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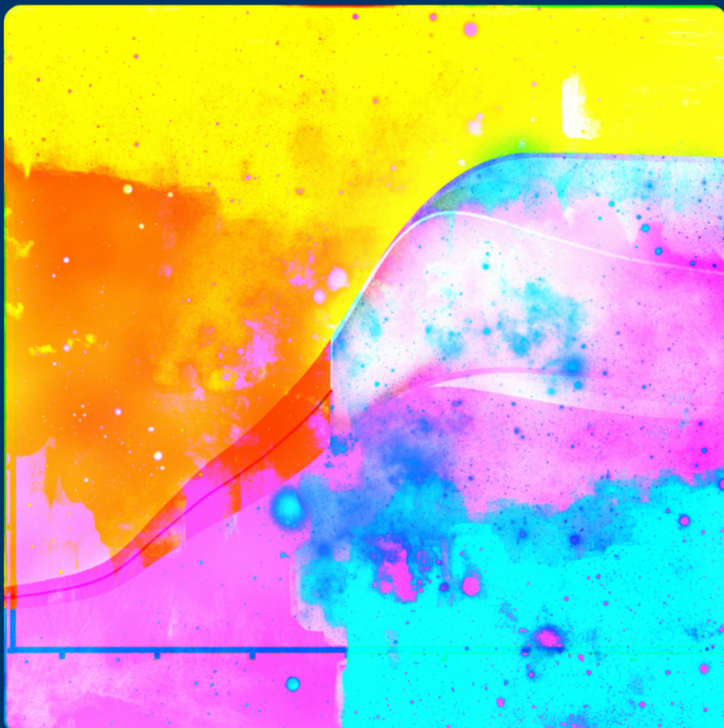


Emission Pathways and System Transitions:

An Assessment of IPCC Special Report on 'Global Warming of 1.5°C'

Presented in:
24th AIM International Workshop
NIES, Tsukuba, Japan
November 5, 2018

Understanding Global Warming of 1.5°C


Ashley Cooper / Aurora Photos

Where are we now?

Since pre-industrial times, human activities have caused approximately 1°C of global warming.

- Already seeing consequences for people, nature and livelihoods
- At current rate, would reach 1.5°C between 2030 and 2052
- Past emissions alone do not commit the world to 1.5°C

Projected Climate Change, Potential Impacts and Associated Risks

Impacts of global warming 1.5°C


Jason Florio / Aurora Photos

At 1.5°C compared to 2°C:

- Less extreme weather where people live, including extreme heat and rainfall
- By 2100, global mean sea level rise will be around 10 cm lower but may continue to rise for centuries
- 10 million fewer people exposed to risk of rising seas
- Up to several hundred million fewer people exposed to climate-related risk and susceptible to poverty by 2050

Impacts of global warming 1.5°C

At 1.5°C compared to 2°C:

- Lower impact on biodiversity and species
- Smaller reductions in yields of maize, rice, wheat
- Lower risk to fisheries and the livelihoods that depend on them
- Global population exposed to increased water shortages is up to 50% less

Emission Pathways and System Transitions Consistent with 1.5°C Global Warming

Carbon Budget (GtCO_2)

- Using global mean surface temperature (GMST) methodology, the remaining carbon budget is **770 Gt CO_2 for a 50% probability** of limiting warming to 1.5°C and **570 Gt CO_2 for a 66% probability**

- The remaining carbon budget is being depleted by current emissions of **42 ± 3 Gt** CO_2 per year.

- Additional carbon release from future permafrost thawing and methane release from wetlands would reduce budgets by up to **100 Gt CO_2**

