Global Warming of 1.5° C.

IPCC, 2018: Summary for Policymakers.

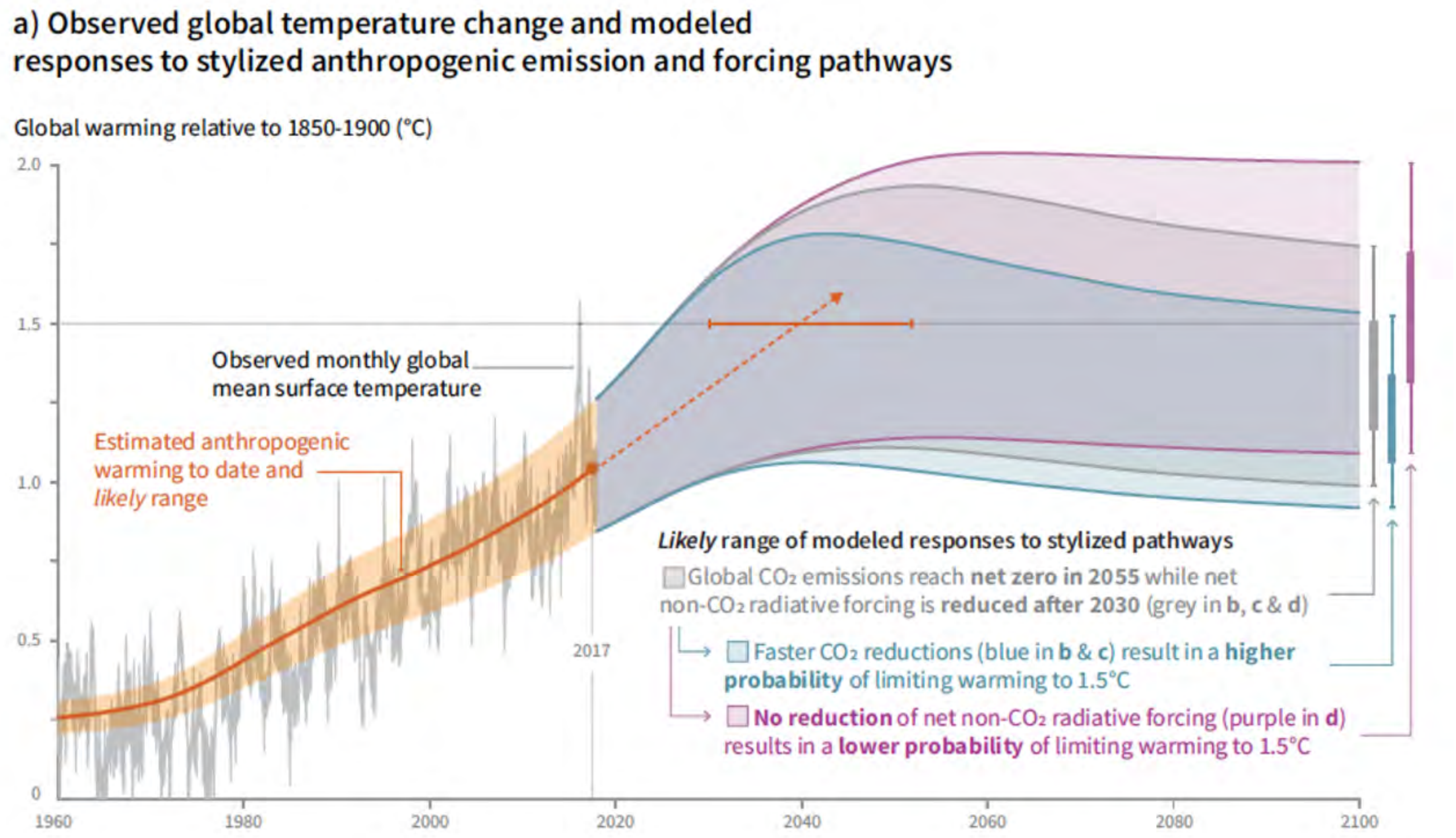
Understanding Global Warming of 1.5° C

- Human activities are estimated to have caused approximately 1.0 degree C of global warming above pre-industrial levels, with a likely range of 0.8 to 1.2 degree C. Global warming is likely to reach 1.5 degree C between 2030 and 2052 if it continues to increase at the current rate.

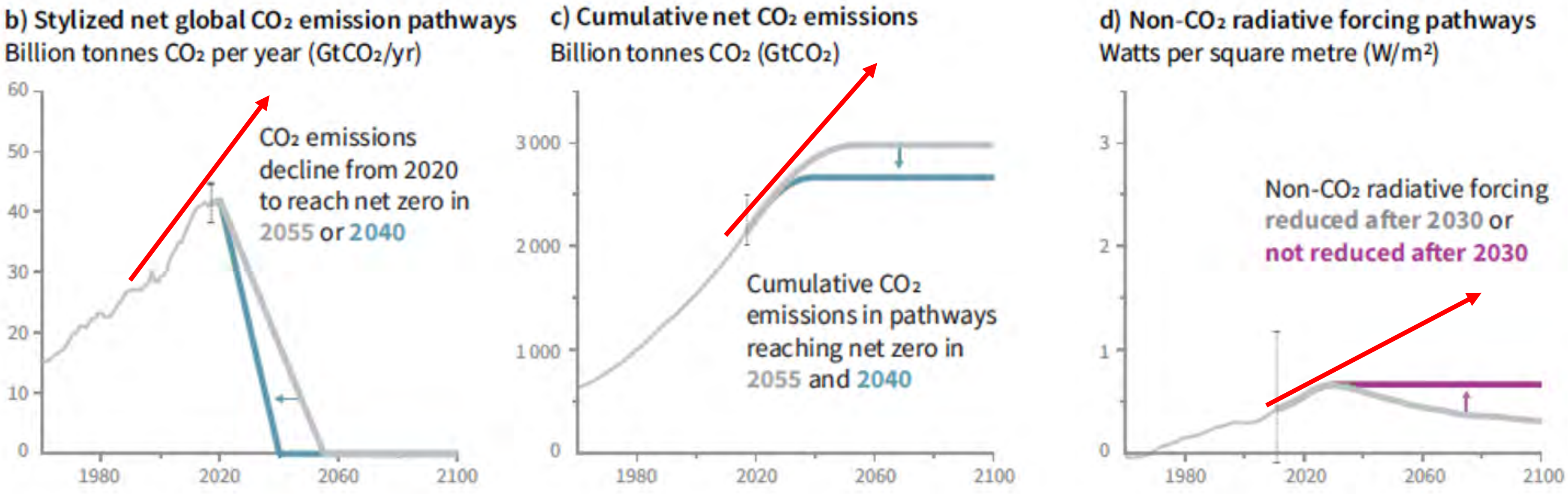
Warming from anthropogenic emissions from the pre-industrial period to the present will persist for centuries to millennia

- and will continue to cause further long-term changes in the climate system, such as sea level rise, with associated impacts (high confidence),
- but these emissions alone are unlikely to cause global warming of 1.5 degree.

