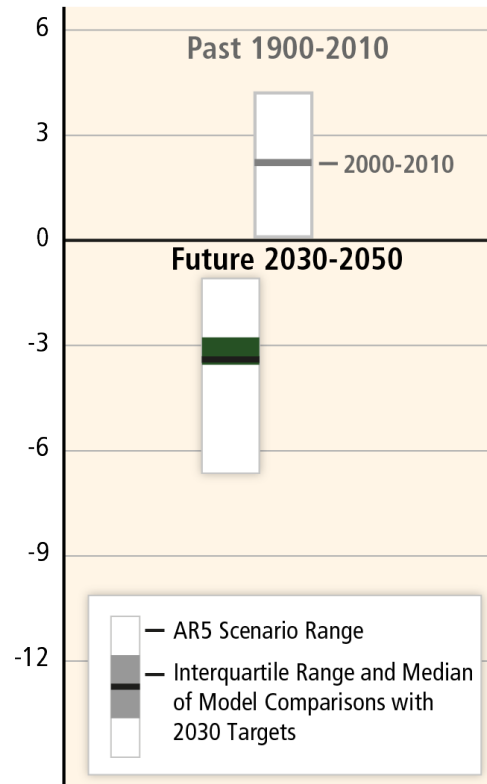
Before 2030

GHG Emissions Pathways [GtCO₂eq/yr]



After 2030

Rate of CO₂ Emission Change [%/yr]

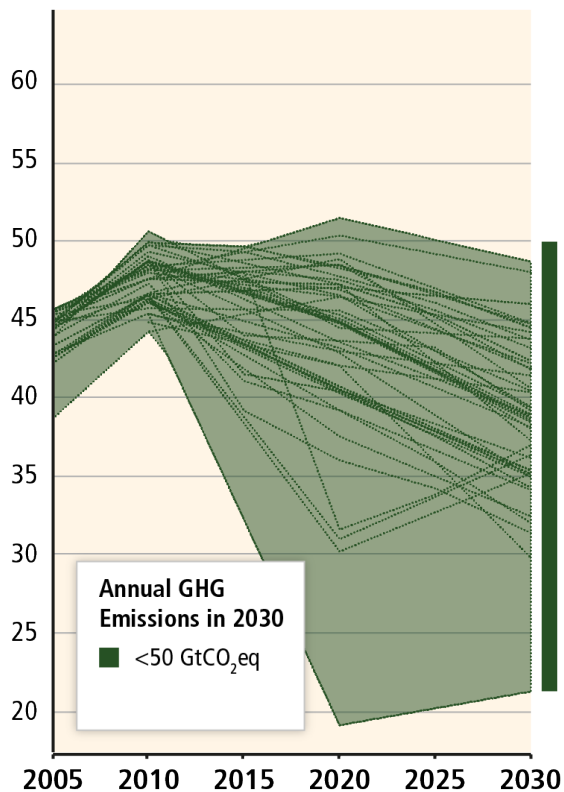


Based on Figures 6.32 and 7.16

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

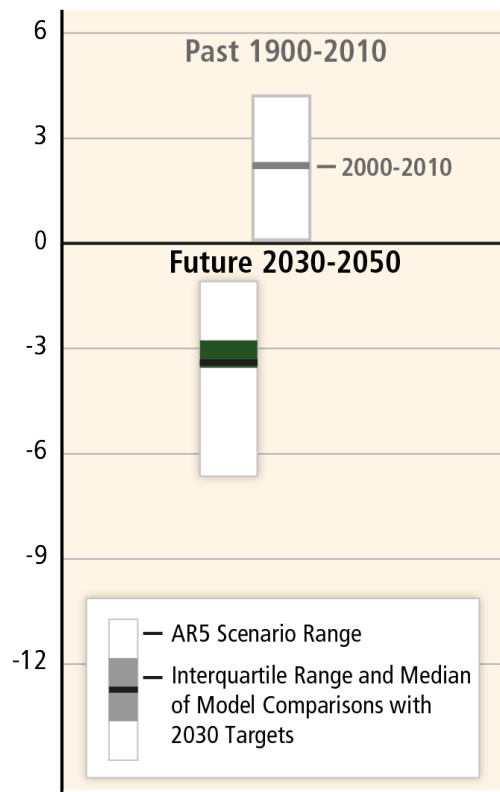
Before 2030

GHG Emissions Pathways [GtCO₂eq/yr]

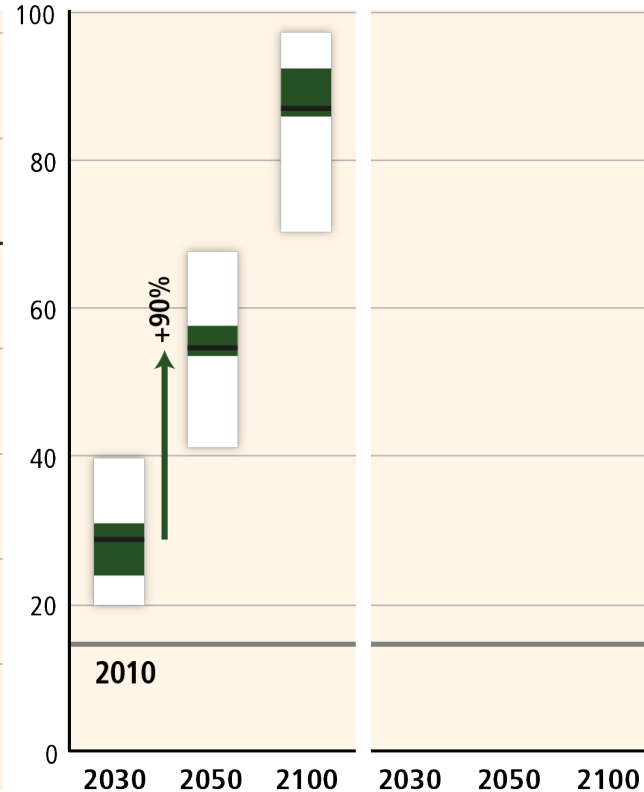


After 2030

Rate of CO₂ Emission Change [%/yr]



Share of Low-Carbon Energy [%]

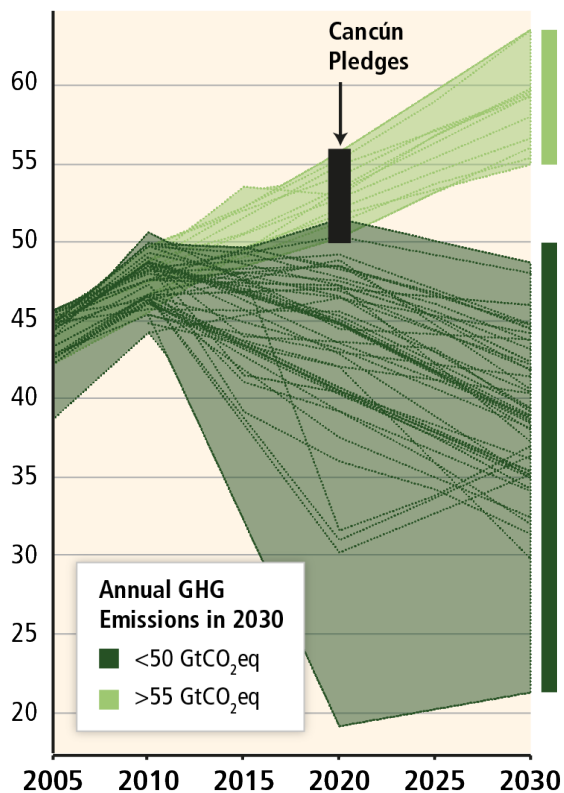


Based on Figures 6.32 and 7.16

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

Before 2030

GHG Emissions Pathways [GtCO₂eq/yr]



“Delayed Mitigation”

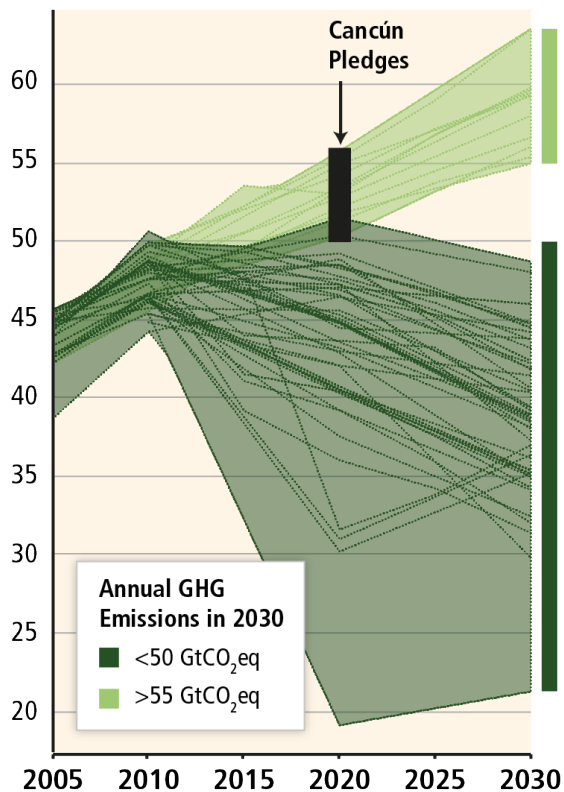
“Immediate Action”

Based on Figures 6.32 and 7.16

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

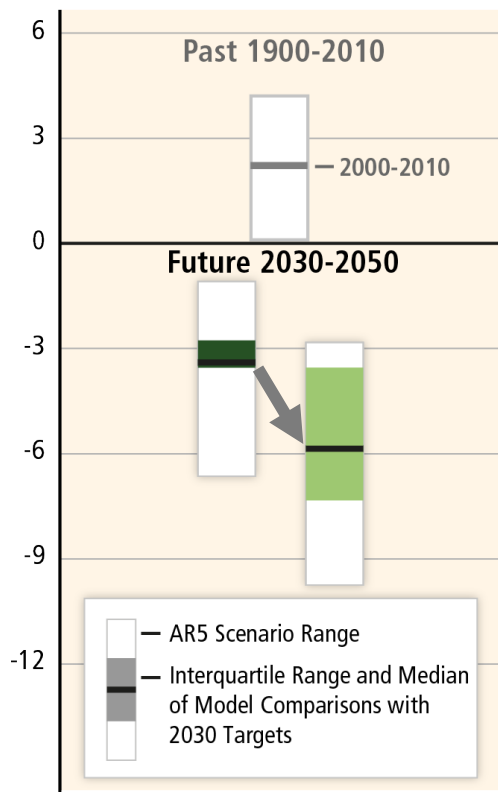
Before 2030

GHG Emissions Pathways [GtCO₂eq/yr]

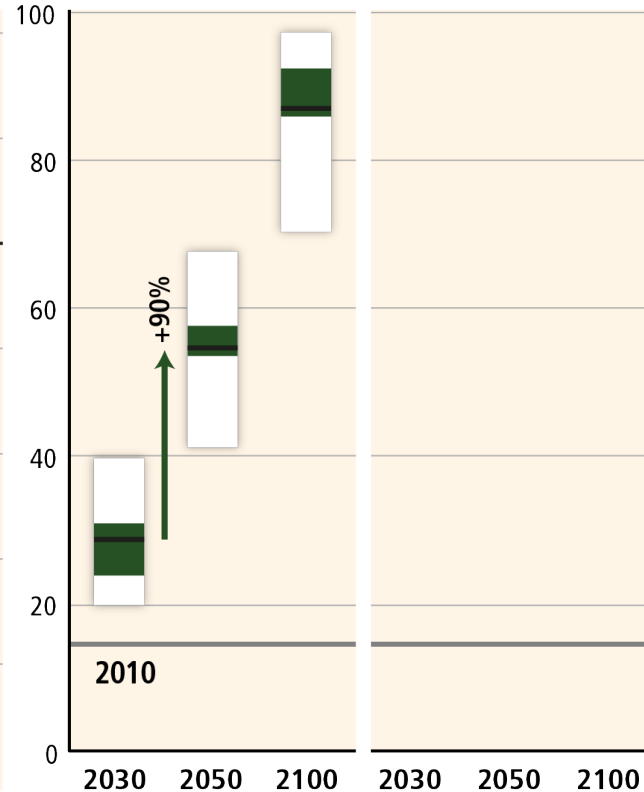


After 2030

Rate of CO₂ Emission Change [%/yr]

