# Greenhouse gas mitigation scenarios for major emitting countries

## Analysis of current climate policies and mitigation commitments: 2018 update

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This update report builds on Kuramochi et al. (2017). This report has been prepared by PBL/NewClimate Institute/IIASA under contract to European Commission, DG CLIMA (EC service contract N° 340201/2017/764007/SER/CLIMA.C1), started in November 2017.



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# Executive Summary

This report, prepared by NewClimate Institute, PBL Netherlands Environmental Assessment Agency and IIASA presents an up-to-date assessment of progress by 25 countries towards achieving the mitigation components of the 2025/2030 targets (NDCs and INDCs) presented in the context of the Paris Agreement, as well as their progress towards their 2020 pledges under the UNFCCC Cancún Agreements. More specifically, the report provides an overview of projected GHG emissions up to 2030, taking into account existing and in some cases planned climate and energy policies, and compares them with the emissions targets under the NDCs and INDCs.

This report, compared to our 2017 report (Kuramochi et al., 2017), includes the following updates: new policy developments in the last year, review of policy packages by in-country experts and more recent GHG emissions data from national inventories.

This 2018 update report finds that countries have made progress toward their 2020 pledges and 2030 NDC targets to varying degrees.

Not all major emitting countries are expected to meet their **2020 pledges**:

- Nine countries (Brazil, China, EU28, India, Japan, Mexico, Russian Federation, Thailand, Ukraine) are on track to meet their 2020 pledges with implemented policies.
- Seven countries (Australia, Canada, Indonesia, Kazakhstan, Republic of Korea, South Africa, the USA) are projected to miss their 2020 pledges.

The pledge assessment remained the same as in the 2017 report for all countries. Eight countries (Argentina, Chile, Colombia, D.R. Congo, Ethiopia, Morocco, Philippines, Saudi Arabia) did not submit their 2020 pledges while one country, Turkey, was not obligated to do so (UNFCCC, 2010).

The degree to which countries/regions are likely to **achieve their NDCs** under current policies was found to vary (Figure ES-1):

- Countries likely or roughly on track to achieve or even overachieve their self-determined unconditional NDC targets with implemented policies are: China, Colombia, India, Russian Federation, Saudi Arabia, Turkey and Ukraine.
- Countries that require additional measures to achieve their 2030 targets are: Argentina, Australia, Brazil, Canada, Chile, D.R. Congo, Ethiopia, Indonesia, Japan, Kazakhstan, Morocco, Republic of Korea, South Africa, Thailand, the Philippines and the United States.
- For EU28 and Mexico, it is uncertain if they are on track to meet their NDC targets. For both countries, NewClimate Institute projections were higher than the NDC emission levels whereas the PBL projections were lower than the NDC target emission levels.

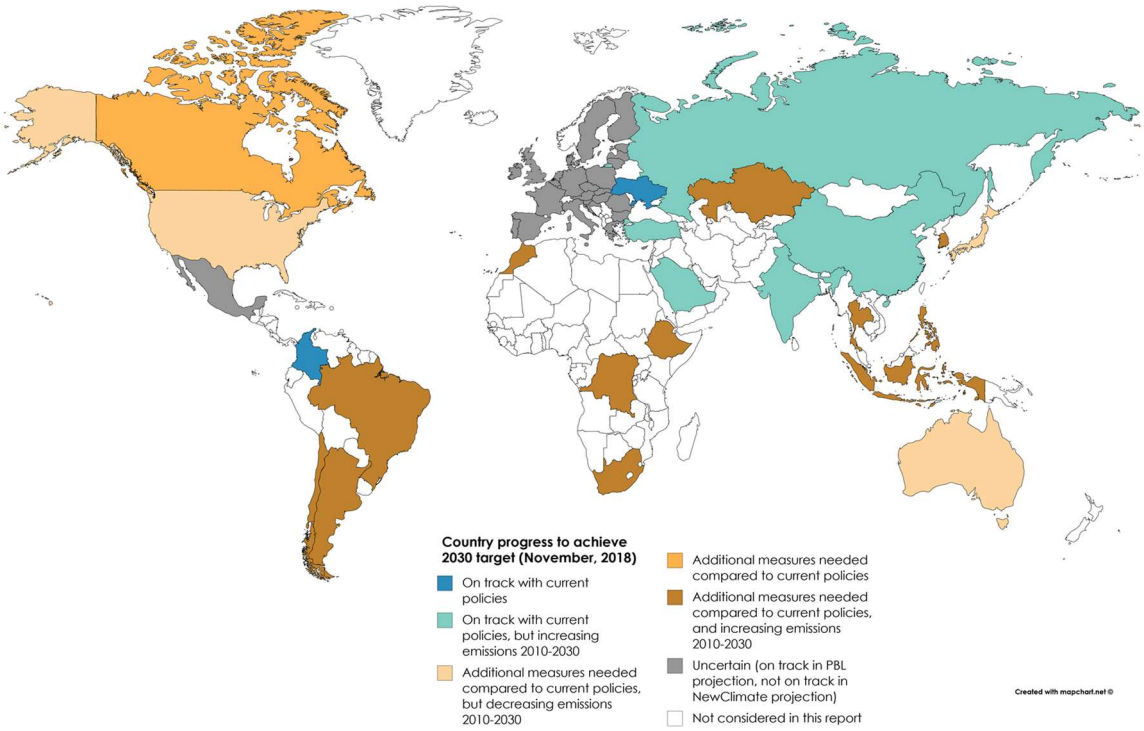


Figure ES-1: Progress of countries toward achieving their self-chosen 2030 targets under current policies. Note: current policies do not include implementation measures that are under development at the time of publication.

The assessment results have changed compared to last year for the following countries:

- From “on track” to “not on track”: Brazil and Japan. In Brazil, emissions from forestry are higher than those used last year. In Japan, the nuclear power share projection used by PBL is now lower and more in line with the current situation.
- From “on track” to “uncertain”: Mexico. Emissions from forestry, as well as GDP and electricity projections, are now higher than last year.
- From “not on track” to “uncertain”: EU28. The upper end of the range (NewClimate Institute projections) are based on Member States’ own projections focused on existing measures, as reported by the European Environment Agency, and further adapts to harmonise with historical data. This shows that the EU is not on track with currently implemented measures at the national level. These Member States' projections do not include new and additional measures needed to achieve agreed targets at the EU level, such as the national greenhouse gas emissions reduction targets for sectors outside of the Emissions Trading System (ETS) for the period up to 2030 (Effort Sharing Regulation), nor the 2030 targets on energy efficiency and renewable energy. The lower end of the range (PBL calculations) instead assumed full implementation of the ETS 2030 target, as well as the collective achievement of the effort sharing regulation, showing the EU to be on track. The projections by PBL do not account for the achievement of the new renewable energy and energy efficiency targets. EU Member States are developing National Energy and Climate Change plans with a view on detailing further policies and actions to achieve the agreed and legislated 2030 targets at the EU level.
- For some countries (e.g. Argentina, Brazil and Indonesia), there were substantial changes in historical LULUCF sector GHG emissions reported in the most recent inventory used in this report, compared to the older inventory used in the 2017 report. Combined with the change in data harmonisation year, the projections for Argentina became lower than in the 2017 report while the projections became higher for Brazil and Indonesia.

Other key findings on 2030 emissions projections include the following:

- Significant overachievement of NDCs: India, Russian Federation, Turkey and Ukraine. For these countries, the current policies scenario projections for 2030 are more than 10% lower than the unconditional NDC target levels. These countries could revise their NDCs with more ambitious targets under the Paris Agreement's ratcheting mechanism.
- Uncertainty on Indonesia's emission levels: For Indonesia, there is large uncertainty in LULUCF sector GHG emissions due to peat fires, the emissions of which are included in the business-as-usual (BAU) emissions underlying the NDC target. The GHG emissions resulting from peat fires can be as large as 500 $MtCO_2e$/year. Indonesia is likely not on track to meet its NDC target, but the difference between the current policies projection and the NDC target depends strongly on the assumed peat fire emissions.

Three years after the adoption of the Paris Agreement, it is also time to review how countries' current policies scenario projections for 2030 have changed since 2015 (Table ES-1). The findings are as follows:

- Progress can be observed in six out of 13 countries (Australia, Canada, China, EU28, Turkey and the USA), where this year's current policies scenario projections are lower compared to the 2015 report. For a few countries (Australia, EU28), the growth rates of historical emissions up to 2016 were considerably lower than those projected in the 2015 report.
- Stagnation can be observed in India, Japan, Mexico (with a widened projection range) and Russian Federation, where the emissions projections for 2030 in this report were similar to those in the 2015 report.
- Reverse development is observed in four countries (Brazil, Indonesia, Mexico, and Republic of Korea), where the projected emission levels for 2030 in this report were found to be higher than those in the 2015 report.
  - For Brazil, the updated GHG inventory data, especially in the LULUCF sector, had a significant impact—the updated inventory shows an increasing trend of GHG emissions since 2010 with over 1,750 $MtCO_2e$/year for 2016 and reaching 13% to 30% above 2010 levels by 2030, while the 2015 report projected a decreasing emissions trend since 2010, with about 1,600 $MtCO_2e$/year for 2016 and reaching 10% below 2010 levels by 2030.
  - For Indonesia, the main difference is observed in the non-LULUCF sector; the historical emissions growth since 2009 has been faster than projected for the same period in the 2015 report and this report projects faster growth up to 2030 than projected in the 2015 report.
  - For Mexico, the updated inventory and to a greater extent, methodological changes to reflect uncertainties in the development of the energy sector, have resulted in a larger range for current policies projections.
  - For the Republic of Korea, the main difference is also observed in the non-LULUCF sector; the historical emissions growth since 2010 has been considerably faster than those projected for the same period in the 2015 report.

Table ES-1: Changes in current policies scenario projections since pre-Paris

| Country (incl. LULUCF unless otherwise stated) | 2030 projections | | | |
|---|---|---|---|---|
| | vs. 2010: this report | vs. 2010: 2015 report (den Elzen et al., 2015) | Change since 2015 [1)] | Meeting unconditional NDC with currently implemented policies |
| **Australia** | **-11% to -5%** | *+20% to +36%* | Lower | No |
| **Brazil** | **+13% to +30%** | *-12% to -9%* | Higher | No |
| **Canada** (excl. LULUCF) | **-9% to +11%** | *-5% to +17%* | Lower | No |
| **China** | **+18% to +35%** | *+46% to +53%* | Lower | Yes |
| **EU28** (excl. LULUCF) | **-33% to -20%** | *-23% to -10%* | Lower | Uncertain |
| **India** | **+109% to +129%** | *+103% to +132%* | Similar | Yes |
| **Indonesia** | **+140% to +175%** | *+1% to +5%* | Higher | No |
| **Japan** (excl. LULUCF) | **-16% to -7%** | *-17% to -6%* | Similar | No |
| **Mexico** | **+3% to +25%** | *+12% to +14%* | Similar | Uncertain |
| **Republic of Korea** (excl. LULUCF) | **+10% to +15%** | *-7% to +11%* | Higher | No |
| **Russian Federation** (excl. LULUCF) | **+8% to +13%** | *-3% to +25%* | Similar | Yes |
| **Turkey** (excl. LULUCF) | **+47% to +97%** | *+52% to +189%* | Lower | Yes |
| **United States of America (2025)** | **-19% to -7%** | *(-12% to +10%)* | Lower | No |

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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 |
| **$CH_4$** | methane |
| **CNG** | compressed natural gas |
| **$CO_2$** | carbon dioxide |
| **$CO_2e$** | carbon dioxide equivalent |
| **COP21** | UNFCCC Conference of the Parties 21st session (Paris) |
| **CPP** | United States of America's Clean Power Plan |
| **CSP** | concentrated solar power |
| **DESA** | UN Department of Economic and Social Affairs |
| **DRC** | Democratic Republic of the Congo |
| **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 |
| **$NF_3$** | 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) |
| **GWh** | gigawatt-hour (billionwatts per hour) |
| **GWP** | Global Warming Potential |
| **$H_2$** | hydrogen |
| **Ha** | hectare |
| **HWP** | harvested wood products |
| **HEPS** | High Energy Performance Standards |
| **HFC** | hydrofluorocarbon |
| **ICCT** | International Council on Clean Transportation |
| **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 |

# Acronyms (continued)

| | |
|---|---|
| **LULUCF** | land use, land-use change, and forestry |
| **MEPS** | Minimum Energy Performance Standards |
| **MJ** | megajoule (million joules) |
| **$Mm^3$** | mega cubic metres (million cubic metres) |
| **mpg** | miles per gallon |
| **Mt** | megatonne (million tonnes) |
| **Mtoe** | million tonnes of oil equivalent |
| **MW** | megawatt (million watts) |
| **$N_2O$** | nitrous oxide |
| **N/A** | not available |
| **NAMA** | Nationally Appropriate Mitigation Actions |
| **NC6** | Sixth National Communication |
| NRE | New and renewable energy |
| **NCRE** | Non-Conventional 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 |
| **PV** | photovoltaic |
| **RE** | renewable energy |
| **REC** | Renewable Energy Certificate |
| **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 |
| **REDD-PAC** | REDD+ Policy Assessment Centre |
| **RPS** | renewable portfolio standards |
| **$SF_6$** | sulphur hexafluoride |
| **SSP2** | Shared Socio-economic Pathways middle scenario |
| **t** | tonne (thousand kilograms) |
| **tce** | tonne coal equivalent (29.288 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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This update builds on the project's 2017 update report (Kuramochi et al., 2017) as well as on its policy development update document published in April 2018 (NewClimate Institute, PBL IIASA, 2018). The calculations by NewClimate Institute are largely based on its analyses for and informed by the Climate Action Tracker project jointly carried out with Ecofys and Climate Analytics, while those by PBL are based on scenario development for the CD-LINKS project.

This report has been prepared by PBL/NewClimate Institute/IIASA under contract to European Commission, DG CLIMA (EC service contract N° 340201/2017/64007/SER/CLIMA.C1) started in December 2017.

# 1 Introduction

## 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 new international climate policy agreement for the post-2020 period (UNFCCC, 2015a). In the lead-up to COP21, governments were asked to put forward offers 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, 2015b). As of 13 July 2018, 179 Parties covering more than 89% (Climate Analytics, 2018) of global GHG emissions have ratified the Paris Agreement, and with each ratification their INDCs became "nationally determined contributions" (NDCs).

The urgency for enhanced action to achieve the long-term goal of the Paris Agreement is more evident than ever—the recently published 1.5℃ special report by the Intergovernmental Panel on Climate Change (IPCC) shows that global $CO_2$ emissions need to reach net zero by around 2050 to limit warming to 1.5℃ with no or limited overshoot (IPCC, 2018). 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.

## Objectives

This report, prepared by NewClimate Institute, PBL Netherlands Environmental Assessment Agency and IIASA presents an up-to-date assessment of progress by 25 countries toward the achievement of the mitigation components of the 2025/2030 targets (NDCs and INDCs) presented in the context of the Paris Agreement as well as their progress towards their 2020 pledges under the UNFCCC Cancún Agreements. More specifically, the report provides an overview of projected GHG emissions up to 2030, taking into account existing and in some cases planned climate and energy policies, and compares them with the targeted emissions under NDCs and INDCs.

The 25 countries assessed in this report are: Argentina, Australia, Brazil, Canada, Chile, China, Colombia, Democratic Republic of the Congo (DRC), Ethiopia, the European Union (EU), India, Indonesia, Japan, Kazakhstan, Mexico, Morocco, the Philippines, Republic of Korea, the Russian Federation, South Africa, Saudi Arabia, Thailand, Turkey, Ukraine, and the United States. These 25 countries cover all of the G20 countries (excluding the four individual EU member states) and accounted for about 80% of total global GHG emissions in 2017 (JRC/PBL, 2014).[1]

Hereafter we will use the term NDC throughout the report, given all but two of the 25 countries (Russian Federation and Turkey) assessed in this report have ratified the Paris Agreement.

In this report, the current policies scenario assumes that no additional mitigation action is taken beyond currently implemented climate policies as of a cut-off date. Whenever possible, current policy trajectories reflect all adopted and implemented policies, which are defined here as legislative

[1] The emissions data from the EDGAR database excludes short-cycle biomass burning (e.g. agricultural waste burning and Savannah burning) but includes other biomass burning (e.g. forest fires, post-burn decay, peat fires and decay of drained peatlands) and carbon emissions/removals of land-use, land-use change and forestry (LULUCF).

decisions, executive orders, or their equivalent. This excludes publicly announced plans or strategies, while policy instruments to implement such plans or strategies would qualify. Thus, we do not automatically assume that policy targets 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).

## Summary of methods

NewClimate Institute, IIASA and PBL have estimated the impact of the most effective current policies on future GHG emissions. The main updates and methodological changes made in this report from our 2017 report (Kuramochi et al., 2017) include the following:

- Policy developments since the 2017 report have been taken into account in the emissions projections (cut-off date: 1 July 2018), based on our April policy update document (NewClimate PBL IIASA, 2018) and the periodical updates under the European CD-LINKS project (CD-LINKS, 2018).[2]
- Country-level current policies packages for quantification in GHG emissions scenarios were reviewed by in-country experts involved in the CD-LINKS project (CD-LINKS, 2018) to identify policies, not limited to those focused on energy and climate, expected to deliver significant impact.
- Historical GHG emissions data was taken from latest inventories submitted to the UNFCCC (cut-off date: 1 July 2018).
- GHG emissions projections under current policies were harmonised to the latest historical emissions data described above.[3] The harmonisation year was changed to 2016 for Annex I countries (previously 2015) and the latest data year for non-Annex I countries (previously 2010 for most countries).
- 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.

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 1).

[2] The policy impact quantification (including decisions on whether the policies would be fully implemented) has been updated for all countries except for Colombia and Ethiopia.

[3] 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 1: Sources for the official estimates of emissions in 2020 and 2030 under pledge and NDC case and current policies scenarios for the 25 countries.

| Country | 2020 pledge case | NDC case [1)] | Current policies scenario |
|---|---|---|---|
| **Argentina** | No pledge | NDC | Ministry of the Environment and Sustainable Development Argentina (Government of Argentina, 2016) |
| **Australia** | Australian Government (2016) | NDC | UNFCCC (2018a) [2)] |
| **Brazil** | Government of Brazil (2010) | NDC | N/A |
| **Canada** | Government of Canada (2016) | NDC; Government of Canada (2017a) | UNFCCC (2018a) [2)] |
| **China** | The People's Republic of China (2012) | N/A | N/A |
| **Chile** | No pledge | N/A | N/A |
| **Colombia** | No pledge | NDC | N/A |
| **D.R. Congo** | No pledge | NDC | N/A |
| **Ethiopia** | No pledge | NDC | N/A |
| **EU28** | EEA (2014) | NDC | EEA (2017); European Commission (2017b, 2016a); E3MLab and IIASA (2018) [2)] |
| **India** | Planning Commission Government of India (2011, 2014) | N/A | N/A |
| **Indonesia** | BAPPENAS (2015) | NDC | N/A |
| **Japan** | Government of Japan (2016) | NDC | N/A [2)] |
| **Kazakhstan** | N/A | NDC | N/A [2)] |
| **Mexico** | NCCS (2013) | NDC | N/A |
| **Morocco** | No pledge | NDC | N/A |
| **The Philippines** | No pledge | N/A | N/A |
| **Republic of Korea** | Republic of Korea (2016) | NDC | N/A |
| **Russian Federation** | Government of Russian Federation (2014) | INDC | UNFCCC (2018a) [2)] |
| **Saudi Arabia** | No pledge | N/A | N/A |
| **South Africa** | Department of Environmental Affairs Republic of South Africa (2011a, 2011b) | NDC | N/A |
| **Thailand** | N/A | NDC | N/A |
| **Turkey** | No pledge | INDC | Republic of Turkey Ministry of Environment and Urbanization (2016) |
| **Ukraine** | N/A | NDC | N/A [2)] |
| **USA** | U.S. Department of State (2016a) | NDC | U.S. Department of State (2016a) |

*[1)] INDC and NDC documents were taken from UNFCCC (2015b, 2018c). We considered that the NDC target is reported 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, Canada, EU28 and Russian Federation we refer to the "With measures" scenario projections reported in the Third Biennial Reports (BR3) submitted to the UNFCCC. For Japan, Kazakhstan and Ukraine, we did not find any scenario projections comparable by definition to our current policies scenario projections.*

The calculations by **NewClimate Institute** are largely based on its analyses for, and informed by, the Climate Action Tracker project jointly carried out with Ecofys and Climate Analytics (CAT, 2017, CAT, 2018a), and used existing scenarios from national and international studies (e.g. IEA's World Energy Outlook 2017) as well as their own calculations of the impact of individual policies in different subsectors.

**PBL** has updated their calculations of the impact 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) (www.pbl.nl/ndc). The starting point for the calculations of the impact of climate policies is the latest SSP2 (no 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 project (CD-LINKS, 2018, NewClimate Institute, 2016), were added to that baseline. 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.

Both NewClimate 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). For PBL, IIASA's LULUCF $CO_2$ projections were added to the IMAGE GHG emissions projections excluding LULUCF $CO_2$. Although only emissions projections excluding LULUCF $CO_2$ 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). LULUCF non-$CO_2$ emissions were taken from the IMAGE model for the PBL projections. For the NewClimate projections, the LULUCF non-$CO_2$ emissions from the last reported year were held constant throughout the entire projection period. For Annex I countries this last reported year is 2016. For non-Annex I countries the last reported year can be found in A1 of the Appendix.

In this report, GHG emission values are expressed in terms of global warming potentials (GWPs) as stated in a country's NDC, unless otherwise noted.

## Limitations of this report

It should be noted that 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 (Höhne et al., 2018, Pan et al., 2017, Robiou du Pont et al., 2016). 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.

Nevertheless, 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.

There are a number of methodological limitations related to the current assessment, which are largely attributable to the differences in the nature and characteristics of NDCs and climate policies across countries.

- First, this report considers a wide range of effective national climate and energy policies, but does not provide a complete assessment of all policies. This has the risk of underestimating or overestimating the total impact of a country's policies on GHG emissions.
- Second, existing policies may change and/or be abandoned for a variety of reasons, and new policies may be implemented. This implies that all numbers are subject to change; this study reflects the current state.
- Third, countries are implementing policies in various areas to a varying degree. 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; some countries could have implementation barriers (e.g. fossil fuel subsidies) alongside renewable energy support policies.
- Fourth, for bottom-up calculations performed by NewClimate Institute using external emissions scenarios from various sources, it is not always fully clear how the impacts of existing policy measures were quantified by those sources.
- Fifth, 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.

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 datasets used in this study as well as an overview table of GHG emissions under NDCs and current policies. Detailed descriptions of the quantification of future GHG emissions under NDCs and current policies are provided in a supporting information document for each country on the NewClimate Institute website.[4]

[4] https://newclimate.org/publications/

# 2 Key findings

Countries make progress toward their 2020 pledges and NDC targets to varying degrees (Table 2).

Not all major emitting countries are expected to meet their **2020 pledges**:

- Nine countries (Brazil, China, EU28, India, Japan, Mexico, Russian Federation, Thailand, Ukraine) are on track to meet their 2020 pledges with implemented policies.
- Seven countries (Australia, Canada, Indonesia, Kazakhstan, Republic of Korea, South Africa, the USA) are projected to miss their 2020 pledges.

The assessment results remained the same as in the 2017 report for all countries. Eight countries (Argentina, Chile, Colombia, D.R. Congo, Ethiopia, Morocco, Philippines, Saudi Arabia) did not submit their 2020 pledges while one country, Turkey, was not obligated to submit its Cancun pledge (UNFCCC, 2010).

The degree to which countries/regions are likely to **achieve their NDCs** under current policies was found to vary:

- Countries likely or roughly on track to achieve or even overachieve their self-determined unconditional NDC targets with implemented policies are: China, Colombia, India, Russian Federation, Saudi Arabia, Turkey and Ukraine.
- Countries that require additional measures to achieve their 2030 targets are: Argentina, Australia, Brazil, Canada, Chile, D.R. Congo, Ethiopia, Indonesia, Japan, Kazakhstan, Morocco, Republic of Korea, South Africa, Thailand, the Philippines and the United States.
- For EU28 and Mexico, it is uncertain if they are on track to meet their NDC targets. For both countries, NewClimate Institute projections were higher than the NDC emission levels whereas the PBL projections were lower than the NDC target emission levels.

The assessment results have changed for the following countries:

- From “on track” to “not on track”: Brazil and Japan.
  - For Brazil, the main reason for the change is the GHG inventory data update for the LULUCF sector, which showed higher emission levels than in the inventory data used in the 2017 report.
  - For Japan, the main reason for the change is due to the change in nuclear power share projection by PBL, which is now more in line with the current situation in Japan.
- From “not on track” to “uncertain”: EU28. The upper end of the range (NewClimate Institute projections) are based on Member States’ own projections focused on existing measures, as reported by the European Environment Agency, and further adapts to harmonise with historical data. This shows that the EU is not on track with currently implemented measures at the national level. These Member States' projections do not include new and additional measures needed to achieve agreed targets at the EU level, such as the national greenhouse gas emission reduction targets for sectors outside of the Emissions Trading System (ETS) for the period up to 2030 (Effort Sharing Regulation), nor the 2030 targets on energy efficiency and renewable energy. The lower end of the range (PBL calculations) instead assumed full implementation of the ETS 2030 target, as well as the collective achievement of the effort sharing regulation, showing the EU to be on track. The projections by PBL do not account for the achievement of the new renewable energy and energy efficiency targets. EU Member States are developing National Energy and Climate Change plans with a view on detailing further policies and actions to achieve the agreed and legislated 2030 targets at the EU level.

- From “on track” to “uncertain”: Mexico. Our evaluation changed from our 2017 report mainly due to updated LULUCF values for historical and projected emissions, and updated GDP and electricity projections for NewClimate Institute calculations. Less prominently, an update of Mexico’s GHG emissions inventory has also resulted in a slight change in the historical emissions.
- From “not on track” to “on track”: Saudi Arabia. The change in rating is mainly due to the updated data harmonisation year.
- For Argentina, the projected emissions were about 15% lower than the 2017 projections due to the harmonisation with 2014 levels instead of 2010 levels (2017 report), which leads to lower projections as the GHG emissions have declined over the period 2010–2014.

Other key findings on 2030 emissions projections include the following:

- For four countries (India, Russian Federation, Turkey and Ukraine), current policies scenario projections for 2030 were found to be more than 10% lower than the unconditional NDC target levels. These countries could revise their NDCs with more ambitious targets by 2020 under the Paris Agreement’s ratcheting mechanism.
- For Indonesia there is large uncertainty in LULUCF sector GHG emissions due to peat fires, the emissions of which are included in the business-as-usual (BAU) emissions underlying the NDC target. The GHG emissions resulting from peat fires can be as large as 500 $MtCO_2e$/year. Indonesia is likely not on track to meet its NDC target, but the difference between the current policies projection and the NDC target depends strongly on the assumed peat fire emissions in the harmonisation year.
- For some countries (e.g. Argentina, Brazil and Indonesia), there were substantial changes in historical LULUCF sector GHG emissions reported in the most recent inventory used in this report compared to the older inventory used in the 2017 report. Combined with the change in data harmonisation year, the projections for Argentina became lower than in the 2017 report while the projections became higher for Brazil and Indonesia.
- For Kazakhstan, the 2020 and 2030 target emission levels were lower and the current policies scenario projections were higher than in the 2017 report due to the major changes in historical emissions reported in the 2018 national GHG inventory.
- Currently implemented policies do not prevent emissions (sector coverage consistent with the NDC targets) from increasing from 2010 levels by 2030, not only in developing countries (Argentina, Brazil, China, DRC, Ethiopia, India, Indonesia, Kazakhstan, Morocco, the Philippines, Russian Federation, Saudi Arabia, South Africa, and Thailand) but also in OECD countries (Chile, Mexico, Republic of Korea, and Turkey). The 2030 GHG emissions in Canada and Ukraine are projected to be roughly at 2010 levels (although for Canada with a large projection range), while they are projected to remain below 2010 levels under current policies for Australia, Colombia Japan, the EU28, and the USA.

Table 2: Progress of countries toward meeting their 2020 pledges and NDC targets. Asterisks (*) denote that a country's current policies scenario projection is more than 10% below the NDC emission levels.

| Country | Share in global GHG emissions excluding LULUCF in 2012 (JRC/PBL, 2014) | On track to meet the targets with current policies? (in bold when the assessment changed from the 2017 report) | | |
|---|---|---|---|---|
| | | Cancun Pledges | NDC: unconditional | NDC: conditional |
| **Argentina** | 0.8% | (no pledge) | No | No |
| **Australia** | 1.3% | No | No | --- |
| **Brazil** | 2.4% | Yes | **No** | No |
| **Canada** | 1.5% | No (left KP-CP2) | No | --- |
| **Chile** | 0.2% | No | No | No |
| **China** | 26.1% | Yes | Yes [1)] | --- |
| **Colombia** [2)] | 0.3% | (no pledge) | Yes | Yes |
| **D.R. Congo** | 0.1% | (no pledge) | (partially conditional) | No |
| **Ethiopia** [2)] | 0.3% | (no pledge) | --- | No |
| **EU28** | 9.9% | Yes | **Uncertain** [3)] | --- |
| **India** | 7.4% | Yes | Yes* | Yes |
| **Indonesia** | 1.9% | No | No | No |
| **Japan** | 2.9% | Yes | **No** | --- |
| **Kazakhstan** | 0.7% | No | No | No |
| **Mexico** | 1.4% | Yes | **Uncertain** | No |
| **Morocco** | 0.2% | (no pledge) | No | No |
| **Philippines** | 0.4% | (no pledge) | --- | No |
| **Republic of Korea** | 1.4% | No (target rescinded domestically) | No [4)] | --- |
| **Russian Federation** | 4.9% | Yes | Yes* | --- |
| **Saudi Arabia** | 1.2% | (no pledge) | **Yes** | --- |
| **South Africa** | 1.0% | Yes | No (2030) | --- |
| **Thailand** | 0.9% | Yes | No | --- |
| **Turkey** | 1.0% | (no pledge) | Yes* | --- |
| **Ukraine** | 0.9% | Yes | Yes* | --- |
| **USA** | 13.2% | No | No | --- |

*[1)] An increase in coal consumption in 2017 is reported to have led to an increase in $CO_2$ emissions (Peters, 2017), but this is not captured in our analysis.*

*[2)] Projections not updated from the 2017 report.*

*[3)] The EU has recently adopted a large package of policies in several areas to achieve the NDC target. In this study, they are considered as planned policies (not quantified in this report) because they have just been adopted and, therefore, we cannot assess the implementation status.*

*[4)] The Republic of Korea recently published a new energy supply and demand outlook as well as a revised NDC implementation roadmap. In this report, these government strategy documents are considered as planned policies.*

We also assessed how countries' current policies scenario projections for 2030 have changed since before Paris. Table 3 presents the findings from the comparison with our 2015 update report (den Elzen et al. 2015). We compared the emissions relative to 2010 levels reported in the two reports; we did not directly compare the emissions in absolute terms due to the differences in GWPs and the historical emissions dataset used in the two studies. The findings are as follows:

- Six out of 13 countries (Australia, Canada, China, EU28, Turkey and the USA) show lower current policies scenario projections compared to the 2015 report. For a few countries (Australia, EU28), the growth rates of historical emissions up to 2016 were considerably lower than those projected in the 2015 report.
- For India, Japan, Mexico (with a wider projection range) and Russian Federation, the emissions projections for 2030 in this report were similar to those in the 2015 report.
- For the other four countries (Brazil, Indonesia, Mexico, and Republic of Korea), the projected emission levels for 2030 in this report were found to be higher than those in the 2015 report.
  - For Brazil, the updated GHG inventory data, especially in the LULUCF sector, had a significant impact—the updated inventory shows an increasing trend of GHG emissions since 2010 with over 1,750 $MtCO_2e$/year for 2016 and reaching 13% to 30% above 2010 levels by 2030, while the 2015 report projected a decreasing emission trend since 2010, with about 1,600 $MtCO_2e$/year for 2016 and reaching 10% below 2010 levels by 2030.
  - For Indonesia, the main difference is observed in the non-LULUCF sector; the historical emissions growth since 2009 has been faster than projected for the same period in the 2015 report and this report projects faster growth up to 2030 than projected in the 2015 report.
  - For Mexico, the updated inventory and to a greater extent, methodological changes to reflect uncertainties in the development of the energy sector, have resulted in a larger range for current policies scenario projections.
  - For the Republic of Korea, the main difference is also observed in the non-LULUCF sector; the historical emissions growth since 2010 has been considerably faster than projected for the same period in the 2015 report.