Cumulative emissions of CO_2 and future non-CO_2 radiative forcing determine the probability of limiting warming to 1.5°C



Proposed pathways for the reduction of net global CO_2 and non-CO_2 radiative forcing emissions.



Faster immediate CO_2 emission reductions limit cumulative CO_2 emissions shown in panel (**c**).

Maximum temperature rise is determined by cumulative net CO_2 emissions and net non-CO_2 radiative forcing due to methane, nitrous oxide, aerosols and other anthropogenic forcing a

Trend without emission reduction.

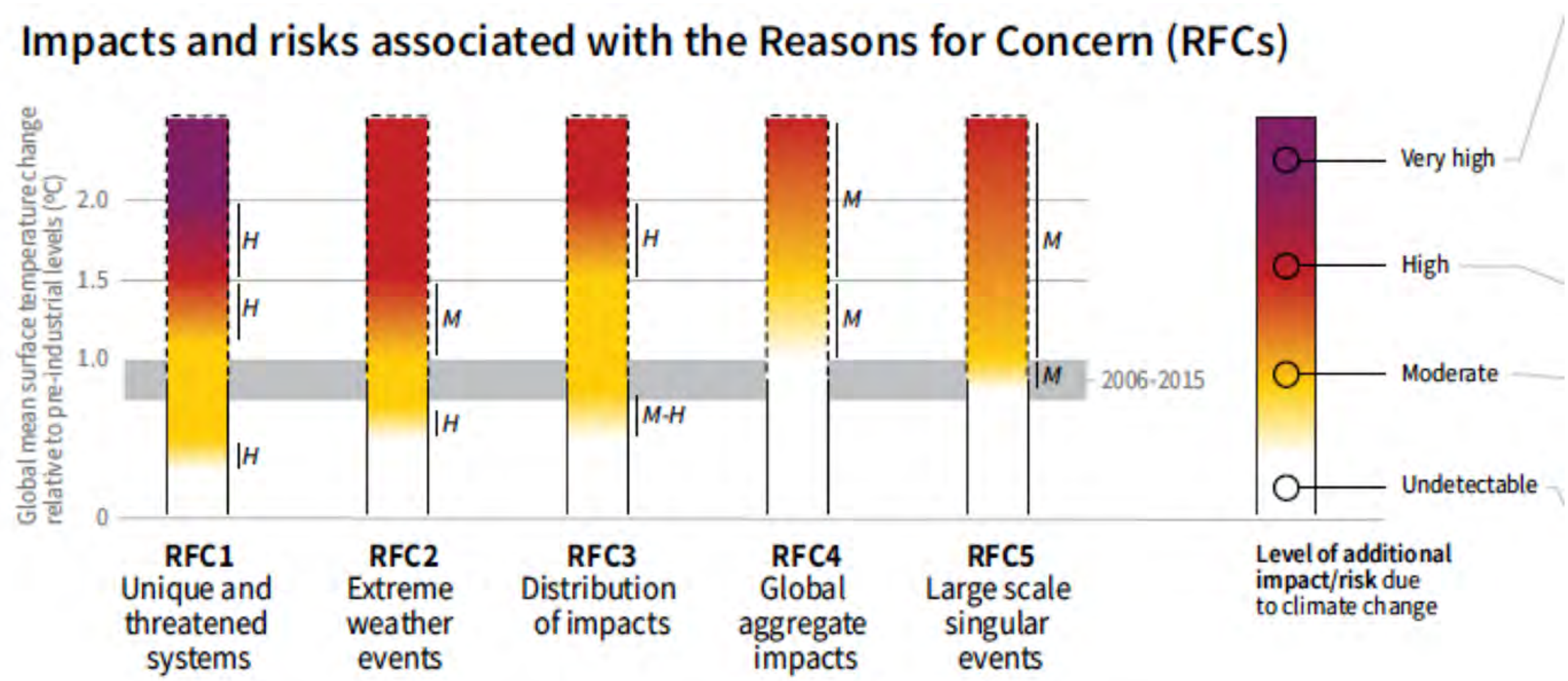
Projected Climate Change, Potential Impacts and Associated Risks

- Climate models project robust differences in regional climate characteristics between present-day and global warming of 1.5 degree C, and between 1.5 and 2 degree C.
- These differences include increases in:
- mean temperature in most land and ocean regions, hot extremes in most inhabited regions,
- heavy precipitation in several regions, and the probability of drought and precipitation deficits in some regions

