



Greenhouse gas mitigation scenarios for major emitting countries

Analysis of current climate policies and mitigation commitments:
2022 update

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Acronyms

| | |
|------------------------|--|
| AFOLU | agriculture, forestry and other land use |
| AR4 | Fourth Assessment Report of the IPCC |
| AR5 | Fifth Assessment Report of the IPCC |
| BAU | business-as-usual |
| CAFE | Corporate Average Fuel Economy Standards |
| CAT | Climate Action Tracker |
| CCS | carbon capture and storage |
| CH₄ | methane |
| CO₂ | carbon dioxide |
| CO_{2e} | carbon dioxide equivalent |
| COP21 | UNFCCC Conference of the Parties 21 st session (Paris) |
| CPP | United States of America's Clean Power Plan |
| CSP | concentrated solar power |
| DESA | UN Department of Economic and Social Affairs |
| EDGAR | Emissions Database for Global Atmospheric Research |
| EEA | European Energy Agency |
| EPA | United States Environmental Protection Agency |
| ERF | Emissions Reduction Fund |
| ETS | emissions trading system |
| FAIR | PBL's Framework to Assess International Regimes for differentiation of commitments |
| NF₃ | nitrogen trifluoride |
| F-gas | fluorinated gas |
| G4M | IIASA's Global Forest Model |
| GCF | Green Climate Fund |
| GDP | gross domestic product |
| GHG | greenhouse gas |
| GLOBIOM | IIASA's Global Biosphere Management Model |
| Gt | gigatonne (billion tonnes) |
| GW | gigawatt (billion watts) |
| GWP | Global Warming Potential |
| H₂ | hydrogen |
| Ha | hectare |
| HWP | harvested wood products |
| HEPS | High Energy Performance Standards |
| HFC | hydrofluorocarbon |
| IEA | International Energy Agency |
| IIASA | International Institute for Applied Systems Analysis |
| IMAGE | PBL's Integrated Model to Assess the Global Environment |
| INDC | intended nationally determined contribution |
| IPCC | Intergovernmental Panel on Climate Change |
| IPPU | Industrial Processes and Product Use |
| km/l | kilometre per litre |
| ktoe | thousand tonnes of oil equivalent |
| kWh | kilowatt-hour (thousand watts-hour) |
| LPG | liquefied petroleum gas |
| LULUCF | land use, land-use change, and forestry |
| MEPS | Minimum Energy Performance Standards |

| | |
|-----------------------|--|
| MJ | megajoule (million joules) |
| Mm³ | mega cubic metres (million cubic metres) |
| mpg | miles per gallon |
| Mt | megatonne (million tonnes) |
| Mtoe | million tonnes of oil equivalent |
| MW | megawatt (million watt) |
| N₂O | nitrous oxide |
| NAMA | Nationally Appropriate Mitigation Actions |
| NC6 | Sixth National Communication |
| NRE | New and renewable energy |
| NDC | nationally determined contribution |
| NO_x | nitrogen oxides |
| NRE | New and Renewable Energies |
| OECD | Organisation for Economic Co-operation and Development |
| PBL | PBL Netherlands Environmental Assessment Agency |
| PES | Payments for Ecosystem Services |
| PFC | perfluorocarbon |
| PIK | Potsdam institute for climate impact and research |
| Pkm | passenger-kilometre |
| PPP | Purchasing Power Parity |
| PV | photovoltaic |
| RE | renewable energy |
| REDD+ | Reducing Emissions from Deforestation and Forest Degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries |
| SF₆ | sulphur hexafluoride |
| SSP2 | Shared Socio-economic Pathways 'middle of the road' scenario |
| t | tonne (thousand kilograms) |
| tce | tonne coal equivalent (29.288 GJ) |
| toe | tonne of oil equivalent (41.868 GJ) |
| TIMER | PBL's Targets IMage Energy Regional Model |
| tkm | tonne-kilometre |
| TPES | total primary energy supply |
| TWh | terawatt-hour |
| SAR | IPCC's Second Assessment Report |
| UN | United Nations |
| UNEP | United Nations Environment Programme |
| UNFCCC | United Nations Framework Convention on Climate Change |
| WEO | IEA's World Energy Outlook report |

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1 Introduction

1.1 Background

The 21st session of the Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC) held in 2015 adopted the Paris Agreement as the main international climate policy agreement for the post-2020 period (UNCCC, 2015).

Parties to the Paris Agreement communicate Nationally Determined Contributions (NDCs), which are pledges containing their contribution to the challenge of reducing global emissions and keeping end-of-century warming below 1.5 °C. There is no yardstick to measure the adequacy of NDCs or the actual progress towards them. Therefore, to measure progress on the implementation of countries' policies and targets is essential to make the Paris Agreement work.

Most countries have updated their NDCs and adopted additional policies since the Paris Agreement came into force. The latest submitted targets are an improvement in comparison to the original ones but remain globally insufficient to curb global emissions (den Elzen et al., 2022a). Policies have also improved since 2015 but projections under currently adopted policies suggest emissions are still expected to increase up to 2030 (Nascimento et al., 2022). Despite these improvements, a global ambition gap exists between countries' target and policies and the collective mitigation goals of the Paris Agreement. It is, therefore, crucial to continually track countries' progress towards their NDCs and inform policymakers with up-to-date knowledge to ensure effective implementation of the ratcheting mechanism under the Paris Agreement.

1.2 Objectives

This report is prepared by NewClimate Institute, PBL Netherlands Environmental Assessment Agency and IIASA and presents a preliminary assessment of progress by 25 countries toward the achievement of the mitigation components of their 2030 targets. More specifically, the report provides an overview of projected greenhouse gas (GHG) emissions up to 2030, considering existing, and in some cases planned, climate and energy policies, and compares them with the emissions implied by the NDCs. In this year's update, we compare updated NDC submissions to the original ones submitted between 2014 and 2016 to assess how countries' NDCs compare to each other and whether current policies are sufficient to meet them.

The 25 countries analysed here are: Argentina, Australia, Brazil, Canada, China, Colombia, Egypt, Ethiopia, the European Union (EU27), India, Indonesia, Iran, Japan, Mexico, Morocco, Republic of Korea, the Russian Federation, South Africa, Saudi Arabia, Thailand, Türkiye, the United Arab Emirates, the United Kingdom, the United States of America (USA) and Viet Nam. These 25 countries cover all of the G20 countries (three individual EU member states are covered as part of EU27).

The ongoing Russian invasion of Ukraine has severe implications for policy scenarios for many countries, regarding emissions in the short and medium term, and a country's capacity to implement current mitigation policies. This is especially critical for Ukraine. We therefore do not analyse Ukraine in this update report. The long-term effect of the invasion and its numerous implications, for example with regards to ongoing energy policy reforms, are not fully quantified. However, we include any policies adopted before June 2022 and that affect GHG emission projections in the analysed countries.

We use the term 'NDC' throughout the report, given that only Iran from the 25 countries assessed in this report has not ratified the Paris Agreement. We use the term 'country' to refer to both the EU and the remaining 24 economies.

In this report, the current policies scenario assumes that no additional mitigation action is taken beyond currently implemented climate policies, unless stated otherwise. Whenever possible, current policy

trajectories reflect all implemented policies, which are defined here as legislative decisions, executive orders, or their equivalent. This excludes publicly announced plans or strategies, but policy instruments to implement such plans or strategies do qualify. We do not assume that overarching plans and strategies will be achieved even when they are enshrined in the form of a law or a strategy document. Ultimately, however, these definitions could be interpreted differently and involve some degree of subjective judgement. This definition of current policies scenario is consistent with that applied in Roelfsema et al. (2020a) and Kuramochi et al. (2021).

1.3 Overview of methods

NewClimate Institute, IIASA and PBL have estimated the impact of the most effective current policies on future GHG emissions. The main methods used in this report are consistent with previous updates (more details about the modelling approach in Annexes A1 to A6). In this year's update, we include policies adopted up until June 2022 and NDCs submissions through September 2022.

The calculations by **NewClimate Institute** are largely based on its analyses for, and informed by, the Climate Action Tracker project (Climate Action Tracker, 2022a). The calculations use existing scenarios from national and international studies (e.g. IEA's World Energy Outlook 2019 and Fekete et al. (2021)) and own calculations of the effect of individual policies in different subsectors (Kuramochi et al., 2021). NewClimate emission estimates including the effect of COVID-19 assume that emission intensity over gross domestic product (GDP) remains the same as it would under current policies excluding the effect of COVID-19 and that the reduction in emissions is induced by a slowdown in GDP growth.

PBL estimates the effect of individual policies in different subsectors using the IMAGE integrated assessment modelling framework (Stehfest et al., 2014), including a global climate policy model (FAIR), a detailed energy-system model (TIMER), and a land-use model (IMAGE land). The starting point for the calculations of the impact of climate policies is the latest SSP2 (no additional climate policy) baseline as implemented in the IMAGE model (van Vuuren et al., 2021). Current climate and energy policies in G20 countries, as identified in ENGAGE (2020), were added to that baseline (Roelfsema et al., 2020b, 2022). For countries that are part of a larger IMAGE region (Australia, Kazakhstan, Republic of Korea and Russian Federation), emission projections were downscaled using the country's share in the region's 2015 emissions as a constant scaling factor. PBL emission projections account for two distinct mechanisms to account for the effect of COVID-19: GDP growth reduction and short-term impact on activity levels in specific sectors (Dafnomilis et al., 2022).

Both NewClimate Institute and PBL scenario calculations were supplemented with those on land-use and agricultural policies using **IIASA's** global land-use model GLOBIOM (Havlík et al., 2014) and global forest model G4M (Gusti & Kindermann, 2011) and PBL's global land-use model (Doelman et al., 2020). For PBL, IMAGE's LULUCF CO₂ projections (only for Brazil, China, India and Indonesia) and IIASA's LULUCF CO₂ projections (all 25 countries) were added to the IMAGE GHG emissions projections excluding LULUCF CO₂. Although only emission projections excluding LULUCF CO₂ were used, the IMAGE framework was applied fully, including the IMAGE land model, to ensure consistency of results (e.g. feedback between bioenergy demand and land use). IIASA projections also account for the effect of COVID-19. They are based on the same GDP reductions used by PBL. LULUCF non-CO₂ emissions were taken from the IMAGE model for the PBL projections.

1.4 Limitations of this report

The current assessment has several methodological limitations, which are attributable to the differences in the nature and characteristics of NDCs and climate policies across countries:

- The COVID-19 pandemic still affects most countries. Most countries show a rebound in emissions in 2021 but estimates for non-CO₂ gases and sectors beyond energy are still preliminary. The exact

magnitude of the rebound will remain unclear until official inventory submissions cover the period up to 2021.

- The ongoing Russian invasion of Ukraine has direct implications to emission projections in both countries but also affect several other countries analysed. For example, the European Union is in the process of implementing many reforms in its energy and climate policy to reduce dependency on Russian fossil gas. Most reforms are ongoing and their impact remains unclear.
- Current policies scenario projections are subject to the uncertainty associated with macroeconomic trends, such as GDP, population growth and technology developments, as well as the impact of policies. Some NDCs are also subject to the uncertainty of future GDP growth and other underlying assumptions.
- Existing policies may change and/or be abandoned for a variety of reasons, and new policies may be adopted. This implies that all numbers are subject to change; this study reflects the state up to the analysis' policy cut-off date. Frequent updates are fundamental to assess progress of policy implementation over time.
- The last historical year can have considerable impact on GHG emission projections. This is particularly the case for the LULUCF emissions, which could fluctuate from year to year due to peat fires or natural disturbances. Severe droughts, such as those seen in Europe and China, also affect soil carbon storage and is an additional source of uncertainty. The impact of natural disturbances is not considered in the land use projections.

1.5 Other considerations for this report

A country that is likely to meet its NDC does not necessarily undertake a more stringent action on mitigation than a country that is not on track (den Elzen et al., 2019):

- The targets differ in their ambition levels across countries. A country off track to meet its NDC target may have set itself a very ambitious target or a country on track to meet its NDC target may have set a relatively unambitious target. This study does not assess the level of ambition and fairness of the NDC targets; there are a number of studies available that assessed them in the light of equity principles (Climate Action Tracker, 2020a; Höhne et al., 2017; Pan et al., 2017; Robiou du Pont & Meinshausen, 2018). NDCs are also nationally determined and heterogeneous by nature, so a fair comparison of progress across countries is not always straightforward.
- Countries have different policy-making approaches. Some countries use their pledges or targets as a device to drive more ambitious policies, while others use them merely to formalise the expected effect of existing measures.

This report assesses to which degree countries are on track to meet their own target but does not assess how countries' adopted policies or NDC targets contribute to the achievement of global mitigation objectives, such as the collective temperature goals of the Paris Agreement.

In this report, we highlight that:

- In July 2022, the Biden administration adopted the Inflation Reduction Act, which is expected to substantially reduce emission projections in comparison to our 2021 update. In this report, we discuss the potential effect of this legislation but exclude it from our current policy scenario (as it was adopted after our policy cut-off date). We will closely monitor its implementation status to inform the inclusion of its impact in our current policy scenario for the next update rounds.
- China and India have pledges indexed to economic growth, implying that the absolute emission levels under their targets are highly uncertain. Emission projections of other fast-growing economies are also uncertain due to economic growth expectations, especially considering the ongoing pandemic.

- Emissions from land use, land-use change, and forestry (LULUCF) strongly influence total emission projections. This is especially the case for countries with high share of LULUCF emissions, such as Brazil and Indonesia.

The main findings of this study are presented in the next section and in fact sheets below, followed by an Appendix with a brief description of the methods and datasets used.

2 Key findings

2.1 National GHG emissions

Our findings suggest that emissions are on the way to reach pre-pandemic levels. Of the 25 countries analysed, emissions under current policies have increased from 36.3-36.8 GtCO_{2e} in 2020 to 37.2-38.1 GtCO_{2e} in 2021; this translates to a rebound of 2.5-3.5% since the COVID-19-induced emissions dip observed in 2020. Recent estimates of global CO₂ emissions suggest a rebound of between 4.2% and 6.5% in 2021 (Davis et al., 2022; Jackson et al., 2022). Our values are lower partly due to the fact we include other GHG emissions, which are less affected by the short-term dip associated with lower activity levels. The upper end of our 2021 estimates of emissions under current policies overlap with historical 2019 emission levels (38.1-38.2 GtCO_{2e}).

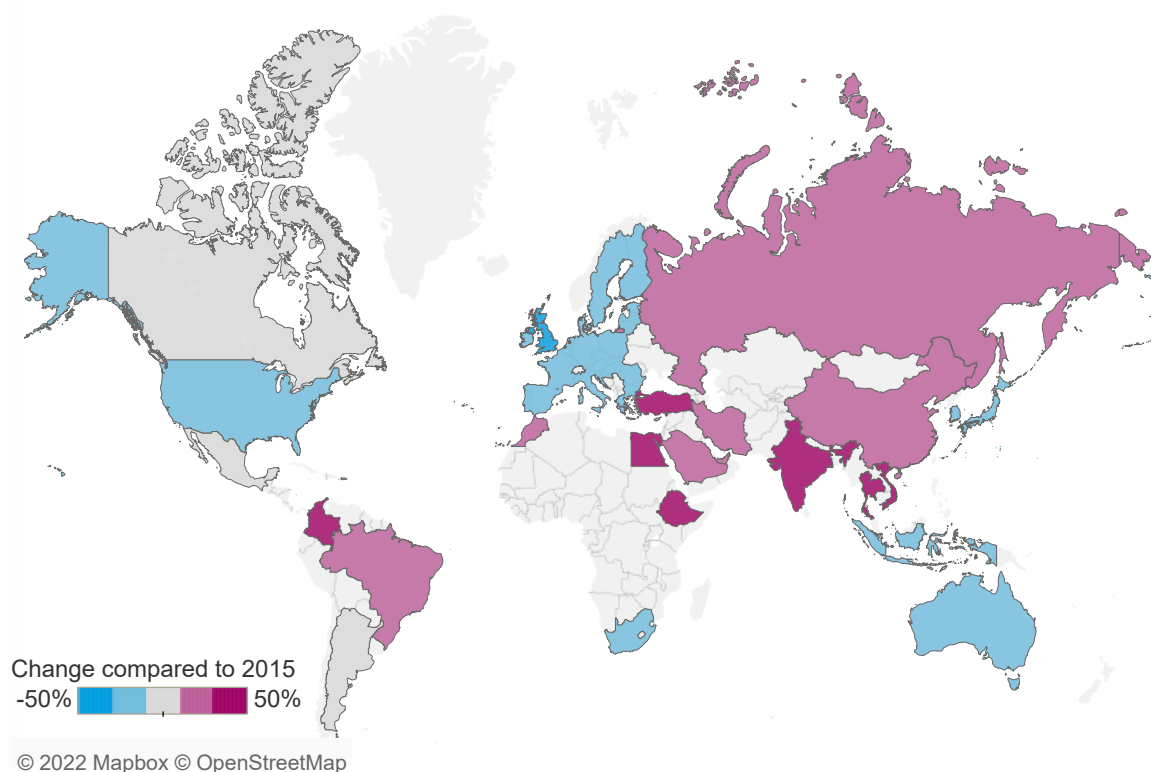


Figure 1: 2030 emissions under current policies compared to 2015 levels. The emissions coverage for GHG emissions is consistent with the scope of NDC targets (figure produced by authors).

Emissions under current policies in the group of countries analysed are projected to reach 36.2-41.7 GtCO_{2e} by 2030, which corresponds to a change between -4% and +11% compared to 2019, pre-pandemic levels. The aggregated emission levels in 2030 have not substantially change since our 2021 update report. In 2021, we projected current policies to reach 36.5-42.4 GtCO_{2e} by 2030. This finding suggests that countries remain far off track to meet the collective goals of the Paris Agreement, which require emissions to be 43% below 2019 levels by 2030 (G7 Germany, 2022). Additionally, the Paris Agreement stated the aim of reaching a global peaking of emissions as soon as possible. This has not happened before 2020 and is not projected to happen before 2025, which is needed to keep the long-term goals of the Paris Agreement according with the latest scientific consensus (IPCC, 2022).

In 2015, most countries committed to the global goal of peaking global emissions and reaching net-zero emissions before the end of the century when they ratified the Paris Agreement (UNFCCC, 2015). Any choice of base year results in bias towards some countries. For example, Japan and Indonesia have unusually high emissions in 2015. In Japan it results from the coal dash following the Fukushima

accident and in Indonesia from the high yearly emissions associated with peat fires. Using 2015 as a base year, thus favours these countries. However, choosing earlier years, such as 1990 or 2005, disproportionately affects developing countries. In this report, we present emissions projections using 2015 as a base year for reporting and comparability reasons considering the adoption of the Paris Agreement and the common goal by developed and developing countries alike to reduce their own emissions.

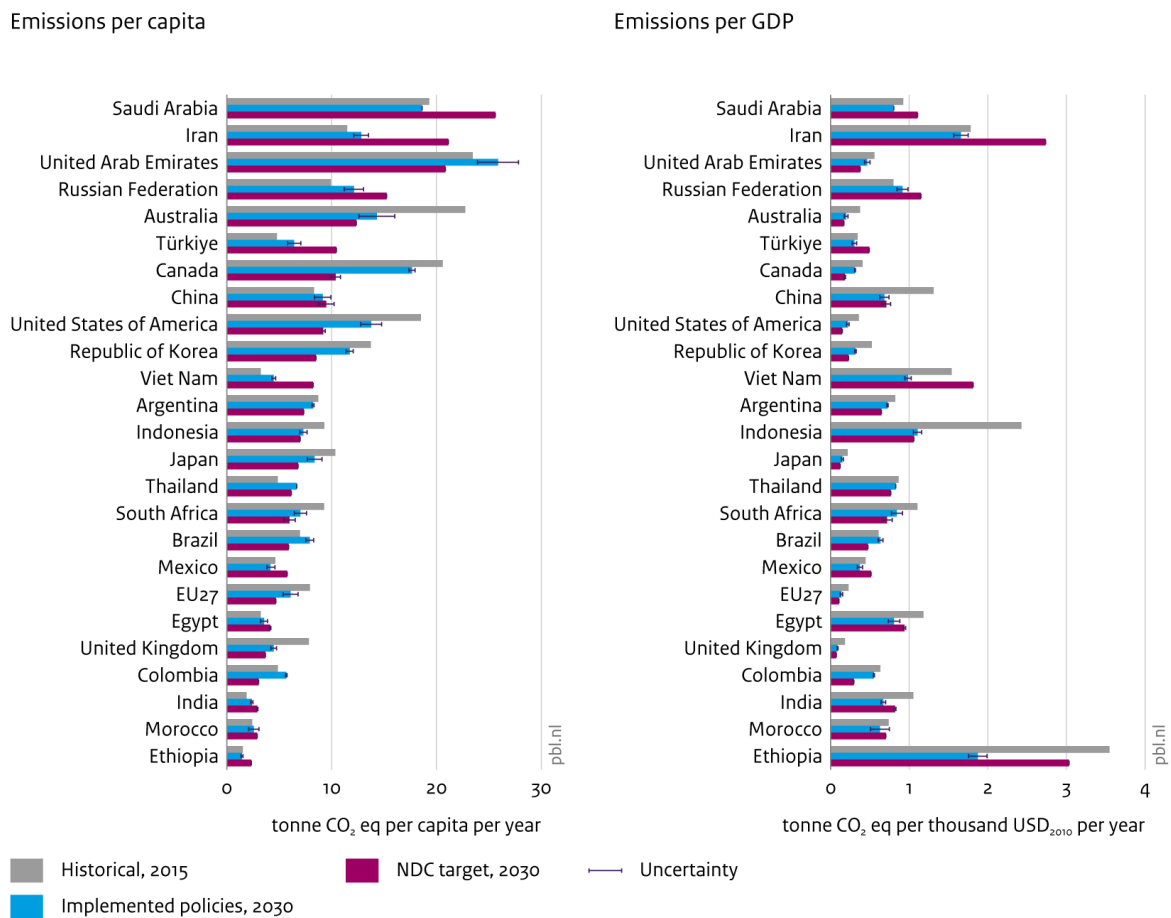
Emissions under current policies are projected to remain above 2015 levels in most countries (16) analysed and range from a decrease of 40% to an increase of 70% between 2015 and 2030 (Figure 1). Of the 25 countries, the lower end of the 2030 economy wide GHG emission range is expected to be 4% below 2015 levels under current policies. Although the upper end of the emissions range still results in an increase of 11% in the same period. These key metrics remain mostly unchanged since our 2021 update report.

Nine countries have emissions projections below 2015 levels by 2030. Australia, the EU27, Japan and the UK all have projected in 2030 GHG emission reduction by more than 20% compared to 2015 values. These countries have multiple climate-relevant policies in place even though, in some cases, such as in Australia's, where their climate policy is largely driven by subnational commitments (Nascimento et al., 2022). Emissions in the United States are now expected to reach almost 20% below 2015 levels by 2030. This value will improve if the country implements the new Inflation Reduction Act to its full extent (Section 3.3). In Indonesia, emissions are roughly 10% lower than 2015 values in 2030, due to a peak in land-use-related emissions in 2015, economy-wide emissions in the country are still projected to increase between 2022 and 2030. In South Africa and the Republic of Korea, emissions are expected to be over 10% lower compared to 2015 levels. In the Republic of Korea, the Korean ETS drives a large share of the expected emissions reductions, while in South Africa, the expected reductions result from the planned decommissioning of the country's coal-fired electricity capacity. Emissions in Canada are marginally below 2015 levels by 2030. The continuation of Canada's policies to reduce emissions associated with fossil fuel exploration post-2025 could increase the level of emissions reductions in 2030. Together, these nine countries represent approximately one-third of global emissions in 2019 (FAOSTAT, 2021; Olivier & Peters, 2020).

The remaining 16 countries analysed have emissions in 2030 above 2015 values. In 2019, these countries were responsible for almost half of global emissions (FAOSTAT, 2021; Olivier & Peters, 2020). Considering the upwards emissions trend, these countries will probably represent an even higher share of emissions in 2030. Significant additional policies are required to curb their emissions. Emissions in Egypt, India, Türkiye and Viet Nam are projected to increase by approximately 50% between 2015 and 2030.

Emissions per capita also vary substantially across scenarios (Figure 2). In this section, we compare emissions under current policies to emissions associated with countries' unconditional NDC targets, except for Egypt, which only has a conditional target. Emissions per capita in Türkiye and Viet Nam are expected to more than double between 2015 and 2030 under the countries' NDC targets. While in Australia, Canada, United States, United Kingdom they are expected to fall by half in the same period. Average emissions per capita in both NDC and current policy scenarios are around 9 tCO_{2e}, and there is significant overlap between the distribution under both scenarios. Of the 25 NDC targets analysed the average per capita emissions in 2030 is expected to reach 8.8 tCO_{2e} per capita (range: 2.3 to 25.6 tCO_{2e}). Looking at current policies, this value is 8.9 tCO_{2e} (range: 1.4 to 25.9 tCO_{2e}). On average, this represents a reduction in comparison to historical 2015 values – 9.6 tCO_{2e} per capita (range: 1.5 to 23.5 tCO_{2e}). We observe a reduction in NDC target emissions since our last update but no substantial change in the current policies scenario in most countries.

Impact of implemented policies on greenhouse gas emissions in major emitting countries



Source: PBL FAIR/TIMER model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 2: GHG emissions intensity per capita and GDP in 2030 under current policies (adopted up until June 2022) and NDC scenarios and compared to 2015 levels (figure produced by authors). The NDC target figures refer to unconditional target, except for Egypt.

The variation in emissions intensity per GDP across scenarios is relevant in many countries (Figure 2). In both NDC and current policy scenarios, we project that emissions intensity of the economy will almost half in many countries: Australia, Indonesia, China, the Republic of Korea, the United States and the United Kingdom and the European Union. In several additional cases, NDC targets imply emissions intensity will be substantially lower than historical levels, such as in Colombia, Canada and Japan. Although in others NDC targets imply an extensive increase compared to historical levels, as is the case for Iran, the Russian Federation and Türkiye. The average emissions per GDP under the NDC scenario is expected to be approximately 0.8 tCO_{2e} per thousand USD₂₀₁₀ (range: 0.1 to 3.0). Under current policies, this value is 0.7 tCO_{2e} (range: 0.2 to 1.9 tCO_{2e}).

In our analyses of emissions per capita and per GDP indicators, the indicator range per country is driven by uncertainty in current policy emissions trajectories (Chapter 3). Both the minimum and maximum of the emissions ranges are based on the same population and economic growth forecasts.

2.2 Achievement of NDC targets

Few countries improved their NDCs since 2021 Glasgow call to update targets

During COP 26 in Glasgow, countries were invited to submit improved NDC targets because updated NDCs submitted remained insufficient to meet the collective goals of the Paris Agreement (den Elzen et al., 2022b; UNFCCC, 2021b). However, out of the countries analysed, only Australia, Brazil, Egypt, India, Indonesia, the United Arab Emirates and the United Kingdom submitted new NDCs in 2022. In Egypt, India and Indonesia the updated NDC targets remain above current policy projections.

Brazil's NDC is an improvement in comparison to the target submitted in 2021 but still leads to higher emissions compared to the original 2016 NDC. This increase is a result from a revision in the emissions inventory and consequent change in emissions in the target base year. Egypt's NDC is the first to contain an emissions target. It presents emission reduction targets below BAU for difference sectors. However, these sectors represent only a fraction of the country's economy-wide emissions. The Egyptian target is also conditional on international support; Egypt did not submit an unconditional target. Both India and Indonesia submitted new targets in 2022. However, the impact of these targets is limited since they still result in emissions above our current policy scenario for the two countries. Australia and the United Arab Emirates are the only two countries analysed that submitted a NDC update targets in 2022 that result in emissions below their original 2016 target and below current policy projections. The United Kingdom NDC update adds information to the existing targets but does not lead to lower emissions compared the previous NDC. All targets are presented and discussed in detail in Chapter 3.

Out of the 25 countries analysed, eleven are on track and fourteen are off track to meet their current NDCs. Iran and Türkiye are yet to submit updated NDC targets.

Several countries analysed updated their NDCs between 2020 and 2022. Here, we compare these targets to the original NDCs submitted between 2014 and 2016 (Table 1). A country that was off-track to meet their original NDC target will be further off-track once it has set itself a more ambitious target, though full implementation of current policies and possible enhanced policies are expected to close this gap over time. Further action is still required in most countries analysed.

Eleven countries are on track to meet their current NDCs targets (Table 1). This number remains unchanged compared to our 2021 update report. However, there are some national differences. Brazil was on track to meet its targets but is now off track due to an increase in land use emission projections (section 3.3). Indonesia was on track to meet its NDC unconditional target but is now set to miss it due to an increase in land-use historical emissions (section 3.11). Mexico was close to meet its target and now is well on track due to revision in emission inventories (section 3.14). Egypt did not have a quantifiable target in our 2021 and is now on track to meet its NDC target (section 3.7).

Several of the countries on track to meet their targets have NDCs that result in 2030 emissions substantially higher than their current policies, which indicates that these countries can meet their targets without the adoption of any additional policies. The NDC targets that are substantially above the current policy scenario in 2030 belong to India (20%), Iran (40%), Mexico (30%), Russian Federation (20%), Türkiye (30%), Viet Nam (50%) and Ethiopia (40%).

Fourteen countries look set to miss their NDC targets: Argentina, Australia, Brazil, Canada, Colombia, the EU27, Indonesia, Japan, Republic of Korea, South Africa, Thailand, the UAE, the United Kingdom and the United States.

Brazil and Indonesia were on track to meet their targets in our 2021 report but are now off track. In both countries, we include new historical data related to land use, land-use change and forestry (LULUCF) emissions. In both countries historical emissions are substantially higher than estimated due to natural disturbances (such as peat fires) and an increase deforestation. The increase in historical LULUCF emissions has a substantial effect on these countries' ability to meet their own targets.

Table 1 Progress towards meeting original (2015-2016) and latest unconditional NDC targets (as of September 2022). 'N/A' indicates that no target is available (table produced by authors).

| | Updated NDC | On track to meet original NDC | On track to meet latest NDC |
|----------------------|---|-------------------------------|-----------------------------|
| Argentina | Latest target leads to lower 2030 emissions | ✓ | ✗ |
| Australia | Latest target leads to lower 2030 emissions | ✓ | ✗ |
| Brazil | Latest target leads to higher 2030 emissions | ✗ | ✗ |
| Canada | Latest target leads to lower 2030 emissions | ✗ | ✗ |
| China | Latest target leads to lower 2030 emissions | ✓ | ✓ |
| Colombia | Latest target leads to lower 2030 emissions | ✗ | ✗ |
| Egypt * | Submitted emissions target for the first time | N/A | ✓ |
| Ethiopia ** | Latest target leads to lower 2030 emissions | ✗ | ✓ |
| EU27 | Latest target leads to lower 2030 emissions | ✓ | ✗ |
| India | Latest target leads to lower 2030 emissions | ✓ | ✓ |
| Indonesia | Latest target leads to lower 2030 emissions | ✗ | ✗ |
| Iran | N/A | ✓ | N/A |
| Japan | Latest target leads to lower 2030 emissions | ✓ | ✗ |
| Mexico *** | Latest target leads to higher 2030 emissions | ✓ | ✓ |
| Morocco | Latest target leads to lower 2030 emissions | ✓ | ✓ |
| Republic of Korea | Latest target leads to lower 2030 emissions | ✗ | ✗ |
| Russian Federation | Latest target leads to same 2030 emissions | ✓ | ✓ |
| Saudi Arabia | Latest target leads to lower 2030 emissions | ✓ | ✓ |
| South Africa | Latest target leads to lower 2030 emissions | ✓ | ✗ |
| Thailand | Latest target leads to same 2030 emissions | ✗ | ✗ |
| Turkey | N/A | ✓ | N/A |
| United Arab Emirates | Latest target leads to lower 2030 emissions | N/A | ✗ |
| United Kingdom | Latest target leads to lower 2030 emissions | N/A | ✗ |
| USA | Latest target leads to lower 2030 emissions | ✗ | ✗ |
| Viet Nam | Latest target leads to lower 2030 emissions | ✓ | ✓ |

Submitted updated NDC

Did not submit updated NDC

* Here we consider progress towards Egypt's conditional target

** Ethiopia remains off-track to meet its conditional but on track to meet its unconditional target.

*** Mexico submitted a less ambitious target in 2020 but had to retract it as a result from a lawsuit. The current domestic target is the original NDC target.

In some countries, missing the NDC target is a result of increased ambition. This is the case for Argentina, Australia, Japan, the EU27 and South Africa. These countries are on track to meet their previous targets but would miss their update NDCs since they lead to lower emissions in comparison to the previous one. The remaining countries are expected to miss both their previous and current NDC. They require considerably more stringent policies to meet their self-determined targets.

Iran and Türkiye have yet to submit updated NDCs. Both countries are on track to meet their original targets and could enhance and meet their NDCs without implementation of additional policies.

3 Results per country

This chapter summarises the results per country. We include:

- Description of recent developments.
- Projected impact of climate policies on GHG emissions (absolute, relative to 2015 levels); updated between 2021 and 2022 for all countries.
- Description of NDC targets.
- Overview of key quantified climate change mitigation policies.
- Latest historical emissions data.

In this report, GHG emission values are expressed in terms of AR4 GWPs unless otherwise noted. All projections presented in this report are compared to 2015 historical levels. The sectoral emissions coverage for GHG emission indicators is consistent with the NDC targets, unless stated otherwise. In other words, when the NDC target excludes LULUCF, we also exclude LULUCF from our aggregated current policy projections.

The GHG emissions under current policies are presented including or excluding LULUCF, depending on the sector coverage of the NDCs. The term 'land use' used in the figures refers to LULUCF emissions and removals.

For the calculation of per capita emissions, population projections (median variant) were taken from the UN population statistics (United Nations, 2022).

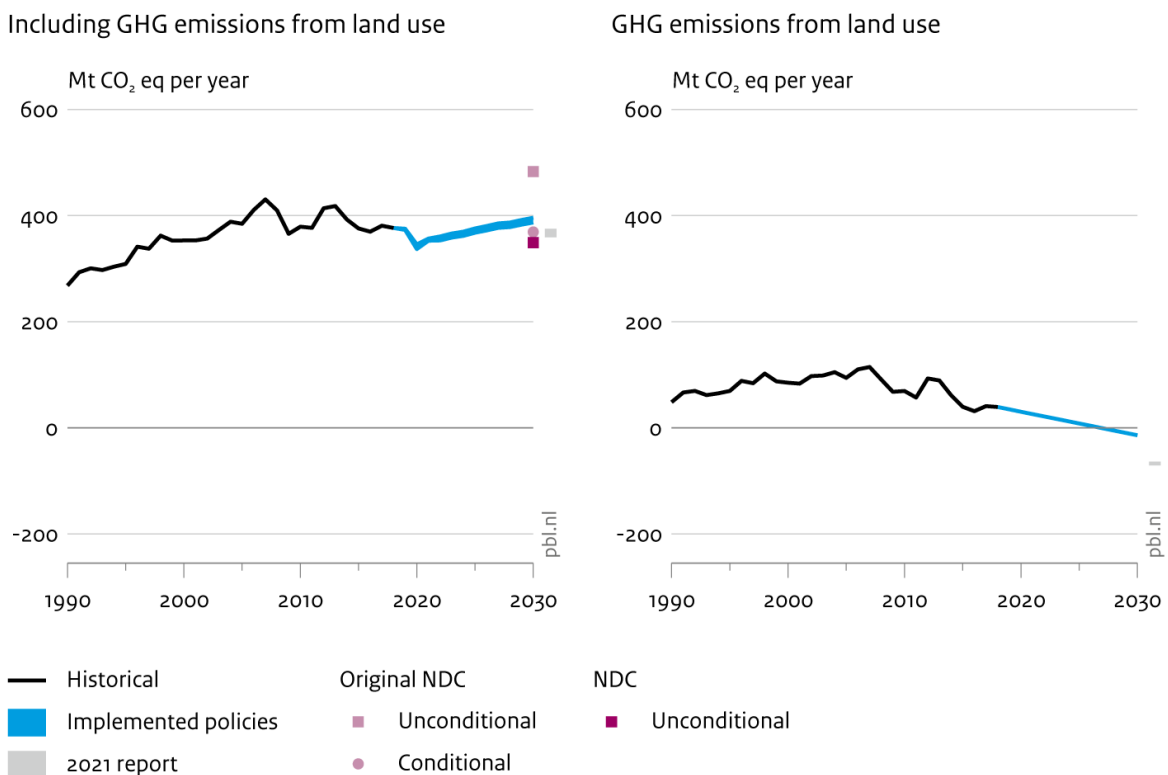
The Appendix provides explanations on historical GHG emissions data sources and the harmonisation of GHG emissions projections to the historical data (A2), quantification of NDC emissions levels (A3), general description of calculation methods used by NewClimate Institute, PBL and IIASA to quantify emissions projections under current policies (A4 to A6).

3.1 Argentina

Recent developments: The government of Argentina submitted an updated second Nationally Determined Contribution (NDC) in November 2021. It sets the absolute, economy-wide and unconditional goal of limiting GHG emissions to 349 MtCO₂e (incl. LULUCF) by 2030, 2% lower than its 2020 NDC target. In 2020, the government had announced a long-term strategy (LTS) aiming for carbon neutrality by 2050. There have not been any major climate policy developments since the new administration took office in December 2019. Argentina's energy sector priorities have shifted from renewables to gas and nuclear. This includes new plans to develop gas pipelines and increase shale gas production (Government of Argentina, 2022b), as well as the construction of a new nuclear power plant with 1.2 GW capacity (Government of Argentina, 2022a). Other relevant developments include a restructuring of energy subsidies for residential consumers. Prices had been frozen since 2019 due to high inflation, and because of debt negotiations with the IMF, the government committed to a plan of fiscal stabilization which included a subsidy reform. In August 2022, the government adopted a new segmented tariff scheme to make energy subsidies more progressive (Rivas Molina, 2022), but it is not yet possible to determine its impact on reducing fiscal costs and total energy consumption.

Projections: Argentina is on track to meet its original target but set to miss its latest NDC target with existing policies. Emissions excluding land use remain on a strong upwards trend but are counterbalanced by an increase in land use sinks. Our current policies scenario this year is slightly higher than our 2021 projections, mainly due the inclusion of additional historical data and a reduction in project emission sinks in 2030.

Impact of climate policies on greenhouse gas emissions in Argentina



Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 3: Impact of climate policies on greenhouse gas emissions in Argentina. Emissions trajectories are based exclusively on NewClimate and IIASA's projections. The grey bar gives the range of our 2021 projections.

