

Greenhouse gas mitigation scenarios for major emitting countries

Analysis of current climate policies and mitigation commitments:
2021 update

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NewClimate Institute, PBL Netherlands Environmental Assessment Agency,
International Institute for Applied Systems Analysis



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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 international climate policy agreement for the post-2020 period (UNCCC, 2015). In the lead-up to COP21, governments were asked to put forward pledges on how – and by how much – they were willing to reduce their greenhouse gas (GHG) emissions after 2020; these are so-called ‘intended nationally determined contributions’ (INDCs). Nearly 200 countries submitted their INDCs before the COP21 (UNFCCC, 2019a), which became ‘nationally determined contributions’ (NDCs) following the ratification of the agreement.

The urgency for enhanced action to achieve the long-term goal of the Paris Agreement is more evident than ever. The 1.5 °C special report by the Intergovernmental Panel on Climate Change (IPCC) shows that global CO₂ emissions need to reach net zero by around 2050 to limit warming to 1.5 °C with no or limited overshoot (IPCC, 2018). However, the collective ambition of first NDCs has been far short of what is needed to keep warming to 1.5 °C (Höhne et al., 2020) and countries are collectively projected to fall short of meeting the targeted emission levels under NDCs (UNEP, 2020). It is, therefore, crucial to continually track countries’ progress on climate change mitigation 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, prepared by NewClimate Institute, PBL Netherlands Environmental Assessment Agency and IIASA, presents a preliminary assessment of progress by 26 countries toward the achievement of the mitigation components of the 2025/2030 targets (NDCs and INDCs). More specifically, the report provides an overview of projected GHG emissions up to 2030, considering existing, and in some cases planned, climate and energy policies, and compares them with the targeted emissions under NDCs. In this year’s update, we also explore the effect of the ongoing COVID-19 pandemic on future emissions trajectories and compare updated NDC submissions to the previous ones, whenever possible.

The 26 countries assessed in this report 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, Turkey, Ukraine, the United Arab Emirates, the United Kingdom, the United States of America (USA) and Viet Nam. These 26 countries cover all of the G20 countries (three individual EU member states are covered as part of EU27) and accounted for about 81% of total global GHG emissions in 2019 including land use, land-use change and forestry (LULUCF) (FAOSTAT, 2021; Olivier & Peters, 2020).

We will use the term ‘NDC’ throughout the report, given that all but two (Iran and Turkey) of the 26 countries assessed in this report have ratified the Paris Agreement. We use the term ‘country’ to refer to both the EU and the remaining 25 economies.

In this report, the current policies scenario assumes that no additional mitigation action is taken beyond currently implemented climate policies as of November 2020, 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 would 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 a current policies scenario is consistent with that applied in den Elzen et al. (2019) and Roelfsema et al. (2020).

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). The cut-off date for policies is November 2020 and dedicated COVID recovery measures were excluded, unless mentioned otherwise. In this year's update, we have a different cut-off date for NDCs submissions. NDCs submitted or proposed up to September 2021 were included in our analysis.

The calculations by **NewClimate Institute** are largely based on its analyses for, and informed by, the Climate Action Tracker project jointly carried out with Climate Analytics (Climate Action Tracker, 2021) and 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). In this update we also assess the effect of COVID-19 on GHG emissions projections. NewClimate emissions estimates including the effect of COVID-19 assume that emissions intensity over 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., 2017). Current climate and energy policies in G20 countries, as identified in the CD-LINKS, COMMIT, and ENGAGE projects (NewClimate Institute, 2019) and previous policy overview updates (Moisio et al., 2020), were added to that baseline (Roelfsema et al., 2018). For countries that are part of a larger IMAGE region (Australia, Kazakhstan, Republic of Korea, Russian Federation, and Ukraine), emissions projections were downscaled using the country's share in the region's 2015 emissions as a constant scaling factor. PBL emissions 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., 2021).

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 (www.iiasa.ac.at/GLOBIOM) and global forest model G4M (www.iiasa.ac.at/G4M) 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 26 countries) were added to the IMAGE GHG emissions projections excluding LULUCF CO₂. Although only emissions 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. For the NewClimate projections, the LULUCF non-CO₂ emissions from the last reported year were held constant throughout the entire projection period. For Annex I countries this last reported year is 2019. For non-Annex I countries the last reported year can be found in A2 of the Appendix.

1.4 Limitations of this report

The current assessment has several methodological limitations, which are largely attributable to the differences in the nature and characteristics of NDCs and climate policies across countries and the highly uncertain effect of COVID-19:

- This report considers a wide range of national climate and energy policies but does not provide a complete assessment of all policies. This leads to uncertainty on the aggregated effect of the analysed policies on GHG emissions.
- The COVID-19 pandemic still affects all countries. The impact on GHG emissions is highly uncertain due to both the duration and stringency of the restrictive measures and the national recovery strategies.
- Current policies scenario projections are subject to the uncertainty associated with macroeconomic trends, such as gross domestic product (GDP), population growth and technology developments, as well as the impact of policies. Some NDCs are also subject to the uncertainty of future GDP growth and other underlying assumptions. These all add to the fundamental uncertainty resulting from COVID-19.
- 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.
- Policy implementation varies across jurisdictions. For example, many countries have set renewable energy targets, which are to be achieved by national support policies; for some countries, in particular the non-OECD countries, there is not enough information about the implementation status. Even for countries with evidence of concrete support policies in place, it is often difficult to assess whether the targets would be fully achieved; most countries have implementation barriers (e.g. fossil fuel subsidies) alongside renewable energy support policies.
- The bottom-up calculations performed by NewClimate Institute often rely on external emissions scenarios from various sources. It is not always clear how the impacts of existing policy measures were quantified by those sources.
- The choice of data harmonisation year can have considerable impact on GHG emissions projections. This is particularly the case for the LULUCF sector emissions, which could fluctuate from year to year due to peat fires or natural disturbances. Due to methodological limitations, the impact of natural disturbances and peat fires are not accounted in for the land use projections.

Additionally, a country that is likely to meet its NDC does not necessarily undertake 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 not on 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 recent studies available that assessed them in the light of equity principles (Climate Action Tracker, 2020b; 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.
- Gaps between the mitigation targets and current policies scenario projections may close in the years to come as countries adopt implementation measures. For this reason, it is essential that this report and similar efforts are periodically updated in the years to come.
- This report assesses to which degree countries are on track to meet their own target but does not assess how countries' implemented policies or NDC targets contribute to the achievement of global mitigation objectives, such as the collective temperature goals of the Paris Agreement.

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 and NDC targets

Emissions remain above 2005 levels in most countries analysed

Absolute emissions levels vary considerably across the countries analysed. In this report, we present emissions projections using 2005 as a base year for reporting and comparability reasons. Economy-wide GHG emissions in the 26 countries as a group are expected to increase between 8% and 25% between 2005 and 2030 under current policies. Emissions are projected to remain above 2005 levels in the majority of countries (16) analysed and range from a decrease of 51% between 2005 and 2030 to an increase of 140% in the same period (Figure 1).

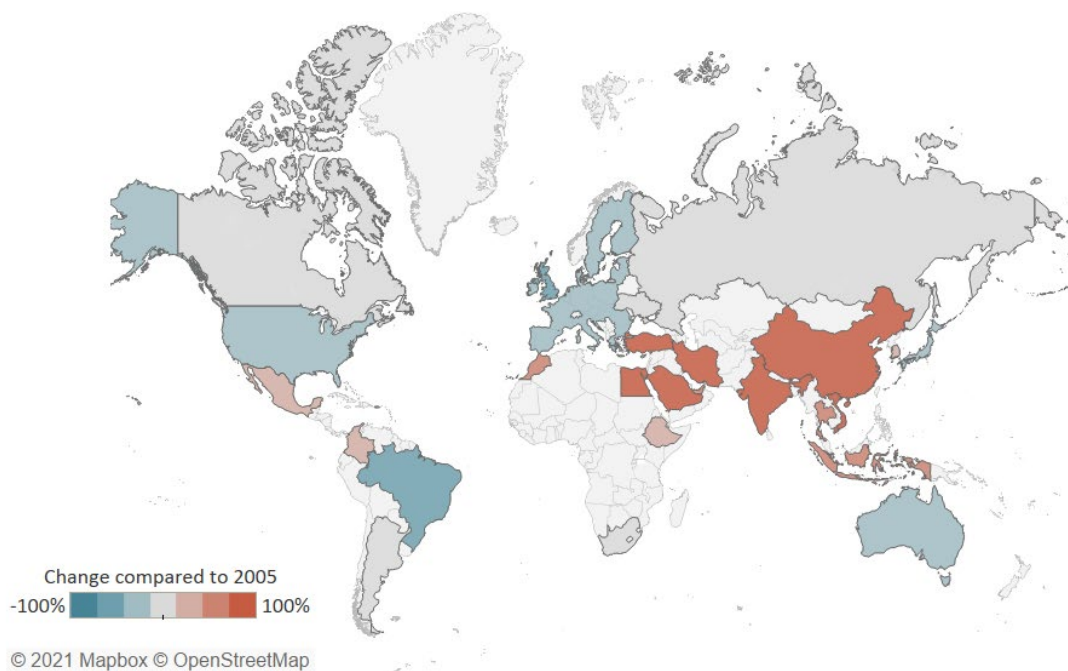


Figure 1: 2030 emissions under current policies, including the effect of COVID-19, compared to 2005 levels. The sector coverage for GHG emissions is consistent with the NDC targets.

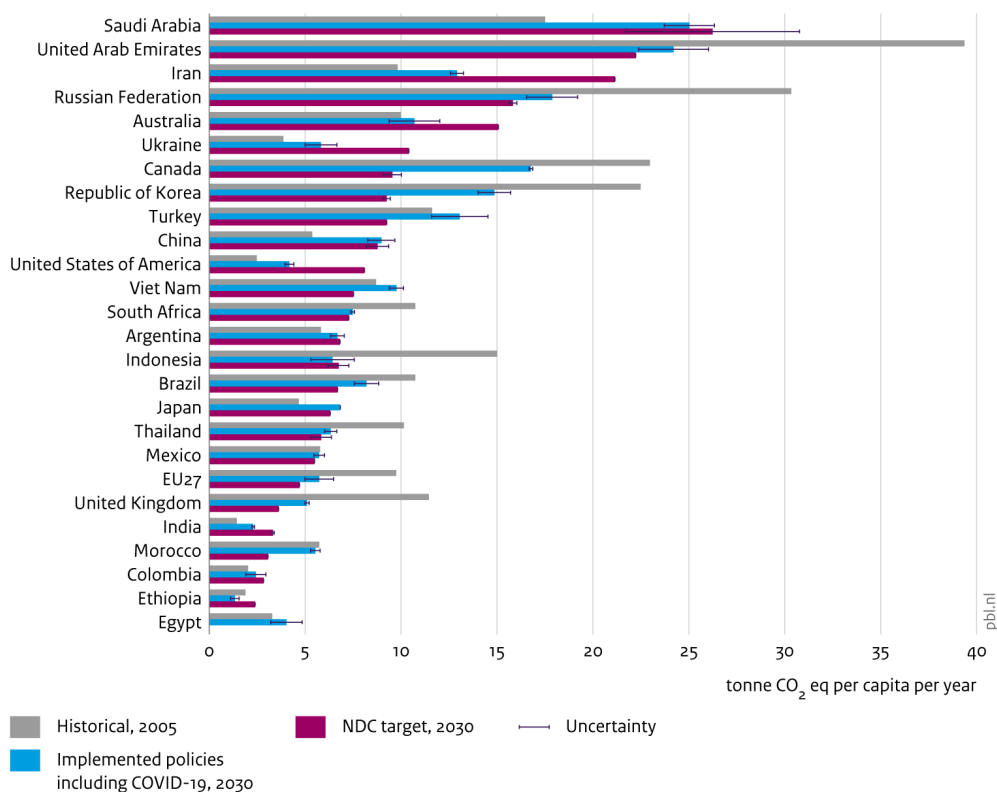
Countries with 2030 emissions projections significantly below 2005 levels are mostly Annex I countries, the only exception is Brazil. The UK, the EU27, Japan and the USA all have projected GHG emissions in 2030 more than 20% below 2005 values. These countries have multiple climate-relevant policies in place and emissions are on a declining trend. Brazil also presents low 2030 emissions level in comparison to 2005. This is due to the high, deforestation-induced historical emissions. The post-2020 emissions trends in Brazil are highly unclear due to uncertainty in the implementation and enforcement of land-use related policies. Emissions excluding LULUCF remain on a slightly upwards trend until 2030 (Section 3.3).

Sixteen countries have emissions in 2030 above 2005 values. In 2019, these countries were responsible for half of global emissions (FAOSTAT, 2021; Olivier & Peters, 2020). Considering the upwards emissions trend, these countries will likely represent an even higher share of emissions in 2030. Significant additional policies are required to curb their emissions. Emissions in India, Saudi Arabia and Viet Nam are expected to more than double by 2030 in comparison to 2005.

Per capita emissions under current policies are projected to be slightly lower than under NDC targets in 2030 in the group of countries analysed, even though there is significant overlap between the ranges

(Figure 2). The median per capita emissions in 2030 under of the 26 NDC targets analysed is expected to be approximately 7.3 tCO₂e per capita (range: 2.4 to 26.2 tCO₂e). Under current policies, this value is 6.8 tCO₂e (range: 1.3 to 25 tCO₂e).

Impact of current policies on greenhouse gas emissions per capita in major emitting countries



Source: PBL FAIR/TIMER model; NewClimate Institute calculations

Figure 2: Per capita GHG emissions in 2030 under current policies (adopted up until November 2020) and NDC scenarios, sorted by NDC values and compared to 2005 levels. The NDC target figures refer to unconditional target.

NDC updates affect progress towards emissions targets and only ten countries are on track to meet their current targets

Several countries analysed updated their NDCs between 2020 and 2021 (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 should close this gap over time. Our analysis indicates that further action is required in several major emitters analysed.

Out of the 26 countries analysed, sixteen are on track or close to meet their previous NDCs

Eight of these sixteen countries have used this update round to submit more ambitious NDCs. Argentina, the EU27, Morocco, South Africa, Ukraine and Viet Nam are on track to meet the previous targets and have submitted targets that lead to overall lower emissions in 2030. China and Japan have proposed more ambitious targets but are still to submit them to the UNFCCC.

The remaining eight countries, that are on track or close to meet their previous targets, have not yet submitted targets that lead to lower 2030 emissions. The Russian Federation and Indonesia are both on track to meet their original targets but submitted an update that led to absolute emissions levels within the range of the previous one. Brazil and Mexico are close to meet their previous targets and

have updated the reference to their NDC targets, which results in higher emissions in 2030. India, Iran, Saudi Arabia and Turkey are on track to meet their targets and are still to submit updated NDCs.

Table 1 Progress towards meeting previous and current unconditional NDC targets in comparison to the ambition progression of NDC updates (as of September 2021). 'N/A' indicates that no target is available.

	Updated NDC		On track to meet previous NDC	On track to meet updated NDC
Argentina	Yes	Submitted target leads to lower 2030 emissions	✓	Close
Australia	Yes	Submitted target leads to same 2030 emissions	✗	✗
Brazil	Yes	Submitted target leads to higher 2030 emissions	Close	✓
Canada	Yes	Submitted target leads to lower 2030 emissions	✗	✗
China *	No	Proposed target leads to lower 2030 emissions	✓	✓
Colombia	Yes	Submitted target leads to lower 2030 emissions	✗	✗
Egypt **	No	N/A	N/A	N/A
Ethiopia ***	Yes	Submitted target leads to lower 2030 emissions	✗	✓
EU27	Yes	Submitted target leads to lower 2030 emissions	✓	✗
India	No	N/A	✓	N/A
Indonesia	Yes	Submitted target leads to same 2030 emissions	✓	✓
Iran	No	N/A	✓	N/A
Japan *	Yes	Proposed target leads to lower 2030 emissions	✓	✗
Mexico	Yes	Submitted target leads to higher 2030 emissions	Close	Close
Morocco	Yes	Submitted target leads to lower 2030 emissions	✓	✓
Republic of Korea *	Yes	Proposed target leads to lower 2030 emissions	✗	✗
Russian Federation	Yes	Submitted target leads to similar 2030 emissions	✓	✓
Saudi Arabia	No	N/A	✓	N/A
South Africa	Yes	Submitted target leads to lower 2030 emissions	✓	✓
Thailand	Yes	Submitted target leads to same 2030 emissions	✗	✗
Turkey	No	N/A	✓	N/A
Ukraine	Yes	Submitted target leads to lower 2030 emissions	✓	✗
United Arab Emirates	Yes	Submitted emissions target for the first time	N/A	✗
United Kingdom	Yes	Submitted target leads to lower 2030 emissions	N/A	✗
USA	Yes	Submitted target leads to lower 2030 emissions	✗	✗
Viet Nam	Yes	Submitted target leads to lower 2030 emissions	✓	✓

* These countries have proposed updated 2030 GHG targets. Even though the new 2030 targets have not been submitted to the UNFCCC, we consider them the current national target. ** Egypt's NDC does not present a quantifiable target. *** Ethiopia remains off-track to meet its conditional target but has now submitted an unconditional target, which the country is on track to meet.

Out of the 26 countries analysed, ten are on track to meet their updated NDCs, eleven are off-track and five are still to submit updated NDCs

Ten countries are on track to meet their NDCs targets. Emissions under currently implemented policies in Brazil, China, Ethiopia, Indonesia, Morocco, Russian Federation, South Africa, Viet Nam are below NDC targets levels in 2030.

Brazil is now on track to meet its unconditional NDC target as a result of the revision of its NDC reference, but significant uncertainty about its land use emissions remains. Morocco was off track in our previous analysis (Kuramochi et al., 2019). However, a downwards revision on its emissions inventory in combination with the effect of COVID-19 and consideration of additional policies in the emissions quantification has put the country under way to meet both its previous and current NDC targets. Argentina and Mexico are very close to meet their NDC targets, especially because of the effect of the pandemic on GHG emissions.

Eleven countries look set to miss their NDC targets: Australia, Canada, Colombia, the EU27, Japan, Republic of Korea, Thailand, Ukraine, the UAE, the UK and the USA.

In some countries, missing the NDC target is a result of increased ambition. This is the case for Japan, the EU27 and Ukraine. 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.

Five countries have yet to submit updated NDCs. India, Iran, Saudi Arabia and Turkey are on track to meet their original targets and could enhance their NDCs without implementation of additional policies. Egypt has not yet submitted an updated NDC and the current NDC does not present any quantifiable target.

2.2 COVID-19 emissions impact

The COVID-19 pandemic presents an enormous global challenge, with ramifications way beyond public health. The short-term reduction of energy-related activities and the economic downturn impact current climate mitigation efforts and future GHG emissions pathways (Climate Action Tracker, 2020a; Dafnomilis et al., 2020).

The pandemic's effect on GHG emissions is significant in the short term. It induced a drop in energy-related CO₂ emissions of approximately 7% (range: 6% to 13%) in 2020 (Friedlingstein et al., 2020; Le Quéré et al., 2020). However, more recent analyses indicate that energy-related CO₂ emissions are almost back to pre-pandemic levels (IEA, 2021a, 2021b). The short-term effect of the pandemic on land use emissions is more unclear and the outcomes vary due to differences in national circumstances (Amador-Jiménez et al., 2020; FAO, 2020a; López-Feldman et al., 2020; Rondeau et al., 2020; Vale et al., 2021). As of August 2021, there are no comprehensive emissions statistics available that indicate the change in land-use emissions in 2020.

The effect of COVID-19 on emissions up to 2030 is very uncertain. First, the depth and duration of restrictive measures and respective short-term economic effects have not fully played out. Second, future emissions will be largely affected by the extent to which low-carbon measures are integrated in economic responses (Climate Action Tracker, 2020c; Kuramochi et al., 2020, 2021; Moisiso et al., 2020).

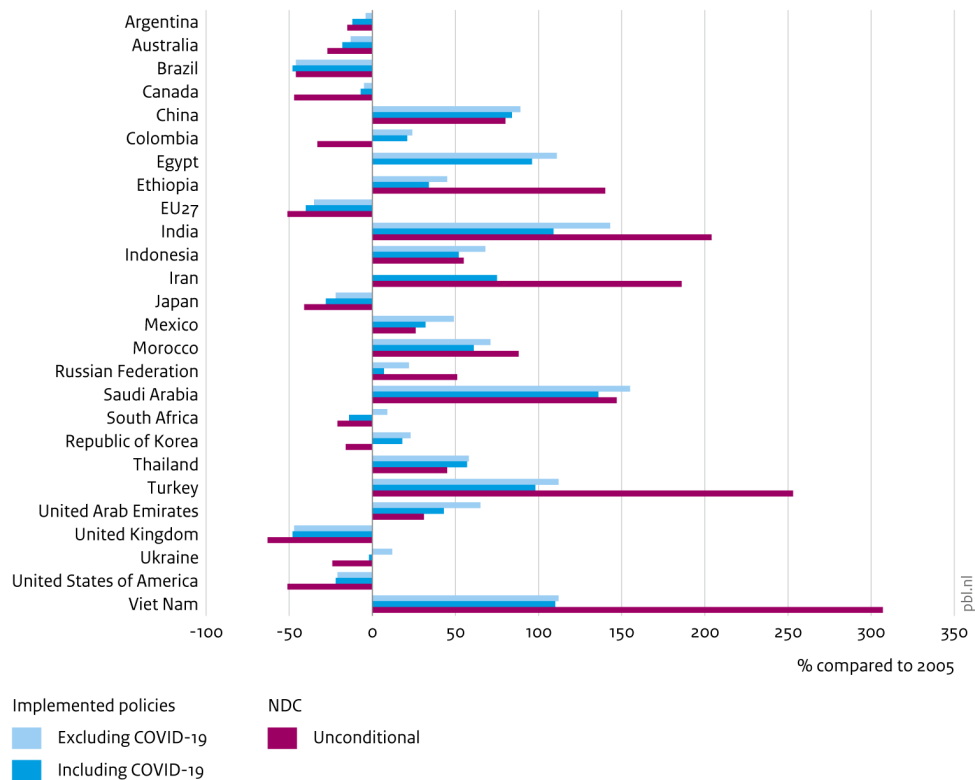
In this report we explore the effect of the pandemic on the timeframe towards 2030 (Figure 3). We evaluate scenarios excluding and including COVID-19 to assess whether it has implications for the countries analysed in terms of their ability to meet NDC targets. The 'excluding COVID-19' scenario includes all policies implemented before the cut-off date of this report but does not account for the effect of the pandemic on the GDP or activity levels. The effect of the pandemic is considered in the 'including

COVID-19' scenario. This scenario includes the 2020 drop and the long-term macroeconomic impact but does not consider the effect of recovery measures – especially those implemented after the cut-off date of this report. We compare emissions using a base year to allow for comparison of trends across countries. We also present individual country projections in Chapter 3.

COVID-19 is projected to result in 2030 emissions estimates (including LULUCF) that are 7% lower (median estimate with a 10th to 90th percentile range of 1% to 12%) than projections excluding COVID-19. Emissions projections for China and Thailand are very similar to projections excluding COVID-19 in 2030. However, in all other countries, the pandemic is projected to result in lower 2030 emissions. Despite this effect, emissions in two thirds of the countries analysed are projected to remain above 2005 levels (Figure 3).

The effect of COVID-19 is expected to lower emissions and bring countries closer to their NDC targets. However, countries that have insufficient policies to meet their NDCs remain off track to meet their targets, once COVID-19 is considered. Only Indonesia is now on track to meet its NDC target due to emissions reductions resulting from the pandemic. The effect of rescue and recovery measures is not fully reflected in our estimates since the cut-off date of our projections limits their inclusion. Whether the pandemic recovery will trigger sufficient new and additional policies to set countries on track to meet their self-determined targets therefore remains unclear.

Impact of implemented policies on greenhouse gas emissions in major emitting countries, 2005 – 2030



Source: PBL FAIR/TIMER model; NewClimate Institute calculations

Figure 3: 2030 emissions projections (incl. LULUCF) compared to 2005 levels. Negative values represent emissions below 2005. The 'excluding COVID-19' scenario shows the result of quantification based on recently implemented policies alone. The 'including COVID-19' scenario shows the combined effect of these policies and the economic downturn resulting from the COVID-19 pandemic. Chart based on average for clarity. Scenario projections 'excluding COVID-19' are not presented for Iran (uncertainty on future economic growth related to economic sanctions). Egypt does not have a quantifiable NDC.

2.3 Uncertainty in the emissions projections

GHG emissions projections are inherently uncertain since future political and economic circumstances are often difficult to evaluate. These are compounded by methodological differences across countries on the treatment of some sectors. In this report, we highlight that:

- The Biden administration has brought the USA back into international climate negotiations. New national policies will probably reverse many rollbacks adopted by the Trump administration. The updated NDC proposes cuts of 50% to 52% below 2005 levels by 2030. The proposed American Jobs Plan aims to invest more than USD 2 trillion in infrastructure until 2030 – a large part of the plan targets low-carbon infrastructure and RD&D. The effect of these latest developments is not yet reflected in our projections.
- China and India have pledges indexed to economic growth, implying that the absolute emissions levels under their targets are highly uncertain. Emissions 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 emissions projections. This is especially the case for countries with high share of LULUCF emissions, such as Argentina, Brazil, Colombia, Ethiopia and Indonesia.

3 Results per country

This section summarises the results per country for current policies and 2030 targets (NDCs). For each country section, the following information is presented:

- Description of recent developments.
- Projected impact of climate policies on greenhouse gas emissions (absolute, relative to 2005 levels); updated between 2020 and 2021 for all countries. We present emissions trajectories both including and excluding the effect of the COVID-19 pandemic.
- Description of NDC targets.
- Overview of key climate change mitigation policies.
- Latest inventory data year used for harmonisation.

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 2005 historical levels. The sector coverage for GHG emission indicators is consistent with the NDC targets, unless stated otherwise.

We use the terms 'previous' and NDCs when comparing two NDCs from the same country. In this report we compare countries' 2030 GHG emissions targets. In case the country submits a 2030 target for the first time; we do not compare the current version to the previous. This is the case for the USA, which previously only had a target for 2025, and the UAE, which previously did not have a quantifiable GHG emissions target.

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 (UN, 2019a).

