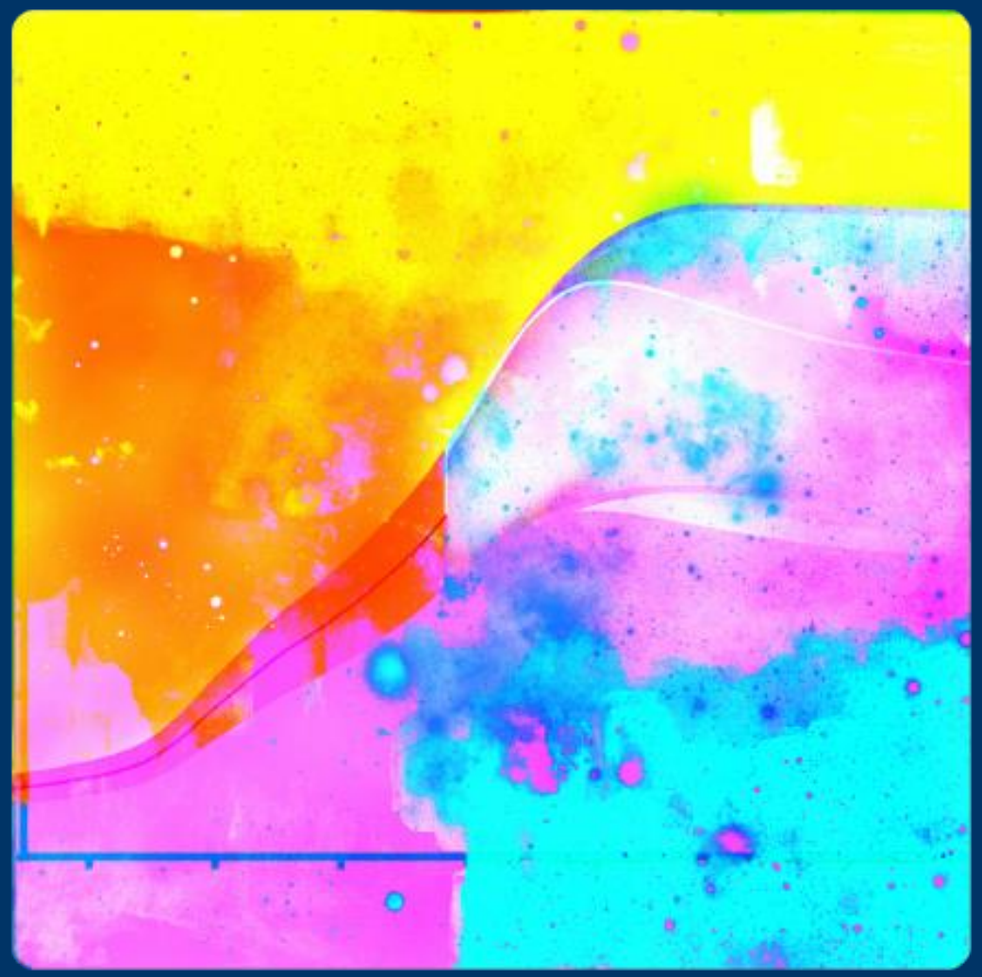

TEC-18

IPCC Special Report on Global Warming of 1.5°C

Heleen de Coninck

March 25, 2019

Ashley Cooper / Aurora Photos

Outline of this presentation

Short introduction to the IPCC process

Key messages of the SR1.5

Pathways and systems transitions

- Feasibility of mitigation and adaptation options

Enabling conditions for system transitions

- Technological innovation in the SR1.5

Personal reflections on relevance to the TEC

Outlook to the IPCC Sixth Assessment (AR6)

Role of the IPCC

"… to assess on a comprehensive, objective, open and transparent basis the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation."

"IPCC reports should be neutral with respect to policy, although they may need to deal objectively with scientific, technical and socio-economic factors relevant to the application of particular policies."

Policy relevant
but not policy prescriptive

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SR1.5 – Agreed outline and pages

Summary for Policy Makers (up to 10 pages)

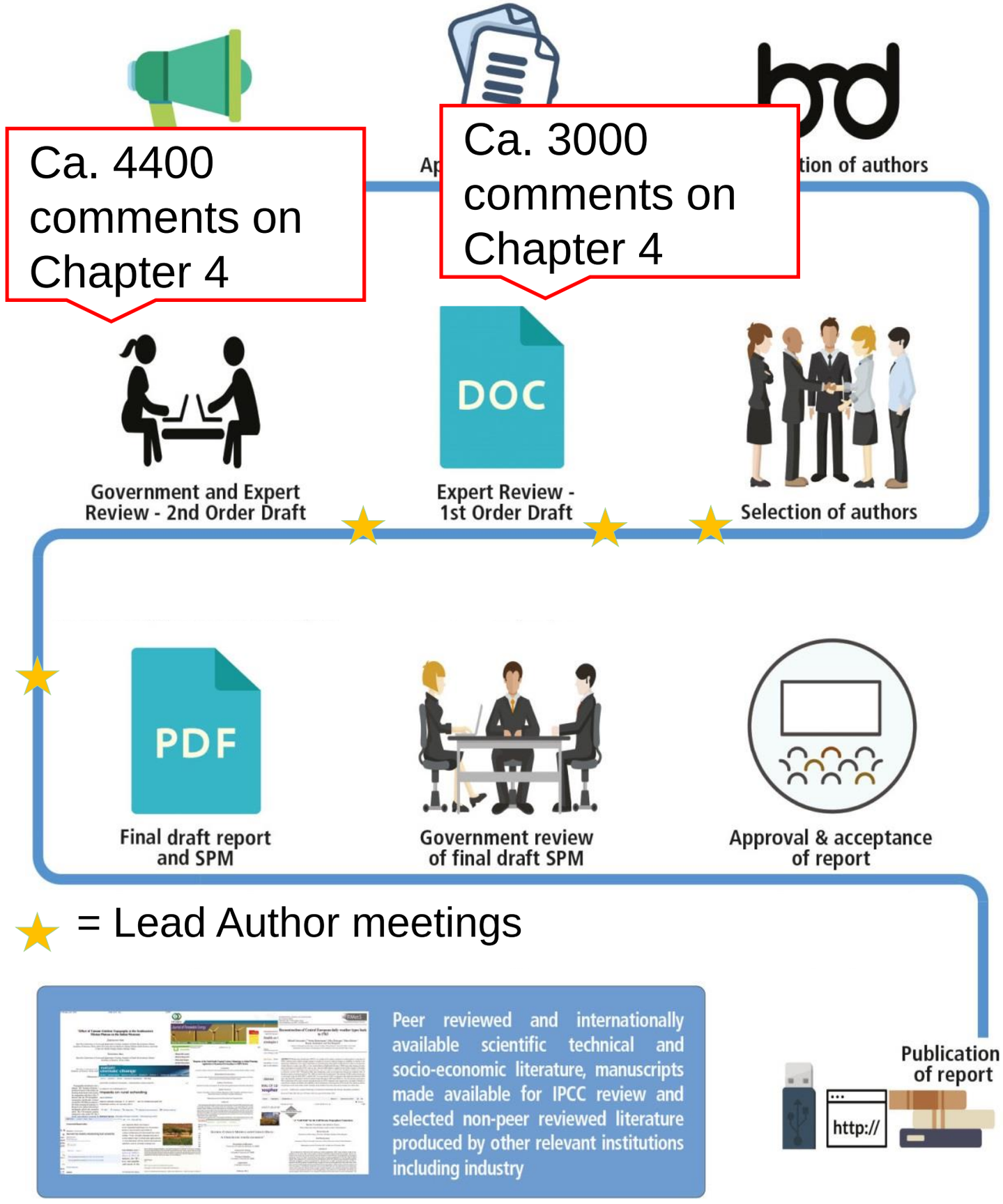
1. Framing and context (15 pages)
2. Mitigation pathways compatible with 1.5°C in the context of sustainable development (40 pages)
3. Impacts of 1.5°C global warming on natural and human systems (60 pages)
4. **Strengthening and implementing the global response to the threat of climate change (50 pages)**
5. Sustainable development, poverty eradication and reducing inequalities (20 pages)

Boxes - integrated case studies/regional and cross-cutting themes (up to 20 pages)

FAQs (10 pages)

Process for writing an IPCC report and the SR1.5

- Normally Special Reports written in well over 2 years' time. This report in 1.5 years
- Fast developing literature base: both sparse and plentiful
- Very diverse group of authors, spanning three working groups
- Huge amounts of comments
- Discussed during SBSTA-49 (Katowice)

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WMO
UNEP
hth Session of the IPCC and
nt Session of Working Groups I, II and III
1-5 October 2018 Incheon, Republic of Korea