Source: C1.3 SPM

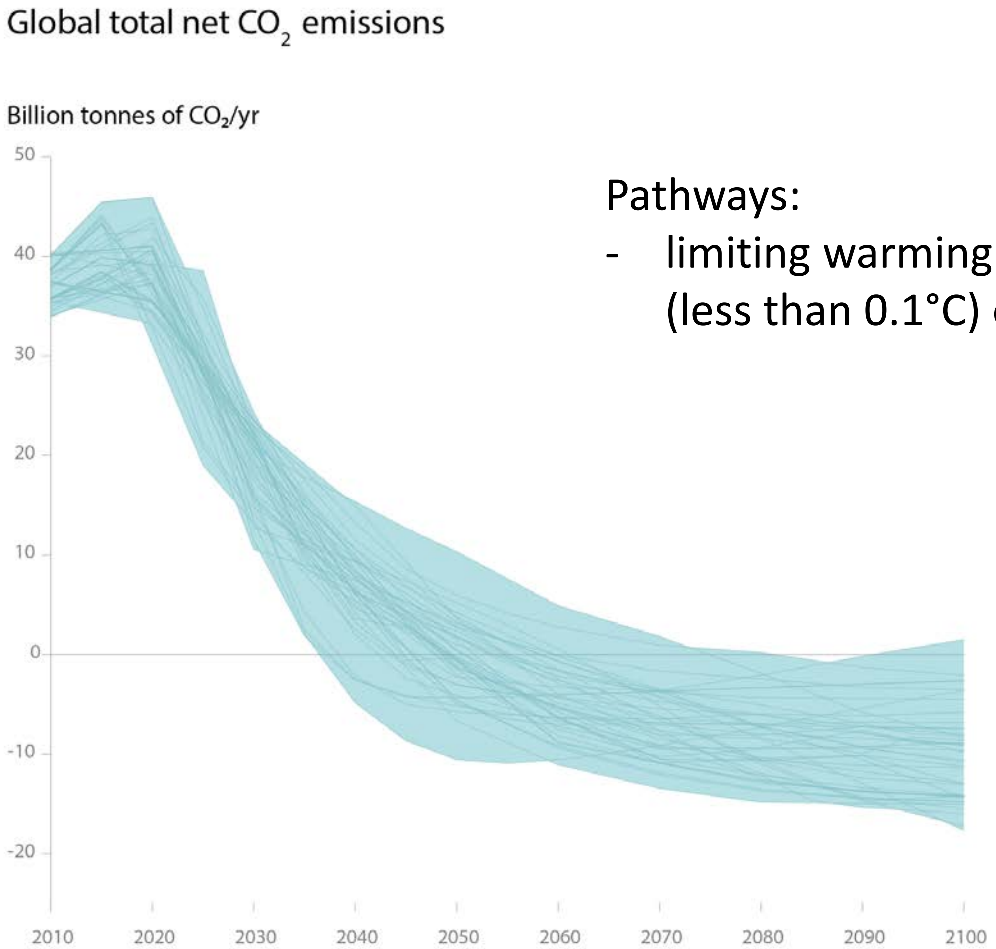
Greenhouse gas emissions pathways

- To limit warming to 1.5°C, CO_2 emissions fall by about 45% by 2030 (from 2010 levels)
  - → Compared to 20% for 2°C
- To limit warming to 1.5°C, CO_2 emissions would need to reach ‘net zero’ around 2050
  - → Compared to around 2075 for 2°C
- Reducing non-CO_2 emissions would have direct and immediate health benefits

Source: C1 SPM

Figures SPM3a & SPM3b

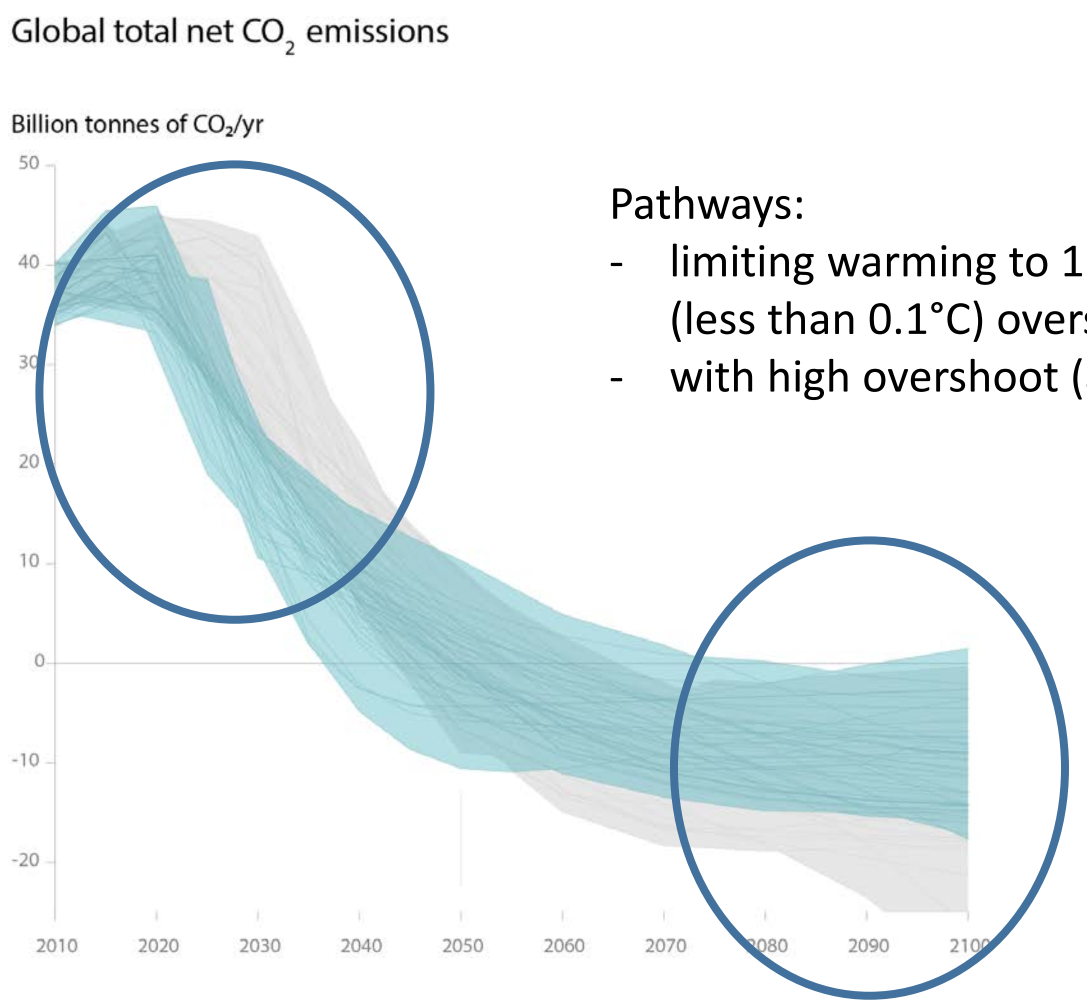
SPM3a: Global emissions pathway characteristics