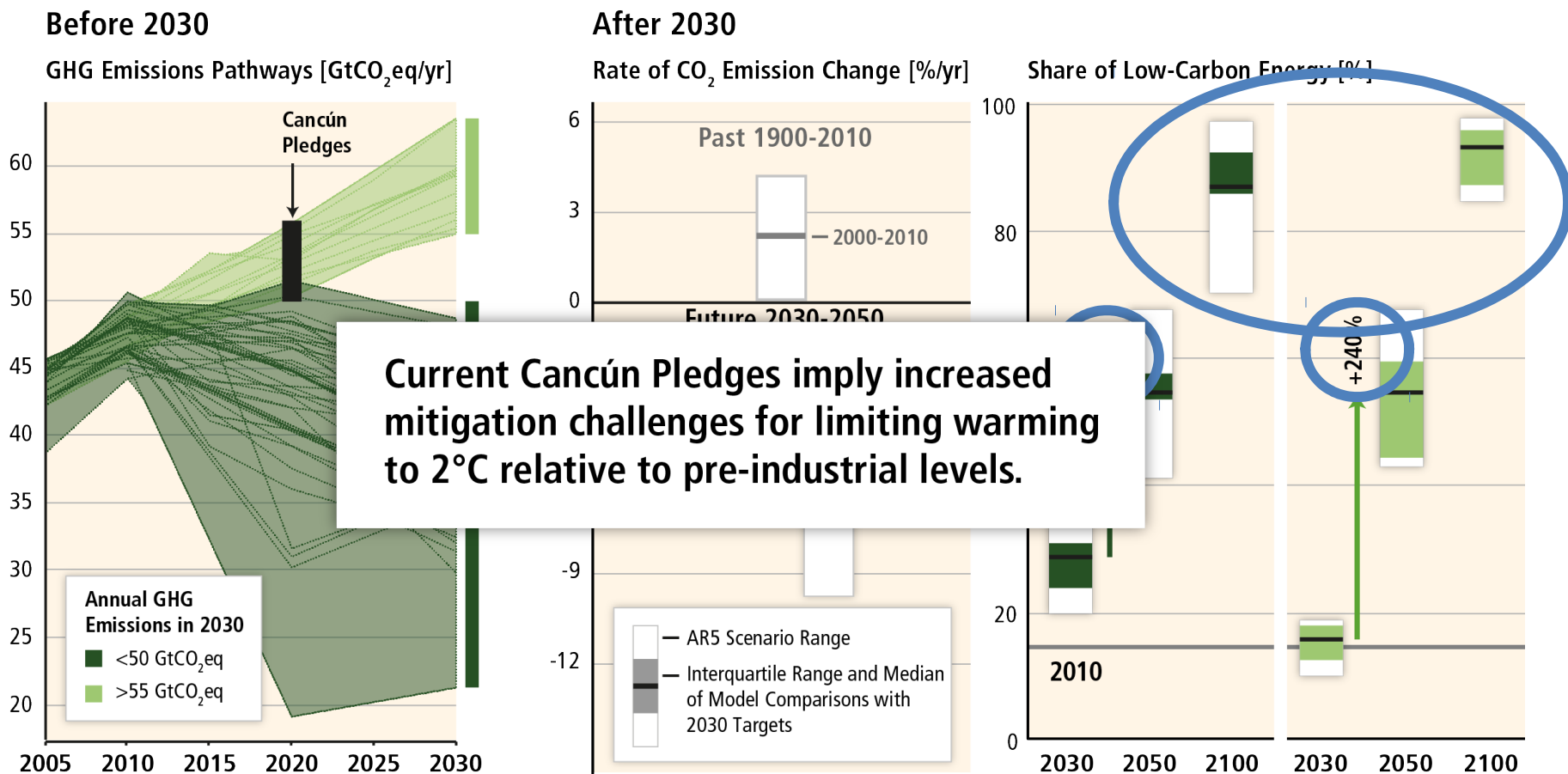


Share of Low-Carbon Energy [%]



Based on Figures 6.32 and 7.16

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

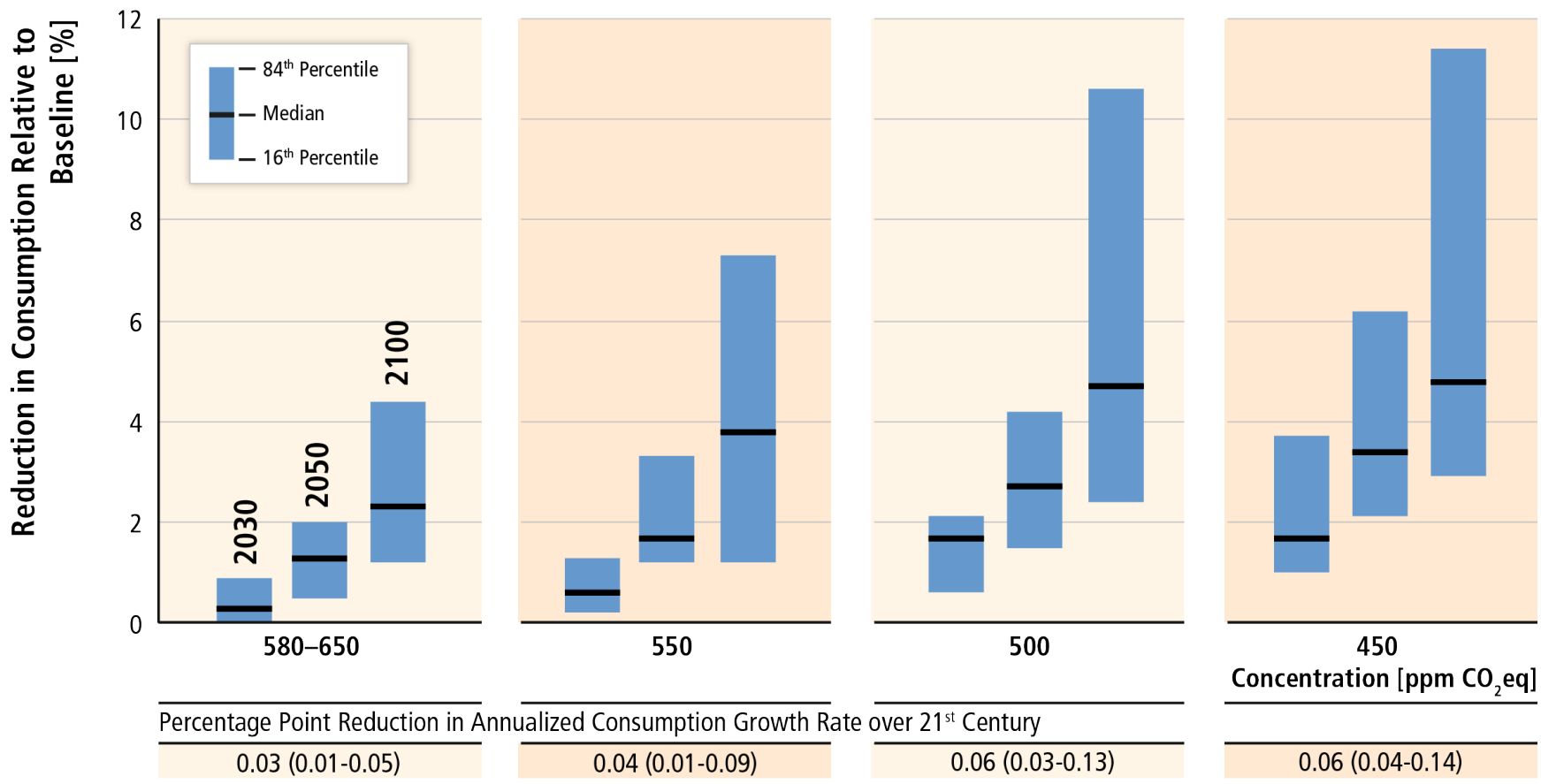


Based on Figures 6.32 and 7.16

A large container ship is shown from an elevated perspective, sailing on the ocean. The ship is white with a red hull and is heavily loaded with colorful shipping containers. The text is overlaid on the image in a bold, white font.

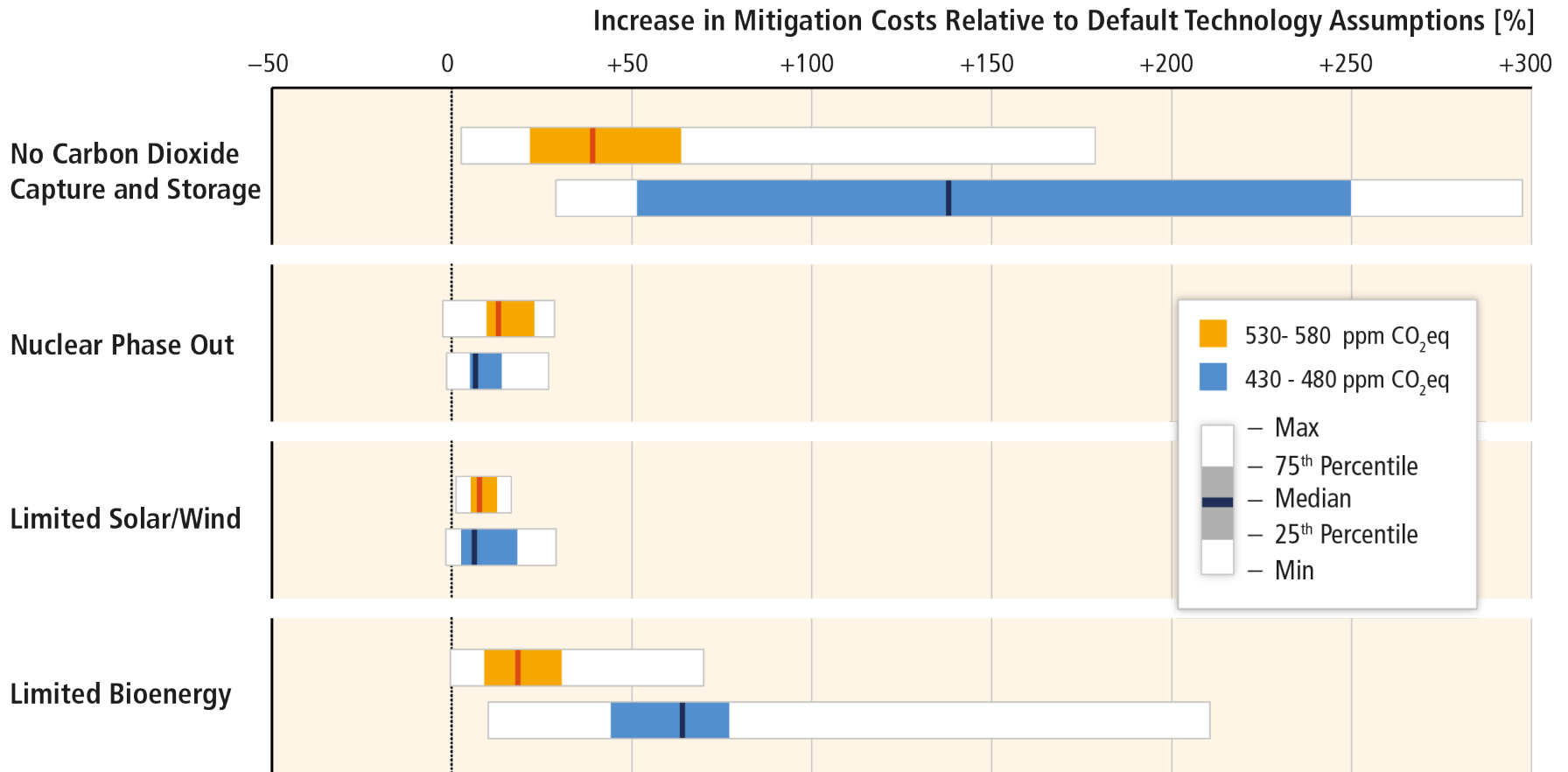
Mitigation cost estimates vary, but global GDP growth may not be strongly affected.