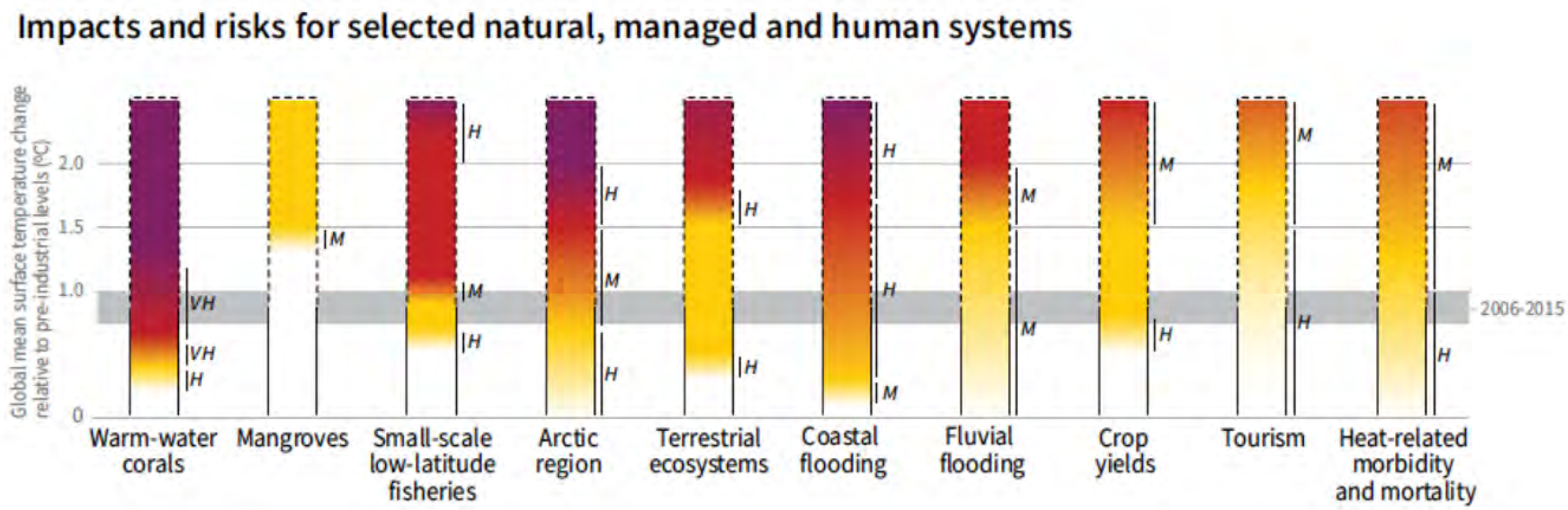
Climate and weather extremes

- Evidence from attributed changes in some climate and weather extremes for a global warming of about 0.5 degree C supports the assessment that an additional 0.5 degree C of warming compared to present is associated with further detectable changes in these extremes.

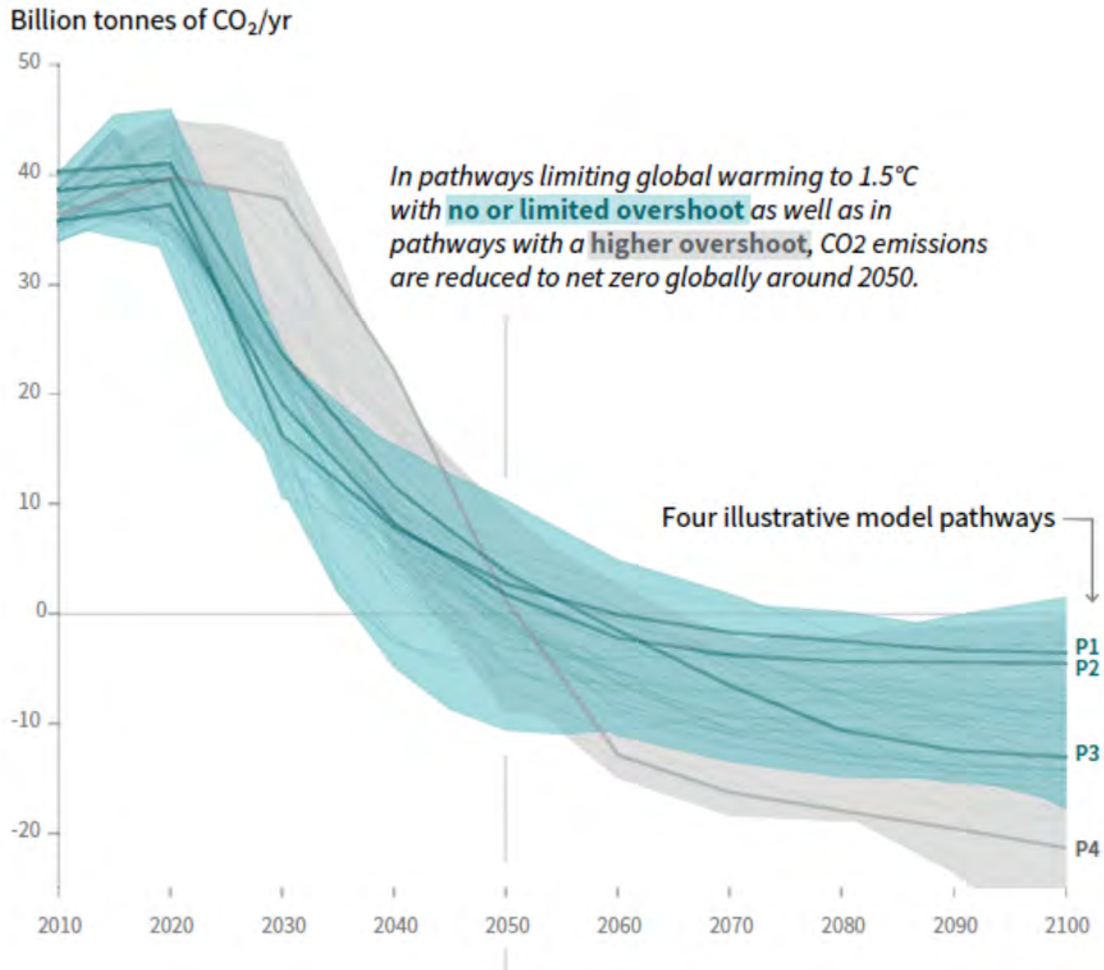
Impacts and risks associated with the Reasons for Concerns.



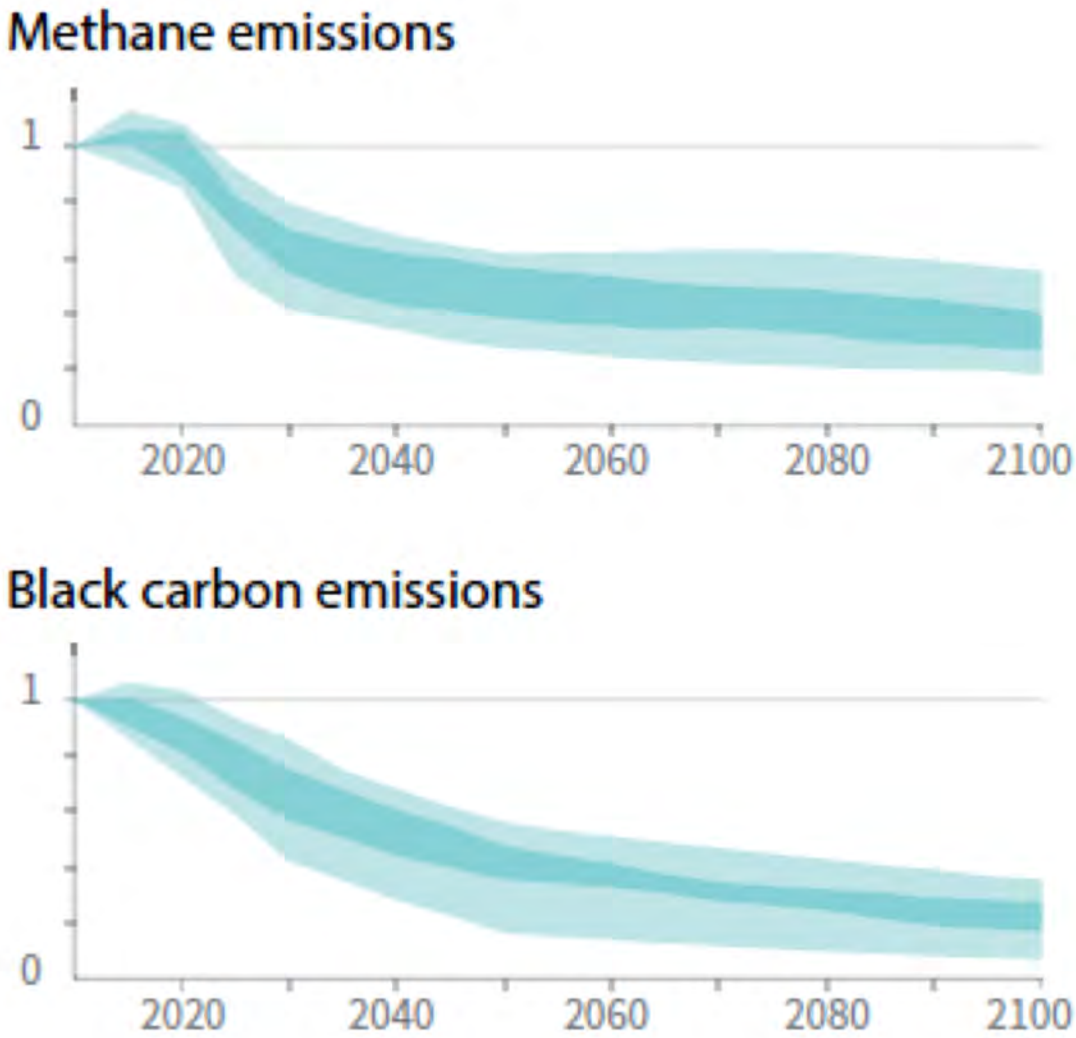
Impacts and risks for selected natural, managed and human systems.



