Greenhouse gas mitigation scenarios for major emitting countries

Analysis of current climate policies and mitigation commitments: 2019 update

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Acronyms

AFOLU	agriculture, forestry and other land use
AR4	Fourth Assessment Report of the IPCC
AR5	Fifth Assessment Report of the IPCC
BAU	business-as-usual
CAFE	Corporate Average Fuel Economy Standards
CAT	Climate Action Tracker
CCS	Carbon capture and storage
CH$_4$	Methane
CNG	compressed natural gas
CO$_2$	carbon dioxide
CO$_2$e	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)
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
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$_2$O	nitrous oxide
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
PPP	Purchasing Power Parity
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 of the road" scenario
t	tonne (thousand kilograms)
tce	tonne coal equivalent (29.288 GJ)
toe	tonne of oil equivalent (41.868 GJ)
TIMER	PBL's Targets IMage Energy Regional Model
Tkm	tonne-kilometre
TPES	total primary energy supply
TWh	terawatt-hour
SAR	IPCC's Second Assessment Report
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WEO	IEA's World Energy Outlook report

Acknowledgements

1 Introduction

1.1 Background

The 21st session of the Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC) held in 2015, adopted the Paris Agreement as the 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), which became "nationally determined contributions" (NDCs) following the ratification of the agreement.

The urgency for enhanced action to achieve the long-term goal of the Paris Agreement is more evident than ever—the recently published 1.5 °C 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 °C 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.

1.2 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 of America (USA). These 25 countries cover all of the G20 countries (excluding the four individual EU member states) and accounted for about 77% of total global GHG emissions in 2018 (Olivier and Peters, 2018, FAOSTAT, 2018).

Hereafter, we will use the term NDC throughout the report, given that all but one (Turkey) of the 25 countries 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 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).

1.3 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 2018 report (Kuramochi et al., 2018) include the following:

- Policy developments since the 2018 report have been taken into account in the emissions projections (cut-off date: 1 July 2019, with a few exceptions), based on our June policy update document (NewClimate Institute et al., 2019b) and the periodical updates under the European CD-LINKS project (CD-LINKS, 2018).
- 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 updated according to latest inventories submitted to the UNFCCC (cut-off date: 1 July 2019; see Appendix A.1 for details).
- GHG emissions projections under current policies were harmonised to the latest historical emissions data described above, i.e. adding the absolute emissions difference in the harmonisation year between the inventory data and the model data to the model projections. [1] The harmonisation year was updated to 2017 for Annex I countries (previously 2016) and the latest data year for non-Annex I countries (See Appendix A.1 for details).
- In addition to national total GHG emissions and GHG emissions per capita, this report presents the 2010 historical data and 2030 projections for several additional indicators whenever available:
  - GHG emissions per GDP (in USD at 2010 Purchasing Power Parities (PPP))
  - Share of renewables in total primary energy supply (TPES)
  - Share of renewables in total electricity generation
  - TPES per capita
  - TPES per GDP (in USD at 2010 Purchasing Power Parities (PPP))

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

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

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

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

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).

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. N/A: not available.

Country	2020 pledge case	NDC case [1]	Current policies scenario
Argentina	No pledge	NDC	Ministry of the Environment and Sustainable Development (Government of Argentina, 2016)
Australia	Australian Government (2018)	(Australian Government, 2018)	Australian Government (2018) [2]
Brazil	Government of Brazil (2010)	NDC	N/A
Canada	Government of Canada (2016)	NDC; Government of Canada (2017a)	Environment and Climate Change Canada (2018) [2]
China	N/A	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 (2018) [3]	NDC	(European Commission, 2018c, EEA, 2019a) [2]
India	Planning Commission Government of India (2011, 2014)	N/A	N/A
Indonesia	Second Biennial Report [4]	NDC	N/A
Japan	Third Biennial Report (UNFCCC, 2019f)	NDC	N/A [2]
Kazakhstan	Third Biennial Report	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	Third Biennial Report	NDC	UNFCCC (2019g) [2]
Saudi Arabia	No pledge	N/A	N/A
South Africa	Department of Environmental Affairs (2011a, 2011b)	NDC	N/A
Thailand	N/A	NDC	N/A
Turkey	Third Biennial Report	INDC	UNFCCC (2019g) [2]
Ukraine	N/A	NDC	N/A [2]
USA	Third Biennial Report	NDC	U.S. Department of State (2016a)

[1] INDC and NDC documents were taken from UNFCCC (2015b, 2018). We considered that the official estimates of an NDC target is available in absolute terms when it is provided in: (i) absolute terms, (ii) provided as a base year target with the base year GHG emissions reported in the national GHG inventory reports submitted to the UNFCCC, or (iii) BAU target with the BAU emission levels reported in the (I)NDC document, with description of the accounting of land use, land use change, and forestry (LULUCF) emissions.

[2] On Annex I countries, for Australia, Russian Federation and Turkey we refer to the "With measures" scenario projections reported in the Third Biennial Reports (BR3) submitted to the UNFCCC (2019f). For Japan, Kazakhstan and Ukraine, we did not find any scenario projections comparable definition-wise to our current policies scenario projections. For the EU and Canada, we refer to more recent, annual official publications using national GHG inventories.

[3] Target value from EEA (2018) includes emissions from international aviation and thus not used for the analysis.

[4] Official estimates not used due to potential inconsistency with other data provided in the document.

The calculations by **NewClimate Institute** are largely based on its analyses for, and informed by, the Climate Action Tracker project jointly carried out with Climate Analytics (Climate Action Tracker, 2019) and use existing scenarios from national and international studies (e.g. IEA's World Energy Outlook 2019) 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) and the June update (NewClimate Institute et al., 2019b), were added to that baseline (Roelfsema et al., 2018). For countries that are part of a larger IMAGE region (Australia, Kazakhstan, Republic of Korea, Russian Federation, and Ukraine), emissions projections were downscaled using the country's share in the region's 2015 emissions as a constant scaling factor.

Both NewClimate Institute and PBL scenario calculations were supplemented with those on land-use and agricultural policies using **IIASA**'s global land-use model GLOBIOM (www.iiasa.ac.at/GLOBIOM) and global forest model G4M (www.iiasa.ac.at/G4M). 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.

1.4 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,

Climate Action Tracker, 2019). NDCs are also nationally determined and heterogeneous by nature, so a fair comparison of progress across countries is not always straightforward.

- Countries have different policy-making approaches. Some countries use their pledges or targets as a device to drive more ambitious policies, while others use them merely to formalise the expected effect of existing measures.
- Gaps between the mitigation targets and current policies scenario projections may close in the years to come as countries adopt implementation measures. For this reason, it is essential that this report and similar efforts are periodically updated in the years to come.

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 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.

2   Key findings

2.1   National total GHG emissions

Countries are making progress toward their 2020 pledges and NDC targets to varying degrees (Table 2). For **2020 pledges**, not all major emitting countries are expected to meet their pledges:

- Eleven countries or regions (Brazil, Chile, China, EU28, India, Japan, Mexico, Russian Federation, South Africa, Thailand, Ukraine) are projected to meet their 2020 pledges with implemented policies.
- Six countries (Australia, Canada, Indonesia, Kazakhstan, Republic of Korea, USA) are projected to miss their 2020 pledges.

The assessment results remained the same as in the 2017 report for all countries except for South Africa. Of the remaining countries, seven (Argentina, Colombia, D.R. Congo, Ethiopia, Morocco, Philippines, Saudi Arabia) did not submit 2020 pledges while Turkey was not obligated to submit its Cancun pledge (UNFCCC, 2010).

For **NDCs**, the degree to which countries/regions are likely to achieve their targets under current policies was found to vary (Table 2, also in Figure 1):

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

Table 2: Progress of countries and regions toward meeting their 2020 pledges and NDC targets. Asterisks (*) denote that a country's current policies scenario projection is more than 15% below the NDC emission levels. Please note 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.

Country	Share in global GHG emissions in 2017 excluding LULUCF (including LULUCF)[1]	Projected to meet the targets with current policies? (in bold when the assessment changed from 2018)		
		Cancun Pledges	NDC: unconditional	NDC: conditional
Argentina	0.8% (0.9%)	(no pledge)	**Yes**	Additional action required
Australia	1.2% (1.1%)	No	Additional action required	---
Brazil	2.3% (2.9%)	Yes	Additional action required	Additional action required
Canada	1.6% (1.8%)	No (left KP-CP2)	Additional action required	---
Chile	0.2% (0.1%)	Yes	**Yes**	Yes
China	26.8% (25.0%)	Yes	Yes	---
Colombia	0.3% (0.3%)	(no pledge)	Yes	Yes
D.R. Congo [2]	0.1% (0.1%)	(no pledge)	(partially conditional)	Additional action required
Ethiopia	0.3% (0.3%)	(no pledge)	---	Additional action required
EU28	9.0% (7.9%)	Yes	**Yes** [3]	---
India	7.0% (7.1%)	Yes	Yes*	Yes
Indonesia	1.7% (4.9%)	No	Additional action required	Additional action required
Japan	3.0% (2.9%)	Yes	**Yes**	---
Kazakhstan	0.8% (0.8%)	No	Additional action required	Additional action required
Mexico	1.5% (1.5%)	Yes	Uncertain	Additional action required
Morocco [2]	0.2% (0.2%)	(no pledge)	Additional action required	Additional action required
Philippines	0.4% (0.4%)	(no pledge)	---	Additional action required
Republic of Korea	1.6% (1.3%)	No (target rescinded domestically)	Additional action required [4]	---
Russian Federation	4.6% (4.3%)	Yes	Yes	---
Saudi Arabia	1.5% (1.4%)	(no pledge)	Yes	---
South Africa	1.1% (1.1%)	**Yes** [5]	**Yes** [5]	---
Thailand	0.8% (0.8%)	Yes	Additional action required (close)	---
Turkey	1.2% (1.0%)	(no pledge)	Yes*	---
Ukraine	0.5% (0.5%)	Yes	Yes*	---
USA	13.1% (12.5%)	No	Additional action required	---

[1] Olivier et al. (Olivier and Peters, 2018), excluding LULUCF/including LULUCF. LULUCF emissions based on FAO data (FAOSTAT, 2018). [2] Projections not updated from the 2018 report. [3] This report considered a full implementation of directives, regulations and legislation adopted in 2018 and 2019 that comprise the Clean Planet for all Europeans policy package. [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. [5] Considers full implementation of the recently adopted 2019 Integrated Resource Plan.

The assessment results for 2030 have changed for the following countries compared to the 2018 report:

- From "uncertain" to "projected to meet the target": EU28. This report considered a full implementation of directives, regulations and legislation adopted in 2018 and 2019 that comprise the Clean Planet for all Europeans policy package. If the status of policy implementation on an EU member state-level is considered, studies indicate that additional action is required for the EU to meet its NDC target (EEA, 2019b).
- From "not on track" to "projected to meet the target": Argentina, Chile, Japan and South Africa.
  - Argentina: Projections were revised downward mainly due to the lower economic growth projections for the energy and industry sectors, and the downward revision of the LULUCF emissions projections.
  - Chile: Projections have gone down as potential emissions reductions from Chile's Electromobility Strategy and the first stage of its coal-phase out plan are now included.
  - Japan: Our projections have been revised downward mainly due to the higher share of renewables in the electricity mix. Our current policies scenario projections for Japan have been close to the NDC target for the last few years.
  - South Africa: Our projections have been revised significantly downward mainly due to the consideration of the recently updated Integrated Resource Plan (IRP 2019) as well as the most recent national GHG inventory report that revised the historical emissions data downward.

Other key findings on 2030 emissions projections include the following:

- For three countries (India, Turkey and Ukraine), current policies scenario projections for 2030 were found to be more than 15% lower than the unconditional NDC target levels (comparison on the basis of average values). 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.
- For Kazakhstan and Russian Federation, there were substantial changes in historical GHG emissions reported in the most recent inventory used in this report compared to the older inventory used in the 2018 report. In particular for Russian Federation, the lower historical emissions (maximum about 500 $MtCO_2e$/year) led to a downward revision of current policies scenario projections and the NDC target estimates.
- For the USA, the Trump administration continues to roll back climate policies. The GHG emissions projections, however, remained similar to the previous projections because, among different factors, the decline of coal-fired power is happening at a faster rate than previous projected.
- Currently implemented policies do not prevent emissions (sector coverage consistent with the NDC targets) from increasing from 2010 levels by 2030, not only in non-OECD 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.
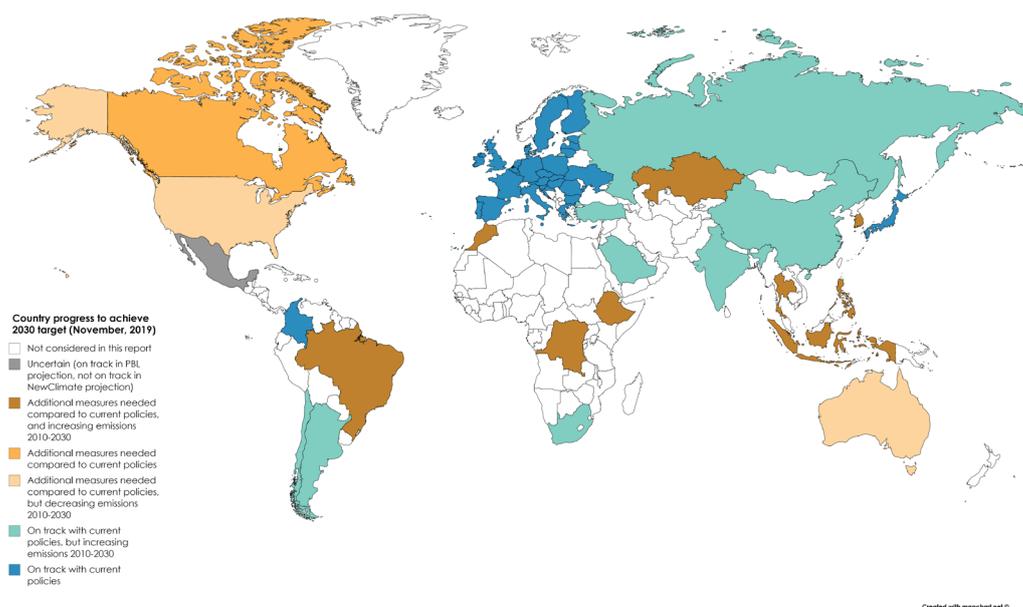
Figure 1: Progress of countries toward achieving their self-chosen 2030 targets under current policies. Note: current policies do not include implementation measures that are under development at the time of publication.

2.2 Changes in emissions projections since pre-Paris

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:

- Seven out of 13 countries (Australia, Canada, China, EU28, Japan, Turkey, and the USA) have lower current policies scenario projections compared to the 2015 report. For a few countries or regions (Australia, EU28), the growth rates of historical emissions up to 2016 were considerably lower than those projected in the 2015 report.
- For Brazil, India, Mexico, and the Russian Federation, the emissions projection ranges for 2030 in this report were either similar to, or have widened compared to, 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 1,500 $MtCO_2e$/year for 2017 and reaching about 4% to 17% above 2010 levels by 2030, while the 2015 report projected a decreasing emission trend since 2010, with about 1,500 $MtCO_2e$/year for 2017, and reaching 10% below 2010 levels by 2030.
  - 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 Indonesia, the emissions trajectories have been changing substantially annually, in part due to the revision of national GHG inventory reports. While the emissions projections for 2030 are roughly similar between 2015 and 2019 reports, the historical emissions for 2010 are significantly lower in the latest GHG inventory report used in this 2019 update.
- For one country (Republic of Korea), the projected emission levels for 2030 in this report were found to be higher than those in the 2015 report.
  - 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 estimated for the same period in the 2015 report.

Table 3: Changes in current policies scenario projections since pre-Paris. Please note that a country or region that is likely to meet its NDC does not necessarily undertake more stringent action on mitigation than a country that is not on track.

Country (incl. LULUCF unless otherwise stated)	2030 projections			Possible explanations for the changes in projections	Policies implemented since 2015
	vs. 2010: this report	Change since 2015 report (based on the comparison of relative emission levels vs. 2010) [1]	Projected to meet the NDC with current policies? (unconditional)		
Australia	-12% to -7%	Lower	Additional action required	• Projected emissions revised downwards due to lower 2010-2016 emissions	• Revised / additional renewable energy targets • Domestic implementation of Kigali Amendment to reduce HFCs • Climate Solutions Fund
Brazil [2]	+4% to +17%	Higher	Uncertain	• Revised emission inventory (in particular LULUCF)	• 10-Year National Energy Expansion Plan (PDE) • RenovaBIO to improve carbon intensity of biofuels [2]
Canada (excl. LULUCF)	-9% to +10%	Lower	Additional action required	• Projected emissions revised downwards due to lower 2010-2016 emissions	• Updated CO_2 standard for power plants (coal phase-out) • Greenhouse gas pollution pricing act [3] • Regulations to address methane in the oil and gas sector • Regulation of HFCs • Forest Bioeconomy Framework [3]

Country (incl. LULUCF unless otherwise stated)	2030 projections			Possible explanations for the changes in projections	Policies implemented since 2015
	vs. 2010: this report	Change since 2015 report (based on the comparison of relative emission levels vs. 2010) [1]	Projected to meet the NDC with current policies? (unconditional)		
China	+23% to +40%	Lower	Yes	• Lower future GDP growth assumptions vs. 2015 projections • Higher renewable technology forecasts • Lower future growth assumptions of non-CO_2 gases	• 13th Five Year Plan • Green Industry Development Plan • Emissions trading program • Made in China 2025 (standards for auto-industry)
EU28 (excl. LULUCF)	-38% to -33%	Lower	Yes	• Projected emissions revised downwards due to lower 2010-2016 emissions • Quantification of various adopted policies under the Clean Energy for all Europeans package	• Various directives, regulations and legislation under the Clean Energy for all Europeans package • Emissions standards for new cars, vans, and heavy-duty vehicles
India	+107% to +126%	Similar	Yes	• Upward revision of renewable electricity generation projections	• National Electricity Plan • Upward revision of RE capacity targets • FAME subsidy scheme for hybrid and electric vehicles under the National Electric Mobility Mission

Country (incl. LULUCF unless otherwise stated)	2030 projections			Possible explanations for the changes in projections	Policies implemented since 2015
	vs. 2010: this report	Change since 2015 report (based on the comparison of relative emission levels vs. 2010) [1]	Projected to meet the NDC with current policies? (unconditional)		
Indonesia [4]	+91% to +96%	Higher	Additional action required	• LULUCF: revised emission inventory, with significantly lower emissions for 2010, but higher emission growth projection	• National Electricity Plan (target update); • Electricity Supply Business Plan (capacity targets update)
Japan (excl. LULUCF)	-22% to -16%	Lower	Yes	• Lower energy demand growth projection • Higher renewable electricity generation projections	• 2018 Basic Energy Plan • Long-term energy demand and supply outlook • Updated vehicle fuel efficiency standards • Legislation to accelerate onshore wind power projects • Increasing F-gas recovery rates
Mexico	+3% to +24%	Similar (with larger range)	Uncertain	• Revised emission inventory • Change in methodology	• Energy Transition Law and its National Transition Strategy to promote the use of clean fuels and technologies; • REDD+ National Strategy • National Emissions Trading Scheme [3]
Republic of Korea (excl. LULUCF)	+9% to +19%	Higher	Additional action required	• Higher emissions growth between 2010–2014 • Change in methodology • Change of government	• Domestically rescinded the 2020 target • New Plan for Electricity Supply and Demand [3] • New Energy Master Plan

Country (incl. LULUCF unless otherwise stated)	2030 projections			Possible explanations for the changes in projections	Policies implemented since 2015
	vs. 2010: this report	Change since 2015 report (based on the comparison of relative emission levels vs. 2010) [1]	Projected to meet the NDC with current policies? (unconditional)		
Russian Federation (excl. LULUCF)	+12% to +21%	Similar	Yes	• Different GWP values used (AR4 vs. SAR)	• Russian State Programme's targets for energy efficiency and renewable electricity generation
Turkey (excl. LULUCF)	+56% to +118%	Lower	Yes	• Lower historical emissions growth 2010 to 2016 than projected • Change in methodology	• Energy Efficiency Action Plan [3]
United States of America (2025)	-16% to -8%	Lower	Additional action required	• Revised historical emission inventory • Higher technology forecasts than projected in 2015 report (renewables and gas)	• Started official withdrawal process from the Paris Agreement • Replacement of the Clean Power Plan; • Freezing light-duty vehicle standards; • Rescinded appliance standards; • Weakened methane standards from oil and gas production • 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 report and thus rated as "similar". [2] Assessment based on the high-LULUCF emissions case. [3] Not quantified in our assessment. [4] Excludes emissions from peat fires.

2.3 Other key indicators (for G20 members)

The high-level decarbonisation indicators presented in this section and country sections include some of the IPAT[2] and Kaya identity indicators (Ehrlich and Holdren, 1971, Blanco et al., 2014). For each indicator, we also present national targets when they are available. With these indicators, we aim to provide additional insights into the countries' current effort levels and the mitigation contributions under the Paris Agreement. This section focuses on the G20 members (excluding EU Member States).

Figure 1 (left panel) shows the 2010 historical data and 2030 projections of GHG emissions per capita (2025 projections for the USA). The consideration of LULUCF emissions differs across members, depending on the sector coverage defined in their respective NDCs. On the one hand, there are a few OECD countries, such as the EU and Mexico, with projected emissions around 5 to 6 tCO_2e/capita by 2030, which is a little lower than the 2015 global average (excluding LULUCF) of 6.7 tCO_2e/capita (Crippa et al., 2019). The EU's per capita emissions are projected to continue declining, while Mexico's per capita emissions are projected to stabilise. On the other hand, there are many countries, such as China, with projections for 2030 close to or above 10 tCO_2e/capita. In particular, six G20 members (Australia, Canada, Republic of Korea, Russian Federation, Saudi Arabia, and the USA) are projected to emit more than 15 tCO_2e/capita by 2030. India has the lowest per capita emissions due to its comparatively lower GDP.

Figure 1 (right panel) shows the 2010 historical data and 2030 projections and targets of GHG emissions intensity per GDP (2025 projections for the USA), expressing the extent to which current policies are projected to lead to a decoupling of economic growth and emissions. GHG emission intensity is expected to decrease for most G20 members to a varying degree, typically ranging between 30% and 50% compared to 2010 levels. The exceptions are Russian Federation and Saudi Arabia, two major fossil fuel producers, for which the emission intensity projections for 2030 are expected to remain at, or be higher than, the 2010 levels. The findings here are consistent with those in den Elzen et al. (2019) (which used 2015 as reference year), except for South Africa. This report projects significantly lower 2030 emissions for South Africa than estimated in den Elzen et al. (2019), due to the new Integrated Resource Plan and revised historical GHG emissions data considered here.

Figure 2 shows the 2010 historical data and 2030 projections of total primary energy supply (TPES) per capita (left panel) and per GDP (right panel). Overall trends projected up to 2030 are similar to those observed for GHG intensity per GDP and per capita, including countries with large LULUCF emissions. However, the relative values compared to 2010 levels are generally higher for TPES intensity than for GHG intensity because the latter also account for the expected reduction of carbon intensity in primary energy use.

Figure 3 shows the 2010 historical data and 2030 projections and targets of renewable energy shares (excluding traditional biomass in final consumption) in total primary energy supply (TPES, left panel) and in total electricity generation (right panel). The global average renewable energy share in 2010 was 6.6% in TPES and 12% in electricity generation (IEA, 2019b). G20 members with high renewable energy shares in their energy mix are typically those with relatively large hydropower capacity (e.g. Brazil, Canada, Chile, and Turkey) and biofuels in final consumption (Brazil), with an exception of the EU. For renewable electricity share, most G20 members fall short of the 2030 levels required, according to scenarios assessed by the IPCC, for limiting global warming to 1.5 °C with no or limited overshoot (interquartile range: 47% to 65%) (IPCC, 2018).

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[2] The IPAT identity, proposed by Ehrlich and Holdren (1971) is described as: Impact = Population * Affluence * Technology. The Kaya identity is a special case of the IPAT identity and deals with the subset of GHG emissions, i.e. energy-related CO_2 emissions (Blanco et al., 2014).

Impact of current policies on greenhouse gas emissions in the G20 economies

Emissions per capita   Emissions per GDP
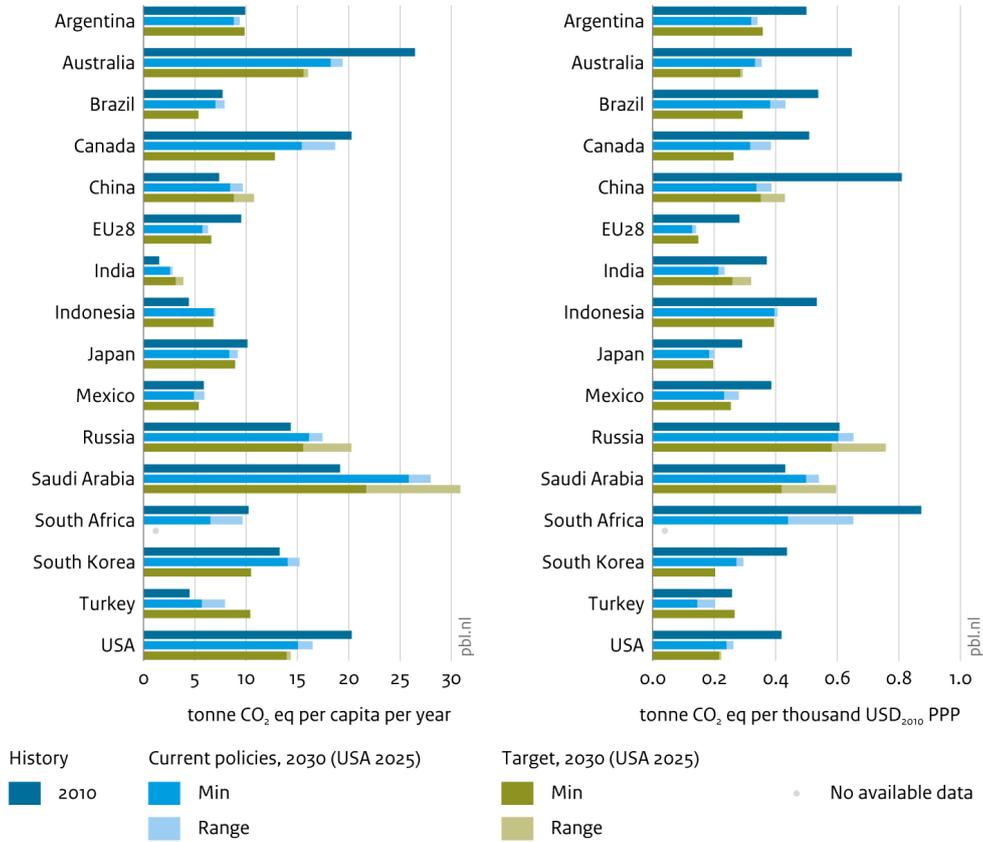
Source: PBL FAIR/TIMER model; NewClimate Institute calculations

Figure 2: 2010 historical data and 2030 projections (2025 for the USA) of greenhouse gas (GHG) emissions per capita (left panel) and per GDP (right panel). The coverage of GHG emissions are consistent with that defined in respective NDCs. Source: this study for projections and targets, IEA (2019) for historical data.

Impact of current policies on primary energy consumption of the G20 economies

Energy consumption per capita

Energy consumption per GDP

Source: PBL FAIR/TIMER model; NewClimate Institute calculations

Figure 3: 2010 historical data and 2030 projections of total primary energy supply (TPES) per GDP (left panel) and per capita (right panel). Source: this study for projections and targets, IEA (2019) for historical data.

Notes: Target values are not presented here because they are not provided in absolute terms for most countries. USA: results are based on higher heating values. For Australia, Mexico and Turkey, the current policies scenario projections presented are based only on PBL projections.