Global costs rise with the ambition of the mitigation goal.



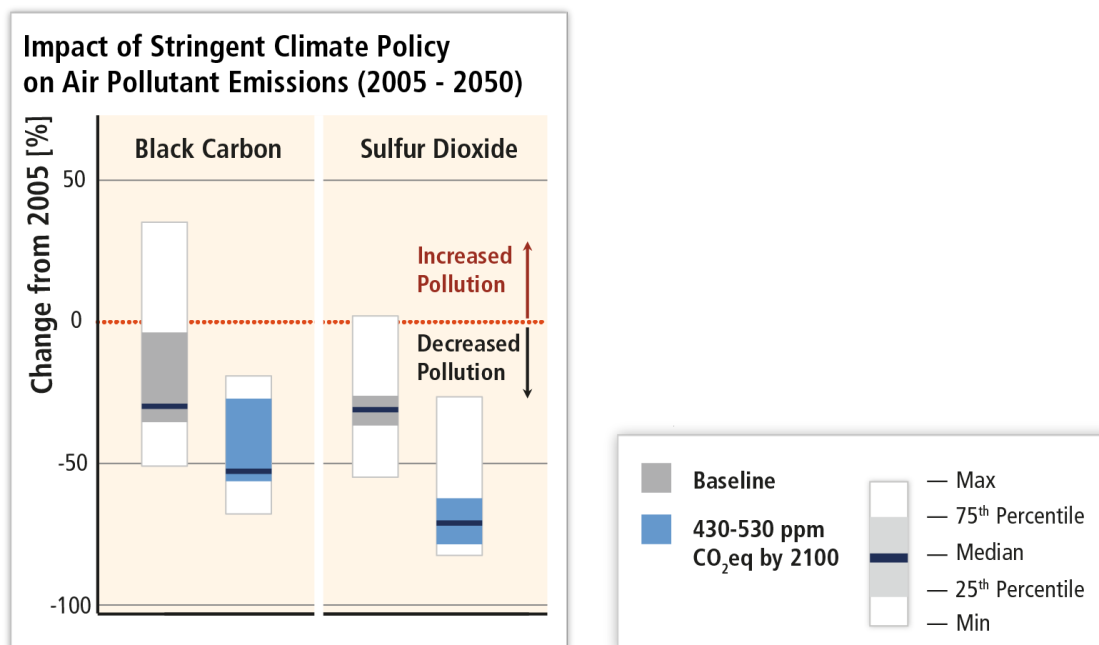
Based on Table SPM.2

Technological limitations can increase mitigation costs.



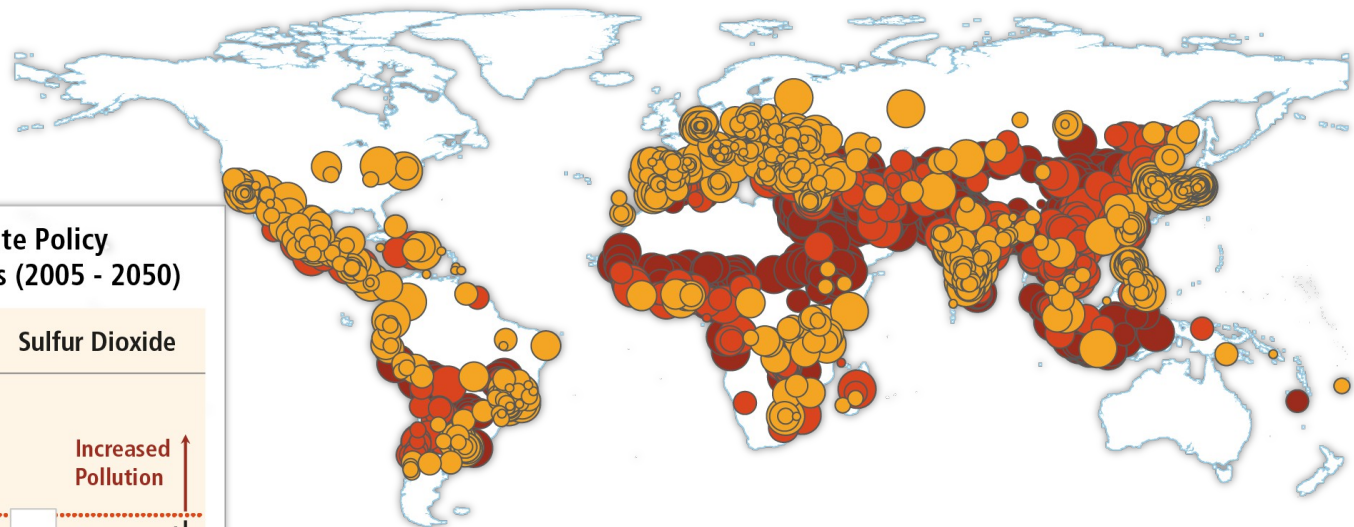
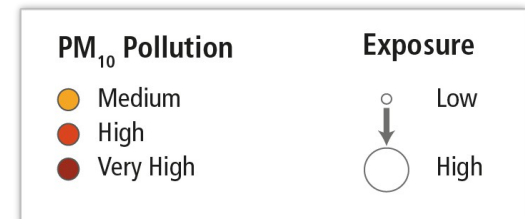
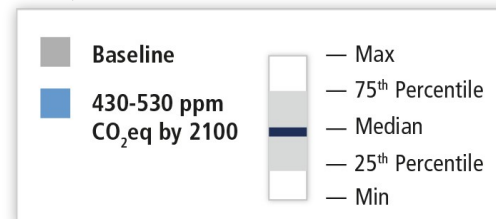
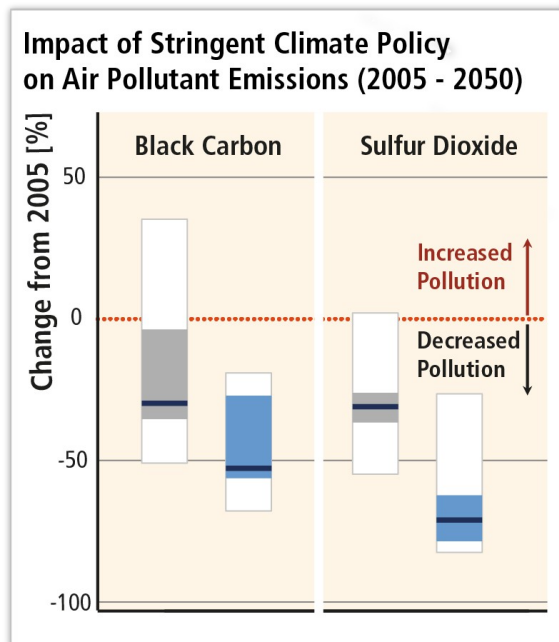
Based on Figure 6.24

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



Based on Figures 6.33 and 12.23

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

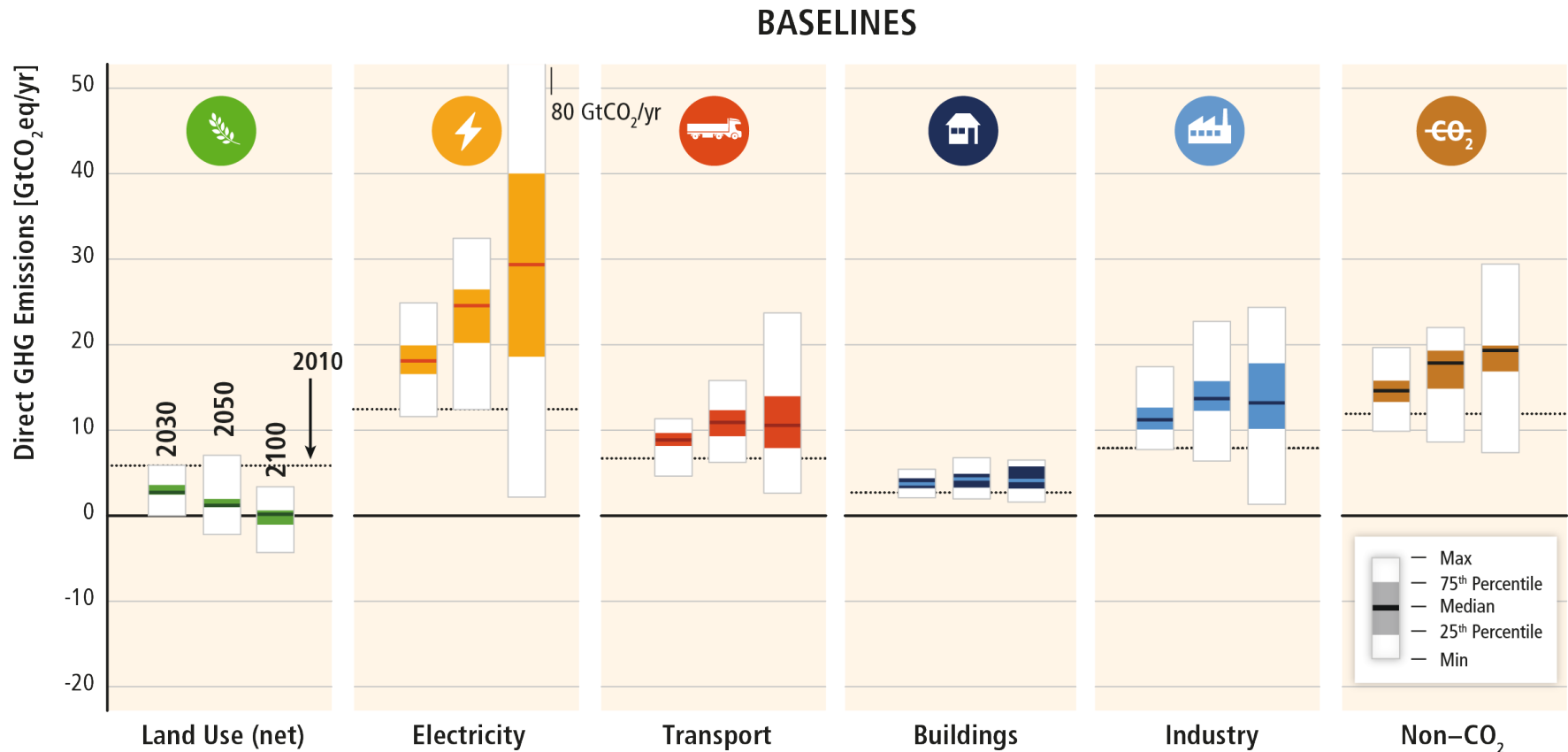


Based on Figures 6.33 and 12.23

An aerial, high-angle photograph of a complex industrial facility, likely a refinery or chemical plant. The scene is dominated by a dense network of silver-colored metal pipes, walkways, and structural beams. A single worker in a bright yellow safety jacket and white hard hat is visible in the center, providing a sense of scale to the massive infrastructure. The entire image has a blue color cast. Overlaid on the lower-left portion of the image is white text.

