**Sixth Assessment Report**
WORKING GROUP III – MITIGATION OF CLIMATE CHANGE

ipcc
INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

## Climate Change 2022

# Mitigation of Climate Change

Structured expert dialogue (PR2-SED3) – Part I
8 June 2022 Bonn

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# Key findings of WG III AR6 – Part I :

## WG III insights into the effect of steps taken by parties in order to achieve the long- term temperature goal of the convention

Four part presentation:

- Knowledge gaps and gaps filled since AR5 – *Raphael Slade*
- Aggregate effect of steps taken by Parties – *Michael Grubb*
- Emissions and progress to date – *Shonali Pachauri*
- Progress in establishing enabling conditions – *Navroz Dubash*

## Knowledge has advanced since AR5 #1

# Drivers and constraints of a low-carbon transition are better understood including:

- The breadth and extent of the systemic change required to limit warming
- The key characteristics of scenarios limiting warming to 1.5°C and 2°C
- Insights from sector case studies of successful technology deployment and transfer
- The growing feasibility of low-carbon electrification – a core option for transport, industry and buildings
- The effective demonstration of low-carbon industrial processes
- Increased understanding of the linkages and trade-offs between mitigation and adaptation

## Knowledge has advanced since AR5 #2

# The importance of social sciences and sustainable development has been increasingly recognised, including:

- How behavioural change motivates and can contribute to mitigation
- How attention to *justice*, *equality* and *fairness* can help shift development pathways towards sustainability
- The importance of understanding local and regional context in shifting development pathways towards sustainability

# Knowledge gaps remain, including:

- The real-world feasibility of scenarios that embody prompt, ambitious mitigation action and the plausibility of extensive CDR
- How the global benefits of mitigation may change with warming levels (including economic repercussions)
- Social and environmental limits on the pace and extent of change
- The opportunities, limitations, and reversibility, of ecosystem based mitigation and adaptation

# Data and methodological advances could tackle many knowledge gaps:

- Low-income countries remain poorly represented in literature on mitigation and in studies on innovation and technology development and transfer
- Data quality, frequency, and resolution of global GHG estimates needs to be improved, along with the causal mechanisms between individual, social, and structural drivers of change
  - Uncertainty in contemporary emissions and sinks within AFOLU is still high. Including inventories, accounting systems, and emission factors
  - The effectiveness of mitigation policies in industry remains poorly understood. (As industry is often sheltered from climate policy due to the concerns of competitiveness and carbon leakage)
- GHG accounting frameworks can be improved
- Methodological challenges in understanding the effectiveness of international agreements and institutions can be overcome

