

Mitigation of Climate Change Key Insights from IPCC AR5

Keywan Riahi

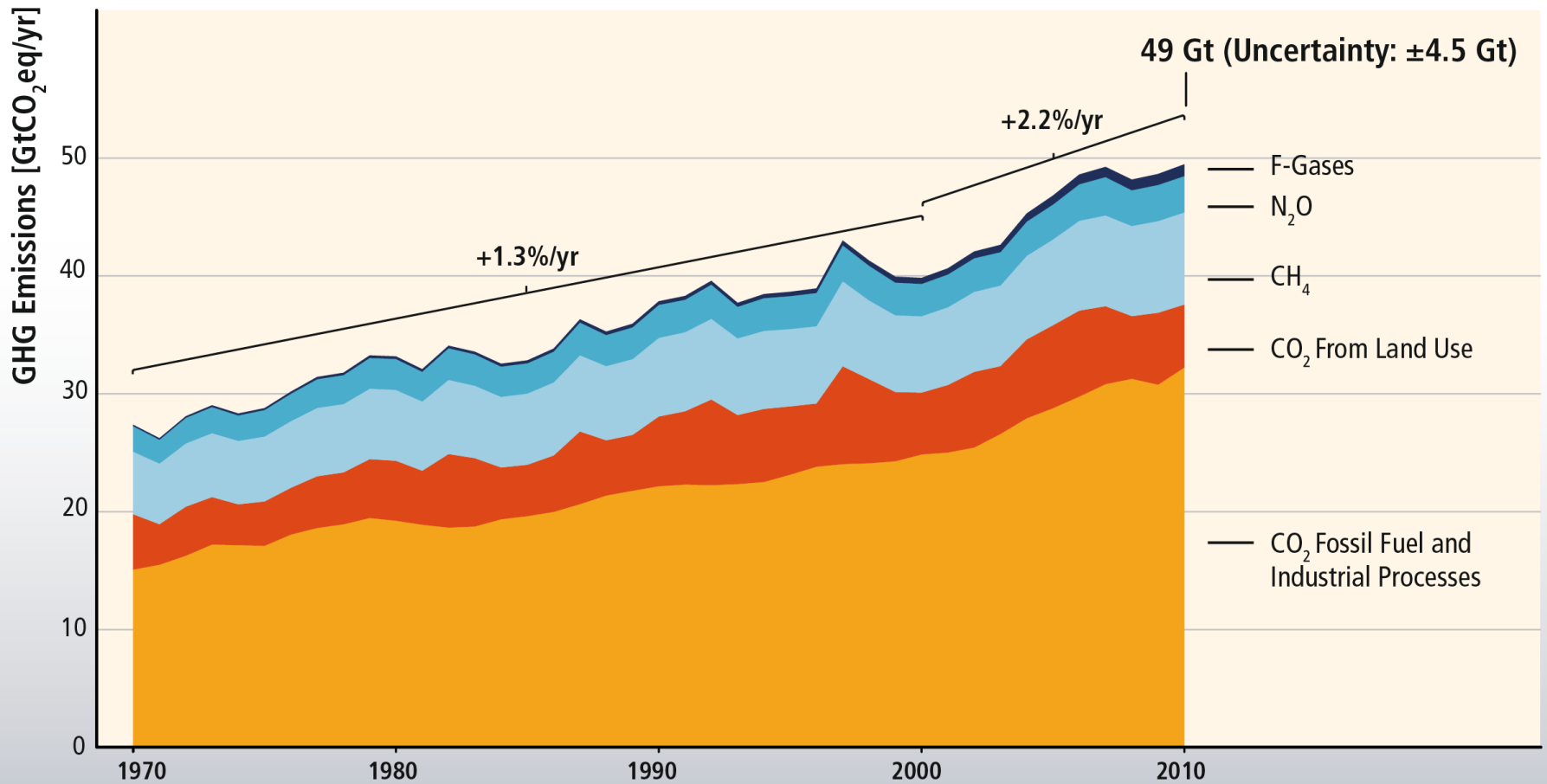
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*Osterreichische Akademie der Wissenschaften
Wien, 24 November 2014*

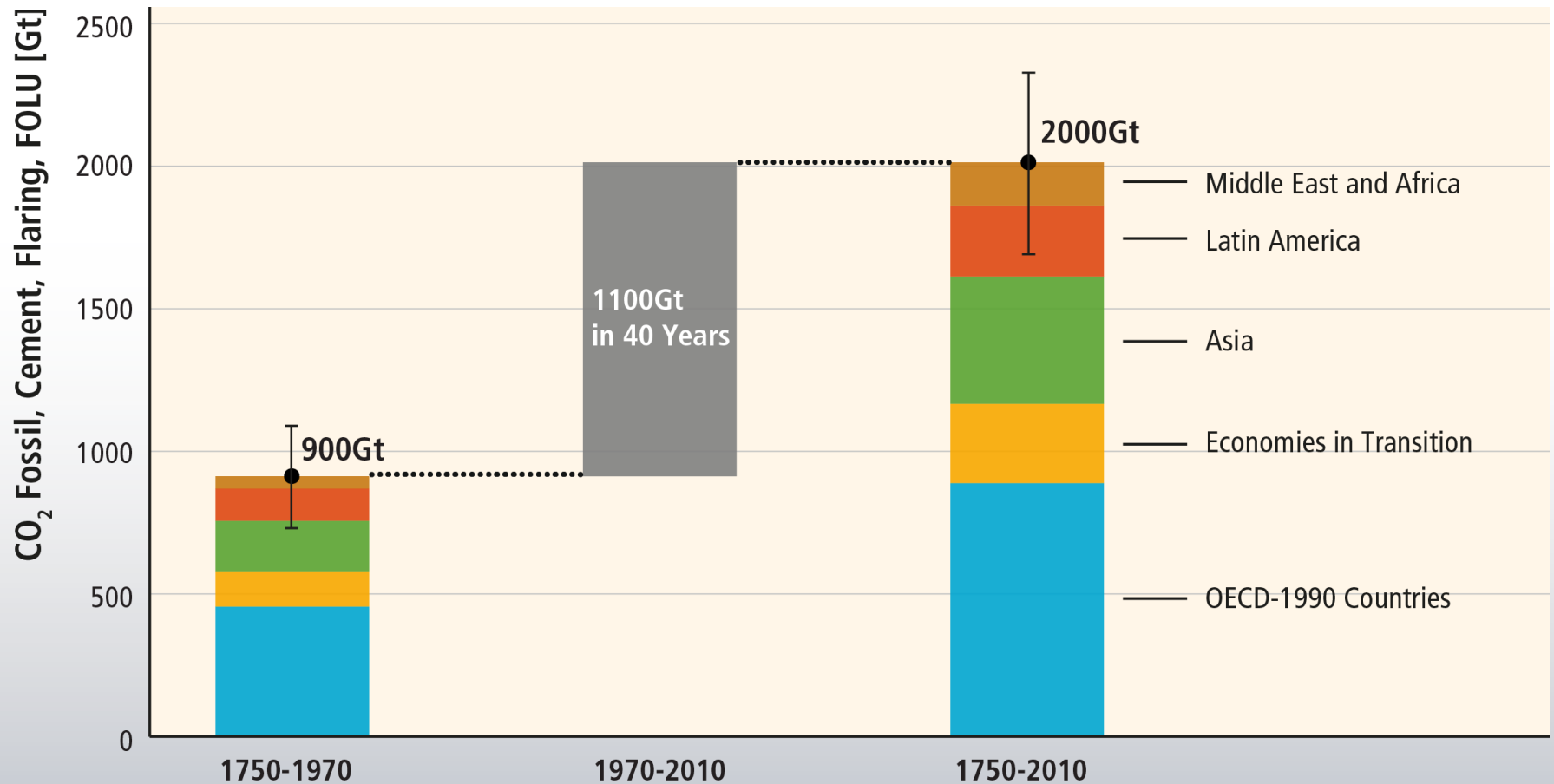
An aerial photograph of a dense urban landscape, likely a major city like Shanghai, featuring a complex multi-level highway interchange in the foreground and a dense cluster of skyscrapers in the background. The image is overlaid with a semi-transparent blue filter. Centered over the image is the text "GHG emissions growth has accelerated despite reduction efforts." in a white, bold, sans-serif font.

GHG emissions growth has accelerated despite reduction efforts.

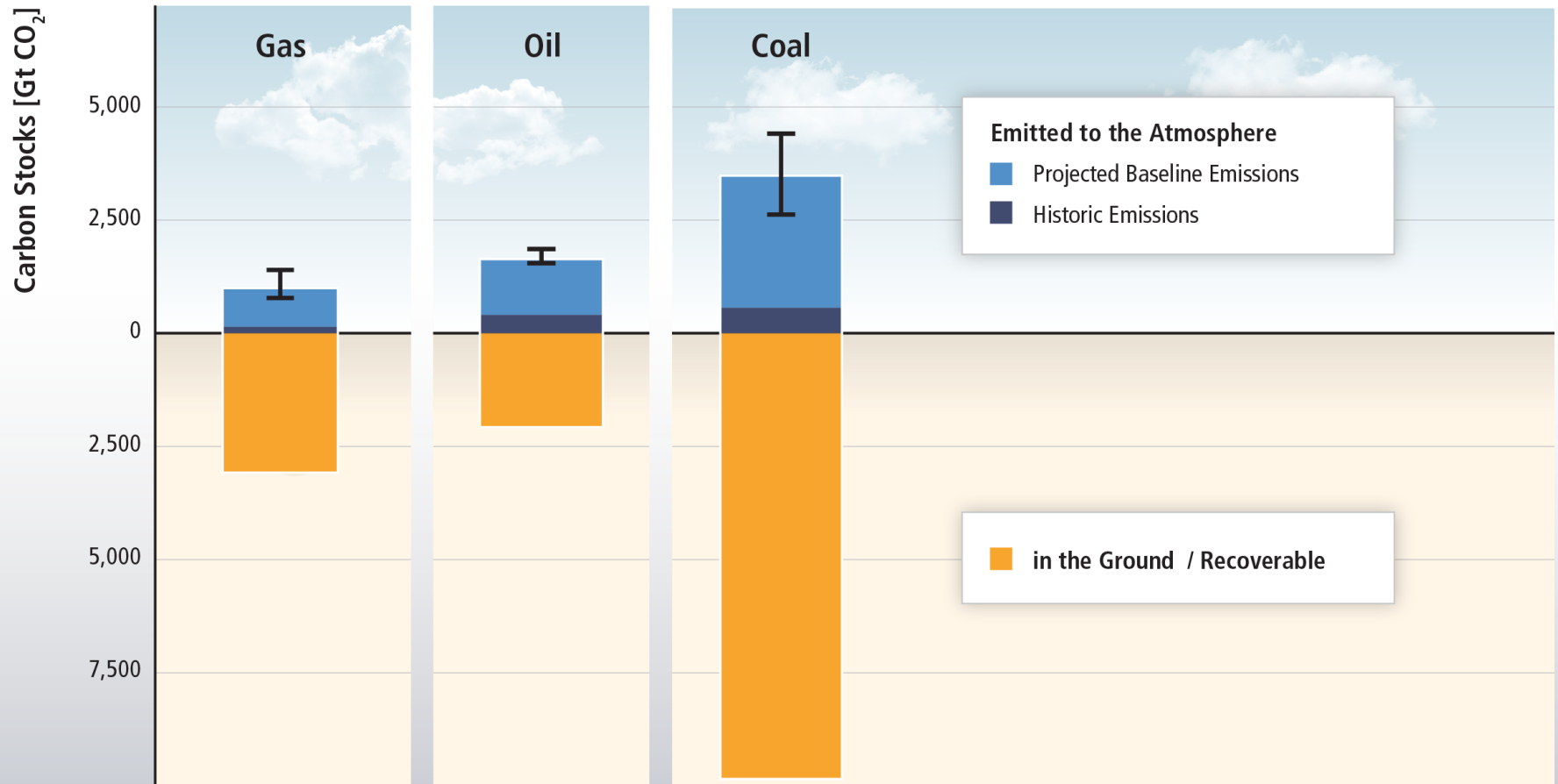
Most emission growth is CO₂ from fossil fuel combustion.