Low stabilization scenarios depend on a full decarbonization of energy supply.

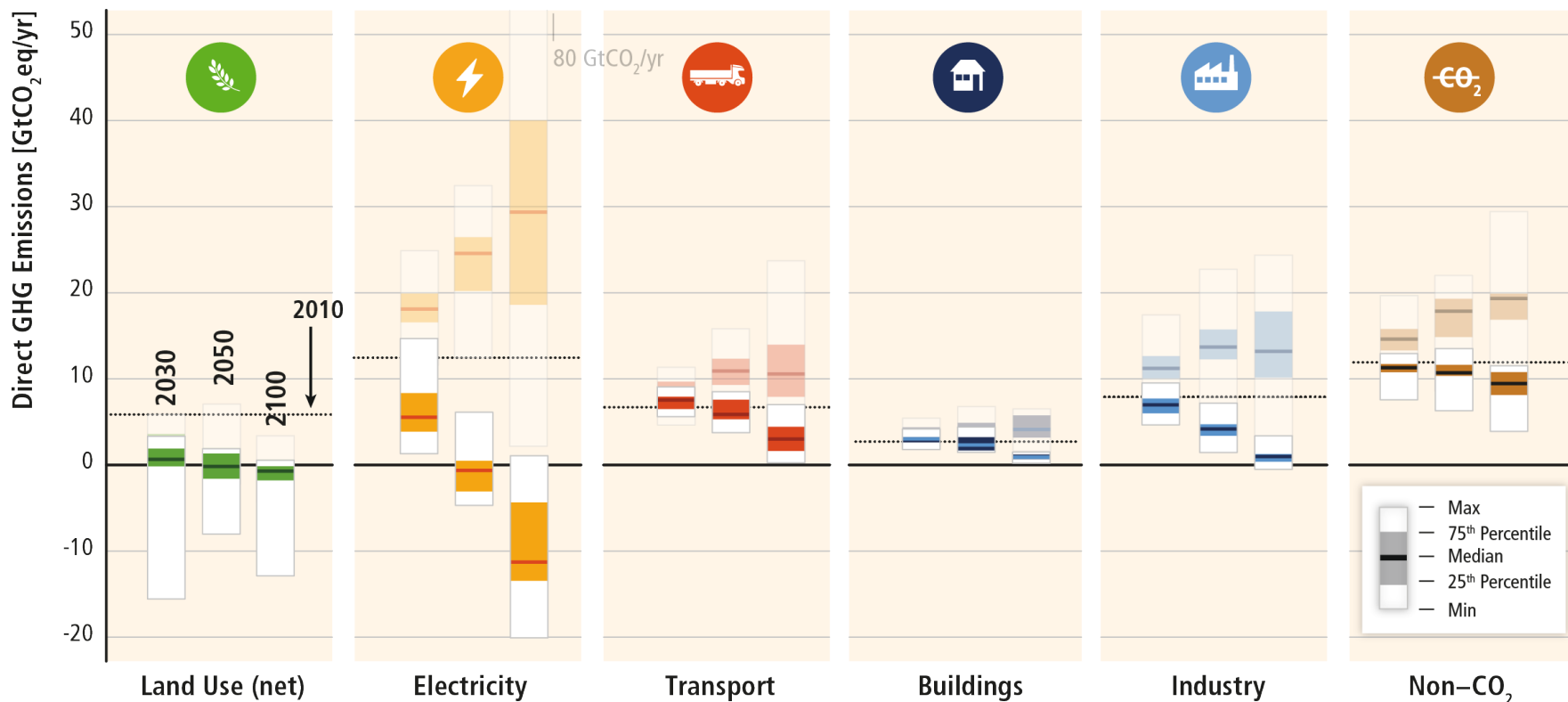
Baseline scenarios suggest rising GHG emissions in all sectors, except for CO₂ emissions from the land use sector.



Based on Figure TS.15

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

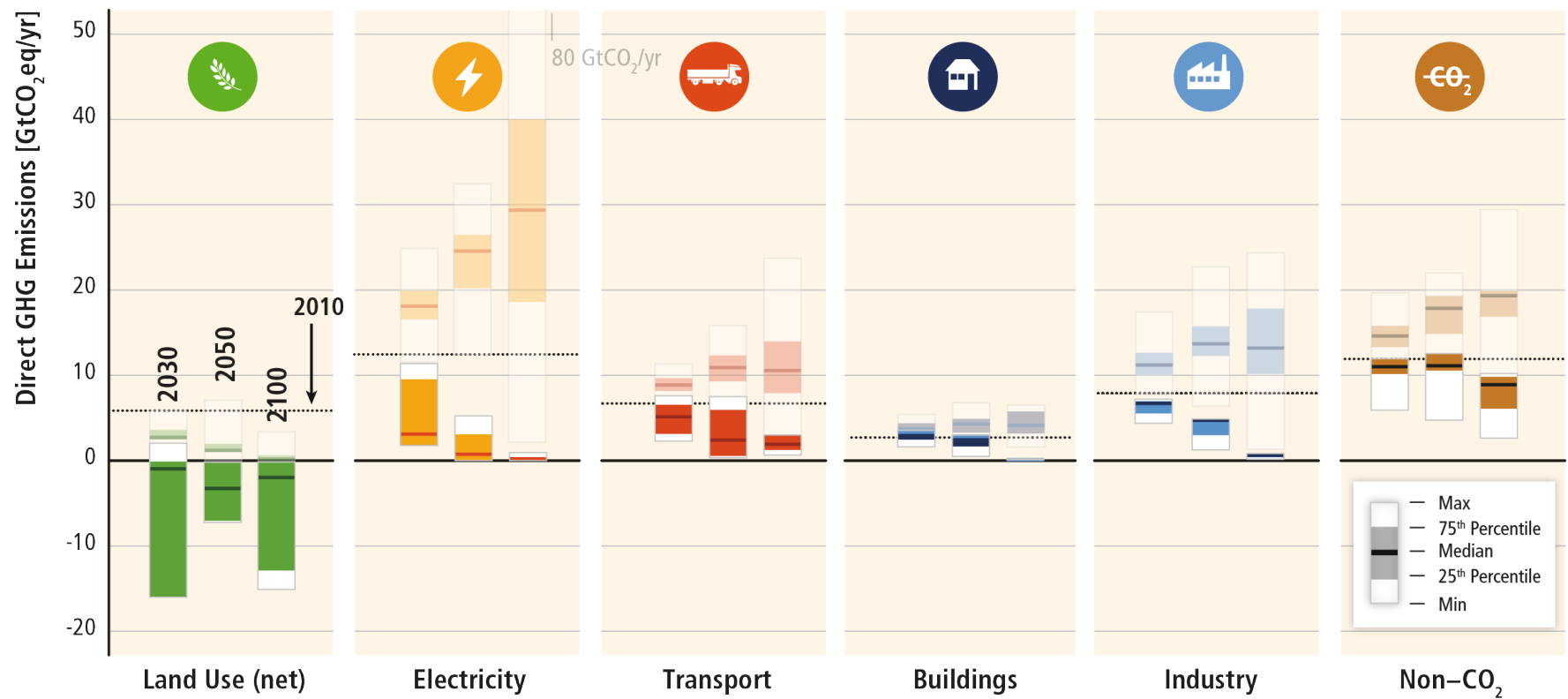
450 ppm CO₂eq with Carbon Dioxide Capture and Storage



Based on Figure TS.17

Mitigation efforts in one sector determine efforts in others.

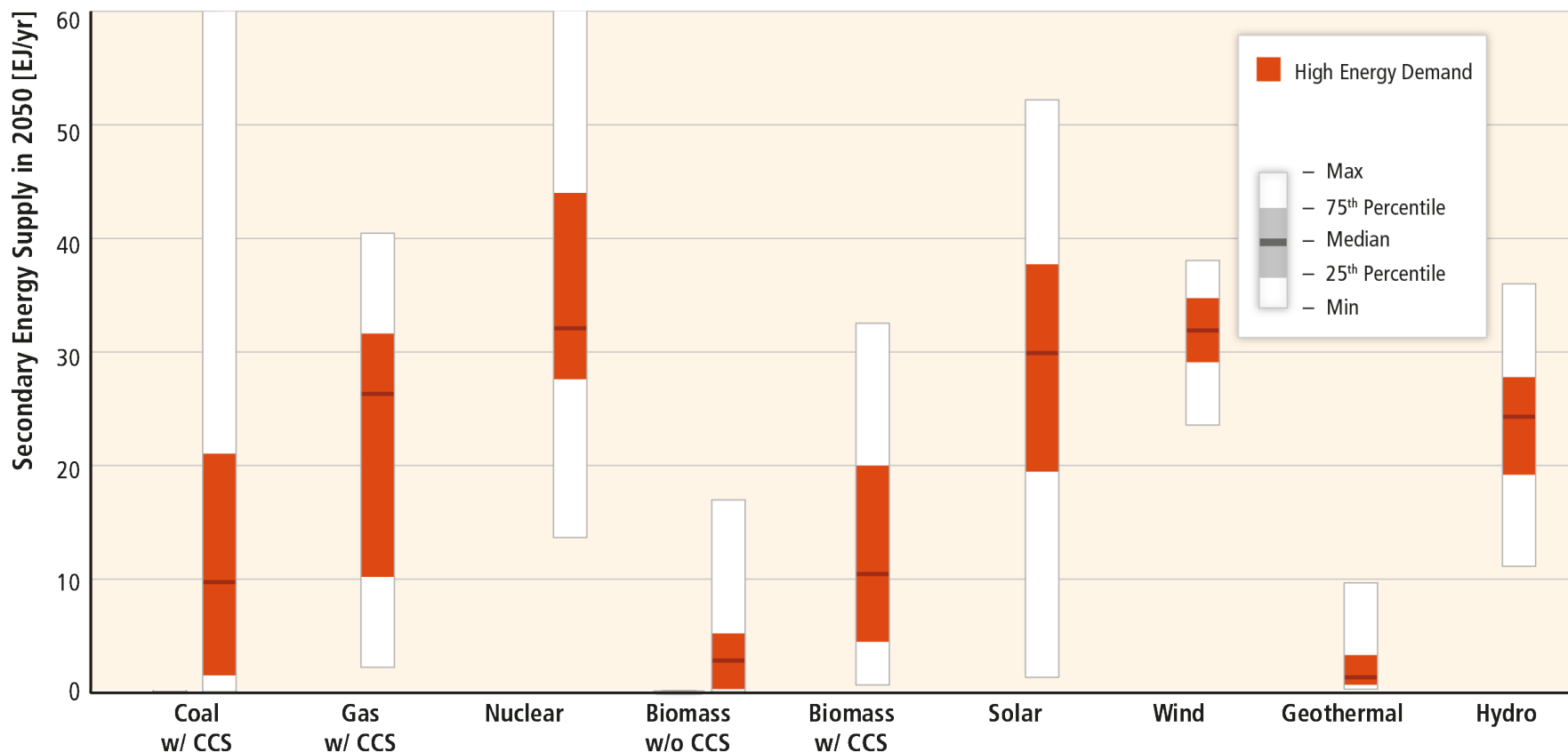
450 ppm CO₂eq without Carbon Dioxide Capture and Storage