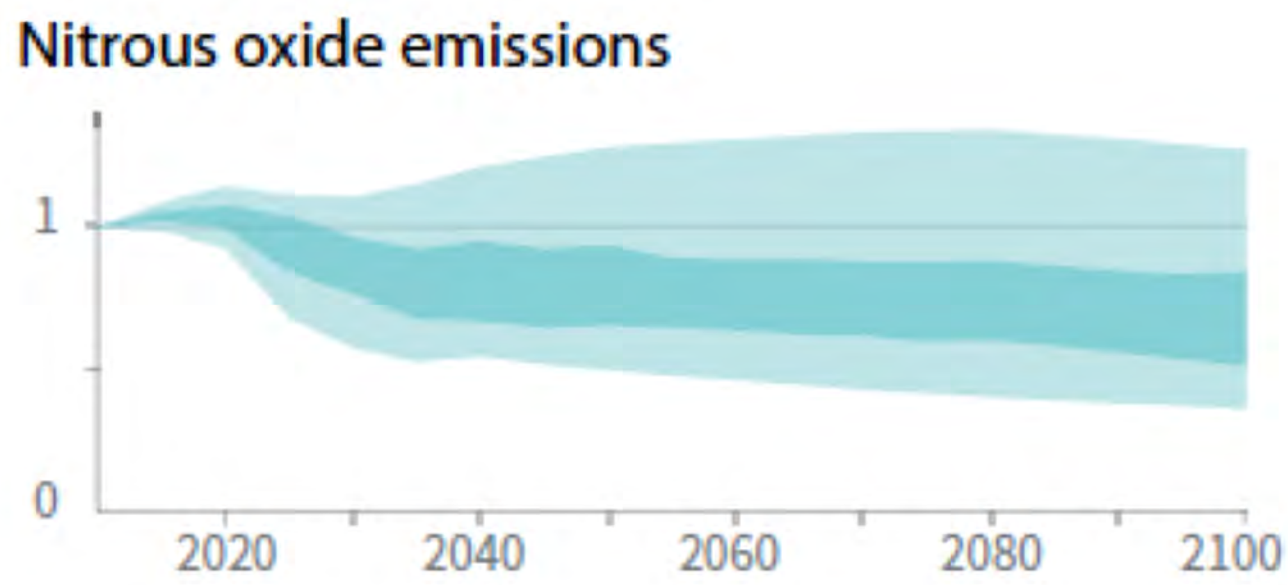
Pathwasys limiting global warming to 1.5 degree C.



Projected non-CO_2 emissions for CH_4 and black carbon in model pathways that limit global warming to 1.5° C.

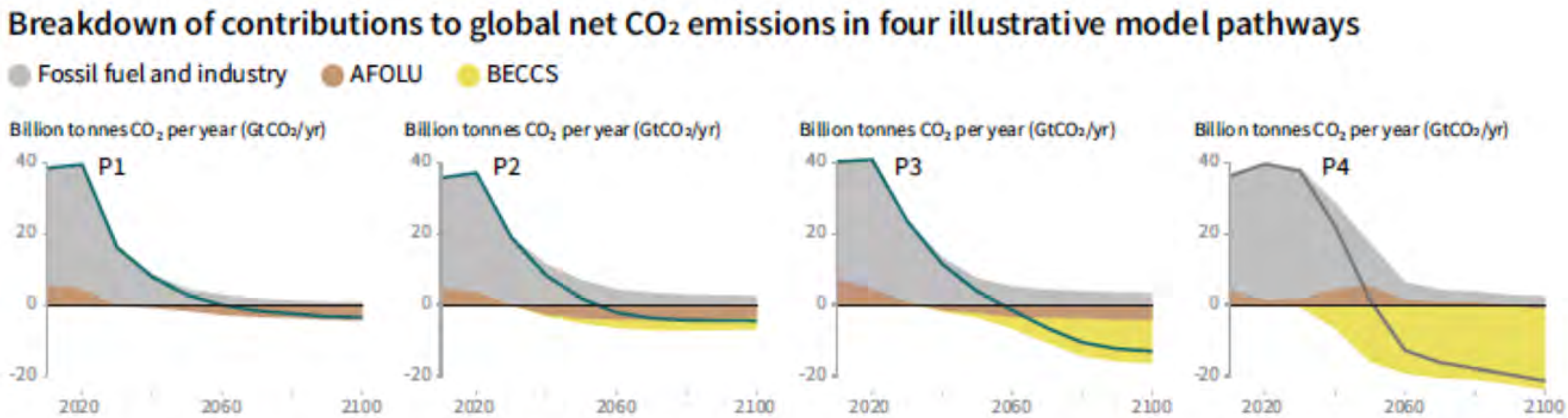


Projected non-CO_2 emissions for N_2O in model pathways that limit global warming to 1.5° C.



High bioenergy demand can increase emissions of nitrous oxide in some 1.5 degree C pathways.

