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INTERGOVERNMENTAL PANEL ON climate change

CLIMATE CHANGE 2014

Mitigation of Climate Change

Bioenergy
Coordinating Lead Author
Special Report Renewable Energy Sources and Climate Change
2011

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Contributor to the Summary for Policymakers
Working Group III contribution to the
IPCC Fifth Assessment Report

WMO UNEP

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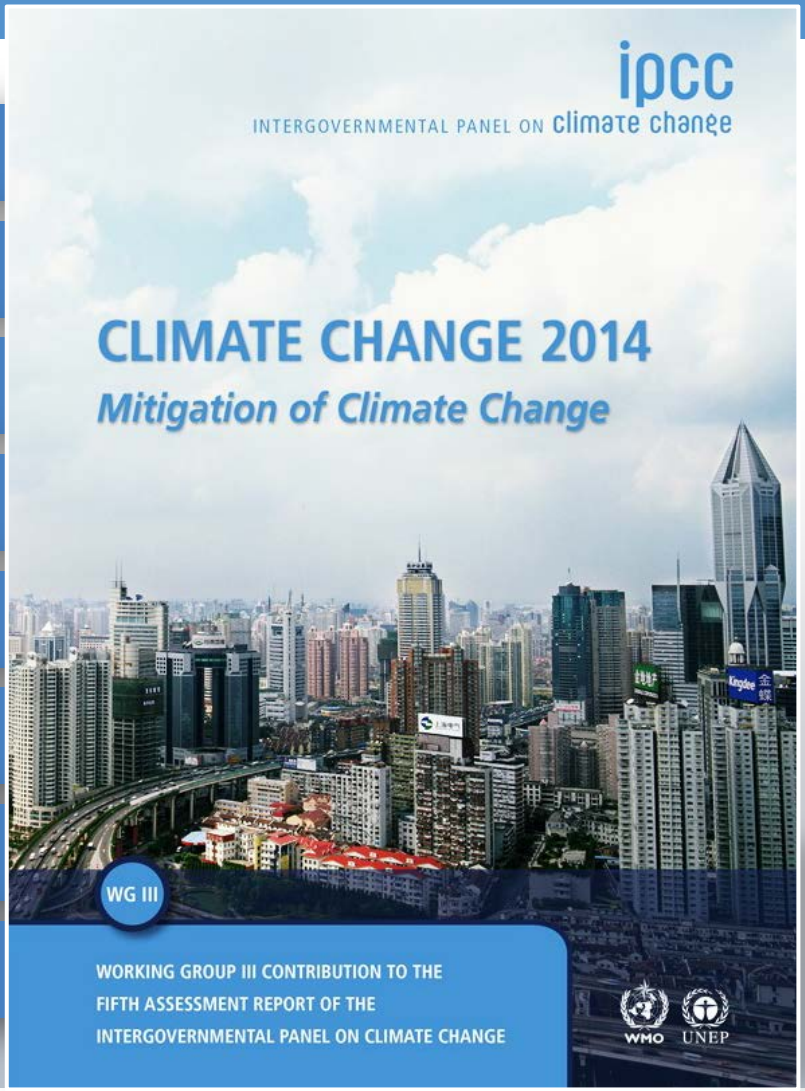
Climate change is a global
commons problem.

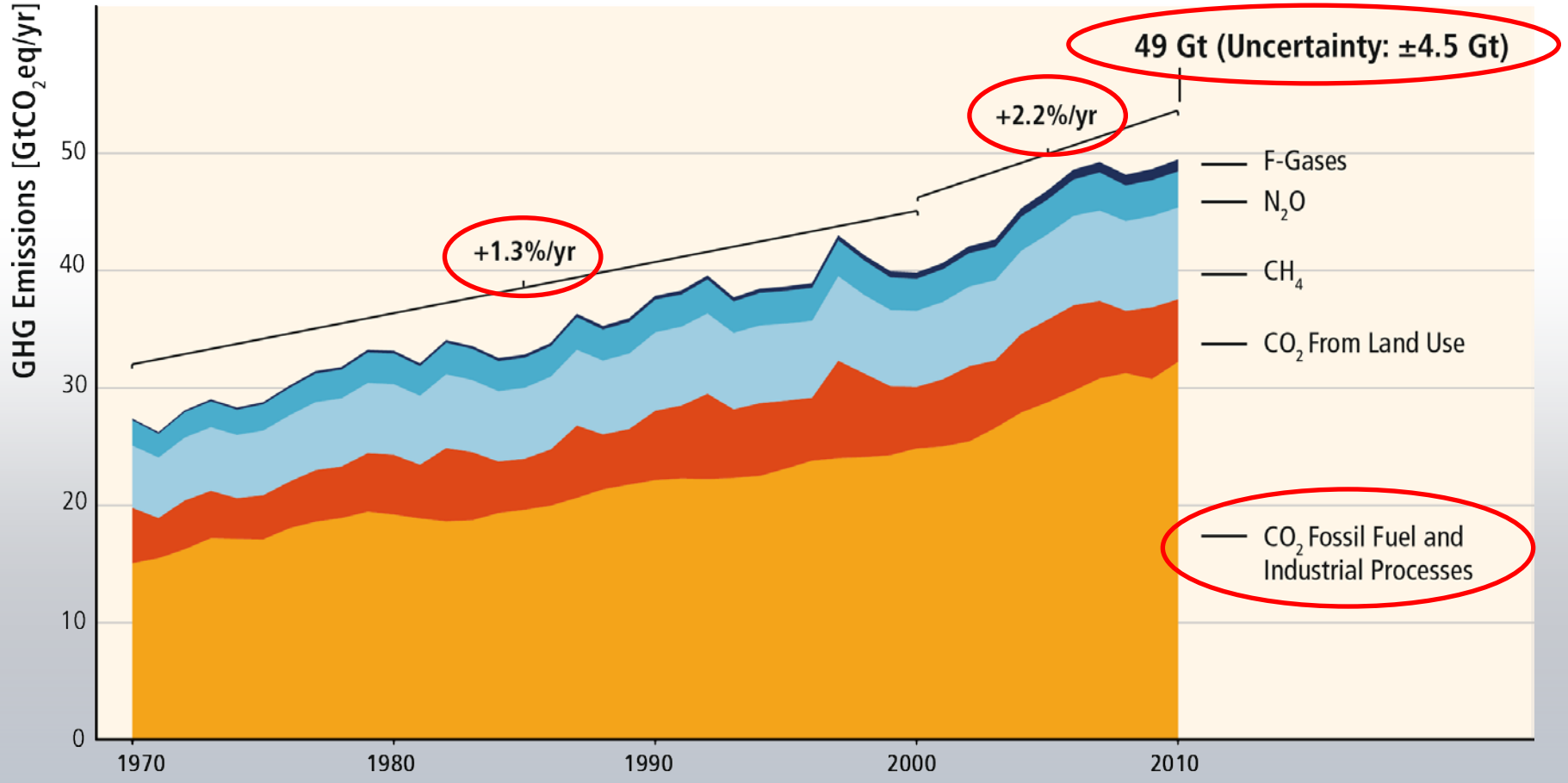
IPCC reports are the result of extensive work of many scientists from around the world.

