The 23rd IEEJ Webinar for the World

17 November 2026

Toward achieving the 2°C target
- Evaluation of G20's NDC 3.0 and the importance of CDR and adaptation -

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60th Anniversary

IEE JAPAN

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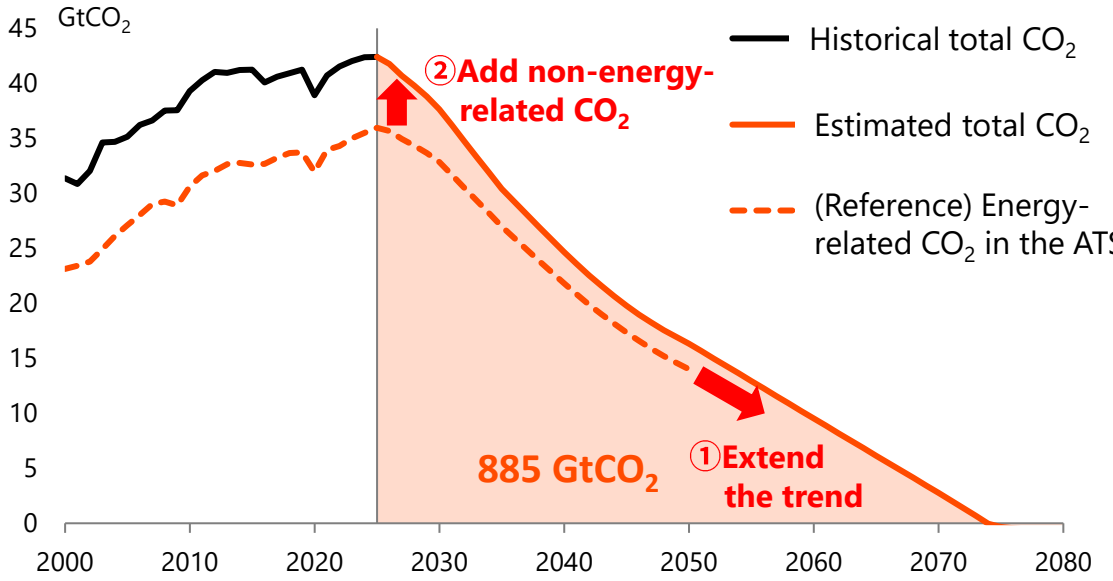
Demonstrate that the ATS provides a pathway toward the 2°C target.
Identify the measures needed to achieve the 2°C target using the ATS.

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Estimated warming: Comparison of the ATS and the remaining carbon budget for 2°C

✓ Cumulative CO_2 emissions through net-zero in the ATS are smaller than the remaining carbon budget for 2°C (50% probability), indicating that the scenario is consistent with the 2°C target.

Estimated cumulative CO_2 emissions through net-zero*1



Comparison of estimated CO_2 emissions and remaining carbon budgets

Scenario		Cumulative CO_2 from 2026 onward ($GtCO_2$)
Estimated pathway (through net-zero)		885
2°C (50% prob.)	IPCC AR6 WG1 (adjusted)*2	1,100
	GCB 2025	1,055
	IGCC 2025	1,050
2°C (67% prob.)	IPCC AR6 WG1 (adjusted)*2	900
	GCB 2025	na
	IGCC 2025	860

GCB 2025: https://globalcarbonbudget.org/gcb-2025/ (Friedlingstein et al., 2026)
IGCC 2025: https://essd.copernicus.org/articles/18/3889/2026/ (Forster et al., 2026)

