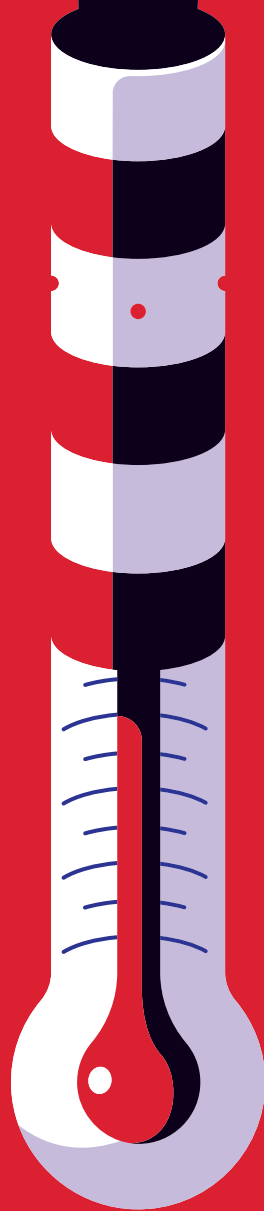


The Heat Is On

A world of climate promises
not yet delivered

Appendices



Emissions Gap Report 2021

The Heat Is On — A world of climate promises not yet delivered

Appendices

Appendix A.

CHAPTER 2. Trends in global emissions, new pledges for 2030 and G20 status an outlook

A1. Limitations of the analysis of G20 economies toward their NDCs

The most important caveats are similar to those of previous Emissions Gap Reports (adapted from den Elzen *et al.* 2019).

First, whether a country is projected to achieve or miss its Cancun Pledge or NDC targets with existing policies depends on both the strength and stringency of the existing climate policy packages and the ambition level of the targets given structural factors (such as demographic and macroeconomic trends) that shape how easy or difficult a target is to achieve. Although targets have been assessed as diverging in ambition, this report does not assess the degree of each country's efforts to achieve a certain mitigation projection, and does not assess the ambition of the targets in the context of equity principles. Countries that are projected to achieve their NDCs with existing policies are therefore not necessarily undertaking more mitigation actions than countries that are projected to miss them, and vice versa.

Second, current policy scenario projections are subject to the uncertainty associated with macroeconomic trends, such as gross domestic product (GDP), population growth and technology developments, as well as the impact of policies. Some pledges are also subject to the uncertainty of future GDP growth and other underlying assumptions. These all add to the fundamental uncertainty resulting from COVID-19.

A2. Definitions of scenarios investigated (adapted from: den Elzen *et al.* 2019)

1. NDC scenarios (unconditional and conditional): identifies the GHG emissions that each member could emit in 2030 under the unconditional and, when available, conditional NDCs. In figure 2.5, where available, the emission levels in absolute terms reported by the national governments are presented. For other countries, we refer to the estimates by independent studies when official values in absolute terms were not available; the emission levels are calculated from base-year or baseline data based on the NDCs

and on other official documents submitted by countries to the UNFCCC (e.g. national GHG inventories, national communications, biennial reports and biennial update reports).

2. Current policies scenario (official data): identifies the most recent, available official estimates of target year emissions, accounting for the projected emission trends resulting from current climate-, energy- and land-use policies. In the 2021 update, we present official projections from Australia, Canada, the EU27 and the UK. We considered scenario projections that were published in 2020 or later.

3. Current policies scenario (independent studies): identifies emissions estimates for the target year, accounting for emission projections resulting from the full implementation of current policies based on independent studies. We considered studies that were published in 2018 or later. Emissions projections reviewed here cover main energy and climate policies that were implemented by a cut-off date (depending on the studies) and do not consider prospective policies that were still under consideration or planning as of the cut-off date. Moreover, while studies differ in their approaches for policy impact quantification, they do not automatically assume that policy targets will be achieved when they are enshrined in the form of a law or a strategy document – studies also consider the status of policy implementation and the extent to which the policy plan is supported by measures. These independent analysis of current policy trajectories supplements the official sources described under point two by providing data that targets consistency across countries and political independence.

4. Announced pledges: Officially announced mitigation pledges for 2030 that have not yet been submitted as NDCs.

A3. Data sources for NDCs and country-level emissions projections

Official and independent sources for emissions data in 2030 under the NDC and current policies scenarios for G20 members are presented in Table A-1.

We excluded a number of pre-2020 studies when their emissions estimates for 2020 were already more than 10 per cent higher than the highest of the estimates by the three studies published in 2021 that considered the impact of COVID-19 and recent policies implemented in 2020 and 2021 (Climate Action Tracker 2021; Joint Research Centre [JRC] 2021; Nascimento *et al.* 2021).

Table A.1. Official and independent sources for emissions data in 2030 under the NDC and current policies scenarios for G20 members

Country	Updated or new NDC and other announced 2030 target: official data sources ¹	Current policies scenario: Official data sources	Current policies scenario and NDC scenario: Independent sources (1. global models and 2. national models)
Argentina	United Nations Framework Convention on Climate Change (UNFCCC) (2021)	N/A	1. Climate Action Tracker (2021), Joint Research Centre (JRC 2021), Climate Resource (Meinshausen <i>et al.</i> 2021) (NDC only) 2. Keesler, Orifici and Blanco (2019)
Australia	Commonwealth of Australia (Australia, Department of Industry, Science, Energy and Resources [DISER] 2020a)	Commonwealth of Australia (Australia, DISER 2020a)	1. Climate Action Tracker (2021), Joint Research Centre (JRC 2021), PBL (den Elzen <i>et al.</i> 2021; Nascimento <i>et al.</i> 2021), Climate Resource (Meinshausen <i>et al.</i> 2021) (NDC only) 2. TIMES (Fragkos <i>et al.</i> 2021)