- 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



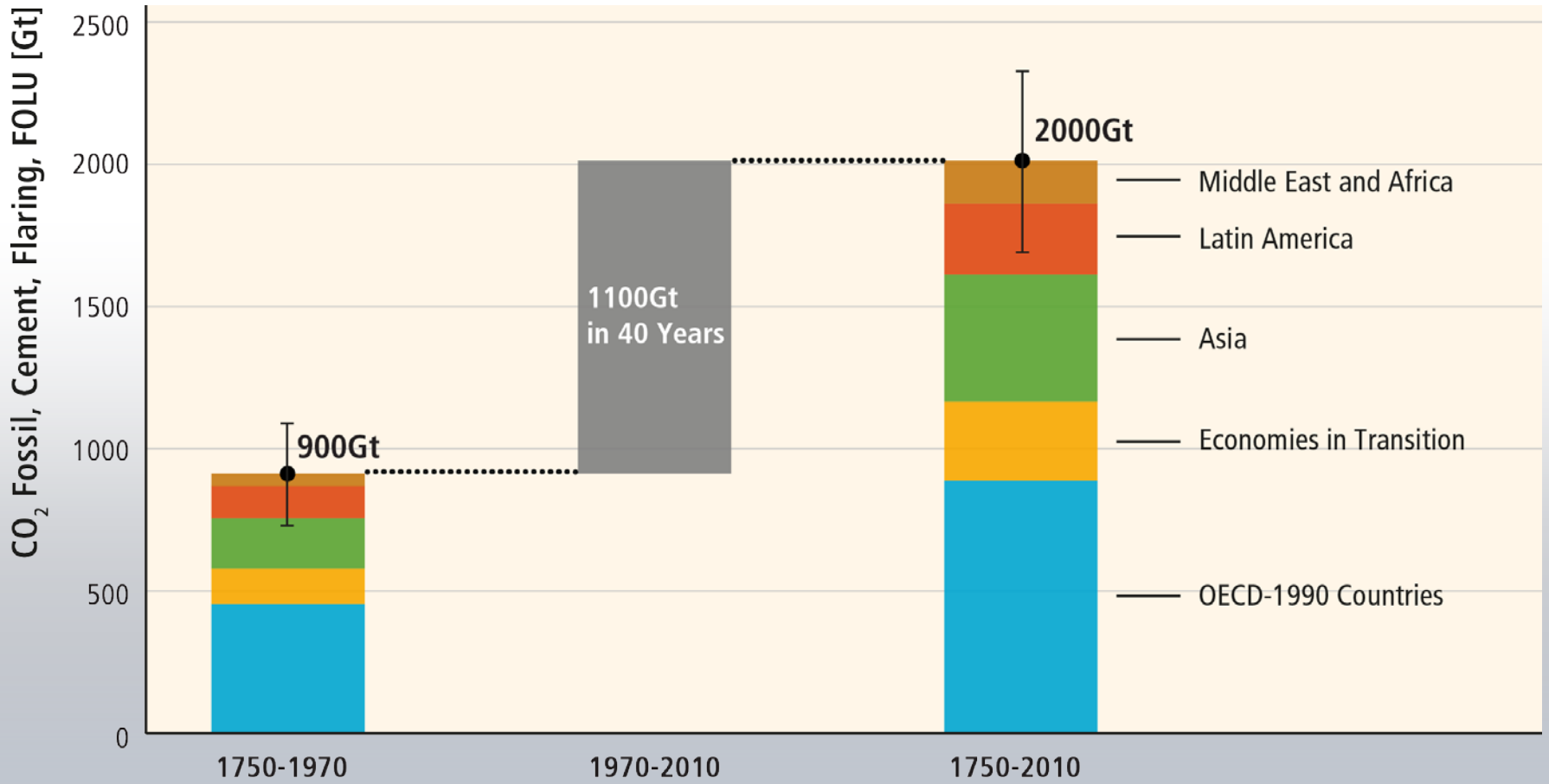
GHG emissions growth has accelerated despite reduction efforts.

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 CO_2 emissions between 1750 and 2010 have occurred in the last 40 years.

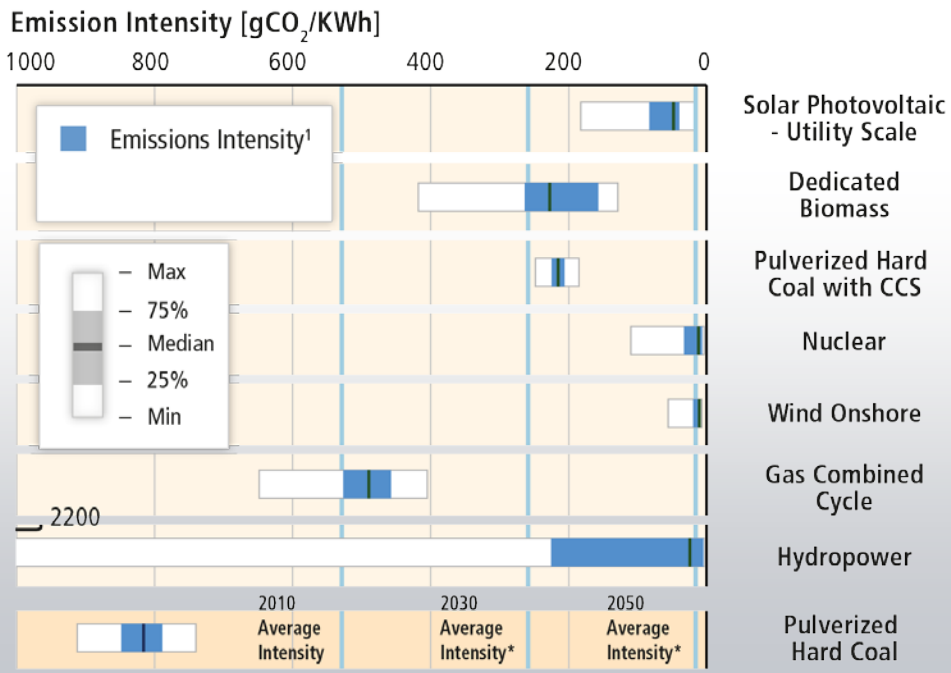


Based on Figure 5.3

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

Examples from power supply: Many technologies exist to reduce GHG emissions, but do so to different degrees.

Some Mitigation Technologies for Electricity Generation

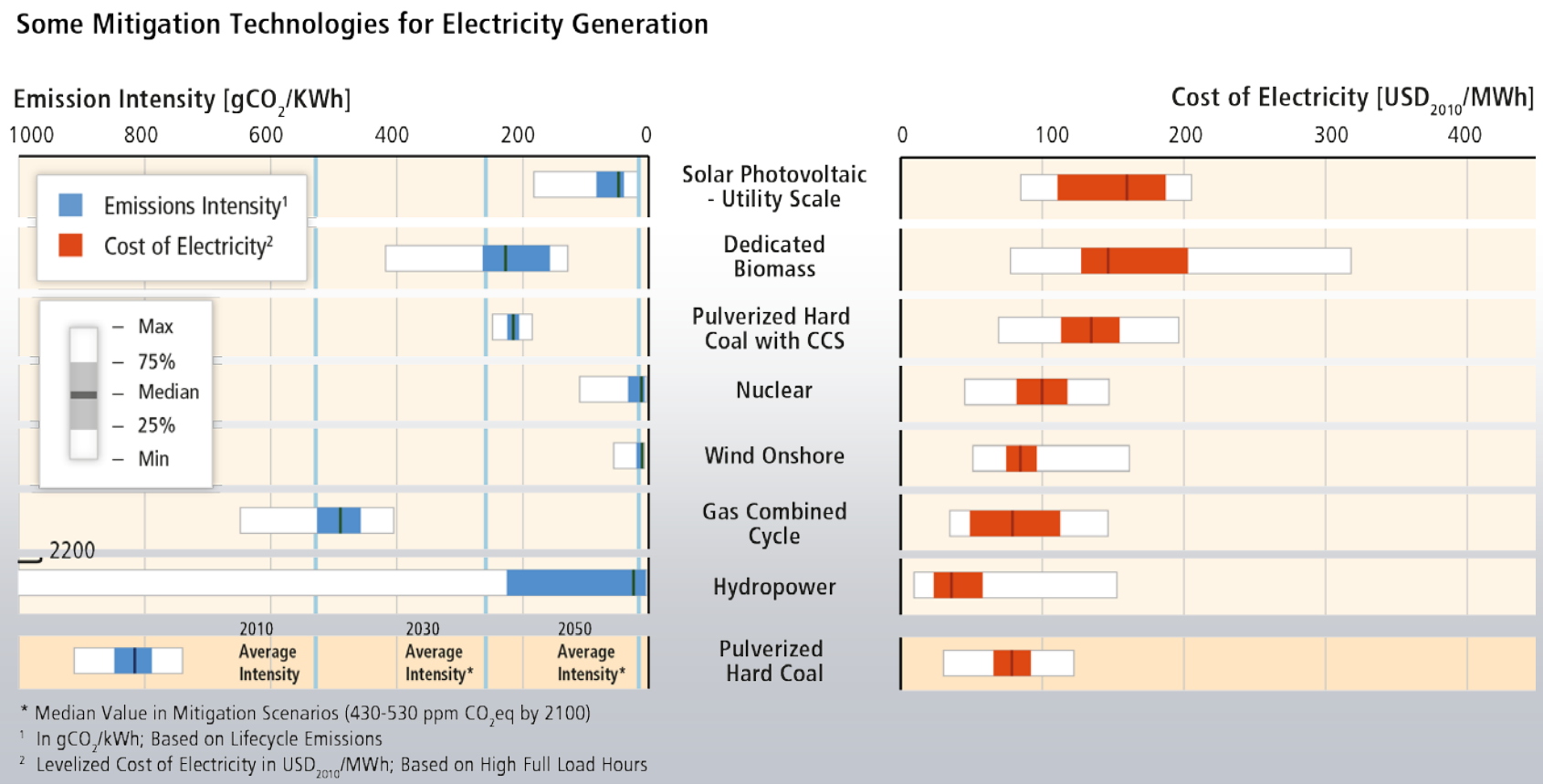


* Median Value in Mitigation Scenarios (430-530 ppm CO_2eq by 2100)

[1] In gCO_2/kWh; Based on Lifecycle Emissions

Developing CCS

Costs of many power supply technologies decreased substantially, some can already compete with conventional technologies.