Image: ENB

The report in numbers

91 Authors from **40** Countries

133 Contributing authors

6000 Studies

1 113 Reviewers

42 001 Comments

Ashley Cooper / Aurora Photos

Key messages from the report

Already 1°C of global warming

At current rate, would reach 1.5°C between 2030 and 2052

Clear benefits to limiting warming to 1.5°C

We can still limit warming to 1.5°C but this requires unprecedented changes

Waiting for NDCs means missing 1.5°C

Limiting warming to 1.5°C would go hand in hand with achieving other societal goals

Jason Florio / Aurora Photos

Impacts of warming of 1.5°C

At 1.5°C compared to 2°C (for example):

- Less extreme weather, 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
- Coral reefs disappearing vs. some remaining
- Ice-free North Pole every 100 vs every 10 years
- By 2050 hundreds of millions of people fewer affected

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 25% for 2°C

- To limit warming to 1.5°C, CO_2 emissions would need to reach ‘net zero’ around 2050

  ↳ Compared to around 2070 for 2°C

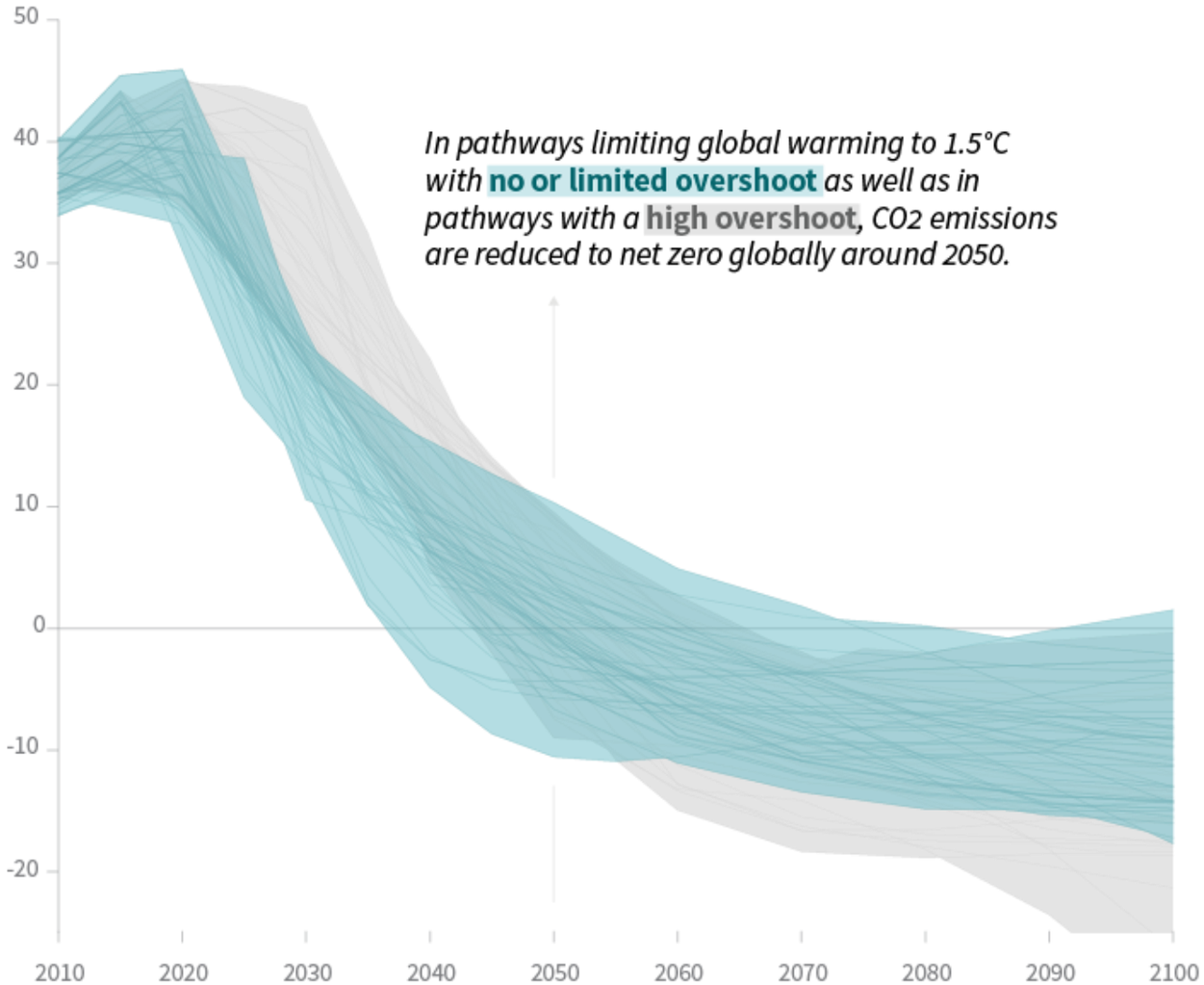
- Negligible difference in reducing non-CO_2 emissions between 1.5 and 2°C

Gerhard Zwerger-Schoner / Aurora Photos

Global emissions pathway characteristics

Global total net CO_2 emissions

Billion tonnes of CO_2/yr



*In pathways limiting global warming to 1.5°C with **no or limited overshoot** as well as in pathways with a **high overshoot**, CO2 emissions are reduced to net zero globally around 2050.*

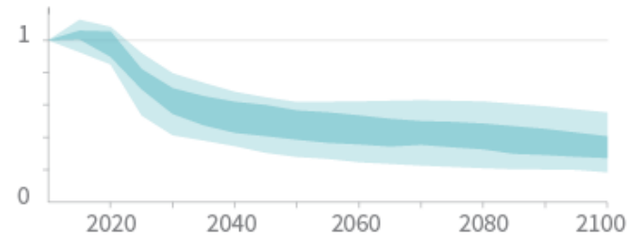
Timing of net zero CO_2
Line widths depict the 5-95th percentile and the 25-75th percentile of scenarios

- Pathways limiting global warming to 1.5°C with **no or low** overshoot
- Pathways with **high overshoot**
- Pathways limiting global warming below 2°C (Not shown above)

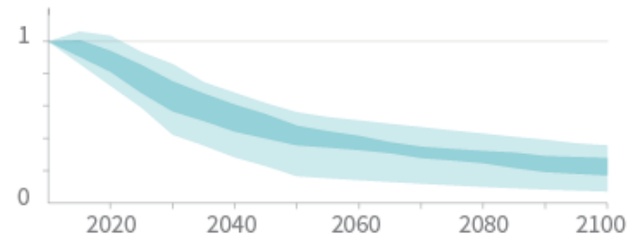
Non-CO_2 emissions relative to 2010

Emissions of non-CO_2 forcers are also reduced or limited in pathways limiting global warming to 1.5°C with **no or limited overshoot**, but they do not reach zero globally.