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



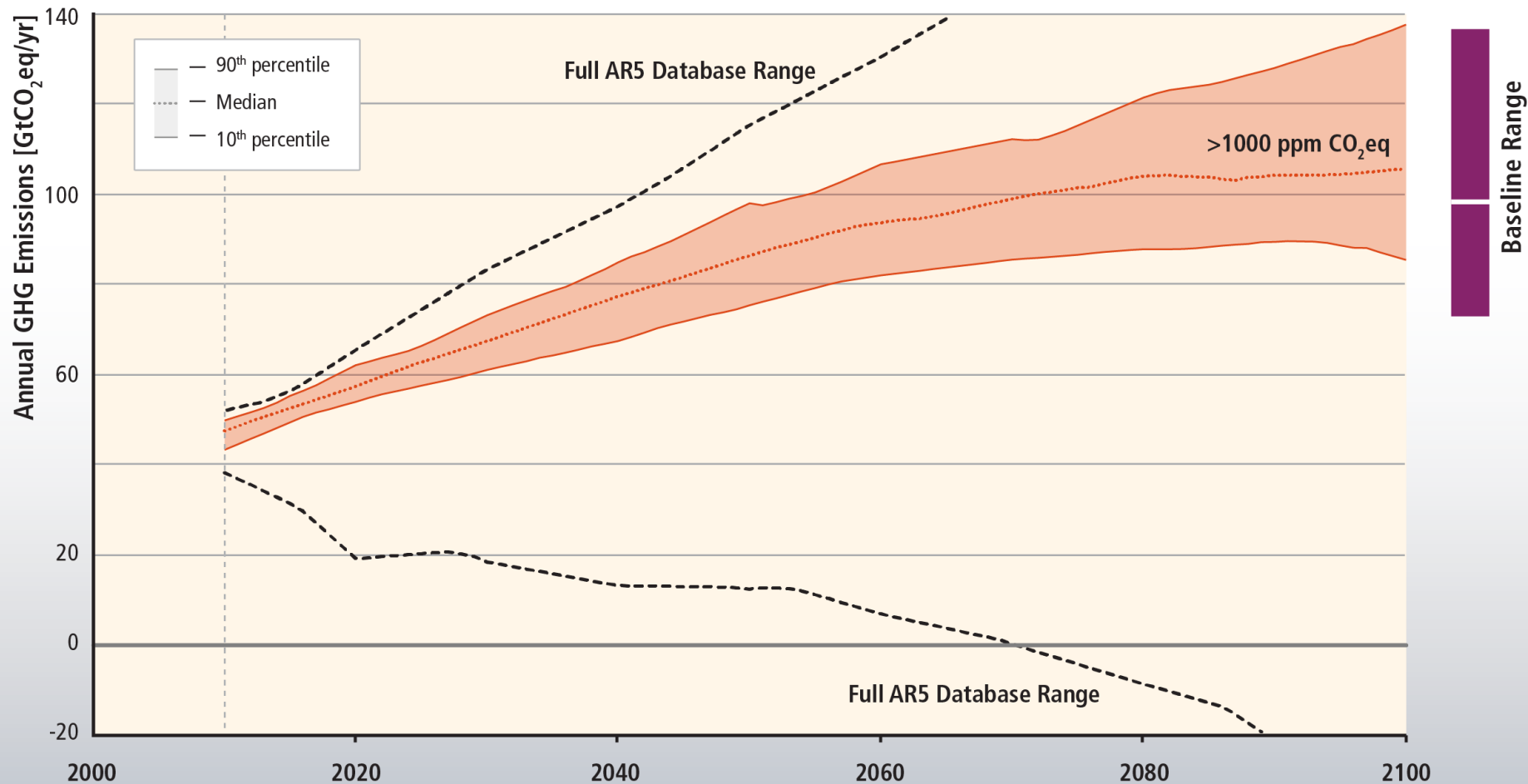
There is far more carbon in the ground than emitted in any baseline scenario.



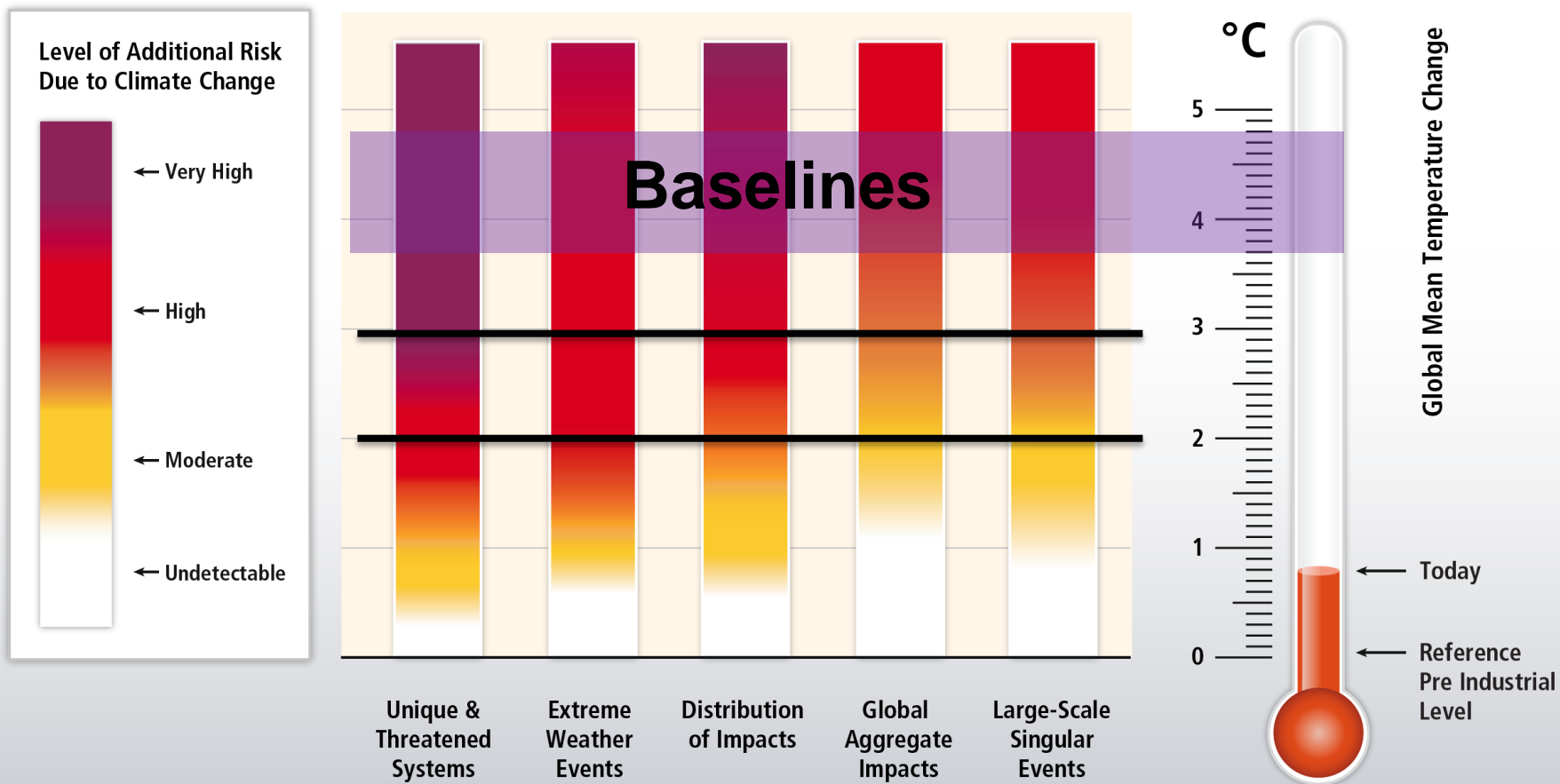
An aerial photograph of a dense urban landscape, likely a major city in East Asia, featuring a complex multi-level highway interchange in the foreground and a dense cluster of high-rise buildings in the background. The sky is a deep, overcast blue. Overlaid on the center of the image is a white text message.

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

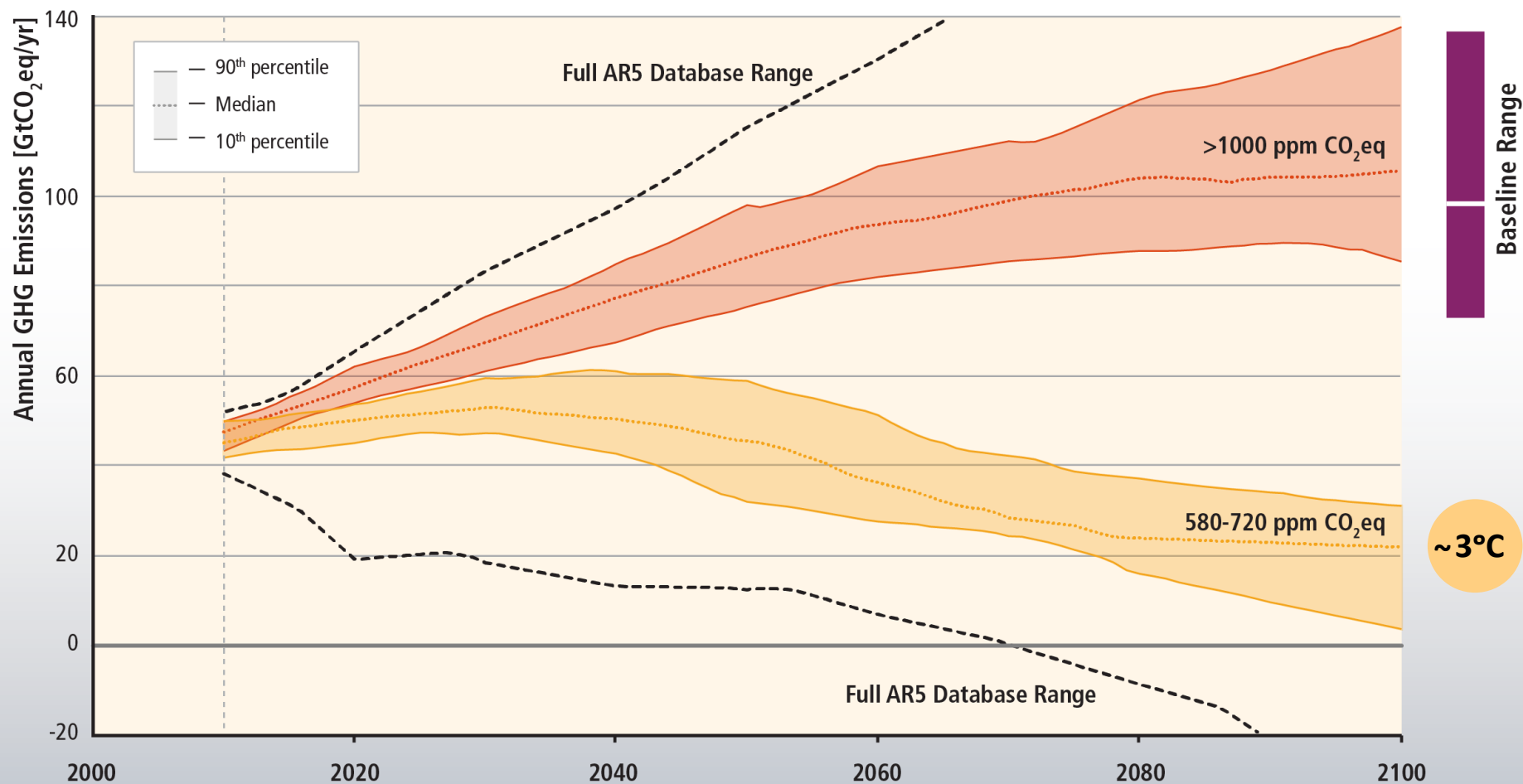
Without additional mitigation, GHG emissions continue to increase by a factor of about two compared to today.