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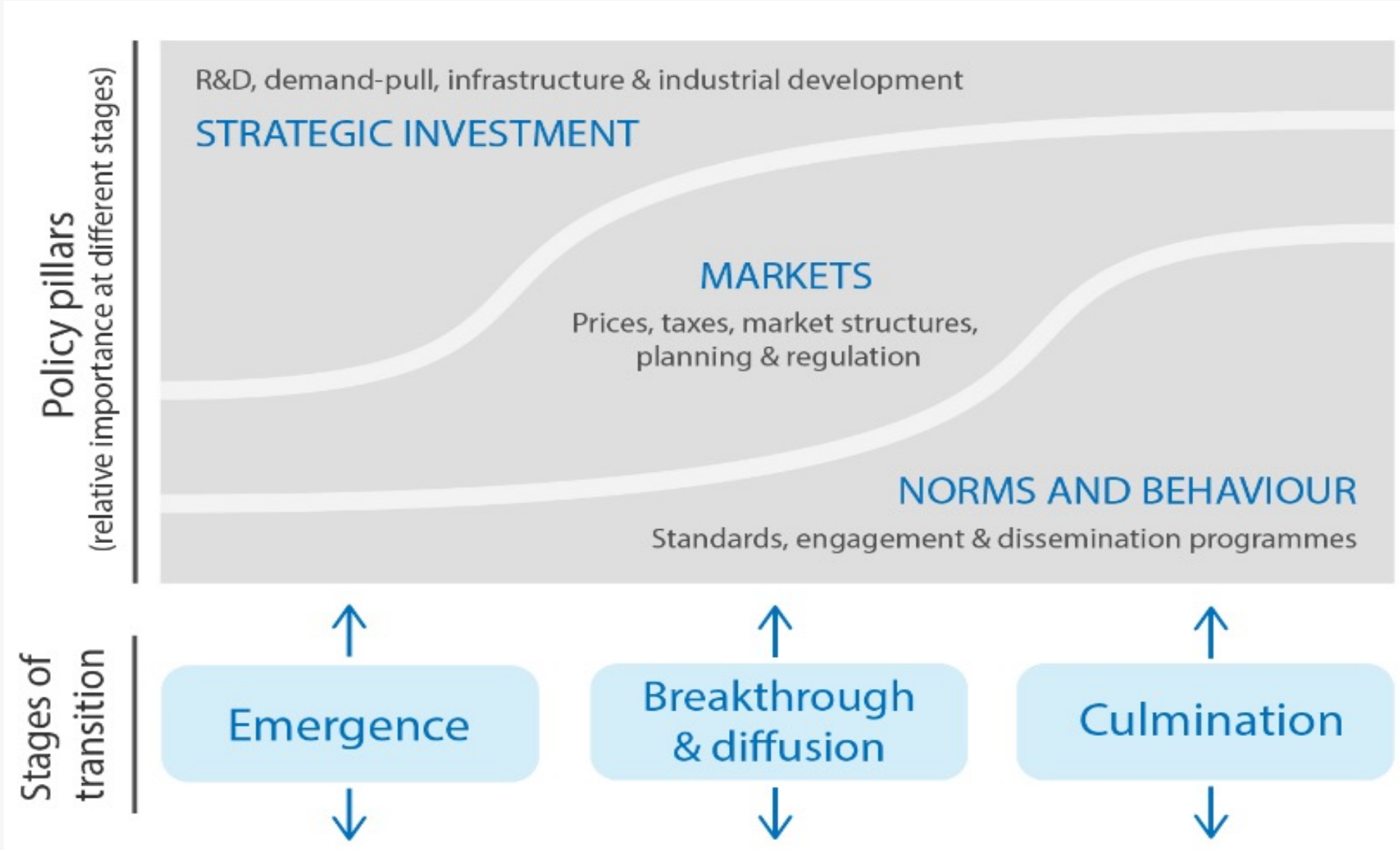
# Progress on Mitigation to date is insufficient but not negligible

**B.5.3** .. policies have enhanced energy efficiency, reduced rates of deforestation and accelerated technology deployment … **Multiple lines of evidence suggest that mitigation policies have led to avoided global emissions of several Gt $CO_2$-eq $yr^{-1}$ (*medium confidence*). At least 1.8 Gt $CO_2$-eq $yr^{-1}$** ..by aggregating separate estimates for the effects of economic and regulatory instruments. Growing numbers of laws and executive orders have **impacted global emissions and were estimated to result in 5.9 Gt $CO_2$-eq $yr^{-1}$ less in 2016**