Impact of current policies on share of renewables of the G20 economies

Share in primary energy consumption

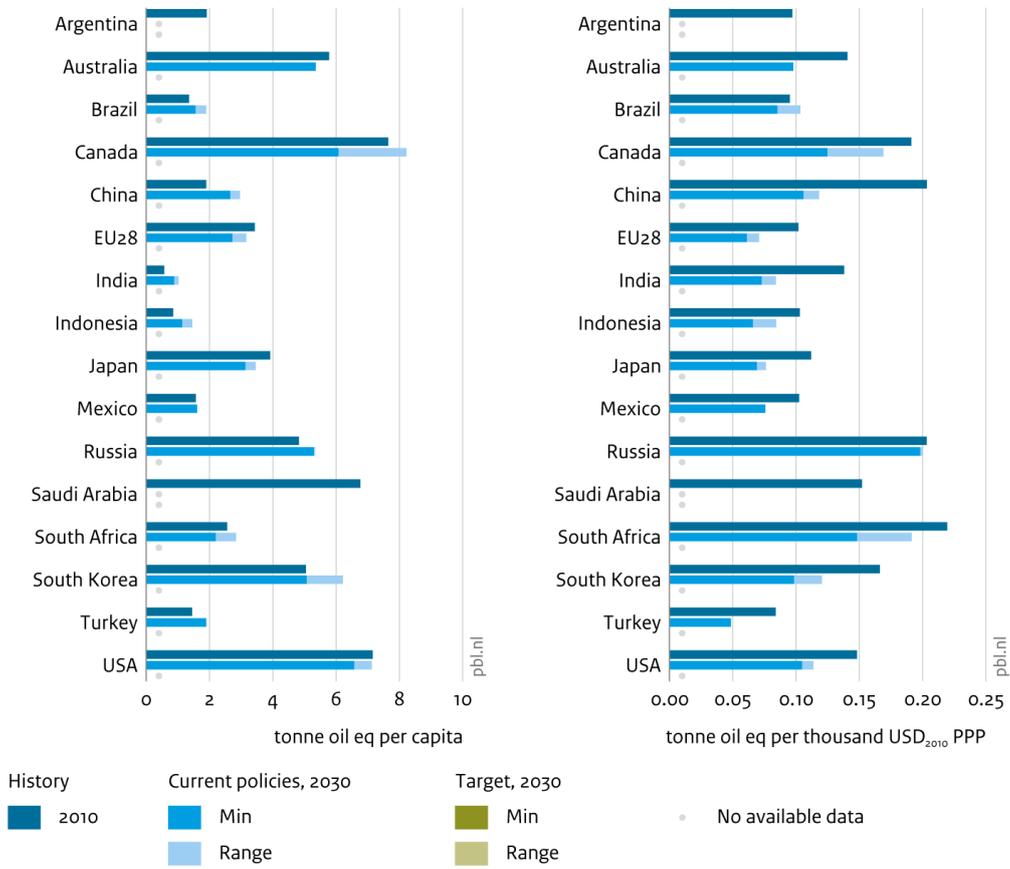Share in total electricity generation
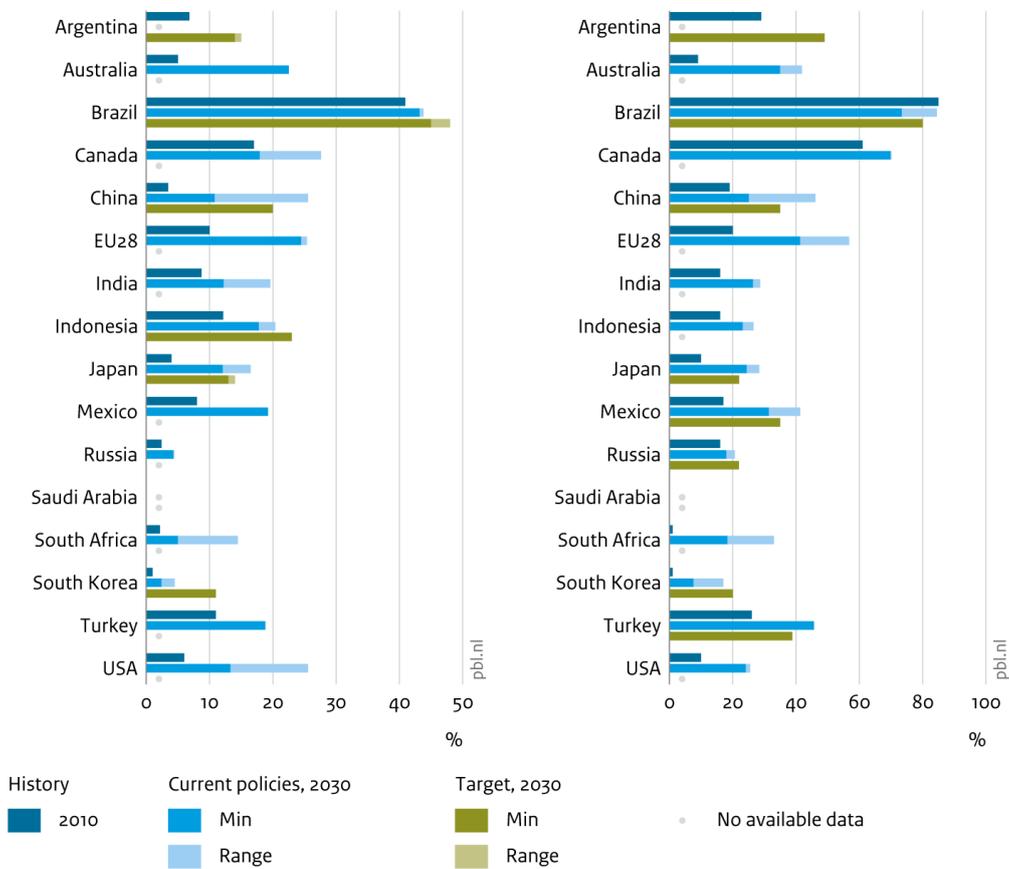
Source: PBL FAIR/TIMER model; NewClimate Institute calculations

Figure 4: 2010 historical data and 2030 projections of renewable energy shares in total primary energy supply (TPES) excluding traditional biomass use (left panel) and in total electricity generation (right panel). Source: this study for projections and targets, IEA (2019) for historical data.

Notes on the left panel. Brazil: target for 2029. China: the target includes nuclear. EU: target only available as share in final energy consumption. Indonesia: target for 2025. USA: results based on higher heating values. For Australia, Mexico and Turkey, the current policies scenario projections presented are based only on PBL projections.

Notes on the right panel: Argentina: the target excludes hydro, the share of which is assumed here to follow current trends. Australia: target only available for 2020 (not shown here). Brazil: the target excludes hydro, the share of which is assumed constant at 2017 level (IEA, 2019b) up to 2030. EU: target only available as share in final energy consumption. India: only capacity target available (not shown here). Mexico: the target year is 2024 and the target includes efficient gas-fired cogeneration. Philippines: only capacity target available (not shown here). Russian Federation: the target year is 2024 and the target excludes hydro, the share of which is assumed constant at 2017 level (IEA, 2019b) up to 2030. For Australia, Canada, Mexico and Turkey, the current policies scenario projections presented are based only on PBL projections.

2.4 Uncertainty on the emissions projections

For several countries there is large uncertainty on the GHG emissions projections related to political and economic circumstances as well as on specific sectors:

- In the USA, the Trump administration started the official withdrawal from the Paris Agreement and ceased implementation of the NDC (United States of America, 2019). 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 have emerged, 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 quantifiable non-state and subnational targets reported to international databases and networks, if fully implemented, could result in emissions that are 21% to 24% below 2005 levels by 2025 (incl. LULUCF) (NewClimate Institute et al., 2019a, 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 energy-related plans published between 2017 and 2019 will be fully implemented.
- China and India have pledges indexed to economic growth, implying that the absolute emissions levels under their targets are highly 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); updated in December 2019 for all countries.
- Projected impact of climate policies on the selected indicators in comparison with NDC or domestic targets
  - GHG emissions per GDP
  - Share of renewables (excluding traditional biomass) in total primary energy supply (TPES)
  - Share of renewables in total electricity generation
  - TPES per capita (current policies scenario projections only)
  - TPES per GDP (current policies scenario projections only)

All projections presented in this report are compared to 2010 historical levels.

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 DESA, 2019).

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).

3.1 Argentina

Key policies implemented since 2015: Argentina is one of the few countries that have updated their NDCs. Main policies implemented after 2015 related to GHG emissions reductions in Argentina include the Biofuels Law, Renewable Energy Law (RenovAr), and afforestation programmes. The renewable energy share achieved through the current instruments, mainly RenovAr auctions, is far below the target under the Renewable Energy Law of 20% (excluding hydropower) by 2025. Other implemented policies, the impacts of which are not quantified in this report, include the carbon tax scheme introduced in 2017 (US$10/tCO$_2$) and the Law 27.424 on the distributed generation of renewable energy sources under net metering, which is expected to enhance renewable energy deployment.

Recent developments (including proposed policies): Recently, the Secretariat of Energy has been promoting the exploitation of non-conventional fossil fuels from the Vaca Muerta reservoir, which could cancel the estimated emissions reductions resulting from the renewable energy plan (Iguacel, 2018). The initial exploration and future exploitation of offshore oil and natural gas is already taking place (Baruj and Drucaroff, 2018, Boletín Oficial de la República Argentina, 2019). Government entities have been preparing national climate change adaptation and mitigation action plans for all sectors. These action plans present sectoral strategies for the implementation of mitigation and adaptation measures that seek to strengthen Argentina's climate change commitments (Argentina National Climate Change Cabinet, 2019). It is unclear how the change of government, with recently elected President Alberto Fernández, will affect climate policy in Argentina.

Projections: It is projected that Argentina will likely meet its unconditional NDC target with existing policies. Our current policies scenario projections this year are lower than our 2018 projections, mainly due to the lower economic growth projections for the energy and industry sector emissions, and the downward revision of the LULUCF emissions projections.

Impact of climate policies on greenhouse gas emissions in Argentina

Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model
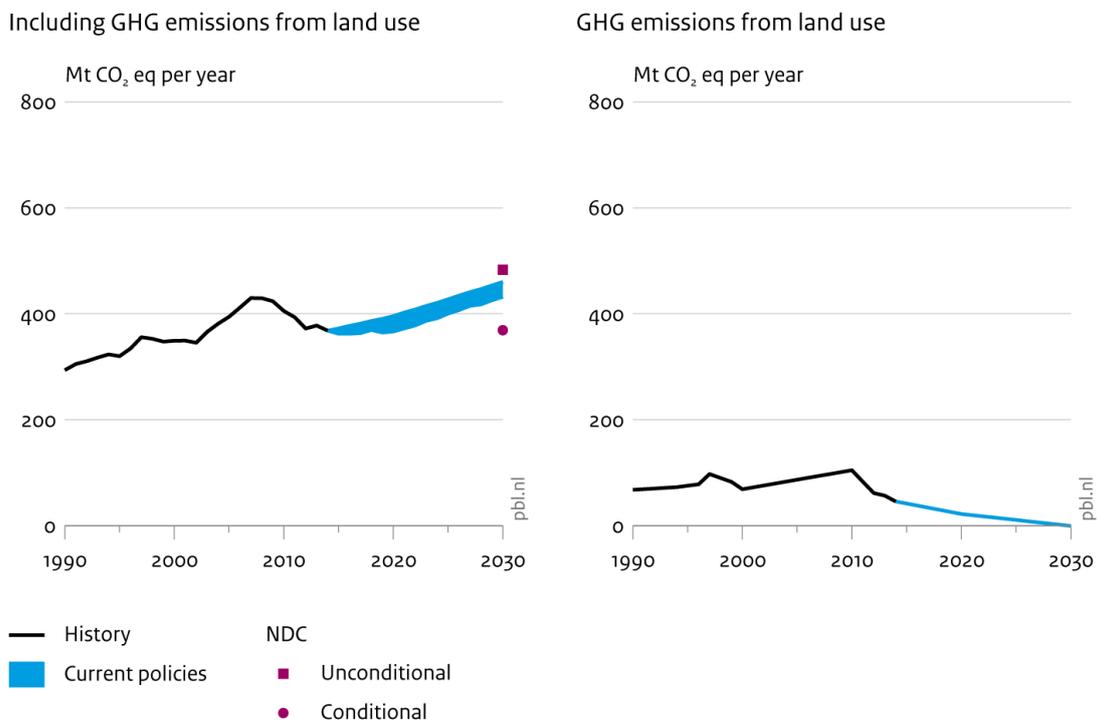
Figure 5: Impact of climate policies on greenhouse gas emissions in Argentina (including land use, i.e. LULUCF). Emission values are based on SAR GWP-100.

Table 4: Description of Argentina's NDC. N/A: not available.

Indicator	NDC
Target: unconditional	Limit GHG emissions to 483 MtCO$_2$e in 2030
Target: conditional	Limit GHG emissions to 369 MtCO$_2$e in 2030, subject to international financing, support for transfer, innovation and technology development, and capacity building
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$_2$O, HFCs, PFCs and SF$_6$
Consideration of LULUCF	Land-use sector is included in the target. Accounting approaches and methodologies are not specified
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 Environment and Sustainable Development of Argentina, 2015, Ministry of Justice and Human Rights of Argentina, 2017, Ministry of Energy and Mining of Argentina, 2016, LSE Grantham Research Institute on Climate Change and the Environment, 2018, Pensamiento Civil, 2019, Ministry of Environment and Sustainable Development of Argentina, 2018, Fratantoni, 2018)

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Energy supply	Renewable Energy Law 27.191 setting renewable targets (2016) [1], National Development Scheme for the Use of Renewable Energy Sources (RenovAr)	Total individual electric consumption to be substituted with renewable sources (excl. hydro larger than 50MW) given the following schedule: 8% by 2017, 18% by 2023 and 20% by 2025. Four rounds of renewable auctions until November 2018. The cumulative capacity contracted was 4,725 MW.
	Carbon tax on energy (2017) [1]	Starting at $10/tCO$_2$ (adjusted every trimester). Targeting emissions from transport fuels and coal. The carbon tax excludes natural gas consumption and shale gas production (FARN, 2019).
	Promotion of large-scale expansion of natural gas reserves ("Vaca Muerta") [2]	Subsidies allocated to the exploration and exploitation of non-conventional gas. Long-term energy plan projects doubling the production of oil and gas in 5 years.
Transport	Biofuels Law (updated 2016) [3]	Blending mandate of 10% for biodiesel and 12% for ethanol in the gasoline from 2016.
Buildings	Law 27.424 on net-metering for distributed generation (2017) [1]	Enable renewable generation at distribution level. Excess power can be sold under a net metering mechanism.
Forestry and Agriculture	Joint resolution 1/2018 creating the Environmental and Insurance Sustainability Program (September 2018)	Increasing forest plantations from 1.3 million hectares to 2 million hectares by 2030. To reach 2 million hectares by 2030 would mean expanding forested areas by 62,000 hectares per year.

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Forestry and Agriculture	Extension and amendment of Law 25.080 related to the investments for cultivated forests (2018)	The law aims to increase the investments, area, and enhancement of the sustainable management of cultivated forests within the country. The law grants among other benefits, an annual non-refundable Economic Contribution to some 3,000 small and medium forest producers.
	Minimum Budgets for Environmental Protection of Native Forest (Presupuestos Minimos de Proteccion) (2007) (+) [4]	Regulatory frame to control the reduction of native forest surface and achieve lasting surface over time.
	National Forest Management Plan with Integrated Livestock (Plan Nacional de Manejo de Bosques con Ganadería Integrada) (2015) [4]	To improve and maintain ecological and cultural processes in native forest and promote activities for a sustainable management of native forest. Contributes to sustainable use of native forests through incorporating livestock activities in native forest area in a sustainable manner.
	Investments for Cultivated forests (Inversiones Para Bosques Cultivados) (2008)	Development of afforestation projects on a total of 500,000 hectares of land based on economic incentives.

[1] Not quantified in the NewClimate Institute projections. [2] Not quantified in PBL TIMER projections. [3] 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 Table 1 and Appendix (A1). Emission values are based on IPCC Second Assessment Report (SAR)'s 100-year Global Warming Potential (GWP) values. N/A: not available.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data [conditional]	**NewClimate estimates [conditional]**	**Official data**	**NewClimate estimates**
405 $MtCO_2e$	2030: 483 $MtCO_2e$ [369 $MtCO_2e$, -9%]	2020: N/A 2030: 483 $MtCO_2e$, +19% [369 $MtCO_2e$, -9%]	N/A	2020: 367 to 396 $MtCO_2e$, -10% to -2% 2030: 433 to 460 $MtCO_2e$, +7% to +14%

Table 7: 2010 historical data and 2030 projections of key GHG and energy indicators for Argentina. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on SAR GWP-100. N/A: not available.

Indicator*	2010 (historical)	2030 projections (change rate vs. 2010 levels)	
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO$_2$e/thousand USD$_{2010}$ PPP)	0.50	0.32 to 0.34 (-36% to -32%)	0.36 (-28%)
GHG emissions per capita (tCO$_2$e/cap)	9.9	8.8 to 9.4 (-11% to -5%)	9.8 (-1%)
RE share in TPES (excl. traditional biomass)	6.8%	N/A	14.0% to 15.0% (+7.2 to +8.2 %-points)
RE share in total electricity generation (incl. hydro)	29.0%	N/A	49.0% to 54.0% (+20.0 to +25.0 %-points)
TPES per GDP (toe/thousand USD$_{2010}$ PPP)	0.097	N/A	N/A
TPES per capita (toe/cap)	1.91	N/A	N/A

* Projections based on NewClimate Institute projections. Note: the renewable energy target in electricity generation excludes hydro, the share of which is assumed here to follow current trends.
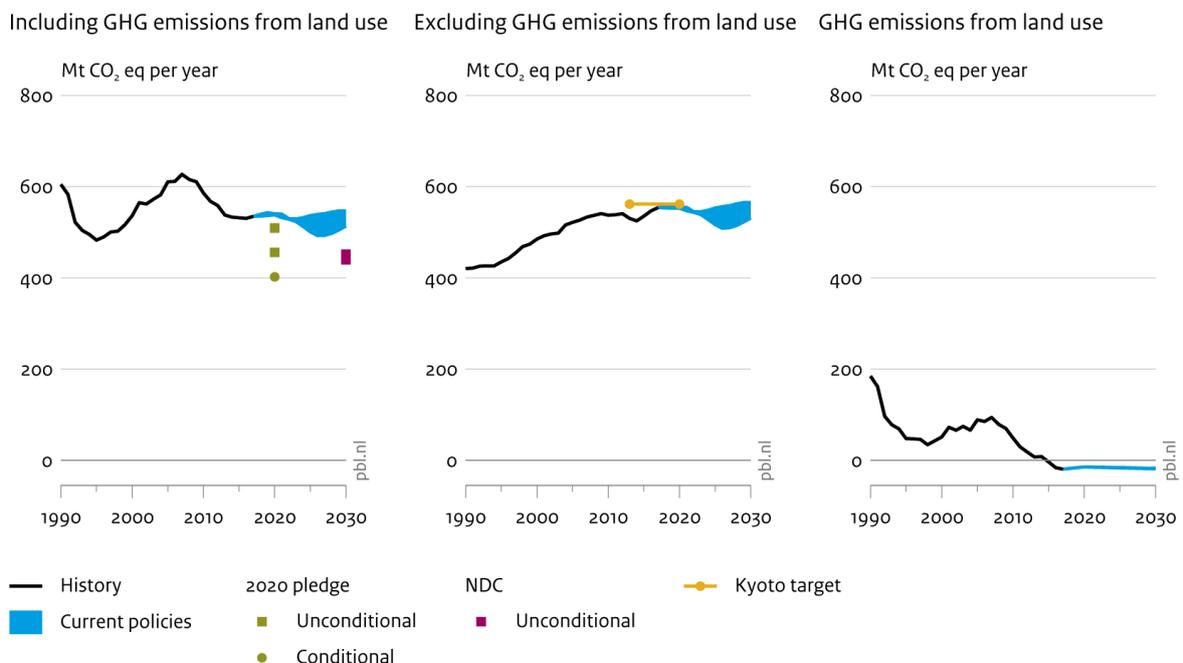
3.2 Australia

Key policies implemented since 2015: The Emissions Reduction Fund (ERF), established in 2014 and renamed in 2019 as the Climate Solutions Fund, is at the core of Australia's climate change policies. The Climate Solutions Fund (impact not quantified) is a reverse auction mechanism that aims to "reduce emissions at lowest cost over the period to 2020" (Australian Government, 2014)—and has a linked safeguard mechanism. The current government decided earlier in 2019 to provide an additional 2 billion Australian dollars to the Climate Solutions Fund (initially proposed to last 10 years, but according to the latest budget, 15 years); the Australian Government estimates that these measures will contribute to 100 MtCO2e of additional emissions reductions by 2030. The safeguard mechanism began operations in July 2016 and aims to ensure that the emissions reductions purchased through the ERF would not be displaced by emissions increases elsewhere, in particular large-scale industrial emission sources.

Recent developments (including proposed policies): The Climate Solutions Package from 2019 includes the Climate Solutions Fund, the Battery of the Nation project (impact not quantified) that aims to boost pumped storage potential between Tasmania and the mainland, and the development of a National Electric Vehicle Strategy (which has no quantified targets as of November 2019; impact not quantified). The proposed National Energy Guarantee, which aimed to secure sufficient supply of reliable power while lowering CO_2 emissions (targeting 26% power sector emissions reduction by 2030, below 2005 levels), never materialised and the government decided not to raise the Renewable Energy Target between 2020 and 2030 (see also Table 11). The federal government seeks to introduce policies aimed at maintaining the competitiveness of coal-based electricity generation (Murphy, 2018). However, all states and territories (except Western Australia) now have renewable energy targets and/or zero emissions targets in place (Climate Council, 2017).

Projections: It is projected that Australia will likely miss its NDC target with existing policies. Our current policies scenario projections this year are similar to our 2018 projections.

Impact of climate policies on greenhouse gas emissions in Australia

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

Figure 6: 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). The LULUCF projections exclude removals from non-anthropogenic natural disturbances in line with Australia's 2019 GHG Inventory Submission to the UNFCCC. Emission values are based on AR4 GWP-100.

Table 8: Description of Australia's 2020 pledge and NDC. N/A: not available.

Indicator	2020 pledge	NDC
Target: unconditional	5% GHG reduction by 2020 from 2000 level 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 Accounting approach is specified as Kyoto Protocol accounting rules (Article 3.7)[1] Land use credits: 27 $MtCO_2e$ by 2020	Land-use sector is included in the target Net-net approach will be used for emission account-ing
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 9: Overview of key climate change mitigation policies in Australia (Australian Government, 2015, Australian Department of the Environment and Energy, 2019, Australian Government, 2017a, Australian Government, 2017b).

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	Climate Solutions Package (2019) [1]	A policy package including, among others, the Climate Solutions Fund, the Battery of the Nation Project in Tasmania, and the development of a National Electric Vehicle Strategy.
	Emissions Reduction Fund (ERF) (2014) (+) [2] – *relabelled Climate Solutions Fund in 2019*	Auctions are set up to purchase emissions reductions at the lowest available cost, thereby contracting successful bidders.
Energy supply	Renewable Energy Target (2010) (+)	Targets [3] 33 TWh from large-scale generators (23.5% of total electricity generation) by 2020.
Transport	Fuel tax (2006, last amendment in 2019)[4]	Fuel tax for diesel and gasoline is set at AUD 0.418 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. 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. In total, 6.1 MtCO$_2$e/year reductions of LULUCF emissions from 2010 levels expected by 2020.
	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 [5]	Ensures that advances in land management technologies and techniques for emissions reduction and adaptation will lead to enhanced productivity and sustainable land use under a changing climate.
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 separately in NewClimate Institute and PBL TIMER projections. [2] Not quantified in PBL TIMER model projections. [3] The target was reduced in 2015 from its original 41 TWh (Scott, 2015). [4] OECD (2013). Policy instrument not quantified separately in NewClimate Institute and PBL TIMER projections. [5] Not quantified in IIASA model projections.

Table 10: 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 Table 1 and Appendix (A1). Emission values are based on IPCC Fourth Assessment Report (AR4) GWP-100. N/A: not available.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	PBL and NewClimate estimates [conditional]	Official data	PBL and NewClimate estimates
586 MtCO$_2$e	2020: 523 MtCO$_2$e 2030: 435 to 442 MtCO$_2$e	2020: 456 to 509 MtCO$_2$e, -22% to -13% [402 MtCO$_2$e, -31%] 2030: 440 to 452 MtCO$_2$e, -25% to -23%	2020: 540 Mt CO$_2$e 2030: 563 MtCO$_2$e	2020: 538 to 541 MtCO$_2$e, -8% 2030: 514 to 547 MtCO$_2$e, -12% to -7%

Table 11: 2010 historical data and 2030 projections of key GHG and energy indicators for Australia. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on AR4 GWP-100. N/A: not available.

Indicator*	2010 (historical)	2030 projections (change rate vs. 2010 levels)	
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO$_2$e/thousand USD$_{2010}$ PPP)	0.65	0.33 to 0.35 (-48% to -45%)	0.28 to 0.29 (-56% to -55%)
GHG emissions per capita (tCO$_2$e/cap)	26.4	18.2 to 19.4 (-31% to -27%)	15.6 to 16 (-41% to -39%)
RE share in TPES (excl. traditional biomass)	5.0%	22.5% (+17.5 %-points)	N/A
RE share in total electricity generation (incl. hydro)	9.0%	35.0% to 41.9% (+26.0 to +32.9 %-points)	N/A (target only available for 2020)
TPES per GDP (toe/thousand USD$_{2010}$ PPP)	0.140	0.102 (-27%)	N/A
TPES per capita (toe/cap)	5.78	5.61 (-3%)	N/A

* Projections for RE share in TPES, RE share in total electricity generation, TPES per GDP and TPES per capita based on PBL TIMER model projections.
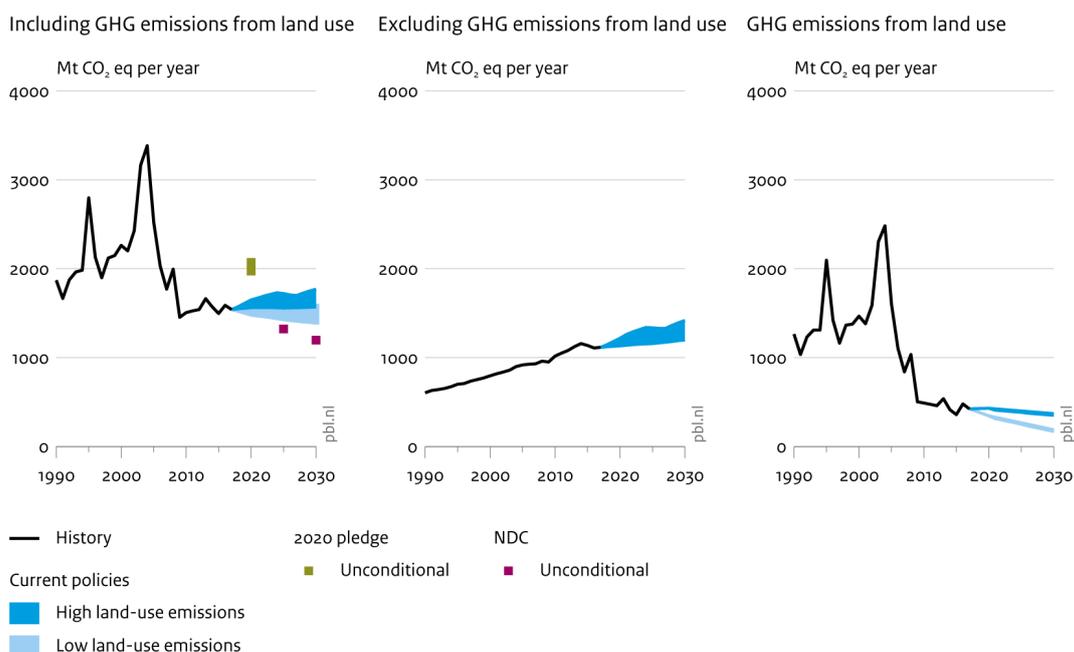
3.3 Brazil

Key policies implemented since 2015: Brazil's main climate change mitigation-related policies implemented to date include the 10-year National Energy Expansion Plan (PDE), biofuel blending mandates in the transport sector, and various policies in the land-use sector, including the Brazilian Forest Code and the Low-Carbon Agriculture (ABC) Plan. The Brazilian government has further updated the PDE. The targets in this document are in line with NDC targets by 2025, or even lead to an overachievement (see progress in Table 15). The government has also launched the RenovaBio program to increase the amount of biofuel in the national energy mix, contributing to security of supply, and reduce the carbon footprint of the national fuel mix. It led to an additional production of 31.9 million m³ of bioethanol and biodiesel in 2016 and 2017 (Ministry of Science and Technology of Brazil, 2019).

Recent developments (including proposed policies): The latest PDE is extended to 2029 and was published in November 2019, after the cut-off date of this report. Therefore, the PDE 2029 was not yet quantified; our projections are based on the capacity expansion as presented in the PDE 2027. The latest plan mentions an increase in wind and natural gas power generation in comparison to the PDE 2027. The Federal Government further plans to increase the share of railway transport in the next eight years, from 15% to 29%. On the other hand, Brazil's progress in LULUCF emissions reductions observed since 2005 has stopped, with deforestation and resulting emissions increase picking up speed again in recent years (PRODES, 2019). President Bolsonaro, among other things, eliminated 95% of the Ministry of Environment's budget for climate change-related activities and changed the Forest Code to extend deadlines for enforcement measures (Associated Press, 2019, Observatório do Clima, 2019a, Observatório do Clima, 2019b, The New York Times, 2019).

Projections: It is projected that Brazil will likely miss its NDC target with existing policies. Our current policies scenario projections this year are lower than our 2018 projections due to lower historical emissions from the SEEG inventory data, which outweighs the higher land use emissions projections. We developed two scenarios for the LULUCF policies, i.e. full implementation (leading to low LULUCF emissions) and partial implementation (leading to high LULUCF emissions).

Impact of climate policies on greenhouse gas emissions in Brazil

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

Figure 7: 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). Emission values are based on AR5 GWP-100). Emissions inventory from SEEG (2018).

Table 12: Description of Brazil's 2020 pledge and NDC. N/A: not available.

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
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 Accounting approaches and methodologies are not specified	Land-use sector is included in the target Accounting approaches and methodologies are not specified
Use of bilateral, regional and international credits	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 (28% to 33% excluding hydro) 23% share of renewables in total electricity generation (excluding hydro) by 2030 10% efficiency gains in the electricity sector by 2030

Table 13: Overview of key climate change mitigation policies in Brazil (Ministry of Mines and Energy, 2012, Government of Brazil, 2008, Presidency of the Federative Republic of Brasil, 2017, Ministry of Mines and Energy of Brazil, 2018)

Sector	Policies (marked with "(+)" when mentioned in the NDC document) [1]	Description
Energy supply	10-Year National Energy Expansion Plan (PDE) (2011: updated in 2019 as PDE 2029) [2]	27 GW wind, 17 GW biomass, 8.9 GW small hydropower and 103 GW large hydropower installed by 2027. 47% renewable share (35% excluding hydropower) in total primary energy supply by 2027 [3]. 86% renewable share (26% excluding hydropower) in total electricity generation by 2027 [3].
	National Plan on Climate Change (2008)	16% renewable electricity (excluding hydropower) by 2020 (supported by renewable energy auctions, Government of Brazil, 2007) [3].
Transport	National Biodiesel Programme (2005)	Biodiesel share in diesel of 7% from 2015 and 10% from 2018 onwards, increasing by 1%-point every March until 15% by March 2023.
	Ethanol Blending Mandate (1993)	Bioethanol share in gasoline of 27% from 2015 onwards.
	Inovar-Auto (2012)	30% tax on cars sold between 2013 and 2017, except for cars meeting 1.82 MJ/km. Expected average fuel efficiency 1.14 MJ/pkm by 2017.
	RenovaBIO (2017) [4]	Improve carbon intensity of biofuels (gCO_2e/MJ) by 7% between 2017 and 2028.
Forestry & Agriculture	The Brazilian Forest Code (2012) (+) [5]	Enforcement of the Brazilian Forest Code for the Cerrado region and the rest of Brazil. Restoring and reforesting 12 million hectares of forests by 2030.
	National Plan on Climate Change (2008) [5]	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) [5]	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) [6]	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] The PDE 2029 is not yet quantified since it was published after the cut-off date of this analysis, projections are based on the capacity expansion presented in the PDE 2027. [3] Not quantified separately in PBL TIMER and NewClimate Institute projections (only capacity targets were included). [4] Not quantified in PBL TIMER and NewClimate Institute projections. [5] The policy is included in the Low LULUCF scenario, but excluded from the High LULUCF scenario. [6] Not quantified separately in the IIASA model projections.