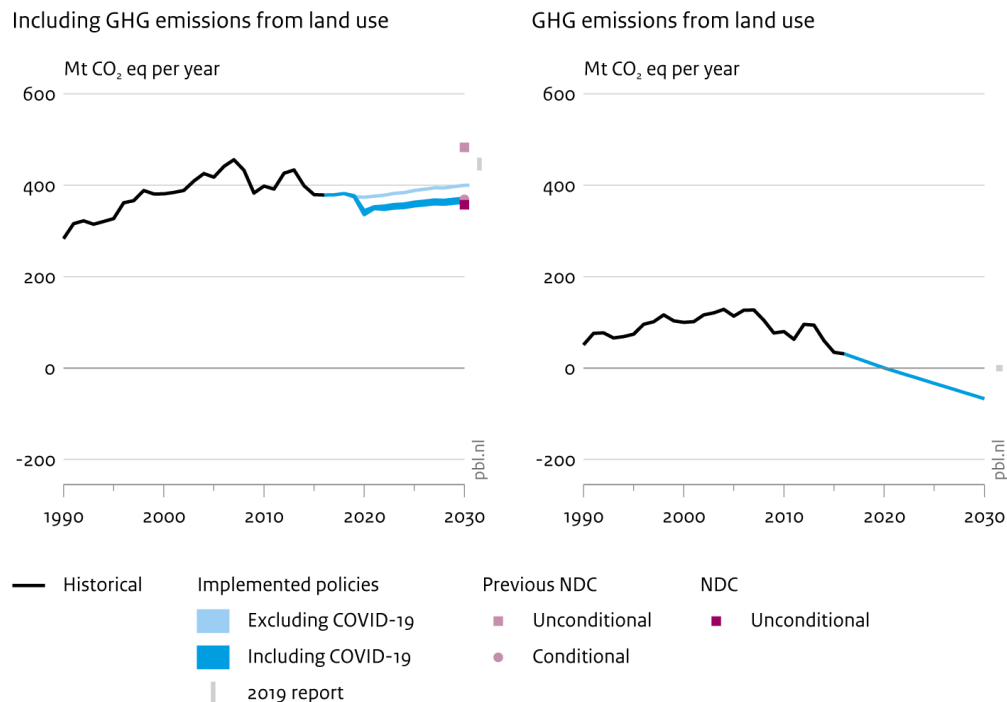
The Appendix provides explanations on historical GHG emissions data sources and the harmonisation of GHG emissions projections to the historical data (A2), quantification of NDC emissions levels (A3), general description of calculation methods used by NewClimate Institute, PBL and IIASA to quantify emissions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

3.1 Argentina

Recent developments (including proposed policies): The government of Argentina submitted its second Nationally Determined Contribution (NDC) in December 2020. The second NDC sets the absolute, economy-wide and unconditional goal of limiting greenhouse gas emissions to 359 MtCO_{2e} (incl. LULUCF) by 2030, 26% below its previous NDC target (Government of Argentina, 2020). The government has also committed to submit in 2021 a long-term strategy (LTS) aiming to carbon neutrality by 2050. Current policies and sectoral plans remain at odds with the increase in ambition of the updated target. Argentina continues to focus its energy sector strategy on the exploitation of abundant gas reserves in the ‘Vaca Muerta’ formation as a source of cheap oil and gas for national consumption and exports. Efforts in the land use sector, such as afforestation and forest restoration, are relatively small in comparison.

Projections: Argentina is close to meet its NDC target with existing policies. Our current policies scenario projections this year are lower than our 2019 projections, mainly due to COVID-19, lower economic growth projections for the energy and industry sector emissions, and the downward revision of land use emissions projections.

Impact of climate policies on greenhouse gas emissions in Argentina



Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 4: Impact of climate policies on greenhouse gas emissions in Argentina. Emissions trajectories are based exclusively on NewClimate and IIASA’s projections. All values are presented in AR4 GWP-100. NDC targets according to the latest submission. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019).

Table 2: Description of Argentina’s previous and current NDC, as presented in official sources. N/A: not available or not applicable.

Indicator	Previous NDC	NDC
Business-as-Usual (BAU)	N/A	N/A
Target: unconditional	Limit GHG emissions to 483 MtCO _{2e} in 2030	Limit GHG emissions to 359 MtCO _{2e} in 2030

Indicator	Previous NDC	NDC
Target: conditional	Limit GHG emissions to 369 MtCO _{2e} in 2030, subject to international financing, support for transfer, innovation and technology development, and capacity building	N/A
Sectoral coverage	Economy-wide	Economy-wide
General Accounting method	IPCC 2006 guidelines; 100-year GWPs from the Second Assessment Report	IPCC 2006 guidelines; 100-year GWPs from the Second Assessment Report
GHGs covered	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
Other sector-level targets	N/A	N/A
Use of bilateral, regional and international credits	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 the NDC document)	Description
Energy supply	Renewable Energy Law 27.191 setting renewable targets (2016) ¹⁾ , National Development Scheme for the Use of Renewable Energy Sources (RenovAr)	Total electricity consumption to be substituted with non-conventional renewable sources (excl. hydro larger than 50 MW) given the following schedule: 18% by 2023 and 20% by 2025.
	Carbon tax on energy (2017) ¹⁾	Starting at \$10/tCO ₂ (adjusted every trimester). Targeting emissions from transport fuels and coal. The carbon tax excludes natural gas consumption and shale gas production.
	Promotion of large-scale expansion of natural gas reserves ('Vaca Muerta') ^{1), 2)}	Subsidies allocated to the exploration and exploitation of non-conventional gas. Long-term energy plan projects doubling the production of oil and gas in 5 years.
	Law 27.424 on net-metering for distributed generation (2017) ¹⁾	Enable renewable generation at distribution level. Excess power can be sold under a net metering mechanism.
Transport	Biofuels Law (updated 2016) ³⁾	Blending mandate of 10% for biodiesel and 12% for ethanol in the gasoline from 2016.
Agriculture and Forestry	Joint resolution 1/2018 creating the Environmental and Insurance Sustainability Program (September 2018)	Increasing forest plantations from 1.3 million hectares to 2 million hectares by 2030. To reach 2 million hectares by 2030 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)	The law aims to increase the investments, area, and enhancement of the sustainable management of cultivated forests within the country. The law grants among other benefits, an annual non-refundable Economic Contribution to some 3,000 small and medium forest producers.
	Minimum Budgets for Environmental Protection of Native Forest (Presupuestos Minimos de Proteccion) (2007) (+) ⁴⁾	Regulatory frame to control the reduction of native forest surface and achieve lasting surface over time.
	National Forest Management Plan with Integrated Livestock (Plan Nacional de Manejo de Bosques con Ganadería Integrada) (2015) ⁴⁾	To improve and maintain ecological and cultural processes in native forest and promote activities for a sustainable management of native forest. Contributes to sustainable use of native forests through incorporating livestock activities in native forest area in a sustainable manner.

Sector	Policies (marked with '(+)' when mentioned in the NDC document)	Description
	Investments for Cultivated forests (Inversiones Para Bosques Cultivados) (2008)	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)	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.

¹⁾ Not quantified in NewClimate Institute projections. ²⁾ Subsidy not explicitly quantified but projections include a comparable increase in fossil fuel production. ³⁾ No information available on implementation status. In the current analysis, we have assumed full implementation ⁴⁾ Not quantified in IIASA model projections.

Table 4: 2005 historical data and 2030 projections of key GHG indicators for Argentina. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. Sector coverage for GHG emission indicators is consistent with the NDC targets. Emissions values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

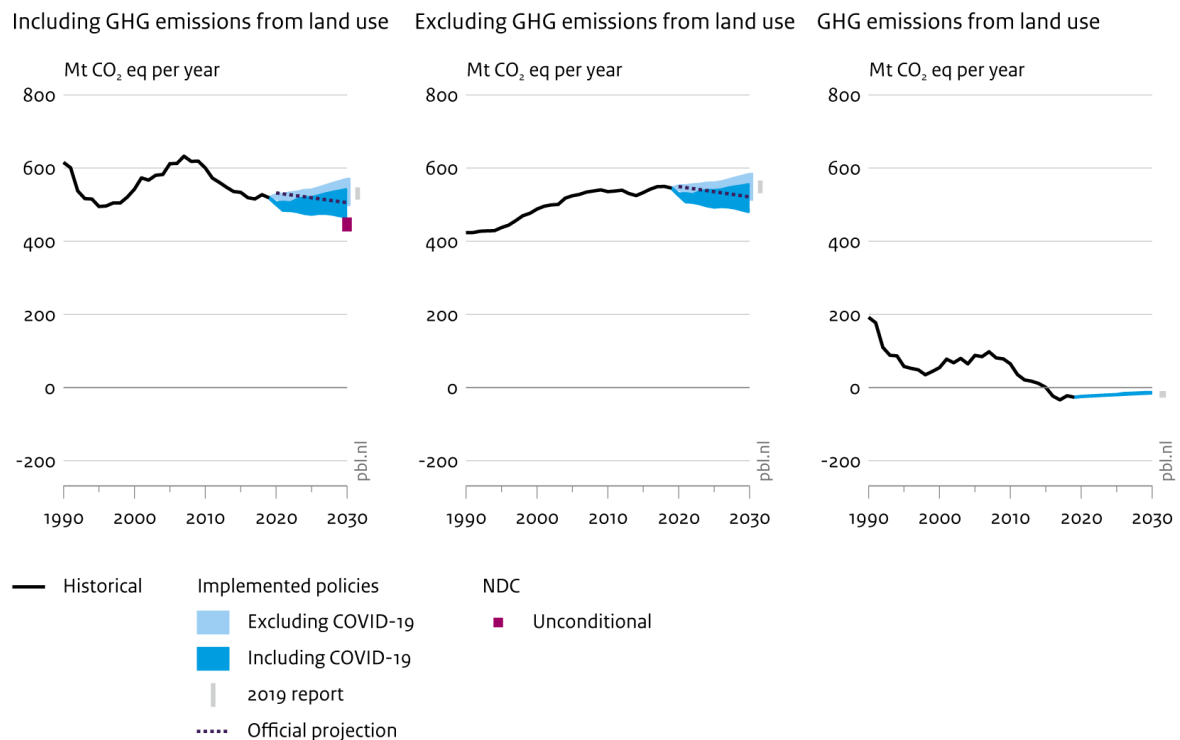
Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO₂e)	418	363 to 371 (-13% to -11%)	357 (-15%)
GHG emissions per capita (tCO₂e/cap)	10.7	7.4 to 7.6 (-31% to -29%)	7.3 (-32%)

3.2 Australia

Recent developments (including proposed policies): In May 2020, the Technology Investment Roadmap Discussion Paper was released for public consultation, ultimately aiming to inform Australia's Long-Term Strategy. The Paper advocates 'technology neutrality'. A few months later, in September, the first Low Emissions Technology statement was published, outlining five technologies that require investments: 'clean' hydrogen, energy storage, low-carbon materials, CCS, and soil carbon sequestration. In addition, the Energy Efficient Communities Program financially supports businesses and community organisations to invest in energy efficiency. The Climate Solutions Package from 2019 includes the development of a National Electric Vehicle Strategy, which has no quantifiable targets as of September 2021. Although the 2020 target was achieved a year early, no new renewable energy targets have been put forward for the post-2020 period.

Projections: Australia will likely miss its NDC target with existing policies. Projections including the effect of COVID-19 are lower but still insufficient to meet 2030 target. Official projections fall within our range.

Impact of climate policies on greenhouse gas emissions in Australia



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

Figure 5: 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 to the UNFCCC. All values are based on AR4 GWP-100. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019). Official projections are based on Australian Government (2020a).

Table 5: Description of Australia's previous and current NDC, as presented in official sources. N/A: not available or not applicable. Specifics of the accounting rules are elaborated in Iversen et al. (Iversen et al., 2014).

Indicator	Previous NDC	NDC
Business-as-Usual (BAU)	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
Target: conditional	Not specified	Not specified
Sectoral coverage	Economy wide	Economy-wide
General Accounting method	IPCC guidelines; 100-year GWPs from the Fourth Assessment Report	IPCC 2006 Guidelines; 100-year GWPs from the Fifth 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 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
Use of bilateral, regional and international credits	N/A	N/A

Table 6: Overview of key climate change mitigation policies in Australia (Australian Government, 2020a; Australian Government Department of Environment, 2016; Australian Government Department of the Environment and Energy, 2017; Department of Industry Science Energy and Resource, 2019)

Sector	Policies (marked with '+' when mentioned in the NDC document)	Description
Cross-cutting	Emissions Reduction Fund (ERF) (2014) (+) ¹ – <i>relabelled Climate Solutions Fund in 2019</i>	Reverse auction mechanism designed to reduce emissions at the lowest available cost. The government purchase carbon credits generated by companies that voluntarily reduce their emissions.
	Energy Productivity Plan (2015) ¹	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)	Reduce HFC emissions by 55% by 2030, relative to 2010 (85% by 2036).
Energy supply	Renewable Energy Amendment Act (2015) (+)	Targets 33 TWh ² from large-scale generators (23.5% of total electricity generation) by 2020.
	State-level renewable energy targets	Renewable energy targets of Victoria and Queensland would translate to a 35% share by 2025 and 50% by 2030 on the federal level.
	CCS Flagships Programme (2009) ¹	Supports the construction and demonstration of large-scale integrated CCS projects with over \$125 million.
Transport	Fuel tax (2006, last amendment in 2019) ⁴	Fuel tax for diesel and gasoline is set at AUD 0.418 per litre.
Agriculture and Forestry	Emissions Reduction Fund (2014): Vegetation & Agriculture ¹	Encourages native forests protection and sustainable farming, adaptation, and uptake of techniques for reducing emissions such as dietary supplements or efficient cattle herd management, capturing methane from effluent waste at piggeries, and enhancing soil carbon levels through adaptive farming practices. In total, 6.1 MtCO ₂ e/year reductions of LULUCF emissions from 2010 levels expected by 2020.
	20 Million Trees Programme (2014) ¹	Plant 20 million trees by 2020 (20,000 ha) to re-establish green corridors and urban forests.
	Emissions Reduction Fund (2014): Agriculture ^{1, 5}	Ensures that advances in land management technologies and techniques for emissions reduction and adaptation will lead to enhanced productivity and sustainable land use under a changing climate.

¹⁾ Not quantified (separately) in PBL IMAGE model projections. ²⁾ The target was reduced in 2015 from its original 41 TWh (Scott, 2016). ³⁾ Based on national expert review of the H2020 ENGAGE project current policies protocol. ⁴⁾ OECD (2013). Policy instrument not quantified separately in NewClimate Institute projections. ⁵⁾ Not quantified in IIASA model projections.

Table 7: 2005 historical data and 2030 projections of key GHG indicators for Australia. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise.

Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO₂e)	612	466 to 541 (-24% to -12%)	452 to 440 (-26% to -28%)
GHG emissions per capita (tCO₂e/cap)	30.3	16.5 to 19.2 (-45% to -37%)	15.6 to 16 (-49% to -47%)

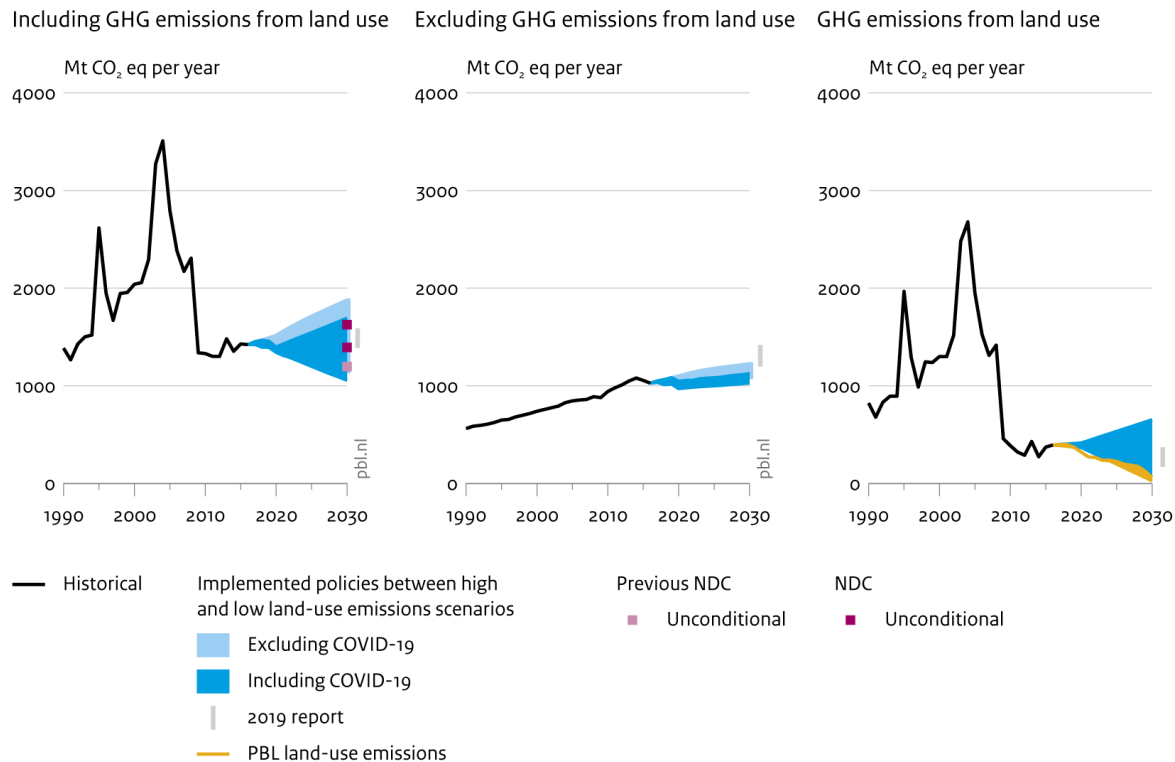
3.3 Brazil

Recent developments (including proposed policies): Brazil's updated NDC keeps the same unconditional 2030 target to reduce emissions by 43% below 2005 values (Federative Republic of Brazil, 2015; Government of Brazil, 2020a). However, the updated target is based on a different inventory and results in a range of higher absolute emissions levels in 2030. The 2005 emissions based on the Third National Inventory Report (NIR3), as given in the updated NDC submission, and the (lower) emissions from the subsequent fourth National Communication, are both higher than the 2005 emissions of the NIR2 (which was the reference emissions inventory used in the previous NDC). The updated NDC also includes a tentative carbon neutrality target, but scope and implementation plan remain unspecified.

In 2021, Brazil approved its updated 10-year energy expansion plan (PDE). The plan includes a revision of projected energy demand due to COVID-19 but does not outline any major changes in the next decade in comparison to the PDE quantified. Brazil's progress in LULUCF emissions reductions observed since 2005 has stopped, with deforestation-induced emissions picking up speed again (SEEG, 2021). Two bills before the Brazilian Congress pose further risk of increased deforestation (Wenzel, 2021). In 2020 and early 2021, the biodiesel blending mandate was lowered to 10% (FAO, 2020b; S&P Global, 2020). In July 2021, it was increased to 12% but remains below this year's original target of 13% (Araújo, 2021).

Projections: Brazil is on track to meet its NDC target with existing policies. This is partially due to the increase in the absolute emissions target following the updated inventory. Our current policies scenario projections are highly dependent on the enforcement of policies related to land use. IIASA developed two scenarios for the LULUCF policies. One that considers full enforcement of LULUCF policies (leading to lower emissions) and another that relaxes the enforcement of policies that aim to reduce illegal deforestation in the Amazon and of the Brazilian Forest Code. In addition, PBL separately quantified the effect of the Brazilian Forest Code.

Impact of climate policies on greenhouse gas emissions in Brazil



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

Figure 6: Impact of climate policies on greenhouse gas emissions in Brazil (upper end: PBL IMAGE model, lower end: NewClimate Institute calculations). Land use emissions based on both IIASA and PBL projections. Emission values are based on AR4 GWP-100. NDC targets according to the latest submission, using the 2005 emissions from the third and fourth National Communication. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019).

Table 8: Description of Brazil's previous and current NDC, as presented in official sources. N/A: not available or not applicable.

Indicator	Previous NDC	NDC*
BAU	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
Target: conditional	N/A	N/A
Sectoral coverage	Economy-wide	Economy-wide
General Accounting method	IPCC guidelines; 100-year GWPs from IPCC Fifth Assessment Report	IPCC 2006 Guidelines; 100-year GWPs from IPCC Fifth Assessment Report
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	Land-use sector is included in the target Accounting approaches and methodologies are not specified
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
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	N/A

* The updated NDC refers to the 3rd National Inventory Report. 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.

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

Sector	Policies (marked with '+' when mentioned in the NDC document)	Description
Energy supply	10-Year National Energy Expansion Plan (PDE) (2011: updated in 2019 as PDE 2029)	39.56 GW wind, 20.44 GW solar, 25.54 GW biomass, 9.96 GW small hydropower and 104.7 GW large hydropower installed by 2029. 48% renewable share (36% excluding hydropower) in total primary energy supply by 2029 ¹⁾ . 22% renewable share (excluding hydropower) in total electricity generation by 2029 ¹⁾ . 17% biofuel share in total primary energy supply by 2029.
	National Biodiesel Programme (2005)	Biodiesel share in diesel of 7% from 2015 and 11% from 2019 onwards, increasing by 1%-point every March until 15% by March 2023.
Transport	Ethanol Blending Mandate (1993)	Bioethanol share in gasoline of 27% from 2015 onwards.
	Inovar-Auto (2012)	Expected average fuel efficiency 1.62 MJ/pkm by 2022.
Agriculture and Forestry	RenovaBIO (2017) ²⁾	Improve carbon intensity of biofuels (gCO ₂ e/MJ) by 7% between 2017 and 2028, reaching 66.8 gCO ₂ /MJ by 2028.
	The Brazilian Forest Code (2012) (+) ³⁾	Enforcement of the Brazilian Forest Code for the Cerrado region and the rest of Brazil. Restoring and reforesting 12 million hectares of forests by 2030.
	National Plan on Climate Change (2008) ²⁾	Reducing deforestation rates in all Brazilian biomes, in order to reach zero illegal deforestation.

Sector	Policies (marked with '(+)' when mentioned in the NDC document)	Description
	The Low-Carbon Agriculture (ABC) Plan (2010) (+) ²⁾	Restoring an additional 15 million hectares of degraded pasturelands by 2030 and enhancing 5 million hectares of integrated cropland-livestock-forestry systems by 2030.
	Plan for Prevention and Control of Deforestation in the Amazon (2004) (+) ^{2), 3)}	Zero illegal deforestation by 2030 in the Amazon and compensating for greenhouse gas emissions from legal suppression of vegetation by 2030.
	Action Plan for the Prevention and Control of Deforestation and Forest Fires in the Cerrado biome (2010) ^{2), 4)}	Focus on reducing the deforestation rates and forest degradation, as well as the incidence of forest fires in the Cerrado biome.

¹⁾ Not quantified separately in IMAGE nor NewClimate Institute projections (only capacity targets were included.) ²⁾ Not quantified in IMAGE projections. ³⁾ The policy is included in the Low LULUCF scenario but excluded from the High LULUCF scenario. ⁴⁾ Not quantified separately by IIASA.

Table 10: 2005 historical data and 2030 projections of key GHG indicators for Brazil. Absolute emission levels (high LULUCF emission case) and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO₂e)	2790	1190 to 1690 (-58% to -39%)	1630 to 1390 (-42% to -50%)
GHG emissions per capita (tCO₂e/cap)	15.0	5.3 to 7.6 (-65% to -50%)	6.2 to 7.3 (-59% to -51%)

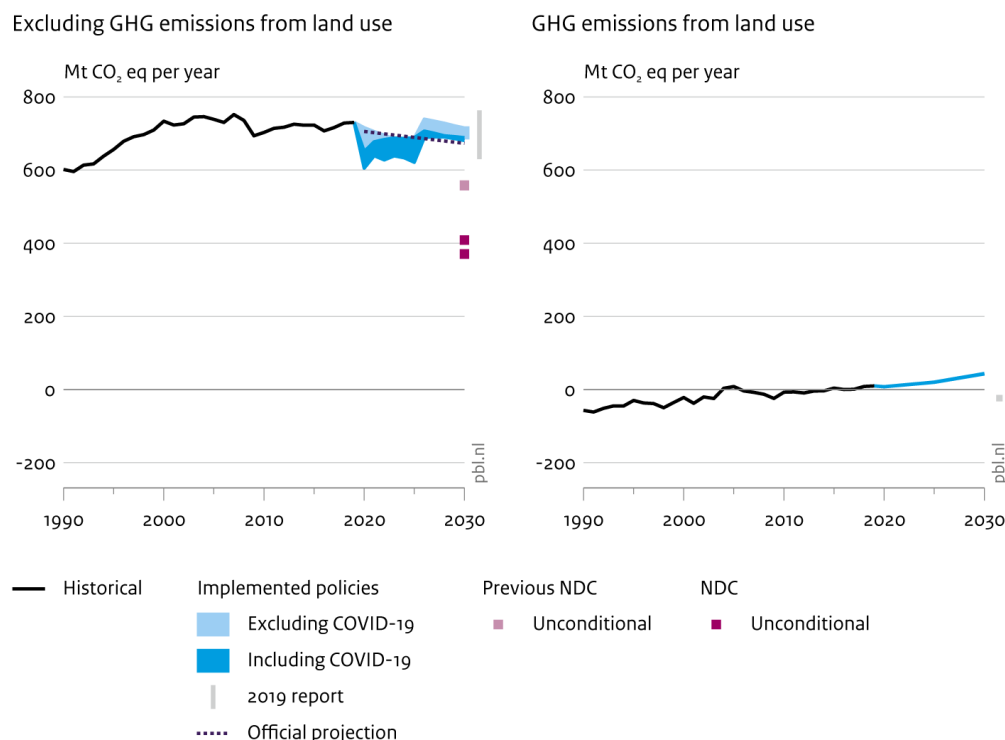
3.4 Canada

Recent developments (including proposed policies): In December 2020, Canada introduced a strengthened climate plan – ‘A Healthy Environment and a Healthy Economy’. Official projections indicate that if the plan were to be fully implemented, Canada’s GHG emissions would be reduced by 31% below 2005 levels and overachieving its previous NDC target of 30% below 2005 levels. In July 2021, Canada submitted a updated NDC that sets a reduction target of “at least” 40-45% below 2005 levels. The current plan remains insufficient to achieve the updated target (Environment and Climate Change Canada, 2021).

Regulations to reduce emissions from oil and gas by 40% to 45% by 2025 compared to 2012 levels went into effect in 2020. Final regulations are still under consultation but should be released in late 2021. The Greenhouse Gas Pollution Pricing Act was upheld by the Supreme Court, after three provinces had filed lawsuits over its constitutionality. The carbon price is planned to rise to CAD 170 per tonne CO₂ by 2030. The Federal Greenhouse Gas Offset System is under development to cover activities not covered by existing carbon pricing regulation (Environment and Climate Change Canada, 2020b). Since the submission of its first NDC, Canada has established accounting approaches for each LULUCF sub-sector (Canada, 2018; Environment and Climate Change Canada, 2020a).

Projections: Canada will likely miss both its previous and current NDC target with existing policies. Current policy scenario projections for the LULUCF sector excludes emissions from natural disturbances in-line with the accounting approaches established by Canada and the NDC target accounts for the amounts of credits/debits generated by the LULUCF sector.

Impact of climate policies on greenhouse gas emissions in Canada



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

Figure 7: 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. Emission values are based on AR4 GWP-100. The grey column gives the range of

our 2019 projections in Kuramochi et al. (2019). Official projections based on (Environment and Climate Change Canada (2021).