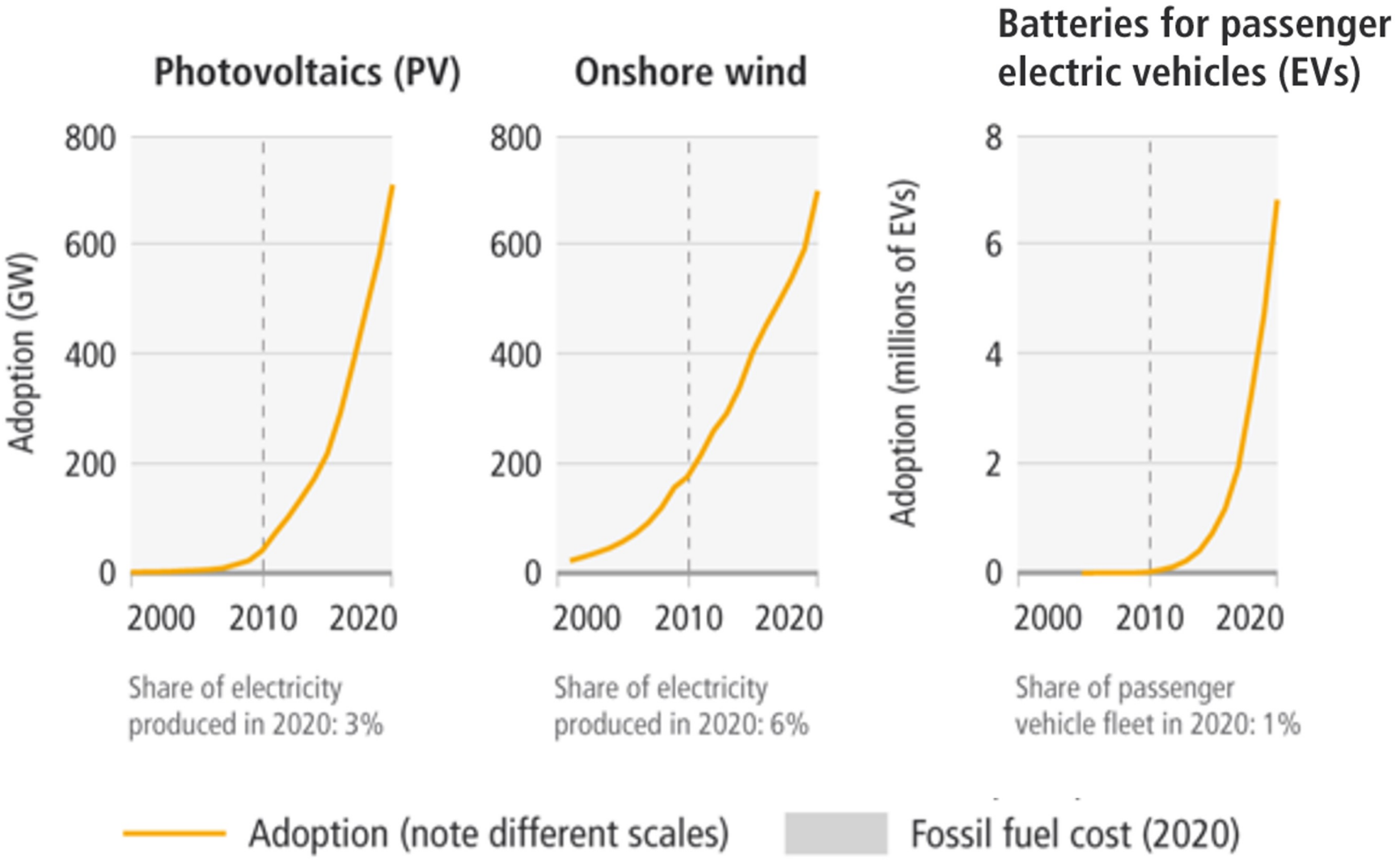
- The context – policies, technologies and resulting emissions all evolve as a result of policies
- Policy trends
- Global emission impacts – lines of evidence and estimates
- …. In context of global emission trends

# Large scale transitions take time and an evolving mix of policies




**IPCC WGIII Technical Summary Figure TS.28**

To date, most progress in electricity sector and associated clean & efficient technologies




Electricity systems in some countries and regions are already predominantly powered by renewables.

**Also see Technical Summary, and Chapters 2 and 6**

# Policy Trends (SPM B5.2)

- ‘Direct’ climate laws in 56 countries covering 53% of global emissions
- Policy packages tailored to national contexts and technological characteristics have been effective in supporting low-emission innovation and technology diffusion .. with co-benefits ... Adoption lags in most developing countries, particularly LDCs, due in part to weaker enabling conditions ..
- Over 20% of global GHG emissions covered by carbon taxes or emissions trading systems, although coverage and prices insufficient ..
- Coverage remains limited for emissions from agriculture and production of industrial materials and feedstocks
- Annual tracked total financial flows [mainly mitigation] increased c. 60% 2013/14 to 19/20, but uneven across regions and sectors, slowed since 2018

# Policies

Increase in **number** of mitigation policies implemented worldwide

*e.g.* RD&D funding, technology support instruments

*e.g.* regulation, carbon pricing, voluntary agreements

*e.g.* policy mixes including regulation, technology support, carbon pricing

## Technologies

Increased **investments** in and **diffusion** of low-carbon technologies, especially for wind and solar energy, electric vehicles, energy-efficient appliances and low-carbon heating.

Decline in **costs** of low-carbon technologies, e.g. solar PV, battery technology.

## Proximate emission drivers

Reductions in **energy intensity** globally and in all but one world region.

Reductions in **carbon intensity** in Europe, Eurasia, the Middle East, North America; and globally.

Reductions in the **rate of deforestation** in several countries, especially developing countries.