Table 2: Argentina's NDCs as presented in official sources. N/A: not available or not applicable.

| Indicator | 2016 NDC | 2020 NDC | 2021 NDC |
|---|--|--|--|
| Business-as-Usual (BAU) | N/A | N/A | N/A |
| Target: unconditional | Limit GHG emissions to 483 MtCO ₂ e in 2030 | Limit GHG emissions to 359 MtCO ₂ e in 2030 | Limit GHG emissions to 349 MtCO ₂ e in 2030 |
| Target: conditional | Limit GHG emissions to 369 MtCO ₂ e in 2030, subject to international financing, support for transfer, innovation and technology development, and capacity building | N/A | N/A |
| Sectoral coverage | Economy-wide | Economy-wide | Economy-wide |
| General Accounting method | IPCC guidelines; 100-year GWPs from SAR | IPCC guidelines; 100-year GWPs from SAR | IPCC guidelines; 100-year GWPs from SAR |
| GHGs covered | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs and SF ₆ | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs and SF ₆ | CO ₂ , CH ₄ , N ₂ O, HFCs and PFCs |
| Consideration of LULUCF | Land-use sector is included in the target Accounting approaches and methodologies are not specified | Land-use sector is included in the target Accounting approaches and methodologies are not specified | Land-use sector is included in the target Accounting approaches and methodologies described in the third BUR. |
| Other sector-level targets | N/A | N/A | N/A |
| Use of bilateral, regional and international credits | N/A | N/A | N/A |

Table 3: Overview of key climate change mitigation policies in Argentina (Eversheds Sutherland (US) LLP & Fratantoni, 2018; FARN, 2019; Government of Argentina, 2019; Resolución 136 - E/2016. Energía Eléctrica de Fuentes Renovables. Convocatoria Abierta Nacional e Internacional, 2016; Impuesto a Las Ganancias. Ley 27430. Modificación, 2017; LSE Grantham Research Institute on Climate Change and the Environment, 2018; MADS, 2015; Ministry of Environment and Sustainable Development of Argentina, 2018; Pensamiento Civil, 2019)

| Sector | Policies (marked with '+' when mentioned in NDC) | Description |
|----------------------|--|--|
| Energy supply | Renewable Energy Law 27.191 setting renewable targets (2015) ¹⁾ , National Development Scheme for the Use of Renewable Energy Sources (RenovAr) | This law sets out renewable electricity targets of 18% by 2023 and 20% by 2025 (excl. hydro larger than 50 MW), as well as a tendering scheme to support their achievement. |
| | Carbon tax on energy (2017) ^{1) 2)} | Tax levels are adjusted every trimester, reaching a top rate of USD 5/tCO ₂ in 2020. Targeting emissions from transport fuels and coal. The carbon tax excludes natural gas consumption and shale gas production. |

| Sector | Policies (marked with '(+)' when mentioned in NDC) | Description |
|---------------------------------|--|---|
| | Decree 892/2020 on natural gas supply and demand scheme (2020) ^{1) 2)} | This plan aims to produce 30,000 Mm ³ of natural gas in four years. It includes incentives and benefits for companies looking to produce unconventional natural gas. |
| | Law 27.424 on net-metering for distributed generation (2017) ^{1) 2)} | This law supports distributed renewable energy generation and establishes a net metering mechanism. |
| Transport | Biofuels Law (updated 2021) ^{1) 2)} | Blending mandate of 5% for biodiesel and 12% for ethanol in gasoline from 2021. This new regime allows authorities to adjust blending mandates based on input prices, with a floor of 3%. |
| Agriculture and Forestry | Joint resolution 1/2018 creating the Environmental and Insurance Sustainability Program (September 2018) ²⁾ | This policy aims to increase forest plantations from 1.3 million hectares to 2 million hectares by 2030. This would mean expanding forested areas by 62,000 hectares per year. |
| | Extension and amendment of Law 25.080 related to the investments for cultivated forests (2018) ²⁾ | The law aims to increase the investments, area, and quality of cultivated forests within the country. The law grants among other benefits, an annual non-refundable economic contribution to approximately 3,000 small and medium forest producers. |
| | Law for Minimum Budgets for Environmental Protection of Native Forest (2007) ^{2) 3)} | Regulatory frame to control the reduction of native forest area and prevent net deforestation. |
| | National Forest Management Plan with Integrated Livestock (2015) ^{2) 3)} | This policy aims to contribute to the sustainable use of native forests through incorporating livestock activities in native forest area in a sustainable manner, thus preventing further agricultural land expansion. |
| | Investments for Cultivated forests (2008) ²⁾ | Development of afforestation projects on a total of 500,000 hectares of land based on economic incentives. |
| | National plan for the restoration of native forests (2019) ²⁾ | Creation of the National Plan for the Restoration of Native Forests, which seeks to restore 20 thousand hectares of native forest per year by 2030. |
| | Strategic plan for forestry and industrial forestry Argentina 2030 ^{2) 3)} | This policy aims to improve the management of productive forest areas, developing the value chain and benefiting communities of producers. |

¹⁾ Not quantified in NewClimate Institute projections. ²⁾ Not quantified in PBL IMAGE model projections.

³⁾ Not quantified in IIASA model projections.

Table 4: 2015 historical data and 2030 projections of key GHG indicators for Argentina. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

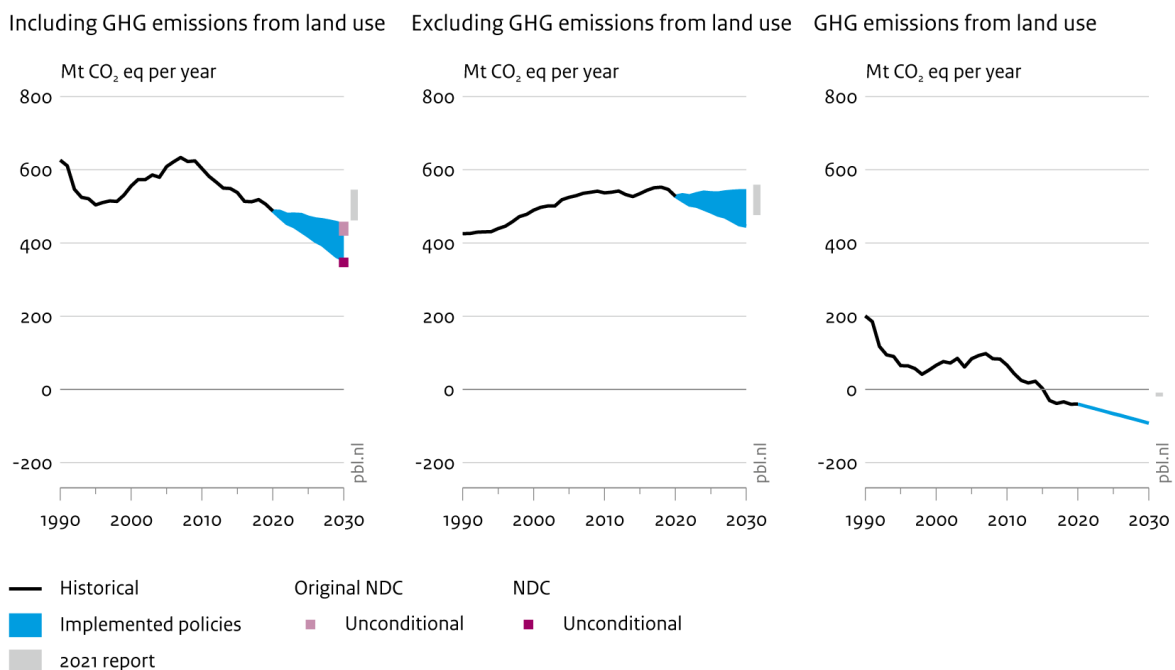
| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|---|----------------------|--|--|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (incl. LULUCF) – estimates (MtCO₂e) | 376 | 387 to 396 (3% to 5%) | 349 (-7%) |
| GHG emissions per capita (tCO₂e/cap) | 8.7 | 8.1 to 8.3 (-7% to -5%) | 7.3 (-16%) |
| GHG emissions per GDP (tCO₂e/thousand USD) | 0.6 | 0.7 (-13% to -11%) | 0.6 (-22%) |

3.2 Australia

Recent developments: In June 2022, Australia submitted an updated NDC (Australian Government, 2022). The new unconditional target stipulates a 43% GHG reduction below 2005 levels by 2030 and reiterates Australia's goal to achieve net zero emissions in 2050. The government enshrined these targets into law in September 2022 (*Climate Change Bill 2022*, 2022). Australia's Long Term Emissions Reduction Plan outlines the country's net zero emissions pathway for 2050, including the previously published Technology Investment Roadmap Paper and the Low Emissions Technology Statements (Australian Government, 2021; DISER, 2020; Government of Australia, 2021). The Low Emissions Technology Statement of 2020 that outlines key technologies for the low-carbon transition was updated in November 2021 and includes 'ultra low-cost solar' as a priority technology. In November 2021, the Australian Government published its Future Fuels and Vehicles Strategy to promote electric and hydrogen vehicles infrastructure, integrate new electric vehicles in the electricity grid and broaden consumer confidence in new vehicle technologies (Government of Australia, 2021). The new Government plans to create funds to support the development, manufacturing, and deployment of renewable energy and other low emissions technologies. In addition to the development of a National Electric Vehicle Strategy, which would include an electric car tax discount, and declining emission limits (also called baselines) for the Safeguard Mechanism (Australian Government, 2022).

Projections: Australia is on track to meet its original target but will likely miss its latest and improved NDC target with existing policies. Projections are lower than estimated in 2021, mainly related to updated LULUCF projections. Australia projects that the LULUCF sector will remain stable from 2020 to 2030, while IIASA projects a continuation of the historical trend and a steady increase in the LULUCF sink over time, mainly due to increasing carbon sequestration in newly afforested land.

Impact of climate policies on greenhouse gas emissions in Australia



Source: PBL IMAGE model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 4: Impact of climate policies on greenhouse gas emissions in Australia (upper end: PBL IMAGE model, lower end: NewClimate Institute calculations). The LULUCF projections exclude removals from non-anthropogenic natural disturbances in line with Australia's 2021 GHG Inventory Submission. The grey bar gives the range of our 2021 projections.

Table 5: Australia's NDCs as presented in official sources. N/A: not available or not applicable. Accounting rules are elaborated in Iversen et al. (2014).

| Indicator | 2016 NDC | 2021 NDC | 2022 NDC |
|---|---|---|--|
| Business-as-Usual (BAU) | N/A | N/A | N/A |
| Target: unconditional | 26 to 28% GHG reduction by 2030 from 2005 level | 26 to 28% GHG reduction by 2030 below 2005 level | 43% GHG reduction by 2030 below 2005 level |
| Target: conditional | N/A | N/A | N/A |
| Sectoral coverage | Economy-wide | Economy-wide | Economy-wide |
| General Accounting method | IPCC guidelines; 100-year GWPs from AR4 | IPCC guidelines; 100-year GWPs from AR5 | IPCC guidelines; 100-year GWPs from AR5 |
| GHGs covered | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ and NF ₃ | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ and NF ₃ | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ and NF ₃ |
| Consideration of LULUCF | Land-use sector is included in the target Based on a net-net approach for emission accounting | Land-use sector is included in the target Based on a net-net approach for emission accounting | Land-use sector is included in the target Based on a net-net approach for emission accounting. Australia will use a stock-change approach. In addition, carbon stock changes from natural disturbances are included. |
| Use of bilateral, regional and international credits | N/A | N/A | Intention of participating in international carbon markets under Article 6 of the Paris Agreement. |

Table 6: Overview of key climate change mitigation policies in Australia (ACT Government, 2011, 2018; Australian Government, 2020; Australian Government Department of Environment, 2016; Australian Government Department of the Environment and Energy, 2017; Climate Analytics, 2021; Department of Industry Science Energy and Resource, 2019; Government of Australia, 2017, 2019, 2020; Government of Australia Department of Climate Change, Energy, 2015; Government of Australia Department of Industry Science and Resources, 2021; Government of South Australia, 2020; Northern Territory Government, 2015; NSW Government, 2014; Queensland Government, 2021; South Australia Government, 2015; Tasmania Government, 2019; West Australia Government, n.d.)

| Sector | Policies | Description |
|----------------------|---|--|
| Cross-cutting | Emissions Reduction Fund (ERF) (2014, updated in 2022) ¹⁾ – <i>relabelled Climate Solutions Fund in 2019</i> | The fund sets out a reverse auction mechanism designed to reduce emissions at the lowest available cost. The government purchases carbon credits generated by companies that voluntarily reduce their emissions. The fund was modified in 2022 to allow existing purchase contracts to be terminated and for companies to sell their credits in the market. |

| Sector | Policies | Description |
|--------------------------|--|--|
| | Energy Productivity Plan (2015) ¹⁾ | This policy sets out a target to increase energy productivity (unit of GDP per unit of energy use) by 40% by 2030, relative to 2015 levels. |
| | Hydrofluorocarbon (HFC) emissions reduction under the Montreal Protocol (2017) | This policy sets out a target to reduce HFC emissions by 55% by 2030, relative to 2010 (and 85% by 2036). |
| | Federal Budget 2021 - 2022 ¹⁾ | The budget includes climate-related measures including the funding for hydrogen hubs and CCS, support for farmers to reduce emissions through the national soil carbon innovation challenge and trials for low-emission technologies, the implementation of a Safeguard Crediting Mechanism, support for voluntary climate action through an expanded Climate Active framework, and investment to help Australian businesses and supply chains adopt energy efficiency measures. |
| Energy supply | Technology Investment Roadmap and Low Emissions Technology Statement ¹⁾ | The Technology Investment Roadmap sets a process to develop and deploy low emissions technologies. The Low Emissions Technology Statement sets government's technology priorities and goals. For 2021 these include: clean hydrogen (also from fossil sources), ultra-low-cost solar, electricity storage, low emissions steel and aluminium, carbon capture and storage, and soil carbon. |
| | State-level renewable energy targets and roadmaps | Renewable energy targets of Victoria, Queensland ⁴⁾ , Tasmania ⁴⁾ , and the Northern Territory and the New South Wales Electricity Infrastructure Road Map. |
| | CCS Flagships Programme (2009) ^{1) 2)} | This programme supports the construction and demonstration of large-scale integrated CCS projects with a budget of over \$125 million. |
| | Energy Efficient Communities Program ¹⁾ | This program provides yearly grants for businesses and community organisations to improve energy efficiency and reduce electricity bills. |
| Transport | Fuel tax (2006, last amendment in 2019) ^{1) 3)} | This policy sets out a fuel tax for diesel and gasoline currently set at AUD 0.42 per litre. |
| | Future Fuels and Vehicle Strategy (2021) ¹⁾ | This strategy sets out a technology-led approach to tackle emissions in the transport sector aimed at increasing the uptake of hybrid, hydrogen, electric and biofuelled vehicles. It plans to reduce 8 MtCO ₂ e by 2035. |
| | State-level vehicle strategies and policies ^{1) 2)} | Most states and territories (ACT, NSW, VIC, QLD, SA) offer different degrees of registration discounts for electric vehicles. The State of South Australia aims for all new passenger vehicles sold to be fully electric by 2035. The ACT government has an action plan for zero-emissions vehicles with a target to achieve net-zero GHG emissions by 2045. Both NSW and Victoria have policies requiring that 50% of all new cars sold in 2030 must be EVs. |
| Buildings | National Construction Code (2019) (updated in May 2022) ^{1) 2)} | This update to the building code includes new residential energy efficiency provisions. |
| Agriculture and Forestry | 20 Million Trees Programme (2014) ¹⁾ | This program aims to plant 20 million trees by 2020 (20,000 ha) to re-establish green corridors and urban forests. |
| | Growing a better Australia. A billion trees for jobs and growth (2018) ¹⁾ | This program aims to plant a billion new trees to boost the Australian economy and drive jobs and growth in its rural industries and regional manufacturing. |

| Sector | Policies | Description |
|--------|---|---|
| Waste | National Food Waste Strategy (2017) ¹⁾ | This policy provides a framework to support action towards the national goal of halving Australia's food waste by 2030. |
| | State-based waste policy frameworks ¹⁾ | Most states and territories have specific waste strategies and most also additional targets to the national targets. |
| | National Waste Policy (2018) and Action plan (2019) ¹⁾²⁾ | This policy sets national targets to the export of some waste, reducing total waste generation in Australia, setting minimum waste recovery standards from all waste streams, increasing the use of recycled content, phasing out some plastics, halving the amount of organic waste sent to landfill and improving data availability to support investment and policy decisions. |

¹⁾ Not quantified in PBL IMAGE model projections.²⁾ Not quantified in New Climate Institute projections.

³⁾ Quantification based on OECD (2013)⁴⁾ Renewable electricity exports are excluded from the share.

Table 7: 2015 historical data and 2030 projections of key GHG indicators for Australia. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

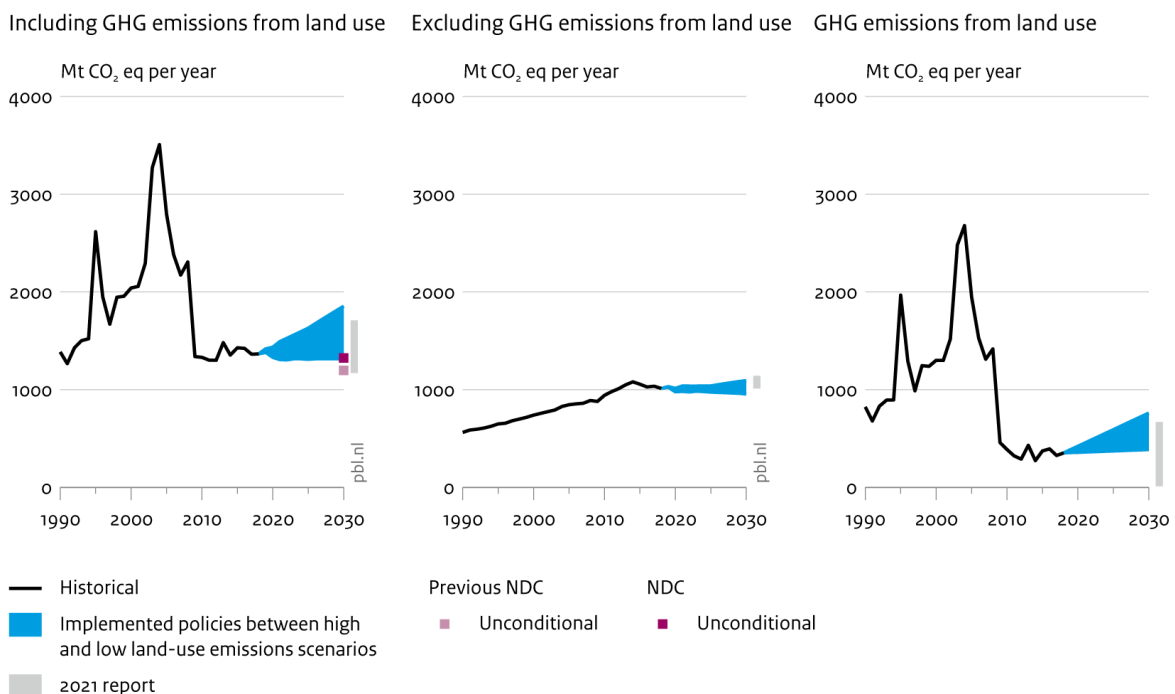
| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|---|----------------------|--|---|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (incl. LULUCF) – estimates (MtCO ₂ e) | 538 | 354 to 450 (-34% to - 16%) | 347 (-35%) |
| GHG emissions per capita (tCO ₂ e/cap) | 22.7 | 12.6 to 16 (-45% to - 30%) | 12.4 (-46%) |
| GHG emissions per GDP (tCO ₂ e/thousand USD) | 0.4 | 0.2 (-53% to -41%) | 0.2 (-54%) |

3.3 Brazil

Recent developments: Brazil submitted an updated NDC in 2022 that improves on the 2020 update but still leads to higher absolute emissions when compared to the original 2016 NDC. The latest NDC presents a target to reduce emissions by 50% below 2005 levels in 2030. However, the updated target is based on a different inventory than the original NDC and results in a range of higher absolute emissions levels in 2030. The updated NDC includes a tentative carbon neutrality target, but the scope and implementation plan remain unspecified, and reintroduces the target to end illegal deforestation in the Amazon – the target is now to end it by 2028, compared to 2030 in the original NDC. Brazil's presidential elections will take place in October 2022. Bolsonaro's administration did not introduce any substantial new policies to reduce emissions. On the contrary, the country has observed a consistent increase in deforestation, dismantling of environmental protection agencies and weakening of important mechanisms, such as the Amazon Fund (Hochstetler, 2021; Silva Junior et al., 2021). Most presidential candidates for the upcoming elections voice support for ending deforestation but none have presented a clear strategy for climate change mitigation efforts post-elections. The former president Lula, who currently leads the polls, aims to improve cross-national cooperation and reinstate his commitment to use climate change mitigation as a development strategy (Freua, 2022).

Projections: Brazil improved its NDC compared to its 2020 update and is set to miss both original and latest NDC targets with existing policies. Current policies for the land-use sector are also insufficient to meet deforestation-related targets in the updated NDC. Large scale deforestation of the Amazon has progressively increased over the last years and is projected to continue over time as the government has scaled back the enforcement of environmental protection laws. Considering recent trends, we no longer present a low-deforestation scenario for Brazil.

Impact of climate policies on greenhouse gas emissions in Brazil



Source: PBL IMAGE model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 5: Impact of climate policies on greenhouse gas emissions in Brazil (upper end: NewClimate Institute calculations, lower end: PBL IMAGE model). The grey bar gives the range of our 2021 projections.

Table 8: Brazil's NDCs as presented in official sources. N/A: not available or not applicable.

| Indicator | 2016 NDC | 2020 NDC* | 2022 NDC |
|---|---|--|--|
| BAU | N/A | N/A | N/A |
| Target: unconditional | 37% GHG reduction below 2005 level by 2025 and indicative 43% GHG reduction below 2005 level by 2030 | 37% GHG reduction below 2005 level by 2025 and 43% GHG reduction below 2005 level by 2030 | 37% GHG reduction below 2005 level by 2025 and 50% GHG reduction below 2005 level by 2030 |
| Target: conditional | N/A | N/A | N/A |
| Sectoral coverage | Economy-wide | Economy-wide | Economy-wide |
| General Accounting method | IPCC guidelines; 100-year GWPs from AR5 | IPCC guidelines; 100-year GWPs from AR5 | IPCC guidelines; 100-year GWPs from AR5 |
| GHGs covered | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, and SF ₆ | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, and SF ₆ | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, and SF ₆ |
| Consideration of LULUCF | Land-use sector is included in the target Accounting approaches and methodologies are not specified | Land-use sector is included in the target Accounting approaches and methodologies are not specified | Land-use sector is included in the target. Accounting approach is in line with IPCC 2006 guidelines. |
| Use of bilateral, regional and international credits | Possible use of market mechanisms that may be established under the Paris Agreement | Intention in participating in international carbon markets under Article 6 of the Paris Agreement | Intention of participating in international carbon markets under Article 6 of the Paris Agreement, pending the development of relevant national legislation. |
| Other sector-level targets | 45% share of renewables in total energy mix by 2030 (28% to 33% excluding hydro) 23% share of renewables in total electricity generation (excluding hydro) by 2030 10% efficiency gains in the electricity sector by 2030 Zero illegal deforestation by 2030 Restoring and reforestation 12 million ha of forest by 2030. | N/A | Zero illegal deforestation by 2028. |

* The 2020 NDCs refers to the 3rd National Inventory Report as the reference for the target base year's emissions. However, the updated NDC also specifies that 'Information on emissions in 2005 and reference values may be updated and recalculated due to methodological improvements applicable to the inventories.' The 4th National Communication would fall under this category. Therefore, a range for the NDC targets is presented based on the emissions in 2005 from both inventories, which differ significantly.

Table 9: Overview of key climate change mitigation policies in Brazil (Government of Brazil, 2007, 2008, 2020a, 2020b, 2020c, 2021a, 2021b; Ministério de Minas e Energia – MME, 2019).

| Sector | Policies (marked with '+' when mentioned in NDC) | Description |
|--------------------------|--|---|
| Energy supply | 10-Year National Energy Expansion Plan (PDE) (2011: updated in 2019 as PDE 2029) ¹⁾²⁾ | This policy sets out various targets, including reaching installed capacities of 40 GW for wind, 20 GW for solar, 26 GW for biomass, 10 GW for small hydropower and 105 GW for large hydropower by 2029. It also includes a target of 48% renewable share (36% excluding hydropower) in total primary energy supply by 2029, 22% renewable share (excluding hydropower) in total electricity generation by 2029 and 17% biofuel share in total primary energy supply by 2029. |
| | Resolution No 806 of 2020 from ANP Brazil (2020) ²⁾ | This resolution regulates flaring and losses from oil and gas developments, establishing that burning of crude oil and non-associated gas is forbidden unless due to emergency reasons |
| Transport | National Biodiesel Programme (2005) ²⁾ | This program mandates a biodiesel share in diesel of 7% from 2015 and 11% from 2019 onwards, increasing by 1%-point every March until reaching 15% by March 2023. |
| | Ethanol Blending Mandate (1993) | This program mandates a bioethanol share in gasoline of 27% from 2015 onwards. |
| | Inovar-Auto (2012) | This policy aims to improve average fuel efficiency to 1.62 MJ/pkm by 2022. |
| | RenovaBIO (2018) ²⁾ | This policy aims to improve the carbon intensity of biofuels by 7% between 2017 and 2028, reaching 66.8 gCO ₂ /MJ by 2028. |
| Agriculture and forestry | National Plan on Climate Change (2008) ²⁾ | This plan aims to reduce deforestation rates in all Brazilian biomes, in order to reach zero illegal deforestation. |
| | The Low-Carbon Agriculture (ABC) Plan) (2010) (+) ²⁾ | This plan aims to restore an additional 15 million hectares of degraded pasturelands by 2030 and enhance 5 million hectares of integrated cropland-livestock-forestry systems by 2030. |
| | Green Rural Product Certificate (Rural Verde Producers Certificate) (2021) ²⁾ | This policy regulates the issue of Rural Product Certificates, related to the activities of conservation and recuperation of native forests and their biomes, dealt with in item II of § 2 of art. 1 of Law N° 8.929, of August 22, 1994. |

¹⁾ Not quantified in NewClimate Institute projections ²⁾ Not quantified in PBL IMAGE projections.

Table 10: 2015 historical data and 2030 projections of key GHG indicators for Brazil. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

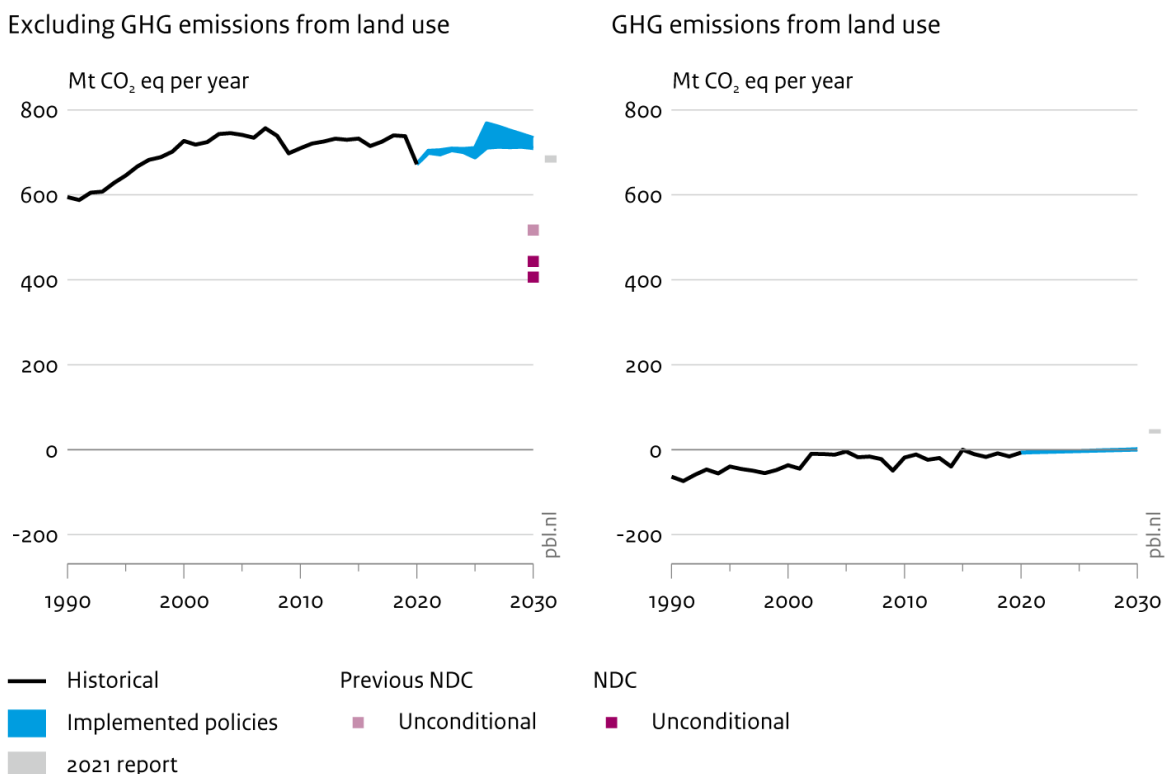
| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|--|-------------------|--|--|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (incl. LULUCF) – estimates (MtCO ₂ e) | 1430 | 1690 to 1850 (18% to 30%) | 1320 (-8%) |
| GHG emissions per capita (tCO ₂ e/cap) | 7.0 | 7.5 to 8.3 (+8% to +19%) | 5.9 (-16%) |
| GHG emissions per GDP (tCO ₂ e/thousand USD) | 0.8 | 0.6 to 0.7 (-1% to +9%) | 0.5 (-23%) |

3.4 Canada

Recent developments: In its NDC, Canada commits to reducing its GHG emissions to net zero by 2050, supported by the first of a series of Emission Reduction Plans (ERPs) published in March 2022 (Government of Canada, 2022). The ERPs outline sector-by-sector how the government proposes to set and achieve its climate targets – through cutting oil and gas sector emissions by about 45% by 2030, accelerating clean technology innovation and deployment (especially CCUS), investing in clean electricity, and supporting the switch to zero-emission on-road vehicles. Regulations to reduce emissions from oil and gas by 40% to 45% by 2025 compared to 2012 levels went into effect in 2020. In December 2021, Environment and Climate Change Canada provided an update that Canada is on track to meet its 2025 methane reduction target, while recognizing that more work needs to be done to drive further reductions in this sector. As part of its endorsement of the Global Methane Pledge announced in COP26, Canada signalled its ambition in a discussion paper published in March 2022 to achieve 75% reduction of methane emissions in the oil and gas sector relative to 2012 levels by 2030 (Canada, 2022). Regulations to meet this target will be introduced in early 2023.

Projections: Canada is set to miss both its original and latest NDC targets with existing policies by a large margin. The ERP suggests measures that would reduce emissions to the less ambitious end of the target range, but those measures are in part not yet implemented in legislation. Current policy scenario projections for the LULUCF sector exclude emissions from natural and the NDC target accounts for the of credits generated by the LULUCF sector. Emissions post-2025 are highly dependent on the continued enforcement of policies to reduce emissions from fossil fuel extraction and production.

Impact of climate policies on greenhouse gas emissions in Canada



Source: PBL IMAGE model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 6: Impact of climate policies on greenhouse gas emissions in Canada (upper end: PBL IMAGE model – see footnote 2 of Table 12 for an explanation of the trajectory post-2025, lower end: NewClimate Institute calculations). The NDC unconditional target for 2030 accounts for credits/debits generated by the LULUCF sector. The grey bar gives the range of our 2021 projections.

Table 11: Description of Canada's previous and current NDC, as presented in official sources. N/A: not available or not applicable.

| Indicator | 2016 NDC | 2017 NDC | 2021 NDC |
|---|---|--|--|
| Business-as-Usual (BAU) | N/A | N/A | N/A |
| Target: unconditional | 30% GHG reduction by 2030 from 2005 level | 30% GHG reduction by 2030 from 2005 level | At least 40% to 45% GHG reduction by 2030 from 2005 level |
| Target: conditional | N/A | N/A | N/A |
| Sectoral coverage | Economy-wide | Economy-wide | Economy-wide |
| General Accounting method | IPCC guidelines; 100-year GWPs from AR4 | IPCC guidelines; 100-year GWPs from AR5 | IPCC guidelines; 100-year GWPs from AR5 |
| GHGs covered | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ and NF ₃ | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ and NF ₃ | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ and NF ₃ |
| Consideration of LULUCF | Land-use sector is included in the target Based on a net-net approach for emission accounting and "production approach" for harvested wood products. Excluding emissions for natural disturbances | Land-use sector is included in the target Accounting approach not specified, and under examination ¹⁾ Use of "production approach" for harvested wood products. Excluding emissions for natural disturbances | Land-use is excluded in the base year but is included in the target. Accounting approach for emissions and removals from forest land is based on forest inventory information that includes forest ages and age-dependent growth rates. Use of Simple Decay Approach for harvested wood products. For all other LULUCF sub-sectors, Canada applies the net-net accounting approach. ²⁾ |
| Use of bilateral, regional and international credits | N/A | International mechanisms may be used | International mechanisms may be used, but Canada 'prioritizes action to reduce emissions within Canada.' |

¹⁾ Canada does, however, specify that it intends to use the production approach for accounting for harvested wood products (HWP) consistent with IPCC guidance (Government of Canada, 2017a; Iversen et al., 2014) ²⁾ LULUCF credits are accounted for in the calculation of the NDC target for 2030. For simplicity reasons, we assume that the net-net accounting approach is applied to all LULUCF sub-categories (including managed forests and HWP).

Table 12: Overview of key climate change mitigation policies in Canada (Government of Canada, 2014, 2017b, 2018a, 2018b, 2022; Transport Canada, 2021)

| Sector | Policies (marked with '+' when mentioned in the NDC document) | Description |
|----------------------|--|--|
| Cross-cutting | Greenhouse Gas Pollution Pricing Act (adopted June 2018; pricing started January 2019) ¹⁾ | The Act consists of two parts: one puts a carbon levy on small emitters including industries under 50 ktCO ₂ e, and the other sets a cap-and-trade system or output-based pricing system bigger facilities. The federal price on emissions, starting at C\$20/tCO ₂ e in 2019 and rising by C\$10/tCO ₂ e per year until \$50/tCO ₂ e in 2022, |

| Sector | Policies (marked with '(+)' when mentioned in the NDC document) | Description |
|---------------|--|---|
| | | applies to provinces and territories that request it or have not implemented their own carbon pricing regime ('backstop'). |
| | Regulation of HFCs (2020) | Reduce HFC emissions by 85% by 2036, relative to a baseline. |
| | 2030 Emissions Reduction Plan ⁵⁾ | The plan outlines sector-by-sector measures to achieve a 40% reduction of total GHGs by 2030, and net-zero emissions by 2050. The measures are not yet fully implemented. |
| Energy supply | CO ₂ standard for new power plants (2012) – updated in November 2018 to phase out traditional coal | This policy sets out a standard of 420 gCO ₂ /kWh from 1 July 2015; plants must comply by 2030 at the latest. It includes a phase-out of traditional coal (without CCS) by 2030. |
| | Regulations limiting carbon dioxide from natural gas fired electricity generation (January 2019) ⁵⁾ | This regulation limits CO ₂ emissions from natural gas plants to 420 g/kWh for boiler units and large combustion units, and 550 g/kWh for smaller combustion units. |
| | Regulations to address methane in the oil and gas sector (2018) ²⁾ | This policy sets out a target to reduce CH ₄ emissions from oil and gas by 40-45% by 2025, relative to 2012. Implementation starts in 2020. To support this goal, the government announced a CAD 750 million (EUR 480 million) Emissions Reduction Fund for reducing methane emissions in the oil and gas sector and to establish a leak detection and repair programme to reduce fugitive emissions. |
| | Hydrogen Strategy for Canada (2020) | The Strategy aims to reduce GHG emissions to 45 million metric tonnes a year in 2030 and would create up to 350 000 new jobs by 2050, building a \$50 billion domestic hydrogen market. |
| Transport | Efficiency standards light commercial vehicles (2004) | This policy sets out new fuel efficiency standards of 34.1 mpg (14.9 km/l) by 2017, and 55 mpg (23.2 km/l / 0.91 MJ/pkm) by 2025. |
| | Efficiency standards heavy-duty trucks (2013) | This policy sets out new fuel efficiency standards of per type of truck (aligned with federal-level regulations in the US) to 1.38 MJ/tkm by 2027 for medium trucks, 0.83 MJ/tkm by 2027 for heavy trucks. |
| | Renewable fuel regulations (biofuel bill – amendment to the Canadian Environmental Protection Act) (2008) | This regulation sets out a mandate of bioethanol share in gasoline of 5% from 2011 onwards, and biodiesel share in diesel of 2% from 2011 onwards. |
| | Zero Emission Vehicle Infrastructure Deployment (2019, updated 2021) | This policy sets out a target of a 30% share of low-emissions vehicles in new light-duty vehicle sales by 2030 (10% by 2025 and 100% by 2040). To support that, CAD130 million is available through the 2019 Budget (2019-2024), for deploying charging and refuelling stations in localized areas, among others. In 2021, the target year has been moved from 2040 to 2035. The 2021 update has not been quantified. |
| Buildings | EcoENERGY efficiency (2011) ³⁾ | This program supports the implementation of energy codes, among other things, to improve energy efficiency of buildings. |
| | Federal Energy Efficient Equipment and Appliances Program (2007) | This policy is expected to result in GHG emissions reduction of 10.4 MtCO ₂ eq by 2030, relative to baseline. |
| | Building Energy Technology Programme (2019) ⁵⁾ | This policy sets out a target of a 50% improvement in energy performance of buildings. Various levels of government will develop increasingly stringent building codes, starting in 2020, aiming for provinces and territories to adopt a 'net-zero energy ready' model building code by 2030 |

| Sector | Policies (marked with '(+)' when mentioned in the NDC document) | Description |
|--------------------------|--|---|
| Agriculture and forestry | The Growing Forward 2 (2013) ^{4), 5)} | Supports the initiatives to advance environmentally sustainable agriculture. |
| | Green Construction through Wood Program (2018) ^{4), 5)} | This program supports projects and activities that increase the use of wood as a building material in infrastructure projects |

¹⁾ Not quantified in NewClimate Institute projections. We note that emissions reduction of 50 – 60 MtCO₂e in 2022 are expected (British Columbia, 2019). ²⁾ In IMAGE, this policy is not extended beyond the target year (Appendix A5), which results in a rebound after 2025. NewClimate Institute calculations assume continuation of the policy, in line with official projections. ³⁾ Quantified in PBL IMAGE model as building codes for space heating. The second biennial report estimated the mitigation impact of this policy to be 6.5 MtCO₂/year by 2020, relative to their baseline (Government of Canada, 2016). ⁴⁾ Not quantified in IIASA model projections. ⁵⁾ Not quantified in PBL IMAGE model projections.

Table 13: 2015 historical data and 2030 projections of key GHG indicators for Canada. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|--|-------------------|--|--|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (excl. LULUCF) – estimates (MtCO ₂ e) | 733 | 710 to 734 (-3% to 0%) | 443 to 406 (-40% to -45%) |
| GHG emissions per capita (tCO ₂ e/cap) | 20.6 | 17.4 to 18 (-16% to -13%) | 9.9 to 10.8 (-52% to -47%) |
| GHG emissions per GDP (tCO ₂ e/thousand USD) | 0.5 | 0.3 (-25% to -22%) | 0.2 (-53% to -57%) |

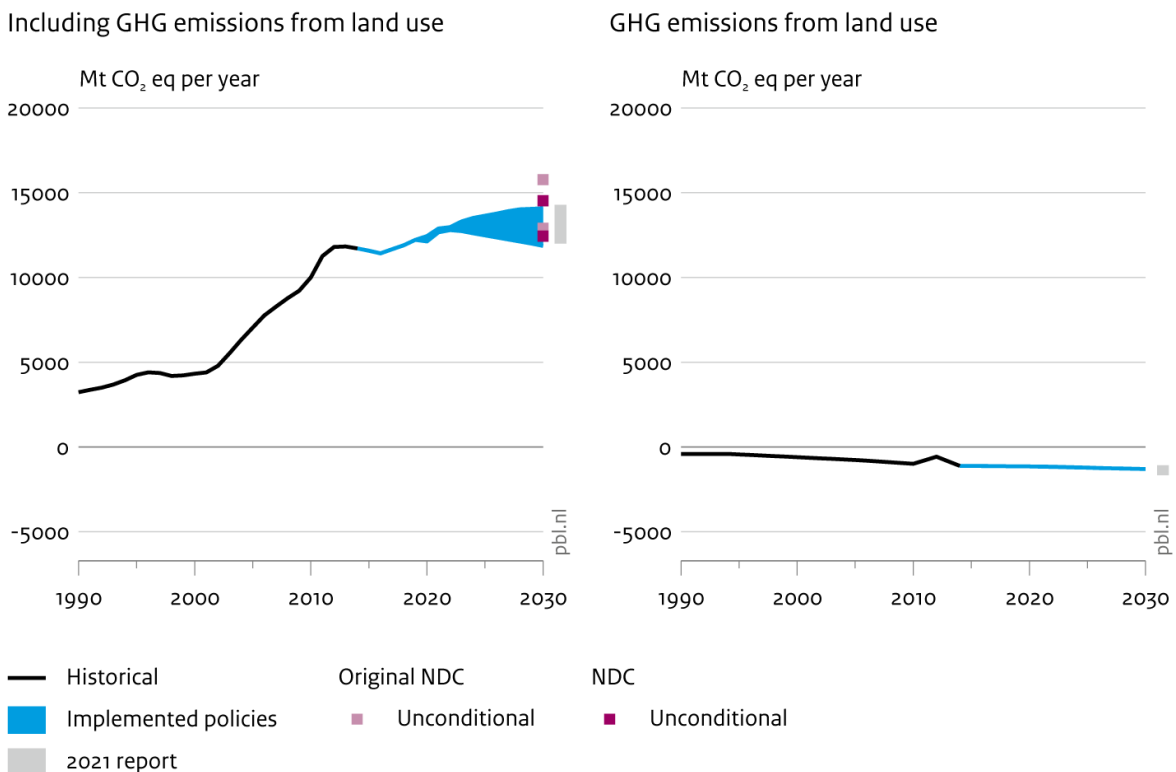
3.5 China

Recent developments: China submitted its carbon neutrality before 2060 target and updated NDC targets, improving on its non-fossil share (around 25% in 2030, up from 20%) and carbon intensity targets (over 65% in 2030 from the 2005 level, up from the previous by 60–65%), while adding a new renewable energy target (1,200 GW of wind and solar by 2030) (Government of China, 2021c, 2021b).