Based on Figure 7.7

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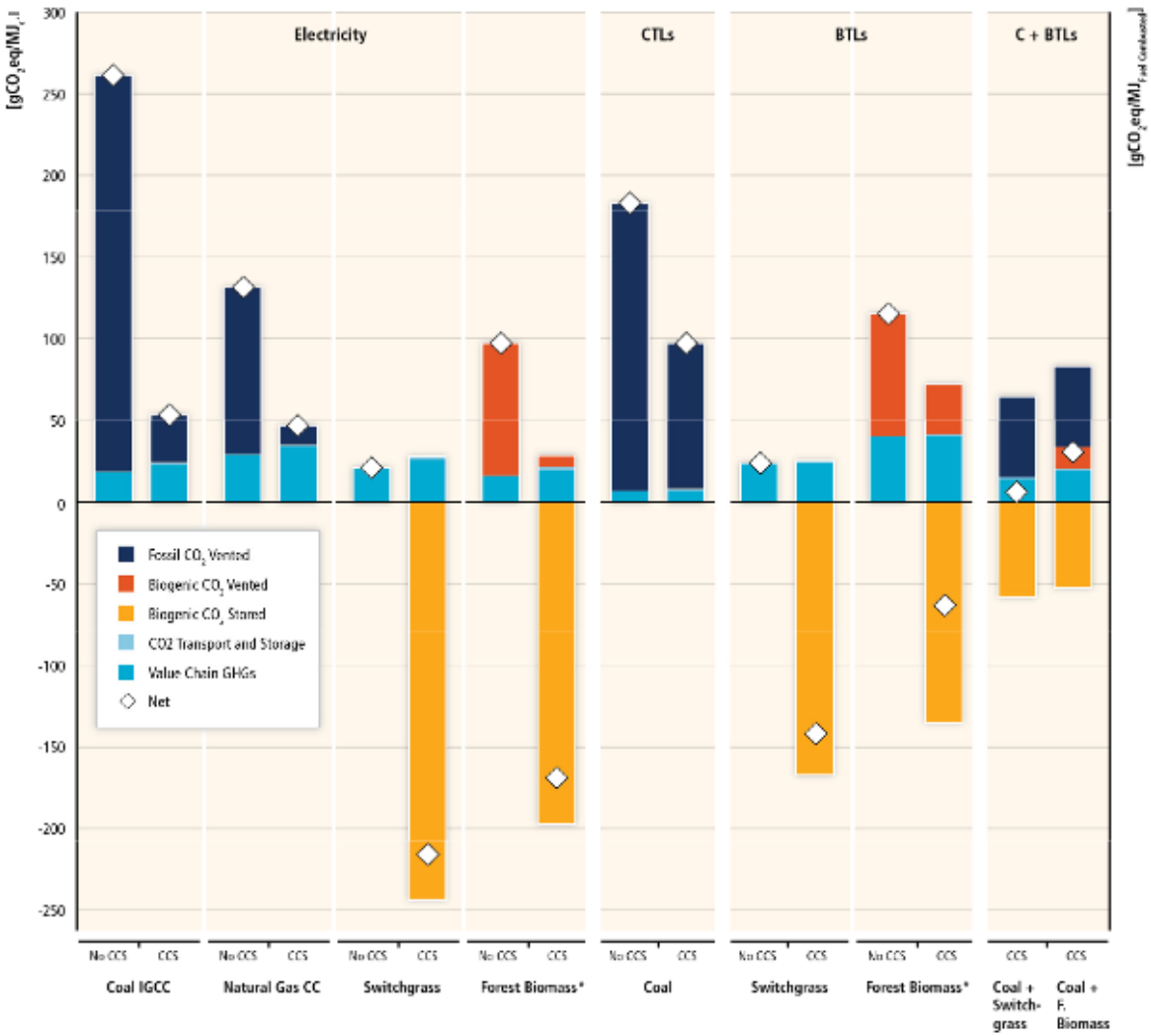
Fossil and Biomass Gasification to power or liquid fuels
Large uncertainties – need data and assessments on integrated operating plants at scale, monitoring overall performance



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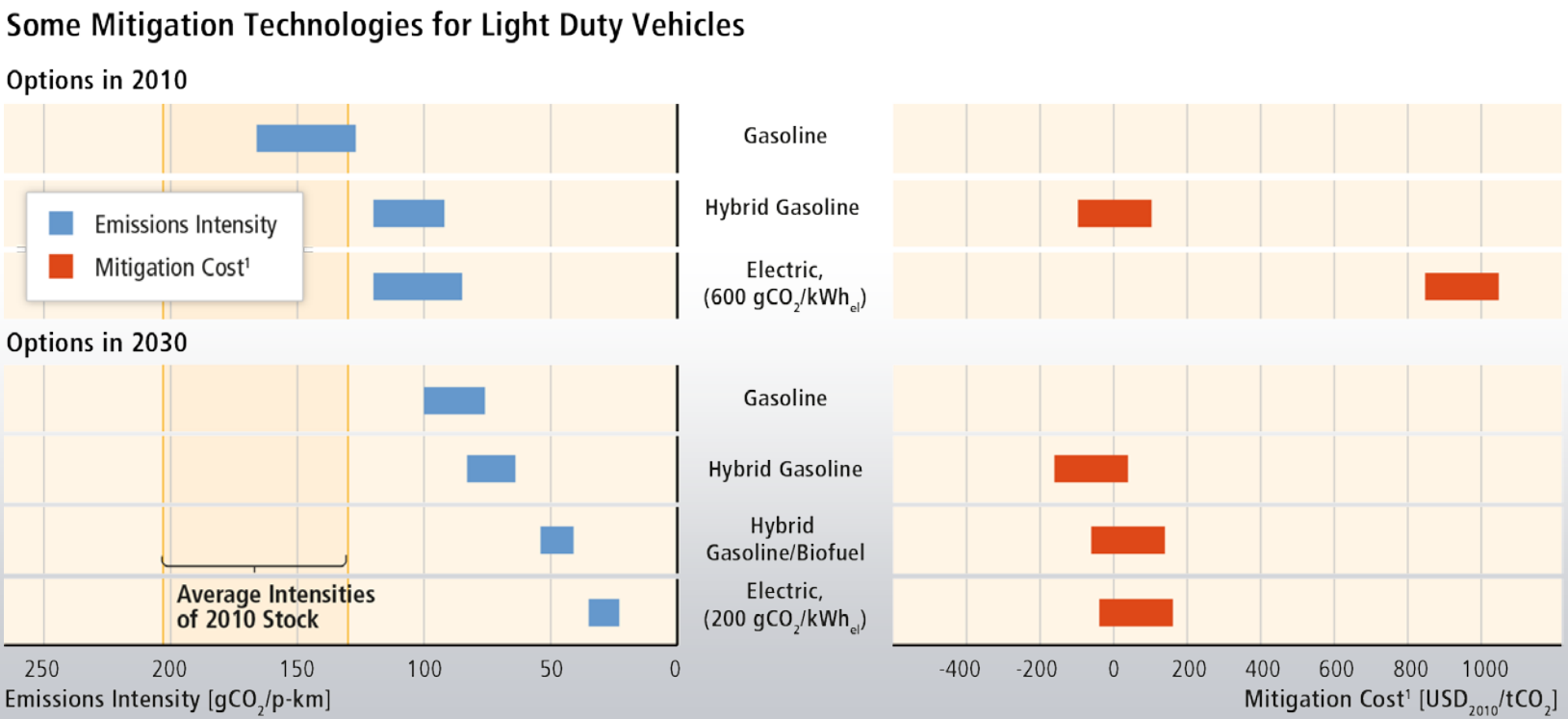
Private costs of reducing emissions in transport vary widely. Societal costs remain uncertain.