Table 14: Impact of climate policies on greenhouse gas emissions (including LULUCF, based on the high LULUCF emissions case) in Brazil. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. References for official emissions data are provided in Table 1 and Appendix (A1). Emission values are based on AR5 GWP-100. N/A: not available.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates
1,510 MtCO$_2$e	2020: 1,970 to 2,070 MtCO$_2$e 2025:1,300 MtCO$_2$e 2030: 1,200 MtCO$_2$e	2020: 1,970 to 2,070 MtCO$_2$e, +31% to +37% 2030: 1,200 MtCO$_2$e, -20%	N/A	2020: 1,560 to 1,650 MtCO$_2$e, +4% to +9% 2030: 1,570 to 1,770 MtCO$_2$e, +4% to +17%

Table 15: 2010 historical data and 2030 projections of key GHG and energy indicators for Brazil. Absolute emission levels (high LULUCF emission case) and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on AR5 GWP-100. N/A: not available.

Indicator	2010 (historical)	2030 projections (change rate vs. 2010 levels)	
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO$_2$e/thousand USD$_{2010}$ PPP)	0.54	0.38 to 0.43 (-29% to -20%)	0.29 (-46%)
GHG emissions per capita (tCO$_2$e/cap)	7.7	7 to 7.9 (-9% to +3%)	5.4 (-30%)
RE share in TPES (excl. traditional biomass)	40.9%	43.2% to 43.8% (+2.3 to +2.9 %-points)	45.0% to 48.0% (+4.1 to +7.1 %-points)
RE share in total electricity generation (incl. hydro)	85.0%	73.4% to 84.5% (-11.6 to -0.5 %-points)	80.0% (-5.0 %-points)
TPES per GDP (toe/thousand USD$_{2010}$ PPP)	0.095	0.085 to 0.087 (-10% to -9%)	N/A
TPES per capita (toe/cap)	1.35	1.56 to 1.59 (+15% to +17%)	N/A

Note: the renewable electricity target excludes hydro, the share of which is assumed constant at 2017 level (IEA, 2019b) up to 2030.

3.4 Canada

Recent policies with major impact: Canada's Pan-Canadian Framework on Clean Growth and Climate Change, announced in 2016, serves as an overarching strategy document for emissions reductions. Other key policies implemented after 2015 include the new stringent standards for coal-fired power plants (420 gCO_2/kWh in 2030, the same as is required for gas plants) implemented in 2018, which are designed to phase out traditional coal-fired power plants by 2030. Also implemented recently is the Greenhouse Gas Pollution Pricing Act of 2018 (it went into effect in 2019; impact not quantified), which consists of two parts: one puts a carbon levy on small emitters such as buildings, transportation and industries under 50 kt CO_2e, and one puts a cap-and-trade system or output-based pricing system on industrial facilities over 50 kt CO_2e. The Act only applies in provinces that do not have carbon pricing; British Columbia, Quebec, and Northwest Territories are fully exempt.

Recent developments (including proposed policies): Regulations to reduce emissions from oil and gas by 40% to 45% by 2025 compared to 2012 levels were introduced in 2018 and will go into effect in 2020. Despite these steps to reduce emissions, Canada's federal government purchased the politically-charged Trans Mountain pipeline in August 2018, and is considering expanding it to transport more oil from Alberta's oil sands to export ports. Canada is also conducting consultations on a clean fuel standard intended to reduce GHG emissions from fuel use. The standard would go into effect in 2022 (liquid fuels) and 2023 (gaseous and solid fuels). The federal government has further set targets for sales of zero-emission vehicles (10% by 2025, 30% by 2030, and 100% by 2040), supported by a 300 million Canadian dollar investment in these vehicles.

Projections: It is projected that Canada will likely miss its NDC target with existing policies. Our current policies scenario projections this year are similar to our 2018 projections. Historical net-emissions and current policies scenario projections for the LULUCF sector exclude emissions from natural disturbances.

Impact of climate policies on greenhouse gas emissions in Canada

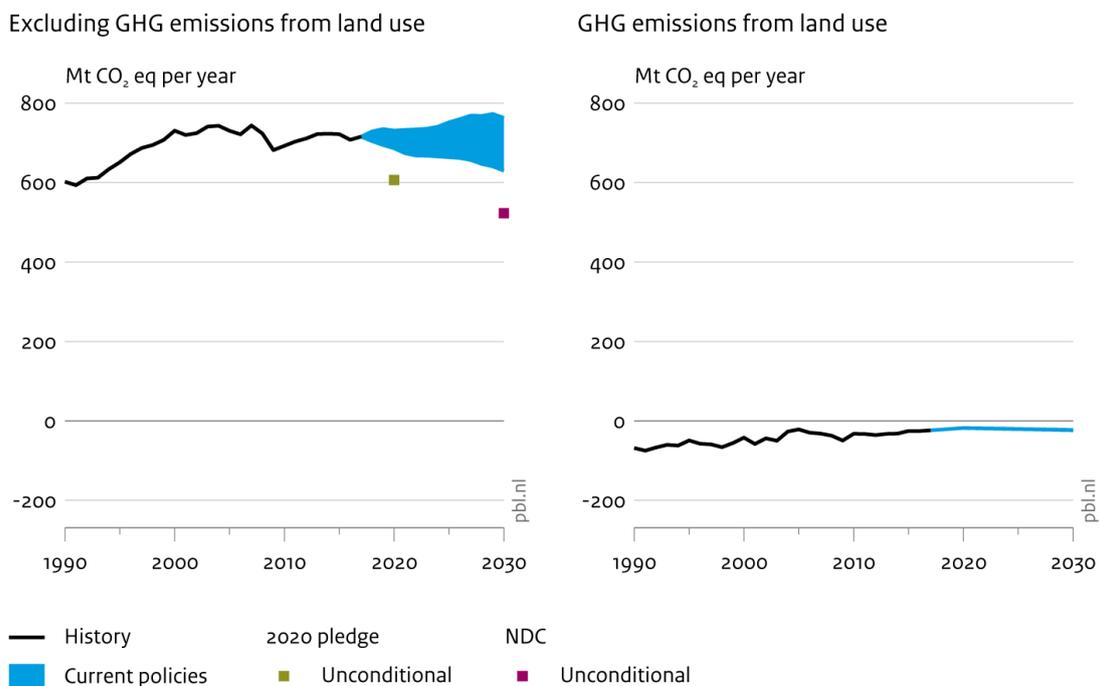Source: PBL FAIR/TIMER model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 8: Impact of climate policies on greenhouse gas emissions in Canada (left panel: excluding land use, i.e. LULUCF, and right panel: only land use). Emission values are based on AR4 GWP-100.

Table 16: Description of Canada's 2020 pledge and NDC. N/A: not available.

Indicator	2020 pledge	NDC (5 October 2016)
Target: unconditional	17% GHG reduction by 2020 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 Net-net approach will be used for emission accounting [1] Excludes emissions from natural disturbances LULUCF accounting could produce 19 $MtCO_2e$ of credits per year (Government of Canada, 2014, Climate Action Tracker, 2019) [2]	Land-use sector is included in the target Accounting approach not specified, approach being used to account for the LULUCF sector being examined [1] Excludes emissions from natural disturbances and only account for anthropogenic emissions and removals
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 17: Overview of key climate change mitigation policies in Canada (Government of Canada, 2014, Government of Canada, 2015, Government of Canada, 2017b, Government of Canada, 2018b)

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	Greenhouse Gas Pollution Pricing Act (adopted June 2018; pricing started January 2019)[1]	The Act consists of two parts: one puts a carbon levy on small emitters including industries under 50 $ktCO_2e$, and one puts a cap-and-trade system or output-based pricing system on industrial facilities over 50 kt CO_2e. The federal price on GHG emissions, starting at C\$20/tCO_2e in 2019 and rising by C\$10/tCO_2e per year until \$50/tCO_2e in 2022, applies to provinces and territories that request it or have not implemented their own carbon pricing regime ("backstop").
Energy supply	CO_2 standard for new power plants (2012) – updated in November 2018 to phase out traditional coal	420 gCO_2/kWh from 1 July 2015; plants must comply by 2030 at the latest.
	Regulations limiting carbon dioxide from natural gas fired electricity generation (January 2019)	Limits CO_2 emissions from natural gas plants to 420 g/kWh for boiler units and large combustion units, 550 g/kWh for smaller combustion units.
	Regulations to address methane in the oil and gas sector (2018)	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. Biodiesel share in diesel of 2% from 2011 onwards.
Buildings	EcoENERGY efficiency (2011) [2]	Supported the implementation of energy codes, among other things, to improve energy efficiency of buildings.
Forestry & Agriculture	The Growing Forward 2 (2013) [3]	Supports the initiatives to advance environmentally sustainable agriculture.
	Green Construction through Wood Program (2018) [3]	Supports projects and activities that increase the use of wood as a building material in infrastructure projects.
	Forest Bioeconomy Framework for Canada (2017) [3]	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] Because the differences between provinces / territories could not be modelled and the impact depends on the choices governments make, we did not quantify this measure, noting that its expected impact could be a GHG emissions reduction of 50 – 60 MtCO2e in 2022 (Government of Canada, 2018a). [2] 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). [3] Not quantified in IIASA model projections.

Table 18: 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 Table 1 and Appendix (A1). Emission values are based on AR4 GWP-100. N/A: not available.

2010 GHG emissions, excl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates
693 MtCO2e	2020: 622 MtCO2e 2030: 513 MtCO2e	2020: 606 MtCO2e, -12% 2030: 523 MtCO2e, -25%	2020: 728 MtCO2e 2030: 722 MtCO2e	2020: 686 to 731 MtCO2e, -1% to +6% 2030: 630 to 763 MtCO2e, -9% to +10%

Table 19: 2010 historical data and 2030 projections of key GHG and energy indicators for Canada. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on AR4 GWP-100. N/A: not available.

Indicator*	2010 (historical)	2030 projections (change rate vs. 2010 levels)	
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO2e/thousand USD_{2010} PPP)	0.51	0.32 to 0.38 (-38% to -25%)	0.26 (-48%)
GHG emissions per capita (tCO2e/cap)	20.3	15.4 to 18.7 (-24% to -8%)	12.8 (-37%)
RE share in TPES (excl. traditional biomass)	17.0%	17.9% to 27.6% (+0.9 to +10.6 %-points)	N/A
RE share in total electricity generation (incl. hydro)	61.0%	69.9% to 70.2% (+8.9 to +9.2 %-points)	N/A
TPES per GDP (toe/thousand USD_{2010} PPP)	0.191	0.123 to 0.169 (-36% to -12%)	N/A
TPES per capita (toe/cap)	7.65	5.97 to 8.22 (-22% to +8%)	N/A

* Projections for RE share in TPES, RE share in total electricity generation based on PBL TIMER model projections.

3.5 Chile

Key policies implemented since 2015: The overarching Climate Action Plan 2017–2022 (impact not quantified) guides climate mitigation actions in Chile. For the energy sector, Chile set renewable energy targets of at least 60% by 2035 and 70% by 2050 for electricity generation. In 2017, it implemented a carbon tax of 5 USD/tCO_2 for stationary sources (impact not quantified), and in 2018 it reformed its "Net Billing" Law (impact not quantified). In June 2019, Chile announced a coal phase-out plan divided into two stages. For the transport sector, Chile published its Electromobility Strategy end of 2017—an action plan to achieve electrification of a 40% share of the private vehicle fleet and 100% of public vehicles by 2050.

Recent developments (including proposed policies): In 2018, Chile introduced a new Energy Efficiency Law—which has been approved by the Congress but not yet implemented (impact not quantified). Chile has developed a draft Climate Change Framework Law which main objectives are to build an institutional framework for climate change mitigation and adaptation policies in every sector, in order to better integrate and achieve mitigation targets. In June 2019, Chile announced their aim to be carbon-neutral by 2050 and released a draft NDC update for public consultation in October 2019. This draft includes an unconditional absolute target of 97 $MtCO_2e$ in 2030 excl. LULUCF, a GHG emissions budget of between 1,110 and 1,175 $MtCO_2e$ excl. LULUCF between 2020 and 2030, and a peak year for GHG emissions: 2027. It also includes a conditional target of up to 45% net GHG emissions from 2016 levels by 2030 and three specific targets for the LULUCF sector.

Projections: It is projected that Chile will likely meet its unconditional NDC target as well as the upper range of the conditional NDC target with existing policies. Our current policies scenario projection this year is lower than our 2018 projection. Projections have gone down as potential emissions reductions from Chile's Electromobility Strategy and the first stage of its coal phase-out plan are now included.

Impact of climate policies on greenhouse gas emissions in Chile
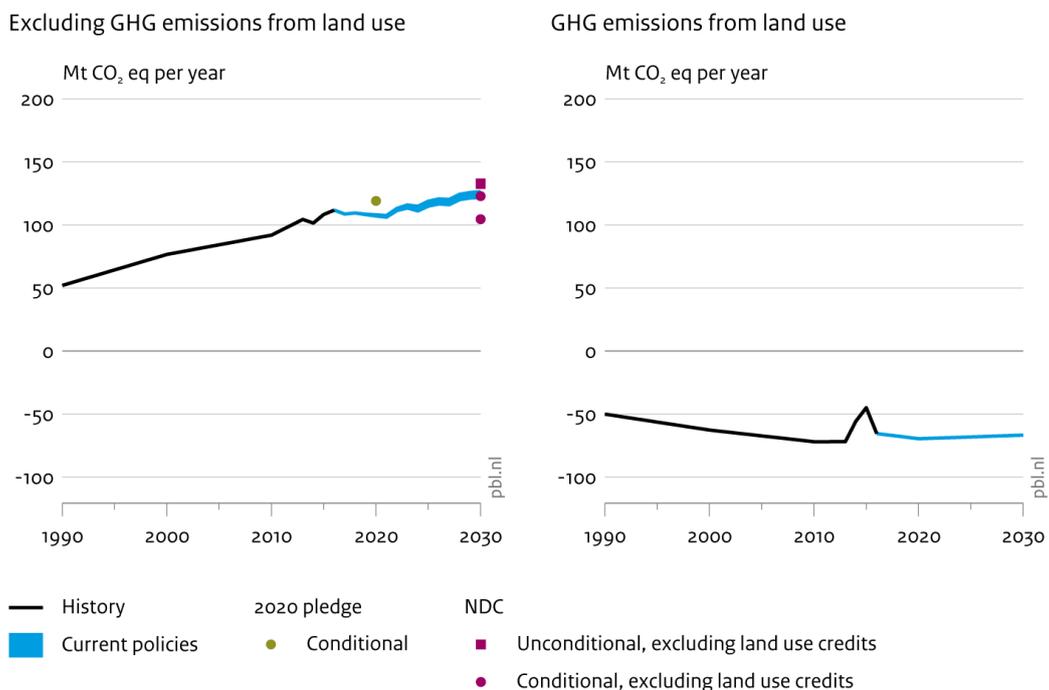
Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 9: Impact of climate policies on greenhouse gas emissions in Chile (left panel: excluding land use (i.e. LULUCF), right panel: only land use). Please see Appendix (A2) on the consideration of LULUCF for the NDC quantification. Emission values are based on AR4 GWP-100.

Table 20: Description of Chile's 2020 pledge and NDC. N/A: not available.

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
Consideration of LULUCF	Land use is included in the target Accounting approaches and methodologies not specified	LULUCF sector is excluded from NDC 2030 intensity target 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 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 (AR4). Historical emissions, projections and NDC values are shown now in AR4 GWPs.

Table 21: 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 of Chile, 2014, Ministry of the Environment of Chile, 2015, Ministry of the Environment of Chile, 2016, National Forest Corporation and Ministry of Agriculture, 2012, National Environmental Commission, 2010, Ministry of Energy of Chile, 2015, MInistry of Energy of Chile, 2018a, Government of Chile, 2012, Government of Chile, 2017a, Government of Chile, 2014, Ministry of Energy of Chile, 2018b, Government of Chile, 2013b, Government of Chile, 2016, Ministry of the Environment of Chile, 2017, Ministry of Energy of Chile, 2019a, Government of Chile, 2017b, Government of Chile, 2018, Ministry of Finance of Chile, 2014, Ministry of the Environment of Chile, 2019, Ministry of Energy of Chile, 2019b, Government of Chile, 2019)

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).
	Carbon neutrality by 2050 (June)	Chile announced in June 2019 its aim to be carbon neutral by 2050.
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.
	Coal phase-out plan announcement (2019)	Plan to phase out coal by 2040 divided into two stages. First stage: detail schedule for the closing of eight plants by 2024. Second stage: closing the remaining plants without a specific schedule.
	Law 20.698: 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)	Targets a 40% 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. 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 22: 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 Table 1 and Appendix (A1). Emission values are based on AR4 GWP-100. N/A: not available.

2010 GHG emissions, excl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	NewClimate estimates [conditional]	Official data	NewClimate estimates
92 MtCO$_2$e	N/A	2020: N/A [119 MtCO$_2$e, 30%] 2030: 133 MtCO$_2$e, +44% to +45% [105 to 123 MtCO$_2$e, +14% to +34%]	N/A	2020: 107 to 108 MtCO$_2$e, +17% to +18% 2030: 122 to 126 MtCO$_2$e, +32% to +38%

Table 23: 2010 historical data and 2030 projections of key GHG and energy indicators for Chile. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on AR4 GWP-100. N/A: not available.

Indicator*	2010 (historical)	2030 projections (change rate vs. 2010 levels)	
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO$_2$e/thousand USD$_{2010}$ PPP)	0.30	0.23 (-24% to -21%)	0.25 (-17% to -17%)
GHG emissions per capita (tCO$_2$e/cap)	5.4	6.3 to 6.5 (+16% to +21%)	6.8 (+26% to +27%)
RE share in TPES (excl. traditional biomass)	22.0%	N/A	N/A
RE share in total electricity generation (incl. hydro)	40.0%	N/A	20.0% (-20%-points)
TPES per GDP (toe/thousand USD$_{2010}$ PPP)	0.099	N/A	N/A
TPES per capita (toe/cap)	1.81	N/A	N/A

* Projections based on NewClimate Institute projections.

3.6 China

Key policies implemented since 2015: The 13th Five-Year Plan for Power Sector Development and the one for the Development of Renewable Energy set targets for capacity installations of renewable and nuclear sources and call for the establishment of a national trading system for Renewable Energy Green Certificates. In the transport sector, China has revised its subsidies and provided tax exemptions for new energy vehicles [3] in order to have one million new energy vehicles sold by 2020; they have also implemented emissions standards for light-duty and heavy-duty vehicles. In the industry sector, China has set targets to reduce the energy intensity of industry through the Industrial Green Development Plan. China has also started implementing Stage 2 of their HCFC Phase-out Management Plan in 2018, to reduce HCFC consumption in industry subsectors (impact not quantified). China continually implements mandatory energy efficiency codes and provides financial incentives for building retrofits, in an attempt to retrofit all eligible buildings in the northern heating zone by 2020. The "2018 – 2020 Blue Sky War" seeks to reduce air pollution in Chinese cities by setting standards for atmospheric pollutants, and indirectly contributes to reducing GHG emissions.

Recent developments (including proposed policies): Important planned policies include the nationwide Emissions Trading System (ETS) announced in 2017, which will initially apply only to the power sector. It is expected to be operational in 2020; when fully operational, it will be the world's largest ETS. Its impact on emissions will depend on the cap that is still to be set.

Projections: It is projected that China will likely meet its NDC targets with existing policies. Our current policies scenario projections this year is similar to our 2018 projections.

Impact of climate policies on greenhouse gas emissions in China
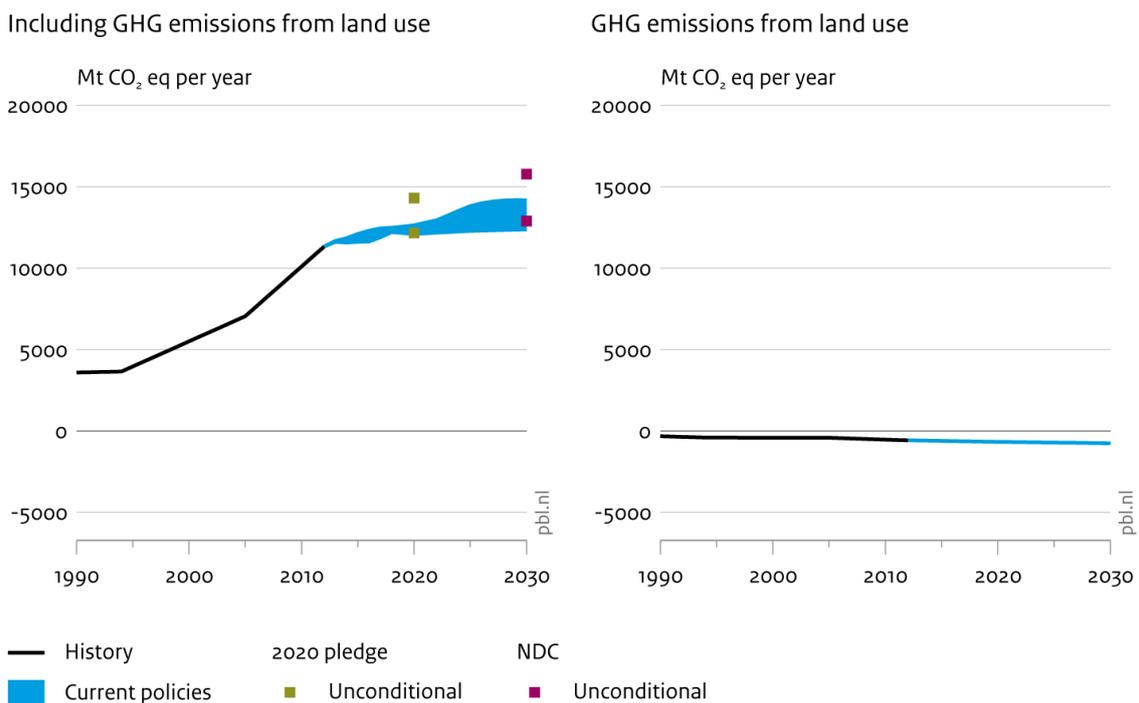
Source: PBL FAIR/TIMER model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 10: 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)). Emission values are based on SAR GWP-100.

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[3] "New energy vehicle" is a term used in China to refer to plug-in electric vehicles, including battery electric vehicles, plug-in hybrid electric vehicles, and fuel cell electric vehicles

Table 24: Description of China's 2020 pledge and NDC. N/A: not available.

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 supply 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 The forest stock in China will be increased by 1.3 billion m^3 by 2020, compared to 2005 levels Accounting approaches and methodologies are not specified	Targets for the land-use sector are included in the NDC The forest stock in China will be increased by 4.5 billion m^3 by 2030, compared to 2005 levels 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) Gas target (10% of TPES by 2020) Coal cap (max. 58% of TPES by 2020)

Table 25: 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, The 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, and limiting annual growth rate of primary energy consumption to 2.5%. Decrease CO_2 intensity by 18% from 2015 levels by 2020. Decrease energy intensity (TPES/GDP) by 15% by 2020, relative to 2015.
Energy supply	Energy Development Strategy Action Plan (2014-2020)	• Cap on coal consumption in 2020 at 4.1 billion tce (84.5 EJ/year) • A 10% target share of gas in primary energy supply in 2020 • Limit share of coal to 58% of total energy supply by 2020 • 15% non-fossil fuel share in TPES in 2020 • Renewable electricity: 340 GW hydropower excl. pumped storage, 210 GW wind, 105 GW solar PV, 5 GW solar thermal, 15 GW biomass, 0.1 GW tidal • 800 million m^2 collector area • 10 million tonnes ethanol, 2 million tonnes biodiesel • 58 GW nuclear power (150 GW by 2030)
	Action Plan for Upgrading of Coal Power Energy Conservation and Emission Reduction Released (2014)	Reduce average net coal consumption rate of new coal-fired power plants to 300 g of standard coal per kWh (implemented as a coal-fired power plant standard of 840 gCO_2/kWh by 2020) [2].
Transport	Vehicle fuel economy standards (2004)	Fuel efficiency of new heavy-duty trucks: 1.2 MJ/tkm by 2021.
	Expansion of Ethanol Production and Promotion for Transportation Fuel (2017)	Ethanol blending mandates 10% (E10) in selected provinces by 2020.
	"Made in China 2025" standards for auto industry (2013)	Fuel economy standards of 5L/100 km by 2020. 1 million units of new energy vehicles sold in 2020.
Industry	"Made in China 2025" CO_2 intensity target (2013) [2]	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.

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
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.
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 transforming 35 million hectares of low-yield forest area.
	National Afforestation and Greening Plan 2011-2020	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. 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 26: 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 Table 1 and Appendix (A1). Emission values are based on SAR GWP-100. N/A: not available.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	PBL [1] and NewClimate estimates	Official data	PBL and NewClimate estimates
10,100 MtCO$_2$e	N/A	2020: 12,200 to 14,300 MtCO$_2$e, +20% to +42% 2030: 12,900 to 15,800 MtCO$_2$e, +28% to +56%	N/A	2020: 12,100 to 12,600 MtCO$_2$e, +20% to +25% 2030: 12,400 to 14,200 MtCO$_2$e, +23% to +40%

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

Table 27: 2010 historical data and 2030 projections of key GHG and energy indicators for China. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on SAR GWP-100. N/A: not available.

| Indicator	2010 (historical)	2030 projections (change rate vs. 2010 levels)	
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO$_2$e/thousand USD$_{2010}$ PPP)	0.81	0.34 to 0.39 (-58% to -52%)	0.35 to 0.43 (-57% to -47%)
GHG emissions per capita (tCO$_2$e/cap)	7.4	8.5 to 9.7 (+15% to +31%)	8.8 to 10.8 (+19% to +46%)
RE share in TPES (excl. traditional biomass)	3.5%	10.8% to 25.6% (+7.4 to +22.1 %-points)	20.0% (+16.5 %-points)
RE share in total electricity generation (incl. hydro)	19.0%	25.1% to 46.1% (+6.1 to +27.1 %-points)	35.0% (+16.0 %-points)
TPES per GDP (toe/thousand USD$_{2010}$ PPP)	0.203	0.106 to 0.118 (-48% to -42%)	N/A
TPES per capita (toe/cap)	1.90	2.66 to 2.96 (+40% to +56%)	N/A

3.7 Colombia

Key policies implemented since 2015: The *Climate Change Law 1931* of 2018 defines guidelines to include climate change in decisions taken by public and private actors at national, regional and local levels. Relevant policies implemented since 2015 include the tax reform in Law 1819 of 2016 (in force since 2017), which established a national carbon tax on the combustion of fossil fuels, except for coal. The Decree 926 of 2017 incentivises actors in the distribution chain to offset the emissions associated with the combustion of these fossil fuels in exchange for an exemption of the carbon tax (Ministry of Finance and Public Credit of Colombia, 2017). The government has put forward regulatory instruments that have an impact on GHG emissions, including a national plan to incentivise energy efficiency in the transportation, energy, industry, and buildings sectors – PROURE.

Recent developments (including proposed policies): In October 2019, Colombia carried out for the first time an auction to support the large-scale development of non-conventional renewables (i.e. solar and wind), contracting 1.3 GW of renewable capacity that is expected to come online in 2022. The current administration is exploring the possibility to open fracking pilot projects in Colombia, sparking a political debate regarding its regulation. Additionally, the recent National Development Plan has set a deforestation target of 30% by 2022 with respect to the current scenario (Departamento Nacional de Planeación, 2018) (impact not quantified). Given that the level under a reference scenario is 360,000 hectares per year, it would lead to a deforestation rate of around 250,000 hectares per year, which is significantly higher than the previous administration's target (90,000 hectares per year).

Projections: It is projected that Colombia will likely meet its unconditional NDC targets with existing policies. Our current policies scenario projection this year is similar to our 2018 projection. The new national GHG inventory report shows considerably different historical emissions data compared to previous inventories, in particular for the LULUCF sector.