China's international targets are supported by its *Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality and Action Plan For Carbon Dioxide Peaking Before 2030*, as well as the 14th Five Year Plan (FYP). These include economy-wide energy (-13.5% compared to 2020) and carbon intensity (-18% compared to 2020) reduction targets, as well as a peak in coal consumption by 2025 (NDRC, 2021, 2022b; People's Government of Fujian Province, 2021). Other high-impact targets from the 14th FYP include 2025 electrification (30% of final energy consumption) and renewable energy targets (3300 TWh of renewable generation) (NDRC, 2022a; NDRC & NEA, 2022). China has been strengthening energy security in the wake of the global energy supply crunch: in 2021, it produced its highest-ever annual output in coal production but also installed renewable capacity passing 1,000 GW (National Bureau of Statistics, 2022). Emissions have declined in the first half of 2022 as the Chinese economy is continually constrained with the country's zero-covid policy.

Projections: China's updated NDC is more ambitious than the previous and the country is on track to meet it with existing policies. The lower end of our emission projections indicates that the country could peak its emissions between before 2025 but the upper end still projects emissions increasing up to 2030, although at a slower rate compared to historical growth.

Impact of climate policies on greenhouse gas emissions in China



Source: PBL IMAGE model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 7: Impact of climate policies on greenhouse gas emissions in China (upper end: PBL IMAGE model, lower end: NewClimate Institute calculations). The grey bar gives the range of our 2021 projections.

Table 14: China's NDCs as presented in official sources. N/A: not available or not applicable.

| Indicator | 2016 NDC | 2021 NDC |
|---|--|---|
| Business-as-Usual (BAU) | N/A | N/A |
| Target: unconditional | Peaking CO ₂ emissions around 2030; 60-65% CO ₂ emission intensity reduction by 2030, compared to 2005 levels; 20% non-fossil fuels in primary energy supply by 2030 and increased forest stock volume | Peaking CO ₂ emissions before 2030 (and achieving carbon neutrality before 2060); lowering CO ₂ emission per unit of GDP by over 65% by 2030 below 2005 levels; around 25% share of non-fossil fuels in primary energy consumption by 2030, increasing forest stock (see below), increasing total installed capacity of wind and solar to 1,200 GW by 2030. |
| Target: conditional | N/A | N/A |
| Sectoral coverage | Not specified | Not specified |
| General Accounting method | Not specified | Not specified |
| GHGs covered | CO ₂ only | CO ₂ only |
| Consideration of LULUCF | Targets for the land-use sector are included in the NDC The forest stock in China will be increased by 4.5 billion m ³ by 2030, compared to 2005 levels Accounting approaches and methodologies are not specified | Targets for the land-use sector are included in the NDC The forest stock in China will be increased by 6 billion m ³ by 2030, compared to 2005 levels Accounting approaches and methodologies are not yet specified |
| Use of bilateral, regional and international credits | Not specified | Not specified |
| Other sector-level targets | Reductions of HCFC22 production of 35% by 2020 and 67.5% by 2025 below 2010 levels | Not specified |

Table 15: Overview of key climate change mitigation policies in China (Central Compilation & Translation Press, 2016; Government of China, 2021; Government of China, 2014, 2016, 2021a; Government of P. R. China, 2020; Jinnan, 2022; Library of Congress, 2020; Science and Technology Innovation Bureau, 2022; Sino-German Cooperation on Climate Change, 2021; South China Morning Post, 2018; State Council, 2015; UNFCCC, 2012; Wang, 2022; Xinhua, 2019)

| Sector | Policies (marked with '(+)' when mentioned in the NDC document) | Description |
|----------------------|---|--|
| Cross-cutting | National Action Plan on Climate Change (2014) ^{1), 2)} | This plan sets out an emissions trading program for the power sector expected to be operational by 2020. |
| | 14th Five-Year Plan (2021-2025) ⁵⁾ | This policy sets out several targets, including: 20% non-fossil share in TPES in 2025 (NDC non-fossil target moved to 2025) Energy intensity cut by 13.5% over the period ²⁾ Carbon intensity cut by 18% over the period ²⁾ |

| Sector | Policies (marked with '(+)' when mentioned in the NDC document) | Description |
|---------------|---|--|
| | Medium and Long-Term Plan for the Development of Hydrogen Energy Industry (2021-2035) ^{2) 1)} | This policy sets out the target of producing 100,000-200,000 tonnes of hydrogen with renewable sources by 2025 |
| | Kigali Amendment ¹⁾ | <p>Phase down schedule for the use of HFCs expressed in % compared to baseline, in year:</p> <ul style="list-style-type: none"> - Peak in 2024 at consumption levels of 2020-2022 - 90% by 2029 - 70% by 2035 - 50% by 2040 - 20% by 2045 |
| Energy supply | 14 FYP Modern Energy System Planning ⁷⁾ | <p>This policy sets out several targets, including:</p> <p>"About" 39% non-fossil power generation 2025</p> <p>Energy production capacity of 4.6 billion tonnes coal equivalent, 200 million tonnes of oil and 230 billion cubic metres of gas by 2025</p> <p>Electricity generation 30% of total final energy consumption</p> <p>Total installed power capacity 3000 GW</p> |
| | Energy Supply and Consumption Revolution Strategy (2016-2030) ¹⁾ | <p>This policy sets out several targets, including:</p> <p>15% share of gas in total primary energy consumption in 2030⁸⁾</p> <p>Cap at 6 billion tonnes coal equivalent in total primary energy consumption in 2030</p> <p>Non-fossil share of electricity generation over 50% by 2030</p> |
| | Notice on Printing and Distributing the "Guiding Opinions on Promoting the High-quality Development of Central Enterprises and Doing a Good Job in Carbon Neutralization" ¹⁾ | This policy sets out the target of renewables making up half of all installed power capacity by 2025 |
| | Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy ¹⁾ | <p>This policy sets out several targets, including:</p> <p>Strictly limit the increase in coal consumption over the 14th Five-Year Plan period (2021-2025) and phase it down in the 15th Five-Year Plan period (2026-2030)</p> <p>Petroleum consumption to reach its peak and plateau during the 15th Five year plan period (2026-2030)</p> |
| | Energy Development Strategy Action Plan (2014-2020) ¹⁾ | <p>This policy sets out several targets, including:</p> <p>Cap on coal consumption in 2020 at 4.1 billion tce (84.5 EJ/year) ⁵⁾</p> <p>A 10% target share of gas in primary energy supply in 2020 ^{5) 6)}</p> <p>Limit share of coal to 58% of total energy supply by 2020 ¹⁾</p> <p>15% non-fossil fuel share in TPES in 2020 ⁵⁾</p> <p>Renewable electricity: 340 GW hydropower excl. pumped storage, 210 GW wind, 105 GW solar PV, 5 GW solar thermal, 15 GW biomass, 0.1 GW tidal</p> <p>800 million m² collector area ¹⁾</p> <p>10 million tonnes ethanol, 2 million tonnes biodiesel ¹⁾</p> |

| Sector | Policies (marked with '(+)' when mentioned in the NDC document) | Description |
|--------------------------|--|--|
| | | 58 GW nuclear power (150 GW by 2030) |
| | Action Plan for Upgrading of Coal Power Energy Conservation and Emission Reduction Released (2014) ¹⁾ | This policy sets out the target to reduce average net coal consumption rate of new coal-fired power plants to 300 g of standard coal per kWh (implemented as a coal-fired power plant standard of 840 gCO ₂ /kWh by 2020) ²⁾ . |
| | Renewable portfolio standard benchmark China (2019) | Implemented to achieve non-fossil share target of NDC, will increase consumption of RE and reduce curtailment rates. Covering the period 2020-2025. It includes 35% of electricity to be from RE sources by 2030, also increased 2018 and 2020 non-hydro power consumption targets for some provinces |
| Transport | Mid-Century Long-Term Low Greenhouse Gas Emission Development Strategy ¹⁾ | This policy sets out the target to achieve around 40% market share of vehicles sold for NEVs (new energy vehicles, including EVs) |
| | Vehicle fuel economy standards (2005) | This policy sets out new fuel efficiency standards for new heavy-duty trucks of 1.2 MJ/tkm by 2021. |
| | Expansion of Ethanol Production and Promotion for Transportation Fuel (2017) | This policy sets out a new ethanol blending mandate of 10% (E10) in selected provinces by 2020. In January 2020, the rollout of the 10% mandate was suspended and it remains suspended indefinitely. |
| | 'Made in China 2025' standards for auto industry (2013) | This policy sets out the target of implementing new fuel economy standards of 5L/100 km by 2020, as well as reaching 1 million units of new energy vehicles sold in 2020. |
| Industry | Carbon peaking for steel sector ¹⁾ | This policy sets out the target of peaking carbon from the steel sector by 2030 |
| | 'Made in China 2025' CO ₂ intensity target (2013) ^{2) 5)} | This policy sets out the target for manufacturing industries to reduce their CO ₂ emissions per unit of added value by 22% by 2020 and 40% by 2025 from 2015 levels. |
| Buildings | Green Industry Development Plan (2016-2020) China 2016 ^{2) 5)} | This policy sets out the target to decrease energy consumption per value added by 18% between 2015 and 2020. |
| | Mid-Century Long-Term Low Greenhouse Gas Emission Development Strategy ¹⁾ | This policy sets out several targets, including: Implementing green building standards in 100% of new buildings by 2025 "strive to" install solar panels on 50% of the rooftops on new public buildings and factories starting in 2025 8% replacement of fossil fuel energy consumption by renewables by 2025 |
| | Appliance Standards and Labelling Programme ¹⁾ | Energy efficiency program supplemented with subsidies and awareness-raising campaigns. |
| | National Building Energy Standard ⁴⁾¹⁾ | This policy sets out the target of 30% of newly constructed buildings to meet new standards by 2020. |
| Agriculture and Forestry | The 14th Five-Year Plan for the development of forestry and grassland conservation (2021-2025) ¹⁾ | This policy sets out several targets, including: Forest coverage to reach 24.1% (ca. 230.53 million hectare) with forest stock volume of 19 billion cubic meters. |

| Sector | Policies (marked with '(+)' when mentioned in the NDC document) | Description |
|--------|--|--|
| | | <p>Commercial harvest over natural forest to be prohibited, preserving 1.944 billion mu of forests (129.6 million hectares).</p> <p>Grassland vegetation cover to reach 57% and protection rate of wetland to reach 55%.</p> <p>Increase of nature reserve areas to 18% of national land area, and transformation of decertified land by 0.1 billion mu (6.67 million hectares).</p> |
| | Program plan for national reserve forest (2018-2035) ¹⁾ | <p>This policy sets out several targets, including:</p> <p>New planted reserve forest (for wood products) of 7 million hectares by 2020, and 20 million hectares by 2035 (i.e., 13 million hectares between 2021 and 2035), with annual forest stock volume increases of 200 million cubic meters (i.e., 10 cubic meters per hectare).</p> <p>Annual forest stock volume increase of native species and the large-diameter timber volume to reach 63 million cubic meters.</p> |
| | Revision of Forestry Law of the People's Republic of China (2019) ¹⁾ | <p>China revised its Forest Law for the first time in 20 years, with the most significant policy change being the implementation of a ban (in effect as of July 2020) on the purchasing, processing, or transport of illegal logs for Chinese companies. The law enhances protection for forests classified by the law as public-benefit, natural, protected, or rare. The law also includes changes to the forest tenure system, afforestation mechanism, forest resource protection system, and the forest management, and harvesting mechanism.</p> |
| | Revision of Land Administration Law of the People's Republic of China (2019) ¹⁾ | <p>The law, which became effective in January 2020, re-affirms a policy redline of a minimum of 120 Mha of arable land. In case of conversion of agricultural land, the law requires the same area and quality of land be reclaimed for agricultural use.</p> |
| | 15-year plan (2021-2035) to protect ecosystems (2020) ³⁾ | <p>This policy sets out several objectives, including targets to increase forest cover to 26% of national land area by 2035 and forest stock volume to 21 cubic meters, to stabilize natural forest area at 200 million h and to increase grassland vegetation cover to 60% and nature reserve areas to 18%</p> |

¹⁾ Not quantified in PBL IMAGE model projections. ²⁾ Not quantified in NewClimate Institute projections.

³⁾ Not quantified in IIASA model projections. ⁴⁾ Implemented by PBL via assuming standard means 439 MJ/m². ⁵⁾ Not quantified separately in PBL IMAGE projections, but achievement checked after implementation of other (related) targets. ⁶⁾ The Energy Supply and Consumption Revolution Strategy (2016-2030) presents a 15% natural gas target in energy supply by 2030. This target is included in NewClimate projections instead of the one presented in the Energy Development Strategy Action Plan (2014-2020). ⁷⁾ The 14th FYP Modern Energy System Planning is partially implemented in the IMAGE model, but the 39% non-fossil target is unfeasible by 2025 (33% reached instead). ⁸⁾ In NewClimate Institute's projections this target was considered unfeasible and was revised to 12% in 2030 aligned with CNPC projections

Table 16: 2015 historical data and 2030 projections of key GHG indicators for China. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|---|----------------------|--|---|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (incl. LULUCF) – estimates (MtCO₂e) | 11600 | 11900 to 14100 (2% to 22%) | 14500 to 12400 (25% to 7%) |
| GHG emissions per capita (tCO₂e/cap) | 8.3 | 8.4 to 9.9 (+1% to +19%) | 8.8 to 10.2 (+5% to +23%) |
| GHG emissions per GDP (tCO₂e/thousand USD) | 1.0 | 0.6 to 0.7 (-52% to -43%) | 0.8 to 0.7 (-42% to -50%) |

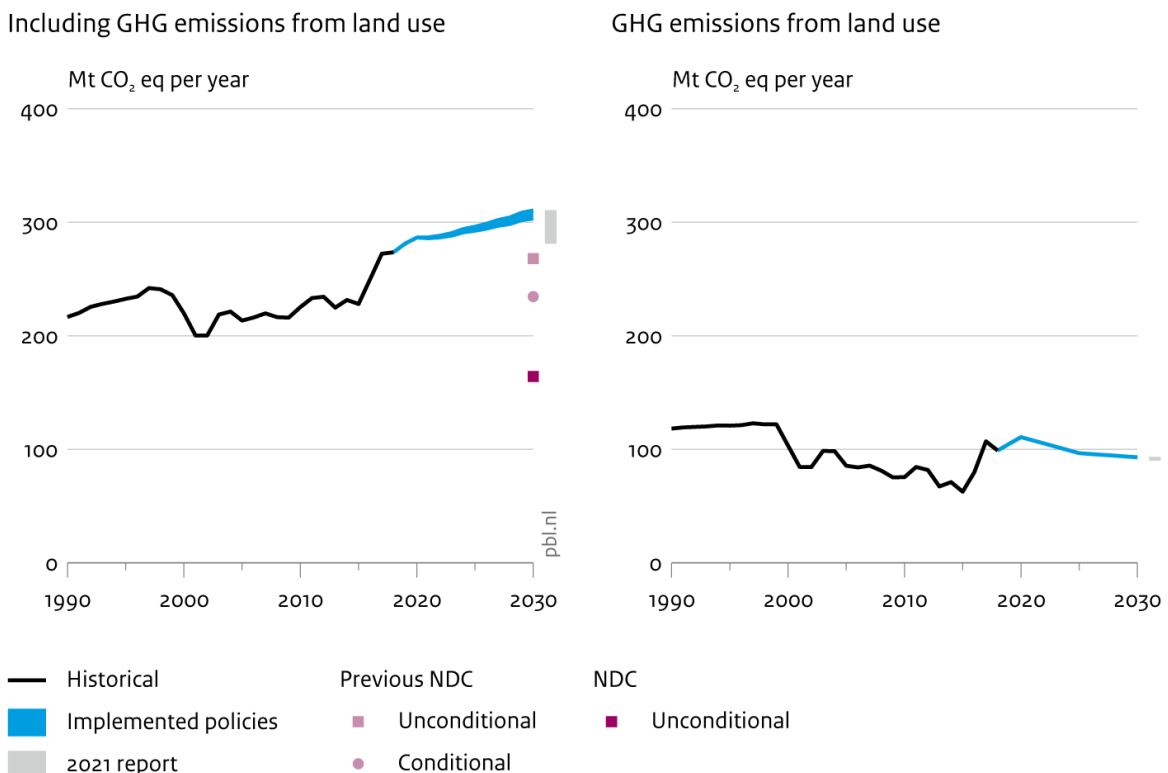
3.6 Colombia

Recent developments: Colombia submitted its updated NDC in December 2020, which is more ambitious and robust than the previous one. The updated NDC sets an absolute emissions limit of 169 MtCO₂e, equivalent to a 51% reduction of emissions by 2030 compared to the BAU scenario. The target mentions the intention to peak emissions between 2027-2030 and to achieve most of the emissions reductions through the LULUCF sector, supported by a target of reducing deforestation to 50,000 hectares by 2030, with a view of net zero deforestation by 2030. This is not in line with current deforestation levels, which continue to grow every year and reached 174,000 hectares in 2021.

Colombia's President Gustavo Petro, who was sworn into office in August 2022, has made climate change and the energy transition one of his government's top priorities. Some measures proposed so far include to increase the penetration of non-conventional renewable energies in the electricity system, suspend new oil and gas exploration, suspend pilot projects for exploration and production of unconventional fossil deposits using hydraulic fracturing (fracking) techniques, and put climate efforts at the centre of negotiations and trade with other countries. It is still unclear how these objectives will be reflected in policies and action.

Projections: Colombia will likely miss both original and updated targets with the current adopted policies. Emissions projections are higher in comparison to our previous projections mostly due to new accounting methods for natural forests and the projected increase in deforestation-induced, land use emissions.

Impact of climate policies on greenhouse gas emissions in Colombia



Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 8: Impact of climate policies on greenhouse gas emissions in Colombia. Emissions trajectories are based exclusively on NewClimate and IIASA's projections. The grey bar gives the range of our 2021 projections.

Table 17: Colombia's NDCs as presented in official sources. N/A: not available or not applicable.

| Indicator | 2018 NDC | 2020 NDC |
|---|--|---|
| Business-as-Usual (BAU) | 335 MtCO ₂ e in 2030 | N/A |
| Target: unconditional | 20% GHG reduction with respect to BAU by 2030 | Generate a maximum of 169.44 MtCO ₂ e, which corresponds to a 51% reduction in emissions compared to the reference scenario. |
| Target: conditional | 30% GHG reduction with respect to BAU by 2030, subject to international support | N/A |
| Sectoral coverage | Economy-wide | Economy-wide |
| General Accounting method | IPCC guidelines; 100-year GWPs from SAR | IPCC guidelines; 100-year GWP from IPCC AR5 |
| GHGs covered | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ |
| Consideration of LULUCF | Land-use sector is included in the target. Accounting approaches and methodologies are not specified. BAU calculation excludes removals from natural forests that remain as natural forests in the target year | Land-use sector is included in the target. Based on NREF projections to 2030 using a national methodology, deforestation emission reductions are calculated for the NDC, the MRV system is in charge of the SMBYC. The objective is to reduce the deforestation rate to 50,000 ha/year by 2030. The carbon dioxide removals for the natural forests that remain as such are not accounted. |
| Use of bilateral, regional and international credits | Intention of participating in international carbon markets under Article 6 of the Paris Agreement | Intention of participating in international carbon markets under Article 6 of the Paris Agreement |

Table 18: Overview of key climate change mitigation policies in Colombia (Assman, 2017; CCAP, 2016; Government of Colombia, 2018a, 2018b, 2021a, 2021b; IEA, 2013; Ministry of Environment and Sustainable Development, 2016, 2017b, 2017a; Ministry of Finance and Public Credit, 2017; Ministry of Mines and Energy of Colombia, 2020; National Congress of Colombia, 2016; Transport NAMA Database, 2017b, 2017a; UPME, 2017)

| Sector | Policies ³⁾ (marked with '(+)' when mentioned in the NDC document) | Description |
|----------------------|---|--|
| Cross-cutting | Decree 926 (2017) ¹⁾ | This decree establishes a mechanism for exemption of the national liquid fossil fuel Carbon Tax (Law 1819 Art 221). To be exempt, actors need to demonstrate carbon neutrality (achieved through offsets from external projects on, e.g., renewable energy and energy efficiency.) |
| | Resolution No.1988 (September 2017) ¹⁾ Resolution No.585 (October 2017) ¹⁾ | Resolution No. 1988 establishes the adoption of environmental goals and measures in the transportation, energy, industry, and buildings sectors, as described in the Indicative Action Plan on energy efficiency (PROURE) 2017–2022 (Resolution No. 41286 of 2016). The resolution No. 585 establishes procedures to carry out those measures. |
| Energy supply | Colombian Low-Carbon Development Strategy (+) (ECDBC) (2012) | Through the implementation of eight Sectoral Mitigation Action Plans, this strategy aims to deviate from BAU emissions levels, which are estimated to be over 60% from current levels by 2030. |

| Sector | Policies ³⁾ (marked with '(+)' when mentioned in the NDC document) | Description |
|--------------------------|--|--|
| | Law 697: Programme for rational and efficient use of energy and other forms of non-conventional Energy (PROURE) (2010; latest adopted in 2016) ¹⁾ | This policy sets out the target to reach a 9.05% energy efficiency improvement in the transport and industry sectors between 2017 and 2022. |
| Buildings | NAMA Project for the domestic refrigeration sector (2017-2021) | This program aims at a reduction of emissions from the domestic refrigeration sector. It sets out the target of an annual reduction of around 3.8 MtCO ₂ e by 2030 (50% reduction from BAU) and 16.8 MtCO ₂ e over the lifetime of a single equipment. |
| | National policy for sustainable buildings (2018) ¹⁾ | This policy aims at making new construction in Colombia more energy efficient. |
| Transport | NAMA Project for Transit Development (TOD) (2015 to 2019) | This program supports the construction of lasting infrastructure and buildings that will lock in efficient land use and travel patterns with estimated annual emissions reduction between 3.6 to 5.5 MtCO ₂ e/year by 2040. |
| Agriculture and Forestry | The National Development Plan of Colombia (+) (2015) | This policy sets out the target to reduce the annual deforestation rate from 121,000 hectares in 2013 to 90,000 hectares by 2018. |
| | REDD+ Zero Deforestation in the Amazon by 2020 (2009) ²⁾ | This plan consists of four phases of strategy with a total of 18.5 million USD for planning and implementation. |
| | Resolution to increase the area of protected forest land in the Amazon (2018) | This policy sets out a target to increase Colombia's protected forest area coverage to 30 million hectares to reach a total of 38 million hectares. |
| | National Policy for the Control of Deforestation and Sustainable Management of Forests (2021) ²⁾ | This policy aims to implement cross-sectoral strategies for deforestation control and forest management that promote the sustainable use of natural capital, the forest economy, and community development in areas of high deforestation. |
| | Decree 690 on the sustainable management of wild flora and non-timber forest products (2021) ²⁾ | This policy regulates the sustainable management of wild flora and non-timber forest and non-timber forest products, to be applied by environmental authorities and by anyone interested in the management of these products. of these products. |

¹⁾ Not quantified in NewClimate Institute projections. ²⁾ Not quantified in IIASA model projections.

Table 19: 2015 historical data and 2030 projections of key GHG indicators for Colombia. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|--|-------------------|--|--|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (incl. LULUCF) – estimates (MtCO ₂ e) | 228 | 303 to 310 (33% to 36%) | 164 (-28%) |
| GHG emissions per capita (tCO ₂ e/cap) | 4.9 | 5.6 to 5.8 (+16% to +18%) | 3 (-38%) |
| GHG emissions per GDP (tCO ₂ e/thousand USD) | 0.8 | 0.5 to 0.6 (-14% to -12%) | 0.3 (-53%) |

3.7 Egypt

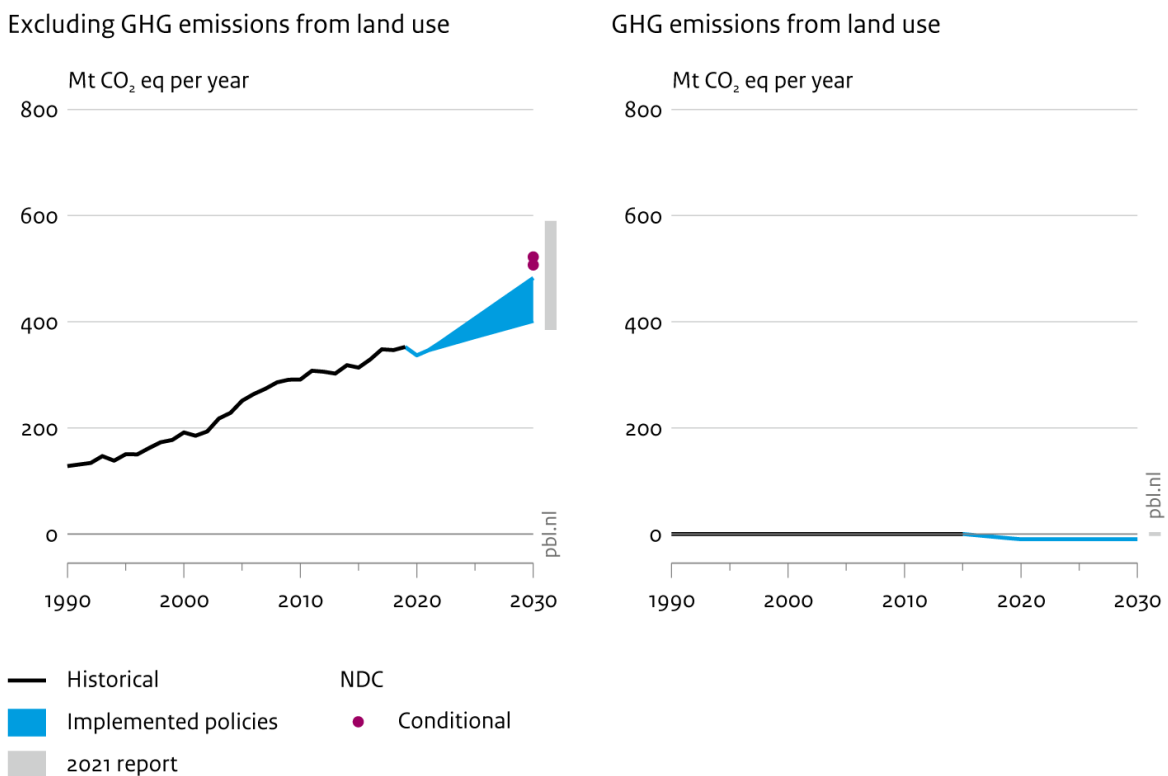
Recent developments: In July 2022, Egypt submitted an update to its NDC that includes quantified emissions reduction targets for the electricity, transport and oil and gas sectors, as well as non-quantified measures for the industry, tourism, buildings and waste sectors.

The Integrated Sustainable Energy Strategy to 2035 (ISES 2035), issued in 2015, is still the main energy sector policy. The strategy maintains the target set in the 2008 National Renewable Energy Strategy of reaching 20% of the electricity generation mix from renewables (IEA, 2008) but postpones the deadline to 2022 and adds the target of 42% by 2035 (IRENA, 2018). This target was confirmed again in the updated NDC, which also sets an interim objective of reaching 40% of renewable energy by 2030 (Government of Egypt, 2022). In 2020, electricity generation from renewable energy stood at 12% (IRENA, 2022a).

Egypt is planning to increase the use of gas in various sectors, including transport. In 2020, President al-Sisi announced a plan to convert 450,000 cars to run on compressed natural gas (CNG) by 2023—which would bring the total number of cars running on CNG to one million (Government of Egypt, 2021). The government is also working on a national hydrogen strategy (EBRD, 2022).

Projections: Egypt's updated NDC for the first time included a quantifiable target. However, the target is fully conditional on international support, does not cover all sectors and results in emissions above our estimates under currently adopted policies. Egypt is well on track to meet its NDC target.

Impact of climate policies on greenhouse gas emissions in Egypt



Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 9: Impact of climate policies on greenhouse gas emissions in Egypt. Emissions trajectories are based exclusively on NewClimate and IIASA's projections. The grey bar gives the range of our 2021 projections.

Table 20: Egypt's NDCs as presented in official sources. N/A: not available or not applicable

| Indicator | 2017 NDC | 2022 NDC |
|---|---|---|
| Business-as-Usual (BAU) | N/A | BAU for electricity generation, transmission and distribution: 214.7 MtCO ₂ e in 2030 BAU for oil and gas upstream: 2.6 MtCO ₂ e in 2030 BAU for transport: 124.4 MtCO ₂ e in 2030 |
| Target: unconditional | N/A | N/A |
| Target: conditional | N/A | Electricity mitigation target: 33% reduction below BAU levels by 2030 Oil and gas mitigation target: 65% reduction below BAU levels by 2030 Transport mitigation target: 7% reduction below BAU levels by 2030 |
| Sectoral coverage | N/A | Electricity (power generation, transmission, and distribution), oil and gas and transport |
| General Accounting method | N/A | IPCC guidelines; 100-year GWP from SAR |
| GHGs covered | N/A | CO ₂ , CH ₄ , N ₂ O |
| Consideration of LULUCF | N/A | Land-use sector is not included in the target. |
| Use of bilateral, regional and international credits | Intention of participating in international carbon markets under Article 6 of the Paris Agreement | Intention of participating in international carbon markets under Article 6 of the Paris Agreement |

Table 21: Overview of key climate change mitigation policies in Egypt (Egypt Today, 2021; Government of Egypt, 2021; Mazghouny & Co, 2022; Middle East Insights, 2022)

| Sector | Policies | Description |
|---------------------------------|---|--|
| Energy supply | Integrated Sustainable Energy Strategy to 2035 (2015) | This policy sets out a target to reach 20% of power generation from renewable sources by 2022 and 42% by 2035, focusing on wind (14%), hydro (2%) and PV (25%). |
| | Renewable Energy Law (2014) ²⁾ | This law seeks to stimulate the private sector to invest in renewable power generation. The regulation brings diverse mechanisms such as competitive bidding and Feed-in tariffs. |
| | Renewable Energy Tax Incentives (2015) ²⁾ | This policy sets out a reduction of energy sales taxes to 5%, in order to attract private sector investment. |
| Transport | Presidential decree to promote the use of compressed natural gas in transport | This decree sets out the goal of converting 450 thousand vehicles to CNG, reaching a total of 1 million. |
| Agriculture and Forestry | Egypt targets to increase agricultural production by 30% in 2024 (2021) ²⁾ | The Minister of Planning and Economic Development Hala El-Said announced a target to increase the gross domestic product (GDP) contribution of agriculture to 12 percent by 2024, in addition to increasing agricultural production by 30 percent by 2024. |
| | Prime Ministerial Decree no. 104/2022 (2022) ¹⁾²⁾ | This policy sets out investment incentives under articles 11 of Egypt's Investment Law No. 72/2017 and 10 of its Executive Regulations issued by Prime Ministerial Decree no. |

| Sector | Policies | Description |
|--------|--|--|
| | | 2310/2017 including renewable energy projects, agriculture, livestock. |
| | Decree No. 20 includes within the economic development strategy the production, storage, and export of hydrogen and green ammonia. (2022) ¹⁾ ²⁾ | It is established that the production, storage, and export of hydrogen and green ammonia are part of the Economic Development Strategy. To enhance the production of these products is also accompanied by fiscal and tax incentives in the Investment Law No 72 of 2017 (Investment Law). |

¹⁾ Not quantified in IIASA model projections, ²⁾ Not quantified in NewClimate institute projections.

Table 22: 2015 historical data and 2030 projections of key GHG indicators for Egypt. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|---|----------------------|--|--|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (excl. LULUCF) – estimates (MtCO₂e) | 313 | 402 to 482 (28% to 54%) | [522 to 507 (67% to 62%)] |
| GHG emissions per capita (tCO₂e/cap) | 3.2 | 3.2 to 3.9 (-0% to +20%) | [4.2 to 4.1 (26% to 30%)] |
| GHG emissions per GDP (tCO₂e/thousand USD) | 0.9 | 0.7 to 0.9 (-38% to -25%) | [0.9 to 1 (-19% to -21%)] |

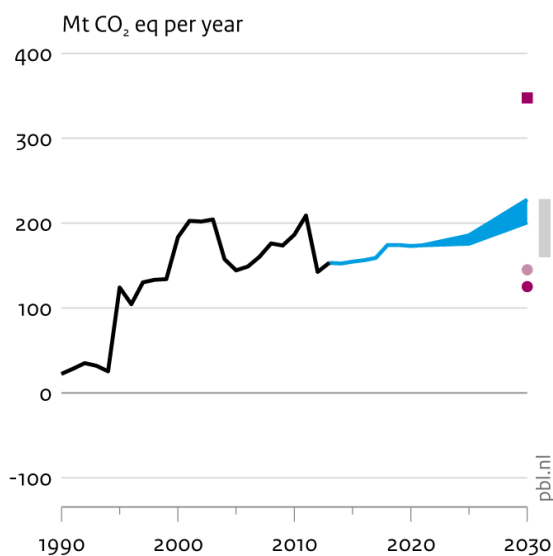
3.8 Ethiopia

Recent developments: Since the start of the civil war at the end of 2020, the Ethiopian government has not announced any larger climate policy developments. The ‘Climate Resilient Green Economy’ (CRGE), first published in 2011 outlining Ethiopia’s mitigation efforts, remains under revision as of August 2022. In 2020, Ethiopia released its *Ten Years Development Plan: A Pathway to Prosperity (2021-2030)* (Government of Ethiopia, 2020), which includes targets for Ethiopia’s so-called “greenhouse gas emissions reduction capacity” without specifying whether and how this links to specific climate policies. A second phase of the Growth and Transformation Plan (GTP II) for 2016 to 2020 aimed for the full implementation of the CRGE by 2025 (NPC, 2016). The GTP II neither specifies on which specific policies the full implementation of the CRGE shall be achieved by 2025 nor how international funding will contribute to its full implementation. For this reason, the GTP II is not included in the current policies scenario projections. The Grand Ethiopian Renaissance Dam (5 GW) and the Koysha dam (2 GW) remain under construction (Gomaa, 2022; Groenendaal, 2020). Since 2019, Ethiopia has implemented large-scale annual tree planting initiatives as part of its Green Legacy initiative (Government of Ethiopia, 2022). The initiative aims to plant more than 20 million seedlings between 2019 and 2022.

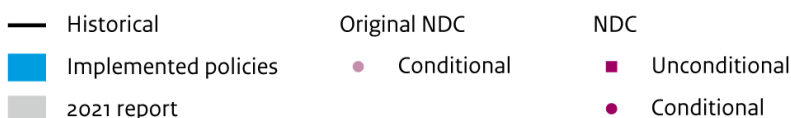
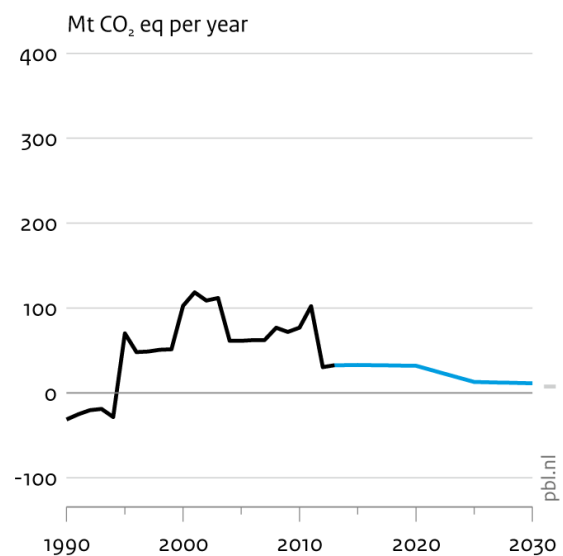
Projections: Ethiopia will likely miss its NDC conditional target with existing policies, but it will meet its unconditional NDC target. 2030 emissions projections are now higher than projected in 2021, this mostly due to an increase in economic growth implied in the Ethiopian official submissions to the UNFCCC and the fast-than-expected growth in historical emissions.

Impact of climate policies on greenhouse gas emissions in Ethiopia

Including GHG emissions from land use



GHG emissions from land use



Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 10: Impact of climate policies on greenhouse gas emissions in Ethiopia. Emissions trajectories are based exclusively on NewClimate and IIASA’s projections. The grey bar gives the range of our 2021 projections.

Table 23: Ethiopia's NDCs as presented in official sources. N/A: not available or not applicable.

| Indicator | 2017 NDC | 2021 NDC |
|---|--|--|
| Business-as-Usual (BAU) | 400 MtCO ₂ e in 2030 | 404 MtCO ₂ e in 2030 |
| Target: unconditional | N/A | 347 MtCO ₂ e including LULUCF in 2030, equivalent 14% (-56 MtCO ₂ e) reduction compared to revised BAU in 2030 and in line with Ethiopia's intention of 20% unconditional contributions |
| Target: partially conditional | 64% GHG reduction (255 MtCO ₂ e reduction) from the BAU scenario in 2030 (partially conditional on international financial resources) | 126 MtCO ₂ e including LULUCF in 2030, equivalent 69% (-277.7 MtCO ₂ e) reduction compared to revised BAU in 2030 and in line with Ethiopia's intention of 80% conditional contributions |
| Sectoral coverage | Agriculture, Forestry, Industry (including mining), Transport, Buildings (including Waste and Green Cities), Electric power | Economy-wide |
| General Accounting method | IPCC 2006 guidelines; 100-year GWPs from AR4 | IPCC 2006 guidelines and 2013 IPCC Kyoto Protocol Supplement; 100-year GWPs from AR5 |
| GHGs covered | CO ₂ , CH ₄ and N ₂ O | CO ₂ , CH ₄ and N ₂ O |
| Consideration of LULUCF | LULUCF is included in the target. A reduction of net LULUCF emissions is expected in the range of 90 MtCO ₂ e from agriculture and 130 MtCO ₂ e from forestry by 2030 as compared to projected BAU levels. These reductions are part of the total reduction target. Accounting approaches and methodologies have not been specified. | LULUCF is included in both the unconditional and conditional targets. In the unconditional target, it contributes with reduction of 48.4 MtCO ₂ e and in the conditional target with reductions of 240.1 MtCO ₂ e below 2030 BAU. Accounting approaches and methodologies have not been specified. |
| Use of bilateral, regional and international credits | Intention of participating in international carbon markets under Article 6 of the Paris Agreement | Intention of participating in international carbon markets under Article 6 of the Paris Agreement |

Table 24: Overview of key climate change mitigation policies in Ethiopia (Eshete & Stoop, 2007; Ethiopian News Agency, 2020; Ethiopian Press Agency, 2020; Federal Democratic Republic of Ethiopia, 2011, 2016; Ministry of Environment and Forest, 2015)

| Sector | Policies ⁴⁾ (marked with '(+)' when mentioned in the NDC document) | Description |
|----------------------|--|---|
| Cross-cutting | Climate Resilience and Green Economy Strategy (CRGE) (2011) (+) ¹⁾ | This strategy includes various mitigation measures to limit economy-wide GHG emissions in 2030 to 150 MtCO ₂ e (250 MtCO ₂ e below BAU). It also sets out the target of developing up to 25 GW of renewable power capacity by 2030. |
| Energy supply | Growth and Transformation Plan II (2016) (+) ¹⁾ | This policy defines twelve major targets for the energy sector for the period 2015 to 2020 such as increasing power generating capacity from 4 GW in 2015 to 17 GW by 2020 (with hydropower accounting for over 13 GW) and increasing electricity access from 60% in 2015 to 90% by 2020. |
| | Scaling-Up Renewable Energy Program for Ethiopia (SREP Investment Plan) (2012) | This policy sets out the target to increase power generation capacity from the present level of 2 GW to 10 GW by 2015 and to 25 GW by 2030. |

| Sector | Policies ⁴⁾ (marked with '(+)' when mentioned in the NDC document) | Description |
|---------------------------------|--|---|
| | | Focus on five major investment projects of wind, geothermal and hydroelectric energy generation. |
| | National Biogas Programme (2007) | This policy sets out the target to build 20,000 biogas plants by 2017 (2nd phase: 2014-2017). |
| Transport | Intra-Urban Electric Rail NAMA (2012) ¹⁾ | This policy sets out the target to replace 50% of cargo transport with electric rail transport. This is expected to reduce emissions by 8.9 MtCO ₂ e/year by 2030. |
| Agriculture and Forestry | Afforestation and reforestation actions (part of the CRGE and further specified in NDC of 2021) (2011, update in 2021) (+) | This policy sets out various targets, including the unconditional target of 7 million hectares of afforestation and reforestation by 2030 ¹⁾ Further targets conditional on financial support: <ul style="list-style-type: none"> - Reforestation of 3 million hectares of land by 2030 - Restoration of 5 million hectares of land by 2030 and 9 million hectares of land by 2050 15,000-17,000 hectares of forest to be brought under protection and natural regeneration over a 30-year planning period as part of Ethiopia's Forest Sector Development Plan and other initiatives |
| | Green Legacy initiative (2019) ¹⁾ (+) | The large-scale tree planting initiative aims to plant more than 20 million seedlings through four annual seeding campaigns between 2019 and 2022. |

²⁾ Not quantified in NewClimate Institute's projections.