Table 3: Changes in current policies scenario projections since pre-Paris

| Country (incl. LULUCF unless otherwise stated) | 2030 projections | | | | Possible explanations for the changes in projections | Policies implemented since 2015 |
|---|---|---|---|---|---|---|
| | vs. 2010: this report | vs. 2010: 2015 report (den Elzen et al., 2015) | Change since 2015 [1)] | On track for NDC (unconditional) | | |
| **Australia** | **-11% to -5%** | *+20% to +36%* | Lower | No | • Lower historical emissions growth 2010 to 2016 than projected in the 2015 report | • Revised / additional renewable energy targets<br>• Domestic implementation of Kigali Amendment to reduce HFCs |
| **Brazil** | **+13% to +30%** | *-12% to -9%* | Higher | No | • Revised emission inventory (in particular LULUCF) | • RenovaBIO to improve carbon intensity of biofuels [2)] |
| **Canada** (excl. LULUCF) | **-9% to +11%** | *-5% to +17%* | Lower | No | • Historical growth of emissions from 2010 to 2016 close to the lower bound projections in the 2015 report | • Regulations to address methane in the oil and gas sector<br>• Regulation of HFCs<br>• Forest Bioeconomy Framework [2)] |
| **China** | **+18% to +35%** | *+46% to +53%* | Lower | Yes | • Lower future GDP growth assumptions vs. 2015 projections<br>• Higher renewable technology forecasts | • 13th Five Year Plan<br>• Green Industry Development Plan<br>• Emissions trading program<br>• Made in China 2025 (standards for auto-industry) |
| **EU28** (excl. LULUCF) | **-33% to -20%** | *-23% to -10%* | Lower | Uncertain | • Lower historical emissions growth from 2010 to 2016 than projected in the 2015 report | • Effort sharing decision<br>• F-gas regulation<br>• Reform of the ETS |

| Country (incl. LULUCF unless otherwise stated) | 2030 projections | | | | Possible explanations for the changes in projections | Policies implemented since 2015 |
|---|---|---|---|---|---|---|
| | vs. 2010: this report | vs. 2010: 2015 report (den Elzen et al., 2015) | Change since 2015 [1)] | On track for NDC (unconditional) | | |
| **India** | **+109% to +129%** | *+103% to +132%* | Similar | Yes | • Upward revision of renewable electricity generation forecasts | • National Electricity Plan<br>• Upward revision of RE capacity targets |
| **Indonesia** | **+140% to +175%** | *+1% to +5%* | Higher | No | • LULUCF: revised emission inventory and higher emission growth projections | • National Electricity Plan (target update);<br>• Electricity Supply Business Plan (capacity targets update) |
| **Japan** (excl. LULUCF) | **-16% to -7%** | *-17% to -6%* | Similar | No | • Larger than expected energy savings after 2011<br>• Higher projection for renewable electricity<br>• Larger uncertainty on coal and nuclear power | • 2018 Basic Energy Plan<br>• Long-term energy demand and supply outlook |
| **Mexico** | **+3% to +25%** | *+12% to +14%* | Similar (with larger range) | Uncertain | • Revised emission inventory<br>• Change in methodology | • General Law on Climate Change<br>• National Transition Strategy to promote the use of clean fuels and technologies;<br>• REDD+ National Strategy |

| Country (incl. LULUCF unless otherwise stated) | 2030 projections | | | | Possible explanations for the changes in projections | Policies implemented since 2015 |
|---|---|---|---|---|---|---|
| | vs. 2010: this report | vs. 2010: 2015 report (den Elzen et al., 2015) | Change since 2015 [1)] | On track for NDC (unconditional) | | |
| **Republic of Korea** (excl. LULUCF) | **+10% to +15%** | *-7% to +11%* | Higher | No | • Higher emission growth 2010 to 2014 than previously projected<br>• Change in methodology<br>• Change of government | • Domestically rescinded the 2020 target<br>• New Plan for Electricity Supply and Demand [2)] |
| **Russian Federation** (excl. LULUCF) | **+8% to +13%** | *-3% to +25%* | Similar | Yes | • Different GWP values used (AR4 vs. SAR) | • Strategy for development of building materials sector for the period up to 2020 and 2030 [2)] |
| **Turkey** (excl. LULUCF) | **+47% to +97%** | *+52% to +189%* | Lower | Yes | • Lower historical emissions growth 2010 to 2016 than projected<br>• Change in methodology | • Energy Efficiency Action Plan [2)] |

| Country (incl. LULUCF unless otherwise stated) | 2030 projections | | | | Possible explanations for the changes in projections | Policies implemented since 2015 |
|---|---|---|---|---|---|---|
| | vs. 2010: this report | vs. 2010: 2015 report (den Elzen et al., 2015) | Change since 2015 [1)] | On track for NDC (unconditional) | | |
| **United States of America (2025)** | -19% to -7% | *(-12% to +10%)* | Lower | No | • Revised historical emission inventory<br>• Higher technology forecasts than projected in 2015 report (renewables and gas) | • Replacement of the Clean Power Plan;<br>• freezing light-duty vehicle standards;<br>• rescinded appliance standards;<br>• weakened methane standards from oil and gas production<br>• HFC regulations not enforced |

*[1)] We evaluated as "lower" / "higher" when both upper and lower bounds of the updated emission range was lower / higher than in those in the 2015 report. "Similar" was applied when the updated emission range was within that in the 2015 report. When the updated emission range contained the entire 2015 emission range, which was the case for Mexico, the evaluation was based on the central estimate, i.e. average of the upper and lower bound values. Mexico's central estimate was only 1% higher than that in the 2015 and thus rated as "similar".*

*[2)] Not quantified in our assessment.*

Uncertainty around future estimates remains high:

- In the United States, the Trump administration officially communicated to the United Nations its intent to abandon the Paris Agreement and cease implementation of the NDC (The Representative of the United States of America to the United Nations, 2017). It has also rolled back or proposed to weaken a number of key Obama administration climate policies, including the Clean Power Plan, light-duty vehicle standards, and HFC regulations. At the same time, several sub-national and non-state initiatives are emerging, including the "America's Pledge" launched by California Governor Jerry Brown and Former Mayor of New York Michael Bloomberg to move forward with the "country's commitments under the Paris Agreement — with or without Washington" (America's Pledge Initiative on Climate, 2017). The potential mitigation impact of these actions was not quantified in this study, but other studies have estimated that recorded and quantified non-state and subnational targets, if fully implemented, could result in emissions that are 17 to 24% below 2005 levels by 2025 (incl. LULUCF) (Data-Driven Yale et al., 2018, America's Pledge Initiative on Climate, 2018).
- Canada is currently expected to apply the net-net accounting rule for the LULUCF sector, but there is still some uncertainty on its treatment and it is possible that a different accounting approach for the LULUCF sector will be applied.
- In Japan, the uncertainties around the future role of nuclear power continue to affect the emissions projections for the power sector.
- In the Republic of Korea, it remains to be seen if the policy direction to reduce reliance on nuclear and coal power while increasing renewables in the electricity sector laid out in the new Plan for Energy Supply and Demand published in 2017 will be fully implemented.
- In Australia, the effect of policies replacing the carbon pricing mechanism is difficult to assess. In addition, the government recently removed mandatory GHG emission reductions for the power sector from the National Energy Guarantee plan, the effect of which has not yet been estimated in our projections.
- China and India have pledges indexed to economic growth, implying that the absolute emission target level is very uncertain.
- Emissions projections for Turkey and other developing countries are subject to considerable uncertainty related to economic growth.
- In Argentina, Colombia, DRC, Ethiopia, Indonesia and the Philippines, emissions from land use, land use change, and forestry (LULUCF), which are very uncertain, strongly influence total emissions projections.

# 3 Results per country

This section summarises the results per country for current policies, 2020 pledges, and 2030 targets (NDCs). For each country section, the following are presented:

- Description of 2020 pledge and NDC, including the latest inventory data year used for harmonisation;
- Overview of key climate change mitigation policies;
- Projected impact of climate policies on greenhouse gas emissions (absolute, relative to 2010 levels, and per capita).

Each country section presents emissions projection figures. The left-panel presents emissions for sectors consistent with those covered by the NDC, while other panels are presented for additional information.

Regarding LULUCF emissions, 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, 2017).

The Appendix provides explanations on historical GHG emissions data sources and the harmonisation of GHG emissions projections to the historical data (A1), quantification of 2020 pledge and NDC emissions levels (A2), general description of calculation methods used by NewClimate Institute, PBL and IIASA to quantify emissions projections under current policies (A3 to A5). Country-specific details on emissions projections under current policies are described in the Supporting Information.

## Argentina

Argentina pledged to limit its GHG emissions to 483 $MtCO_2e$/year by 2030 unconditionally and to 369 $MtCO_2e$/year by 2030, conditional on various elements (both numbers incl. LULUCF) (see Table 1). With these targets, Argentina revised its earlier NDC of 15% below business-as-usual (BAU), moving to absolute emissions levels rather than a relative target and decreasing the resulting level of emissions in 2030. Argentina has not proposed a GHG reduction pledge for 2020.

The emissions projections for Argentina under current policies include the Biofuels Law, Renewable Energy Law, and afforestation projects. The short-term impact on net emissions from the afforestation projects may be limited and only provide an additional 5 $MtCO_2e$/year sequestration per year by 2030. The current policies scenario projection for 2030 was lowered by 100 $MtCO_2e$/year (about 15%) from our 2017 projection due to the updated data harmonisation year (2014, previously 2010); the GHG emissions have shown a decline between 2010 and 2014 mainly because the LULUCF emissions were sharply reduced after 2010.

Argentina is not yet on track to meet its unconditional NDC, and further mitigation actions are needed. The renewable energy share achieved through the current RenovAr auctions is far below the target under the Renewable Energy Law of 20% by 2025. New policies, not yet included in the calculations, are the recently adopted carbon tax (starting at US$10/$tCO_2$) and the Law No.27424 on the distributed generation of renewable energy sources under net metering, which is expected to enhance renewable energy deployment.

Table 4: Description of Argentina's NDC

| Indicator | NDC |
|---|---|
| Target: unconditional | • Limit GHG emissions to 483 $MtCO_2e$ in 2030 |
| 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 |
| Sectoral coverage | • Energy, agriculture, waste, industrial processes, LULUCF |
| General Accounting method | • IPCC 2006 guidelines; 100-year GWPs from the 2nd Assessment Report |
| GHGs covered | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs and $SF_6$ |
| Consideration of LULUCF | • Land use sector is included in the target<br>• Accounting approaches and methodologies are not specified |
| Other sector-level targets | • N/A |
| Use of bilateral, regional and international credits | • N/A |

*Note: Argentina has not set its 2020 pledge.*

Table 5: Overview of key climate change mitigation policies in Argentina (Ministry of the Environment and Sustainable Development, 2015, Ministerio de Justicia y Derechos Humanos, 2017, Ministerio de Energia y Mineria, 2016)

| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Economy-wide** | National Program for Rational and Efficient Use of Energy (PRONUREE) (2007) | • 10-12% of energy savings by 2016 in residential, public/private services<br>• Decrease electricity consumption by 6% compared to baseline scenario and energy savings of 1500 megawatts (MW) by 2016 |
| **Energy supply** | Renewable Energy Programme in Rural Markets (2000) | • Reduce GHG emissions by replacing small-diesel electricity generation with renewable energy systems |
| | Renewable Energy Law 27191. National Development Scheme for the Use of Renewable Energy Sources (RenovAr) (2016) [1)] | • Total individual electric consumption to be substituted with renewable sources given the following schedule: 8% by 2017, 18% by 2023 and 20% by 2025 |
| | PROBIOMASA: promotion of biomass energy (2013) [1)] | • Additional biomass capacity: each 200 MW electric and thermal by 2018, each 1325 MW electric and thermal by 2030 |
| | Energy Efficiency Project (2009) | • USD 99.44 million to reduce 10.7 $MtCO_2e$ by the end of 2016 are the global benefits of the Energy Efficiency Project |
| | Carbon tax on energy [1)] | • Starting at \$10/$tCO_2$ (adjusted every trimester). Targeting emissions from transport fuels, natural gas and coal, as well as the country's burgeoning oil and shale gas industry. |
| **Transport** | Biofuels Law (updated 2016) [2)] | • 12% requirement of biodiesel or ethanol blend in the gasoline from 2016 |
| **Industry** | N/A | • N/A |
| **Buildings** | Program for Rational and Efficient use of Energy in Public Buildings (2007) | • Various measures in line with the 10% energy savings by 2016 |
| **F-gases** | N/A | • N/A |
| *Table to be continued on next page* | | |

| | | |
|---|---|---|
| **Forestry & Agriculture** | Minimum Budgets for Environmental Protection of Native Forest (Presupuestos Minimos de Proteccion) (2007) (+) [3] | • 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) [3] | • To improve and maintain ecological and cultural processes in native forest and promote activities for a sustainable management of native forest<br>• Contributes to sustainable use of native forests through incorporating livestock activities in native forest area in a sustainable manner |
| | Investments for Cultivated forests (Inversiones Para Bosques Cultivados) (2008) | • Development of afforestation projects on a total of 500,000 hectares (Ha) of land based on economic incentives. |

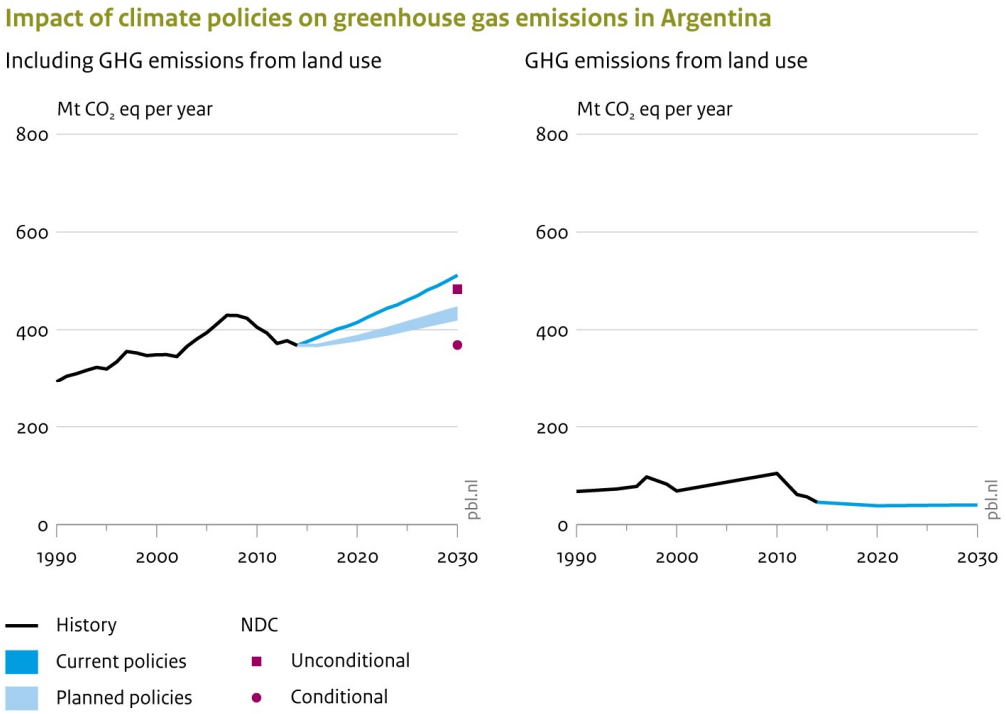
[1] *Not quantified in the NewClimate Institute projections.*

[2] *No information available on implementation status. For the current analysis, we have assumed full implementation.*

[3] *Not quantified in IIASA model projections.*

Table 6: Impact of climate policies on greenhouse gas emissions (including LULUCF) in Argentina. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emission values are based on IPCC Second Assessment Report (SAR)'s 100-year Global Warming Potential (GWP) values.

| **2010 GHG emissions, incl. LULUCF** | **2020 pledge and NDC** | | **Current policies** | | **Planned policies** |
|---|---|---|---|---|---|
| | **Official data** | **NewClimate estimates [conditional]** | **Official data** | **NewClimate estimates** | **NewClimate estimates** |
| Absolute: 405 $MtCO_2e$ | 369 to 483 $MtCO_2e$ by 2030 | 485 [370] $MtCO_2e$, 19% [-9%] by 2030 | 463 $MtCO_2e$, 3% by 2020 549 $MtCO_2e$, 23% by 2030 | 415 $MtCO_2e$, 2% by 2020 510 $MtCO_2e$, 26% by 2030 | 380 to 385 $MtCO_2e$, -6% to -5% by 2020 425 to 445 $MtCO_2e$, 4% to 10% by 2030 |
| Per capita: 9.8 $tCO_2e$/capita | N/A | 9.8 [7.5] $tCO_2e$/capita by 2030 | N/A | 9.1 $tCO_2e$/capita by 2020 10.4 $tCO_2e$/capita by 2030 | 8.3 to 8.5 $tCO_2e$/capita by 2020 8.6 to 9.0 $tCO_2e$/capita by 2030 |




Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 1: Impact of climate policies on greenhouse gas emissions in Argentina (including land use, i.e. LULUCF). Source: NewClimate Institute calculations excluding LULUCF based on its analysis for Climate Action Tracker (CAT, 2018a) and International Institute for Applied Systems Analysis (IIASA) calculations on LULUCF emissions and removals. Projections last updated: November 2018. Emission values are based on SAR GWP-100.

## Australia

The Australian government states that it is "on track" to meet its emissions target of 5% below 2000 levels by 2020 (Australian Government, 2015), and that the Emissions Reduction Fund (ERF) is one of the key measures to achieve the target. However, our current policies scenario projections that include the abatements of the ERF projects project emissions to exceed the pledge level (5% below 2010 levels by 2020). We therefore conclude that Australia is not on track to meet its pledge. This contrasting conclusion drawn from our assessment is partly due to the accounting approach for the emissions reductions purchased through ERF. The Australian Government (2015a) counts all emissions reductions purchased in 2015 (92 $MtCO_2e$) in the 2015/16 emissions reporting, although they occur over many years. In our analysis, we distributed the expected emissions reductions over the average contract period of nine years. The Australian government further considers that it will overachieve its unconditional 2020 target by 294 $MtCO_2e$ using surplus ("carryover") of the first commitment period of the Kyoto Protocol, and by 166 $MtCO_2e$ without carryover (Government of Australia, 2017a).

Australia has stated that it will also meet the 2030 targets (26% to 28% GHG reduction by 2030 from 2005 level) through policies that provide positive incentives to reduce emissions (Australian Government, 2016). At the core of Australia's climate change policies is the Emissions Reduction Fund and linked safeguard mechanisms.

Our current policies scenario projections for 2030 (5% to 11% below 2010 levels) are about 10 percentage points lower compared to our projections in the 2017 report due to higher renewable energy targets and enhanced forestry policy, but still show a significant difference with the NDC emission levels in 2030 (20% to 23% below 2010 levels). We therefore conclude that Australia is not on track to meet its NDC. Recently, the Australian government has removed mandatory GHG emission reductions for the power sector (26% by 2030 below 2005 levels) from the National Energy Guarantee plan (not quantified).

Table 7: Description of Australia's 2020 pledge and NDC

| Indicator | 2020 pledge | NDC |
|---|---|---|
| **Target: unconditional** | • 5% GHG reduction by 2020 from 2000 level<br>• Kyoto target: 108% of 1990 levels 2013-2020 | • 26 to 28% GHG reduction by 2030 from 2005 level |
| **Target: conditional** | • 15% and 25% GHG reduction by 2020 from 2000 level | • Not specified |
| **Sectoral coverage** | • All GHG emissions, including emissions from afforestation, reforestation and deforestation | • Economy wide |
| **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** | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, $SF_6$ and $NF_3$ | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, $SF_6$ and $NF_3$ |
| **Consideration of LULUCF** | • Land use sector is included<br>• Accounting approach is specified as Kyoto Protocol accounting rules (Article 3.7) [1)]<br>• Land use credits: 27 $MtCO_2e$ by 2020 | • Land use sector is included in the target<br>• Net-net approach will be used for emission accounting |
| *Table to be continued on next page* | | |

| | | |
|---|---|---|
| **Use of bilateral, regional and international credits** | • N/A | • N/A |

*1) Specifics of the accounting rules are elaborated in Iversen et al. (2014) .*

Table 8: Overview of key climate change mitigation policies in Australia (Australian Government, 2015, Australian Government, 2017a, Australian Government, 2017b). See Supporting Information for details.

| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Economy-wide** | Emissions Reduction Fund (ERF) (2014) (+) [1)] | • Auctions are set up to purchase emissions reductions at the lowest available cost, thereby contracting successful bidders |
| **Energy supply** | Renewable Energy Target (2010) (+) | • 25% of electricity should come from renewable sources by 2020, 35% by 2025 and 50% by 2030, compared to 13% in 2014. The new target[2)] for large-scale generation of 33,000 gigawatt-hours (GWh) in 2020 would double the amount of large-scale renewable energy being delivered by the scheme compared to current levels |
| **Transport** | Fuel tax (2006) [3)] | • Fuel tax for diesel and gasoline is set at AUD 0.3814 per litre |
| **Forestry & Agriculture, Waste** | Emissions Reduction Fund (2014): Vegetation & Agriculture | • Include protecting native forests by reducing land clearing, planting trees to grow carbon stocks, regenerating native forest on previously cleared land.<br>• Encourages 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.<br>• In total, 6.1 $MtCO_2e$/year reductions of LULUCF emissions in 2020 from 2010 expected. |
| | 20 Million Trees Programme (2014) | • Plant 20 million trees by 2020 (20,000 ha) to re-establish green corridors and urban forests. |
| | Emissions Reduction Fund (2014): Agriculture [4)] | • 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. |
| **Other** | Hydrofluorocarbon (HFC) emissions reduction under the Montreal Protocol (2017) | • Reduce HFC emissions by 55% by 2030, relative to 2010 (85% by 2036) |

*1) Not quantified in PBL TIMER model projections.*

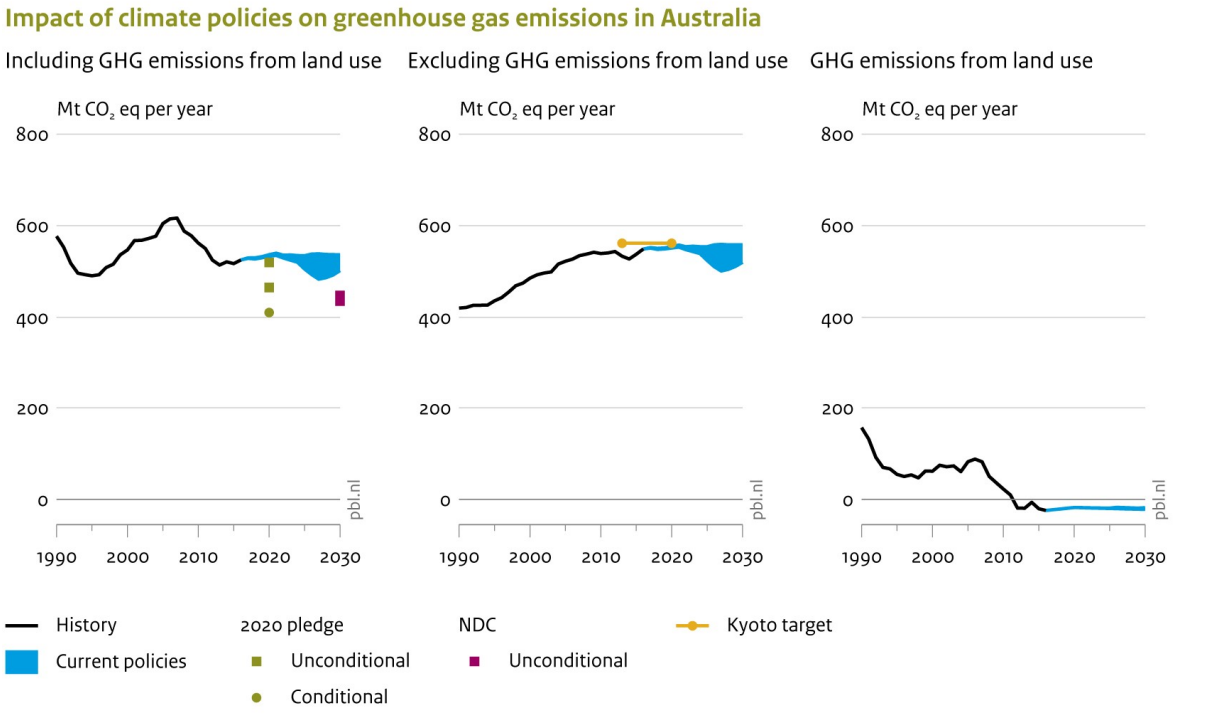
*2) The target was reduced in 2015 from its original 41,000 GWh (Scott, 2015)*

*3) OECD (2013). Policy instrument not quantified separately by NewClimate Institute and PBL.*

*4) Not quantified in IIASA model projections.*

Table 9: Impact of climate policies on greenhouse gas emissions (including LULUCF) in Australia. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emission values are based on IPCC Fourth Assessment Report (AR4) GWP-100.

| 2010 GHG emissions, incl. LULUCF | 2020 pledge and NDC | | Current policies | |
|---|---|---|---|---|
| | Official data | PBL and NewClimate estimates [conditional] | Official data | PBL and NewClimate estimates |
| Absolute: 562 $MtCO_2e$ | 530 $MtCO_2e$ by 2020 | 465 to 520 [410] $MtCO_2e$, -17% to -8% [-27%] by 2020<br><br>435 to 445 $MtCO_2e$, -23% to -20% by 2030 | 554 Mt $CO_2e$ by 2020<br>574 $MtCO_2e$ by 2030 | 535 $MtCO_2e$, -5% by 2020<br>500 to 535 $MtCO_2e$, -11% to -5% by 2030 |
| Per capita: 25.4 $tCO_2e$/capita | N/A | 18.3 to 20.5 [16.2] $tCO_2e$/capita in 2020<br><br>15.4 to 15.8 $tCO_2e$/capita by 2030 | N/A | 21.0 to 21.1 $tCO_2e$/capita by 2020<br>17.8 to 19.0 $tCO_2e$/capita by 2030 |




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

Figure 2: Impact of climate policies on greenhouse gas emissions in Australia (left panel: all gases and sectors, middle panel: excluding land use (i.e. LULUCF) and right panel: only land use). Source: PBL calculations and NewClimate Institute calculations adapted from Climate Action Tracker (CAT, 2018a) excluding LULUCF, and IIASA calculations on LULUCF emissions and removals. The LULUCF projections excludes removals from non-anthropogenic natural disturbances in line with Australia's 2017 GHG Inventory Submission to the UNFCCC (Government of Australia, 2017b). Projections last updated: November 2018. Emission values are based on AR4 GWP-100.

## Brazil

The main GHG mitigation policies in Brazil are in the LULUCF sector, i.e. the enforcement of the Brazilian Forest Code and efforts to reduce deforestation in the Amazon and Cerrado regions. Even though the annual deforestation rate in the Legal Amazon has risen during the last two years (PRODES, 2016), it is expected that successful implementation and enforcement of the current measures to reduce deforestation will lead to long-term reduction of net GHG emissions.

In our analysis, we account for the combined impacts of the different measures of the Forest Code, including control of illegal deforestation, the mandatory restoration of illegally deforested areas, the amnesty of legal reserves provided for small farmers, and the environmental reserve quota mechanism (Soterroni et al., 2018). If all implemented policies are successful, emissions (including those from LULUCF) may reach about 13% to 30% above 2010 levels by 2030. However, it should be noted that if environmental regulations and deforestation control policies are reversed or suspended, it has been estimated that net emissions from deforestation could increase by 850 to 1500 $MtCO_2e$/year by 2030 (Rochedo et al., 2018).

The revised GHG inventory data, especially on the LULUCF sector and the use of IPCC Fifth Assessment Report (AR5) GWP values, had a significant impact—the 2010 historical net GHG emissions including LULUCF were revised from over 1,700 $MtCO_2e$/year in the 2015 report to 1,400 $MtCO_2e$/year in the current report, which is mainly due to the lower net LULUCF $CO_2$ emissions. The net LULUCF $CO_2$ emissions reduced by 86% between 2005 and 2012 (Ministry of Science and Technology of Brazil, 2016), but recent data and analyses show increasing net LULUCF $CO_2$ emissions over the last two years, and any GHG emissions reductions have slowed down or even stopped (SEEG, 2017). The LULUCF $CO_2$ projections under current policies still show a decline from 2016 onwards, reaching 2010 levels by 2030. The resulting GHG emissions now reach 13% to 30% above 2010 levels by 2030, whereas the 2015 report projected a reduction of about 10%, and the 2017 report projected about 8% below to 11% above 2010 levels by 2030.

Our latest assessment shows that Brazil is not on track to meet its NDC with existing policies, which contrasts with the finding of the 2017 report that Brazil is likely on track to meet its NDC target. The main reason for our conclusion is due to the increasing deforestation emissions over recent years. The newly elected president of Brazil has indicated he wants to limit environmental constraints on agriculture (Associated Press, 2018). In its NDC, Brazil announced a 45% share of renewables in the energy mix by 2030, and a 75% share of renewables in its electricity supply by 2030, but we do not include these planned policies in our assessment.

Table 10: Description of Brazil's 2020 pledge and NDC

| Indicator | 2020 pledge | NDC |
|---|---|---|
| **Target: unconditional** | • Between 36.1 and 38.9% reduction by 2020 from a baseline scenario | • 37% GHG reduction by 2025 from 2005 level and indicative contribution of 43% GHG reduction by 2030 from 2005 level (equivalent to 4% to 8% below 2010 levels by 2030) |
| **Target: conditional** | • N/A | • N/A |
| **Sectoral coverage** | • Economy wide | • Economy wide |
| *Table to be continued on next page* | | |

| | | |
|---|---|---|
| **General Accounting method** | • 100-year GWPs from the IPCC Second Assessment Report (SAR) | • IPCC guidelines; 100-year GWPs from AR5 |
| **GHGs covered** | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, and $SF_6$ | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, and $SF_6$ |
| **Consideration of LULUCF** | • Land use sector is included in the target<br>• Accounting approaches and methodologies are not specified | • Land use sector is included in the target<br>• Accounting approaches and methodologies are not specified |
| **Use of bilateral, regional and international credits** | • N/A | • Possible use of market mechanisms that may be established under the Paris Agreement |
| **Other sector-level targets** | • N/A | • 45% share of renewables in total energy mix by 2030 |

Table 11: Overview of key climate change mitigation policies in Brazil (Ministry of Mines and Energy, 2012, Government of Brazil, 2008, Presidência da República Brasil, 2017)

| Sector | Policies (marked with "(+)" when mentioned in the NDC document) [1)] | Description |
|---|---|---|
| **Economy-wide** | 2020 pledge anchored in national law (2010) | • Not specified |
| **Energy supply** | 10-year National Energy Expansion Plan (2011) | • 16.5 GW wind, 13 GW biomass, 5.6 GW small hydropower and 88.5 GW large hydropower installed by 2025 (currently under construction)<br>• 41.4% renewable share in total primary energy supply by 2022 (45% by 2024) |
| | National Plan on Climate Change (2008) | • 16% renewable electricity (excl. hydro) by 2020 (supported by renewable energy auctions, Government of Brazil, 2007) |
| **Transport** | National Plan on Climate Change (2008) | • Not specified |
| | National Biodiesel Programme (2005) | • Biodiesel share in diesel of 7% from 2015 and 10% from 2019 onwards |
| | Ethanol Blending Mandate (1993) | • Bioethanol share in gasoline of 25% from 2015 onwards |
| | Inovar-Auto (2012) | • 30% tax on cars sold between 2013 and 2017, but not for cars meeting 1.82 MJ/km. Expected average fuel efficiency 1.14 MJ/pkm by 2017 |
| | RenovaBIO (2017) [2)] | • Improve carbon intensity of biofuels ($gCO_2e/MJ$) by 7% between 2017 and 2028 |
| *Table to be continued on next page* | | |

| | | |
|---|---|---|
| **Forestry & Agriculture** | The Brazilian Forest Code (2012) (+) | • Enforcement of the Brazilian Forest Code for the Cerrado region and the rest of Brazil<br>• Restoring and reforesting 12 million hectares of forests by 2030 |
| | National Plan on Climate Change (2008) | • Reducing deforestation rates in all Brazilian biomes, in order to reach zero illegal deforestation. |
| | The Low-Carbon Agriculture (ABC) Plan) (2010) (+) | • 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) | • 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) [3)] | • Focus on reducing the deforestation rates and forest degradation, as well as the incidence of forest fires in the Cerrado biome |

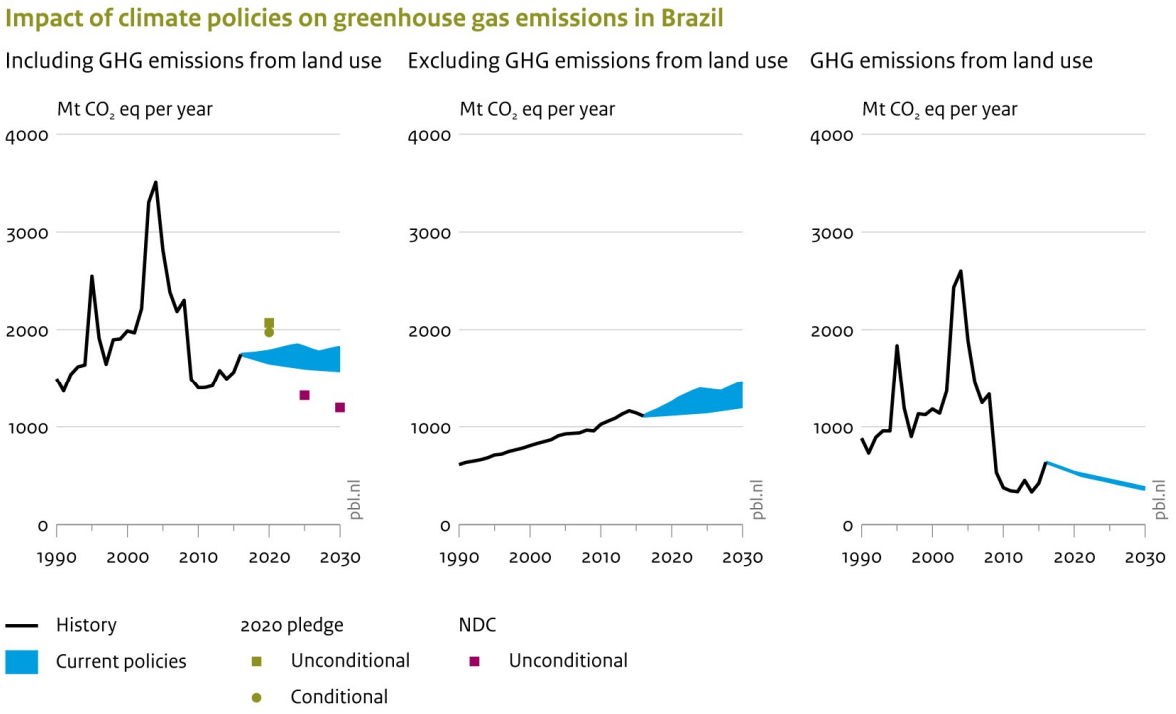
*[1)] The energy- and industry-related NDC policies are not quantified, but partly covered in the current policies projection*

*[2)] Not quantified in PBL TIMER model and NewClimate Institute projections*

*[3)] Not included separately in the IIASA model projections.*

Table 12: Impact of climate policies on greenhouse gas emissions (including LULUCF) in Brazil. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emission values are based on AR5 GWP-100.

| 2010 GHG emissions, incl. LULUCF | 2020 pledge and NDC | | Current policies | |
|---|---|---|---|---|
| | Official data | PBL and NewClimate estimates | Official data | PBL and NewClimate estimates |
| Absolute: 1,401 $MtCO_2e$ | 2,070 $MtCO_2e$ by 2020 | 1,975 to 2,070 $MtCO_2e$, 41% to 48% by 2020<br>1,195 $MtCO_2e$, -15% by 2030 | N/A | 1,660 to 1,780 $MtCO_2e$, 19% to 27% by 2020<br>1,585 to 1,820 $MtCO_2e$, 13% to 30% by 2030 |
| Per capita: 7.1 $tCO_2e$/capita | N/A | 9.2 to 9.7 $tCO_2e$/capita by 2020<br>5.3 $tCO_2e$/capita by 2030 | N/A | 7.8 to 8.3 $tCO_2e$/capita by 2020<br>7.0 to 8.1 $tCO_2e$/capita by 2030 |




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

Figure 3: Impact of climate policies on greenhouse gas emissions in Brazil (left panel: all gases and sectors, middle panel: excluding land use (i.e. LULUCF) and right panel: only land use). Source: NewClimate Institute calculations based on Climate Action Tracker (CAT, 2018a) and PBL calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals (REDD-PAC Brazil, 2015). Projections last updated: November 2018. Emission values are based on AR5 GWP-100).

