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

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2.1 Introduction

This chapter reviews the current status of global greenhouse gas (GHG) emissions as well as the outlook for 2030 emissions under new or updated nationally determined contributions (NDCs) and announced mitigation pledges. It also reviews progress towards implementing 2030 pledges, with a special focus on G20 members.[1]

Section 2.2 provides an overview of current trends in total global GHG emissions and global carbon dioxide (CO_2) emissions from fossil fuel use and industry-related sources, considering the impact of COVID-19 on 2020 and 2021 emissions. Section 2.3 presents new or updated NDCs communicated under the Paris Agreement, as well as additional pledges for 2030 that are yet to be formally submitted as NDCs. It discusses the characteristics of these pledges (in aggregate) and assesses their impact on global and G20 2030 emissions. Section 2.4 presents G20 members' pledges, assessing whether and how they have been updated, along with progress towards their implementation. The assessment covers all individual G20 members and regions, except European Union member states.[2] The cut-off date for the assessments of new or updated NDCs was set as 30 September 2021.

For this Emissions Gap Report, progress towards achieving the Cancun Pledges has not been assessed, due to the large uncertainty around 2020 emissions as a result of the COVID-19 pandemic. A more comprehensive assessment on the achievement of the Cancun Pledges is expected in the Emissions Gap Report 2022.

All GHG emission figures in this report are expressed using the 100-year global warming potentials (GWPs) from the Intergovernmental Panel on Climate Change (IPCC)

1 The members of the G20 are: Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, the Republic of Korea, the Russian Federation, Saudi Arabia, South Africa, Turkey, the United Kingdom, the United States of America and the European Union.

2 The United Kingdom has left the European Union but was in a transition period until the end of 2020, during which the European Union's NDC still applied to the country.

Fourth Assessment Report,[3] unless otherwise noted. In terms of historical emissions data, section 2.2 uses globally consistent and independent data sets rather than officially reported United Nations Framework Convention on Climate Change (UNFCCC) inventory reports, whereas sections 2.3 and 2.4 use UNFCCC inventory reports when comparing historical emissions to individual G20 members' NDC targets.

The methodology and preliminary findings of this chapter were made available to the governments of the countries specifically mentioned to provide them with the opportunity to comment on the findings.

2.2 Current global emissions: status and trends

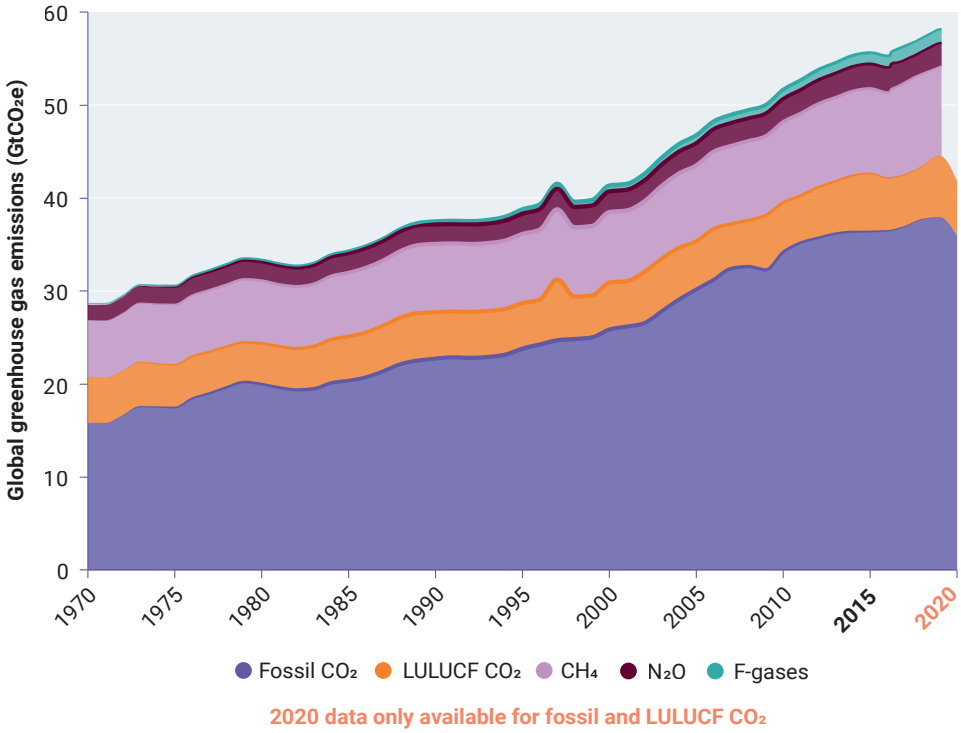
At present, there are no estimates available of total global GHG emissions for 2020. However, the COVID-19 pandemic led to an unprecedented 5.4 per cent drop in CO_2 emissions in 2020 (figure 2.1), with a smaller drop in total GHG emissions expected for the year. From 2010 to 2019, GHG emissions grew by 1.3 per cent per year on average, both with and without land-use change (LUC). GHG emissions reached a record high of 51.5 gigatons of CO_2 equivalent ($GtCO_2e$) in 2019 without LUC emissions and 58.1 $GtCO_2e$ when including LUC[4] (figure 2.1). These 2019 estimates of global GHG emissions have been downward adjusted compared with the Emissions Gap Report 2020, as more complete data have become available.

Different GHGs play different roles in the changes in total GHG emissions (figure 2.1). Fossil CO_2 emissions dominate total GHG emissions including LUC (66 per cent since 2010), as well as the growth in GHG emissions. Fossil CO_2 emissions reached a record 37.9 $GtCO_2$ in 2019, but dropped to 36.0 $GtCO_2$ in 2020. CO_2 emissions from LUC have constituted 10 per cent of cumulative GHG emissions since 2010, and can change significantly from year to year due to climate conditions (Friedlingstein *et al.* 2020; Canadell *et al.* 2021). Estimates in this chapter only consider the direct effects of LUC and represent the average of three bookkeeping models (Friedlingstein *et al.* 2020). Furthermore, the estimates assume that 2020 emissions are similar to the 2010–2019 average, based on preliminary estimates of fire data. No preliminary estimates are available for the growth of non-CO_2 emissions in 2020.

3 This change was made to be more in line with the decisions of the twenty-fourth United Nations Climate Change Conference of the Parties (COP24) held in Katowice, where parties agreed to use GWPs from the IPCC Fifth Assessment Report for reporting reasons. However, a full switch to using Fifth Assessment Report GWPs in this report is not yet possible as the literature is still not up to date on this decision.

4 The GHG emissions data in this report are based on the Emissions Database for Global Atmospheric Research (EDGAR; Crippa *et al.* 2021), PBL Netherlands Environmental Assessment Agency (Olivier and Peters 2021) and LUC from the Global Carbon Project (Friedlingstein *et al.* 2020). EDGAR data are available until 2020 for CO_2, but only until 2018 for non-CO_2 emissions. Non-CO_2 emissions were extrapolated to 2019 based on the Emissions Gap Report 2020. GWPs were used from the IPCC Fourth Assessment Report. All estimates for 2019 and 2020 should be considered preliminary.