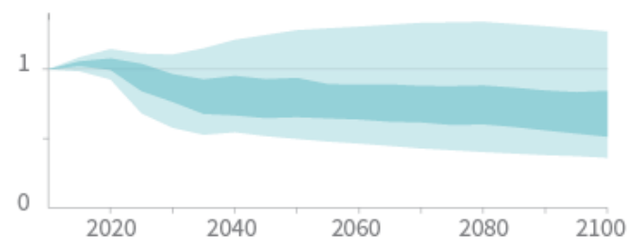
Methane emissions



Black carbon emissions



Nitrous oxide emissions

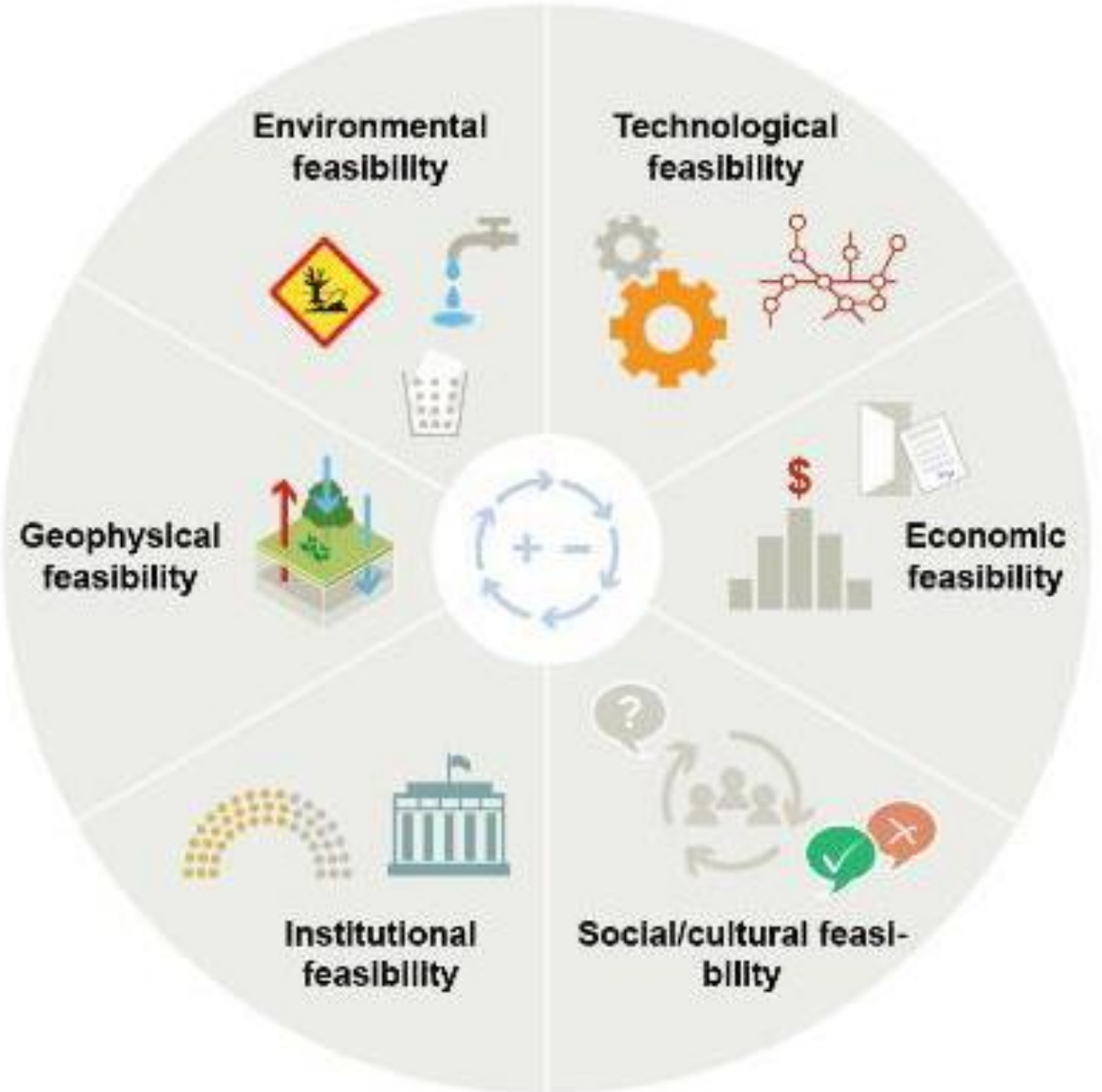


Greenhouse gas emissions pathways

- Limiting warming to 1.5°C would require systemic changes and CO_2 removal
  - → Energy systems transition
  - → Land and ecosystems transition
  - → Urban and infrastructure system transition
  - → Industrial system transition
  - → Carbon dioxide removal
- Mitigation and adaptation options within these systems transitions

Peter Essick / Aurora Photos

Feasibility of options in system transitions



Mitigation and adaptation options assessed along six dimensions

Result: where should a policymaker look first for quick wins? And what barriers need to be overcome?

Feasibility of options in system transitions

	Mitigation Option	Confidence	Economic	Technological	Institutional	Socio-cultural	Environmental-ecological	Geophysical	Context
Energy System Transitions	Solar PV	High							Cost-effectiveness affected by solar irradiation and incentive regime. Also enhanced by legal framework for independent power producers, which affects uptake.
	Power sector CCS	High							Varies with local CO_2 storage capacity, presence of legal framework, level of development and quality of public engagement
Land and Ecosystem Transitions	Ecosystems restoration	High							Depends on location and institutional factors
Urban and Infrastructure System Transitions	Electric cars and buses	Medium							Varies with degree of government intervention; requires capacity to retrofit "fuelling" stations
	Non-motorized transport	High							Viability rests on linkages with public transport, cultural factors, climate and geography
	Low/zero-energy buildings	High							Depends on size of existing building stock and growth of building stock
Industrial System Transitions	Energy efficiency	High							Potential and adoption depend on existing efficiency, energy prices and interest rates, as well as government incentives.
	Industrial CCUS	High							High concentration of CO_2 in exhaust gas improve economic and technical feasibility of CCUS in industry. CO_2 storage or reuse possibilities.
Carbon Dioxide Removal	BECCS	Medium							Depends on biomass availability, CO_2 storage capacity, legal framework, economic status and social acceptance
	Afforestation &	High							Depends on location, mode of implementation, and economic and institutional factors

28 Mitigation and 25 adaptation options assessed along six dimensions; 25 indicators

Result: where should a policymaker look first for quick wins? And what barriers need to be overcome?