A scenario in which social, business and technological innovations result in lower energy demand up to 2050 while living standards rise, especially in the global South.



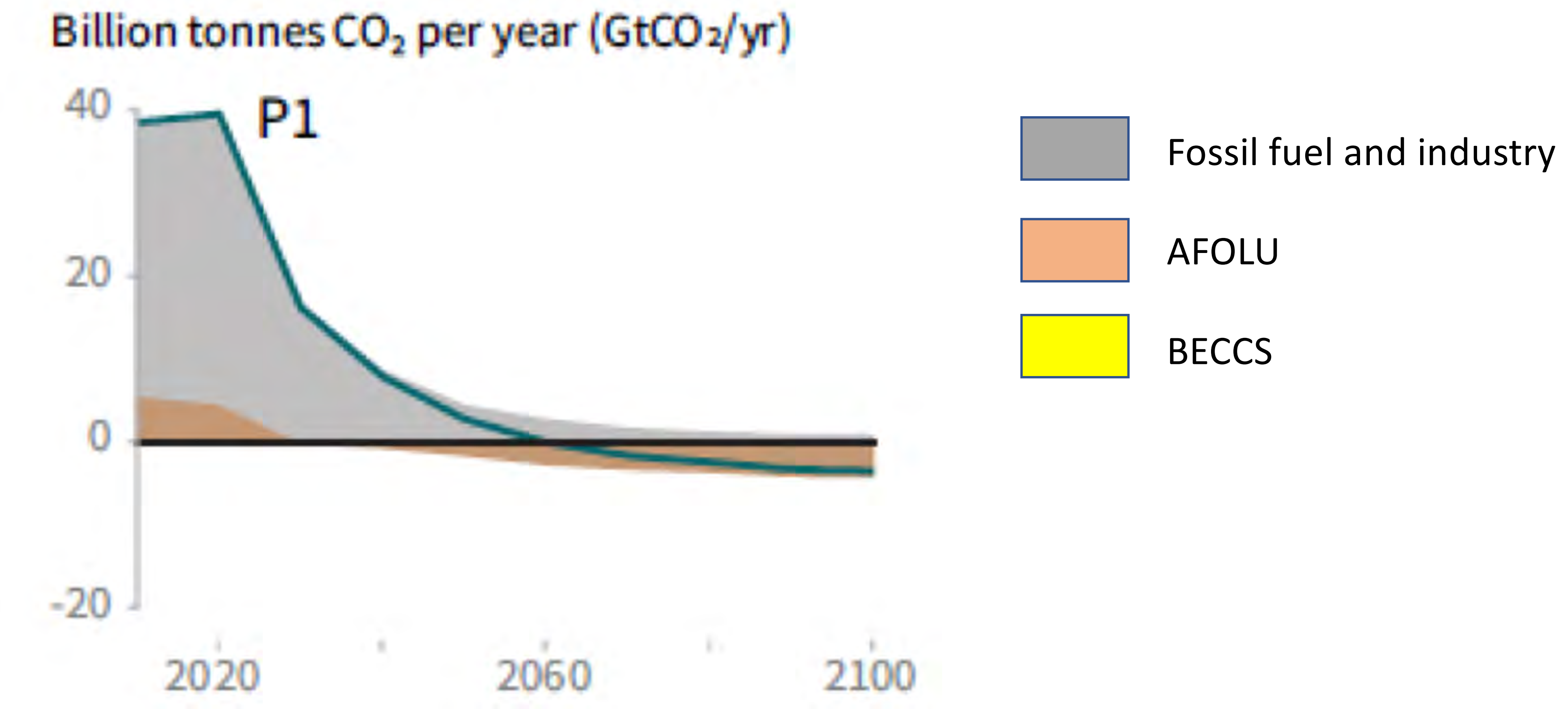
P1: A scenario in which social, business and technological innovations result in lower energy demand up to 2050 while living standards rise, especially in the global South. A downsized energy system enables rapid decarbonization of energy supply. Afforestation is the only CDR option considered; neither fossil fuels with CCS nor BECCS are used.

P2: A scenario with a broad focus on sustainability including energy intensity, human development, economic convergence and international cooperation, as well as shifts towards sustainable and healthy consumption patterns, low-carbon technology innovation, and well-managed land systems with limited societal acceptability for BECCS.

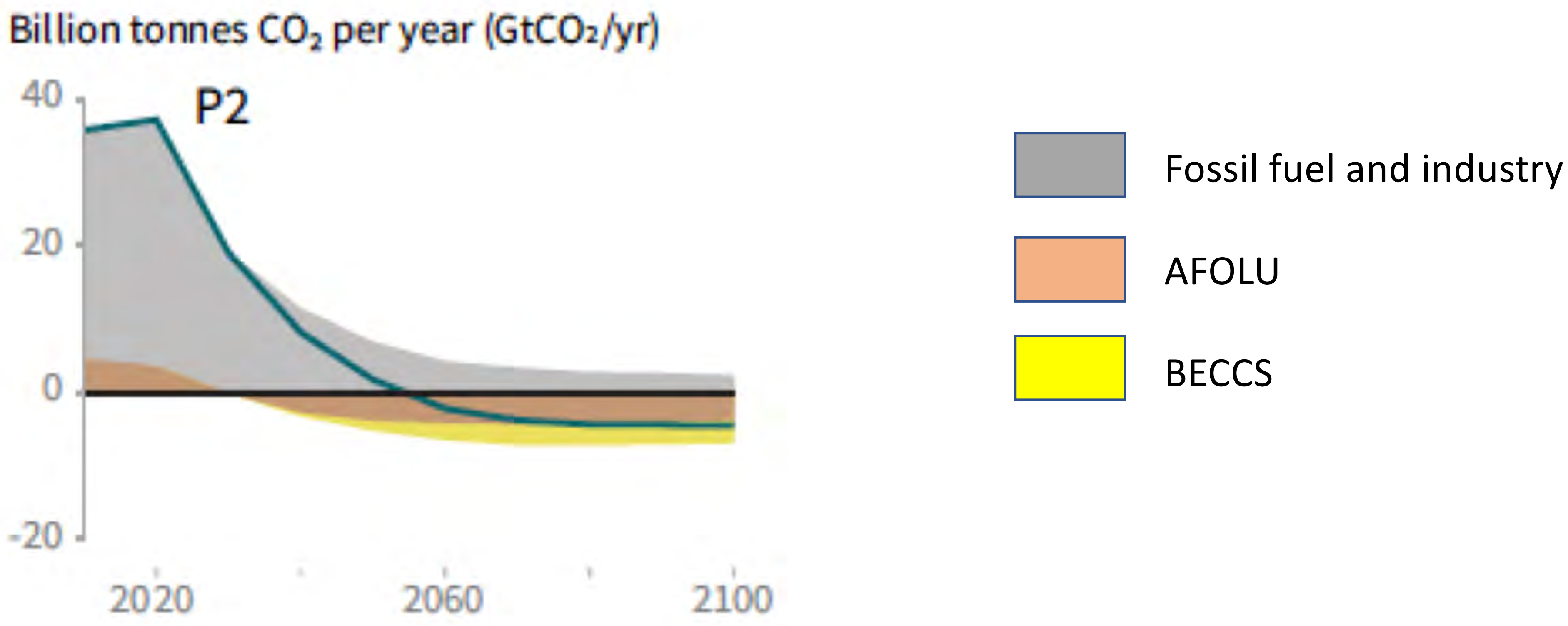
P3: A middle-of-the-road scenario in which societal as well as technological development follows historical patterns. Emissions reductions are mainly achieved by changing the way in which energy and products are produced, and to a lesser degree by reductions in demand.