Figure 2.1. Global greenhouse gas emissions from all sources, 1970–2020



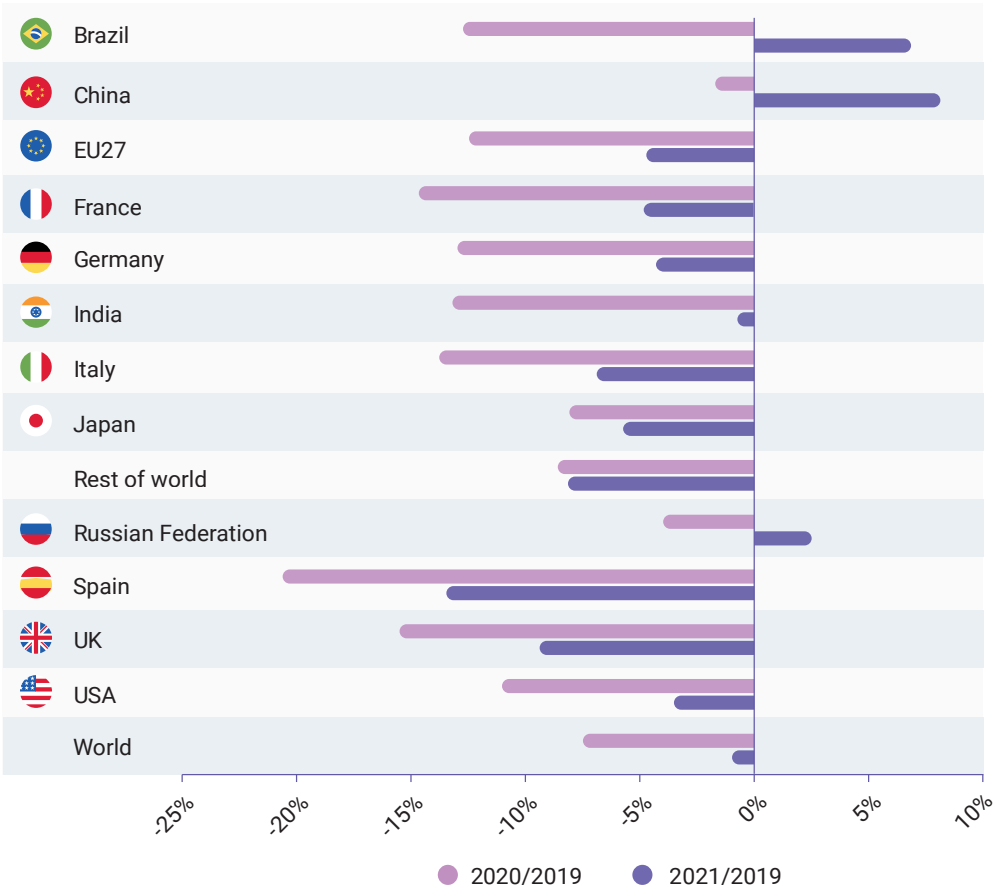
Notes: LULUCF – land use, land-use change and forestry. EDGAR data were used until 2018 for methane, nitrous oxide and fluorinated gases, but were extrapolated to 2019 using growth rates from the previous version of EDGAR (published in the Emissions Gap Report 2019).

Sources: EDGAR – Crippa *et al.* (2021); Olivier and Peters (2021); LUC – Friedlingstein *et al.* (2020)

As mentioned previously, the COVID-19 pandemic led to an unprecedented decline in fossil CO_2 emissions in 2020, both in relative and absolute terms. Global fossil CO_2 emissions fell 5.4 per cent according to this report's data set, with other estimates suggesting declines of 5.8 per cent (Global Carbon Project, updated based on Friedlingstein *et al.* 2020), 5.8 per cent (excluding cement) (International Energy Agency [IEA] 2021) and 6.3 per cent (BP 2021, excluding cement). The change in fossil CO_2 emissions varied across countries. Despite the pandemic, Chinese fossil CO_2 emissions grew 1.3 per cent in 2020, though most other major emitters saw a decline in emissions, including the United States of America (10 per cent), the EU27 (10 per cent), India (6.2 per cent), with international transportation (shipping and aviation) dropping by 20 per cent.

A strong rebound in emissions is expected in 2021 (figure 2.2). In April 2021, the International Energy Agency (IEA) estimated a 4.8 per cent increase in emissions in 2021, after the 5.8 per cent decline in 2020 (IEA 2021). Carbon Monitor (Liu *et al.* 2020) estimates near real-time estimates of daily CO_2 emissions, and based on data from January to July 2021, global fossil CO_2 emissions are only slightly lower (1 per cent) than the same period in 2019. Of the major emitters, only Brazil, China and the Russian Federation show an increase in emissions from January to July 2021 relative to 2019. Based on the IEA and Carbon Monitor data, fossil CO_2 emissions are expected to have a near full recovery in 2021, with emission levels only slightly lower than the record high in 2019.

Figure 2.2. Change in emissions in 2020 and 2021, both relative to 2019 levels due to COVID-19 lockdowns



Source: Liu *et al.* (2020)

Despite the large decline in CO_2 emissions in 2020, the concentration of CO_2 in the atmosphere grew by around 2.3 parts per million, in line with recent trends. It is unlikely that the reductions in emissions in 2020 will be detectible in the atmospheric growth rate for three reasons. First, although emission levels declined, they were still high and around the same levels as those seen in the early 2010s, meaning the amount of CO_2 remaining in the atmosphere is expected to be only marginally less than if emissions grew. Second, CO_2 is a cumulative pollutant with a long lifetime, so sustained emission reductions are needed to see a change in the atmospheric signal. Finally, the natural variability of around one part per million is far greater than the effect of a 5.4 per cent reduction in emissions. Similar factors mean that methane and nitrous oxide concentrations also continued to grow in line with trends, with the increase in these concentrations in 2020 the highest ever recorded. The lack of change in atmospheric concentrations despite a record drop in emissions highlights that solving the climate problem requires rapid and sustained reductions in emissions.