## Canada

Canada's fuel efficiency standard for passenger vehicles has the largest projected effect on GHG emissions of Canada's climate policies and is harmonised with US standards. Another policy is the carbon standard for newly built coal-fired power plants, but this impact on future GHG emissions may be limited as it does not apply to existing power plants. As for non-$CO_2$ emissions, Canada has a Regulation of HFCs, while regulations to reduce $CH_4$ emissions from oil and gas will be implemented from 2020 onwards.

Under current policies, Canada is projected to emit about 635 to 770 $MtCO_2e$/year by 2030 excluding LULUCF (9% below 2010 levels to 11% above 2010 levels) and therefore, not meet its NDC (17% below 2005 level, or 25% below 2010 levels). Canada has recently proposed a plan to price carbon pollution that would require individual provinces to either place a direct price on carbon pollution or adopt a cap and trade system. This planned policy was not included in our analysis. Four provinces already have carbon pricing systems in place (considered as current policies). Other planned policies, not quantified here, includes a phase-out of traditional coal power, the clean fuel standard, and the interconnections of electricity grids. Our latest emissions projections are roughly the same as those in the 2017 report.

Historical net LULUCF emissions come from the GHG inventory data presented in the National Inventory report, which excludes emissions and removals from natural disturbances. The current policies scenario projections for the LULUCF sector have thereby been revised downwards compared to our earlier assessment to be consistent with the NDC target, which excludes emissions from natural disturbances.

Table 13: Description of Canada's 2020 pledge and NDC

| Indicator | 2020 pledge | NDC (5 October 2016) |
|---|---|---|
| **Target: unconditional** | • 17% GHG reduction by 2030 from 2005 level | • 30% GHG reduction by 2030 from 2005 level |
| **Target: conditional** | • N/A | • N/A |
| **Sectoral coverage** | • Economy-wide | • Economy-wide |
| **General Accounting method** | • IPCC guidelines; 100-year GWPs from AR4 | • IPCC guidelines; 100-year GWPs from AR5 |
| **GHGs covered** | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, $SF_6$ and $NF_3$ | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, $SF_6$ and $NF_3$ |
| **Consideration of LULUCF** | • Land use sector is included in the target<br>• Net-net approach will be used for emission accounting [1)]<br>• Excludes emissions from natural disturbances<br>• LULUCF accounting could produce 19 $MtCO_2e$ of credits per year (CAT, 2015, Government of Canada, 2014) [2)] | • Land use sector is included in the target<br>• Accounting approach not specified, approach being used to account for the LULUCF sector being examined [1)]<br>• Excludes emissions from natural disturbances and only account for anthropogenic emissions and removals |
| **Use of bilateral, regional and international credits** | • N/A | • International mechanisms may be used |

*[1)] Canada does, however, specify that it intends to use the production approach for accounting for harvested wood products (HWP) consistent with IPCC guidance (Government of Canada, 2017a, Iversen et al., 2014)*

*[2)] Credits are not accounted for in the NDC. For consistency reasons the credits mentioned in the 2020 pledge are therefore not considered in the calculation of the pledge emissions*

Table 14: Overview of key climate change mitigation policies in Canada (Government of Canada, 2014, Government of Canada, 2015, Government of Canada, 2017b, Government of Canada, 2018)

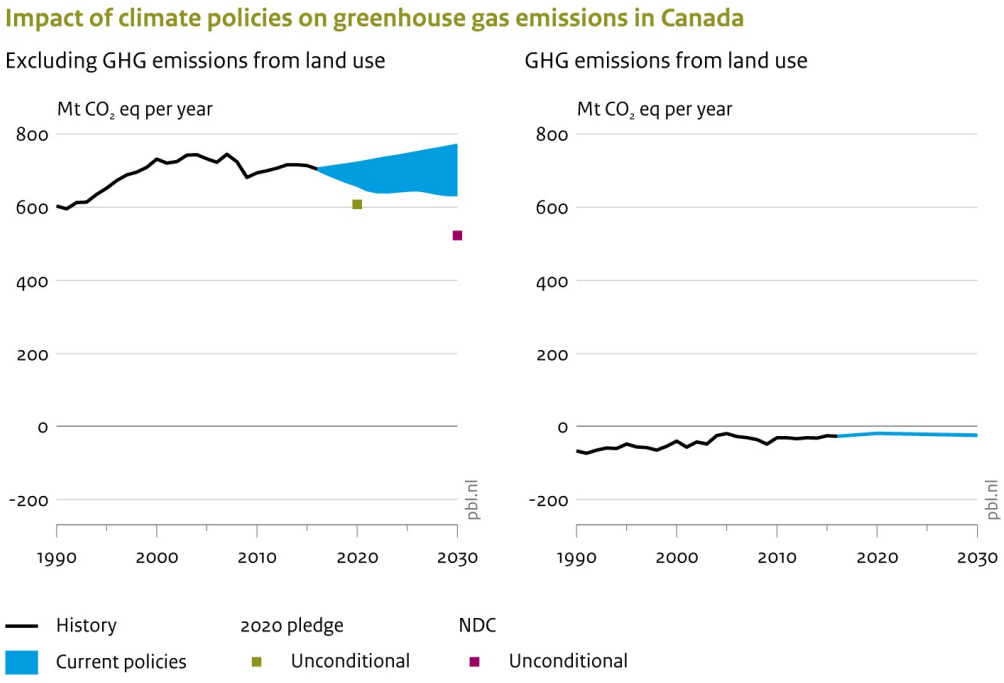
| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Energy supply** | $CO_2$ standard for new power plants (2012) | • 420 $gCO_2$/kWh from 1 July 2015 |
| | Regulations to address methane in the oil and gas sector (2018) | • Reduce $CH_4$ emissions from oil and gas by 40-45% by 2025, relative to 2012. Implementation starts in 2020 |
| **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, 0.92 MJ/tkm by 2027 for heavy trucks |
| | Renewable fuel regulations (biofuel bill - amendment to the Canadian Environmental Protection Act) (2008) | • Bio-ethanol share in gasoline of 5% from 2011 onwards<br>• Biodiesel share in diesel of 2% from 2011 onwards |
| **Buildings** | EcoENERGY efficiency (2011) [1)] | • Supported the implementation of energy codes, among other things, to improve energy efficiency of buildings. |
| **Forestry & Agriculture** | The Growing Forward 2 (2013) [2)] | • Supports the initiatives to advance environmentally sustainable agriculture |
| | Green Construction through Wood Program (2018) [2)] | • Supports projects and activities that increase the use of wood as a building material in infrastructure projects. |
| | Forest Bioeconomy Framework for Canada (2017) [2)] | • Supports the use of forest biomass for advanced bio-products and innovative solutions. |
| **Other** | Regulation of HFCs (2017) | • Reduce HFC emissions by 85% by 2036, relative to baseline |

[1)] *Quantified in PBL TIMER 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, 2015).*

[2)] *Not quantified in IIASA model projections.*

Table 15: Impact of climate policies on greenhouse gas emissions (excluding LULUCF) in Canada. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emission values are based on AR4 GWP-100.

| 2010 GHG emissions, excl. LULUCF | 2020 pledge and NDC | | Current policies | |
|---|---|---|---|---|
| | Official data | PBL and NewClimate estimates | Official data | PBL and NewClimate estimates |
| Absolute: 694 $MtCO_2e$ | 622 $MtCO_2e$ by 2020, 517 $MtCO_2e$ by 2030 | 605 $MtCO_2e$, -12% by 2020<br>520 $MtCO_2e$, -25% by 2030 | 728 $MtCO_2e$ by 2020, 722 $MtCO_2e$ by 2030 | 660 to 720 $tCO_2e$, -5% to 4% by 2020<br>635 to 770 $tCO_2e$, -9% to 11% by 2030 |
| Per capita: 20.3 $tCO_2e$/capita | N/A | 16.2 $tCO_2e$/capita by 2020<br>12.9 $tCO_2e$/capita by 2030 | N/A | 17.6 to 19.2 $tCO_2e$/capita by 2020<br>15.6 to 18.9 $tCO_2e$/capita by 2030 |




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

Figure 4: Impact of climate policies on greenhouse gas emissions in Canada (left panel: excluding land use, i.e. LULUCF, and right panel: only land use). Source: NewClimate Institute calculations adapted from Climate Action Tracker (CAT, 2018a) and PBL calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals. Projections last updated: November 2018. Emission values are based on AR4 GWP-100.

## Chile

By 2030, Chile aims to reduce its GHG emissions intensity per unit of GDP by 30% from 2007 levels under the unconditional NDC, and by 35% to 45% under the conditional NDC, which is subject to international support. Chile is estimated to emit 129 $MtCO_2e$/year by 2030 and 105 to 123 $MtCO_2e$/year under its unconditional and conditional NDC, respectively. These numbers strongly depend on economic growth projections as NDC targets are specified in emissions per GDP. An update on GDP projections used to estimate Chile's unconditional and conditional targets results in lower targets compared to our 2017 report.

Some of its most relevant current policies are the Non-Conventional Renewable Energy Law (NCRE), Law 20698 (20% renewable energy target for 2025) and the Energy Efficiency Action Plan (12% reduction of the final energy demand below BAU by 2020). Chile is currently pursuing its 2050 Energy Strategy, which sets renewable energy targets of at least 60% by 2035 and 70% by 2050 for electricity generation (Ministry of Energy, 2015a). In early 2018, Chile announced that it will not build any new coal-fired power plants without carbon capture and storage (CCS) technologies and will develop a plan to phase out coal, aligned with the objectives set in the 2050 Energy Strategy (MInistry of Energy, 2018a).

Under current policies, GHG emissions in 2030 are projected to be around 142 $MtCO_2e$/year excluding LULUCF. We conclude that Chile is not on track to achieve its unconditional NDC target. Compared to 2010 levels, projected emissions in 2030 represent an increase of 40%. This is a significant reduction from our 2017 report, which estimated emissions in 2030 to be a 100% increase from those in 2010. Our latest emissions projections are considerably lower than those in the 2017 report, due to updated GDP and energy emissions projections (Government of Chile, 2017b).

Table 16: Description of Chile's 2020 pledge and NDC

| Indicator | 2020 pledge | NDC |
|---|---|---|
| **Target: unconditional** | • N/A | • 30% GHG reduction per unit GDP by 2030, from 2007 levels |
| **Target: conditional** | • 20% reduction compared to the BAU emissions growth trajectory (as projected from year 2007) in 2020; conditional to a relevant level of international support | • 35% to 45% GHG reduction per unit GDP in 2030 from 2007 levels, subject to a grant of international monetary funds |
| **Sectoral coverage** | • Energy, agriculture, livestock and forestry, transport, mining, fishing | • Energy, industrial processes, use of solvents and other products, agriculture and waste. Excluding LULUCF sector |
| **General Accounting method** | • N/A | • IPCC guidelines; 100-year GWPs from AR4[1)] |
| **GHGs covered** | • N/A | • $CO_2$, $CH_4$, $N_2O$, $SF_6$, HFCs and PFCs |
| *Table to be continued on next page* | | |

| | | |
|---|---|---|
| **Consideration of LULUCF** | • Land use is included in the target<br>• Accounting approaches and methodologies not specified | • LULUCF sector is excluded from NDC 2030 intensity target<br>• A reduction of net LULUCF emissions is expected in the order of 0.6 $MtCO_2e$/year due to increased sequestration from native forest management, and 0.9 to 1.2 $MtCO_2e$/year due to increased sequestration from afforestation<br>• Accounting approaches and methodologies not specified |
| **Use of bilateral, regional and international credits** | • N/A | • To be considered ("Chile does not rule out using international GHG emission transaction markets to comply with its commitments") |
| **Other sector-level targets** | • N/A | • N/A |

[1] *The Chilean NDC mentions using Global Warming Potentials (GWP) from the Fourth Assessment Report, however, the numbers in their NDC are those from the Second Assessment Report (SAR). We have thus used SAR global warming potentials in our assessment.*

Table 17: Overview of key climate change mitigation policies in Chile (FAO, 2015, Government of Chile, 2013a, Government of Chile, 2015, IEA/IRENA, 2016, Ministry of Energy, 2014, Ministry of Environment, 2015, Ministry of Environment, 2016, National Forest Corporation and Ministry of Agriculture, 2012, National Environmental Commission, 2010, Ministry of Energy, 2015a, MInistry of Energy, 2018a, Government of Chile, 2012, Government of Chile, 2017a, Government of Chile, 2014, Ministry of Energy, 2018b, Government of Chile, 2013b, Government of Chile, 2016)

| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Economy-wide** | Climate Action Plan 2017-2022 (2017) [1] | Overarching instrument to guide climate change policy and advance climate mitigation measures. |
| | Energy Efficiency Action Plan (2012) | 12% reduction of final energy demand below business-as-usual (BAU) by 2020 (as projected from 2010) |

*Table to be continued on next page*

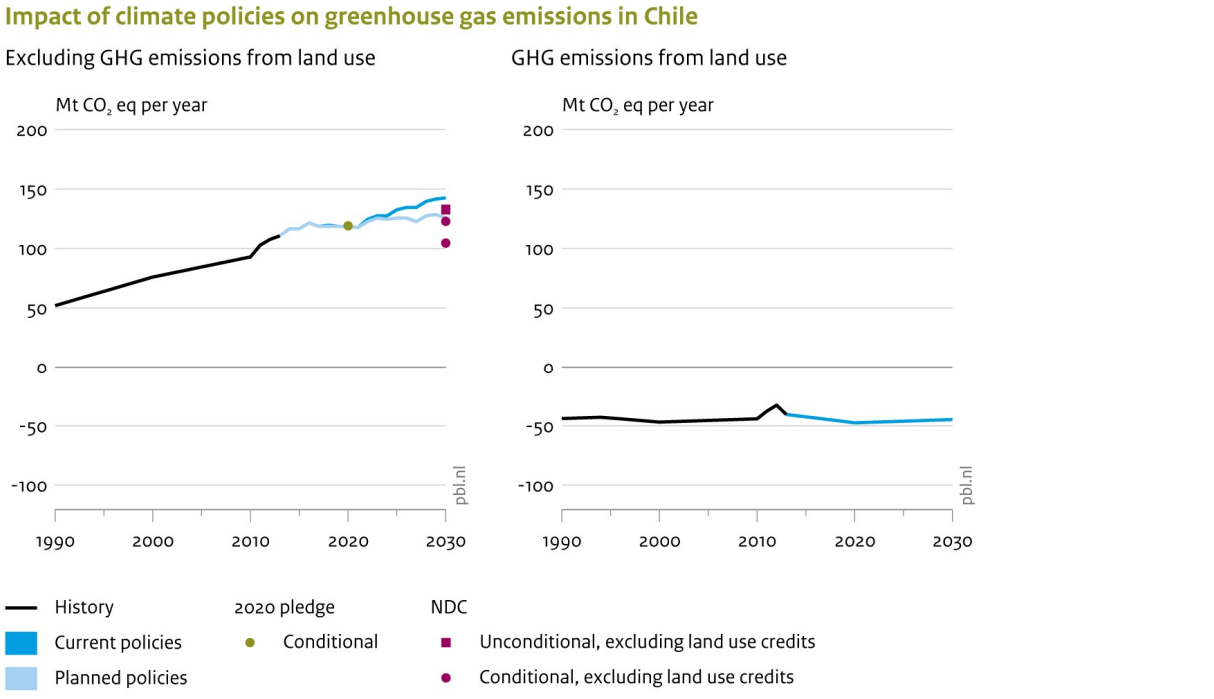
| | | |
|---|---|---|
| **Energy supply** | Agreement between the government and major utilities to cease construction of new coal power plants without CCS (2018) | • This agreement also includes the aim to phase out coal. The timeline is not yet specified. |
| | Law 20698: Non-Conventional Renewable Energy Law (NCRE) (2013) (+) | • Utilities larger than 200 MW to generate 5% of electricity from renewable sources (excl. hydro larger than 40 MW) in 2013, 12% in 2020, 18% in 2024 and 20% in 2025. |
| | Energy Plan 2050 (2016) | • Targets 60% of electricity generation from renewable sources (incl. large hydro) in 2035 and 70% in 2050. |
| | Law 20780: "Green tax on stationary sources" (2017) [1)] | • Carbon tax of $5 USD/ton $CO_2$ implemented in 2017. Applies to stationary sources with capacities greater than 50 $MW_{th}$. |
| | Reform to the Distributed Generation Law ("Net Billing") (2018) [1)] | • The law promotes renewable energy projects (with up to 0.3 MW installed capacity) that produce electricity for self-consumption. |
| **Transport** | Law 20780: "Green tax" second and third stages (+) (2015)[1), 2)] | • The second stage of the "green tax" mandates a 50% tax increase on NOx emissions by 2016 while the third stage mandates a 100% tax increase by 2017 for gasoline- and diesel-based vehicles. |
| | Electromobility Strategy (2017) [1)] | • Targets a40% share of electric vehicles in the overall passenger vehicle fleet and 100% electrification of public transport by 2050. |
| **Buildings** | Law 20.571/2016 (2016) [1)] | • Incentivises the use of solar heating through tax cuts for developers. |
| **Forestry** | National Strategy for Climate Change and Vegetation Resources (2010) | • 100,000 hectares of recovery and sustainable forest management of native forests.<br>• 100,000 hectares of afforestation, mainly native tree species. |

*[1)] Not quantified in NewClimate Institute projections.*

*[2)] Exemption for public transportation for over 10 seats and cargo vans for over 2,000 kg load and closed vans of lower capacity*

Table 18: Impact of climate policies on greenhouse gas emissions (excluding LULUCF) in Chile. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emission values are based on SAR GWP-100.

| 2010 GHG emissions, excl. LULUCF | 2020 pledge and NDC | | Current policies | | Planned policies |
|---|---|---|---|---|---|
| | Official data | NewClimate estimates [conditional] | Official data | NewClimate estimates | NewClimate estimates |
| Absolute: 93 $MtCO_2e$ | N/A | 120 $MtCO_2e$, 28% by 2020 (conditional)<br><br>135 [105 to 125] $MtCO_2e$, 43% [13% to 32%] by 2030 | N/A | 120 $MtCO_2e$, 28% by 2020<br>145 $MtCO_2e$, 53% by 2030 | 120 $MtCO_2e$, 28% by 2020<br>125 $MtCO_2e$, 35% by 2030 |
| Per capita: 5.5 $tCO_2e$/capita | N/A | 6.4 $tCO_2e$/capita by 2020 (conditional)<br>6.7 to 6.8 [5.3 to 6.3] $tCO_2e$/capita by 2030 | N/A | 6.4 $tCO_2e$/capita by 2020<br>7.3 $tCO_2e$/capita by 2030 | 6.4 $tCO_2e$/capita by 2020<br>6.4 $tCO_2e$/capita by 2030 |




Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 5: Impact of climate policies on greenhouse gas emissions in Chile (left panel: excluding land use (i.e. LULUCF), right panel: only land use). Source: NewClimate Institute calculations based on its analysis for Climate Action Tracker (CAT, 2018a) excluding LULUCF, and IIASA calculations on LULUCF emissions and removals. Please see Appendix (A2) on the consideration of LULUCF for the NDC quantification. Projections last updated: November 2018. Emission values are based on SAR GWP-100.

## China

China has pledged to peak $CO_2$ emissions around 2030, to achieve a 20% share of non-fossil fuel energy sources in total primary energy consumption by 2030, and to reduce the carbon intensity of its GDP by 60-65% compared to 2005 levels. Our current policies scenario, which takes the latest renewable capacity targets into account as well as a cap on coal consumption, projects that China's policies are more or less in line with what the NDC targets would mean for overall emissions. Total GHG emissions are projected to keep rising until 2030 but with a much slower growth rate than in the previous decade, reaching 11.9 to 14.3 $GtCO_2e$/year by 2030, which is 0.5 to 0.6 $GtCO_2e$ lower than last year's projections. In the lower end of the range shown in the graph, $CO_2$ emissions have already peaked and slowly decrease towards 2030, based on the assumption that the trend of decreasing coal consumption, observed between 2014 and 2016, will continue. The timing of the emissions peak in China is still uncertain as an increase in coal consumption in 2017 led to an increase in emissions (Peters, 2017). China has announced a new national emissions trading system, which will initially apply only to the power sector (expected to be fully operational by 2020) but may be expanded to other sectors in the future (Jotzo et al., 2018).

Table 19: Description of China's 2020 pledge and NDC

| Indicator | 2020 pledge | NDC |
|---|---|---|
| **Target: unconditional** | • 40-45% $CO_2$ emission intensity reduction by 2020; 15% non-fossil fuels in primary energy consumption and increased forest stock volume | • 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 consumption by 2030 and increased forest stock volume |
| **Target: conditional** | • N/A | • N/A |
| **Sectoral coverage** | • Not specified | • Not specified |
| **General Accounting method** | • Not specified | • Not specified |
| **GHGs covered** | • $CO_2$ only | • $CO_2$ only |
| **Consideration of LULUCF** | • Targets for the land use sector are included<br>• The forest stock in China will be increased by 1.3 billion $m^3$ by 2020, compared to 2005 levels<br>• Accounting approaches and methodologies are not specified | • Targets for the land use sector are included the NDC<br>• The forest stock in China will be increased by 4.5 billion $m^3$ by 2030, compared to 2005 levels<br>• Accounting approaches and methodologies are not specified |
| **Use of bilateral, regional and international credits** | • Not specified | • Not specified |
| **Other sector-level targets** | • Not specified | • Non-fossil fuel target (20% of total primary energy supply (TPES) by 2030)<br>• Gas target (10% of TPES by 2020)<br>• Coal cap (max. 58% of TPES by 2020) |

Table 20: Overview of key climate change mitigation policies in China (The People's Republic of China, 2014a, The People's Republic of China, 2014b, The People's Republic of China, 2012, State Council, 2015, People's Republic of China, 2016b, People's Republic of China, 2016a). Note: Policy targets may change significantly under the 13th Five Year Plan (2016-2020) currently in action.

| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Economy-wide** | 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<br>• Decrease $CO_2$ intensity by 18% between 2015 and 2020<br>• Decrease energy intensity (TPES/GDP) by 15% by 2020, relative to 2015 |
| | The Thirteenth Five Year Energy Development Plan | • Limit share of coal to 58% of total energy consumption |
| **Energy supply** | Energy Development Strategy Action Plan 2014-2020 | • Cap on coal consumption in 2020 at 4.1 billion tce (84.5 EJ/year)<br>• A 10% target share of gas in primary energy supply in 2020<br>• 15% non-fossil fuel share in TPES in 2020<br>• 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<br>• 800 million $m^2$ collector area<br>• 10 million tonnes ethanol, 2 million tonnes biodiesel<br>• 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 (2005) | • Fuel efficiency of new heavy-duty trucks: 1.2 MJ/tkm by 2021 |
| | Biofuel targets | • Ethanol blending mandates 10% in selected provinces |
| | "Made in China 2025" standards for auto industry | • Fuel economy standards of 5L/100 km by 2020<br>• 1 million units of new energy vehicles sold in 2020 |
| **Industry** | "Made in China 2025" $CO_2$ intensity target (2013) [2)] | • 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)] | • Decrease energy consumption per value added by 18% between 2015 and 2020. |

*Table to be continued on next page*

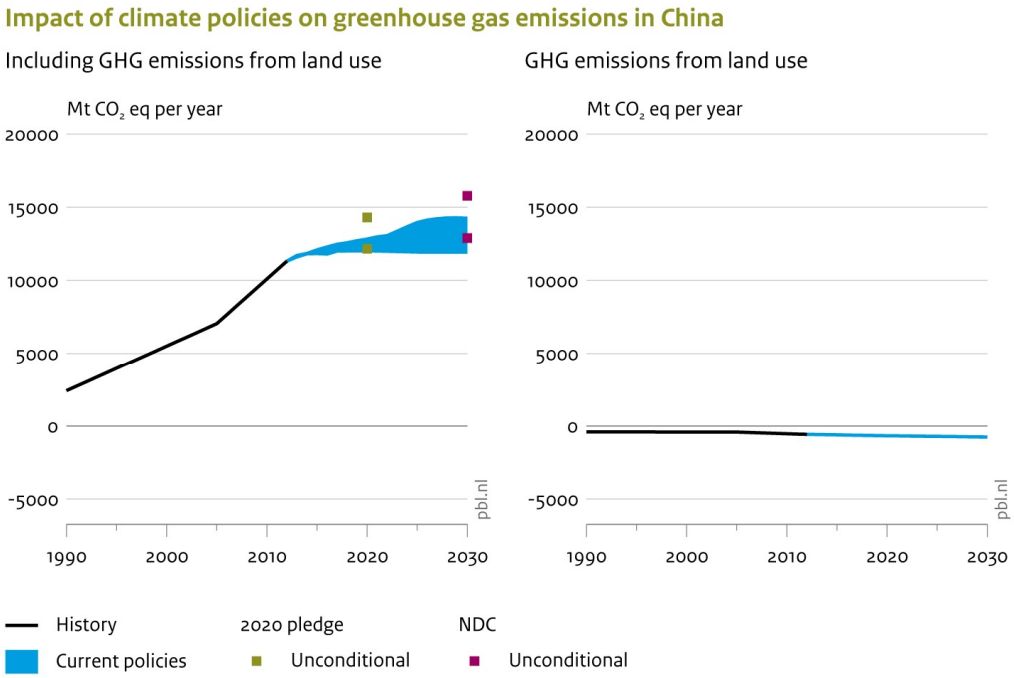
| | | |
|---|---|---|
| **Buildings** | Appliance standards and labelling programme [1)] | • Supplemented with subsidies and awareness-raising campaigns |
| | National Building Energy Standard [4)] | • 30% of newly constructed buildings to meet standards by 2020 |
| **F-gases** | N/A | • N/A |
| **Forestry** | Promotion of afforestation and sustainable forest management | • Increasing the forest area by 40 million hectares and the forest stock volume by 1.3 billion $m^3$ from 2005 levels by 2020. |
| | Program Plan of Fast Growing and High Yielding Timber Plantations (2001) | • Establishment of at least 15 million hectares of fast-growing, high-yield plantations, of which 5.8 million hectares are fast-growing pulpwood plantations |
| | Mid and Long-Term Plan for National Forest Management (2011) [3)] | • Building young and mid-aged forest tending areas and transforming35 million hectares of low-yield forest area |
| | National Afforestation and Greening Plan 2011 to 2020 | • Initiative for enhancing afforestation and greening of dry areas. Increase the forest cover to 21.6% by 2015 |
| | Natural Forest Resources Conservation Programme (2011) | • Afforestation of 2.5 million hectares of land |
| | Programme for Conversion of Slope Farmlands into Forests (2014) | • Convert 533,000 hectares of slope farmlands to forests.<br>• Afforest 55,000 hectares of barren hills and sandy wastelands. |

*[1)] Not quantified in PBL TIMER 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*

Table 21: Impact of climate policies on greenhouse gas emissions (including LULUCF) in China. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emission values are based on SAR GWP-100.

| **2010 GHG emissions, incl. LULUCF** | **2020 pledge and NDC** | | | **Current policies** |
|---|---|---|---|---|
| | **Official data** | **PBL [1)] and NewClimate estimates** | **Official data** | **PBL and NewClimate estimates** |
| Absolute: 10,100 $MtCO_2e$ | 14,500 $MtCO_2e$ | 12,160 to 14,300 $MtCO_2e$, 20% to 42% by 2020<br>12,900 to 15,775 $MtCO_2e$, 28% to 56% by 2030 | N/A | 12,025 to 12,830 $MtCO_2e$, 19% to 27% by 2020<br>11,930 to 14,250 $MtCO_2e$, 18% to 41% by 2030 |
| Per capita: 7.4 $tCO_2e$/capita | N/A | 8.5 to 10.0 $tCO_2e$/capita by 2020<br>8.9 to 10.9 $tCO_2e$/capita by 2030 | N/A | 8.4 to 9.0 $tCO_2e$/capita by 2020<br>8.3 to 9.9 $tCO_2e$/capita by 2030 |

*[1)] Based on den Elzen et al. (2016a)*




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

Figure 6: Impact of climate policies on greenhouse gas emissions in China (left panel: all gases and sectors, and right panel: only land use (i.e. LULUCF)). Source: NewClimate Institute calculations (excluding LULUCF) based on its analysis for the Climate Action Tracker (CAT, 2018a) and PBL Calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals. Projections last updated: November 2018. Emission values are based on SAR GWP-100.

## Colombia

In its NDC, Colombia intends to reduce its GHG emissions by 20% from BAU levels in 2030 and commits to increase the target to 30% subject to provision of international support. Colombia's NDC partially includes LULUCF; emissions and removals from forest plantations and permanent crops are included but removals from natural forests (that remain as natural forests) are excluded. Colombia's unconditional and conditional reduction targets translate to 268 $MtCO_2e$ and 235 $MtCO_2e$ by 2030 respectively, including LULUCF.

The emissions projections under current policies range from 155 to 215 $MtCO_2e$ in 2030, thus Colombia is projected to overachieve its unconditional NDC target with existing policies.