## GHG emissions

Reductions in avg. **annual GHG emissions growth** (2.3% in 2000-10; 1.3% in 2010-18). Sustained **emission reductions** in 24 countries, relative decoupling in 58 countries by

| **Estimates of avoided $CO_2e$ emissions attributable to policies, compared to no-policy** | | |
|---|---|---|
| 5.9 Gt/yr | in 2016; 38 $GtCO_2e$ cumulatively since 1999 | Eskander and Fankhauser (2020) |
| 1.3 Gt/yr | in Annex B country which ratified the Kyoto Protocol (or -7%/yr on average, 2005-12) relative to imputed 'no Kyoto' scenario. Global impact by 2012 supplemented by savings from the CDM . | Maamoun (2019) |
| 1.8-3 Gt/yr | as the result of various policy instruments with demonstrable impact. Includes at least 500 $MtCO_2e$/yr from energy efficiency programs; and 1.3 $GtCO_2e$/yr from renewables diffusion. | Aggregation of multiple sources |
| **Reported abatement by parties to the UNFCCC** | | |
| 3.81 Gt/yr | **Projected by Annex I countries for 2020** in their BR4s (from 2,811 PaMs, with impacts reported for 38% of them) | UNFCCC (2020) |
| **Contextual & comparative indications** | | |
| 4-5 Gt/yr | illustrative cumulative impact on 2019 emissions if policies reduced the annual emission additions by -0.1 $GtCO_2e$ more than previous year, for each year from 2010 | indication of how impact of policy expansion could accumulate (1.4.8) |
| 1-5.5 Gt/yr | in Annex I countries (2001-2018), plus up to c. 500 $MtCO_2e$/yr in non-Annex I countries (2001-2018) | Aggregation of over 150 national/sector/policy studies |

***Box TS.13: Policy impacts on key outcomes***

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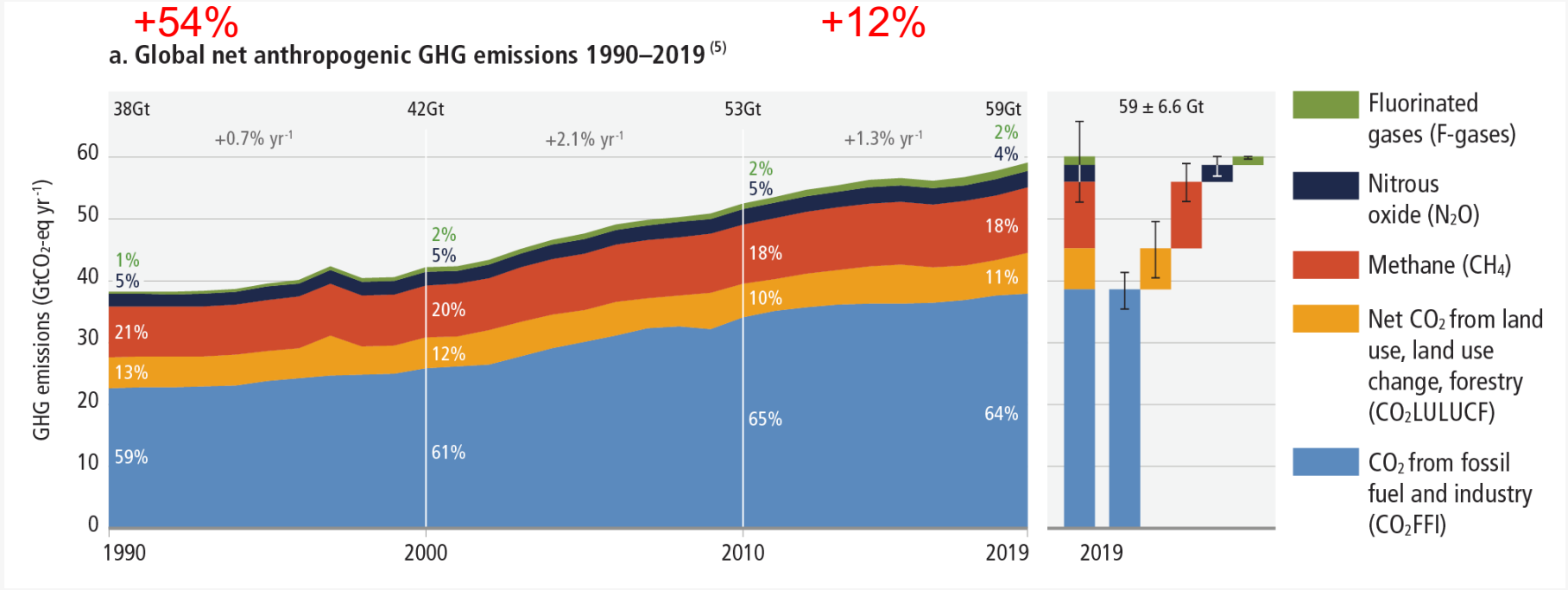
# Global net anthropogenic GHG emissions continue to rise




