Greenhouse gas mitigation scenarios for major emitting countries

Analysis of current climate policies and mitigation commitments: 2017 update

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Executive Summary

This report provides an overview of projected greenhouse gas (GHG) emissions in 25 emitting countries/regions (Argentina, Australia, Brazil, Canada, Chile, China, Colombia, Democratic Republic of the Congo (DRC), Ethiopia, the European Union, India, Indonesia, Japan, Kazakhstan, Mexico, Morocco, the Philippines, Republic of Korea, the Russian Federation, Republic of South Africa, Saudi Arabia, Thailand, Turkey, Ukraine, and the United States) up to 2030, based on current policies and the implementation of (intended) nationally determined contributions ((I)NDCs).

The main updates and methodological changes made in this report compared to our 2016 report (Kuramochi et al. 2016) include the following:

- Policy developments since the last report (e.g. the changes in U.S. climate policy) have been taken into account in the emissions projections (cut-off date: 1 July 2017).
- GHG emissions projections under current policies took into account reviews from in-country experts involved in the European CD-LINKS project (CD-LINKS 2017) to identify policies, not limited to those focused on energy and climate, expected to deliver significant impact.
- Historical GHG emissions data was taken from latest inventories, many of which have been submitted to the UNFCCC in 2017.
- GHG emissions projections under current policies were harmonised to the latest historical emissions data described above. The harmonisation year was changed to 2015 for Annex I countries and 2010 for non-Annex I countries, with exceptions of China (2012) and Brazil (2015) (previously 2010 for all 25 countries).
- 2020 pledges and NDCs were consistently quantified in terms of 100-year global warming potentials (GWP) from the Second Assessment Report (SAR) of the Intergovernmental Panel on Climate Change (IPCC).

The findings of the current study are:

- The degree to which countries/regions are likely to achieve their INDCs/NDCs under current policies was found to vary (Figure ES-1):
  - Countries likely or roughly on track to achieve or even overachieve their self-determined unconditional 2025/2030 targets with currently implemented policies: Brazil, China, Colombia (new), India, Japan (new), Mexico (new), the Russian Federation, Turkey and Ukraine.
  - Countries that require additional measures to achieve their 2030 targets are: Argentina, Australia, Canada, Chile (new), DRC, Ethiopia, the EU, Indonesia, Kazakhstan, Morocco, Republic of Korea, Saudi Arabia, South Africa, Thailand, the Philippines and the United States.
  - Colombia is now assessed to as achieveing its INDC, because recent emissions, in particular from forestry, were lower than assumed in the business-as-usual (BAU) projections provided ofin Colombia's INDC.
  - Mexico is now assessed to as achieveing its NDC with currently implemented measures, mainly because of the historical emissions data update and an updated and lower baseline projections.
  - Chile is now assessed to as requiring additional measures to achieve their its 2030 targets, mainly because of the change in the baseline projections used for the assessment.
- Currently implemented policies are projected to influence greenhouse gas emissions, but do not prevent emissions from increasing up to 2030 (above 2010 levels). This is the case, not only in developing countries (Argentina, China, DRC, Ethiopia, India, Indonesia, Kazakhstan, Morocco, the Philippines, Saudi Arabia, South Africa, and Thailand) but also in OECD countries (Australia, Chile, Mexico, Republic of Korea, and Turkey) up to 2030, compared to 2010 levels. Greenhouse gas emissions in Brazil, Canada, Colombia, the Russian Federation, and the Ukraine are