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

Indicator	Previous NDC	NDC
Business-as-Usual (BAU)	N/A	N/A
Target: unconditional	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
Sectoral coverage	Economy-wide. The target includes the LULUCF sector but will exclude the impacts of natural disturbances and focus on anthropogenic emissions and removals.	Economy-wide. The target includes the LULUCF sector but will exclude the impacts of natural disturbances and focus on anthropogenic emissions and removals.
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, 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 not specified, approach being used to account for the LULUCF sector being examined ¹⁾ Excludes emissions from natural disturbances and only account for anthropogenic emissions and removals.	Land-use is excluded in the base year and accounting approaches have been defined that provides 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. ²⁾
Use of bilateral, regional and international credits	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, 2017; 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 (Environment and Climate Change Canada, 2017; Government of Canada, 2014, 2016, 2018a, 2018b; 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, applies to provinces and territories that request it or have not implemented their own carbon pricing regime ('backstop').
	Regulation of HFCs (2017)	Reduce HFC emissions by 85% by 2036, relative to baseline.
Energy supply	CO ₂ standard for new power plants (2012) – updated in November 2018 to phase out traditional coal	420 gCO ₂ /kWh from 1 July 2015; plants must comply by 2030 at the latest. Phase-out of traditional coal (without CCS) by 2030.
	Regulations limiting carbon dioxide from natural gas fired electricity generation (January 2019)	Limits CO ₂ emissions from natural gas plants to 420 g/kWh for boiler units and large combustion units, 550 g/kWh for smaller combustion units.
	Regulations to address methane in the oil and gas sector (2018) ²⁾	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

Sector	Policies (marked with '(+)' when mentioned in the NDC document)	Description
		emissions in the oil and gas sector and to establish a leak detection and repair programme to reduce fugitive emissions.
Transport	Efficiency standards light commercial vehicles (2004)	34.1 mpg (14.9 km/l) by 2017, 55 mpg (23.2 km/l / 0.91 MJ/pkm) by 2025.
	Efficiency standards heavy-duty trucks (2013)	Differs 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)	Bioethanol share in gasoline of 5% from 2011 onwards Biodiesel share in diesel of 2% from 2011 onwards.
	Zero Emission Vehicle Infrastructure Deployment (2019, updated 2021)	Aims for 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 Budget 2019 (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 updated has not been quantified.
Buildings	EcoENERGY efficiency (2011) ³⁾	Supported the implementation of energy codes, among other things, to improve energy efficiency of buildings.
	Federal Energy Efficient Equipment and Appliances Program (2007)	Expected to result in GHG emissions reduction of 10.4 MtCO ₂ e by 2030, relative to baseline (source: National Communication)
	Building Energy Technology Programme (2019)	Aims for 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
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)}	Supports projects and activities that increase the use of wood as a building material in infrastructure projects.
	Forest Bioeconomy Framework for Canada (2017) ^{4), 5)}	Supports the use of forest biomass for advanced bio-products and innovative solutions.

¹⁾ Because the differences between provinces / territories could not be modelled, we did not quantify this measure. 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: 2005 historical data and 2030 projections of key GHG indicators for Canada. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (excl. LULUCF) – estimates (MtCO ₂ e)	739	681 to 688 (-8% to -7%)	409 to 371 (-45% to -50%)
GHG emissions per capita (tCO ₂ e/cap)	23.0	16.7 to 16.9 (-27% to -27%)	9.1 to 10 (-60% to -56%)

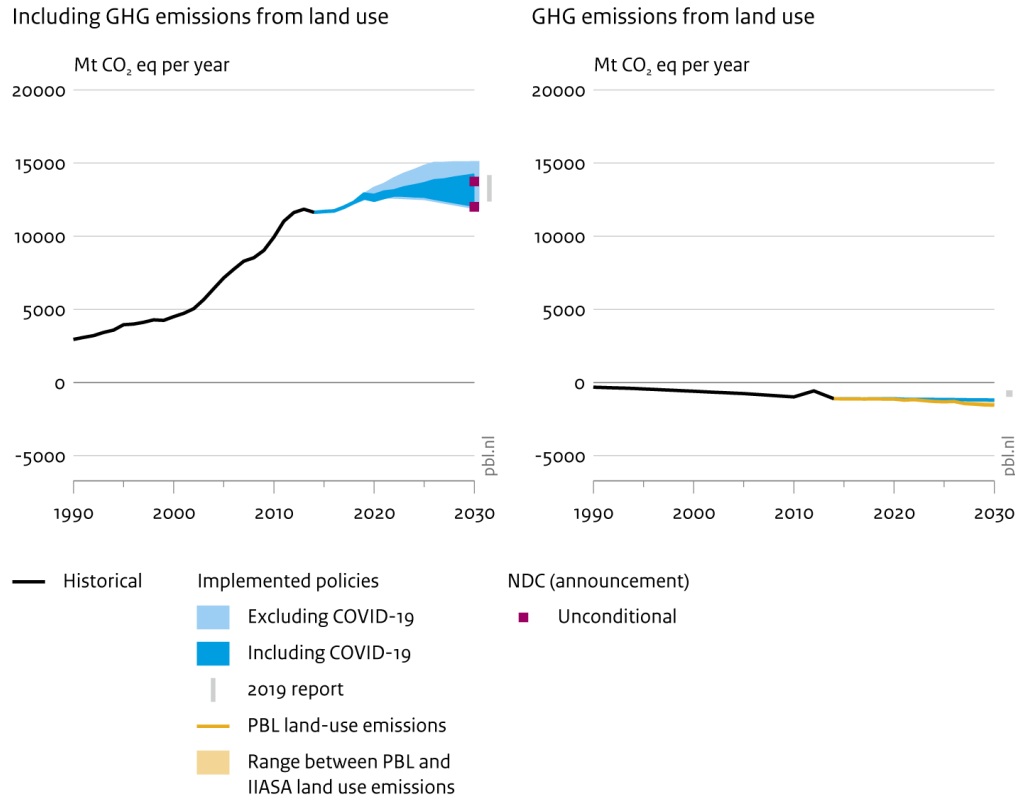
3.5 China

Recent developments (including proposed policies): In September 2020, at the UN general assembly, China announced that it will aim to achieve carbon neutrality before 2060. In December 2020 at the 2020 Climate Ambition Summit, China proposed updated NDC targets. However, as of September 2021, the country has not submitted the revised NDC nor more details about its carbon neutrality target.

The 14th Five Year Plan still plans support for coal, although President Xi Jinping announced that China will strictly control coal generation until 2025, when it will start to gradually phase out. The lower end of our current policy projections is based on the 14th Five Year Plan and other more recent renewable energy signals, such as the 50% renewable capacity target by 2025 and the renewable electricity generation target of 40% by 2030 (Daiss, 2021; Xu & Stanway, 2021). The Emissions Trading System (ETS) is in effect as of July 2021 and initially covers only the power sector. Its impact on emissions depends on the intensity-based cap, that is still to be set. China has adopted a 20% EV in car sales target by 2025 (Xinhua, 2020). The steel and aluminium sectors aim to peak their emissions by 2025 (Bloomberg, 2021; Finance Sina, 2021a, 2021b). China increased forest area and agricultural land protection in the past years, and set targets to increase natural vegetation, forest cover, and nature reserves.

Projections: Even though China's updated target has not been officially submitted to the UNFCCC, we consider it the current NDC target. China will likely meet its updated target with existing policies. For the LULUCF sector, the current policy projections estimate a larger LULUCF sink than our 2019 projections, mainly due the inclusion and harmonization to data from the 2014 national greenhouse gas inventories presented in the Second Biennial Update Report (BUR2) of China (Government of China, 2018).

Impact of climate policies on greenhouse gas emissions in China



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

Figure 8: Impact of climate policies on greenhouse gas emissions in China (upper end: PBL IMAGE model, lower end: NewClimate Institute calculations). Land use emissions based on both IIASA and

PBL projections. Emission values are based on AR4 GWP-100. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019). In this figure we do not show China's previous NDC due to its overlap with current policies scenario.

Table 14: Description of China's previous and current NDC, as presented in official sources. N/A: not available or not applicable.

Indicator	Previous NDC	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; over 65% CO ₂ emission intensity reduction by 2030, compared to 2005 levels; 25% non-fossil fuels in primary energy supply by 2030 and increased forest stock (see below). The updated NDC includes a new wind and solar installed capacity target of 1,200 GW by 2030.
Target: conditional	N/A	N/A
Sectoral coverage	Not specified	Not yet specified
General Accounting method	Not specified	Not yet 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 yet specified
Other sector-level targets	Reductions of HCFC22 production of 35% by 2020 and 67.5% by 2025 below 2010 levels	Not yet specified

Table 15: Overview of key climate change mitigation policies in China (Central Compilation & Translation Press, 2016; Government of China, 2020; Government of P.R. China, 2014; Library of Congress, 2020; State Council, 2015; UNFCCC, 2012; Xinhua, 2019)

Sector	Policies (marked with '(+)' when mentioned in the NDC document)	Description
Cross-cutting	National Action Plan on Climate Change (2014) ^{1), 2)}	Emissions trading program expected to be operational for the power sector by 2020.
	13th Five-Year Plan (2016-2020)	Cap on total primary energy use in 2020 at 5.0 billion tce, and limiting annual growth rate of primary energy consumption to 2.5%. ⁵⁾ Decrease CO ₂ intensity by 18% from 2015 levels by 2020. ⁵⁾ Decrease energy intensity (TPES/GDP) by 15% by 2020, relative to 2015. ⁵⁾
	14th Five-Year Plan (2021-2025) ¹⁾	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⁾
Energy supply	Energy Development Strategy Action Plan (2014-2020)	Cap on coal consumption in 2020 at 4.1 billion tce (84.5 EJ/year) ⁵⁾ A 10% target share of gas in primary energy supply in 2020 ^{5) 6)} Limit share of coal to 58% of total energy supply by 2020 ¹⁾ 15% non-fossil fuel share in TPES in 2020 ⁵⁾

Sector	Policies (marked with '(+)' when mentioned in the NDC document)	Description
		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 800 million m ² collector area ¹⁾ 10 million tonnes ethanol, 2 million tonnes biodiesel ¹⁾ 58 GW nuclear power (150 GW by 2030)
	Action Plan for Upgrading of Coal Power Energy Conservation and Emission Reduction Released (2014)	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⁾ .
Transport	Vehicle fuel economy standards (2004)	Fuel efficiency of new heavy-duty trucks: 1.2 MJ/tkm by 2021.
	Expansion of Ethanol Production and Promotion for Transportation Fuel (2017)	Ethanol blending mandates 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)	Fuel economy standards of 5L/100 km by 2020. 1 million units of new energy vehicles sold in 2020.
Industry	'Made in China 2025' CO ₂ intensity target (2013) ^{2) 5)}	Manufacturing industries reduce their CO ₂ emissions per unit of added value by 22% by 2020 and 40% by 2025 from 2015 levels.
	Green Industry Development Plan (2016-2020) China 2016 ^{2) 5)}	Decrease energy consumption per value added by 18% between 2015 and 2020.
Buildings	Appliance Standards and Labelling Programme ¹⁾	Supplemented with subsidies and awareness-raising campaigns.
	National Building Energy Standard ⁴⁾	30% of newly constructed buildings to meet standards by 2020.
Agriculture and Forestry	The 14th Five-Year Plan for the development of forestry and grassland conservation (2021-2025) ¹⁾	Forest coverage to reach 24.1% (ca. 230.53 million hectare) with forest stock volume of 19 billion cubic meters. Commercial harvest over natural forest has prohibited, preserving 1.944 billion mu of forests (129.6 million hectares). Grassland vegetation cover to reach 57% and protection rate of wetland to reach 55%. 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).
	Outline of the 14th Five-Year Plan (2021-2025) for National Economic and Social Development and Vision 2035 of the People's Republic of China ^{1), 3)}	Redline of a minimum of 1.8 billion mu (ca. 120 million hectare) of arable land, with 1.075 billion mu (ca. 71.67 million hectare) of high-quality arable land. Mechanization rate of crop cultivation to reach 75% by 2025. In 2016, the comprehensive mechanization rate of crop cultivation reached 65.19%.
	Program plan for national reserve forest (2018-2035) ¹⁾	New planted 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 increment of 200 million cubic meters (i.e., 10 cubic meters per hectare). Annual forest stock volume increment of native species and the large-diameter timber volume to reach 63 million cubic meters.
	Revision of Forestry Law of the People's Republic of China (2019) ¹⁾	China revised its Forest Law for the first time in 20 years, with the most significant policy change 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.
	Revision of Land Administration Law of the People's Republic of China (2019) ¹⁾	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

Sector	Policies (marked with '+' when mentioned in the NDC document)	Description
		requires the same area and quality of land be reclaimed for agricultural use.
	15-year plan (2021-2035) to protect ecosystems (2020) ³⁾	Targets include the increase of forest cover to 26% by 2035, the increase of grassland vegetation cover to 60%, and the increase of nature reserve areas to 18% of national land area.

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).

Table 16: 2005 historical data and 2030 projections of key GHG indicators for China. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

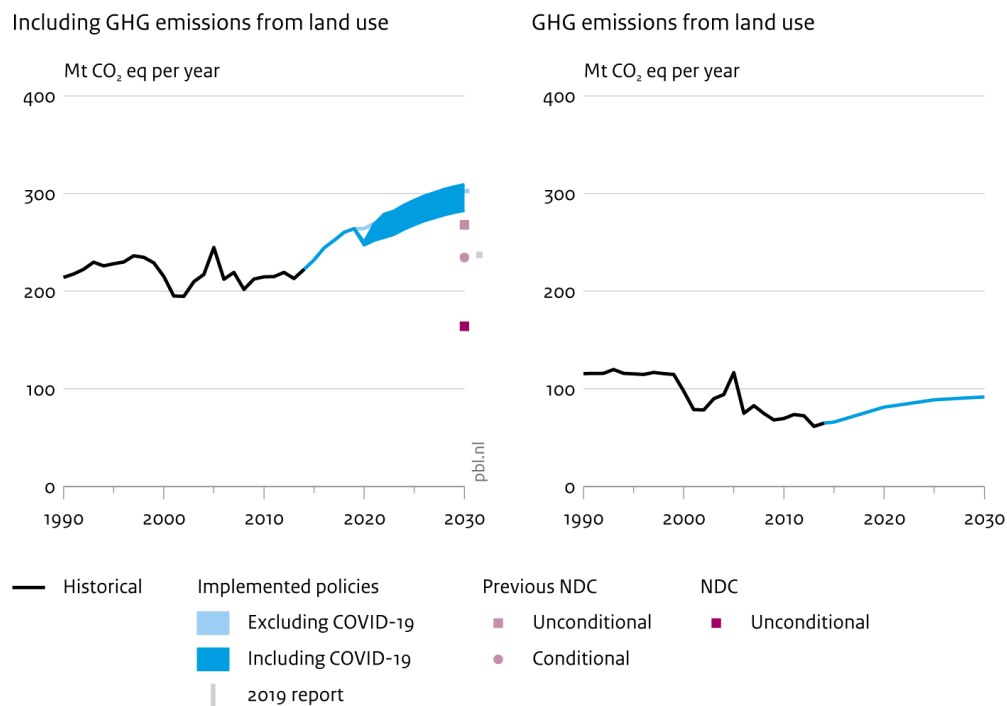
Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO₂e)	7150	12100 to 14200 (69% to 98%)	13700 to 12000 (92% to 68%)
GHG emissions per capita (tCO₂e/cap)	5.4	8.3 to 9.7 (+54% to +80%)	8.2 to 9.4 (+53% to +74%)

3.6 Colombia

Recent developments (including proposed policies): In December 2020, Colombia submitted its updated NDC, 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 in emissions by 2030 compared to the BAU scenario. The target also mentions the intention to peak emissions between 2027-2030. Although the updated target is stronger than the previous one by 6-22%, it relies heavily on reductions from LULUCF. This reliance is not in line with the current National Development Plan which has set a deforestation target of 30% by 2022 compared to the current scenario (Departamento Nacional de Planeación, 2018) (impact not quantified). Given that the deforestation level under the reference scenario is 360,000 hectares per year, it would reduce deforestation to around 250,000 hectares per year, which is still significantly higher than the previous administration's target (90,000 hectares per year). Colombia does not have a strategy to phase-out coal. Colombia has adopted a regulation to allow pilot projects for exploration and production of unconventional fossil reservoirs using fracking techniques.

Projections: Colombia will likely miss both its conditional and unconditional NDC targets. Emissions projections are higher in comparison to our previous projections mostly due to new accounting method for natural forests and the projected increase in deforestation-induced, land use emissions under current policies.

Impact of climate policies on greenhouse gas emissions in Colombia



Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 9: Impact of climate policies on greenhouse gas emissions in Colombia. Emissions trajectories are based exclusively on NewClimate and IIASA's projections. Emission values are based on AR4 GWP-100. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019).

Table 17: Description of Colombia's previous and current NDC, as presented in official sources. N/A: not available or not applicable.

Indicator	Previous NDC	NDC
Business-as-Usual (BAU)	335 MtCO ₂ e in 2030	N/A
Target: unconditional	20% GHG reduction with respect to BAU by 2030	Absolute emissions target of 169.44 MtCO ₂ e in 2030
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 IPCC Second Assessment Report	IPCC guidelines; 100-year GWP from IPCC Fifth Assessment Report
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. However, 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. The carbon dioxide removals for the natural forests that remain as such are not accounted. Reduce deforestation rate to 50,000 hectares/year in 2030.
Use of bilateral, regional and international credits	Colombia will explore the use of market instruments (or other economic instruments) to contribute towards the emissions reduction target	Intention in 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, 2018c; 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.
	Law 697: Programme for rational and efficient use of energy and other forms of non-conventional Energy (PROURE) (2010; latest adopted in 2016) ¹⁾	Aims for 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)	Reduction of emissions from the domestic refrigeration sector. Targets 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)	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.

Sector	Policies ³⁾ (marked with '(+)’ when mentioned in the NDC document)	Description
Agriculture and Forestry	The National Development Plan of Colombia (+) (2015)	Reduction of the annual deforestation rate from 121,000 hectares in 2013 to 90,000 hectares by 2018.
	The Amazon Vision Program (+) (2016) ²⁾	Achieve net-zero deforestation by 2020.
	REDD+ Zero Deforestation in the Amazon by 2020 (2009) ²⁾	Reducing Emissions from Deforestation and Forest Degradation (REDD+) 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)	Increase Colombia’s protected forest area coverage to 30 million hectares to reach a total of 38 million hectares.

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

Table 19: 2005 historical data and 2030 projections of key GHG indicators for Colombia. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO ₂ e)	245	283 to 309 (+15% to +26%)	164 (-33%)
GHG emissions per capita (tCO ₂ e/cap)	5.7	5.3 to 5.8 (-8% to +1%)	3.1 (-47%)

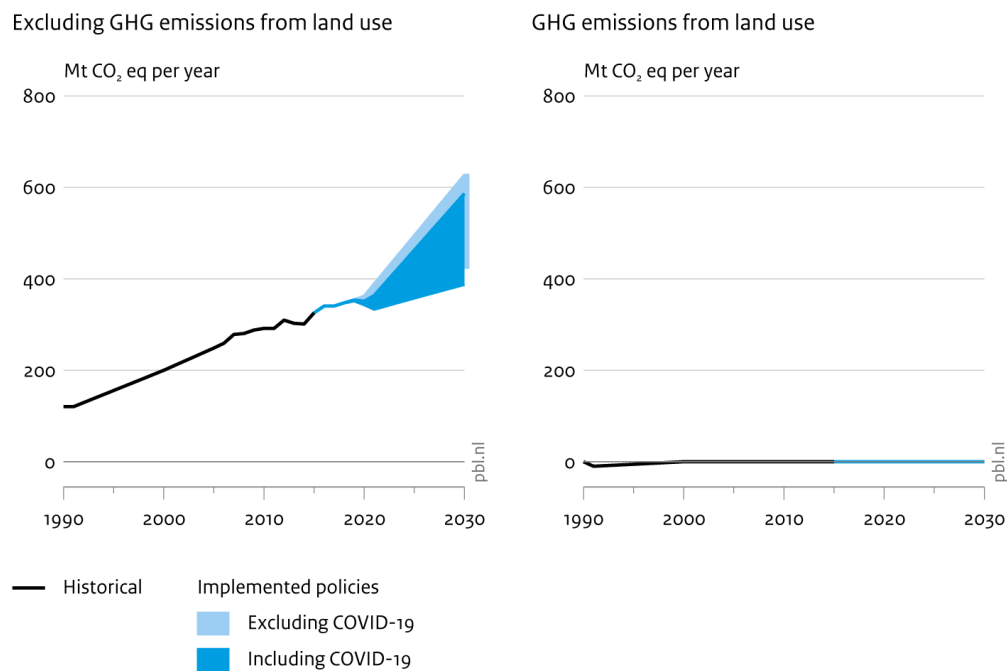
3.7 Egypt

Recent developments (including proposed policies): In 2015, the Ministry of Electricity and Renewable Energy (MoERE) released the Integrated Sustainable Energy Strategy to 2035 (ISES 2035). The Strategy maintains the target set in the 2008 National Renewable Energy Strategy of reaching 20% of the power energy from renewables (IEA, 2008) but postpones the deadline to 2022 and added the target of 42% by 2035 (IRENA, 2018).

To stimulate private sector's investment in renewable sources, the Egypt Renewable Energy Law (2014) established economic instruments, such as the competitive bidding and Feed-in Tariff schemes with fixed electricity prices for solar and wind technologies (*Presidential Decree-Law No. 203/2014 Regarding the Stimulation of Producing Electricity from Renewable Energy Sources*, 2014). Other economic incentives include the Egypt Renewable Energy Tax Incentive (through the Presidential decree No. 17/1015) which established a tax relief on sales from 10% to 5% (IEA, 2016a). In the building sector, Egypt adopted policies to set energy efficiency label requirements (2013/3795), energy efficiency standards for air conditioners (3795-1/2016), and the regulatory instrument 4814/2018 setting non-ducted air conditioners and heat pump minimum energy performance standard (IEA, 2020a, 2020b, 2020d).

Projections: Emissions trajectories (excluding LULUCF) are based on NewClimate projections, and LULUCF emissions projections are from IIASA. Egypt has not yet updated its NDC and the previous submission does not include any quantifiable targets.

Impact of climate policies on greenhouse gas emissions in Egypt



Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 10: Impact of climate policies on greenhouse gas emissions in Egypt. Emissions trajectories are based exclusively on NewClimate and IIASA's projections. Emission values are based on AR4 GWP-100.

Table 20: Overview of key climate change mitigation policies in Egypt.

Sector	Policies marked with '(+)' when mentioned in the NDC document)	Description
Energy supply	Integrated Sustainable Energy Strategy to 2035 (2015)	The Egypt's government established the 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)	To stimulate the private sector to invest in renewable sources to power generation. The regulation brings diverse mechanisms such as competitive bidding, competitive bidding for build-own-operate and Feed-in tariffs.
	Renewable Energy Tax Incentives (2015)	Aiming to attract investments, the government reduce sale tax of energy to 5%.
Buildings	Air Conditioners Energy Efficiency Standard No. 3795-1 / 2016	This policy establishes label requirements for room air conditioners with fixed capacity and fixed compressor based on energy efficiency performance
	Air Conditioners Energy Efficiency Standard No 3795 / 2013	This policy establishes label requirements for room air conditioners based on energy efficiency performance
	Standard 4814 / 2018: Non-ducted air conditioners and heat pumps	This policy sets the minimum energy efficiency performance standard for non-ducted air conditioners and heat pumps. It has become mandatory in 2019.

Table 21: 2005 historical data and 2030 projections of key GHG indicators for Egypt. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

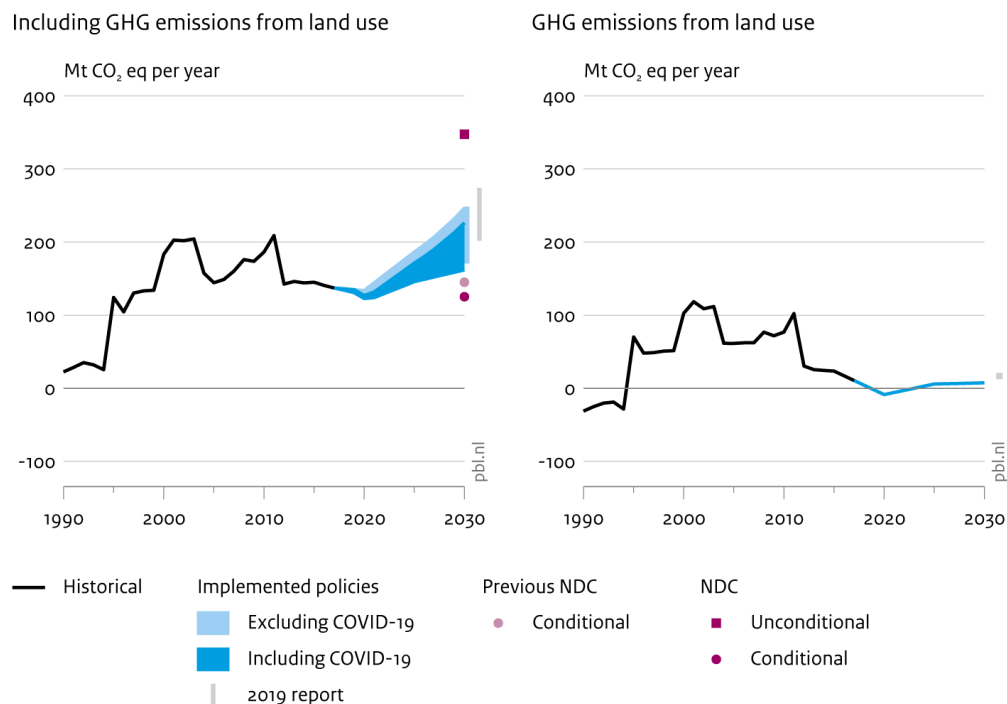
Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO ₂ e)	249	388 to 586 (+56% to +136%)	N/A
GHG emissions per capita (tCO ₂ e/cap)	3.3	3.2 to 4.9 (-2% to +47%)	N/A

3.8 Ethiopia

Recent developments (including proposed policies): The ‘Climate Resilient Green Economy’ (CRGE), first published in 2011 outlining Ethiopia’s mitigation efforts, remains under revision as of August 2021. 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 based 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) is under construction and is expected to be connected to the grid by 2025.

Projections: Ethiopia will likely miss its NDC conditional target with existing policies, but it will meet its unconditional NDC target. The range of current policies scenario projections of this year’s report has been downward revised compared to our 2019 projections. The updated lower bound emissions projection now builds upon a combination of the *Stated Policies Scenario* from IEA’s Africa Energy Outlook 2019 for CO₂ emissions from fuel combustion and non-CO₂ emissions from the US EPA (IEA, 2019a; U.S. EPA, 2019a). The upper-bound assumes that GHG emissions will grow according to the revised business as usual (BAU) scenario projections provided in the Second National Communication submitted to the UNFCCC, assuming full implementation of all the policies listed in First Growth and Transformation Plan (GTP I).