2010-2019: Average annual greenhouse gas emissions at highest levels in human history

WGIII SPM.1

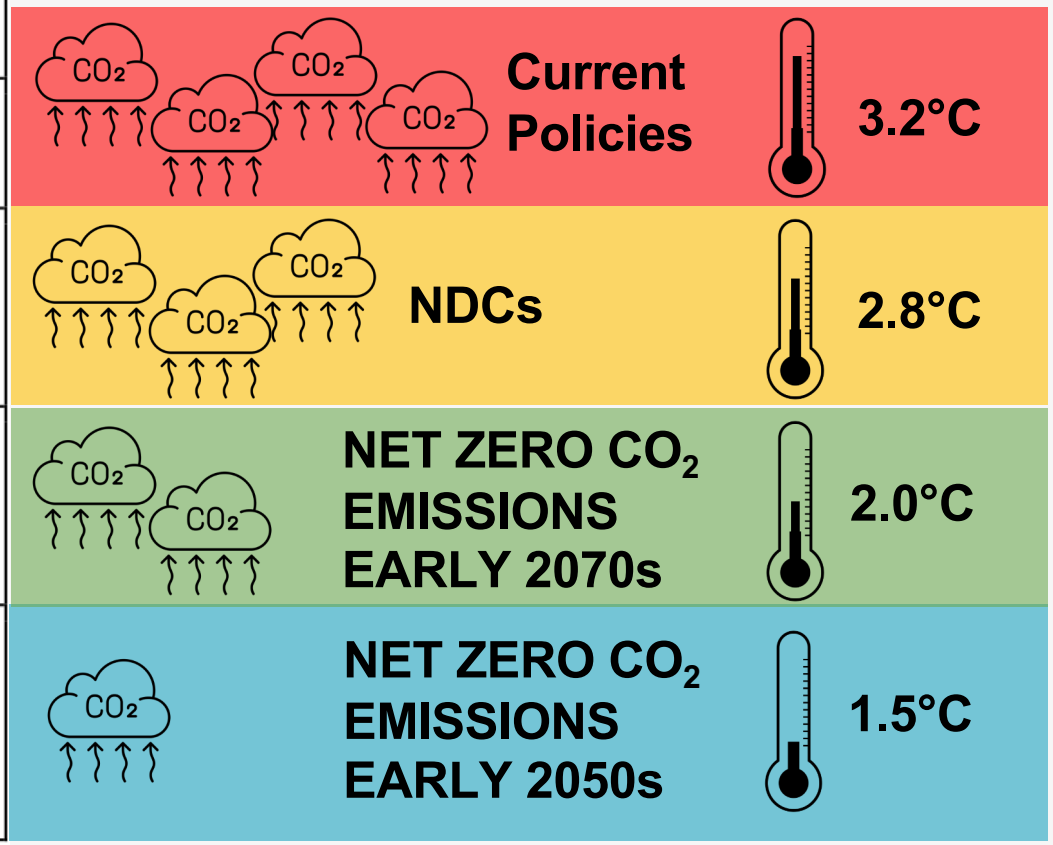
- 2019 emissions 12% higher than in 2010 and 54% higher than in 1990
- Emissions growth slowed from 2.1%/yr for 2000-2009 to 1.3%/yr for 2010-2019