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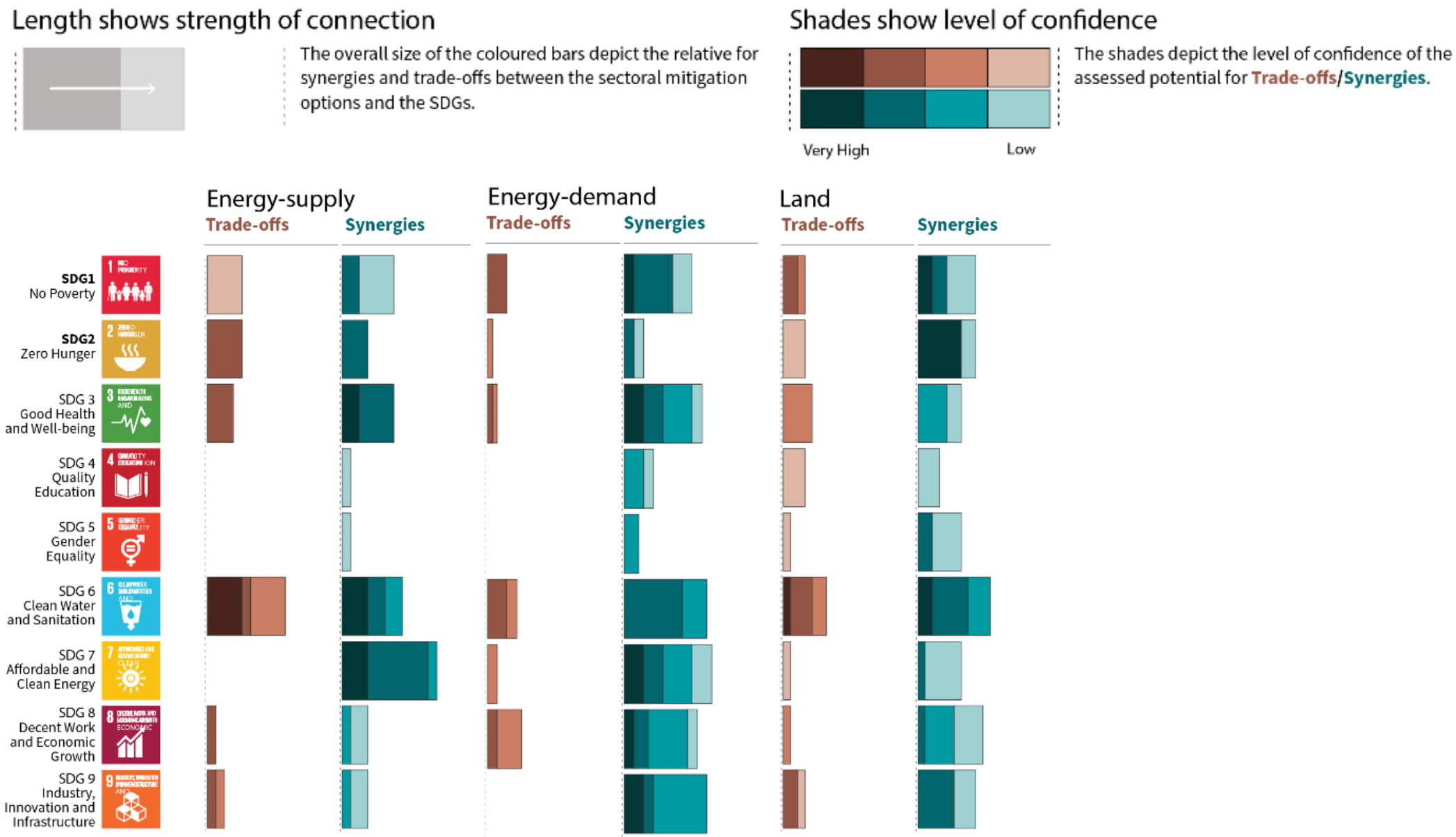
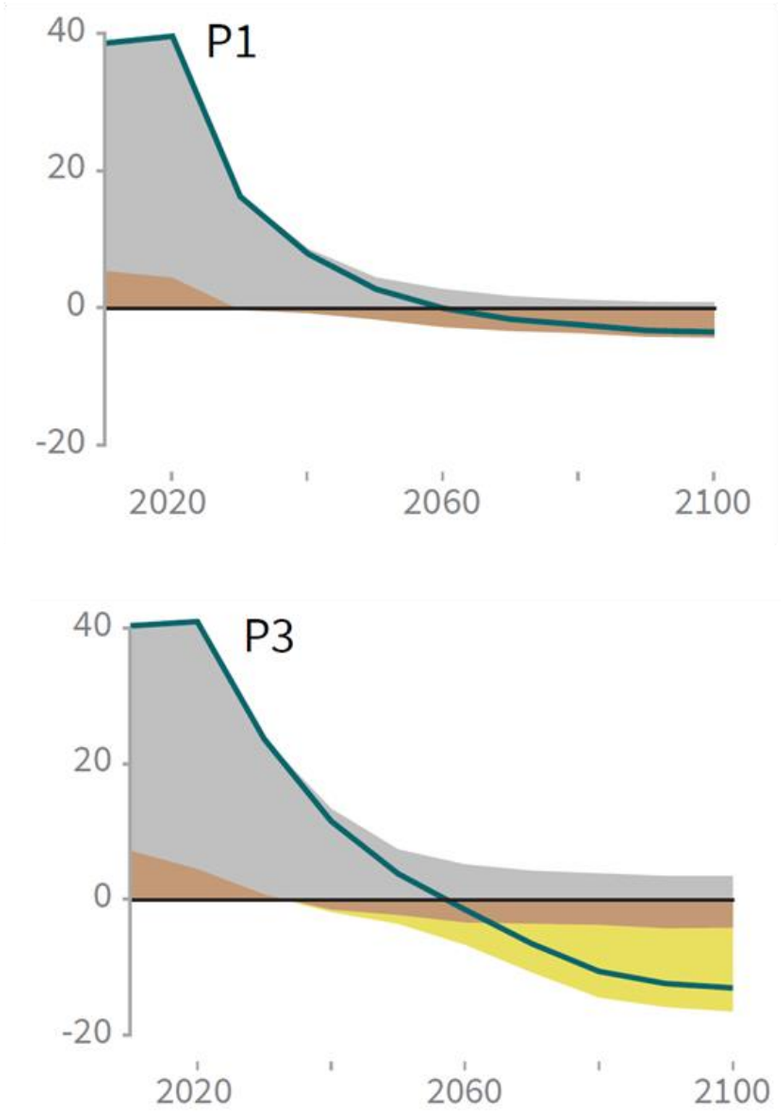
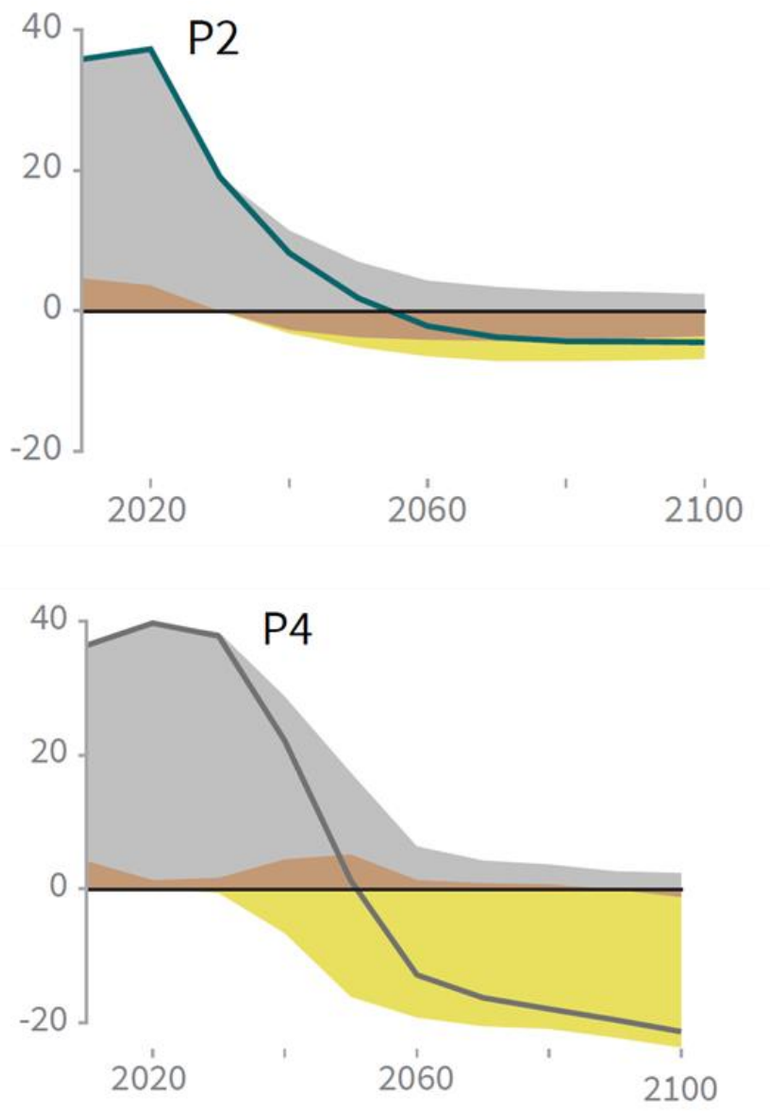
Indicative linkages between mitigation and sustainable development using SDGs (Figure SPM.4)



Characteristics of four illustrative model pathways

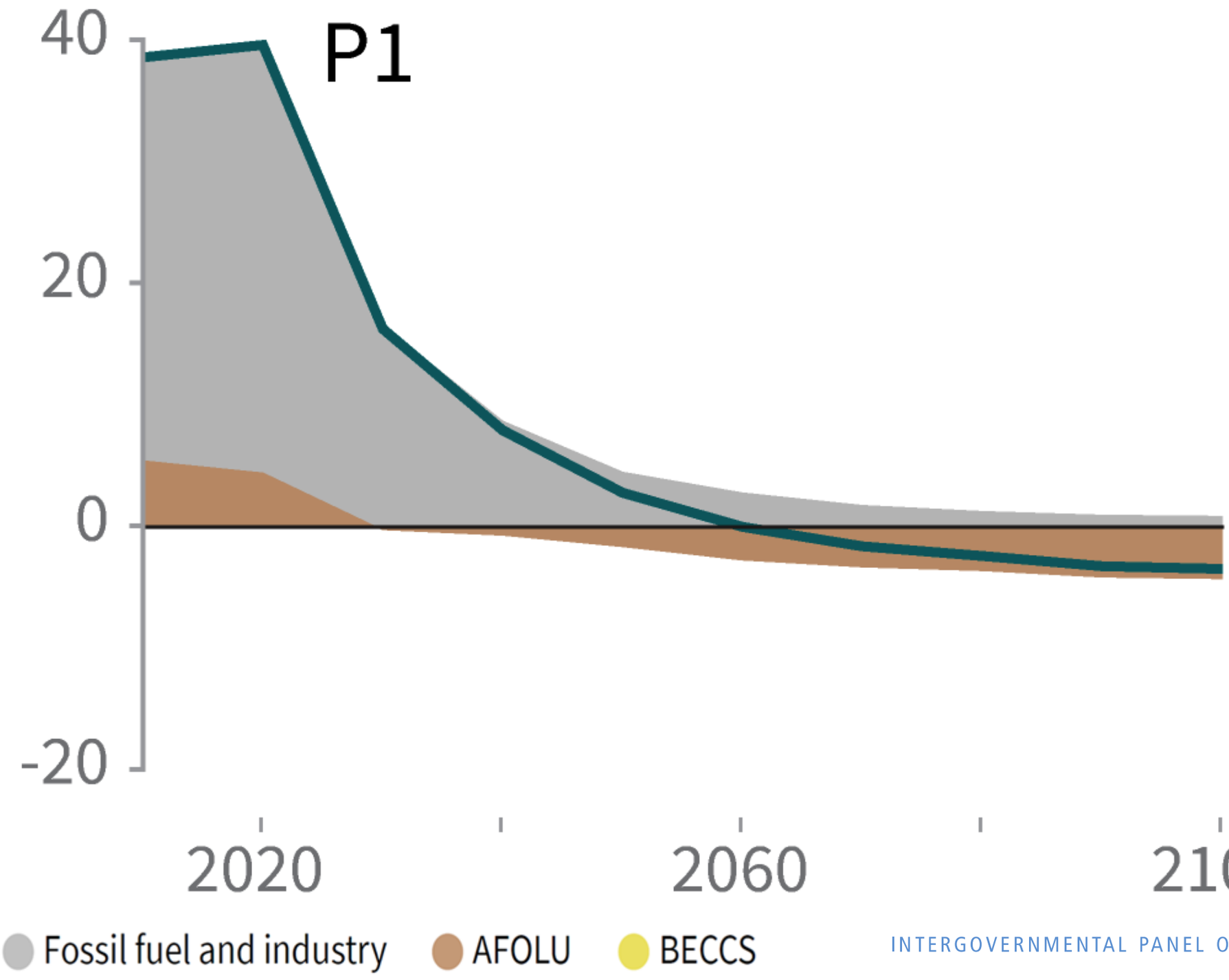




Fossil fuel and industry AFOLU BECCS

Characteristics of four illustrative model pathways:

Achieving 1.5°C in 2100 means a simple choice: **faster emission reductions before 2030** versus CO_2 removal after 2030



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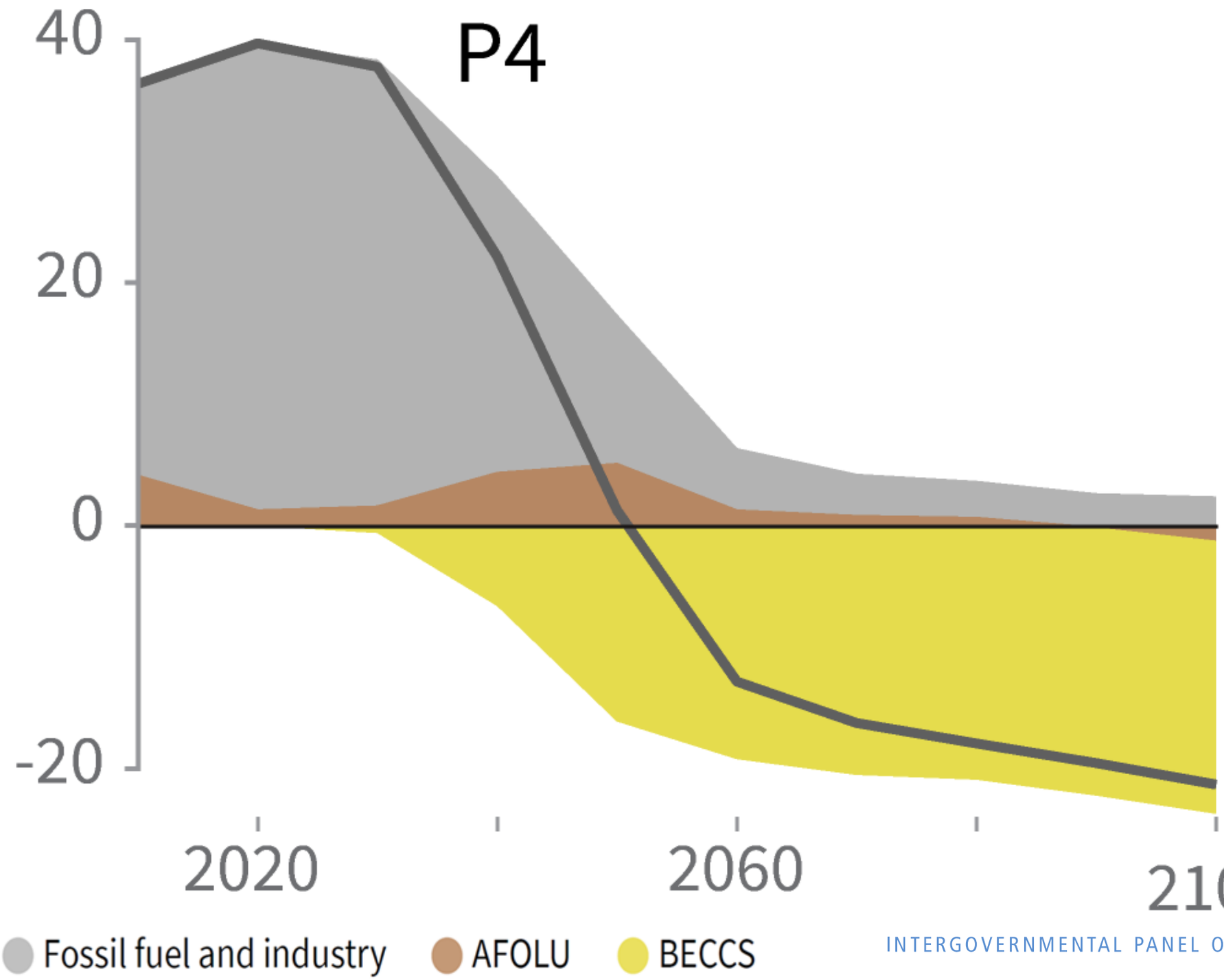
Characteristics of four illustrative model pathways:

Achieving 1.5°C in 2100 means a simple choice: faster emission reductions before 2030 versus **significant CO_2 removal after 2030**



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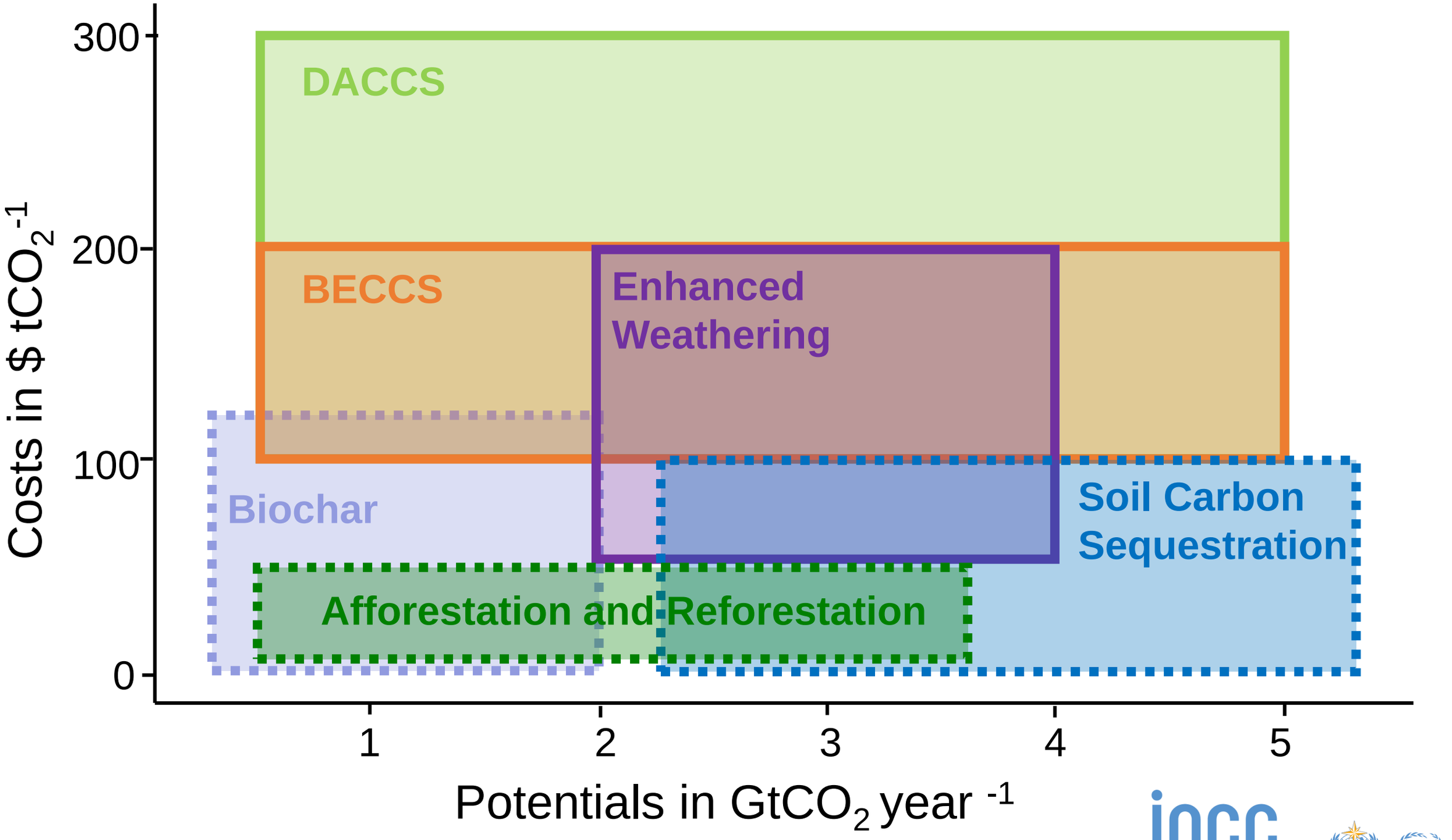
Carbon Dioxide Removal (CDR) options considered in the SR1.5

Natural	Natural & technological	Technological
Afforestation & reforestation	Bio-energy and CO_2 capture and storage (BECCS)	Enhanced Weathering
Biochar		Direct Air CO_2 Capture and Storage (DACCS)
Soil Carbon Sequestration		