Country	Updated or new NDC and other announced 2030 target: official data sources ¹	Current policies scenario: Official data sources	Current policies scenario and NDC scenario: Independent sources (1. global models and 2. national models)
Brazil	UNFCCC	N/A	1. Climate Action Tracker (2021), Joint Research Centre (JRC 2021), PBL (den Elzen <i>et al.</i> 2021; Nascimento <i>et al.</i> 2021), Climate Resource (Meinshausen <i>et al.</i> 2021) (NDC only) 2. Graduate School of Engineering (COPPE) (Rochedo <i>et al.</i> 2018)
Canada	Environment and Climate Change Canada (Canada, ECCC 2021)	Canada, ECCC (2021)	1. Climate Action Tracker (2021), Joint Research Centre (JRC 2021), PBL (den Elzen <i>et al.</i> 2021; Nascimento <i>et al.</i> 2021), Climate Resource (Meinshausen <i>et al.</i> 2021) (NDC only)
China	N/A	N/A	1. Climate Action Tracker (2021), Joint Research Centre (JRC 2021), PBL (den Elzen <i>et al.</i> 2021; Nascimento <i>et al.</i> 2021), CD-LINKS (Roelfsema <i>et al.</i> 2020), Climate Resource (Meinshausen <i>et al.</i> 2021) (NDC only) 2. PECE (Fragkos <i>et al.</i> 2021), ² National Center for Climate Change Strategy and International Cooperation (NCSC), Energy Research Institute (ERI) – Integrated Policy Assessment Model for China (IPAC). NCSC and ERI scenarios are published in the COMMIT scenario database (International Institute for Applied Systems Analysis [IIASA] 2021; van Soest <i>et al.</i> 2021)
EU27	N/A ³	European Commission (2021)	1. Climate Action Tracker (2021), Joint Research Centre (2021), PBL (den Elzen <i>et al.</i> 2021; Nascimento <i>et al.</i> 2021), Climate Resource (Meinshausen <i>et al.</i> 2021) (NDC only) ⁵
India	N/A	N/A	1. Climate Action Tracker (2021), Joint Research Centre (2021), PBL (den Elzen <i>et al.</i> 2021; Nascimento <i>et al.</i> 2021), CD-LINKS (Roelfsema <i>et al.</i> 2020), Climate Resource (Meinshausen <i>et al.</i> 2021) (NDC only) 2. Dubash <i>et al.</i> (2018), Indian Institute of Management (IIM) – Asian-Pacific Integrated Model (AIM) India (Roelfsema <i>et al.</i> 2020)
Indonesia	UNFCCC	N/A	1. Climate Action Tracker (2021), Joint Research Centre (2021), PBL (den Elzen <i>et al.</i> 2021; Nascimento <i>et al.</i> 2021), Climate Resource (Meinshausen <i>et al.</i> 2021) (NDC only)
Japan	UNFCCC	N/A ⁴	1. Climate Action Tracker (2021), Joint Research Centre (2021), PBL (den Elzen <i>et al.</i> 2021; Nascimento <i>et al.</i> 2021), Climate Resource (Meinshausen <i>et al.</i> 2021) (NDC only) 2. ⁵
Mexico	UNFCCC	N/A	1. Climate Action Tracker (2021), Joint Research Centre (2021), PBL (den Elzen <i>et al.</i> 2021; Nascimento <i>et al.</i> 2021)
Russian Federation	UNFCCC	UNFCCC (2020)	1. Climate Action Tracker (2021), Joint Research Centre (2021), PBL (den Elzen <i>et al.</i> 2021; Nascimento <i>et al.</i> 2021), CD-LINKS (Roelfsema <i>et al.</i> 2020), Climate Resource (Meinshausen <i>et al.</i> 2021) (NDC only) 2. HSE – TIMES model (Roelfsema <i>et al.</i> 2020)

Country	Updated or new NDC and other announced 2030 target: official data sources ¹	Current policies scenario: Official data sources	Current policies scenario and NDC scenario: Independent sources (1. global models and 2. national models)
Saudi Arabia	UNFCCC	N/A	1. Climate Action Tracker (2021), Joint Research Centre (2021), Climate Resource (Meinshausen <i>et al.</i> 2021) (NDC only)
South Africa	UNFCCC	N/A	1. Climate Action Tracker (2021), Joint Research Centre (2021), PBL (den Elzen <i>et al.</i> 2021; Nascimento <i>et al.</i> 2021)
Republic of Korea	N/A	N/A	1. Climate Action Tracker (2021), Joint Research Centre (2021), PBL (den Elzen <i>et al.</i> 2021; Nascimento <i>et al.</i> 2021) ⁵
Turkey	UNFCCC	UNFCCC (2020)	1. Climate Action Tracker (2021), Joint Research Centre (2021), PBL (den Elzen <i>et al.</i> 2021; Nascimento <i>et al.</i> 2021), Climate Resource (Meinshausen <i>et al.</i> 2021) (NDC only)
UK	Climate Change Committee (2020)	United Kingdom, Department for Business, Energy & Industrial Strategy (DBEIS) (2020a)	1. Climate Action Tracker (2021)
USA	UNFCCC	N/A	1. Climate Action Tracker (2021), Joint Research Centre (2021), PBL (den Elzen <i>et al.</i> 2021; Nascimento <i>et al.</i> 2021), Climate Resource (Meinshausen <i>et al.</i> 2021) (NDC only) 2. PNNL – GCAM model (Fragkos <i>et al.</i> 2021), Rhodium Group (Pitt <i>et al.</i> 2021)

Notes: N/A: not available.

¹ References provided only when the NDC emission levels are available in absolute terms.

² Augmented with historical non-CO₂ GHG emissions data from China's First Biennial Update Report on Climate Change (Sun 2016), combined with the median estimate of the 2010–2030 non-CO₂ emissions growth rates for China from five integrated assessment models (Tavoni *et al.* 2015), to produce economy-wide figures.

³ European Environment Agency (2020) quantified NDC emissions target levels, which include international aviation but exclude land use, land-use change and forestry (LULUCF) and international navigation. In this table, we present figures excluding international transport, in line with national GHG inventories submitted to the UNFCCC.