# Emission gaps to limit climate change remain large

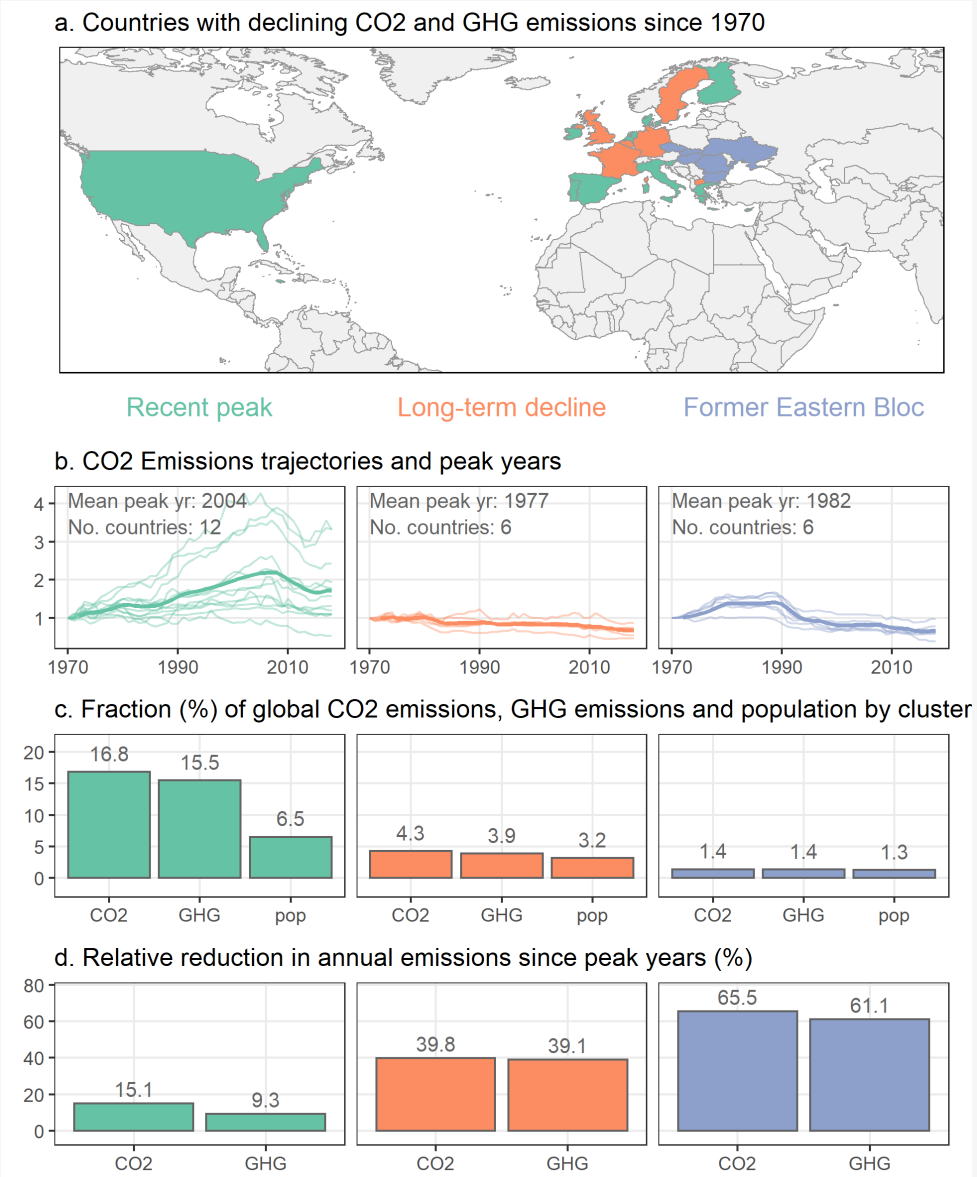
| $GtCO_2$-eq $yr^{-1}$ | Implied by policies implemented by the end of 2020 | Implied by NDCs announced prior to COP26 | |
|---|---|---|---|
| | | Unconditional elements | Inc. conditional elements |
| Median (Min–Max)* | 57 (52–60) | 53 (50–57) | 50 (47–55) |
| Implementation gap between implemented policies and NDCs (Median) | | 4 | 7 |
| Emission gap between NDCs and pathways that limit warming to 2°C (>67%) with immediate action | | 10–16 | 6–14 |
| Emissions gap between NDCs and pathways that limit warming to 1.5°C (>50%) with no or limited overshoot with immediate action | | 19–26 | 16–23 |

WGIII Table SPM.X

For policies implemented by the end of 2020 and NDCs announced prior to COP26,



# A few countries have had sustained emissions reductions




- High year to year variability, but trends are consistent
- 6 Western and Northern European countries started reducing in the 1970s
- 6 former Eastern Bloc countries had consistent reductions since the 1990s
- 12 other nations have seen reductions since the mid-2000s.
- A few nations have had rapid sustained CO2 reduction rates of 4% per year
- Changes have resulted from fuel shifts, policy and economic changes