P4: A resource- and energy-intensive scenario in which economic growth and globalization lead to widespread adoption of greenhouse-gas-intensive lifestyles, including high demand for transportation fuels and livestock products. Emissions reductions are mainly achieved through technological means, making strong use of CDR through the deployment of BECCS.

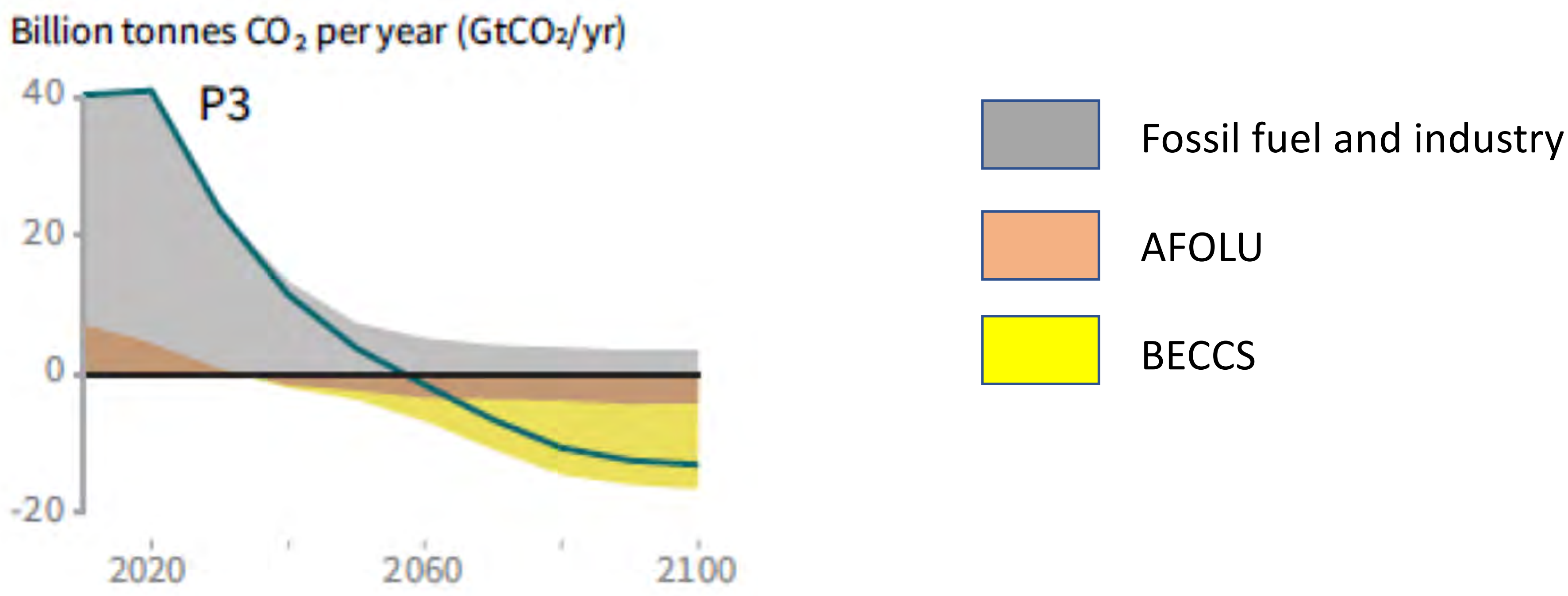
P1: A scenario in which social, business and technological innovations result in lower energy demand up to 2050 while living standards rise, especially in the global South.



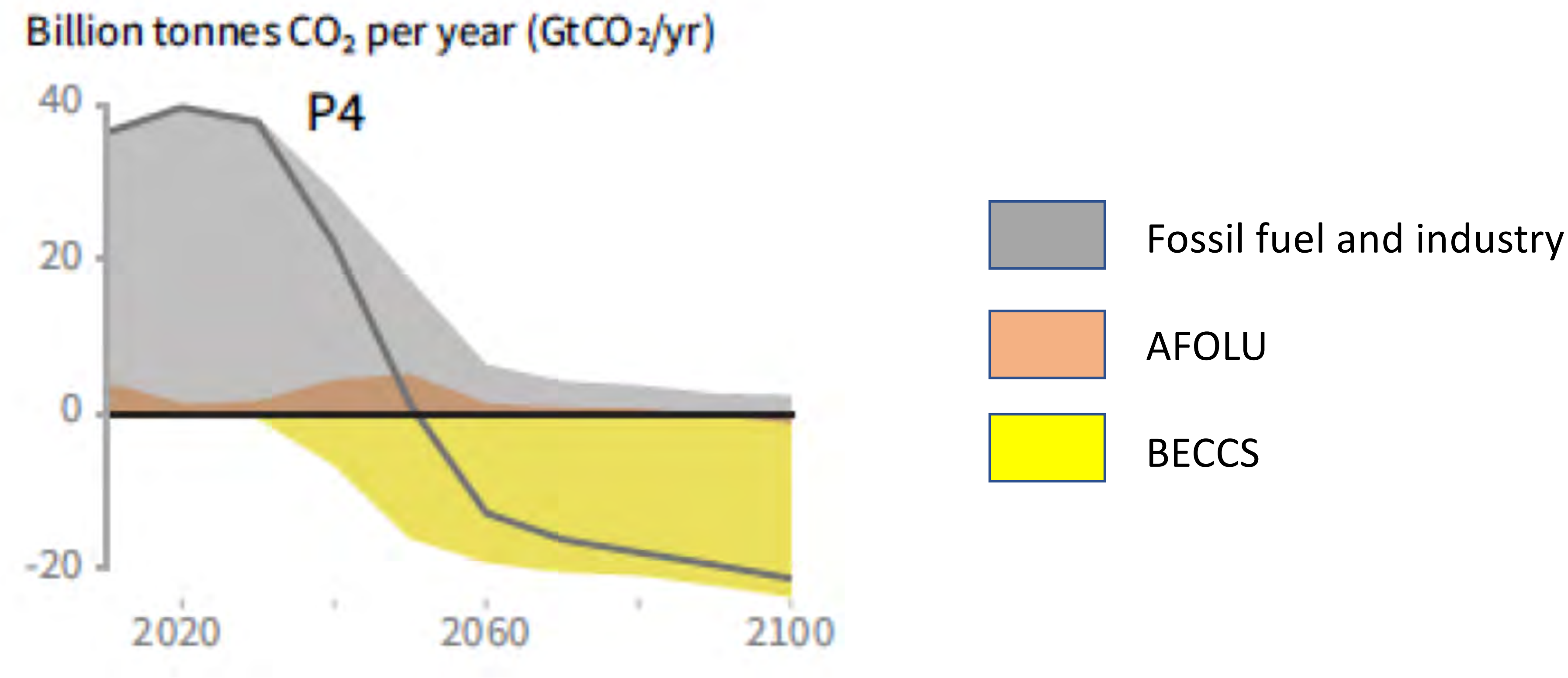
P2: A scenario with a broad focus on sustainability including energy intensity, human development, economic convergence and international cooperation.