BECCS and afforestation/reforestation included in modelled pathways

Inspired by UNEP EGR 2017

CDR in SR1.5: Costs and 2050 potentials



CDR in SR1.5: Side-effects

CDR option	Positive side-effects	Negative side-effects	
Bioenergy & CCS		• Biodiversity • Food security	• Trace GHG • Air pollution
Afforestation and reforestation	Soil quality	• Biodiversity • Food security	• Albedo effects
Direct Air Capture and Storage	?	?	
Enhanced Weathering	Soil quality	• Mining and extraction • (Ground)water pollution • Air pollution	
Biochar	• Soil quality • Trace GHG	Food security	
Soil Carbon Sequestration	• Soil quality • Food security	Trace GHG	

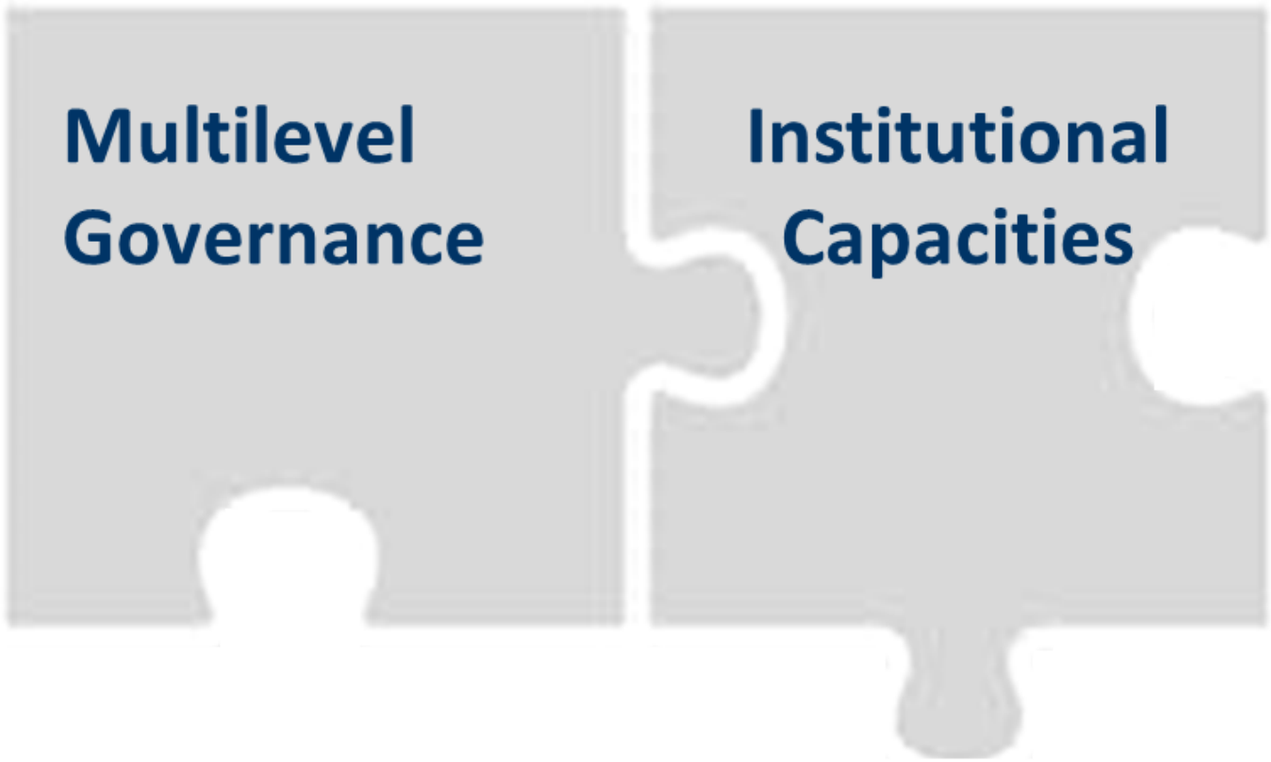
CDR in SR1.5: Feasibility

Mitigation Option	Evidence	Agreement	Economic	Technological	Institutional	Socio-cultural	Environmental	Geophysical	Context
Bioenergy with CCS	Robust	Medium							Depends on biomass availability, CO_2 storage capacity, legal framework, economic status and social acceptance
Direct Air Capture and Storage	Medium	Medium							Depends on CO_2-free energy, CO_2 storage capacity, legal framework, economic status and social acceptance
Afforestation & reforestation	Robust	High							Depends on location, mode of implementation, and economic and institutional factors
Soil carbon sequestration & biochar	Robust	High							Depends on location, soil properties, time span
Enhanced weathering	Medium	Low							Depends on CO_2-free energy, economic status and social acceptance