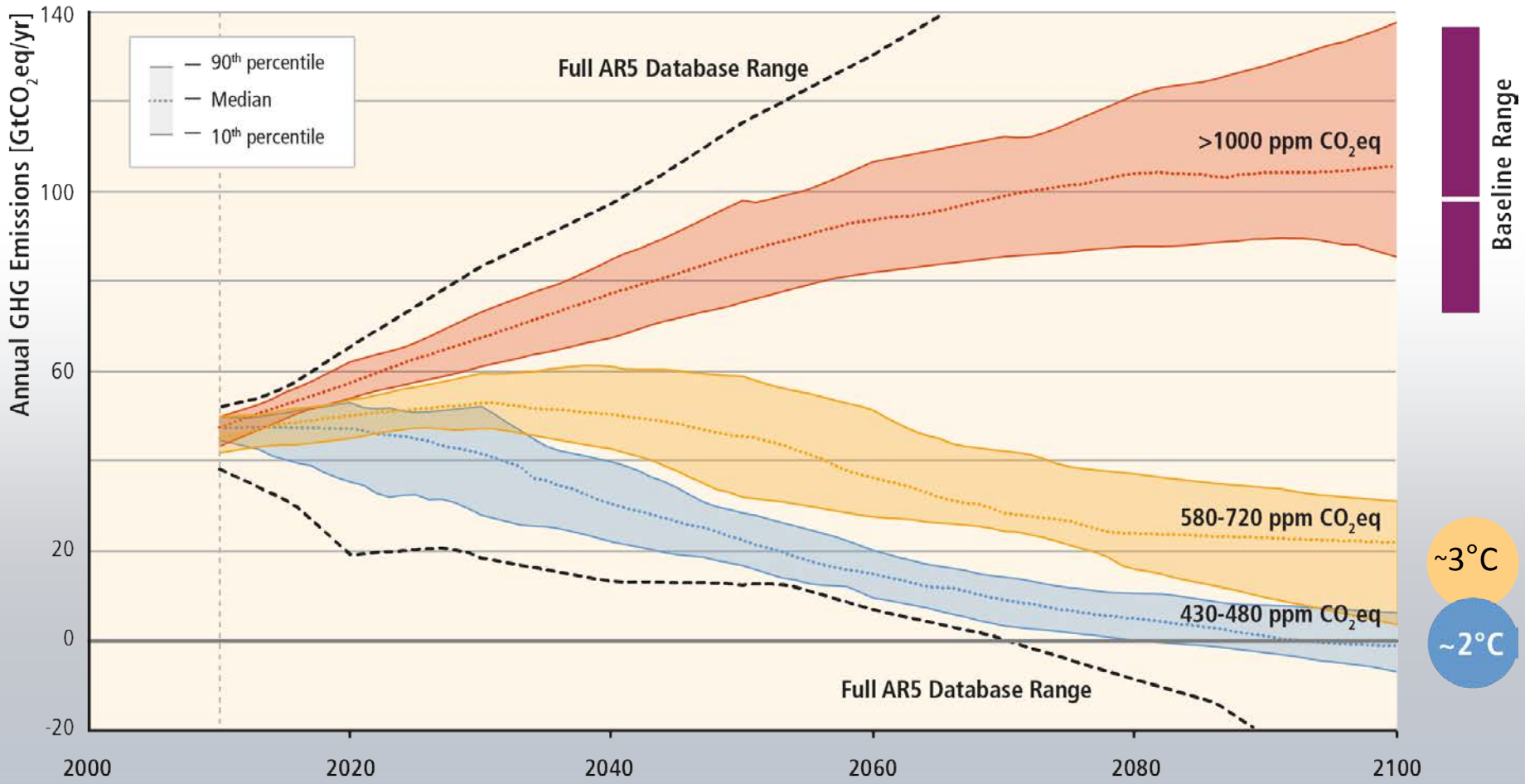


¹ Levelized cost of conserved carbon; calculated against 2010 new gasoline (2030 optimized gasoline) for 2010 (2030) options. Mitigation cost are based on point estimates ±100 USD_{2010}/tCO2 and are highly sensitive to assumptions.

Based on Figure TS.21

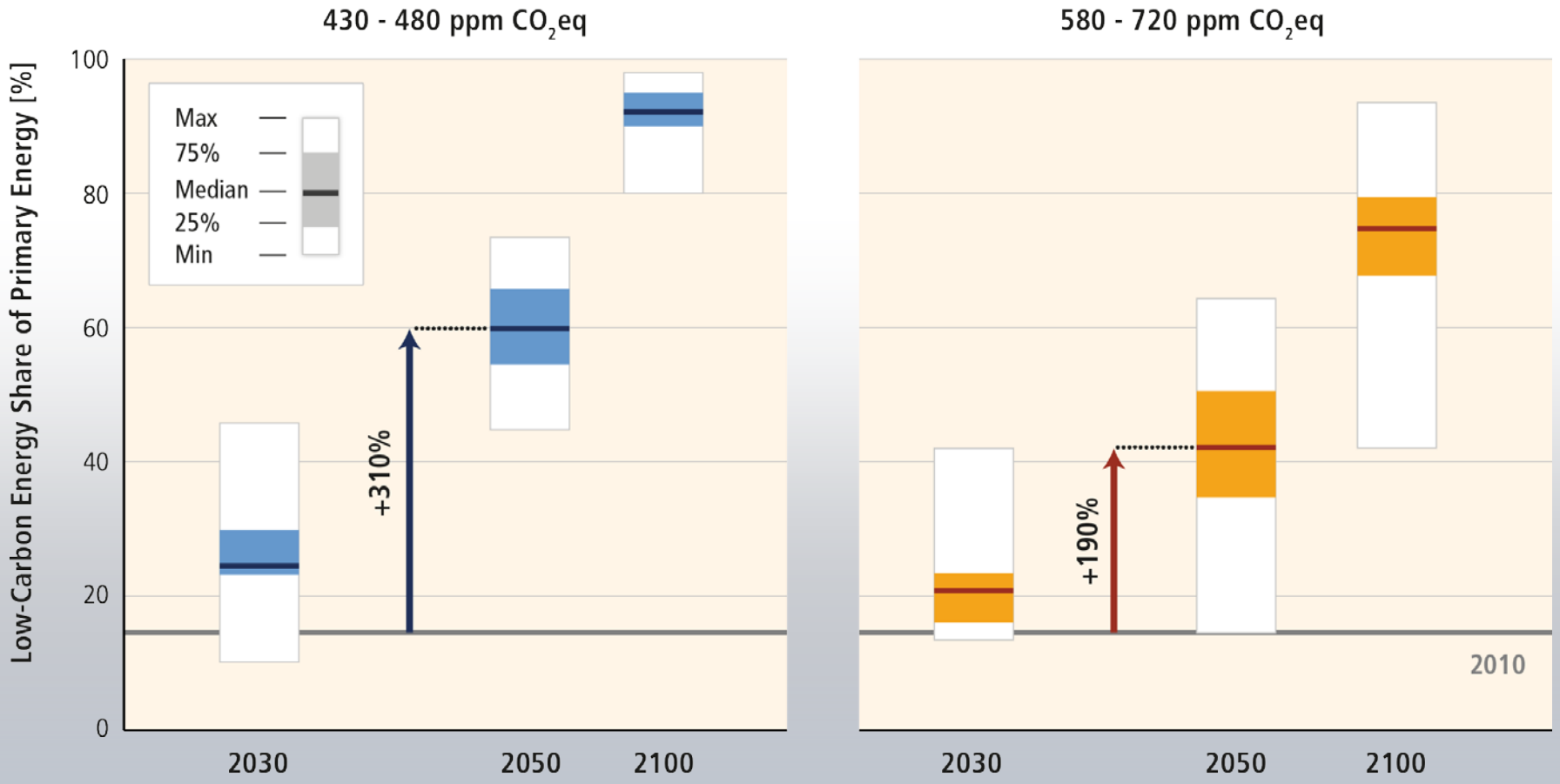
Limiting warming to 2°C involves substantial technological, economic and institutional challenges.

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



Based on Figure 6.7

Mitigation involves substantial upscaling of low-carbon energy.