2.3 Trends and implications of the new or updated NDCs and other announced mitigation pledges for 2030

2.3.1 Global summary of trends in the new or updated NDCs

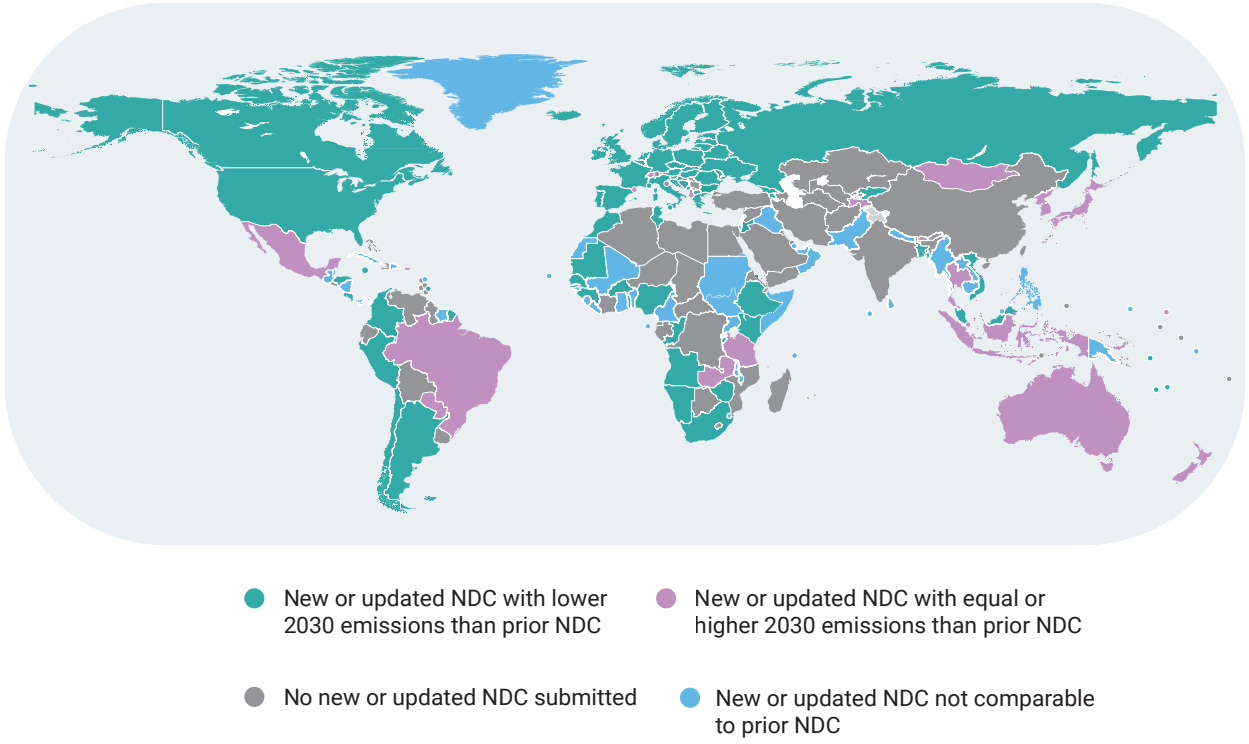
The decision text that accompanied the Paris Agreement (1/CP.21) requested that parties whose intended nationally determined contributions (INDCs) contained a time frame up to 2025 communicate a new NDC, and that parties whose INDC contained a time frame up to 2030 communicate or update that contribution by 2020. As at 30 September 2021,[5] 121 parties (including the European Union and its 27 member states, which submit a single NDC), representing around 52 per cent of 2018 global domestic GHG emissions (Climate Watch 2021), had submitted 94 new or updated NDCs. The NDCs communicated thus far reflect emerging trends related to the ambition, form, coverage and

5 All figures presented in section 2.3 reflect new or updated NDCs submitted until 30 September 2021.

conditionality of GHG mitigation pledges, as well as the expected use of market mechanisms in their achievement.

Effect on 2030 emissions: Of the 94 new or updated NDCs, just under half (46 NDCs from countries representing 32 per cent of global GHG emissions) would result in lower 2030 emissions relative to the previous NDCs (figure 2.3). Eighteen per cent (17 NDCs from countries representing 13 per cent of global GHG emissions) had communicated a new or updated NDC that would not reduce 2030 emissions relative to the previous NDCs. Thirty-four per cent (32 NDCs from countries representing 7 per cent of global emissions) could not be compared with the previous NDCs in terms of 2030 emissions, typically due to insufficient information in the previous NDCs, as transparency has improved in the current NDCs.

Figure 2.3. Effect of new or updated nationally determined contributions on 2030 greenhouse gas emissions relative to previous nationally determined contributions



Source: Climate Watch (2021)

Pledge form: Of the new or updated NDCs, more (89 per cent) have GHG targets than before (75 per cent).[6] These comprise several types of GHG targets, including base-year targets (commitments to reduce or control the increase in emissions by a specified amount relative to a base year) and baseline scenario targets (commitments to reduce emissions by a specified amount relative to a projected emissions baseline scenario), among other formulations. Base-year targets typically (though not always) result in emissions decreasing over time relative to historical levels, whereas baseline scenario targets are typically (though not always) formulated to allow absolute emissions to continue to grow. The form of GHG targets in new or updated NDCs evolved relative to the previous round, with a slightly larger share of NDCs now setting base-year targets (from 19 per cent to 28 per cent of NDCs). Most countries adopting a GHG target for the first time in their new or updated NDC adopted a baseline scenario target.

Sector and gas coverage: GHG targets can be formulated to cover a country's entire economy or only a subset of it. Targets with full coverage include the energy, industrial process and product use, waste and land sectors, as well as CO_2, methane, nitrous oxide, hydrofluorocarbons (HFCs), perfluorochemicals (PFCs), sulfur hexafluoride and nitrogen trifluoride. The GHG targets in the current round of NDCs are only marginally more comprehensive in terms of sector and gas coverage than in the previous round. Of the new or updated NDCs, 19 per cent had full sector and gas coverage, up from 14 per cent in those countries' first NDCs. While

6 These figures include only those countries that have submitted new or updated NDCs.

seven countries improved their NDCs from partial coverage to full or nearly full coverage, three countries downgraded their NDCs from nearly full coverage to partial coverage.

Conditionality: Some parties have submitted NDCs that are entirely or partially conditional on factors such as international support (e.g. finance or technology transfer), while others have submitted NDCs that are not conditional. This round of NDCs includes more unconditional elements than the last round, with 26 per cent completely unconditional, up from 24 per cent in countries' first contributions. This was largely due to countries making any mixed conditional and unconditional elements completely unconditional in their new or updated NDCs. Likewise, the share of completely conditional NDCs fell from 31 per cent to 18 per cent.

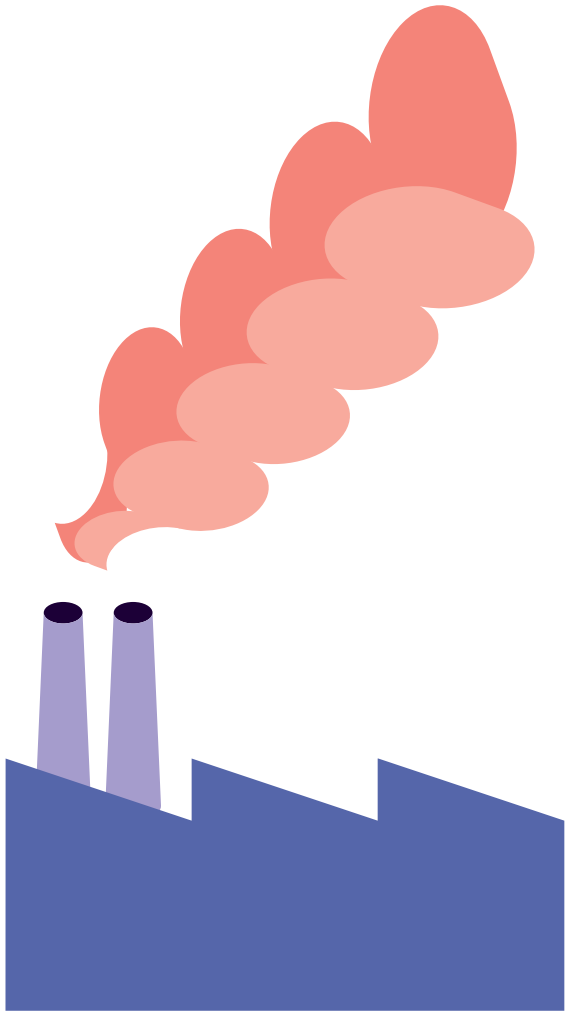
Finally, parties are increasingly recognizing gender integration as a means to enhance the ambition and effectiveness of their climate action in their new or updated NDCs (United Nations Framework Convention on Climate Change [UNFCCC] 2021).