⁴ The 'with measures' scenario from the latest biennial report is not included because it is an NDC achievement scenario, which includes planned policies.

⁵ For the EU27, Fragkos *et al.* (2021) was excluded because it provided emissions projections only for the EU28. For Japan, projections in Roelfsema *et al.* (2020) and Fragkos *et al.* (2021) were excluded because their emissions estimates for 2020 were already more than 10 per cent higher than those by PBL (Nascimento *et al.* 2021), which provided the highest of the estimates by the three post-COVID studies (Climate Action Tracker 2021; JRC 2021; Nascimento *et al.* 2021). For the Republic of Korea, the projections by Fragkos *et al.* (2021) were excluded due to similar reasons as for Japan.

A4. Accounting of LULUCF emissions

Table A.2. Accounting of LULUCF emissions in the assessment

Country/region	LULUCF accounting in the current NDC and other announced 2030 target (as of 30 September 2021)	Assumptions for LULUCF emissions in 2030 when studies only report projections excluding LULUCF	
		NDC scenario	Current policies scenario
Argentina	Incl. LULUCF	(all studies reported projections incl. LULUCF)	2020 inventory (data year: 2016)

Australia	Incl. LULUCF	(all studies reported projections incl. LULUCF)	2021 inventory (data year: 2019)
Brazil	Incl. LULUCF	(all studies reported projections incl. LULUCF)	Minimum and maximum projections from other studies
Canada	Excl. LULUCF with LULUCF credits	(all studies reported projections incl. LULUCF)	2021 inventory (data year: 2019)
China	Incl. LULUCF	2019 inventory (data year: 2014)	2019 inventory (data year: 2014)
EU27	Incl. LULUCF	(all studies reported projections incl. LULUCF)	2021 inventory (data year: 2019)
India	Incl. LULUCF	BUR2 (inventory data year: 2014)	BUR2 (inventory data year: 2014)
Indonesia	Incl. LULUCF	NDC LULUCF	Minimum and maximum projections from other studies
Japan	Excl. LULUCF with LULUCF credits	NDC LULUCF (credit estimates)	NDC LULUCF (credit estimates)
Mexico	Incl. LULUCF	(all studies reported projections incl. LULUCF)	2018 inventory (data year: 2015)
Republic of Korea	Excl. LULUCF with LULUCF credits	2019 inventory (data year: 2016)	2019 inventory (data year: 2016)
Russia	Incl. LULUCF	(all studies reported projections incl. LULUCF)	2021 inventory (data year: 2019)
Saudi Arabia	Excl. LULUCF	2018 inventory (data year: 2012)	2018 inventory (data year: 2012)
South Africa	Incl. LULUCF	(all studies reported projections incl. LULUCF)	2019 inventory (data year 2015)
Turkey	Incl. LULUCF	(all studies reported projections incl. LULUCF)	2021 inventory (data year: 2019)
UK	Incl. LULUCF	(all studies reported projections incl. LULUCF)	2021 inventory (data year: 2019)
USA	Incl. LULUCF	(all studies reported projections incl. LULUCF)	2021 inventory (data year: 2019)

A5. Conversion of GWPs used in country-level GHG emissions projections

In this year's report, all GHG emission figures are expressed using the 100-year global warming potentials (GWPs) from the IPCC Fourth Assessment Report (AR4). Since some studies provide GHG emissions projections using GWPs from the IPCC Second Assessment Report, we converted them into IPCC AR4 GWP terms by applying conversion factors derived from the PRIMAP historical GHG emissions database (Gütschow, Jeffery and Gieseke 2019) ("HISTCR") as well as from Meinshausen and Alexander (2017) using 2015 historical data.

Table A.3. Conversion of GWPs used in country-level GHG emissions

Country	GWP in the current NDC and other announced 2030 target (as of 30 September 2021)	Conversion factor to AR4 GWP (multiplication)	Source
Argentina	SAR	103.8%	Gütschow, Jeffery and Gieseke (2019)
Brazil	AR5	98.3%	Meinshausen and Alexander (2017)
China	<i>Does not specify</i>	N/A	
India	<i>Does not specify</i>	N/A	
Mexico	AR5	98.8%	Meinshausen and Alexander (2017)

Republic of Korea	SAR	100.8%	Gütschow, Jeffery and Gieseke (2019)
Saudi Arabia	Does not specify	N/A	
South Africa	SAR	101.5%	Gütschow, Jeffery and Gieseke (2019)

A6. Key policy measures adopted by G20 members in 2020 and 2021

Table A.4. Overview of key policy measures adopted by G20 members in 2020 and 2021 that would significantly affect the achievement of their NDC targets.

Country/region	Key policy measures adopted in 2020 and 2021
Argentina	<ul style="list-style-type: none"> • A new exceptional tax for the wealth in the light of the economic measures for the recovery of the pandemic effects was approved in early 2021. This tax is expected to raise funds for keeping up with the economic impact from the pandemic. 20% of the funds are destined to medical supplies, while 25% of the funds are meant to support natural gas. • New renewable energy targets were announced in the Climate Leaders Summit in April 2021; the nation aims to reach 30% share of renewable electricity generation by 2030. • The Government is continuing renegotiating its foreign debt with the International Monetary Fund (IMF), with a new approach: debt for climate action swaps. The future of Vaca Muerta is dependent on the results of these negotiations.
Australia	<ul style="list-style-type: none"> • The First Low Emissions Technology Statement, published in September 2020, outlines the five technologies requiring investment for emissions reduction. Priorities include: “clean” hydrogen (including hydrogen produced from off-grid gas with CCS, and coal gasification with CCS), energy storage, low-carbon materials, CCS and soil carbon sequestration (Australia, DISER 2020a). • The Government of Australia pledged \$1.2 billion towards hydrogen (including hydrogen produced from off-grid gas with CCS, and coal gasification with CCS) and separately \$300m for carbon CCS hubs (Australia, DISER 2021a; Australia, DISER 2021b). The Government sees these hubs as critical in utilizing Australia’s “abundant coal and gas resources” (Australia, DISER 2021c). • The Government of Australia has focused on a “gas-fired” economic recovery (Australia, DISER 2021a). In response to the retiring of the Liddell coal power station in 2022, the government has committed AUD 683 million to build out 1000 MW of gas-fired capacity in Hunter Valley, New South Wales (Australia, DISER 2021d). • In September 2020, the Australian Government announced AUD 74.5 million as part of their Future Fuels Package. This funding underpins the Future Fuels Strategy which prioritizes five areas: electric vehicle (EV) charging and hydrogen refueling infrastructure, supporting commercial fleet investment in new vehicle technologies, improving information to consumers regarding new vehicle technologies, supporting research and development in transportation technology (Australia, DISER 2021e). The strategy does not support EV subsidies, or set a phase out date for fossil fuel new car sales.
Brazil	<ul style="list-style-type: none"> • At the Climate Leaders Summit (April 2021), the Brazilian Government confirmed the nation’s commitment to end illegal deforestation by 2030, as part of the NDC implementation package, and announced the increase of funds for law enforcement