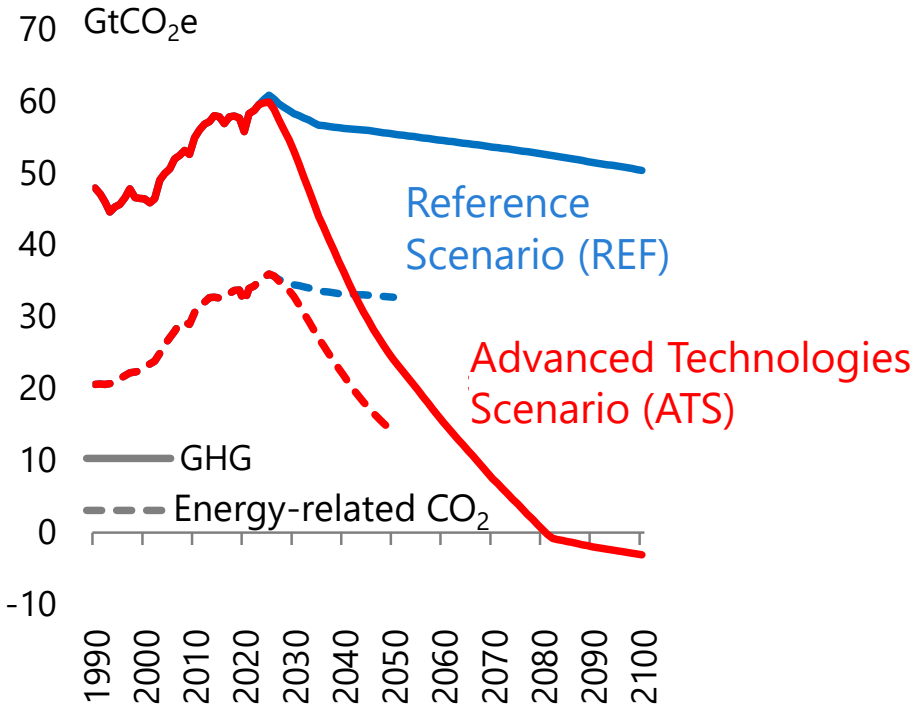
*1: Historical CO_2 emissions are derived from the Global Carbon Budget (GCB) 2025 (2025 values are estimates). Non-energy-related CO_2 emissions are derived from the ModAct, which is one of the illustrative mitigation pathways (IMPs) in the IPCC AR6 WG3. *2: A start year is adjusted from 2020 to 2026.

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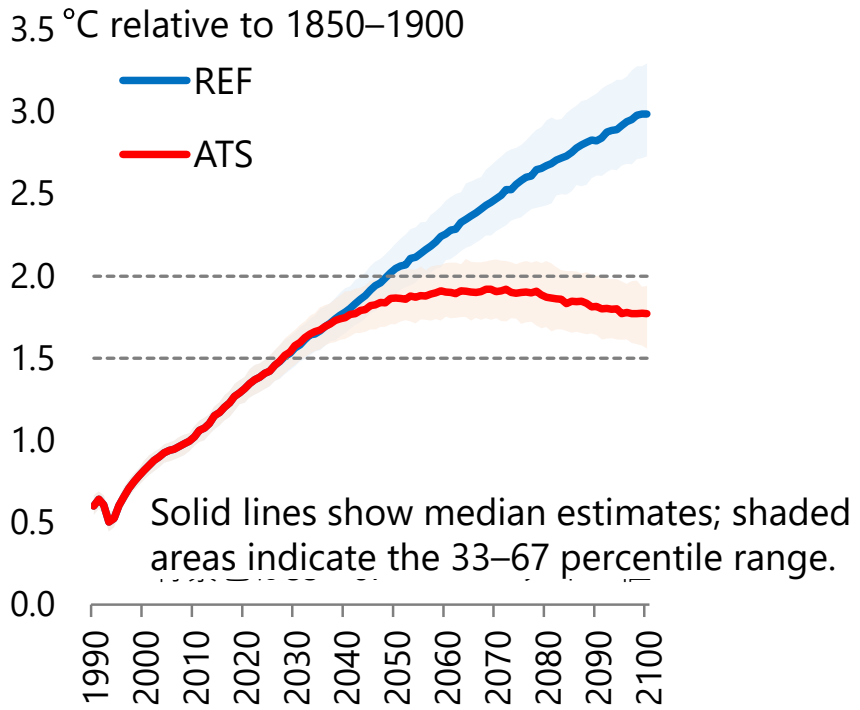
Estimated warming:
(Reference) Warming estimations using a simple climate model*

✓ Global mean temperature rise based on GHG emissions reflecting the ATS peaks around 2070 and remains below 2°C at the median, consistent with the carbon budget analysis.

GHG emissions



Global mean temperature rise



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*: Based on the latest emissions scenarios from van Vuuren et al. (2026) and reproduction code (Sanderson et al., 2026). GHG emissions except energy and industrial process CO_2 follow the Medium (M) and Low (L) scenarios in van Vuuren et al. (2026). Temperature projections use the simple climate model, FaIR.