Impact of climate policies on greenhouse gas emissions in Ethiopia



Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 11: Impact of climate policies on greenhouse gas emissions (CO₂, CH₄ and N₂O) in Ethiopia. Emission values are based on AR4 GWP-100. Emissions trajectories are based exclusively on NewClimate and IIASA’s projections. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019).

Table 22: Description of Ethiopia's NDC and current NDC, as presented in official sources. N/A: not available or not applicable.

Indicator	Previous NDC	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% 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% 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 the Fourth Assessment Report	IPCC 2006 guidelines and 2013 IPCC Kyoto Protocol Supplement; 100-year GWPs from the Fifth Assessment Report
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: <ul style="list-style-type: none"> Unconditional target: 50.2 MtCO₂e of reductions from LUCF and livestock, and 0.1 MtCO₂e from managed soils. Conditional target: 254.9 MtCO₂e of reductions from LUCF and livestock, and 0.3 MtCO₂e from managed soils.
Use of bilateral, regional and international credits	Yes, but expected amount not quantified	Intention in participating in international carbon markets under Article 6 of the Paris Agreement

Table 23: 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) 2)}	Strategy with various mitigation initiatives to limit economy-wide GHG emissions in 2030 to 150 MtCO ₂ e (250 MtCO ₂ e below BAU). Development of up to 25 GW in renewable power capacity by 2030.
Energy supply	Growth and Transformation Plan II (2016) (+) ^{1) 2)}	GTP II 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 coverage from 60% in 2015 to 90% by 2020.
	Scaling-Up Renewable Energy Program for Ethiopia (SREP Investment Plan) (2012) ¹⁾	Increase power generation capacity from the present level of 2 GW to 10 GW by 2015 and to 25 GW by 2030. Focus on five major investment projects of wind, geothermal and hydroelectric energy generation.
	National Biogas Programme (2007) ¹⁾	Construction of 20,000 biogas plants by 2017 (2nd phase: 2014-2017).
Transport	Intra-Urban Electric Rail NAMA (2012) ²⁾	Replace 50% of the cargo transport with electric rail transport. Expected emissions reduction of 8.9 MtCO ₂ e/year by 2030.
Agriculture and Forestry	Afforestation and reforestation actions (part of the CRGE and further specified)	Target in CRGE is 7 million hectares of afforestation and reforestation by 2030 ¹⁾ with further conditional provision building thereupon in the NDC of 2021

Sector	Policies ⁴⁾ (marked with '(+)' when mentioned in the NDC document)	Description
	in NDC of 2021) (2011, update in 2021) (+)	<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
	Second Green Legacy Campaign (2020)	On World Environment Day in June 2020, Ethiopia's Prime Minister launched the Second Green Legacy Campaign aiming to plant 5 billion seedlings. This goal was reportedly achieved in August 2020.

¹⁾ See Climate Action Tracker (Climate Action Tracker, 2020b) for detailed assumptions on the policies and measures under the First Growth and Transformation Plan (GTP I) quantified in the current policies scenario. ²⁾ Excluded from current policy projections due to unclear development and implementation status.

Table 24: 2005 historical data and 2030 projections of key GHG indicators for Ethiopia. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

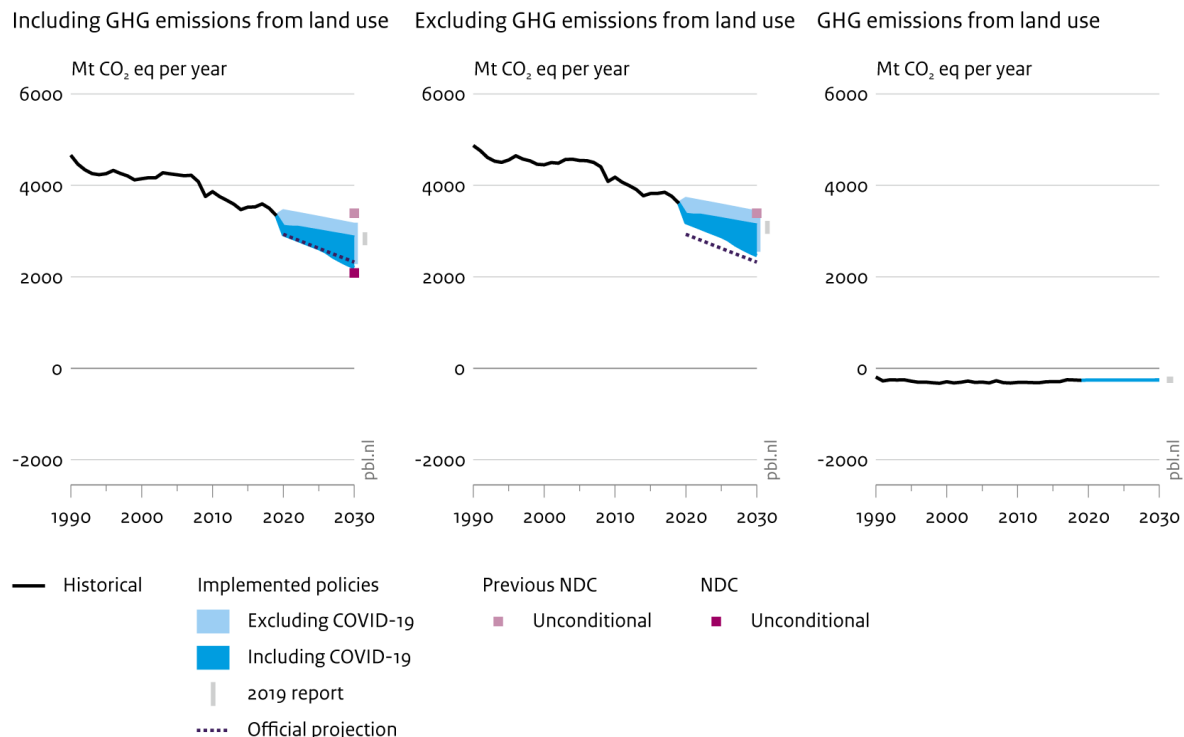
Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO₂e)	144	162 to 226 (+12% to +57%)	347 (+140%) [125 (-13%)]
GHG emissions per capita (tCO₂e/cap)	1.9	1.1 to 1.6 (-41% to -17%)	2.4 (+27%)

3.9 European Union (EU27)

Recent developments: In December 2020, the EU submitted a stronger 2030 NDC target: from at least 40% to at least 55% emissions reductions below 1990. In the context of the European Green Deal, the EU has set a legal objective (under the 2021 European Climate Law, Regulation (EU) 2021/1119) to become climate neutral by 2050 (European Commission, 2020). The EU has published plans to support emissions reductions in transport, buildings, industry, energy, agriculture, among others (European Commission, 2020). The European Biodiversity Strategy also aims to expand protected areas, which might increase emissions sink capacity. In 2021, the EU also released its 'Fit for 55' package, a wide set of legislative proposals to realise the new 2030 GHG target. It includes many reforms of existing legislation to increase ambition and measures such as the introduction of a new Emissions Trading System, that would operate in parallel to the current ETS and cover new sectors, 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, 2021). Policies adopted in 2021 have not been quantified.

Projections: With current policies, the EU27 is projected to overachieve its previous NDC target (40% reduction) but additional policies are needed to meet its updated, more ambitious NDC target. The uncertainty range is partially caused by the differences between Member State (upper end) versus EU-level policies (lower end). The projections presented in this report exclude the UK, which accounted for 11% of EU's total GHG emissions in 2017. The implementation and quantification of recently proposed policies will reduce this uncertainty over time.

Impact of climate policies on greenhouse gas emissions in EU27



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

Figure 12: Impact of climate policies on greenhouse gas emissions in the EU (upper end: NewClimate Institute calculations, lower end: PBL IMAGE model). Emissions values are based on AR4 GWP-100. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019).

Table 25: Description of EU's previous and current NDC, as presented in official sources. N/A: not available or not applicable.

Indicator	Previous NDC	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 the Fourth Assessment Report	IPCC guidelines 2006; 100-year GWPs from the Fifth 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. 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 _{2e} under the European Climate Law (2021/1119).
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 26: Overview of key climate change mitigation policies in the EU27 (EEA, 2019; European Council, 2017; European Parliament, 2009a, 2009b; European Parliament and the Council of the European Union, 2014, 2018; Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018 Amending Directive 2010/31/EU on the Energy Performance of Buildings and Directive 2012/27/EU on Energy Efficiency (Text with EEA Relevance), 2018; The European Parliament and the Council of the European Union, 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)	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)}	Reduce GHG emissions from non-ETS sectors by 30% by 2030, relative to 2005
	Revised Energy Efficiency Directive (EED) EU 2018/2002 ⁴⁾	Target of 32.5% reduction in final energy consumption (compared to the 2007 modelling projections for 2030) with a possible revision in 2023.
	F-gas regulation (517/2014)	Reduce emissions of fluorinated gases by 37% by 2020 and by 79% by 2030, relative to the average values between 2009 and 2012.
Energy supply	Renewable energy directive (Directive 2018/2001; RED II) ⁴⁾	Target of 32% share in final energy consumption by 2030 with a possible revision in 2023. It also includes a binding target of 14% renewable energy consumption in the transport sector.
Buildings	Eco-design Framework Directive (Directive 2009/125/EC)	Specific standards for a wide range of appliances
	Energy Performance of Buildings EU 2018/844	All new buildings to be nearly zero-energy from 2021 onwards.

Sector	Policies (marked with '(+)’ when mentioned in the NDC document)	Description
Transport	Regulation of CO ₂ emissions from passenger vehicles (443/2009, updated April 2019), and heavy-duty vehicles (February 2019)	<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 2030²⁾ - The share of renewable energy within the final consumption of energy in the transport sector is at least 14 % by 2030⁵⁾
LULUCF	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	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 .
Agriculture and Forestry	EU Farm to Fork Strategy (2019) ²⁾	Part of the European Green Deal, a strategy by the European Commission related to fair, healthy and environment-friendly food systems.

¹⁾ Not quantified in NewClimate Institute and PBL IMAGE model projections. ²⁾ Not quantified in IIASA and PBL model projections. ³⁾ Not quantified separately in PBL IMAGE projections, but achievement checked after implementation of other (related) targets.

Table 27: 2005 historical data and 2030 projections of key GHG indicators for the EU. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

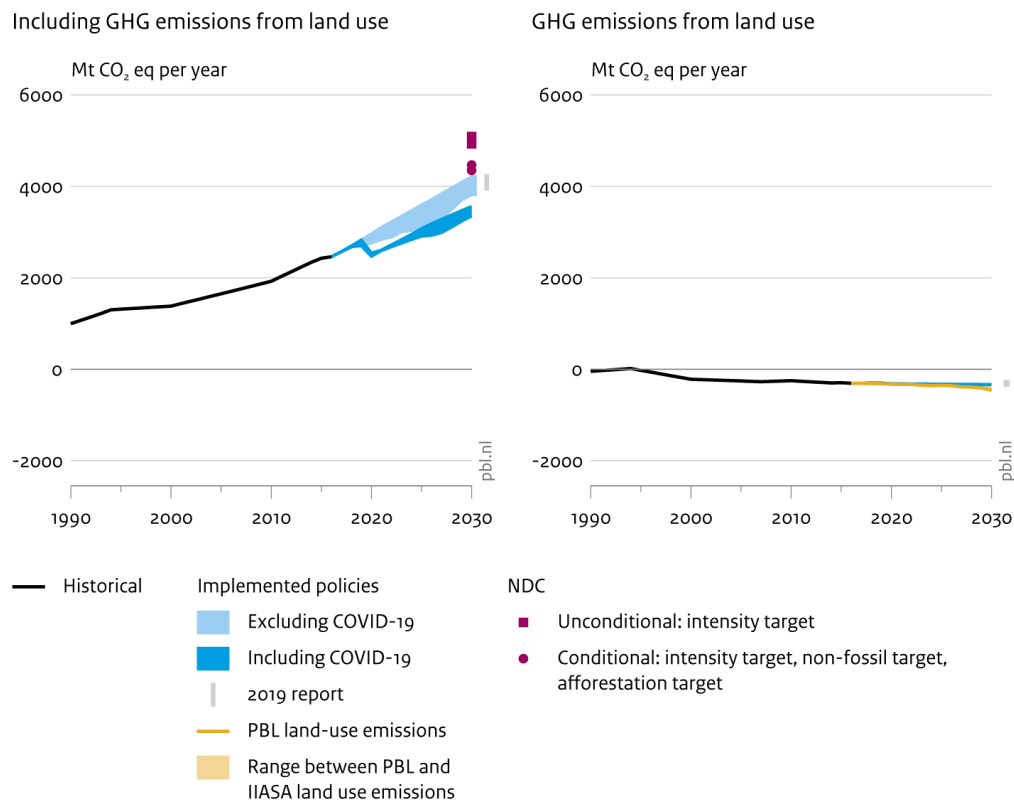
Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO₂e)	4230	2200 to 2870 (-48% to -32%)	2080 (-51%)
GHG emissions per capita (tCO₂e/cap)	9.7	5 to 6.5 (-49% to -33%)	4.7 (-52%)

3.10 India

Recent developments (including proposed policies): India has not yet submitted an updated NDC. India aims at increasing renewable power capacity to 450 GW by 2030, up from about 100 GW today (CEA, 2021; IEA, 2020c). The country also has an interim target for 2022 of 175 GW, which it will likely miss. India's recovery package to overcome the COVID-19 crisis simultaneously supports PV and battery storage development, and fossil energy sources. Under the National Electricity Plan (NEP), India projects adding about 45 GW of coal plants by 2030. The Central Electricity Authority estimates that 64 GW in total are needed (CEA, 2020). 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 both its unconditional and conditional NDC targets with existing policies. Our current policies scenario projections this year are similar to our 2019 projections, except for the effect of COVID-19, that reduced emissions by approximately 10%.

Impact of climate policies on greenhouse gas emissions in India



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

Figure 13: Impact of climate policies on greenhouse gas emissions in India (upper end: PBL IMAGE model, lower end: NewClimate Institute calculations). Emission values are based on AR4 GWP-100. Land use emissions based on both IIASA and PBL projections. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019).

Table 28: Description of India's current NDC, as presented in official sources. N/A: not available or not applicable.

Indicator	NDC
Business-as-Usual (BAU)	N/A
Target: unconditional	Reduce emissions per unit of GDP by 33% to 35% 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 ₂ e through additional forest and tree cover by 2030
Sectoral coverage	Not specified
General Accounting method	Not specified
GHGs covered	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
Use of bilateral, regional and international credits	Yes. Expected amount not quantified.
Other sector-level targets	(Various existing policies and targets are described)

Table 29: 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⁾	Implemented in 2010; currently a tax of INR 400/tonne is imposed on coal, lignite and peat.
	National Mission for Enhanced Energy Efficiency (2008) ¹⁾	The Mission helps 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)) (+)	<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) ²⁾ Renewable Energy Certificate (REC) mechanism (2011) ²⁾
	National Electricity Plan (2018) ¹⁾	The Plan forecasts demand reductions, presents capacity additions for various energy technologies, including a slowdown in installation of new coal fired power plants.
Transport	Fuel economy 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) ²⁾	15% share in car stock by 2023, 30% by 2030. Subsidy for hybrid and full electric vehicles. No licensing required for EV charging stations. Aims to support the uptake of EVs by providing upfront incentives for the purchase of vehicles and by fostering the development of charging infrastructure. The scheme is planned to support 1,000,000 electric two-wheelers, 500,000 electric three-wheelers, 55,000 electric four-wheelers and 7,000 buses.
	Support for biofuels (2007), National Policy on Biofuels (2018) ²⁾	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).

Sector	Policies (marked with '(+)’ when mentioned in the NDC document)	Description
Industry	Energy efficiency in industry (PAT scheme) (2011)	Benchmarking of designated companies’ performance 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)	Increase the forest/tree cover in moderately dense forests: 5 million hectares Improve forest/tree cover of forest areas: 5 million hectares
	National Mission on Sustainable Agriculture (2012) (+) ^{1), 3)}	Enhancing food security and protection of resources such as land, water, biodiversity and genetics

¹⁾ Not quantified in PBL IMAGE model projections. ²⁾ Not quantified (separately) in NewClimate Institute and PBL IMAGE projections. ³⁾ Not quantified in IIASA model projections.

Table 30: 2005 historical data and 2030 projections of key GHG indicators for India. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO ₂ e)	1650	3350 to 3560 (+103% to +116%)	5090 to 4930 (+209% to +199%) [4470 to 4350 (+171% to +164%)]
GHG emissions per capita (tCO ₂ e/cap)	1.4	2.2 to 2.4 (+55% to +65%)	3.3 to 3.4 (+128% to +135%)

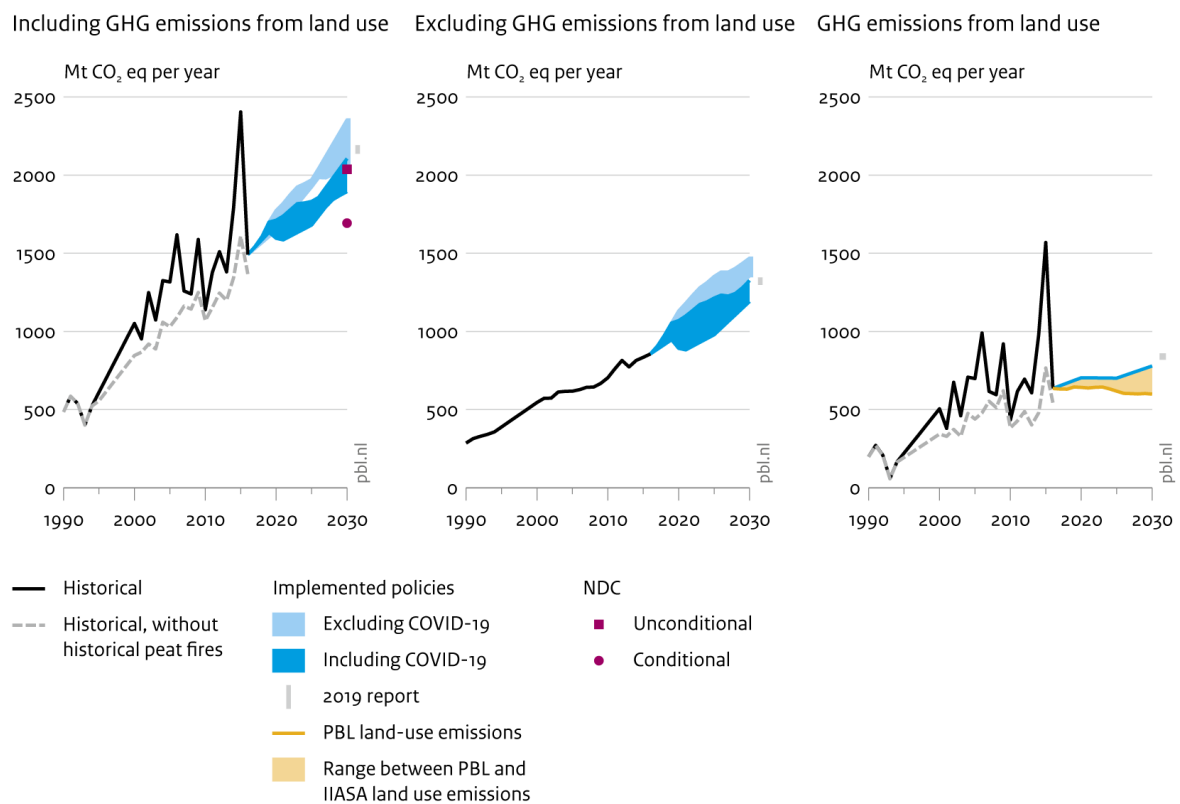
3.11 Indonesia

Recent developments (including proposed policies): In July 2021, Indonesia submitted an updated NDC and a Long-Term Strategy (LTS). The updated NDC keeps the same unconditional target of 29% GHG emissions reduction by 2030 below the baseline scenario. In its LTS, Indonesia does not commit to a net zero target but explores scenarios that could lead to net zero by 2060. Indonesia projects significant emissions reductions from the land use sector in its mitigation scenarios.

Emissions in other sectors are also projected to increase. Since 2019, the state-owned energy utility (PLN) has not published an update to Indonesia's Electricity Supply Plan (RUPTL) (Republic of Indonesia, 2019). The relationship between current capacity expansion plans and the renewable targets presented in the medium-term development plan (RPJMN 2020-2024) are unclear (Kementerian PPN, 2019). In 2020 the government introduced changes in the renewable tendering scheme. The new scheme is an improvement since it does not require power producers to transfer ownership of the land to PLN in the end of contracted period. However, concerns about the tariff regime, among others, remain (Draps et al., 2020). The government continues to advance the implementation regulation 55/2019 to improve EV domestic manufacturing industry. It aims to produce over 600,000 electricity and 2.5 million electric motorcycles by 2030 (Suharto & Aryani, 2021). The government also raised the biodiesel blending mandate to 30% in 2020 with the aim of increasing it to 40% by 2022 (Reuters, 2020).

Projections: Indonesia is set to meet its unconditional NDC target with existing policies. However, emissions remain on an upwards trend. Our current policies scenario this year is similar to our 2019 projections, except for the effect of COVID-19, which brings emissions below the unconditional target.

Impact of climate policies on greenhouse gas emissions in Indonesia



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

Figure 14: Impact of climate policies on greenhouse gas emissions in Indonesia (upper end: PBL IMAGE model, lower end: NewClimate Institute calculations). Emission values are based on AR4 GWP-100. Land use emissions are based on both IIASA and PBL projections but do not account for the impact

and annual fluctuations of natural disturbances and peat fires. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019).

Table 31: Description of Indonesia's previous and current NDC, as presented in official sources. N/A: not available or not applicable.

Indicator	Previous NDC	NDC
Business-as-Usual (BAU)	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
Target: conditional	41% GHG reduction by 2030 from baseline scenario	41% 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
General Accounting method	IPCC guidelines; 100-year GWPs from the Fourth Assessment Report	IPCC guidelines; 100-year GWPs from the Fourth Assessment Report
GHGs covered	All IPCC sectors CO ₂ , CH ₄ , N ₂ O	All IPCC sectors 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
Use of bilateral, regional and international credits	International market mechanisms will not be used to meet the NDC, but Indonesia 'welcomes bilateral, regional and international market mechanisms that facilitate and expedite technology development and transfer, payment for performance, technical cooperation, and access to financial resources to support Indonesia's climate mitigation and adaptation efforts towards a climate resilient future'.	N/A

Table 32: Overview of key climate change mitigation policies in Indonesia (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; Sembiring et al., 2020)

Sector	Policies (marked with '(+)' when mentioned in the NDC document)	Description
Energy Supply	National Energy Policy (NEP) (2014) (+) ¹⁾	23% new and renewable energy (including nuclear) in total primary energy supply by 2025
	Electricity Supply Business Plan (RUPTL 2019–2028) ²⁾	Added electricity capacity over 2019–2028: 6,061 MW hydropower, 4,607 MW geothermal, 3,483 MW solar, 2,563 MW wind.
	RPJMN 2020–2024 ^{1) 5)}	Presents a renewable capacity target of 37.3 GW by 2024.
Transport	Biofuel targets (2013) ³⁾	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) ⁵⁾	Restricting oil palm extension to peatland or to primary forest as defined in the Ministry of Forestry land cover map.
	Presidential Instruction 8/2018 ^{4), 5)}	This instruction presents a three-year moratorium on entire licensing process for palm oil plantations and an order for the relevant central government ministries and regional governments to conduct a massive review of oil palm licensing data.

Sector	Policies (marked with '(+)’ when mentioned in the NDC document)	Description
	National Action Plan for Greenhouse Gas Emission Reduction (Ran-GRK) (2011) ⁴⁾	The action plan proposes an increase in forest protection that would lead to emissions reductions of 672 MtCO ₂ e in the forestry sector relative to the no-policy scenario between 2015 and 2030.
	Food Estate Program (2020) ⁴⁾	Environment ministry regulation allows protected forests to be cleared at a large scale for the purpose of food production.
	Omnibus Law on Job Creation (2020) ⁴⁾	Eliminates a requirement that all regions in Indonesia maintain a minimum 30% of their watershed and/or island area as forest area.

¹⁾ Not quantified separately but checked if achieved after implementation of other policies. ²⁾ NewClimate Institute includes the target of 27 GW of coal-fired power plants included in the plan. PBL does not prescribe a target for coal. ³⁾ Implemented in PBL IMAGE model as 22.5% total biofuel share. ⁴⁾ Not quantified in IIASA model projections. ⁵⁾ Not quantified in PBL IMAGE model projections.

Table 33: 2005 historical data and 2030 projections of key GHG indicators for Indonesia. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO₂e)	1320	1890 to 2110 (+44% to +60%)	2040 (+55%) [1690 (+28%)]
GHG emissions per capita (tCO₂e/cap)	5.8	6.3 to 7 (+9% to +21%)	6.8 (+17%)

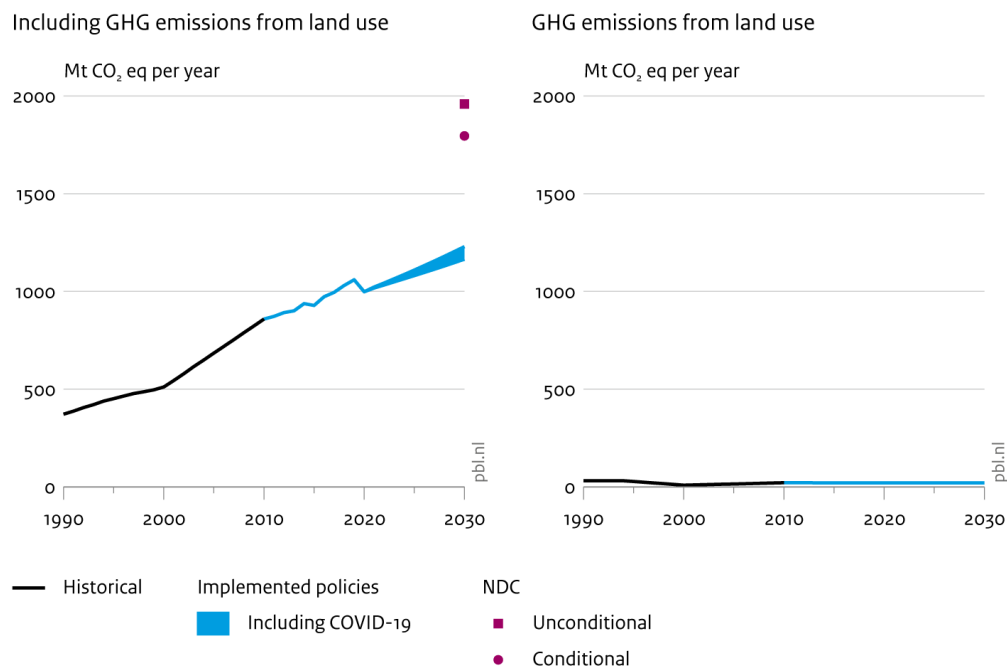
3.12 Iran

Recent developments (including proposed policies): Iran is the largest emitter that has not ratified the Paris Agreement. The current 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 1.1 GW of nuclear power capacity under construction (World Nuclear Association, 2021).