Table 25: 2015 historical data and 2030 projections of key GHG indicators for Ethiopia. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

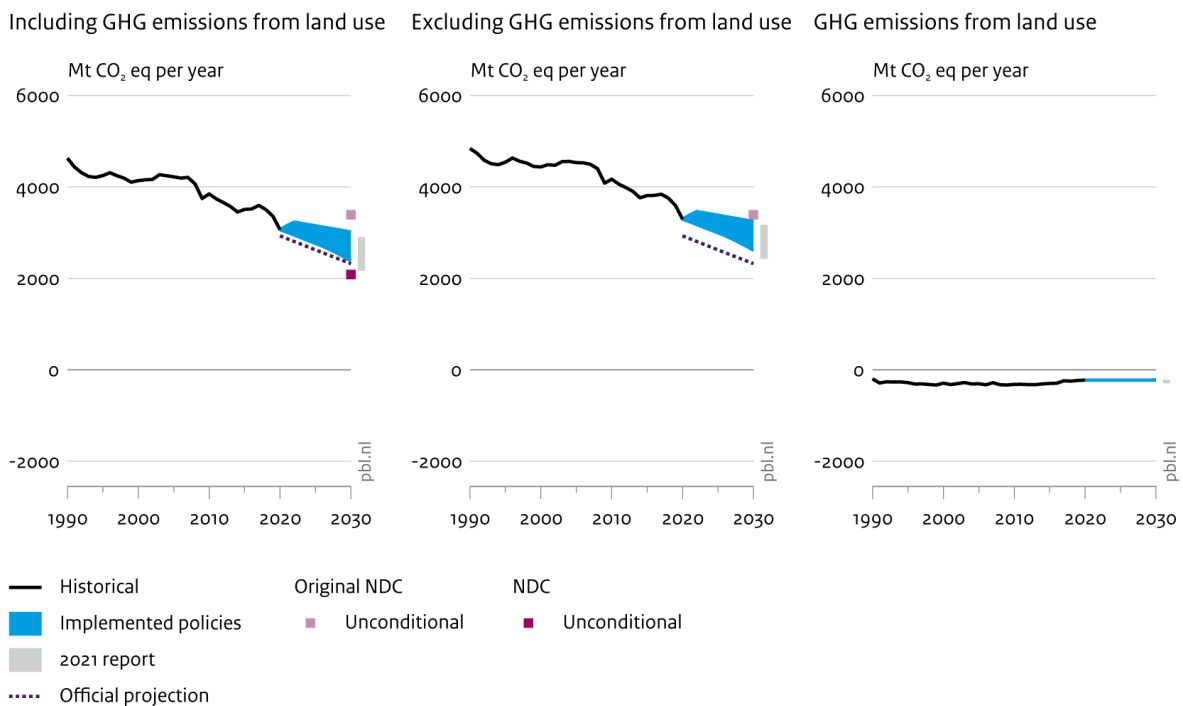
| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|---|-------------------|--|--|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (incl. LULUCF) – estimates (MtCO₂e) | 155 | 201 to 228 (30% to 47%) | 347 (125%) [125 (-19%)] |
| GHG emissions per capita (tCO₂e/cap) | 1.5 | 1.4 to 1.5 (-11% to +1%) | 2.4 (+54%) [0.8 (-45%)] |
| GHG emissions per GDP (tCO₂e/thousand USD) | 2.5 | 1.8 to 2 (-51% to -44%) | 3 (-15%) [1.1 (-69%)] |

3.9 European Union (EU27)

Recent developments: The EU submitted a stronger 2030 NDC target—from at least 40% to at least 55% emissions reductions below 1990—and has set a legal objective to become climate neutral by 2050 under the 2021 European Climate Law (Regulation (EU) 2021/1119). The EU has also adopted multiple plans that would reduce sectoral emissions and increase sink capacity (European Commission, 2020). The ‘Fit for 55’ package sets a wide range of legislative proposals to achieve the 2030 emissions reduction target (European Commission, 2021a). It includes the expansion of the current Emissions Trading System to cover additional sectors, updates to the Effort Sharing Regulation, improvements in the renewables and energy efficiency targets and a carbon border adjustment mechanism, that will ensure that carbon-intensive imports are subject to a carbon price equivalent to that of products from within the EU (European Commission, 2021b). As a response to Russia’s invasion of Ukraine, the EU seeks to rely less on Russian fossil fuel imports. The REpowerEU Plan introduced in May 2022 proposes to further increase renewable targets (from the current 40% to 45% in the overall energy mix by 2030), increase energy efficiency targets (from 9% to 13% below the 2020 reference scenario set out in the Energy Efficiency directive by 2030), among several other measures to diversify its energy supply and reduce overall demand (European Commission, 2022). In July 2022, EU member states also agreed to a 15% voluntary reduction in gas demand until March 2023 (Council of the European Union, 2022).

Projections: The EU27 is projected to overachieve its original NDC target but additional policies are needed to meet its updated, more ambitious NDC target. The full implementation of the Fit for 55 legislative proposals and the REpowerEU Plan (the latter is excluded from our projections) would put the EU on track to achieve its more ambitious target. The uncertainty range in our projections is partially due to the differences between Member State-level (upper end) versus EU-level policies (lower end).

Impact of climate policies on greenhouse gas emissions in EU27



Source: PBL IMAGE model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 11: Impact of climate policies on greenhouse gas emissions in the EU (upper end: NewClimate Institute calculations, lower end: PBL IMAGE model). The grey bar gives the range of our 2021 projections.

Table 26: EU's NDCs as presented in official sources. N/A: not available or not applicable.

| Indicator | 2016 NDC | 2020 NDC |
|---|--|--|
| Business-as-Usual (BAU) | N/A | N/A |
| Target: unconditional | At least 40% greenhouse gas reduction by 2030 from 1990 level | At least 55% net greenhouse gas reduction by 2030 from 1990 level |
| Target: conditional | N/A | N/A |
| Sectoral coverage | Economy-wide | Economy-wide |
| General Accounting method | IPCC guidelines; 100-year GWPs from AR4 | IPCC guidelines 2006; 100-year GWPs from AR5 |
| GHGs covered | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ and NF ₃ | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ and NF ₃ |
| Consideration of LULUCF | Land-use sector is included in the target. A decision on how to include the land-use sector was adopted in 2018. ¹⁾ | Land-use sector is included in the target and the target is defined as a net GHG reduction target. Contribution of net removals in 2030 from the LULUCF sink is limited to 225 MtCO ₂ e under the European Climate Law (2021/1119). Projected reference levels for Managed Forest Land (Forest Land remaining Forest Land) take into consideration age-class structure of forest so that changes in management practices are accounted; see also Art 8 and Annex IV of Regulation (EU) 2018/841. |
| Use of bilateral, regional and international credits | No | No |

¹⁾The regulation on the inclusion of greenhouse gas emissions and removals from the LULUCF sector into the 2030 climate and energy framework (Regulation 2018/841) was adopted by the Council on 14 May 2018 (European Parliament, 2018).

Table 27: Overview of key climate change mitigation policies in the EU27 (Council of the European Union, 2017; European Commission, 2021d; European Environment Agency, 2020; European Parliament, 2009a, 2009b; European Parliament and the Council of the European Union, 2014, 2018)

| Sector | Policies (marked with '(+) when mentioned in the NDC document) | Description |
|----------------------|--|---|
| Cross-cutting | EU ETS Directive (2003/87/EC revised by Directive 2018/410/EU) | This directive establishes a cap on emissions from electricity/heat and industry to reduce emissions by 43% below 2005 levels by 2030. The cap is reduced at an annual rate of 2.2%, from 2021 onwards. |
| | Effort sharing regulation (annual GHG targets for non-ETS sectors in the period 2021-2030) (2018) ^{1) 3)} | This policy sets out a target to reduce GHG emissions from non-ETS sectors by 30% by 2030, relative to 2005 |
| | Revised Energy Efficiency Directive (EED) EU 2018/2002 ³⁾ | This policy sets out a target to reduce final energy consumption by 32.5% (compared to the 2007 modelling projections for 2030) with a possible revision in 2023. |
| | F-gas regulation (517/2014) | This policy sets out a target to reduce F-gas emissions by 37% by 2020 and by 79% by 2030, relative to the average values between 2009 and 2012. |

| Sector | Policies (marked with '(+)' when mentioned in the NDC document) | Description |
|---------------------------------|---|--|
| Energy supply | Renewable energy directive (Directive 2018/2001; RED II) ³⁾ | This policy sets out a target to reach a share of 32% renewables in final energy consumption by 2030 with a possible revision in 2023. |
| Buildings | Eco-design Framework Directive (Directive 2009/125/EC) | This policy sets out a series of specific standards for a wide range of appliances |
| | Energy Performance of Buildings EU 2018/844 | This policy sets out a target for all new buildings to be nearly zero-energy from 2021 onwards. |
| Transport | Regulation of CO ₂ emissions from passenger vehicles (443/2009, updated April 2019), and heavy-duty vehicles (February 2019) | This policy sets out a series of targets, including: <ul style="list-style-type: none"> - Emission standard of 95 gCO₂/km, phasing in for 95% of vehicles by 2020 with 100% compliance by 2021 - By 2030, emissions will have to be 37.5% lower for new cars and 31% lower for new vans compared to 2021 levels. This measure also sets a 15% reduction target by 2025 compared to 2021 levels for both vehicle types - New heavy-duty trucks: 30% reduction of CO₂ emissions per tonne-km from 2019 levels by 2030 - The share of renewable energy within the final consumption of energy in the transport sector is at least 14 % by 2030⁴⁾ |
| Agriculture and Forestry | EU Biodiversity Strategy for 2030 (2020) ²⁾ | Part of the European Green Deal, a strategy by the European Commission which proposes several actions related to biodiversity, including the aim to legally protect 30% of the area in the EU, of which 30% would be strictly protected. |
| | EU LULUCF Regulation (2021) | This policy regulates the inclusion of the LULUCF sector in the overall EU 2030 climate and energy framework and the overall GHG emission reduction target for EU. Provides updated accounting rules and a no-debit rule that all Member State have to ensure that the accounted GHG emissions from the LULUCF sector are balanced by at least an equivalent accounted amount of removals of CO ₂ . |
| | EU Farm to Fork Strategy (2019) ²⁾ | This policy is part of the European Green Deal, a strategy by the European Commission related to fair, healthy and environment-friendly food systems. |
| | 3 Billion Trees Pledge (map tree counter) (2021) | Under the European Green Deal, the EU biodiversity strategy for 2030 commits to planting at least 3 billion additional trees in the EU by 2030 in full respect of ecological principles. |

¹⁾ Not quantified in NewClimate Institute and PBL IMAGE model projections. ²⁾ Not quantified in IIASA model projections. ³⁾ Not quantified separately in PBL IMAGE model projections, but achievement checked after implementation of other (related) targets. The final energy consumption target is interpreted alternatively as a maximum final energy target according to a PRIMES Baseline and is reached. The share of renewables in final energy consumption target is within reach. ⁴⁾ Not quantified separately in PBL IMAGE model projections.

Table 28: 2015 historical data and 2030 projections of key GHG indicators for the EU. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

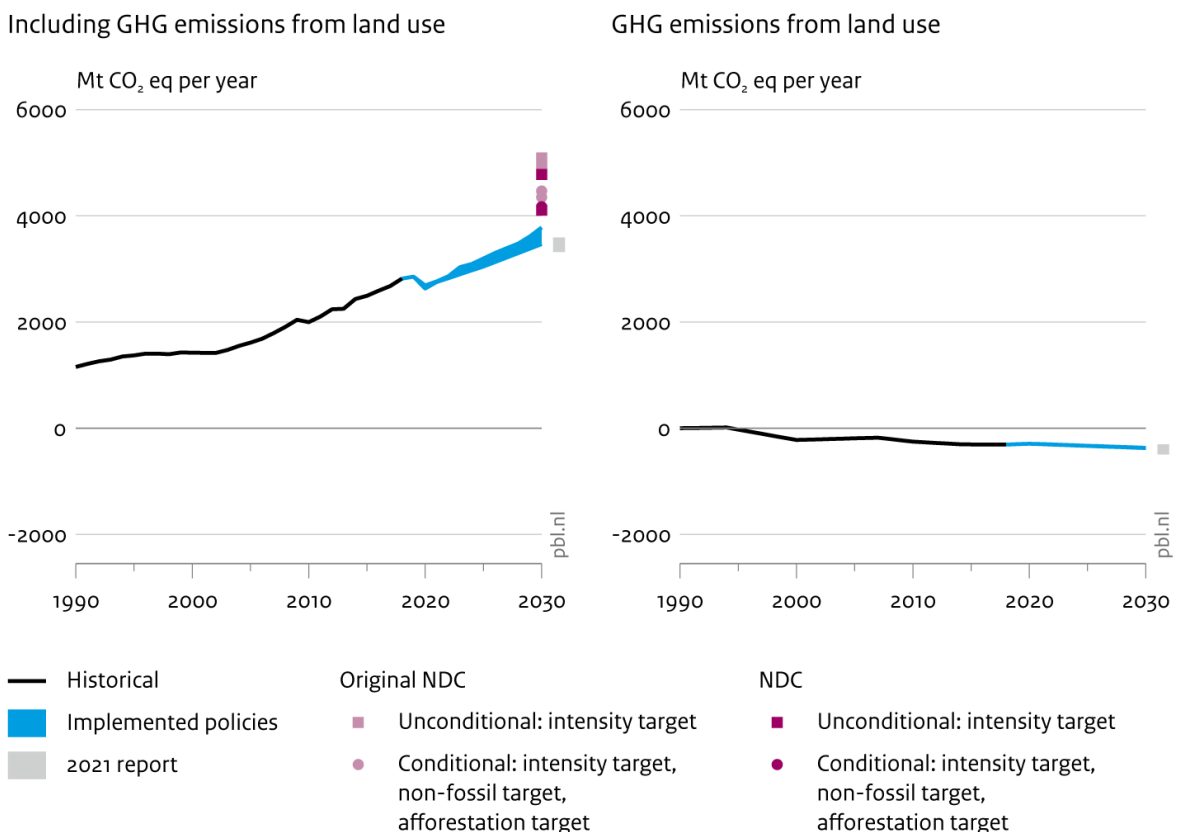
| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|---|----------------------|--|--|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (incl. LULUCF) – estimates (MtCO₂e) | 3510 | 2390 to 3010 (-32% to -14%) | 2080 (-41%) |
| GHG emissions per capita (tCO₂e/cap) | 7.9 | 5.4 to 6.8 (-32% to -14%) | 4.7 (-41%) |
| GHG emissions per GDP (tCO₂e/thousand USD) | 9.2 | 0.1 to 0.2 (-47% to -33%) | 0.1 (-54%) |

3.10 India

Recent developments: India submitted an updated NDC in August 2022, aiming to decrease GHG emissions intensity by 45% below 2005 levels and increase the share of non-fossil energy capacity in the power sector to 50%, both by 2030. Under the National Electricity Plan (NEP) from 2018, India projected an installed coal capacity of 217 GW by 2022 and 238 GW by 2027. In 2022, India released a draft of an updated NEP, under which it reports that the actual coal capacity in 2022 was 210 GW, but it still expects the projected capacity for 2027 to remain at 238GW as per the 2018 NEP, and even a further increase in coal capacity by 2032 up to 250 GW. Gas and nuclear together would supply about 50 GW or about 5% of capacity, and renewable energy sources the remaining 570 GW or 65% by 2032. This means India would likely overachieve its renewable power capacity target of 450 GW by 2030 (CEA, 2021; IEA, 2020), while it will likely miss its interim target for 2022 of 175 GW, as in March, there was 157 GW of renewable energy capacity available (India, 2022). To decrease emissions from transport, India has a target in place to increase the share of electric vehicles in new sales to 30% by 2030. This target is supported through the Faster Adoption and Manufacturing of Electric Vehicles in India (FAME) scheme (Ministry of Road Transport and Highways, 2018).

Projections: India will overachieve its latest unconditional and conditional NDC targets with existing policies. Our current policies scenario projections this year are higher than our 2021 projections due to the inclusion of more recent historical data.

Impact of climate policies on greenhouse gas emissions in India



Source: PBL IMAGE model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 12: Impact of climate policies on greenhouse gas emissions in India (upper end: PBL IMAGE model, lower end: NewClimate Institute calculations). The grey bar gives the range of our 2021 projections.

Table 29: India's NDCs as presented in official sources. N/A: not available or not applicable.

| Indicator | 2016 NDC | 2022 NDC |
|---|---|---|
| Business-as-Usual (BAU) | N/A | N/A |
| Target: unconditional | Reduce emissions per unit of GDP by 33% to 35% below 2005 levels by 2030 | Reduce emissions per unit of GDP by 45% below 2005 levels by 2030 |
| Target: conditional | Non-fossil fuel energy to increase to about 40% of total power capacity with the help of transfer of technology and low-cost international finance including from Green Climate Fund (GCF); Additional forest carbon stock of 2.5 to 3 GtCO _{2e} through additional forest and tree cover by 2030 | To achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030, with the help of transfer of technology and low-cost international finance including from Green Climate Fund (GCF) |
| Sectoral coverage | Not specified | Not specified |
| General Accounting method | Not specified | Not specified |
| GHGs covered | Not specified | Not specified |
| Consideration of LULUCF | Targets for the land-use sector are included. An additional carbon sink of 2.5 to 3 GtCO ₂ through additional forest and tree cover by 2030. However, it is unclear whether the land-use sector is included in the GHG intensity targets Accounting approaches and methodologies are not specified | It is unclear whether the land-use sector is included in the GHG intensity targets Accounting approaches and methodologies are not specified Target to create an additional carbon sink of 2.5 to 3 billion tonnes of CO ₂ equivalent through additional forest and tree cover by 2030 is maintained |
| Use of bilateral, regional and international credits | Intention of participating in international carbon markets under Article 6 of the Paris Agreement | Intention of participating in international carbon markets under Article 6 of the Paris Agreement |
| Other sector-level targets | (Various existing policies and targets are described) | N/A |

Table 30: Overview of key climate change mitigation policies in India (BEE, 2015; Chaliawala, 2021; Department of Heavy Industries, 2015; Ministry of Consumer Affairs Food and Public Distribution, 2015; Ministry of Environment Forest and Climate Change (MoEF&CC), 2015; MNRE, 2017; Union Environment Ministry, 2015)

| Sector | Policies (marked with '(+)' when mentioned in the NDC document) | Description |
|--------------------------|---|---|
| Cross-cutting | Clean energy cess (coal tax) (2010) ¹⁾ | This policy sets a tax of INR 400/tonne is imposed on coal, lignite and peat. |
| | National Mission for Enhanced Energy Efficiency (2008) | The Mission aims to result in greenhouse gas emissions reductions of 98.55 MtCO ₂ e/year when fully implemented. The Mission includes four main initiatives, including the PAT scheme, see below. |
| Energy supply | Renewable energy targets and support schemes, National Solar and Wind Missions (2010)) (+) | Measures in support or renewables include: <ul style="list-style-type: none"> Capacity targets for 2022: 10 GW biomass, 5 GW small hydro, 100 GW solar (of which 40 GW rooftop PV), 60 GW wind (total 175 GW). Capacity target for 2030: 450 GW total renewable power capacity Budgetary support for solar power under the National Solar Mission ²⁾ Renewable Purchase Obligations scheme (2003) ¹⁾²⁾ Renewable Energy Certificate (REC) mechanism (2011) ¹⁾²⁾ |
| | National Electricity Plan (2018) | The Plan forecasts demand reductions, presents capacity additions for various energy technologies, including a slowdown in installation of new coal fired power plants. |
| | Draft National Electricity Plan (2022) ¹⁾²⁾ | This draft plan updates the National Electricity Plan from 2018. |
| Transport | Fuel economy standards | This policy sets out the following standards: 1.3 MJ/pkm to 130 g CO ₂ /km by 2017 and 0.9 MJ/pkm to 113 g CO ₂ /km by 2022, for light-duty vehicles. |
| | Third phase of Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME-III) initiative (2019) ¹⁾²⁾ | This policy supports the uptake of EVs by providing upfront incentives for the purchase of vehicles and by fostering the development of charging infrastructure. It includes the following targets: Subsidizing the purchase of 1,000,000 electric two-wheelers, 500,000 electric three-wheelers, 55,000 electric four-wheelers and 7,000 buses. Reaching 15% EV share in car stock by 2023, 30% by 2030. |
| | Support for biofuels (2007), National Policy on Biofuels (2018) ²⁾ | These policies include the following targets: 5% blending target for ethanol with petrol (no timeline set). 20% blending target for bioethanol in gasoline, 5% biofuel in diesel by 2030 (proposed target). |
| Industry | Energy efficiency in industry (PAT scheme) (2011) | This policy sets out a benchmarking scheme to compare the performance of designed companies against best practice, combined with a market mechanism to trade energy savings certificates. The second cycle (2016–2019) covers 35 Mtoe. The third cycle (2020–2023) is under preparation. |
| Agriculture and Forestry | Green India Mission (2011) | This policy sets out the target to increase the forest/tree cover in moderately dense forests by 5 million hectares, and to improve forest/tree cover of forest areas by 5 million hectares |

¹⁾ Not quantified in PBL IMAGE model projections. ²⁾ Not quantified in NewClimate Institute projections.

Table 31: 2015 historical data and 2030 projections of key GHG indicators for India. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|---|----------------------|--|---|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (incl. LULUCF) – estimates (MtCO₂e) | 2490 | 3470 to 3780 (39% to 52%) | 4490 to 4360 (80% to 75%) [4180 (68%)] |
| GHG emissions per capita (tCO₂e/cap) | 1.9 | 2.3 to 2.5 (+21% to +32%) | 2.9 to 3 (+52% to +57%) [2.8 (46%)] |
| GHG emissions per GDP (tCO₂e/thousand USD) | 1.2 | 0.6 to 0.7 (-39% to -33%) | 0.8 (-21% to -23%) [0.8 (-26%)] |

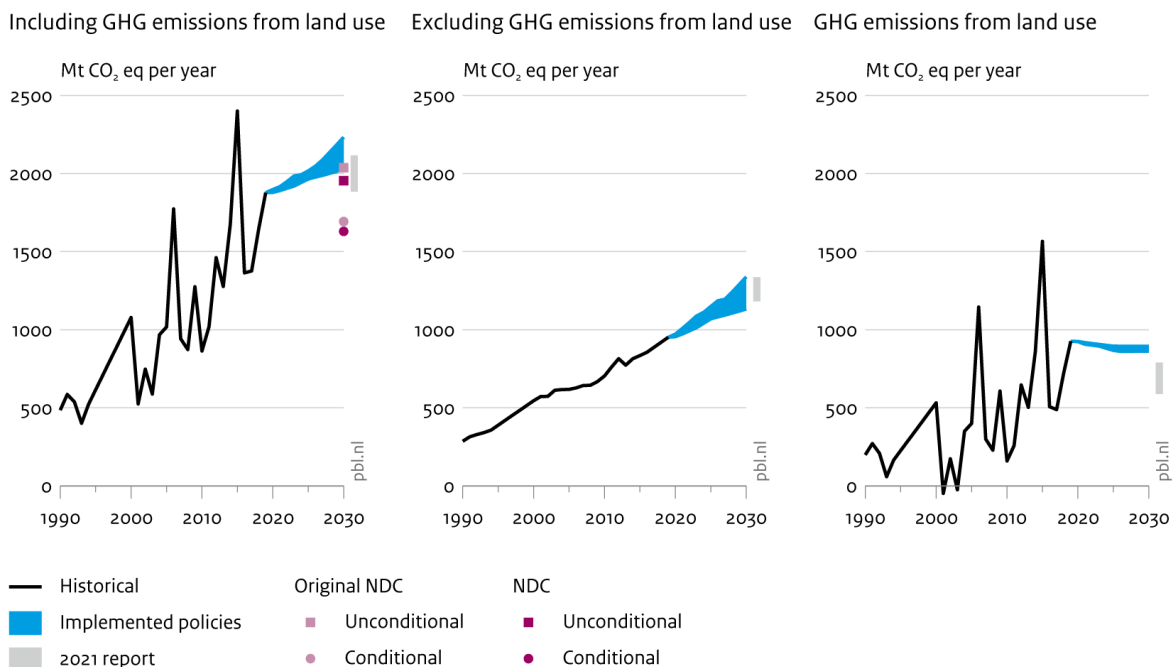
3.11 Indonesia

Recent developments: Indonesia submitted an updated NDC and a long-term strategy (LTS). The updated NDC sets out a slightly higher unconditional target of 31.89% GHG emissions reduction by 2030 below the baseline scenario. Indonesia aims to reach net-zero emissions by 2060 and is currently exploring net-zero pathways. The land use sector accounts for a large share of emissions reductions in its mitigation scenarios, meaning that other sectors will plan substantially less reductions.

In the new electricity supply plan (RUPTL 2021-2030) renewables account for 52% of the planned capacity between 2021-2030 and are set to reach 23% of the electricity mix by 2030. Several regulatory improvements have supported the growth of renewables. In the power sector, the second revision of Regulation 49/2018 (26/2021) addressed some of the barriers facing rooftop solar PV but strict domestic component requirements still limit utility-scale projects (Agus PradiyaTampubolon et al., 2022). Several major policies and plans in the pipeline aim to address these barriers and put the country on a path to reaching net-zero emissions by 2060, including the National Grand Energy Strategy (GSEN), New and Renewable Energy Law, Presidential Regulation on Renewables Tariffs, and carbon tax. In the transport sector, Indonesia aims to increase biofuel blending mandates from 30% to 40% in 2022, develop its mass public transport systems, and expand its domestic electric vehicles industry. Indonesia's emissions trading system (ETS) is in the early phases of its development but recorded 42.5 MtCO₂e of transactions at 2 USD/tCO₂e in its 2022 voluntary pilot phase (Agus PradiyaTampubolon et al., 2022).

Projections: Indonesia is set to miss its NDC targets with existing policies. This is a change compared to our 2021 update report. Although, our current policies projections excluding land use are similar to our 2021 projections, an increase in land-use historical emissions substantially increases total emission levels in 2030. This increase is driven by a peak in land-use related historical emissions.

Impact of climate policies on greenhouse gas emissions in Indonesia



Source: PBL IMAGE model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 13: Impact of climate policies on greenhouse gas emissions in Indonesia (PBL IMAGE model projections are within NewClimate Institute range). Land use emission projections do not account for the impact and annual fluctuations of natural disturbances and peat fires. The grey bar gives the range of our 2021 projections.

Table 32: Description of Indonesia's previous and current NDC, as presented in official sources. N/A: not available or not applicable.

| Indicator | 2016 NDC | 2021 NDC | 2022 NDC |
|---|--|--|--|
| Business-as-Usual (BAU) | 2,869 MtCO ₂ e in 2030 | 2,869 MtCO ₂ e in 2030 | 2,869 MtCO ₂ e in 2030 |
| Target: unconditional | 29% GHG reduction by 2030 from baseline scenario | 29% GHG reduction by 2030 from baseline scenario | 31.89% GHG reduction by 2030 from baseline scenario |
| Target: conditional | 41% GHG reduction by 2030 from baseline scenario | 41% GHG reduction by 2030 from baseline scenario | 43.20% GHG reduction by 2030 from baseline scenario |
| Sectoral coverage | Energy including transport, industrial processes and product use, agriculture, LULUCF, waste | Energy including transport, industrial processes and product use, agriculture, LULUCF, waste | Energy including transport, industrial processes and product use, agriculture, LULUCF, waste |
| General Accounting method | IPCC guidelines; 100-year GWPs from the Fourth Assessment Report | IPCC guidelines; 100-year GWPs from the Fourth Assessment Report | IPCC guidelines; 100-year GWPs from the Second Assessment Report |
| GHGs covered | All IPCC sectors CO ₂ , CH ₄ , N ₂ O | All IPCC sectors CO ₂ , CH ₄ , N ₂ O | CO ₂ , CH ₄ , N ₂ O |
| Consideration of LULUCF | Land-use sector is included in the target Includes emissions from peat fires Accounting approaches and methodologies are not specified | Land-use sector is included in the target Includes emissions from peat fires Accounting approaches and methodologies are not specified Restore 2 million ha and rehabilitation of degraded land of 12 million ha by 2030. | Land-use sector is included in the target Includes emissions from peat fires Accounting approaches and methodologies are not specified Restore 2 million ha and rehabilitation of degraded land of 12 million ha by 2030. |
| Use of bilateral, regional and international credits | Indonesia welcomes bilateral, regional and international market mechanisms as recognised under Article 6 of the Paris Agreement. | Indonesia welcomes bilateral, regional and international market mechanisms as recognised under Article 6 of the Paris Agreement. | Indonesia welcomes bilateral, regional and international cooperation in the NDC implementation as recognised under Article 6 of the Paris Agreement. |

Table 33: Overview of key climate change mitigation policies in Indonesia (Herbert Smith Freehills, 2021; Kementerian PPN, 2019; KESDM, 2016; Kharina et al., 2016; Ministry of Environment and Forestry, 2018; President of the Republic of Indonesia, 2018; PT Perusahaan Listrik Negara (Persero), 2015; Republic of Indonesia, 2019; Reuters, 2021; Sembiring et al., 2020)

| Sector | Policies (marked with '(+) when mentioned in the NDC document) | Description |
|----------------------|--|--|
| Cross-cutting | Carbon trading policy to reduce emissions (2021) ¹⁾ | This policy sets out carbon trading rules to establish a market mechanism to help achieve the country's greenhouse gas reduction targets by 2030 |
| | Indonesia's New Carbon Law (2021) ¹⁾ | This law introduces a general carbon tax, a general carbon price, sector-based emission caps, and a carbon trading framework. |

| Sector | Policies (marked with '(+)’ when mentioned in the NDC document) | Description |
|--------------------------|--|--|
| Energy Supply | National Energy Policy (NEP) (2014) (+) ³⁾ | This policy sets out a target of 23% new and renewable energy (including nuclear) in total primary energy supply by 2025 |
| | Electricity Supply Business Plan (RUPTL 2019–2028) | This policy sets out a target of added electricity capacity over 2019–2028: 9,700 MW hydropower, 4,607 MW geothermal, 3,483 MW solar, 2,563 MW wind. |
| | Electricity Supply Business Plan (RUPTL 2021–2030) | This policy sets out a target of 20.9 GW added renewable electricity capacity over 2021-2030 (52% total). Renewables account for 23% generation mix by 2030. |
| | RPJMN 2020-2024 ¹⁾³⁾ | This policy sets out a target of renewable power capacity of 37.3 GW by 2024. |
| Transport | Biofuel targets (2013) ⁴⁾ | The blending target set out in 2013 was 15% share of biofuels in all transportation fuels by 2025 (25% biodiesel, 20% bioethanol). The biodiesel blending rate was raised to 30% in 2020 with a plan to achieve 40% by 2022. |
| Agriculture and Forestry | Presidential Instruction number 6/2013 on Forest Moratorium (2013) ¹⁾ | This policy restricts oil palm extension to peatland or to primary forest as defined in the Ministry of Forestry land cover map. |
| | Food Estate Program (2020) ¹⁾²⁾ | This policy allows protected forests to be cleared at a large scale for the purpose of food production. |
| | Omnibus Law on Job Creation (2020) ¹⁾²⁾ | This policy eliminates a previous requirement that all regions in Indonesia maintain a minimum 30% of their watershed and/or island area as forest area. |
| | Indonesia’s FOLU Net Sink 2030 (2022) ¹⁾ | This policy sets out the target to make the FOLU sector a Net Sink in 2030. This translates to a 60% reduction in national Greenhouse Gas (GHG) emissions through GHG reduction in the Forestry and Other Land Use (Forest and Other Land use) sector. |

¹⁾ Not quantified in PBL IMAGE model projections. ²⁾ Not quantified in IIASA model projections ³⁾ Not quantified separately but checked if achieved after implementation of other policies. ⁴⁾ Implemented in PBL IMAGE model as 22.5% total biofuel share.

Table 34: 2015 historical data and 2030 projections of key GHG indicators for Indonesia. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|--|-------------------|--|--|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (incl. LULUCF) – estimates (MtCO ₂ e) | 2400 | 2030 to 2230 (-16% to -7%) | 2040 (-15%) [1690 (-30%)] |
| GHG emissions per capita (tCO ₂ e/cap) | 9.3 | 7 to 7.7 (-25% to -18%) | 7 (-25%) [5.8 (-38%)] |
| GHG emissions per GDP (tCO ₂ e/thousand USD) | 2.8 | 1.1 to 1.2 (-57% to -52%) | 1.1 (-56%) [0.9 (-64%)] |

3.12 Iran

Recent developments: Iran is the largest emitter that has not ratified the Paris Agreement. The current Intended Nationally Determined Contributions (INDC) states that Iran's climate targets and mitigation efforts are conditional on the absence of international economic sanctions. International sanctions have been in place since 2018.

The Sixth Development Plan for 2017–2021 is Iran's main economy-wide policy strategy that includes measures to reduce GHG emissions and is aligned with both the 20-Year Vision (2000–2020) and the National Strategic Plan on Climate Change (Government of Iran, 2016). The plan aims for a minimum of 5% or 5 GW of renewable energy in total installed power capacity (excluding large hydropower) by 2021. Current levels of installed renewable power capacity, however, remain low in view of this objective. Other 2021 targets in the Sixth Development Plan include decreasing gas flaring by at least 90%, reducing the energy consumption in buildings by 5%, increasing the share of railway transport, and promoting energy efficiency across various sectors. Iran has currently approximately 1 GW of nuclear power capacity under construction (World Nuclear Association, 2022).

Projections: Iran will likely substantially overachieve its unconditional and conditional targets with existing policies. Emissions this year are in line with estimates developed in 2021.

Impact of climate policies on greenhouse gas emissions in Iran

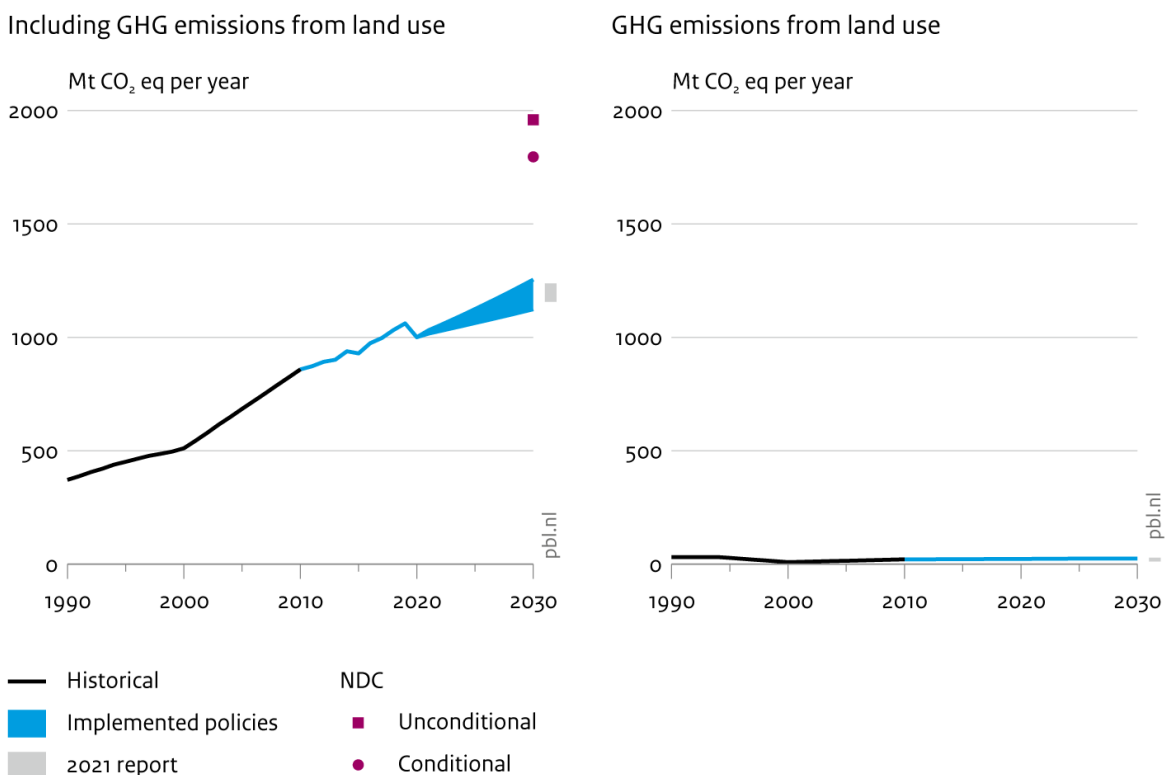


Figure 14: Impact of climate policies on greenhouse gas emissions in Iran. Emissions trajectories are based exclusively on NewClimate and IIASA's projections. The grey bar gives the range of our 2021 projections.

Table 35: Description of Iran's INDC, as presented in official sources. N/A: not available or not applicable.

| Indicator | 2015 INDC |
|---|---|
| Business-as-Usual (BAU) | N/A |
| Target: unconditional | 4% below BAU by 2030 |
| Target: conditional | 12% below BAU by 2030 |
| Sectoral coverage | N/A |
| General Accounting method | IPCC 2006 guidelines |
| GHGs covered | SF6, PFCs, HFCs, NF3, CO2, CH4, N2O |
| Consideration of LULUCF | Not directly specified. No LULUCF-related mitigation measures are mentioned in the INDC. |
| Use of bilateral, regional and international credits | Intention of participating in international carbon markets under Article 6 of the Paris Agreement |

Table 36: Overview of key climate change mitigation policies in Iran (Law of the Sixth Five-Year Economic, Social and Cultural Development Plan of the Islamic Republic of Iran (1396-1400), 2016)

| Sector | Policies (marked with '+' when mentioned in the INDC document) | Description |
|----------------------|--|--|
| Cross-cutting | Sixth Five-Year Development Plan (2017–2021) | <p>This policy includes a range of non-quantified measures, such as increasing the share of railway transport and promoting energy efficiency across various sectors. However, it also sets out several targets, including:</p> <ul style="list-style-type: none"> • Minimum 5% / 5 GW of renewable energy (excl. large hydropower) in installed capacity by 2021 • Minimum 90% decrease in gas flaring by 2021 • 5% reduction of energy use in buildings by 2021 |

Table 37: 2015 historical data and 2030 projections of key GHG indicators for Iran. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|---|-------------------|--|--|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (incl. LULUCF) – estimates (MtCO₂e) | 929 | 1120 to 1250 (21% to 35%) | 1960 (111%) [1800 (94%)] |
| GHG emissions per capita (tCO₂e/cap) | 11.5 | 12.1 to 13.5 (+6% to +18%) | 21.1 (+84%) [19.4 (69%)] |
| GHG emissions per GDP (tCO₂e/thousand USD) | 2.3 | 1.6 to 1.8 (-12% to -2%) | 2.7 (+53%) [2.5 (41%)] |

3.13 Japan

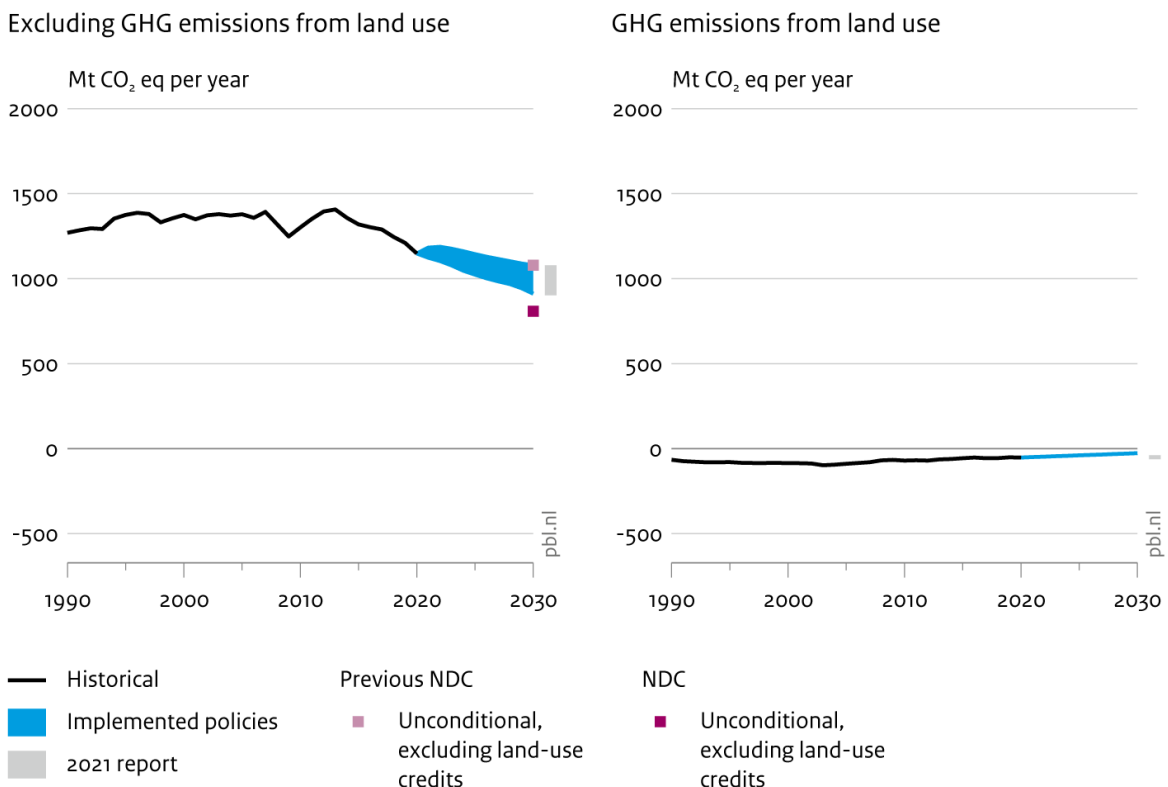
Recent developments: Half year after the announcement, in October 2021 Japan officially submitted its new 2030 GHG emission reduction target of a 46% reduction below 2013 levels as an updated NDC. The updated Plan for Global Warming Countermeasures and the updated long-term strategy under the Paris Agreement were also adopted simultaneously (MOEJ, 2021).