Impact of climate policies on greenhouse gas emissions in Colombia
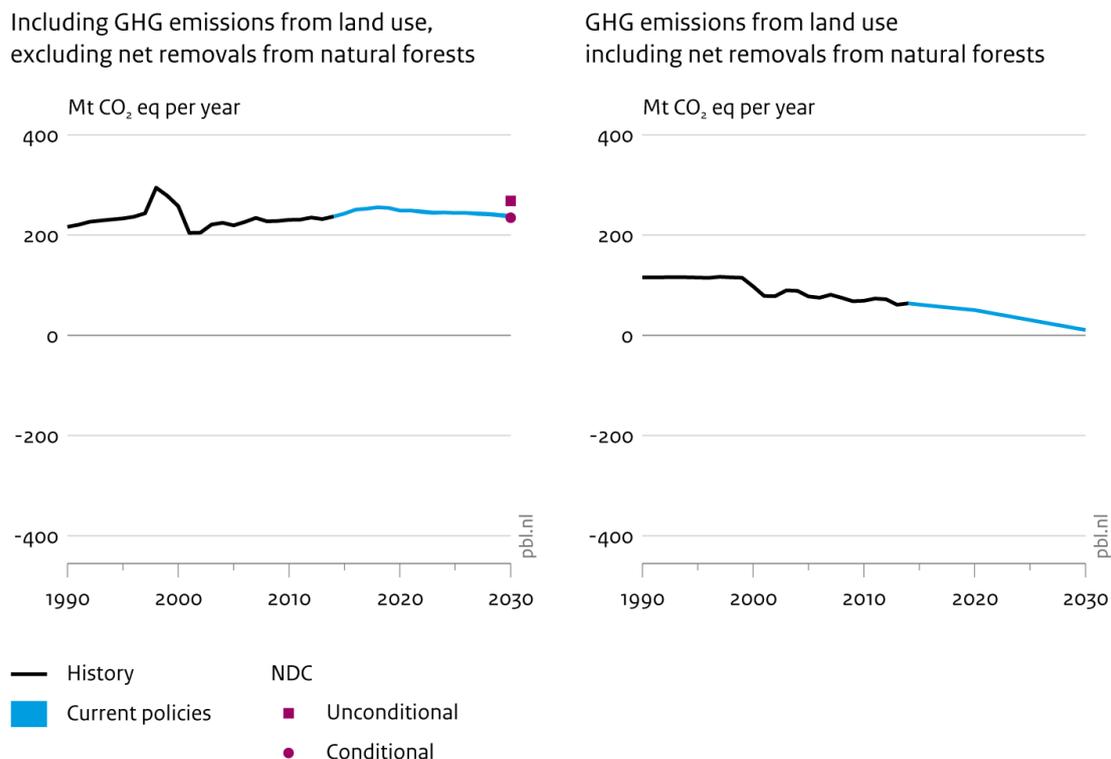
Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 11: Impact of climate policies on greenhouse gas emissions in Colombia (left panel: including land use (i.e. LULUCF), right panel: only land use). Emission values are based on SAR GWP-100.

Table 28: Description of Colombia's 2020 pledge and NDC. N/A: not available.

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 BAU calculation excludes removals from natural forests that remain as natural forests in the target year 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 29: 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, Ministry of Finance and Public Credit of Colombia, 2017, Ministry of Environment and Sustainable Development, 2017a, IEA, 2013, Ministry of Environment and Sustainable Development, 2016, Congreso de la República, 2016, IDEAM et al., 2018)

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 Indicative Action Plan on energy efficiency (PROURE) 2017–2022 (Resolution No. 41286 of 2016). The resolution No. 585 establishes procedures to carry out those measures.
Energy supply	Colombian Low-Carbon Development Strategy (+) (ECDBC) (2012)	Through the implementation of eight Sectoral Mitigation Action Plans, this strategy aims to deviate from BAU emissions levels, which are estimated to be over 60% from current levels by 2030.
	Law 697: Programme for rational and efficient use of energy and other forms of non-conventional Energy (PROURE) (2010; latest adopted in 2016) [1]	Aims for a 9.05% energy efficiency improvement in the transport and industry sectors between 2017 and 2022.
Buildings	NAMA Project for the domestic refrigeration sector (2017-2021)	Reduction of emissions from the domestic refrigeration sector. Targets an annual reduction of around 3.8 $MtCO_2e$ 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.
Forestry	The National Development Plan of Colombia (+) (2015)	Reduction of the annual deforestation rate from 121,000 hectares in 2013 to 90,000 hectares by 2018.
	The Amazon Vision Program (+) (2016) [2]	Achieve net-zero deforestation by 2020.

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Forestry	REDD+ Zero Deforestation in the Amazon by 2020 (2009) [2]	Reducing Emissions from Deforestation and Forest Degradation (REDD+) consists of four phases of strategy with a total of 18.5 million USD for planning and implementation.
	Resolution to increase the area of protected forest land in the Amazon (2018)	Increase Colombia's protected forest area coverage to 30 million hectares to reach a total of 38 million hectares.

[1] Not quantified in NewClimate Institute projections. [2] Not quantified in IIASA model projections.

Table 30: 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 Table 1 and Appendix (A1). Emission values are based on SAR GWP-100. N/A: not available.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	NewClimate estimates [conditional]	Official data	NewClimate estimates
234 MtCO$_2$e	2030: 268 MtCO$_2$e [235 MtCO$_2$e]	2020: N/A 2030: 268 MtCO$_2$e, +16% [235 MtCO$_2$e, +2%]	N/A	2020: 249 MtCO$_2$e, +8% 2030: 238 MtCO$_2$e, +3%

Table 31: 2010 historical data and 2030 projections of key GHG and energy indicators for Colombia. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on SAR GWP-100. N/A: not available.

| Indicator* | 2010 (historical) | 2030 projections (change rate vs. 2010 levels) | |
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO$_2$e/thousand USD$_{2010}$ PPP)	0.47	0.27 (-44% to -43%)	0.3 (-36%)
GHG emissions per capita (tCO$_2$e/cap)	5.1	4.4 to 4.5 (-13% to -12%)	5 (-2%)
RE share in TPES (excl. traditional biomass)	17.6%	N/A	N/A
RE share in total electricity generation (incl. hydro)	72.0%	N/A	N/A
TPES per GDP (toe/thousand USD$_{2010}$ PPP)	0.064	N/A	N/A
TPES per capita (toe/cap)	0.68	N/A	N/A

* Projections based on NewClimate Institute projections.

3.8 Democratic Republic of the Congo (DRC)

Key policies implemented since 2015: The main policies on GHG emissions reductions in the DRC are in the land-use sector, which accounts for about 75% of national total emissions today. Main policies related to the land-use sector were established in 2015 and relate to the protection of permanent forest domains, promotion of sustainable timber management, afforestation and reforestation (Plan de convergence COMIFAC).

Recent developments (including proposed policies): A national strategy for community forestry was developed in 2018; it aims to safeguard local people's rights in order to better protect Congo's forests. The plan calls for an "experimental phase" over the next five years to gradually provide access to an area of roughly 700,000 km^2. On renewables, the Green Mini-Grid Program is currently under development; the program aims to promote the investment in mini and micro hydropower instalments with a target of installing a total power capacity of 10 MW by 2022 and of 100 MW by 2025 in rural areas (Green Climate Fund, 2018; Radio Okapi, 2018). The program is supported by the PNUD, the Green Climate Fund and the African Development Bank.

Projections: It is projected that DRC will likely get close to, but miss its conditional NDC targets with existing policies. Our current policies scenario projections this year are similar to our 2018 projections.

Impact of climate policies on greenhouse gas emissions in Republic of the Congo
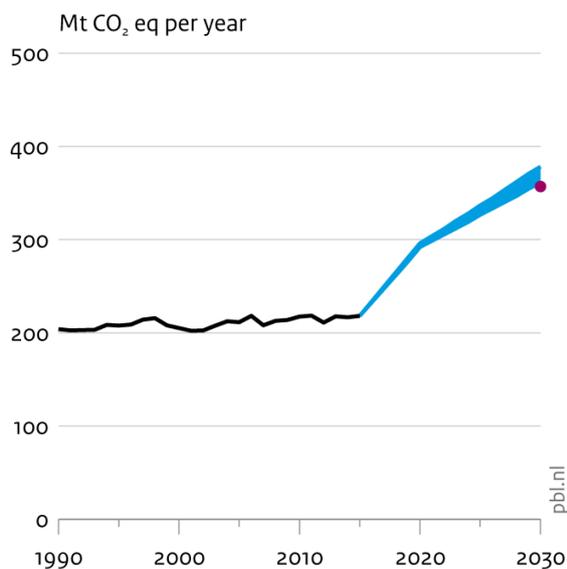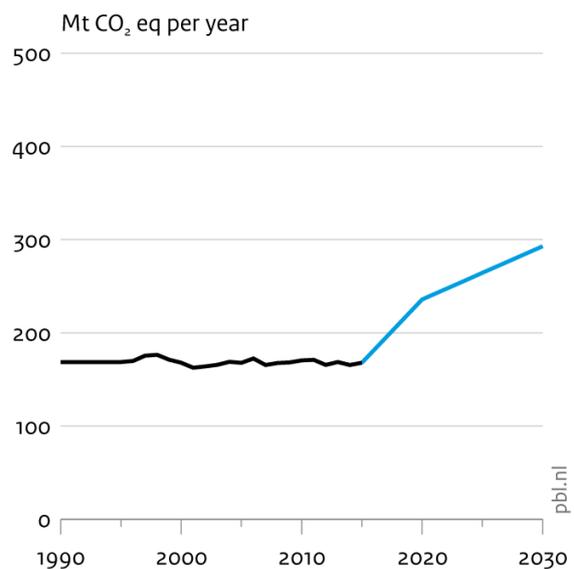
Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 12: 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. Emission values are based on AR4 GWP-100.

Table 32: Description of the Democratic Republic of the Congo's NDC. N/A: not available.

Indicator	NDC
Target: unconditional	The NDC is partially conditional, see below
Target: conditional	17% reduction compared to BAU emissions levels (430 MtCO$_2$e, i.e. slightly more than 70 MtCO$_2$e 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$_2$O
Consideration of LULUCF	Land-use sector is included in the target Accounting approaches and methodologies are not specified
Use of bilateral, regional and international credits	Not specified
Other sector-level targets	Not specified

Note: DRC has not set its 2020 pledge.

Table 33: 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. 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 34: 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 Table 1 and Appendix (A1). Emission values are based on AR4 GWP-100. N/A: not available.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	**NewClimate estimates**	**Official data**	**NewClimate estimates**
217 Mt**CO$_2$e**	357 MtCO$_2$e in 2030	2020: N/A 2030: N/A [357 MtCO$_2$e, +64%]	N/A	2020: 291 to 296 MtCO$_2$e, +34% to +36% 2030: 361 to 378 MtCO$_2$e, +66% to +74%

Table 35: 2010 historical data and 2030 projections of key GHG and energy indicators for the Democratic Republic of the Congo. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on AR4 GWP-100. N/A: not available.

| Indicator* | 2010 (historical) | 2030 projections (change rate vs. 2010 levels) | |
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO₂e/thousand USD₂₀₁₀ PPP)	5.81	N/A	N/A
GHG emissions per capita (tCO₂e/cap)	3.4	3.0 to 3.2 (-11% to -6%)	N/A)
RE share in TPES (excl. traditional biomass)	27.2%	N/A	N/A
RE share in total electricity generation (incl. hydro)	99.0%	N/A	N/A
TPES per GDP (toe/thousand USD₂₀₁₀ PPP)	0.530	N/A	N/A
TPES per capita (toe/cap)	0.31	N/A	N/A

* Projections based on NewClimate Institute projections.

3.9 Ethiopia

Key policies implemented since 2015: The framework climate policy in Ethiopia is the Climate Resilience and Green Economy Strategy (CRGE). Established in 2011, it identifies and prioritizes more than 60 potential climate change mitigation and adaptation initiatives until 2030. The framework development policy is the Growth and Transition Plan (GTP), which is currently in its second phase (2016–2020; impact not quantified).

Recent developments (including proposed policies): A second phase of the GTP (GTP II) for 2016 to 2020 aims for the full implementation of the CRGE by 2025 (Federal Democratic Republic of Ethiopia, 2016). However, because the GTP II specifies neither on the basis of which specific policies the full implementation of the CRGE shall be achieved by 2025 nor how international funding will contribute to its full implementation, the GTP II is not included in the current policies scenario projections.

Projections: It is projected that Ethiopia will likely miss its NDC target with existing policies. Our current policies scenario projections this year are similar to our 2018 projections, with the upper bound projections revised downward. The lower bound emissions projection for non-LULUCF sectors assumes full implementation of the CRGE, whereas the upper bound projection mainly takes account of the expected delivery by the first phase of the GTP (GTP I), which contained renewable energy deployment programmes.

Impact of climate policies on greenhouse gas emissions in Ethiopia
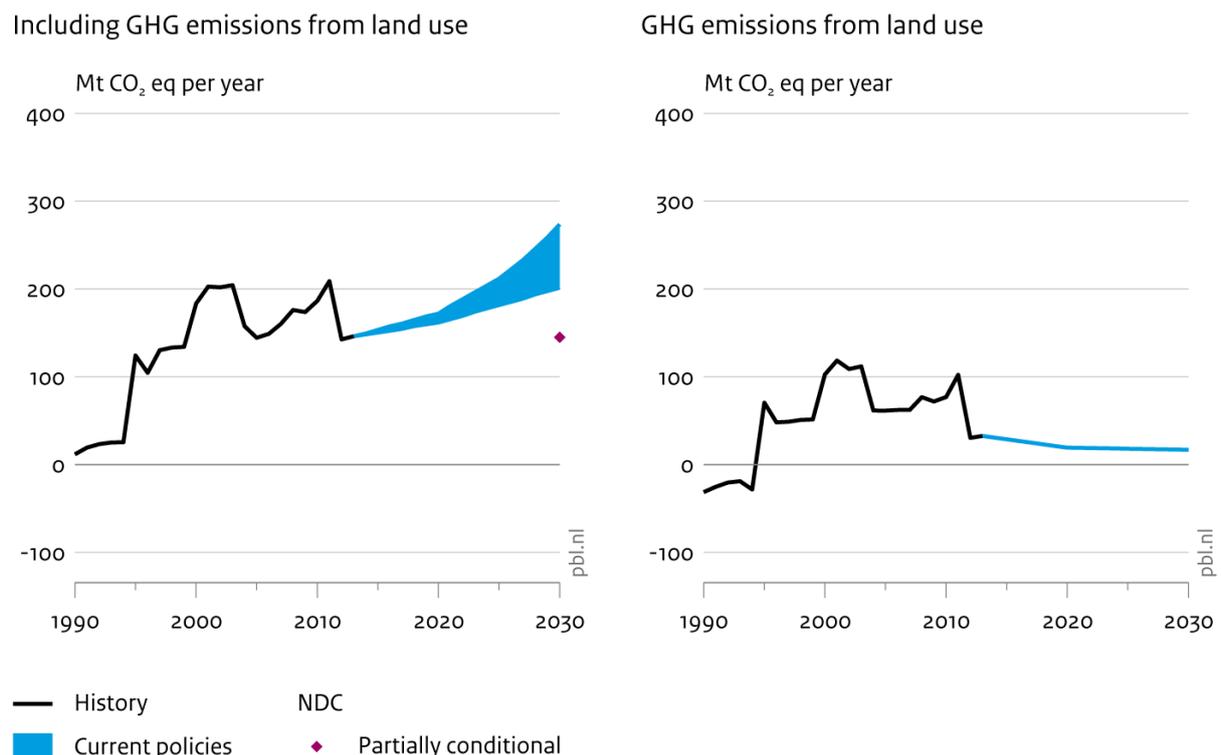
Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 13: Impact of climate policies on greenhouse gas emissions (CO_2, CH_4 and N_2O) including land use (i.e. LULUCF) in Ethiopia. Emission values are based on AR4 GWP-100.

Table 36: Description of Ethiopia's 2020 pledge and NDC. N/A: not available.

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 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. 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 37: 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). 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. 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. 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]. 17,000 hectares of forest to be brought under protection and natural regeneration over a 30-year planning period.

[1] See Climate Action Tracker (2019) 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 due to its unclear implementation status.. [3] Excluded due to its unclear development status.

Table 38: 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 Table 1 and Appendix (A1). N/A: not available.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data [conditional]	NewClimate estimates [conditional]	Official data	NewClimate estimates
186 $MtCO_2e$	2030: N/A [145 $MtCO_2e$]	2020: N/A 2030: N/A [145 $MtCO_2e$, -22%]	N/A	2020: 162 to 172 $MtCO_2e$, -13% to -7% 2030: 202 to 274 $MtCO_2e$, +8% to +47%

Table 39: 2010 historical data and 2030 projections of key GHG and energy indicators for Ethiopia. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on AR4 GWP-100. N/A: not available.

Indicator*	2010 (historical)	2030 projections (change rate vs. 2010 levels)	
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO$_2$e/thousand USD$_{2010}$ PPP)	3.12	N/A	N/A
GHG emissions per capita (tCO$_2$e/cap)	2.1	1.4 to 1.9 (-35% to -11%)	N/A
RE share in TPES (excl. traditional biomass)	7.2%	N/A	N/A
RE share in total electricity generation (incl. hydro)	99.0%	N/A	N/A
TPES per GDP (toe/thousand USD$_{2010}$ PPP)	0.558	N/A	N/A
TPES per capita (toe/cap)	0.38	N/A	N/A

* Projections based on NewClimate Institute projections.

3.10 European Union

Key policies implemented since 2015: Central to the delivery of the EU's NDC is the Clean Energy for All Europeans package drafted in 2016. It consists of eight legislative acts, among which are the revised Renewable Energy (2018/2001) and Energy Efficiency Directives (2018/2002), the Electricity Regulation and Electricity Directive, and the Energy Union Governance Regulation (2018/1999) which obliges member states to present National Energy and Climate Plans (NECPs) describing planned measures to contribute to meeting EU's energy and climate goals. The full implementation of the Clean Energy for All Europeans package is expected to lead to a reduction of GHG emissions by about 45% by 2030 from to 1990 levels, compared to the existing NDC target of a 40% reduction (European Commission, 2018b).

Recent developments (including proposed policies): In the transport sector, the CO_2 emissions standards for passenger cars and vans as well as for new heavy-duty vehicles were updated in early 2019. The preparation of a long-term low greenhouse gas emissions development strategy under the Paris Agreement is also underway; the "Clean Planet for All" strategic long-term vision document (European Commission, 2018a) illustrates how the EU could achieve carbon neutrality by 2050.

Projections: It is projected that the EU will likely meet its NDC target with existing policies. Our current policies scenario projections this year are lower than our 2018 projections, mainly due to the consideration of recently adopted policy packages described above. The projections presented in this report include the UK, which accounted for 11% of EU's total GHG emissions in 2017.

Impact of climate policies on greenhouse gas emissions in EU28
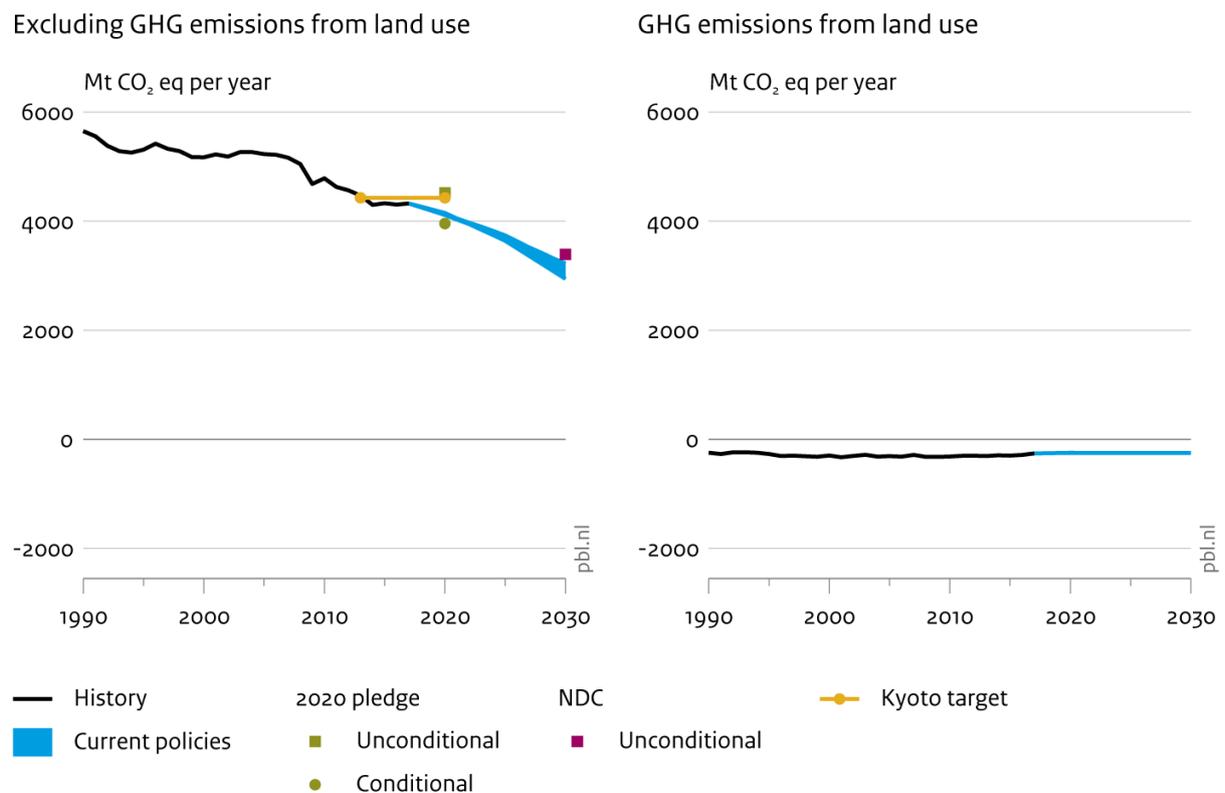
Excluding GHG emissions from land use

GHG emissions from land use

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

Figure 14: Impact of climate policies on greenhouse gas emissions in the EU (left panel: excluding land use (i.e. LULUCF), right panel: only land use). Emissions values are based on AR4 GWP-100.

Table 40: Description of EU's 2020 pledge and NDC. N/A: not available.

Indicator	2020 pledge	NDC
Target: unconditional	20% GHG reduction by 2020 from 1990 level 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
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, 2018b).

Table 41: Overview of key climate change mitigation policies in the EU (European Commission, 2015, European Commission, 2016, EEA, 2018, European Parliament, 2009b, European Parliament, 2009c, Official Journal of the European Union, 2009, European Parliament, 2009a, European Parliament, 2012, European Council, 2017, Official Journal of the European Union, 2018a, European Commission, 2017, Official Journal of the European Union, 2018c, European Commission, 2018d, European Commission, 2018a, European Commission, 2019a, European Commission, 2019b, European Council, 2019)

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]	Cap on emissions from electricity/heat and industry in order to reduce emissions by 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) (2018) [2]	Reduce GHG emissions from non-ETS sectors by 30% by 2030, relative to 2005
Energy supply	Renewable energy directive (Directive 2018/2001; RED II)	Target of 32% share in final energy consumption by 2030 with a possible revision in 2023
	Revised Energy Efficiency Directive (2018/2002)	Target of 32.5% reduction in final energy consumption by 2030 with a possible revision in 2023
Buildings	Eco-design Framework Directive (Directive 2009/125/EC) [3]	Specific standards for a wide range of appliances
	Energy Performance of Buildings Directive (2010; revised 2018) [4]	Near-zero energy buildings by 2020 (residential) and by 2018 (public)
Transport	Regulation of CO_2 emissions from passenger vehicles (443/2009, updated April 2019), and heavy-duty vehicles (February 2019)	• Emission standard of 95 gCO_2/km, phasing in for 95% of vehicles by 2020 with 100% compliance by 2021 • By 2030, emissions will have to be 37.5% lower for new cars and 31% lower for new vans compared to 2021 levels. This measure also sets a 15% reduction target by 2025 compared to 2021 levels for both vehicle types • New heavy-duty trucks: 30% reduction of CO_2 emissions per tonne-km from 2019 levels by 2030 [2] • The share of renewable energy within the final consumption of energy in the transport sector is at least 14 % by 2030
	Directive 2009/28/EC Biofuel target	10% quota for RE in transport fuels (also electricity)
Other	F-gas regulation (2014)	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 Institute and PBL TIMER model projections. [3] Not quantified in PBL TIMER model projections. [4] NewClimate only quantified the policy for residential buildings.

Table 42: 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 Table 1 and Appendix (A1). Emission values are based on AR4 GWP-100. N/A: not available.

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
4,780 MtCO$_2$e	2020: 4,588 MtCO$_2$e 2030: 3,441 MtCO$_2$e	2020: 4,520 MtCO$_2$e, -6% [3,950 MtCO$_2$e, -17%] 2030: 3,390 MtCO$_2$e, -29%	2020: 4,220 MtCO$_2$e 2030: 2,810 to 3,810 MtCO$_2$e	2020: 4,110 to 4,150 MtCO$_2$e, -14% to -13% 2030: 2,940 to 3,220 MtCO$_2$e, -38% to -33%

[1]International aviation is included as a component of the 2020 pledge and NDC, and as part of the projections produced by EEA (2019b).

Table 43: 2010 historical data and 2030 projections of key GHG and energy indicators for the EU. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on AR4 GWP-100. N/A: not available.

Indicator	2010 (historical)	2030 projections (change rate vs. 2010 levels)	
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO$_2$e/thousand USD$_{2010}$ PPP)	0.28	0.13 to 0.14 (-54% to -50%)	0.15 (-47%)
GHG emissions per capita (tCO$_2$e/cap)	9.5	5.7 to 6.3 (-40% to -34%)	6.6 (-30%)
RE share in TPES (excl. traditional biomass)	10.0%	24.5% to 25.4% (+14.5 to +15.4 %-points)	N/A
RE share in total electricity generation (incl. hydro)	20.0%	41.3% to 56.8% (+21.3 to +36.8 %-points)	N/A
TPES per GDP (toe/thousand USD$_{2010}$ PPP)	0.102	0.061 to 0.076 (-40% to -25%)	N/A
TPES per capita (toe/cap)	3.43	2.72 to 3.41 (-21% to -1%)	N/A

Note: renewable energy target only available as share in final energy consumption.

3.11 India

Key policies implemented since 2015: The main policy instruments in India are its RE targets, the Perform, Achieve and Trade (PAT) scheme on industrial energy efficiency, and the Clean Energy Cess (Carbon tax). The 2018 National Electricity Plan (Central Electricity Authority, 2018) 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. In the transport sector, the National Electric Mobility Mission Plan was set up in 2015. The key support scheme under this plan is the Faster Adoption and Manufacturing of (Hybrid and) Electric Vehicles (FAME) subsidy scheme, which is now in its second phase, to deploy 6 to 7 million hybrid and electric vehicles annually by 2020. Other sector-level policies include Unnat Jyoti by Affordable LEDs for All (UJALA), aimed at deeper penetration of LEDs to replace conventional and inefficient lighting systems.

Recent developments (including proposed policies): India has continually been revising its renewable energy targets upward. The Prime Minister, in his speech at the UN Climate Change Summit in September 2019, stated that India intends to be much more ambitious than its 175 GW renewable capacity target suggests and increase power capacity to 450 GW by 2030.

Projections: It is projected that India will likely meet both its unconditional and conditional NDC targets with existing policies. Our current policies scenario projections this year are similar to our 2018 projections.

Impact of climate policies on greenhouse gas emissions in India
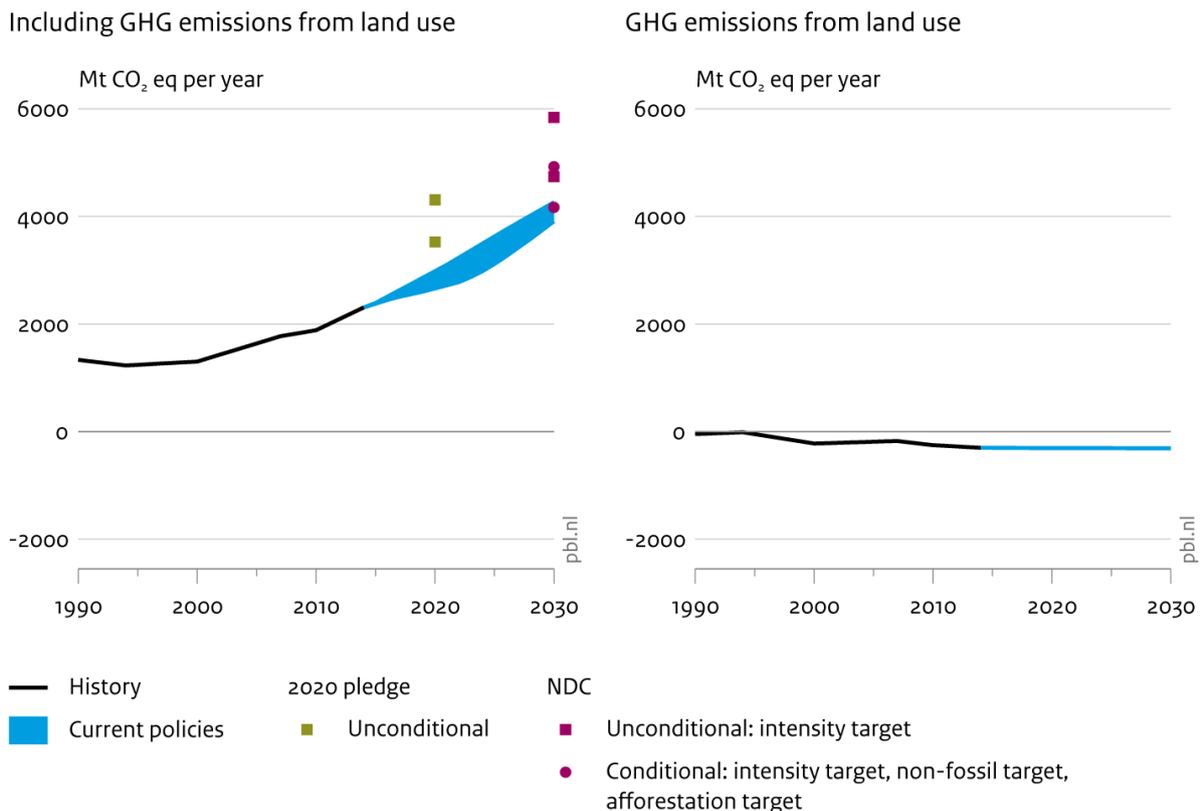
Source: PBL FAIR/TIMER model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 15: 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)). Emission values are based on SAR GWP-100.