Country/ region	Key policy measures adopted in 2020 and 2021
	<p>against deforestation. This is an important announcement, as the December 2020 NDC update did not mention the commitment to eliminate illegal deforestation by 2030.</p> <ul style="list-style-type: none"> • The Brazilian Government approved the Forest+ project in 2020. It will fund environmental services linked with conservation efforts (Brazil, Presidency of the Republic 2021a). However, The Forest + Entrepreneur modality launched in March 2021 encourages entrepreneurship aimed at paying for the provision of environmental services in all biomes. • Decree Nº10.730/2021 authorizes the use of the Army in Guarantee of Law and Order, from June 28 to August 31, 2021, in municipalities of Amazonas, Mato Grosso, Pará and Rondônia (Brazil, Presidency of the Republic 2021b). The use of the Armed Forces aims to stem environmental crimes, especially illegal deforestation. • In February 2021, the Normative Instruction related to criteria and methods for classifying energy efficiency was approved (Brazil, Ministry of Economy and National Institute of Metrology, Quality and Technology 2021). The standard considers the National Energy Efficiency Plan (2011), highlighting that the reduction of energy consumption in buildings is part of the commitments assumed by Brazil in the ratification of the Paris Agreement of 2015, and supports national public policies that promote sustainable development, in context of reducing global greenhouse gas (GHG) emissions. • National Biofuel Policy RenovaBio (Law 13.576/2017) entered into full execution in 2020. This policy aims to increase the use of biofuels in the transport sector.
Canada	<ul style="list-style-type: none"> • In December 2020, in order to accelerate climate action, the Government of Canada launched 'A Healthy Environment and a Healthy Economy', a plan that includes 64 new measures and \$15 billion in investments • Mandatory carbon pricing has been in effect across Canada since 2019. As of 2021, the price was CAD40/tonne and is set to rise to CAD170/tonne by 2030. Provinces and territories may implement their own pricing systems, provided that they meet minimum benchmarks, or apply the federal system. The federal government announced strengthened benchmark criteria in August 2021. In March 2021, the Supreme Court of Canada ruled the federal carbon pricing approach to be constitutional, in response to legal challenges mounted by several provinces. • The <i>Canadian Net-Zero Emissions Accountability Act</i> was passed, requiring that a target for achieving net-zero emissions by 2050 be set, as well as interim targets every five years starting in 2030. The <i>Act</i> also requires an emissions reduction plan, a progress report, and an assessment report for each target and establishes an advisory body to provide advice on achieving net-zero emissions by 2050. • The Canadian Government made funding commitments to various climate-related initiatives, including CAD8 billion (over seven years) to the Net Zero Accelerator, supporting innovation towards decarbonization of industrial sectors, as well as CAD4.4 billion (over five years) towards home energy retrofits, as well as CAD4 billion (over 10 years) towards natural climate solutions. • The Canadian Government set a mandatory target of achieving 100% of sales of light-duty cars and passenger trucks to be zero-emission by 2035, accelerating the previous target of 100% sales by 2040. Canada continues to invest in zero emissions vehicle charging infrastructure and provide point-of-sale rebates for their upfront costs

Country/ region	Key policy measures adopted in 2020 and 2021
China	<ul style="list-style-type: none"> • The Outline of the 14th Five-Year Plan established that by 2025, CO₂ emissions per unit GDP will reduce 18 percent and energy consumption per unit GDP will reduce 13.5 percent from 2020 levels (China, The State Council of the People’s Republic of China 2021). • In July 2021, the national emissions trading scheme began. The first batch of trading covers more than 2000 power companies that exceed the 26 ktCO₂e annual emissions threshold. The total annual emissions of these participating companies are more than 4 GtCO₂e (China, Ministry of Ecology and Environment 2020).
European Union	<ul style="list-style-type: none"> • The European Climate Law (ECL) entered into force on 29 July 2021. The Law makes binding the EU’s goals of reducing EU’s emissions by “at least 55%” by 2030 and reaching climate neutrality by 2050. It also determines the process of setting up EU’s 2040 emissions reduction goal. • The Law establishes European Scientific Advisory Board on Climate Change with the goal of providing scientific and technical expertise in the area of climate change. Among others, it should assess EU’s existing and proposed measures and identify actions and opportunities to reach EU’s emissions reduction goal. • By 15 September 2021 the EU approved Recovery Plans submitted by 18 member states amounting to €412 bn. At least 37% of these plans should be spent on climate action. In some cases, the national plans significantly exceeded this benchmark, with Austria, Belgium, Denmark, and Luxembourg reportedly planning to spend more than half of the amount on climate action. • Also in July 2021 the European Commission presented a package of proposals “Fit For 55” which aims at implementing EU’s new emissions reduction goals. Among others, the proposals would result in ban on sale of combustion vehicles after 2035. It proposes to strengthen the EU emissions trading system, increase national GHG reduction targets and review and strengthen energy efficiency and renewable energy legislation. It also includes a proposal to introduce a separate emissions trading scheme for buildings and transport sectors, flanked by introduction of a Social Climate Action Fund.
India	<ul style="list-style-type: none"> • The Government of India has increased its renewable capacity generation target from 175GW by 2022 to 450 GW by 2030 (India, Ministry of New and Renewable Energy 2020) • The Indian Government has brought forward the indicative target of achieving 20% ethanol blending from 2030 to 2025 under the National policy on Biofuels-2018 (India, Press Information Bureau 2021). • Indian railways aims to completely electrify the network by 2023 and in July 2020 announced its plans to achieve net zero emissions by 2030. • In August 2021, the National Hydrogen Mission was announced with an aim to boost renewable energy-based hydrogen production.
Indonesia	<ul style="list-style-type: none"> • Indonesia’s State-owned Electricity Company (PLN) plans to start closing down coal-fired power plants in 2025 and phase them out in 2055 to be compatible with Indonesia’s target of reaching net zero emission by 2060. The plan implies the retirement of approximately 50 GW of CFPP. (Consumer News and Business Channel [CNBC] Indonesia 2021; Meilanova 2021).