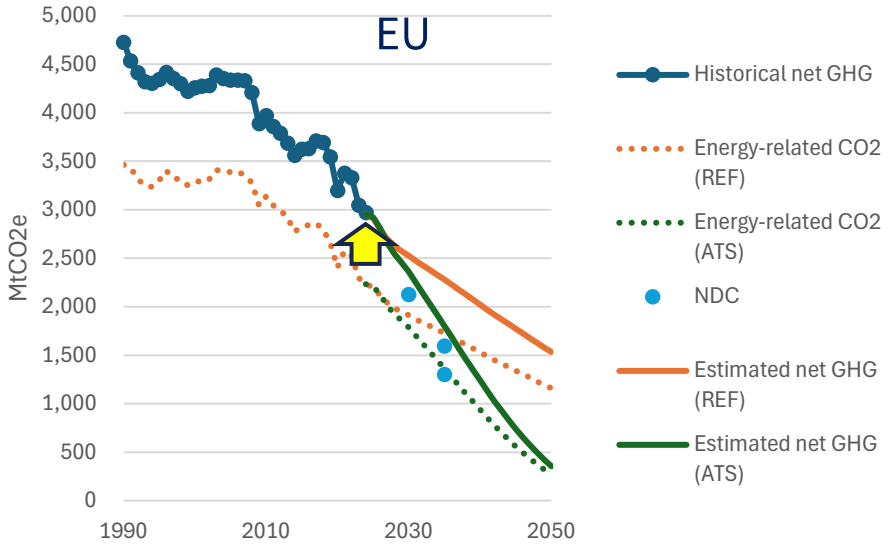
Evaluation of emissions pathways reflecting G20's NDC 3.0: Target countries and methodology

✓ Target countries

- The following G20 members are included: EU, Japan, Russia, US, Brazil, China, India, Indonesia, South Korea, Australia, Canada, UK, Mexico, Saudi Arabia, and South Africa.
- The following countries and regions are excluded:
  - Argentina, which has not submitted a 2035 NDC.
  - Türkiye and Argentina, which are not assessed individually in the IEEJ Outlook.
  - France, Germany, and Italy, which are included in the EU.
  - African Union.
- The US is excluded from the overall G20 assessment but assessed separately against its 2030 NDC.

✓ Methodology

- Each G20 member's NDC is assessed by comparing it with estimated net GHG emissions.
- Net GHG emissions are estimated by converting energy-related CO_2 emissions from the IEEJ Outlook using the recent ratio of net GHG emissions to energy-related CO_2 emissions.



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Evaluation of emissions pathways reflecting G20's NDC 3.0: (Reference) Detailed methodology