Projections: Iran will likely significantly overachieve both its unconditional and conditional targets with existing policies. In the figure below we only show emissions projections including the effect of COVID-19. GDP forecasts pre-pandemic overestimated the effect of economic sanctions on the economy and consequently on Iran's GHG emissions. Due to the high uncertainty associated with Iran's GDP forecasts we cannot provide an estimate of current policy projections excluding the effect of COVID-19.

Impact of climate policies on greenhouse gas emissions in Iran



Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 15: Impact of climate policies on greenhouse gas emissions in Iran. Emissions trajectories are based exclusively on NewClimate and IIASA's projections. All values are presented in AR4 GWP-100.

Table 34: Description of Iran's INDC, as presented in official sources. N/A: not available or not applicable.

Indicator	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	Carbon credits may be used to achieve the 2030 conditional target.

Table 35: 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)	<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 • Also includes a range of non-quantified policies, such as increasing the share of railway transport and promoting energy efficiency across various sectors.

Table 36: 2005 historical data and 2030 projections of key GHG indicators for Iran. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO₂e)	685 MtCO ₂ e	1160 to 1230 MtCO ₂ e, 70% to 79%	1960 MtCO ₂ e, 186% [1800 MtCO ₂ e, 163%]
GHG emissions per capita (tCO₂e/cap)	9.82	12.6 to 13.3 (+28% to +35%)	21.2 (+115%)

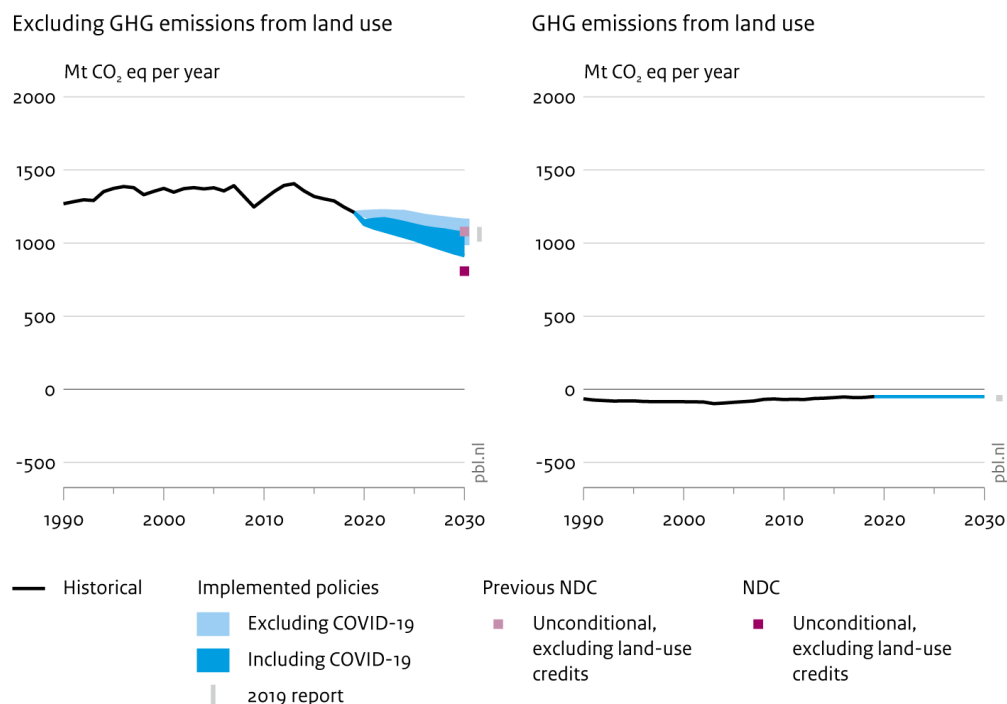
3.13 Japan

Recent developments (including proposed policies): In November 2020, the Japanese government announced its aim to achieve net-zero GHG emissions by 2050; the amended Promotion Act on Global Warming Countermeasures, the nation's framework law on climate policy, was adopted in May 2021 (Jiji Press, 2021; MOEJ, 2021). The revised Green Growth Strategy released in June 2021 provides sector-level, technology-focused roadmaps towards net zero (METI, 2021b). An updated Long Term Strategy that reflects the 2050 net zero goal is also expected to be submitted to the UNFCCC before COP26; a draft has been published (Government of Japan, 2021).

To achieve the 2050 net zero goal, Prime Minister (PM) Yoshihide Suga announced in April 2021 an updated 2030 GHG emissions reduction target, revising Japan's target from a 26% GHG reduction to a 46% reduction below 2013 levels by 2030, and to continue its challenge towards a 50% reduction (CAT, 2021). As of 1 September, 2021, this target has not been officially submitted as the NDC; the official submission to the UNFCCC remains the March 2020 re-submission of the 2015 target. To achieve this updated 2030 target, the draft electricity mix target aims for higher renewable electricity share (36-38%, compared to the current 22-24%) but still assumes 19% coal (26%) (METI, 2021a).

Projections: Even though Japan's target has not been officially submitted to the UNFCCC, we consider it as the updated NDC target. With existing policies, Japan is projected to overachieve its previous NDC target (26% reduction) but still fall short of the updated 46% target. Our current policies scenario projections this year are lower than our 2019 projections mainly due to higher projections on renewable electricity generation and the impact of COVID-19.

Impact of climate policies on greenhouse gas emissions in Japan



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

Figure 16: Impact of climate policies on greenhouse gas emissions in Japan (upper end: PBL IMAGE model, lower end: NewClimate Institute calculations). 2020 and 2030 targets include LULUCF credits (in line with the Kyoto accounting rules) as well as overseas credits. Please see Appendix (A2) on the consideration of LULUCF for the NDC quantification. Emissions values are based on AR4 GWP-100. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019).

Table 37: Description of Japan's previous NDC and NDC announcement, as presented in official sources. N/A: not available or not applicable.

Indicator	Previous NDC	NDC (announcement)
Business-as-Usual (BAU)	N/A	N/A
Target: unconditional	26% GHG reduction by 2030 from 2013 level	46% GHG reduction by 2030 from 2013 level
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 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
Use of bilateral, regional and international credits	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).
Other information	N/A	N/A

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

Sector	Policies (marked with '+' when mentioned in the NDC document)	Description
Cross-cutting	Global warming countermeasures tax (2012) ¹⁾	An upstream tax of 289 JPY/tCO ₂ (around 2.3€) is imposed on fossil fuels on top of existing petroleum and coal tax.
	Amendment of Energy Conservation Act (adopted June 2018) ^{1), 2)}	New certification system to allow for an inter-business initiative to enhance systemic energy savings. Ensures the coverage of e-commerce retailers under the Act.
Energy supply	2021 Basic Energy Plan ⁴⁾ (+)	Renewable electricity (incl. large hydro): 36% to 38% by 2030.
	Renewable Energy Act (feed-in tariff) (2012) ¹⁾	Electric utility operators required to purchase all electricity generated at designated prices; applicable to most renewable technologies.
Buildings	Energy Conservation Act (1993 amendment) ¹⁾	Energy reduction of 1%/year and annual reports to the government by large operators.
	Building Energy Efficiency Act (2016)	Mandatory energy efficiency standards for buildings and houses larger than 2000 m ² .
	2018 Basic Energy Plan ⁴⁾ (+)	Net-zero energy buildings for all new constructions by 2030.
Industry	Energy Conservation Act (1993 amendment) ¹⁾	Energy reduction of 1%/year and annual reports to the government by large operators.
Transport	Passenger vehicle fuel efficiency standards (2019 amendment) ³⁾	25.4 km/l by 2030
	Top Runner Standards (2020 amendment of the Energy Conservation Act) ²⁾	Top runner energy efficiency standards also apply to electric vehicles.
	Green Growth Strategy (June 2021 revision) ²⁾	Aims for 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)	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).

Sector	Policies (marked with '(+)' when mentioned in the NDC document)	Description
		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 ¹⁾ .
	Ozone Layer Protection Act (2018 amendment) ²⁾	Regulation on production and import volumes to comply with the Kigali Amendment of the Montreal Protocol.

¹⁾ Not quantified in the PBL IMAGE projections ²⁾ Not quantified in PBL and NewClimate Institute projections. ³⁾ Not quantified in NewClimate Institute projections. ⁴⁾ Since this is a recently adopted policy, full implementation of its electricity mix target is not assumed in our projections. PBL assumed nuclear energy capacity to reach approximately 30 GW by 2030, which is close to the total capacity of all reactors that applied for restart as of May 2021 (JAIF, 2021).

Table 39: 2005 historical data and 2030 projections of key GHG indicators for Japan. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

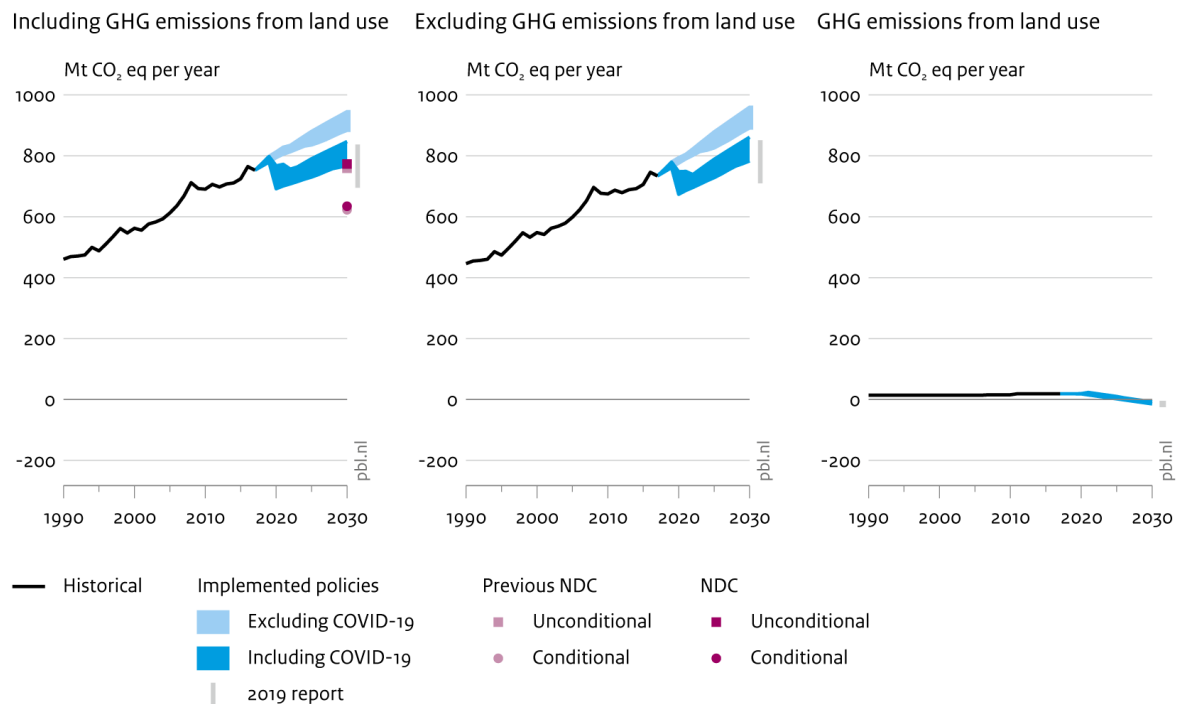
Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (excl. LULUCF) – estimates (MtCO₂e)	1380	914 to 1070 (-34% to -23%)	808 (-41%)
GHG emissions per capita (tCO₂e/cap)	10.7	7.6 to 8.8 (-30% to -18%)	6.7 (-38%)

3.14 Mexico

Recent developments (including proposed policies): Policy developments and announcements by Mexico's president Lopez Obrador continue to reverse progress towards implementation of climate change policies. Mexico's third Special Program on Climate Change (PECC 2020–2024) has already been developed and approved by the Intergovernmental Climate Commission but awaits a second approval is needed by the Regulatory Body of Federal Government and Treasury since August 2020 (SEMARNAT, 2020). In March 2021, the government passed a decree to modify the Electrical Industry Law which will allow fossil plants run by the Federal Electricity Company (CFE) to obtain clean-energy certificates, which were previously planned only for renewable energy suppliers. This amendment reverses key elements of electricity reform, including the order of energy dispatch into the national electricity system. This favours state-owned hydro and fossil-fuelled power plants over private energy providers, in particular those that rely on wind and solar energy. This amendment is expected to result in higher energy tariffs. In his speech at the Leaders' Climate Summit held in April this year, Obrador outlined his proposal to continue oil exploration but restricting it consumption to the domestic market only, clearly failing to demonstrate climate ambition and leadership.

Projections: Mexico is close to meet its unconditional NDC targets with existing policies. Emissions excluding the effect of COVID-19 are considerably higher than our 2019 projections, especially due to policy rollbacks associated with renewable energy uptake. The short-term effect of the pandemic on emissions brings projections closer to the unconditional NDC target.

Impact of climate policies on greenhouse gas emissions in Mexico



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

Figure 17: Impact of climate policies on greenhouse gas emissions in Mexico (PBL projections within NewClimate range). Emission values are based on AR4 GWP-100. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019).

Table 40: Description of Mexico's previous and current NDC, as presented in official sources. N/A: not available or not applicable.

Indicator	Previous NDC	NDC
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 IPCC Fifth Assessment Report	IPCC guidelines; 100-year GWPs from IPCC Fifth Assessment Report
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 in participating in international carbon markets under Article 6 of the Paris Agreement

Table 41: Overview of key climate change mitigation policies in Mexico (Cámara de Diputados del Congreso de la Unión, 2017; Ley de Transición Energética, 2015; LINEAMIENTOS Que Establecen Los Criterios Para El Otorgamiento de Certificados de Energías Limpias y Los Requisitos Para Su Adquisición., 2014; Centro Nacional de Control de Energía, 2017; CONAFOR, 2001; DOF, 2014; Government of Mexico, 2021; IEA, 2016b; 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 (2014 to 2018) ¹⁾	Plan to reduce GHG emissions by implementing specific measures in all sectors.
	Reform to the General Law on Climate Change (LGCC, (+)) (April 2018) ¹⁾	Addition of NDC GHG emissions reduction targets including sectoral targets.
	Emissions Trading Scheme (2018) ¹⁾	National emissions trading scheme that will start the 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⁾	Law section of the Energy Reform (2014). Established a free competition regime in electric power generation and commercialization. It allows participation of private actors in transmission and distribution of electric power. 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.
	Energy Transition Law (2015)	Provides a framework for clean energy, energy efficiency and greenhouse gas emissions reductions Sets targets for clean energy (includes efficient gas-fired cogeneration) of 25% in 2018, 30% in 2021 and 35% by 2024, which is supported by policy instruments, such as power auctions for wind and solar energy.
	National Transition Strategy to Promote the use of clean fuels and technologies (2016)	Policy instrument section of the Energy Transition Law. Planning instrument. It establishes the 'National Strategy to Promote the use of clean fuels and technologies', which is a planning document depicting medium and long-term clean energy (incl. efficient cogeneration) goals of 35% by 2024, 37.5% by 2030 and 50% by 2050.

Sector	Policies (marked with '(+)’ when mentioned in the NDC document)	Description
	Performance criteria and application for flaring and ventilation of natural gas (CNH.06.001/09) (2011) ^{2), 4)}	Emissions reductions in 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.
Transport	CO ₂ emissions standards for light duty vehicles ²⁾	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) ^{3) 4)}	Protected areas according to the payments for an Ecosystem Services (PES) scheme for promoting conservation, restoration and sustainable forest use.
	National Forestry Programme - PRONAFOR (2014) ⁴⁾	Reduction of the annual deforestation rate from 0.24% of total forest area in 2010 to 0.2% by 2018.
	REDD+ National Strategy (2017) ⁴⁾	Continued reduction of LULUCF emissions and achieving net-zero deforestation by 2030.
	Sowing Life Programme (Sembrando Vida, 2020) ^{3) 4)}	The programme aims to reach 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.

¹⁾ Not quantified in PBL and NewClimate Institute projections. ²⁾ Not quantified in the NewClimate Institute projections. ³⁾ Not quantified in IIASA model projections. ⁴⁾ Not quantified in PBL IMAGE model projections.

Table 42: 2005 historical data and 2030 projections of key GHG indicators for Mexico. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

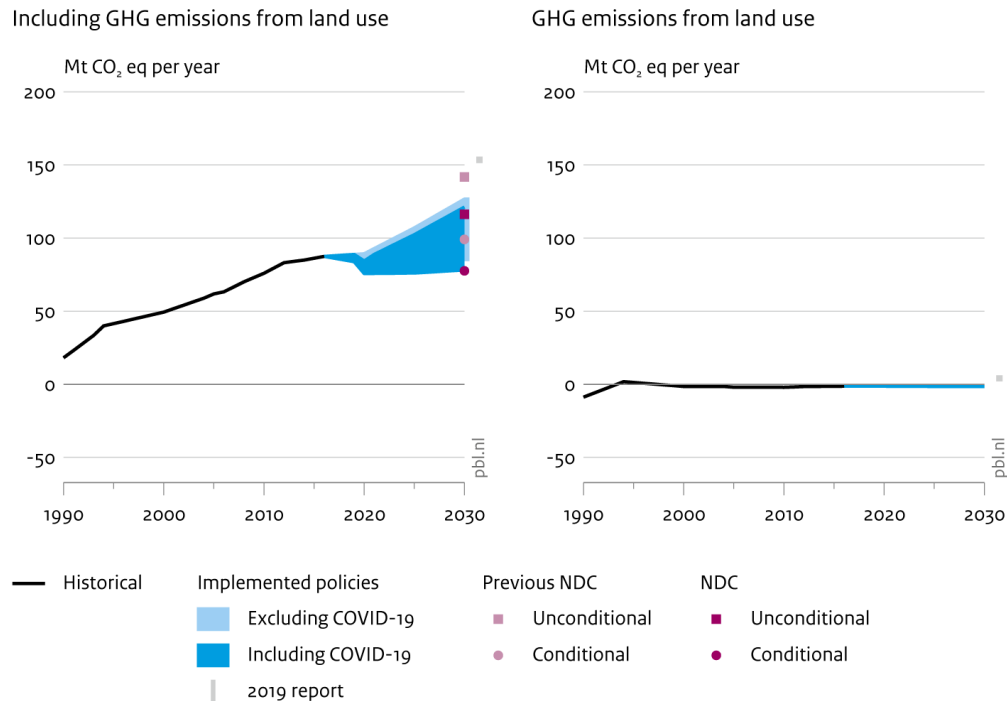
Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO₂e)	612	769 to 846 (+25% to +38%)	773 (+26%) [634 (+4%)]
GHG emissions per capita (tCO₂e/cap)	5.8	5.5 to 6 (-6% to +4%)	5.5 (-5%)

3.15 Morocco

Recent developments (including proposed policies): In 2019, Morocco published its 2030 Climate Action Plan. This strategy reiterates the objectives set in the NDC and the National Energy Strategy and proposes new governance structures, such as the creation of a National Committee for Climate Change that would be tasked with the implementation and coordination of climate policy. Morocco has completed a number of renewable energy tenders, raising the installed renewable energy capacity to 1,405 MW of wind, 734 MW of solar and 1,770 MW of hydroelectricity in 2018 (IRENA, 2021). However, renewable capacity increase has stalled in the recent years. In December 2018, a nearly 1,400 MW coal-fired power plant came online (Médias 24, 2018) and the government is planning to add another coal-fired power plant of around 1,300 MW by 2024 (Dref, 2018).

Projections: Morocco will likely meet its unconditional NDC target with existing policies. Our current policies scenario projections this year are lower than our 2019 projections due to a number of additional measures presented in Morocco's Second BUR, such as policies in the agriculture and waste sectors and mitigation from combined cycle power plants.

Impact of climate policies on greenhouse gas emissions in Morocco



Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 18: Impact of climate policies on greenhouse gas emissions (CO₂, CH₄ and N₂O) in Morocco. Emissions trajectories are based exclusively on NewClimate and IIASA's projections. Emission values are based on AR4 GWP-100. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019).

Table 43: Description of Morocco's previous and current NDC, as presented in official sources. N/A: not available or not applicable.

Indicator	Previous NDC	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 IPCC Second Assessment Report	IPCC guidelines; 100-year GWPs from IPCC Fourth Assessment Report
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 Morocco's Green Plan (PMV) and Preservation and Sustainable Forest Management Strategy are part of NDC as key sectoral strategies Accounting approaches and methodologies are not specified	Land-use sector is included in the overall 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	Yes. Expected amount not quantified.	Intention in participating in international carbon markets under Article 6 of the Paris Agreement

Table 44: Overview of key climate change mitigation policies (Kingdom of Morocco, 2016b) in Morocco (AFD, 2018; Kingdom of Morocco, Minister of Energy, Mines, 2013; Kingdom of Morocco, Ministry Delegate of the Minister of Energy, Mines, 2014; Kingdom of Morocco, 2016a, 2018, 2019; Kingdom of Morocco 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⁾	<ul style="list-style-type: none"> - Aim for an installed 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⁾	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⁾	Overarching coordination and alignment of various sectoral and cross-sectoral national policies tackling climate change.
Energy supply	National Energy Strategy (2009, updated 2012) (+) 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"> - Targets for increased renewable power capacity: 42% share in total capacity by 2020 and 52% by 2030. - 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.

Sector	Policies ⁴⁾ (marked with '(+)’ when mentioned in the NDC document)	Description
Transport	High-speed train line between Rabat, Tangier and Casablanca (2018)	Upgrade of existing railway to high-speed train line completed in 2018.
	Extension of Casablanca tramway (2016)	Extension of Casablanca tramway by 45 km by 2025.
Industry	Energy efficiency program in the industry sector (2011)	Energy efficiency programs for the industry, buildings and transport sector (excluding large energy consuming industries).
Buildings	Energy efficiency program in the building sector (2009)	Minimum requirements for new residential and commercial buildings.
	Energy efficiency program for public lighting (2009)	Instalment of new public lighting technologies.
Agriculture and Forestry	Preservation and Sustainable Forest Management Strategy (+)	Afforestation and regeneration of approximately 50,000 hectares of forest per year.
	Morocco Green Plan (PMV) (2008) (+) ³⁾	Promotion of natural resources and sustainable management and general modernization of the agricultural sector.

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

Table 45: 2005 historical data and 2030 projections of key GHG indicators for Morocco. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO ₂ e)	61.8	78.2 to 121 (+26% to +96%)	116 (+88%) [78 (+26%)]
GHG emissions per capita (tCO ₂ e/cap)	2.0	1.9 to 3 (-6% to +46%)	2.8 (+40%)

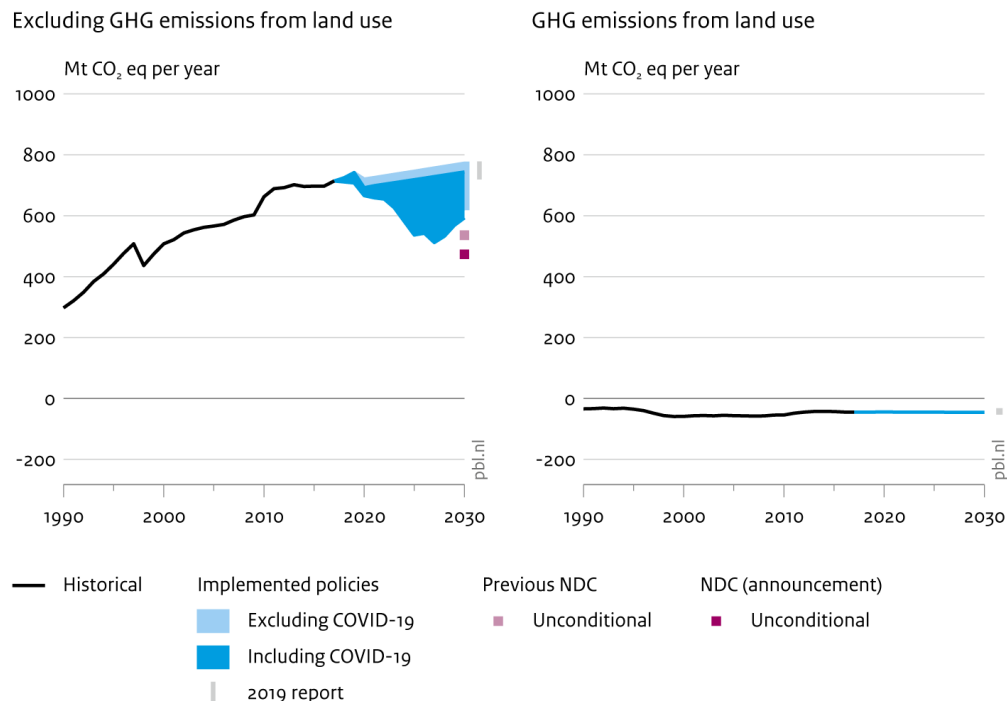
3.16 Republic of Korea

Recent developments (including proposed policies): At the end of 2020, the Republic of Korea submitted its long-term strategy to the UNFCCC. In this strategy, the government sets the goal of carbon neutrality by 2050. In December 2020, the country also submitted an NDC update with a target to reduce emissions by 24.5% below 2017 values. However, in August 2021, the National Assembly approved passed a bill that formalises the carbon neutrality by 2050 target and strengthens the mid-term target to a reduction of 35% below 2018 values by 2030.

In 2020, the Republic of Korea announced its 9th Basic Plan for Long-term Electricity Supply and Demand 2020-2034, its 5th Basic Plan for Renewable Energy. Under these updated plans, the share of renewable energy will increase from 6.5% in 2020 to 25.8% by 2034. The share of coal-fired power generation is expected to decrease from 40.4% to 29.9% in the same period. These targets are roughly in line with the pathway set out in the LTS and with the ambition of President Moon Jae-In goal to phase out coal-fired and nuclear power. 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 has 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. Our current policies scenario projections this year are lower than our 2019 projections, especially because of the Phase III Allocation Plan of Korea's ETS, that runs from 2021-2025. The lower end of the range accounts for the full implementation of the emissions caps for Phase III (2021–2025).

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



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

Figure 19: Impact of climate policies on greenhouse gas emissions in Republic of Korea EU (upper end: NewClimate Institute calculations, lower end: PBL IMAGE model). Emission values are based on AR4 GWP-100. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019).

Table 46: Description of the Republic of Korea's previous NDC and NDC announcement, as presented in official sources. N/A: not available or not applicable.