P3: A middle-of-the-road scenario in which societal as well as technological development follows historical patterns.



P4: A resource- and energy-intensive scenario in which economic growth and globalization lead to widespread adoption of greenhouse-gas-intensive lifestyles.



Indicators for the emission pathways for limiting the global warming to 1.5 degree C.

Pathway classification →	P1	P2	P3	P4	Interquartile range
Global indicators ↓	No or limited overshoot			Higher overshoot	No or limited overshoot
CO_2 emission change in 2030 (% rel to 2010)	-58	-47	-41	4	-58, -40
CO_2 emission change in 2050 (% rel to 2010)	-93	-95	-91	-97	-107, -94
Kyoto-GHG emissions* in 2030 (% rel to 2010)	-50	-49	-35	-2	-51, -39
Kyoto-GHG emissions* in 2050 (% rel to 2010)	-82	-89	-78	-80	-93, -81
Final energy demand** in 2030 (% rel to 2010)	-15	-5	17	39	-12, 7
Final energy demand** in 2050 (% rel to 2010)	-32	2	21	44	-11, 22

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Global indicators ↓	No or limited overshoot			Higher overshoot	No or limited overshoot
Renewable share in electricity in 2030 (%)	60	58	48	25	47, 65
Renewable share in electricity in 2050 (%)	77	81	63	70	69, 86
Primary energy from coal in 2030 (% rel to 2010)	-78	-61	-75	-59	-78, -59
Primary energy from coal in 2050 (% rel to 2010)	-97	-77	-73	-97	-95, -74
Primary energy from oil in 2030 (% rel to 2010)	-37	-13	-3	86	-34, 3
Primary energy from oil in 2050 (% rel to 2010)	-87	-50	-81	-32	-78, -31

Indicators for the emission pathways for limiting the global warming to 1.5 degree C.

Pathway classification →	P1	P2	P3	P4	Interquartile range
Global indicators ↓	No or limited overshoot			Higher overshoot	No or limited overshoot
Primary energy from gas in 2030 (% rel to 2010)	-25	-20	33	37	-26, 21
Primary energy from gas in 2050 (% rel to 2010)	-74	-53	21	-48	-56, 6
Primary energy from nuclear in 2030 (% rel to 2010)	59	83	98	106	44, 102
Primary energy from nuclear in 2050 (% rel to 2010)	150	98	501	468	91, 190
Primary energy from biomass in 2030 (% rel to 2010)	-11	0	36	-1	29, 80
Primary energy from biomass in 2050 (% rel to 2010)	-16	49	121	418	123, 261
from non-biomass renewables in 2030 (% rel to 2010)	430	470	315	110	245, 436
from non-biomass renewables in 2050 (% rel to 2010)	833	1327	878	1137	576, 1299