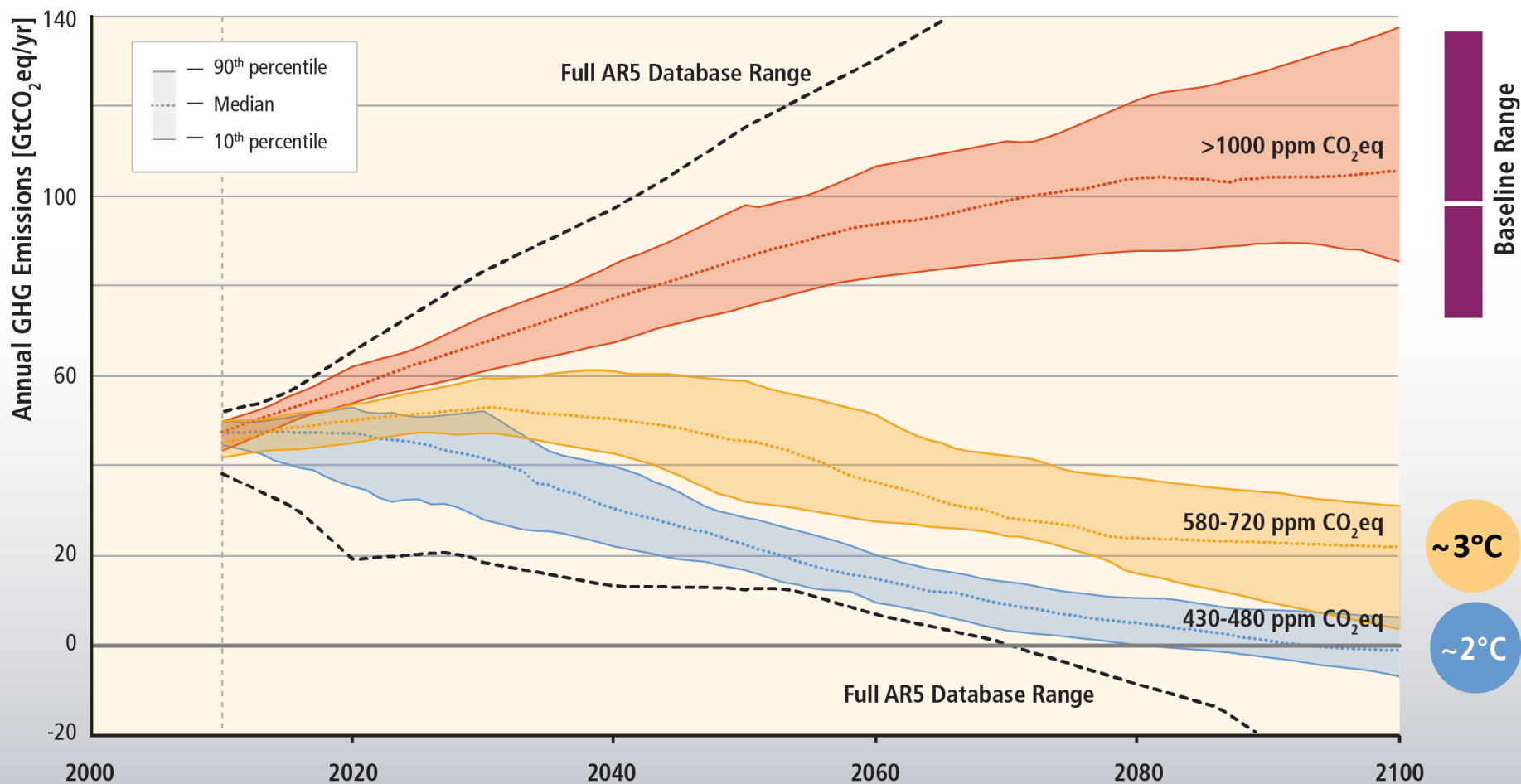
Without additional mitigation, global mean surface temperature is projected to increase by 3.7 to 4.8°C over the 21st century.



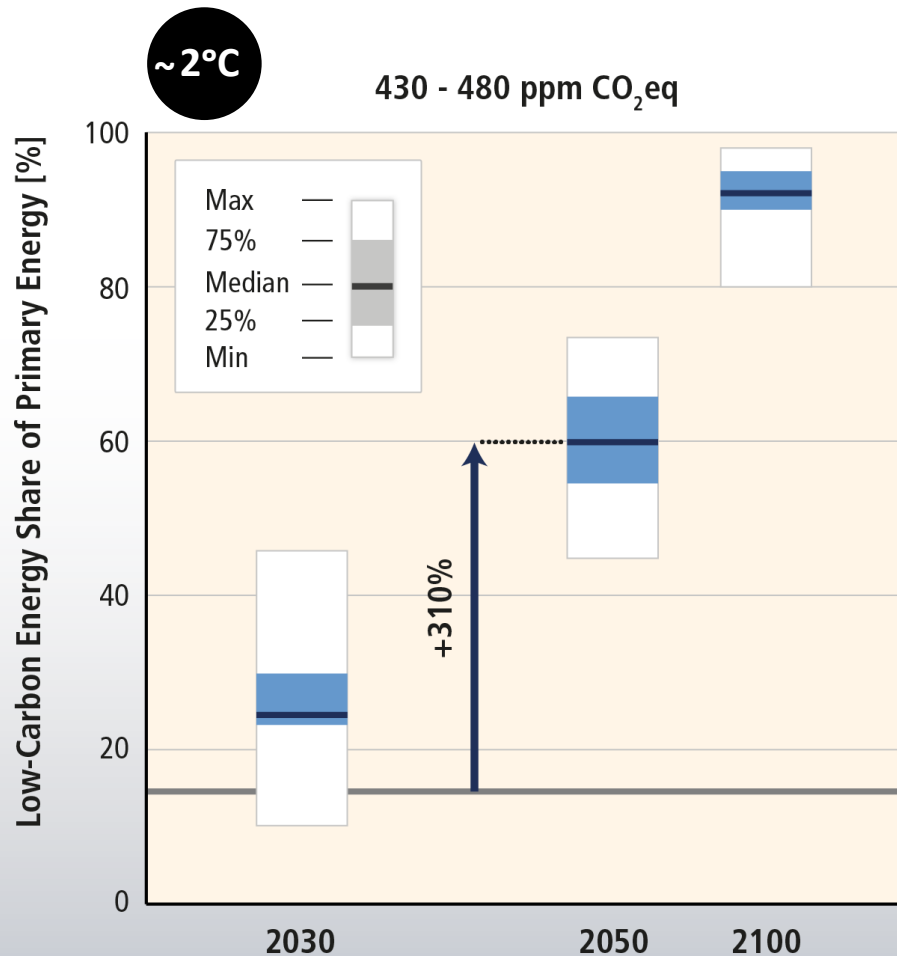
Stabilization of atmospheric concentrations requires moving away from the baseline – regardless of the mitigation goal.



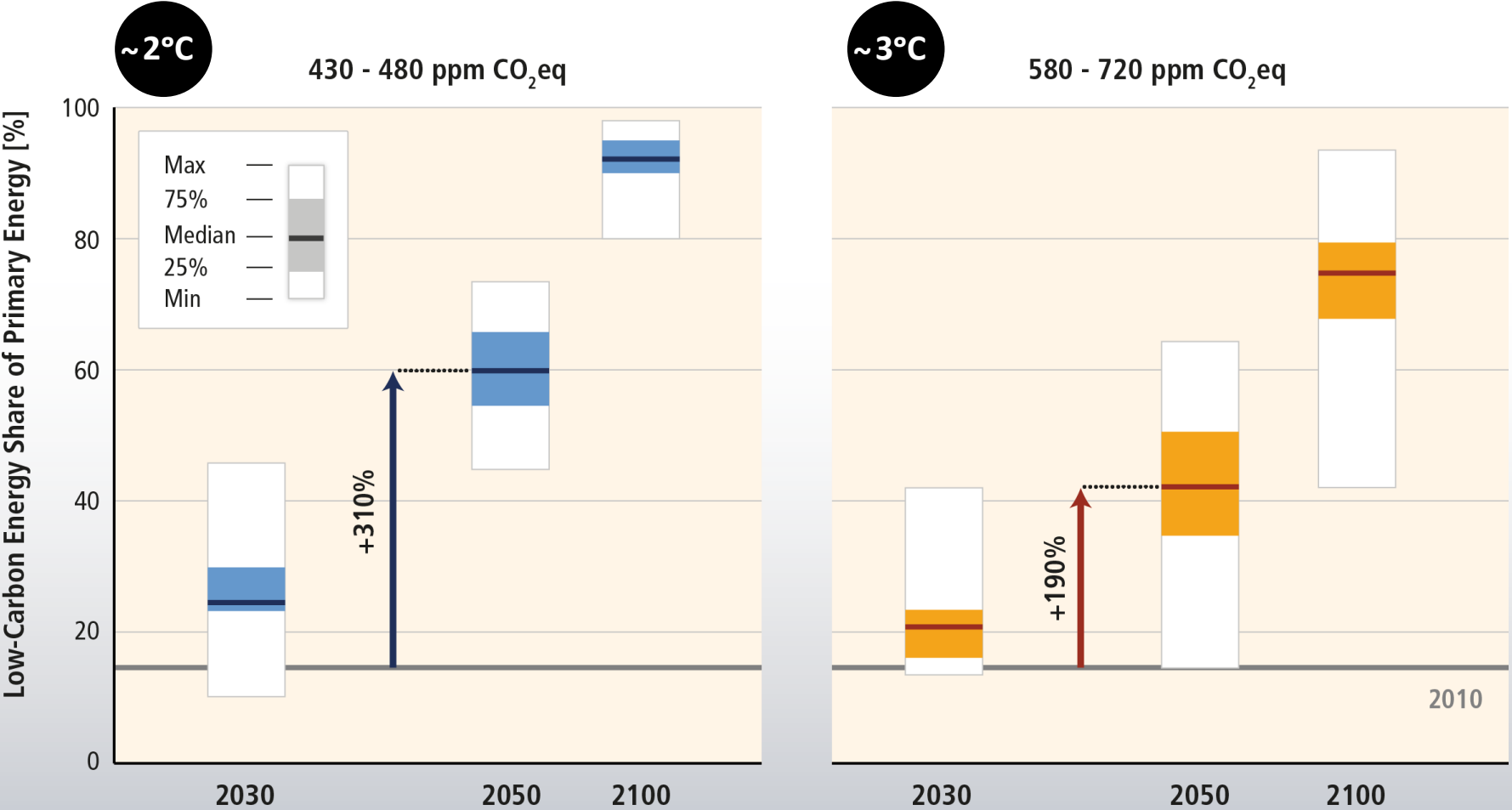
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Mitigation involves substantial upscaling of low-carbon energy.



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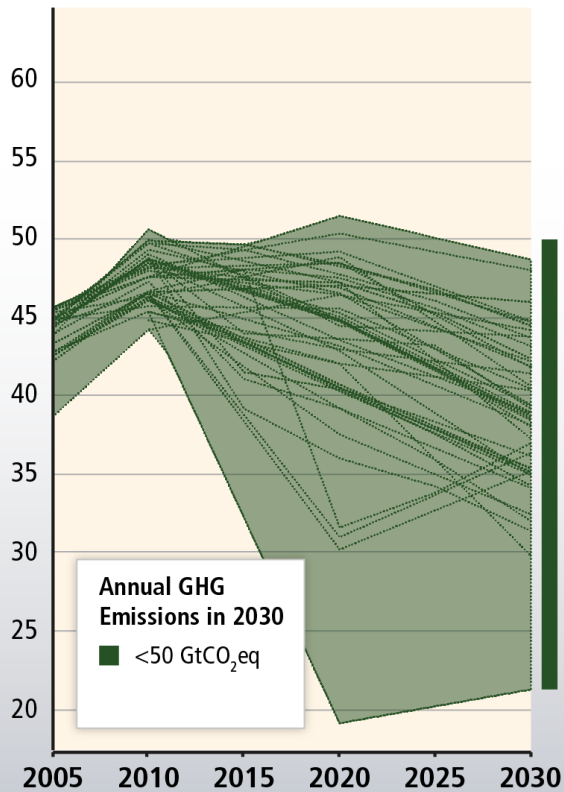
An aerial photograph of a dense urban landscape, likely a major city in Asia. The foreground is dominated by a complex, multi-level highway interchange with several overpasses and ramps. The middle ground is filled with a dense cluster of high-rise buildings, including residential towers and commercial skyscrapers. The background shows a vast cityscape extending to the horizon under a blue sky with scattered white clouds. The overall image has a slightly desaturated, blue-tinted appearance.

**Actions over the next 5-15 years
will be critical**

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

Before 2030

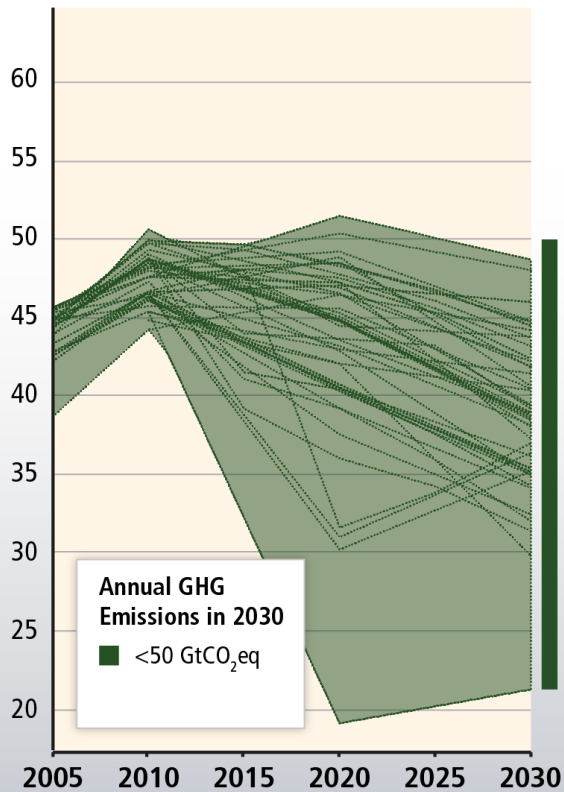
GHG Emissions Pathways [GtCO₂eq/yr]