Indicator	Previous NDC	NDC (announcement) ³⁾
Business-as-Usual (BAU)	850.6 MtCO _{2e}	N/A
Target: unconditional	37% GHG reduction by 2030 from baseline scenario	35% reduction by 2030 from 2018 emission levels
Target: conditional	N/A	N/A
Sectoral coverage	Economy-wide	Economy-wide
General Accounting method	IPCC guidelines; 100-year GWPs from the Second IPCC Assessment Report	N/A
GHGs covered	CO ₂ , CH ₄ , N ₂ O, HFCs, PFCs and SF ₆	N/A
Consideration of LULUCF	A decision on whether to include the land-use sector will be made at a later stage	N/A
Use of bilateral, regional and international credits	Carbon credits from international market mechanisms will be used to achieve part of the 2030 target	N/A

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. ³⁾ This target is presented in the Climate Crisis Response Act and was adopted in August 2021 by the National Assembly. The target has not yet been submitted to the UNFCCC as the updated NDC but is considered as the Republic of Korea's target in this report.

Table 47: Overview of key climate change mitigation policies in the Republic of Korea (APER, 2019; 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⁾	ETS 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)	Share 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.
	5 th Basic Plan for New and Renewable Energy (2019) ¹⁾⁴⁾	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	Fuel efficiency standard (2020 update) (+) ¹⁾	97 gCO ₂ /km (24.1 km/l) by 2020, 89 gCO ₂ /km by 2025, 70 gCO ₂ /km by 2030.
	Renewable Fuel Standard (2013; 2020 update) ³⁾	Biodiesel share in diesel of 3% from 2018 onwards. 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) ³⁾	Increase the national forest carbon stocks to 2.1 billion tCO ₂ in 2022, compared to 1.8 billion tCO ₂ in 2015. 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) ³⁾⁵⁾	Increase the contribution of the LULUCF sink so that by 2030, the LULUCF removal accounts 10% of the total

Sector	Policies (marked with '+' when mentioned in the NDC document)	Description
		emissions for Korea, compared to the previous goal of 5% in 2017.
	2 nd Comprehensive Plan for Wood Use (2019) ^{3) 5)}	Increase domestic wood self-sufficiency rate by 22.4% by 2024, compared to 19% in 2019. 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 (2021) ^{3) 5)}	To reduce GHG emissions from Agriculture to below 19.0 MtCO ₂ e by 2030 compared to 20.4 MtCO ₂ e in 2017.
	2050 Carbon Neutral Forest Sector Promotion Strategy (2021) ^{3) 5)}	Planting three billion trees over 30 years and thereby increase the annual LULUCF removals by 34 MtCO ₂ e.

¹⁾ Not quantified in NewClimate Institute projections. ²⁾ Based on the 8th Basic Plan for Long-term Electricity Supply and Demand. ³⁾ Not quantified in PBL IMAGE model projections. ⁴⁾ Not quantified separately in PBL IMAGE projections, but achievement checked after implementation of other (related) targets. ⁵⁾ Not quantified in IIASA model projections.

Table 48: 2005 historical data and 2030 projections of key GHG indicators for Republic of Korea. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

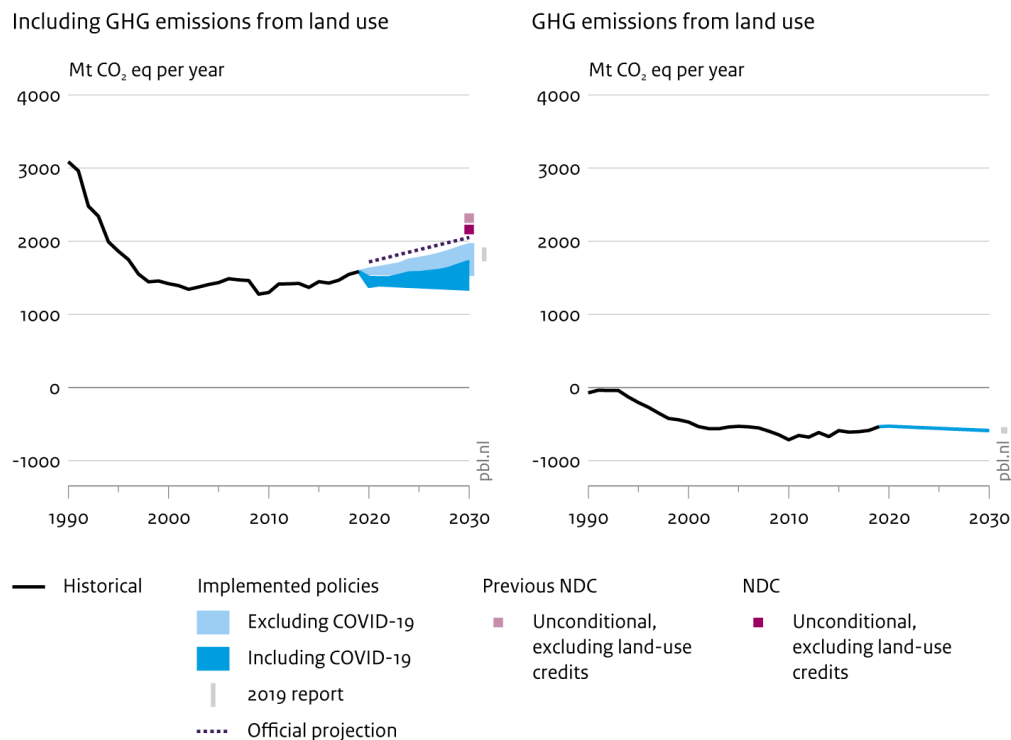
Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (excl. LULUCF) – estimates (MtCO ₂ e)	566	593 to 743 (5% to 31%)	473 (-16%)
GHG emissions per capita (tCO ₂ e/cap)	11.6	11.6 to 14.5 (-0% to +25%)	9.2 (-20%)

3.17 Russian Federation

Recent developments (including proposed policies): The latest energy strategy, approved in June 2020, describes the expected development of the country's energy sector for the next 15 years. The strategy focuses on fossil fuels industries. It describes how the Russian Federation aims to secure its energy-exports position internationally by projecting an increase in production of coal and gas. The strategy only briefly outlines planning for energy efficiency, renewables other than hydro, and alternative synthetic fuels. Government Directive No. 2634-r approving the hydrogen roadmap 2021-2024 (approved October 2020) sets the governmental vision to develop the production and use of hydrogen. In November 2020, the Russian Federation submitted an updated NDC. In July 2021, Federal Law No. 296-FZ on limiting greenhouse gas emissions was approved; it sets the legal framework for mandatory carbon reporting for the most polluting companies (due to start in 2023) and carbon offsetting schemes.

Projections: The Russian Federation will likely meet its unconditional NDC target with existing policies, especially in the current policies projection including the effect of COVID-19. Our current policies scenario projections are also lower than official projections due to the effect of the pandemic.

Impact of climate policies on greenhouse gas emissions in Russian Federation



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

Figure 20: Impact of climate policies on greenhouse gas emissions in the Russian Federation (upper end: PBL IMAGE model, lower end: NewClimate Institute calculations). Please see Appendix (A2) on the consideration of LULUCF for the NDC quantification. Emission values are based on AR4 GWP-100. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019).

Table 49: Description of The Russian Federation's previous and current NDC, as presented in official sources. N/A: not available or not applicable.

Indicator	Previous NDC	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⁾
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 50: Overview of key climate change mitigation policies in Russian Federation (Government of the Russian Federation, 2013, 2016; Nachmany et al., 2015; Russian Federation, 2019).

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'	The law creates the general framework for energy efficiency in Russia. Among others, it contains mandatory energy savings for companies, a ban of inefficient incandescent light bulbs, and incentives for companies investing in energy efficiency. ³⁾
Energy supply	Renewable energy targets (Governmental resolution No. 512-r of 2013, 2015 amendment to the Decree No. 1-r of 2009) ¹⁾	4.5% renewables share in total electricity generation by 2024 (excluding hydropower larger than 25 MW)
Industry	Energy intensity targets (2008) ²⁾	5% limit on associated gas flaring for 2012 and subsequent years.
Buildings	Strategy for development of building materials sector for the period up to 2020 and 2030, adopted by Government Decree no. 868 (2016) ^{3), 4)}	Energy consumption in buildings: 20% reduction in residential heat consumption per m ² by 2030 relative to 2014.
Agriculture and Forestry	National Strategy of Forestry Development by 2020 (2008) ⁴⁾	Increase in forest intensification and harvesting of wood by 5.8% per year compared to 2007.
Waste	Phased launch of a new system for the management of solid utilities waste (MSW) – Federal Law No. 486-FZ (2016) ⁴⁾	Increase the utilization of municipal solid waste generated until of 30% by 2024. ³⁾

¹⁾ Small hydropower is not distinguished from hydropower in the TIMER model, so this target is excluded from PBL's IMAGE projections. The renewable share targets were not quantified separately but checked after implementation of the capacity targets. ²⁾ Not quantified separately in PBL IMAGE projections, but achievement checked after implementation of other (related) targets. ³⁾ Not quantified in PBL IMAGE model and NewClimate Institute projections. ⁴⁾ Not quantified in PBL IMAGE model projections.

Table 51: 2005 historical data and 2030 projections of key GHG indicators for Russian Federation. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

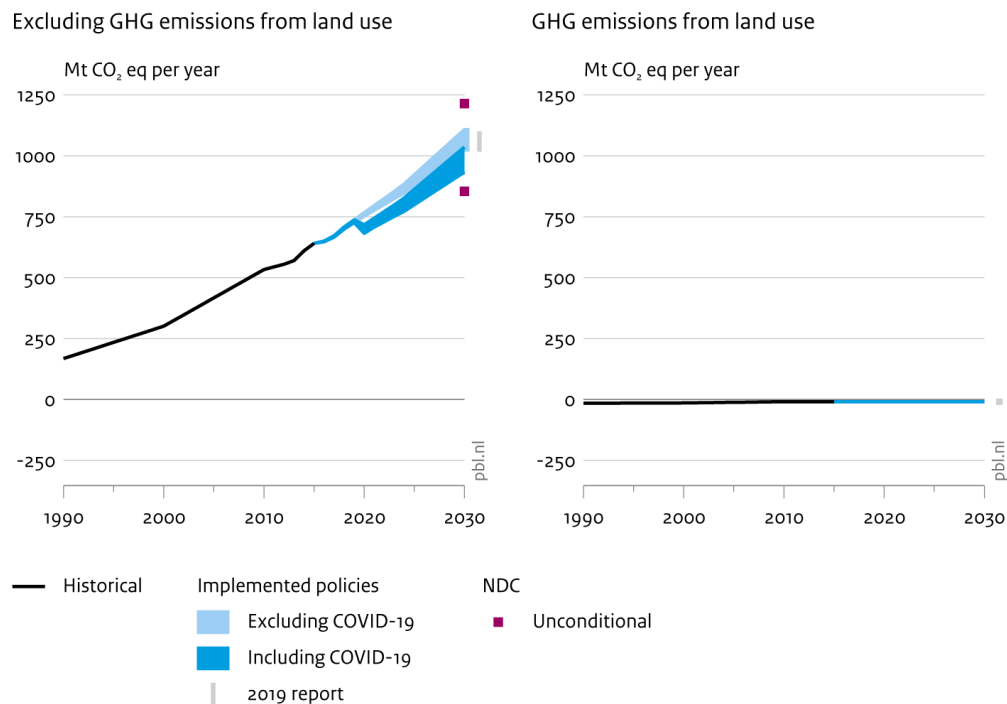
Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO₂e)	1430	1350 to 1720 (-6% to +20%)	2160 (+51%)
GHG emissions per capita (tCO₂e/cap)	10.0	9.4 to 12 (-6% to +20%)	15.1 (+51%)

3.18 Saudi Arabia

Recent developments (including proposed policies): In 2019, Saudi Arabia updated its renewable energy target under the Vision 2030 strategy. It now projects to build 27.3 GW of renewable energy capacity by 2023 and 57.8 GW by 2030, up from a previous target of 9.5 GW by 2023. The Saudi government also intends to develop nuclear power plants under the Saudi National Atomic Energy Project, but there is no clear target at this stage.

Projections: Saudi Arabia will likely achieve its NDC target with existing policies. Our scenario excluding the pandemic effect this year are similar to our 2019 projections, but the emissions are approximately 8% lower once the pandemic is considered.

Impact of climate policies on greenhouse gas emissions in Saudi Arabia



Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 21: Impact of climate policies on greenhouse gas emissions in Saudi Arabia. Emissions trajectories are based exclusively on NewClimate and IIASA's projections. Emission values are based on AR4 GWP-100. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019).

Emission values are based on AR4 GWP-100. The grey column gives the range of our 2019 projections in Kuramochi et al. (Kuramochi et al., 2019).

Table 52: Description of Saudi Arabia's NDC, as presented in official sources. N/A: not available or not applicable.

Indicator	NDC
Business-as-Usual (BAU)	N/A
Target: unconditional	Emissions reductions of up to 130 MtCO ₂ e annually in 2030
Target: conditional	N/A
Sectoral coverage	Mostly energy focused
General Accounting method	Not specified
GHGs covered	Not specified
Consideration of LULUCF	Land-use sector is not covered by NDC's emissions reductions target
Use of bilateral, regional and international credits	Not specified

Indicator	NDC
Other sector-level targets	Not specified
Availability of reference scenarios in the latest UNFCCC submissions	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'.

Table 53: 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; V Nereim, 2017; Vivian Nereim & Cunningham, 2018; SEEC, 2021; Toumi, 2017).

Sector	Policies (marked with '(+)' when mentioned in the NDC document)	Description
Cross-cutting	Vision 2030 (2016, revised in 2019)	The 'Vision 2030' strategy aims 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⁾	Starting January 2018, the government has implemented a 5% VAT on fuels.
Energy supply	National Renewable Energy Program (NREP) (2017, revised 2019)	The NREP 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⁾	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⁾	Fossil fuel price reform delay announced by the government in December 2017, stating that it would slow down the pace of energy subsidy cuts. The plan is now to reach international gasoline parity prices, increase diesel 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)	Energy efficiency labels for a range of household appliances.
	Insulation standards for new buildings (2007)	Insulation standards for some insulation products used in residential buildings.

¹⁾ Not quantified in NewClimate Institute projections.

Table 54: 2005 historical data and 2030 projections of key GHG indicators for Saudi Arabia. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

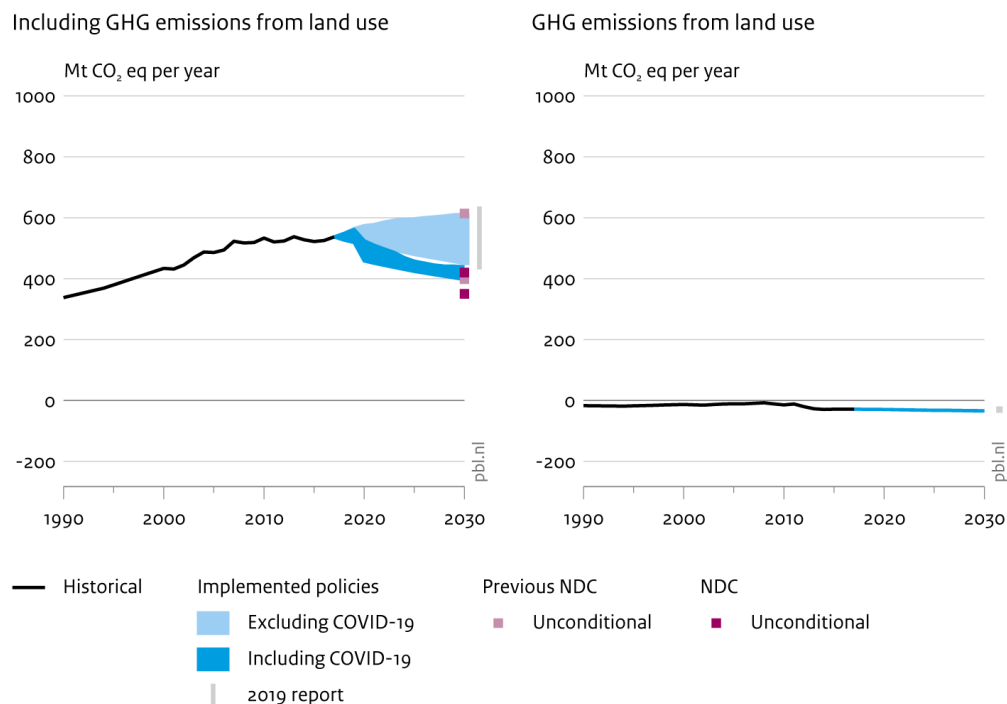
Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO ₂ e)	417	933 to 1040 (+124% to +148%)	1210 to 854 (+190% to +105%)
GHG emissions per capita (tCO ₂ e/cap)	17.5	23.7 to 26.3 (+35% to +50%)	21.7 to 30.8 (+24% to +76%)

3.19 South Africa

Recent developments (including proposed policies): The draft Climate Change Bill that was released in June 2018 (Department of Environmental Affairs, 2018) has not yet been passed into legislation. The South African government adopted the latest Integrated Resource Plan (IRP) in October 2020. It is the first update of the original plan (IRP 2011) and aims to increase renewable power capacity while decommissioning coal. The Biofuels Regulatory Framework (BRF) passed in February 2020, and aims to implement the Biofuels Industrial Strategy, which mandates biofuel blending of 2%–10% for bioethanol and a minimum of 5% for biodiesel from 2015 onwards. The National Climate Change Adaptation Strategy (NCCAS) was approved in August 2020. A Just Transition Plan and the National Energy Efficiency Strategy are under development.

Projections: South Africa's emissions under current policies will likely fall within its NDC range for the period 2020–2030. Our current policies scenario projections this year are lower than our 2019 projections, mainly due to the implementation of the new IRP targets and the effect of COVID-19.

Impact of climate policies on greenhouse gas emissions in South Africa



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

Figure 22: Impact of climate policies on greenhouse gas emissions in South Africa emissions and removals (upper end: PBL IMAGE model, lower end: NewClimate Institute calculations). Emission values are based on AR4 GWP-100. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019).

Table 55: Description of South Africa's previous and current NDC, as presented in official sources. N/A: not available or not applicable.

Indicator	Previous NDC	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 the AR4	IPCC 2006 guidelines; 100-year GWPs from the 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
Other sector-level targets	N/A	N/A
Use of bilateral, regional and international credits	N/A	Intention in participating in international carbon markets under Article 6 of the Paris Agreement

Table 56: Overview of key climate change mitigation policies in South Africa (Department Environmental Affairs (South Africa), 2013; Department of Energy of South Africa, 2011, 2013; Department of Environmental Affairs of South Africa, 2015; Department of Minerals and Energy, 2008; Department of Transport South Africa, 2018; NPC, 2010; Republic of South Africa, 2015; South Africa Department of Energy, 2018).

Sector	Policies (marked with '(+)' when mentioned in the NDC document)	Description
Cross-cutting	National Development Plan (2012) (+) ^{1, 3)}	Among other targets: eliminate poverty, reduce inequality, increase access to water and electricity.
	National Climate Change Response Policy (2011) (+) ^{1, 3)}	Objectives: 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) (+)	<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 build programme, which is not reflected in the actual capacity planning until 2030. • 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 ○ 5 coal
Transport	Petroleum Products Act (Biofuels Industrial Strategy) (2007) ²⁾	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) ³⁾	Building codes and standards.
	Long term mitigation scenarios ^{3), 4)}	Establishment of 760,000 hectares of commercial forest by 2030.

Sector	Policies (marked with '(+)' when mentioned in the NDC document)	Description
Agriculture and Forestry	National Forest Act (1998) ^{3), 4)}	Securing ecologically sustainable development and use of natural resources while promoting justifiable economic and social development ⁴⁾ . Facilitate improved timber availability and secure supply of timber to ensure sustainability of entire timber value chain.
	Strategic Plan for the Development of Agriculture, Forestry and Fisheries (2013) ^{3), 4)}	Promote 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 our current policies scenario. ²⁾ Implemented in PBL IMAGE model projections as 5% total biofuel share from 2015 onwards. ³⁾ Not quantified in PBL IMAGE model projections. ⁴⁾ Not quantified in IIASA model projections.

Table 57: 2005 historical data and 2030 projections of key GHG indicators for South Africa. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

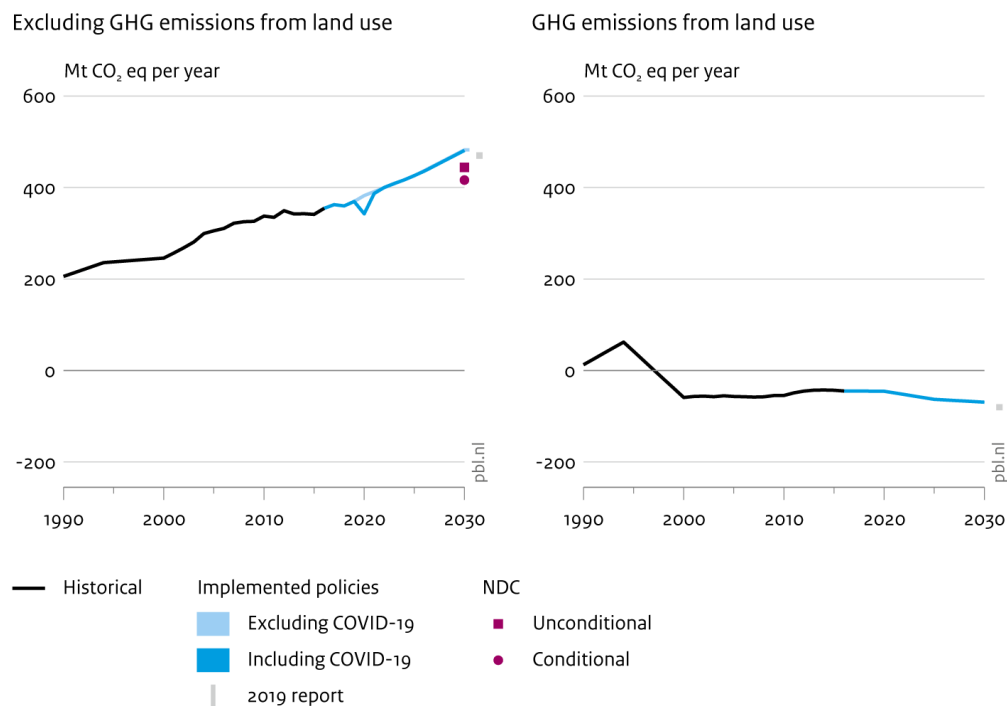
Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO ₂ e)	486	397 to 438 (-18% to -10%)	420 to 350 (-14% to -28%)
GHG emissions per capita (tCO ₂ e/cap)	10.1	6 to 6.6 (-41% to -34%)	5.3 to 6.4 (-48% to -37%)

3.20 Thailand

Recent developments (including proposed policies): In January 2019, a new Power Development Plan (PDP), and its accompanying Alternative Energy Development Plan (AEDP), for 2018–2037 was adopted by the National Energy Policy Committee (Souche, 2019) (impact not quantified). Compared to the 2015 version for 2015–2036, the new PDP foresees a large reduction of coal power generation and a large increase of gas-fired generation. The electricity generation mix for 2037 is projected as follows (2036 projections in the 2015 PDP 2015–2036 in parentheses): coal: 12% (23%), gas: 53% (37%), domestic renewables: 20% (20%), imported hydro: 9% (15%), nuclear: 0% (5%), demand reduction from energy efficiency compared to the 2015 projection: 6%. When limited to domestic electricity generation, these numbers translate to roughly 14% coal, 62% gas and 24% renewables. Compared to our current policies scenario projections for 2030 in the 2018 update report, the 2018 PDP projection for coal power share for 2037 is considerably lower. Thailand is formulating its Long-term Low Greenhouse Gas Emission Development Strategy (LT-LEDS).

Projections: Thailand will likely get close to but miss its unconditional NDC target with existing policies. Our current policies scenario projections this year are similar to our 2019 projections. The COVID-19 pandemic is not expected to result in lower 2030 emissions in the country.

Impact of climate policies on greenhouse gas emissions in Thailand



Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 23: Impact of climate policies on greenhouse gas emissions in Thailand. Emissions trajectories are based exclusively on NewClimate and IIASA's projections. Emission values are based on AR4 GWP-100. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019).

Table 58: Description of Thailand's previous and current NDC, as presented in official sources. N/A: not available or not applicable.

Indicator	Previous NDC	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 of 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 IPCC Fourth Assessment Report	IPCC inventory methodology not specified; GWP values from IPCC Fourth Assessment Report. 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	No detail is provided
Use of bilateral, regional and international credits	Yes, intention to use different market mechanisms Expected amount not quantified (The Kingdom of Thailand, 2015)	Intention in 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.	No sector-level targets specified

Table 59: Overview of key climate change mitigation policies in Thailand (APEREC, 2019; Department of Energy Business, 2015; Ministry of Energy of the Kingdom of Thailand, 2015, 2016; NESDB (Office of The National Economic and Social Development Board), 2016; Office of Natural Resources and Environmental Policy and Planning of the Kingdom of Thailand, 2015; Thailand Automotive Institute, 2020)

Sector	Policies (marked with '+' when mentioned in the NDC document)	Description
Cross-cutting	Climate Change Master Plan (2015-2050) (2015) (+)	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) ¹⁾	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 53%) and overall demand reduction of 6% in comparison to 2018.
	Energy Efficiency Plan (2015-36) (+) ¹⁾	Reduction of energy intensity per GDP (in final energy terms) by 30% by 2036, as compared to 2010 baseline, with total savings of 90 TWh by 2036.
	Oil Plan (2015-2036) ¹⁾	Support measures to save fuel in the transportation sector and enhance ethanol and biodiesel consumption.
Transport	Environmentally Sustainable Transport System Plan (2013-30) (2012) (+) ¹⁾	Improvement of rail infrastructure to reduce annual logistics costs and the annual energy bill by about 2% and 1% of GDP respectively.

Sector	Policies (marked with '(+)' when mentioned in the NDC document)	Description
	National EV Roadmap ²⁾	Aims to transform the country into an EV hub within the ASEAN region. Sets 2025 target of 250 000 EVs, 3 000 electric public buses, and 53 000 electric motorcycles and longer-term for EVs to make up 30% of production by 2030.
	Excise tax on new vehicles (2016) Other	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⁾	Stabilise 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⁾	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⁾	Reduce electricity use for large commercial buildings by > 50% by 2030 compared with BAU.
Agriculture and Forestry	National Economic and Social Development Plan (2012) ²⁾	Several non-quantifiable long-term targets to reduce GHG emissions in the agriculture and land transport sector. Expansion of conservation areas to at least 19% of total area, expansion of forest reserves up to 40%, and annual mangrove coastal reforestation of at least 800 hectares.