*WGIII SPM.B3.5 and chapter 2*

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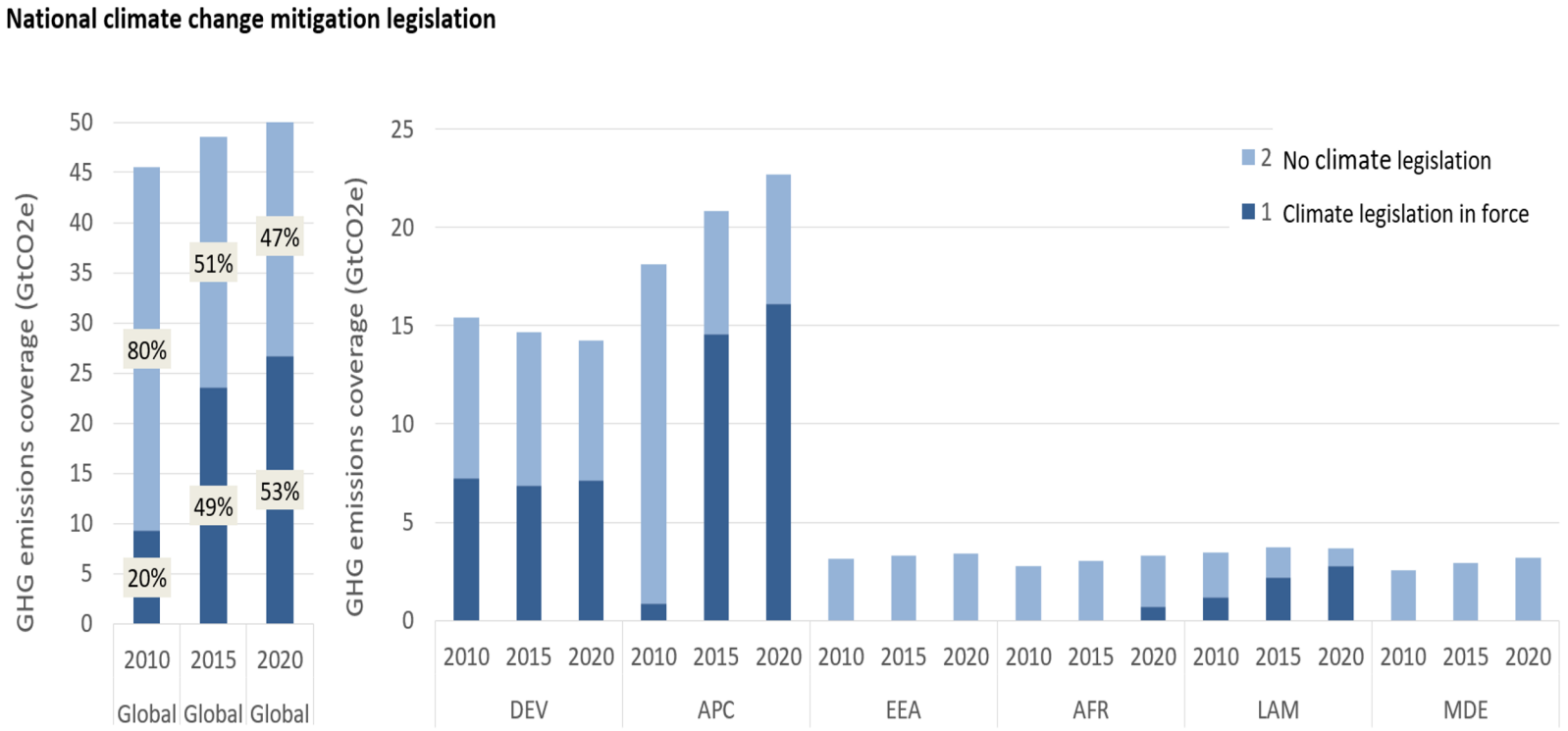
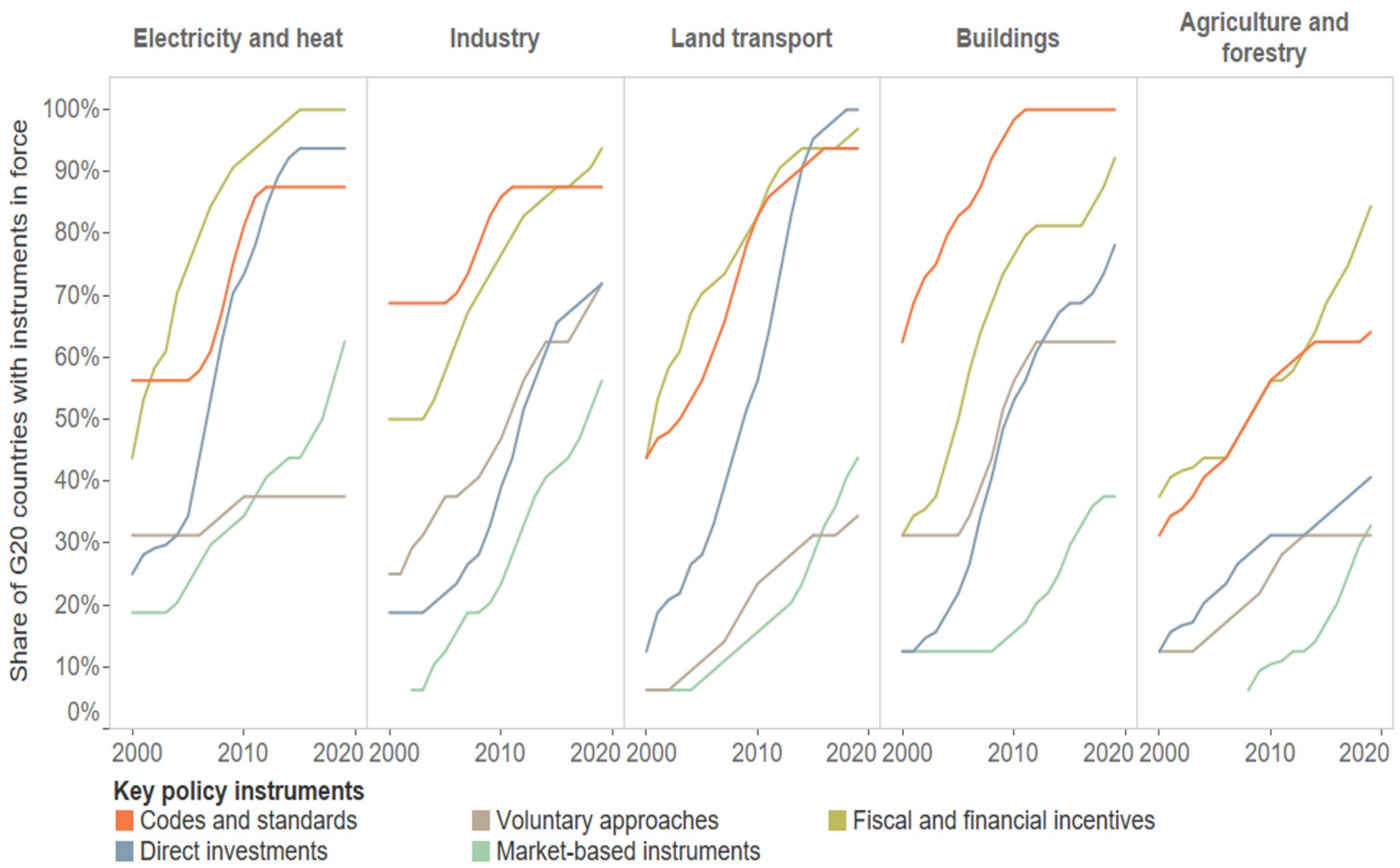
# Climate laws and institutions enable mitigation action