projected to remain stable, approximately at current levels, with currently implemented policies. In Japan and the EU, greenhouse gas emissions are projected to decrease further, under current policies.
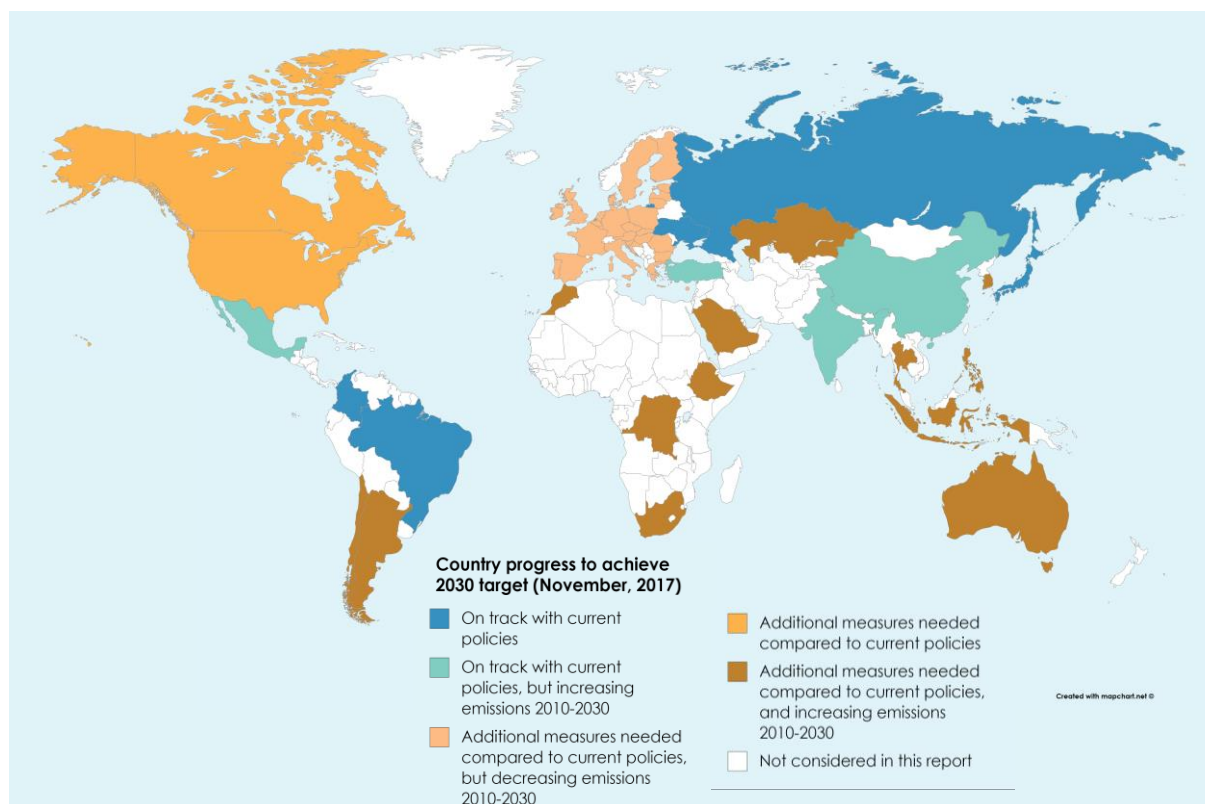

Figure ES-1: Progress of countries to achieve their self-chosen 2030 targets under current policies. Note: current policies do not include implementation measures that are under development at the time of publication.

It should be noted that a country likely to meet its NDC/INDC not necessarily is undertaking more stringent action on mitigation than a country that is not on track due to mainly two reasons. First, the targets differ in their ambition levels across countries because they are nationally determined and heterogeneous by nature. Second, it has only been around two years since the countries formulated their NDCs/INDCs. It is not surprising to see a gap between the mitigation targets and current policy trajectories if countries pledged something above what they would have achieved anyway.

Nevertheless, as countries are adopting implementation measures, it is essential that the gaps between mitigation targets and current policy trajectories begin to close, in the years to come. Most of the countries analysed in this report show progress towards meeting their NDC; some through additional policies and new market developments, some through revision of the underlying data. A few countries risk reversal of the trends (Table ES-1). For this reason, it is essential that this report and similar efforts are updated in the coming years. We also believe that this study provides useful information for the 2018 facilitative dialogue.

Table ES-1: Progress of countries in meeting their NDCs

Country	Meeting NDC with current policies?	Current policy path closer to NDC than last year (may be due to new policies, updates of historical data, selection of other projections or lower assumed economic growth)?
Argentina	No	No (one of the few countries that made NDC more ambitious than INDC)
Australia	No	Yes (projections lower due to inclusion of recent developments)
Brazil	Yes	No (reversal of trends in the reduction of deforestation)
Canada	No	No change
Chile	No	No (projection revised upwards)
China	Yes	Yes (the observed stagnation of coal consumption makes peaking CO_2 emissions earlier than 2030 more likely)
Colombia	Yes	Yes (now meeting NDC due to revision of LULUCF data)
DRC	No	No (projections revised upwards)
Ethiopia	No	Yes (new and lower data source for projections added)
EU28	No	Yes (projections lower due to inclusion of recent developments)
India	Yes	Yes (implementation of new planned policies could lead to overachievement of NDC)
Indonesia	No	No (lower end projections on LULUCF emissions from last year were removed)
Japan	Yes	Yes (more likely to overachieve NDC, mainly because of lower GDP growth assumptions)
Kazakhstan	No	No change
Mexico	Yes	Yes (projection lower due to historical data update and lower baseline projections)
Morocco	No	No change
Philippines	No	No change
Republic of Korea	No	Yes (more optimistic partly due to use of a different source for the baseline projections)
Russia	Yes	No change
Saudi Arabia	No	No change
South Africa	No	Yes (substantially lower projection because of lower economic growth assumption)
Thailand	No	No change
Turkey	Yes	No change
Ukraine	Yes	Yes (projections lower due to inclusion of recent developments)
USA	No	Yes (lower projections, even in case of Clean Power Plan cancellation, mainly due to historical data update)