Based on Figure 7.16

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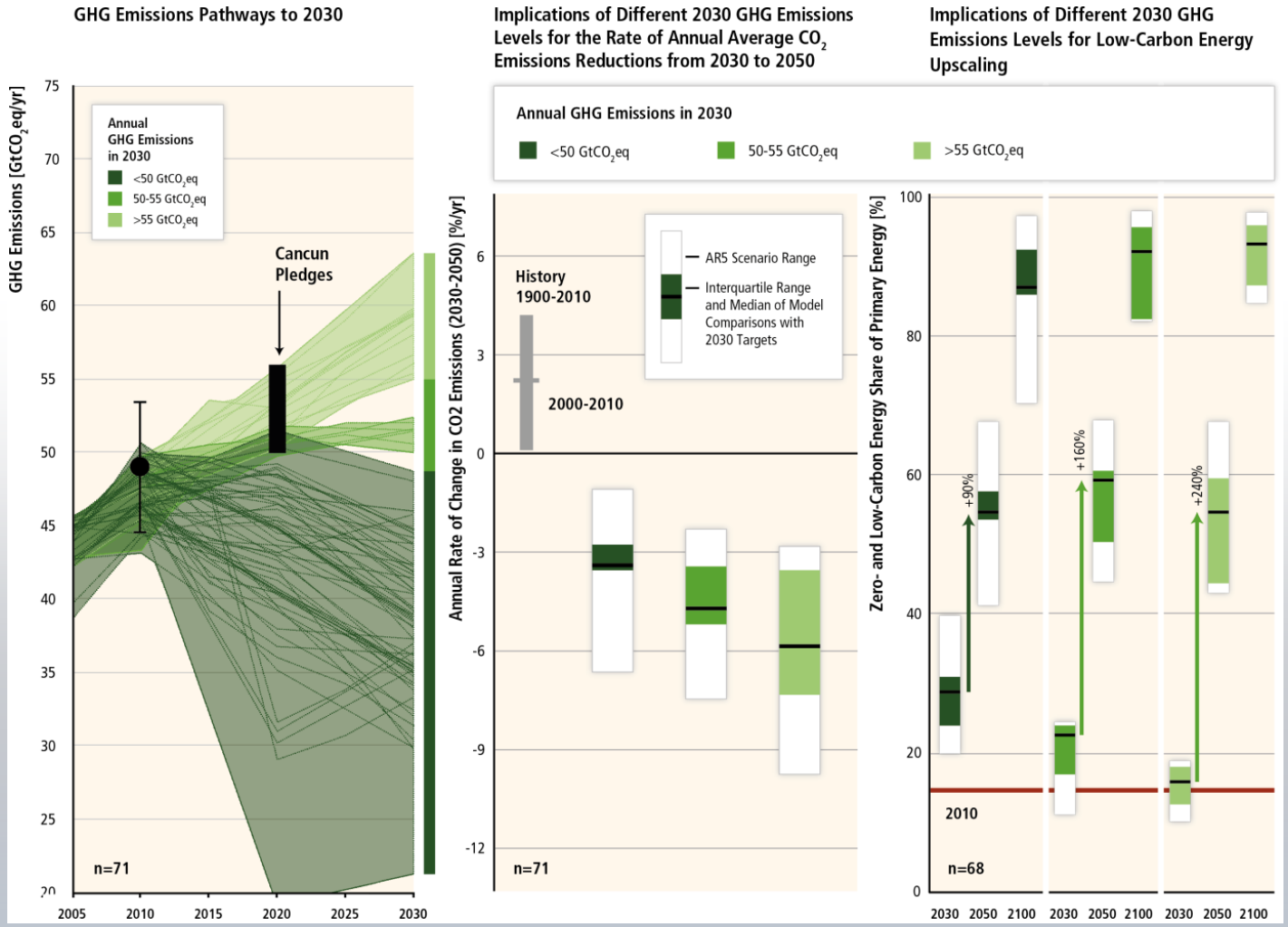
Delaying mitigation is estimated to increase the difficulty and narrow the options for limiting warming to 2°C.



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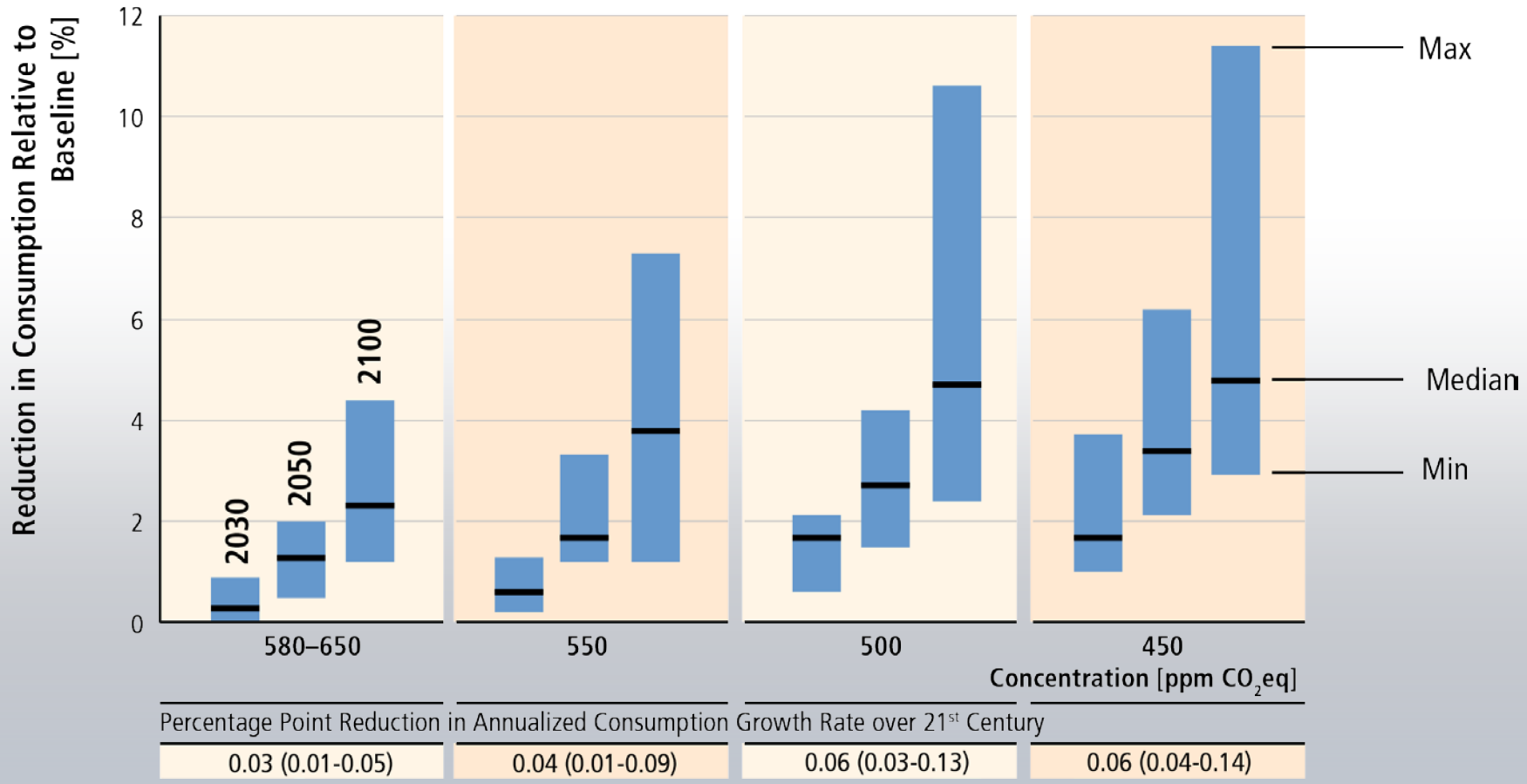
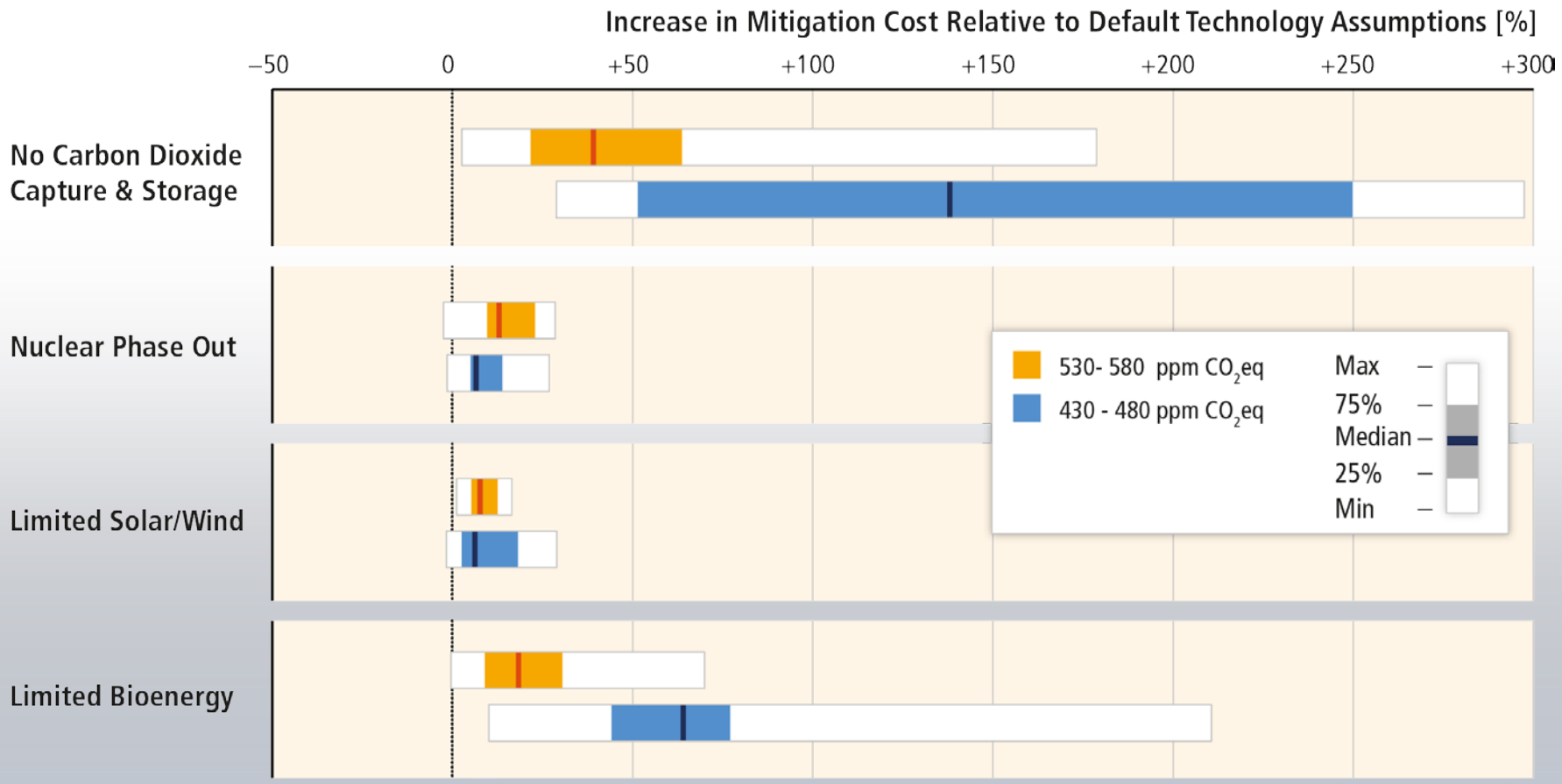
Mitigation cost estimates vary, but do not strongly affect global GDP growth.