Table 22: Description of Colombia's 2020 pledge and NDC

| Indicator | NDC |
|---|---|
| **Target: unconditional** | • 20% GHG reduction with respect to BAU by 2030 |
| **Target: conditional** | • 30% GHG reduction with respect to BAU by 2030, subject to international support |
| **Sectoral coverage** | • Economy-wide |
| **General Accounting method** | • IPCC guidelines; 100-year GWPs from SAR |
| **GHGs covered** | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, $SF_6$ |
| **Consideration of LULUCF** | • Land use sector is included in the target<br>• BAU calculation excludes removals from natural forests that remain as natural forests in the target year<br>• Accounting approaches and methodologies are not specified |
| **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 |

*Note: Colombia has not set its 2020 pledge.*

Table 23: Overview of key climate change mitigation policies in Colombia (Winkelman, 2016, Transport NAMA Database, 2017a, Ministry of Environment and Sustainable Development, 2017b, Unidad de Planeación Minero Energética de Colombia, 2017, Transport NAMA Database, 2017b, NAMA Facility, 2017, Consejo Nacional de Política Económica y Social et al., 2018, Ministerio de Hacienda y Crédito Público, 2017, Ministry of Environment and Sustainable Development, 2017a, IEA, 2013a, Ministry of Environment and Sustainable Development, 2016, Congreso de la República, 2016)

| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Economy-wide** | 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 Indicatory Action Plan on energy efficiency 2017-2022. 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) [1)] | • Plans to achieve a 20% and 30% of renewable energy (RE) sources by 2015 and 2020, respectively. |
| **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 $MtCO_2e$ by 2030 (50% reduction from BAU) and 16.8 $MtCO_2e$ 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 $MtCO_2e$/year by 2040. |

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| | | |
|---|---|---|
| **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 zero net 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 |

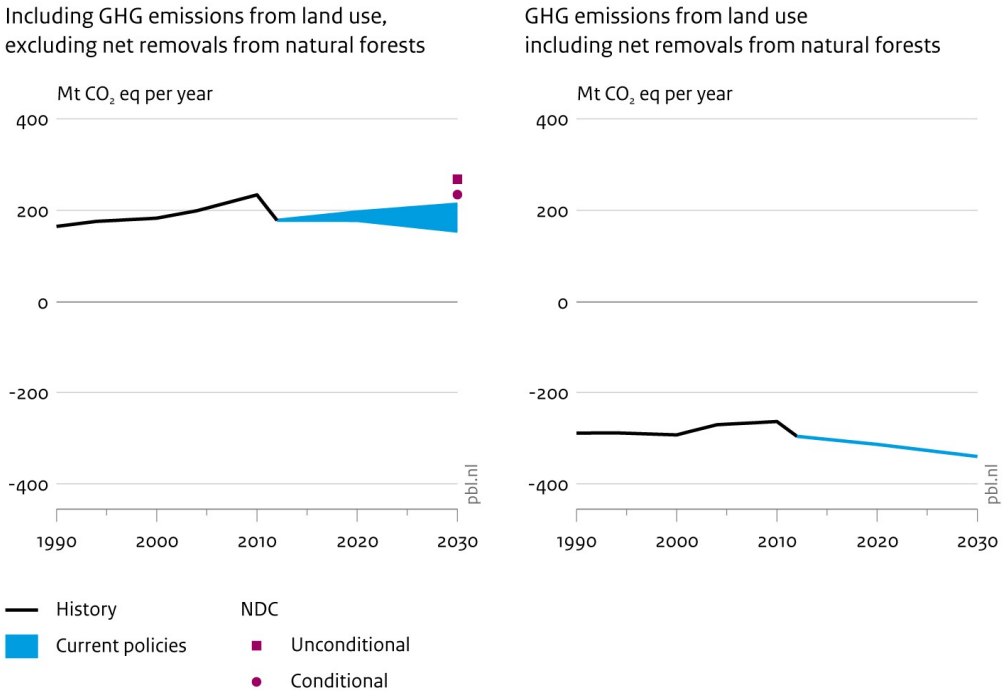
*[1)] Not quantified in NewClimate Institute projections.*

*[2)] Not quantified in IIASA model projections.*

Table 24: Impact of climate policies on greenhouse gas emissions (including LULUCF but excluding net removals from natural forests) in Colombia. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emission values are based on SAR GWP-100.

| 2010 GHG emissions, incl. LULUCF | 2020 pledge and NDC | | Current policies | |
|---|---|---|---|---|
| | Official data | NewClimate estimates [conditional] | Official data | NewClimate estimates |
| Absolute: 234 $MtCO_2e$ | 235 to 268 $MtCO_2e$ by 2030 | 270 [235] $MtCO_2e$, 15% [0 %] by 2030 | N/A | 180 to 195 $MtCO_2e$, -24% to -16% by 2020<br>155 to 215 $MtCO_2e$, -34% to -9% by 2030 |
| Per capita: 5.1 $tCO_2e$/capita | N/A | 5.0 [4.4] $tCO_2e$/capita by 2030 | N/A | 3.5 to 3.9 $tCO_2e$/capita by 2020<br>2.9 to 4.0 $tCO_2e$/capita by 2030 |

**Impact of climate policies on greenhouse gas emissions in Colombia**




Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 7: Impact of climate policies on greenhouse gas emissions in Colombia (left panel: including land use (i.e. LULUCF), right panel: only land use). Source: NewClimate Institute calculations excluding LULUCF and IIASA calculations on LULUCF emissions and removals. Projections last updated: November 2017. Emission values are based on SAR GWP-100.

Note: the BAU emission projection in Colombia's NDC excludes removals from natural forests, which accounted for 263 $MtCO_2e$/year in 2010. Therefore, net removals from natural forests are excluded from the current policies scenario and NDC analysis (figure on the left) but included in the figure on the right.

## Democratic Republic of the Congo (DRC)

In its NDC, the Democratic Republic of the Congo (DRC) pledges to reduce emissions by 17% by 2030 compared to a business-as-usual (BAU) emissions scenario, or a 73 $MtCO_2e$/year reduction in absolute terms. The target covers the agriculture, forestry and energy sectors and it is conditional on international financial support. Under its NDC, DRC's GHG emissions including LULUCF would increase from 217 $MtCO_2e$/year in 2010 up to 385 to 405 $MtCO_2e$/year by 2030.

Under current policies, DRC's GHG emissions are projected to miss its NDC. While current peatland emissions in the DRC are reported to be minor, they may become large in the future if concessions are provided for the vast peat land areas and they were to be exploited in an industrial manner (Dargie et al., 2017). Our latest emissions projections are lower than those in the 2017 report, mainly due to the updated emissions data harmonisation year (from 2010 to 2015).

Table 25: Description of the Democratic Republic of the Congo's NDC

| Indicator | NDC |
|---|---|
| **Target: unconditional** | • The NDC is partially conditional, see below |
| **Target: conditional** | • 17% reduction compared to BAU emission levels (430 $MtCO_2e$, i.e. slightly more than 70 $MtCO_2e$ reduction) by 2030; actions conditional to the provision of adequate support in terms of financial resources, technology transfer and the reinforcement of national capacity (mix of domestic and international resources not specified) |
| **Sectoral coverage** | • Agriculture, forestry and energy |
| **General Accounting method** | • IPCC 1996 (revised) and 2006 guidelines; GWP values not specified |
| **GHGs covered** | • $CO_2$, $CH_4$, $N_2O$ |
| **Consideration of LULUCF** | • Land use sector is included in the target<br>• Accounting approaches and methodologies are not specified |
| **Use of bilateral, regional and international credits** | • Not specified |
| **Other sector-level targets** | • Not specified |

*Note: DRC has not set its 2020 pledge.*

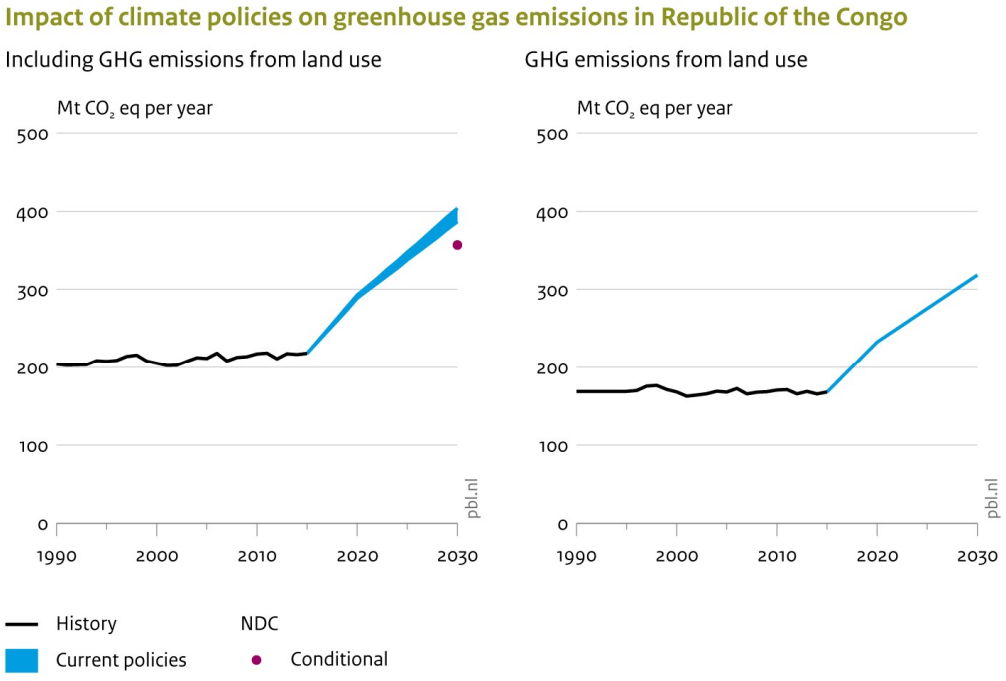
Table 26: Overview of key climate change mitigation policies in the Democratic Republic of the Congo (REDD-PAC, 2016). Only LULUCF policies were assessed.

| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Forestry & Agriculture** | Protection of permanent forest domains (Plan de convergence COMIFAC) (2015) | • No expansion of agriculture into protected forest areas<br>• No expansion of agriculture into forest concessions |
| | Afforestation and reforestation measures (Plan de convergence COMIFAC) (2015) (+) [1)] | • Increase the national forest cover |
| | Sustainable timber management (Plan de convergence COMIFAC) (2015) | • Sustainable timber harvests in existing forest concessions, following management plans |

[1)] *Not quantified in IIASA model projections.*

Table 27: Impact of LULUCF policies on greenhouse gas emissions (including LULUCF) in the Democratic Republic of the Congo. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emission values are based on AR4 GWP-100.

| 2010 GHG emissions, incl. LULUCF | 2020 pledge and NDC | | Current policies | |
|---|---|---|---|---|
| | Official data | NewClimate estimates | Official data | NewClimate estimates |
| Absolute: 217 $MtCO_2e$ | 357 $MtCO_2e$ in 2030 | 355 $MtCO_2e$, 94% by 2030 | N/A | 290 to 295 $MtCO_2e$, 33% to 35% by 2020<br>385 to 405 $MtCO_2e$, 78% to 86% by 2030 |
| Per capita: 3.4 $tCO_2e$/capita | N/A | 3.0 $tCO_2e$/capita by 2030 | N/A | 3.2 to 3.3 $tCO_2e$/capita by 2020<br>3.2 to 3.4 $tCO_2e$/capita by 2030 |




Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 8: Impact of climate policies on greenhouse gas emissions (left panel: all gases and sectors, and right panel: only land use (i.e. LULUCF)) in the Democratic Republic of the Congo. Source: NewClimate Institute calculations excluding LULUCF and IIASA calculations on LULUCF emissions and removals (REDD-PAC, 2016). Projections last updated: November 2018. Emission values are based on AR4 GWP-100.

## Ethiopia

Ethiopia pledged a partially conditional NDC target to reduce GHG emissions by 64% below BAU by 2030, which constitutes a total reduction of at least 255 $MtCO_2e$/year. The current policies scenario projection mainly considers the Growth and Transformation Plan (GTP) phase I (2010–2015) and some initiatives under the Climate Resilience and Green Economy Strategy.

Ethiopia's GHG emissions are projected to be 235 to 300 $MtCO_2e$/year by 2030 (including LULUCF) under current policies. Our latest emissions projections are similar to those in the 2017 report. Ethiopia would, therefore, need to implement additional policies to achieve its NDC target. The current policies projections currently do not consider the second phase of the Growth and Transformation Plan (GTP II) (2016–2020) due to uncertainty on how the Climate Resilience and Green Economy Strategy will be implemented.

Table 28: Description of Ethiopia's 2020 pledge and NDC

| Indicator | NDC |
|---|---|
| **Target: unconditional** | • N/A |
| **Target: partially conditional** | • 64% GHG reduction (255 $MtCO_2e$ reduction) from the BAU scenario in 2030 (partially conditional on international financial resources) |
| **Sectoral coverage** | • Agriculture, Forestry, Industry (including mining), Transport, Buildings (including Waste and Green Cities), Electric power |
| **General Accounting method** | • IPCC 2006 guidelines; 100-year GWPs from the Fourth Assessment Report |
| **GHGs covered** | • $CO_2$, $CH_4$ and $N_2O$ |
| **Consideration of LULUCF** | • Land use sector is included in the target<br>• A reduction of net LULUCF emissions is expected in the range of 90 $MtCO_2e$ from agriculture and 130 $MtCO_2e$ from forestry by 2030 as compared to projected BAU levels. These reductions are part of the total reduction target.<br>• Accounting approaches and methodologies are not specified |
| **Use of bilateral, regional and international credits** | • Yes. Expected amount not quantified. |

*Note: Ethiopia has not set its 2020 pledge.*

Table 29: Overview of key climate change mitigation policies in Ethiopia (Federal Democratic Republic of Ethiopia, 2011, Federal Democratic Republic of Ethiopia, 2016, Federal Democratic Republic of Ethiopia, 2015, Federal Democratic Republic of Ethiopia, 2010, Ministry of Water and Energy, 2012, Ethiopia Rural Energy Development and Promotion Centre (EREDPC), 2007)

| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Economy-wide** | 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 $MtCO_2e$ (250 $MtCO_2e$ below BAU)<br>• Development of up to 25 GW in renewable power capacity by 2030 |
| **Energy supply** | 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<br>• 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) [3)] | • Replace 50% of the cargo transport with electric rail transport<br>• Expected emissions reduction of 8.9 $MtCO_2e$/year by 2030 |
| **Forestry** | Afforestation and reforestation actions (part of the CRGE) (2011) (+) | • Target is 7 million hectares of afforestation and reforestation by 2030. [1)]<br>• 17,000 hectares of forest to be brought under protection and natural regeneration over a 30 years planning period. |

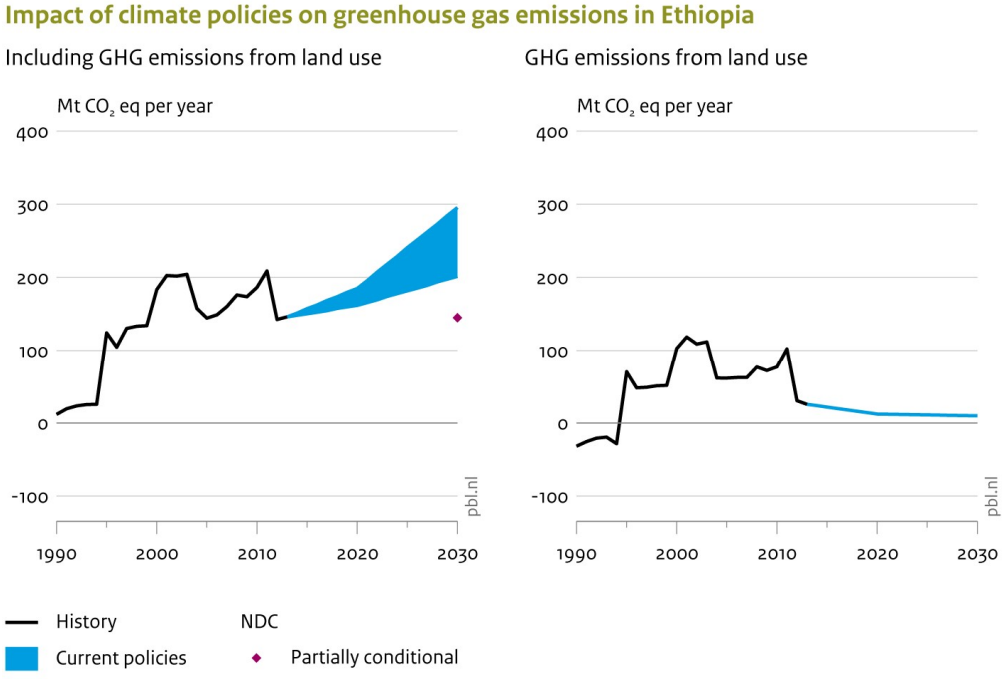
*[1)] See Supporting Information for detailed assumptions on the policies and measures under the First Growth and Transformation Plan (GTP I) quantified in the current policies scenario.*

*[2)] The Second Growth and Transformation Plan (GTP II) aims for the full implementation of CRGE until 2025 (Federal Democratic Republic of Ethiopia, 2016), but is excluded from the current policies emissions projections. See Supporting Information for details.*

*[3)] Excluded due to its uncertain development status.*

Table 30: Impact of climate policies on greenhouse gas emissions (including LULUCF) in Ethiopia. Absolute emissions level and changes in emissions level relative to 2010 levels are presented. Numbers are based on GWP values from the IPCC 4th Assessment Report. References for official emissions data are provided in Appendix (A1).

| 2010 GHG emissions, incl. LULUCF | 2020 pledge and NDC | | Current policies | |
|---|---|---|---|---|
| | Official data | NewClimate estimates | Official data | NewClimate estimates |
| Absolute: 186 $MtCO_2e$ | 145 $MtCO_2e$, -18% by 2030 | 145 $tCO_2e$, -22% by 2030 | N/A | 160 to 185 $MtCO_2e$; -13% to -1% by 2020<br>200 to 295 $MtCO_2e$; 8% to 59% by 2030 |
| Per capita: 2.1 $tCO_2e$/capita | N/A | 1.0 $tCO_2e$/capita by 2030 | N/A | 1.4 to 1.6 $tCO_2e$/capita by 2020<br>1.4 to 2.1 $tCO_2e$/capita by 2030 |




Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 9: Impact of climate policies on greenhouse gas emissions ($CO_2$, $CH_4$ and $N_2O$) including land use (i.e. LULUCF) in Ethiopia. Source: NewClimate Institute calculations excluding LULUCF based on its analysis for Climate Action Tracker (CAT, 2017) and IIASA calculations on LULUCF emissions and removals. Projections last updated: November 2018. Emission values are based on AR4 GWP-100.

## European Union

The EU's NDC aims to reduce its GHG emissions by at least 40% by 2030 from 1990 levels. For 2020, the EU made unconditional and conditional pledges of reducing its GHG emissions by 20% and 30% from 1990 levels, respectively.

Under current policies, now including the effort sharing regulation and F-gas regulations, the EU is likely to overachieve its unconditional 2020 pledge. For 2030, the EU is projected to be short of its NDC target in the NewClimate Institute projections but is projected to overachieve its NDC target in the PBL projections (reaching about 43% below 1990 levels). The NewClimate Institute projections are based on Member States' own projections focused on existing measures, as reported by the European Environment Agency (EEA, 2017), and further adapts to harmonise with historical data. This shows that the EU is not on track with currently implemented measures at the national level. These Member States' projections do not include new and additional measures needed to achieve agreed targets at the EU level, such as the national greenhouse gas emission reduction targets for sectors outside of the Emissions Trading System (ETS) for the period up to 2030 (Effort Sharing Regulation), nor the 2030 targets on energy efficiency and renewable energy. The lower end of the range (PBL calculations) instead assumed full implementation of the ETS 2030 target, as well as the collective achievement of the effort sharing regulation, showing the EU to be on track. The projections by PBL do not account for the achievement of the new renewable energy (European Parliament, 2018) and energy efficiency targets (Official Journal of the European Union, 2018b). EU Member States are developing National Energy and Climate Change plans with a view on detailing further policies and actions to achieve the agreed and legislated 2030 targets at the EU level.

Other new policies, not quantified here, include proposed $CO_2$ emission standards for light-duty vehicles (European Commission, 2017a) and the amendment to the Energy Performance of Buildings Directive (Official Journal of the European Union, 2018b), which aims at full decarbonisation of the building stock by 2050, while new buildings should be nearly zero energy as of 2020. If these recently adopted and agreed policies are fully implemented, EU emissions are estimated to be reduced by around 45% by 2030, according to the new EU climate action progress report (European Commission, 2018).

Compared to the 2017 report, the emissions projection range has been revised downward mainly due the revised historical emissions data (about 75 $MtCO_2e$/year lower in 2010, excluding the LULUCF sector) and the revised data harmonisation year (2016). The rate of emissions reductions observed between 2010 and 2015 was faster than our model projections for the same period.

Table 31: Description of EU's 2020 pledge and NDC

| Indicator | 2020 pledge | NDC |
|---|---|---|
| **Target: unconditional** | • 20% GHG reduction by 2020 from 1990 level<br>• Kyoto target: 20% GHG reduction by 2020 from base year averaged over the second commitment period 2013-2020 | • At least 40% greenhouse gas reduction by 2030 from 1990 level |
| **Target: conditional** | • 30% GHG reduction by 2020 from 1990 level | • N/A |
| **Sectoral coverage** | • Economy wide | • Economy wide |
| **General Accounting method** | • IPCC guidelines; 100-year GWPs from the Fourth Assessment Report | • IPCC guidelines; 100-year GWPs from the Fourth Assessment Report |
| *Table to be continued on next page* | | |
| **GHGs covered** | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, $SF_6$ and $NF_3$ | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, $SF_6$ and $NF_3$ |
| **Consideration of LULUCF** | • Land use sector is not included in the target | • Land use sector is included in the target. A decision on how to include the land use sector was adopted in 2018. [1)] |
| **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 was adopted by the Council on 14 May 2018 (Official Journal of the European Union, 2018c).*

Table 32: Overview of key climate change mitigation policies in the EU (European Commission, 2015, European Commission, 2016b, EEA, 2016, European Parliament, 2009b, European Parliament, 2009c, Official Journal of the European Union, 2009, European Parliament, 2009a, European Parliament, 2012, Council of the European Union, 2017, Official Journal of the European Union, 2018a, European Commission, 2017a, Official Journal of the European Union, 2018d)

| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Economy/ state wide** | EU ETS Directive (2003/87/EC revised by Directive 2018/410/EU) [1)] | • Emission cap on emissions from electricity/heat and industry of 43% below 2005 levels, by 2030, by reducing the cap 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) [2)] | • Reduce GHG emissions from non-ETS sectors by 30% by 2030, relative to 2005 |
| **Energy supply** | Renewable Energy Roadmap/ Directive (2009/28/EC) | • Target of 20% renewable energy by 2020 |
| | Energy Efficiency Directive (2012/27/EC) | • Target of 20% energy efficiency improvement by 2020 |
| **Buildings** | Eco-design Framework Directive (Directive 2009/125/EC) [3)] | • Specific standards for a wide range of appliances |
| | Building Energy Efficiency Directive (2012) [4)] | • Near zero energy buildings by 2020 (residential) and by 2018 (public) |
| **Transport** | Regulation of $CO_2$ emissions from passenger vehicles (443/2009) | • Emission standard of 95 $gCO_2$/km, phasing in for 95% of vehicles by 2020 with 100% compliance by 2021 |
| | | • Light commercial vehicle standards of 147 $gCO_2$/km by 2020 [2)]<br>• New heavy-duty trucks: 0.94 MJ/tkm by 2021 (14% improvement between 2015 and 2021) [5)] |
| | Directive 2009/28/EC Biofuel target | • 10% quota for RE in transport fuels (also electricity) |
| **Other** | F-gas regulation | • Reduce emissions of fluorinated gases by 37% by 2020 and by 79% by 2030, relative to 2015 |

*[1)] See summary assessment on how the impact of this policy was quantified.*

*[2)] Not quantified in NewClimate and PBL calculations (considered as a planned policy).*

*[3)] Not quantified in PBL TIMER model projections.*

*[4)] NewClimate only quantified the policy for residential buildings*

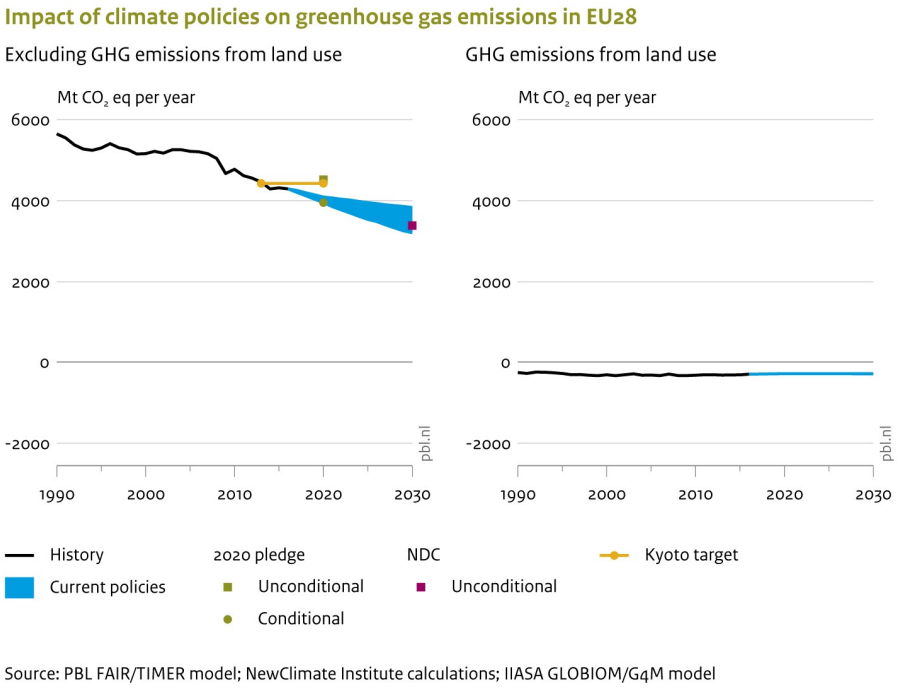
*[5)] Not quantified in the NewClimate Institute projections, as it is only a proposal*

Table 33: Impact of climate policies on greenhouse gas emissions (excluding LULUCF) in the EU. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emission values are based on AR4 GWP-100.

| 2010 GHG emissions, excl. LULUCF | 2020 pledge and NDC | | Current policies | |
|---|---|---|---|---|
| | Official data [1] | PBL and NewClimate estimate [2] [conditional] | Official data [1] | PBL and NewClimate estimate [2] |
| Absolute: 4,775 $MtCO_2e$ | 4,588 $MtCO_2e$ by 2020 (unconditional) 3,441 $MtCO_2e$ by 2030 | 4,515 [3,950] $MtCO_2e$, -5% [-17%] by 2020 3,390 $MtCO_2e$, -29% by 2030 | 4,212 $MtCO_2e$ by 2020 3,988 $MtCO_2e$ by 2030 | 3,955 to 4,090 $MtCO_2e$, -17% to -14% by 2020 3,210 to 3,830 $MtCO_2e$, -33% to -20% by 2030 |
| Per capita: 9.5 $tCO_2e$/capita | N/A | 8.8 [7.7] $tCO_2e$/capita by 2020 6.6 $tCO_2e$/capita by 2030 | N/A | 7.7 to 8.0 $tCO_2e$/capita by 2020 6.3 to 7.5 $tCO_2e$/capita by 2030 |

[1] *International aviation is included as a component of the 2020 pledge and NDC, and as part of the projections produced by EEA (2016) (projected at 152 and 174 $MtCO_2e$/year in 2020 and 2030 respectively).*

[2] *NewClimate Institute estimates are based on the Climate Action Tracker analysis, using projections from EEA (2017) (upper end) and the EU Reference Scenario 2016 (Capros et al., 2016) (lower end). The absolute values presented here differ from the sources for two reasons: (i) the projections were harmonised to historic data, (ii) the EEA data does not include a full implementation of the Building Energy Efficiency Directive, which we thus quantified separately (see details of approach in supplementary information).*




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

Figure 10: Impact of climate policies on greenhouse gas emissions in the EU (left panel: excluding land use (i.e. LULUCF), right panel: only land use). Source: NewClimate Institute calculations based on Climate Action Tracker (CAT, 2018a) and PBL calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals. Projections last updated: November 2018. Emissions values are based on AR4 GWP-100.

## India

India has pledged to reduce its emissions intensity per unit of GDP by 33 to 35% below 2005 by 2030 and create an additional carbon sink of 2.5 to 3 $GtCO_2$. The country further set a target to increase its share of non-fossil-based power in total capacity from 30% today to about 40% by 2030 (with the help of international support). The main mitigation-related policies implemented in India include renewable energy targets and a range of support schemes laid out under the 12th Five Year Plan, the market-based mechanism Perform Achieve and Trade (PAT) scheme for energy efficiency, the Clean Energy Cess (coal tax), and increasingly the support for electric vehicles.

We project that India will overachieve its 2020 pledge and most of the elements of its NDC under current policies. These projected emission levels depend heavily on the assumptions on future economic growth.

In spring 2018, India published the National Electricity Plan, outlining plans for the development of the power sector. This plan projects a stabilisation of the coal capacity at 250 GW in the next decade and it expects renewable energy technologies to expand substantially, to 275 GW by 2026/2027, reflecting a 57% share in total capacity (Central Electricity Authority, 2017) and overachieving the conditional target of the NDC. India has communicated its intention to increase the 2022 RE target from 175 GW (included as current policy) to 225 GW (not quantified). In 2017, India continued discussing a target for electric vehicles: most recent announcements say the share of EVs in the car stock should increase to 15% in the next five years. The Faster Adoption and Manufacturing of Hybrid and Electric vehicles (FAME) scheme and adjustments of legislation to enable easier installation of electric infrastructure support the targets. However, delays in legislation make progress less clear.

The range of our projections has become smaller compared to last year, because of aligning the renewable energy shares in the scenarios. Both PBL and NewClimate results this year reach 175 GW of renewable electric capacity in 2022. The lower end of the range is slightly lower compared to last year.