2.3.2 Impacts on GHG emissions by 2030 at the global and G20 levels, considering new or updated NDCs and announced mitigation pledges

This section quantifies the impacts of the new or updated NDCs and announced mitigation pledges on global 2030 emissions, relative to the previous NDCs. The analysis is based on the difference in projected GHG emissions by 2030 under the full implementation of the new or updated NDC submissions and announced pledges compared with the previous NDCs. The data are from five model groups and two open-source tools.[7],[8]

Aggregate impact on global GHG emissions in 2030

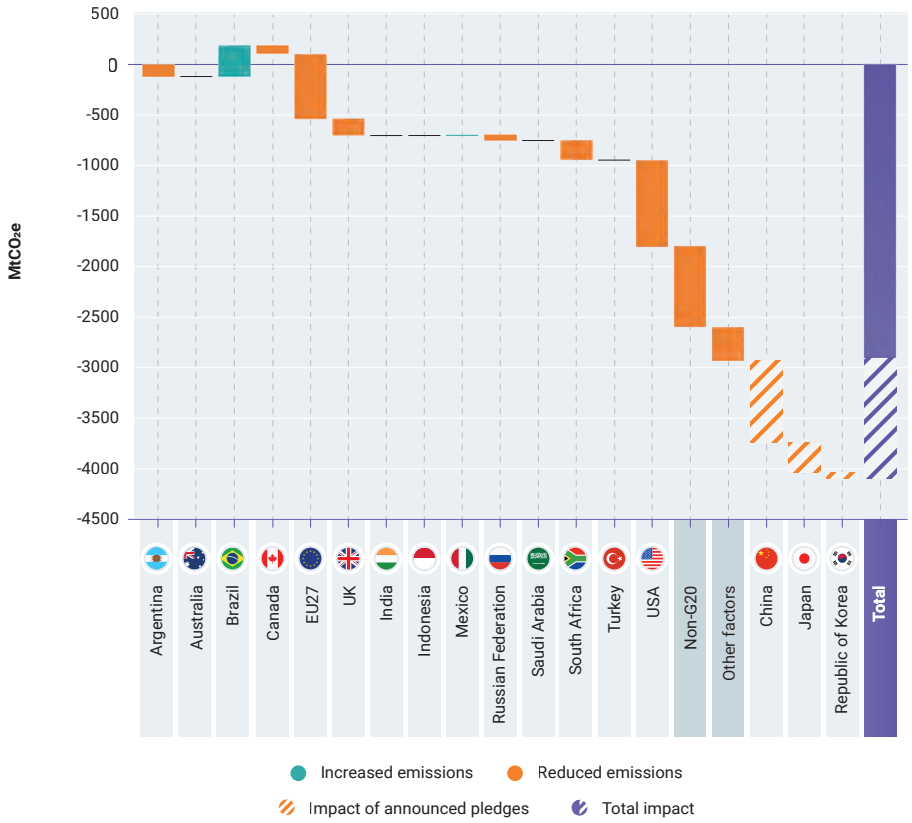
The analysis shows that the aggregate impact of the new or updated unconditional NDCs is estimated to lead to a reduction in 2030 global GHG emissions of about **2.9 $GtCO_2e$**, compared with the previous NDCs (figure 2.4). This estimate includes reductions of around 0.3 $GtCO_2e$ resulting from **other factors**, including lower projections of international aviation and shipping emissions, and adjustments of countries that are projected to overachieve their NDC targets. If the announced pledges of China, Japan and the Republic of Korea are included, this reduction increases to **4.1 $GtCO_2e$**. For the conditional targets, these reductions are **2.8 $GtCO_2e$** and **4.0 $GtCO_2e$**, respectively.



7 Climate Action Tracker (2021a; 2021b); Joint Research Centre with the Prospective Outlook on Long-term Energy Systems (POLES) model (Joint Research Centre 2021); PBL Netherlands Environmental Assessment Agency with the Integrated Model to Assess the Global Environment (IMAGE) model (den Elzen *et al.* 2021, in preparation; Nascimento *et al.* 2021). The two open-source tools that provide NDC emissions projections for many countries are: Climate Resource (Meinshausen *et al.* 2021) and the World Resources Institute's Climate Watch (2021). All GHG emissions projections of the Climate Action Tracker and Climate Resource exclude LULUCF.

8 The following data sources have been used to assess announced pledges that have not yet been formally submitted: Climate Action Tracker, PBL and the Joint Research Centre. Climate Action Tracker accounts for the impact of the announcements of China and Japan, Joint Research Centre for China and Japan, and PBL for the impact of China, Japan and the Republic of Korea.

Figure 2.4. Impact of 2030 pledges (nationally determined contributions and other announced pledges as at 30 September 2021) on 2030 global emissions compared with previous nationally determined contribution submissions



G20 members

Taking a closer look at the G20 members, the combined impact of submitted NDCs and announced GHG reduction targets for 2030 is an annual reduction of about 3 $GtCO_2e$ compared with the previous NDCs. Six G20 members have formally submitted updated NDCs with enhanced GHG mitigation pledges: Argentina, Canada, the EU27 (counting the EU27 and its three individual G20 member states France, Germany and Italy as one), South Africa, the United Kingdom and the United States of America – all of which entail reduced emissions in 2030 of about 2.1 $GtCO_2e$ compared with previous NDCs. Two G20 members (Brazil and Mexico) have submitted targets that lead to an increase in emissions of 0.3 $GtCO_2e$, bringing the net reduction in global GHG emissions of new or updated NDCs submitted by G20 members to 1.8 $GtCO_2e$ annually by 2030. In addition, China, Japan and the Republic of Korea have announced enhanced pledges that result in annual reductions of about 1.2 $GtCO_2e$, but have not yet formally communicated them to the UNFCCC. The largest reductions come from the United States of America, the EU27, the United Kingdom, Argentina and Canada (submitted), and China and Japan (announced). Two G20 members (Australia and Indonesia) have submitted NDC targets, which are assessed not to lead to an additional reduction relative to the previous NDCs. One G20 member (the Russian Federation) has submitted an NDC that improves upon its previous NDC, but still does not go beyond its current policies and another three G20 members (India, Saudi Arabia and Turkey) have not yet submitted a new or updated NDC (table 2.1).

Non-G20 members

In comparison, the aggregate impact of the new or updated NDC submissions for the non-G20 members is an annual reduction of about 0.8 $GtCO_2e$ by 2030.

Other factors

Finally, additional reductions of around 0.3 $GtCO_2e$ come from the decreased international aviation and shipping emissions projections, and from countries that are projected to overachieve their NDC targets. As explained previously, for some countries, NDC emission levels are expected to be above the estimated current policies scenario, with the projections of the current policies scenario assumed for the global emissions estimate. Due to the impact on COVID-19 on GHG emissions projections under the current policies scenario, the emissions projections of many countries have lowered. This means that a larger number of countries are expected to overachieve their NDC targets, in particular India, the Russian Federation and Turkey, which lowers global GHG emissions. In addition, the methodology of the underlying models may have also been updated, which could lead to changes in global emissions estimates between scenarios.