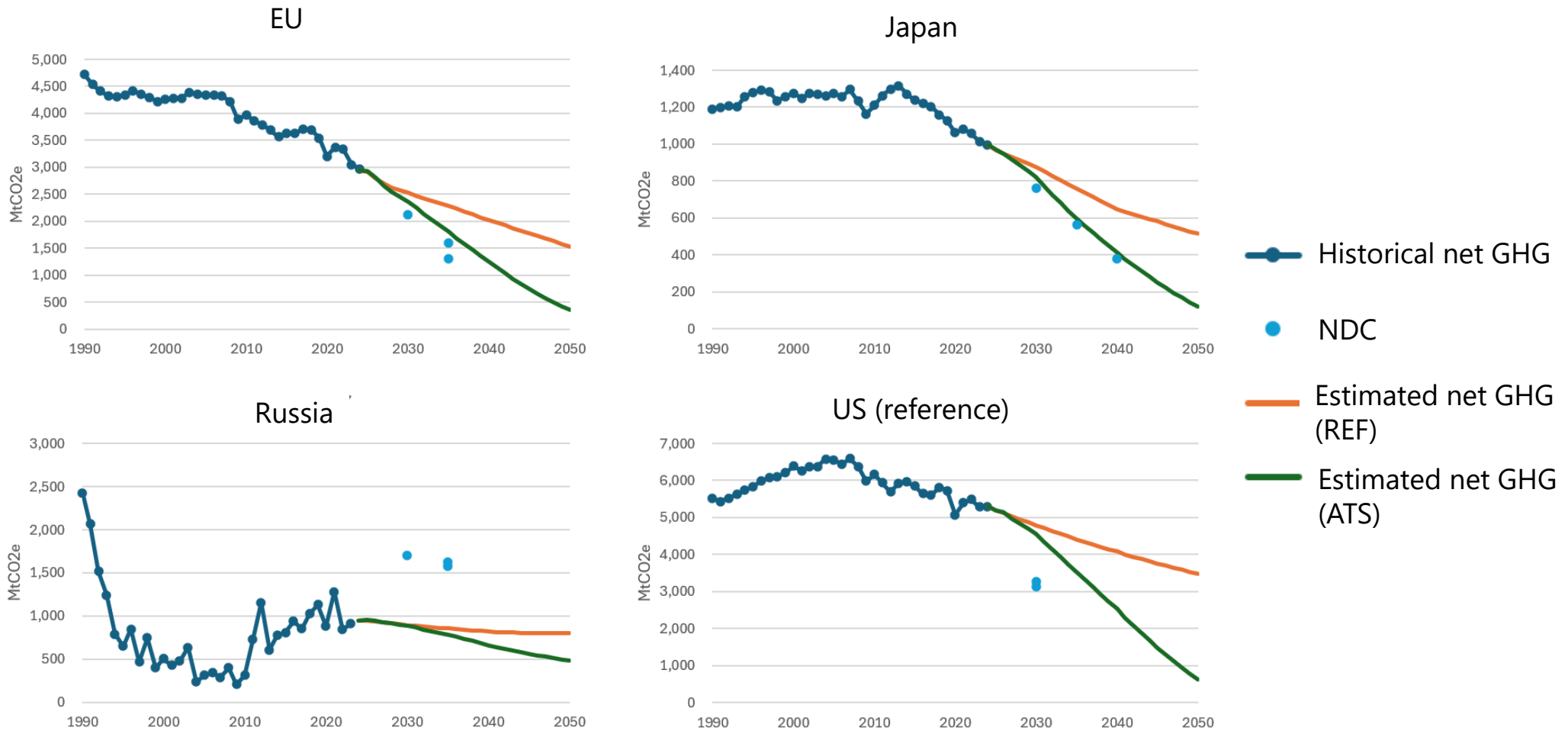
Item	Calculation method
NDC	Follow each economy's NDC methodology, with the following considerations: • China: Use 2021 emissions as the peak level, based on the latest available net GHG emissions data. • China (2030) and India: Convert emissions intensity targets (per GDP) into absolute emissions targets using GDP estimations from the IEEJ Outlook. • China (2030): Convert the CO_2 target (fuel combustion and IPPU*1) into a GHG target. • Mexico (2030): Convert the gross emissions target (excluding LULUCF*2) into a net emissions target (including LULUCF).
Historical net GHG emissions	Adjust data from the Common Reporting Tables (CRT) of National Inventory Documents (NID) or Biennial Transparency Reports (BTR) to align with each economy's NDC methodology. • EU: Include international aviation, international shipping, and indirect CO_2 emissions*3. • Japan: Apply the Kyoto Protocol accounting method for LULUCF and include indirect CO_2 emissions. • Canada: For LULUCF, use the difference from the reference level for forests and harvested wood products, and net emissions relative to 2005 for other categories.
Estimated net GHG emissions	Estimate net GHG emissions from the IEEJ Outlook using the recent ratio of historical net GHG emissions to energy-related CO_2 emissions. For countries with substantial emissions from deforestation, use the year with the lowest ratio to exclude annual fluctuations in logging, forest fires, and other factors.

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*1: IPPU: Industrial processes and product use *2: LULUCF: Land use, land-use change and forestry *3: CO_2 emissions resulting from the atmospheric oxidation of carbon monoxide (CO), methane (CH_4), and non-methane volatile organic compounds (NMVOCs), expressed in CO_2-equivalent terms.

Evaluation of emissions pathways reflecting G20's NDC 3.0: Results: developed countries (Annex I)