On the energy demand side, a significant policy development in the amendment of the Building Energy Efficiency Act in June 2022 (ECCJ, 2022). As of April 2025, all new buildings are now required to meet the minimum energy efficiency standards; previously it was not obligatory for the builders to meet them. The potential impact of this policy update is not quantified in this year's analysis.

On the energy supply side, the government will actively promote the use of carbon capture and storage (CCS), hydrogen and the hydrogen-derived ammonia under the amended Energy Conservation Act adopted in May 2022. The amendment defines hydrogen and ammonia as 'non-fossil energy'. Prime Minister Fumio Kishida has expressed his intent to accelerate the restart of existing nuclear reactors and consider building new reactors in the future (Kyodo, 2022).

Projections: Japan is projected to overachieve its original NDC target with existing policies but still fall short on the updated NDC. Our current policies scenario projections this year are similar to our 2021 projections.

Impact of climate policies on greenhouse gas emissions in Japan



Source: PBL IMAGE model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 15: Impact of climate policies on greenhouse gas emissions in Japan (PBL IMAGE model projections within NewClimate Institute range). The grey bar gives the range of our 2021 projections. 2030 target include LULUCF credits (in line with the Kyoto accounting rules) as well as overseas credits. Please see Appendix (A3) on the consideration of LULUCF for the NDC quantification.

Table 38: Description of Japan's previous NDC and NDC announcement, as presented in official sources. N/A: not available or not applicable.

| Indicator | 2016 NDC | 2020 NDC | 2021 NDC |
|---|---|---|---|
| Business-as-Usual (BAU) | N/A | N/A | N/A |
| Target: unconditional | 26% GHG reduction by 2030 below 2013 level | 26% GHG reduction by 2030 below 2013 level | 46% GHG reduction by 2030 below 2013 level (excl. LULUCF) Equivalent to a 760 MtCO ₂ e _q reduction |
| Target: conditional | N/A | N/A | N/A |
| Sectoral coverage | Economy-wide | Economy-wide | Economy-wide |
| General Accounting method | IPCC guidelines; 100-year GWPs from AR4 | IPCC guidelines; 100-year GWPs from AR4 | IPCC guidelines; 100-year GWPs from AR4 |
| GHGs covered | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ and NF ₃ | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ and NF ₃ | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ and NF ₃ |
| Consideration of LULUCF | Land-use sector is included in the target Accounting approach is specified as Kyoto Protocol approach (gross-net accounting) A reduction of net LULUCF emissions is expected in the range of 37 MtCO ₂ e ¹⁾ | Land-use sector is included in the target Accounting approach is specified as Kyoto Protocol approach (gross-net accounting) A reduction of net LULUCF emissions is expected in the range of 37 MtCO ₂ e ¹⁾ | Land-use sector is included in the target Accounting approach is specified as Kyoto Protocol approach (gross-net accounting) A reduction of net LULUCF emissions is expected in the range of 47.7 MtCO ₂ e ¹⁾ |
| Other sector-level targets | N/A | N/A | N/A |
| Use of bilateral, regional and international credits | Yes. Cumulative 50 to 100 MtCO ₂ e through the Joint Crediting Mechanism (JCM). | Yes. Cumulative 50 to 100 MtCO ₂ e through the Joint Crediting Mechanism (JCM). | Yes. Up to 100 MtCO ₂ e (cumulative) through the Joint Crediting Mechanism (JCM). |

¹⁾The estimate is provided in Japan's NDC and the reduction of LULUCF emissions and removals corresponds to 2.6% reduction of total emissions in 2013.

Table 39: Overview of key climate change mitigation policies in Japan (Government of Japan, 2017; IEA, 2019; METI, 2018a, 2018b, 2018c, 2019, 2020, 2021a, 2021b).

| Sector | Policies (marked with '+' when mentioned in the NDC document) | Description |
|----------------------|---|---|
| Cross-cutting | Global warming countermeasures tax (2012) ¹⁾ | This policy sets out an upstream tax of 289 JPY/tCO ₂ (around 2.3€) on fossil fuels on top of existing petroleum and coal tax. |
| | Amendment of Energy Conservation Act (adopted June 2018) ^{1) 2)} | This policy sets out a new certification system to allow for an inter-business initiative to enhance systemic energy savings, including e-commerce retailers. |

| | | |
|----------------------|--|--|
| | Energy Conservation Act (1993 amendment) ¹⁾ | This policy sets out the target of reducing energy consumption by 1%/year and annual reports to the government by large operators. |
| Energy supply | 2021 Basic Energy Plan (+) | This policy sets out the target of reaching 36% to 38% renewable electricity (incl. large hydro) by 2030. |
| | Renewable Energy Act (feed-in tariff) (2012) ¹⁾ | This policy requires electric utility operators to purchase all electricity generated at designated prices; applicable to most renewable technologies. |
| Buildings | Building Energy Efficiency Act (2016) | This policy sets out mandatory energy efficiency standards for buildings and houses larger than 2000 m ² . |
| | 2018 Basic Energy Plan (+) | This policy sets out the target of making all new buildings net-zero energy by 2030. |
| Transport | Passenger vehicle fuel efficiency standards (2020 amendment) ¹⁾²⁾ | This policy sets out a target of 25.4 km/l by 2030 for passenger vehicles, representing a 32.4% improvement compared to 2016 values. |
| | Top Runner Standards (2020 amendment of the Energy Conservation Act) ¹⁾²⁾ | Top runner energy efficiency standards also apply to electric vehicles. |
| | Green Growth Strategy (June 2021 revision) ¹⁾²⁾ | This policy sets out a target of 100% share of electrified vehicles (including fuel cell vehicles and non-plugin hybrids) in new passenger car sales by 2035. |
| F-gases | Act on Rational Use and Proper Management of Fluorocarbons (2013, last amendment 2019) ¹⁾ | This policy sets out stricter control of the entire F-gas chain (GWP targets for equipment types, obligation of F-gas destruction for entities re-using recovered F-gases). The 2019 amendment includes several penalty and obligatory measures to increase the F-gas recovery rates up to the targeted 50% by 2030 from 38% in 2017. |
| | Ozone Layer Protection Act (2018 amendment) ¹⁾²⁾ | Regulation on production and import volumes to comply with the Kigali Amendment of the Montreal Protocol. |

¹⁾ Not quantified in PBL IMAGE projections ²⁾ Not quantified in NewClimate Institute projections.

Table 40: 2015 historical data and 2030 projections of key GHG indicators for Japan. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

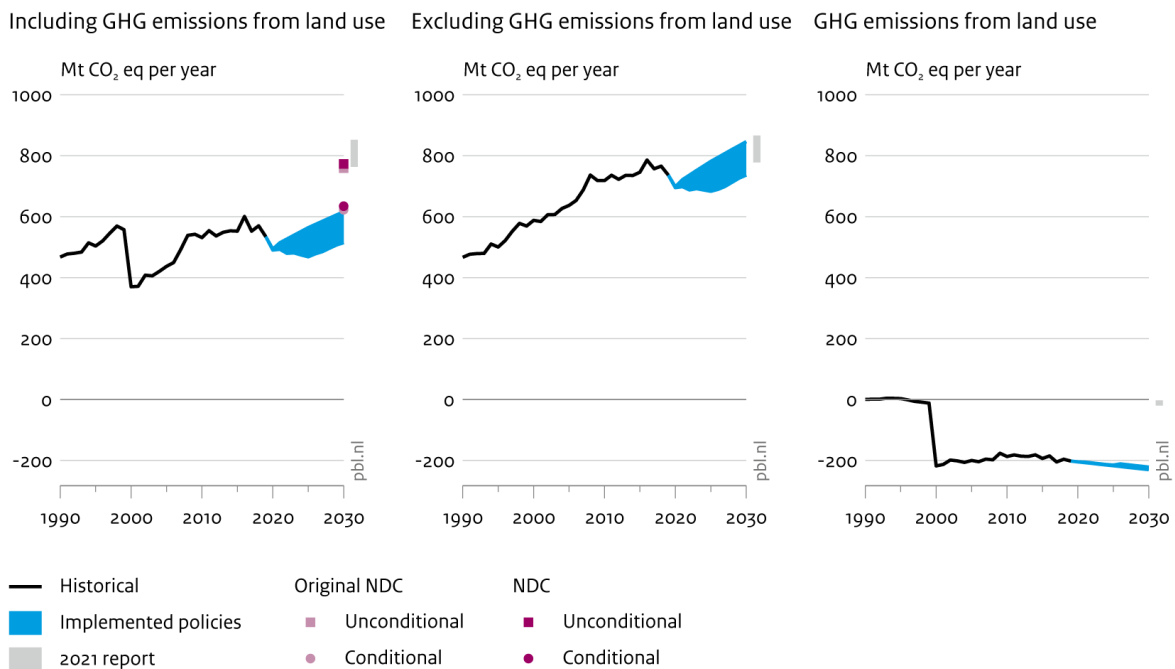
| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|---|-------------------|--|--|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (excl. LULUCF) – estimates (MtCO₂e) | 1320 | 912 to 1080 (-31% to -18%) | 808 (-39%) |
| GHG emissions per capita (tCO₂e/cap) | 10.4 | 7.7 to 9.1 (-26% to -12%) | 6.8 (-34%) |
| GHG emissions per GDP (tCO₂e/thousand USD) | 0.3 | 0.1 to 0.2 (-37% to -25%) | 0.1 (-44%) |

3.14 Mexico

Recent developments: The current administration continues to foster exploration, production, and consumption of fossil fuels and dismantle the existing climate governance structures. Examples of these policies include fossil fuel transport subsidies, increased funding for fossil fuel infrastructure, acquisition of a new oil refinery, and reforms to laws that previously promoted renewable energy generation (Secretaría de Relaciones Exteriores, 2022; SENER, 2019). Mexico's 2020 NDC update was revoked, reinstating all targets from the 2016 submission, after civil society won a lawsuit under the argument that Mexico's updated NDC was less transparent & ambitious – contrary to the Paris Agreement and Mexican Law (Expansión, 2022; Greenpeace México, 2021; Poder Judicial de la Federación, 2021; Secretaría de Relaciones Exteriores, 2022). In April 2022, opposition legislators stopped the executive's proposal (from September 2021) to reform Mexico's Energy Transition Law. With this proposal, the Mexican government intended to significantly limit the participation of private electricity producers and eliminate the National Centre of Energy Control (CENACE) – a regulatory institution and instruments like the Clean Energy Certificates.

Projections: Mexico is well on track to meet its NDC targets with existing policies, in contrast to our 2021 update report. This is caused by an increase of reported historical land-use sinks related to improved representation of surface areas and improvements in emission factors by switching to more precise and disaggregated representation of vegetation types and ecoregions. This change is not a result of improved climate policy.

Impact of climate policies on greenhouse gas emissions in Mexico



Source: PBL IMAGE model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 16: Impact of climate policies on greenhouse gas emissions in Mexico (upper end: NewClimate Institute calculations, lower end: PBL IMAGE model). The grey bar gives the range of our 2021 projections. Mexico's 2020 NDC update was revoked, and previous NDC targets were reinstated at a national level. Mexico's 2020 NDC is however still currently in force at the international level (UNFCCC).

Table 41: Mexico's NDCs as presented in official sources. N/A: not available or not applicable.

| Indicator | 2016 NDC | 2020 NDC (revoked) |
|---|---|---|
| Business-as-Usual (BAU) | 973 MtCO ₂ e in 2030 | 991 MtCO ₂ e in 2030 |
| Target: unconditional | 22% GHG reduction by 2030 from baseline scenario | 22% GHG reduction by 2030 from baseline scenario |
| Target: conditional | 36% GHG reduction by 2030 from baseline scenario | 36% GHG reduction by 2030 from baseline scenario |
| Sectoral coverage | Economy-wide | Economy-wide |
| General Accounting method | IPCC guidelines; 100-year GWPs from AR5 | IPCC guidelines; 100-year GWPs from AR5 |
| GHGs covered | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs and SF ₆ | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs and SF ₆ |
| Consideration of LULUCF | Land-use sector is included in the target Accounting approaches and methodologies are not specified Activity-based approach is expected to be used | Land-use sector is included in the target Accounting approaches and methodologies are not specified. |
| Use of bilateral, regional and international credits | Mexico's unconditional NDC commitment will be met regardless of these mechanisms. However, robust, global, market-based mechanisms will be essential to achieve rapid and cost-efficient mitigation | Intention of participating in international carbon markets under Article 6 of the Paris Agreement |

Table 42: Overview of key climate change mitigation policies in Mexico (Cámara de Diputados del Congreso de la Unión, 2015, 2017; CEMDA, 2020; Centro Nacional de Control de Energía, 2017; CONAFOR, 2001; Diario Oficial de la Federación, 2021; DOF, 2014a, 2014b; Government of Mexico, 2021a, 2021c, 2022a, 2022b, 2020, 2021b; Greenpeace México, 2020; IEA, 2016; Mexico, 2011; Secretaría de Energía (SENER), 2015)

| Sector | Policies (marked with '+' when mentioned in the NDC document) | Description |
|----------------------|--|---|
| Cross-cutting | Special Program on Climate Change (2021 to 2024) ^{1) 2)} | This policy sets out to reduce GHG emissions by implementing specific measures in all sectors. |
| | General Law on Climate Change (LGCC, (+)) (2012, with subsequent reforms in 2014, 2015, 2016, 2018, 2020, and 2022) ^{1) 2)} | This law is the basis for climate policy in Mexico which translates the overarching GHG emission reduction targets (added to the law in a reform in April 2018) into strategies and plans and provides the institutional framework for their implementation. A reform in 2020 dissolved the Climate Change Fund. A further reform is underway to remove the National Ecology and Climate Change Institute (INECC) and transfer its functions to the Environmental Ministry (SEMARNAT). |
| | Emissions Trading Scheme (2018) ^{1) 2)} | This policy sets out a national emissions trading scheme that will start a three-year pilot phase in 2020. The regulatory framework for the ETS is expected to be fully operational by 2023. |
| Energy supply | Electric Industry Law (LIE, (+)) (2014, 2021 update) ^{1) 2)} | This law establishes a free competition regime in electric power generation and commercialization. It also allows participation of private actors in transmission and distribution. |

| Sector | Policies (marked with '(+)' when mentioned in the NDC document) | Description |
|---------------------------------|---|---|
| | | The 2021 amendment allows fossil plants run by the Federal Electricity Company (CFE) to obtain clean-energy certificates which were previously planned exclusively for renewable energy suppliers. It also prioritises fossil fuel electricity generation over renewable energy in the Mexican grid. |
| | Energy Transition Law (2015) | This law provides a framework for clean energy, energy efficiency and greenhouse gas emissions reductions. It also sets out targets for clean energy (includes efficient gas-fired cogeneration) of 25% in 2018, 30% in 2021 and 35% by 2024. Power auctions for wind and solar energy supporting the implementation of the targets were cancelled in 2019. |
| | National Transition Strategy to Promote the use of clean fuels and technologies (2016) | This policy is a planning document for medium and long-term clean energy (incl. efficient cogeneration). It sets out "clean" power generation targets of 35% by 2024, 37.5% by 2030 and 50% by 2050. |
| | Performance criteria and application for flaring and ventilation of natural gas (CNH.06.001/09) (2011) ^{1) 2)} | This policy sets out the target of reducing emissions from oil and gas production through a decrease in venting of 73 MtCO ₂ e below BAU in 2020 and 92 MtCO ₂ e in 2030. |
| | Program for the development of the national electric system (PRODESEN) (2022) ^{1) 2)} | This policy sets out clean energy targets up to 2036, including 25.5% for solar, and 12.8% for wind. |
| Transport | CO ₂ emissions standards for light duty vehicles ²⁾ | This policy sets out the following vehicle emissions standards: Passenger cars: 135 to 180 gCO ₂ /km (depending on vehicle size). Light duty trucks: 163 to 228 gCO ₂ /km (depending on size). |
| Agriculture and Forestry | National Forestry Programme 2025 (2001) ^{1) 3)} | This policy aims to conserve and restore the capacity of strategic forest areas to provide ecosystem services through an inclusive and participatory approach that contributes to guaranteeing a healthy environment for the development and well-being of the population. |
| | REDD+ National Strategy (2017) ¹⁾ | This policy sets out a target to reduce LULUCF emissions and achieve net-zero deforestation by 2030. |
| | Sowing Life Programme (Sembrando Vida, 2020) ^{1) 3)} | This policy sets out a target to plant 1 billion trees and pays farmers to plant fruit or timber trees on small plots of land to encourage industry in deprived rural areas. Impact is still unclear as planting big swaths of commercial species, sometimes on land that held native forests, can potentially end up increasing deforestation rates. |
| | Reform: The general law of sustainable forest development (2022) ¹⁾ | The reformed policy seeks to avoid granting support or economic incentives for agricultural and livestock activities in deforested areas or for those that promote land-use change. |
| | Support for sustainable forestry development (2021) ¹⁾ | This policy supports the owners and inhabitants of forest areas to implement actions that contribute to the protection, conservation, restoration, and incorporation of sustainable forest management practices. |

¹⁾ Not quantified in PBL IMAGE model projections. ²⁾ Not quantified in the NewClimate Institute projections. ³⁾ Not quantified in IIASA model projections.

Table 43: 2015 historical data and 2030 projections of key GHG indicators for Mexico. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|---|----------------------|--|--|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (incl. LULUCF) – estimates (MtCO₂e) | 545 | 507 to 609 (-7% to 12%) | 773 (42%) [634 (16%)] |
| GHG emissions per capita (tCO₂e/cap) | 4.6 | 3.8 to 4.5 (-17% to -1%) | 5.8 (+26%) [4.7 (4%)] |
| GHG emissions per GDP (tCO₂e/thousand USD) | 0.5 | 0.3 to 0.4 (-24% to -9%) | 0.5 (+16%) [0.4 (-5%)] |

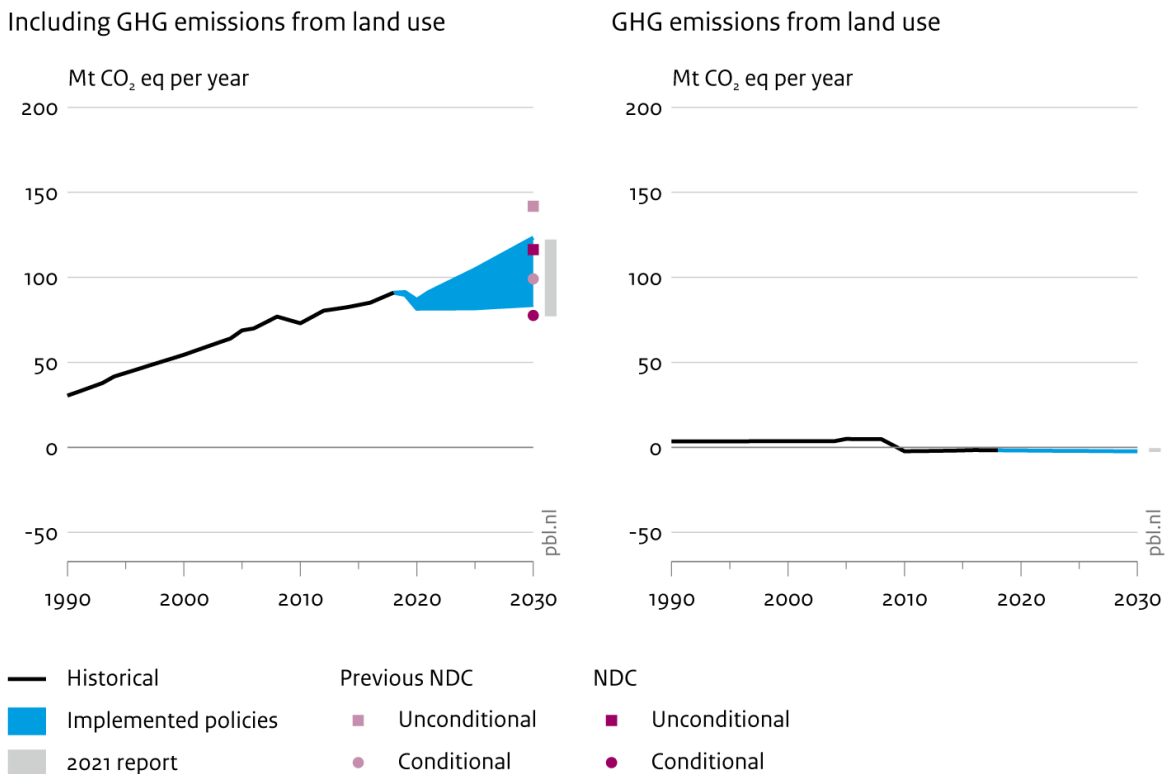
3.15 Morocco

Recent developments: Morocco submitted an updated NDC in July 2021, increasing its unconditional emissions reduction target from 17% to 18.3% below business as usual (BAU) and the conditional one from 42% to 45.5% below BAU. It also substantially decreased its projected BAU emissions.

Developing renewable energy is at the core of Morocco’s emissions reduction efforts. Already in 2009, Morocco set out a target to reach 42% of renewable energy in electric capacity by 2020. It later complemented this with a 2030 target of 52% of renewable energy capacity, which was confirmed in the 2030 National Climate Plan issued in 2019. Renewable capacity stood at 37% of total installed capacity in 2021 (Kingdom of Morocco, 2022). While renewable energy installation increased substantially until 2018, it has however slowed down in the recent years (IRENA, 2022b). The bulk of Morocco’s electricity is still generated with coal.

Projections: Morocco will likely meet its unconditional and miss its conditional NDC target with existing policies. Our current policies scenario projections this year is slightly higher than our 2021 projections due to new historical data.

Impact of climate policies on greenhouse gas emissions in Morocco



Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 17: Impact of climate policies on greenhouse gas emissions in Morocco. Emissions trajectories are based exclusively on NewClimate and IIASA’s projections. The grey bar gives the range of our 2021 projections.

Table 44: Description of Morocco's previous and current NDC, as presented in official sources. N/A: not available or not applicable.

| Indicator | 2016 NDC | 2021 NDC |
|---|--|--|
| Business-as-Usual (BAU) | 170.8 MtCO ₂ e | 142.3 MtCO ₂ e |
| Target: unconditional | 17% reduction in GHG emissions by 2030 compared to BAU scenario | 18.3% reduction in GHG emissions by 2030 compared to BAU scenario |
| Target: conditional | 42% reduction in GHG emissions compared to BAU scenario | 45.5% reduction in GHG emissions compared to BAU scenario. |
| Sectoral coverage | Economy-wide | Economy-wide |
| General Accounting method | IPCC guidelines; 100-year GWPs from AR4 | IPCC guidelines; 100-year GWPs from AR4 |
| GHGs covered | CO ₂ , CH ₄ , N ₂ O | CO ₂ , CH ₄ , N ₂ O and HFCs |
| Consideration of LULUCF | Land-use sector is included in target Accounting approaches and methodologies are not specified | Land-use sector is included in target. Accounting approaches and methodologies are not specified but the NDC does mention that a specific approach will be used to exclude emissions from natural disturbances. |
| Other sector-level targets | NDC outlines key sectoral policy strategies and respective sectoral emission targets | NDC outlines key sectoral policy strategies and respective sectoral emission targets |
| Use of bilateral, regional and international credits | Intention in participating in international carbon markets under Article 6 of the Paris Agreement | Intention in participating in international carbon markets under Article 6 of the Paris Agreement |

Table 45: Overview of key climate change mitigation policies in Morocco (AFD, 2018; Kingdom of Morocco, 2014, 2016a, 2016b, 2018, 2019; Ministry Delegate of the Minister of Energy Mines Water and Environment, 2013; Ministry of Equipment and Transport, 2010; Schinke & Klawitter, 2016)

| Sector | Policies ⁴⁾ (marked with '(+)' when mentioned in the NDC document) | Description |
|----------------------|--|--|
| Cross-cutting | 2030 National Climate Plan (2019) ¹⁾ | This policy sets out various targets, including: <ul style="list-style-type: none"> - Renewable electricity capacity of 52% by 2030. - Reduce energy consumption by 15% by 2030. - 'Significantly' reduce fossil fuel subsidies. - Support afforestation and reforestation. - Governance measures: create a National Commission on Climate Change, enhance inter-sectoral coordination and reinforce the participation of NGOs in climate policy. |
| | Creation of a Strategic Committee for Sustainable Development (Decree 2.17.655) (2018) ¹⁾ | This organization is in charge of the coordination of sustainable development policies, including the implementation of the National Strategy for Sustainable Development, which aims to make Morocco's economy 'green and inclusive' by 2030. |
| | Moroccan Climate Change Policy (MCCP) (2014) ¹⁾ | This policy regulates the coordination and alignment of various sectoral and cross-sectoral national policies tackling climate change. |
| Energy supply | National Energy Strategy (2009, updated 2012) (+) | These policies include the following targets: <ul style="list-style-type: none"> - Renewable power capacity: 42% share in total capacity by 2020 and 52% by 2030. |

| Sector | Policies ⁴⁾ (marked with '(+)' when mentioned in the NDC document) | Description |
|--------------------------|--|---|
| | Morocco Integrated Wind Energy Program (2010) Morocco Solar Plan (2009) ²⁾ Morocco Hydroelectric Plan (continuation of plan started in 1970s) ²⁾ | <ul style="list-style-type: none"> - Energy savings of 12–15% in 2020 and 20% in 2030. - Supply 10–12% of the country's primary energy demand with renewable energy sources by 2020 and 15–20% by 2030. - Extension of national wind farms to total 2,000 MW by 2020. - Extension of solar power capacity to 2,000 MW (both concentrated solar power plants & photovoltaic systems). - Extension of hydro power capacity with 775 MW by 2020. - Extension of small hydropower projects with total capacity of 100 MW in 2030. |
| Transport | High-speed train line between Rabat, Tangier and Casablanca (2018) | This policy sets out the upgrade of existing railway to high-speed train line completed in 2018. |
| | Extension of Casablanca tramway (2016) | This policy sets out the extension of Casablanca tramway by 45 km by 2025. |
| Industry | Energy efficiency program in the industry sector (2011) | This policy sets out energy efficiency programs for the industry, buildings and transport sector (excluding large energy consuming industries). |
| Buildings | Energy efficiency program in the building sector (2009) | This policy sets out minimum requirements for new residential and commercial buildings. |
| | Energy efficiency program for public lighting (2009) | This policy sets out the instalment of new public lighting technologies. |
| Agriculture and Forestry | Preservation and Sustainable Forest Management Strategy (2021) | This policy sets out a target of afforestation and regeneration of approximately 50,000 hectares of forest per year. |
| | Morocco Green Plan (PMV) (2008) (+) ³⁾ | This policy sets out a plan for the sustainable management and general modernization of the agricultural sector. |

¹⁾ Not quantified in NewClimate Institute projections. ²⁾ See Climate Action Tracker (Climate Action Tracker, 2020a) for the implementation status. ³⁾ Not quantified in IIASA model projections.

Table 46: 2015 historical data and 2030 projections of key GHG indicators for Morocco. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

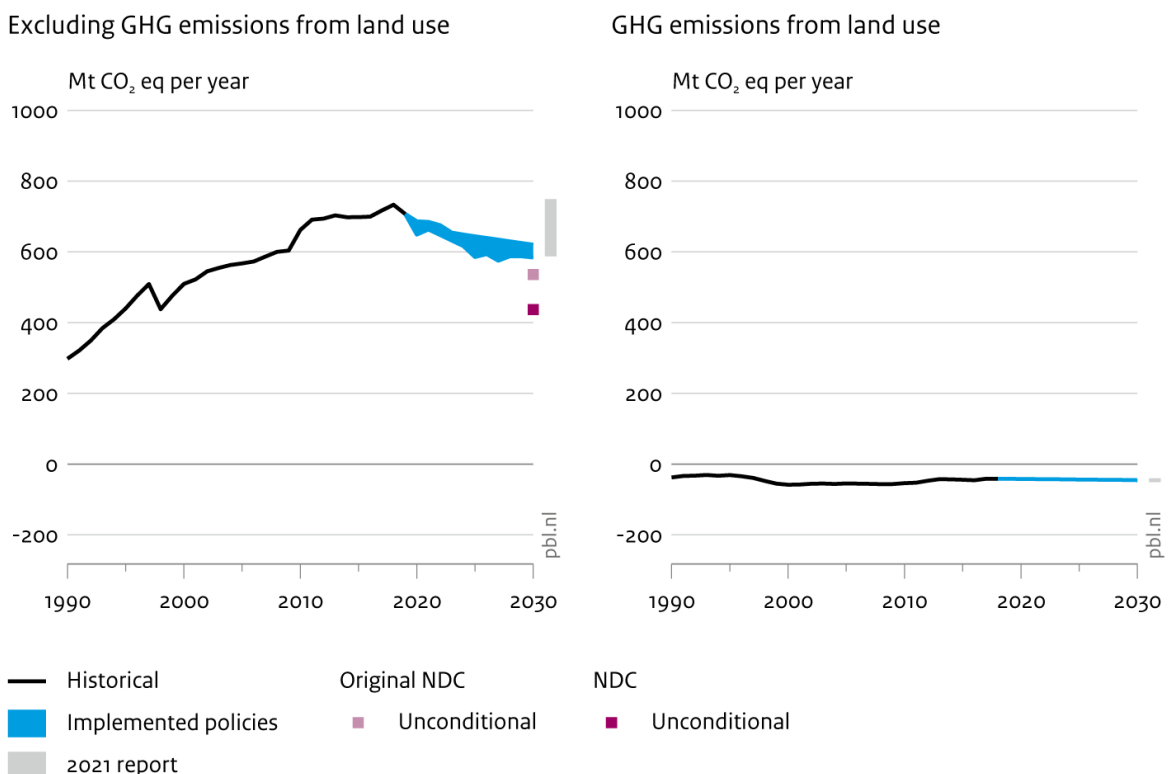
| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|--|-------------------|--|--|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (incl. LULUCF) – estimates (MtCO ₂ e) | 83.7 | 83.7 to 123 (0% to 47%) | 116 (39%) [77.6 (-7%)] |
| GHG emissions per capita (tCO ₂ e/cap) | 2.4 | 2.1 to 3.1 (-14% to +27%) | 2.9 (+19%) [1.9 (-20%)] |
| GHG emissions per GDP (tCO ₂ e/thousand USD) | 0.8 | 0.5 to 0.7 (-31% to +1%) | 0.7 (-5%) [0.5 (-36%)] |

3.16 Republic of Korea

Recent developments: The Republic of Korea submitted a stronger NDC in December 2021, including emissions reductions from LULUCF and international credits. The country's carbon neutrality by 2050 target was enshrined in law in August 2021. To support its increased economy-wide emissions reduction targets, the Republic of Korea announced in 2021 a new renewable electricity generation target of 30% by 2030 and revised its renewable portfolio standard (RPS) (U.S. International Trade Administration, 2022), outlining the minimum required share of renewables for electricity producers each year till 2026. These shares are considerably higher than the 20.8% renewable electricity target set out by the 9th Basic Plan for Long-term Electricity Supply and Demand 2020-2034. However, these plans and targets for new and renewable energy will be re-formulated under the Republic of Korea's new President Yoon Suk-yeol (Tong Keun Seol et al., 2022). The emissions allowances under Korean Emissions Trading Scheme (K-ETS) for the Phase III (2021–2025) will be consistent with the annual target emissions from the 2030 Greenhouse Gas Reduction Roadmap, and the emission caps for Phase IV will be set to achieve the NDC target for 2030. In 2021, the Republic of Korea adopted the Environmentally Friendly Vehicle Dissemination Plan to support the uptake of low emissions vehicles. This policy was adopted after our cut-off date and has not yet been quantified.

Projections: The Republic of Korea will likely miss its NDC target with existing policies but is closer compared to our 2021 update. Our current policies scenario projections this year are lower than our 2021 projections, especially because of the Phase III Allocation Plan of Korea's ETS, that runs from 2021-2025, and reduced uncertainty on the short-term effect of COVID-19 pandemic.

Impact of climate policies on greenhouse gas emissions in Republic of Korea



Source: PBL IMAGE model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 18: Impact of climate policies on greenhouse gas emissions in Republic of Korea (upper end: NewClimate Institute calculations, lower end: PBL IMAGE model). The grey bar gives the range of our 2021 projections. Please see Appendix (A3) on the consideration of LULUCF for the NDC quantification.

Table 47: Republic of Korea's NDCs as presented in official sources. N/A: not available or not applicable.

| Indicator | Previous NDC | 2021 NDC |
|---|---|---|
| Business-as-Usual (BAU) | 850.6 MtCO _{2e} | N/A |
| Target: unconditional | 37% GHG reduction by 2030 from baseline scenario | 40% reduction by 2030 from 2018 emission levels |
| Target: conditional | N/A | N/A |
| Sectoral coverage | Economy-wide | Economy-wide excl. LULUCF in the base year. |
| General Accounting method | IPCC guidelines; 100-year GWPs from SAR | IPCC guidelines; 100-year GWPs from SAR |
| GHGs covered | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs and SF ₆ | GHGs from all sectors are included except NF ₃ . |
| Consideration of LULUCF | A decision on whether to include the land-use sector will be made at a later stage | LULUCF sector is only included in the description of the target. LULUCF use IPCC GPG for cropland and grassland, and 2006 IPCC for rice cultivation, agriculture soils in agricultural sector, forestland and wetland in LULUCF sector. |
| Use of bilateral, regional and international credits | Intention in participating in international carbon markets under Article 6 of the Paris Agreement | Intention in participating in international carbon markets under Article 6 of the Paris Agreement |

¹⁾ In the amended Green Growth Act (Presidential Decree no. 27180, 24 May 2016), the 2020 pledge was abandoned domestically and was replaced by the 2030 NDC target, but to date there is no report that the Republic of Korea abandoned its 2020 pledge made under the UNFCCC. ²⁾ The Republic of Korea does specify that it intends to use the production approach for accounting for harvested wood products (HWP) consistent with IPCC guidance.

Table 48: Overview of key climate change mitigation policies in the Republic of Korea (APEREC, 2019; Argus Media, 2021; Climate Policy Database, 2020; Hwang, 2014; Ministry of Trade, 2017; MOTIE, 2019; Republic of Korea, 2012, 2020)

| Sector | Policies (marked with '(+)' when mentioned in the NDC document) | Description |
|----------------------|--|---|
| Cross-cutting | Emissions Trading System (2015) ¹⁾ | This policy manages 68% of the national GHG emissions and covers nearly 600 companies from 23 sub-sectors. The emissions caps for Phase III (2021–2025) will be strictly set to be consistent with the annual target emissions from the 2030 Greenhouse Gas Reduction Roadmap. |
| Energy supply | Renewable energy targets ¹⁾ 3 rd Energy Master Plan (2019) 9 th Basic Plan for Long-term Electricity Supply and Demand (2019) | These policies set out the following targets: Share of renewables in total electricity generation: 20% by 2030 and 30–35% by 2040. ⁴⁾ Total 58.5 GW renewable capacity by 2030 ²⁾ : 2.1 GW hydropower, 17.7 GW wind, 33.5GW solar power, 1.7GW biomass, and 0.3GW waste capacity. |
| | Renewable Portfolio Standard (2012, 2021 update) | This policy requires generation companies with a capacity over 500 MW to include a certain percentage of renewables. In 2021, the standards were raised, reaching 25% in 2026. |

| Sector | Policies (marked with '(+)' when mentioned in the NDC document) | Description |
|---------------------------------|---|--|
| | 5th Basic Plan for New and Renewable Energy (2019) | This policy sets out a target to reach 20.3% supply of new and renewable energy in total electricity generation by 2030, and 25.8% by 2034 (Renewable energy 22.2%, New energy 3.6%). |
| Transport | Renewable Fuel Standard (2013; 2020 update) ²⁾ | This policy mandates a biodiesel share in diesel of 3% from 2018 onwards. The 2020 update aims to improve share to approximately 5% in 2030. The update has not been yet quantified in our projections. |
| Agriculture and Forestry | 2 nd Comprehensive Plan for Improvement of Carbon Sinks (2018) ²⁾ | This policy sets out the following targets: To increase national forest carbon stocks to 2.1 billion tCO ₂ in 2022, compared to 1.8 billion tCO ₂ in 2015. To expand carbon storage in domestic harvested wood products (HWP) by up to 36 Mt by 2022, compared to 23 Mt in 2017. |
| | 6 th Forest Master Plan (2018) ^{2) 3)} | This policy sets out a target to increase the contribution of the LULUCF sink so that by 2030, it accounts for 10% of total emissions. |
| | 2 nd Comprehensive Plan for Wood Use (2019) ^{2) 3)} | This policy sets out the following targets: To increase domestic wood self-sufficiency rate by 22.4% by 2024, compared to 19% in 2019. To expand the size of timber industry to \$40 billion by 2024 by utilizing currently unused domestic forest biomass resources. |
| | Food and Rural Affairs' Business Plan (2022) ^{2) 3)} | This policy sets out a target to reduce GHG emissions from Agriculture to below 18.0 MtCO ₂ e by 2030 and 15.3 MtCO ₂ e by 2050, compared to 20.4 MtCO ₂ e in 2017. |
| | Agriculture and Food Carbon Neutral Action Plan (2022) ^{2) 3)} | Reduce total emissions in the non-energy sectors by 28.3% by 2050 compared with 2018 estimates. This policy sets out targets to reduce emissions from rice production by 0.54 MtCO ₂ e, fertilizer use by 2.25 MtCO ₂ e, livestock waste treatments by 2.25 MtCO ₂ e. |
| | 2050 Carbon Neutral Forest Sector Promotion Strategy (2021) ^{2) 3)} | This policy sets out a target of increasing the annual LULUCF removals by 23.6 MtCO ₂ e. This policy set out the following targets: Increase forest plantations in idle land and urban area from 17 thousand ha to 61 thousand ha. Afforestation of 288 thousand ha forest using carbon-efficient tree species. Restore 11 thousand ha of forest by 2050. Reduce the annual forest area damaged by disaster to 636 ha by 2050, compared to the expectation of 2,339 ha. |
| | 2030 NDC Advance (2021) ^{2) 3)} | This policy sets out a target to enhance the national carbon sinks from 22.1 MtCO ₂ e in 2020, to 26.7 MtCO ₂ e by 2030 including forest, ocean, and other natural sinks. |

| Sector | Policies (marked with '(+)' when mentioned in the NDC document) | Description |
|--------|---|--|
| | 2022 Forest Restoration Action Plan (2022) ²⁾ ³⁾ | Aim to increase the annual planting of temperate native species to 85 ha in 2022, compared to 40 ha in 2021. |
| | 4th Protection plan from environmental disruption caused by mining (2022) ²⁾ ³⁾ | Financial investment of 20.9 billion KRW (about \$15.2 million) for restoring forest damaged by mining. The policy aims to afforest 43.5 ha of land. |

¹⁾ Not quantified in NewClimate Institute projections. ²⁾ Not quantified in PBL IMAGE model projections..