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

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

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

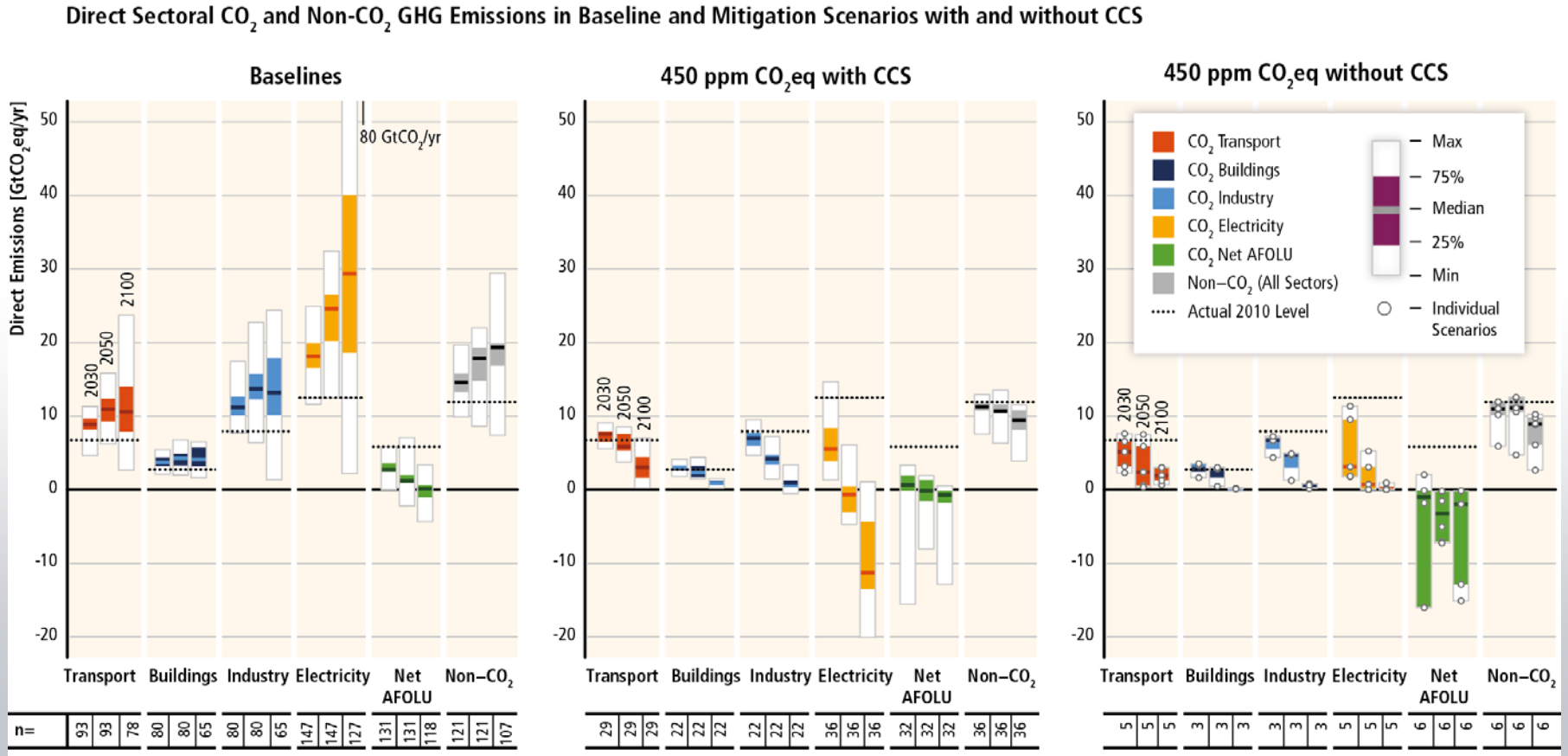
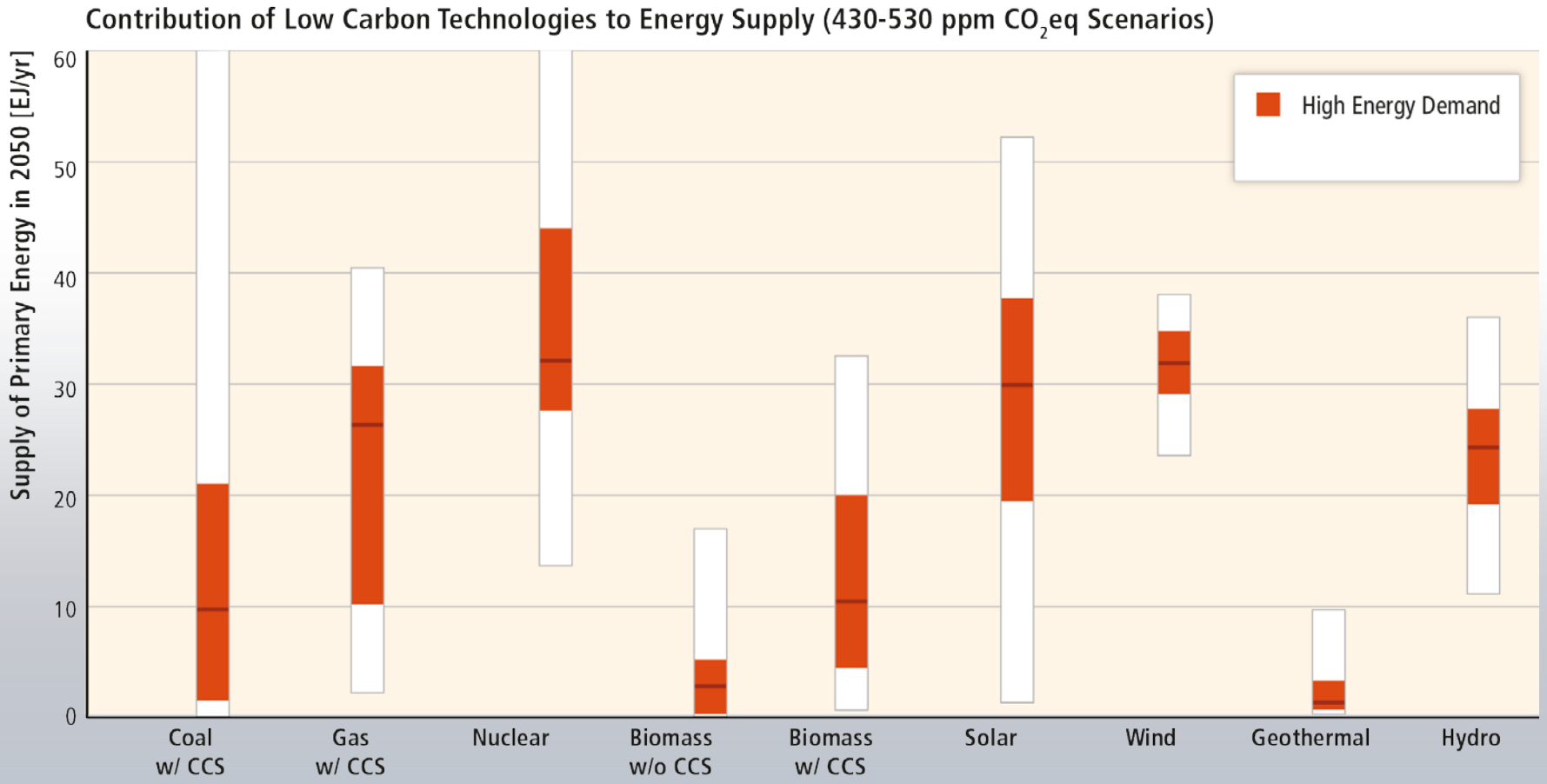