Country/ region	Key policy measures adopted in 2020 and 2021
	<ul style="list-style-type: none"> • Presidential regulation on carbon pricing and carbon tax bill are currently being finalized. The emission trading system is being piloted in Indonesia coal-fired power plants (CFPPs) for both owned by Stated-owned company (PLN) and private sector (International Carbon Action Partnership [ICAP] 2021). Meanwhile, carbon tax will apply to carbon-intensive sectors such as pulp and paper, cement, electricity generation and petrochemical industries (Reuters 2021a), with a minimum tariff of Rp75 per KgCO₂e or equal to around \$5.2 per ton of CO₂e. The carbon tax is planned to be implemented by 2022 (Indonesia, The House of Representatives of the Republic of Indonesia 2021). • Otoritas Jasa Keuangan (OJK/Indonesia Financial Services Authority) has finalized sustainable finance roadmap phase II (2021-2025), which include the development of green taxonomy. Green taxonomy will be used as a guidance for investors to invest in green projects; hence, it can accelerate sustainable financing and investment in Indonesia. It is forecasted that the green taxonomy will be finalized by 2022 (Otoritas Jasa Keuangan 2021). • Presidential Instruction No. 5/2019 on Termination of New Permit and Improvement of Primary Natural Forest and Peatland Governance (President of the Republic of Indonesia 2019). This would make the previously temporary moratorium on new forest-clearing activities permanent.
Japan	<ul style="list-style-type: none"> • The Government of Japan established a Green Innovation Fund of 2 trillion yen (US\$ 18 billion) to support companies for 10 years, from R&D and demonstration to social implementation of decarbonisation technologies with an aim to achieving the 2050 carbon neutrality target. The Fund opened for applications in April 2021 (Japan, Ministry of Economy, Trade and Industry [METI] 2021a). • A public-private council to strengthen the competitiveness of the offshore wind industry established targets for approving offshore wind power of 10 GW by 2030 and 30-45 GW by 2040, and agreed with a 60% local content requirement by 2040 (Japan, METI 2020). • An interim report of the inefficient coal power “fade-out” policy was issued by the Government. The report makes reference to an exemption of captive coal power plants from this fade-out policy (Japan, METI 2021b). • The Bank of Japan launched a new scheme to support projects addressing climate change, which includes the provision of no-interest loans to financial institutions that are undertaking disclosure initiatives, for example, under the Task Force on Climate-related Financial Disclosures, as well as the purchase of green bonds in foreign currencies (Japan, Bank of Japan 2021).
Mexico	<ul style="list-style-type: none"> • The Government of Mexico passed a bill on fiscal support to its state-owned petroleum company (Pemex) and released its Business Plan 2021-2025, which fosters oil and gas exploration and extraction investments. In 2020 and 2021, US\$ 2.2 billion of public expenditures (from US\$ 9 billion expected total costs) were allocated to refinery Dos Bocas (PEMEX 2021). • The recently proposed amendments to the Electricity Industry Law by the federal government recover the state-centralized management of the power sector, halting renewables and prioritizing large, large, hydro, and fossil fuel-fired power plants (Mexico, Mexican Congress 2021). No significant renewable power capacity has been added in 2020 and 2021; renewables (excluding large hydropower) account for