Table 34: Description of India's 2020 pledge and NDC

| Indicator | 2020 pledge | NDC |
|---|---|---|
| **Target: unconditional** | • Reduce emissions per unit of GDP by 20% to 25% below 2005 level by 2030 (excluding agriculture emissions) | • Reduce emissions per unit of GDP by 33% to 35% below 2005 levels by 2030 |
| **Target: conditional** | • N/A | • 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);<br>• Additional forest carbon stock of 2.5 to 3 $GtCO_2e$ through additional forest and tree cover by 2030 |
| **Sectoral coverage** | • Excluding agriculture | • Not specified |
| **General Accounting method** | • Not specified | • Not specified |
| **GHGs covered** | • Not specified | • Not specified |
| *Table to be continued on next page* | | |

| | | |
|---|---|---|
| **Consideration of LULUCF** | • Not specified | • 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<br>• Accounting approaches and methodologies are not specified |
| **Use of bilateral, regional and international credits** | • N/A | • Yes. Expected amount not quantified. |
| **Other sector-level targets** | • Not specified | • (various existing policies and targets are described) |

Table 35: Overview of key climate change mitigation policies in India (*planned policies in italics*) (BEE, 2015, Government of India, 2015a, Government of India, 2015b, Ministry of Consumer Affairs Food and Public Distribution, 2015, MNRE, 2009, MNRE, 2017, Aradhey and Wallace, 2018, Ministry of Heavy Industries & Public Enterprises, 2018)

| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Economy-wide** | Clean energy cess (coal tax) (2010) [1)] | • Implemented in 2010; currently a tax of INR 400/tonne is imposed on coal, lignite and peat |
| **Energy supply** | Renewable energy targets and support schemes (12th Five Year Plan (2012 to 2017), National Solar and Wind Missions (2010)) (+) | • Capacity targets for 2022: 10 GW biomass, 5 GW small hydro, 100 GW solar (of 40 GW rooftop PV), 60 GW wind (total 175 GW). Aspirational target: 227 GW in 2022<br>• Budgetary support for solar power under the National Solar Mission [2)]<br>• Renewable Purchase Obligations scheme (2003)[2)]<br>• Renewable Energy Certificate (REC) mechanism (2011) [2)] |
| | Government Assistance for Small Hydropower Stations (2003), National Solar and Wind Missions (2010) | • 5 GW small hydropower, 10 GW biomass, 100 GW solar power, 60 GW wind power capacity by 2022 *(aspirational, revised target: 227 GW total renewable energy capacity)* |
| | 12th Five Year Plan (2012 to 2017): supercritical power generation [3)] | • Base new thermal power plants mainly on supercritical technology from 2017 onwards. Implemented as power plant standard after 2016 for new coal-fired power plants, resulting in 47% efficiency (840 $gCO_2$/kWh) |
| | National Electricity Plan (2018)[1)] | • Capacity additions for various energy technologies<br>• Demand reductions<br>• Slow-down in installation of new coal fired power plants |

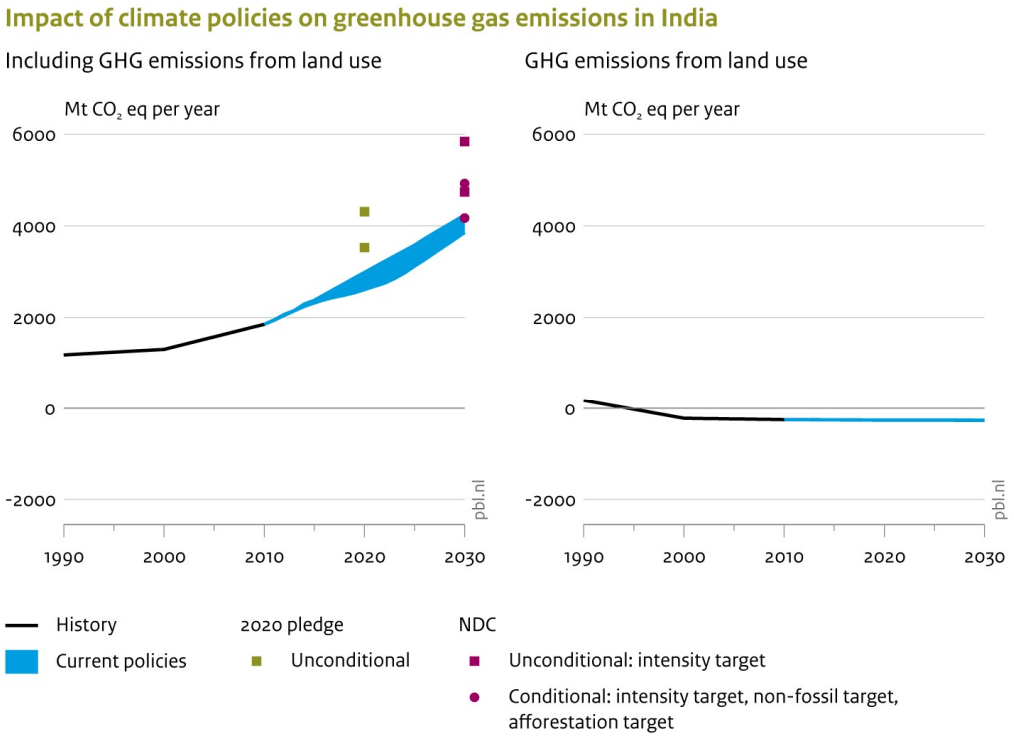
*Table to be continued on next page*

| | | |
|---|---|---|
| **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 |
| | Electric vehicle target (2018), Faster Adoption and Manufacturing of Hybrid and Electric vehicles I (FAME I) (2015) | • 15% share in car stock by 2023, 30% by 2030 [4)]<br>• Subsidy for hybrid and full electric vehicles<br>• No licensing required for EV charging stations |
| | Support for biofuels (2007), National Policy on Biofuels (2018) [4)] | • 5% blending target for ethanol with petrol (no timeline set)<br>• *20% blending target for bioethanol in gasoline, 5% biofuel in diesel by 2030 (proposed target)* |
| **Industry** | Energy efficiency in industry (PAT scheme) (2011) | • The first phase was expected to save 6.6 Mtoe (4.8% energy reduction in the industries covered, representing around 60% of primary energy consumption) and to reduce 26 $MtCO_2e$ over the 2012-2015 period |
| **Forestry** | Green India Mission (2011) | • Increase the forest/tree cover in moderately dense forests: 5 million hectares<br>• Improve forest/tree cover on forest areas: 5 million hectares |
| **Agriculture** | National Mission on Sustainable Agriculture (2012) (+) [5)] | • Enhancing food security and protection of resources such as land, water, biodiversity and genetics |

[1)] *Not quantified in PBL TIMER model projections.*
[2)] *Not quantified separately*
[3)] *Based on the middle of the range presented in IEA (2013b)*
[4)] *Not quantified in NewClimate Institute projections.*
[5)] *Not quantified in IIASA model projections.*

Table 36: Impact of climate policies on greenhouse gas emissions (including LULUCF) in India. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emission values are based on SAR GWP-100.

| 2010 GHG emissions, incl. LULUCF | 2020 pledge and NDC | | Current policies | |
|---|---|---|---|---|
| | Official data | PBL and NewClimate estimates [conditional] | Official data | PBL and NewClimate estimates |
| Absolute: 1,848 $MtCO_2e$ | 3,815 $MtCO_2e$ | 3525 to 4305 $MtCO_2e$, 91% to 133% by 2020<br>4740 to 5840 [4920 to 4170] $MtCO_2e$, 156% to 216% [166% to 126%] by 2030 | N/A | 2605 to 2980 $MtCO_2e$, 41% to 61% by 2020<br>3855 to 4235 $MtCO_2e$, 109% to 129% by 2030 |
| Per capita: 1.5 $tCO_2e$/capita | N/A | 2.5 to 3.1 $tCO_2$/capita by 2020<br>3.1 to 3.9 [2.8 to 3.3] $tCO_2e$/capita by 2030 | N/A | 1.9 to 2.2 $tCO_2e$/capita by 2020<br>2.5 to 2.8 $tCO_2e$/capita by 2030 |




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

Figure 11: Impact of climate policies on greenhouse gas emissions in India (left panel: all gases and sectors, including land use (i.e. LULUCF) and right panel: only land use (i.e. LULUCF)). Source: NewClimate Institute calculations adapted from Climate Action Tracker (CAT, 2018a) and PBL calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals. For reporting reasons, the emissions projections excluding LULUCF are not presented, as these are similar to those including LULUCF. Projections last updated: November 2018. Emission values are based on SAR GWP-100.

## Indonesia

Indonesia's NDC target aims for a 29% emissions reduction by 2030 relative to a baseline scenario. Our latest estimates indicate that GHG emissions from land use, land use change and forestry (LULUCF) are expected to increase over time, driven to a large extent by continued expansion of large-scale oil palm plantations, and that other emissions might roughly double by 2030 compared to current levels.

A significant share of Indonesia's emissions is connected to forestry and land use, due to deforestation, peatland destruction, and land-use change. There is large uncertainty in LULUCF emissions, particularly related to peat oxidations (not including peat fires), which can account for around 30% to 50% of total LULUCF emissions. Uncertainty concerning emissions from peat fires is also high and it is well known that these emissions vary significantly between years. This has made it difficult to determine the emissions projections for Indonesia and to assess whether the 2020 pledge and 2030 NDC targets will be achieved. Therefore, the projected emissions are shown excluding and including (historical) peat fire emissions. If projections are harmonised to historical data including peat fire emissions, the LULUCF current policies scenario projection for 2030 emissions becomes higher by 460 to 510 $MtCO_2e$/year (about 57% to 64%) compared to our 2017 projection. As a result, Indonesia's emission reductions resulting from the policies assessed in our analysis are projected to be smaller than the uncertain amount of emissions from land-use changes and forestry.

As such, Indonesia would likely fall short of meeting its unconditional NDC target under current policies, with overall emission levels ranging from 2,690 to 3,080 $MtCO_2e$/year by 2030 (including LULUCF, including historical peat fires). The major change compared to the 2017 projection is an increase of over 900 $MtCO_2e$ in the upper end of the range. The projection is influenced by the harmonisation to 2014 including peat fires (vs 2010 in the previous report), and more renewable energy policies.

Table 37: Description of Indonesia's 2020 pledge and NDC.

| Indicator | 2020 pledge | NDC |
|---|---|---|
| **Target: unconditional** | • 26% GHG reduction by 2020 from baseline scenario | • 29% GHG reduction by 2030 from baseline scenario |
| **Target: conditional** | • N/A | • 41% GHG reduction by 2030 from baseline scenario |
| **Sectoral coverage** | • Not Specified | • Energy including transport, industrial processes and product use, agriculture, LULUCF, waste |
| **General Accounting method** | • Not Specified | • IPCC guidelines; 100-year GWPs from the Fourth Assessment Report |
| **GHGs covered** | • Not Specified | • All IPCC sectors $CO_2$, $CH_4$, $N_2O$ |
| **Consideration of LULUCF** | • Land use sector is included in the target<br>• Accounting approaches and methodologies are not specified | • Land use sector is included in the target;<br>• Accounting approaches and methodologies are not specified |

*Table to be continued on next page*

| | | |
|---|---|---|
| **Use of bilateral, regional and international credits** | • N/A | • 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". |

Table 38: Overview of key climate change mitigation policies in Indonesia (ADB, 2016, Kharina et al., 2016, Republic of Indonesia, 2016a, Republic of Indonesia, 2016b, Ministry of Energy and Mineral Resources, 2018)

| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Energy supply** | Renewable energy targets (2014) (+)[1)] | • 15%-23% share of renewable energy in primary energy supply by 2025 |
| | National Electricity Plan (2018) [1)] | • 23% new and renewable energy (including nuclear) by 2025 (planned: 25%) |
| | Electricity Supply Business Plan (2018) [2)] | • Added electricity capacity by 2022: 2.4 GW hydro, 1.2 GW geothermal, 1.1 GW solar/wind |
| **Transport** | Biofuel targets (2013) [3)] | • 15% share of biofuels in all transportation fuels by 2025 (25% biodiesel, 20% bioethanol) |
| **Forestry** | Presidential Instruction number 6/2013 on Forest Moratorium | • Restricting oil palm extension to peatland or to primary forest as defined in the Ministry of Forestry land cover map |

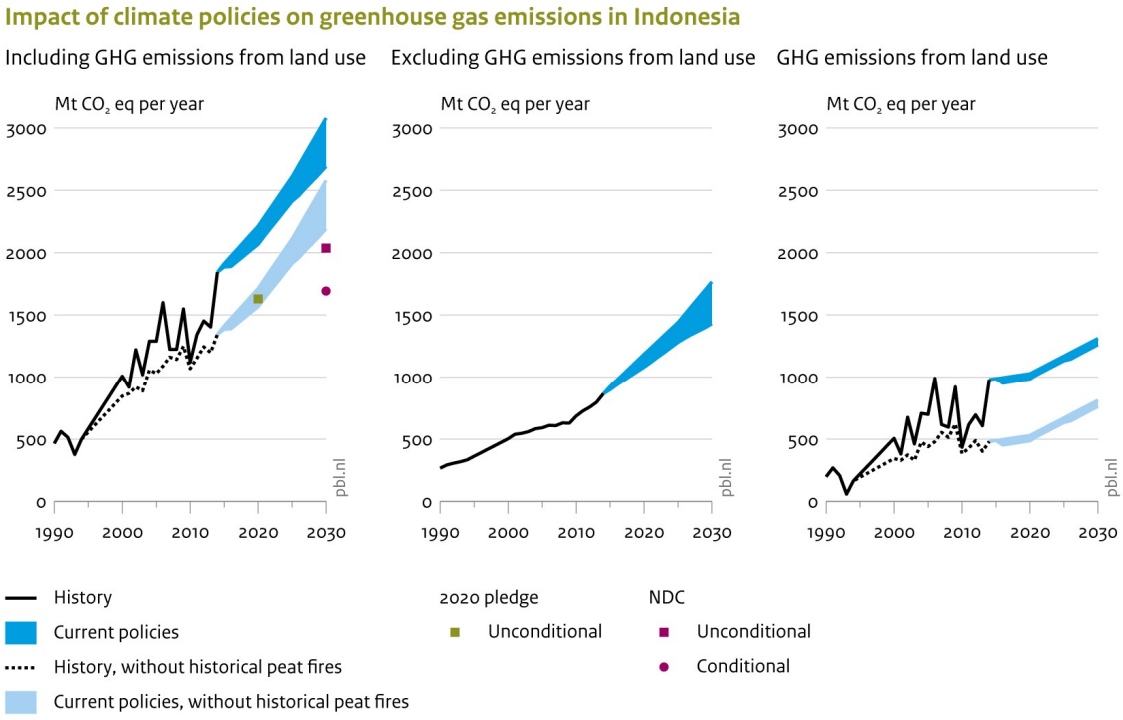
*[1)] Not included separately, but checked if achieved after implementation of other policies*

*[2)] NewClimate additionally 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 TIMER model as 22.5% total biofuel share*

Table 39: Impact of climate policies on greenhouse gas emissions (including LULUCF emissions, including emissions from peat oxidation and from deforestation) in Indonesia, harmonised to historical data including peat fires (current policies projections do not include peat fires). Absolute emissions level and changes in emissions level relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emissions values are based on SAR GWP-100 (except NDC: AR4).

| 2010 GHG emissions, incl. LULUCF | 2020 pledge and NDC | | Current policies | |
|---|---|---|---|---|
| | Official data [conditional] | PBL and NewClimate estimates [conditional] | Official data | PBL and NewClimate estimates |
| Absolute: 1,120 $MtCO_2e$ | 2,050 $MtCO_2e$ [1,700 $MtCO_2$] by 2030 | 1,630 $MtCO_2e$, 45% by 2020<br>2,035 [1,695] $MtCO_2e$, 82% [51%] $MtCO_2e$ by 2030 | N/A | 2,065 to 2,215 $MtCO_2e$; 84% to 98% by 2020<br>2,690 to 3,080 $MtCO_2e$; 140% to 175% by 2030 |
| Per capita: 4.6 $tCO_2e$/capita | N/A | 6.0 $tCO_2e$/capita by 2020<br>6.9 [6.0] $tCO_2e$/capita by 2030 | N/A | 7.6 to 8.1 $tCO_2e$/capita by 2020<br>9.1 to 10.4 $tCO_2e$/capita by 2030 |




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

Figure 12: Impact of climate policies on greenhouse gas emissions in Indonesia. Left panel: Total emissions including land use (i.e. LULUCF emissions and emissions from peat oxidation from deforestation), middle panel: total emissions excluding land use, and right panel: land use emissions and removals only. Solid lines and dark blue shading: historical data including peat fires, projections excluding peat fires; dotted lines and light blue shading: both historical data and projections excluding peat fires, to show the effect of harmonising to historical data including this uncertain emission source with high variation. Source: NewClimate Institute calculations based on its analysis for Climate Action Tracker (CAT, 2018a) and PBL calculations excluding LULUCF, and IIASA calculations on LULUCF

emissions and removals (including emissions from peat oxidation). Projections last updated: November 2018. Emission values are based on SAR GWP-100 (except NDC: AR4).

For comparison, the CAIT Indonesia tool (WRI, 2016) gives an estimate of 1,805 $MtCO_2e$ for the projected national 2020 emissions, based on the same historical emissions.

## Japan

Japan aims in its NDC to reduce GHG emissions by 26% by 2030 compared to 2013 levels. The main GHG mitigation policies implemented in Japan include the renewable feed-in tariff scheme, 2018 Basic Energy Plan, Top Runner Standards programme as well as the F-gas Act and the Ozone Layer Protection Act on F-gases.

Our latest assessment indicates that Japan is projected to miss its NDC target under current policies. This is largely due to the revised projections on  on F-gases as well as nuclear power generation, done by PBL. For 2020, the current policies scenario projections indicate that Japan would overachieve its current pledge (3.8% below 2005 levels by 2020).

Japan plans to prepare its long-term decarbonisation strategy by June 2019. Another encouraging development is in the transport sector—the Government is planning to set a long-term target of reducing tank-to-wheel $CO_2$ emissions by 90% below 2010 levels by 2050 for new passenger vehicles (METI, 2018b).

Table 40: Description of Japan's 2020 pledge and NDC

| Indicator | 2020 pledge | NDC |
|---|---|---|
| **Target: unconditional** | • 3.8% reduction by 2020 from 2005 level | • 26% 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 the Fourth Assessment Report | • IPCC guidelines; 100-year GWPs from the Fourth Assessment Report |
| **GHGs covered** | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, $SF_6$ and $NF_3$ | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, $SF_6$ and $NF_3$ |
| **Consideration of LULUCF** | • Land use sector is included in the target<br>• Accounting approach is specified as Kyoto Protocol approach (gross-net accounting) | • Land use sector is included in the target<br>• Accounting approach is specified as Kyoto Protocol approach (gross-net accounting)<br>• A reduction of net LULUCF emissions is expected in the range of 37 $MtCO_2e$ [1)] |
| **Other sector-level targets** | • N/A | • N/A |
| **Use of bilateral, regional and international credits** | • Yes. Expected amount not specified. | • Yes. Cumulative 50 to 100 $MtCO_2e$ through the Joint Crediting Mechanism (JCM). |
| **Other information** | • 2020 pledge assumes zero nuclear power generation following the Fukushima nuclear disaster | • N/A |

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

Table 41: Overview of key climate change mitigation policies in Japan (Government of Japan, 2013, IEA, 2015, METI, 2018b, METI, 2018a, METI, 2018c, METI, 2018d, Government of Japan, 2017)

| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Economy-wide** | 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) [2)] | • New certification system to allow for an inter-business initiative to enhance systemic energy savings<br>• Ensures the coverage of e-commerce retailers under the Act |
| **Energy supply** | 2018 Basic Energy Plan [3)] (+) | • Renewable electricity (incl. large hydro): 22 to 24% 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 (2007) [1)] | • Energy reduction of 1%/year and annual reports to the government by large operators<br>• Energy efficiency standards for buildings and houses larger than 300 $m^2$ |
| **Transport** | Top Runner Programme: vehicle efficiency standards (1999) | • 20.3 km/l by 2020 |
| **F-gases** | Act on Rational Use and Proper Management of Fluorocarbons (2013) | • 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) |
| | Ozone Layer Protection Act (2018 amendment) [2)] | • Regulation on production and import volumes to comply with the Kigali Amendment of the Montreal Protocol |

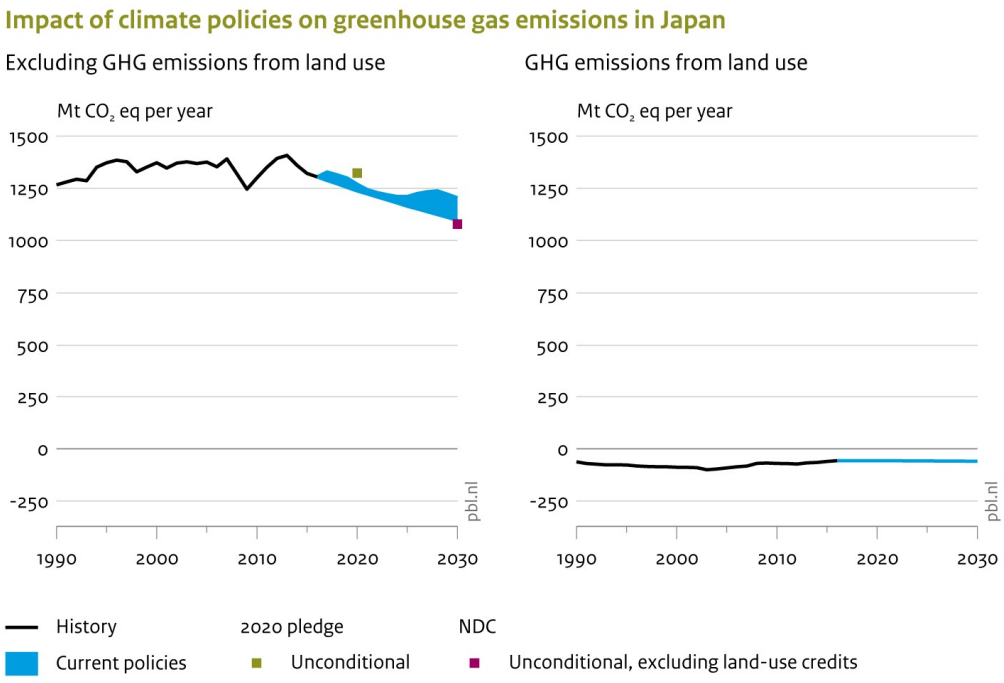
*[1)] Not quantified in the PBL TIMER projections*

*[2)] Not quantified in PBL and NewClimate Institute projections.*

*[3)] Due to the large uncertainty regarding the feasibility of the 2014 Basic Energy Plan on 2030 electricity mix, NewClimate Institute performed independent calculations on a possible 2030 electricity mix. PBL assumed nuclear energy capacity to reach 21.7 GW by 2030, which is close to the total capacity of all reactors that applied for restart (roughly 25 GW) as of September 2018 (JAIF, 2018).*

Table 42: Impact of climate policies on greenhouse gas emissions (excluding LULUCF, excluding credits) in Japan. Absolute emissions levels and changes in emissions levels relative to 2010 levels are presented. Official emissions data are provided in Appendix (A1). Emission values are based on AR4 GWP-100.

| 2010 GHG emissions, excl. LULUCF | 2020 pledge and NDC | | Current policies | |
|---|---|---|---|---|
| | Official data | PBL and NewClimate estimates | Official data | PBL and NewClimate estimates |
| Absolute: 1,300 $MtCO_2e$ | 1,399 $MtCO_2e$ by 2020, 1,079 $MtCO_2e$ by 2030 | 1,325 $MtCO_2e$, 2% by 2020<br>1,080 $MtCO_2e$, -17% by 2030 | N/A | 1,240 to 1,270 $MtCO_2e$, -5% to -2% by 2020<br>1,100 to 1,205 $MtCO_2e$, -16% to -7% by 2030 |
| Per capita: 10.1 $tCO_2e$/capita | N/A | 10.5 $tCO_2e$/capita by 2020<br>8.9 $tCO_2e$/capita by 2030 | N/A | 9.8 to 10.0 $tCO_2e$/capita by 2020<br>9.0 to 9.9 $tCO_2e$/capita by 2030 |




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

Figure 13: Impact of climate policies on greenhouse gas emissions in Japan; left: excluding land use (i.e. LULUCF), right: only land use. 2020 and 2030 targets include LULUCF credits (in line with the Kyoto accounting rules) as well as overseas credits. Source: NewClimate Institute calculations based on its analysis for Climate Action Tracker (CAT, 2018a), PBL calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals. Please see Appendix (A2) on the consideration of LULUCF for the NDC quantification. Projections last updated: November 2018. Emissions values are based on AR4 GWP-100.

## Kazakhstan

Kazakhstan pledged an unconditional NDC target to reduce GHG emissions by 15% below 1990 levels by 2030, and a conditional target to reduce emissions by 25% below 1990 by 2030. The current policies projection includes the Action Plan for the development of alternative and renewable energy in Kazakhstan for 2013 to 2020, as well as forestry policies.

Under current policies, Kazakhstan's GHG emissions are projected to be 395 to 430 $MtCO_2e$/year by 2030 (including LULUCF), which is similar to last year's projections (despite the updates to include forestry policies and use more recent historical data and GWP values). Kazakhstan would, therefore, fail to achieve its unconditional NDC target by 2030 (280 $MtCO_2e$/year including LULUCF). The ETS was relaunched in 2018 but due to uncertainties regarding its implementation, it was not included in the current policies scenario projections.

Table 43: Description of Kazakhstan's 2020 pledge and NDC

| Indicator | 2020 pledge | NDC |
|---|---|---|
| **Target: unconditional** | • 15% reduction from 1990 levels [1)]<br>• 7% reduction from 1990 base year levels [1)] | • 15% reduction in GHG emissions by 2030 compared to the 1990 base year |
| **Target: conditional** | • N/A | • 25% reduction in GHG emissions by 2030 compared to the 1990 base year, conditional on international investments, the transfer of low carbon technologies, green climate funds and flexible mechanisms for transition economy countries |
| **Sectoral coverage** | • N/A | • All sectors, incl. LULUCF |
| **General Accounting method** | • N/A | • IPCC 2006 guidelines, 100-year GWPs from the Fourth Assessment Report |
| **GHGs covered** | • N/A | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, $SF_6$ |
| **Consideration of LULUCF** | • N/A | • Land use sector is included in the target<br>• Accounting approaches and methodologies are not specified |
| **Use of bilateral, regional and international credits** | • N/A | • Option to use market-based mechanisms |

[1)] *Kazakhstan's Copenhagen pledge was to reduce emissions by 15% below 1992 levels incl. LULUCF by 2020, with the base year changed to 1990 later in 2012. For the 2nd commitment period of the Kyoto Protocol, Kazakhstan submitted a target of 7% reduction below 1990 levels (Government of the Republic of Kazakhstan, 2015, Ministry of Energy of the Republic of Kazakhstan, 2015).*

Table 44: Overview of key climate change mitigation policies in Kazakhstan (Ministry of Environment and water resources of the Republic of Kazakhstan, 2013, Government of Kazakhstan, 2016, Decree of the President of the Republic of Kazakhstan, 2013, Republic of Kazakhstan, 2012, Republic of Kazakhstan, 2009, Braliyev, 2007, Government of the Republic of Kazakhstan, 2018, ICAP, 2018)

| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Economy-wide** | Concept for Kazakhstan's Transition to Green Economy: Energy efficiency targets (2015) (+) [1)] | • Reduction of energy intensity per GDP of 25% by 2020, of 30% by 2030 and of 50% by 2050 compared to 2008 levels<br>• Combined share of wind and solar in total electricity production more than 3% in 2020 and 30% by 2030 |
| | Strategic Development Plan before 2020 (Decree No. 922) (2010) [2)] | • Increase renewable energy share in total energy consumption to 1.5% by 2015 and 3% by 2020<br>• Reduction of energy intensity by at least 10% by 2015 and by at least 25% by 2025 as compared to 2008 |
| | Concept of Transition of the Republic of Kazakhstan to Sustainable Development for the Period 2007-2024 (Presidential Decree No. 216 of 2006) [2)] | • 5% of national energy consumption provided by renewable sources by 2024 |
| **Energy supply** | Support scheme for renewable energy (2014) [1)] | • Feed-in-tariff for wind, solar, small hydro and biogas plants |
| | Action Plan for the development of alternative and renewable energy in Kazakhstan for 2013-2020 (2013) | • Plan to build around 106 renewable energy installations with a total installed capacity of 3054.55 MW into operation by 2020 |
| | National Allocation Plan for GHG emissions under KAZ ETS for 2018 to 2020 (December 2017)[3)] | • Cap of 162 $MtCO_2e$/year for 2018–2020 |
| **Buildings** | Program on modernization of housing and communal services (2012)[1)] | • Reduction of emissions associated with housing and communal services by 10% by 2030 |
| **Forestry** | Strategic Plan of the Ministry of Environment and Water Resources (2014) | • Wildfire suppression activities. A reduction of associated emissions by 0.3 $MtCO_2e$/year by 2030.<br>• Combating land degradation and desertification. A reduction of associated emissions by 25 $MtCO_2e$/year by 2030 compared to 1991 levels. |
| | State Program for Agro-industrial Complex Development of the Republic of Kazakhstan (2017) | • Reduction of forest felling volumes that is expected to increase associated sinks by 0.1 $MtCO_2e$/year by 2030 compared to 1991 levels.<br>• Increasing forest area and forest area regeneration. An increase of associated sinks by 0.3 $MtCO_2e$/year by 2030 compared to 1991 levels. |

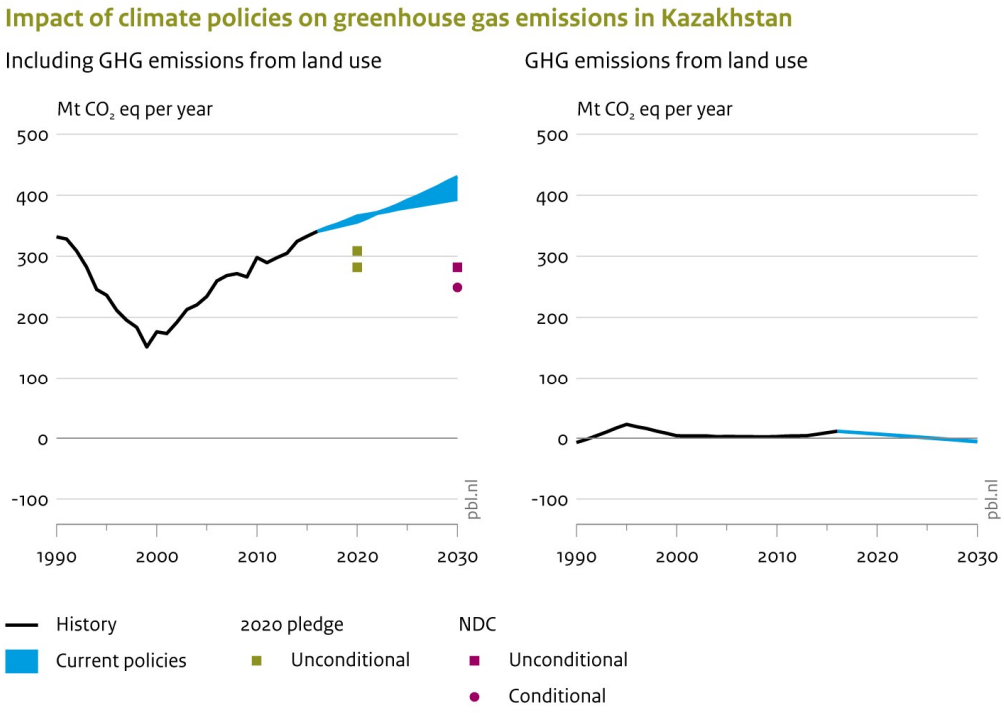
*[1)] Policy not included. None of the policies in this overview were quantified in PBL's TIMER model.*

*[2)] Not quantified in PBL and NewClimate Institute projections (only indirectly via renewable energy capacity deployment under the Action Plan for the development of alternative and renewable energy in Kazakhstan for 2013-2020).*

[3] *Kazakhstan's ETS (phase III: 2016-2020) was suspended until 2018 (ICAP, 2016). Although it has been relaunched, uncertainties remain over its implementation; therefore, it is not included as current policy.*

Table 45: Impact of climate policies on greenhouse gas emissions (including LULUCF) in Kazakhstan. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emission values are based on AR4 GWP-100.

| 2010 GHG emissions, incl. LULUCF | 2020 pledge and NDC | | Current policies | |
|---|---|---|---|---|
| | Official data | PBL and NewClimate estimates [conditional] | Official data | PBL and NewClimate estimates |
| Absolute: 298 $MtCO_2e$ | N/A | 280 to 310 $MtCO_2e$, -5% to 4% by 2020<br>280 [250] $MtCO_2e$, -5% [-16%] by 2030 | N/A | 355 to 365 $MtCO_2e$, 20% to 23% by 2020<br>395 to 430 $MtCO_2e$, 32% to 43% by 2030 |
| Per capita: 18.2 $tCO_2e$/capita | N/A | 15.0 to 16.4 $tCO_2e$/capita by 2020<br>13.9 [12.3] $tCO_2e$/capita by 2030 | N/A | 19.0 to 19.5 $tCO_2e$/capita by 2020<br>19.4 to 21.2 $tCO_2e$/capita by 2030 |




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

Figure 14: Impact of climate policies on greenhouse gas emissions in Kazakhstan (left panel: all gases, including land use (i.e. LULUCF), right panel: only land use GHG emissions). Source: NewClimate Institute calculations adapted from Climate Action Tracker (CAT, 2018a), PBL calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals. Projections last updated: November 2018. Emission values are based on AR4 GWP-100.

## Mexico

Mexico aims in its NDC to reduce its GHG emissions by 22% (unconditional), and by 36% (conditional) from BAU by 2030. An assessment of the Energy Transition Law (24/12/2015) that provides a framework for clean energy, energy efficiency and GHG emissions reductions, reveals that this target is less ambitious compared to what was proposed by previous renewable energy laws and their Secretariat of Energy (SENER) projections. The basis for climate policy in Mexico is the General Climate Change Law adopted in 2012, which translates the overarching targets into strategies and plans, and provides the institutional framework for implementation. Mexico has recently reformed this law to include its NDC commitments—also at the sectoral level—and to establish a national emissions market, which was previously only voluntary.

Under its current policies, it is uncertain whether Mexico is on track to meet its unconditional NDC target as NewClimate Institute and PBL provided different assessments. Additional mitigation actions are needed to meet their conditional NDC target. Our evaluation changed from our 2017 report mainly due to updated LULUCF historical and projected emissions, as well as updated GDP and electricity projections for NewClimate Institute calculations. Less prominently, an update of Mexico's GHG emissions inventory has also resulted in a slight change in historical emissions.

In its NDC, Mexico also includes the target to reduce black carbon by 51% unconditionally and 70% conditionally below BAU emissions of 124 $MtCO_2e$/year in 2030. While the reduction of black carbon has important health benefits, its impact on temperature levels is highly uncertain (Bond et al., 2013).