Based on Figure TS.17

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

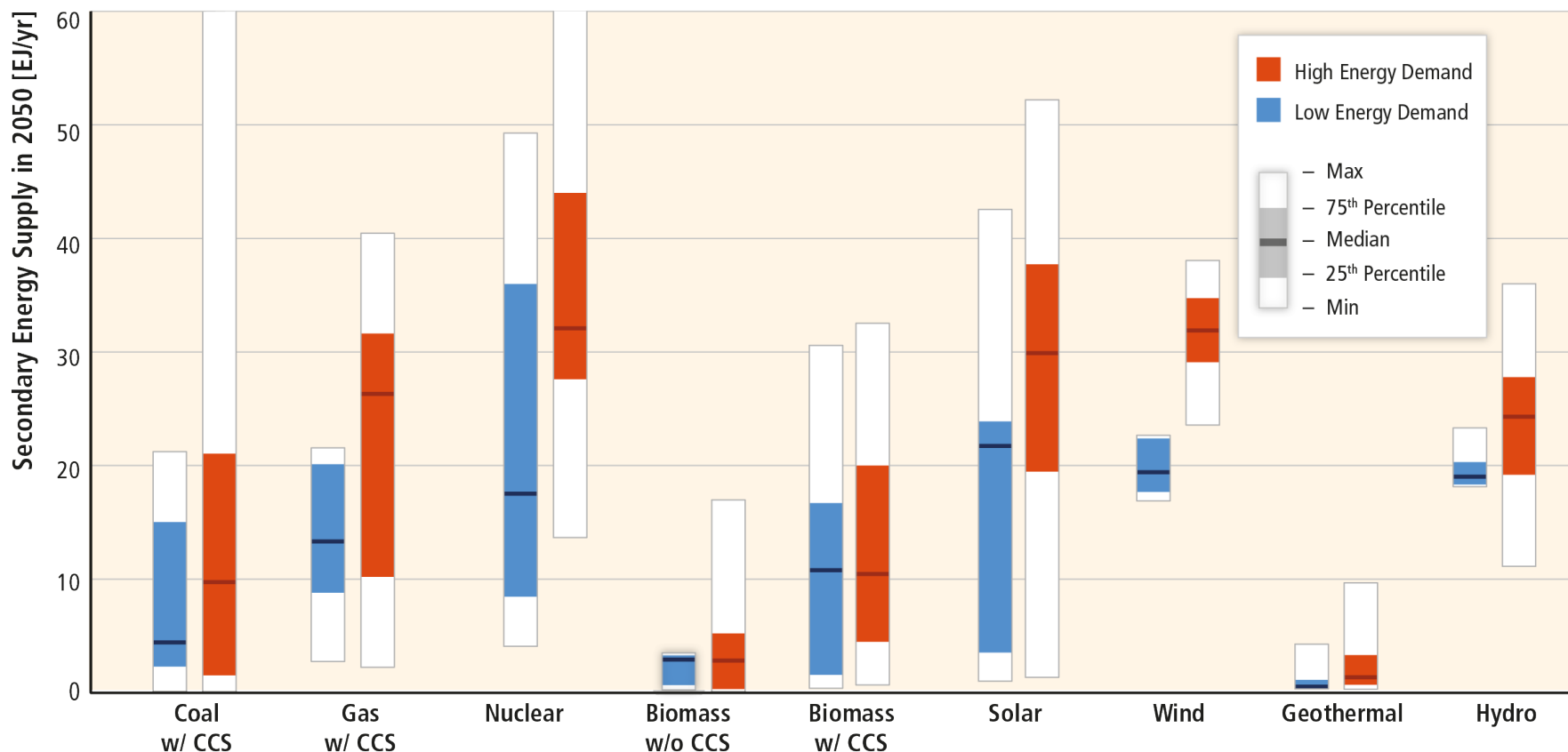
Contribution of Low Carbon Technologies to Energy Supply (430-530 ppm CO₂eq Scenarios)



Based on Figure 7.11

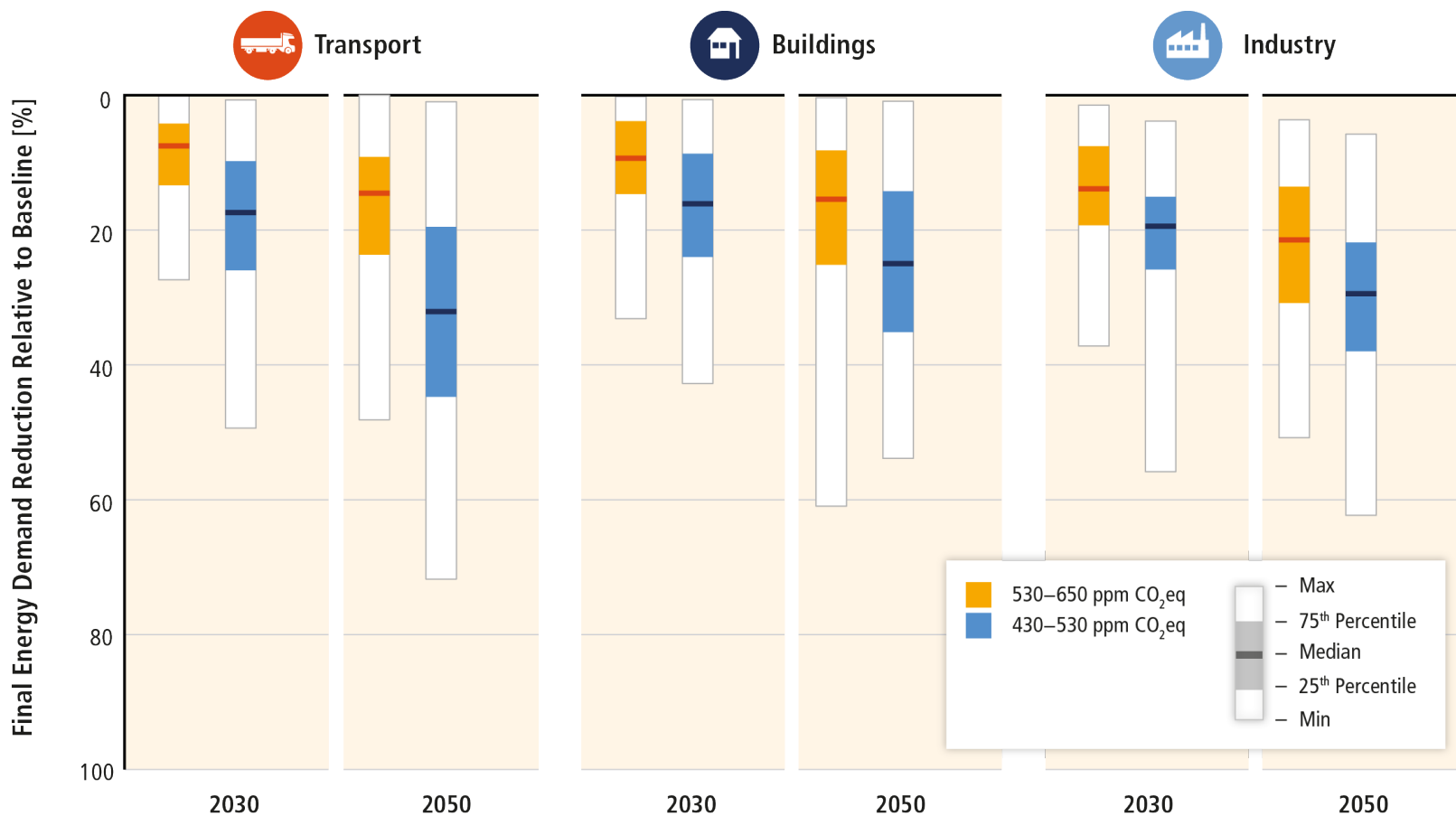
Energy demand reductions can provide flexibility, hedge against risks, avoid lock-in and provide co-benefits.

Contribution of Low Carbon Technologies to Energy Supply (430-530 ppm CO₂eq Scenarios)



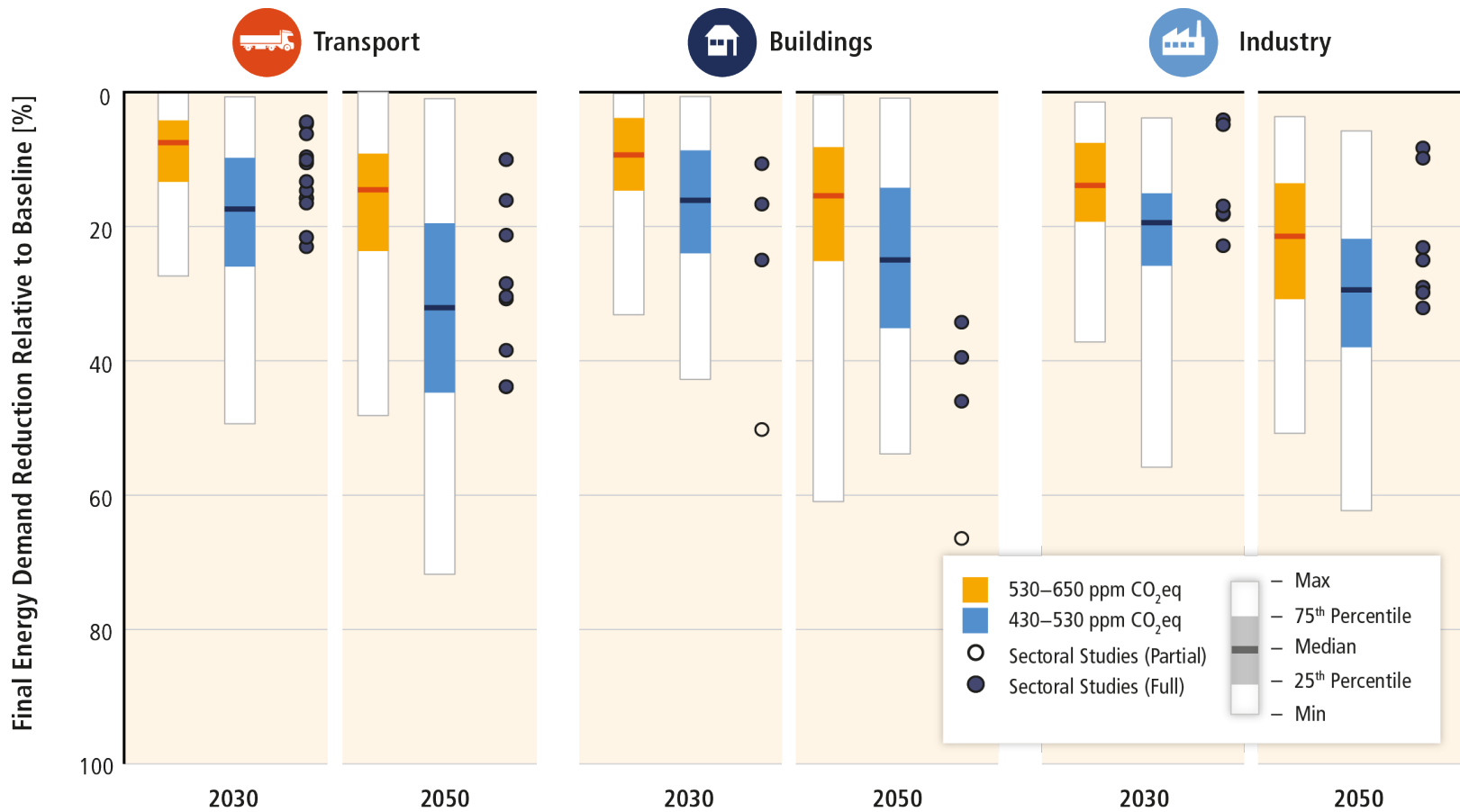
Based on Figure 7.11

Reducing energy demand through efficiency enhancements and behavioural changes is a key mitigation strategy.



Based on Figure 6.37

Reducing energy demand through efficiency enhancements and behavioural changes are a key mitigation strategy.