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

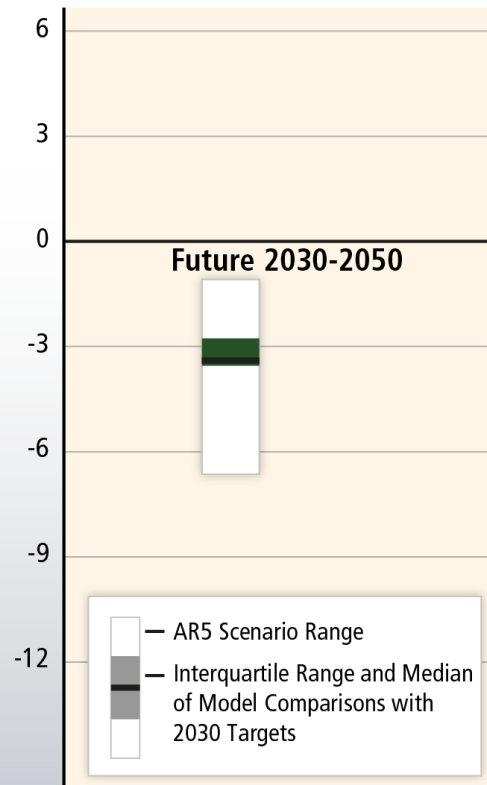
Before 2030

GHG Emissions Pathways [GtCO₂eq/yr]



After 2030

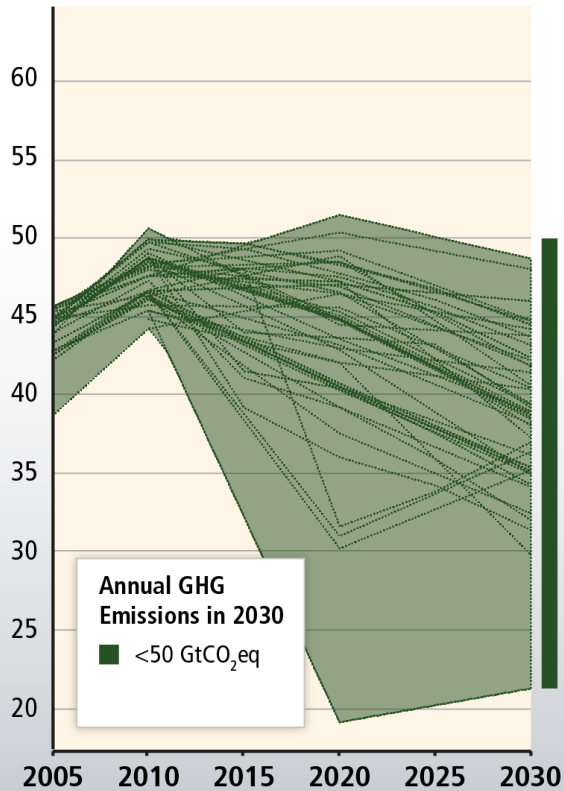
Rate of CO₂ Emission Change [%/yr]



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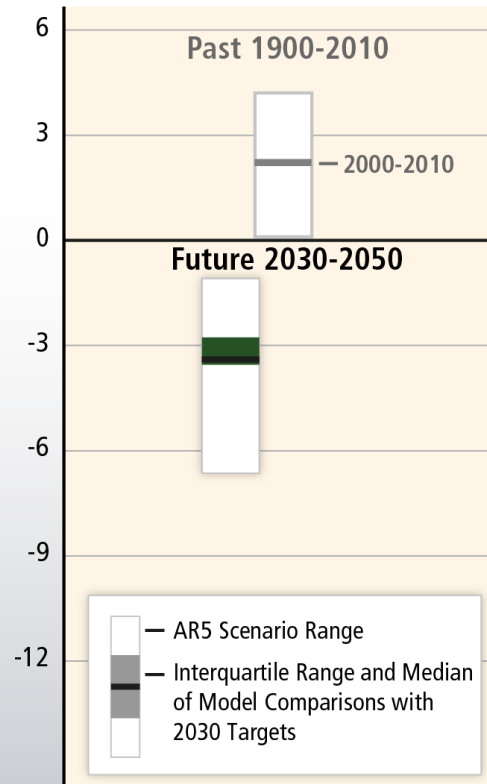
Before 2030

GHG Emissions Pathways [GtCO₂eq/yr]



After 2030

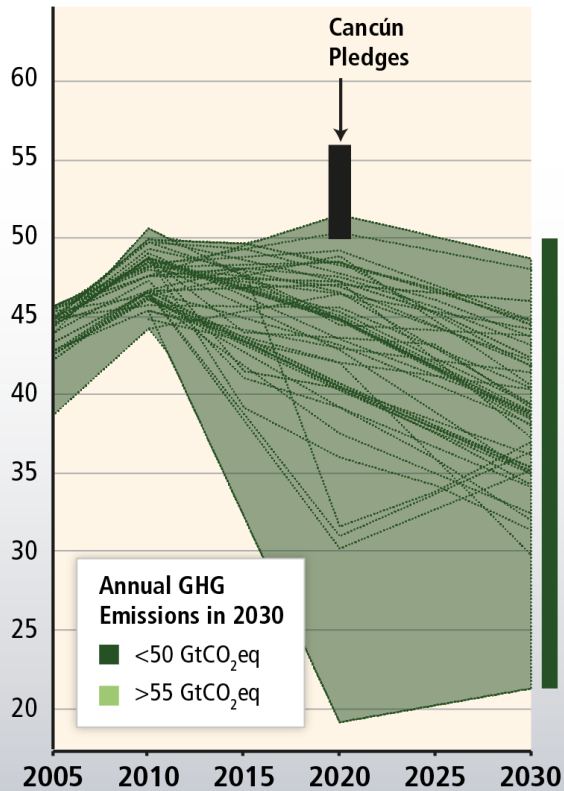
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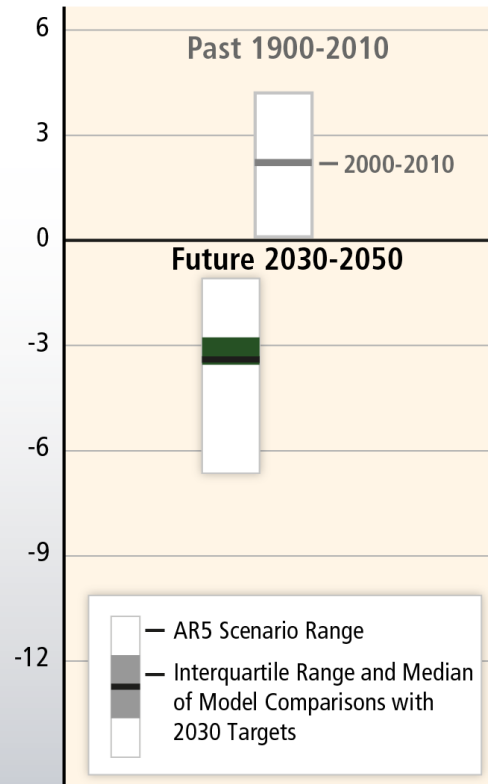
Before 2030

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After 2030

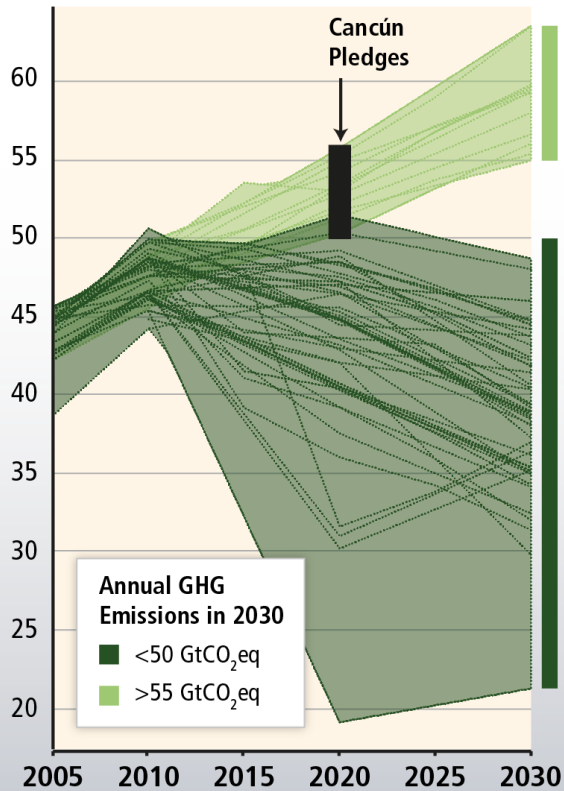
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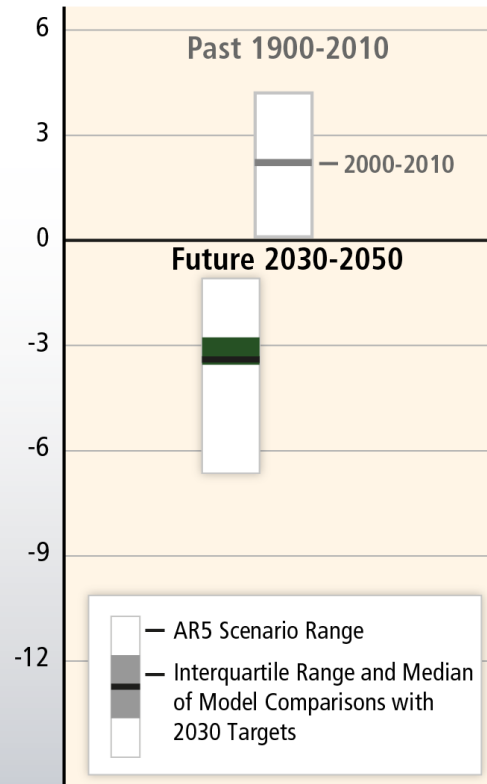
Before 2030

GHG Emissions Pathways [GtCO₂eq/yr]



After 2030

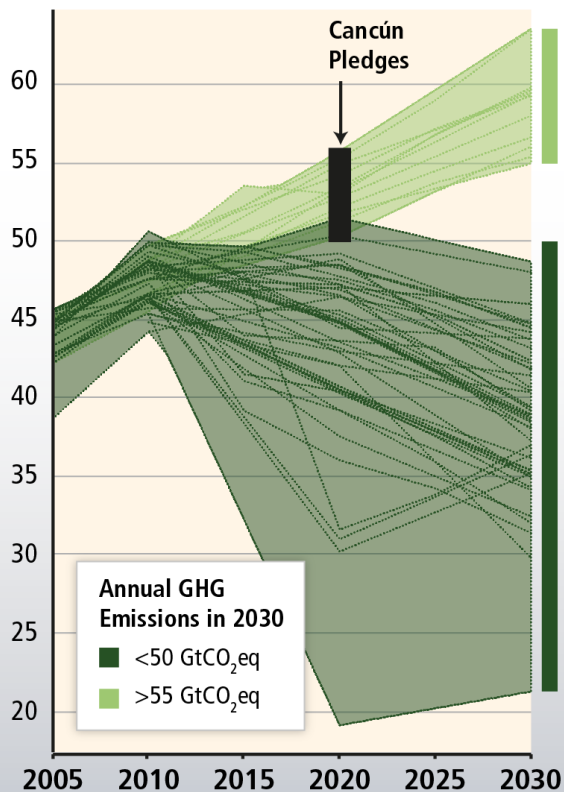
Rate of CO₂ Emission Change [%/yr]



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

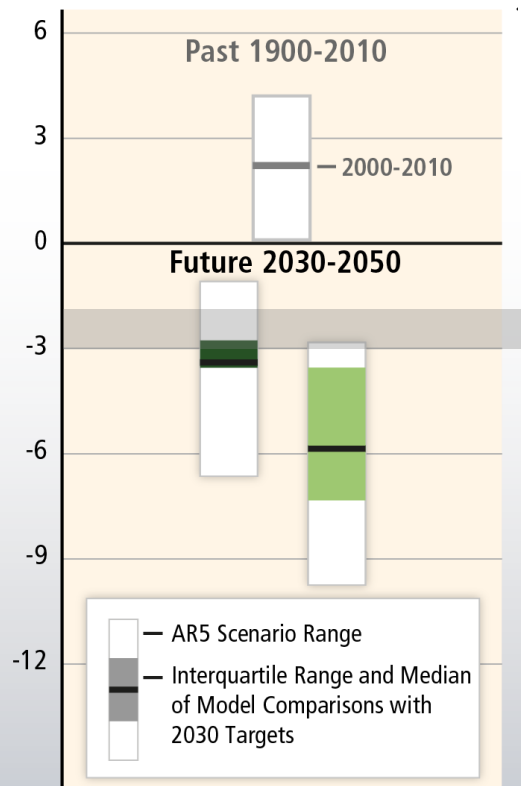
Before 2030

GHG Emissions Pathways [GtCO₂eq/yr]



After 2030

Rate of CO₂ Emission Change [%/yr]