Pathways:

- limiting warming to 1.5°C with no or limited (less than 0.1°C) overshoot

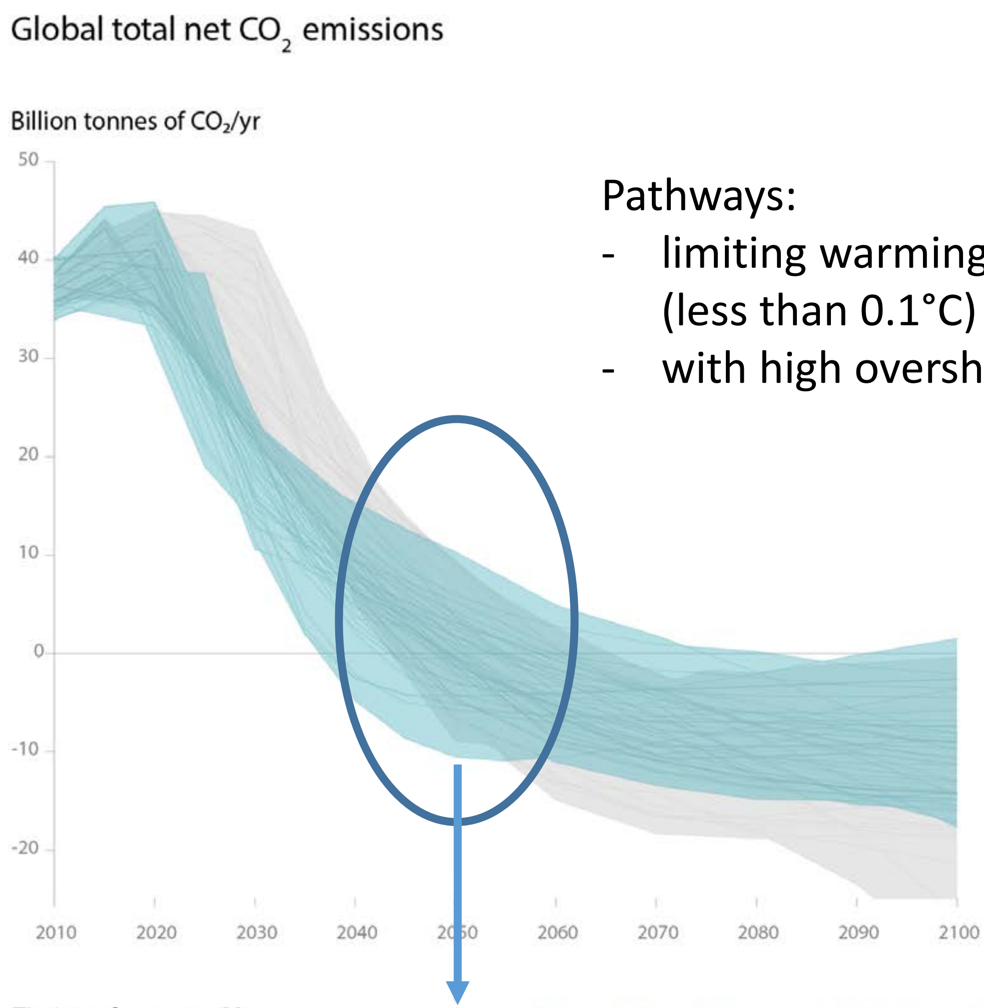
SPM3a: Global emissions pathway characteristics



Pathways:

- limiting warming to 1.5°C with no or limited (less than 0.1°C) overshoot
- with high overshoot (at least 0.1°C and larger)