³⁾ Not quantified in IIASA model projections. ⁴⁾ Not quantified separately in PBL IMAGE projections, but achievement checked after implementation of other (related) targets

Table 49: 2015 historical data and 2030 projections of key GHG indicators for Republic of Korea. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

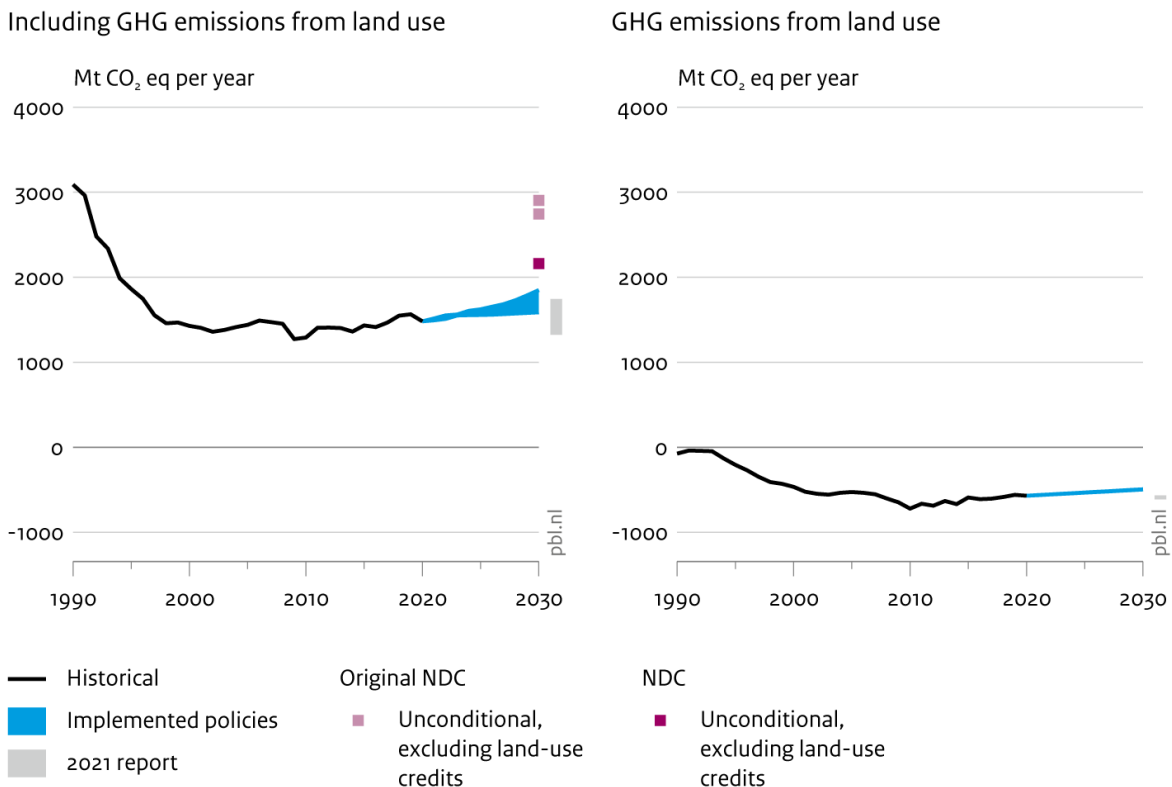
| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|--|----------------------|--|---|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (excl. LULUCF) – estimates (MtCO ₂ e) | 698 | 584 to 620 (-16% to -11%) | 437 (-37%) |
| GHG emissions per capita (tCO ₂ e/cap) | 13.7 | 11.4 to 12.1 (-17% to -12%) | 8.5 (-38%) |
| GHG emissions per GDP (tCO ₂ e/thousand USD) | 0.5 | 0.3 (-42% to -38%) | 0.2 (-56%) |

3.17 Russian Federation

Recent developments: In the lead up to the COP26 UN climate negotiations in Glasgow, the Russian Federation announced it would set a 2060 net-zero target. This was followed by government approval of the ‘Strategy of socio-economic development of the Russian Federation with low GHG emissions levels by 2050’ which formalised this target and included a target of reaching an 80% reduction in GHG emissions below 1990 levels by 2050 under its ‘intensive’ scenario. The long-term strategy reiterating these targets was submitted to UNFCCC in September 2022. The country’s NDC remains the same, with a target of a 30% emissions reduction below 1990 levels. Under a new support scheme, the government plans to subsidise domestically produced or assembled EVs to stimulate production and demand. The maximum subsidy is 25% of the total value of the vehicle. Russia is targeting an annual EV production of 220,000 units by 2030, or 15% of the market. It is unclear how the Russian Federation’s energy policy and emissions will be affected under recent developments – the invasion of Ukraine and subsequent sanctions on energy exports, airspace closures, etc.

Projections: The Russian Federation will likely meet its unconditional NDC target with existing policies. Emissions are still expected to remain on a slightly upwards trend up until 2030. The effect of the ongoing invasion of Ukraine is not quantified. Ongoing sanctions and EU’s efforts to phase out Russian imports might affect Russia’s emissions projections in coming updates.

Impact of climate policies on greenhouse gas emissions in Russian Federation



Source: PBL IMAGE model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 19: Impact of climate policies on greenhouse gas emissions in the Russian Federation (upper end: PBL IMAGE model, lower end: NewClimate Institute calculations). The grey bar gives the range of our 2021 projections. Please see Appendix (A2) on the consideration of LULUCF for the NDC quantification.

Table 50: The Russian Federation's NDCs as presented in official sources. N/A: not available or not applicable.

| Indicator | 2015 NDC | 2020 NDC |
|---|--|--|
| Business-as-Usual (BAU) | N/A | N/A |
| Target: unconditional | Limiting anthropogenic greenhouse gases to 70% to 75% of 1990 levels by 2030 | Limiting anthropogenic greenhouse gases to 70% of 1990 levels by 2030 |
| Target: conditional | N/A | N/A |
| Sectoral coverage | Economy-wide | Economy-wide |
| General Accounting method | IPCC guidelines; 100-year GWPs from IPCC Fourth Assessment Report | IPCC guidelines; 100-year GWPs from IPCC Fourth Assessment Report |
| GHGs covered | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ and NF ₃ | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ and NF ₃ |
| Consideration of LULUCF | Land-use sector is included in the target Accounting approaches and methodologies are unclear ¹⁾ | Land-use sector is included in the target Accounting approaches and methodologies are unclear ¹⁾ Accounting emissions and removals of greenhouse gases from the carbon pool of harvested wood, an atmospheric flux approach is used in accordance with the IPCC methodological guidance. The impact of natural changes in the structure of age classes in forests on the offset of greenhouse gas emissions and removals is minimized, given that the historical level of 1990 is used as a baseline. |
| Use of bilateral, regional and international credits | No use of international market mechanisms | No clear use of international market mechanisms |

¹⁾ Russian Federation's NDC states that the target is 'subject to the maximum possible account of absorbing capacity of forests. We assume that the Russian Federation applies a net-net accounting approach (see Appendix A2 for details).

Table 51: Overview of key climate change mitigation policies in Russian Federation (Government of the Russian Federation, 2013, 2014, 2015, 2016, 2018, 2019, 2020, 2021a, 2021b; Nachmany et al., 2015; TASS, 2022).

| Sector | Policies (marked with '(+)' when mentioned in the INDC document) | Description |
|----------------------|--|---|
| Cross-cutting | Federal Law No. 261-FZ 'On energy saving and improvement of energy efficiency' ^{1) 2)} | This law creates the general framework for energy efficiency in Russia. It contains mandatory energy saving requirements for companies, a ban of inefficient incandescent light bulbs, and incentives for companies investing in energy efficiency. |
| | Energy intensity targets (2008) ⁴⁾ | This policy sets out a target to reduce the energy intensity of GDP by 40% between 2007 and 2020, and by 44% between 2005 and 2030. |
| | Regional energy savings programmes (Decree of July 31, 2014, No. 754) | This policy provides subsidies and government financing to regions for improving energy-efficient technologies and energy conservation programmes. |
| | Social-economic development of the Russian Federation with low GHG emissions levels (Decree of October 21, 2021 No. 3052-r) | This policy reiterates 2030 NDC target and outlines strategy to achieve carbon neutrality by 2060. The reductions are mostly bolstered by negative LULUCF emissions and increasing forest's carbon storage capacity. |
| Energy supply | Renewable energy targets (Governmental resolution No. 512-r of 2013, 2015 amendment to the Decree No. 1-r of 2009) ^{3) 5)} | This policy sets out a target to reach 4.5% renewables share in total electricity generation by 2024 (excluding hydropower larger than 25 MW). |
| Transport | Transport strategy until 2030 with a forecast up to 2035 (2021) | Target to reduce the energy consumption of the transport sector by 30% by 2030 by employing measures including vehicle standards, energy efficiency, alternative fuels, and electric vehicles. |
| Industry | On measures to stimulate the reduction of atmospheric air pollution by-products of associated petroleum gas flaring (Decree of January 8, 2009, No. 7) | 5% limit on associated gas flaring for 2012 and subsequent years. |
| | Investment tax credit for energy-efficient technologies and projects (Decree of June 17, 2015, No. 600) | This policy provides investment tax loans to organisations that invest in eligible energy-efficient technologies or projects. The number of eligible technologies has increased from an original 4 to 56. |
| Buildings | Strategy for development of building materials sector for the period up to 2020 and 2030, adopted by Government Decree no. 868 (2016) ¹⁾ | This policy sets out a target of a 20% reduction in residential heat consumption per m ² by 2030 relative to 2014. |
| | On clarification of energy efficiency requirements for public procurement objects (Decree of April 21, 2018, No. 486 and December 31, 2009, No. 1221) | This policy establishes energy efficiency requirements for public procurement objects, new and refurbished apartment buildings, and public and administrative buildings. |

| Sector | Policies (marked with '(+)' when mentioned in the INDC document) | Description |
|--------------------------|---|---|
| Agriculture and Forestry | National Strategy of Forestry Development by 2020 (2008) ²⁾⁴⁾ | This policy sets out a target to increase forest intensification and harvesting of wood by 5.8% per year compared to 2007. |
| | Decree banning timber-related exports to the EU (2022) ²⁾⁴⁾ | This policy bans the export of wood and timber-related products, including raw materials to produce paper and plywood, to 'unfriendly countries' until the end of 2022. |
| Waste | Phased launch of a new system for the management of solid utilities waste (MSW) – Federal Law No. 486-FZ (2016) ¹⁾ | This policy sets out a target to increase the utilization of municipal solid waste generated until of 30% by 2024. |

¹⁾ Not quantified in PBL projections. ²⁾ Not quantified in NewClimate Institute projections. ³⁾ Small hydropower is not distinguished from hydropower in the TIMER model. The renewable share targets were not quantified separately but checked after implementation of capacity targets. ⁴⁾ Not quantified separately in PBL projections, but achievement checked after implementation of other targets. ⁵⁾ NewClimate Institute projections assume the 4.5% target will be reached in 2030 due to the slow progress.

Table 52: 2015 historical data and 2030 projections of key GHG indicators for Russian Federation. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

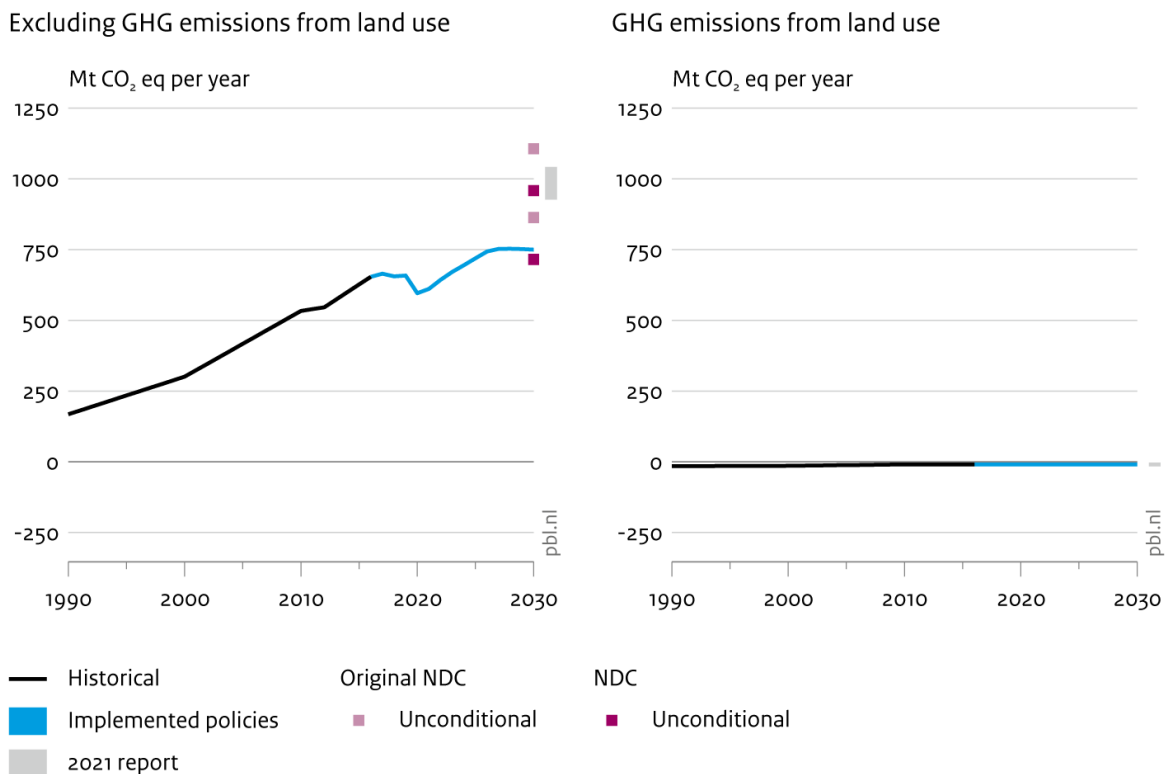
| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|--|-------------------|--|--|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (incl. LULUCF) – estimates (MtCO ₂ e) | 1430 | 1590 to 1690 (11% to 18%) | 2160 (51%) |
| GHG emissions per capita (tCO ₂ e/cap) | 9.9 | 11.2 to 12 (+13% to +21%) | 15.2 (+54%) |
| GHG emissions per GDP (tCO ₂ e/thousand USD) | 1.1 | 0.8 to 0.9 (+6% to +13%) | 1.2 (+44%) |

3.18 Saudi Arabia

Recent developments: Saudi Arabia submitted an updated NDC and announced a net-zero target by 2060 as part of the Saudi Green Initiative launch in October 2021. The Initiative lists five measures through which the updated emissions reduction target is to be reached (Kingdom of Saudi Arabia, 2021). These include increasing the share of renewable energy to 50% by 2030, enhancing energy efficiency, producing hydrogen, using carbon capture to produce methanol and improving waste management. The new target to reach 50% of renewable energy in the electricity mix by 2030 is also part of Saudi Arabia's Vision 2030 strategy. Saudi Arabia had previously announced it would install 27 GW of renewable electricity capacity by 2023 and 58 GW by 2030. As of 2021, there was just 0.4 GW of installed renewable capacity (IRENA, 2022b). Natural gas grew substantially in the past years, from 34% in 2015 to 56% in 2019 (IEA, 2021).

Projections: We estimate that Saudi Arabia will probably achieve its NDC target with existing policies. Our current policy projections are substantially lower than in previous years mostly due to increased uptake of renewables after 2025. We assume that both original and latest NDC targets refer to reductions below the same baseline scenario of 990-1240 MtCO₂e in 2030, in the absence of official estimates (Climate Action Tracker, 2020b). Our estimates result in absolute emissions between 715-958 MtCO₂e in 2030. Other studies interpret Saudi Arabia's target differently and project emissions ranging between 310-799 MtCO₂e in 2030 (Climate Action Tracker, 2022b; JRC, 2021; Meinshausen et al., 2022). The lack of transparency and clarity on the reference for the target increases the uncertainty of the analysis of progress towards Saudi Arabia's NDC.

Impact of climate policies on greenhouse gas emissions in Saudi Arabia



Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 20: Impact of climate policies on greenhouse gas emissions in Saudi Arabia. Emissions trajectories are based exclusively on NewClimate and IIASA's projections. The grey bar gives the range of our 2021 projections.

Table 53: Saudi Arabia's NDCs as presented in official sources. N/A: not available or not applicable.

| Indicator | 2016 NDC | 2021 NDC |
|---|---|---|
| Business-as-Usual (BAU) | N/A | N/A |
| Target: unconditional | Emissions reductions of up to 130 MtCO ₂ e annually in 2030 | Emissions reductions of up to 278 MtCO ₂ e annually in 2030 |
| Target: conditional | N/A | N/A |
| Sectoral coverage | Mostly energy focused | Mostly energy focused |
| General Accounting method | Not specified | Not specified |
| GHGs covered | Not specified | Not specified |
| Consideration of LULUCF | Land-use sector is not covered by NDC's emissions reductions target | Land-use sector is not covered by NDC's emissions reductions target |
| Use of bilateral, regional and international credits | Not specified | Intention of participating in international carbon markets under Article 6 of the Paris Agreement |
| Other sector-level targets | Not specified | Not specified |
| Availability of reference scenarios in the latest UNFCCC submissions | No | No |
| Other information | Target is not conditional on international financial support, but is contingent on the continuation of economic growth, and 'a robust contribution from oil export revenues to the national economy'. | NDC mentions 2019 as a base year for the NDC. However, it does not clarify whether it is the base year for the development of the 'dynamic baselines' or whether the target is a reduction below 2019 emission level. We assume the former. |

Table 54: Overview of key climate change mitigation policies in Saudi Arabia (Al-Ghabban, 2013; Borgmann, 2016; General Authority of Zakat and Tax, 2018; Kingdom of Saudi Arabia, 2015, 2016, 2017; Nereim, 2017; Nereim & Cunningham, 2018; Saudi Green Initiative, 2021; Toumi, 2017)

| Sector | Policies (marked with '+' when mentioned in the NDC document) | Description |
|----------------------|---|---|
| Cross-cutting | Vision 2030 (2016, revised in 2019) | This policy sets out to reform and diversify Saudi Arabia's oil-dependent economy, including by reducing fossil fuel subsidies. When launched in 2016, the strategy called for 9.5 GW of renewable power capacity by 2023. In 2019, this target was revised upwards (see NREP below). |
| | 5% VAT in fuel prices (2018) ¹⁾²⁾ | This policy sets out a 5% VAT on fuels. |
| Energy supply | National Renewable Energy Program (NREP) (2017, revised 2019) | This is the policy through which the Ministry of Energy implements the 'Vision 2030' renewable energy targets of 27.3 GW of renewable power capacity by 2023 and 58.7 GW by 2030. Renewable power capacity is auctioned through competitive tenders. |
| Transport | Corporate Average Fuel Economy Standards (CAFE) Saudi Arabia (2013) ¹⁾ | This policy sets out fuel efficiency targets for new vehicles as of 2020: 13.9 to 18.5 km/l for passenger vehicles, 10.7 to 15.4 km/l for light trucks. |
| | Fossil fuel price reform (2017) ¹⁾²⁾ | This policy sets out a new slower schedule for energy subsidy cuts. The plan is now to reach international gasoline parity prices, increase diesel |

| Sector | Policies (marked with '(+)’ when mentioned in the NDC document) | Description |
|--------------------------|---|---|
| | | prices up to 90% of international prices, and raise the price for other fuels between 2018 and 2025. |
| Buildings | Energy efficiency labels for appliances (2008) ²⁾ | This policy sets out energy efficiency labels for a range of household appliances. |
| | Insulation standards for new buildings (2007) ²⁾ | This policy sets out insulation standards for some insulation products used in residential buildings. |
| Agriculture and Forestry | Greening Saudi Initiative (2022) ²⁾ | This Initiative contributes to the target of planting 10 billion trees across Saudi Arabia. |

¹⁾ Not quantified in NewClimate Institute projections. ²⁾ Not quantified in PBL IMAGE projections

Table 55: 2015 historical data and 2030 projections of key GHG indicators for Saudi Arabia. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|--|-------------------|--|--|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (excl. LULUCF) – estimates (MtCO ₂ e) | 627 | 750 (20%) | 958 to 715 (53% to 14%) |
| GHG emissions per capita (tCO ₂ e/cap) | 19.3 | 18.6 (-4%) | 17.8 to 23.8 (-8% to +23%) |
| GHG emissions per GDP (tCO ₂ e/thousand USD) | 1.0 | 0.8 (-13%) | 1 to 0.8 (+11% to -17%) |

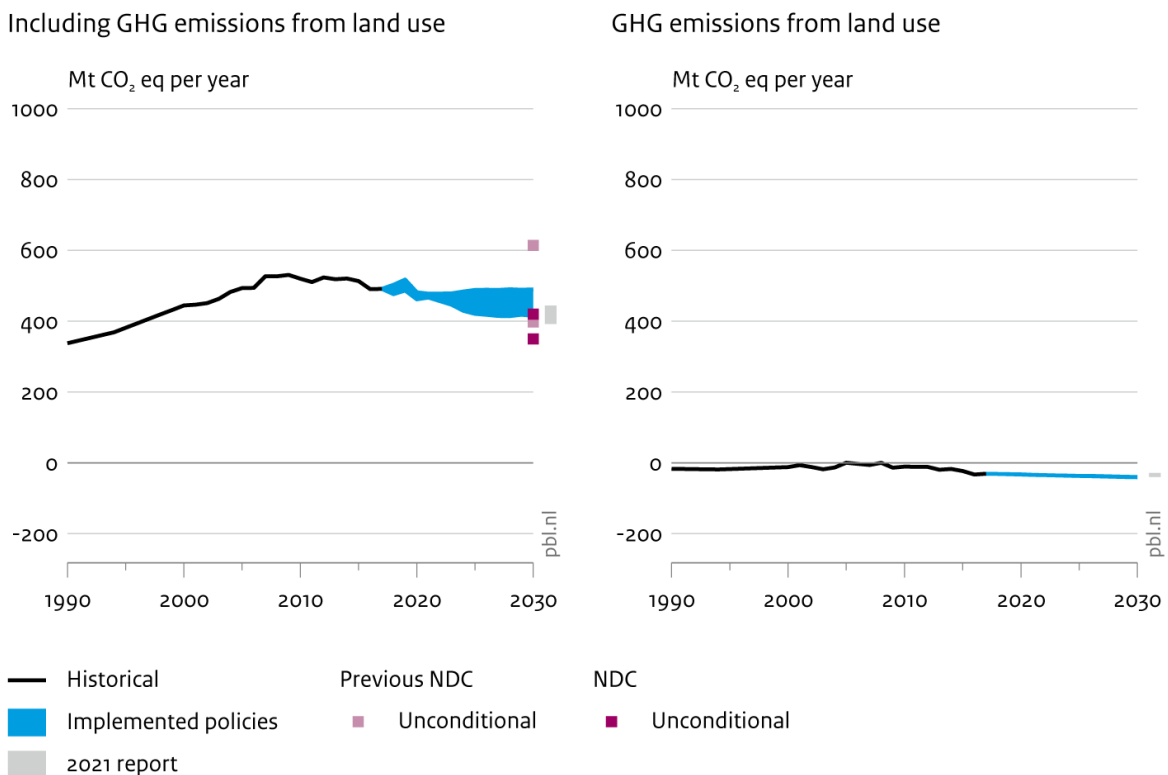
3.19 South Africa

Recent developments: In 2022, the South African government announced its intention to finalise the Just Energy Transition Partnership (JETP) investment plan of around USD 8.5 billion in 2022 and a longlist of policy actions proposed by President Ramaphosa to improve the South African electricity system (Presidential Climate Finance Task Team & International Partners Group, 2022; Ramaphosa, 2022). The former aims, among others, to accelerate the retirement of coal plants while the latter proposes wide-ranging measures in the energy sector. As of October 2022, both initiatives have not been further approved in the legislative processes.

The draft Climate Change Bill has been formally introduced to Parliament in February 2022 (Department of Environmental Affairs, 2018; Government of South Africa, 2021, 2022). South Africa adopted the latest Integrated Resource Plan (IRP) in October 2020 which aims to increase renewable power capacity while decommissioning coal. This policy is planned for review, but the timeline is not yet clear (Creamer, 2022). The Presidential Climate Commission released a framework for a just transition in South Africa in June 2022 to enable deep, just, and transformational shifts (Presidential Climate Commission, 2022). A National Energy Efficiency Strategy remains under development.

Projections: South Africa's emissions under current policies will likely fall within its NDC range in 2025. However, the country is set to miss its 2030 targets. Our current policies scenario projections this year are higher than our 2021 projections, mainly due to the impact of additional crude refineries to come into operation before the end of the decade.

Impact of climate policies on greenhouse gas emissions in South Africa



Source: PBL IMAGE model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 21: Impact of climate policies on greenhouse gas emissions in South Africa emissions and removals (upper end: NewClimate Institute calculations, lower end: PBL IMAGE model). The grey bar gives the range of our 2021 projections.

Table 56: Description of South Africa's previous and current NDC, as presented in official sources. N/A: not available or not applicable.

| Indicator | 2016 NDC | 2021 NDC |
|---|--|---|
| Business-as-Usual (BAU) | N/A | N/A |
| Target: unconditional | 398 to 614 MtCO ₂ e by 2025 and 2030 (PPD trajectory) | 398 to 510 MtCO ₂ e by 2025 and 350 to 420 MtCO ₂ e by 2030 |
| Target: conditional | N/A | N/A |
| Sectoral coverage | Economy-wide | Economy-wide |
| General Accounting method | IPCC 2006 guidelines; 100-year GWPs from AR4 | IPCC 2006 guidelines; 2013 Kyoto Protocol Supplement for harvested wood products. 100-year GWPs from SAR |
| GHGs covered | Six GHGs, material focus on CO ₂ , CH ₄ , N ₂ O | CO ₂ , CH ₄ , N ₂ O, HFCs and PFCs. |
| Consideration of LULUCF | Land-use sector is included in the target Accounting approaches and methodologies are not specified | Land-use sector is included in the target but excludes emissions from natural disturbances in the land use sector. It takes a land base approach. |
| Other sector-level targets | N/A | N/A |
| Use of bilateral, regional and international credits | N/A | Intention of participating in international carbon markets under Article 6 of the Paris Agreement |

Table 57: Overview of key climate change mitigation policies in South Africa (Department Environmental Affairs (South Africa), 2013; Department of Energy, 2013; Department of Environmental Affairs South Africa, 2015; Department of Minerals and Energy, 2008; Department of Transport South Africa, 2018; Marquard et al., 2021; NPC, 2010; Republic of South Africa, 2015; South Africa Department of Energy, 2018; South African Department of Energy, 2011)

| Sector | Policies (marked with '(+)' when mentioned in the NDC document) | Description |
|----------------------|--|---|
| Cross-cutting | Carbon tax (2019) (+) ^{1, 2)} | The carbon tax covers fossil fuel combustion emissions, industrial processes and product use emissions, and fugitive emissions such as those from coal mining. |
| | National Development Plan (2012) (+) ^{1, 2)} | This policy aims to eliminate poverty, reduce inequality, increase access to water and electricity. |
| | National Climate Change Response Policy (2011) (+) ^{1, 2)} | This policy aims to effectively manage climate change impacts and make a fair contribution to the global effort to stabilise GHG concentrations. |
| Energy supply | Integrated Resource Plan for electricity (supported by REIPP, Renewable Energy Independent Power Producer Programme) (2011; 2019 update) (+) | This policy sets out the following plans and targets: <ul style="list-style-type: none"> • Nuclear to remain stable at 1,860 MW throughout 2030. <ul style="list-style-type: none"> ○ Extending lifetime of existing plant. ○ The Government's intentions to support nuclear capacity in the future remain uncertain. Policy Position 8 of the IRP2019 emphasises the need for a 2.5 GW nuclear |

| Sector | Policies (marked with '(+)' when mentioned in the NDC document) | Description |
|---------------------------------|--|---|
| | | <p>build programme, which is not reflected in the actual capacity planning until 2030.</p> <ul style="list-style-type: none"> Renewable electricity generation capacity targets: <ul style="list-style-type: none"> Hydropower to reach 4,600 MW by 2030 (adding 2,500 MW) Solar photovoltaic to reach 8,288 MW by 2030 (adding 6,000 MW beyond already committed/contracted capacity) Wind to reach 17,742 MW by 2030 (adding 14,400 MW beyond already committed/contracted capacity) Concentrated solar power to reach 600 MW by 2030 (adding 300 MW, which is already contracted) <ul style="list-style-type: none"> Decommissioning of 5.4 GW of coal |
| Transport | Petroleum Products Act (Biofuels Industrial Strategy) (2007) ²⁾ | This policy sets out mandatory blending of biofuels. Concentration for blending: 2-10% for bio-ethanol and minimum 5% for biodiesel from 2015 onwards. |
| Buildings | National Building Regulation (2011) ²⁾ | This policy sets out building codes and standards. |
| Agriculture and Forestry | National Forest Act (1998) ^{2), 3)} | <p>This law aims at securing ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.</p> <p>It also seeks to facilitate improved timber availability and secure supply of timber to ensure sustainability of entire timber value chain.</p> |
| | Strategic Plan for the Development of Agriculture, Forestry and Fisheries (2013) ^{2), 3)} | This policy aims to promote the conservation of forest biological diversity, ecosystems and habitats, while promoting the fair and equitable distribution of their economic, social, health and environmental benefits. |

¹⁾ Not explicitly quantified in NewClimate Institutes projections. ²⁾ Implemented in PBL IMAGE model projections ³⁾ Not quantified in IIASA model projections.

Table 58: 2015 historical data and 2030 projections of key GHG indicators for South Africa. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|---|-------------------|--|--|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (incl. LULUCF) – estimates (MtCO₂e) | 513 | 415 to 490 (-19% to -5%) | 420 to 350 (-18% to -32%) |
| GHG emissions per capita (tCO₂e/cap) | 9.3 | 6.4 to 7.6 (-31% to -18%) | 5.4 to 6.5 (-42% to -30%) |
| GHG emissions per GDP (tCO₂e/thousand USD) | 1.5 | 0.8 to 0.9 (-30% to -17%) | 0.8 to 0.7 (-29% to -41%) |

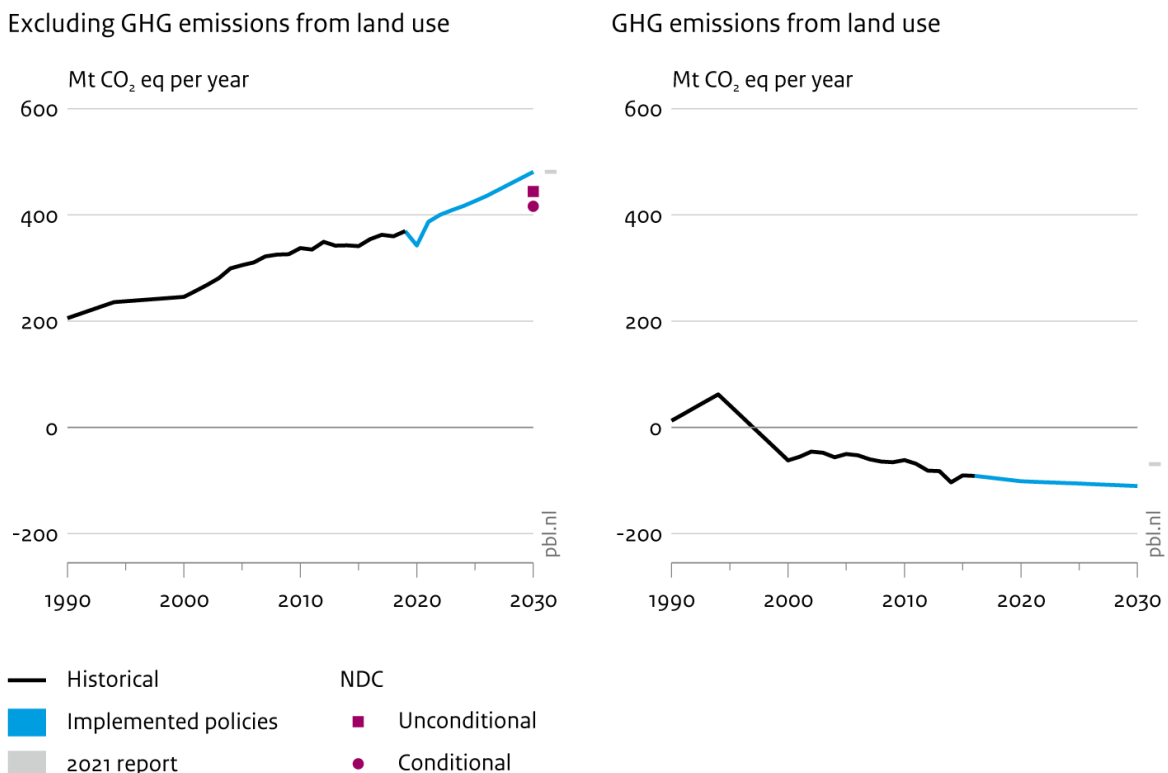
3.20 Thailand

Recent developments: Thailand submitted a “carbon neutrality” by 2065 target to the UNFCCC before COP26, but it also announced at the conference that it is considering moving the target up to 2050 while aiming for net zero GHGs in 2065 (Government of Thailand, 2021a). Thailand plans to employ considerable LULUCF sinks and CCS/CCUS to reach those targets. The country re-submitted its updated NDC in October 2020, (Government of the Kingdom of Thailand, 2020)., but preparations are underway to submit a stronger NDC target prior to COP27.

Thailand is finalising its first-ever National Energy Plan in 2022, which would consolidate all national energy and power sector policies. It remains to be seen whether the existing Power Development Plan (PDP) and Alternative Energy Development Plan (AEDP) would be revised after the process (Government of Thailand, 2021b). Currently the PDP foresees a large reduction of coal power generation (compared to previous plans) with a large shift towards gas. Since 2021, Thailand has been pursuing a range of measures to increase energy security with a push towards both fossil fuels (such as postponing the retirement of coal-fired power plants, building new gas-fired plants, and purchasing new gas fields in neighbouring countries) and renewables (policies for increasing renewable energy purchases from small producers and residential sector) (Electricity Generating Authority of Thailand, 2022; Praiwan, 2022).

Projections: Thailand will likely miss its unconditional NDC target with existing policies. Our current policies scenario projections this year are similar to our 2021 projections.

Impact of climate policies on greenhouse gas emissions in Thailand



Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 22: Impact of climate policies on greenhouse gas emissions in Thailand. Emissions trajectories are based exclusively on NewClimate and IIASA’s projections. The grey bar gives the range of our 2021 projections.

Table 59: Thailand's NDCs as presented in official sources. N/A: not available or not applicable.

| Indicator | 2016 NDC | 2020 NDC |
|---|---|---|
| Business-as-Usual (BAU) | 555 MtCO ₂ e in 2030 | 555 MtCO ₂ e in 2030 |
| Target: unconditional | GHG reduction of 20% by 2030 compared to BAU level | GHG reduction of 20% by 2030 compared to BAU level |
| Target: conditional | GHG reduction of 25% by 2030 compared to BAU level, conditional on adequate and enhanced access to technology development and transfer, financial resources and capacity building | GHG reduction up to 25% by 2030 compared to BAU level, subject to adequate and enhanced access to technology development and transfer, financial resources and capacity building support. |
| Sectoral coverage | Economy-wide, excl. LULUCF | Economy-wide, excl. LULUCF |
| General Accounting method | IPCC inventory methodology not specified; GWP values from AR4 | IPCC inventory methodology not specified; GWP values from AR4. Inventory based on 1996 IPCC guidelines and is in process of transitioning to 2006. |
| GHGs covered | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ |
| Consideration of LULUCF | Inclusion of the land-use sector in the NDC is to be taken at a later stage | Not specified |
| Use of bilateral, regional and international credits | Intention of participating in international carbon markets under Article 6 of the Paris Agreement | Intention of participating in international carbon markets under Article 6 of the Paris Agreement |
| Other sector-level targets | 18% share of power generation from renewable sources, excluding hydro, in 2036. This target is based on the Power Development Plan 2015-2036. | N/A |

Table 60: Overview of key climate change mitigation policies in Thailand (APEREC, 2019; Department of Energy Business, 2015; Energy Policy and Planning Office, 2015; Government of Thailand, 2019; Ministry of Energy of the Kingdom of Thailand, 2016; NESDB (Office of The National Economic and Social Development Board), 2016; Thailand Automotive Institute, 2020; The Kingdom of Thailand, 2015)

| Sector | Policies (marked with '(+)' when mentioned in the NDC document) | Description |
|----------------------|--|--|
| Cross-cutting | Climate Change Master Plan (2015-2050) (2015) (+) | This policy sets out the following targets: 7–20% GHG emissions reductions by 2020 below BAU in the energy and transport sectors. Share of at least 25% of the total energy consumption from renewable energy sources by 2021. Reduction of energy intensity by at least 25% compared to BAU by 2030. |
| Energy supply | Alternative Energy Development Plan and Power Development Plan (2015 (+); 2018 rev. ¹) | This policy sets out the following targets: Increase of renewable energy shares to 30% of total energy consumption, 20% of power generation (plus additional 9% from imported hydro), 35% of heat generation and 35% of transport fuels by 2037. The plans also project a reduction in coal-fired power generation (23% to 12%), an increase in gas-fired power generation (37% to |

| Sector | Policies (marked with '(+)' when mentioned in the NDC document) | Description |
|--------------------------|---|---|
| | | 53%) and overall demand reduction of 6% in comparison to 2018. |
| | Energy Efficiency Plan (2015-36) (+) ¹⁾ | This policy sets out a target to reduce energy intensity per GDP (in final energy terms) by 30% by 2036, as compared to 2010, with total savings of 90 TWh by 2036. |
| | Oil Plan (2015-2036) ¹⁾ | This policy sets out measures to save fuel in the transportation sector and enhance ethanol and biodiesel consumption. |
| Transport | Environmentally Sustainable Transport System Plan (2013-30) (2012) (+) ¹⁾ | This policy supports the improvement of rail infrastructure to reduce annual logistics costs and the annual energy bill by about 2% and 1% of GDP respectively. |
| | National EV Roadmap ²⁾ | This policy aims to transform the country into an EV hub within the ASEAN region. It sets out a target to reach 250 000 EVs, 3 000 electric public buses, and 53 000 electric motorcycles by 2025 and for EVs to make up 30% of production by 2030. |
| | Excise tax on new vehicles (2016) | The tax varies between 20-50%, depending on the type of vehicle and CO2 emissions intensity. It aims to help the adoption of cleaner and more efficient vehicles. The policy is expected to be revised in the upcoming years to push for quicker adoption of EVs, necessary to respect the EV Roadmap's objectives |
| Industry | Energy Conservation and Promotion Act (1992, amended 2007) ¹⁾ | This law sets out a target to stabilise the share of energy demand for the three most energy-intensive sectors at 40% by 2030. |
| Buildings | Minimum Energy and High Energy Performance Standards (MEPS/HEPS) (2011) ¹⁾ | This policy sets out mandatory MEPS for air conditioners, refrigerators, self-ballasted compact fluorescent lamps and double-capped fluorescent lamps. HEPS for 28 appliances and types of equipment. |
| | Building energy code (2009) ¹⁾ | This policy sets out a target to reduce electricity use by large commercial buildings by > 50% by 2030 compared with BAU. |
| Agriculture and Forestry | National Forest Financing Strategy of Thailand (2021) ²⁾ | This policy describes different strategies put in place to finance forestry activities. |

¹⁾ For policies in energy and industry sectors, see APERC (2019) for detailed assumptions. ²⁾ Not quantified in IIASA model projections.

Table 61: 2015 historical data and 2030 projections of key GHG indicators for Thailand. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|--|-------------------|--|--|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (excl. LULUCF) – estimates (MtCO ₂ e) | 341 | 481 (41%) | 444 (30%) [416 (22%)] |
| GHG emissions per capita (tCO ₂ e/cap) | 4.9 | 6.7 (+37%) | 6.2 (+27%) [5.8 (19%)] |
| GHG emissions per GDP (tCO ₂ e/thousand USD) | 0.9 | 0.8 (-4%) | 0.8 (-12%) [0.7 (-17%)] |

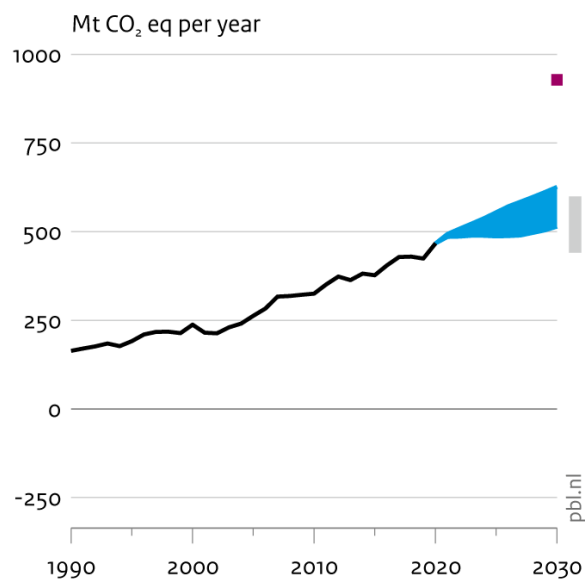
3.21 Türkiye

Recent developments: Türkiye ratified the Paris Agreement in 2021 and committed to reach net-zero emissions by 2053. The new renewable energy support mechanism (YEKDEM) provided 10-year FITs and 5-year domestic production incentives for renewable power projects but this mechanism expired in June 2021. The government is currently deciding on alternatives to replace it. Construction of the country's first nuclear power plant will be completed by 2023. The first of four reactors is expected to be operational by mid-2023.