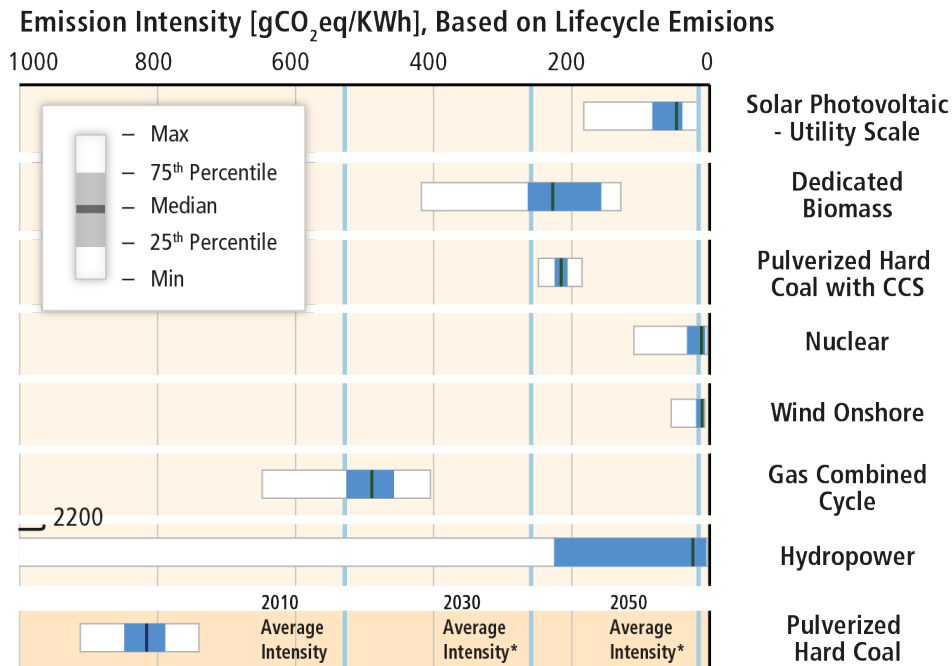


Based on Figure 6.37

A large offshore wind turbine stands in the ocean at dusk. The sky is a deep blue, and the water is dark. In the foreground, a white service vessel with a red hull is moving towards the turbine, leaving a white wake. The turbine's three blades are visible against the sky. The overall scene is serene and industrial.

The wide-scale application of best-practice low-GHG technologies could lead to substantial emission reductions.

Examples from electricity generation: Low emission technologies exist, but emissions are reduced to different degrees.

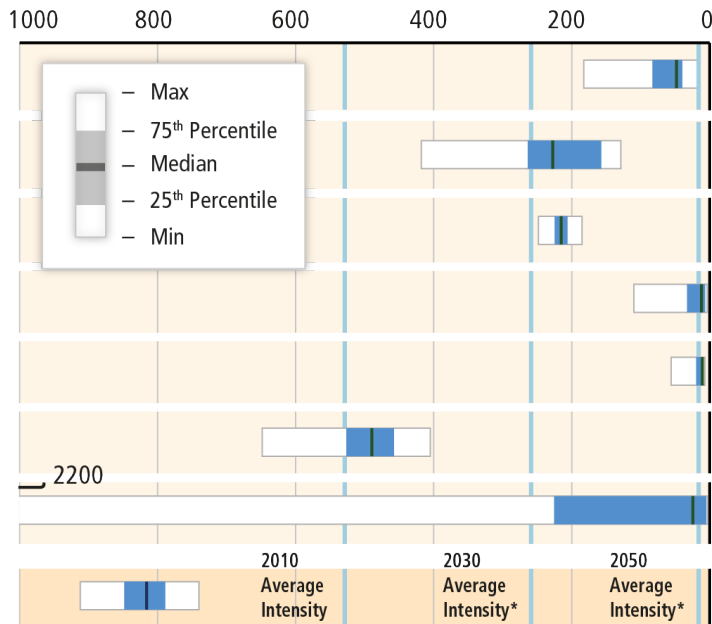


* Median Value in Mitigation Scenarios (430-530 ppm CO₂eq by 2100)

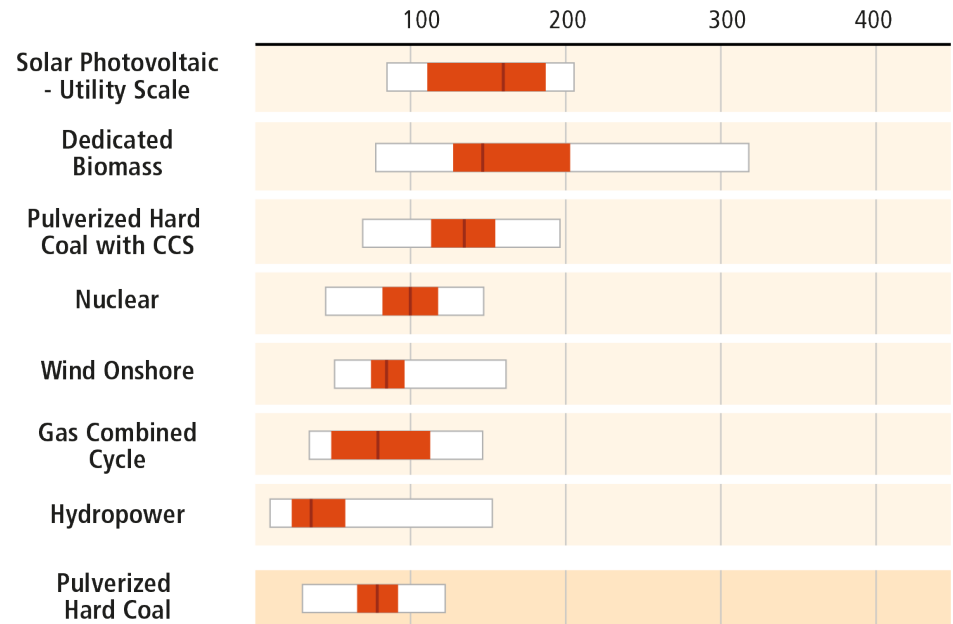
Based on Figure 7.7

Due to cost decline, renewable energy technologies are becoming economical solutions in an increasing number of countries.

Emission Intensity [gCO₂eq/KWh], Based on Lifecycle Emissions



Cost of Electricity [USD₂₀₁₀/MWh], Based on High Full Load Hours



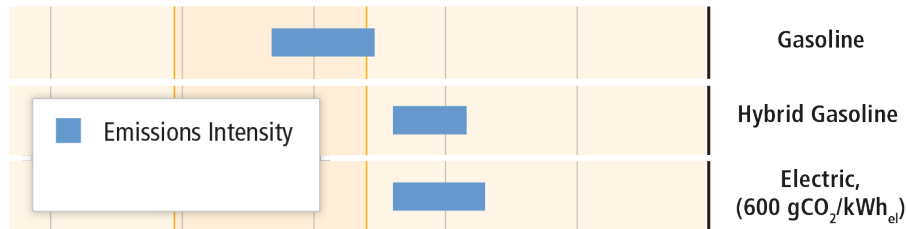
* Median Value in Mitigation Scenarios (430-530 ppm CO₂eq by 2100)

Based on Figure 7.7

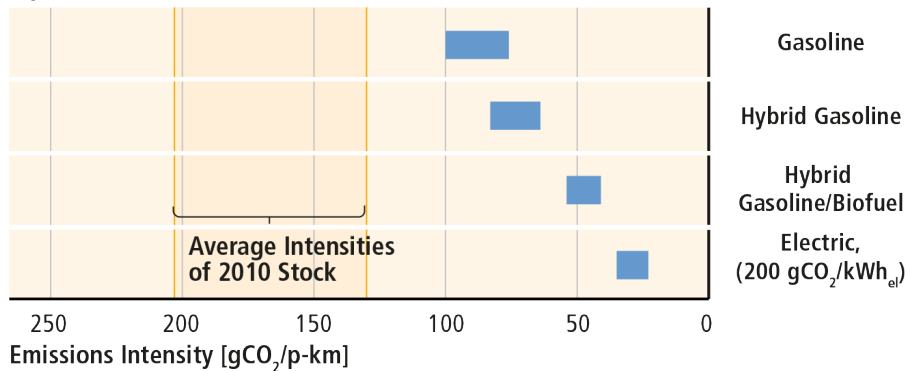
Examples from transport: Several strategies exist to reduce emissions from transportation.

Some Mitigation Technologies for Light Duty Vehicles

Options in 2010



Options in 2030

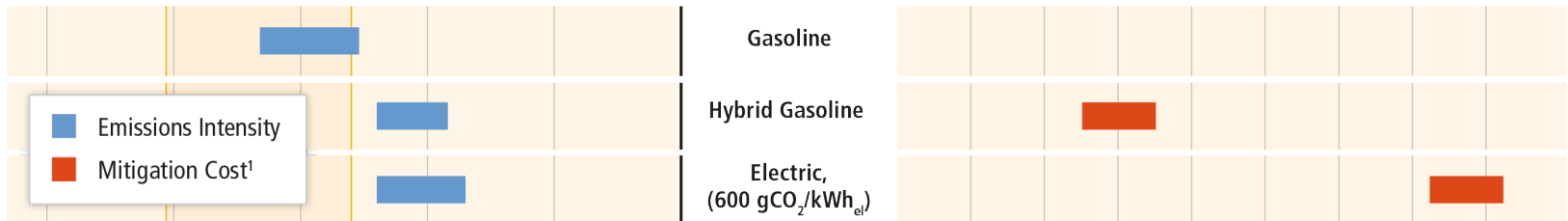


Based on Figure TS.21

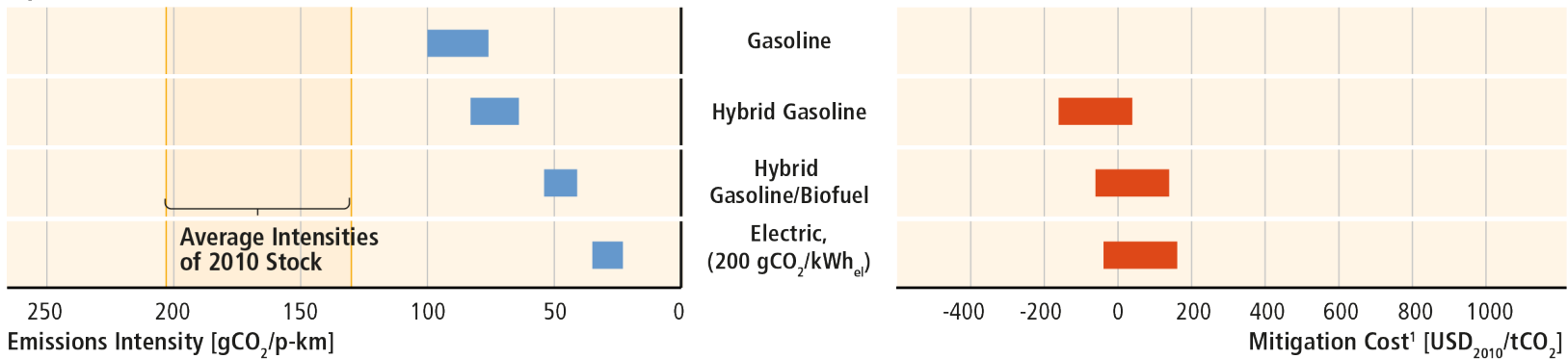
Private costs of reducing emissions in transport vary widely. Societal costs remain uncertain.