Table 46: Description of Mexico's 2020 pledge and NDC

| Indicator | 2020 pledge | NDC |
|---|---|---|
| **Target: unconditional** | • N/A | • 22% GHG reduction by 2030 from baseline scenario |
| **Target: conditional** | • 30% GHG reduction by 2030 from baseline scenario | • 36% GHG reduction by 2030 from baseline scenario |
| **Sectoral coverage** | • Economy-wide | • Economy-wide |
| **General Accounting method** | • Not-specified | • IPCC guidelines; 100-year GWPs from the 5th IPCC Assessment Report |
| **GHGs covered** | • Not-specified | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs and $SF_6$ |
| **Consideration of LULUCF** | • Land use sector is included in the target<br>• Accounting approaches and methodologies are not specified | • Land use sector is included in the target<br>• Accounting approaches and methodologies are not specified<br>• Activity-based approach is expected to be used |
| **Use of bilateral, regional and international credits** | • N/A | • 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 |

Table 47: Overview of key climate change mitigation policies in Mexico(Cámara de Diputados, 2015, IEA, 2015, Government of Mexico, 2014, Government of Mexico, 2016, Secretaria de Energia, 2014, SEMARNAT, 2001, Secretaría de Energía, 2011)

| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Economy-wide** | Special Program on Climate Change (2014 to 2018) | Plan to reduce GHG emissions by implementing specific measures in all sectors[1)] |
| | Reform to the General Law on Climate Change (LGCC, (+)) (April 2018) | Addition of NDC GHG emission reduction targets including sectoral targets[1)]. |
| **Energy supply** | Electric Industry Law (LIE, (+)) (2014) [1)] | • Law section of the Energy Reform (2014)<br>• Establishes a free competition regime in electric power generation and commercialization. It allows participation of private actors in transmission and distribution of electric power.<br>• Under this Law, market rulebooks exist (e.g. auctioning and interconnections) |
| | Energy Transition Law (2015) | • Provides a framework for clean energy, energy efficiency and greenhouse gas emissions reductions<br>• Sets targets for clean energy 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 (IEA, 2016) |
| | National Transition Strategy to Promote the use of clean fuels and technologies (2016) | • Policy instrument section of the Energy Transition Law. Planning instrument.<br>• 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. |
| | Performance criteria and application for flaring and ventilation of natural gas (CNH.06.001/09) (2011) | • Emissions reductions in oil and gas production through a decrease in venting of 73 $MtCO_2e$ below BAU in 2020 and 92 $MtCO_2e$ in 2030[2)] |
| **Transport** | $CO_2$ emissions standards for light duty vehicles[2)] | • Passenger cars: 135 to 180 $gCO_2$/km (depending on vehicle size)<br>• Light duty trucks: 163 to 228 $gCO_2$/km (depending on size) |
| **Forestry** | National Forestry Programme 2025 (2001) | • Protected areas according to the payments for an Ecosystem Services (PES) scheme for promoting conservation, restoration and sustainable forest use [3)] |
| | National Forestry Programme - PRONAFOR (2014) | • Reduction of the annual deforestation rate from 0.24% of total forest area in 2010 to 0.2% by 2018 |
| | REDD+ National Strategy (2017) | • Continued reduction of LULUCF emissions and achieving net zero deforestation by 2030. |

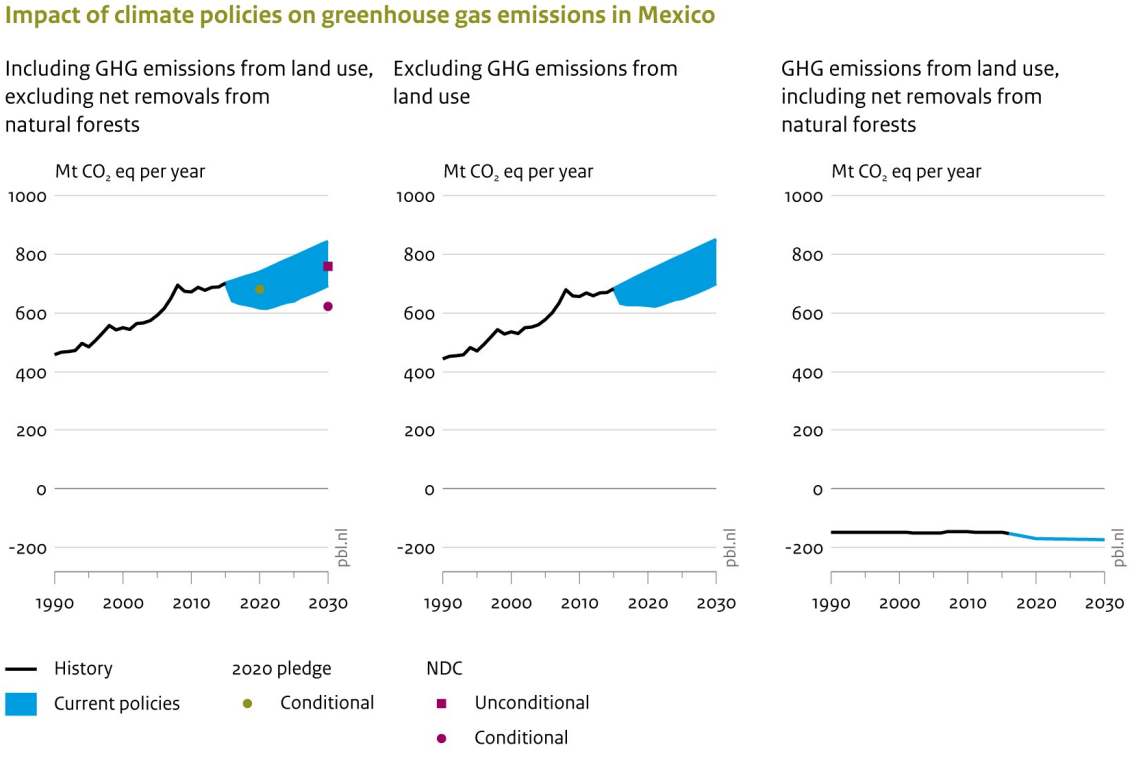
*[1)] Not quantified in PBL and NewClimate Institute projections.*

*[2)] Not quantified in the NewClimate Institute projections.*

*[3)] Not quantified in IIASA model projections.*

Table 48: Impact of climate policies on greenhouse gas emissions (including LULUCF, excluding net removals from natural forests) in Mexico. Absolute emission levels and changes in emissions levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emission values are based on AR5 GWP-100.

| 2010 GHG emissions, incl. LULUCF | 2020 pledge and NDC | | Current policies | |
|---|---|---|---|---|
| | Official data | PBL and NewClimate estimates [conditional] | Official data | PBL and NewClimate estimates |
| Absolute: 672 $MtCO_2e$ | N/A | 680 $MtCO_2e$, 1% by 2020<br>760 [625] $MtCO_2e$, 13% [7%] by 2030 | N/A | 615 to 740 $MtCO_2e$, -8% to 10% by 2020<br>695 to 845 $MtCO_2e$, 3% to 25% by 2030 |
| Per capita: 5.7 $tCO_2e$/capita | N/A | 5.0 $tCO_2e$/capita by 2020<br>5.1 [4.2] $tCO_2e$/capita by 2030 | N/A | 4.6 to 5.5 $tCO_2e$/capita by 2020<br>4.7 to 5.7 $tCO_2e$/capita by 2030 |




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

Figure 15: Impact of climate policies on greenhouse gas emissions in Mexico; left panel: all GHG emissions including land use (i.e. LULUCF, excluding net removals from natural forests), middle panel: excluding land use and right panel: only land use (including net removals from natural forests) separately. Source: NewClimate Institute calculations based on its analysis for Climate Action Tracker (CAT, 2018a),PBL calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals. Projections last updated: November 2018. Emission values are based on AR5 GWP-100.

Note: the BAU emission projection in Mexico's NDC excludes removals from natural forests, which accounted for -162 $MtCO_2e$/year in 2010. Therefore, net removals from natural forests are excluded from the current policies scenario and NDC analysis (figures on the left and middle panels) but included in the figure on the right.

## Morocco

Morocco pledged an unconditional NDC target to reduce GHG emissions by 17% below BAU by 2030, and a conditional target to reduce emissions by 42% below BAU by 2030. The current policies projection considers the National Energy Strategy, including the Morocco Solar Plan, as well as the Morocco Integrated Wind Energy Program.

Morocco's GHG emissions are projected to be 153 $MtCO_2e$ by 2030 (including LULUCF) under current policies projections. Morocco would, therefore, not achieve its unconditional NDC target of 142 $MtCO_2e$ including LULUCF by 2030 under existing policies. Our latest emissions projections are roughly the same as those in the 2017 report.

Table 49: Description of Morocco's NDC. Note: Morocco has not set its 2020 pledge.

| Indicator | NDC |
|---|---|
| **Target: unconditional** | • 17% reduction in GHG emissions by 2030 compared to BAU scenario (4% coming from AFOLU actions) |
| **Target: conditional** | • 42% reduction in GHG emissions compared to BAU scenario conditional on international financial support of USD 35 billion (8% coming from AFOLU actions) |
| **Sectoral coverage** | • Economy-wide (Electricity production, Housing, Agriculture, Industry, Transportation, Waste, Forestry) |
| **General Accounting method** | • 1996 IPCC Guidelines; GWP values of Second IPCC Assessment Report |
| **GHGs covered** | • $CO_2$, $CH_4$, $N_2O$ |
| **Consideration of LULUCF** | • Land use sector is included in target<br>• Morocco's Green Plan (PMV) and Preservation and Sustainable Forest Management Strategy are part of NDC as key sectoral strategies<br>• Accounting approaches and methodologies are not specified |
| **Other sector-level targets** | • NDC outlines key sectoral policy strategies and respective sectoral emission targets |
| **Use of bilateral, regional and international credits** | • Yes. Expected amount not quantified. |

Table 50: Overview of key climate change mitigation policies in Morocco (Kingdom of Morocco, 2016b, Kingdom of Morocco, 2016a, Kingdom of Morocco, 2014, Kingdom of Morocco - Ministry Delegate of the Minister of Energy Mines Water and Environment, 2013, Ministry of Equipment and Transport, 2010, Schinke and Klawitter, 2016)

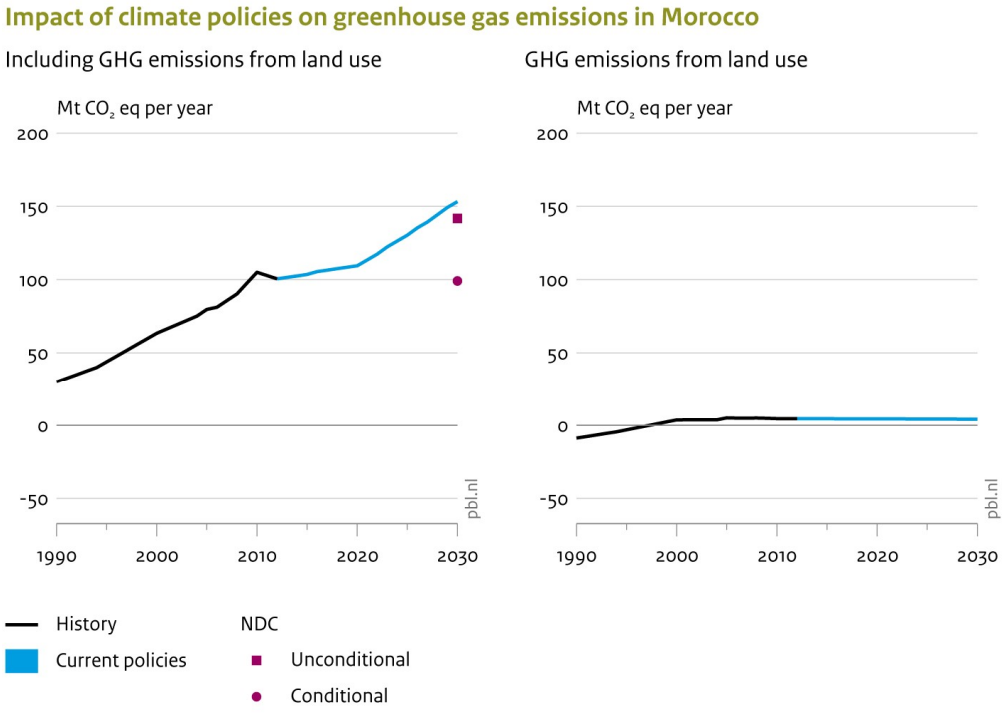
| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Economy-wide** | Moroccan Climate Change Policy (MCCP) (2014) | • Overarching coordination and alignment of various sectoral and cross-sectoral national policies tackling climate change |
| **Energy supply** | National Energy Strategy (2009, updated 2012) (+)<br>• Morocco Integrated Wind Energy Program (2010)<br>• Morocco Solar Plan (2009) [1)]<br>• Morocco Hydro-Electric Plan (continuation of plan started in 1970s) [1)] | • Aim for an installed renewable electricity capacity of 42% by 2020 and 52% by 2030<br>• Energy savings of 12-15% in 2020 and 20% in 2030<br>• Supply 10-12% of the country's primary energy demand with renewable energy sources by 2020 and 15-20% by 2030<br>• Extension of national wind farms to total 2,000 MW by 2020<br>• Extension of solar power capacity to 2,000 MW (both concentrated solar power plants & photovoltaic systems)<br>• Extension of hydro power capacity with 775 MW by 2020<br>• Extension of small hydropower projects with total capacity of 100 MW in 2030 |
| **Transport** | Extension of Rabat and Casablanca tramways (2016) | • Extension of Rabat tramway by 20 km by 2019<br>• 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 |
| **Forestry** | Preservation and Sustainable Forest Management Strategy (+) | • Afforestation and regeneration of approximately 50,000 hectares of forest per year |
| | Morocco Green Plan (PMV) (2008) (+)[2)] | • Promotion of natural resources and sustainable management<br>• Modernization of the agricultural sector |

[1)] *See Supporting Information for the implementation status*

[2)] *Not quantified in IIASA model projections.*

Table 51: Impact of climate policies on greenhouse gas emissions (including LULUCF) in Morocco. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emission values are based on SAR GWP-100.

| 2010 GHG emissions, incl. LULUCF | 2020 pledge and NDC | | Current policies | |
|---|---|---|---|---|
| | Official data | NewClimate estimates [conditional] | Official data | NewClimate estimates |
| Absolute: 105 $MtCO_2e$ | 99 to 141 $MtCO_2e$ by 2030 | 140 [100] $MtCO_2e$, 35% [-6%] by 2030 | N/A | 110 $MtCO_2e$, 4% by 2020<br>155 $MtCO_2e$, 46% by 2030 |
| Per capita: 3.2 $tCO_2e$/capita | N/A | 3.5 [2.4] $tCO_2e$/capita by 2030 | N/A | 3.0 $tCO_2e$/capita by 2020<br>3.7 $tCO_2e$/capita by 2030 |




Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 16: Impact of climate policies on greenhouse gas emissions in Morocco ($CO_2$, $CH_4$ and $N_2O$; including land use (i.e. LULUCF)). Source: NewClimate Institute calculations excluding LULUCF based on its analysis for Climate Action Tracker (CAT, 2018a) and IIASA calculations on LULUCF emissions and removals. Projections last updated: November 2018. Emission values are based on SAR GWP-100.

## Philippines

The Philippines' NDC includes a conditional GHG reduction target of 70% below BAU levels by 2030. Calculations for 2030 emissions levels under the NDC show between 32% and 40% below 2010 levels (excl. LULUCF). The uncertainty for the commitment comes from the lack of a definition regarding the BAU pathway. The NDC emissions level excluding LULUCF is estimated to be between 90 and 102 $MtCO_2e$ in 2030. Under current policies, the Philippines' emissions level is projected to reach 234 $MtCO_2e$ by 2020 and 321 $MtCO_2e$ by 2030, excluding LULUCF.

Although there is uncertainty related to LULUCF emissions and the lack of data on the BAU scenario mentioned in the country's NDC, our projections suggest that the Philippines are not on track to meet its conditional NDC target. Our latest emissions projections are roughly the same as those in the 2017 report.

Table 52: Description of The Philippines' NDC

| Indicator | NDC |
|---|---|
| **Target: unconditional** | • N/A |
| **Target: conditional** | • 70% GHG reduction by 2030 relative to its BAU scenario 2000-2030. Conditioned to financial resources, technology development & transfer, and capacity building |
| **Sectoral coverage** | • Energy, transport, waste, forestry and industry |
| **General Accounting method** | • IPCC guidelines; 100-year GWPs from AR4 |
| **GHGs covered** | • Not specified |
| **Consideration of LULUCF** | • The forest sector is included in the target and is expected to contribute to the GHG emission reduction target<br>• Accounting approaches and methodologies are not specified |
| **Use of bilateral, regional and international credits** | • N/A |

*Note: The Philippines has not set its 2020 pledge.*

Table 53: Overview of key climate change mitigation policies in the Philippines (APERC, 2017, Department of Energy, 2015b, Department of Energy, 2015a, London School of Economics and Political Science, 2015, Philippine Institute for Development Studies, 2014)

| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Economy-wide** | Energy Efficiency and Conservation Roadmap (EE&C) (2014)<br>Energy Efficiency and Conservation Action Plan (2016) | • 20.2% energy savings by 2030 compared to BAU, from 2005 levels<br>• 3% per year economy-wide improvement in energy intensity compared to BAU<br>• 21 $MtCO_2$ reduction by 2030, compared to BAU<br>• Savings of c.a. 10,665 ktoe (1/3 of current demand) by 2030 |
| **Energy supply** | Sitio Electrification Program (SEP) of the National Electrification Administration (2012) | • Aims to energize sitios[1)] through on-grid electrification<br>• 2015 target: 100% sitios energized; covering at least 648,820 households [2)] |
| | National Renewable Energy Program (NREP) (2012) | • Increase renewable energy capacity of the country to an estimated 15,304 MW by 2030 (almost triple its 2010 level)<br>• The aimed installed capacity by 2030 is broken down as follows: 3,461 MW from geothermal; 8,724 from small hydropower (<50 MW); 316 from biomass; 2,378 from wind; 285 from solar; 71 from ocean. |
| **Transport** | EE&C Roadmap (2014) and Action Plan (2016) | • 14.3% energy savings in transport sector compared to BAU by 2020<br>• 25% energy savings compared to BAU by 2030 |
| **Industry** | EE&C Roadmap (2014) and Action Plan (2016) | • 8.7% energy savings in industrial sector by 2020 compared to BAU, 15% energy savings by 2030 |
| **Buildings** | EE&C Roadmap (2014) and Action Plan (2016)<br>• Appliance Standards and Labelling Program<br>• Government Buildings Efficiency Program | • 10% energy savings in commercial buildings by 2020 and 25% by 2030, compared to BAU by 2030<br>• 6.6% energy savings in residential buildings by 2020 and 20% by 2030, compared to BAU by 2030 |
| **Forestry** | The Philippine National REDD+ Strategy (2010) (+) [3)] | • Continued reduction of deforestation and forest degradation |

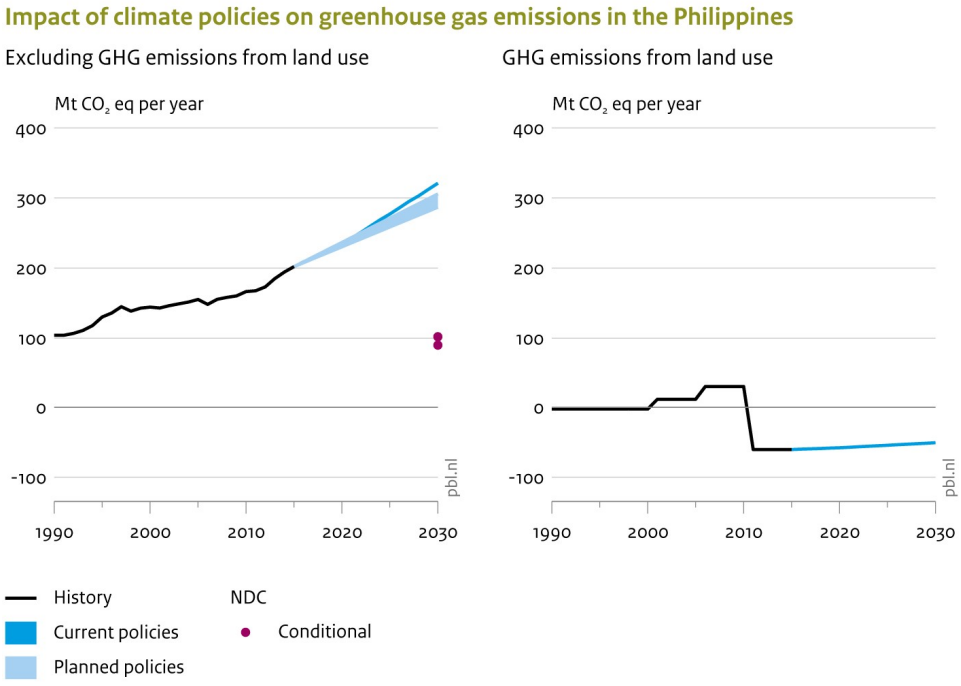
[1)] *A "sitio" is defined as territorial enclave within a barangay (smallest administrative division in the Philippine, equivalent to town or district) which may be distant from the barangay centre.*

[2)] *A sitio is considered energized if it is successfully connected to the grid and at least 20 households are given electricity connections.*

[3)] *Not quantified in IIASA model projections.*

Table 54: Impact of climate policies on greenhouse gas emissions (excluding LULUCF) in the Philippines. Absolute emissions levels and changes in emissions levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emission values are based on AR4 GWP-100.

| 2010 GHG emissions, excl. LULUCF | 2020 pledge and NDC | | Current policies | | Planned policies | |
|---|---|---|---|---|---|---|
| | Official data | NewClimate estimates | Official data | NewClimate estimates | Official data | NewClimate estimates |
| Absolute: 166 $MtCO_2e$ | N/A | 90 to 100 $MtCO_2e$, -46 % to -39% by 2030 (conditional) | N/A | 235 $MtCO_2e$, 41% by 2020<br>320 $MtCO_2e$, 93% by 2030 | N/A | 230 to 236 $MtCO_2e$, 41% by 2320<br>286 to 305 $MtCO_2e$, 72 to 84% by 2030 |
| Per capita: 1.8 $tCO_2e$/capita | N/A | 0.7 to 0.8 $tCO_2e$/capita by 2030 | N/A | 2.1 $tCO_2e$/capita by 2020<br>2.6 $tCO_2e$/capita by 2030 | N/A | 2.1 $tCO_2e$/capita by 2020<br>2.3 to 2.5 $tCO_2e$/capita by 2030 |




Source: NewClimate Institute calcul ons; IIASA GLOBIOM/G4M model

Figure 17: Impact of climate policies on greenhouse gas emissions in the Philippines; left: excluding land use (i.e. LULUCF), right: only land use. Source: NewClimate Institute calculations excluding LULUCF based on its analysis for Climate Action Tracker (CAT, 2018a, CAT, 2017) and IIASA calculations on LULUCF emissions and removals. Projections last updated: November 2018. Emission values are based on AR4 GWP-100.

## Republic of Korea

The Republic of Korea's NDC aims to reduce GHG emissions by 37% below BAU levels by 2030. The government also pledged internationally to reduce its GHG emissions by 30% below BAU levels by 2020, but this target has been abandoned domestically through the amended Green Growth Act. In June 2018, the NDC implementation roadmap originally developed in 2016 was amended to reduce reliance on overseas credits (from 11.3% to 4.5%) (Ministry of Environment, 2018).

Current policies considered here are renewable energy targets for 2020 and 2030 and the national emissions trading system (ETS). According to our assessment, the ETS and renewable energy targets could result in stabilisation of Republic of Korea's emission levels (excluding LULUCF) at 695 to 710 $MtCO_2e$/year by 2020 and 720 to 750 $MtCO_2e$/year by 2030, which is only marginally (10 to 20 $MtCO_2e$) lower than last year. This is a deviation from the historical trend of strongly increasing emissions and is an important step towards achieving the pledge. However, it is not expected to be sufficient to achieve the pledged emissions levels by 2020 and 2030.

The new 15-year Plan for Electricity Supply and Demand published in 2017, not included yet due to its status (planned policy), is expected to result in a shift in electricity generation from coal and nuclear towards more renewables (20% renewables and 23.9% nuclear by 2030). Our latest emissions projections are marginally lower than those in the 2017 report.

Table 55: Description of the Republic of Korea's 2020 pledge and NDC

| Indicator | 2020 pledge | NDC |
|---|---|---|
| **Target: unconditional** | • 30% GHG reduction by 2030 from BAU scenario [1)] | • 37% GHG reduction by 2030 from baseline scenario |
| **Target: conditional** | • N/A | • N/A |
| **Sectoral coverage** | • Economy-wide | • Economy-wide (energy, industrial processes and product use, agriculture and waste) |
| **General Accounting method** | • Not-specified | • IPCC guidelines; 100-year GWPs from the Second IPCC Assessment Report |
| **GHGs covered** | • Not-specified | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs and $SF_6$ |
| **Consideration of LULUCF** | • Land sector is included in the target<br>• Accounting approaches and methodologies are unclear | • A decision on whether to include the land use sector will be made at a later stage |
| **Use of bilateral, regional and international credits** | • N/A | • Carbon credits from international market mechanisms will be partly used to achieve the 2030 target |

[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.*

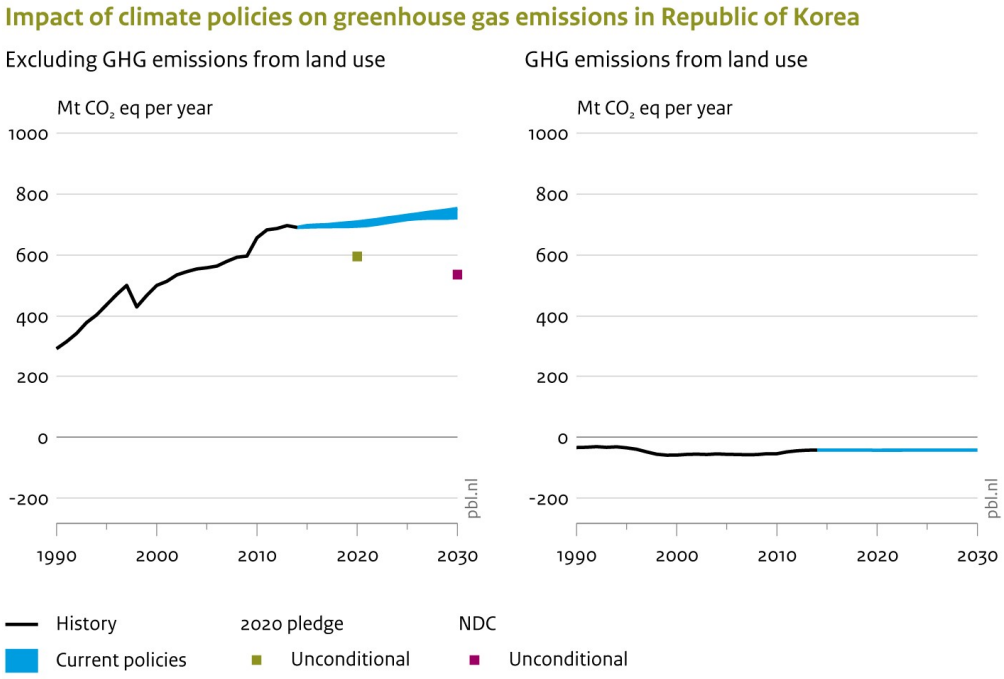
Table 56: Overview of key climate change mitigation policies in the Republic of Korea (Republic of Korea, 2014, Republic of Korea, 2012, MOTIE, 2015, Hwang, 2014, MOTIE, 2017)

| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Economy-wide** | Emissions Trading System (2015) [1)] | • Emission cap is in line with the 30% reduction below baseline (planned: 37%) |
| **Energy supply** | Renewable energy targets (4th Basic Plan on New and Renewable Energies, 7th Basic Plan for Long-term Electricity Supply and Demand) (2018) | • 11% share of new and renewable energy (NRE) in TPES by 2035 (5% by 2020, 9.7% by 2030);<br>• 13.4% of total electricity supplied by NRE by 2035 (4th Basic Plan on NRE), 11.7% by 2029 (7th Basic Plan for Long-term Electricity Supply and Demand);<br>o 1.8 GW hydropower, 0.8 GW onshore wind, 1 GW offshore wind, 16.6 GW solar power, 0.2 GW biomass, and 0.2 GW waste capacity by 2029 |
| | Renewable portfolio standards (2012) [2)] | • 10% supply of NRE in total electricity generation by 2024 |
| **Buildings** | Renewable energy targets (4th Basic Plan on New and Renewable Energies, 7th Basic Plan for Long-term Electricity Supply and Demand) (2014) [3), 4)] | • Budgetary support for one million green homes (which covers various renewable energy resources such as solar PV, solar thermal, geothermal, small wind and bioenergy) by 2020 |
| **Transport** | Fuel efficiency standard (2005) (+) [4)] | • 140 $gCO_2$/km (16.7 km/l) by 2015, 97 g $CO_2$/km (24.1 km/l) by 2020 |
| | Renewable Fuel Standard (2013) | • Biodiesel share in diesel of 3% from 2018 onwards |
| **Forestry** | Act on the Sustainable use of Timber (2012) | • The forest harvest level will increase by 2.3 million $m^3$ by 2020, compared to the 2014 level |
| | Act on the Management and Improvement of Carbon Sink (2013) | • Increase the forest carbon stocks by 200 million t-$CO_2$ by 2019, compared to the 2014 level |
| | Forest Carbon Offset Program (2013) [5)] | • Promote activities and forest management practices that enhance the forest carbon sink, facilitate the use of harvested wood products for construction and enhance the use of forest biomass for energy production. |

*[1)] Not quantified in PBL TIMER model projections.*
*[2)] Policy not included separately*
*[3)] Quantified in the PBL TIMER model as a tax on the residential sector*
*[4)] Not quantified in NewClimate Institute projections.*
*[5)] Not quantified in IIASA model projections.*

Table 57: Impact of climate policies on greenhouse gas emissions (excluding LULUCF) in Republic of Korea. Absolute emissions levels and changes in emissions levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emissions values are based on SAR GWP-100.

| 2010 GHG emissions, excl. LULUCF | 2020 pledge and NDC | | Current policies | |
|---|---|---|---|---|
| | Official data | PBL and NewClimate estimates | Official data | PBL and NewClimate estimates |
| Absolute: 657 $MtCO_2e$ | 535 $MtCO_2e$ in 2030 | 595 $MtCO_2e$, -9% by 2020<br>535 $MtCO_2e$, -18% by 2030 | N/A | 695 to 710 $MtCO_2e$, 6% to 8% by 2020<br>720 to 750 $MtCO_2e$, 10% to 15% by 2030 |
| Per capita: 13.3 $tCO_2e$/capita | N/A | 11.6 $tCO_2e$/capita by 2020<br>10.2 $tCO_2e$/capita by 2030 | N/A | 13.5 to 13.8 $tCO_2e$/capita by 2020<br>13.7 to 14.3 $tCO_2e$/capita by 2030 |




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

Figure 18: Impact of climate policies on greenhouse gas emissions in Republic of Korea; left panel: excluding land use (i.e. LULUCF), right panel: land use emissions and removals only. Source: NewClimate Institute calculations based on Climate Action Tracker (CAT 2017),PBL calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals. Projections last updated: November 2018. Emission values are based on SAR GWP-100.

## Russian Federation

Russian Federation's INDC aims to limit GHG emissions to 70% to 75% of 1990 levels by 2030. The current policies analysed here include the Russian State Programme's targets for energy efficiency and renewable electricity generation. Russia's gas flaring policy could lead to additional emission reductions, but it is unclear whether this policy will be fully implemented. Other planned policies, not included here, include the transport strategy and the plan to stimulate the development of renewable energy generation facilities with installed capacity up to 15 kW. The transport strategy aims for 20% to 25% emissions reductions from road, 50% to 53% from rail, 20% to 34% from air, and 20% to 24% from water transport, between 2011 and 2030.

The current policies project an emissions level of 2,635 to 2,740 $MtCO_2e$/year by 2020 (2% to 7% above 2010 levels) and 2,790 to 2,915 $MtCO_2e$/year by 2030 (8% to 13% above 2010 levels) excluding LULUCF, which is similar to last year. Russian Federation is, therefore, likely to reach its 2020 pledge, and reach the lower end of its 2030 INDC range (2,615 to 3,605 $MtCO_2e$/year). Our latest emissions projections are slightly higher than those in the 2017 report due to the use of different GWP values (AR4 instead of SAR).