Uncertainty around future estimates remains high:

- In the United States, the Trump administration officially communicated to the United Nations its intent to abandon the Paris Agreement and cease implementation of the NDC (The Representative of the United States of America to the United Nations 2017). At the same time, there are several sub-national and non-state initiatives emerging, including the "America's Pledge" recently 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 2017). The potential mitigation impact of these actions was not quantified in this study.

- Canada is currently expected to apply the net-net accounting rule for the LULUCF sector, but there is still some uncertainty on the treatment of the LULUCF sector and it is possible that a different accounting approach for the LULUCF sector will be applied.

- In Japan, decisions on the future of nuclear power will strongly influence the development of emissions in the power sector.

- In the Republic of Korea, it remains to be seen if the long-term phase-out of nuclear and coal-fired power announced by the new President would be supported by policies and laws.

- In Australia, the effect of policies replacing the carbon pricing mechanism is difficult to assess.

- China and India have pledges indexed to economic growth, implying that the absolute emission target level is very uncertain.

- Emissions projections for Turkey and other developing countries are subject to considerable uncertainty related to economic growth.

- In Argentina, Colombia, DRC, Ethiopia, Indonesia and the Philippines, emissions from land use, land use change, and forestry (LULUCF), which are very uncertain, strongly determine total emissions projections. Our evaluation on Colombia's progress has been revised from the 2016 report largely due to the downward revision of the GHG inventory data for the LULUCF sector.

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Acronyms

AFOLU	agriculture, forestry and other land use
BAU	business-as-usual
CAFE	Corporate Average Fuel Economy Standards
CAT	Climate Action Tracker
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
EDGAR	Emissions Database for Global Atmospheric Research
EEA	European Energy Agency
EPA	United States Environmental Protection Agency
ERF	Emissions Reduction Fund
ETS	emissions trading system
FAIR	PBL's Framework to Assess International Regimes for differentiation of commitments
NF$_3$	nitrogen trifluoride
F-gas	fluorinated gas
G4M	IIASA's Global Forest Model
GCF	Green Climate Fund
GDP	gross domestic product
GHG	greenhouse gas
GLOBIOM	IIASA's Global Biosphere Management Model
Gt	gigatonne (billion tonnes)
GW	gigawatt (billion watts)
GWh	gigawatt-hour (billionwatts per hour)
GWP	Global Warming Potential
H$_2$	hydrogen
Ha	hectare
HWP	harvested wood products
HEPS	High Energy Performance Standards
HFC	hydrofluorocarbon
ICCT	International Council on Clean Transportation
IEA	International Energy Agency
IIASA	International Institute for Applied Systems Analysis
IMAGE	PBL's Integrated Model to Assess the Global Environment
INDC	intended nationally determined contribution
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
km/l	kilometre per litre
ktoe	thousand tonnes of oil equivalent
kWh	kilowatt-hour (thousand watts-hour)
LPG	liquefied petroleum gas
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)

Acronyms (continued)

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

Acknowledgements

1 Introduction

Background

The 21st session of the Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC) held in 2015, adopted the Paris Agreement as the new international climate policy agreement for the post-2020 period (UNFCCC 2015a). In the lead-up to COP21, governments were asked to put forward offers on how - and by how much - they were willing to reduce their greenhouse gas (GHG) emissions after 2020; these are so-called "intended nationally determined contributions" (INDCs). Nearly 200 countries submitted their INDCs before the COP21 (UNFCCC 2015c). As of 8 September 2017, 160 Parties covering more than 65% (JRC/PBL 2014, WRI 2017) of global GHG emissions have ratified the Paris Agreement, and with each ratification their INDCs became "nationally determined contributions" (NDCs).