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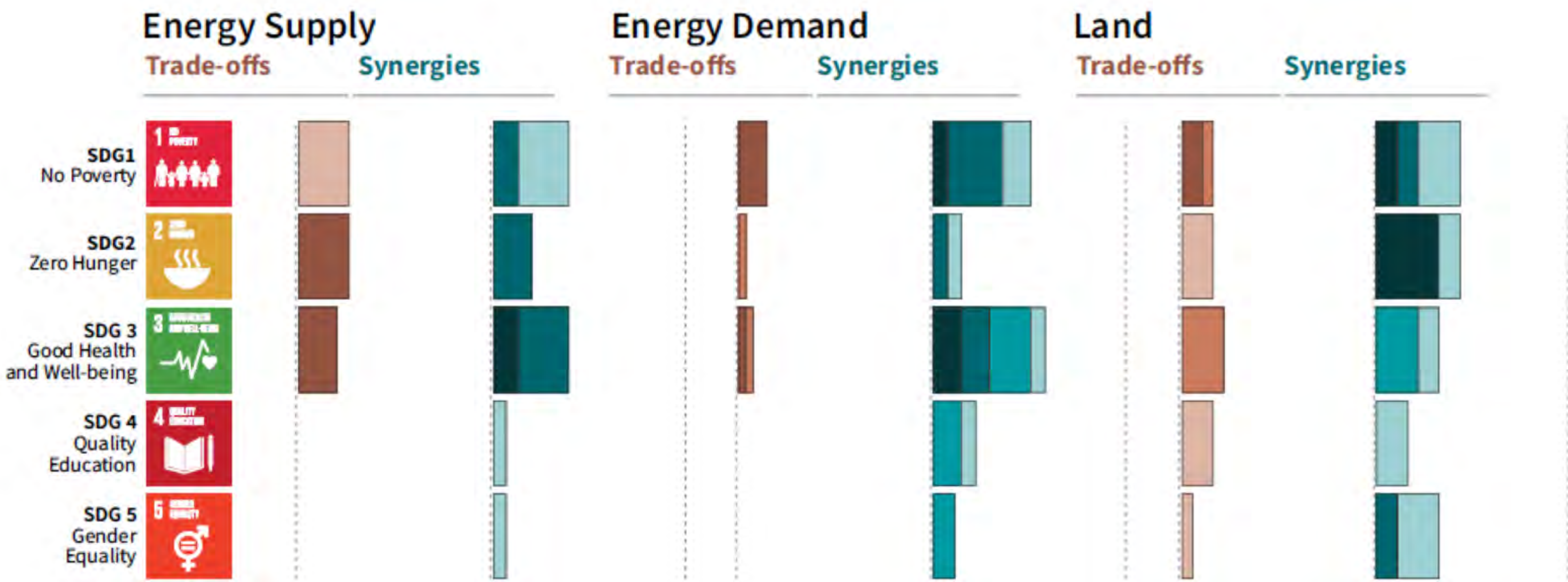
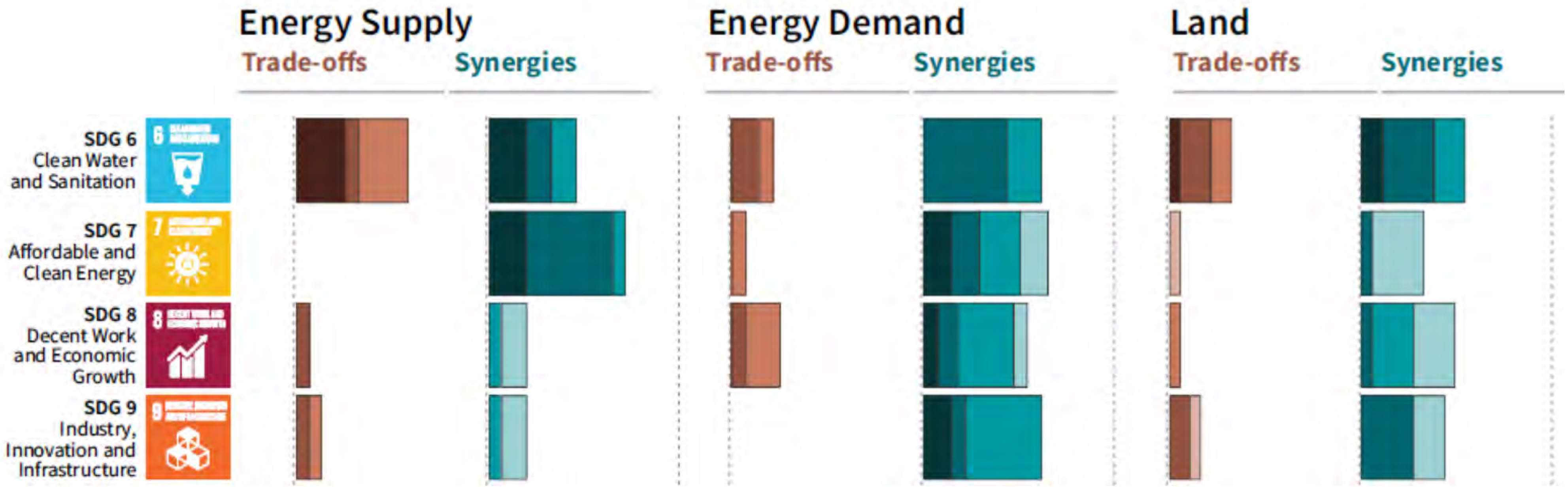
Pathway classification →	P1	P2	P3	P4	Interquartile range
Global indicators ↓	No or limited overshoot			Higher overshoot	No or limited overshoot
Cumulative CCS until 2100 ($GtCO_2$)	0	348	687	1218	550, 1017
Cumulative BECCS until 2100 ($GtCO_2$)	0	151	414	1191	364, 662
Land area of bioenergy crops in 2050 (10^6 km^2)	0.2	0.9	2.8	7.2	1.5, 3.2
Agricultural CH_4 emissions in 2030 (% rel to 2010)	-24	-48	1	14	-30, -11
Agricultural CH_4 emissions in 2050 (% rel to 2010)	-33	-69	-23	2	-47, -24
Agricultural N_2O emissions in 2030 (% rel to 2010)	5	-26	15	3	-21, 3
Agricultural N_2O emissions in 2050 (% rel to 2010)	6	-26	0	39	-26, 1

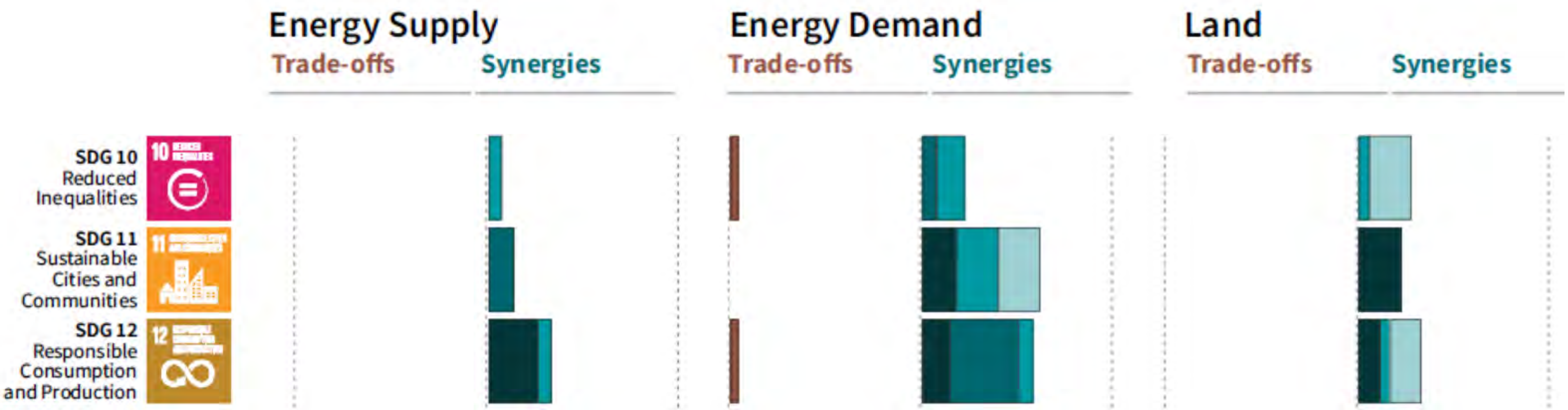
Potential synergies and trade-offs between the sectoral portfolio of climate change mitigation options and the Sustainable Development Goals (SDGs 1, 2, 3, 4, 5).



Potential synergies and trade-offs between the sectoral portfolio of climate change mitigation options and the Sustainable Development Goals (SDGs 6, 7, 8, 9).



Potential synergies and trade-offs between the sectoral portfolio of climate change mitigation options and the Sustainable Development Goals (SDGs 10, 11, 12).



Potential synergies and trade-offs between the sectoral portfolio of climate change mitigation options and the Sustainable Development Goals (SDGs 14, 15, 16, 17).