Country/ region	Key policy measures adopted in 2020 and 2021
	<p>12.63 per cent in July 2021 (OBTRENMX 2021). The state-owned power company (CFE) released its 2021-2025 Business Plan in which no additional capacity for renewables is planned until 2027 (Comisión Federal de Electricidad [CFE] 2021).</p> <ul style="list-style-type: none"> • “Sembrando Vida” federal program incentivizes agroforestry and agricultural systems in rural areas with a target of 1 million hectares of trees planted. Though, independent analyses report the loss of tree cover of 73,000 ha in its first year of implementation (Warman <i>et al.</i> 2019). To reap the mitigation benefits of this program, high survival rate of trees and their long-lasting permanence of agroforestry areas will be needed. • This year, federal states and cities have significantly increased their commitments to enhance climate action at the subnational level. Mexico City, Jalisco, Querétaro, Guanajuato, Yucatán, Quintana Roo, Puebla, Hidalgo, Sonora, Aguascalientes, among others, have created either new and ambitious climate policies, legislation or instruments to deep decarbonization and climate action.
Republic of Korea	<ul style="list-style-type: none"> • Under the Ninth Electricity Plan for Long-Term Electricity Supply and Demand published in December 2020, 30 coal-fired power plants will be phased out by 2034, and among them 24 coal-fired power plants will be switched to gas-fired power plants. The new plan’s targets for 2030 are 29.9 per cent for coal, 25 per cent for nuclear, 23.3 per cent for natural gas and 20.8 per cent for renewables of the electricity generation. • The Government’s Green New Deal includes a plan to boost renewable energy deployment and low-carbon infrastructure, as well as support to put 1.13 million EVs and 200,000 hydrogen vehicles on the roads by 2025. • Emissions Trading Scheme (ETS) will be utilized to meet the NDC, accounting for 73.5% of national GHG emissions. To meet the power sectors’ GHG emission cap of 193 MtCO₂e per year by 2030, coal power generation will be put under regulation with a benchmark system. • In August 2020, the green finance task force was formed and operated to strengthen public-private cooperation in green finance. “Korean Green Taxonomy” suitable for domestic conditions will be prepared.
Russian Federation	<ul style="list-style-type: none"> • In July 2021, the Russian Federation signed legislation that will require companies from January 2023 to report their greenhouse gas emissions (Reuters 2021b). • A draft energy efficiency plan, published in August 2020, sets a 2030 target of reducing total energy intensity of GDP by 20 per cent below 2017 levels. • The long-delayed 2035 Energy Strategy was adopted in June 2020, which focuses on expanding fossil fuel production, exports and domestic consumption. Plans for expanding renewable energy generation are absent.
Saudi Arabia	<ul style="list-style-type: none"> • The Government of Saudi Arabia’s Green Initiative was launched in March 2021. It aims to plant 10 billion trees in Saudi Arabia and achieve 50% renewable share in the national energy mix by 2030 (Saudi Arabia, Saudi Green Initiative 2021).
South Africa	<ul style="list-style-type: none"> • South Africa’s Cabinet has formally approved the Presidential Climate Change Coordinating Commission, an independent group that will advise on and facilitate a just transition in the country. 22 members have been appointed to the Commission, comprising high-level representatives from business, youth, labour, academia, advocacy, civil society, research institutions, and traditional leadership (collectively,

Country/ region	Key policy measures adopted in 2020 and 2021
	<p>the “social partners”) (South Africa, The Presidency of the Republic of South Africa 2020).</p> <ul style="list-style-type: none"> • The Government of South Africa has increased the cap that allows private investors and companies to generate and sell electricity without a license. The cap was lifted from 1 MW to 100 MW (South Africa, The Presidency of the Republic of South Africa 2021). • Eskom, South Africa’s largest greenhouse gas emitter, has committed, in principle, to net-zero emissions by 2050. Sasol, the petrochemical giant in South Africa, is exploring pathways to achieving net-zero by 2050. Exxaro, one of South Africa’s largest coal mining companies, has also committed to reaching carbon neutrality by 2050 (South Africa, The Presidential Climate Commission 2021).
Turkey	<ul style="list-style-type: none"> • The Government of Turkey continues to expand its coal-fired power generation. 1.5 GW of planned capacity is currently under construction. • Turkey sought auctions for small-scale solar projects of total 1 GW in the early 2021 and concluded them by June 2021. One solar PV auction of 1GW already took place in 2017 and two onshore wind auctions of 1GW each in 2017 and 2019. Bids for third onshore wind auction of 2GW capacity are announced to be collected in October 2021 and bids for a new solar PV auction of 1GW (of 15 auctions) in March 2022. • Since 2019 there is a target of 14% of energy efficiency countrywide and 15% of energy savings for public buildings to be realized by 2023 as part of Turkey’s National Energy Efficiency Action Plan 2017-2023.
United Kingdom	<ul style="list-style-type: none"> • The Industrial Decarbonisation Strategy outlines a heavy reliance on ‘low carbon’ hydrogen and carbon, capture, utilisation, and storage. Roughly GBP 1.5 billion has been committed so far to develop these technologies over the next decade, with additional funding for both set to be forthcoming (United Kingdom, DBEIS 2021). • The Transport Decarbonisation Plan outlines the government’s commitment to phase out the sale of fossil fuel cars and vans by 2030, ten years prior than originally planned. Consultations will be undertaken on newly outlined targets to phase out fossil fuel heavy duty vehicle sales and for domestic aviation to reach net zero by 2040 (United Kingdom, Department for Transport 2021) • The government’s Energy White Paper was released in December 2020 United Kingdom, DBEIS 2020a). Two of the key measures outlined are commitments to 40 GW of offshore wind capacity by 2030 (including 1 GW of offshore wind) and 5 GW of low-carbon hydrogen production capacity.
United States of America	<ul style="list-style-type: none"> • In December 2020, Congress passed an extension of the solar Investment Tax Credit, which subsidizes investment in solar energy on residential and commercial properties. • The American Innovation and Manufacturing Act of 2020 was signed on Dec 27, 2020, authorizing a 15-year phase down of HFCs in alignment with the Kigali Amendment to the Montreal Protocol • The United States of America rejoined the Paris Agreement on February 19, 2021 • Congress enacted legislation to reinstate methane emission reduction standards for the oil and gas industry (June 2021).

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Appendix B.

CHAPTER 5. Are COVID-19 fiscal recovery measures bridging or extending the emissions gap?

B.1. Reported priorities for a green recovery and high-impact policy options, by region

Continental Unions and Regional Economic Commissions of the United Nations all highlight strong opportunities for green recovery across sectors (see table). Alongside stated priority investments, the United Nations Economic Commission for Africa (UNECA) calls for crowding-in private sector investment through development of a repurchasing market, deepening local financial markets, and implementing a global price on carbon (facilitating carbon offsets and trading). The African Union Commission (AUC) notes the importance of climate finance, including increasing flows, efficiency, and impact of funding; the United Nations Economic and Social Commission for Western Asia (UNESCWA) also calls for extending debt service relief and access to concessional loans to MICs and vulnerable countries. In addition, UNESCWA proposes a “Social Expenditure Monitor” to improve transparency and reduce leakages and a “Regional Solidarity Fund” targeting support to the most vulnerable countries. Several sources emphasise the transition to a digital economy (African Union Commission [AUC] 2021a; United Nations Economic Commission for Latin America and the Caribbean [UNECLAC] 2020; Bruegel 2021). Bruegel also highlights the need for education and training to support digital skills.