Table 44: Description of India's 2020 pledge and NDC N/A: not available.

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); 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
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 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 45: 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, BEE, 2019)

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, National Solar and Wind Missions (2010)) (+)	• Capacity targets for 2022: 10 GW biomass, 5 GW small hydro, 100 GW solar (of which 40 GW rooftop PV), 60 GW wind (total 175 GW). Aspirational target: 227 GW total renewable power capacity • Budgetary support for solar power under the National Solar Mission [2] • Renewable Purchase Obligations scheme (2003) [2] • Renewable Energy Certificate (REC) mechanism (2011) [2]
	Scheme "Kisan Urja Suraksha evam Utthaan Mahabhiyan (KUSUM)" (March 2019)	Promotes solar energy in rural areas. It aims to install up to 10 GW of solar power generation and rollout solar agricultural pumps reaching around 26 GW of solar capacity by 2022 [2].
	National Electricity Plan (2018)[1]	Capacity additions for various energy technologies. Demand reductions. Slow-down in installation of new coal fired power plants.
Transport	Fuel economy standards	1.3 MJ/pkm to 130 g CO_2/km by 2017 and 0.9 MJ/pkm to 113 g CO_2/km by 2022, for light-duty vehicles.
	Second phase of Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME-II) initiative (2019) [3]	15% share in car stock by 2023, 30% by 2030. Subsidy for hybrid and full electric vehicles. No licensing required for EV charging stations. Aims to support the uptake of EVs by providing upfront incentives for the purchase of vehicles and by fostering the development of charging infrastructure. The scheme is planned to support 1,000,000 electric two-wheelers, 500,000 electric three-wheelers, 55,000 electric four-wheelers and 7,000 buses.
	Support for biofuels (2007), National Policy on Biofuels (2018) [3]	5% blending target for ethanol with petrol (no timeline set). *20% blending target for bioethanol in gasoline, 5% biofuel in diesel by 2030 (proposed target).*
Industry	Energy efficiency in industry (PAT scheme) (2011)	Benchmarking of designated companies' performance against best practice combined with a market mechanism to trade energy savings certificates. The second cycle (2016–2019) covers 35 Mtoe. The third cycle (2020–2023) is under preparation.

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Forestry	Green India Mission (2011)	Increase the forest/tree cover in moderately dense forests: 5 million hectares Improve forest/tree cover of forest areas: 5 million hectares
Agriculture	National Mission on Sustainable Agriculture (2012) (+) [4]	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] Not quantified in NewClimate Institute projections. [4] Not quantified in IIASA model projections.

Table 46: 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 Table 1 and Appendix (A1). Emission values are based on SAR GWP-100. N/A: not available.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	PBL and NewClimate estimates [conditional]	Official data	PBL and NewClimate estimates
1,880 MtCO₂e	3,815 MtCO₂e	2020: 3,520 to 4,310 MtCO₂e, +87% to +129% 2030: 4,740 to 5,840 MtCO₂e, +151% to +210% [4,170 to 4,920 MtCO₂e, +121% to +161%]	N/A	2020: 2,660 to 2,980 MtCO₂e, +41% to +58% 2030: 3,910 to 4,260 MtCO₂e, +107% to +126%

Table 47: 2010 historical data and 2030 projections of key GHG and energy indicators for India. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on SAR GWP-100. N/A: not available.

Indicator	2010 (historical)	2030 projections (change rate vs. 2010 levels)	
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO₂e/thousand USD₂₀₁₀ PPP)	0.37	0.21 to 0.23 (-42% to -37%)	0.26 to 0.32 (-30% to -14%)
GHG emissions per capita (tCO₂e/cap)	1.5	2.6 to 2.8 (+70% to +86%)	3.2 to 3.9 (+106% to +154%)
RE share in TPES (excl. traditional biomass)	8.7%	12.2% to 19.6% (+3.5 to +10.8 %-points)	N/A
RE share in total electricity generation (incl. hydro)	16.0%	26.4% to 28.7% (+10.4 to +12.7 %-points)	N/A (only capacity targets available)
TPES per GDP (toe/thousand USD₂₀₁₀ PPP)	0.138	0.063 to 0.084 (-54% to -39%)	N/A
TPES per capita (toe/cap)	0.57	0.77 to 1.02 (+35% to +79%)	N/A

Note: renewable energy target only available as capacity target (not shown here).
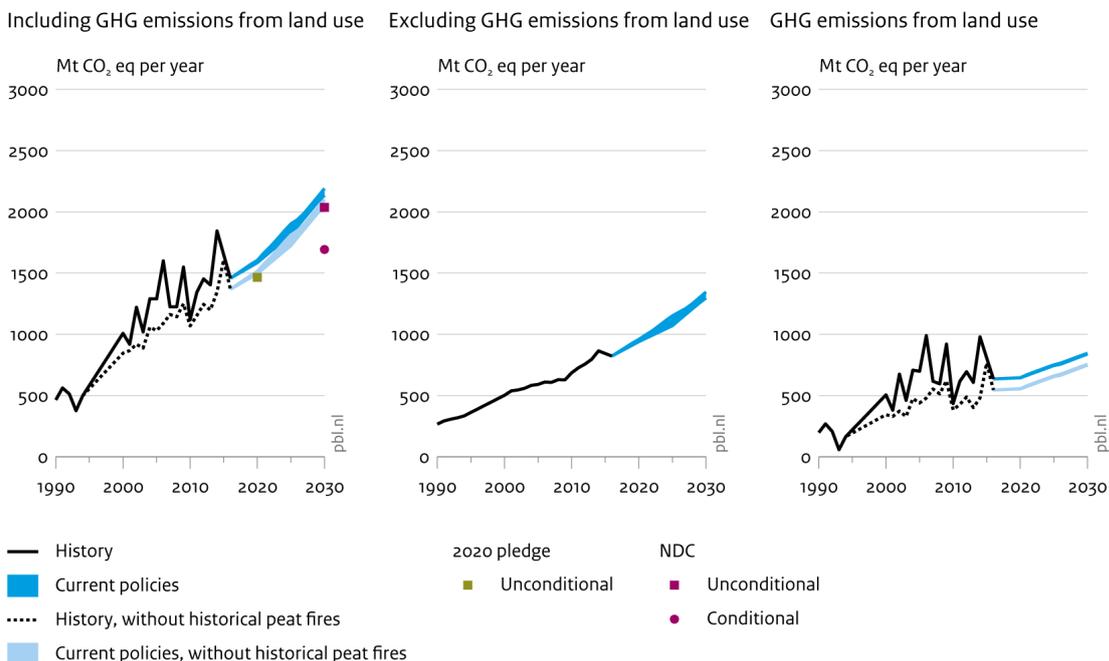
3.12 Indonesia

Key policies implemented since 2015: Main policies related to GHG emissions reductions in Indonesia include the National Energy Policy (NEP, 2014), Electricity Supply Business Plan (RUPTL 2019–2028) and a range of measures in the land-use sector. The NEP, also mentioned in the NDC, aims to increase renewable energy to 23% of total primary energy supply (TPES) by 2025. The RUPTL 2019–2028 aims to increase renewable power capacity significantly, but also plans an increase of roughly 40 GW in fossil fuel capacity by 2028. The measures in the land-use sector include: licensing process for palm oil plantations, forest-clearing permits for logging and plantations, and peat drainage moratorium, but the effectiveness of these measures is uncertain considering the historical deforestation trends.

Recent developments (including proposed policies): In 2019, Indonesia published its RPJMN 2020-2024 development plan. This document includes more ambitious targets for the electricity sector than announced in the RUPTL. However, it does not include new targets for the share of renewables in total primary energy supply. In 2019, the government issued a regulation to boost the domestic electric vehicle (EV) industry and to support reaching the EV targets in the General Plan of National Energy published in 2017. The government also aims for 20% of all vehicles being produced domestically to be low-carbon by 2025.

Projections: It is projected that Indonesia will get close to but miss its unconditional NDC target with existing policies. Our current policies scenario projections this year are considerably lower than our 2018 projections due to the updated GHG inventory data as well as an upward revision of renewable electricity generation projections.

Impact of climate policies on greenhouse gas emissions in Indonesia

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

Figure 16: 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. Emission values are based on SAR GWP-100 (except NDC: AR4).

Table 48: Description of Indonesia's 2020 pledge and NDC. N/A: not available.

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 Accounting approaches and methodologies are not specified	Land-use sector is included in the target Includes emissions from peat fires Accounting approaches and methodologies are not specified
Use of bilateral, regional and international credits	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 49: 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 of Indonesia, 2018, BAPPENAS, 2019, President of the Republic of Indonesia, 2018, Indonesia, 2018, APERC, 2019)

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Energy Supply	National Energy Policy (NEP) (2014) (+) [1]	23% new and renewable energy (including nuclear) in total primary energy supply by 2025
	Electricity Supply Business Plan (RUPTL 2019–2028) [2]	Added electricity capacity over 2019–2028: 6,061 MW hydropower, 4,607 MW geothermal, 3,483 MW solar, 2,563 MW wind.
	RPJMN 2020-2024 [1]	Presents a renewable capacity target of 37.3 GW by 2024.
Transport	Biofuel targets (2013) [3]	15% share of biofuels in all transportation fuels by 2025 (25% biodiesel, 20% bioethanol).
Forestry	Presidential Instruction number 6/2013 on Forest Moratorium (2013)	Restricting oil palm extension to peatland or to primary forest as defined in the Ministry of Forestry land cover map.
	Presidential Instruction 8/2018 [4]	This instruction presents a three-year moratorium on entire licensing process for palm oil plantations and an order for the relevant central government ministries and regional governments to conduct a massive review of oil palm licensing data.

[1] Not quantified separately, but checked if achieved after implementation of other policies. [2] NewClimate Institute 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. [4] Not quantified in IIASA model projections.

Table 50: 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 Table 1 and Appendix (A1). Emissions values are based on SAR GWP-100 (except NDC: AR4). N/A: not available.

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
1,070 MtCO$_2$e	2020: 1,581 MtCO$_2$e 2030: 2,034 MtCO$_2$e [1,787 MtCO$_2$e]	2020: 1,470 MtCO$_2$e, +37% 2030: 2,040 MtCO$_2$e, +91% [1,690 MtCO$_2$e, +58%]	N/A	2020: 1,490 to 1,510 MtCO$_2$e, +40% to +42% 2030: 2050 to 2,100 MtCO$_2$e, +91% to +96%

Table 51: 2010 historical data and 2030 projections of key GHG and energy indicators for Indonesia. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on SAR GWP-100. N/A: Not available or only available in other units (for targets). N/A: not available.

| Indicator | 2010 (historical) | 2030 projections (change rate vs. 2010 levels) | |
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO$_2$e/thousand USD$_{2010}$ PPP)	0.53	0.4 to 0.41 (-26% to -24%)	0.39 (-26%)
GHG emissions per capita (tCO$_2$e/cap)	4.4	6.8 to 7 (+55% to +59%)	6.8 (+54%)
RE share in TPES (excl. traditional biomass)	12.2%	17.8% to 20.4% (+5.6 to +8.2 %-points)	23.0% (+10.8 %-points)
RE share in total electricity generation (incl. hydro)	16.0%	23.2% to 26.6% (+7.2 to +10.6 %-points)	N/A
TPES per GDP (toe/thousand USD$_{2010}$ PPP)	0.103	0.066 to 0.070 (-36% to -32%)	N/A
TPES per capita (toe/cap)	0.85	1.14 to 1.21 (+34% to +42%)	N/A

3.13 Japan

Key policies implemented since 2015: The main GHG mitigation policies implemented in Japan include the renewable energy support (feed-in tariff and auctions), support for zero-energy houses and buildings, Top Runner Standards programme on energy efficiency as well as the F-gas Act (recovery of HFCs from end-of-life appliances) and the Ozone Layer Protection Act (regulation of production and consumption) for HFC emissions reductions. One recent major policy development is in the transport sector—in 2018, the Government, together with all major car manufacturing companies, set a long-term target of reducing tank-to-wheel CO_2 emissions by 90% below 2010 levels by 2050 for new passenger vehicles, assuming a near 100% share of electric vehicles (METI, 2018b) (impact not quantified). Other developments include new legislation in 2019 (METI, 2019a) that would resolve the issues related to offshore wind power plant deployment between the developers and fisheries and local residents (impact not quantified).

Recent developments (including proposed policies): On renewables, the Environmental Impact Assessment Act will apply also to solar PV projects with capacities greater than 40 MW from April 2020 (METI, 2019c). The Government has also started reviewing the scope of renewable energy projects to be supported under the feed-in tariff (FIT) scheme, which contributed to the large increase of solar PV capacity in the last years, to control the increasing surcharge (METI, 2019c). The new rules could slow down the speed of deployment and renewable energy in general.

Projections: It is projected that Japan will likely meet its conditional NDC targets with existing policies. Our current policies scenario projections this year are lower than our 2018 projections mainly due to higher projections on renewable electricity generation.

Impact of climate policies on greenhouse gas emissions in Japan
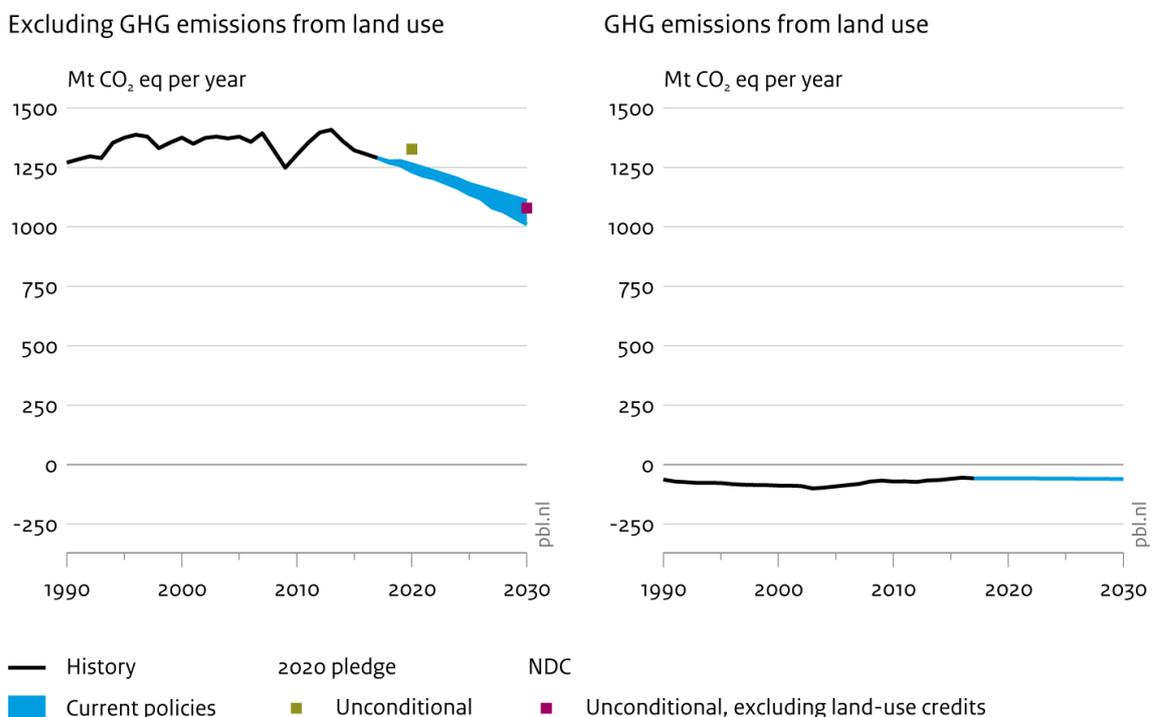
Source: PBL FAIR/TIMER model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 17: Impact of climate policies on greenhouse gas emissions in Japan; left: excluding land use (i.e. LULUCF), right: land use only. 2020 and 2030 targets include LULUCF credits (in line with the Kyoto accounting rules) as well as overseas credits. Please see Appendix (A2) on the consideration of LULUCF for the NDC quantification. Emissions values are based on AR4 GWP-100.

Table 52: Description of Japan's 2020 pledge and NDC. N/A: not available.

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 Accounting approach is specified as Kyoto Protocol approach (gross-net accounting)	Land-use sector is included in the target Accounting approach is specified as Kyoto Protocol approach (gross-net accounting) A reduction of net LULUCF emissions is expected in the range of 37 $MtCO_2e$ [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 53: Overview of key climate change mitigation policies in Japan (IEA, 2019c, Government of Japan, 2017, METI, 2018a, METI, 2018c, METI, 2018d, METI, 2019b)

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. 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 (1993 amendment) [1]	Energy reduction of 1%/year and annual reports to the government by large operators.
	Building Energy Efficiency Act (2016)	Mandatory energy efficiency standards for buildings and houses larger than 2000 m^2.
	2018 Basic Energy Plan [3] (+)	Net-zero energy buildings for all new constructions by 2030.
Industry	Energy Conservation Act (1993 amendment) [1]	Energy reduction of 1%/year and annual reports to the government by large operators.
Transport	Passenger vehicle fuel efficiency standards (2019 amendment)	25.4 km/l by 2030
F-gases	Act on Rational Use and Proper Management of Fluorocarbons (2013, last amendment 2019)	Stricter control of the entire F-gas chain (GWP targets for equipment types, obligation of F-gas destruction for entities re-using recovered F-gases). The 2019 amendment includes several penalty and obligatory measures to increase the F-gas recovery rates up to the targeted 50% by 2030 from 38% in 2017 [1].
	Ozone Layer Protection Act (2018 amendment) [2]	Regulation on production and import volumes to comply with the Kigali Amendment of the Montreal Protocol.

[1] Not quantified in the PBL TIMER projections [2] Not quantified in PBL and NewClimate Institute projections. [3] Due to the large uncertainty regarding the feasibility of the 2018 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 as of November 2019 (JAIF, 2019).

Table 54: 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 Table 1 and Appendix (A1). Emission values are based on AR4 GWP-100. N/A: not available.

2010 GHG emissions, excl. LULUCF	2020 pledge and NDC			Current policies	
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates	
1,300 MtCO$_2$e	2020: 1,364 MtCO$_2$e 2030: 1,079 MtCO$_2$e	2020: 1,360 MtCO$_2$e, +5% 2030: 1,080 MtCO$_2$e, -17%	N/A	2020: 1,230 to 1,250 MtCO$_2$e, -5% to -4% 2030: 1,010 to 1,100 MtCO$_2$e, -22% to -16%	

Table 55: 2010 historical data and 2030 projections of key GHG and energy indicators for Japan. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on AR4 GWP-100. N/A: not available.

| Indicator	2010 (historical)	2030 projections (change rate vs. 2010 levels)	
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO$_2$e/thousand USD$_{2010}$ PPP)	0.29	0.18 to 0.2 (-37% to -31%)	0.2 (-32%)
GHG emissions per capita (tCO$_2$e/cap)	10.1	8.4 to 9.1 (-17% to -10%)	8.9 (-12%)
RE share in TPES (excl. traditional biomass)	4.0%	12.1% to 16.5% (+8.1 to +12.5 %-points)	13.0% to 14.0% (+9.0 to +10.0 %-points)
RE share in total electricity generation (incl. hydro)	10.0%	24.4% to 28.4% (+14.4 to +18.4 %-points)	22.0% to 24.0% (+12.0 to +14.0 %-points)
TPES per GDP (toe/thousand USD$_{2010}$ PPP)	0.112	0.069 to 0.073 (-38% to -35%)	N/A
TPES per capita (toe/cap)	3.92	3.14 to 3.32 (-20% to -15%)	N/A

3.14 Kazakhstan

Key policies implemented since 2015: The "Concept of Kazakhstan's Transition to Green Economy" of 2013 is considered to be an overarching strategy to reduce GHG emissions in the long term. Other key policies considered in our projections include the Action Plan for the Development of Alternative and Renewable Energy in Kazakhstan for 2013 to 2020, as well as land-use policies, laid out in the Strategic Plan of the Ministry of Environment and Water Resources, to limit wildfires and combat land degradation and desertification. Further, in 2018, the Kazakhstan Renewable Energy Auction was put into force, aiming at increasing renewable energy capacity and reducing costs (KOREM, 2018) (see Table 66 for progress).

Recent developments (including proposed policies): Kazakhstan is also implementing an emissions trading scheme. The Kazakhstan Emission Trading Scheme restarted operation in January 2018 with new trading procedures and allocation methods (ICAP, 2019). An online CO_2 emissions reporting and monitoring system as well as National Allocation Plan for 2018-2020 are under development. A National Low Carbon Strategy is also under development, aiming to serve as a framework for a new Environmental Code – a first draft is to be submitted by the end of 2019.

Projections: It is projected that Kazakhstan will likely miss its NDC target with existing policies. Our current policies scenario projections this year are similar to our 2018 projections.

Impact of climate policies on greenhouse gas emissions in Kazakhstan
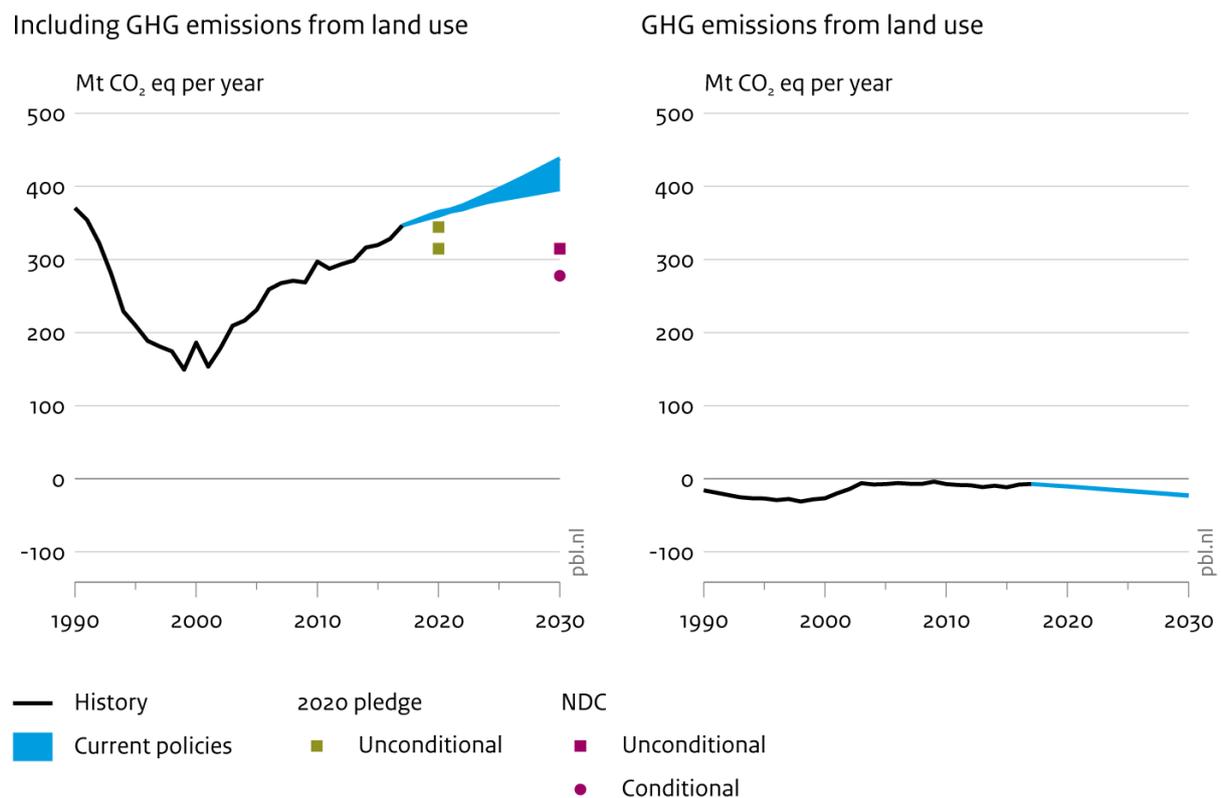
Source: PBL FAIR/TIMER model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 18: 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). Emission values are based on AR4 GWP-100.

Table 56: Description of Kazakhstan's 2020 pledge and NDC. N/A: not available.

Indicator	2020 pledge	NDC
Target: unconditional	15% reduction from 1990 levels [1] 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 4th 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 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 57: 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, 2019)

Sector	Policies (marked with "(+)" when mentioned in the NDC document) [1]	Description
Economy-wide	Concept for Kazakhstan's Transition to Green Economy: Energy efficiency targets (2015) (+)	Reduction of energy intensity per GDP of 25% by 2020, of 30% by 2030 and of 50% by 2050 compared to 2008 levels. 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)	Increase renewable energy share in total energy consumption to 1.5% by 2015 and 3% by 2020. 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)	5% of national energy consumption provided by renewable sources by 2024.
Energy supply	Support scheme for renewable energy (2014)	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)	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. 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. 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] None of the policies in this overview were quantified in PBL and NewClimate Institute projections. [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. Although it has been relaunched, uncertainties remain over its implementation; therefore, it is not quantified as current policy.

Table 58: 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 Table 1 and Appendix (A1). Emission values are based on AR4 GWP-100. N/A: not available.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	PBL and NewClimate estimates [conditional]	Official data	PBL and NewClimate estimates
297 MtCO2e	N/A	2020: 315 to 344 MtCO2e, +6% to +16% 2030: 315 MtCO2e, +6% [278 MtCO2e, -7%]	N/A	2020: 360 to 365 MtCO2e, +21% to +23% 2030: 396 to 438 MtCO2e, +33% to +48%

Table 59: 2010 historical data and 2030 projections of key GHG and energy indicators for Kazakhstan. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on AR4 GWP-100. N/A: not available.

Indicator*	2010 (historical)	2030 projections (change rate vs. 2010 levels)	
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO2e/thousand USD2010 PPP)	1.12	0.75 to 0.83 (-33% to -26%)	0.6 (-47%)
GHG emissions per capita (tCO2e/cap)	18.3	19.2 to 21.2 (+5% to +16%)	15.2 (-17%)
RE share in TPES (excl. traditional biomass)	1.0%	1.5% (+0.5 %-points)	N/A
RE share in total electricity generation (incl. hydro)	10.0%	7.3% (-2.7 %-points)	22.0% (+12.0 %-points)
TPES per GDP (toe/thousand USD2010 PPP)	0.261	0.396 (+51%)	N/A
TPES per capita (toe/cap)	4.24	10.1 (+138%)	N/A

* Projections for RE share in TPES, RE share in total electricity generation, TPES per GDP and TPES per capita based on PBL TIMER model projections.

3.15 Mexico

Key policies implemented since 2015: In December 2015, Mexico introduced its Energy Transition Law (impact not quantified), which includes clean energy targets: 25% of electricity generation by 2018, 30% by 2021, and 35% by 2024. As an instrument to achieve these targets, Mexico introduced the "long-term electricity auctions" and the "clean energy certificates". Results of the first three electricity auctions rounds—held on an annual basis since 2015—show a large number of projects being awarded, with record low prices. In 2018, Mexico reformed its General Law on Climate Change (LGCC; impact not quantified) to include Mexico's NDC commitments—also at the sectoral level (excl. the forestry sector)— and to establish a national emissions market, which was previously only voluntary.

Recent developments (including proposed policies): The recent decisions by Mexico's new administration under Lopez Obrador–in office since December 2018–reverse progress towards implementation of climate change policies. Lopez Obrador's administration has neither developed nor announced the third Special Program on Climate Change (PECC 2019–2024) that is required under art. 66 of Mexico's General Law on Climate Change. It has allocated most of the Federal Electricity Company (CFE) 2019 budget to the "modernisation" of coal, diesel, gas and oil-fuelled power plants, some of which the previous administration had already scheduled for retirement (Solís, 2018). It has cancelled Mexico's 2018 "Long-term electricity auctioning" round (Centro Nacional de Control de Energía, 2019). A new round for 2019 has not been announced.

Projections: It is uncertain if Mexico would meet its unconditional NDC targets with existing policies due to a large range in 2030 emissions projections. Our current policies scenario projections this year are similar to our 2018 projections.

Impact of climate policies on greenhouse gas emissions in Mexico
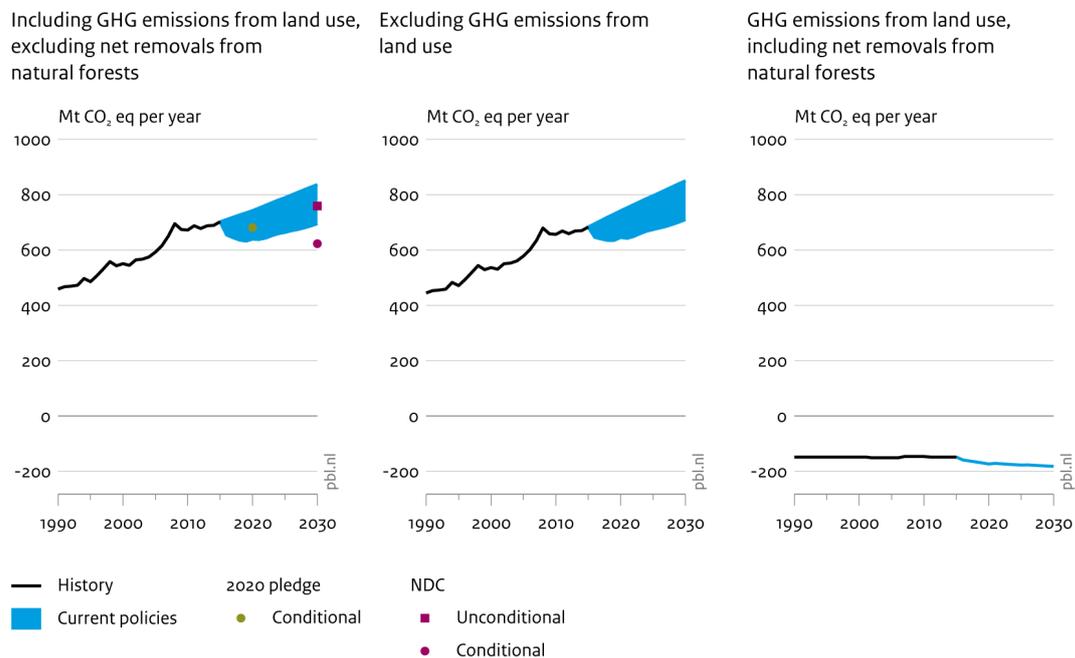
Source: PBL FAIR/TIMER model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 19: Impact of climate policies on greenhouse gas emissions in Mexico (left panel: all gases and sectors, middle panel: excluding land use (i.e. LULUCF) and right panel: only land use). Emission values are based on AR5 GWP-100.