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

Table 60: 2005 historical data and 2030 projections of key GHG indicators for Thailand. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

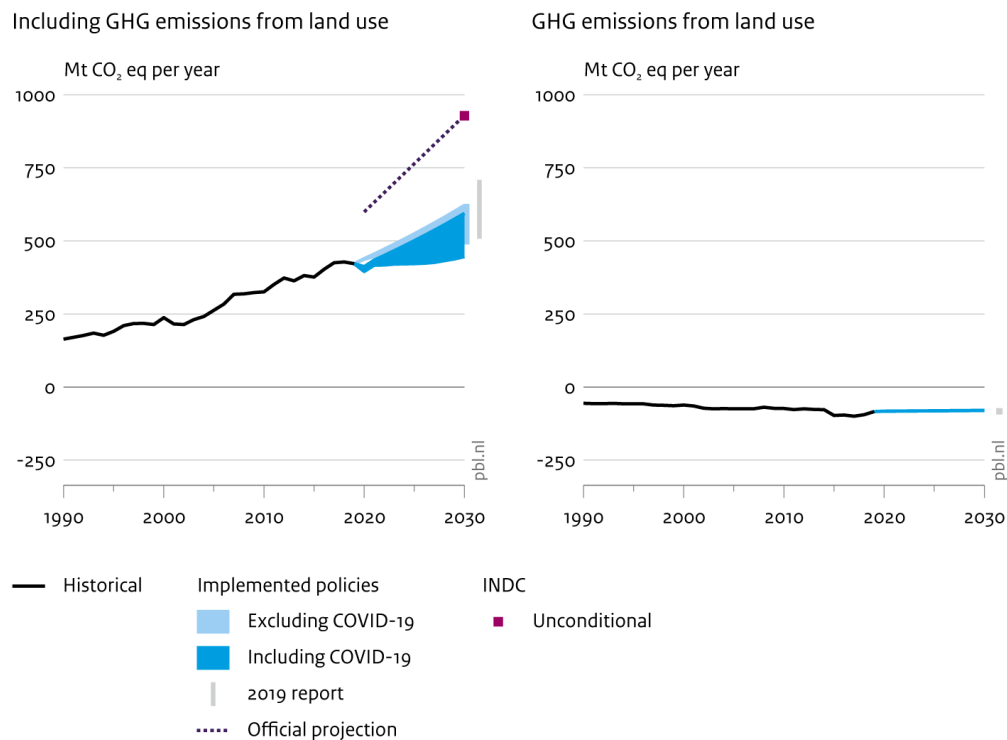
Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (excl. LULUCF) – estimates (MtCO₂e)	305	481 (+57%)	444 (+45%) [416 (+36%)]
GHG emissions per capita (tCO₂e/cap)	4.7	6.8 (+46%)	6.3 (+35%)

3.21 Turkey

Recent developments (including proposed policies): The progress towards renewable energy targets has been supported by a feed-in tariff (FIT) scheme, but the outlook is unclear after 2020, when the FIT scheme was expected to end. Turkey builds its first nuclear power plant. The foundation of the Akkuyu power plant has started in April 2018. The initial plan was that the electricity generation from three reactors would start by 2023.

Projections: Turkey will likely overachieve its NDC target with existing policies. Emissions projections are lower than projected in 2019, especially due to a revision of historical emissions and the effect of the COVID-19 pandemic.

Impact of climate policies on greenhouse gas emissions in Turkey



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

Figure 24: Impact of climate policies on greenhouse gas emissions in Turkey (upper end: NewClimate Institute calculations, lower end: PBL IMAGE model). NewClimate projections are based on the historical elasticity of GHG emissions from energy and industrial processes sectors to GDP observed between 1990 and 2017. Emission values are based on AR4 GWP-100. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019).

Table 61: Description of Turkey's INDC, as presented in official sources. N/A: not available or not applicable.

Indicator	Current INDC
Business-as-Usual (BAU)	N/A
Target: unconditional	21% GHG reduction by 2030 from baseline scenario
Target: conditional	N/A
Sectoral coverage	Economy-wide
General Accounting method	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
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	Carbon credits from international market mechanisms will be used to achieve the 2030 target
Last available year for GHG inventory reporting	2016

Table 62: Overview of key climate change mitigation policies in Turkey (Government of Turkey, 2009, 2019; Ministry of Energy and Natural Resources, 2014, 2018; Ministry of Environment and Urbanization, 2010, 2011).

Sector	Policies (marked with '(+)' when mentioned in the INDC document) ¹⁾	Description
Cross-cutting	Energy intensity target (Energy Efficiency Law) (2012) ²⁾	Reduce primary energy intensity by 20% by 2023, compared to the 2008 level.
	Energy Efficiency Action Plan (2018) ²⁾	Reduce primary energy consumption by 14% compared to the BAU scenario in 2023.
Energy supply	11 th Development Plan (2019) ²⁾	Sets a target of 38.8% renewables in electricity production by 2023.
	Renewable capacity target (Renewable Energy Action Plan) (2014) ⁴⁾	61 GW renewable capacity by 2023: 34 GW of hydro, 20 GW wind, 5 GW solar, 1 GW geothermal, 1 GW biomass.

¹⁾ NewClimate Institute projections do not explicitly account for the policies listed. ²⁾ Not quantified separately (but target achieved in PBL scenario). ³⁾ Not quantified in PBL IMAGE projections. ⁴⁾ No information available on implementation status. PBL assumed full implementation.

Table 63: 2005 historical data and 2030 projections of key GHG indicators for Turkey. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

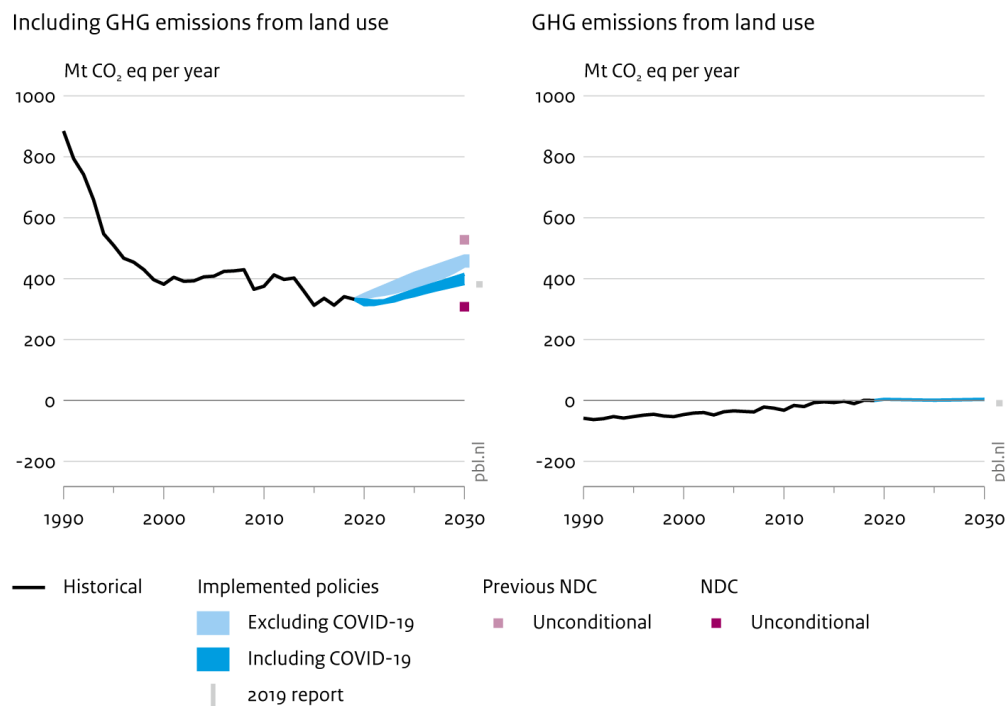
Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO₂e)	263	446 to 594 (+70% to +126%)	928 (+253%)
GHG emissions per capita (tCO₂e/cap)	3.9	5 to 6.7 (+29% to +72%)	10.4 (+169%)

3.22 Ukraine

Recent developments (including proposed policies): In December 2020, the Ministry of Energy and Environmental Protection proposed quotas for the renewable electricity auction system, aiming for the first auctions to take place in June 2021. The main elements of the national MRV system supporting the ETS are in place. The MRV law entered into force in spring 2020 and has been applied from 1 January 2021 onwards (ICAP, 2020). Ukraine further presented a draft version of the Ukraine Green Deal on January 21, 2020. The Ministry conducted public hearings on Ukraine's 'Green' Energy Transition Concept in June 2020, aiming for all strategic documents to be approved by 2021. The main objectives are: 1) renewables in the energy balance up to 70% by 2050; 2) Phase out coal by 2050; 3) Reduce nuclear power generation to 20-25%; 4) Energy demand reduction by at least 50%, by increasing energy efficiency. The NDC was updated in July 2021 and presents a 65% reduction below 1990 levels by 2030 and net zero no later than 2060. This target is stronger than the previous NDC.

Projections: With existing policies, Ukraine is projected to overachieve its previous NDC target (40% reduction below 1990) but still fall short of the updated 65% target. Our current policies scenario that considers the COVID-19 impact is similar to our 2019 projections. Because of the uncertainties about the policy implementation status resulting from recent political circumstances as well as administrative and bureaucratic barriers in Ukraine, our projections do not explicitly account for recently implemented policies.

Impact of climate policies on greenhouse gas emissions in Ukraine



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

Figure 25: Impact of climate policies on greenhouse gas emissions in Ukraine (PBL projections within NewClimate range). Emission values are based on AR4 GWP-100. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019).

Table 64: Description of Ukraine's previous NDC and current NDC, as presented in official sources. N/A: not available or not applicable.

Indicator	Previous NDC	NDC
Business-as-Usual (BAU)	N/A	N/A
Target: unconditional	Not exceed 60% of 1990 GHG emission level in 2030	65% below 1990 by 2030
Target: conditional	N/A	N/A
Sectoral coverage	Energy, industrial processes and product use, agriculture, LULUCF, waste	Energy, industrial processes and product use, agriculture, LULUCF, waste
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, NF ₃ , HFC, PFC and SF ₆	CO ₂ , CH ₄ , N ₂ O, NF ₃ , HFC, PFC and SF ₆
Consideration of LULUCF	Land use is included in the NDC target. Accounting approach to be used for the land-use sector is to be defined not later than 2020	Land use is included in the NDC target. The NDC does not document the accounting approaches to be used for each LULUCF sub-sector but it appears likely that a net-net approach will be applied for a majority, if not all, sub-sectors.
Other sector-level targets	N/A	N/A
Use of bilateral, regional and international credits	Ukraine will participate in the development and implementation of market mechanisms, but the 2030 GHG target does not account for this participation	Intention in participating in international carbon markets under Article 6 of the Paris Agreement

Table 65: Overview of key climate change mitigation policies in Ukraine (Energy Community Secretariat, 2015; Energy in Central and Eastern Europe, 2014; Government of Ukraine, 2018; ICAP, 2016; KPMG Ukraine, 2019; Ministry of Transport of Ukraine, 2017; State Agency on Energy Efficiency and Energy Saving of Ukraine, 2014; Supreme Council of Ukraine, 2015).

Sector	Policies ¹⁾ (marked with '+' when mentioned in the NDC document)	Description
Cross-cutting	National Renewable Energy Action Plan 2020 (2014)	20% reduction of CO ₂ emissions per final consumption of fuel by 2035 from 2010 levels (5% by 2020, 10% by 2025, 15% by 2030). 11% share of renewable energy sources in gross final energy consumption by 2020.
Energy supply	Green Tariff (renewables feed-in-tariff) (2015 amendment)	5% premium for 30% of domestic equipment. 10% premium when using 50% of domestic equipment. To be replaced by a competitive auction system as of 2020.
	Energy Strategy of Ukraine until 2035 (2017)	Aims for the following electricity mix by 2035: 13% from renewables excluding hydropower, 7% from hydropower, 48% from nuclear and 32% from thermal power plants.
Transport	Law on Alternative Liquid and Gaseous Fuels (2012 amendment)	Gradual increase in the share of production and use of biofuels and blended motor fuels of: 5% by 2013; 5% by 2014–2015; 7% by 2016; 10% by 2020.
	National Transport Strategy 2035 (2017)	Aims for at least 50% share of electric cars in the car sales market by 2030.
Industry	Corporate income tax exemptions for Renewable Energy Sector (2011)	Reduction of 80% in corporate profit tax for five years for the sale of equipment that operates on renewable energy sources and/or that is used for producing alternative fuels.
Agriculture and Forestry	Enhancement of forest cover (2015)	Increase of the forest area up to 17% of total land cover by 2020.
	State Programme 'Forest of Ukraine' (2009)	Target of 429,000 hectares of afforestation and 231,000 hectares of reforestation by 2030.

¹⁾ PBL and NewClimate Institute did not quantify the policies in this overview due to the lack of data and the uncertainty on their implementation status.

Table 66: 2005 historical data and 2030 projections of key GHG indicators for Ukraine. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

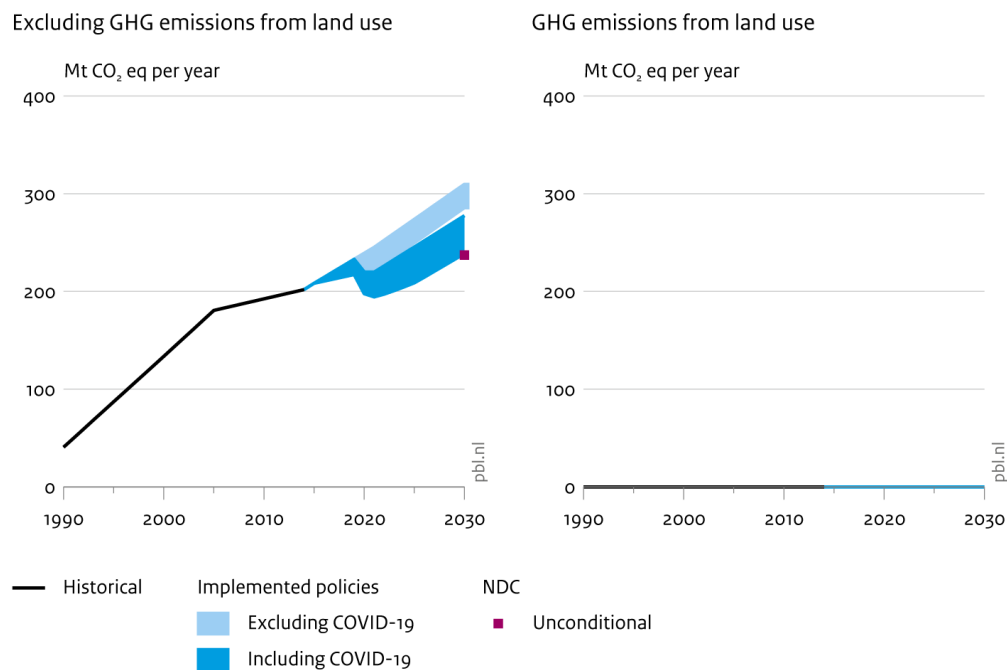
Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO₂e)	408	384 to 414 (-6% to +1%)	308 (-24%)
GHG emissions per capita (tCO₂e/cap)	8.7	9.4 to 10.1 (+8% to +16%)	7.5 (-13%)

3.23 United Arab Emirates

Recent developments (including proposed policies): 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 natural gas (WAM, 2017). The strategy foresees the following electricity mix by 2050: 44% of renewable energy, 38% gas, 12% coal and 6% nuclear. The emirate of Abu-Dhabi connected 1.2 GW from the Noor solar PV plant to the grid in 2019 and tendered 1.5 GW to be connected in 2022 (Bellini, 2020; Gulf News, 2019). Dubai expects to reach 5 GW of solar PV and CSP by 2030 in the Mohammed bin Rashid Al Maktoum Solar Park, of which 2.9 GW have been tendered (Gulf Today, 2019). The government 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 meet its NDC target, but this is mostly driven by the uncertain effect of COVID-19 on short-term emissions. Current policies projections remain in an upwards trend.

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



Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 26: Impact of climate policies on greenhouse gas emissions in the United Arab Emirates Emissions trajectories are based exclusively on NewClimate and IIASA's projections. Emission values are based on AR4 GWP-100.

Table 67: Description of UAE's previous NDC and current NDC, as presented in official sources. N/A: not available or not applicable.

Indicator	Previous NDC	NDC
Business-as-Usual (BAU)	N/A	310 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
Target: conditional	N/A	N/A

Indicator	Previous NDC	NDC
Sectoral coverage	Energy	Economy-wide
General Accounting method	N/A	N/A
GHGs covered	Not relevant	CO ₂ , CH ₄ , N ₂ O, PFCs
Consideration of LULUCF	No	No
Use of bilateral, regional and international credits	N/A	UAE may consider using voluntary cooperation under Article 6 of the Paris Agreement

Table 68: 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) (+)	The plan has three aims: To develop an inventory of climate mitigation and adaptation measures, to build a national adaptation planning and implementation and to boost green industry with energy efficiency and voluntary agreements.
Energy supply	UAE's National Energy Strategy 2050 (2017) (+)	50% of clean energy in the electricity mix by 2050, including renewables (44%) and nuclear (6%).
Transport	Fuel pricing reform (2015) (+)	Phasing out subsidies for gasoline and diesel
	Federal Decree Law No. 8 (2018)	Petrol and diesel prices are subject to a 5% VAT rate, but crude oil and natural gas are exempted.
	Vehicle fuel quality standard (+)	10 ppm sulphur content and Euro 5 standards.
	Dubai Green Mobility Strategy (2020) (+)	2% share of electric and hybrid cars in Dubai's road fleet by 2030, and a 30% share in government-procured vehicles.
	Federal Law No. 2 (2009)	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)	Measures include building retrofits, increasing the penetration of district cooling, and facilitating access to project finance.
	Energy Efficiency Standardization and Labelling Program	The policy covers a range of household goods and appliances.

Table 69: 2005 historical data and 2030 projections of key GHG indicators for UAE. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO₂e)	181	239 to 278 (+32% to +54%)	237 (+31%)
GHG emissions per capita (tCO₂e/cap)	39.4	22.4 to 26 (-43% to -34%)	22.2 (-44%)

3.24 United Kingdom

Recent developments: The UK adopted its net zero emissions target in 2019 and has multiple policies that support emissions reductions. The UK projects a phase out of coal-fired power plants by 2024 (UK Government, 2019d). The UK Emission Trading Scheme (UK-ETS) started operations in 2021 (UK Government, 2020b). Electricity from renewables surpassed fossil-fuelled generation for the first time in 2019 and is projected to reach 52% of the energy mix by 2030 (Department for Business Energy & Industrial Strategy, 2020b; Evans, 2019).

The Energy White Paper presents many measures to reduce energy-related emissions. For example, it outlines a plan to increase four times the offshore wind capacity and invest in nuclear power and proposes an increase of investments in R&D and CCS (UK Government, 2020a). Another goal is to halt sales of petrol, diesel cars and vans from 2030 (UK Government, 2020a). The share of electric vehicles has reached 6.1% in June 2020 (Society of Motor Manufacturers and Traders, 2020). The UK government also released the Ten Point Plan for a Green Industrial Revolution, that aims to mobilise public and private fund to support the development of low-carbon technologies. The country maintains a heavy reliance on natural gas in the building heating sector. The Transport Decarbonisation Plan, outlining a plan to reach net-zero by 2050, and the Heat and Buildings Strategy to steer a reduction in the use of natural gas, are expected in 2021. The UK intends to phase out coal power generation by 2024, one year earlier than original phase out announced date (Europe Beyond Coal, 2021).

Projections: Under current policies, the UK is set to miss its updated NDC target. However, this is largely driven by the increase in ambition presented in the latest target update. Emissions have been in a downwards trends but are expected to plateau around 400 MtCO₂e. Steeper emissions reductions are necessary to meet the updated target, which is in line with decarbonisation by mid-century.

Impact of climate policies on greenhouse gas emissions in United Kingdom

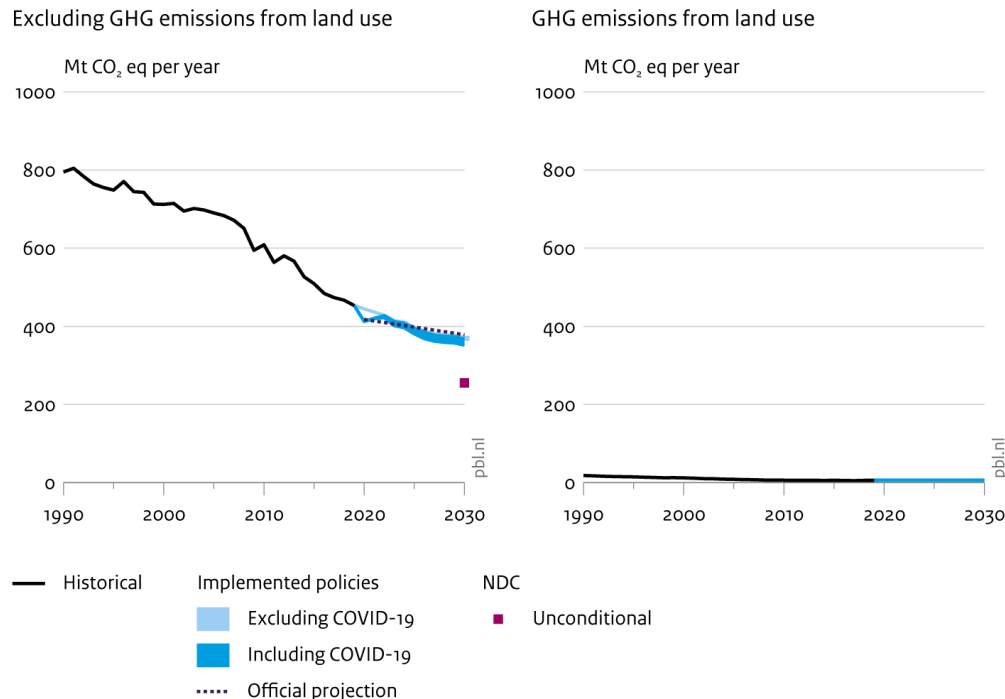


Figure 27: Impact of climate policies on greenhouse gas emissions in United Kingdom. Emissions trajectories are based exclusively on NewClimate and IIASA's projections. Emission values are based on AR4 GWP-100. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019).

Table 70: Description of the United Kingdom's previous and current NDC, as presented in official sources. N/A: not available or not applicable.

Indicator	Previous NDC	NDC
Business-as-Usual (BAU)	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
Target: conditional	N/A	N/A
Sectoral coverage	Economy-wide	Economy-wide
General Accounting method	IPCC guidelines; 100-year GWPs from the Fourth Assessment Report	2006 IPCC guidelines; 100-year GWPs from the Fifth 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. A decision on how to include the land-use sector was adopted in 2018.	Land-use sector is included in the economy-wide target but no separate target for LULUCF specified. 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.
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

Table 71: Overview of key climate change mitigation policies in the United Kingdom (Committee on Climate Change, 2019; Department for Business Energy & Industrial Strategy, 2020a; 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"> An 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 levels for 2030 of 68% compared with 1990 levels. This reduction target has subsequently adopted by the UK government.
	Ten Point Plan for a Green Industrial Revolution (2020) (+)	<ul style="list-style-type: none"> The Ten Point Plan defines out 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
	Clean Growth Strategy (2017) (+)	<ul style="list-style-type: none"> The strategy 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"> The 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>The Energy 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

Sector	Policies ¹⁾ (marked with '(+)' when mentioned in the NDC document)	Description
		<ul style="list-style-type: none"> 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 <p>Increase installation rate of electric heat pumps from 30,000 per year to 600,000 per year by 2028</p>
Transport	Transport Decarbonisation Strategy (2021) ¹⁾	<ul style="list-style-type: none"> The 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.
	Energy White Paper (2020) supported by Ten Point Plan for a Green Industrial Revolution (2020) (+)	<ul style="list-style-type: none"> Announced ban to sell 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)
	UK Road Vehicle Emission Performance Standards (2019)	<p>The 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
Industry	Energy White Paper (2020) (+) supported by Ten Point Plan for a Green Industrial Revolution (2020) (+)	<ul style="list-style-type: none"> GBP 1 billion up to 2025 to facilitate the deployment of CCUS in two industrial clusters by the mid-2020s, and a further two clusters by 2030 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"> The 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"> Aiming to improve the natural environment, the plan presents 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"> It is a £50 million incentive scheme to increase the planting trees rate across England. Working with Woodland Carbon Units (WCU),

Sector	Policies ¹⁾ (marked with '(+)’ when mentioned in the NDC document)	Description
		the scheme allows landowners to sell the carbon credits generated to either the government or to the open market up to 2055/56.

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

Table 72: 2005 historical data and 2030 projections of key GHG indicators for the United Kingdom. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO₂e)	690	352 to 368 (-49% to -47%)	255 (-63%)
GHG emissions per capita (tCO₂e/cap)	11.4	5 to 5.2 (-56% to -54%)	3.6 (-68%)

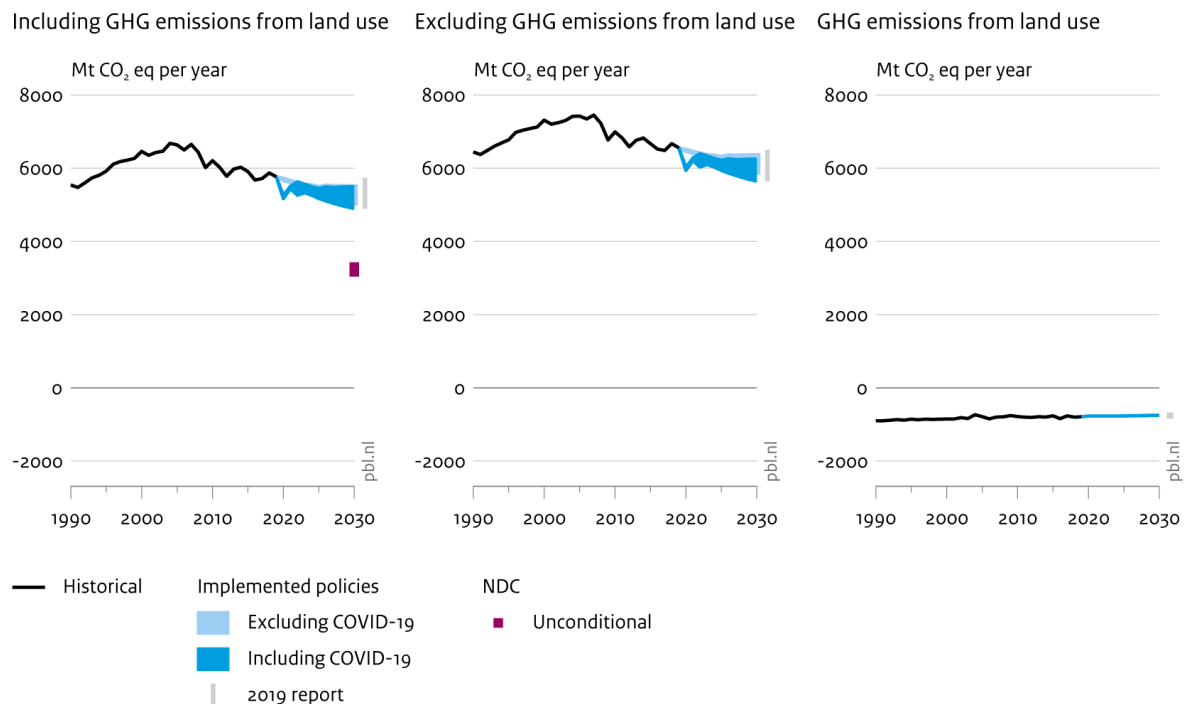
3.25 United States of America

Recent developments (including proposed policies): Joe Biden's administration has taken steps to address climate change as one of its priorities, reverse climate policy rollbacks of his predecessor, and exercise international diplomacy to line up the US as a global leader on climate change. The Biden administration has set 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.