Objectives

This report prepared by NewClimate Institute, IIASA and PBL presents an up-to-date assessment of progress by 25 countries on the achievement of the mitigation part of the 2030 targets (NDCs and INDCs) presented in the context of the Paris Agreement as well as on their 2020 pledges in the UNFCCC Cancún Agreements. More specifically, the report provides an overview of projected GHG emissions up to 2030, taking into account the emissions trajectories under existing and in some cases planned climate and energy policies, as well as under the full implementation of 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, Iran, Japan, Kazakhstan, Mexico, Morocco, the Philippines, Republic of Korea, the Russian Federation, South Africa, Saudi Arabia, Thailand, Turkey, Ukraine, and the United States. These 25 countries cover all of G20 countries (excluding the four individual EU member states) and comprised 79% of total global GHG emissions in 2012 (JRC/PBL 2014).[1]

Hereafter we will use the term NDC throughout the report, given the many countries with NDCs. From our 25 countries, Colombia, Democratic Republic of the Congo, Russia and Turkey have not ratified the Paris Agreement, and for those we still refer to INDCs.

In this report, emissions projections under the current policies scenario assume that no additional mitigation action is taken beyond currently implemented climate policies, even if it results in 2020 pledges and 2030 targets not being achieved or being overachieved. 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. Ultimately, however, these definitions could be interpreted differently, and therefore this assessment is bound by the interpretations that our research group uses. This definition of current policies scenario is consistent with that applied in the UNEP Emissions Gap Report (UNEP, 2015).

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

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 2016 report (Kuramochi et al. 2016) include the following:

- Policy developments since the last report (e.g. the changes in U.S. climate policy) have been taken into account in the emissions projections (cut-off date: 1 July 2017).
- GHG emissions projections under current policies took into account reviews from in-country experts involved in the European CD-LINKS project (CD-LINKS 2017) to identify policies, not limited to those focused on energy and climate, that are expected to deliver significant impact on GHG emissions.
- Historical GHG emissions data was taken from latest inventories, many of which have been submitted to the UNFCCC in 2017.
- GHG emissions projections under current policies were harmonised to the latest historical emissions data described above. The harmonisation year was changed to 2015 for Annex I countries and 2010 for non-Annex I countries, with exceptions of China (2012) and Brazil (2015) (previously 2010 for all 25 countries).
- 2020 pledges and NDCs were consistently quantified in terms of 100-year global warming potentials (GWP) from the Second Assessment Report (SAR) of the Intergovernmental Panel on Climate Change (IPCC).

With regard to the fourth point, the 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 of the GHG emissions trends in recent years.

The calculations by **NewClimate Institute** are largely based on its analyses for, and informed by, the Climate Action Tracker project jointly carried out with Ecofys and Climate Analytics (CAT 2017), and used existing scenarios from national and international studies (e.g. IEA's World Energy Outlook 2016) 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 (NewClimate Institute 2016, CD-LINKS 2017), were added to that baseline. For countries that are part of a larger IMAGE region (Australia, Kazakhstan, Republic of Korea, and Ukraine), emission projections were downscaled using the country's share in the region's 2010 emissions as a constant scaling factor.

Both NewClimate and PBL scenario calculations were supplemented with those on land-use and agricultural policies using **IIASA**'s global land-use model GLOBIOM (www.iiasa.ac.at/GLOBIOM) and global forest model G4M (www.iiasa.ac.at/G4M). For PBL, IIASA's LULUCF CO_2 projections were added to the IMAGE GHG emission 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).

In this report, GHG emission values are expressed in terms of global warming potentials (GWPs) from the IPCC's 2nd Assessment Report (SAR) unless otherwise noted.

Limitations of this report

It should be noted that a country being likely to meet its NDC does not necessarily mean that it undertakes more stringent action on mitigation than a country that is not on track for a number of reasons. First, the targets differ in their ambition levels across countries because they are nationally determined and heterogeneous by nature. Second, it has only been around two years since the countries formulated their NDCs. It is not surprising to see a gap between the mitigation targets and current policy trajectories if countries pledged something above what they would have achieved anyway. Third, countries have different policy-making approaches. Some countries use their pledges or targets as a device to drive more ambitious policies, while others use them merely to formalise the expected effect of existing measures.

Nevertheless, gaps between the mitigation targets and current policy trajectories may close in the years to come as countries adopt implementation measures. For this reason, it is essential that this report, and similar efforts, is 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 provides the current state of play.
- Third, countries are implementing policies in various areas to a varying degree. 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. For some countries, we have assumed a full implementation of those targets without sufficient evidence of concrete support policies, in some cases by considering other factors (e.g. historical trends and projections from other studies), but this has the risk of overestimating the reductions.
- 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.