Some Mitigation Technologies for Light Duty Vehicles

Options in 2010




Options in 2030



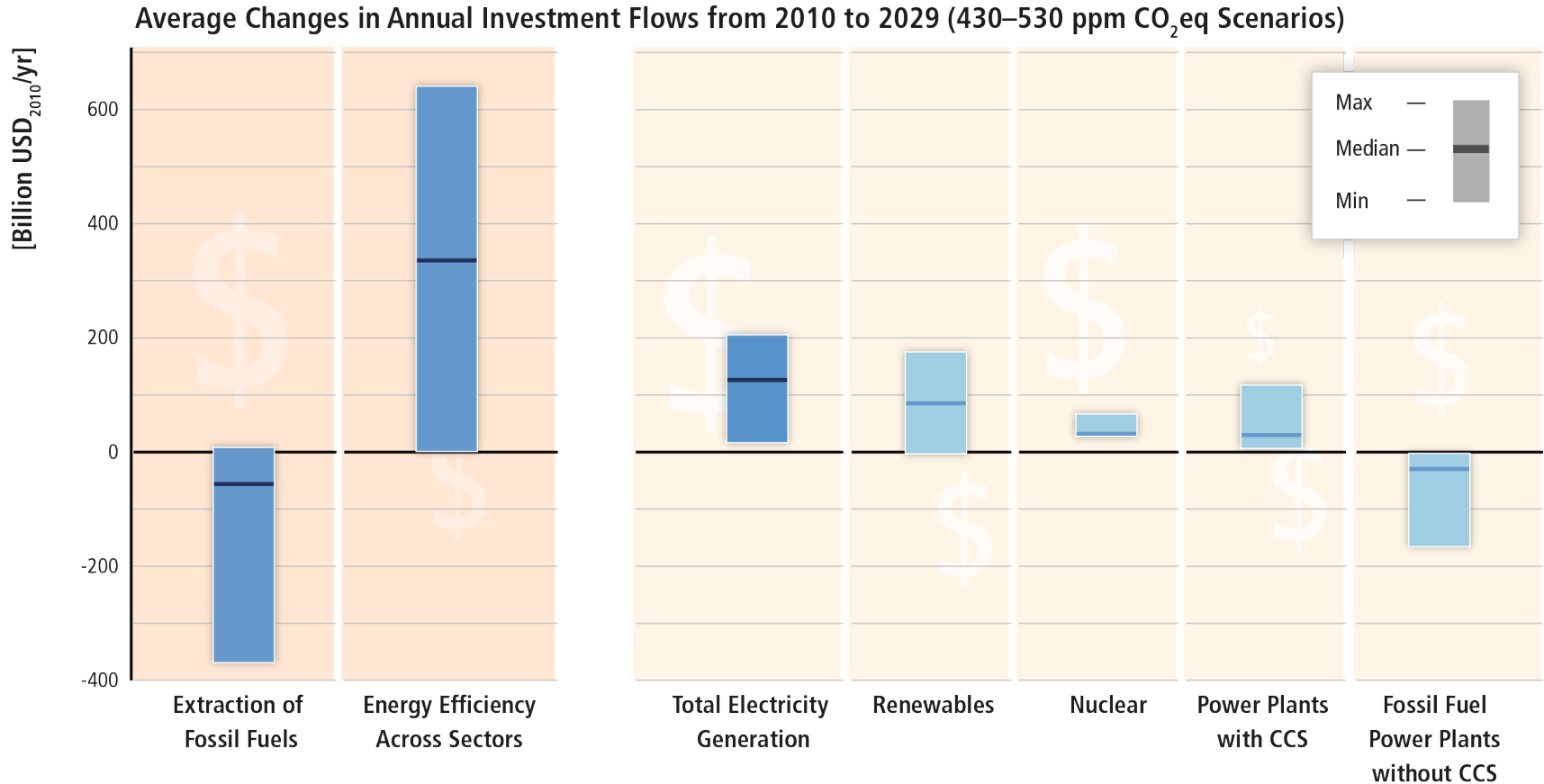
¹ Levelized cost of conserved carbon; calculated against 2010 new gasoline (2030 optimized gasoline) for 2010 (2030) options. Mitigation cost are based on point estimates ±100 USD₂₀₁₀/tCO₂ and are highly sensitive to assumptions.

Based on Figure TS.21

A close-up photograph of a wooden gavel resting on a wooden block. The gavel is positioned diagonally across the frame. To the right of the gavel, there is a stack of papers or a book. The background is blurred, showing what appears to be a courtroom or a similar setting. The lighting is soft and even.

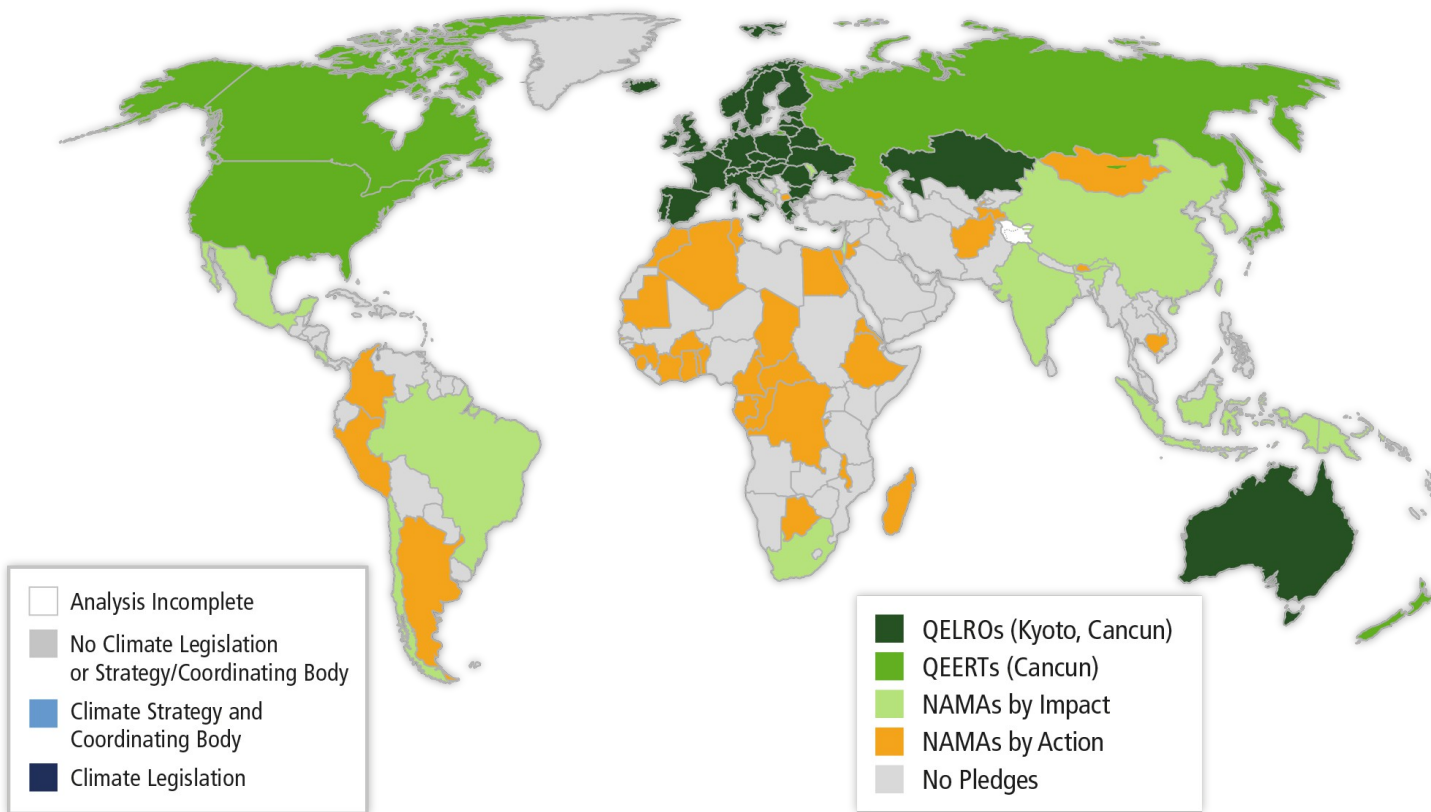
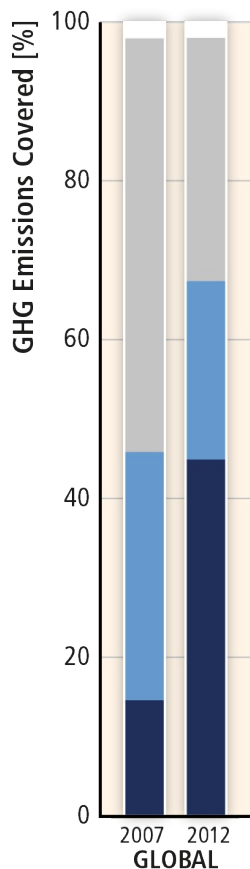
Effective mitigation will not be achieved if individual agents advance their own interests independently.