The US Senate passed a USD 1tn infrastructure investment bill (*'Infrastructure Investment and Jobs Act'*) with bipartisan support, which aims to spur economic recovery and update the country's infrastructure while accelerating climate action, including investments in public transit, roads, and electric vehicles. The Biden administration proposed stricter fuel economy and emissions standards for passenger vehicles for model years 2023-2026 and a phase down in the production and consumption of hydrofluorocarbons (HFCs) over the next 15 years. While the Biden administration has set more ambitious targets and broad plans for climate action, new legislation will need to be passed through the US Congress to put the United States on a path towards the ambition levels pledged.

Projections: The US will likely miss its NDC targets with existing policies. Our current policies scenario projections this year are similar to our 2019 projections as most recent announcements have not yet been reflected in policy implementation and, consequently, in emissions projections.

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 28: Impact of climate policies on greenhouse gas emissions in the United States of America (upper end: NewClimate Institute calculations, lower end: PBL IMAGE model). Emission values are based on AR4 GWP-100. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019).

Table 73: Description of the United States of America's previous and current NDC, as presented in official sources. N/A: not available or not applicable.

Indicator	Previous NDC	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 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 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 74: 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
Energy supply	Clean Air Act (1963) (+) ¹⁾	Clean Power Plan (CPP) was repealed in August 2019.
	Methane waste prevention rule (2016) ¹⁾²⁾	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⁾	Provides a tax credit for carbon dioxide captured through CCS (section 45Q), including carbon dioxide used for enhanced oil recovery.
Transport	Fuel efficiency standards (CAFE) and emissions standards for light-duty vehicles (+)	Emission standards currently in place require increase the stringency of the standards of LDV by 1.5% year-to-year from model year 2021 to 2026, reaching 43 mpg (18.4 km/l) by 2026.
	Efficiency standards heavy-duty vehicles	Differentiated standards per truck type.
	Renewable fuel standard (2015)	Volume of renewable fuel required to be blended into transportation fuel 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) ²⁾	Help American commercial and industrial buildings become at least 20% more energy efficient by 2020.
	Energy Star Tax credits for buildings ¹⁾	Tax credits for energy efficiency products and solar energy systems.
	Building Energy Codes Program	Efficiency codes are adopted at a state level.
Industry	Curbing emissions of hydrofluorocarbons (HFCs) (+) ¹⁾	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, President Biden directed to ratify the Kigali Amendment which aims to phase down HFCs worldwide. In 2021, the Biden administration proposed a regulation that establishes the mechanism to set national limits on HFCs. The proposed rule aims to gradually reduce the production and imports of HFCs by 85% over 15 years starting in 2022

Sector	Policies (marked with '(+)' when mentioned in the NDC document)	Description
Agriculture and Forestry	Forest Ecosystem Restoration and Hazardous Fuels Reduction Programs (2000) ^{1), 3)}	Mix of actions to increase forest resilience, reduce wildfire, 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 75: 2005 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 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO₂e)	6630	4900 to 5490 (-26% to -17%)	3300 to 3170 (-50% to -52%)
GHG emissions per capita (tCO₂e/cap)	22.5	0.00	9.1 to 9.4 (-60% to -58%)

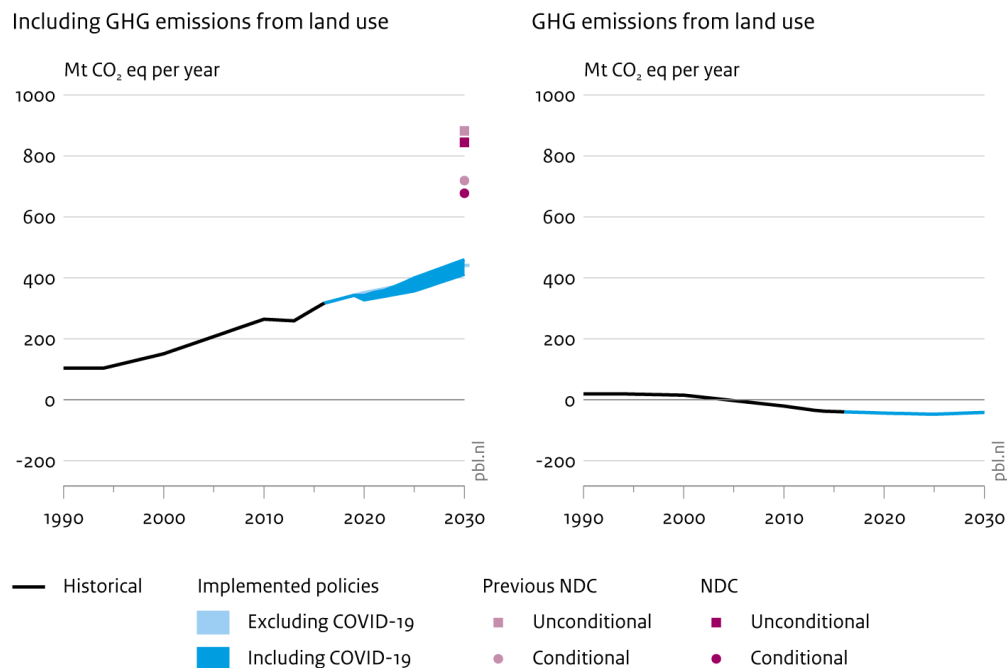
3.26 Viet Nam

Recent developments (including proposed policies): In 2019 Viet Nam had 4.5 GW renewable capacity installed, supported by a feed-in-tariff mechanism. This mechanism was expected to be in force until 2019 but was extended in 2020 (Decision 13/2020) after 10 months gap (Publicover, 2020b). The government has a pilot transition plan from feed-in-tariff to an auction scheme, which has already 29 solar projects (1.6 GW) to be approved and potential for other 103 projects reaching 10 GW capacity (Publicover, 2020a). The 7th Power Development Plan (PDP7) plans investments in coal, but those might be partially postponed or cancelled (Brown & Vu, 2020; MDI, 2020). Around 18 GW is still planned to be connected to the country's generation capacity by 2030 (Burke & Thanh Hai, 2021a; Viet Nam Government, 2020).

In November 2020 the Ministry of Natural Resources and Environment (MONRE) released a draft law replacing the Environment Protection law, mandating the creation of a national plan to reduce GHG emissions (Burke et al., 2020) The government discusses the proposal for a pilot programme where the country's 100 largest emitters (cement manufacturers and coal-fired power plants) would pay forest communities and landowners to protect and expand forests. Early in 2021, Viet Nam released the draft PDP8, which is not quantified in our projections. The plan projects expansion of natural gas, via LNG imports, and renewables role in the power mix (Burke & Thanh Hai, 2021b).

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. 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 previous NDC did not include industrial processes emissions. To quantify the absolute emissions levels of the previous NDC, we added an estimated current policy scenario emissions projection for industrial processes to the implied emissions target. The current NDC target includes this sector and results in slightly lower emissions.

Impact of climate policies on greenhouse gas emissions in Viet Nam



Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 29: Impact of climate policies on greenhouse gas emissions in Viet Nam (including LULUCF). Emission values are based on AR4 GWP-100. Emissions trajectories are based exclusively on

NewClimate and IIASA's projections. The grey column gives the range of our 2019 projections in Kuramochi et al. (2019).

Table 76: Description of Viet Nam's previous NDC and current NDC, as presented in official sources. N/A: not available or not applicable.

Indicator	Previous NDC	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
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 the IPCC Fourth Assessment Report	IPCC Guidelines; 100-year GWP values from the IPCC Fourth Assessment Report
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% compared to the BAU scenario (unconditional) and 2.3% compared to the BAU scenario (conditional).
Use of bilateral, regional and international credits	Not specified	Country considers international credits as a potential source of finance

Table 77: Overview of key climate change mitigation policies in Viet Nam (MNRE, 2011; Viet Nam Government, 2012, 2016, 2020).

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)	The strategy presents 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) (+)	The strategy aims 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)	The PDP 7 sets 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⁾	Resolution 55, which will be reflected in the next PDP, scales 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.
	Decision No. 11/2017/QD-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)	Green growth – roadmap 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	It 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	It sets out energy savings targets for specific sectors, such as the chemical, cement and also for the new industrial parks.

Sector	Policies ³⁾ (marked with '(+)’ when mentioned in the NDC document)	Description
Agriculture and Forestry	Forestry Law (2017) (+) ²⁾	Regulates the management of forests.
	Tree Planting Plan (2020) ²⁾	Aims to plan 1 billion trees by 2025.

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

Table 78: 2005 historical data and 2030 projections of key GHG indicators for the Viet Nam. Absolute emission levels and changes in emission levels relative to 2005 levels are presented. The sector coverage for GHG emission indicators is consistent with the NDC targets. All values are based on AR4 GWP-100 unless stated otherwise. N/A: not available or not applicable.

Indicator	2005 (historical)	2030 projections (change rate vs. 2005 levels)	
		Current policies scenario	NDC unconditional [conditional] target
GHG emissions (incl. LULUCF) – estimates (MtCO₂e)	208	412 to 459 (+98% to +121%)	844 (+307%) [677 (+226%)]
GHG emissions per capita (tCO₂e/cap)	2.5	4 to 4.4 (+60% to +78%)	8.1 (+227%)

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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. The main updates and methodological changes made in this report from our 2019 report include the following (Kuramochi et al., 2019):

- Policy developments since the 2019 report have been taken into account in the emissions projections (cut-off date: December 2020, with a few exceptions), based on our 2020 policy update document (Moisio et al., 2020) and the periodical updates under the European CD-LINKS and ENGAGE projects (CD-LINKS, 2017; ENGAGE, 2020).
- Country-level policies packages for quantification in GHG emissions scenarios were reviewed by in-country experts involved in the CD-LINKS and ENGAGE projects to identify policies, not limited to those focused on energy and climate, expected to deliver significant impact.
- Historical GHG emissions data was updated according to latest inventories submitted to the UNFCCC (cut-off date: April 2021; see Appendix A.1 for details).
- GHG emissions projections under current policies were harmonised to the latest historical emissions data described above, i.e. adding the absolute emissions difference in the harmonisation year between the inventory data and the model data to the model projections.¹ The harmonisation year was updated to 2019 for Annex I countries (previously 2017) and the latest data year for non-Annex I countries (See Appendix A.1 for details).

GHG emissions values are provided in terms of global warming potentials (GWPs) specified in respective NDC documents, if in agreement with GWPs used in historical data. This allows for a direct comparison of current policies scenario projections to the official target emission levels reported by the national governments. For some countries, the GWPs used in the most recent GHG inventories and those specified in NDCs were different. In such cases, the GWPs used in the historical data were also used for the projections (which are harmonised to historical data), and a note highlighting the inconsistency with the GWP used in the NDCs was added.

To calculate per capita and per GDP indicators, we used the population projections from the UN World Population Prospects 2019 (UN, 2019b) and GDP projections from the OECD long-term forecast (OECD, 2018), supplemented with the projections underlying the Climate Action Tracker analysis (Climate Action Tracker, 2020b) for a few countries (no projections available for DRC and Ethiopia).

On energy-related indicators, primary energy values are based on the physical energy content method and on lower heating values in consistency with the IEA statistics (IEA, 2019b), unless otherwise noted.

The information on pre-2020 pledges, NDC targets and official emissions projections under current policies or equivalent are collected mainly from the government documents submitted to the UNFCCC (Table A-1).

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

¹ A harmonisation step is applied to reconcile the common historical emissions data used for this report (i.e. from latest national GHG inventories) and the estimates of historical emissions used in the tools that generate this report's emissions projections. The use of a more recent inventory data year for harmonisation allows for better accounting for the GHG emissions trends in recent years.

Table A-1: Sources for the official estimates of emissions in 2030 under NDC case and current policies scenarios. N/A: not available.

Country	NDC case ¹⁾	Current policies scenario
Argentina	NDC	N/A
Australia	(Commonwealth of Australia, 2019)	Australian Government (2020b) ²⁾
Brazil	NDC	N/A
Canada	NDC	Environment and Climate Change Canada (2021) ²⁾
China	N/A	N/A
Colombia	NDC	N/A
Egypt	N/A	N/A
Ethiopia	NDC	N/A
EU27	NDC	(European Commission, 2021) ²⁾
India	N/A	N/A
Indonesia	NDC	N/A
Iran	NDC	N/A
Japan	NDC	N/A ²⁾
Mexico	NDC	N/A
Morocco	NDC	N/A
Republic of Korea	NDC	N/A
Russian Federation	NDC	(UNFCCC, 2019c) ²⁾
Saudi Arabia	N/A	N/A
South Africa	NDC	N/A
Thailand	NDC	N/A
Turkey	INDC	(UNFCCC, 2019c) ²⁾
Ukraine	NDC	N/A ²⁾
United Arab Emirates	NDC	N/A
United Kingdom	NDC	BEIS (2020) ²⁾
USA	NDC	N/A
Viet Nam	NDC	N/A

¹⁾ INDC and 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.

²⁾ On Annex I countries, for Australia, Russian Federation, and Turkey we refer to the 'With measures' scenario projections reported in the Fourth Biennial Reports (BR4) submitted to the UNFCCC (UNFCCC, 2019b). Japan's 'With measures' scenario is an NDC achievement scenario and thus, not presented as official current policies scenario projections in this report. For Ukraine, we did not find any scenario projections comparable definition-wise to our current policies scenario projections. For the EU, Canada, Australia and the UK, we refer to more recent, annual official publications.

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

Historical GHG emissions data sources

For Annex I countries (Australia, Canada, the European Union, Japan, Kazakhstan, the Russian Federation, Turkey, the USA and Ukraine), we used the GHG inventories submitted in 2021 to the UNFCCC; the inventories used 100-year global warming potential (GWP) values from the IPCC Fourth Assessment Report (AR4).

For historical emissions for non-Annex I Parties, Table A-1 presents an overview of data sources. For many countries, the data was taken from the UNFCCC GHG databases (UNFCCC, 2014), in which the GHG inventory data reported in most recent Biennial Update Reports (BURs) submitted to the UNFCCC were compiled. National Inventory Reports (NIR) and National Communications (NC) were also used for some countries. All values were converted to AR4 whenever presented in another GWP. At a country level, the dataset provided by the Potsdam Institute for Climate Impact Research (PIK) to the Climate Action Tracker project shows that for the inventory submitted in 2017 by Annex I countries, the emission values become smaller by 1-5% excluding LULUCF and 1-7% including LULUCF when they are converted from AR4 GWPs to SAR GWPs (data years: 1990 to 2015).

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 P. R. 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-2: Data sources for historical GHG emissions in non-Annex I countries (Gütschow et al., 2017; UNFCCC, 2016, 2017)

Country	GHG emissions excluding LULUCF		LULUCF emissions	
	Source	Last reported data-year	Source	Last reported data-year
Argentina	BUR3	2016	BUR3	2016
Brazil	BUR3, NC4	2016, 2016	NC4	2016
China	CO ₂ : PRIMAP database (1990 - 2018) ¹⁾ Non-CO ₂ GHGs: UNFCCC database, BUR2 (for 2014)	2014 / 2018	UNFCCC database, BUR2 (for 2014)	2014
Colombia	BUR2	2014	BUR2	2014
Egypt	BUR1	2015	BUR1	2015
Ethiopia	UNFCCC database PRIMAP database (2014 – 2017)	2013 / 2017	UNFCCC database	2013
India	UNFCCC database, PRIMAP database (2014 – 2018)	2014 / 2018	UNFCCC database / BUR3	2016
Indonesia	NC3, UNFCCC database, BUR2 (only for 2016)	2016	NC3, UNFCCC database, BUR2 (only for 2016)	2016
Iran	NC3	2010	NC3	2010
Republic of Korea	UNFCCC database	2017	UNFCCC database	2017
Mexico	National GHG inventory (INECC, 2018)	2017	National GHG inventory (INECC, 2018)	2015
Morocco	UNFCCC database	2016	UNFCCC database	2012
Saudi Arabia	UNFCCC database PRIMAP database (2015 – 2017)	2015 / 2017	UNFCCC database	2010
South Africa	UNFCCC database, BUR3 PRIMAP database (2016 – 2017)	2014 / 2017	UNFCCC database, BUR3	2017
Thailand	UNFCCC database, NC3, BUR3	2016	UNFCCC database, NC3, BUR3	2016
United Arab Emirates	UNFCCC database, NC4	2014	UNFCCC database, NC4	2014
Viet Nam	BUR3/NIR	2016	BUR3/NIR	2016

¹⁾ China's historical emissions are based on officially reported data up to 2014 based on the second BUR but are harmonised with PRIMAP data for more recent years.

A3: Quantification of 2020 pledges and (I)NDC emission levels

Target type

The mitigation components of the INDCs and NDCs represent several types of targets:

1. **Base year target:** reduction from historical base year emissions. INDCs/NDCs report on a reduction from historical base year emissions. The base year chosen varies, with 1990, 2005 and 2010 being the most common. This category covers from the selected 25 countries of this report: Australia, Brazil, Canada, the European Union, Japan, Kazakhstan, the Republic of Korea, the Russian Federation, Ukraine, the United Kingdom, and the USA.
2. **Baseline or BAU target:** emissions reductions relative to a baseline or business-as-usual projection (specified in the INDCs/NDCs). The mitigation component of the INDCs/NDCs specifies the business-as-usual emission projection. The type of emissions reductions relative to a baseline or business-as-usual projection has been chosen for many INDCs/NDCs, and in this report for: Ethiopia, Indonesia, Mexico, Morocco, Thailand, Turkey, 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 INDCs/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. For Saudi Arabia, we assumed a baseline based on national CO₂ emissions projections (KAUST, 2014).
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 has a trajectory target stating the emission ranges for 2025 and 2030. Several countries, such as Colombia and Argentina, put forward a fixed-level target, specifying the MtCO_{2e} that they intend not to exceed in a given year.
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. This group of countries covers about 6% of the global emissions of 2010, and none of the selected countries.

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, 2020b).

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.

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 approach² (den Elzen, Admiraal, et al., 2016). This report identified two countries that apply the gross-net accounting approach³ (Japan and Republic of Korea). 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 Canada⁴ and the EU27⁵. 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.

Land-use is excluded in the base year and accounting approaches have been defined that provides 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

Table A-3: Overview of NDC configuration per country

Country	Target type	LULUCF sector is included in the NDC	Approach for NDC quantification by authors		
			Reference emissions include LULUCF	LULUCF treated separately	LULUCF accounting method applied
Argentina	Baseline specified	Yes	Yes	No	Net-Net
Australia	Base year	Yes	Yes	No	Net-Net
Brazil	Base year	Yes	Yes	No	Net-Net
Canada	Base year	Yes	No	No	Net-Net

² 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.

³ In this approach the actual reported net emissions (or removals) in each year of the commitment period is accounted for without comparing the estimates with a base year.

⁴ For further information about the accounting approaches that have been established for Canada we refer to 2018 Canada's Greenhouse Gas and Air Pollutant Emissions Projections (http://publications.gc.ca/collections/collection_2018/eccc/En1-78-2018-eng.pdf) and Canada's Fourth Biennial Report on Climate Change (<https://unfccc.int/documents/209928>).

⁵ For further information about the accounting approaches have been established for EU27 we refer to the Revision of the Regulation on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry (https://ec.europa.eu/info/sites/default/files/revision-regulation-ghg-land-use-forestry_with-annex_en.pdf)

Country	Target type	LULUCF sector is included in the NDC	Approach for NDC quantification by authors		
			Reference emissions include LULUCF	LULUCF treated separately	LULUCF accounting method applied
China	Intensity and non-GHG	Yes	Yes	No	Net-Net
Colombia	Baseline specified	Yes	Yes	No	Net-Net
Egypt	N/A	N/A	N/A	N/A	N/A
Ethiopia	Baseline specified	Yes	Yes	No	Net-Net
European Union	Base year	Yes	No	No	Net-Net
India	Intensity and non-GHG	Yes	Yes	No	Net-Net
Indonesia	Baseline specified	Yes	Yes	No	Net-Net
Iran	Base year	Yes	Yes	No	Net-Net
Japan	Base year	Yes	No	Yes	Gross-Net
Mexico	Baseline specified	Yes	Yes	No	Net-Net
Morocco	Baseline specified	Yes	Yes	No	Net-Net
Republic of Korea	Baseline specified	No	No	No	Gross-Net
Russian Federation	Base year	Yes	No	Yes	Net-Net
Saudi Arabia	Trajectory	No	No	No	None
South Africa	Trajectory	Yes	Yes	No	Net-Net
Thailand	Baseline specified	No	No	No	None
Turkey	Baseline specified	Yes	Yes	No	Net-Net
Ukraine	Base year	Yes	Yes	No	Net-Net
UAE	Baseline specified	No	No	No	None
United Kingdom	Base year	Yes	No	No	Net-Net
USA	Base year	Yes	Yes	No	Net-Net
Viet Nam	Baseline specified	Yes	Yes	No	Net-Net

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, 2020b). The starting point for the calculation of current policies emissions projections is a publicly available 'reference' policy scenario 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 (e.g. 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 accredited research organisations and think tanks.

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

The IEA WEO projections on energy-CO₂ emissions were used for several countries. The Stated Policies Scenario, which only considers policy measures implemented as of mid-publication year, was used in most cases.

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. Moreover, where considered relevant, strong implementation barriers, such as for example political resistance or technical difficulties, are considered in projecting the effect of specific policies or targets.

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. A number of case-specific assumptions are usually made on which fuels would be replaced by the increased renewable energy production.
- **Vehicle fuel efficiency standards:** A simplified stock turnover model is used for a number of countries. Calculations were done using the underlying data from the Global Transportation Roadmap Model of the International Council on Clean Transportation (ICCT, 2012).

- **Building codes:** as with vehicle fuel efficiency standards, a simplified stock turnover model is used for the EU.
- **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. The emissions projections for non-LULUCF sectors for non-CAT countries were developed as follows:

- Colombia: based on the BAU projections from the Third National Communication (Government of Colombia, 2017), with consideration of planned policies and measures described in the Second Biennial Update Report (Government of Colombia, 2018b) that have been implemented to date.
- Egypt: based on a compilation of different emissions projections sources. We refer to Abdallah & El (Abdallah & El, 2020) for CO₂ emissions projections under current policies for the power sector. We complement remaining CO₂ emissions with projections from the IEA for the Middle East and non-CO₂ emissions from US EPA. The lower end of our current policies scenario assumes continuation of existing trends in all sectors.
- Iran: based on trends from the 2025 Mitigation Scenario provided in the third national communication (Department of Environment of Iran, 2017). For the Agriculture and Waste sectors we use expected growth rates under this scenario. For Energy and Industrial processes, we use the trends in GDP elasticity of emissions. This represents the lower end of our emissions projections. The upper end is based on historical trends of GDP elasticity of energy and industry GHG emissions between 1990 and 2020.
- Thailand: based on the reference projections from the APEC Energy Demand and Supply Outlook 2019 (APEREC, 2019), with consideration of renewable deployment projections by IRENA (IRENA, 2017).

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

Country	URL	Date updated
Argentina	https://climateactiontracker.org/countries/argentina	July 2020
Australia	https://climateactiontracker.org/countries/australia	September 2021
Brazil	https://climateactiontracker.org/countries/brazil	September 2020
Canada	https://climateactiontracker.org/countries/canada	September 2020
China	https://climateactiontracker.org/countries/china	September 2021
Colombia	Not assessed by Climate Action Tracker	N/A
Egypt	Not assessed by Climate Action Tracker	N/A
Ethiopia	https://climateactiontracker.org/countries/ethiopia	July 2020
European Union	https://climateactiontracker.org/countries/eu	September 2021
India	https://climateactiontracker.org/countries/india	September 2021
Indonesia	https://climateactiontracker.org/countries/indonesia	September 2020
Iran	Not assessed by Climate Action Tracker	N/A
Japan	https://climateactiontracker.org/countries/japan	September 2021
Mexico	https://climateactiontracker.org/countries/mexico	September 2020
Morocco	https://climateactiontracker.org/countries/morocco	July 2020
Republic of Korea	https://climateactiontracker.org/countries/southkorea	July 2020
Russian Federation	https://climateactiontracker.org/countries/russianfederation	September 2020
Saudi Arabia	https://climateactiontracker.org/countries/saudiarabia	September 2020
South Africa	https://climateactiontracker.org/countries/southafrica	September 2020
Thailand	Not assessed by Climate Action Tracker	N/A
Turkey	https://climateactiontracker.org/countries/turkey	July 2020
United Arab Emirates	https://climateactiontracker.org/countries/uae/	November 2020
Ukraine	https://climateactiontracker.org/countries/ukraine	July 2020
United Kingdom	https://climateactiontracker.org/countries/uk/	September 2021
USA	https://climateactiontracker.org/countries/usa	July 2020
Viet Nam	https://climateactiontracker.org/countries/vietnam/	November 2020

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., 2017).

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 and vehicle efficiency standards, 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 parameters were changed in such a way that the 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 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 the standard. Power plant standards applying to existing stock are implemented through a carbon tax on the energy supply sector.

Coal phase-out policies were 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 (i.e. nuclear capacity in Japan after 2030) were 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 PBL 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 was set to such a level that it results in the desired biofuel share for the total liquid car fleet.

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 was 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 carbon 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 pumps installation is avoided in some cases as the region's poor electricity fuel mix 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 four countries with considerable AFOLU emission reductions.

For Brazil, this entailed the implementation of the Brazilian Forest Code, by reforesting degraded areas between 2015 and 2030 by 12 million ha compared to the no-policy baseline scenario. In IMAGE-land, it was assumed that this increase would not compromise agricultural land, but would be allocated to degraded lands first.

China has an ambitious goal in its NDC to afforest 100 million ha (6 billion m³) compared to 2005 levels. However, following Gallagher et al. (2019) and for feasibility reasons, we followed the smaller ambition to allocate 26% of the land cover to forests by 2030. In IMAGE-land this implies an increase of 44.2 million ha from 2020 to 2030 relative to the no-policy baseline scenario.

In India, re- and afforestation of 10 million ha (Green India Mission 2011) was implemented between 2015 and 2030 and relative to the no-policy scenario. Unlike in Brazil, for both India and China it was assumed that these plantations could be allocated to (previous) agricultural lands, but reductions in agricultural lands could in turn be compensated elsewhere, both nationally and abroad.

Indonesia's National Action Plan for Greenhouse Gas Emission Reduction (Ran-GRK) consists of a reduction of 672 Mt CO₂e emissions in the forestry sector relative to the no-policy scenario between 2015 and 2030, which is reached via forest protection.

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, 2021).

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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