Table 2.1. Summary of greenhouse gas mitigation pledges in previous and new or updated nationally determined contributions by G20 members

G20 member	Original NDC	New or updated 2030 pledge	Change in 2030 emissions relative to original NDC Based on modelling studies (median and range)
G20 members that have submitted new or updated NDCs			
Argentina	Cap 2030 net emissions at 483 megatons of CO_2 equivalent ($MtCO_2e$) (unconditional) and 369 $MtCO_2e$ (conditional)	Cap 2030 net emissions at 359 $MtCO_2e$ (unconditional)	-0.12 $GtCO_2e$ (range: -0.11 – -0.13)
Australia	Reduce GHG emissions by 26–28 per cent from 2005 levels by 2030*	Reduce GHG emissions by 26–28 per cent from 2005 levels by 2030*	No change
Brazil	Reduce GHG emissions by 37 per cent from 2005 levels by 2025 and (indicatively) 43 per cent from 2005 levels by 2030	Reduce GHG emissions by 43 per cent from 2005 levels by 2030[9]	0.3 $GtCO_2e$ (range: 0.15–0.4)
Canada	Reduce GHG emissions by 30 per cent from 2005 levels by 2030	Emissions 40–45 per cent below 2005 levels by 2030	-0.09 $GtCO_2e$ (range: -0.08 – -0.1)
EU27	Reduce GHG emissions by at least 40 per cent from 1990 levels by 2030 (applied originally to EU28 collectively)	Reduce net GHG emissions by at least 55 per cent from 1990 levels by 2030	-0.6 $GtCO_2e$ (range: -0.5 – -0.7)
Indonesia	Reduce GHG emissions by 29 per cent (unconditional) and 41 per cent (conditional) relative to business as usual (BAU) by 2030	Reduce GHG emissions by 29 per cent (unconditional) and 41 per cent (conditional) relative to BAU by 2030	No change
Mexico	Reduce GHG emissions by 22 per cent (unconditional) and 36 per cent (conditional) from BAU by 2030	Reduce GHG emissions by 22 per cent (unconditional) and 36 per cent (conditional) from BAU by 2030	Marginal increase due to change in BAU scenario
Russian Federation	Limit 2030 emissions to 70–75 per cent of 1990 level	Limit 2030 emissions to 70 per cent of 1990 levels	Reduced, but the target still results in higher emissions than the current policy projection
South Africa	Limit 2025–2030 emissions to 398– 614 $MtCO_2e$	Limit 2030 emissions to 350–420 $MtCO_2e$	Reduced

9 The updated NDC leads to an absolute increase in emissions. Both NDCs present the same reduction target of 43 per cent by 2030 below 2005 emission levels. Brazil's NDC emissions (and therefore the absolute emissions in the NDC scenario) vary a great deal due to revisions of the 2005 base year. The country's second and third inventory reports and Fourth National Communication (its latest) give different values. The first NDC refers to the second inventory report, while the updated NDC cites the 2005 base year emissions of the third inventory report (Fifth Assessment Review metrics), but also specifies that "information on emissions in 2005 and reference values may be updated and recalculated due to methodological improvements applicable to the inventories" (Brazil 2020).

United Kingdom	Contribution to EU28-wide emissions target: reduction target of at least 40 per cent	Reduce GHG emissions by at least 68 per cent from 1990 levels by 2030	-0.17 $GtCO_2e$ (range: -0.1 – -0.2)
United States of America	Reduce GHG emissions by 26–28 per cent from 2005 levels by 2025[10]	Reduce GHG emissions by 50–52 per cent from 2005 levels by 2030	-0.85 $GtCO_2e$ (range: -0.8 – -0.9)[11]
G20 members that have announced mitigation pledges for 2030			
China	Peak CO_2 emissions around 2030 Reduce CO_2/gross domestic product (GDP) by 60–65 per cent from 2005 levels by 2030 Increase the share of non-fossil fuels in primary energy consumption to around 20 per cent by 2030 Increase forest stock volume by around 4.5 billion m3 by 2030	Peak CO_2 emissions before 2030 Reduce CO_2/GDP by 65 per cent from 2005 levels by 2030 Increase the share of non-fossil fuels in primary energy consumption to around 25 per cent by 2030 Increase forest stock volume by around 6 billion cubic metres in 2030 Increase the installed capacity of wind and solar power to 1,200 GW by 2030	-0.8 $GtCO_2e$ (range: -0.5 – -1.2)
Japan	Reduce GHG emissions by 26 per cent from 2013 levels by 2030	Reduce GHG emissions by 46 per cent from fiscal year 2013 levels by fiscal year 2030, with efforts to reduce by 50 per cent	-0.27 $GtCO_2e$ (range: -0.17 – -0.32)
Republic of Korea	Reduce GHG emissions by 37 per cent from BAU by 2030	Reduce GHG emissions by 35 per cent from 2018 levels by 2030**	Reduced**
G20 members that have not yet submitted new or updated NDCs or announced pledges			
India	Reduce emissions/GDP by 33–35 per cent from 2005 levels by 2030 Increase the share of non-fossil fuels in primary electricity production to 40 per cent (conditional)	N/A	N/A
Saudi Arabia	Annually abate up to 130 $MtCO_2e$ by 2030	N/A	N/A
Turkey	Reduce GHG emissions by up to 21 per cent from BAU by 2030	N/A	N/A

Notes: *Australia's original NDC was 'to be developed into an emissions budget' over the 2021–2030 period. The updated NDC of December 2020 provided an indicative emissions budget of 4,832–4,764 $MtCO_2e$.

**On 31 August 2021, the National Assembly passed the Framework Act on Carbon Neutrality, which outlines the new 2030 target (Republic of Korea, Ministry of Environment 2021). There is no study available yet that compares the ambition of the new 2030 target with the previous NDC.

Sources: Climate Watch (2021)

10 For comparison with the updated NDC, modelling studies interpolate the previous 2025 and 2050 targets (80 per cent from 2005 levels).

11 Climate Action Tracker (2021a) also reports the calculated impact relative to the current policies scenario. As the withdrawal of the United States of America from the Paris Agreement took effect on 4 November 2020, the country no longer had an official NDC in 2020. The calculated impact of the updated NDC relative to the current policies scenario would therefore be a reduction of about 2.0 $GtCO_2e$.

2.4 Assessment of G20 members' progress towards NDCs and mitigation pledges for 2030

This section assesses the progress of G20 members towards their previous NDC targets and indicates progress towards new, updated or announced 2030 targets based on emissions projections. GHG emissions projections were compiled and reviewed to assess the emission levels expected for G20 members under existing policies, i.e. the current policies scenario,[12] and whether members are likely to meet their respective emission reduction targets for 2030. Projections of the current policies scenario assume that no additional mitigation policies and measures are taken beyond those adopted and/or implemented as of a certain cut-off date (den Elzen *et al.* 2019). This report's assessment is based on 'point-in-time' emissions projections in the NDC target year.

2.4.1 Methods and limitations

Current policies scenario projections were compared against the original unconditional NDCs at the time of publication of the Emissions Gap Report 2020 (November 2020), as presented in table 2.1. This assessment follows the methodology of den Elzen *et al.* (2019) to enable a robust comparison of projections published by independent research institutions. European Union member states are assessed as the EU27 (and not individually), with the United Kingdom now assessed separately. Official assessments published by national governments were compared with independent assessments. All data sources are presented in appendix A (available online). Policy cut-off dates ranged from 2017 to 2021 across studies. The progress assessment was based on emissions figures including land use, land-use change and forestry (LULUCF; see appendix A on how the emissions projections excluding LULUCF were adjusted).

Recently published emissions projections for the current policies scenario and NDC scenario were collected from independent studies and considered. As at October 2021, only a few of the institutions regularly publishing national-level CO_2 and GHG emissions projections for the current policies scenario had released updates that considered the potential impact of COVID-19. Annually published global studies, such as Climate Action Tracker (2021b), Joint Research Centre of the European Commission (Joint Research Centre 2021) and PBL Netherlands Environmental Assessment Agency (Nascimento *et al.* 2021; PBL Netherlands Environmental Assessment Agency 2021), as well as national studies, such as the Rhodium Group study for the United States of America (Pitt *et al.* 2021), all include the impact of COVID-19 and recent policies. For these studies, the progress assessment used NDC target emission estimates from their previous updates (used in the Emissions Gap Report 2020).