Table 58: Description of The Russian Federation's 2020 pledge and INDC

| Indicator | 2020 pledge | INDC (submitted 1 April 2015) |
|---|---|---|
| **Target: unconditional** | • 15% to 25% GHG reduction by 2030 from 1990 levels | • Limiting anthropogenic greenhouse gases to 70% to 75% 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 AR4 | • IPCC guidelines; 100-year GWPs from AR4 |
| **GHGs covered** | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs and $SF_6$ | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs and $SF_6$ |
| **Consideration of LULUCF** | • Acknowledges the need for an appropriate accounting for the potential of its LULUCF sector in meeting its target | • Land use sector is included in the target<br>• Accounting approaches and methodologies are unclear [1)] |
| **Use of bilateral, regional and international credits** | • N/A | • No use of international market mechanisms |

[1)] *Russian Federation's INDC states that the target is "subject to the maximum possible account of absorbing capacity of forests". We assume that Russian Federation applies a gross-net accounting approach (see Appendix A2 for details). The current policies scenario projection for the LULUCF sector would provide Russian Federation with approximately 800 $MtCO_2e$ of land-use credits in 2030 (the difference between the historical 1990 LULUCF emissions/removals and the projected 2030 LULUCF levels, based on AR4 GWP-100). The INDC range presented is a combination of a minimum amount of land-use (0 $MtCO_2e$) and maximum amount of land-use credits (800 $MtCO_2e$) for the unconditional targets.*

Table 59: Overview of key climate change mitigation policies in Russian Federation (Nachmany et al., 2015, Government of Russian Federation, 2016, Government of Russian Federation, 2017)

| Sector | Policies (marked with "(+)" when mentioned in the INDC document) | Description |
|---|---|---|
| **Economy-wide** | Energy intensity targets (2008) [1)] | • 40% reduction of energy intensity of GDP by 2020, relative to 2007 |
| **Energy supply** | Renewable energy targets (2013) [2)] | • 2.5% renewable energy in the power sector by 2020 (excluding hydro larger than 25 MW) (supported by regulated capacity prices for renewable energy, Government of the Russian Federation, 2013)<br>• 3.6 GW wind, 1.52 GW solar and 75 MW small hydropower capacity by 2020 |
| **Industry** | Decrease flaring in oil (2009) [3)] | • 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)] | • Energy consumption in buildings: 20% reduction in residential heat consumption by 2030, relative to 2014 |
| **Forestry** | National Strategy of Forestry Development by 2020 (2008) | • Increase in forest intensification and harvesting of wood by 5.8% per year compared to 2007 |

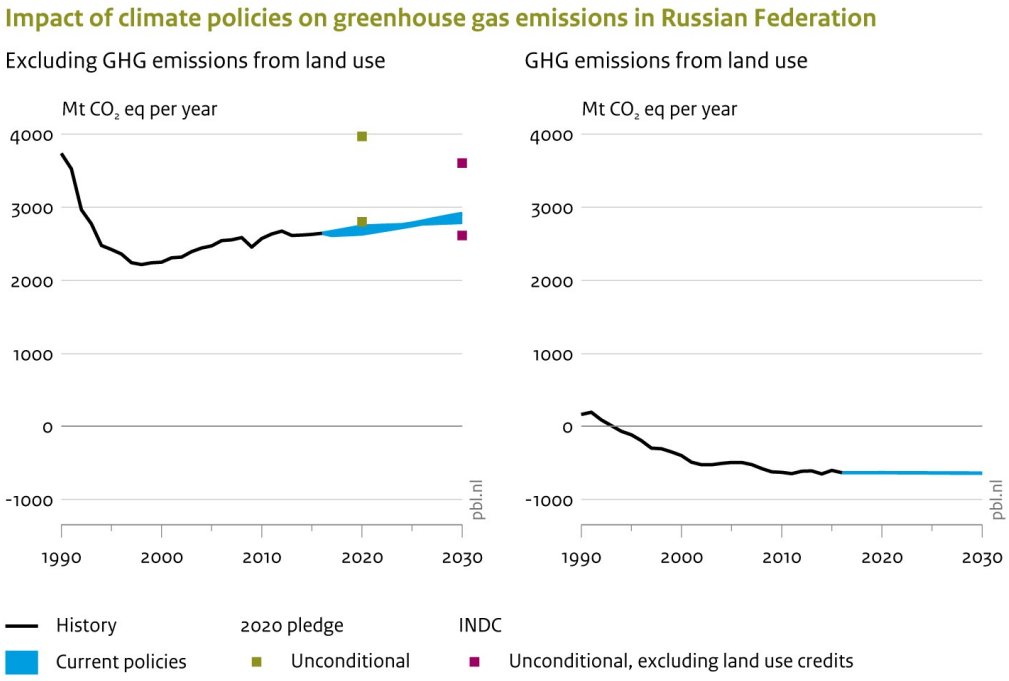
*[1)] Achievement status was checked after implementation of other policies (see Supplementary Information for details).*

*[2)] Small hydropower is not distinguished from hydropower in the TIMER model, so this target was excluded from PBL's projection.*

*[3)] Not quantified in PBL TIMER model and NewClimate calculations.*

Table 60: Impact of climate policies on greenhouse gas emissions (excluding LULUCF) in the Russian Federation. Absolute emissions levels and changes in emissions levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emissions values are based on AR4 GWP-100.

| 2010 GHG emissions, excl. LULUCF | 2020 pledge and INDC | | Current policies | |
|---|---|---|---|---|
| | Official data | PBL and NewClimate estimates | Official data | PBL and NewClimate estimates |
| Absolute: 2,573 $MtCO_2e$ | N/A | 2,800 to 3,970 $MtCO_2e$, 9% to 54% by 2020<br>2,615 to 3,605 $MtCO_2e$, 2% to 40% by 2030 | 2,792 $MtCO_2e$ by 2030 | 2,635 to 2,740 $MtCO_2e$, 2% to 7% by 2020<br>2,790 to 2,915 $MtCO_2e$, 8% to 13% by 2030 |
| Per capita: 18.0 $tCO_2e$/capita | N/A | 19.5 to 27.6 $tCO_2e$/capita by 2020<br>18.6 to 25.6 $tCO_2e$/capita by 2030 | N/A | 18.3 to 19.1 $tCO_2e$/capita by 2020<br>19.9 to 20.7 $tCO_2e$/capita by 2030 |




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

Figure 19: Impact of climate policies on greenhouse gas emissions in the Russian Federation; left panel: excluding land use (i.e. LULUCF), right panel: land use emissions only. Source: NewClimate Institute calculations adapted from Climate Action Tracker (CAT, 2018a), PBL calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals. Please see Appendix (A2) on the consideration of LULUCF for the NDC quantification. Projections last updated: November 2018. Emission values are based on AR4 GWP-100.

## Saudi Arabia

In its NDC, Saudi Arabia pledged to reduce up to 130 $MtCO_2e$/year by 2030 through actions that contribute to economic diversification and adaptation. The Saudi government has not yet defined a baseline scenario. In 2013, the government announced its plan to build 54 GW of renewable power and 17 GW of nuclear power by 2032 to cover 40 to 45% of future electricity production. In 2015, the government announced an eight-year delay of its implementation.

In 2016, the government further downscaled the target to 9.5 GW of renewable electricity capacity until 2023 without specifying any additional capacity extension targets for the time after 2023. This downward revision of the renewable electricity target is projected to result in additional emissions of 75 to 135 $MtCO_2e$/year in 2030.

Delays have also been announced for other policies; in December 2017, a slowdown in the pace of energy subsidy cuts was announced. This will result in the delay of fossil fuel price reform. 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.

We conclude that Saudi Arabia is on track to meet its NDC target. The change in rating from the 2017 report is mainly due to the updated data harmonisation year.

Table 61: Description of Saudi Arabia's NDC

| Indicator | NDC |
|---|---|
| **Target: unconditional** | • Emissions reduction of up to 130 $MtCO_2e$ 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 emission reduction target |
| **Use of bilateral, regional and international credits** | • Not specified |
| **Other sector-level targets** | • Not specified |
| **Availability of reference scenarios in the latest UNFCCC submissions** | • No |
| **Other information** | • Achievement of this goal 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." Additionally, it is stated that technology cooperation and capacity building for NDC implementation will play a key role in the process.<br>• Baseline not yet defined: "dynamic baseline will be developed on a basis of a combination of two scenarios, which are scenarios based on whether more oil is locally consumed or exported.[1)] |

*Note: Saudi Arabia has no mitigation pledge for 2020.*

Table 62: Overview of key climate change mitigation policies in Saudi Arabia (Al-Ghabban, 2013; KAUST, 2014; Kingdom of Saudi Arabia, 2015, 2016, 2017; SEEC, 2015; Borgmann, 2016; Nereim, 2017; Toumi, 2017).

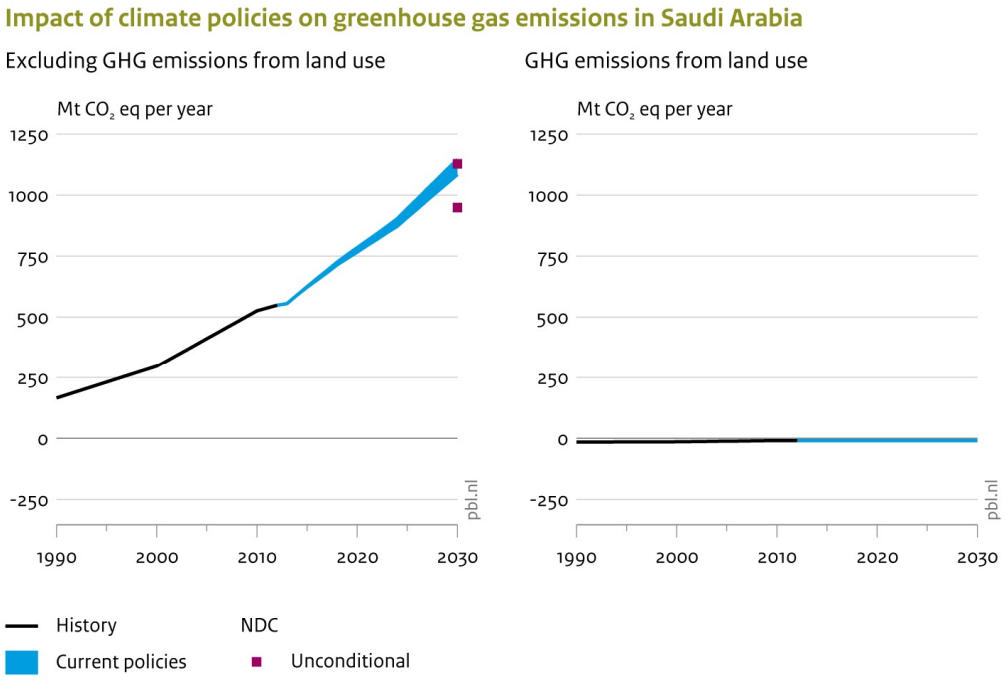
| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Economy-wide** | King Abdullah City for Atomic and Renewable Energy (K.A.CARE) (+) (2010) | Aims to develop a substantial alternative energy capacity. Initially aiming to deploy 54GW of renewable electricity by 2032, the target has been revised downward to 9.5 GW by 2023. |
| | 5% VAT in fuel prices (2018) [1)] | Starting January 2018, the government has implemented a 5% VAT on fuels. |
| **Energy** | National Renewable Energy Plan (NREP) | Increased share of renewable energy in the total energy mix, targeting the generation of 3.45 GW of renewable energy by 2020 under the National Transformation Program and 9.5 GW by 2023 towards Vision 2030 |
| **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 included in NewClimate calculations*

Table 63: Impact of climate policies on greenhouse gas emissions (excluding LULUCF) in Saudi Arabia. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emission values are based on SAR GWP-100.

| 2010 GHG emissions, excl. LULUCF | 2020 pledge and NDC | | Current policies | |
|---|---|---|---|---|
| | Official data | NewClimate estimates [1)] | Official data | NewClimate estimates [1)] |
| Absolute: 525 $MtCO_2e$ | N/A | 950 to 1,130 $MtCO_2e$, 81% to 115% by 2030 | N/A | 765 to 785 $MtCO_2e$, 46% to 49% by 2020<br>1,085 to 1,145 $MtCO_2e$, 106% to 118% by 2030 |
| Per capita: 19.2 $tCO_2e$/capita | N/A | 24.0 to 28.6 $tCO_2e$/capita by 2030 | N/A | 22.1 to 22.6 $tCO_2e$/capita by 2020<br>27.5 to 29.0 $tCO_2e$/capita by 2030 |

[1)] *Only the results from NewClimate Institute are presented.*




Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 20: Impact of climate policies on greenhouse gas emissions (excluding land use (i.e. LULUCF)) in Saudi Arabia. Source: NewClimate Institute calculations excluding LULUCF based on Climate Action Tracker (CAT, 2018a) and IIASA calculations on LULUCF emissions and removals. Projections last updated: November 2018. Emission values are based on SAR GWP-100.

## South Africa

South Africa's NDC submission consists of a peak, plateau and decline (PPD) greenhouse gas emissions trajectory range, with a range of 398 to 614 $MtCO_2e$ by 2025 and 2030, a peak between 2020 and 2025, a plateau for the following decade, and absolute declines thereafter. The current policies projection includes the Integrated Resource Plan for electricity, the most important policy affecting South Africa's GHG emissions.

Under current policies, South Africa's GHG emissions are projected to be 630 to 730 $MtCO_2e$/year by 2030 (including LULUCF) (similar to last year), thus higher than the upper range of the PPD trajectory. Our latest emissions projections are roughly the same as those in the 2017 report. South Africa has proposed a carbon tax bill, with a price of 120 Rand (roughly 6 EUR) /$tCO_2e$ in the 2018-2022 period, but it has not been adopted yet (it entered the parliamentary process in February 2018). It further published the draft Integrated Resource Plan 2018, which is open for public comments until November 2018 (as such, it is not considered as current policy in this report). According to the Climate Action Tracker (CAT, 2018b), the IRP update would bring South Africa closer to meeting its NDC, by decommissioning old coal capacity and increasing gas, wind and solar power capacity by 2030.

Table 64: Description of South Africa's 2020 pledge and NDC

| Indicator | 2020 pledge | NDC |
|---|---|---|
| **Target: unconditional** | • N/A | • 398 to 614 $MtCO_2e$ by 2025 and 2030 (PPD trajectory) |
| **Target: conditional** | • 34% reduction below BAU by 2020 | • "South Africa's INDC is premised on the adoption of a comprehensive, ambitious, fair, effective and binding multilateral rules-based agreement under the UNFCCC at the 21st Conference of the Parties (COP21) in Paris" |
| **Sectoral coverage** | • N/A | • Economy-wide, all sectors<br>• IPCC: energy, IPPU, waste and AFOLU |
| **General Accounting method** | • N/A | • IPCC 2006 guidelines; 100-year GWPs from the AR4 |
| **GHGs covered** | • N/A | • Six GHGs, material focus on $CO_2$, $CH_4$, $N_2O$ |
| **Consideration of LULUCF** | • Not specified | • Land use sector is included in the target<br>• 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 65: Overview of key climate change mitigation policies in South Africa (Department of Energy, 2011, Department of Energy, 2013, Department of Minerals and Energy, 2007, Republic of South Africa, 2015, Government of South Africa, 2012, National Planning Commission, 2012, Department of Environmental Affairs, 2014, Department of Energy, 2018)

| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Economy-wide** | National Development Plan (2012) (+) [1)] | • Among other targets: eliminate poverty, reduce inequality, increase access to water and electricity |
| | National Climate Change Response Policy (2011) (+)[1)] | • 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; draft 2018 update published[1)]) (+) | • Additional renewable electricity generation capacity to be built between 2010 and 2030 in the policy-adjusted plan[2)]: 8.4 GW solar PV, 8.4 GW wind (plus 800 MW already committed), 1 GW CSP; resulting total capacity[3)] 8.4 GW solar PV, 9.2 GW wind, 1 GW CSP |
| **Transport** | Mandatory blending of biofuels under the Petroleum Products Act (Biofuels Industrial Strategy) (2007) [4)] | • Concentration for blending: 2-10% for bio-ethanol and minimum 5% for biodiesel from 2015 onwards |
| **Buildings** | National Building Regulation (2011) [5)] | • Building codes and standards |
| **Forestry** | Long term mitigation scenarios | • Establishment of 760,000 hectares of commercial forest by 2030 |
| | National Forest Act (1998) [6)] | • Securing ecologically sustainable development and use of natural resources while promoting justifiable economic and social development [6)]<br>• 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) [6)] | • 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 included in our current policies scenario.*

*[2)] Based on Table 1 in the IRP update report of 2013 (Department of Energy, 2013). The decision to install nuclear capacity might be delayed. As the status was uncertain at the time of developing the projections, the target was excluded from the current policies scenario (see Supporting Information for more details)*

*[3)] Based on Table 4 in the promulgated IRP (Department of Energy, 2011)*

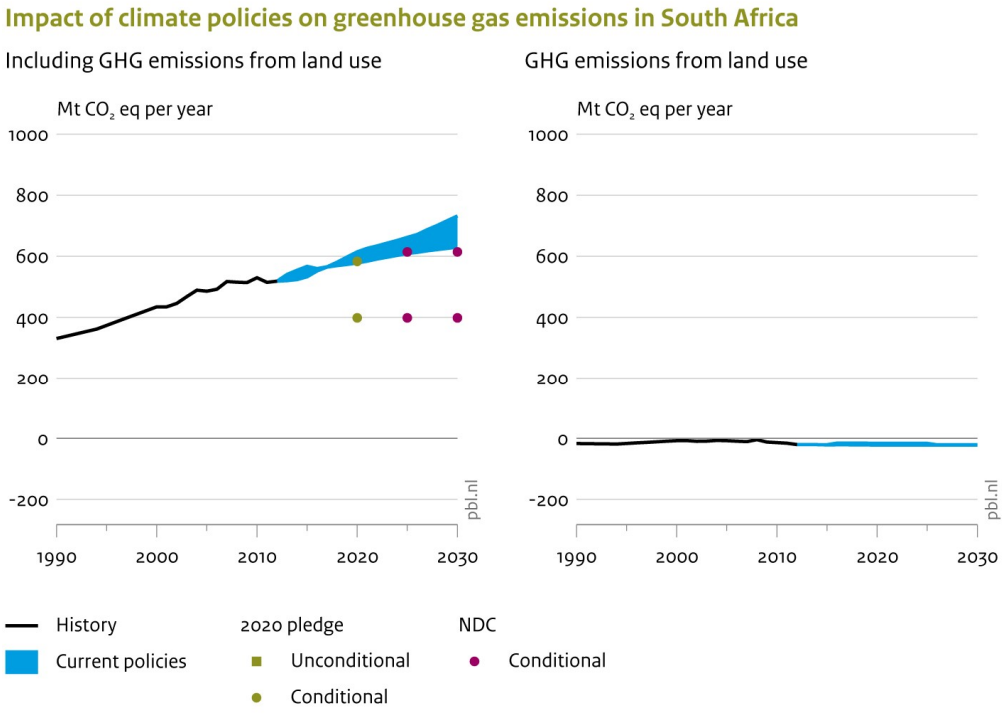
*[4)] Implemented in PBL TIMER model projections as 5% total biofuel share from 2015 onwards.*

*[5)] Not quantified in PBL TIMER model projections.*

*[6)] Not quantified in IIASA model projections.*

Table 66: Impact of climate policies on greenhouse gas emissions (including LULUCF) in South Africa. Absolute emissions levels and changes in emissions levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emissions values are based on SAR GWP-100 (except NDC: AR4).

| 2010 GHG emissions, incl. LULUCF | 2020 pledge and NDC | | Current policies | |
|---|---|---|---|---|
| | Official data | PBL and NewClimate estimates | Official data | PBL and NewClimate estimates |
| Absolute: 529 $MtCO_2e$ | 398 to 614 $MtCO_2e$ by 2025-2030 | 400 to 585 $MtCO_2e$, -25% to 10% by 2020<br>400 to 615 $MtCO_2e$, -25% to 16% by 2030 | N/A | 575 to 615 $MtCO_2e$, 9% to 16% by 2020<br>630 to 730 $MtCO_2e$, 19% to 38% by 2030 |
| Per capita: 10.3 $tCO_2e$/capita | N/A | 6.8 to 9.9 $tCO_2e$/capita by 2020<br>6.2 to 9.5 $tCO_2e$/capita by 2030 | N/A | 9.8 to 10.5 $tCO_2e$/capita by 2020<br>9.8 to 11.4 $tCO_2e$/capita by 2030 |




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

Figure 21: Impact of climate policies on greenhouse gas emissions in South Africa; left panel: all gases and sectors, right panel: land use (i.e. LULUCF) emissions and removals only. Source: NewClimate Institute calculations based on its analysis for Climate Action Tracker (CAT, 2018a),PBL calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals. Projections last updated: November 2018. Emission values are based on SAR GWP-100 (except NDC: AR4).

## Thailand

Thailand pledged an unconditional NDC target to reduce GHG emissions by 20% below BAU by 2030, and a conditional target to reduce emissions by 25% below BAU by 2030. The current policies projection includes the Thailand Integrated Energy Blueprint, comprising policies on alternative energy development, energy efficiency, smart grid, and oil and gas production.

Under current policies, Thailand is projected to miss its NDC target by 2030. However, largely due to the upward revision of the renewable energy production, our latest emissions projections for 2030 have been revised downward compared to the 2017 update.

Table 67: Description of Thailand's 2020 pledge and NDC

| Indicator | 2020 pledge | NDC |
|---|---|---|
| **Target: unconditional** | • N/A | • GHG reduction of 20% by 2030 compared to BAU level |
| **Target: conditional** | • 7-20% GHG emission reduction by 2020 below BAU in the energy and transport sectors, conditional on the level of international support | • 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 |
| **Sectoral coverage** | • Energy and transport sectors | • Economy-wide, excl. LULUCF |
| **General Accounting method** | • N/A | • IPCC inventory methodology not specified; GWP values of the AR4 |
| **GHGs covered** | • N/A | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, $SF_6$ |
| **Consideration of LULUCF** | • N/A | • Inclusion of the land use sector in the NDC is to be taken at a later stage |
| **Use of bilateral, regional and international credits** | • N/A | • Yes, intention to use different market mechanisms. Expected amount not quantified. (The Kingdom of THailand, 2015b) |
| **Other sector-level targets** | • N/A | • 20% share of power generation from renewable sources in 2036 |

Table 68: Overview of key climate change mitigation policies in Thailand (The Kingdom of Thailand, 2015a, Ministry of Energy, 2015c, Ministry of Energy, 2015b, Ministry of Energy, 2016, National Economic and Social Development Board of the Kingdom of Thailand, 2012, APERC, 2016)

| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Economy-wide** | Climate Change Master Plan (2015-2050) (2015) (+)[1)] | • 7-20% GHG emission reduction by 2020 below BAU in the energy and transport sectors<br>• Share of at least 25% of the total energy consumption from renewable energy sources by 2021<br>• Reduction of energy intensity by at least 25% compared to BAU by 2030 |
| **Energy supply** | Thailand Integrated Energy Blueprint (2015) [1)] | |
| | • Alternative Energy Development Plan (2015-36) (2015) (+) and Power Development Plan (2015-36) (+) | • Increase of renewable energy shares by 2036 to 30% of total energy consumption, 20% of power generation (plus additional 15% from imported hydro), 35% of heat generation and 35% of transport fuels |
| | • Energy Efficiency Plan (2015-36) (+)[3)] | • 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) | • Support measures to save fuel in the transportation sector and enhance ethanol and biodiesel consumption |
| | • Smart Grid Development Master Plan (2015-36) (+) | • Aims for high penetration of renewable energy, mainly mini-hydro and solar PV |
| **Transport** | Environmentally Sustainable Transport System Plan (2013-30) (2012) (+) | • Improvement of rail infrastructure to reduce annual logistics costs and the annual energy bill by about 2% and 1% of GDP respectively |
| **Industry** | Energy Conservation and Promotion Act (1992, amended 2007) | • 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) | • Mandatory MEPS for air conditioners, refrigerators, self-ballasted compact fluorescent lamps and double-capped fluorescent lamps<br>• HEPS for 28 appliances and types of equipment |
| | Building energy code (2009) | • Reduce electricity use for large commercial buildings by > 50% by 2030 compared with BAU |
| **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<br>• 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 |

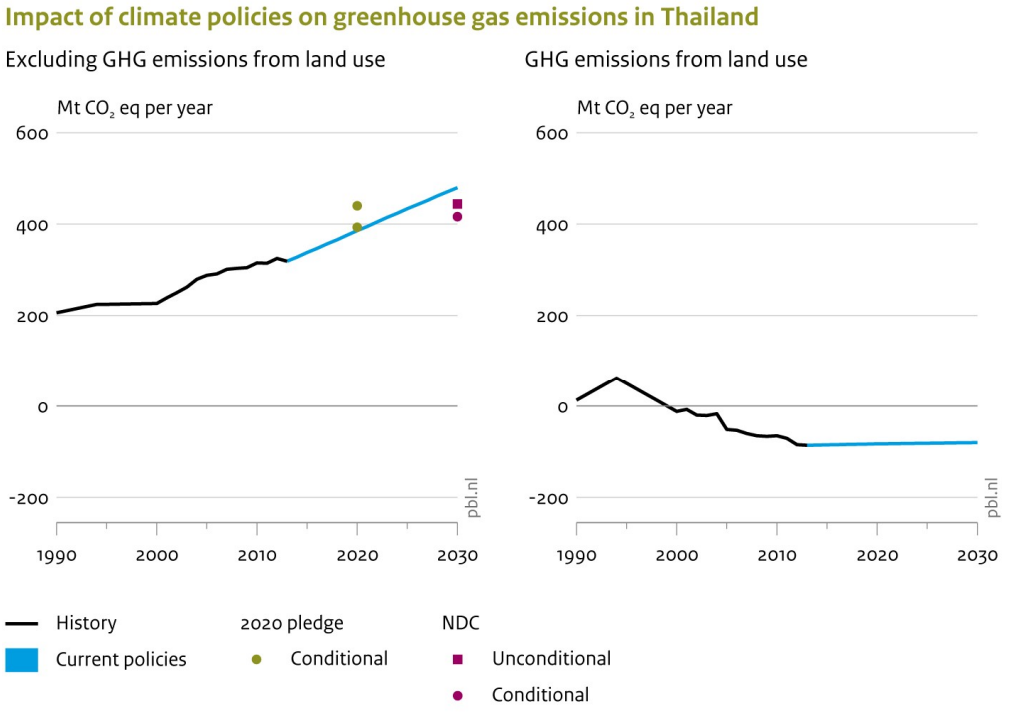
*[1)] See Supporting Information for detailed assumptions on the policies and measures quantified.*

*[2)] Not quantified in IIASA model projections.*

*[3)] No information available on implementation status. For the current analysis we have assumed full implementation.*

Table 69: Impact of climate policies on greenhouse gas emissions (excluding LULUCF) in Thailand. Absolute emissions levels and changes in emissions levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emissions values are based on SAR GWP-100 (except NDC: AR4).

| 2010 GHG emissions, excl. LULUCF | 2020 pledge and NDC | | Current policies | |
|---|---|---|---|---|
| | Official data | NewClimate estimates [conditional] | Official data | NewClimate estimates |
| Absolute: 315 $MtCO_2e$ | N/A | 395 to 440 $MtCO_2e$, 25% to 40% by 2020<br>445 [415] $MtCO_2e$, 41% [32%] by 2030 | N/A | 385 $MtCO_2e$, 22% by 2020<br>480 $MtCO_2e$, 52% by 2030 |
| Per capita: 4.7 $tCO_2e$/capita | N/A | 5.7 to 6.3 $tCO_2e$/capita by 2020<br>6.4 [6.0] $tCO_2e$/capita by 2030 | N/A | 5.6 $tCO_2e$/capita by 2020<br>6.9 $tCO_2e$/capita by 2030 |




Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 22: Impact of climate policies on greenhouse gas emissions in Thailand (left: excluding land use (i.e. LULUCF), right: only land use). Source: NewClimate Institute calculations excluding LULUCF and IIASA calculations on LULUCF emissions and removals. Projections last updated: November 2018.Emission values are based on SAR GWP-100 (except NDC: AR4).

## Turkey

In its INDC submission, Turkey established an economy-wide greenhouse gas emission reduction target of up to 21% below business-as-usual (BAU) in 2030. The government provides a BAU scenario in the INDC, against which the target is estimated to result in a reduction of 246 $MtCO_2e$/year.

The current policies projection includes renewable energy and energy intensity targets. If effective policies are implemented to achieve these targets, they could lead to emissions levels of 525 to 700 $MtCO_2e$/year by 2030 (47% to 97% above 2010 levels). The lower limit is similar as last year, but the upper limit has decreased by 300 $MtCO_2e$/year due to the NewClimate Institute's updated calculations, which revised the GDP elasticity of energy and industrial processes sector emissions to the level consistent with historical trends (note that also GWP values changed, from SAR to AR4).

We conclude that Turkey is on track to meet its INDC. In a planned policy that is not quantified here, the national energy efficiency action plan, primary energy consumption could be reduced by 14% by 2023 compared to a "business as usual" scenario, while renewables would reach 30% of total power capacity by 2023.

Table 70: Description of Turkey's 2020 pledge and INDC

| Indicator | INDC (submitted 30 September 2015) |
|---|---|
| **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 AR4 |
| **GHGs covered** | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, $SF_6$ and $NF_3$ |
| **Consideration of LULUCF** | • Land use sector is included in the target<br>• 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 |

*Note: Turkey has not set its 2020 pledge.*

Table 71: Overview of key climate change mitigation policies in Turkey (Ministry of Energy and Natural Resources, 2014, Ministry of Environment and Urbanization, 2011, Ministry of Environment and Urbanization, 2010, Ministry of Energy and Natural Resources, 2009, Ministry of Energy and Natural Resources, 2018)

| Sector | Policies (marked with "(+)" when mentioned in the INDC document) | Description |
|---|---|---|
| **Economy-wide** | Energy intensity target (Energy Efficiency Law) (2012) [1)] | • 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 "business as usual" scenario in 2023 |
| **Energy supply** | Renewable energy target (Law for the Utilisation of the Renewable Energy Resources for the Electricity Energy Production) (2005) [1)] | • 13% to 30% share of renewable energy resources in electricity production by 2023 (supported by feed-in tariffs, IEA, 2011) |
| | Renewable capacity target (Renewable Energy Action Plan) (2014) [3)] | • 61 GW renewable capacity by 2023: 34 GW of hydro, 20 GW wind, 5 GW solar, 1 GW geothermal, 1 GW biomass |
| **Forestry** | National Climate Change Action Plan (2011) | • Decreasing deforestation by 20% by 2020, compared to the 2007 level<br>• Increasing carbon sequestered in forested areas by 15% until 2020, compared with 2007 |

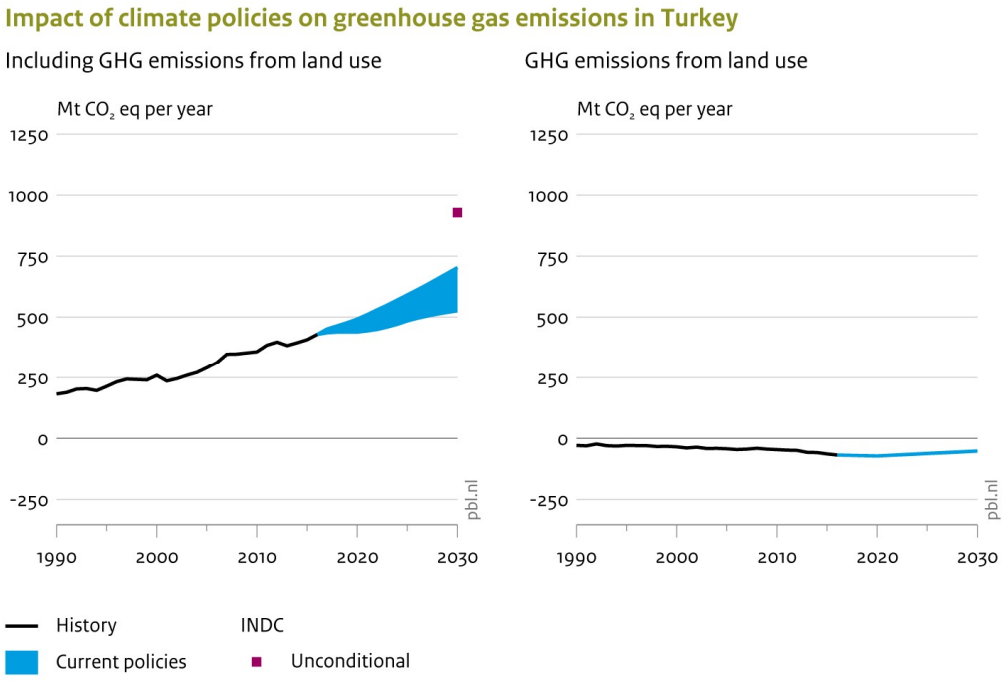
[1)] *Not included separately (but target achieved in PBL scenario)*

[2)] *Not quantified in NewClimate and PBL projections.*

[3)] *No information available on implementation status. For the current analysis we have assumed full implementation.*

Table 72: Impact of climate policies on greenhouse gas emissions (including LULUCF) in Turkey. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emission values are based on AR4 GWP-100.

| 2010 GHG emissions, incl. LULUCF | 2020 pledge and INDC | | Current policies | |
|---|---|---|---|---|
| | Official data | PBL and NewClimate estimates | Official data | PBL and NewClimate estimates |
| Absolute: 357 $MtCO_2e$ | N/A | 930 $MtCO_2e$, 160% by 2030 | N/A | 440 to 490 $MtCO_2e$; 23% to 38% by 2020<br>525 to 700 $MtCO_2e$; 47% to 97% by 2030 |
| Per capita: 4.9 $tCO_2e$/capita | N/A | 10.5 $tCO_2e$/capita by 2030 | N/A | 5.2 to 5.9 $tCO_2e$/capita by 2020<br>5.9 to 7.9 $tCO_2e$/capita by 2030 |




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

Figure 23: Impact of climate policies on greenhouse gas emissions in Turkey; left panel: including land use (i.e. LULUCF), right panel: land use emissions only. Source: NewClimate Institute calculations adapted from Climate Action Tracker (CAT 2017), PBL projections excluding LULUCF, and IIASA calculations on LULUCF emissions and removals. NewClimate projections are based on the historical elasticity of GHG emissions from energy and industrial processes sectors to GDP observed between 2002 and 2016. Projections last updated: November 2018. Emission values are based on AR4 GWP-100.