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



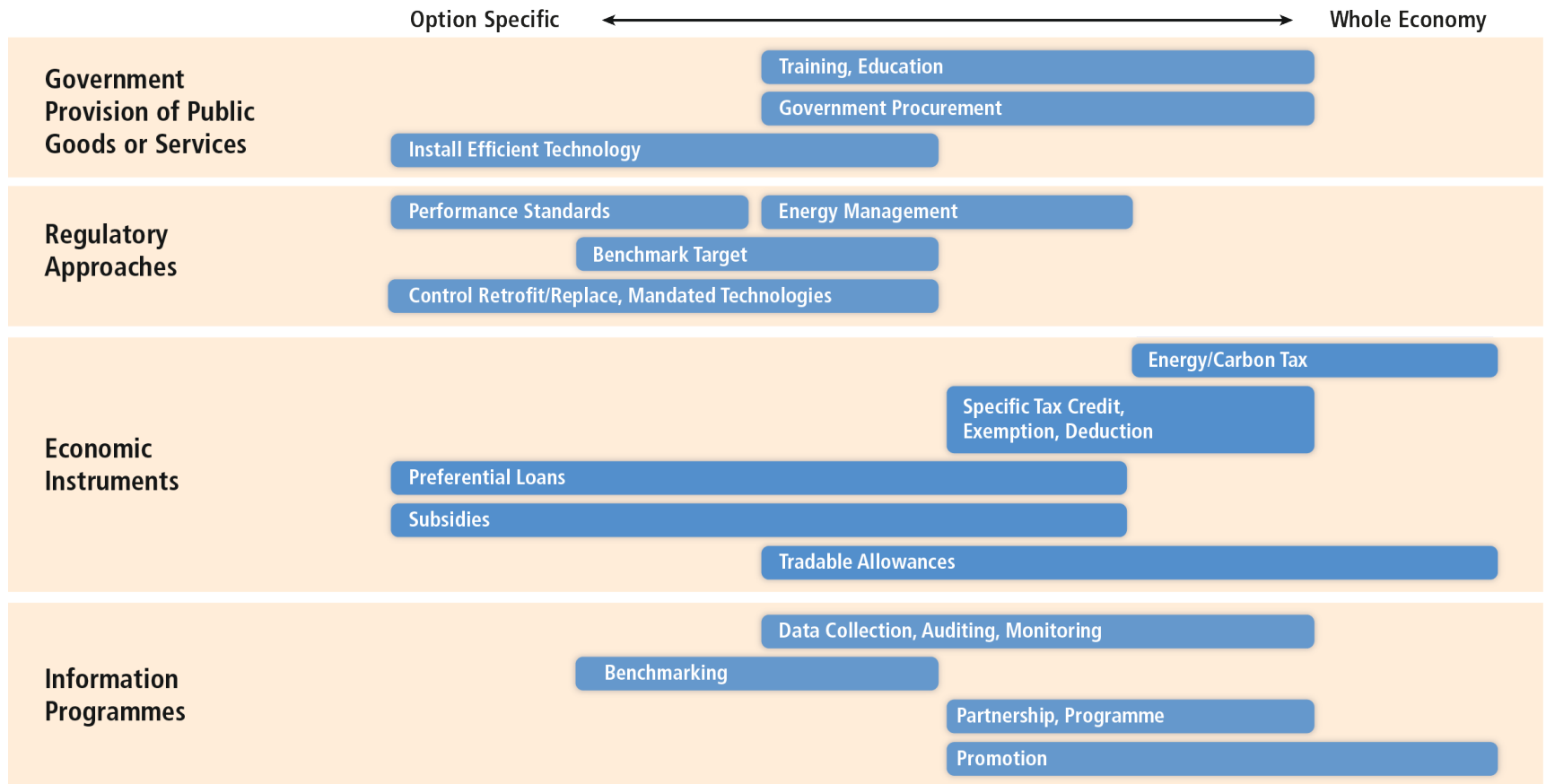
Based on Figure 16.3

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



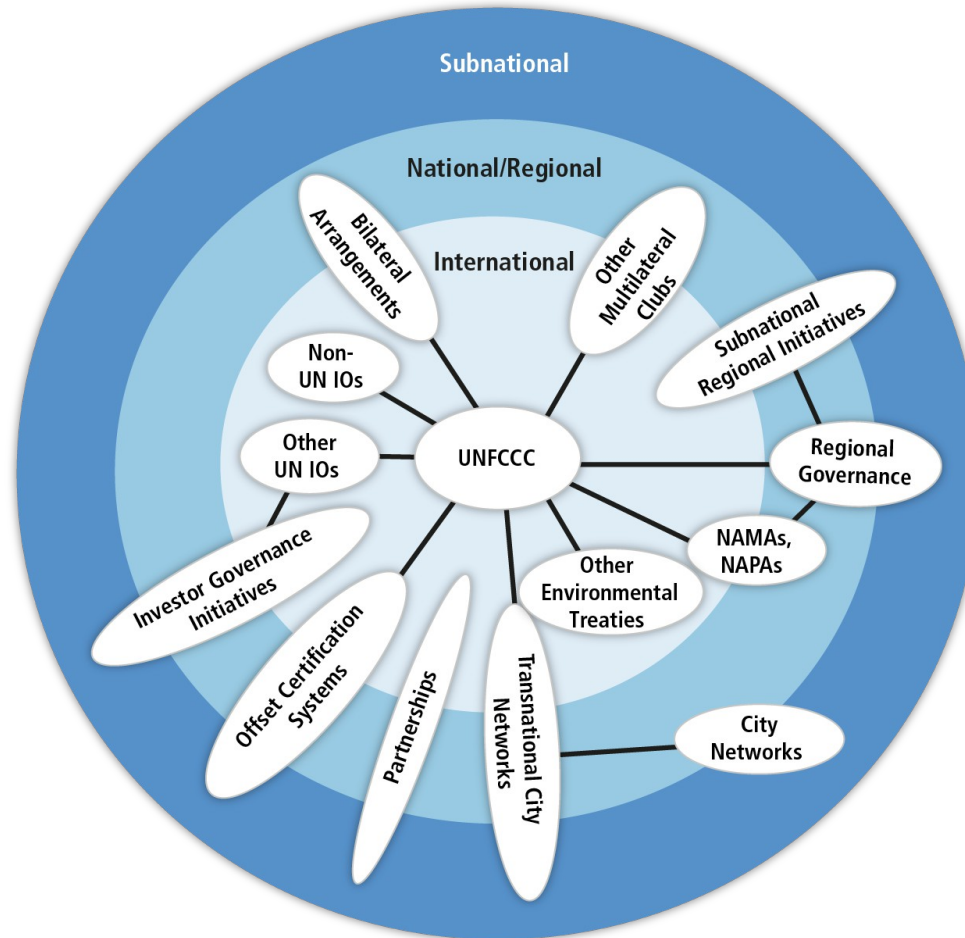
Based on Figures 15.1 and 13.3

Sector-specific policies have been more widely used than economy-wide policies.



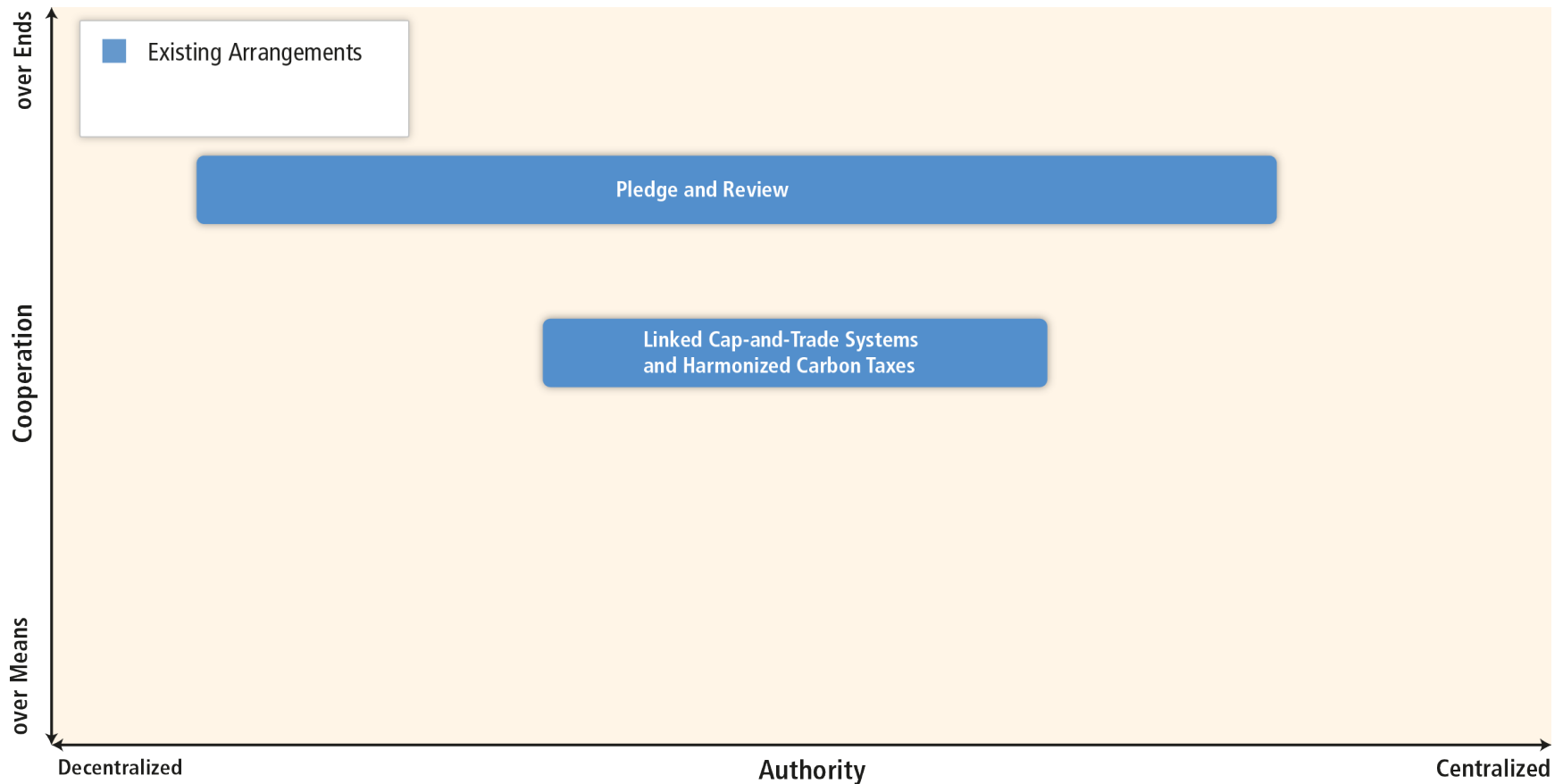
Based on Figure 10.15

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



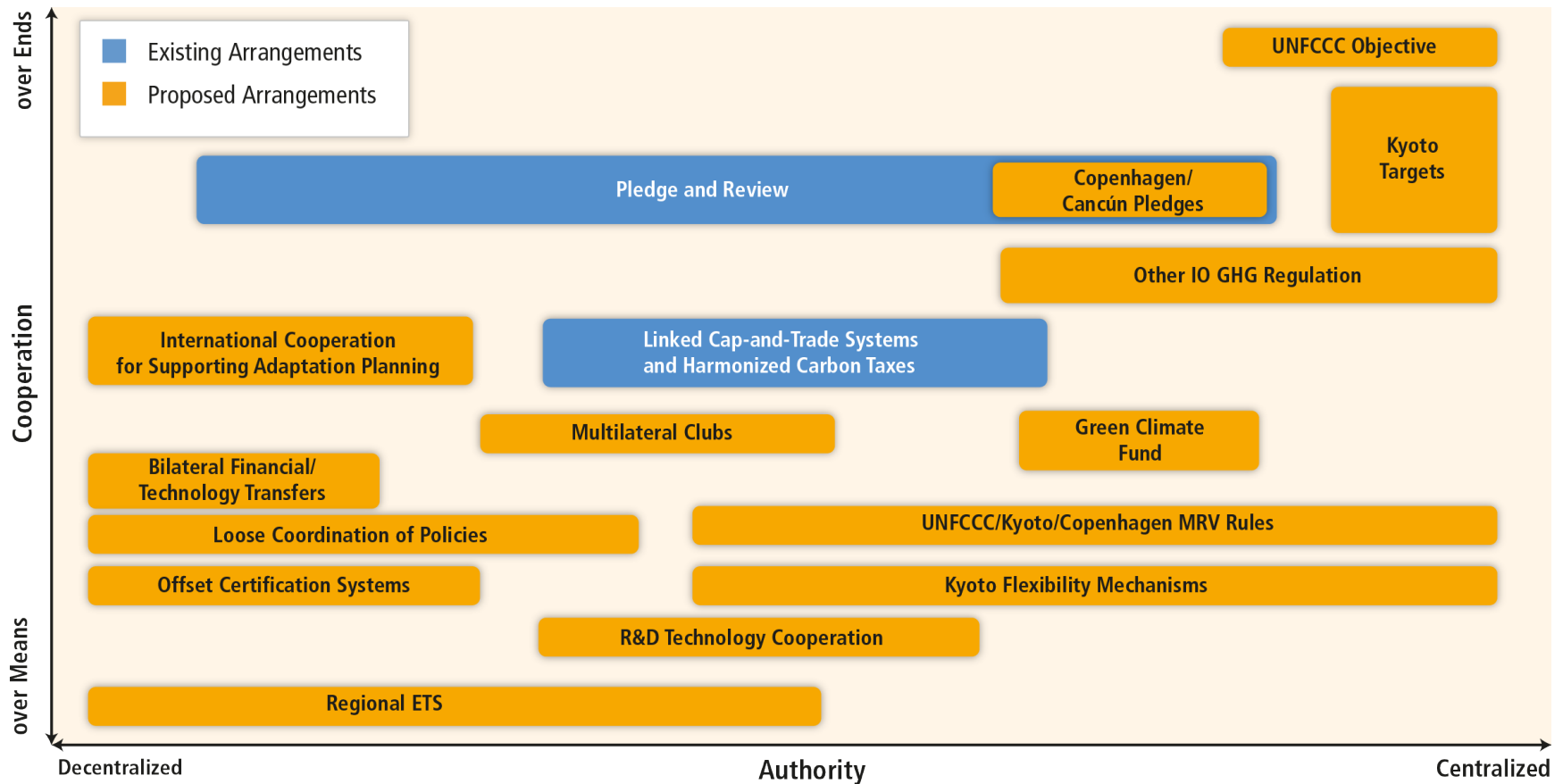
Based on Figure 13.1

International cooperation can focus on the ends or means and vary in the degree of centralization.



Based on Figure 13.2

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



Based on Figure 13.2

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