The main findings of this study are presented in the next Chapter and in fact sheets below, followed by an Appendix with a brief description of the datasets used in this study as well as an overview table of GHG emissions under NDCs and current policies. Detailed descriptions of the quantification of future GHG emissions under NDCs and current policies are provided as supporting information document for each country on the NewClimate Institute website.[2]

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[2] http://newclimate.org/2017/11/01/greenhouse-gas-mitigation-scenarios-for-major-emitting-countries-2017

2 Main findings

The findings of the current study are:

- The degree to which countries/regions are likely to achieve their INDCs/NDCs under current policies was found to vary (Figure ES-1):
  - Countries likely or roughly on track to achieve or even overachieve their self-determined unconditional 2025/2030 targets with currently implemented policies: Brazil, China, Colombia (new), India, Japan (new), Mexico (new), the Russian Federation, Turkey and Ukraine.
  - Countries that require additional measures to achieve their 2030 targets are: Argentina, Australia, Canada, Chile (new), DRC, Ethiopia, the EU, Indonesia, Kazakhstan, Morocco, Republic of Korea, Saudi Arabia, South Africa, Thailand, the Philippines and the United States.
  - Colombia is now assessed to as achieveing its INDC, because recent emissions, in particular from forestry, were lower than assumed in the business-as-usual (BAU) projections provided ofin Colombia's INDC.
  - Mexico is now assessed to as achieveing its NDC with currently implemented measures, mainly because of the historical emissions data update and an updated and lower baseline projections.
  - Chile is now assessed to as requiring additional measures to achieve their its 2030 targets, mainly because of the change in the baseline projections used for the assessment.
- Currently implemented policies are projected to influence greenhouse gas emissions, but do not prevent emissions from increasing up to 2030 (above 2010 levels). This is the case, not only in developing countries (Argentina, China, DRC, Ethiopia, India, Indonesia, Kazakhstan, Morocco, the Philippines, Saudi Arabia, South Africa, and Thailand) but also in OECD countries (Australia, Chile, Mexico, Republic of Korea, and Turkey) up to 2030, compared to 2010 levels. Greenhouse gas emissions in Brazil, Canada, Colombia, the Russian Federation, and the Ukraine are projected to remain stable, approximately at current levels, with currently implemented policies. In Japan and the EU, greenhouse gas emissions are projected to decrease further, under current policies.

It should be noted that a country likely to meet its NDC/INDC not necessarily is undertaking more stringent action on mitigation than a country that is not on track due to mainly two reasons. First, the targets differ in their ambition levels across countries because they are nationally determined and heterogeneous by nature. Second, it has only been around two years since the countries formulated their NDCs/INDCs. It is not surprising to see a gap between the mitigation targets and current policy trajectories if countries pledged something above what they would have achieved anyway.

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Table 1: Progress of countries in meeting their NDCs

Country	Meeting NDC with current policies?	Current policy path closer to NDC than last year (may be due to new policies, updates of historical data, selection of other projections or lower assumed economic growth)?
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South Africa	No	Yes (substantially lower projection because of lower economic growth assumption)
Thailand	No	No change
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Uncertainty around future estimates remains high:

- In the United States, the Trump administration officially communicated to the United Nations its intent to abandon the Paris Agreement and cease implementation of the NDC (The Representative of the United States of America to the United Nations 2017). At the same time, there are several sub-national and non-state initiatives emerging, including the "America's Pledge" recently 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

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- 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 determine total emissions projections. Our evaluation on Colombia's progress has been revised from the 2016 report largely due to the downward revision of the GHG inventory data for the LULUCF sector.

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;
- Overview of key climate change mitigation policies;
- Impact of climate policies on greenhouse gas emissions (absolute, relative to 2010 levels, and per capita).

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 2015). Historical GHG emissions data sources are described below.

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

Historical GHG Emissions data sources
For Annex I countries (Australia, Canada, the European Union, Japan, Kazakhstan, the Russian Federation, Turkey, the United States of America and Ukraine), the GHG emissions data submitted via the Common Reporting Format 2017 (2016 inventory for the USA and Canada) to the UNFCCC (2017b) was used after converting global warming potential (GWP) values from those in the IPCC Fourth Assessment Report (AR4) to those in the IPCC Second Assessment Report (SAR). The GWP conversion was conducted by the Potsdam Institute for Climate Impact Research (PIK) for the Climate Action Tracker project.

For historical emissions in non-Annex I Parties, Table 2 presents an overview of data sources. For many countries the data was taken from the UNFCCC GHG database (UNFCCC 2017a), in which the GHG inventory data reported in most recent Biennial Update Reports (BURs) submitted to the UNFCCC (2017c) are compiled. For some countries the emissions data were directly taken from BURs, used as it is or after conversion from AR4 GWPs to SAR GWPs. When national data were not available, EDGAR database (JRC/PBL 2014) were used for non-energy-related CO_2 emissions and anthropogenic non-CO_2 GHG emissions and FAO (2014) were used for LULUCF emissions. For Brazil, the emissions inventory from Sistema de Estimativa de Emissões de Gases de Efeito Estufa (SEEG 2017) was used.