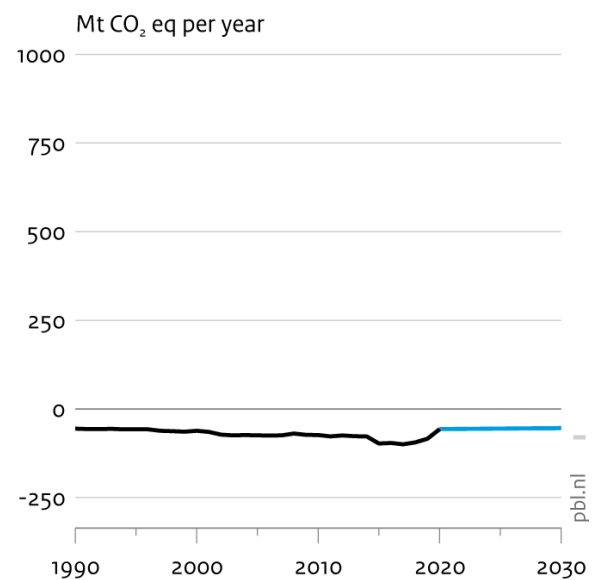
Projections: Türkiye will likely overachieve its NDC target with existing policies. Emissions projections are similar to our 2021 projections, especially due to a revision of historical emissions, which better account now for the effect of the COVID-19 pandemic.

Impact of climate policies on greenhouse gas emissions in Türkiye

Including GHG emissions from land use



GHG emissions from land use



— Historical
 ■ INDC
 ■ Unconditional
 ■ 2021 report

Source: PBL IMAGE model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 23: Impact of climate policies on greenhouse gas emissions in Türkiye (upper end: NewClimate calculations, lower end: PBL IMAGE model). The grey bar gives the range of our 2021 projections.

Table 62: Description of Türkiye's NDC, as presented in official sources. N/A: not available or not applicable.

| Indicator | 2021 NDC |
|---|--|
| Business-as-Usual (BAU) | Not specified |
| Target: unconditional | 21% GHG reduction by 2030 from baseline scenario |
| Target: conditional | N/A |
| Sectoral coverage | Economy-wide |
| General Accounting method | IPCC 2006 guidelines and IPCC 2013 KP supplement; 100-year GWPs from AR4 |
| GHGs covered | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ and NF ₃ |
| Consideration of LULUCF | Land-use sector is included in the target Accounting approaches and methodologies are not specified |
| Use of bilateral, regional and international credits | Intention of participating in international carbon markets under Article 6 of the Paris Agreement |
| Last available year for GHG inventory reporting | 2016 |

Table 63: Overview of key climate change mitigation policies in Türkiye (Government of Turkey, 2009, 2019; Ministry of Energy and Natural Resources, 2014, 2018; Ministry of Environment and Urbanization, 2010, 2011).

| Sector | Policies | Description |
|---------------------------------|---|---|
| Cross-cutting | Energy intensity target (Energy Efficiency Law) (2012) ¹⁾²⁾ | Reduce primary energy intensity by 20% by 2023, compared to the 2008 level. |
| | Energy Efficiency Action Plan (2017) ¹⁾²⁾ | Reduce primary energy consumption by 14% compared to the BAU scenario in 2023. |
| Energy supply | 11 th Development Plan (2019) ¹⁾²⁾ | Sets a target of 38.8% renewables in electricity production by 2023. |
| | Natural Resources Strategic Plan 2019-2023 (2019) ¹⁾ | This policy sets out the following targets by 2023: Wind capacity 11.8 GW Hydroelectric capacity 32 GW Geothermal capacity 2.8 GW Solar capacity 10 GW |
| Agriculture and Forestry | Initiative to plant 252 million saplings by year end (2021) ¹⁾³⁾ | This initiative sets out a target to plant 252 million tree saplings by the end of 2021, as well as a target to plant 7 billion saplings by the end of 2023 |

¹⁾ Not quantified in NewClimate Institute projections. ²⁾ Not quantified separately (but target checked in PBL scenario). ³⁾ Not quantified in PBL IMAGE model. ⁴⁾ No information available on implementation status. PBL assumed full implementation.

Table 64: 2015 historical data and 2030 projections of key GHG indicators for Türkiye. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|---|----------------------|--|---|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (incl. LULUCF) – estimates (MtCO₂e) | 377 | 514 to 626 (36% to 66%) | 928 (146%) |
| GHG emissions per capita (tCO₂e/cap) | 4.8 | 5.8 to 7.1 (+21% to +48%) | 10.5 (+119%) |
| GHG emissions per GDP (tCO₂e/thousand USD) | 0.4 | 0.3 (-21% to -4%) | 0.5 (+43%) |

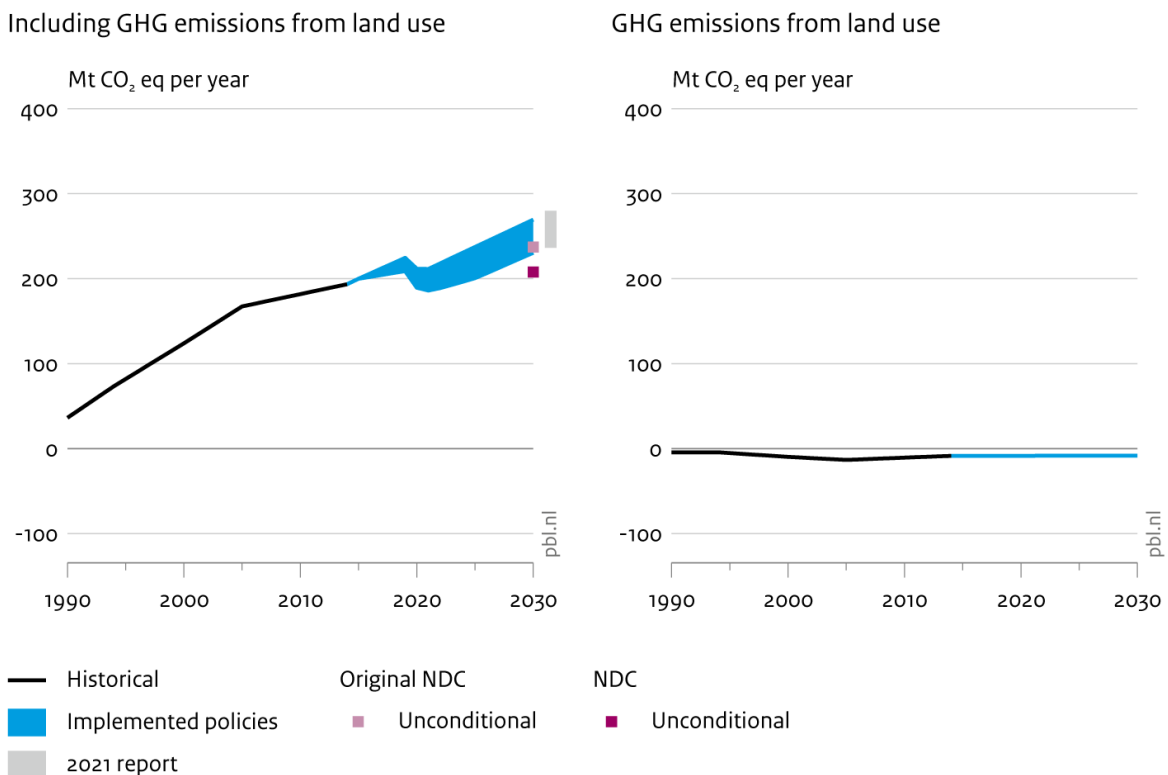
3.22 United Arab Emirates

Recent developments: the government of the United Arab Emirates submitted an updated NDC in September 2022. It sets the economy-wide and unconditional goal of reducing GHG emissions by 31% (incl. LULUCF) below business as usual (BAU) by 2030. The new NDC also includes an updated BAU scenario which slightly revises 2030 emissions downwards, from 310 to 301 MtCO₂e in 2030. In 2021, the government also announced a 2050 net zero target, but no official documents have yet been released.

In 2017, the UAE announced its 2050 Energy Strategy aiming to improve energy efficiency and diversify the electricity mix, which until recently was nearly exclusively based on gas (WAM, 2017). The strategy foresees the following electricity mix by 2050: 44% of renewable energy, 38% gas, 12% coal and 6% nuclear. As of 2020, renewable energy made up 4% of total electricity generation (IRENA, 2022a). The UAE also intends to expand nuclear capacity (Emirates News Agency, 2020). The UAE has a 2.4 GW coal-fired power plant under construction, the first in the country. The first unit was completed in May 2020 and full operation is expected in 2023 (Power Technology, 2017; SASAC, 2020). On 1 January 2018, the Federal Decree Law No. 8 added 5% of value-added tax (VAT) to diesel and petrol and a fuel economy standard has been proposed (Government of the United Arab Emirates, 2019; Ministry of Finance, 2017).

Projections: The UAE is close to meeting its original NDC target but still set to miss its latest target submitted in 2022. Current policies projections remain in an upwards trend between 2020 and 2030.

Impact of climate policies on greenhouse gas emissions in United Arab Emirates



Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 24: Impact of climate policies on greenhouse gas emissions in the United Arab Emirates Emissions trajectories are based exclusively on NewClimate and IIASA's projections. The grey bar gives the range of our 2021 projections.

Table 65: Description of UAE's previous NDC and current NDC, as presented in official sources. N/A: not available or not applicable.

| Indicator | 2016 NDC | 2020 NDC | 2022 NDC |
|---|---|---|---|
| Business-as-Usual (BAU) | N/A | 310 MtCO ₂ e | 301 MtCO ₂ e |
| Target: unconditional | Increase of clean energy to 24% of the total energy mix by 2021 | Reduction of 23.5% in GHG emissions for the year 2030, relative to BAU | Reduction of 31% in GHG emissions for the year 2030, relative to BAU |
| Target: conditional | N/A | N/A | N/A |
| Sectoral coverage | Energy | Economy-wide | Economy-wide |
| General Accounting method | N/A | N/A | N/A |
| GHGs covered | N/A | CO ₂ , CH ₄ , N ₂ O, PFCs | CO ₂ , CH ₄ , N ₂ O, PFCs |
| Consideration of LULUCF | No | LULUCF sector is included in the target, however, it is not clear for the baseline year. | LULUCF sector included in the target. Includes target of planting 100 million seedlings by 2030. |
| Use of bilateral, regional and international credits | N/A | Intention of participating in international carbon markets under Article 6 of the Paris Agreement | Intention of participating in international carbon markets under Article 6 of the Paris Agreement |

Table 66: Overview of key climate change mitigation policies in UAE (UAE Ministry of Climate Change and Environment, 2017).

| Sector | Policies ¹⁾ (marked with '+' when mentioned in the NDC document) | Description |
|----------------------|---|---|
| Cross-cutting | National Climate Change Plan (2017-2050) (2017) (+) | This policy has three aims: To develop an inventory of climate mitigation and adaptation measures, to build a national adaptation planning and implementation strategy and to boost green industry with energy efficiency and voluntary agreements. |
| Energy supply | UAE's National Energy Strategy 2050 (2017) (+) | This policy sets out a target of reaching 50% of clean energy in the electricity mix by 2050, including renewables (44%) and nuclear (6%). |
| Transport | Fuel pricing reform (2015) (+) | This policy aims at phasing out subsidies for gasoline and diesel |
| | Federal Decree Law No. 8 (2018) | This law sets out a 5% VAT tax for petrol and diesel, but crude oil and natural gas are exempted. |
| | Vehicle fuel quality standard (+) | This policy sets out a fuel quality standard of 10 ppm sulphur content and Euro 5 standards. |
| | Dubai Green Mobility Strategy (2020) (+) | This policy sets out a target of reaching 2% share of electric and hybrid cars in Dubai's road fleet by 2030, and a 30% share in government-procured vehicles. |

| Sector | Policies ¹⁾ (marked with '(+)' when mentioned in the NDC document) | Description |
|-----------|---|--|
| | Federal Law No. 2 (2009) | This law approves the creation of Etihad Rail to build and operate a 1200 km national railway network. |
| Buildings | Green building codes in Abu Dhabi (2011) and Dubai (2014) | These policies include measures to support building retrofits, increasing the penetration of district cooling, and facilitating access to project finance. |
| | Energy Efficiency Standardization and Labelling Program | This policy covers a range of household goods and appliances. |

Table 67: 2015 historical data and 2030 projections of key GHG indicators for UAE. Absolute emission levels and changes in emission levels relative to 2015 levels are presented. N/A: not available or not applicable.

| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|--|----------------------|--|--|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (incl. LULUCF) – estimates (MtCO ₂ e) | 200 | 230 to 269 (15% to 35%) | 208 (4%) |
| GHG emissions per capita (tCO ₂ e/cap) | 22.5 | 23.1 to 27 (+3% to +20%) | 20.9 (-7%) |
| GHG emissions per GDP (tCO ₂ e/thousand USD) | 0.6 | 0.4 to 0.5 (-22% to -9%) | 0.4 (-30%) |

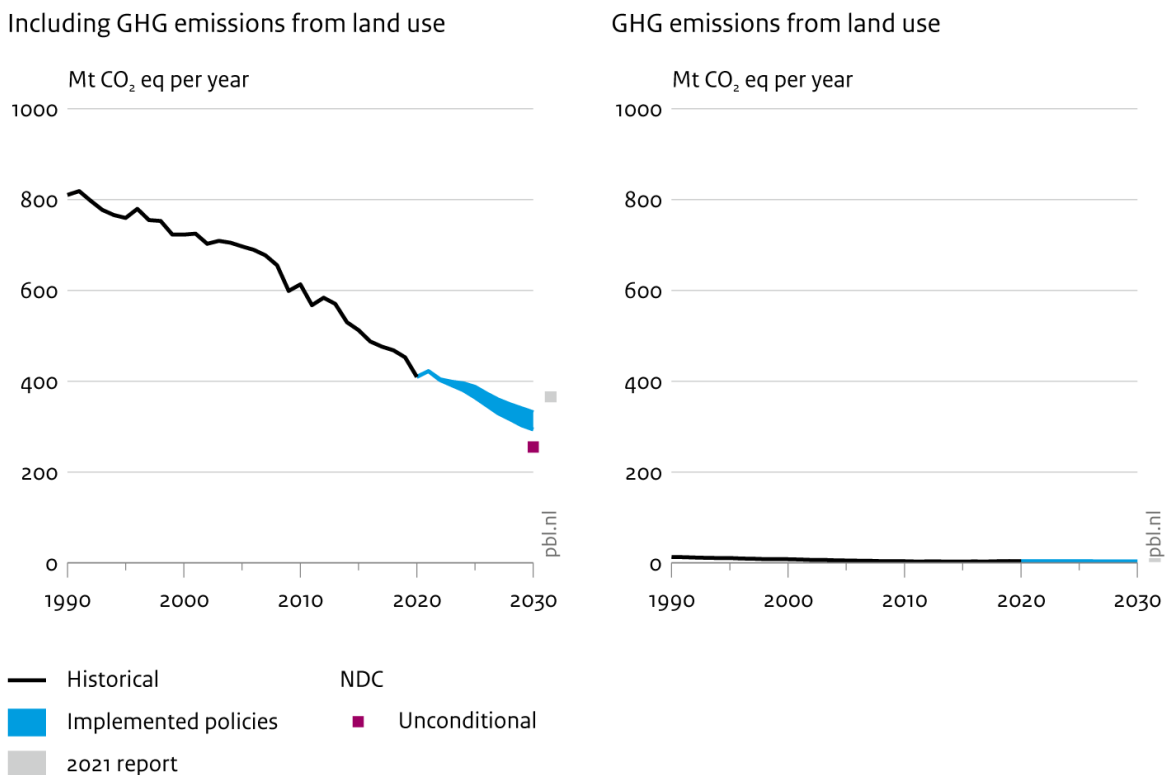
3.23 United Kingdom

Recent developments: The UK enshrined its 2050 net-zero emissions target in law in 2019 and has introduced multiple policies and sectoral plans that support emissions reductions in the aftermath. Based on these policies, the UK government released a Net Zero Strategy in October 2021 and submitted it to the UNFCCC (UK Government, 2021). However, the UK government has been ordered by the Royal Courts of Justice to update its strategy by March 2023 given the inadequate level of transparency, which was considered in breach with the Climate Change Act of 2008 (Royal Courts of Justice, 2022). The Climate Change Committee currently considers only less than 40% of the emission reductions required to achieve the NDC target are covered by credible policies (CCC, 2022).

The Energy White Paper released in December 2020 presents many measures to reduce energy-related emissions (UK Government, 2020b), including the phase out of coal-fired power plants by 2024 and plans to increase the offshore wind capacity four fold, to invest in nuclear power and to increase investments in R&D and CCS (UK Government, 2020b). The UK Emission Trading Scheme (UK-ETS) started operations in 2021 (UK Government, 2020c). In the transport sector, the UK government commits to halt sales of petrol, diesel cars and vans from 2030 onward (UK Government, 2020a).

Projections: The UK is set to miss its NDC target under current policies. Emissions have been and are now expected to remain on a downwards trend up to 2030. Steeper emissions reductions are necessary to meet the updated target, which is in line with decarbonisation by mid-century. Emissions are lower in comparison to our 2021 projections due to an update on land use emissions sinks projections.

Impact of climate policies on greenhouse gas emissions in United Kingdom



Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 25: Impact of climate policies on greenhouse gas emissions in United Kingdom. Emissions trajectories are based exclusively on NewClimate and IIASA's projections. The grey bar gives the range of our 2021 projections.

Table 68: United Kingdom's NDCs as presented in official sources. N/A: not available or not applicable.

| Indicator | 2016 NDC | 2020 NDC | 2022 NDC |
|---|---|--|---|
| Business-as-Usual (BAU) | N/A | N/A | N/A |
| Target: unconditional | At least 40% greenhouse gas reduction by 2030 from 1990 levels (as a member of the EU) | At least 68% GHG emissions reduction by 2030 compared to 1990 levels | At least 68% GHG emissions reduction by 2030 compared to 1990 levels |
| Target: conditional | N/A | N/A | N/A |
| Sectoral coverage | Economy-wide | Economy-wide | Economy-wide |
| General Accounting method | IPCC guidelines; 100-year GWPs from AR4 | 2006 IPCC guidelines; the 2013 IPCC Kyoto Protocol Supplement and the 2013 IPCC Wetlands Supplement; 100-year GWPs from AR4 | 2006 IPCC guidelines; the 2013 IPCC Kyoto Protocol Supplement and the 2013 IPCC Wetlands Supplement; 100-year GWPs from AR5 |
| GHGs covered | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ and NF ₃ | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ and NF ₃ | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ and NF ₃ |
| Consideration of LULUCF | Land-use sector is included in the target. A decision on how to include the land-use sector was adopted in 2018. | Land-use sector is included in the economy-wide target. Accounting approaches and methodologies are not specified but it is believed that UK will apply a reference level approach for managed forest and associated harvested wood products (HWP) similar to that of EU27. | Land-use sector is included in the economy-wide target. Accounting approaches and methodologies described in the NDC. All LULUCF pools are included in the NDC and no specific approach will be applied to exclude emissions from natural disturbances. |
| Use of bilateral, regional and international credits | No | The NDC states that if the UK were to use voluntary cooperation under Article 6 of the Paris Agreement, such use would be accounted for in accordance with relevant decisions adopted by the Conference of the Parties | The UK intends to meet its NDC target through domestic emissions reductions. If the UK were to use voluntary cooperation under Article 6 of the Paris Agreement, such use would be accounted for in accordance with relevant decisions adopted by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (the "CMA"). |

Table 69: Overview of key climate change mitigation policies in the United Kingdom (Committee on Climate Change, 2019; Department for Business Energy & Industrial Strategy, 2020; Department of Transport, n.d.; UK Government, 2008, 2019c, 2019a, 2019b, 2020a).

| Sector | Policies ¹⁾ (marked with '(+)' when mentioned in the NDC document) | Description |
|----------------------|--|--|
| Cross-cutting | Climate Change Act (2008, 2019 update) (+) | <ul style="list-style-type: none"> This amendment in 2019 introduced a net-zero 2050 emissions target, strengthening its previous 2050 goal of at least an 80% GHG emissions reduction below 1990 levels by 2050 The sixth carbon budget proposed by the Committee on Climate Change (CCC) in December 2020 sets an emission reduction target for 2030 of 68% compared with 1990 levels. This target was subsequently adopted by the UK government. |
| | Ten Point Plan for a Green Industrial Revolution (2020) (+) | <ul style="list-style-type: none"> This policy defines several policy interventions in the energy, buildings, transport, nature, and technologies sectors, aiming to mobilise GBP 12 billion of government investment of which GBP 4 billion is new funding |
| | National Infrastructure Strategy United Kingdom (2020) | <ul style="list-style-type: none"> This strategy presents an overview of multiple policy interventions and actions across different sectors, many of which also reflected in sectoral plans. |
| | Clean Growth Strategy (2017) (+) | <ul style="list-style-type: none"> This policy presents intended actions by the UK government to accelerate the shift to low carbon transport, deliver clean and flexible power, improve energy efficiency, and reduce emissions from households. |
| | Climate Change Levy (2001, 2018 update) (+) | <ul style="list-style-type: none"> Amended in 2018 to increase the tax levels over time, the Climate Change Levy taxes the supply of energy in the industry, commerce and public sectors (electricity, gas, solid fuel, liquefied gases). |
| | UK F-Gas regulation (2019) (+) | <ul style="list-style-type: none"> This regulation ensures the continuation of emission reductions beyond the UK's exit from the EU from January 2021 onwards of a 79% phase down of hydrofluorocarbons while further banning some F-gases and strengthening regulations related to leakage and repair. |
| Energy supply | Energy White Paper (2020) (+) supported by Ten Point Plan for a Green Industrial Revolution (2020) (+) | <p>This white paper outlines an expected 230 MtCO₂e in cumulative emissions reductions by 2032, presenting several measures in the energy supply sector:</p> <ul style="list-style-type: none"> Announcement of UK Emissions Trading System (UK-ETS), which started operations in 2021 Investments in nuclear power with a commitment to make a final investment decision of at least one nuclear power plant by 2024 and funding for research on advanced nuclear technology Targeting 40 GW of offshore wind power capacity by 2030, incl. 1 GW of innovative floating offshore wind Increase installation rate of electric heat pumps from 30,000 per year to 600,000 per year by 2028 |
| Transport | Transport Decarbonisation Strategy (2021) (+) | <ul style="list-style-type: none"> This strategy outlines the government's intention end the sale of fossil fuel heavy goods vehicles (HGVs) by 2040, with sales of smaller trucks banned by 2035. These dates have not been finally adopted as of August 2021. The strategy also presents plans to make domestic aviation net-zero emissions by 2040, with total aviation emissions to reach net-zero by 2050. |
| | National Bus Strategy (2021) | <ul style="list-style-type: none"> The strategy outlines the government's plans to enhance and expand the public bus networks across the United Kingdom, |

| Sector | Policies ¹⁾ (marked with '(+)' when mentioned in the NDC document) | Description |
|------------------|--|--|
| | <p>Energy White Paper (2020) supported by Ten Point Plan for a Green Industrial Revolution (2020) (+)</p> <p>UK Road Vehicle Emission Performance Standards (2019)</p> | <p>among other measures, by support the purchase of at least 4,000 new zero emission buses.</p> <ul style="list-style-type: none"> • These policies set out a ban on selling petrol and diesel vans and cars by 2030, with all vehicles being required to have a significant zero emissions capability from 2030 and be 100% zero emissions from 2035. • Several investment packages to support the following: <ul style="list-style-type: none"> ○ Electrification of UK vehicles and their supply chains (GBP 1 billion) ○ Accelerate the roll out of charging infrastructure (GBP 1.3 billion) ○ Enhancement and renewal of rail networks and city public transport (more than GBP 10 billion) ○ Supporting clean maritime technology (GBP 20 million) and support the production of sustainable aviation fuels (GBP 15 million) <p>This regulation sets vehicle emission standards in line with EU regulations stipulating a limit of 95g CO₂/km for new passenger vehicles and 147g CO₂/km for vans from 2020 onwards with the subsequent changes:</p> <ul style="list-style-type: none"> • From 2025 onwards, these will further be adjusted to a 15% emissions reduction below a 2021 baseline for both cars and vans • From 2030, these will further be adjusted to a 37.5% reduction below the 2021 baseline |
| Buildings | <p>Heat and Buildings Strategy (2021) (+)</p> <p>Energy White Paper (2020) (+) supported by Ten Point Plan for a Green Industrial Revolution (2020) (+)</p> | <ul style="list-style-type: none"> • This strategy outlines the government's intention to make all new heating systems to be 'net-zero compatible' by 2035 through a ban of new natural gas boilers. In the meantime, the government aims to install 600,000 heat pumps per year by 2028 and reducing costs for heat pumps by 25-50% by 2030. • The strategy further outlines action areas for supply chain improvements for domestic heat pump production, increased R&D, and hydrogen-based heating applications. <p>These policies include the following relevant measures:</p> <ul style="list-style-type: none"> • Implementation of the Future Home Standard for new residential buildings (timeline not defined) • 600,000 heat pump installations per year by 2028 • Extension of Green Homes Grant Voucher and Local Authority Delivery schemes by one year (for 2021) |
| Industry | <p>Industrial Decarbonisation Strategy United Kingdom (2021)</p> <p>Hydrogen Strategy United Kingdom (2021)</p> <p>Energy White Paper (2020) (+) supported by Ten Point Plan</p> | <ul style="list-style-type: none"> • This strategy outlines the government's intention to reduce industry sector emissions by around 66% by 2035 and at least 90% by 2050, both compared to 2018 baseline. • For this purpose, the strategy outlines several policy actions in the industry sector and non-GHG targets. On the latter, the government aims for 3 MtCO₂ captured through Carbon Capture, Usage and Storage (CCUS) and around 20 TWh switching to low carbon fuels by 2030. • The strategy outlines the government's plans to develop hydrogen production and use in the UK. For 2030, among other targets, the government aims to achieve 1 GW of low carbon production capacity by 2025 and 5GW post-2030. <p>These policies include the following relevant measures:</p> <ul style="list-style-type: none"> • GBP 1 billion up to 2025 to facilitate the deployment of CCUS in |

| Sector | Policies ¹⁾ (marked with '(+)’ when mentioned in the NDC document) | Description |
|--------------------------|---|--|
| | for a Green Industrial Revolution (2020) (+) | <p>two industrial clusters by the mid-2020s, and a further two clusters by 2030</p> <ul style="list-style-type: none"> Target to develop 5GW of low-carbon hydrogen production capacity by 2030 and create a Net Zero Hydrogen Fund of GBP 240 million Support of four low carbon clusters by 2030 and at least one fully net-zero cluster by 2040 |
| | Industrial Decarbonisation and Energy Efficiency Action Plans (2017) | <ul style="list-style-type: none"> Voluntary commitments by the government, industry, and other parties to accelerate decarbonisation and to improve energy efficiency in the industry sector. |
| | Industrial Strategy (2017) | <ul style="list-style-type: none"> This strategy outlines an investment of GBP 162 million in innovation in low-carbon industry with a key focus on a reduction of energy use. |
| | Carbon Reduction Commitment Energy Efficiency Scheme (2010) | <ul style="list-style-type: none"> This mandatory scheme for large businesses aims to improve energy efficiency by mandating that businesses to measure their energy consumption and put in place cost-effective energy savings measures. |
| Agriculture and Forestry | 25 Year Environment Plan (2018) (+) ²⁾ | <ul style="list-style-type: none"> This policy sets out a target to increase the area of woodland in England to 12% by 2060 by planting 180,000 ha by 2042. |
| | Woodland Carbon Guarantee (2019) ²⁾ | <ul style="list-style-type: none"> This policy sets out a £50 million incentive scheme to increase the planting trees rate across England. Working with Woodland Carbon Units (WCU), the scheme allows landowners to sell the carbon credits generated to either the government or to the open market up to 2055/56. |
| | England Trees Action Plan 2021 to 2024 (2021) ²⁾ | <p>This plan sets out the government’s long-term vision for the treescape it wants to see in England by 2050 and beyond. It provides a strategic framework for implementing the Nature for Climate Fund and outlines over 80 policy actions the government is taking over this Parliament to help deliver this vision.</p> |

¹⁾ Not quantified in NewClimate Institute projections. ²⁾ Not quantified in IIASA model projections.

Table 70: 2015 historical data and 2030 projections of key GHG indicators for the United Kingdom. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|--|-------------------|--|--|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (incl. LULUCF) – estimates (MtCO ₂ e) | 512 | 294 to 332 (-43% to -35%) | 255 (-50%) |
| GHG emissions per capita (tCO ₂ e/cap) | 7.9 | 4.3 to 4.8 (-46% to -39%) | 3.7 (-53%) |
| GHG emissions per GDP (tCO ₂ e/thousand USD) | 0.2 | 0.1 (-54% to -48%) | 0.1 (-60%) |

3.24 United States of America

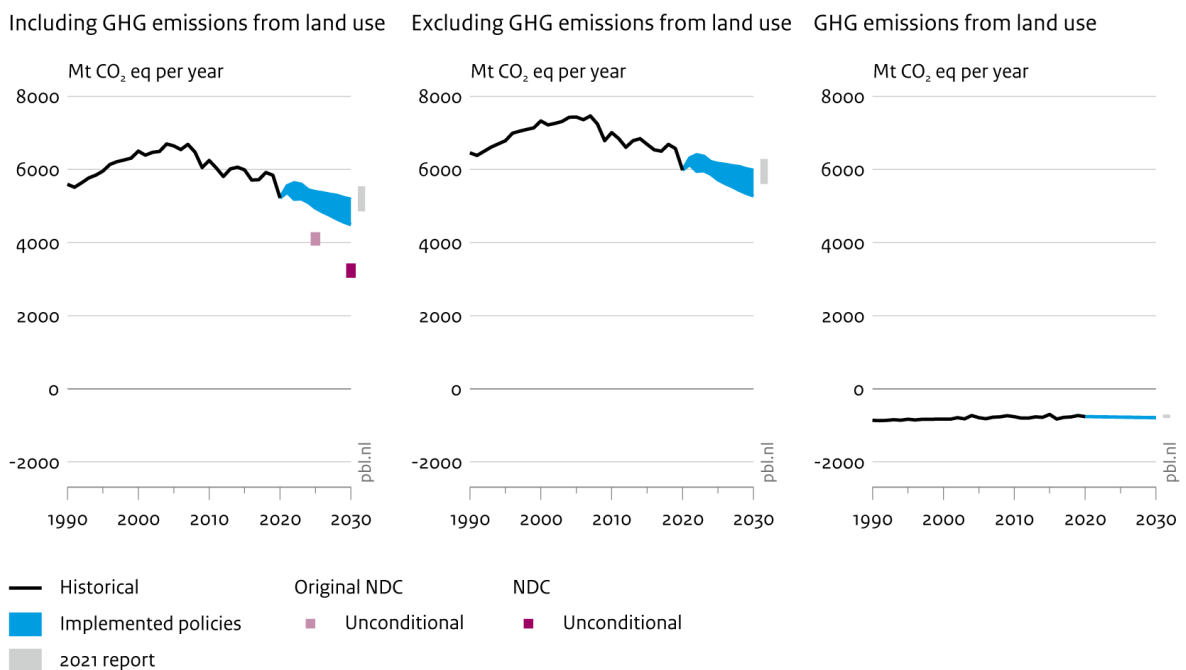
Recent developments: The Biden administration has taken steps to address climate change as one of its priorities, reverse climate policy rollbacks of their predecessor, and exercise international diplomacy to line up the US as a global leader on climate change. This includes setting economy-wide and sectoral decarbonisation goals such as net zero emissions by 2050, carbon-free power sector by 2035 and make half of all new vehicles sold in 2030 zero-emissions vehicles.

In August 2022, President Biden signed into law the Inflation Reduction Act (IRA), the most important climate policy in US history. The IRA injects USD 369bn in the form of tax credits, grants and loans directed to develop and deploy the clean energy technologies and investments that will be essential to decarbonisation of the economy (Jenkins et al., 2022a).

The US took important measures to reduce GHG emissions at sectoral level. In the transport sector, the Biden administration reversed one of the most detrimental rollbacks from the Trump-era and set stricter fuel economy and GHG emissions standards for passenger vehicles for model years 2023-2026. In the industry sector, the administration enacted a bill to phase down the production and consumption of hydrofluorocarbons (HFCs) over the next 15 years. The US Supreme Court ruled to limit the Environmental Protection Agency's ability to regulate carbon emissions from power plants, setting a worrying precedent for more cases coming through the courts that could affect other aspects of future climate action (Newburger & Mangan, 2022).

Projections: The US will likely miss its NDC targets with existing policies. Our current policies scenario projections this year is lower than our 2021 projections but does not include the effect of the Inflation Reduction Act. The Act would bring the US closer but remains insufficient to put the country on track to meet its latest NDC target (Jenkins et al., 2022b; Mahajan et al., 2022; Rhodium Group, 2022).

Impact of climate policies on greenhouse gas emissions in United States of America



Source: PBL IMAGE model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 26: Impact of climate policies on greenhouse gas emissions in the United States of America (upper end: NewClimate Institute calculations, lower end: PBL IMAGE model). The grey bar gives the range of our 2021 projections.

Table 71: United States of America's NDCs as presented in official sources. N/A: not available or not applicable.

| Indicator | 2016 NDC | 2021 NDC |
|---|---|---|
| Business-as-Usual (BAU) | N/A | N/A |
| Target: unconditional | 26-28% GHG reduction by 2025 from 2005 levels | 50-52% GHG reduction by 2030 from 2005 levels |
| Target: conditional | N/A | N/A |
| Sectoral coverage | Economy-wide | Economy-wide |
| General Accounting method | IPCC guidelines; 100-year GWPs from AR4 | IPCC guidelines; 100-year GWPs from AR4 |
| GHGs covered | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ and NF ₃ | CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs, SF ₆ and NF ₃ |
| Consideration of LULUCF | Land-use sector is included in the target Net-net accounting is specified to be used for emission accounting ¹⁾ | Land-use sector is included in the target Net-net accounting is specified to be used for emission accounting ¹⁾ |
| Use of bilateral, regional and international credits | N/A | N/A |

¹⁾ The US also specifies that it intends to use the production approach for accounting for harvested wood products (HWP) consistent with IPCC guidance.

Table 72: Overview of key climate change mitigation policies in the United States of America (U.S. Department of State, 2016; U.S. EPA, 2018a, 2018b, 2019b; U.S. EPA & U.S. NHTSA, 2020)

| Sector | Policies (marked with '(+)’ when mentioned in the NDC document) | Description |
|----------------------|---|---|
| Cross-cutting | Infrastructure Investment and Jobs Act (2021) ¹⁾ | This act comprises investments in a wide range of areas (totalling USD 1.2tn) that can indirectly enable the transition to a low-carbon economy, including the development of EV charging infrastructure, upgrading the power grid, and improving energy efficiency and electrification in buildings. |
| Energy supply | Methane waste prevention rule (2016) ¹⁾²⁾ | This policy sets out specific standards for oil and gas production to reduce CH ₄ emissions by 35% from 2014 levels by 2025. The November 2018 amendment removed requirements of the 2016 rule. |
| | Bipartisan Budget Act (2018) ¹⁾ | This act provides a tax credit for carbon dioxide captured through CCS (section 45Q), including carbon dioxide used for enhanced oil recovery. |
| | Renewable Portfolio Standards (+) ¹⁾ | 31 Renewable Portfolio Standards (RPS) in place at a state level. |
| Transport | Emissions standards for light-duty vehicles (2021) | This policy sets out more stringent GHG emissions standards for LDVs for model year (MY) 2023 through 2026. The new standards require automakers to achieve a vehicle mileage of 52 miles per gallon (mpg) by 2026 |
| | Fuel efficiency standards for light-duty vehicles (CAFE) (2022) | The new standards set out a target to increase fuel efficiency 8% annually for MY 2024-2025 and 10% annually for model year 2026, achieving a fleet average of 49 mpg by 2026, improving by nearly 10 mpg relative to MY 2021 |

| Sector | Policies (marked with '(+)’ when mentioned in the NDC document) | Description |
|--------------------------|--|---|
| | Efficiency standards heavy-duty vehicles | The new standards include differentiated requirements per truck type. |
| | Renewable fuel standard (2015) | This policy sets out new standards for biofuel blending, setting out a target to increase biofuel use from nine billion gallons in 2008 to 36 billion gallons by 2022. In 2020, the USD 1 per gallon biodiesel blending tax credit was extended to 2022 and the required advanced category biofuel (i.e. biodiesel) volume was raised relative to 2019 levels. |
| Buildings | Better buildings Challenge (commercial buildings) ^{1) 2)} | This policy sets out a target to increase energy efficiency in commercial and industrial buildings by 20% by 2020. |
| | Energy Star Tax credits for buildings ¹⁾ | Tax credits for energy efficiency products and solar energy systems. |
| | Building Energy Codes Program | This program sets out efficiency codes adopted at a state level. |
| Industry | Curbing emissions of hydrofluorocarbons (HFCs) (+) | As of April 2018, the US EPA has announced that it will not enforce HFC regulations under the Significant New Alternatives Policy Program (SNAP) In 2021, the Biden Administration requested the US Senate’s consent to ratify the Kigali Amendment, which aims to phase down hydrofluorocarbons (HFCs) worldwide. |
| | American Innovation and Manufacturing (AIM) Act (2021) | This Act directs the US Environmental Protection Agency (EPA) to phase down the production and consumption of HFCs. The rule aims to gradually reduce the production and imports of HFCs by 85% over the following 15 years after its implementation (2021–2036). |
| Agriculture and Forestry | Forest Ecosystem Restoration and Hazardous Fuels Reduction Programs (2000) ^{1), 3)} | These programs set out a mix of actions to increase forest resilience, reduce wildfires, and increase the area of set aside forests. |

¹⁾ Not quantified in PBL IMAGE model projections. ²⁾ Not quantified in NewClimate Institute projections.

³⁾ Not quantified in IIASA model projections.

Table 73: 2015 historical data and 2030 projections of key GHG indicators for the United States of America. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|--|-------------------|--|--|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (incl. LULUCF) – estimates (MtCO ₂ e) | 5990 | 4490 to 5190 (-25% to -13%) | 3300 to 3170 (-45% to -47%) |
| GHG emissions per capita (tCO ₂ e/cap) | 18.5 | 12.8 to 14.8 (-31% to -20%) | 9 to 9.4 (-51% to -49%) |
| GHG emissions per GDP (tCO ₂ e/thousand USD) | 0.3 | 0.2 (-43% to -35%) | 0.1 (-58% to -60%) |

3.25 Viet Nam

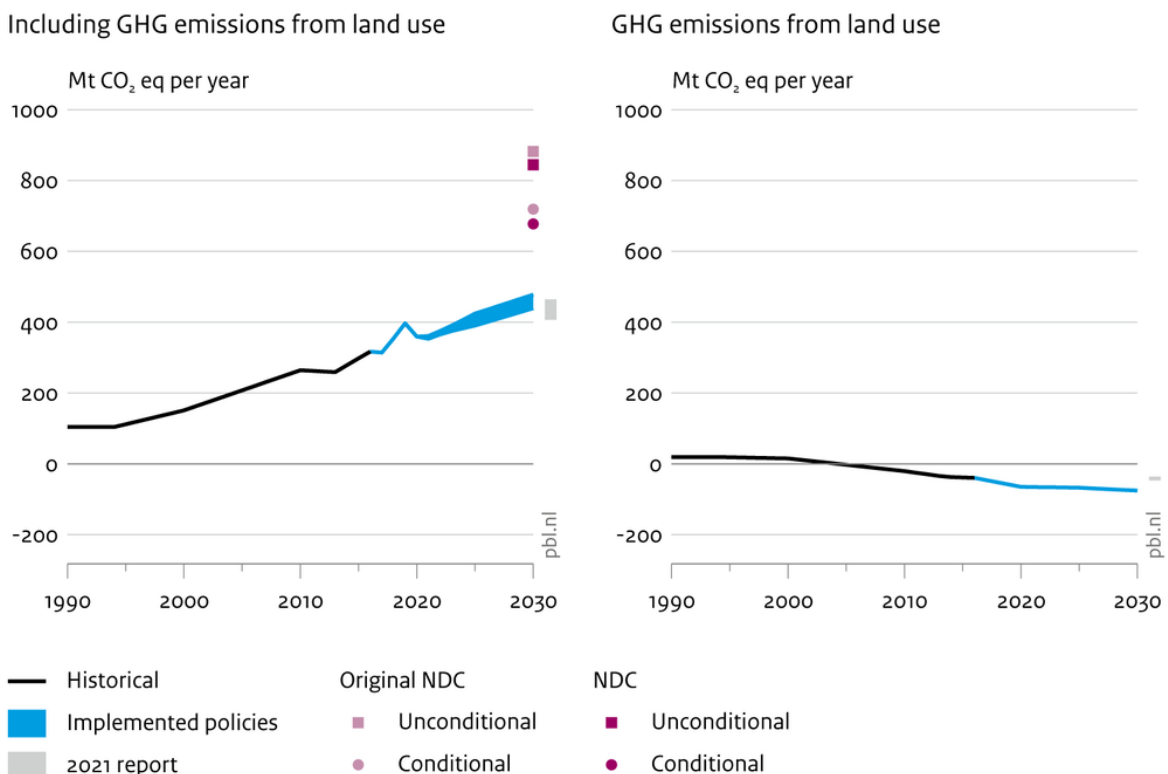
Recent developments: Viet Nam's National Strategy on Climate Change for 2050 was approved mid-2022. The plan aims to reduce emissions by 43.5% by 2030 compared to a business-as-usual (BAU) scenario, peak national emissions by 2035, and reach net-zero by 2050. Sectoral emissions targets are also set for 2030 and 2050. Viet Nam's new NDC is assessed to be slightly more ambitious than its previous NDC, mainly due to the expanded coverage of sectors.