Table B.1. Priorities for a green recovery and high-impact policy options by region

	Stated Priority Investments by Organisation and Study											
	Clean energy	Sustainable natural infrastructure – forestry	Sustainable natural infrastructure – conservation	Sustainable natural infrastructure – waterways	Sustainable natural infrastructure – agriculture	Sustainable tourism	Sustainable transport – surface	Sustainable transport – air and water	Building upgrades and efficiency	Green urbanisation and connectivity (incl. broadband)	Circular economy	Adaptation & resilience (including disaster prep.)
Africa												
AUC 2021a												
AUC 2021b												
United Nations Economic Commission for Africa (UNECA) 2021												
Latin America and the Caribbean												
UNECLAC 2020												
East Asia / Pacific												
United Nations Economic and Social Commission for Asia and												

the Pacific [UNESCAP] 2021												
Europe												
Bruegel 2021 ¹												
European Commission 2020												

Appendix B.2. Examples of low-carbon spending in traditionally ‘neutral’ sectors

These deliver green benefits through green conditionalities, incentives, and tuned policy. The measures do not necessarily have as large an impact in reducing GHG emissions as measures in some green sectors, but their mitigation potential, adaptation potential, and/or other environmental impacts are certainly significant.

Table B.2. Examples of ‘neutral’ spending with accompanying green incentives

Country	Case Study	Sources
Energy efficiency requirements for new initiatives and upgrades		
USA	(Proposed) US\$100bn to build new and upgrade existing school buildings; construction will prioritise energy-efficient and resilient design as well as widespread electrification	(United States, Office of the President 2021)
UK	US\$0.77bn for 580 building projects at academies, sixth form colleges and voluntary aided schools in England; the funding will prioritise upgrading of boilers and other facilities to new green, energy-efficient models	(United Kingdom, Department for Education 2020)
Spain	US\$0.087bn for architectural projects, building works and urban actions that include elements of innovation, including the introduction of sustainability criteria in renovations or reforms	(Valencia Plaza 2020)
Renewable energy, air pollution and natural capital requirements for new initiatives and upgrades		
South Korea	US\$5bn for various government building and schools upgrades which will be required to increase the share of renewable energy in their consumption patterns	(South Korea, Ministry of Economy and Finance 2020)
USA	(Proposed) US\$17bn in inland waterways, coastal ports, land ports of entry, and ferries, including a Healthy Ports program to support, among others, clean energy programs in freight and aviation	(United States, Office of the President 2021)
EU	US\$11.76bn in recovery aid for EU farmers and food producers, which must be used in line with the Farm to Fork and Biodiversity	(European Parliament 2021)

¹ Bruegel with input from the United Nations Economic Commission for Europe.

	strategies, as well as being consistent with other international commitments	
Kenya	US\$0.1bn for expanded public works; projects concentrated in and around informal settlements with the aim of improving service delivery infrastructure, including the construction of green spaces and pocket parks, as well as community gardens.	(Kenya, Ministry of Transport, Infrastructure, Housing and Urban Development 2020)

Education and retraining with positive green externalities		
Spain	US\$0.049bn for the Comprehensive Employment Plan for the Canary Islands to implement training plans for vulnerable groups, including the execution of projects related to sustainable development and green and circular economies	(Spain, Government of the Canary Islands 2020)
EU	US\$33.3bn to fund learning mobility and cross-border cooperation projects; the programme will offer financial incentives to participants using sustainable modes of transport in their education pursuits and invest in projects promoting awareness of environmental issues	(European Commission 2021)
Denmark	Educational benefits to provide unemployed individuals the opportunity to learn new skills and gain new jobs; the initiative will highlight the significance of the green transition for new job functions and competencies	(Denmark, Ministry of Employment 2020)
France	EUR 750M for support to France Compétences, the national authority responsible for the regulation and financing of apprenticeships and professional training, supporting among others training in energy and environmental transition	(France, Ministry of Finance 2021)

Sustainable supply chain requirements		
Japan	US\$2.05bn to promote investment and strengthen supply chains to support the development of domestic manufacturing bases, including the installation of self-consumption type solar power generation facilities	(Japan, Ministry of the Environment 2020)
USA	(Proposed) US\$52bn to invest in capital access programs with a proven track record of success to strengthen domestic supply chains, and including a tax credit for investments in manufacturing facilities for clean energy technologies	(United States, Office of the President 2021)

Appendix B.3. Existing literature on the impact of fiscal rescue and recovery spending on emissions.

COVID-19 spending so far seems likely to increase net greenhouse gas emissions. However, if nations were to invest in lower-carbon alternatives, studies suggest that the net impacts of the COVID-19 pandemic would reduce global warming. Table B.3 presents existing literature on the impact of fiscal rescue and recovery spending on emissions.

Table B.3. Overview of available literature on the impact of fiscal rescue and recovery spending on emissions (using stylised assumptions, actual fiscal spending estimates, or a mix of both).