SPM3a: Global emissions pathway characteristics



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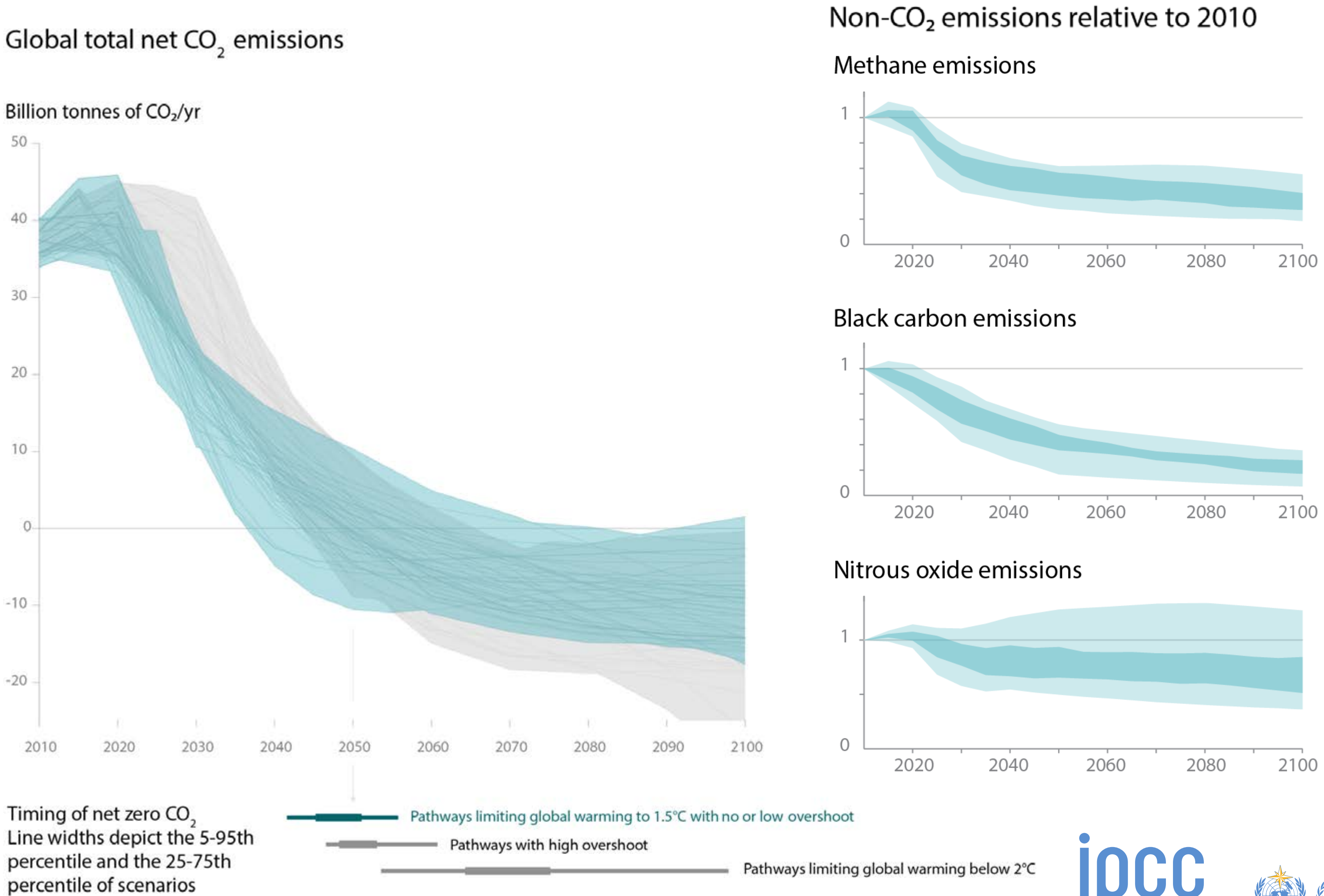
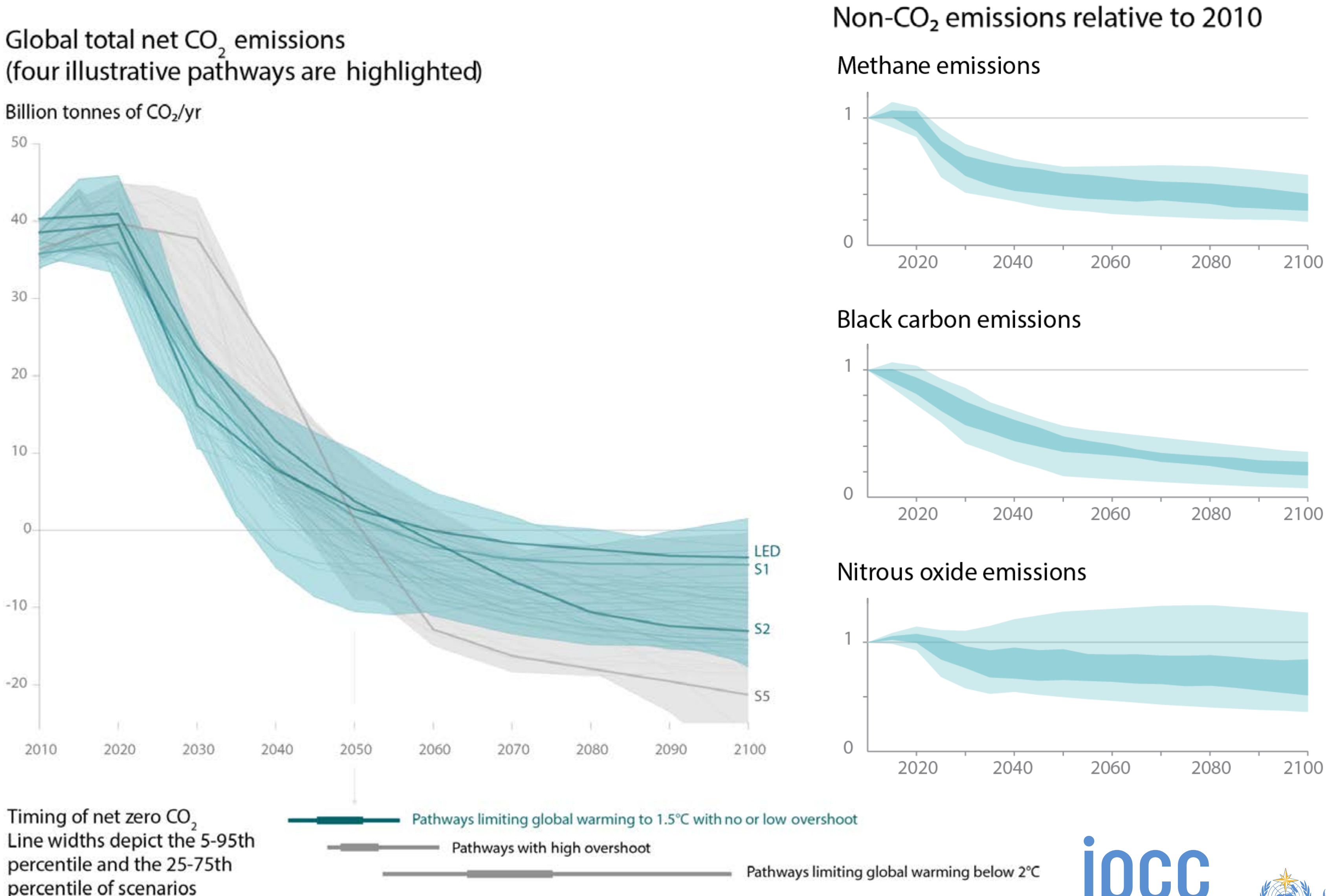


INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

SPM3a: Global emissions pathway characteristics



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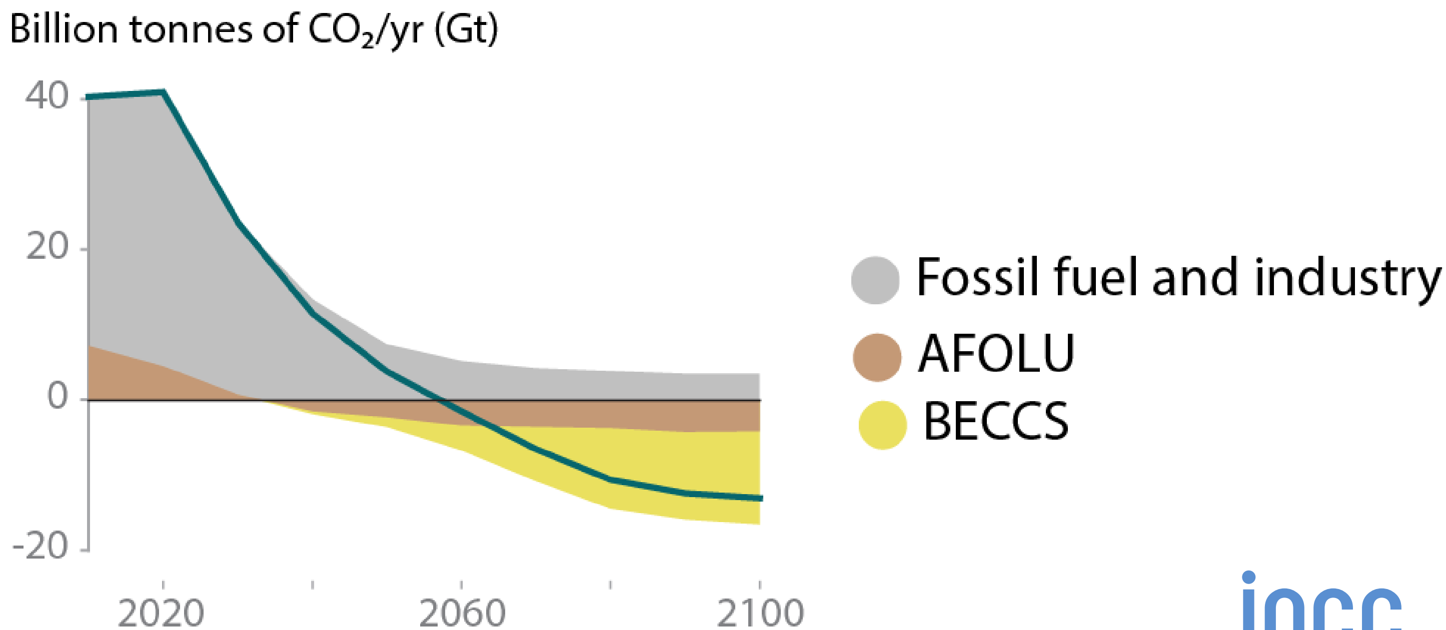
SPM3b: Characteristics of four illustrative pathways
Breakdown of global net anthropogenic CO_2 emissions

Three contributions to global net anthropogenic CO_2 emissions

- CO_2 emissions from fossil fuel and industry
- Net CO_2 emissions from agriculture, forestry, and other land use (AFOLU)
- CO_2 removal by bioenergy with carbon capture and storage (BECCS)