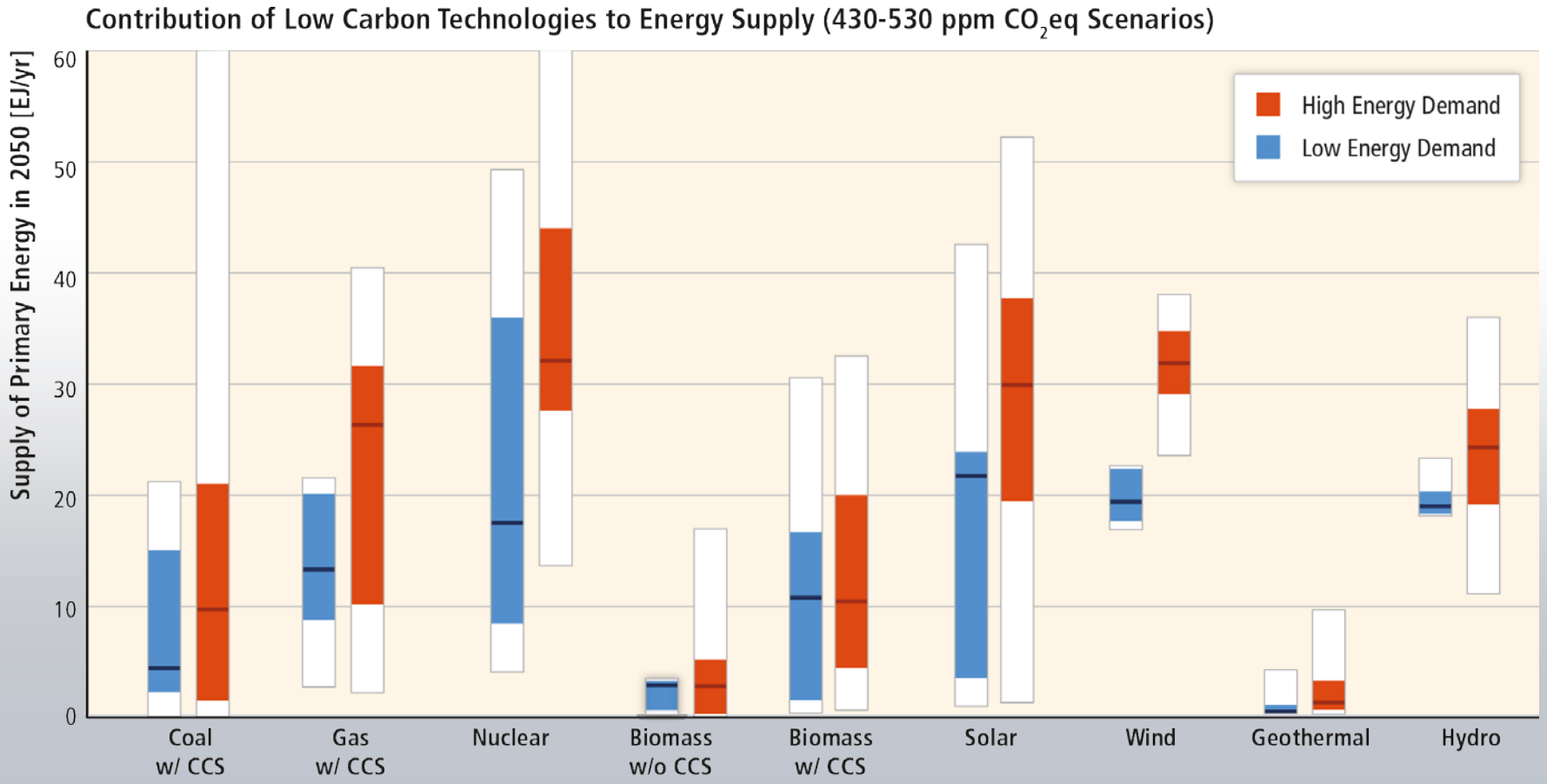
Figure SPM.7. Direct emissions of CO_2 by sector and total non-CO_2 GHGs (Kyoto gases) across sectors in baseline (left panel) and mitigation scenarios that reach around 450 (430–480) ppm CO_2eq with CCS (middle panel) and without CCS (right panel). The numbers at the bottom of the graphs refer to the number of scenarios included in the range which differs across sectors and time due to different sectoral resolution and time horizon of models. Note that many models cannot reach 450 ppm CO_2eq concentration by 2100 in the absence of CCS, resulting in a low number of scenarios for the right panel [Figures 6.34 and 6.35]. [Subject to final quality check and copy edit.]