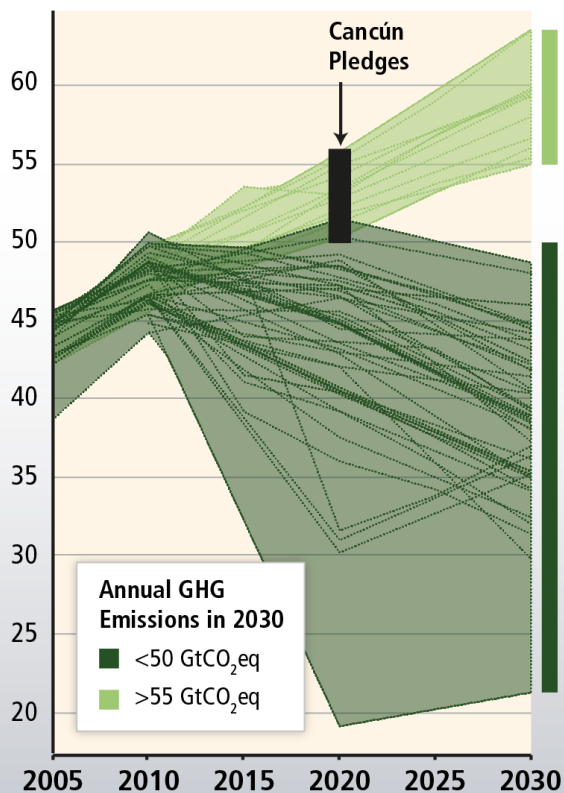


Sweden & France after the oil crisis

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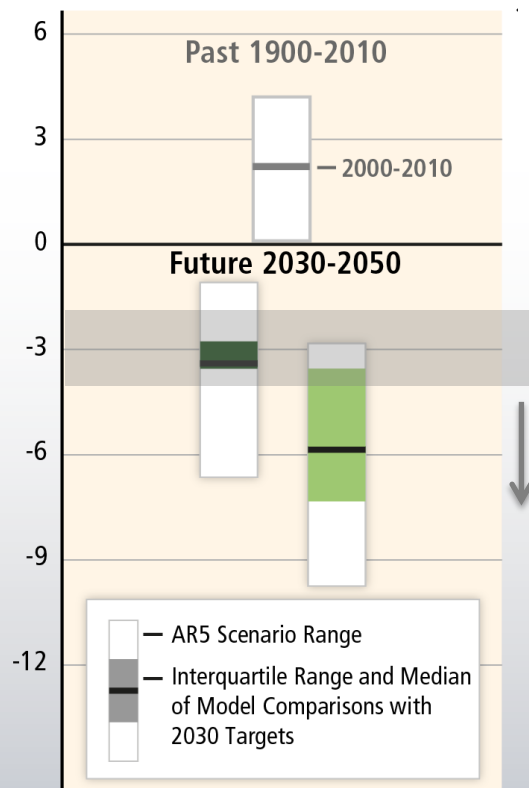
Before 2030

GHG Emissions Pathways [GtCO₂eq/yr]



After 2030

Rate of CO₂ Emission Change [%/yr]



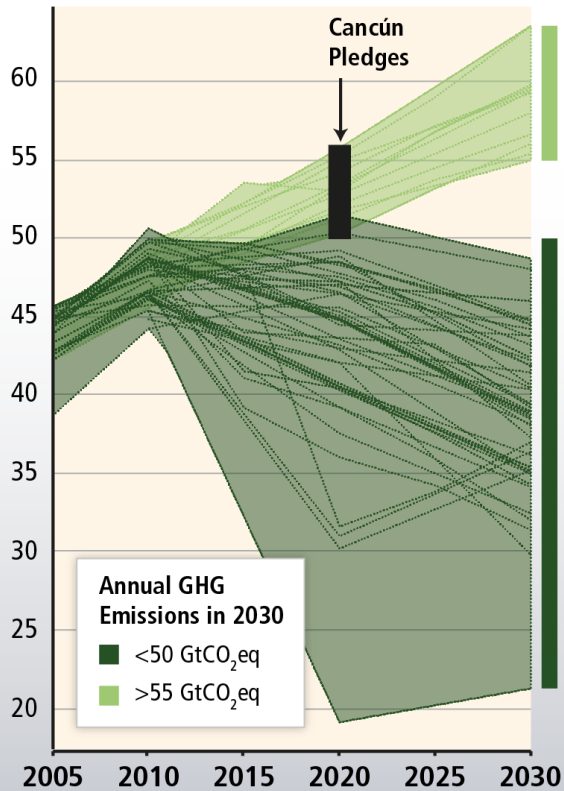
Collapse of the former Soviet Union

Europe WWI & II (>4%)

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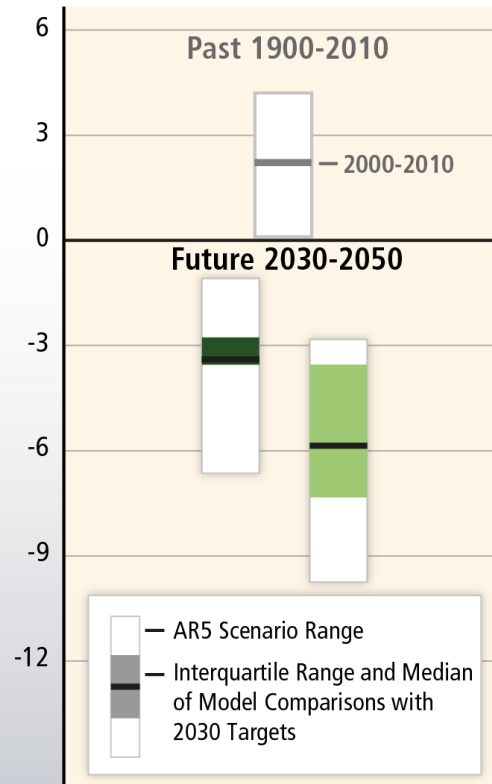
Before 2030

GHG Emissions Pathways [GtCO₂eq/yr]

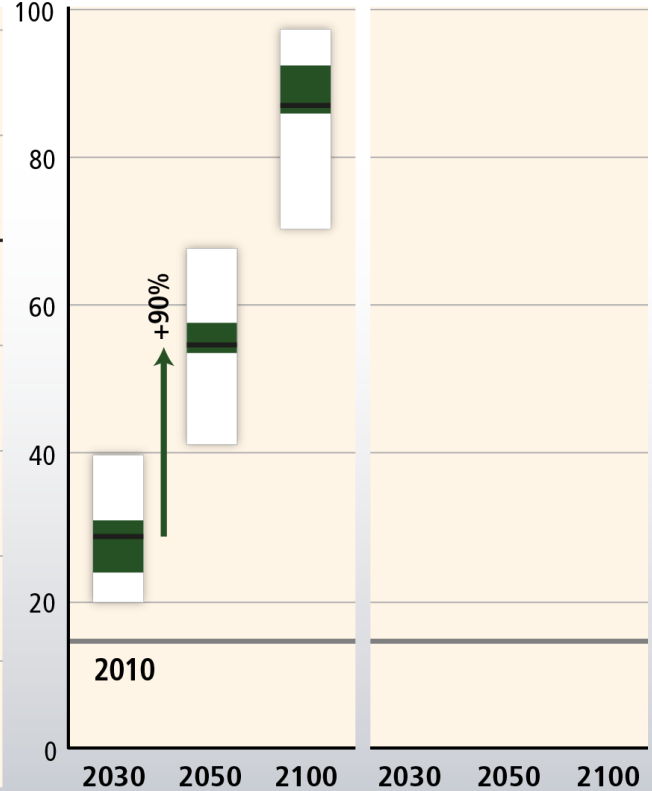


After 2030

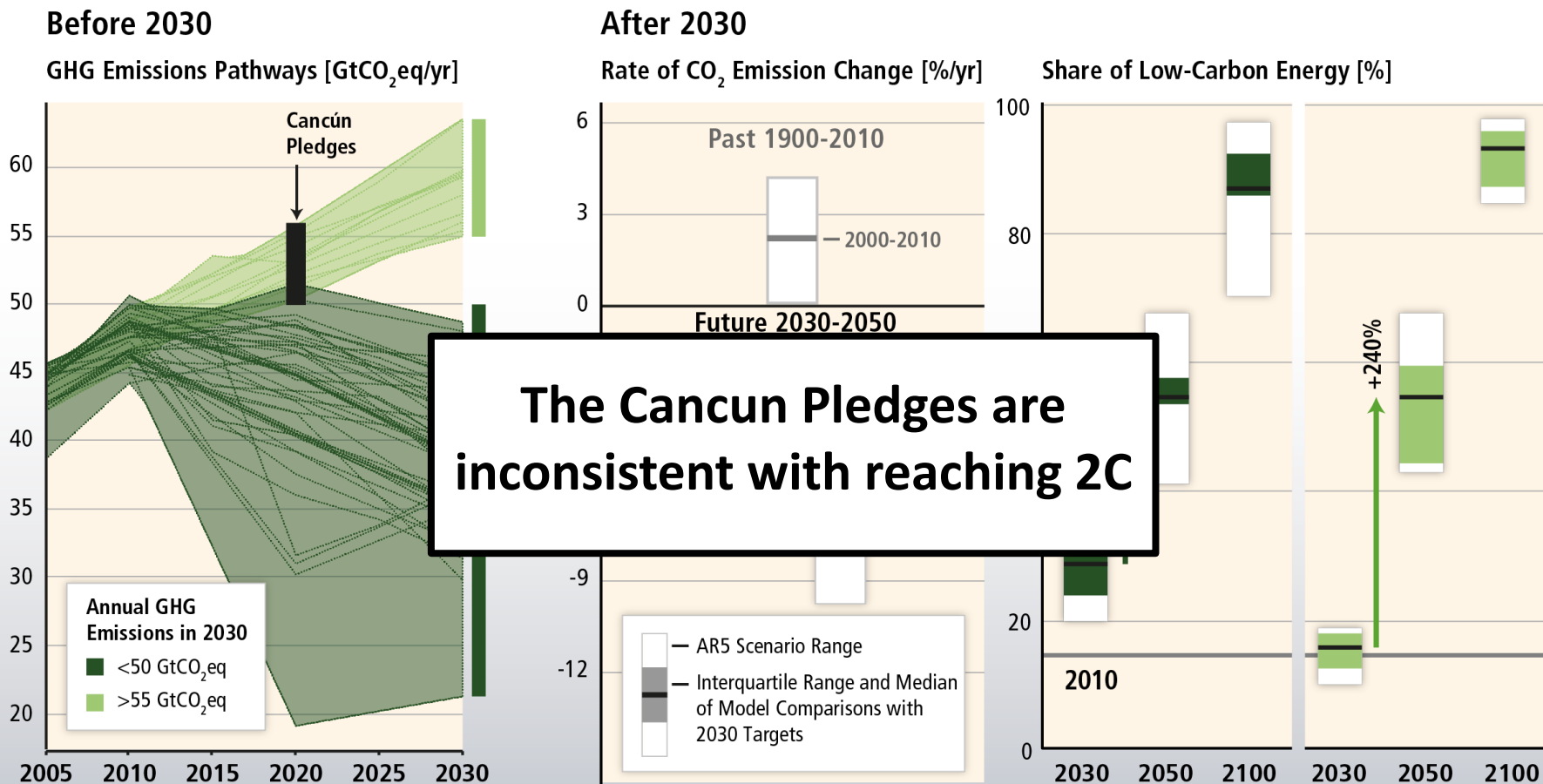
Rate of CO₂ Emission Change [%/yr]




Share of Low-Carbon Energy [%]