Other recent studies included several new national model scenarios from Fragkos *et al.* (2021) and the COMMIT[13] scenario database (International Institute for Applied Systems Analysis [IIASA] 2021; van Soest *et al.* 2021) for Australia, China (two national studies), the EU27 and the United States of America. These studies updated some 2020 national model scenario projections from the European Horizon 2020 Linking Climate and Development Policies – Leveraging International Networks and Knowledge Sharing (CD-LINKS) project (Roelfsema *et al.* 2020). However, it should be noted that these scenarios did not include the impact of COVID-19. After examining the projections from the studies collected, a number of pre-2020 studies were excluded whose 2020 emission estimates were more than 10 per cent higher than the highest estimates of the three studies published in 2021 that considered the impact of COVID-19 and recent policies (Climate Action Tracker 2021b; Joint Research Centre 2021; Nascimento *et al.* 2021).

Up-to-date official emissions projections published since November 2020 were collected from various sources, including countries' recently published national communications and biennial update reports, and other national government reports (see appendix A). Such information included annually updated projections made by the Australian and Canadian governments (Australia, Department of Industry, Science, Energy and Resources 2020; Canada, Environment and Climate Change Canada 2021).

The most important limitation for the 2021 assessment is the impact of the COVID-19 pandemic on the current policies scenario projections. As at September 2021, several recent projections had either been published or prepared prior to the pandemic, and therefore did not account for its potentially significant impact on emission trends in 2020 and 2021, and in the period until 2030. Other important limitations are similar to those of previous Emissions Gap Reports (see appendix A).

2.4.2 G20 progress towards previous NDC targets and indications of progress towards new, updated or announced targets for 2030

Collectively, the G20 members are projected to fall short of their new or updated unconditional NDCs and other announced mitigation pledges for 2030. Similarly, G20 members are projected to collectively fall short of their previous unconditional NDCs (as at November 2020) by 1.1 $GtCO_2e$ per year, if the unconditional NDCs of the three G20 members that are projected to significantly overachieve

12 Current policy scenario projections assume that no additional mitigation action is taken beyond current policies, even if it results in NDC targets not being achieved or being overachieved (United Nations Environment Programme [UNEP] 2015; den Elzen *et al.* 2019). Current policies scenario projections reflect all adopted and implemented policies, which for the purpose of this report are defined as legislative decisions, executive orders or their equivalent. This implies that officially announced plans or strategies alone would not qualify, while individual executive orders to implement such plans or strategies would qualify.

13 COMMIT – Climate policy assessment and mitigation modeling to integrate national and global transition pathways.

their targets (India, the Russian Federation and Turkey; see table 2.2) are substituted with current policies scenario projections. However, the G20 members are collectively expected to slightly overachieve their previous unconditional NDCs by about 0.3 $GtCO_2e$ per year by 2030, based on scenario projections by independent studies.

Table 2.2 shows the progress of G20 members towards their previous NDC targets as of November 2020, organized by the status and assessment of their new or updated NDC targets and other announced 2030 targets submitted or announced thereafter. Ten of 17[14] G20 members are likely to achieve their unconditional NDC targets based on previous or first NDC submissions under current policies (i.e. Argentina, China, the EU27, India, Japan, the Russian Federation, Saudi Arabia, South Africa, Turkey and the United Kingdom – as a former European Union member state; see table 2.2). Three G20 members (India, the Russian Federation and Turkey) are projected to be at least 15 per cent lower than their previous unconditional emission target levels and therefore have significant room to increase the ambition of their NDCs (figure 2.5). Central estimates of emissions projections for 2030 under current policies were lower than those of the Emissions Gap Report 2020 for all previously mentioned G20 members, with the exception of Argentina, whose estimate remained largely unchanged. For example, for the EU27 and South Africa, current projections are roughly 10 per cent and 20 per cent lower than the projections of last year's assessment, respectively, due to enhanced policies and the impact of COVID-19.

14 An assessment of individual European Union member states was not conducted.

Table 2.2. Assessment of progress towards achieving the previous unconditional nationally determined contribution targets for G20 members under current policies based on independent studies mainly published after the COVID-19 outbreak

		Projected progress towards the previous NDC target [*x* studies meet the target/out of *y* studies]		
		Achieve previous target (indicated by +, if overachieved by more than 15 per cent)	Miss previous target	Uncertain
Status of NDC or announced target	Submitted stronger target	Argentina [3/3], EU27 [in Emissions Gap Report 2020 for EU27+UK; 1/3, one within reach],[1,2] Russian Federation+ [4/5],[1] South Africa [3/3], UK (formerly part of the EU)	USA [0/5], Canada [1/3]	
	Announced stronger target	China [4/6], Japan [3/3]	Republic of Korea [0/3][3]	
	No new target submitted	India+ [4/6], Saudi Arabia [2/2], Turkey+ [3/3]		
	Submitted equivalent or weaker target		Australia [1/4], Brazil [1/4, one within reach], Mexico [0/3]	Indonesia [0/3, two within reach]

Notes: See appendix A for the list of studies reviewed. The number of independent studies that project a country to meet its previous or first NDC target were compared with the total number of studies and are indicated in square brackets. 'Within reach' indicates that only the lower bound estimate of the current policies scenario is within the NDC target range.

1. Current policies scenario projections were also examined from official publications. The number of official publications that projected countries would achieve their point-in-time NDC target were: Australia: 0 of 1, Canada: 0 of 1, EU27: 0 of 1, Russian Federation: 0 of 1 and the United Kingdom: 0 of 1.
2. The EU Reference Scenario was used for the EU27, which assumes full implementation of the national energy and climate plans by European Union member states and sees European Union emissions reduce by around 43 per cent below 1990 levels by 2030 (European Commission 2021). Including net removals from LULUCF increases the reduction to 45 per cent. This baseline scenario indicates that additional effort would be required to meet the European Union's current 2030 energy-efficiency target, though its current 2030 renewable energy target would be met. Additional measures for member states are being prepared to fully implement national energy and climate plans submitted in 2020 (European Commission 2020).
3. The Republic of Korea's Emissions Trading Scheme (K-ETS) is an instrument used to fully achieve the country's NDC target and covers about 70 per cent of its GHG emissions. Among the three independent studies, only one (PBL Netherlands Environmental Assessment Agency) explicitly quantified the impact of the K-ETS up to 2025 based on the Master Plans for K-ETS Phase III (2021–2025) and Phase IV (2026–2030) and the Phase III National Allowances Allocation Plan. This partially explains why the studies project that the Republic of Korea will miss its NDC target under current policies.

For **China**, four out of six independent studies projected that the country would achieve its original NDC target. However, since five of the six studies reviewed only provided a single NDC target value for 2030 – despite China's NDC containing multiple targets, which are partly dependent on GDP growth rates – it was not possible to analyse in detail which targets would likely be met or overachieved. The long-term impacts of COVID-19 on GHG emissions were also highly uncertain, especially given the fact that China's fossil CO_2 emissions rebounded strongly in the second half of 2020 and in 2021 (section 2.2). This stronger-than-expected rebound was not considered in China's latest emissions projections that estimated the impact of COVID-19 (Climate Action Tracker (2021b), Joint Research Centre (2021) and PBL Netherlands Environmental Assessment Agency (2021)).

Six G20 members' GHG emissions were projected to fall short and therefore require further action of varying degree to meet their previous (or original) unconditional NDC targets. These G20 members are Australia, Brazil, Canada, Mexico, the Republic of Korea and the United States of America.