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



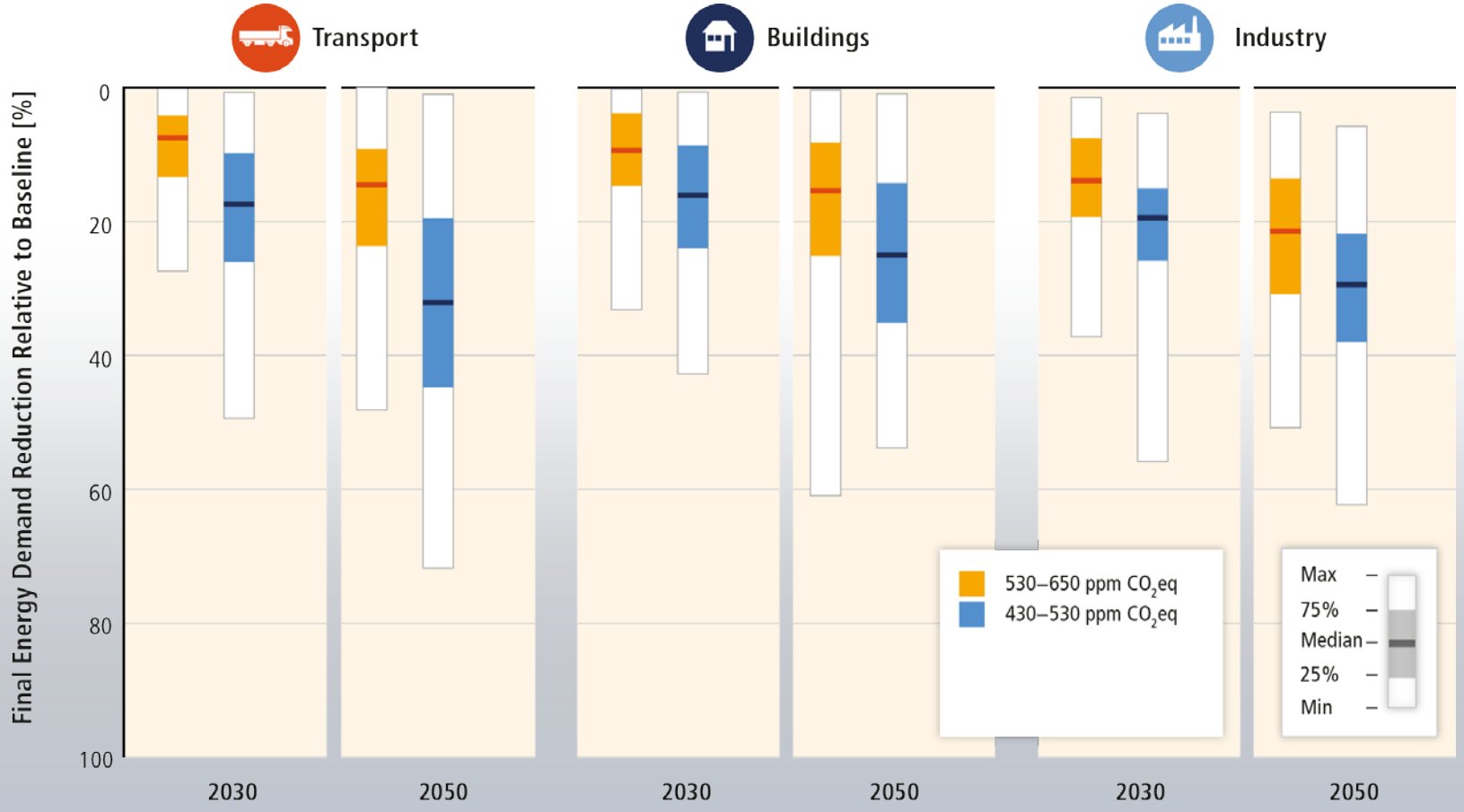
Based on Figure 7.11

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



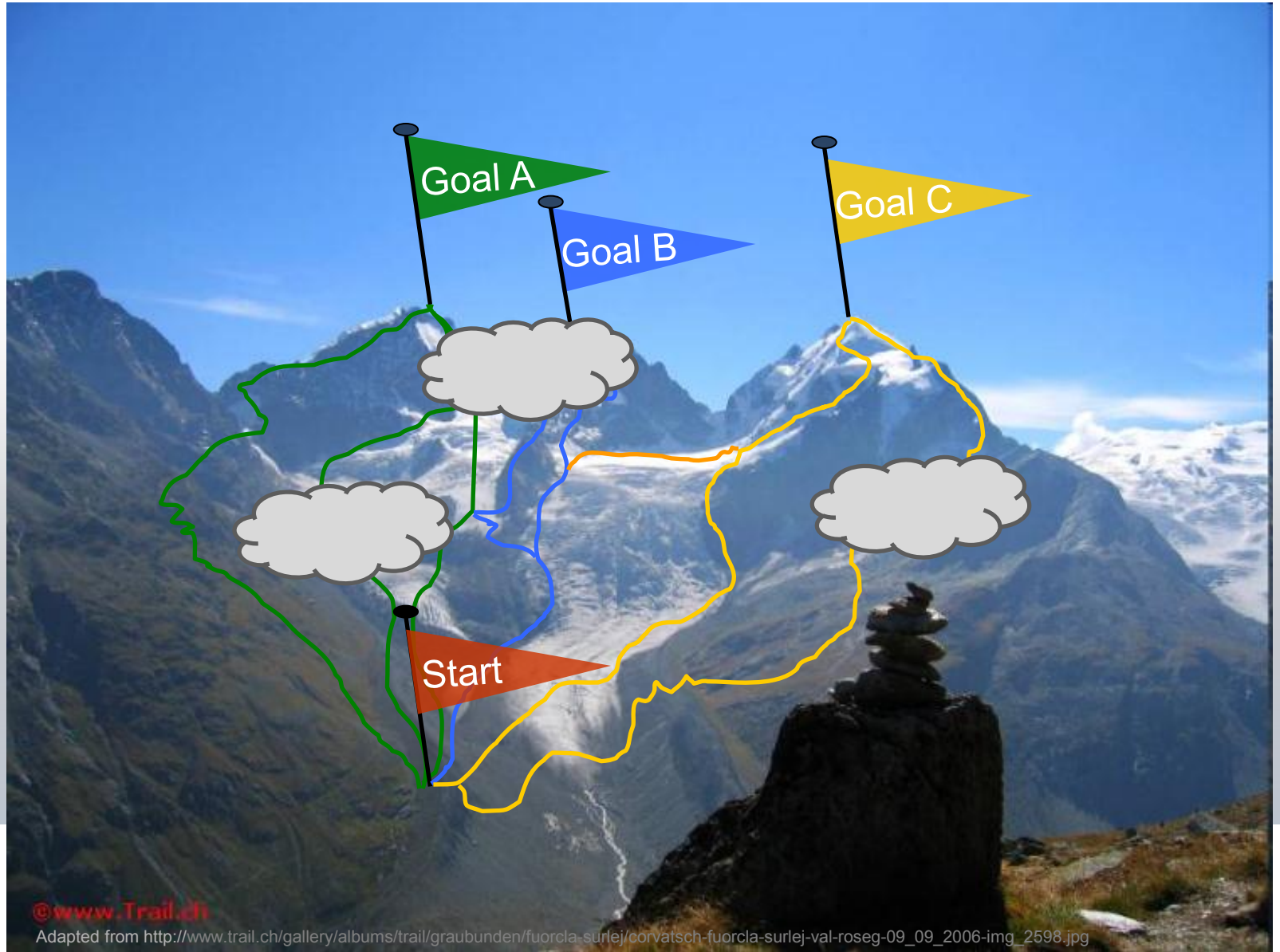
Based on Figure 7.11

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



Based on Figure 6.37

Mapping policy pathways to allow for iterative learning process



Adapted from http://www.trail.ch/gallery/albums/trail/graubunden/fuorcla-surlej/corvatsch-fuorcla-surlej-val-roseg-09_09_2006-img_2598.jpg

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(1) Summary for Policymakers and (2) Final Draft Report (some edits)
http://mitigation2014.org/report/final-draft/

Chapter 7. Energy Systems

Chapter 7 on **Energy Systems** by CLAs: T. Bruckner I. A. Bashmakov Y. Mulugetta; Lead Authors: H. Chum, A. De la V. Navarro, J. Edmonds, A. Faaij, B. Fungtammasan, A. Garg, E. Hertwich, D. Honnery, D. Infield, M. Kainuma, S. Khennas, S. Kim, H. B. Nimir, K. Riahi, N. Strachan, R. Wiser, X. Zhang. 138 pages.

Chapter 11. Agriculture, Forestry, and Other Land Use includes bioenergy Appendix

Bioenergy Appendix and other authors wrote a review article that shows disagreements to levels of bioenergy higher than those presented in the bulk of this presentation.

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Agriculture chapter authors prior publication:

Smith, P.; Haberl, H.; Popp, A.; Erb, K.-h.; Lauk, C.; Harper, R.; Tubiello, F. N.; de Siqueira Pinto, A.; Jafari, M.; Sohi, S.; Masera, O.; Böttcher, H.; Berndes, G.; Bustamante, M.; Ahammad, H.; Clark, H.; Dong, H.; Elsiddig, E. A.; Mbow, C.; Ravindranath, N. H.; Rice, C. W.; Robledo Abad, C.; Romanovskaya, A.; Sperling, F.; Herrero, M.; House, J. I.; Rose, S., How much land-based greenhouse gas mitigation can be achieved without compromising food security and environmental goals? *Global Change Biology* **2013,** *19*, (8), 2285-2302

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