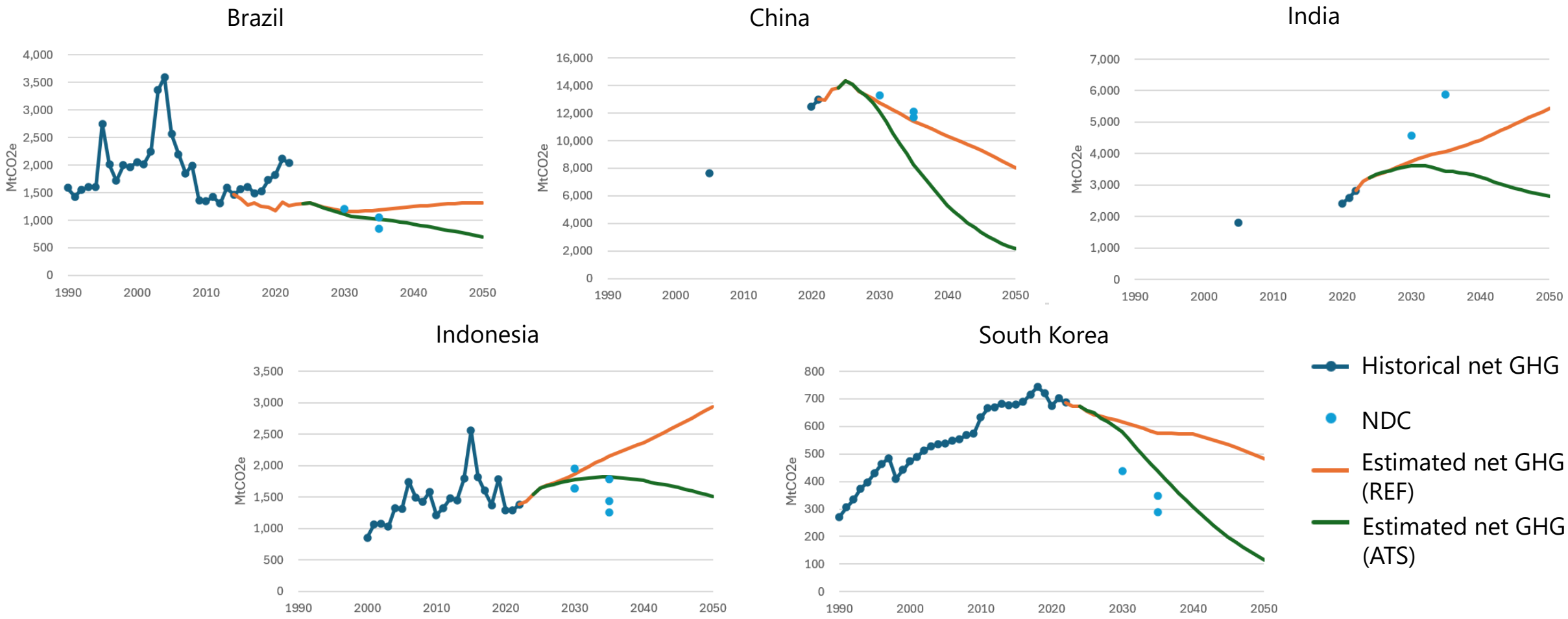
- ✓ The EU and Japan have set NDC targets that are more ambitious than estimated net GHG emissions under the ATS.



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Evaluation of emissions pathways reflecting G20's NDC 3.0: Results: developing countries (non-Annex I)

- ✓ China's NDC targets are broadly in line with estimated net GHG emissions under the REF, while India's NDC targets are less stringent than the REF.

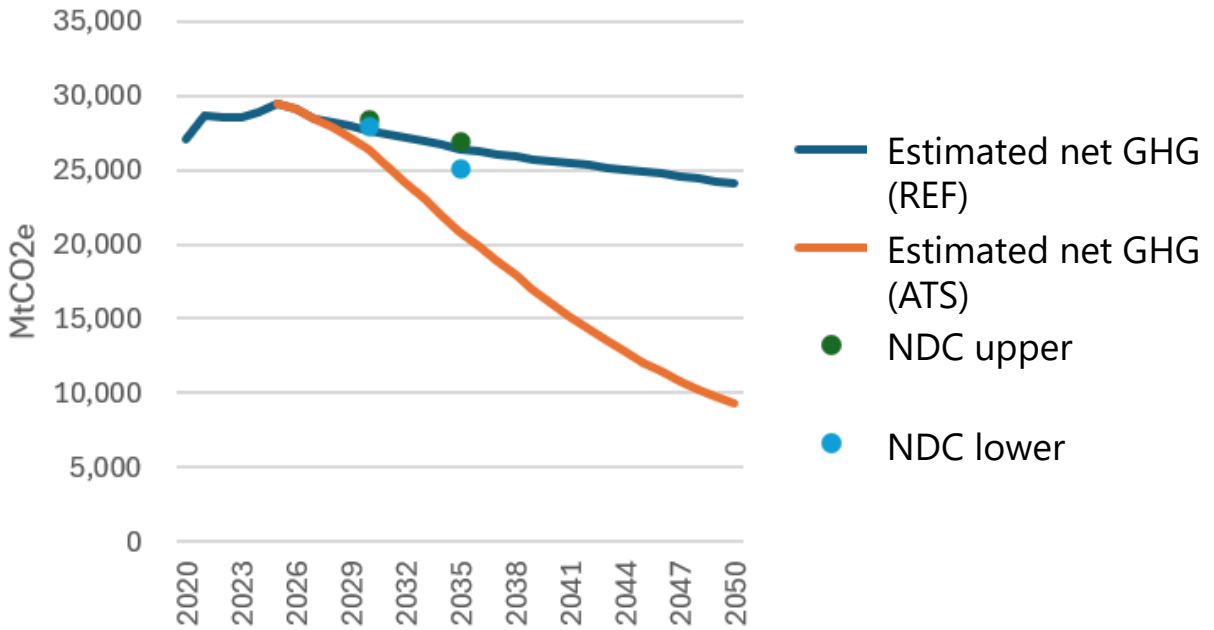


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Evaluation of emissions pathways reflecting G20's NDC 3.0: Results: G20