- Climate laws in more countries covering more emissions - 20% of emissions in 2010 to 53% of emissions across 56 countries in 2020
- 'Indirect' laws are also important and have proliferated – 340 in 2010 and 690 laws by 2020
- Subnational entities have jurisdiction over key areas of climate action and are a source of experimentation
- Spread of national climate institutions to address challenges of coordination, strategy setting and building consensus

# Increasing range of policies across sectors and instruments




- Regulatory instruments are particularly effective at the sector level
- Over 20% of global emissions are covered by carbon taxes or trading that incentivise low-cost reductions - additional mechanisms and/or higher price needed for high-cost measures
- Policy packages can be more effective than single instruments, particularly for systems transitions, distributional outcomes, and shifts in development pathways

# International cooperation is having positive and measurable results

- Global mitigation challenge is framed both as a global commons problem and one of accelerating socio-technical transitions and shifting development pathways
- Kyoto Protocol led to measurable and substantial avoided emissions, including in 20 countries with Kyoto first commitment period targets
- Paris Agreement marks shift toward facilitating national-level mitigation action towards a shared goal -- jury is out on whether it will succeed
- International cooperation can be strengthened through:
  - support for NDCs
  - more ambitious goals for bunker fuels
  - ensuring trade, energy, investment agreements do not hinder mitigation
  - enhancing cooperation on SRM and CDR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## THANK YOU FOR YOUR ATTENTION

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