With regard to the magnitude of uncertainty related to the choice of GWPs, global total GHG emissions for 2014 are reported to be 3% higher when AR4 GWPs are used compared to when SAR GWPs are used (Gütschow et al. 2017). At a country level, the dataset provided by PIK to the Climate Action Tracker project shows that for the inventory submitted in 2017 by Annex I countries, the emission values become smaller by 1-5% excluding LULUCF and 1-7% including LULUCF when they are covered from AR4 GWPs to SAR GWPs (data years: 1990-2015).

In the following country fact sheets, we report in the first table of each country the latest GHG inventory submitted to the UNFCCC and its latest reported year when it differs from the dataset presented in Table 2.

Table 2: Data sources for historical GHG emissions in non-Annex I countries (UNFCCC 2017c, UNFCCC 2017d, UNFCCC 2017e) .

Country	GHG emissions excluding LULUCF		LULUCF emissions	
	Source	Last reported year	Source	Last reported year
Argentina	BUR1	2010	BUR1	2010
Brazil	SEEG (2017)	2015	SEEG (2017)	2015
Chile	BUR	2013	BUR	2013
China	BUR1, UNFCCC database	2012	BUR1, UNFCCC database	2012
Colombia	BUR1	2012	BUR1	2012
D.R. Congo	EDGAR	2010	UNFCCC database	2010
Ethiopia	UNFCCC database	2013	UNFCCC database	2013
India	UNFCCC database	2010	UNFCCC database	2010
Indonesia	BUR1, UNFCCC database	2012	BUR1, UNFCCC database	2012
Republic of Korea	UNFCCC database	2012	UNFCCC database	2012
Mexico	UNFCCC database	2012	UNFCCC database	2012
Morocco	UNFCCC database	2012	UNFCCC database	2012
Saudi Arabia	UNFCCC database	2010	UNFCCC database	2010
South Africa	UNFCCC database, BUR1	2010	UNFCCC database, BUR1	2010
The Philippines	EDGAR	2010	FAO	2015
Thailand	UNFCCC database, BUR1	2011	UNFCCC database, BUR1	2011

Table 3: Sources for the official estimates of the emissions in 2020 and 2030 under pledge and NDC case and current policy trajectory cases for the 25 countries.

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

[a] *Argentina, Saudi Arabia and Turkey have not proposed GHG reduction pledges, and here we assume current policies.*

Argentina

Argentina pledged to limit its GHG emissions to 483 $MtCO_2$e/year in 2030 unconditionally and to 369 $MtCO_2$e/year in 2030 conditionally to various elements (both numbers incl. LULUCF) (see Table 1). With these targets, Argentina revised its earlier INDC of a reduction of 15% below BAU, moving to absolute emission levels rather than a relative target and decreasing the resulting level of emissions in 2030. Argentina has not proposed a GHG reduction pledge for 2020.

The emissions projections for Argentina under current policies consider its biofuels law and renewable energy law. As a result, GHG emissions in 2030 including LULUCF are projected to be about 610 $MtCO_2$e or 36% above 2010 levels. Argentina is, therefore, not yet on track to meet its unconditional NDC.

Table 4: Description of Argentina's NDC

Indicator	NDC (updated NDC submitted on 17 November 2016)
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_2O, 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
Availability of reference scenarios in the latest UNFCCC submissions	• Yes, NDC also includes a BAU scenario
Last available year for GHG inventory reporting	• 2012 (Government of Argentina 2015).

Note: Argentina has not set its 2020 pledge.

Table 5: Overview of key climate change mitigation policies in Argentina. Source: (Ministry of the Environment and Sustainable Development 2015)