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

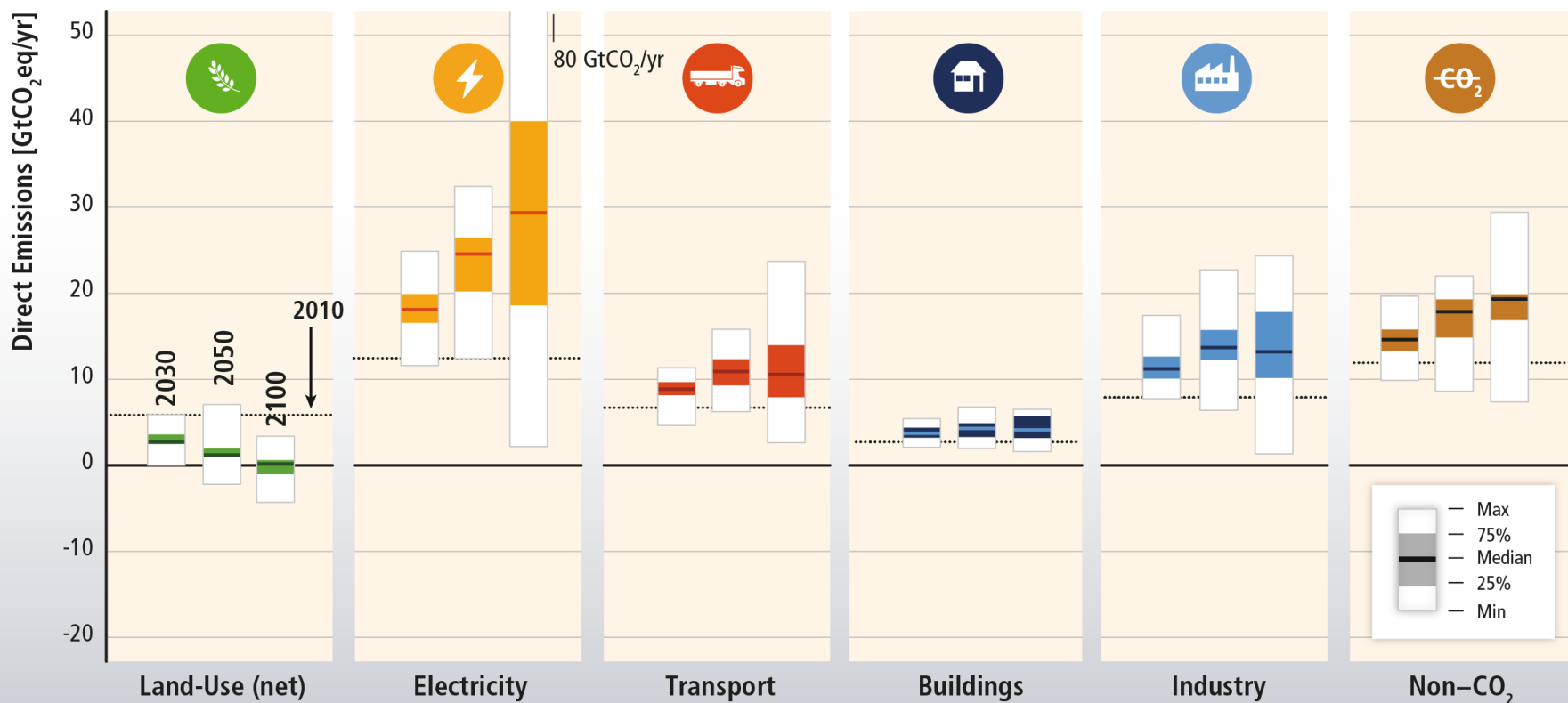




Reaching low stabilization requires rapid decarbonization of energy supply + efforts across all sectors

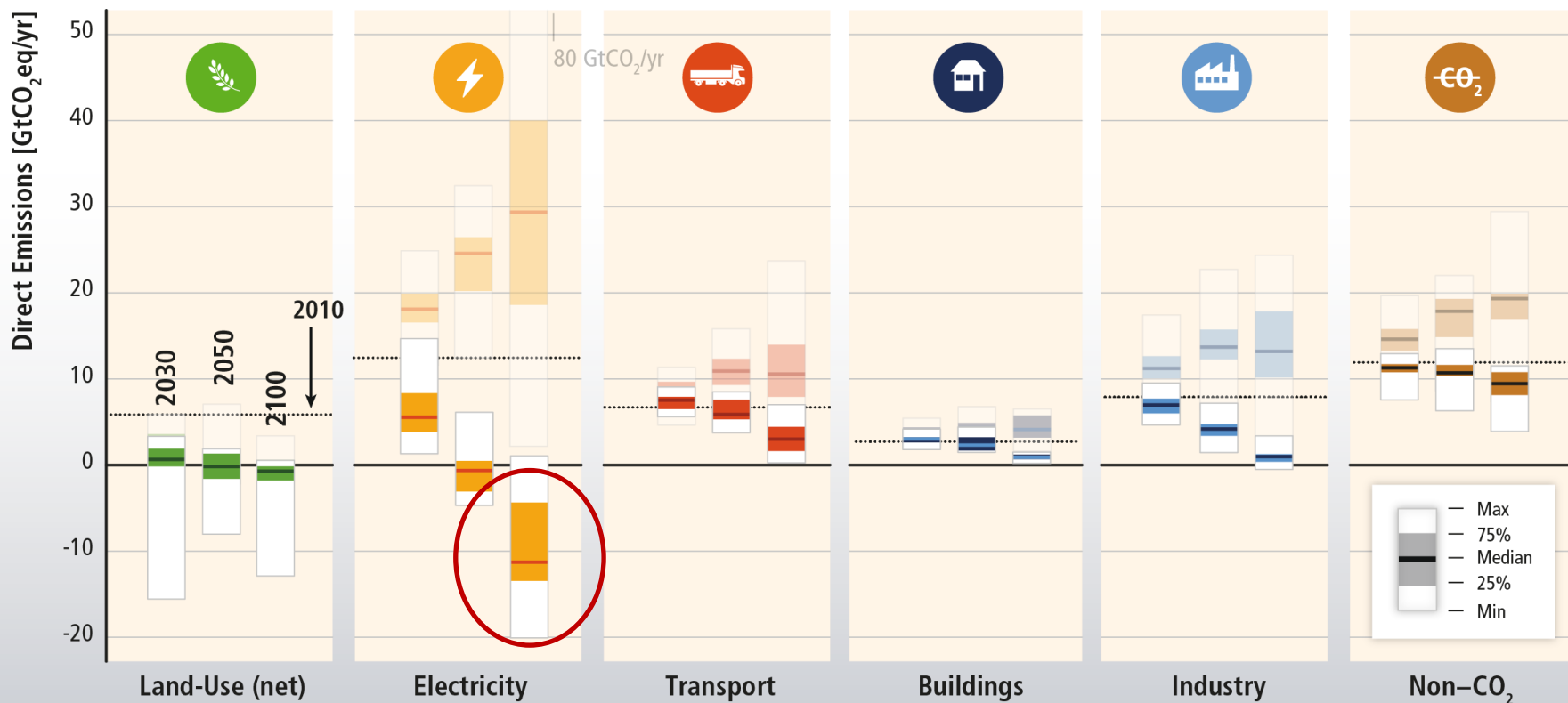
Mitigation requires changes throughout the economy. Efforts in one sector determine mitigation efforts in others.

BASELINES



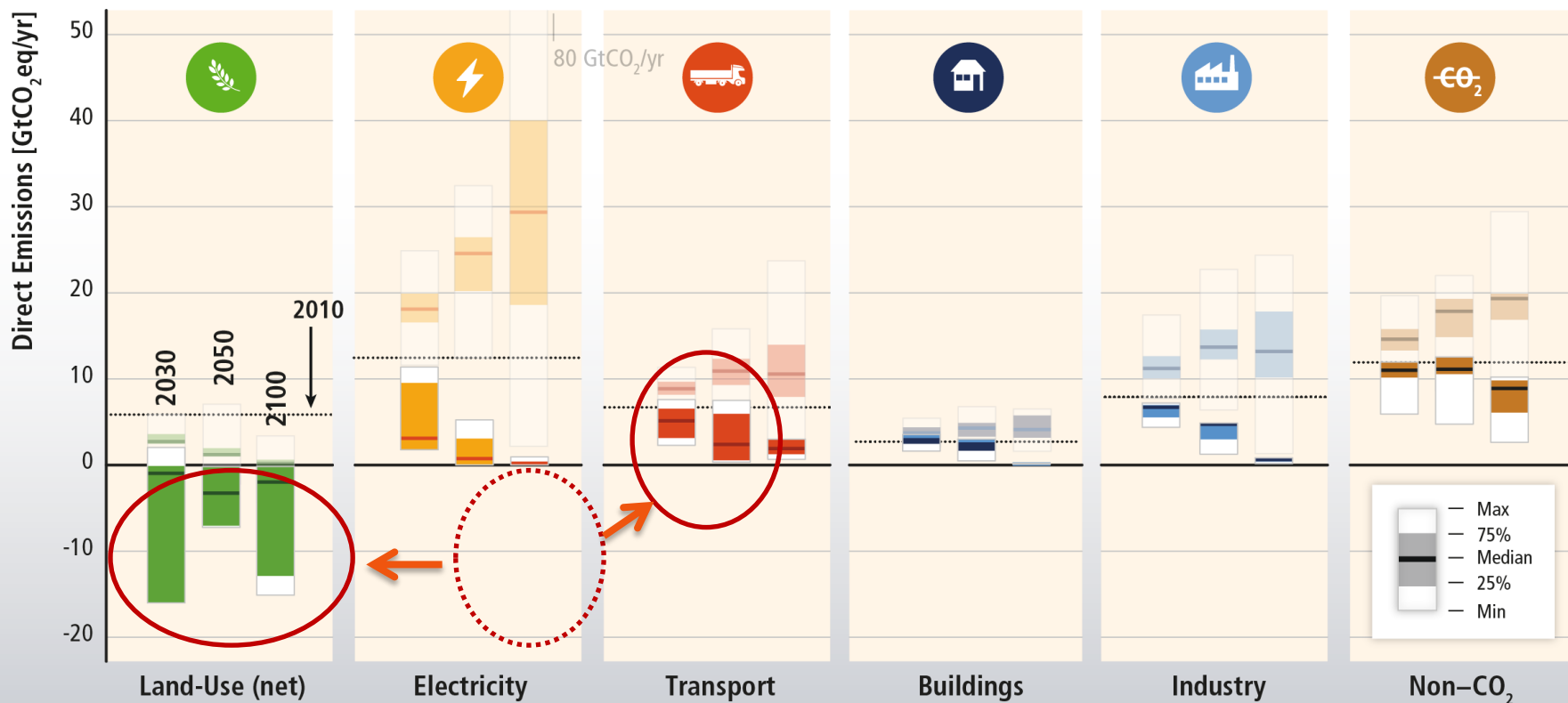
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450 ppm CO₂eq with Carbon Dioxide Capture & Storage