## Ukraine

Ukraine's NDC aims to limit GHG emissions to less than 60% of the 1990 levels by 2030. In the recently-published long-term strategy document (Government of Ukraine, 2017), Ukraine is projected to reduce its GHG emissions to 54% of 1990 level by 2030 excluding LULUCF, thus overachieving its NDC.
The NewClimate Institute's current policies projection was based on the 'with measures' scenario from Ukraine's Sixth National Communication, most importantly accounting for the National Renewable Energy Action Plan 2020. No current policies were included in the PBL projection because of the political circumstances as well as administrative and bureaucratic barriers in Ukraine, leading to uncertainties about the policy implementation status.

Under current policies, Ukraine is on track to achieve its NDC (535 $MtCO_2e$/year by 2030), with estimated emissions levels of 400 to 415 $MtCO_2e$/year by 2030 (8% to 12% above 2010 levels) including LULUCF. Our latest emissions projections are similar to those in the 2017 report.

Table 73: Description of Ukraine's 2020 pledge and NDC

| Indicator | 2020 pledge | NDC |
|---|---|---|
| **Target: unconditional** | • 20% emissions reductions below 1990 levels. Update Kyoto target: 76% of 1990 levels 2013-2020 (not yet ratified) | • Not exceed 60% of 1990 GHG emission level in 2030 |
| **Target: conditional** | • N/A | • N/A |
| **Sectoral coverage** | • Economy-wide | • Energy, industrial processes and product use, agriculture, LULUCF, waste |
| **General Accounting method** | • IPCC guidelines; 100-year GWPs from SAR | • IPCC guidelines; 100-year GWPs from AR4 |
| **GHGs covered** | • $CO_2$, $CH_4$, $N_2O$, $NF_3$, HFC, PFC and $SF_6$ | • $CO_2$, $CH_4$, $N_2O$, $NF_3$, HFC, PFC and $SF_6$ |
| **Consideration of LULUCF** | • LULUCF is excluded from the target<br>• The impact of LULUCF credits is expected to be small (Grassi et al., 2012)) | • Land use is included in the NDC target<br>• Accounting approach to be used for the land use sector is to be defined not later than 2020 |
| **Other sector-level targets** | • N/A | • N/A |
| **Use of bilateral, regional and international credits** | • Condition: "To keep the existing flexible mechanisms of the Kyoto Protocol" | • Ukraine will participate in development and implementation of market mechanisms, but the 2030 GHG target does not account for this participation. |

Table 74: Overview of key climate change mitigation policies in Ukraine (Energy Community Secretariat, 2015, Energy in Central and Eastern Europe, 2014, International Carbon Action Partnership, 2016, Supreme Council of Ukraine, 2015, State Agency on Energy Efficiency and Energy Saving of Ukraine, 2014, Government of Ukraine, 2018)

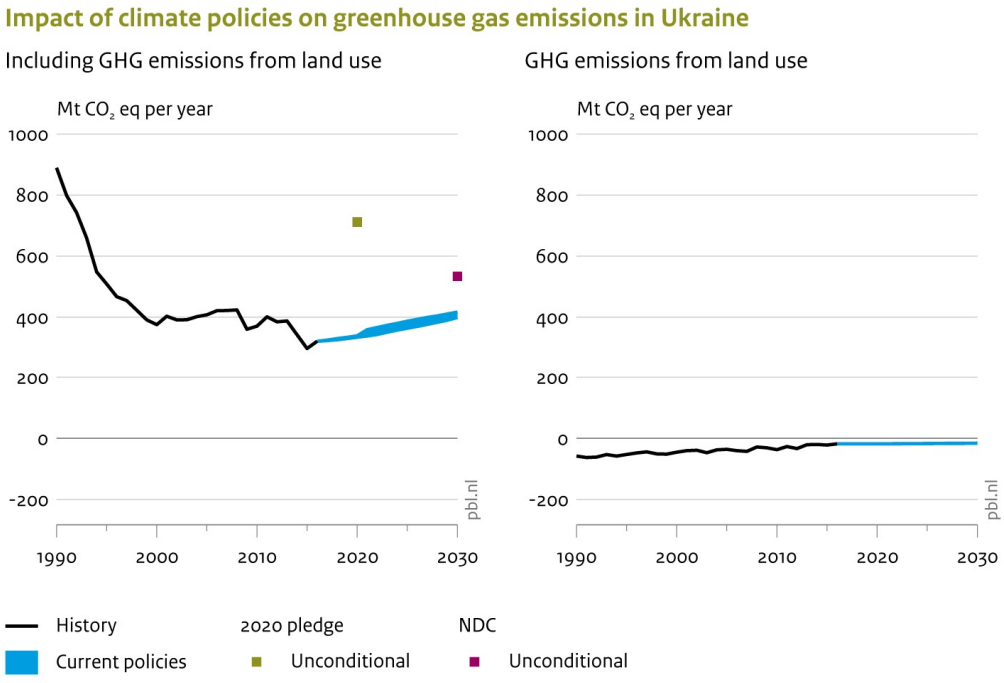
| Sector | Policies[1] (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Economy-wide** | National Renewable Energy Action Plan 2020 (2014) [2] | • 20% reduction of $CO_2$ emissions per final consumption of fuel by 2035 from 2010 levels (5% by 2020, 10% by 2025, 15% by 2030)<br>• 11% share of renewable energy sources in gross final energy consumption by 2020 to achieve 78080 ktoe in heating and cooling, electricity and transport |
| **Energy supply** | Green Tariff (renewables feed-in-tariff) (2015 amendment) [2] | • 5% premium for 30% of domestic equipment<br>• 10% premium when using 50% of domestic equipment |
| | Energy Strategy of Ukraine until 2035 (2017) [2] | • Aims for the following electricity mix by 2035: 25% from renewables excluding hydro, 13% from hydro, 50% from nuclear and 12% 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 |
| **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 |
| **Forestry** | Enhancement of forest cover | • 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] *Policies that are implemented after 2013 were not explicitly considered in the current policies scenario projections due to the lack of data and the uncertainty on their implementation status. PBL did not quantify any of the policies in this overview.*

[2] *Not quantified in NewClimate Institute projections.*

Table 75: Impact of climate policies on greenhouse gas emissions (including LULUCF) in Ukraine. Absolute emissions levels and changes in emissions levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emissions values are based on AR4 GWP-100.

| 2010 GHG emissions, incl. LULUCF | 2020 pledge and NDC | | Current policies | |
|---|---|---|---|---|
| | Official data | PBL and NewClimate estimates | Official data | PBL and NewClimate estimates |
| Absolute:<br>370 $MtCO_2e$ | N/A | 710 $MtCO_2e$,<br>92% by 2020<br>535 $MtCO_2e$,<br>44% by 2030 | N/A | 335 to 340 $MtCO_2e$,<br>-10% to -9% by 2020<br>400 to 415 $MtCO_2e$,<br>8% to 12% by 2030 |
| Per capita:<br>8.1 $tCO_2e$/capita | N/A | 16.3 $tCO_2e$/capita by 2020<br>13.0 $tCO_2e$/capita by 2030 | N/A | 7.7 to 7.8 $tCO_2e$/capita by 2020<br>9.7 to 10.1 $tCO_2e$/capita by 2030 |




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

Figure 24: Impact of climate policies on greenhouse gas emissions in Ukraine; left panel: all gases and sectors, right panel: land use (i.e. LULUCF) emissions and removals only. Source: NewClimate Institute calculations adapted from Climate Action Tracker (CAT, 2018a),PBL calculations excluding LULUCF, and IIASA projections on LULUCF emissions and removals. Current policies projections last updated: November 2018, NDC projection last updated November 2018, Emission values are based on AR4 GWP-100.

## United States of America

The United States of America submitted its NDC to reduce its GHG emissions by 26-28% from 2005 levels (20 to 24% from 2010 levels) by 2025 and ratified the Paris Agreement in September 2016. The government also set a 2020 pledge of a 17% reduction from 2005 levels (13% from 2010 levels).

However, the Trump administration has announced that the United States intends to "exercise its right to withdraw" from the Paris Agreement and cease implementation of the NDC. In 2018, the administration has rolled back, replaced, or proposed to weaken many of the main federal level mitigation-related policies implemented to date. This includes a less stringent replacement for the Clean Power Plan, a proposal to freeze light duty vehicle (CAFE) standards at 2021 levels, an announcement that HFC regulations under the Significant New Alternative will not be enforced, and a proposal to weaken methane standards for the oil and gas industry. There are various state or regional-level policies such as renewable portfolio standards (RPS) and regional emissions trading schemes that remain in place.

PBL and NewClimate calculations indicate that the United States is not on track to meet its 2020 and 2025 NDC targets with existing policies. 2020 emission levels are projected to be 6 to 9% below 2010 levels, and 2025 emissions levels are projected to be 7 to 19% below 2010 levels. Our latest emissions projections are lower than those (without the Clean Power Power Plan implementation) in the 2017 report.

Table 76: Description of the United States' 2020 pledge and NDC

| Indicator | 2020 pledge | NDC |
|---|---|---|
| **Target: unconditional** | • GHG reduction in the range of 17% by 2020 below 2005 levels | • 26-28% GHG reduction by 2025 from 2005 levels |
| **Target: conditional** | • N/A | • N/A |
| **Sectoral coverage** | • Economy wide | • Economy wide |
| **General Accounting method** | • IPCC guidelines; 100-year GWPs from AR4 | • IPCC guidelines; 100-year GWPs from AR4 |
| **GHGs covered** | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, $SF_6$ and $NF_3$ | • $CO_2$, $CH_4$, $N_2O$, HFCs, PFCs, $SF_6$ and $NF_3$ |
| **Consideration of LULUCF** | • Land use sector is included in the target<br>• Net-net accounting is specified to be used for emission accounting | • Land use sector is included in the target<br>• 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 United States also specifies that it intends to use the production approach for accounting for harvested wood products (HWP) consistent with IPCC guidance.*

Table 77: Overview of key climate change mitigation policies in the United States (EPA, 2018b, EPA, 2018c, NHTSA and EPA, 2018, EPA, 2018a, U.S. Department of State, 2016b). State-level policies are presented in Supporting Information.

| Sector | Policies (marked with "(+)" when mentioned in the NDC document) | Description |
|---|---|---|
| **Economy-wide** | Clean Air Act (1963) (+) | • Act governed by the EPA that is implemented through actions such as the Clean Power Plan (CPP) |
| **Energy supply** | Clean Power Plan (CPP) (2014) (+) | • As of August 2018, the EPA has proposed to replace the CPP with less stringent standards for power plants (i.e. not included as current policy).<br>• Formerly, the CPP aimed to reduce emissions from the power sector by 32% below 2005 levels by 2030 |
| | Reduction in $CH_4$ emissions from oil and gas production | • 40% to 45%, from 2012 levels, by 2025 [1)]<br>• Specific standards for oil and gas production<br>• As of September 2018, the US EPA has proposed a revision of standards for methane from oil and gas production |
| | Blueprint for a Secure Energy Future [2)] | • Reduce oil imports by 50% by 2020 |
| **Transport** | Efficiency standards light-duty vehicles (CAFE) (+) | • 34.1 mpg (14.9 km/l) by 2016, 41 mpg (17.4 km/l) by 2021. The EPA has proposed new standards after 2021 that will maintain fleet efficiency at 2021 levels. |
| | 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 |
| **Buildings** | Better buildings Challenge (commercial buildings) [1), 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<br>• Mix of actions to reduce HFCs use and encouraging the use of alternatives |
| **Forestry** | Forest Ecosystem Restoration and Hazardous Fuels Reduction Programs (2000) [3)] | • Mix of actions to increase forest resilience, reduce wildfire, and increase the area of set aside forests |

*[1)] Not quantified in PBL TIMER model projections.*

*[2)] Not quantified in NewClimate Institute projections.*

*[3)] Not quantified in IIASA model projections.*

Table 78: Impact of climate policies on greenhouse gas emissions (including LULUCF) in the United States. Absolute emissions levels and changes in emissions levels relative to 2010 levels are presented. References for official emissions data are provided in Appendix (A1). Emission values are based on AR4 GWP-100.

| 2010 GHG emissions, incl. LULUCF | 2020 pledge and NDC | | Current policies | |
|---|---|---|---|---|
| | Official data | PBL and NewClimate estimates | Official data | PBL and NewClimate estimates |
| Absolute: 6,206 $MtCO_2e$ | 5,344 $MtCO_2e$ by 2020 | 5,470 $MtCO_2e$, -12% by 2020<br>4,745 to 4,875 $MtCO_2e$, -24% to -21% by 2025 | 5,451 to 5,597 $MtCO_2e$ by 2020<br>5,379 to 5,672 $MtCO_2e$ by 2025 | 5,670 to 5,850 $MtCO_2e$, -9% to -6% by 2020<br>5,050 to 5,760 $MtCO_2e$, -19% to -7% by 2025 |
| Per capita: 20.1 $tCO_2e$/capita | N/A | 16.5 $tCO_2e$/capita by 2020<br>13.4 to 13.7 $tCO_2e$/capita by 2025 | N/A | 17.1 to 17.7 $tCO_2e$/capita by 2020<br>14.2 to 16.2 $tCO_2e$/capita by 2025 |

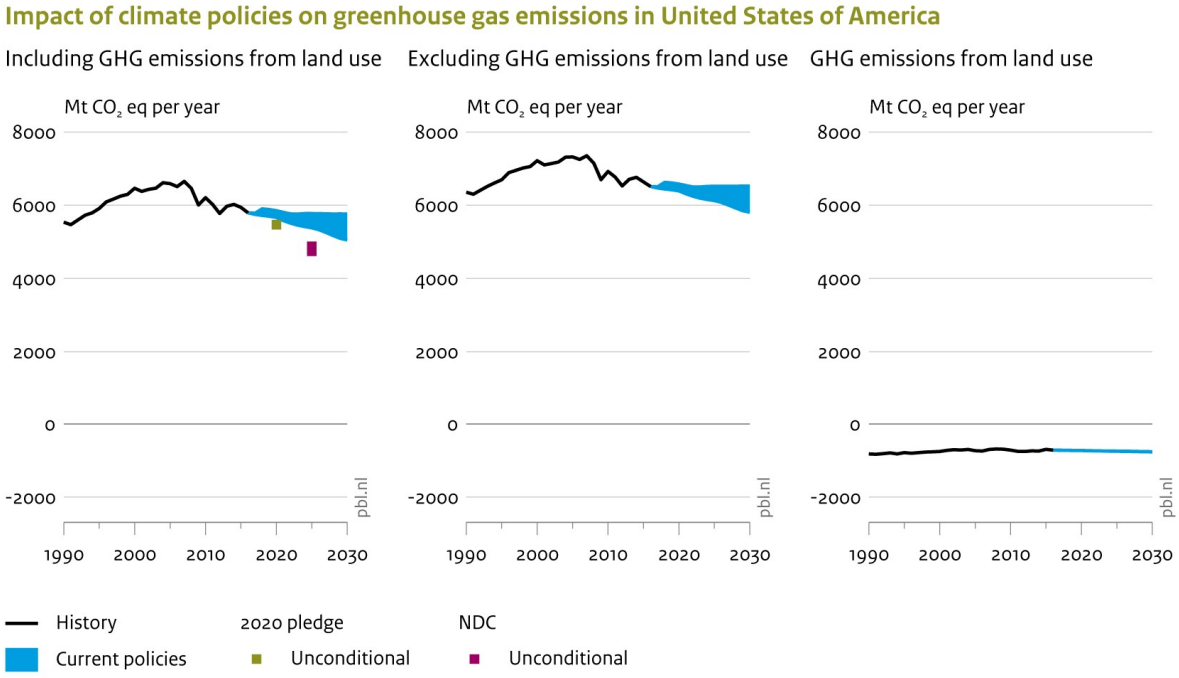



Figure 25: Impact of climate policies on greenhouse gas emissions in the United States; left panel: all gases and sectors, middle panel: excluding land use (i.e. LULUCF) and right panel: only land use) and only land use (right) separately. Source: NewClimate Institute calculations based on its analysis for Climate Action Tracker (CAT, 2018a), PBL calculations excluding LULUCF, and IIASA projections on LULUCF emissions and removals. Projections last updated: November 2018. Emission values are based on AR4 GWP-100.

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# Appendix

## A1: 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 United States of America and Ukraine), we used the GHG inventories submitted in 2018 to the UNFCCC was used (2018b); the inventories use 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 database (UNFCCC, 2017a), in which the GHG inventory data reported in most recent Biennial Update Reports (BURs) submitted to the UNFCCC (2017b) are compiled. National Inventory Reports (NIR) and National Communications (NC) were also used for some countries. For Brazil, the emissions inventory from Sistema de Estimativa de Emissões de Gases de Efeito Estufa (SEEG, 2017) was used.

Compared to the 2017 report, in which GHG emissions were uniformly expressed in terms of GWPs from the IPCC Second Assessment Report, the historical emission values presented in this report differ for some countries due to the different GWPs used. With regard to the magnitude of uncertainty related to the choice of GWPs, global total GHG emissions for 2014 are reported to be 3% higher when AR4 GWPs are used compared to when SAR GWPs are used (Gütschow et al., 2017). 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 covered from AR4 GWPs to SAR GWPs (data years: 1990 to 2015).

In the country fact sheets, in the first table of each country we report the latest GHG inventory submitted to the UNFCCC and its latest reported year when it differs from the dataset presented in Table A-1.

***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 A1 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 2016 historical emissions. For non-Annex I countries, the column “Last reported year” in A1 serves as a reference for the harmonisation year.

Table A-1: Data sources for historical GHG emissions in non-Annex I countries (UNFCCC, 2017a, UNFCCC, 2017b, UNFCCC, 2017c)

| Country | GHG emissions excluding LULUCF | | | LULUCF emissions | |
|---|---|---|---|---|---|
| | Source | Last reported data-year | | Source | Last reported data-year |
| **Argentina** | BUR2 | 2014 | | BUR2 | 2014 |
| **Brazil** | SEEG (2017) [1)] | 2016 | | SEEG (2017) | 2016 |
| **Chile** | BUR2 | 2013 | | BUR2 | 2013 |
| **China** | UNFCCC database | 2012 | | UNFCCC database | 2012 |
| **Colombia** | BUR1 | 2012 | | BUR1 | 2012 |
| **D.R. Congo** | EDGAR | 2015 | | FAO | 2015 |
| **Ethiopia** | UNFCCC database | 2013 | | UNFCCC database | 2013 |
| **India** | UNFCCC database | 2010 | | UNFCCC database | 2010 |
| **Indonesia** | NC3, UNFCCC database | 2014 | | NC3, UNFCCC database | 2014 |
| **Republic of Korea** | UNFCCC database | 2014 | | UNFCCC database | 2014 |
| **Mexico** | UNFCCC database | 2015 | | UNFCCC database | 2015 |
| **Morocco** | UNFCCC database | 2012 | | UNFCCC database | 2012 |
| **Saudi Arabia** | UNFCCC database | 2012 | | UNFCCC database | 2010 |
| **South Africa** | UNFCCC database, NIR | 2012 | | UNFCCC database, NIR | 2012 |
| **The Philippines** | EDGAR | 2015 | | FAO | 2015 |
| **Thailand** | UNFCCC database, NC3 | 2013 | | UNFCCC database, NC3 | 2013 |

*1) Brazil's BUR2 reports historical GHG emissions data up to 2012 but it is not used in this report.*

## A2: Quantification of 2020 pledges and (I)NDC emission levels

***Target type***

The mitigation components of the INDCs and NDCs represent several types of targets, as summarised below (PBL, 2017):

1. **Base year target**: economy-wide absolute reduction from historical base year emissions. INDCs/NDCs report on an absolute 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 Russian Federation, Ukraine, and the United States.
2. **Baseline or BAU target**: emission 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 emission reduction relative to a baseline or business-as-usual projection has been chosen for many INDCs/NDCs, and in

this report for: Argentina, Colombia, Democratic Republic of the Congo, Indonesia, Mexico, Morocco, Republic of Korea, Thailand and Turkey.

3. **Baseline or BAU target (not specified):** emission 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 the Philippines and 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 recent national $CO_2$ emissions projections (King Abdullah University of Science and Technology, 2014).
4. **Intensity target**: emission reductions relative to GDP as the main type of mitigation. Chile is the only country that falls in this category.
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 Ethiopia, 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 (Van Vuuren et al., 2014) 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 den Elzen et al., 2016a, and for further details for China, den Elzen et al., 2016b). The NDC projection for China of PBL is also harmonised to 2012 emissions, which leads to a higher projection. For NewClimate calculations, we refer to Climate Action Tracker (CAT, 2017).

***Accounting method chosen for quantification***

Table A-2 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. Although there are uncertainties concerning which accounting approaches and methodologies countries will apply to account for LULUCF related emissions and removals, we assume that a majority of countries will apply the net-net accounting approach[5] (den Elzen et al., 2016a).

[5] In this approach, activities are accounted using the reported net emissions in each year of the accounting period minus the net emissions in the base year. In the situation where the net emissions have decreased, a country may issue credits (i.e. removal units, or RMUs) and if net emissions have increased, it must cancel units (i.e. take on debits). The net-net LULUCF accounting method implies that credits and debits from the LULUCF sector are treated in the same way as any other GHG inventory sector, where emissions are compared to those in the base year.

This report identified three countries that apply the gross-net accounting approach[6] (Chile, Japan and Russian Federation). 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 account for the expected amount of carbon credits.

For countries that explicitly mentioned in their NDCs that emissions and removals from the LULUCF sector are excluded (Republic of Korea, Saudi Arabia and Thailand) and for the Philippines, which sets an NDC target against a BAU including LULUCF but without specifying the BAU emission levels, the LULUCF sector is excluded from the calculation of the NDC target emission levels and current policies scenario projections. There are also countries that state that emissions and removals from the LULUCF sector are included in their NDC, but refrain from specifying how exactly to include them in the NDC calculations (Canada and the EU28). For these two sets of countries we assumed neither accounting approaches and excluded the LULUCF sector from the calculations of NDC target.

Table A-2: 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 |
| **China** | Intensity and non-GHG | Yes | Yes | No | Net-Net |
| **Colombia** | Baseline specified | Yes | Yes | No | Net-Net |
| **DRC** | Baseline specified | Yes | Yes | No | Net-Net |
| **Ethiopia** | Baseline specified | Yes | Yes | No | Net-Net |
| **India** | Intensity and non-GHG | Yes | Yes | No | Net-Net |
| **Indonesia** | Baseline specified | Yes | Yes | No | Net-Net |
| **Kazakhstan** | Base year | Yes | Yes | No | Net-Net |
| **Mexico** | Baseline specified | Yes | Yes | No | Net-Net |
| **Morocco** | Baseline specified | Yes | Yes | No | Net-Net |
| **South Africa** | Trajectory | Yes | Yes | No | Net-Net |
| **Turkey** | Baseline specified | Yes | Yes | No | Net-Net |
| **Ukraine** | Base year | Yes | Yes | No | Net-Net |
| **USA** | Base year | Yes | Yes | No | Net-Net |
| **Canada** | Base year | Yes | No | No | None |
| **Republic of Korea** | Baseline specified | No | No | No | None |
| **The Philippines** | Baseline not specified | No | No | No | None |
| **Saudi Arabia** | Trajectory | No | No | No | None |

*Table to be continued on next page*

[6] 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.

| | | | | | |
|---|---|---|---|---|---|
| **Thailand** | Baseline specified | No | No | No | None |
| **European Union** | Base year | Yes | No | No | None |
| **Chile** | Intensity | Yes | No | Yes | Gross-net |
| **Japan** | Base year | Yes | No | Yes | Gross-net |
| **Russian Federation** | Base year | Yes | No | Yes | Gross-net |

## A3: NewClimate Institute calculations (based on the Climate Action Tracker analysis)

***Current policies projections***

The NewClimate Institute analysis follows the calculation steps used in the Climate Action Tracker (CAT, 2017). The starting point for the calculation of current policies emissions projections is a publicly available "baseline" policy scenario projections for economy-wide GHG emissions or energy-related $CO_2$ 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 "baseline" 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 the reasonableness of key underlying assumptions (e.g. GDP and population growth).

The IEA WEO projections on energy-$CO_2$ emissions were used for several countries. The Current Policies Scenario (CPS), which only considers policy measures implemented as of mid-publication year, was used in most cases.

When a scenario with only energy-related $CO_2$ 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-$CO_2$ GHG emissions, the US EPA report on global anthropogenic GHG emissions (2012) were used for several countries. Projections for non-energy $CO_2$ emissions are most often taken from national governments' submissions to the UNFCCC.

For all publicly available emissions projections we used for the 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 taken into account in projecting the effect of specific policies or targets, by assuming that only a fraction of the target is achieved.

***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 $CO_2$ reduction impact values estimated in external sources are applied directly to "baseline" scenarios for energy-related $CO_2$ emissions, whereas in other cases more detailed technical calculations are carried out. However, below is a generic approach to different policy types:

**Renewable energy targets**: $CO_2$ emissions reductions are calculated based on the energy balance projections underlying the "baseline" scenario for energy-related $CO_2$ 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 calculations consider economic measures such as carbon tax, feed-in tariff scheme and subsidies only if their mitigation impacts have already been quantified by other institutions.

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

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

| Country | URL | Date updated |
|---|---|---|
| **Argentina** | https://climateactiontracker.org/countries/argentina | Forthcoming |
| **Australia** | https://climateactiontracker.org/countries/australia | 30 April 2018 (adapted) |
| **Brazil** | https://climateactiontracker.org/countries/brazil | 30 April 2018 |
| **Canada** | https://climateactiontracker.org/countries/canada | 30 April 2018 (adapted) |
| **Chile** | https://climateactiontracker.org/countries/chile | 16 August 2018 |
| **China** | https://climateactiontracker.org/countries/china | 30 April 2018 |
| **Colombia** | Not assessed by Climate Action Tracker | N/A |
| **Democratic Republic of the Congo** | Not assessed by Climate Action Tracker | N/A |
| **Ethiopia** | https://climateactiontracker.org/countries/ethiopia | 6November 2017 |
| **European Union** | https://climateactiontracker.org/countries/eu | 30 April 2018 |
| **India** | https://climateactiontracker.org/countries/india | 30 April 2018 (adapted) |
| **Indonesia** | https://climateactiontracker.org/countries/indonesia | Forthcoming |
| **Japan** | https://climateactiontracker.org/countries/japan | Forthcoming |

*Table to be continued on next page*

| | | |
|---|---|---|
| **Kazakhstan** | **https://climateactiontracker.org/countries/kazakhstan** | **30 April 2018 (adapted)** |
| **Mexico** | https://climateactiontracker.org/countries/mexico | Forthcoming |
| **Morocco** | https://climateactiontracker.org/countries/morocco | Forthcoming |
| **The Philippines** | https://climateactiontracker.org/countries/philippines | Forthcoming |
| **Republic of Korea** | https://climateactiontracker.org/countries/southkorea | 30 April 2018 |
| **Russian Federation** | https://climateactiontracker.org/countries/russianfederation | 30 April 2018 (adapted) |
| **Saudi Arabia** | https://climateactiontracker.org/countries/saudiarabia | 30 April 2018 |
| **South Africa** | https://climateactiontracker.org/countries/southafrica | Forthcoming |
| **Thailand** | Not assessed by Climate Action Tracker | N/A |
| **Turkey** | https://climateactiontracker.org/countries/turkey | 30 April 2018 (adapted) |
| **Ukraine** | https://climateactiontracker.org/countries/ukraine | 30 April 2018 (adapted) |
| **United States of America** | https://climateactiontracker.org/countries/usa | Forthcoming |

## A4: The IMAGE model

For the PBL analysis, we used the integrated assessment model (IAM) IMAGE 3.0 (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. 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, bio-energy, 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.

***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 Roelfsema et al., 2014, and for the TIMER energy model, de Boer and van Vuuren, 2017). The calculations were done using the IMAGE/TIMER implementation of the SSP2 scenario (van Vuuren et al., 2017) .

In general, climate polices 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.

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.

**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 and van Vuuren, 2017).

**Power plant standards** (i.e. the $CO_2$ 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.

**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, 2007). A feed-in-tariff cannot be implemented as such, but are translated to target shares for renewable energy, often by assuming these tariffs support a strategic policy document. Such a document would, in itself, not be defined as current policies, 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 emission reduction 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 $H_2$ 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 $H_2$ 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.

**Building codes** are implemented in TIMER's residential buildings module. Useful heating efficiency, an input parameter ($MJ/m^2/HDD$), is set to the target level for residential buildings, interpolating between 2015 and the target year and accounting for the heating degree days (HDD) per region.

**Regulation on F-gases** is implemented by first translating the desired emission reduction 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.

## A5: 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 and 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., 2008), 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 (Argentina, Australia, Canada, Chile, China, Colombia, Ethiopia, India, Japan, Kazakhstan, Mexico, Morocco, Republic of Korea, Russia Federation, Saudi Arabia, South Africa, Thailand, Turkey, United States of America, and Ukraine), 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).

***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.

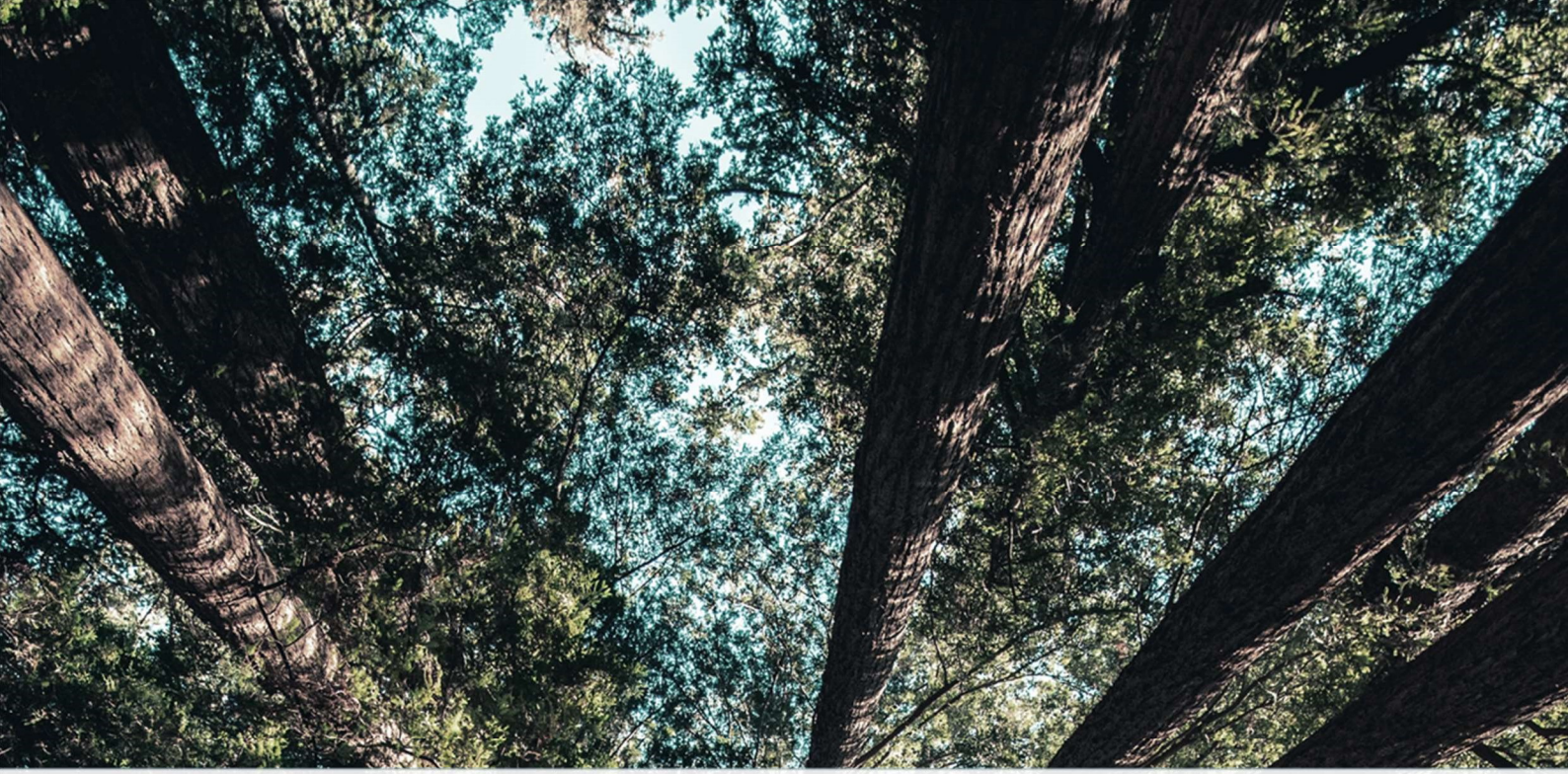
**Deforestation targets**, i.e. a reduction of the annual deforestation rate by X% or X hectares, can be prescribed in G4M using a carbon tax on the forest sector that directly reduced the annual deforestation rate. The carbon tax is set at a level that leads to the target level being reached the desired 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 $m^3$, 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.

**Emission reduction 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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