- ✓ For the G20 as a whole, NDC targets, largely influenced by China and India, are less ambitious than or broadly comparable to estimated net GHG emissions under the REF.
- ✓ More ambitious targets, particularly in China and India, would be expected to align the G20 emissions pathway with the 2°C target.

G20 (excluding Argentina, Türkiye, the US, and the African Union)

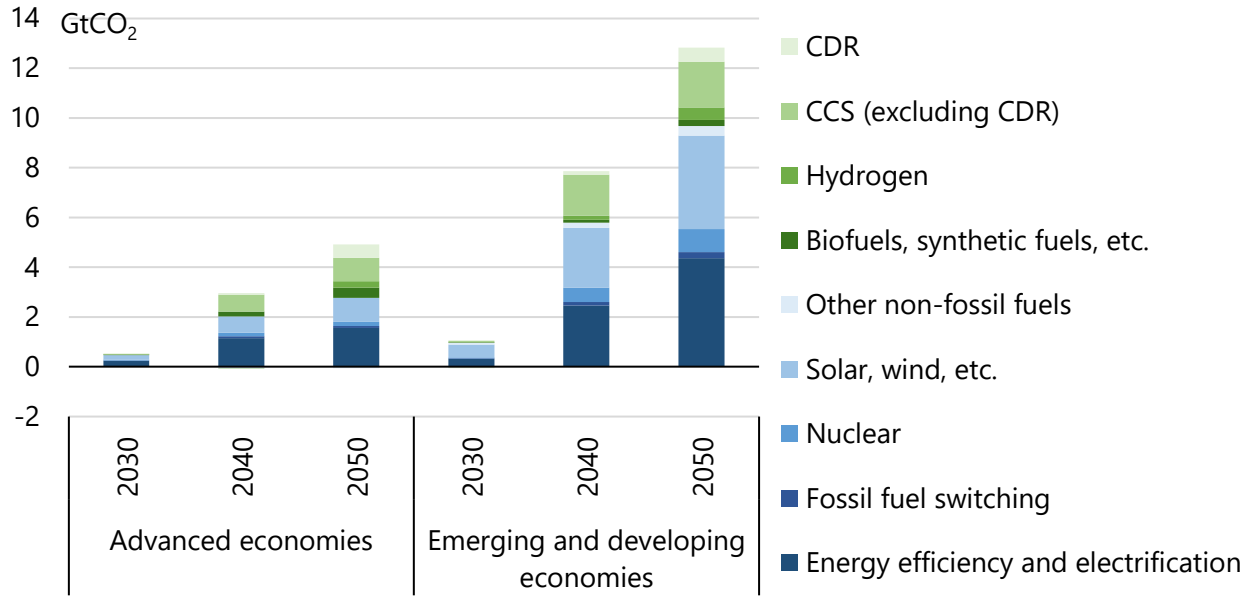


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Decomposition analysis of emissions reductions: By AE (Advanced economies) and EDE (Emerging and Developing Economies)

- ✓ Decomposing the emissions gap between the REF and ATS identifies the additional mitigation technologies needed to achieve the ATS or the 2°C target.
- ✓ In 2050, CCS, hydrogen, and synthetic fuels account for nearly half of emissions reductions in AE. In EDE, energy efficiency, electrification, solar, and wind remain the major contributors.