- For **Australia**, official projections showed that it will fall short of achieving its point-in-time target of 26–28 per cent by 2030 with implemented measures. Australia is also projected to miss its emissions budget targets for 2021–2030 without relying on past overachievement (Australia, Department of Industry, Science, Energy and Resources 2020). However, the official projections also indicated that Australia would achieve its point-in-time NDC target if its Technology Investment Roadmap is fully implemented ('High technology' scenario) (Australia, Department of Industry, Science, Energy and Resources 2020).

- For **Canada**, official projections indicated that if its strengthened climate plan, A Healthy Environment and a Healthy Economy, introduced in December 2020, is fully implemented, its GHG emissions would be reduced by 31 per cent below 2005 levels, thus overachieving its previous NDC target of 30 per cent below 2005 levels (Canada, Environment and Climate Change Canada 2021).

- For **Mexico**, all three independent studies reviewed in this assessment showed a (minor) increase in 2030 emissions projections compared with previous assessments included in the Emissions Gap Report 2020, finding that the country would narrowly miss its original NDC target.

- The **United States of America** has returned to the Paris Agreement and reversed many policies of the Trump Administration that would have led to increased emissions. The central estimate for the country's 2030 emissions in this year's assessment decreased by about 0.5 $GtCO_2e$/year (about 10 per cent). The main reasons for this result include the exclusion of two projections developed with a 2017 cut-off date for policies (Chai *et al.* 2017; Roelfsema *et al.* 2020), which were replaced with one updated national model projection of the COMMIT scenario database, and the inclusion of projections that quantified the potential impact of the COVID-19 pandemic on emissions in 2020 and beyond, and to a lesser extent on the quantified impact of the reversal of the previous Administration's policies.

It is worth noting that **Canada** and the **United States of America** have strengthened their NDC targets, though independent studies suggest that they are not on track to meet their earlier NDC targets with implemented policies. Although positive trends have been observed as described previously, these two countries need to make significant additional efforts to meet their new NDC targets.

Independent studies either do not agree or are inconclusive on whether Indonesia is on track to meet its unconditional NDCs. This is mainly due to the uncertainty of LULUCF emissions projections as a result of peat fires. The central estimate for 2030 emissions in this year's assessment are higher than that of the 2020 assessment, partially due to the major revision of LULUCF emissions data and projections.

The aggregate emissions for G20 members in 2030 under current policies are projected to be about 2 $GtCO_2e$ lower than that of the 2020 assessment. Consideration of 2020 emission reductions and the long-term impact of COVID-19 on the global economy has contributed significantly to the lower emissions projections. Another key factor behind these estimated lower emissions is the impact of policies adopted by G20 members in recent years, which will affect their progress towards achieving their NDC targets.[15] A list of key policy measures that may have significant direct impacts on future GHG emissions adopted in 2020 and 2021 are presented in appendix A. Many of these policies were adopted after the publication of the scenario studies reviewed in this section. Although there have been many positive developments, there have also been several negative ones, such as the implementation of fossil fuel extraction projects and coal-fired power plant construction plans, as well as the rollback of environmental regulations during the pandemic. Based on the central estimates of independent studies, several G20 members, namely Argentina, Brazil, China, India, Indonesia, Mexico, the Russian Federation and Saudi Arabia, are expected to emit more emissions in 2030 than they did in 2010 under implemented policies. Figure 2.5 provides a more detailed overview of G20 members' projected GHG emissions under various scenarios, which are also compared with historical emissions.

15 There are several other factors for the lower emissions projections, including revisions in GHG inventory data and changes in emissions scenario methodologies, along with other underlying assumptions.

Figure 2.5. Greenhouse gas emissions (all gases and sectors, including land use, land-use change and forestry) of the G20 and its individual members by 2030 under the current policies scenario, previous nationally determined contributions and new, updated or announced pledges compared with historical emissions

Figure 2.5a

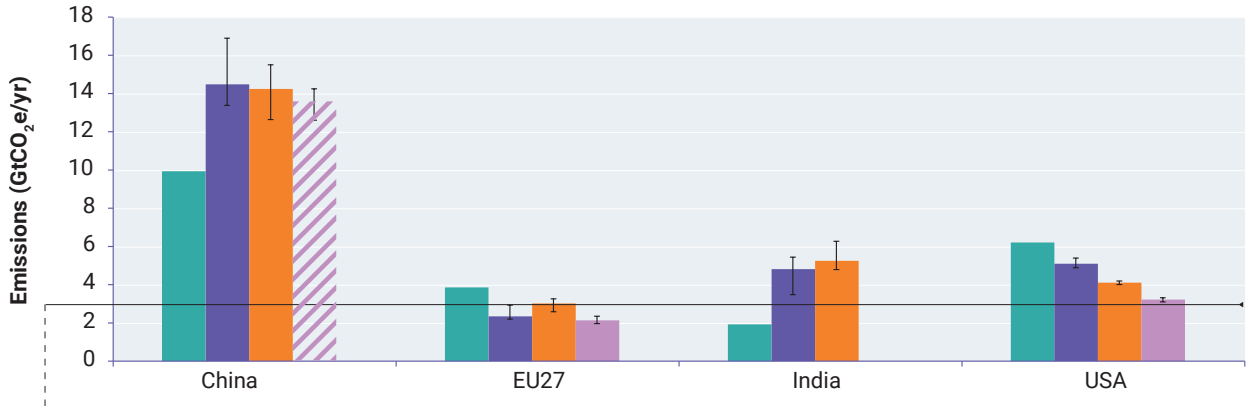
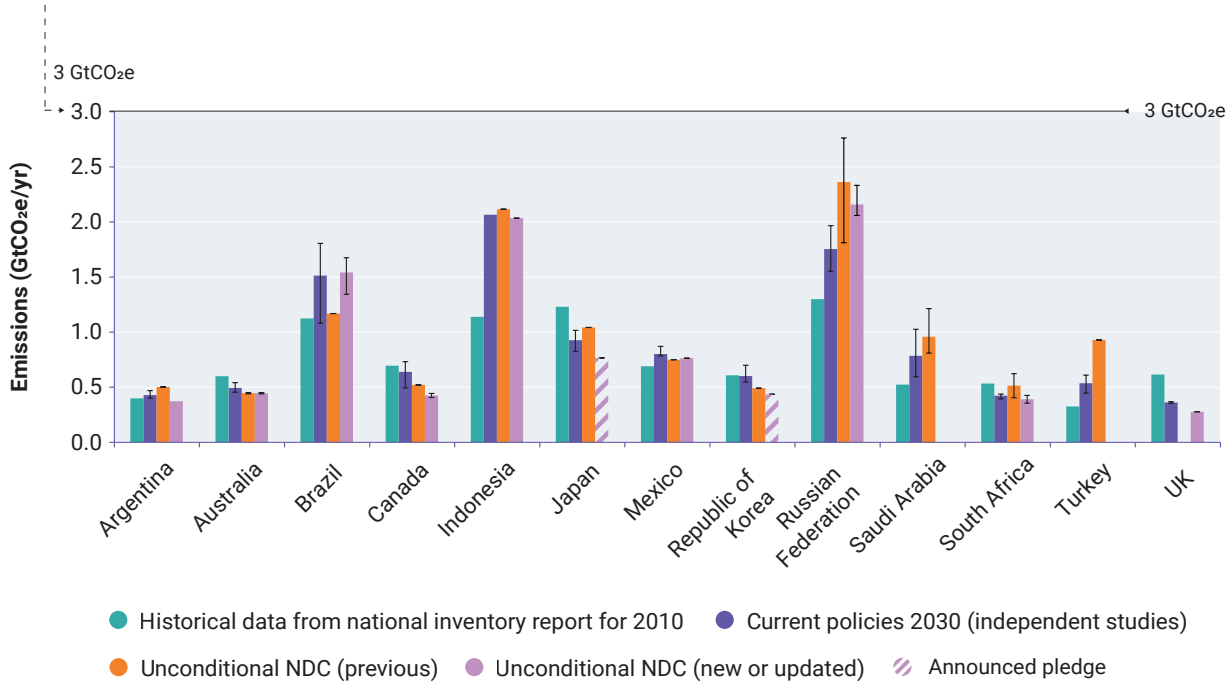