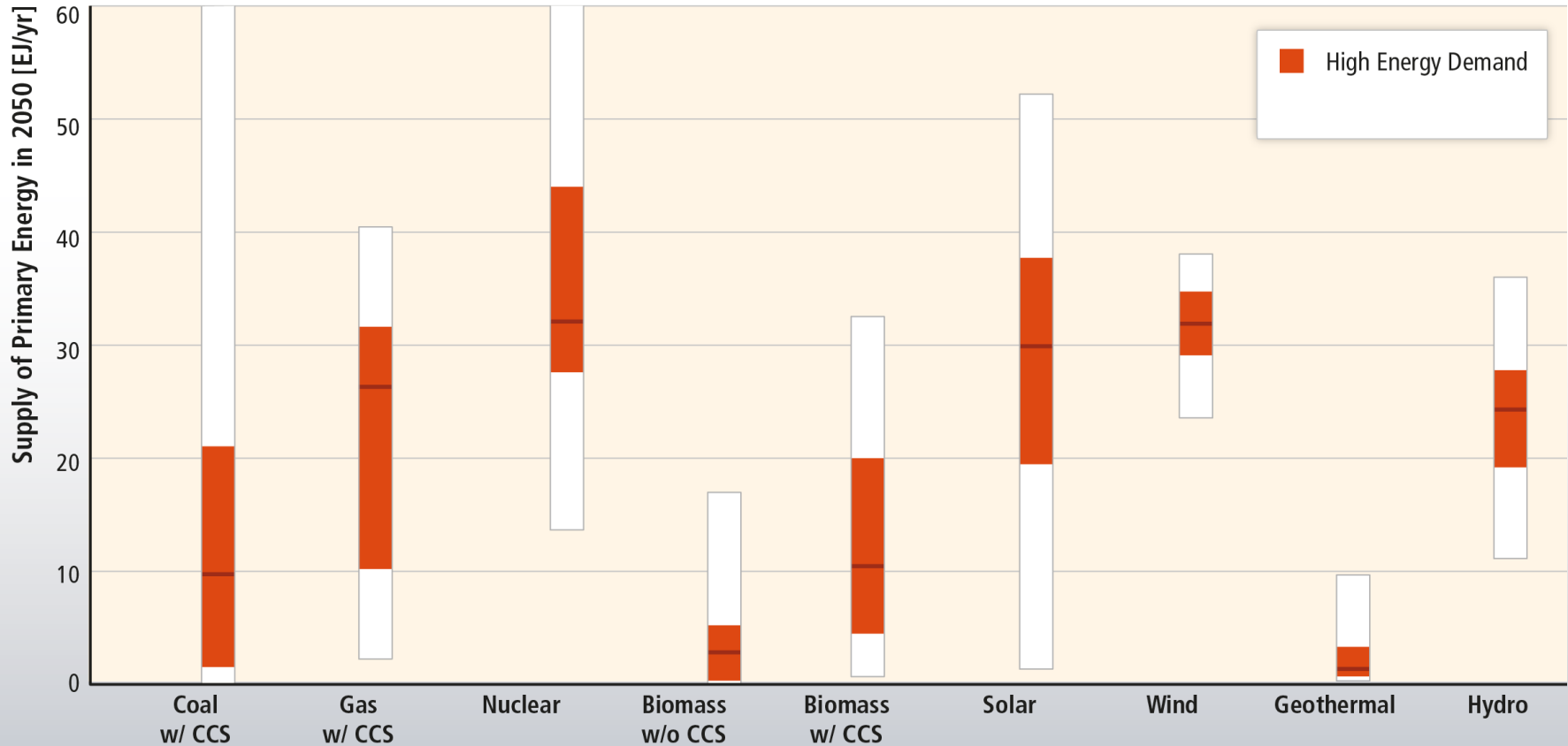
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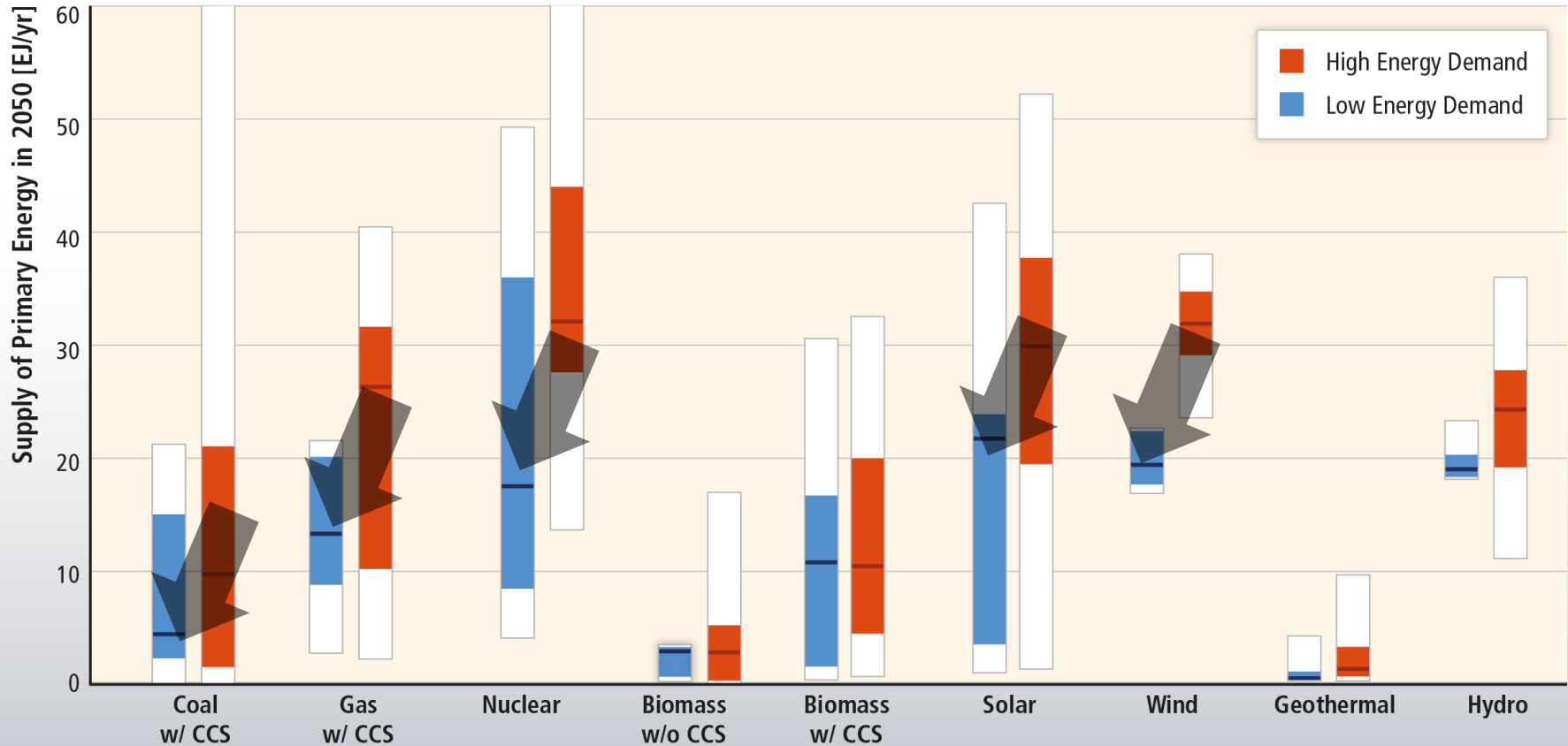
Decarbonization of energy supply is a key requirement for stabilizing atmospheric CO₂eq concentrations below 580 ppm.


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



Decarbonization of energy supply is a key requirement for stabilizing atmospheric CO₂eq concentrations below 580 ppm.

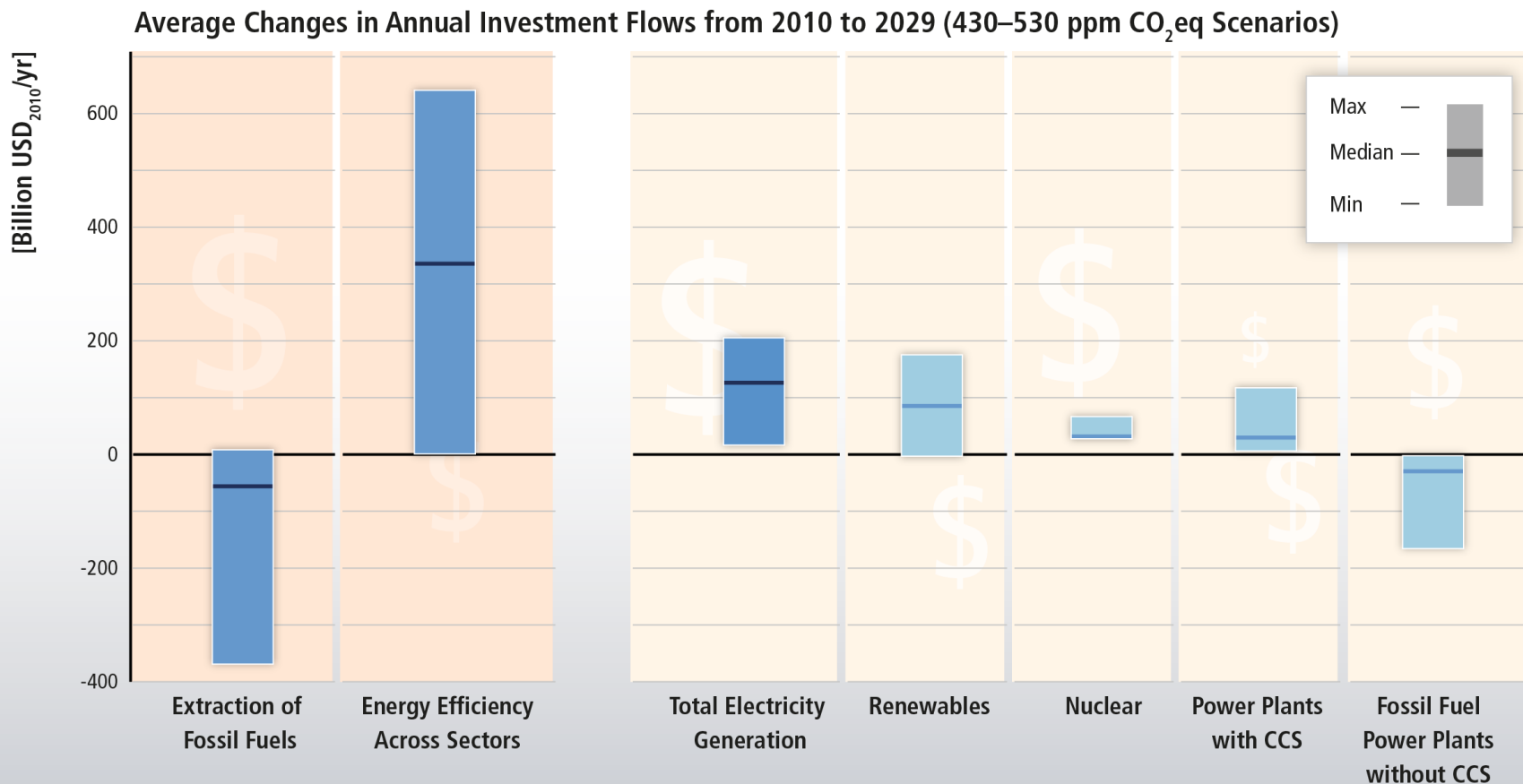
Contribution of Low Carbon Technologies to Energy Supply (430-530 ppm CO₂eq Scenarios)



An aerial photograph of a dense urban cityscape, likely in East Asia, featuring a complex multi-level highway interchange in the foreground. The city is filled with numerous high-rise buildings and residential blocks. The sky is overcast with grey clouds. The text is overlaid in the center of the image.

Achieving low stabilization requires substantial investments, which can lead to co-benefits for other local or national policy objectives