Decomposition analysis of emissions reductions (REF - ATS) by AE and EDE

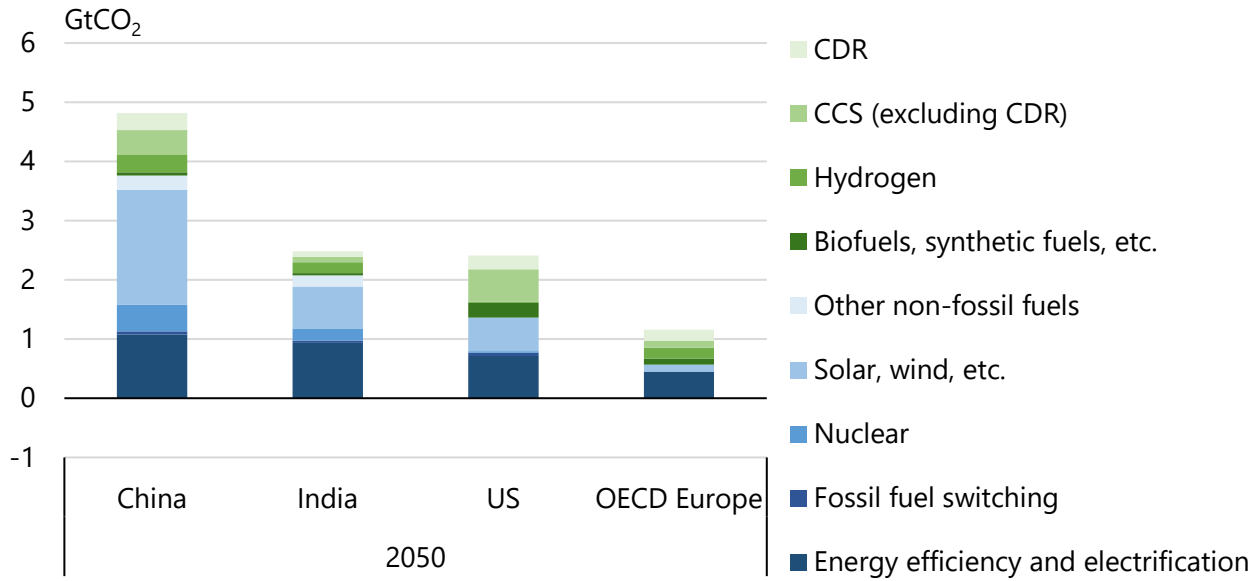


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Decomposition analysis of emissions reductions: By major economies

- ✓ In 2050, solar and wind account for a relatively large share of emissions reductions in China, energy efficiency and electrification in India, CCS in the US, and hydrogen in OECD Europe.

Decomposition analysis of emissions reductions (REF - ATS) by major economies, 2050



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Marginal abatement costs under the ATS

- ✓ Marginal abatement costs are estimated using a global cost-minimizing linear programming model, with regional energy-related CO_2 emissions under the ATS imposed as constraints.
- ✓ Marginal abatement costs under the ATS are consistent with the 2°C target (50% probability). Achieving the target requires a gradual strengthening of climate policies in all countries.

Comparison of marginal abatement costs and carbon prices*

Source	Scenario	Region	Year	USD/tCO_2
IEEJ Outlook 2027	ATS	Global (weighted average)	2050	**123**
		AE (weighted average)	2050	164
		EDE (weighted average)	2050	109
IPCC AR6 WG3	2°C (50% prob.)	Global	2050	**Approx. 120**
	2°C (67% prob.)	Global	2050	210 (140-340)
	1.5°C (50% prob.)	Global	2050	630 (430-990)
World bank, State and Trends of Carbon Pricing 2026	ETS, carbon tax	Global (weighted average)	2026	21
	Carbon tax	Norway	2026	170

* IEEJ Outlook 2027 and IPCC AR6 WG3 values are in constant 2015 USD, while World Bank values are in constant 2026 USD. IEEJ Outlook 2027 covers energy-related CO_2, with values calculated as emissions-weighted averages under the Reference Scenario. Values in parentheses for IPCC AR6 WG3 indicate the 25–75 percentile range. As the 2°C (50% probability) value is not reported in the main text, the median is estimated from Figure 3.32 of the report.

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Importance of CDR and adaptation: Carbon dioxide removal (CDR)

- ✓ Conventional CDR, mainly afforestation and reforestation, currently removes around 2,200 $MtCO_2$, while novel CDR removes about 1 $MtCO_2$.
- ✓ Demonstration funding is concentrated in a few countries, and a single buyer accounts for most credit purchases in both conventional and novel CDR markets.
- ✓ Scenarios consistent with 2°C require 1.1–1.6 $GtCO_2$ of novel CDR in 2050, compared with less than 0.001 $GtCO_2$ today. Scaling up novel CDR is therefore essential.