Note: the BAU emissions projection in Mexico's NDC excludes removals from natural forests, which accounted for -162 MtCO2e/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.

Table 60: Description of Mexico's 2020 pledge and NDC. N/A: not available.

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 Accounting approaches and methodologies are not specified	Land-use sector is included in the target Accounting approaches and methodologies are not specified 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 61: Overview of key climate change mitigation policies in Mexico (Government of Mexico, 2014, Government of Mexico, 2016, Secretariat of Energy of Mexico, 2014, SEMARNAT, 2001, Secretariat of Energy of Mexico, 2011, Cámara de Diputados del H. Congreso de la Unión, 2015, Centro Nacional de Control de Energía, 2017, SENER, 2016, Diario Oficial de la Federación, 2018)

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 emissions reduction targets including sectoral targets [1].
	Emissions Trading Scheme (2018)	National emissions trading scheme that will start the three-year pilot phase in 2020. The regulatory framework for the ETS is expected to be fully operational by 2023 [1].
Energy supply	Electric Industry Law (LIE, (+)) (2014) [1]	Law section of the Energy Reform (2014). Establishes a free competition regime in electric power generation and commercialization. It allows participation of private actors in transmission and distribution of electric power. 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 Sets targets for clean energy (includes efficient gas-fired cogeneration) of 25% in 2018, 30% in 2021 and 35% by 2024, which is supported by policy instruments, such as power auctions for wind and solar energy (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. 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). Light duty trucks: 163 to 228 gCO_2/km (depending on size).

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Forestry	National Forestry Programme 2025 (2001) [3]	Protected areas according to the payments for an Ecosystem Services (PES) scheme for promoting conservation, restoration and sustainable forest use.
	National Forestry Programme - PRONAFOR (2014)	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 62: 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 Table 1 and Appendix (A1). Emission values are based on AR5 GWP-100. N/A: not available.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	**PBL and NewClimate estimates [conditional]**	**Official data**	**PBL and NewClimate estimates**
672 MtCO$_2$e	N/A	2020: N/A [681 MtCO$_2$e, +1%] 2030: 759 MtCO$_2$e, +13% [623 MtCO$_2$e, -7%]	N/A	2020: 639 to 743 MtCO$_2$e, -5% to +11% 2030: 695 to 837 MtCO$_2$e, +3% to +24%

Table 63: 2010 historical data and 2030 projections of key GHG and energy indicators for Mexico. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on AR5 GWP-100. N/A: not available.

Indicator*	2010 (historical)	2030 projections (change rate vs. 2010 levels)	
		Current policies scenario	NDC (or domestic targets), unless otherwise noted
GHG emissions per GDP (tCO$_2$e/thousand USD$_{2010}$ PPP)	0.39	0.23 to 0.28 (-40% to -27%)	0.25 (-34%)
GHG emissions per capita (tCO$_2$e/cap)	5.9	4.9 to 5.9 (-16% to +1%)	5.4 (-9%)
RE share in TPES (excl. traditional biomass)	8.0%	19.2% (+11.2 %-points)	N/A
RE share in total electricity generation (incl. hydro)	17.0%	31.4% to 41.3% (+14.4 to +24.3 %-points)	2024: 35.0% (+18.0 %-points) incl. efficient gas-fired cogeneration
TPES per GDP (toe/thousand USD$_{2010}$ PPP)	0.102	0.068 (-34%)	N/A
TPES per capita (toe/cap)	1.57	1.43 (-9%)	N/A

* Projections for RE share in TPES, RE share in total electricity generation, TPES per GDP and TPES per capita based on PBL TIMER model projections.

3.16 Morocco

Key policies implemented since 2015: Main policies related to GHG emissions reductions implemented to date include the National Energy Strategy, which comprises of, among others, the Morocco Solar Plan and the Morocco Integrated Wind Energy Program. Under these plans, Morocco aims to install 2,000 MW of wind and solar capacity each by 2020, and to extend the hydroelectric capacity by 775 MW by the same date. The National Energy Strategy also calls for raising the share of renewable energy in total installed electricity production capacity to 42% by 2020 and 52% by 2030. Morocco has revised its NDC in 2016.

Recent developments (including proposed policies): In 2019, Morocco published its 2030 Climate Action Plan. This strategy reiterates the objectives set in the NDC and the National Energy Strategy and proposes new governance structures, such as the creation of a National Committee for Climate Change that would be tasked with the implementation and coordination of climate policy. In the past few years, the Moroccan government has completed a number of renewable energy tenders, raising the installed renewable energy capacity to 1,220 MW of wind, 740 MW of solar and 1,770 MW of hydroelectricity in 2018 (IRENA, 2019). At the same time, Morocco is also expanding its coal-fired electricity generation. In December 2018, a nearly 1,400 MW coal-fired power plant came online (Médias 24, 2018) and the government is planning to add another coal-fired power plant of around 1,300 MW by 2024 (Dref, 2018).

Projections: It is projected that Morocco will likely miss its unconditional NDC target with existing policies. Our current policies scenario projections this year is similar to our 2018 projection.

Impact of climate policies on greenhouse gas emissions in Morocco
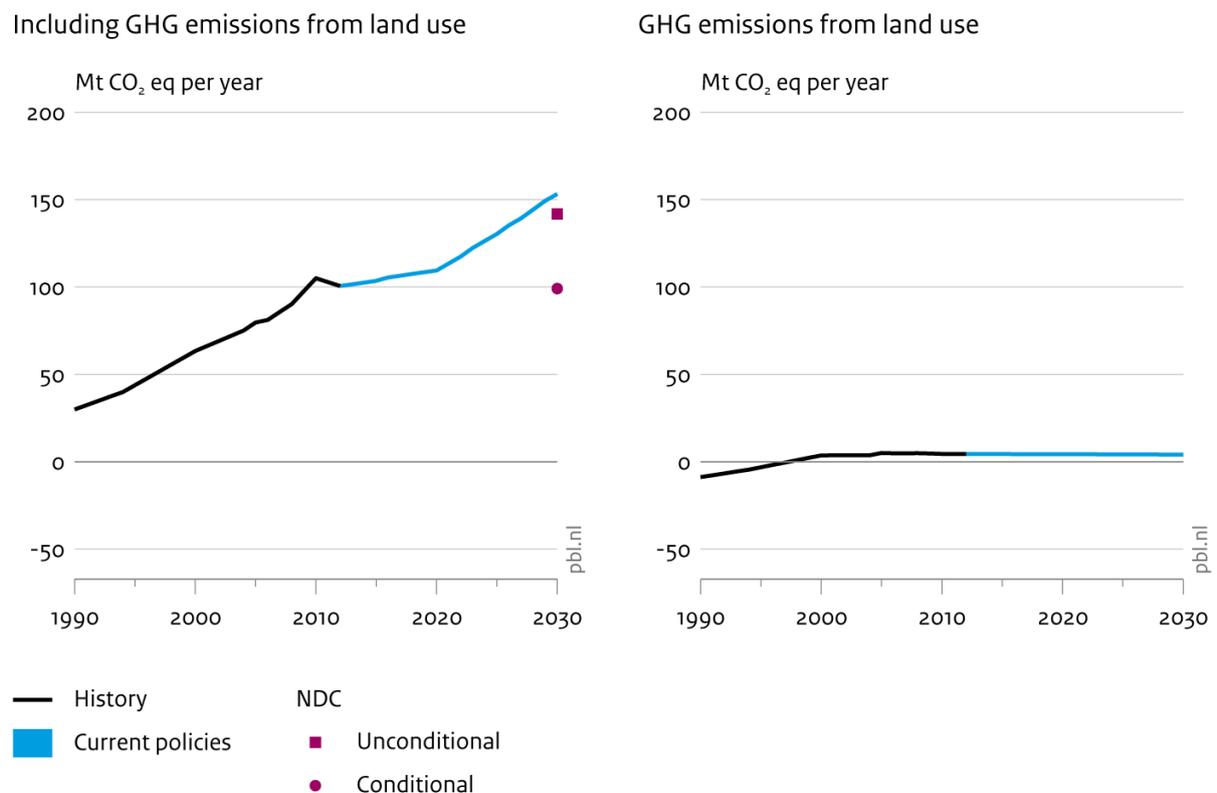
Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 20: Impact of climate policies on greenhouse gas emissions in Morocco (CO_2, CH_4 and N_2O; including land use (i.e. LULUCF)). Emission values are based on SAR GWP-100.

Table 64: Description of Morocco's NDC. N/A: not available.

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 Morocco's Green Plan (PMV) and Preservation and Sustainable Forest Management Strategy are part of NDC as key sectoral strategies Accounting approaches and methodologies are not specified
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.

Note: Morocco has not set its 2020 pledge.

Table 65: 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, AFD, 2018, Kingdom of Morocco, 2019, Kingdom of Morocco, 2018)

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	2030 National Climate Plan (2019) [1]	- Aim for an installed renewable electricity capacity of 52% by 2030. - Reduce energy consumption by 15% by 2030. "Significantly" reduce fossil fuel subsidies. - Support afforestation and reforestation. - Governance measures: create a National Commission on Climate Change, enhance inter-sectoral coordination and reinforce the participation of NGOs in climate policy.
	Creation of a Strategic Committee for Sustainable Development (Decree 2.17.655) (2018) [1]	Coordination of sustainable development policies, including the implementation of the National Strategy for Sustainable Development, which aims to make Morocco's economy "green and inclusive" by 2030.
	Moroccan Climate Change Policy (MCCP) (2014) [1]	Overarching coordination and alignment of various sectoral and cross-sectoral national policies tackling climate change.
Energy supply	National Energy Strategy (2009, updated 2012) (+) Morocco Integrated Wind Energy Program (2010) Morocco Solar Plan (2009) [2] Morocco Hydroelectric Plan (continuation of plan started in 1970s) [2]	- Targets for increased renewable power capacity: 42% share in total capacity by 2020 and 52% by 2030. - Energy savings of 12–15% in 2020 and 20% in 2030. - Supply 10–12% of the country's primary energy demand with renewable energy sources by 2020 and 15–20% by 2030. - Extension of national wind farms to total 2,000 MW by 2020. - Extension of solar power capacity to 2,000 MW (both concentrated solar power plants & photovoltaic systems). - Extension of hydro power capacity with 775 MW by 2020. - Extension of small hydropower projects with total capacity of 100 MW in 2030.
Transport	High-speed train line between Rabat, Tangier and Casablanca (2018)	Upgrade of existing railway to high-speed train line completed in 2018.
	Extension of Rabat and Casablanca tramways (2016)	- Extension of Rabat tramway by 20 km by 2019. - 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).

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
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) (+) [3]	• Promotion of natural resources and sustainable management. • Modernization of the agricultural sector.

[1] Not quantified in NewClimate Institute projections. [2] See Climate Action Tracker (2019) for the implementation status. [3] Not quantified in IIASA model projections.

Table 66: 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 Table 1 and Appendix (A1). Emission values are based on SAR GWP-100. N/A: not available.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	NewClimate estimates [conditional]	Official data	NewClimate estimates
105 MtCO$_2$e	2030: 141 MtCO$_2$e [99 MtCO$_2$e]	2020: N/A 2030: 141 MtCO$_2$e, +35% [99 MtCO$_2$e, -6%]	N/A	2020: 109 MtCO$_2$e, +4% 2030: 153 MtCO$_2$e, +46%

Table 67: 2010 historical data and 2030 projections of key GHG and energy indicators for Morocco. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on SAR GWP-100. N/A: not available.

Indicator*	2010 (historical)	2030 projections (change rate vs. 2010 levels)	
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO$_2$e/thousand USD$_{2010}$ PPP)	0.49	0.32 (-35%)	0.29 (-40%)
GHG emissions per capita (tCO$_2$e/cap)	3.2	3.8 (+16%)	3.5 (+7%)
RE share in TPES (excl. traditional biomass)	6.1%	N/A	N/A
RE share in total electricity generation (incl. hydro)	17.0%	N/A	N/A
TPES per GDP (toe/thousand USD$_{2010}$ PPP)	0.079	N/A	N/A
TPES per capita (toe/cap)	0.53	N/A	N/A

* Projections based on NewClimate Institute projections.

3.17 Philippines

Key policies implemented since 2015: The main policy related to GHG emissions reductions implemented in the Philippines to date is the Energy Efficiency and Conservation Action Plan (2017), which sets energy efficiency improvement targets at both economy-wide and end-use sector levels. The TRAIN (Tax Reform for Acceleration and Inclusion) Act, implemented in 2018, includes raising taxes on coal production (from 0.20 USD in 2017 up to 2.85 USD per metric tonne in 2020). The Department of Energy (DOE) has strengthened its policy in line with the president's vision, including the full electrification target by 2022 and the improvement of the power supply reliability through a more technology-neutral approach to power capacity expansion.

Recent developments (including proposed policies): The Philippines may deliver a strengthened NDC by end-2019. In April 2019, the president signed into law the Energy Efficiency and Conservation (EE&C) Act that established the general governance and strategies to improve energy use, aiming to reduce overall demand by 24% below BAU by 2040. Moreover, President Duterte recognised in his fourth State of the Nation Address (SONA) in July 2019 the need to "*fast-track the development of renewable energy sources and to reduce dependence on traditional energy sources such as coal.*" However, since 2015, the Philippines has installed about 3.2 GW of coal-fired power capacity. As of July 2019, another 2.6 GW of new coal plants were under construction, and 12.0 GW in the pipeline.

Projections: It is projected that the Philippines will likely miss its unconditional NDC target with existing policies. Our current policies scenario projection this year is lower than our 2018 projections mainly due to the updated reference external of projections energy-related CO_2 emissions and other GHGs.

Impact of climate policies on greenhouse gas emissions in the Philippines

Excluding GHG emissions from land use | GHG emissions from land use
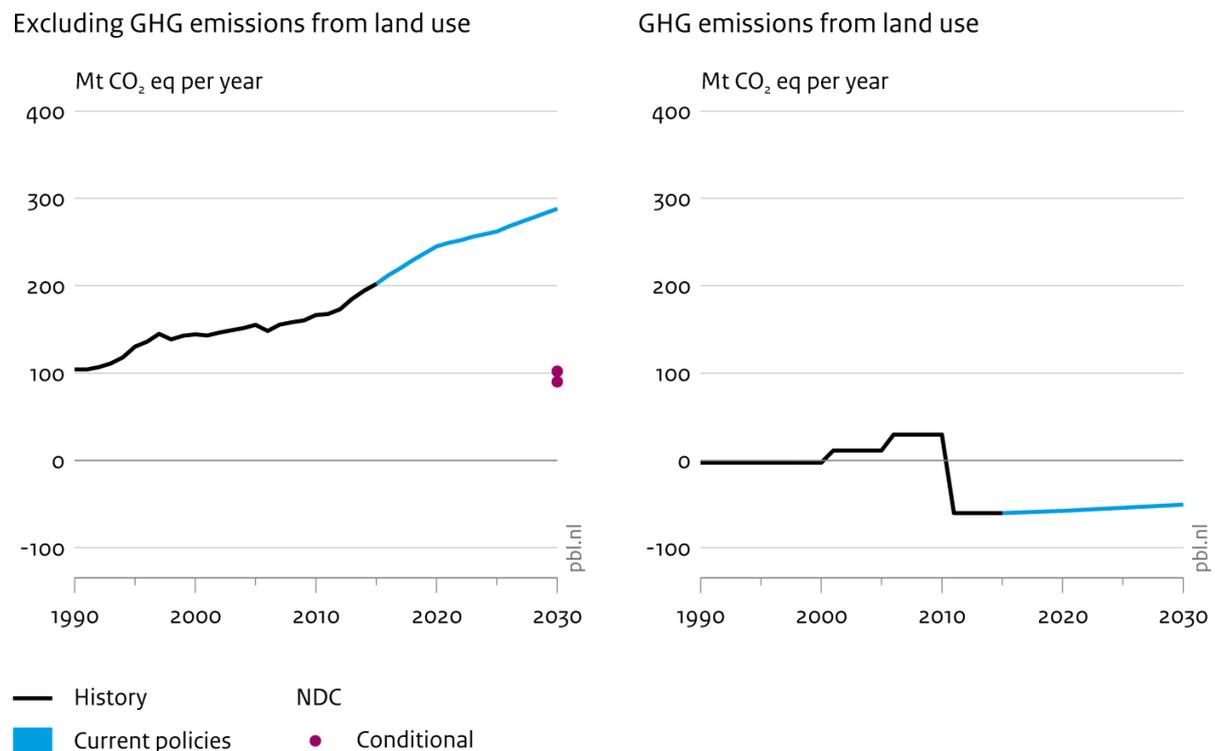
Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 21: Impact of climate policies on greenhouse gas emissions in the Philippines; left: excluding land use (i.e. LULUCF), right: only land use. Emission values are based on AR4 GWP-100.

Table 68: Description of The Philippines' NDC. N/A: not available.

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 emissions reduction target 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 69: Overview of key climate change mitigation policies in the Philippines (Department of Energy, 2015b, Department of Energy, 2015a, London School of Economics and Political Science, 2015, Philippine Institute for Development Studies, 2014, Lister, 2017, APERC, 2019)

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	Energy Efficiency and Conservation Roadmap (EE&C) (2017)	24% energy savings by 2040 compared to BAU. 3% per year economy-wide improvement in energy intensity compared to BAU. Savings of c.a. 10,000 ktoe by 2040.
Energy supply	Sitio Electrification Program (SEP) of the National Electrification Administration (2012)	Aims to energize sitios [1] through on-grid electrification. 2015 target: 100% sitios energized; covering at least 648,820 households. [2]
	National Renewable Energy Program (NREP) (2012)	Increase renewable energy capacity to an estimated 15,304 MW by 2030 (almost triple its 2010 level). 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 (2017)	25% energy savings compared to BAU by 2040.
Industry	EE&C Roadmap (2017)	15% energy savings compared to BAU by 2040.
Buildings	EE&C Roadmap (2017) Appliance Standards and Labelling Program Government Buildings Efficiency Program	25% energy savings in commercial buildings by 2040, compared to BAU. 20% energy savings in residential buildings by 2040, compared to BAU.
Forestry	The Philippine National REDD+ Strategy (2010) (+) [3] The Philippines Development Plan 2017-2022 (2017)	Continued reduction of deforestation and forest degradation. Complete delineation of final forest limits, including production and high value conservation areas, as protection forest. Enhance management of Protected Areas and strengthen sustainable management through the issuance of appropriate tenure and management arrangement.

[1] A "sitio" is defined as territorial enclave within a barangay (smallest administrative division in the Philippines, 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 70: 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 Table 1 and Appendix (A1). Emission values are based on AR4 GWP-100. N/A: not available.

| 2010 GHG emissions, excl. LULUCF | 2020 pledge and NDC | | Current policies | |
	Official data	NewClimate estimates [conditional]	Official data	NewClimate estimates
166 MtCO₂e	N/A	2020: N/A 2030: N/A [90 to 102 MtCO₂e, -46% to -39%]	N/A	2020: 245 MtCO₂e, +47% 2030: 287 MtCO₂e, +73%

Table 71: 2010 historical data and 2030 projections of key GHG and energy indicators for the Philippines. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on AR4 GWP-100. N/A: not available.

| Indicator* | 2010 (historical) | 2030 projections (change rate vs. 2010 levels) | |
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO₂e/thousand USD₂₀₁₀ PPP)	0.33	0.19 (-42%)	N/A
GHG emissions per capita (tCO₂e/cap)	1.8	2.3 (+31%)	N/A
RE share in TPES (excl. traditional biomass)	31.0%	N/A	N/A
RE share in total electricity generation (incl. hydro)	26.0%	N/A	N/A
TPES per GDP (toe/thousand USD₂₀₁₀ PPP)	0.080	0.052 (-35%)	N/A
TPES per capita (toe/cap)	0.43	0.63 (+47%)	N/A

* Projections based on NewClimate Institute projections. Note: renewable energy target only available as capacity target (not shown here).
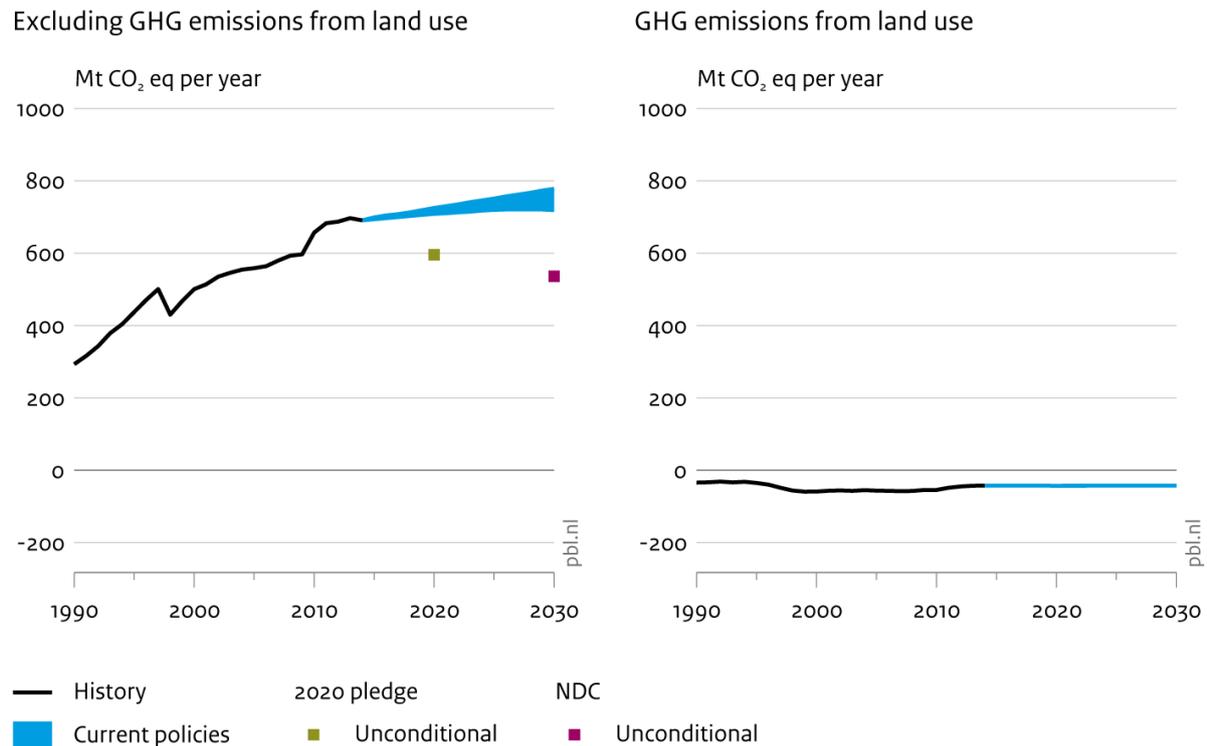
3.18 Republic of Korea

Key policies implemented since 2015: The main policies implemented to date to reduce GHG emissions include the emissions trading scheme (KETS), and the new 15-year Plan for Electricity Supply and Demand published in 2017, which aims to make a shift in electricity generation from coal and nuclear towards more renewables (20% renewables and 23.9% nuclear by 2030). However, if fully implemented, the plan would likely only stabilise, not decrease, emissions because under this plan, South Korea's power generation mix will rely on coal in the future. 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 of the Republic of Korea, 2018).

Recent developments (including proposed policies): The most recent, major development is the 3rd Energy Master Plan adopted in June 2019. Under the new plan, the Republic of Korea aims to increase its renewable share in total electricity generation to 35% by 2040 from 6% in 2017, will refrain from building new fossil fuel-fired power plants and aims to promote hydrogen use in the transport sector (ibid.). The targets are roughly in line with the ambition of the President Moon Jae-In to phase out coal-fired power and nuclear power in the long term.

Projections: It is projected that the Republic of Korea will likely miss its NDC target with existing policies. Our current policies scenario projections this year are similar to our 2018 projections.

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

Excluding GHG emissions from land use

GHG emissions from land use

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

Figure 22: 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. Emission values are based on SAR GWP-100.

Table 72: Description of the Republic of Korea's 2020 pledge and NDC. N/A: not available.

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 use sector is included in the target 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 73: Overview of key climate change mitigation policies in the Republic of Korea (Republic of Korea, 2014, Republic of Korea, 2012, Hwang, 2014, MOTIE, 2017, MOTIE, 2019, APERC, 2019)

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	Emissions Trading System (2015) [1] [2]	ETS manages 68% of the national GHG emissions and covers nearly 600 companies from 23 sub-sectors.
Energy supply	Renewable energy targets [2] 3rd Energy Master Plan (2019) 8th Basic Plan for Long-term Electricity Supply and Demand (2017)	Share in total electricity generation: 20% by 2030 and 30–35% by 2040. Total 58.5GW renewable capacity by 2030: 2.1GW hydropower, 17.7 GW wind, 33.5GW solar power, 1.7GW biomass, and 0.3GW waste capacity.
	Renewable portfolio standards (2012) [3]	10% supply of new and renewable energy in total electricity generation by 2024.
Transport	Fuel efficiency standard (last update 2014) (+) [2]	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.

[1] Not quantified in PBL TIMER model projections. [2] Not quantified in NewClimate Institute projections. [3] Policy not quantified separately

Table 74: 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 Table 1 and Appendix (A1). Emissions values are based on SAR GWP-100. N/A: not available.

2010 GHG emissions, excl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates
657 MtCO$_2$e	2030: 536 MtCO$_2$e	2020: 595 MtCO$_2$e, -9% 2030: 536 MtCO$_2$e, -18%	N/A	2020: 709 to 725 MtCO$_2$e, +8% to +10% 2030: 719 to 778 MtCO$_2$e, +9% to +19%

Table 75: 2010 historical data and 2030 projections of key GHG and energy indicators for Republic of Korea. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on SAR GWP-100. N/A: not available.

| Indicator	2010 (historical)	2030 projections (change rate vs. 2010 levels)	
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO$_2$e/thousand USD$_{2010}$ PPP)	0.44	0.27 to 0.3 (-37% to -32%)	0.2 (-53%)
GHG emissions per capita (tCO$_2$e/cap)	13.3	14.1 to 15.2 (+6% to +15%)	10.5 (-21%)
RE share in TPES (excl. traditional biomass)	1.0%	2.4% to 4.5% (+1.4 to +3.5 %-points)	11.0% (+10.0 %-points)
RE share in total electricity generation (incl. hydro)	1.0%	7.6% to 17.0% (+6.6 to +16.0 %-points)	20.0% (+19.0 %-points)
TPES per GDP (toe/thousand USD$_{2010}$ PPP)	0.166	0.116 to 0.120 (-30% to -27%)	N/A
TPES per capita (toe/cap)	5.05	5.96 to 6.21 (+18% to +23%)	N/A

3.19 Russian Federation

Key policies implemented since 2015: Implemented policies related to GHG emissions reductions include the Russian State Programme's targets for energy efficiency and renewable electricity generation (see Table 79 for progress on these indicators). The Russian gas flaring policy could lead to additional emissions reductions, but it is unclear whether this policy will be fully implemented.

Recent developments (including proposed policies): In October 2019, the Russian Federation officially accepted the Paris Agreement (UN, 2019). While the ratification date is uncertain, a draft decree of the President on a new 2030 emissions reduction target is to be prepared by December 2019, and a draft implementation plan to achieve the 2030 target is expected in 2020 (UNFCCC, 2019c). Other planned policies include the transport strategy, which 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 National Project "Ecology" sets ten environmental goals toward 2024. Some goals on air pollution reduction, reforestation and waste management may have important synergies with climate mitigation. In December 2018, the government introduced draft legislation, amending the Law on Environmental Protection, which would establish a cap-and-trade system for major carbon emitters by 2025.

Projections: It is projected that the Russian Federation will likely meet its unconditional NDC targets with existing policies. Our current policies scenario projections this year are considerably lower than our 2018 projections due to the updated national GHG inventory.