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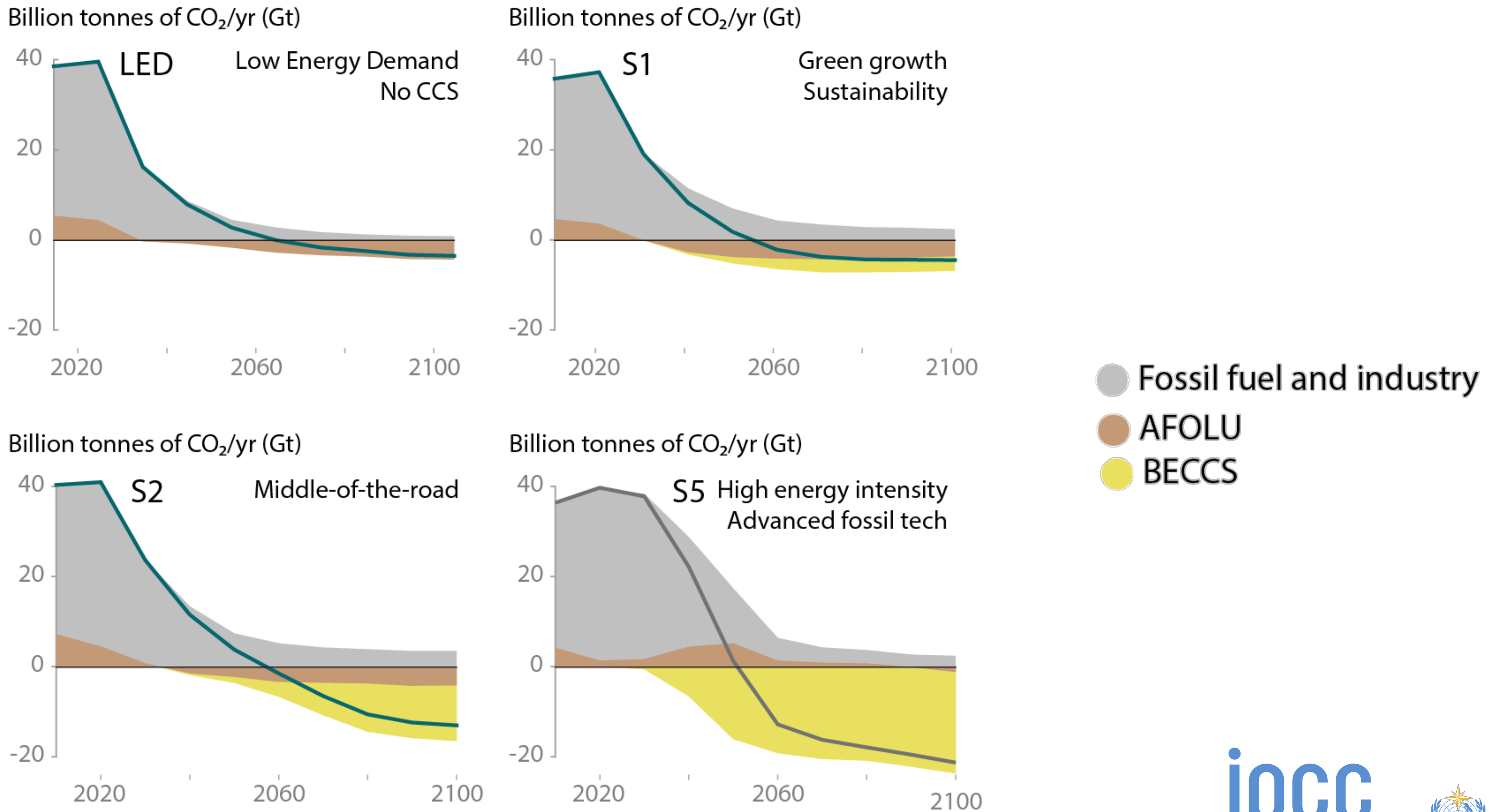
SPM3b: Characteristics of four illustrative pathways
Breakdown of global net anthropogenic CO_2 emissions

Four carefully selected illustrative pathways:



INTERGOVERNMENTAL PANEL ON climate change

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SPM3b: Characteristics of four illustrative pathways

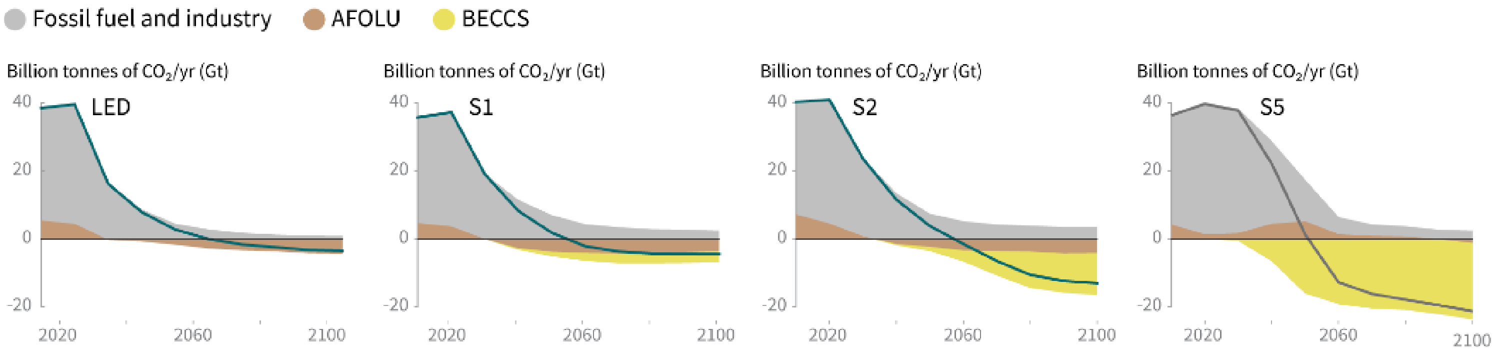
Set of pathway characteristics, carefully selected to illustrate:

- Climate outcome and emissions implications
- Energy system transition
- Carbon dioxide removal (CDR) and land implications

Estimated overshoot of 1.5°C
Kyoto-GHG emissions in 2030
Kyoto-GHG emissions in 2050
CO_2 emission change in 2030
Final energy demand in 2030
Final energy demand in 2050
Renewable share of electricity in 2030
Renewable share of electricity in 2050
Primary energy from coal in 2030
Primary energy from coal in 2050
Cumulative BECCS until 2100
Cumulative CCS until 2100
Land-use CO_2 emissions in 2050
Land footprint of bioenergy crops

SPM3b: Characteristics of four illustrative pathways

Breakdown of contributions to global net CO_2 emissions in four illustrative pathways



LED: 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 down-sized energy system enables rapid decarbonisation of energy supply. Afforestation is the only CDR option considered; neither fossil fuels with CCS nor BECCS are used.

S1: 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.

S2: 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.

S5: 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.

	LED	S1	S2	S5
Estimated overshoot of 1.5°C	No or less than 0.1°C	No or less than 0.1°C	Less than 0.1°C	Larger than 0.2°C
Kyoto-GHG emissions in 2030	24 GtCO$_2$eq/yr	25 GtCO$_2$eq/yr	33 GtCO$_2$eq/yr	47 GtCO$_2$eq/yr
Kyoto-GHG emissions in 2050	9 GtCO$_2$eq/yr	7 GtCO$_2$eq/yr	11 GtCO$_2$eq/yr	10 GtCO$_2$eq/yr
CO_2 emission change in 2030	-58 % rel to 2010	-49 % rel to 2010	-41 % rel to 2010	4 % rel to 2010
Final energy demand in 2030	309 EJ/yr	325 EJ/yr	424 EJ/yr	494 EJ/yr
Final energy demand in 2050	245 EJ/yr	349 EJ/yr	438 EJ/yr	512 EJ/yr
Renewable share of electricity in 2030	60 %	58 %	48 %	25 %
Renewable share of electricity in 2050	77 %	81 %	63 %	70 %
Primary energy from coal in 2030	-78 % rel to 2010	-61 % rel to 2010	-75 % rel to 2010	-59 % rel to 2010
Primary energy from coal in 2050	-97 % rel to 2010	-77 % rel to 2010	-73 % rel to 2010	-97 % rel to 2010
Cumulative BECCS until 2100	0 GtCO$_2$	151 GtCO$_2$	414 GtCO$_2$	1191 GtCO$_2$
Cumulative CCS until 2100	0 GtCO$_2$	348 GtCO$_2$	687 GtCO$_2$	1218 GtCO$_2$
Land-use CO_2 emissions in 2050	-1,7 GtCO$_2$/yr	-3,8 GtCO$_2$/yr	-2,3 GtCO$_2$/yr	5,2 GtCO$_2$/yr
Land footprint of bioenergy crops	22 Mha	93 Mha	283 Mha	724 Mha

Feasibility Indicators for '1.5°C' Consistent Pathways

Characteristics	Indicators to Assess Feasibility of Mitigation Options
Economic	Cost-effectiveness; Absence of distributional effects; Employment & productivity, enhancement potential
Technological	Technical scalability; Maturity; Simplicity; Absence of risk
Institutional	Political acceptability; Legal & administrative feasibility Institutional capacity; Transparency & accountability potential
Socio-cultural	Social co-benefits (health, education); Public acceptance Social & regional inclusiveness; Intergenerational equity Human capabilities
Environmental/ Ecological	Reduction of air pollution; Reduction of toxic waste Reduction of water use; Improved biodiversity
Geophysical	Physical feasibility (physical potentials); Limited use of land; Limited use of scarce (geo)physical resources; Global spread