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



Sustainable development means overcoming several energy challenges



Energy Poverty



Energy Security



Land Use & Forests



Climate Change

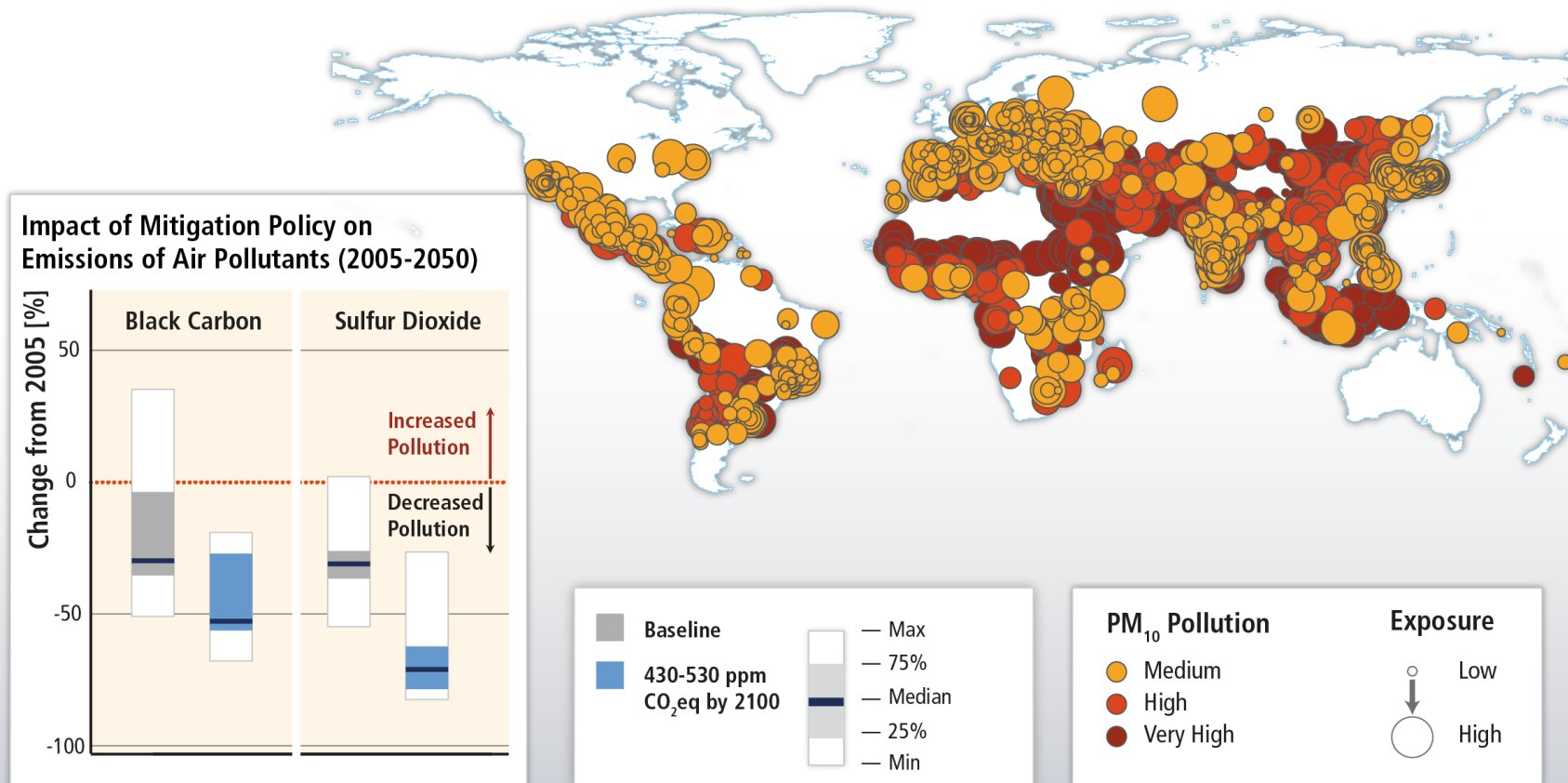


Water



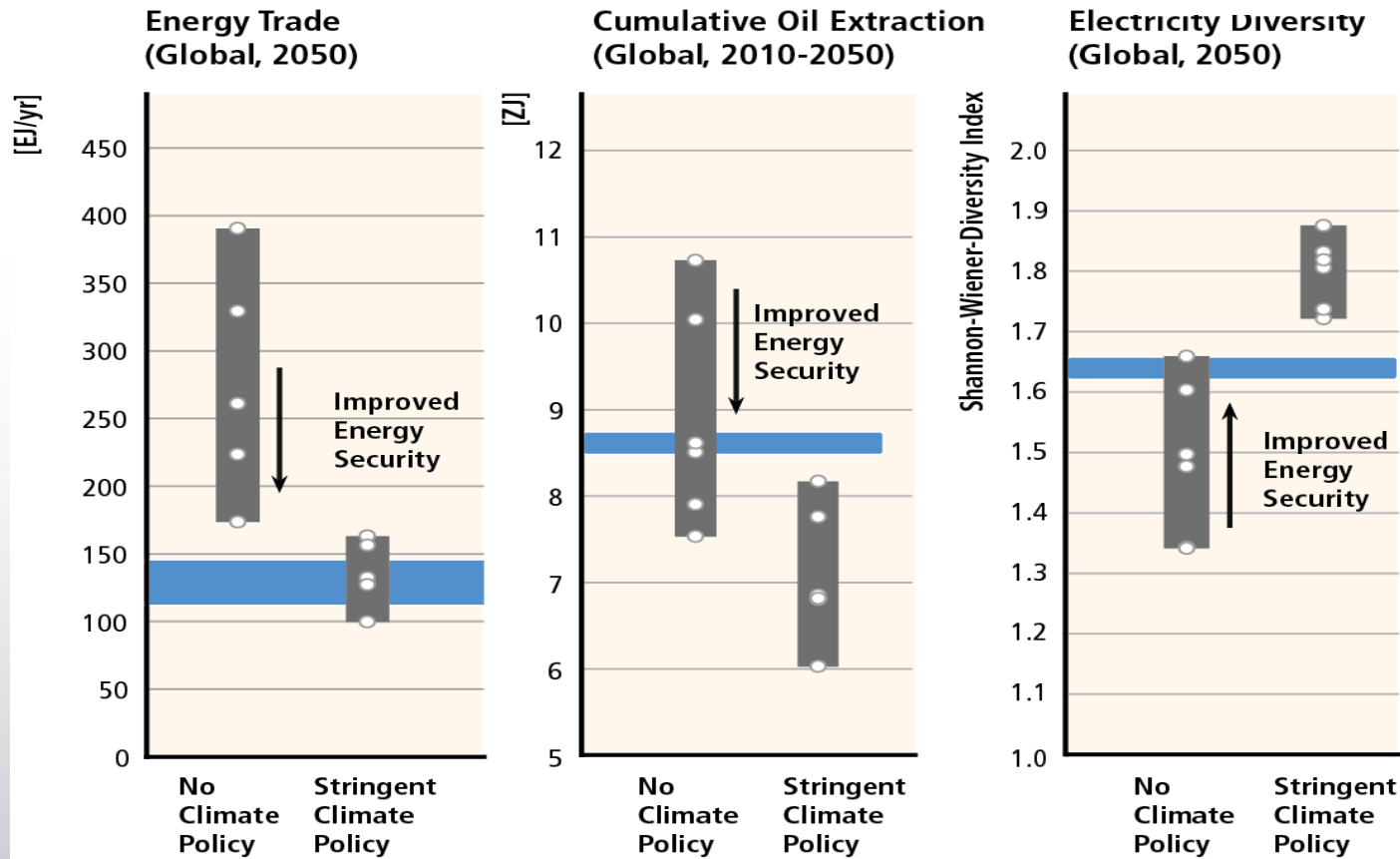
Air Pollution

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



Mitigation can help to reduce energy security concerns

Impact of Climate Policy on Energy Security

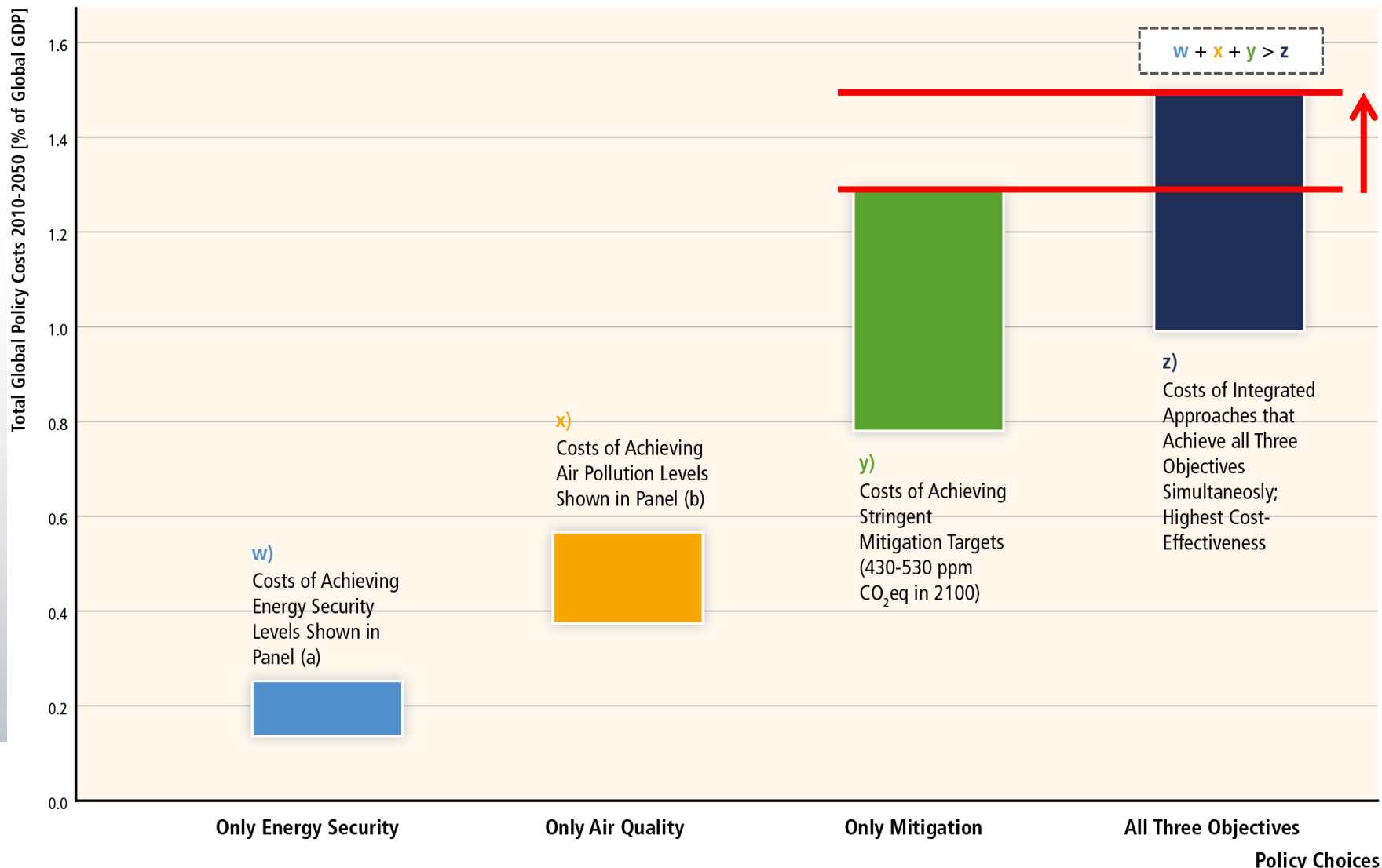


■ Energy Security Levels of GEA Scenarios in Bottom Panel

Integration across climate and other objectives is key for cost-effectively addressing environmental challenges

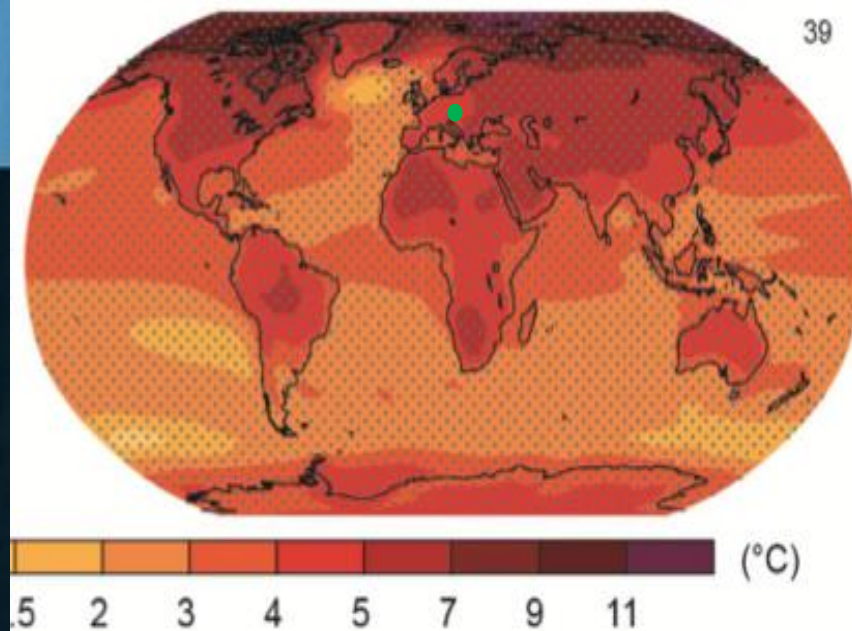
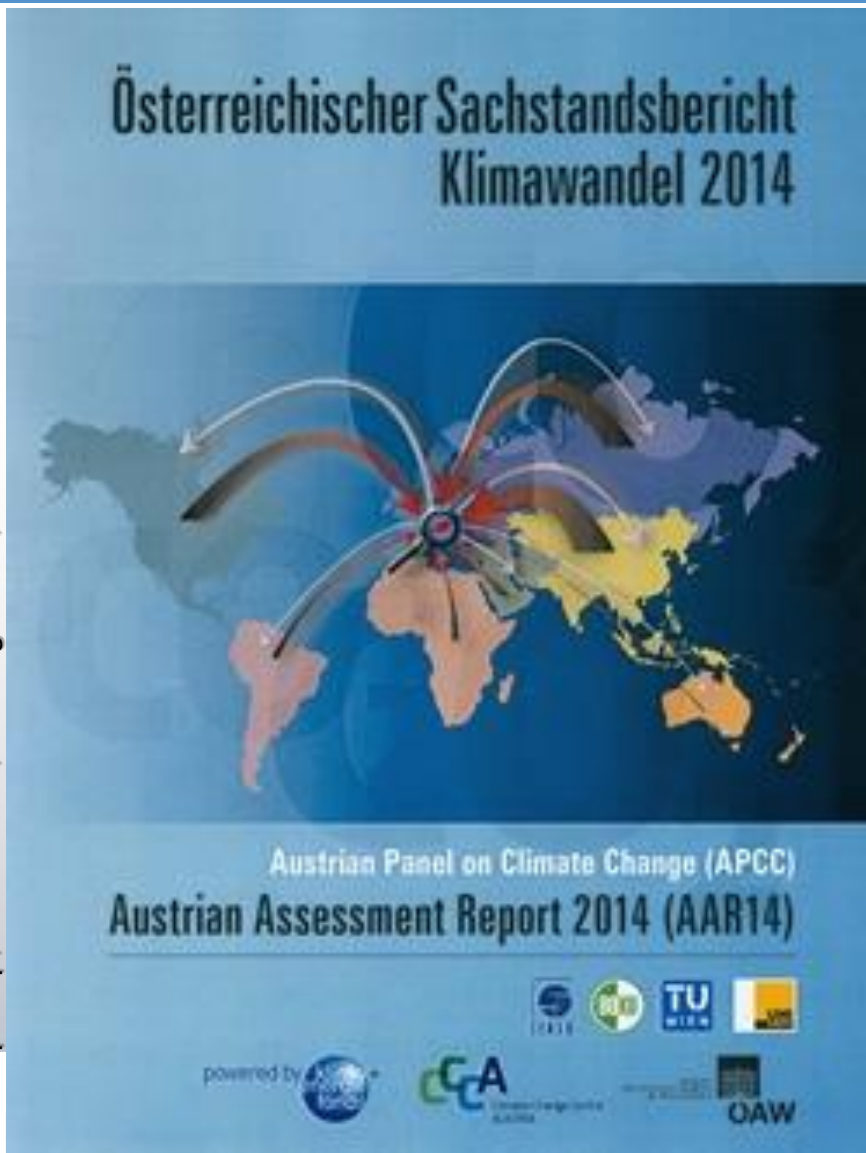
Policy Costs of Achieving Different Objectives

Global Energy Assessment Scenario Ensemble (n=624)



APCC-AAR14: Austria in the context of global climate change

Kromp-Kolp, Nakicenovic, Steining et al., 2014



Change in average surface temperature in case of high emissions (1986–2005 to 2081–2100)

An aerial photograph of a city skyline, likely Hong Kong, with a blue overlay. The image shows a dense urban landscape with numerous skyscrapers and a complex network of highways. The sky is a deep blue with some light clouds. The text is overlaid in white, bold font.

Thank you!

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**IIASA-IPCC database:
<https://secure.iiasa.ac.at/web-apps/ene/AR5DB>**