Impact of climate policies on greenhouse gas emissions in Russian Federation
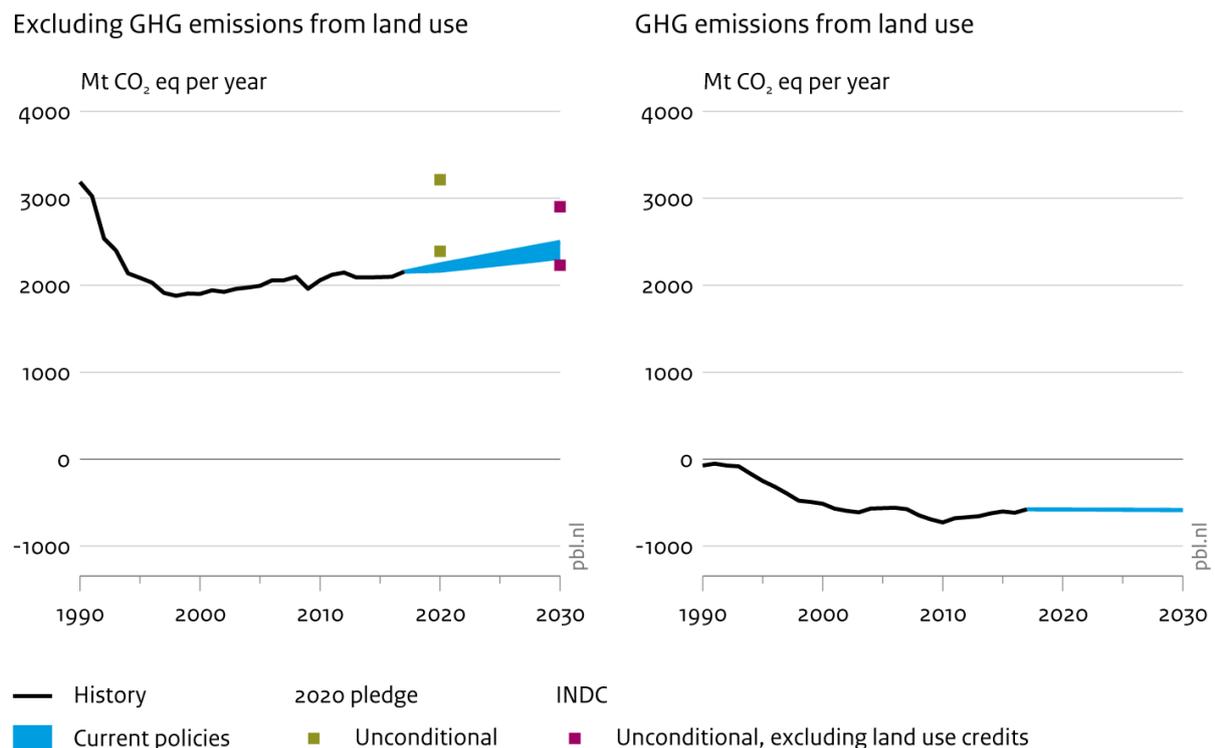
Source: PBL FAIR/TIMER model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 23: 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. Please see Appendix (A2) on the consideration of LULUCF for the NDC quantification. Emission values are based on AR4 GWP-100.

Table 76: Description of The Russian Federation's 2020 pledge and NDC. N/A: not available.

Indicator	2020 pledge	INDC (submitted 1 April 2015)
Target: unconditional	15% to 25% GHG reduction by 2020 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 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 NDC states that the target is "subject to the maximum possible account of absorbing capacity of forests". We assume that the Russian Federation applies a gross-net accounting approach (see Appendix A2 for details). The current policies scenario projections for the LULUCF sector would provide the Russian Federation with approximately 500 $MtCO_2e$ 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 NDC range presented is a combination of a minimum amount of land-use (0 $MtCO_2e$) and maximum amount of land-use credits (500 $MtCO_2e$) for the unconditional targets.

Table 77: 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 (Governmental resolution No. 512-r of 2013, 2015 amendment to the Decree No. 1-r of 2009) [2]	2.5% renewables share in total electricity generation by 2020 (excluding hydropower larger than 25 MW) and 4.5% by 2024 (supported by regulated capacity prices for renewable energy, Government of the Russian Federation, 2013). 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 per m^2 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 projections. The renewable share targets were not quantified separately, but checked after implementation of the capacity targets. [3] Not quantified in PBL TIMER model and NewClimate Institute projections.

Table 78: 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 Table 1 and Appendix (A1). Emissions values are based on AR4 GWP-100. N/A: not available.

2010 GHG emissions, excl. LULUCF	2020 pledge and INDC		Current policies	
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates
2,060 MtCO$_2$e	N/A	2020: 2,390 to 3,210 MtCO$_2$e, +16% to +56% 2030: 2,230 to 2,900 MtCO$_2$e, +8% to +41%	N/A	2020: 2,170 to 2,240 MtCO$_2$e, +5% to +9% 2030: 2,310 to 2,500 MtCO$_2$e, +12% to +21%

Table 79: 2010 historical data and 2030 projections of key GHG and energy indicators for Russian Federation. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on AR4 GWP-100. N/A: not available.

Indicator	2010 (historical)	2030 projections (change rate vs. 2010 levels)	
		Current policies scenario	NDC (or domestic targets), unless otherwise noted
GHG emissions per GDP (tCO$_2$e/thousand USD$_{2010}$ PPP)	0.61	0.6 to 0.65 (-0% to +7%)	0.58 to 0.76 (-4% to +25%)
GHG emissions per capita (tCO$_2$e/cap)	14.3	16.1 to 17.4 (+13% to +22%)	15.6 to 20.3 (+9% to +41%)
RE share in TPES (excl. traditional biomass)	2.4%	4.3% to 4.4% (+1.9 to +2.0 %-points)	N/A
RE share in total electricity generation (incl. hydro)	16.0% (nearly entirely hydro)	18.0% to 20.6% (+2.0 to +4.6 %-points)	2024: 21.9% [1] (+5.9 %-points)
TPES per GDP (toe/thousand USD$_{2010}$ PPP)	0.203	0.195 to 0.200 (-4% to -2%)	N/A
TPES per capita (toe/cap)	4.82	5.22 to 5.34 (+8% to +11%)	N/A

1) The target excludes hydro, the share of which is assumed constant at 2017 level (IEA, 2019b) up to 2030.

3.20 Saudi Arabia

Key policies implemented since 2015: Saudi Arabia's main policies related to GHG emissions reductions pertain to renewable energy, but limited progress has been observed (less than 1% share in 2017; IEA, 2019a). In 2016, Saudi Arabia published its "Vision 2030" strategy; its current target, set under the National Renewable Energy Program (NREP), is to increase the renewable power capacity from 0.14 GW in 2018 (IRENA, 2019) to 27.3 GW in 2023 and 58.7 GW in 2030 (Ministry of Energy of Saudi Arabia, 2019a, Ministry of Energy of Saudi Arabia, 2019b). Besides renewable energy policies, Saudi Arabia has also implemented economy-wide policies and has plans for projects in the transport sector. The government has implemented a 5% VAT for fuel prices from January 2018 onwards. The government further aims to cut energy subsidies under the "Vision 2030", but the progress has been slow: in 2017, the government announced it would slow down the phase-out to revive the economy.

Recent developments (including proposed policies): On nuclear power, recent developments and a statement by the new Minister of Energy indicate that Saudi Arabia plans to build two reactors of total 2.8 GW by 2030 (Cockayne, 2019).
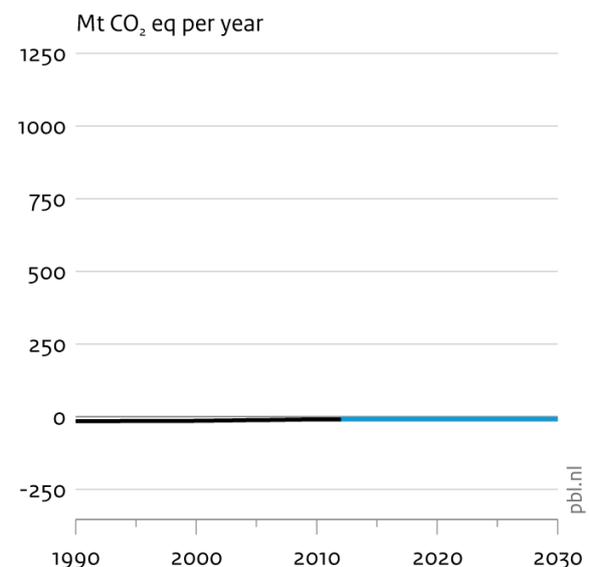
Projections: It is projected that Saudi Arabia will likely achieve its NDC target with existing policies. Our current policies scenario projections this year are similar to our 2018 projections.

Impact of climate policies on greenhouse gas emissions in Saudi Arabia
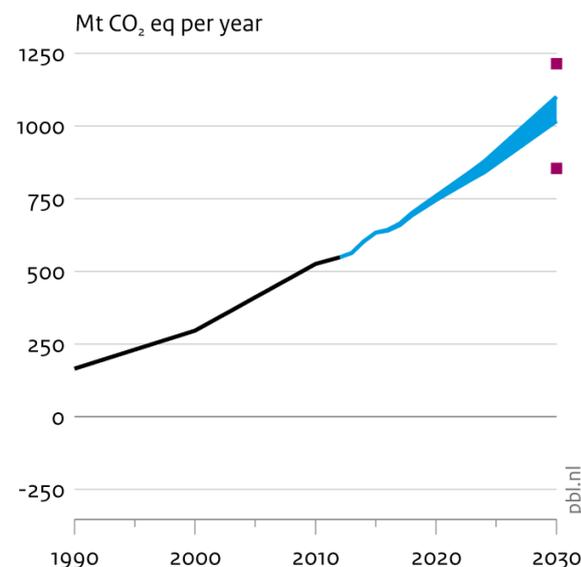
Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 24: Impact of climate policies on greenhouse gas emissions (excluding land use (i.e. LULUCF)) in Saudi Arabia. Emission values are based on SAR GWP-100.

Table 80: Description of Saudi Arabia's NDC. N/A: not available.

Indicator	NDC
Target: unconditional	Emissions reductions 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 emissions reductions 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. 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 81: Overview of key climate change mitigation policies in Saudi Arabia (KAUST, 2014, Borgmann, 2016, Nereim and Cunningham, 2018, Nereim, 2017, Al-Ghabban, 2013, SEEC, 2015, Toumi, 2017, Kingdom of Saudi Arabia, 2017, Kingdom of Saudi Arabia, 2016b, Kingdom of Saudi Arabia, 2015, General Authority of Zakat and Tax, 2019, Kingdom of Saudi Arabia, 2016a)

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	Vision 2030 (2016, revised in 2019)	The "Vision 2030" strategy aims to reform and diversify Saudi Arabia's oil-dependent economy, including by reducing fossil fuel subsidies. When launched in 2016, the strategy called for 9.5 GW of renewable power capacity by 2023. In 2019, this target was revised upwards (see NREP below).
	5% VAT in fuel prices (2018) [1]	Starting January 2018, the government has implemented a 5% VAT on fuels.
Energy supply	National Renewable Energy Program (NREP) (2017, revised 2019)	The NREP is the policy through which the Ministry of Energy implements the "Vision 2030" renewable energy targets of 27.3 GW of renewable power capacity by 2023 and 58.7 GW by 2030. Renewable power capacity is auctioned through competitive tenders.
Transport	Corporate Average Fuel Economy Standards (CAFE) Saudi Arabia (2013) [1]	Fuel efficiency targets for new vehicles as of 2020: 13.9 to 18.5 km/l for passenger vehicles, 10.7 to 15.4 km/l for light trucks.
	Fossil fuel price reform (2017) [1]	Fossil fuel price reform delay announced by the government in December 2017, stating that it would slow down the pace of energy subsidy cuts. The plan is now to reach international gasoline parity prices, increase diesel prices up to 90% of international prices, and raise the price for other fuels between 2018 and 2025.
Buildings	Energy efficiency labels for appliances (2008)	Energy efficiency labels for a range of household appliances.
	Insulation standards for new buildings (2007)	Insulation standards for some insulation products used in residential buildings.

[1] Not quantified in NewClimate Institute projections

Table 82: 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 Table 1 and Appendix (A1). Emission values are based on SAR GWP-100. N/A: not available.

2010 GHG emissions, excl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	NewClimate estimates [1]	Official data	NewClimate estimates [1]
525 MtCO$_2$e	N/A	2020: N/A 2030: 854 to 1210 MtCO$_2$e, +63% to +131%	N/A	2020: 745 to 759 MtCO$_2$e, +42% to +45% 2030: 1,020 to 1,100 MtCO$_2$e, +94% to +109%

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

Table 83: 2010 historical data and 2030 projections of key GHG and energy indicators for Saudi Arabia. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on SAR GWP-100. N/A: not available.

| Indicator	2010 (historical)	2030 projections (change rate vs. 2010 levels)	
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO$_2$e/thousand USD$_{2010}$ PPP)	0.43	0.5 to 0.54 (+16% to +25%)	0.42 to 0.6 (-3% to +38%)
GHG emissions per capita (tCO$_2$e/cap)	19.2	25.9 to 28 (+35% to +46%)	21.7 to 30.9 (+13% to +61%)
RE share in TPES (excl. traditional biomass)	0.0%	N/A	N/A
RE share in total electricity generation (incl. hydro)	0.0%	N/A	N/A
TPES per GDP (toe/thousand USD$_{2010}$ PPP)	0.152	N/A	N/A
TPES per capita (toe/cap)	6.76	N/A	N/A

3.21 South Africa

Key policies implemented since 2015: In October 2019, the South African government adopted the new Integrated Resource Plan (IRP 2019), which contains targets for renewable energy capacity and aims to decommission 35 GW (of 42 GW currently operating) coal power capacity by 2050, with 12 GW by 2030. Uncertainty around the financial solvency of Eskom, the national electricity utility, remains a main contributing factor to overall planning uncertainty and ongoing delays in progress on renewable capacity extension (see Table 97). A carbon tax (impact not quantified) has been imposed since June 2019, covering fossil fuel combustion emissions, industrial processes and product-use emissions, and fugitive emissions (Roelf, 2019). A basic tax-free threshold for around 60% of emissions and additional allowances for specific sectors would result in tax exemptions for up to 95% of emissions during the first phase until 2022 (KPMG, 2019).

Recent developments (including proposed policies): Also adopted in June 2019 is the Green Transport Strategy 2018–2050, presenting a vision to reduce the transport sector GHG emissions and other environmental impacts by 5% (no baseline specified) by 2050 (impact not quantified). South Africa further released a draft Climate Change Bill in June 2018 for public comments (Department of Environmental Affairs, 2018). Under the proposed legislation, a Ministerial Committee on Climate Change overseeing and coordinating the activities across all sector departments will be established, and sectoral emissions targets (SETs) in line with the national emissions target would be set for each GHG emitting sector every five years.

Projections: It is projected that South Africa's emissions will likely fall within its PPD trajectory range with existing policies for the period 2020–2030 if the decommissioning of coal power is implemented as stipulated in the IRP2019. Our current policies scenario projections this year are lower than our 2018 projections, mainly due to the implementation of the new IRP targets and a slower than expected economic growth.

Impact of climate policies on greenhouse gas emissions in South Africa
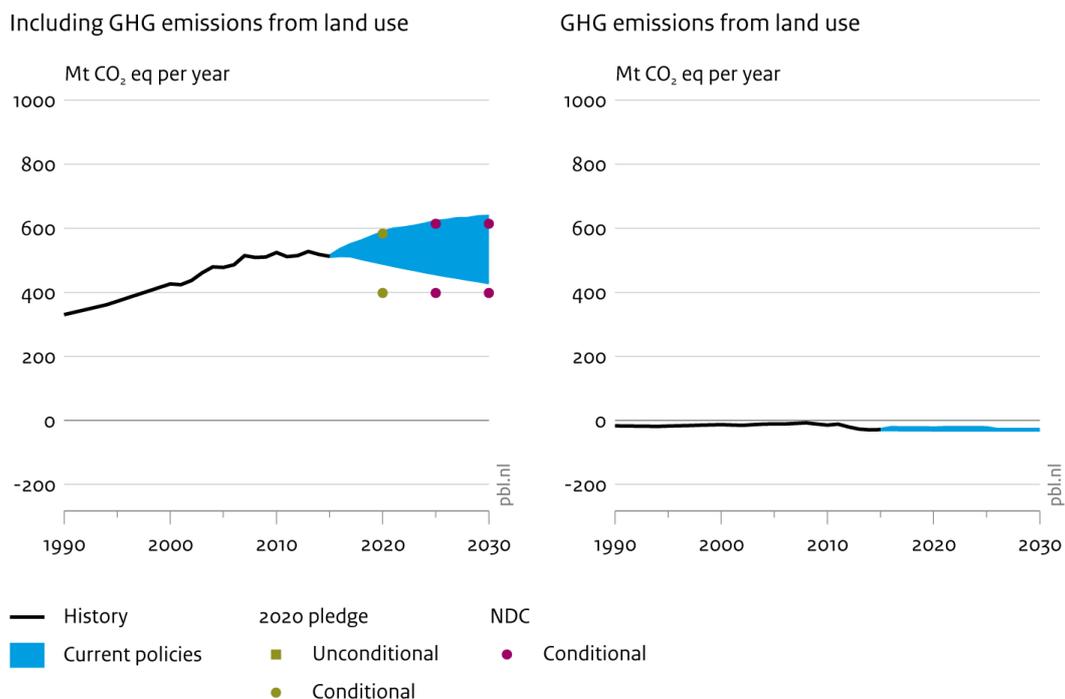
Source: PBL FAIR/TIMER model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 25: 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. Emission values are based on SAR GWP-100 (except NDC: AR4).

Table 84: Description of South Africa's 2020 pledge and NDC. N/A: not available.

Indicator	2020 pledge	NDC
Target: unconditional	N/A	398 to 614 MtCO$_2$e 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 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$_2$O
Consideration of LULUCF	Not specified	Land-use sector is included in the target Accounting approaches and methodologies are not specified
Other sector-level targets	N/A	N/A
Use of bilateral, regional and international credits	N/A	N/A

Table 85: 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, Department of Transport of the Republic of South Africa, 2019, Department of Energy, 2019)

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.
	Carbon Tax (June 2019) [1]	Tax rate of 120 Rand per tCO_2e. Tax-free allowances of up to 95% during the first phase until 2022 might reduce the effective rate to 6-54 Rand per tCO_2e.

Energy supply	Integrated Resource Plan for electricity (supported by REIPP, Renewable Energy Independent Power Producer Programme) (2011; 2019 update) (+)	• Nuclear to remain stable at 1,860 MW throughout 2030.
		  ○ Extending lifetime of existing plant.
		• Renewable electricity generation capacity targets:
		  ○ Hydropower to reach 4,600 MW by 2030 (adding 2,500 MW)
		• Solar photovoltaic to reach 8,288 MW by 2030 (adding 6,000 MW beyond already committed/contracted capacity)
		• Wind to reach 17,742 MW by 2030 (adding 14,400 MW beyond already committed/contracted capacity)
		• Concentrated solar power to reach 600 MW by 2030 (adding 300 MW, which is already contracted)

Transport	Petroleum Products Act (Biofuels Industrial Strategy) (2007) [2]	Mandatory blending of biofuels. Concentration for blending: 2-10% for bio-ethanol and minimum 5% for biodiesel from 2015 onwards.
	Green Transport Strategy 2018–2050 (2019) [1]	Reduce the transport sector GHG emissions and other environmental impacts by 5% (no reference point provided).
Buildings	National Building Regulation (2011) [3]	Building codes and standards.
Forestry	Long term mitigation scenarios	Establishment of 760,000 hectares of commercial forest by 2030.
	National Forest Act (1998) [4]	Securing ecologically sustainable development and use of natural resources while promoting justifiable economic and social development [4]. Facilitate improved timber availability and secure supply of timber to ensure sustainability of entire timber value chain.
	Strategic Plan for the Development of Agriculture, Forestry and Fisheries (2013) [4]	Promote conservation of forest biological diversity, ecosystems and habitats, while promoting the fair and equitable distribution of their economic, social, health and environmental benefits.

[1] Not quantified in our current policies scenario. [2] Implemented in PBL TIMER model projections as 5% total biofuel share from 2015 onwards. [3] Not quantified in PBL TIMER model projections. [4] Not quantified in IIASA model projections.

Table 86: 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 Table 1 and Appendix (A1). Emissions values are based on SAR GWP-100 (except NDC: AR4). N/A: not available.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates
524 MtCO2e	2025–2030: 398 to 614 MtCO2e	2020: N/A [398 to 585 MtCO2e, -24% to +11%] 2030: N/A [398 to 614 MtCO2e, -24% to +17%]	N/A	2020: 491 to 587 MtCO2e, -6% to +12% 2030: 430 to 637 MtCO2e, -18% to +21%

Table 87: 2010 historical data and 2030 projections of key GHG and energy indicators for South Africa. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on SAR GWP-100. N/A: not available.

Indicator	2010 (historical)	2030 projections (change rate vs. 2010 levels)	
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO2e/thousand USD2010 PPP)	0.87	0.44 to 0.65 (-50% to -25%)	N/A
GHG emissions per capita (tCO2e/cap)	10.2	6.5 to 9.7 (-36% to -6%)	N/A
RE share in TPES (excl. traditional biomass)	2.2%	5.0% to 14.5% (+2.8 to +12.3 %-points)	N/A
RE share in total electricity generation (incl. hydro)	1.0%	18.3% to 33.0% (+17.3 to +32.0 %-points)	33.1% (+32.1 %-points)
TPES per GDP (toe/thousand USD2010 PPP)	0.219	0.148 to 0.188 (-32% to -14%)	N/A
TPES per capita (toe/cap)	2.56	2.20 to 2.79 (-14% to +9%)	N/A

3.22 Thailand

Key policies implemented since 2015: Thailand's Climate Change Master Plan (2015–2050) is considered an overarching climate change strategy, which critically builds upon sectoral policies for its implementation. The main policies related to GHG emissions reductions include the Integrated Energy Blueprint (TIEB) of 2015, which consists of five pillars: Alternative Energy Development Plan (AEDP) (2015–2036), Energy Efficiency Plan (EEP) (2015–2036), Power Development Plan (PDP) (2015–2036), Oil Plan (2015–2036), Gas Plan (2015–2036). The Waste Management Roadmap is not considered in the current policies scenario, as this policy does not provide quantifiable targets for 2020 and beyond.

Recent developments (including proposed policies): In January 2019, a new PDP for 2018–2037 was adopted by the National Energy Policy Committee (Souche, 2019) (impact not quantified). Compared to the 2015 version for 2015–2036, the new 2019 PDP foresees a large reduction of coal power generation and a large increase of gas-fired generation. The electricity generation mix for 2037 is projected as follows (2036 projections in the 2015 PDP 2015–2036 in parentheses): coal: 12% (23%), gas: 53% (37%), domestic renewables: 20% (20%), imported hydro: 9% (15%), nuclear: 0% (5%), demand reduction from energy efficiency compared to the 2015 projection: 6%. When limited to domestic electricity generation, these numbers translate to roughly 14% coal, 62% gas and 24% renewables. Compared to our current policies scenario projections for 2030 in the 2018 update report (25% coal, 57% gas, 18% renewables), the 2019 PDP projection for coal power share for 2037 is considerably lower.

Projections: It is projected that Thailand will likely get close to but miss its unconditional NDC target with existing policies. Our current policies scenario projections this year are similar to our 2018 projections.

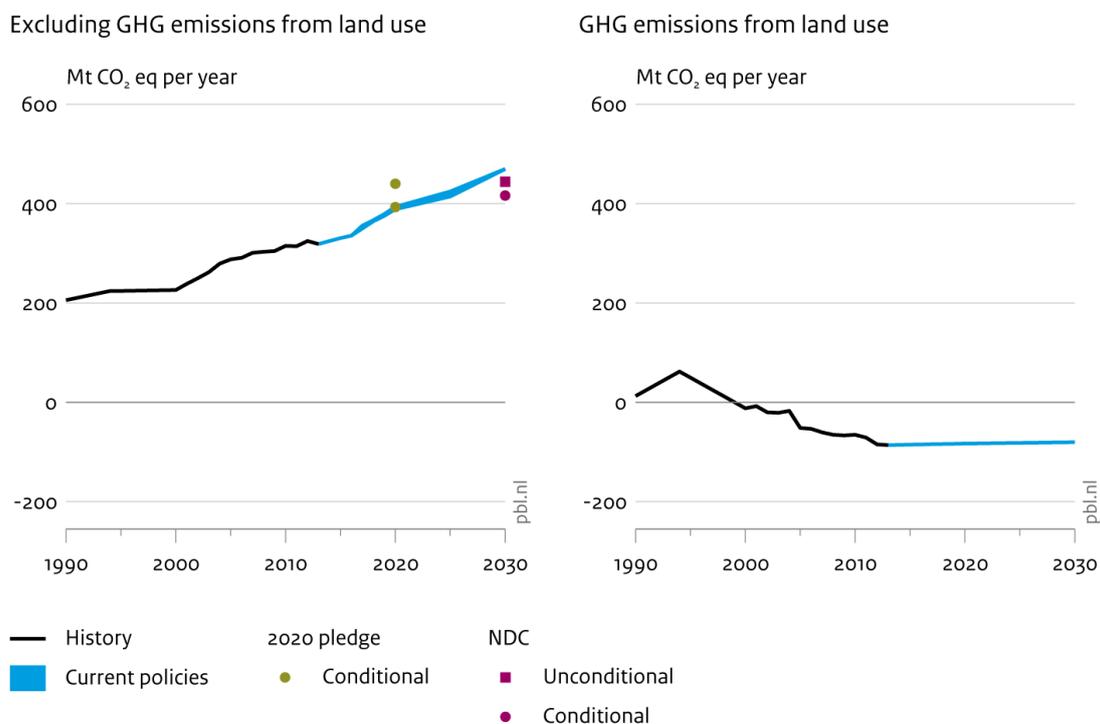### Impact of climate policies on greenhouse gas emissions in Thailand

Figure 26: Impact of climate policies on greenhouse gas emissions in Thailand (left: excluding land use (i.e. LULUCF), right: only land use). Emission values are based on SAR GWP-100 (except NDC: AR4).

Table 88: Description of Thailand's 2020 pledge and NDC. N/A: not available.

Indicator	2020 pledge	NDC
Target: unconditional	N/A	GHG reduction of 20% by 2030 compared to BAU level
Target: conditional	7-20% GHG emissions 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 89: Overview of key climate change mitigation policies in Thailand (The Kingdom of Thailand, 2015a, Ministry of Energy of Thailand, 2015b, Ministry of Energy of Thailand, 2015a, Ministry of Energy of Thailand, 2016, National Economic and Social Development Board of the Kingdom of Thailand, 2012, APERC, 2019)

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide [1]	Climate Change Master Plan (2015-2050) (2015) (+)	7–20% GHG emissions reductions by 2020 below BAU in the energy and transport sectors. Share of at least 25% of the total energy consumption from renewable energy sources by 2021. Reduction of energy intensity by at least 25% compared to BAU by 2030.
Energy supply	Alternative Energy Development Plan (2015-36) (2015) (+)[1] and Power Development Plan (2015-36) (+) [1]	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) (+) [1]	Reduction of energy intensity per GDP (in final energy terms) by 30% by 2036, as compared to 2010 baseline, with total savings of 90 TWh by 2036.
	Oil Plan (2015-2036) [1]	Support measures to save fuel in the transportation sector and enhance ethanol and biodiesel consumption.
	Smart Grid Development Master Plan (2015-36) (+) [1]	Aims for high penetration of renewable energy, mainly mini-hydro and solar PV.
Transport	Environmentally Sustainable Transport System Plan (2013-30) (2012) (+) [1]	Improvement of rail infrastructure to reduce annual logistics costs and the annual energy bill by about 2% and 1% of GDP respectively.
Industry	Energy Conservation and Promotion Act (1992, amended 2007) [1]	Stabilise share of energy demand for the three most energy-intensive sectors at 40% by 2030.
Buildings	Minimum Energy and High Energy Performance Standards (MEPS/HEPS) (2011) [1]	Mandatory MEPS for air conditioners, refrigerators, self-ballasted compact fluorescent lamps and double-capped fluorescent lamps. HEPS for 28 appliances and types of equipment.
	Building energy code (2009) [1]	Reduce electricity use for large commercial buildings by > 50% by 2030 compared with BAU.
Forestry	National Economic and Social Development Plan (2012) [2]	Several non-quantifiable long-term targets to reduce GHG emissions in the agriculture and land transport sector. Expansion of conservation areas to at least 19% of total area, expansion of forest reserves up to 40%, and annual mangrove coastal reforestation of at least 800 hectares.

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

Table 90: 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 Table 1 and Appendix (A1). Emissions values are based on SAR GWP-100 (except NDC: AR4). N/A: not available.

2010 GHG emissions, excl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	NewClimate estimates [conditional]	Official data	NewClimate estimates
315 MtCO$_2$e	N/A	2020: N/A [393 to 440 MtCO$_2$e, +25% to +40%] 2030: 444 MtCO$_2$e, +41% [416 MtCO$_2$e, +32%]	N/A	2020: 389 to 394 MtCO$_2$e, +23% to +25% 2030: 470 MtCO$_2$e, +49%

Table 91: 2010 historical data and 2030 projections of key GHG and energy indicators for Thailand. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on SAR GWP-100. N/A: not available.

Indicator*	2010 (historical)	2030 projections (change rate vs. 2010 levels)	
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO$_2$e/thousand USD$_{2010}$ PPP)	0.37	0.27 (-26%)	0.26 (-30%)
GHG emissions per capita (tCO$_2$e/cap)	4.7	6.7 (+42% to +42%)	6.3 (+35%)
RE share in TPES (excl. traditional biomass)	13.9%	N/A	N/A
RE share in total electricity generation (incl. hydro)	6.0%	N/A	N/A
TPES per GDP (toe/thousand USD$_{2010}$ PPP)	0.137	0.111 to 0.112 (-19% to -18%)	N/A
TPES per capita (toe/cap)	1.75	N/A	N/A

* Projections based on NewClimate Institute projections.

3.23 Turkey

Key policies implemented since 2015 : Turkey's main policies to reduce GHG emissions include the 2018 National Energy Efficiency Action Plan, which aims to reduce the national total primary energy consumption by 14% by 2023 compared to baseline levels, and the 2014 National Renewable Energy Action Plan (NREAP), aiming at increasing renewable power capacity from 25.5 GW in 2013 to 61 GW in 2023. At the same time, Turkey is also making significant investments in coal-fired power: one of the goals in Turkey's Strategic Plan 2015–2019 is to increase the annual electricity generation from domestic coal by 54% above 2012 levels by 2019 (Ministry of Energy and Natural Resources, 2016). As a result, 2018 saw Turkey breaking its record in domestic coal production (Anadolu Agency, 2019).