	Carbon-intensive recovery	Current trajectory	Low-carbon recovery		Other scenario/note
Shan et al. (2021)	GHG emissions rebound 16.4% (23.2 GtCO ₂ e) by 2024	GDP rebounds 1.27% & GHG emissions rebound 1.45% (2.04 GtCO ₂ e) by 2024	GHG emissions reduction of 4.7% (6.6 GtCO ₂ e) by 2024		
Forster et al. (2020)	GHG emissions increase 10% by 2030	GHG emissions recover to baseline levels by end of 2022	Moderate: GHG emissions decrease 35% by 2030	Strong: GHG emissions decrease 50% by 2030	
Malliet et al. (2020)	Low oil price scenario: CO ₂ emissions increase 16% by 2040				<ul style="list-style-type: none"> • COVID & low oil & carbon tax: GDP increases 3% & CO₂ emissions reduce 31% by 2040
Meles, Ryan and Wheatley (2020) on EU			If a <i>Green Deal</i> is implemented in EU, GHG emissions decrease by 52.5% by 2030 rather than 43.3% (muted recovery)		
Pollitt et al. (2021)			~12% decrease from baseline (pre-pandemic) GHG emissions by 2030		<ul style="list-style-type: none"> • Neutral recovery (VAT reduction of 5%): ~3% decrease from baseline GHG emissions by 2030
IEA Sustainable Recovery Tracker (2021)		CO ₂ emissions climb to record levels in 2023 continuing to rise thereafter			<ul style="list-style-type: none"> • Provides live country-level data on clean energy spend & estimates of emissions impacts • Current green spending is 35% of what is needed for net-zero emissions by 2050

Appendix B.4. Different approaches to assessing the greenness of COVID-19 spending

Several organisations have tracked the ‘greenness’ of government fiscal responses to the COVID-19 crisis. Methodologies have ranged from policy-by-policy assessments to sector-based assessments to detailed archetype-based methodologies. The policy-by-policy approach benefits from a highly detailed approach to classifying individual measures but presents no trackable methodology, complicating comparisons with other trackers. Sector-based tracking uses established categories and allows researchers to assign categories rapidly. However, it struggles to capture nuance across policy types and assess environmental impact beyond a simplistic, one-dimensional scale. Archetype methodology, building on Barbier (2010), relies on sorting policies into pre-defined archetypes [and sub-archetypes], which are specifically designed to capture nuance in environmental impact assessment. Tracking policy archetypes is less time-intensive than policy-by-policy assessments, and provides greater traceability, but faces a trade-off between archetype complexity and tracking effort. While the IMF’s Green Monitor (now discontinued) captured 39 archetypes (18 green, 21 red), Oxford’s Global Recovery Observatory includes 158 sub-archetypes across 40 policy archetypes.

Trackers tend to prioritise advanced economies, both due to their high profile in international policy debate and due to data accessibility concerns. Coverage ranges from 19 Eurozone countries (Wuppertal Institute and E3G 2021) up to 89 economies including advanced, emerging market, and developing economies (Global Recovery Observatory). All trackers covered in this chapter consider national economic packages only.

Scoring complexity varies across trackers. While some use a binary assessment (such as the IMF’s Green Monitor’s use of ‘Green’, ‘Red’ and ‘Conditional Red’ and the OECD Green Recovery database use of ‘positive’, ‘mixed’, and negative impacts), others employ a Likert scale to describe the ‘greenness’ of policies. Some trackers (e.g. Beyer and Vandermosten 2021) also include underlying sector contexts or other adjustment factors in their scoring and might consider regulatory changes too. Definitions for what is ‘green’ vary widely across trackers.

Table B.4. COVID-19 policy trackers – summary of key characteristics.

	Data source	Country coverage	Relevance criteria	Classification system	Scoring system
E3G Green Recovery Tracker	Legislated national economic recovery packages	19 countries (Eurozone countries)	Impact on GHG emissions	Policy-by-policy assessment	4-point Likert scale
Global Recovery Observatory	Public domain	89 countries + EU (50 largest economies + 39 additional countries); 7,500 policies	Impact on GHG emissions, air pollution, natural capital, and adaptation / resilience	Archetype (40) and sub-archetype (158) methodology, expanded from Hepburn <i>et al.</i> (2020)	5- and 3-point Likert scale and emissions intensity adjustment factors with sectors

OECD Green Recovery Database	Led by country submissions, supplemented by public sources	43 countries plus EU; 1,700 policies	Apparent net impact on environment	Policy-by-policy assessment (recovery policies only)	3-point Likert scale
Vivid Economics Greenness of Stimulus Index	IMF Policy Tracker and the public domain	30 countries (G20 + ten additional countries)	Impact on GHG emissions, pollution, and biodiversity	Archetype methodology (20 green, 23 red) across five sectors	5-point Likert scale and underlying sector context
Energy Policy Tracker	Public domain	31 countries + 9 multilateral institutions	Only clean energy measures included – considers impact on environment	Energy type	4-point Likert scale with mechanisms, sectors and policy type
International Energy Agency (IEA) Sustainable Recovery Tracker	IEA policies and measures database	42 countries	Only clean energy measures included – considers impact on environment	Emissions modelling	World Energy Model used to assess impacts on global CO ₂ emissions
IMF's Green Monitor (discontinued)	IMF Policy Tracker	20 countries + EU (G20 + Spain)	Impact on GHG emission, climate resilience	Archetype methodology (18 green, 21 red) across five sectors	Green, Red, Conditional Red

Appendix B.5. Comparison of mechanisms for redistributing IMF SDRs

Table B.5. Comparison of existing PRGT mechanism, proposals for Resilience and Sustainability Trust (IMF) and Liquidity and Sustainability Facility (LSF)

	PRGT- Poverty Reduction and Growth Trust (IMF) (existing)	Resilience and Sustainability Trust (IMF) (proposed, see Georgieva 2021)	Proposed Liquidity and Sustainability Facility (LSF) (proposed)
Funding source	Market loans supported by subsidies to create concessional treatment	On-lending of SDRs	On-lending of SDRs, official development assistance (ODA), central and multilateral development banks
Scale	Initial resources of ~ US\$1.7 billion p.a. with 245% increase to annual access limit in 2021.	Not yet defined. US\$100 billion mentioned by IMF.	US\$30 billion proposal
Target countries	LICs	Special focus for MICs, SIDS, vulnerable countries	Vulnerable middle - income countries, countries with market access
Core support areas	Poverty reduction	Health response to COVID-19, climate resilience	Liquidity, climate resilience, sustainable infrastructure
Private sector support	Not part of the mandate	Not part of the mandate as per current proposal	De-risking of private sector investment into vulnerable countries

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