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	National Program for Rational and Efficient Use of Energy (PRONUREE) (2007)	• 10-12% of energy savings by 2016 in residential, public/private services • Decrease electricity consumption by 6% compared to baseline scenario and energy savings of 1500 MW by 2016
Energy supply	Renewable Energy Programme in Rural Markets (2000)	• Reduce GHG emissions by replacing small-diesel electricity generation with renewable energy systems
	Renewable Energy Law 27191. National Development Scheme for the Use of Renewable Energy Sources (RenovAr) (2016)	• Total individual electric consumption to be substituted with renewable sources given the following schedule: 8% by 2017, 18% by 2023 and 20% by 2025 [1]
	PROBIOMASA: promotion of biomass energy (2013)	• Additional biomass capacity: each 200 MW electric and thermal by 2018, each 1325 MW electric and thermal by 2030[1]
	Energy Efficiency Project (2009)	• USD 99.44 million to reduce 10.7 MtCO$_2$e by the end of 2016 are the global benefits of the Energy Efficiency Project
Transport	Biofuels Law (updated 2016)	• 12% requirement of biodiesel or ethanol blend in the gasoline from 2016 [1]
Industry	N/A	• N/A
Buildings	Program for Rational and Efficient use of Energy in Public Buildings (2007)	• Various measures in line with the 10% energy savings by 2016
F-gases	N/A	• N/A
Forestry & Agriculture	Minimum Budgets for Environmental Protection of Native Forest (Presupuestos Minimos de Proteccion) (2007) (+)	• Regulatory frame to control the reduction of native forest surface and achieve lasting surface over time [1]
	National Forest Management Plan with Integrated Livestock (Plan Nacional de Manejo de Bosques con Ganadería Integrada) (2015)	• To improve and maintain ecological and cultural processes in native forest and promote activities for a sustainable management of native forest [2] • Contributes to sustainable use of native forests through incorporating livestock activities in native forest area in a sustainable manner [2]

[1] *No information available on implementation status. For the current analysis, we have assumed full implementation.*
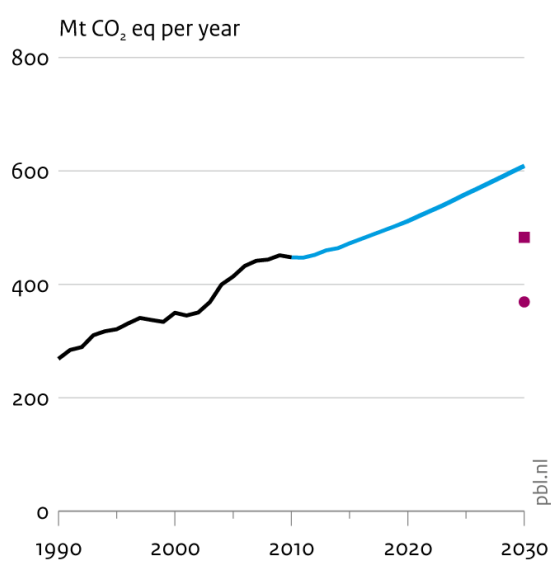
[2] *Policy not quantified in the IIASA LULUCF projections*

Table 6: Impact of climate policies on greenhouse gas emissions (including LULUCF) in Argentina. Absolute emission levels and emission levels relative to 2010 levels are presented. References for official emission data are provided in Table 3.
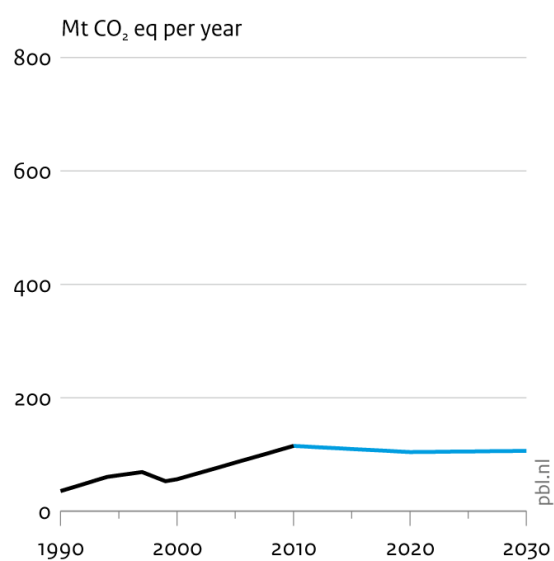
2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	NewClimate estimates	Official data	NewClimate estimates
Absolute: 448 MtCO$_2$e	369 to 483 MtCO$_2$e by 2030	370 to 485 MtCO$_2$e, -18% to 8% by 2030	463 MtCO$_2$e, 3% by 2020 549 MtCO$_2$e, 23% by 2030	510 MtCO$_2$e, 14% to 14% by 2020 610 MtCO$_2$e, 36% by 2030
Per capita: 10.9 tCO$_2$e/capita	N/A	7.5 to 9.8 tCO$_2$e/capita by 2030	N/A	11.2 tCO$_2$e/capita by 2020 12.3 to 12.4 tCO$_2$e/capita by 2030

Impact of climate policies on greenhouse gas emissions in Argentina

Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 1: Impact of climate policies on greenhouse gas emissions in Argentina (including land use, i.e. LULUCF). Source: NewClimate Institute calculations excluding LULUCF based on its analysis for Climate Action Tracker (CAT 2017) and IIASA calculations on LULUCF emissions and removals.