The latest draft of the 8th Power Development Plan (PDP8) is still in discussion (Massmann, 2022). The draft was first issued for public comment on February 2021 and has been through several revisions with differing outlooks for renewables, coal, and gas.

At COP26 Viet Nam signed the Coal to Clean Power Transition Statement, aiming to rapidly scale up renewables and energy efficiency measures, cease issuance of permits for new unabated coal-fired power plants, and strengthen efforts to achieve a just transition from coal in the 2040s. Viet Nam also signed the Global Methane Pledge to cut methane emissions by 30% by 2030.

Projections: Viet Nam is well on track to meet both its unconditional and conditional NDC targets. However, these targets are well above 2020 emissions. Current policies are expected to remain on an upwards trend in the next decade.

Impact of climate policies on greenhouse gas emissions in Viet Nam



Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 27: Impact of climate policies on greenhouse gas emissions in Viet Nam (including LULUCF). Emissions trajectories are based exclusively on NewClimate and IIASA's projections. The grey bar gives the range of our 2021 projections.

Table 74: Description of Viet Nam's previous NDC and current NDC, as presented in official sources. N/A: not available or not applicable.

| Indicator | 2016 NDC | 2020 NDC |
|---|--|---|
| Business-as-Usual (BAU) | 787.4 MtCO ₂ e (excluding industrial processes) | 927.9 MtCO ₂ e (including industrial processes) |
| Target: unconditional | To reduce 8% compared to BAU by 2030 Reduce emission intensity / GDP unit by 20% | To reduce 9% compared to BAU by 2030, equivalent to 83.9 million tonnes CO ₂ eq |
| Target: conditional | To reduce 25% compared to BAU by 2030 Reduce emission intensity / GDP unit by 30% | To reduce 27% compared to BAU by 2030 |
| Sectoral coverage | Excludes industrial processes | Economy-wide |
| General Accounting method | IPCC Guidelines; 100-year GWP values from AR4 | IPCC Guidelines; 100-year GWP values from AR4 |
| GHGs covered | CO ₂ , CH ₄ , N ₂ O | CO ₂ , CH ₄ , N ₂ O and HFCs |
| Consideration of LULUCF | Forest cover will increase to the level of 45% | Increase GHG sequestration by 1.0% (9.3 million tonnes of CO ₂ eq) compared to the BAU scenario (unconditional) and 2.3% (21.2 million tonnes of CO ₂ eq) compared to the BAU scenario (conditional). |
| Use of bilateral, regional and international credits | Not specified | Intention of participating in international carbon markets under Article 6 of the Paris Agreement |

Table 75: Overview of key climate change mitigation policies in Viet Nam (Massmann, 2022; MNRE, 2011; Thuy, 2021; Viet Nam Government, 2012, 2016, 2020, 2021)

| Sector | Policies ³⁾ (marked with '(+)' when mentioned in the NDC document) | Description |
|----------------------|--|---|
| Cross-cutting | Decision No. 2139/QD-TTg approving The National Climate Change Strategy (2011) | This strategy sets out a target to reduce 20% GHG emissions from agriculture; to increase forest coverage to 45%; hydropower plants' capacity reaches 20,000 MW+; to increase share of renewables to 11% by 2050; 90% of industry using cleaner production and reduction energy consumption. |
| | Decision 1393/QD-TTg implementing the Green Growth Strategy (2012) (+) | This strategy sets out a target to reduce intensity of GHG emissions per GDP unit by 1-1.5% per year until 2020 and between 1.5-2% between 2020 and 2050. |
| Energy supply | Power Development Plan 7 (PDP7) (+) approved by Decision No. 428/QD-TTg (2016) | This plan sets out a target for electricity capacity and generation. 10.7% is projected for energy production from renewables (solar, wind, biomass, and small hydro) and 12.4% from large hydro. Regarding electricity capacity 16.9% from large hydro and 21% from other renewables by 2030. Gas is projected to reach 16.8% of electricity generation by 2030. |
| | Resolution No 55NQ/TW on the orientation of the National Energy Development Strategy of Vietnam to 2030 (2020) (+) ¹⁾ | This policy sets out a target to scale down coal-fired power generation. It also outlines 15-20% proportion of renewables in the energy mix by 2030 and aims to reduce 15% of GHG emissions by 2030 and 20% by 2040 from an unspecified BAU. |

| Sector | Policies ³⁾ (marked with '(+)' when mentioned in the NDC document) | Description |
|---------------------------------|---|---|
| | Decision No. 11/2017/QĐ-TTg (Solar support mechanism – Feed-in tariff) (2017) ¹⁾ | Although this decision has ended in 2019, it was amended in April 2020 and enter into force in July 2020 (Circular No. 18) and regulates the support mechanism (feed-in tariff) for solar installations. |
| Transport | Action Plan (2016-2020) | This plan sets out a target to mix at least 5% of bioethanol in gasoline and energy labelling for LDVs and motorcycles. |
| Buildings | National Energy Efficiency Programme (VNEEP) for the period of 2019 – 2030 | This policy outlines mandatory energy labelling and minimum energy efficiency standards roadmap for equipment and appliances. |
| Industry | National Energy Efficiency Programme (VNEEP) for the period of 2019 – 2030 | This policy sets out energy savings targets for specific sectors, such as the chemical, cement and also for the new industrial parks. |
| Agriculture and Forestry | Forestry Law (2017) (+) ²⁾ | This law regulates the management of forests. |
| | Tree Planting Plan (2020) ²⁾ | This plan sets out the target to plant 1 billion trees by 2025. |
| | Decision No. 523/QĐ-TTg dated April 01, 2021 of the Prime Minister approving Vietnam's forestry development strategy for the 2021-2030 period, with a vision toward 2050 (2021) ²⁾ | This strategy sets out the following targets: The growth rate of forestry production value will be 5% to 5.5%/year; Planting of production forests will be about 340,000 ha/year by 2030; The value of incomes earned from production forests will increase 1.5 times by 2025 and twice per area unit by 2030, as compared to 2020; By 2025, the average income of ethnic minority people working in forestry will increase more than twice compared to 2020, etc. |
| | Sustainable forestry development programme by 2025 (2021) ²⁾ | This policy sets out the following targets: Protecting the existing forest coverage in a sustainable manner and developing new areas in 2021-2025; strictly managing the transfer of forest use into other purposes, maintaining stably the national forest coverage at 42 per cent; while increasing productivity and forest quality to meet demands of materials for production and protection and environment protection, and to preserving biodiversity. |

¹⁾ Not quantified in NewClimate Institute projections. ²⁾ Not quantified in IIASA model projections.

Table 76: 2015 historical data and 2030 projections of key GHG indicators for the Viet Nam. Absolute emission levels and changes in emission levels relative to 2015 levels are presented.

| Indicator | 2015 (historical) | 2030 projections (change rate vs. 2015 levels) | |
|---|-------------------|--|--|
| | | Current policies scenario | NDC unconditional [conditional] target |
| GHG emissions (incl. LULUCF) – estimates (MtCO₂e) | 298 | 439 to 478 (48% to 60%) | 844 (184%) [677 (127%)] |
| GHG emissions per capita (tCO₂e/cap) | 3.2 | 4.3 to 4.7 (+32% to +44%) | 8.2 (+154%) [6.6 (104%)] |
| GHG emissions per GDP (tCO₂e/thousand USD) | 1.3 | 0.9 to 1 (-39% to -33%) | 1.8 (+18%) [1.5 (-6%)] |

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Appendix

A1: Summary of methods

NewClimate Institute, IIASA and PBL have estimated the impact of current policies on future GHG emissions. Here, we summarise the main updates and methodological changes in this report:

- Policy developments since the 2021 report have been included in the emissions projections (cut-off date: June 2022, with a few exceptions) based on the periodical updates of the Climate policy Database (NewClimate Institute & Wageningen University and Research, 2022) under the European ENGAGE projects (ENGAGE, 2020).
- Country-level policies packages for quantification in GHG emissions scenarios were reviewed by in-country experts involved in ENGAGE to identify policies, not limited to those focused on energy and climate, expected to deliver significant emission reduction impact.
- Historical GHG emissions data was updated according to latest inventories submitted to the UNFCCC (cut-off date: April 2022; see Appendix A.2).
- GHG emissions projections under current policies were harmonised to the latest historical emissions data by adding the absolute emissions difference in the harmonisation year between the inventory data and the model data to the model projections (see Appendix A.3).

To calculate per capita and per GDP indicators, we used the population projections from the UN World Population Prospects 2022 (United Nations, 2022) and GDP projections from IMF's World Economic Outlook (IMF, 2022).

The information about NDC targets and official emissions projections under current policies or equivalent are collected mainly from the government documents submitted to the UNFCCC. NDC documents were taken from UNFCCC NDC registry. We considered that the official estimates of an NDC target is available in absolute terms when it is provided in: (i) absolute terms, (ii) provided as a base year target with the base year GHG emissions reported in the national GHG inventory reports submitted to the UNFCCC, or (iii) BAU target with the BAU emission levels reported in the (I)NDC document, with description of the accounting of land use, land use change, and forestry (LULUCF) emissions.

In this report, GHG emission values are expressed in terms of AR4 GWPs unless otherwise noted.

A2: Harmonisation of GHG emissions projections under current policies to the historical emissions data

Historical GHG emissions data sources

For Annex I countries, we used official GHG inventories submitted in 2022; the inventories used 100-year global warming potential (GWP) values from the IPCC Fourth Assessment Report (AR4).

Table A-1 presents an overview of data sources for historical emissions of non-Annex I Parties. For many countries, we used data from the most recent Biennial Update Reports (BURs) and National Communications submitted to the UNFCCC. All values were converted to AR4 whenever presented in another GWP.

Whenever country-report data for historical emission excluding LULUCF were unavailable, we used PRIMAP-hist to extend the historical time series (Gütschow et al., 2021). We only extend time series in cases where officially reported data is outdated (over 5 years old) and historical data available in officially reported datasets and PRIMAP-hist are consistent. This approach is aligned with the estimates prepared by the CAT project. We rely on PRIMAP-hist because it offers the option to prioritise country-reported historical emissions when compiling the full time series (Gütschow et al., 2016). This approach is similar to ours and is therefore compatible with estimates for other countries.

For China, LULUCF projections are harmonized to the historical data from the 2014 GHG inventories presented in the Second Biennial Update Report (BUR2) of China (Government of China, 2018). In the BUR2 report, the LULUCF sink was reported as -1.115 MtCO₂eq for 2014. This constitutes an increase of the LULUCF sink as compared to the 2012 reported estimate of -576 MtCO₂eq (Government of P. R. China, 2016) which was used for harmonizing the LULUCF projections for China in our 2019 report (Kuramochi et al., 2019).

Data harmonisation

The GHG emissions projections under current policies from NewClimate Institute, PBL and IIASA were all harmonised to the historical emissions dataset presented in Table A-2 by applying a constant offset value (i.e. the difference in emissions of the two datasets in the harmonisation year) to the entire emission pathway. For Annex I countries, emissions projections were harmonised to 2019 historical emissions. For non-Annex I countries, the column 'Last reported year' in Table A-2 serves as a reference for the harmonisation year.

Table A-1: Data sources for historical GHG emissions in non-Annex I countries (Gütschow et al., 2021; UNFCCC, 2021a). For all countries, data not reported in the document indicated are collected from previous versions and/or the UNFCCC non-Annex-I emissions inventory database (UNFCCC, 2021a).

| Country | GHG emissions excluding LULUCF | | LULUCF emissions | |
|-----------------------------|--------------------------------|-------------------------|----------------------|-------------------------|
| | Source | Last reported data-year | Source | Last reported data-year |
| Argentina | BUR4 | 2018 | BUR4 | 2018 |
| Brazil | BUR4 | 2018 | BUR4 | 2018 |
| China | BUR2 & PRIMAP ¹⁾ | 2014 / 2019 | BUR2 | 2014 |
| Colombia | BUR3 | 2018 | BUR3 | 2018 |
| Egypt | BUR1 & PRIMAP ¹⁾ | 2015 / 2019 | LULUCF outside scope | N/A |
| Ethiopia | NC2 & PRIMAP ¹⁾ | 2013 / 2018 | NC2 | 2013 |
| India | BUR3 & PRIMAP ¹⁾ | 2016 | BUR3 | 2016 |
| Indonesia | BUR3 | 2019 | BUR3 | 2019 |
| Iran | NC3 | 2010 | NC3 | 2010 |
| Republic of Korea | NIR 2021 | 2019 | NIR 2021 | 2019 |
| Mexico | NIR 2022 | 2019 | NIR 2022 | 2019 |
| Morocco | BUR3 | 2018 | BUR3 | 2018 |
| Saudi Arabia | BUR1 | 2016 | BUR1 | 2016 |
| South Africa | BUR4 | 2017 | BUR4 | 2017 |
| Thailand | BUR3 & PRIMAP ¹⁾ | 2016 / 2019 | BUR3 | 2016 |
| United Arab Emirates | NC4 | 2014 | NC4 | 2014 |
| Viet Nam | BUR3 | 2016 | NC2 | 2014 |

¹⁾ Historical emissions data is based on Biennial Update Reports or National Communications up until the latest officially reported year but is extended using PRIMAP to account for more recent developments.

A3: Quantification of NDC targets

Target type

In this research, we quantified and presented targets in terms of absolute emissions. However, countries submitted targets that follow distinct typologies:

1. **Base year target:** reduction from historical base year emissions. NDCs set a target reduction below historical base year emission level. This category covers: Australia, Brazil, Canada, the European Union, Japan, the Republic of Korea, the Russian Federation, the United Kingdom, and the USA.
2. **Baseline or business-as-usual (BAU) target:** emissions reductions relative to a baseline or BAU projection (specified in the NDCs). The mitigation component of the NDCs specifies the BAU emission projection. The type of emissions reductions relative to a baseline or BAU projection has been chosen for countries, and in this report for: Ethiopia, Egypt (even though not economy-wide), Indonesia, Iran, Mexico, Morocco, Thailand, Türkiye, UAE and Viet Nam.
3. **Baseline or BAU target (not specified):** emissions reductions relative to a baseline projection (not specified). Same as under point 2, but here, for the NDCs, baseline or business-as-usual emissions projections are not specified, such as for those of Saudi Arabia. For the calculations, we used the baseline projections from national studies (when available) and the estimates from the Climate Action Tracker.
4. **Intensity target:** emissions reductions relative to GDP as the main type of mitigation.
5. **Intensity and non-GHG target:** emission intensity target and non-GHG target. China and India aim for emission intensity improvements, a target for non-fossil fuels in primary energy consumption/power capacity, and for China, a target year for the peaking of emissions.
6. **Trajectory and fixed-level target:** South Africa presents a trajectory target stating the emission ranges for 2025 and 2030. Colombia and Argentina put forward a fixed-level target, specifying the MtCO_{2e} that they intend not to exceed.
7. **Submitted actions (cannot be quantified):** finally, many countries include mere qualitative descriptions of mitigation actions in their INDCs/NDCs, or specific targets for sub-sectors, such as for the implementation of renewable energy. As such targets complicate a precise quantification, we have not analysed them here.

The calculation of the NDC projection for the countries for all groups except group 5 is straightforward. China and India are the only G20 economies from group 5 that have proposed a combination of targets, which are less straightforward in the calculation, and highly depend on model parameterization. The targets include non-fossil energy targets, forest targets, and emission intensity targets (i.e., improvements of the ratio of emissions to GDP). For the PBL calculations, their combined effect was calculated using the PBL TIMER energy model (Rutledge, 2019) for energy- and industry-related emissions and the IIASA GLOBIOM/G4M land use model (Havlík et al., 2014) for the land use, land-use change and forestry (LULUCF) emissions (see also (den Elzen, Admiraal, et al., 2016), and for further details for China, (den Elzen, Fekete, et al., 2016). For countries not analysed by PBL (Colombia, Egypt, Ethiopia, Iran, Morocco, Saudi Arabia, and Thailand), we refer to Climate Action Tracker (Climate Action Tracker, 2020a).

Accounting method chosen for quantification

Table A-3 provides an overview of how the NDC targets have been quantified and lists them by the accounting method which we have assumed. Most of the analysed countries report emission target levels that include removals from activities related to the LULUCF sector. For countries that explicitly mentioned in their NDCs that emissions and removals from the LULUCF sector are excluded (Saudi Arabia and Thailand), the LULUCF sector is excluded from the calculation of the NDC target emission levels and current policies scenario projections.

Table A-2: Overview of NDC configuration per country

| Country | Target type | LULUCF sector is included in the NDC |
|---------------------------|---------------------------------|--|
| Argentina | Fixed-level target | LULUCF sector is included in the 2030 target. There is no baseline year, it is an absolute target. |
| Australia | Base year | LULUCF sector is included in the baseline year and the target. |
| Brazil | Base year | LULUCF sector is included in the baseline year and the target. |
| Canada | Base year | LULUCF sector is excluded in the baseline year and included in the target. |
| China | Intensity and non-GHG | LULUCF sector is included in the baseline year and the target. |
| Colombia | Baseline specified | LULUCF sector is included in the baseline year and the target. The NDC's deforestation emissions reduction target is calculated independently and in a unified manner at the national level in line with NREF projections to 2030. |
| Egypt | N/A | LULUCF sector is excluded in the NDC target |
| Ethiopia | Baseline specified | LULUCF sector is included in the baseline year and the target. |
| European Union | Base year | LULUCF sector is included in the baseline year and the target. |
| India | Base year intensity and non-GHG | LULUCF sector is included in the target, however, it is not clear for the baseline year and the intensity targets. |
| Indonesia | Baseline specified | LULUCF sector is included in the baseline year and the target. |
| Iran | Base year | LULUCF sector is included in the baseline year and the target. |
| Japan | Base year | LULUCF sector is excluded in the baseline year however it is included in the target. |
| Mexico | Baseline specified | LULUCF sector is included in the baseline year and the target. |
| Morocco | Baseline specified | LULUCF sector is included in the baseline year and the target. |
| Republic of Korea | Base year | LULUCF sector is excluded in the baseline year however it is included in the target. |
| Russian Federation | Base year | LULUCF sector is included in the baseline year and the target. |
| Saudi Arabia | Trajectory | LULUCF sector is excluded in the NDC target |
| South Africa | Trajectory | LULUCF sector is included in the baseline year and the target. |
| Thailand | Baseline specified | LULUCF sector is excluded in the NDC target |
| Türkiye | Baseline specified | LULUCF sector is included in the baseline year and the target. |
| Ukraine | Base year | LULUCF sector is included in the baseline year and the target. |
| UAE | Baseline specified | LULUCF sector is included in the target and the base year. |
| United Kingdom | Base year | LULUCF sector is included in the baseline year and the target. |
| USA | Base year | LULUCF sector is included in the baseline year and the target. |
| Viet Nam | Baseline specified | LULUCF sector is included in the baseline year and the target. |

Although there are uncertainties concerning which accounting approaches and methodologies countries will apply to account for LULUCF related emissions and removals, we assume that a majority of countries will apply the net-net accounting approach (den Elzen, Admiraal, et al., 2016). In this approach, activities are accounted using the reported net emissions in each year of the accounting period minus the net emissions in the base year. In the situation where the net emissions have decreased, a country may issue credits (i.e. removal units, or RMUs) and if net emissions have increased, it must cancel units (i.e. take on debits). The net-net LULUCF accounting method implies that credits and debits from the LULUCF sector are treated in the same way as any other GHG inventory sector, where emissions are compared to those in the base year.

This report identified two countries that apply the gross-net accounting approach (Japan and Republic of Korea). In this approach, the actual reported net emissions (or removals) in each year of the commitment period are accounted for without comparing the estimates with a base year. These countries expect the LULUCF sector to be net carbon sink in the target year, thus treating the LULUCF sector as a source of carbon credits. For these countries, our NDC target estimates exclude the expected amount of carbon credits and are compared to current policies scenario projections excluding LULUCF.

A few countries have established accounting approaches for each LULUCF sub-sector and documented these in national documents and regulations. Two such examples are Canada and the EU27. For the EU27 we apply a simplistic approach and assume that the EU27 will account for all LULUCF sub-sectors using the net-net accounting approach as this is the case for the majority of the sub-sectors. For Canada, land-use is excluded in the base year and accounting approaches provide a contribution of the LULUCF sector to Canada's target. Canada uses a reference level approach for managed forest and associated harvested wood products (HWP). For all other LULUCF sub-sectors, Canada applies the net-net accounting approach. For this assessment we make a simple assumption assume that Canada will be using the net-net accounting for all sub-sectors.

A4: NewClimate Institute projections (based on the Climate Action Tracker analysis)

Current policies projections

NewClimate Institute analysis follows the calculation steps used in the Climate Action Tracker (Climate Action Tracker, 2020a). The starting point for the calculation of current policies emissions projections is a publicly available 'reference' projections for economy-wide GHG emissions or energy-related CO₂ emissions. For most countries, we use one of the sources below or a combination or two to show a range:

- Most recent government submissions to the UNFCCC (such as, National Communications, Biennial Reports and Biennial Update Reports)
- Other national policy projections (government source)
- Projections from international organisations such as the International Energy Agency (IEA) World Energy Outlook (WEO) and other internationally research organisations.

The choice of a 'reference' scenario depends on a number of factors such as the coverage of policies, detailedness of the projections and its description (sector, gas, policies considered), and key underlying assumptions (e.g. GDP and population growth).

When a scenario with only energy-related CO₂ emissions was used as basis, emissions projections for other GHGs were gathered from various sources to ensure complete coverage of all emissions sources. For non-CO₂ GHG emissions, the US EPA report on global anthropogenic GHG emissions (U.S. EPA, 2019a). Projections for non-energy CO₂ emissions are most often taken from national governments' submissions to the UNFCCC.

For all publicly available emissions projections in this analysis, we examined whether important policies implemented to date and planned policies with a high degree of certainty of implementation in the near future are included. If a recently implemented policy with a considerable expected mitigation impact potential is not covered, the impact of that policy is accounted for by carrying out separate 'add-on' calculations based on the information from various sources.

Methodology for specific policy instruments and targets

Current policies projections by NewClimate Institute include add-on mitigation impact calculations for recently implemented policies. The calculation steps are policy specific; in some cases, CO₂ reduction impact values estimated in external sources are applied directly to 'reference' scenarios for energy-related CO₂ emissions, whereas in other cases more detailed technical calculations are carried out. The choice of quantification method is also heavily dependent on data availability. We present common approaches used to quantify distinct policy types:

- **Renewable energy targets:** CO₂ emissions reductions are calculated based on the energy balance projections underlying the 'reference' scenario for energy-related CO₂ emissions. Case-specific assumptions define which fuels would be replaced by the increased renewable energy production.
- **Vehicle fuel efficiency standards:** A simplified stock turnover model is used for many countries. Calculations were done using the underlying data from the Global Transportation Roadmap Model of the International Council on Clean Transportation (ICCT, 2012).
- **Emissions trading schemes:** The targeted emission levels are applied to the sectors covered by the scheme. Carbon price levels are not considered in the analysis.
- **Economic measures:** Due to the limitation of bottom-up, spreadsheet-based calculations, NewClimate Institute projections consider economic measures such as carbon tax, feed-in tariff scheme and subsidies only if their mitigation impacts have already been quantified by other institutions.

Table A-1 presents the URLs and the posted dates of country assessment updates by the Climate Action Tracker project.

Table A-1: Country assessments by Climate Action Tracker referenced in this report.

| Country | URL | Last updated |
|-----------------------------|---|----------------|
| Argentina | https://climateactiontracker.org/countries/argentina | September 2021 |
| Australia | https://climateactiontracker.org/countries/australia | May 2022 |
| Brazil | https://climateactiontracker.org/countries/brazil | August 2022 |
| Canada | https://climateactiontracker.org/countries/canada | September 2021 |
| China | https://climateactiontracker.org/countries/china | May 2022 |
| Colombia | https://climateactiontracker.org/countries/colombia/ | October 2021 |
| Egypt | https://climateactiontracker.org/countries/egypt/ | June 2022 |
| Ethiopia | https://climateactiontracker.org/countries/ethiopia | November 2022 |
| European Union | https://climateactiontracker.org/countries/eu | June 2022 |
| India | https://climateactiontracker.org/countries/india | September 2021 |
| Indonesia | https://climateactiontracker.org/countries/indonesia | November 2022 |
| Iran | https://climateactiontracker.org/countries/iran/ | September 2021 |
| Japan | https://climateactiontracker.org/countries/japan | November 2021 |
| Mexico | https://climateactiontracker.org/countries/mexico | July 2022 |
| Morocco | https://climateactiontracker.org/countries/morocco | September 2021 |
| Republic of Korea | https://climateactiontracker.org/countries/southkorea | March 2022 |
| Russian Federation | https://climateactiontracker.org/countries/russianfederation | February 2022 |
| Saudi Arabia | https://climateactiontracker.org/countries/saudiarabia | November 2021 |
| South Africa | https://climateactiontracker.org/countries/southafrica | November 2022 |
| Thailand | https://climateactiontracker.org/countries/thailand/ | September 2021 |
| Türkiye | https://climateactiontracker.org/countries/Türkiye | November 2022 |
| United Arab Emirates | https://climateactiontracker.org/countries/uae/ | November 2021 |
| United Kingdom | https://climateactiontracker.org/countries/uk/ | November 2022 |
| USA | https://climateactiontracker.org/countries/usa | July 2022 |
| Viet Nam | https://climateactiontracker.org/countries/vietnam/ | October 2021 |

* In a few cases, the information used in this analysis will become available on the CAT website after the publication of this report.

A5: The IMAGE model

For the PBL analysis, we used the integrated assessment model (IAM) IMAGE 3.2 (Stehfest et al., 2014) to assess the impact of national current policies. The IMAGE model is well suited for such an assessment given the relatively high degree of detail with which this model represents the activity levels in the different sectors and its focus on a physical description of activities (allowing a rather straightforward interpretation of the implemented policies).

More specifically, the IMAGE model framework includes the TIMER energy model, where most of the policies were implemented. The TIMER model simulates long-term energy baseline and mitigation scenarios (van Vuuren et al., 2006) on the global and regional level. The TIMER energy model describes energy demand in five different end-use sectors, i.e. industry, transport, residential sector, service sector and other, mostly on the basis of relatively detailed sub-models. In these sub-models, the demand for energy services is described for 26 world regions in terms of physical indicators (person kilometre travelled; tons of steel produced etc.). Different energy carriers can be chosen to fulfil this demand based on their relative costs. The model can also decide to invest in energy efficiency instead. On the supply side, the model describes the production of primary energy for fossil fuels, bioenergy, and several other renewable energy carriers. The costs of these primary energy carriers depend on depletion, technology development and trade. The demand and supply models are connected via several models describing energy conversion processes such as the electric power and hydrogen production model.

IMAGE-land is a spatially explicit part of the model and is coupled with the agro-economic model MAGNET (Woltjer & Kuiper, 2014). It contains a detailed representation of environmental aspects including land use, land use change and forestry (LULUCF), the carbon cycle, and the global agricultural economy. This integration allows for assessments of countries' current land-based mitigation policies on their future land use and land use change and its interactions across the borders.

Methodology for specific policy instruments and targets

For all policies and targets analysed in this study (see tables in country chapters), the methodology for calculating the effect on emissions is described briefly below (for more details, see (de Boer & van Vuuren, 2017; Roelfsema et al., 2014)). The calculations were done using the IMAGE/TIMER implementation of the SSP2 scenario (van Vuuren et al., 2021).

In general, climate policies are implemented in integrated assessment models through a carbon tax, at a level resulting in a desired GHG emission level. A carbon tax attaches a price to carbon emissions and induces a response of the energy system where investments in energy efficiency, fossil fuel substitution and additional investments in non-fossil options increase (Van Vuuren, 2007). These carbon taxes can be differentiated at regional and sector levels. Other policy instruments, such as feed-in-tariffs, cannot be directly implemented in these models. Therefore, policy instruments were translated to targets that can be implemented in the IMAGE model, most notably the TIMER energy model. Model input parameters were changed in such a way that the desired target is achieved.

After the target year, no assumptions were made on continuation of the policy, as information on if and how a policy may be continued or even strengthened is not always available. However, due to technology learning, effects of the policy may continue. This is especially the case for renewable energy capacity additions but does not happen in the case of more generic policy instruments like carbon taxation.

Some measures, such as energy and emissions intensity targets, cannot be implemented as such, but are checked afterwards, by calculating the resulting energy use or emissions divided by GDP. If the targets are not met, they are calculated iteratively by the implementation of either other policy measures, or a carbon tax.

Renewable mix targets, i.e., a certain share of renewable energy in a target year. The share of renewable energy is either measured in terms of primary energy supply or electricity generation (which is a form of secondary energy supply). The difference between the two is that primary energy supply also includes energy use outside the electricity sector and that it accounts for energy losses in power plants within the electricity sector. The target in the share of electricity production from a certain renewable technology (e.g., wind, solar), can be prescribed using desired fractions in the energy supply module of TIMER, which uses a multinomial logit equation to determine investment shares of each energy technology. Along those lines, technologies can be made more expensive by applying a premium factor, used to simulate e.g. coal phase-out targets.

Renewable capacity targets, i.e., a certain amount of installed power capacity of a certain renewable source, can be prescribed using desired capacities in the energy supply module of TIMER. Learning-by-doing, i.e. cumulative installed renewable energy capacity, lowers the capital costs and as such affects installed capacity also after the policy target year (de Boer & van Vuuren, 2017).

Power plant standards (i.e., the CO₂ emissions per unit generated electricity) applying to new power plants are implemented as such in TIMER. In essence, the implementation of a standard results in no new installation of technologies with emissions intensity above said standard. Power plant standards applying to existing stock are implemented through a carbon tax on the energy supply sector.

Coal phase-out policies are implemented imposing a premium factor on electricity production from coal, and as such making coal power production unattractive compared to other technologies such as natural gas power plants or renewable electricity production.

Capacity caps on certain technologies are implemented by making the technology unavailable for that region after the target year capacity has been achieved. TIMER keeps the existing capacity operating until the end of its lifetime but will not add any more capacity even if it is financially or technologically more attractive.

Efficiency goals for new and existing capacity are goals set for specific electricity generation technologies and are implemented as such in TIMER. If new capacity does not meet this goal, it will not be installed, and respectively, if existing capacity does not meet this goal, it will be retired.

Feed-in-tariffs is an energy-supply policy focused on supporting the development of new renewable power generation. The most common feed-in-tariffs policy provides a fixed rate per kilowatt hour (US\$/kWh) for the electricity produced for a guaranteed period of time (Blok & Nieuwlaar, 2016). A feed-in-tariff cannot be implemented as such, but is proxied by target shares for renewable energy, by assuming these tariffs support a strategic policy document. Such a document would, in itself, not be defined as current policy, but classifies when it is supported by policy instruments such as feed-in tariffs.

Emissions Trading Systems (ETS) are implemented by applying a carbon tax to the sectors that are covered by the ETS (e.g., energy supply and industry) in order to reach the emissions reductions targeted by the ETS.

A **fuel efficiency car standard** aims to achieve a certain fuel efficiency for new cars within a specific period. The effect of fuel efficiency standards for cars is calculated by the TIMER transport model (Girod et al., 2012). Fuel efficiency of new cars is an input parameter and is set for fossil fuel cars to the policy target for the specific target year. The fuel efficiency for years before the target year is interpolated between 2015 and the target year, but only if that results in more efficient cars compared to the SSP baseline. Non-energy costs, such as car manufacturing costs, are changed accordingly.

A **biofuel target** sets a mandatory minimum volume or share of biofuels to be used in the total transportation fuel supply. Biofuel targets are also included using the TIMER transport model. Cars in TIMER drive on one fuel (except for electric and H₂ cars), so biofuel blending is modelled by fixing the ratio of biofuel cars and liquid fuel cars. However, the biofuel target input variable that can be set applies

to the biofuel share of the total new fleet in a specific year, i.e., including electric and H₂ cars, and only applying to new cars. Therefore, this parameter is set to such a level that it results in the desired biofuel share for the total liquid car fleet.

Electric vehicle targets are included in the TIMER transport model. Electric vehicle targets are usually described in national policy documents as either a percentage of the total vehicle fleet at a target year, or as a percentage of sales of new vehicles by a target year and are implemented in the TIMER model as such.

Fuel taxes or subsidies are implemented directly in the TIMER transport model. Subsidy per person-kilometer (pkm) driven is an input parameter in the TIMER transport model, which can be interpreted as negative taxes. The total vehicle costs decrease when a subsidy is implemented, thereby changing the output of the multinomial logit function that determines vehicle shares. Fuel tax in terms of currency per liter is translated to 2005 US dollar per pkm by using the exchange rate between the specific currency and dollars (for specific years), as well as the fuel efficiency in terms of km/L. The latter is calculated from the fuel efficiency per car type (MJ/pkm), which is an input parameter to the TIMER model, by assuming a fixed energy content of 34.8 MJ/L fuel and average load of 1.6 persons per car.

Regulation on methane (CH₄) leakage from coal, oil and gas production is implemented by increasing the reduction potential of methane leakage. This is a parameter in TIMER and is set to such a level that it results in the desired reduction of methane emissions.

Regulation on F-gases is implemented by first translating the desired emissions reductions to an absolute target level for F-gases. Then an exogenous emissions tax is applied only to F-gases in order to reach the target level per region.

Building codes are implemented in TIMER's residential buildings module through a variety of ways:

Buildings energy efficiency is improved through insulation. A premium factor on building insulation levels simulates a minimum standard policy. Furthermore, subsidies for insulation are introduced for new and older buildings during their construction and a renovation process, respectively.

Appliance standards (kWh/year) are implemented as such in TIMER. Appliances must adhere to a maximum unit energy consumption (UEC) based on relevant policies.

Residential PVs and/or heat pumps are installed to all new buildings in specific regions. This implementation simulates the construction of NZEB in which the energy demand is covered by renewables. Heat pump installation is avoided in some cases as a region's poor electricity fuel mix can lead to an increase in emissions.

Policies related to **agriculture, forestry, and other land use** (AFOLU) were implemented in IMAGE-land. We only considered policies that are currently embedded in national laws and focused on countries with considerable AFOLU emission reductions.

A6: The GLOBIOM and G4M models

For the IIASA analysis of LULUCF projections, two complementary models are being used, an economic land use model (GLOBIOM) (Havlík et al., 2014) and a detailed forestry model (G4M) (Gusti & Kindermann, 2011). The GLOBIOM model is a partial equilibrium model with a detailed sectoral coverage and detailed representation of production technologies and geographically explicit representation of land use and associated greenhouse gas emission. GLOBIOM relies on forestry productivity information from the G4M model which also estimates the impact of forestry activities (afforestation, deforestation and forest management) on biomass and carbon stocks.

More specifically, the GLOBIOM model is a global recursive dynamic partial equilibrium model of the forest and agricultural sectors. The model is based on a bottom-up approach where the supply side of the model is built-up from the bottom (land cover, land use, management systems) to the top (production/markets). The agricultural and forest productivity is modelled at the level of grid cells of 5 x 5 to 30 x 30 minutes of arc (Skalský et al., 2009), using biophysical models. The demand and international trade is represented at the level of 35 regions covering the world. Besides primary products, the model has several final and by-products for the different sectors, for which processing activities are defined. The model computes market equilibrium for agricultural and forest products by allocating land use among production activities to maximize the sum of producer and consumer surplus, subject to resource, technological, demand and policy constraints. The level of production in a given area is determined by the agricultural or forestry productivity in that area (dependent on suitability and management), by market prices (reflecting the level of demand), and by the conditions and cost associated to conversion of the land, to expansion of the production and, when relevant, to international market access. Trade is modelled following the spatial equilibrium approach, which means that the trade flows are balanced out between different specific geographical regions. Trade is furthermore based purely on cost competitiveness as goods are assumed to be homogenous. This allows tracing of bilateral trade flows between individual regions.

The G4M model is applied and developed by IIASA and estimates the impact of forestry activities (afforestation, deforestation and forest management) on biomass and carbon stocks. By comparing the income of used forest (difference of wood price and harvesting costs, income by storing carbon in forests) with income by alternative land use on the same place, a decision of afforestation or deforestation is made. As G4M is spatially explicit (currently on a 0.5° x 0.5° resolution), different levels of deforestation pressure at the forest frontier can also be handled. The model can use external information, such as wood prices and information concerning land use change estimates from GLOBIOM. As outputs, G4M produces estimates of forest area change, carbon sequestration and emissions in forests, impacts of carbon incentives (e.g. avoided deforestation) and supply of biomass for bioenergy and timber.

For the countries where the G4M model was applied to assess the current policies projections (Colombia, Ethiopia, Iran, Morocco, Saudi Arabia, Thailand, United Arab Emirates and Vietnam), the G4M was calibrated to historical afforestation and deforestation rates for the period of 2000-2010 as reported by the country to the 2015 FAO Forest Resources Assessment (FAO FRA) (Keenan et al., 2015). The calibration is done in such a way that net forest area change rate (afforestation rate minus deforestation rate) matches that of FAO FRA data. Additional constraints were imposed on minimum afforestation rate, minimum deforestation rate and the trend of net forest area change (a difference between 2000-2005 average net forest area change and 2005-2010 average net forest area change). For the EU and UK, combined GLOBIOM/G4M estimates are being applied and projections are for the UK based on the 2016 EU Reference Scenario (European Commission, 2016) and for the EU based on the 2020 EU Reference Scenario (European Commission, 2021c).

Methodology for specific policy instruments and targets

Current policies projections by IIASA have been assessed for the specific country using the GLOBIOM and/or the G4M model. The model that has been used to develop the projection for a specific county is specified in the country chapters. Below follows a generic description of the methodology used for calculating the effect of the policies for the LULUCF sector. In general, climate policies are implemented in GLOBIOM and G4M through a carbon tax or directly in the models by changing parameters or adding constraints in such a way that a target is achieved.

Afforestation / Reforestation targets, i.e. an increase of the annual afforestation/reforestation rate by X% or X hectares, can be prescribed in G4M using a carbon tax on the forest sector that directly increases the annual afforestation/reforestation rate. The carbon tax is set at a level that leads to the target level being reached the desired year.

Deforestation targets, i.e. a reduction of the annual deforestation rate by X% or X hectares, can be prescribed in G4M using a carbon tax on the forest sector that directly reduced the annual deforestation rate. The carbon tax is set at a level that leads to the target level being reached the desired year.

Forest area targets, i.e. an increase of the forest area by X% or X hectares, can be prescribed in G4M using a carbon tax on the forest sector that reduced the annual deforestation rate and increases the annual afforestation rate.

Harvest intensity targets, i.e. an increase of the forest harvest rate by X% or X m³, can be prescribed in GLOBIOM or G4M applying constraints directly in the models.

Forest carbon stock targets, i.e. an increase of the forest carbon stock, or the current carbon sink, by X% or X MtCO_{2e} are implemented through a carbon tax in G4M on the forest sectorial emissions and removals. The carbon tax is set at a level that leads to the target level being reached the desired year.

Emissions reductions targets, i.e. a reduction of the net LULUCF emissions by X% or X MtCO_{2e} are implemented in GLOBIOM through a carbon tax on the emissions and removals from the LULUCF sector, and in G4M through a carbon tax on the forest sectorial emissions and removals



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