Enabling conditions for systems transitions

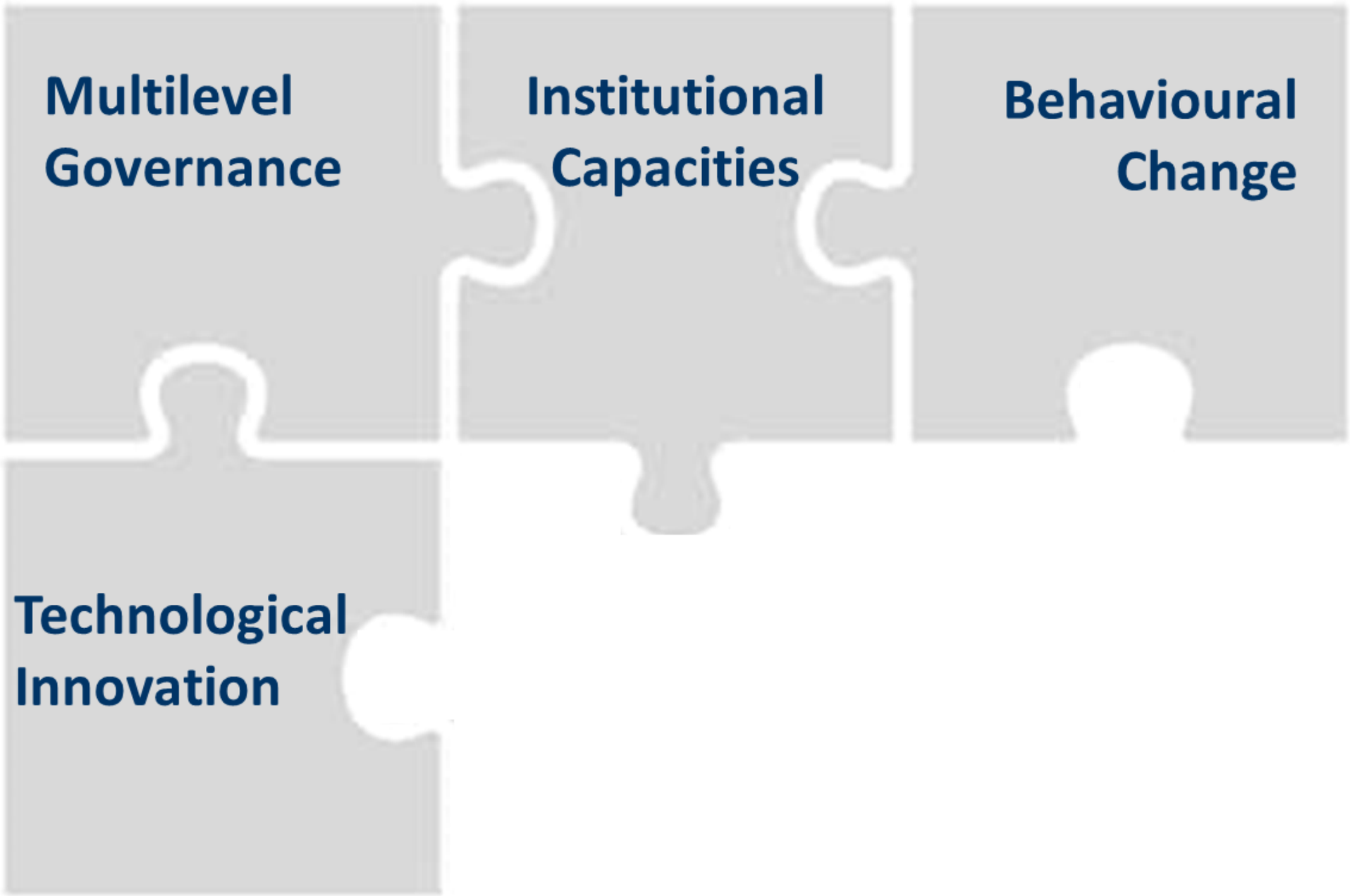
Multilevel Governance

Enabling conditions

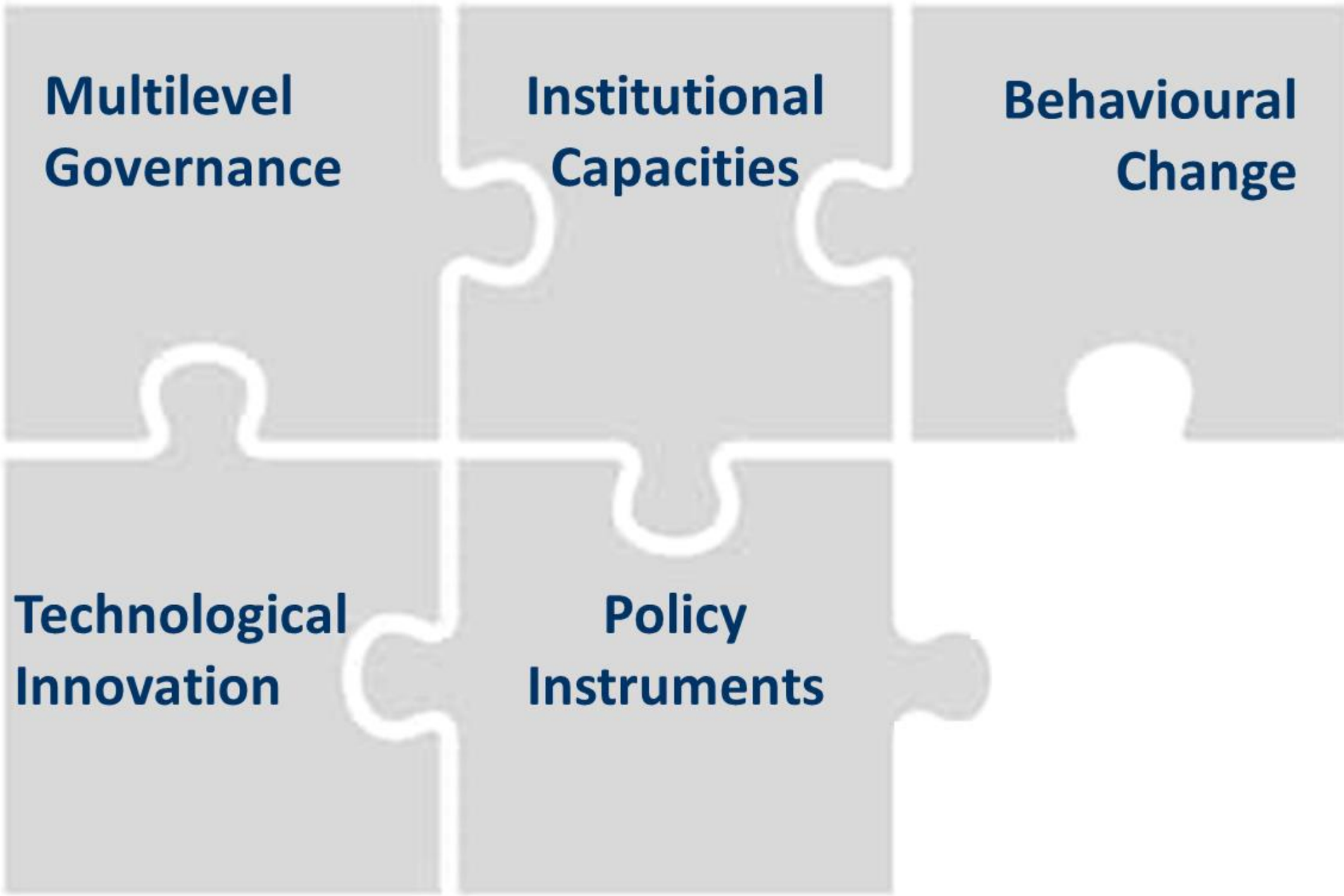


Enabling conditions

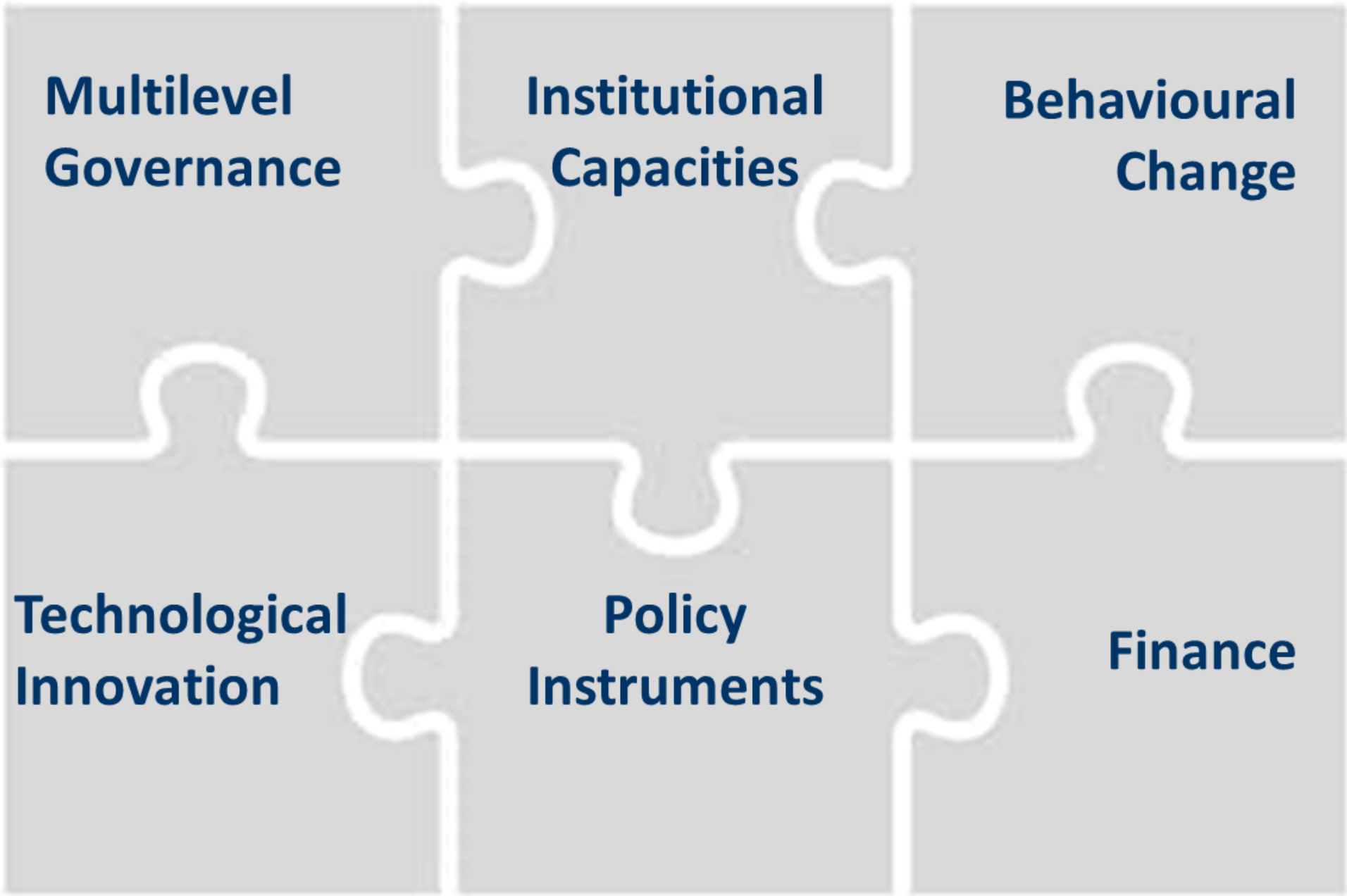
Enabling conditions



Enabling conditions



Enabling conditions



Enabling conditions: technology

For 1.5°C, adoption of new technologies needs to be widespread

National innovation policies and international cooperation

Technological innovation capabilities (industry, finance)

Combination of public support for R&D with policy mixes incentivizing technology diffusion