Category	Technology	2025	2050 "Targets & Pledges" (equivalent to 2℃)	2050 "Highest Ambition" (equivalent to 1.5℃)
Conventional CDR	Afforestation/reforestation	2,200Mt	4,300Mt	5,600Mt
	Other (e.g., soil carbon sequestration)			
Novel CDR	Biochar	0.49Mt	1,600Mt	3,500Mt
	BECCS*	0.51Mt		
	DACCS**	0.0015Mt		
	Other	0.0560Mt		
Total		2,201Mt	5,900Mt	8,800Mt

1,063Mt
In the IEEJ Outlook

* BECCS: Bio Energy with Carbon Capture and Storage
** DACCS: Direct Air Carbon Capture and Storage

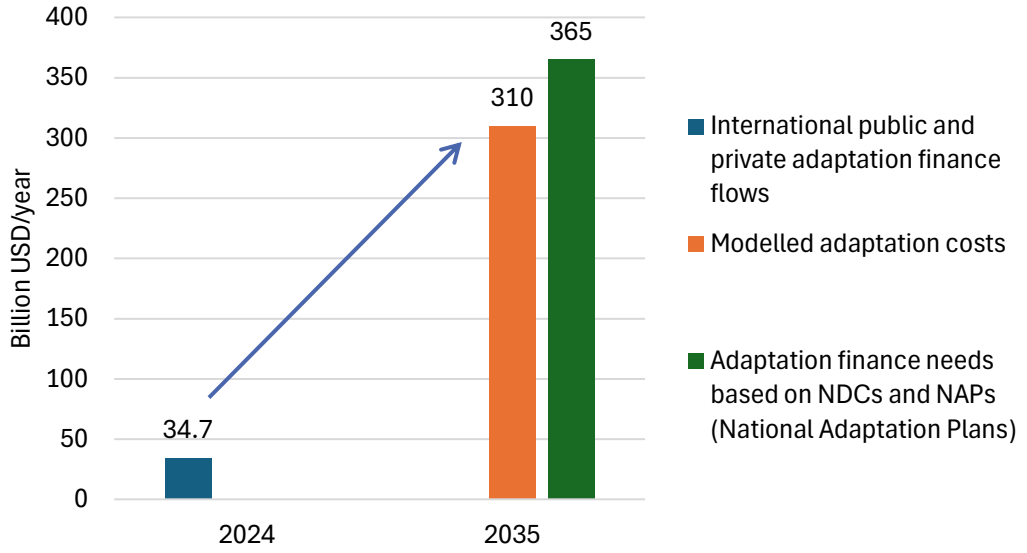
Source: Edwards, M. R., et al. (2026). The State of Carbon Dioxide Removal 3rd Edition 2026. DOI: 10.17605/OSF.IO/ZRD65.
Note: Values for conventional and novel CDR are medians, and their sum does not equal the median of total.

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Importance of CDR and adaptation: Adaptation

- ✓ Climate action requires both mitigation and adaptation. While mitigation remains the priority for reducing climate impacts, adaptation is increasingly important as warming is likely to exceed 1.5°C.
- ✓ The adaptation finance gap in EDE remains substantial. Scaling up adaptation finance is essential, with public funding playing a larger role than in mitigation.
- ✓ In September 2026, the EU announced plans to establish a “Climate Insurance Alliance” to increase insurance coverage against extreme weather events.

Adaptation finance gap in developing countries



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*1: Created from OECD (2026). Climate Finance Provided and Mobilised by Developed Countries in 2013-2024; UNEP (2025). Adaptation Gap Report 2025.

Importance of CDR and adaptation: (Reference) Examples of adaptation measures in Japan

✓ In Japan, the following adaptation measures are considered necessary to address priority climate risks.

Sector		Climate impacts	Adaptation measures
Water resources	Water supply (surface water)	Increased shortages of water	Development of water infrastructure, including dams
Natural disasters and coastal areas	Flooding	Increase in the number of flood locations	River dredging, levees, flood control and water retention measures, pilotis-style buildings
	Inland flooding	Increased risk and duration of inundation	Improved drainage capacity, land elevation, pilotis-style buildings
	Landslides and debris flows	More frequent landslides due to increased hourly rainfall	Disaster prevention infrastructure, early detection of deep-seated landslides, aerial electromagnetic surveys
Health	Extreme heat	More emergency transports and deaths from heatstroke	Increased use of air conditioning
Industry and economic activity	Energy industry	Higher summer cooling demand and large-scale power outages from natural disasters	Securing backup supply capacity, business continuity planning (BCP), flood protection and improved resilience of facilities
Daily and urban life	Infrastructure and lifelines	Disruption to electricity, gas and water due to heavy rain and typhoons	Securing adequate supply capacity, strengthening regional coordination, deploying emergency fuel tanker trucks, and supporting the installation of fuel tanks and backup generators.

Source: Created from the Ministry of the Environment, Japan (2026), Third Climate Change Impact Assessment Report (FY2025 edition).

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