Figure 2.5b

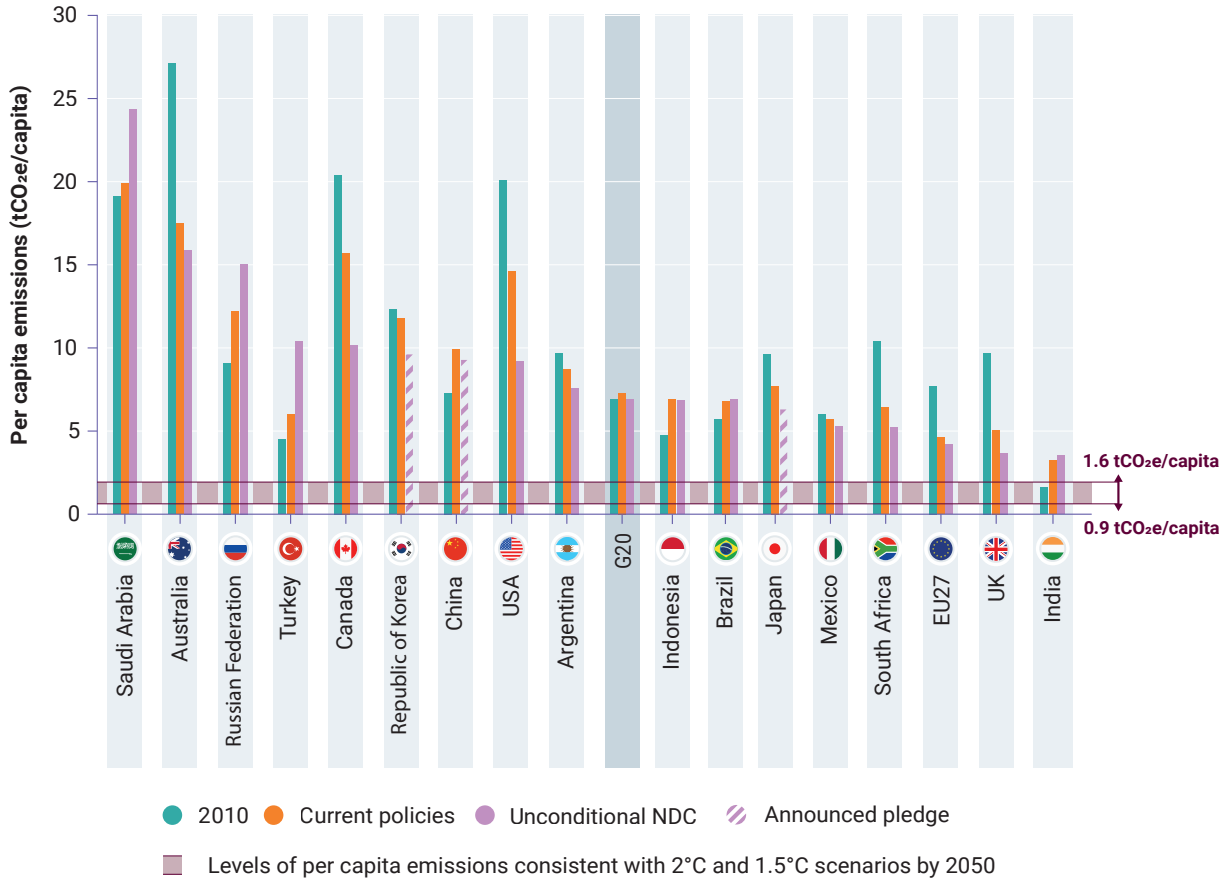


Notes: For current policies scenario projections, estimates based on independent studies are presented. For NDCs, official values (adjusted to Fourth Assessment Report GWPs) are presented where available. For reporting reasons, the emissions projections for China, the EU27, India and the United States of America are shown in figure 2.5a, and the other countries shown in figure 2.5b, using two different vertical axes. See appendix A for details. For the United States of America's previous NDC, the average of 2030 estimates from two studies are shown (Joint Research Centre 2021; Climate Action Tracker 2021b). For China and South Africa, the estimated emissions under the new 2030 announced targets are based on Climate Action Tracker and PBL Netherlands Environmental Assessment Agency studies (Nascimento *et al.* 2021; Climate Action Tracker 2021b). Estimates for China, Japan and the Republic of Korea use announced targets.

To supplement the findings presented above, figure 2.6 presents per capita GHG emissions under the current policies scenario, NDC targets and other announced 2030 pledges as at 30 September 2021, as well as the 2010 historical estimates for the 17 G20 members (counting the EU27 and its three individual G20 member states as one). In 2030, the average per capita emissions of G20 members under latest NDCs and other announced 2030 pledges are projected to be slightly lower (7 tCO_2e) than under the current policies scenario (7.4 tCO_2e) and the previous NDCs (7.2 tCO_2e). However, compared with 2010 levels, average emissions are not expected to be lower and as the figure illustrates they are still far off the median estimates consistent with 2°C and 1.5°C scenarios by 2050, which are 1.9 tCO_2e (tenth

and ninetieth percentile range: 1.2–2.3 tCO_2e) and 0.6 tCO_2e (0.3–1.1 tCO_2e), respectively.[16] Per capita emissions vary significantly across G20 members, with India's emissions about half the G20 average for example, and Saudi Arabia's three times greater. The EU27 and the United Kingdom perform well in both absolute and per capita emission levels by 2030 and their reduction rates compared with 2010 levels. Australia and South Africa are also projected to reduce their per capita emissions by more than one third between 2010 and 2030 under current policies. Mexico also performs well in terms of its projected development of per capita emissions under both current policies and NDC scenarios. Per capita emissions under current unconditional NDC targets are projected to increase between 2010 and 2030 for seven G20 members.

Figure 2.6. Per capita greenhouse gas emissions of the G20 and its individual members by 2030 under nationally determined contributions and other announced 2030 pledges as at 30 September 2021, current policies scenario projections from independent studies mainly published after the COVID-19 outbreak, and 2010 historical levels



Notes: i) Figures include LULUCF. ii) Central estimates are a median value when five or more studies were available, otherwise they are average values. iii) Data on historical and projected (medium fertility variant) population per country are taken from the 2019 Revision of World Population Prospects (United Nations Department of Economics and Social Affairs [UN DESA], Population Division 2019). iv) The figures presented here may not exactly match official data due to the differences in data sources. v) G20 members are sorted in decreasing order of NDC emissions projections. vi) To estimate G20 total emissions for the NDC and announced 2030 pledges scenario, emissions projections under the current policies scenario were used for India, the Russian Federation and Turkey.

16 Estimated based on emission estimates from the IPCC Special Report on global warming of 1.5°C and United Nations population projections. The medium fertility variant was used (UN DESA, Population Division 2019).