Source: Table 4.10

Changes at Unprecedented Scale

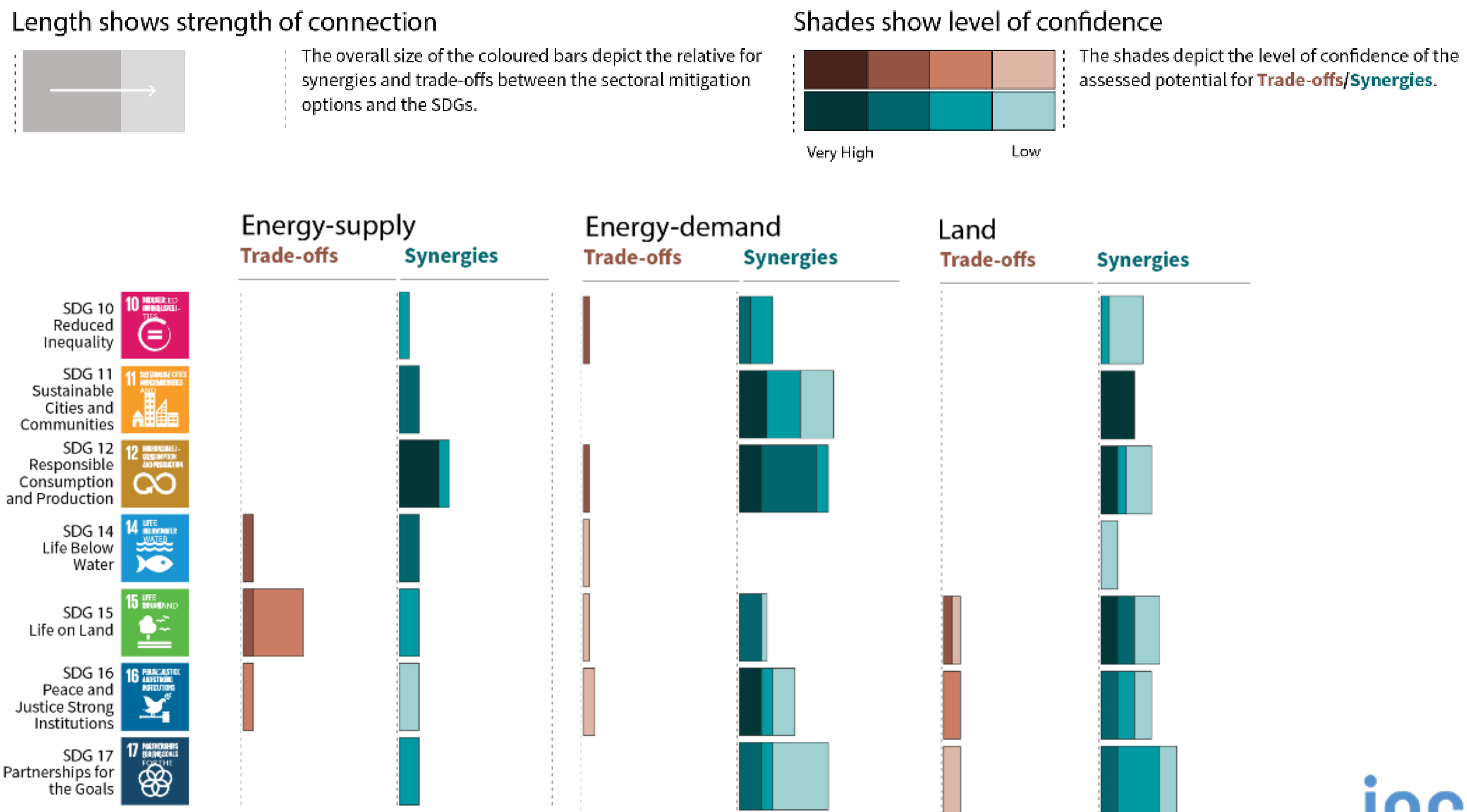
- Limiting warming to 1.5°C would require changes on an unprecedented scale
  - → Rapid and far-reaching transitions all sectors
  - → A range of technologies
  - → Behavioural changes
  - → Increased investment in low carbon options

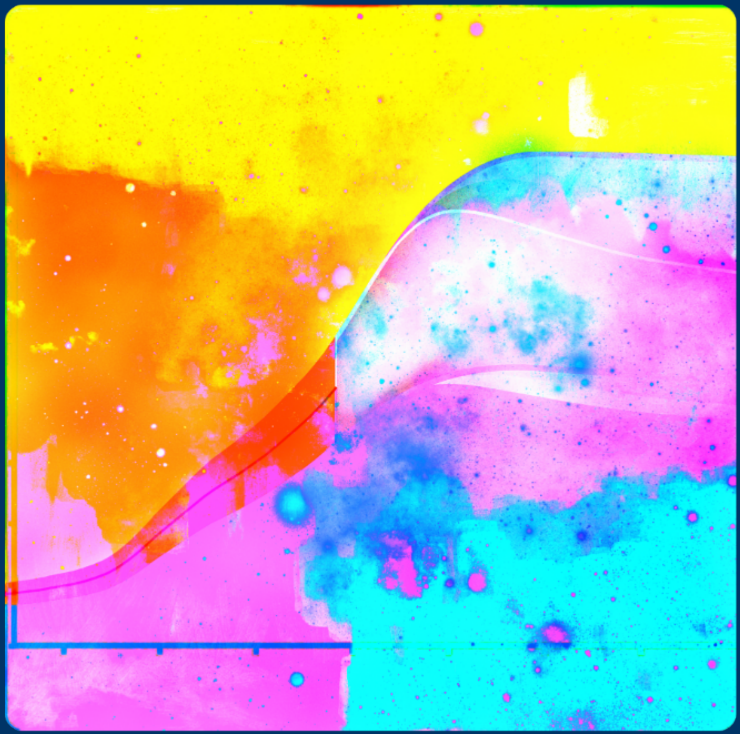
Source: C3 SPM

Aligning Ambition and Actions

- National pledges are not enough to limit warming to 1.5°C (D1 SPM)
- Progress in renewables would need to be mirrored in other sectors.
- The solutions required to limit warming to 1.5ºC are available. What is required is to speed and scale up implementation.
- These solutions confer synergies with sustainable development

SPM4 | Indicative linkages between mitigation and sustainable development using SDGs (the linkages do not show costs and benefit)





Questions?