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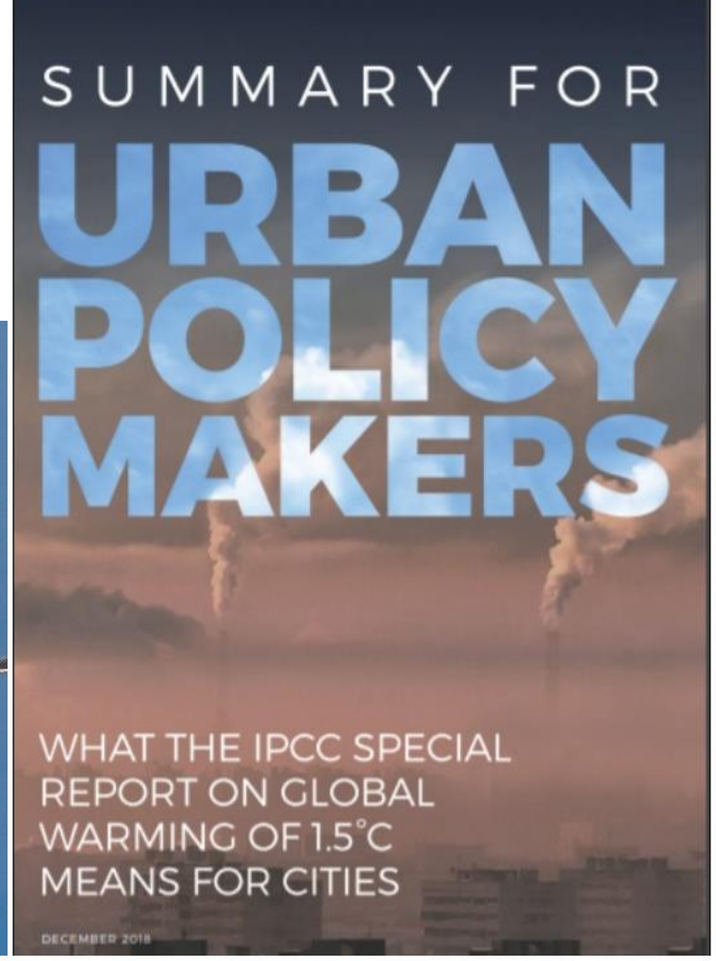

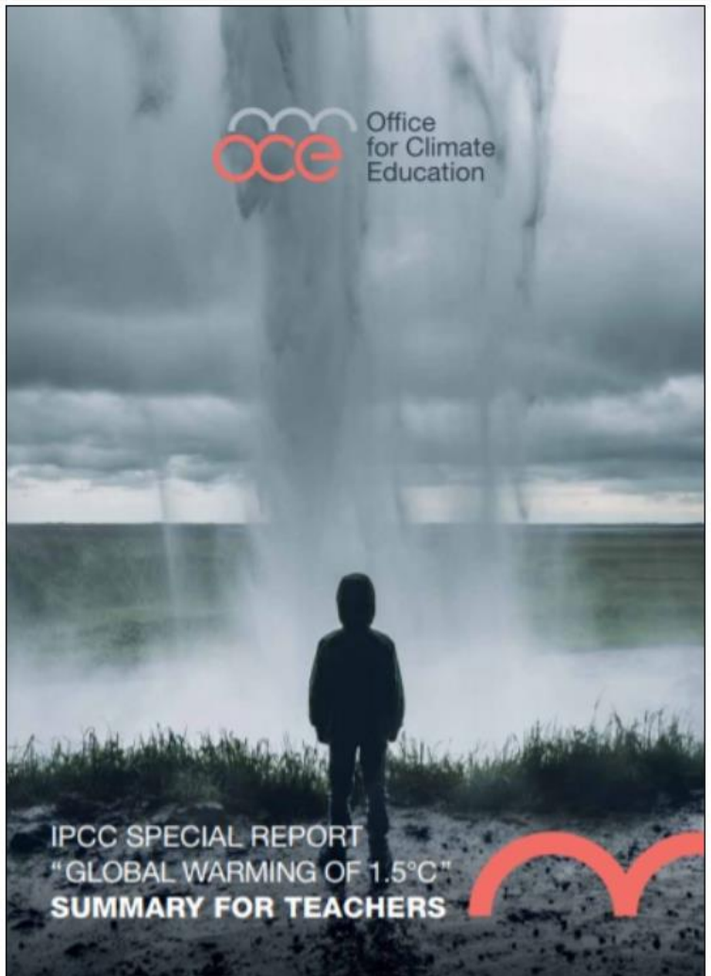

Potential relevance to the TEC

'Feasibility assessment': a method for assessing mitigation and adaptation options along multiple dimensions

1.5C-pathways clarify both the variation and the no-regret technologies for mitigation

Interaction of mitigation options with Sustainable Development Goals

Role of international cooperation and technology innovation

Specific, literature-based case studies

A summary for technology decision-makers?

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Outlook IPCC AR6 WGIII on Mitigation

Approval and publication: July 2021

Chapter 16: Innovation, technology development and transfer

- Coordinating Lead Authors: Gabriel Blanco (Argentina) and Taishi Sugiyama (Japan)

Chapter 16: Innovation, technology development and transfer

- Key findings from AR5 and recent developments
- Role of innovation, technology development, diffusion and transfer in contributing to sustainable development and the aims of the Paris Agreement, including mitigation pathways
- Innovation and technology as systemic issues, evaluating literature on cases of technological innovation systems and innovation policy
- Assessment of international institutions partnerships and cooperative approaches relevant to technology, innovation and R&D
- Capacity for transformative change, including capabilities for innovation, engineering, governance, R&D cooperation and deployment incentives
- Assessment of experiences with accelerating technological change through innovation policy for climate change at the national level, including successful case studies
- Specific challenges in emerging economies and least-developed countries, e.g. SIDS and land-locked countries
- Acceptability and social inclusion in decision-making, communication and information diffusion
- Characterisation and implications of new disruptive technologies
- Links to adaptation and sustainable development (including co-benefits, synergies and trade-offs)

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Outlook IPCC AR6 WGIII on Mitigation

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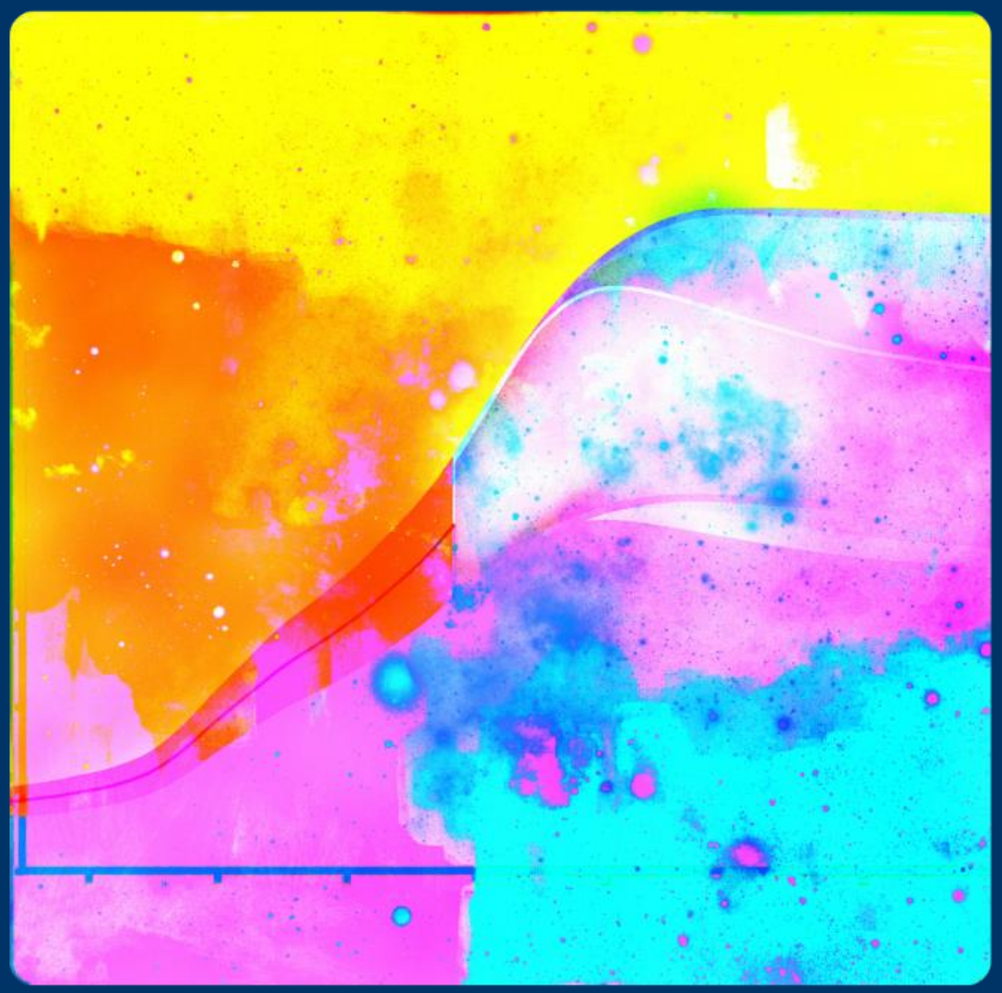
Seeking your feedback on initial thoughts:

- Framework for assessing capabilities
- Evaluation of RD&D needs for mitigation pathways, also specifically for emerging economies and least-developed countries
- Assessment of cooperative approaches and partnerships



Questions?