Recent developments (including proposed policies): The progress towards renewable energy targets has been supported by a feed-in tariff (FIT) scheme, but the outlook is unclear after 2020, when the FIT scheme ends. Turkey has also begun constructing its first nuclear power plant. The foundation of the Akkuyu power plant has started in April 2018. The initial plan was that the electricity generation from three reactors would start by 2023.
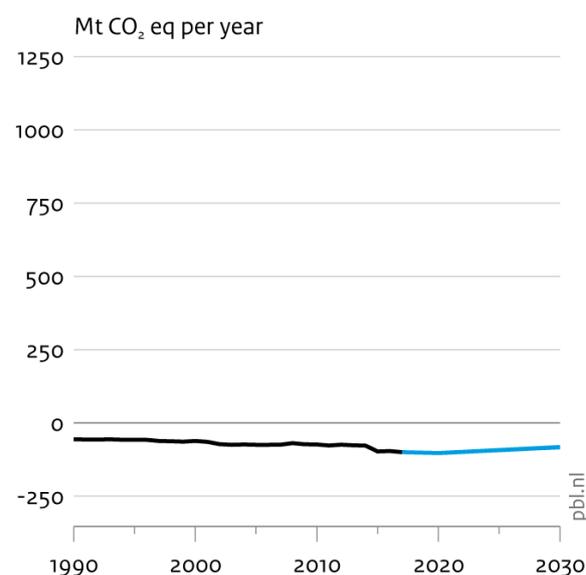
Projections: It is projected that Turkey will likely considerably overachieve its NDC target with existing policies. Our current policies scenario projections this year are similar to our 2018 projections.
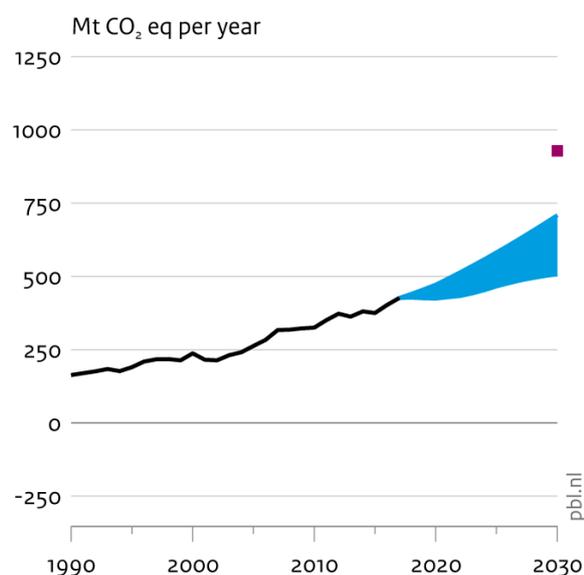
Impact of climate policies on greenhouse gas emissions in Turkey

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

Figure 27: Impact of climate policies on greenhouse gas emissions in Turkey; left panel: including land use (i.e. LULUCF), right panel: land-use emissions only. NewClimate projections are based on the historical elasticity of GHG emissions from energy and industrial processes sectors to GDP observed between 1990 and 2017. Emission values are based on AR4 GWP-100.

Table 92: Description of Turkey's 2020 pledge and INDC. N/A: not available.

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 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 93: Overview of key climate change mitigation policies in Turkey (Ministry of Energy and Natural Resources of Turkey, 2014, Ministry of Environment and Urbanization, 2011, Ministry of Environment and Urbanization, 2010, Ministry of Energy and Natural Resources of Turkey, 2009, Ministry of Energy and Natural Resources of Turkey, 2018, Presidency of the Republic of Turkey, 2019)

Sector	Policies (marked with "(+)" when mentioned in the INDC document) [1]	Description
Economy-wide	Energy intensity target (Energy Efficiency Law) (2012) [2]	Reduce primary energy intensity by 20% by 2023, compared to the 2008 level.
	Energy Efficiency Action Plan (2018) [3]	Reduce primary energy consumption by 14% compared to the BAU scenario in 2023.
Energy supply	11th Development Plan (2019) [2]	Sets a target of 38.8% renewables in electricity production by 2023.
	Renewable capacity target (Renewable Energy Action Plan) (2014) [4]	61 GW renewable capacity by 2023: 34 GW of hydro, 20 GW wind, 5 GW solar, 1 GW geothermal, 1 GW biomass.
Forestry	National Climate Change Action Plan (2011)	Decreasing deforestation by 20% by 2020, compared to the 2007 level. Increasing carbon sequestered in forested areas by 15% until 2020, compared with 2007.

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

Table 94: 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 Table 1 and Appendix (A1). Emission values are based on AR4 GWP-100. N/A: not available.

2010 GHG emissions, incl. LULUCF	2020 pledge and INDC		Current policies	
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates
325 MtCO$_2$e	N/A	2020: N/A 2030: 929 MtCO$_2$e, +185%	N/A	2020: 424 to 472 MtCO$_2$e, +30% to +45% 2030: 507 to 709 MtCO$_2$e, +56% to +118%

Table 95: 2010 historical data and 2030 projections of key GHG and energy indicators for Turkey. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on AR4 GWP-100. N/A: not available.

Indicator*	2010 (historical)	2030 projections (change rate vs. 2010 levels)	
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO$_2$e/thousand USD$_{2010}$ PPP)	0.26	0.15 to 0.2 (-43% to -21%)	0.27 (+3%)
GHG emissions per capita (tCO$_2$e/cap)	4.5	5.7 to 7.9 (+27% to +77%)	10.4 (+132%)
RE share in TPES (excl. traditional biomass)	11.0%	18.8% (+7.8 %-points)	N/A
RE share in total electricity generation (incl. hydro)	26.0%	45.6% (+19.6 %-points)	38.8% (+12.8 %-points)
TPES per GDP (toe/thousand USD$_{2010}$ PPP)	0.084	0.049 (-41%)	N/A
TPES per capita (toe/cap)	1.45	1.93 (+34%)	N/A

* Projections for RE share in TPES, RE share in total electricity generation, TPES per GDP and TPES per capita based on PBL TIMER model projections.

3.24 Ukraine

Key policies implemented since 2015 (impact of individual policies not explicitly quantified)**:** The main policies implemented to date include the National Renewable Energy Action Plan (NREA: 2014), National Energy Strategy (2017), and the National Transport Strategy of Ukraine 2030 (2017). The National Energy Strategy aims to increase the share of renewables and nuclear power in total electricity generation to 38% and 50% by 2035, respectively (see Table 99 for progress). The National Transport Strategy of Ukraine 2030 sets a target to reach at least 50% share of electric cars in the car sales market by 2030.

Recent developments (including proposed policies) (impact of individual policies not explicitly quantified): The Electricity Market Law (Law No. 4493), which entered into force in July 2019, liberalises Ukraine's national electricity market through the alignment of Ukraine's national legislation with the regulation from the European Union's Third Energy Package on the European gas and electricity markets. Electricity from renewable energy sources will be bought on the basis of the feed-in tariff regulation. In January 2020, Ukraine will start a renewable electricity auction system, which will replace the current green tariff scheme implemented since 2009 (which had limited impact on the renewable electricity share). Ukraine is also planning to establish a national emissions trading system (ETS) in line with its obligations under the 2017 Ukraine-EU Association Agreement.

Projections: It is projected that Ukraine will likely significantly overachieve its NDC target with existing policies. Our current policies scenario projections this year are similar to our 2018 projections. Because of the uncertainties about the policy implementation status resulting from recent political circumstances as well as administrative and bureaucratic barriers in Ukraine, our projections do not explicitly account for the policies implemented in recent years and policy plans.

Impact of climate policies on greenhouse gas emissions in Ukraine
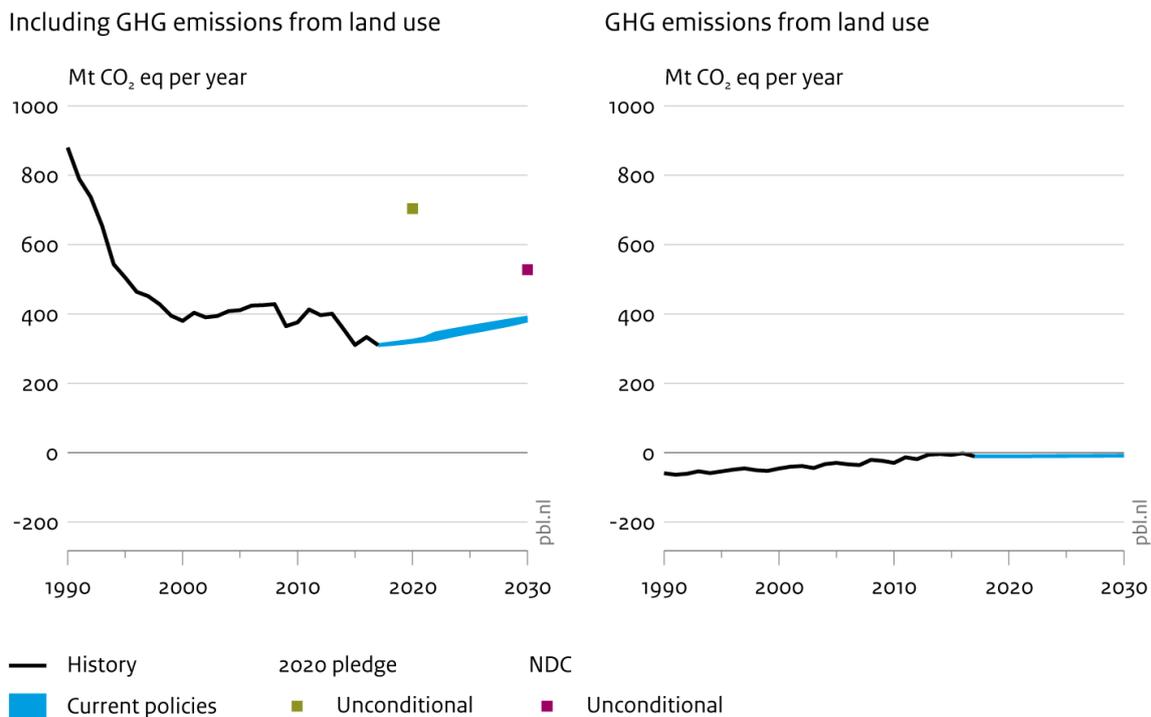
Source: PBL FAIR/TIMER model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 28: 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. Emission values are based on AR4 GWP-100.

Table 96: Description of Ukraine's 2020 pledge and NDC. N/A: not available.

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 The impact of LULUCF credits is expected to be small (Grassi et al., 2012)	Land use is included in the NDC target Accounting approach to be used for the land-use sector is to be defined not later than 2020
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 the development and implementation of market mechanisms, but the 2030 GHG target does not account for this participation

Table 97: 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, KPMG-Ukraine, 2019, Ministry of Transport of Ukraine, 2017)

Sector	Policies [1] (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	National Renewable Energy Action Plan 2020 (2014)	20% reduction of CO_2 emissions per final consumption of fuel by 2035 from 2010 levels (5% by 2020, 10% by 2025, 15% by 2030). 11% share of renewable energy sources in gross final energy consumption by 2020 to achieve 78,080 ktoe in heating and cooling, electricity and transport.
Energy supply	Green Tariff (renewables feed-in-tariff) (2015 amendment)	5% premium for 30% of domestic equipment. 10% premium when using 50% of domestic equipment. To be replaced by a competitive auction system as of 2020.
	Energy Strategy of Ukraine until 2035 (2017)	Aims for the following electricity mix by 2035: 13% from renewables excluding hydropower, 7% from hydropower, 48% from nuclear and 32% from thermal power plants.
Transport	Law on Alternative Liquid and Gaseous Fuels (2012 amendment)	Gradual increase in the share of production and use of biofuels and blended motor fuels of: 5% by 2013; 5% by 2014–2015; 7% by 2016; 10% by 2020.
	National Transport Strategy 2035 (2017)	Aims for at least 50% share of electric cars in the car sales market by 2030.
Industry	Corporate income tax exemptions for Renewable Energy Sector (2011)	Reduction of 80% in corporate profit tax for five years for the sale of equipment that operates on renewable energy sources and/or that is used for producing alternative fuels.
Forestry	Enhancement of forest cover (2015)	Increase of the forest area up to 17% of total land cover by 2020.
	State Programme "Forest of Ukraine" (2009)	Target of 429,000 hectares of afforestation and 231,000 hectares of reforestation by 2030.

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

Table 98: 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 Table 1 and Appendix (A1). Emissions values are based on AR4 GWP-100. N/A: not available.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates
376 MtCO$_2$e	N/A	2020: 703 MtCO$_2$e, +87% 2030: 528 MtCO$_2$e, +40%	N/A	2020: 320 to 323 MtCO$_2$e, -15% to -14% 2030: 381 to 389 MtCO$_2$e, +1% to +4%

Table 99: 2010 historical data and 2030 projections of key GHG and energy indicators for Ukraine. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on AR4 GWP-100. N/A: not available.

Indicator*	2010 (historical)	2030 projections (change rate vs. 2010 levels)	
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO$_2$e/thousand USD$_{2010}$ PPP)	0.96	0.43 to 0.44 (-55% to -54%)	0.6 (-37%)
GHG emissions per capita (tCO$_2$e/cap)	8.2	9.3 to 9.5 (+14% to +16%)	12.9 (+57%)
RE share in TPES (excl. traditional biomass)	1.4%	5.9% (+4.6 %-points)	17.0% (+15.6 %-points)
RE share in total electricity generation (incl. hydro)	7.0%	11.1% (+4.1 %-points)	16.7% (+9.7 %-points)
TPES per GDP (toe/thousand USD$_{2010}$ PPP)	0.338	0.204 (-40%)	N/A
TPES per capita (toe/cap)	2.89	3.57 (+24%)	N/A

* Projections for RE share in TPES, RE share in total electricity generation, TPES per GDP and TPES per capita based on PBL TIMER model projections.
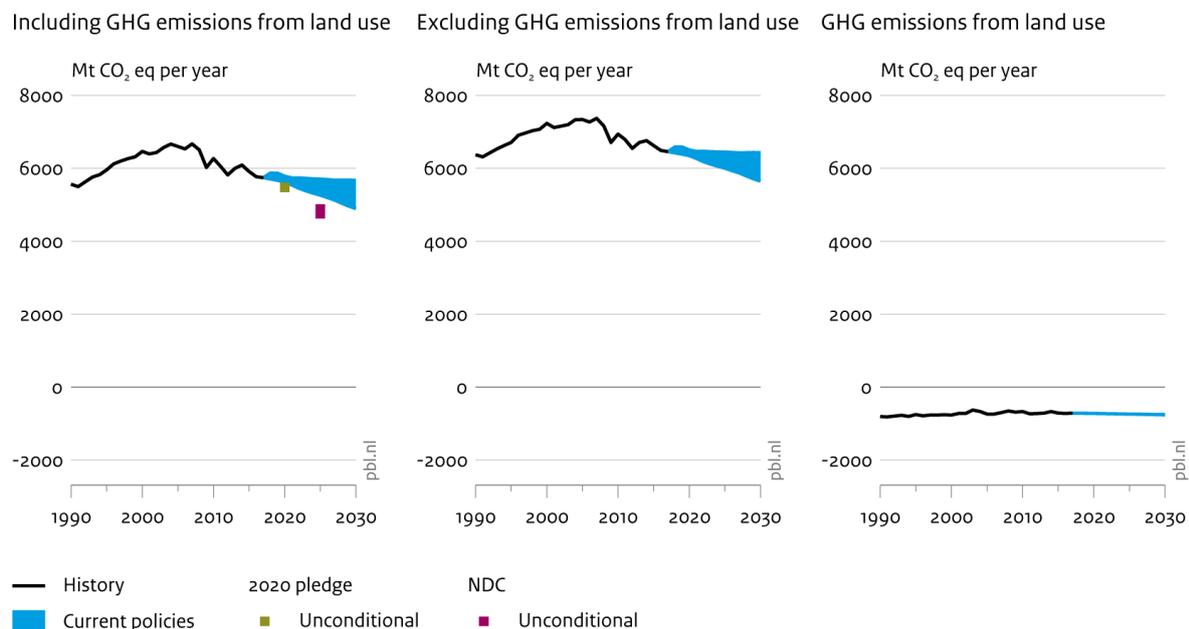
3.25 United States of America

Key policies implemented since 2015: Significant changes in climate policy since the beginning of the Trump administration include the repeal of the Clean Power Plan (August 2019) which was designed to reduce emissions from the power sector, and the 2018 decision not to enforce regulations to limit HFC emissions, previously regulated under the Significant New Alternatives Policy Program (SNAP). Moreover, it was proposed in 2018 to freeze vehicle efficiency standards after 2020, under the Safer Affordable Fuel-Efficient Vehicles (SAFE) rule, instead of requiring more stringent standards over time as was previously foreseen under the CAFE standards. The proposed changes in the fuel-economy standards for light duty vehicles consider the creation of a national vehicle emissions standards (One National Program), limiting the setting of stricter standards at state-level. In this line, the Trump Administration put forward a rule that would revoke California's authority to set its own emissions standards for cars and trucks that exceed the federal ones. Other relevant changes in climate policy in the US include the proposal to weaken the CO_2 emissions standards for coal-fired power plants and the proposal to modify standards for methane emissions from oil and gas production.

Recent developments (including proposed policies): Climate action has forcefully entered the political debate in the USA following the introduction of the "Green New Deal" bill in February 2019; it did not pass the Republican-controlled Senate, but called for economy-wide action to "achieve net-zero greenhouse gas emissions through a fair and just transition" (Ocasio-Cortez, 2019). In November 2019, the Trump Administration formally requested the withdrawal of the US from the Paris Agreement. By contrast, action by states, cities, and businesses is significant in the US. The campaigns such as "We Are Still In" and "America's Pledge" unite a large number of actors to still support the Paris Agreement.

Projections: It is projected that the USA will likely miss its unconditional NDC targets with existing policies. Our current policies scenario projections this year are similar to our 2018 projections.

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

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

Figure 29: Impact of climate policies on greenhouse gas emissions in the United States of America; left panel: all gases and sectors, middle panel: excluding land use (i.e. LULUCF) and right panel: only land use. Emission values are based on AR4 GWP-100.

Table 100: Description of the United States of America's 2020 pledge and NDC. N/A: not available.

Indicator	2020 pledge	NDC
Target: unconditional	17% GHG reduction 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 Net-net accounting is specified to be used for emission accounting	Land-use sector is included in the target Net-net accounting is specified to be used for emission accounting [1]
Use of bilateral, regional and international credits	N/A	N/A

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

Table 101: Overview of key climate change mitigation policies in the United States of America (U.S. EPA, 2018c, U.S. EPA, 2018b, U.S. EPA, 2018d, NHTSA and EPA, 2018, U.S. EPA, 2018a, U.S. Department of State, 2016b, U.S. EPA, 2019a, U.S. EPA and U.S. NHSA, 2019, U.S. EPA, 2019b).

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	Clean Air Act (1963) (+)	Clean Power Plan (CPP) was repealed in August 2019.
Energy supply	Methane waste prevention rule (2016) [1][2]	Specific standards for oil and gas production to reduce CH_4 emissions by 35% from 2014 levels by 2025. The November 2018 amendment removed requirements of the 2016 rule.
	Blueprint for a Secure Energy Future [2]	Reduce oil imports by 50% by 2020.
	Bipartisan Budget Act (2018) [1]	Provides a tax credit for carbon dioxide captured through CCS (section 45Q), including carbon dioxide used for enhanced oil recovery.
Transport	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) (+)	As of April 2018, the US EPA has announced that it will not enforce HFC regulations under the Significant New Alternatives Policy Program. 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 102: Impact of climate policies on greenhouse gas emissions (including LULUCF) in the United States of America Absolute emissions levels and changes in emissions levels relative to 2010 levels are presented. References for official emissions data are provided in Table 1 and Appendix (A1). Emission values are based on AR4 GWP-100. N/A: not available.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates
6,270 MtCO$_2$e	2020: 5,344 MtCO$_2$e 2025: 4,640 to 4,760 MtCO$_2$e	2020: 5,480 MtCO$_2$e, -13% 2025: 4,880 to 4,750 MtCO$_2$e, -22% to -24%	N/A	2020: 5,630 to 5,820 MtCO$_2$e, -10% to -7% 2025: 5,260 to 5,760 MtCO$_2$e, -16% to -8%

Table 103: 2010 historical data and 2030 projections of key GHG and energy indicators for the United States of America. Absolute emission levels and changes in emission levels relative to 2010 levels are presented. The sector coverage for GHG emission indicators are consistent with the NDC targets and our assumptions on them. Emission values are based on AR4 GWP-100. N/A: not available.

Indicator	2010 (historical)	2030 projections (change rate vs. 2010 levels), unless otherwise noted	
		Current policies scenario	NDC (or domestic targets)
GHG emissions per GDP (tCO$_2$e/thousand USD$_{2010}$ PPP)	0.42	2025: 0.24 to 0.26 (-43% to -37%)	2025: 0.22 (-48% to -47%)
GHG emissions per capita (tCO$_2$e/cap)	20.3	2025: 15.1 to 16.5 (-26% to -19%)	2025: 14.0 to 14.3 (-31% to -29%)
RE share in TPES (excl. traditional biomass)	6.0%	13.3% to 25.5% (+7.3 to +19.5 %-points)	N/A
RE share in total electricity generation (incl. hydro)	10.0%	24.1% to 25.5% (+14.1 to +15.5 %-points)	N/A
TPES per GDP (toe/thousand USD$_{2010}$ PPP)	0.148	0.108 to 0.114 (-27% to -23%)	N/A
TPES per capita (toe/cap)	7.16	6.76 to 7.13 (-6% to -0%)	N/A

Note: TPES values in higher heating values.

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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 USA and Ukraine), we used the GHG inventories submitted in 2019 to the UNFCCC (2019b); the inventories used 100-year global warming potential (GWP) values from the IPCC Fourth Assessment Report (AR4).

For historical emissions for non-Annex I Parties, Table A-1 presents an overview of data sources. For many countries, the data was taken from the UNFCCC GHG databases (UNFCCC, 2019b, UNFCCC, 2019a), in which the GHG inventory data reported in most recent Biennial Update Reports (BURs) submitted to the UNFCCC were compiled. National Inventory Reports (NIR) and National Communications (NC) were also used for some countries. For Brazil, the emissions inventory from Sistema de Estimativa de Emissões de Gases de Efeito Estufa (SEEG, 2018) was used.

The GHG emission values are reported in GWPs as defined in the NDCs of respective countries. 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 were used compared to when SAR GWPs were 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 converted 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 2017 historical emissions. For non-Annex I countries, the column "Last reported year" in A1 serves as a reference for the harmonisation year.

The only exception is China, for which we used the report data-year 2012 from the national communications, instead of 2014 data from the Second Biennial Update Report (BUR2) of China (The People's Republic of China, 2018). In its BUR2, China has updated their methods and data sources used for their national calculations (see section Chapter 1.1 p. 9-10), but they did not re-calculate their historical estimates in order to get a consistent time period. In the initial, the second, and the third national communications and the first biennial update report, China submitted its National GHG Inventories of 1994, 2005, 2010 and 2012, based on a consistent time series of historical emissions estimates, which were used here.

Table A-1: Data sources for historical GHG emissions in non-Annex I countries (UNFCCC, 2019b, UNFCCC, 2019d, UNFCCC, 2019e)

Country	GHG emissions excluding LULUCF		LULUCF emissions	
	Source	Last reported data-year	Source	Last reported data-year
Argentina	BUR2	2014	BUR2	2014
Brazil	SEEG (2018) [1]	2017	SEEG (2018)	2017
Chile	BUR3	2016	BUR2	2016
China	UNFCCC database, BUR2 (for 2014)	2012 (used in this report) /2014	UNFCCC database, BUR2 (for 2014)	2012 (used in this report) /2014
Colombia	BUR2	2014	BUR2	2014
D.R. Congo	EDGAR	2015	FAO	2015
Ethiopia	UNFCCC database	2013	UNFCCC database	2013
India	UNFCCC database	2014	UNFCCC database	2014
Indonesia	NC3, UNFCCC database, BUR2 (only for 2016)	2016	NC3, UNFCCC database, BUR2 (only for 2016)	2016
Republic of Korea	UNFCCC database	2014	UNFCCC database	2014
Mexico	National GHG inventory (INECC, 2018)	2015	National GHG inventory (INECC, 2018)	2015
Morocco	UNFCCC database	2012	UNFCCC database	2012
Saudi Arabia	UNFCCC database	2012	UNFCCC database	2010
South Africa	UNFCCC database, BUR3	2014	UNFCCC database, BUR3	2014
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 USA.

2. **Baseline or BAU target**: emissions reductions relative to a baseline or business-as-usual projection (specified in the INDCs/NDCs). The mitigation component of the INDCs/NDCs specifies the business-as-usual emission projection. The type of emissions reductions relative to a baseline or business-as-usual projection has been chosen for many INDCs/NDCs, and in this report for: Argentina, Colombia, Democratic Republic of the Congo, Indonesia, Mexico, Morocco, Republic of Korea, Thailand and Turkey.

3. **Baseline or BAU target (not specified):** emissions reductions relative to a baseline projection (not specified). Same as under point 2, but here, for the INDCs/NDCs, baseline or business-as-usual emissions projections are not specified, such as for those of 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**: emissions 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). For countries not analysed by PBL (Chile, Colombia, DRC, Ethiopia, Morocco, Philippines, Saudi Arabia, and Thailand), we refer to Climate Action Tracker (2019).

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 [4] (den Elzen et al., 2016a).

This report identified three countries that apply the gross-net accounting approach 5 (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 exclude the expected amount of carbon credits and are compared to current policies scenario projections excluding LULUCF.

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

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[4] 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.

[5] 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.

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
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
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 projections (based on the Climate Action Tracker analysis)

Current policies projections

The NewClimate Institute analysis follows the calculation steps used in the Climate Action Tracker (2019). 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 Institute projections consider economic measures such as carbon tax, feed-in tariff scheme and subsidies only if their mitigation impacts have already been quantified by other institutions.

Table A-1 presents the URLs and the posted dates of country assessment updates by the Climate Action Tracker project. On the three countries not covered by the Climate Action Tracker, the emissions projections for non-LULUCF sectors were developed as follows:

- Colombia: based on the BAU projections from the Third National Communication (IDEAM et al., 2017), with consideration of planned policies and measures described in the Second Biennial Update Report (IDEAM et al., 2018) that have been implemented to date.
- Democratic Republic of the Congo: based on an extrapolation of historical emission trends and Stiebert (2013).
- Thailand: based on the reference projections from the APEC Energy Demand and Supply Outlook 2019 (APERC, 2019), with consideration of renewable deployment projections by IRENA (IRENA, 2017).

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

Country	URL	Date updated
Argentina	https://climateactiontracker.org/countries/argentina	December 2019
Australia	https://climateactiontracker.org/countries/australia	September 2019
Brazil	https://climateactiontracker.org/countries/brazil	September 2019
Canada	https://climateactiontracker.org/countries/canada	September 2019
Chile	https://climateactiontracker.org/countries/chile	December 2019
China	https://climateactiontracker.org/countries/china	December 2019
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	September 2019
European Union	https://climateactiontracker.org/countries/eu	September 2019
India	https://climateactiontracker.org/countries/india	September 2019
Indonesia	https://climateactiontracker.org/countries/indonesia	December 2019
Japan	https://climateactiontracker.org/countries/japan	December 2019
Kazakhstan	https://climateactiontracker.org/countries/kazakhstan	September 2019 (adapted)
Mexico	https://climateactiontracker.org/countries/mexico	December 2019
Morocco	https://climateactiontracker.org/countries/morocco	December 2019
The Philippines	https://climateactiontracker.org/countries/philippines	December 2019
Republic of Korea	https://climateactiontracker.org/countries/southkorea	December 2019
Russian Federation	https://climateactiontracker.org/countries/russianfederation	September 2019
Saudi Arabia	https://climateactiontracker.org/countries/saudiarabia	September 2019
South Africa	https://climateactiontracker.org/countries/southafrica	December 2019
Thailand	Not assessed by Climate Action Tracker	N/A
Turkey	https://climateactiontracker.org/countries/turkey	September 2019
Ukraine	https://climateactiontracker.org/countries/ukraine	September 2019 (adapted)
United States of America	https://climateactiontracker.org/countries/usa	December 2019

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, bioenergy, and several other renewable energy carriers. The costs of these primary energy carriers depend on depletion, technology development and trade. The demand and supply models are connected via several models describing energy conversion processes such as the electric power and hydrogen production model.

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. Along those lines, technologies can be made more expensive by applying a premium factor, used to simulate e.g. coal phase-out targets.

Renewable capacity targets, i.e. a certain amount of installed power capacity of a certain renewable source, can be prescribed using desired capacities in the energy supply module of TIMER. Learning-

by-doing, i.e. cumulative installed renewable energy capacity, lowers the capital costs and as such affects installed capacity also after the policy target year (de Boer 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 is 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 policy, but classifies when it is supported by policy instruments such as feed-in tariffs.

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

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

A **biofuel target** sets a mandatory minimum volume or share of biofuels to be used in the total transportation fuel supply. Biofuel targets are also included using the TIMER transport model. Cars in TIMER drive on one fuel (except for electric and 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 emissions reductions to an absolute target level for F-gases. Then an exogenous carbon tax is applied only to F-gases in order to reach the target level per region.

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, USA, 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.

Emissions reductions targets, i.e. a reduction of the net LULUCF emissions by X% or X $MtCO_2e$ are implemented in GLOBIOM through a carbon tax on the emissions and removals from the LULUCF sector, and in G4M through a carbon tax on the forest sectorial emissions and removals

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