Australia

The Australian government states that it is "on track" to meet its target of 5% below 2000 levels by 2020 (Australian Government 2015a), and that the Emissions Reduction Fund (ERF) plays a major role in lowering the abatement task. However, our current policies scenario that include the abatements of the ERF projects emissions above the pledge level (2 to 4% below 2010 levels by 2020). This contrasting conclusion drawn from our assessment is partly due to the accounting approach for the emissions reductions purchased through ERF. The Australian Government (2015a) counts all emissions reductions purchased in 2015 (92 MtCO$_2$e) in the 2015/16 emissions reporting, although they occur over many years. In our analysis, we distributed the expected emissions reductions over the average contract period of 9 years. The Australian government further considers that it will meet its unconditional 2020 target using surplus ('carryover') of the first commitment period of the Kyoto Protocol (Australian Government 2015b, Australian Government 2016, Loynes 2016).

Australia has stated that it will also meet the 2030 targets (26 to 28% GHG reduction by 2030 from 2005 level) through policies that provide positive incentives to reduce emissions (Australian Government 2016). At the core of Australia's climate change policies is the Emissions Reduction Fund and linked safeguard mechanisms. Our current policies scenario (9 below to 5% above 2010 levels in 2030) shows a significant difference with the NDC trajectory in 2030 (21 to 23% below 2010 levels).

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

Indicator	2020 pledge	NDC (submitted 9 November 2016)
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$_2$O, HFCs, PFCs, SF$_6$ and NF$_3$	• CO$_2$, CH$_4$, N$_2$O, HFCs, PFCs, SF$_6$ and NF$_3$
Consideration of LULUCF	• Land use sector is included • Accounting approach is specified as Kyoto Protocol accounting rules (Article 3.7) [1] • Land use credits: 27 MtCO$_2$e by 2020 (den Elzen et al. 2015)	• Land use sector is included in the target • Net-net approach will be used for emission accounting
Use of bilateral, regional and international credits	• N/A	• N/A
Availability of reference scenarios in the latest UNFCCC submissions	• Yes	• Yes

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

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

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	Emissions Reduction Fund (ERF) (2014) (+)	• Auctions are set up to purchase emissions reductions at the lowest available cost, thereby contracting successful bidders[1]
Energy supply	Renewable Energy Target (RET) (2010) (+)	• 23.5% of electricity should come from renewable sources by 2020, compared to 13% in 2014. The new target[2] for large-scale generation of 33,000 GWh in 2020 would double the amount of large-scale renewable energy being delivered by the scheme compared to current levels
Transport	Fuel tax (2015)	• Fuel tax for diesel and gasoline is set at AUD 0.3814 per litre[3]
Forestry & Agriculture, Waste	The Carbon Farming Initiative [4] (2014) (Now integrated into ERF)	• Encourages sustainable farming and thereby increase carbon storage or reducing GHG emissions from land use. Expected 4.2 $MtCO_2e$ reduction of net LULUCF emissions and 1.9 $MtCO_2e$ reduction of net agriculture emissions by 2020, relative to 2010.
	20 Million Trees Programme (2014)	• Plant 20 million trees by 2020 (20,000 ha) to re-establish green corridors and urban forests.
	The Carbon Farming Futures (2011) (Now integrated into ERF) (+)	• 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.[5]
Other	HFC emissions reduction under the Montreal Protocol (2016)	• Reduce HFC emissions by 55% by 2030, relative to 2010 (85% by 2036)

[1] Not quantified in PBL IMAGE framework

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

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

[4] Australian Government (2015c)

[5] Policy not quantified in the IIASA LULUCF projections

Table 9: Impact of climate policies on greenhouse gas emissions (including LULUCF) in Australia. Absolute emission levels and emission levels relative to 2010 levels are presented. Note that the official values for 2020 and 2030 are based on GWP values from the IPCC 4th Assessment Report. References for official emission data are provided in Table 3.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates
Absolute: 544 MtCO2e	530 MtCO2e by 2020	400 to 505 MtCO2e, -27% to -7% by 2020 415 to 430 MtCO2e, -23% to -21% by 2030	577 to 656 Mt CO2e by 2020 724 MtCO2e by 2030	520 to 535 MtCO2e, -4% to -2% by 2020 495 to 570 MtCO2e, -9% to 5% by 2030
Per capita: 24.6 tCO2e/capita	N/A	15.7 to 19.9 tCO2e/capita by 2020 14.8 to 15.2 tCO2e/capita by 2030	N/A	20.5 to 21 tCO2e/capita by 2020 17.4 to 20.2 tCO2e/capita by 2030

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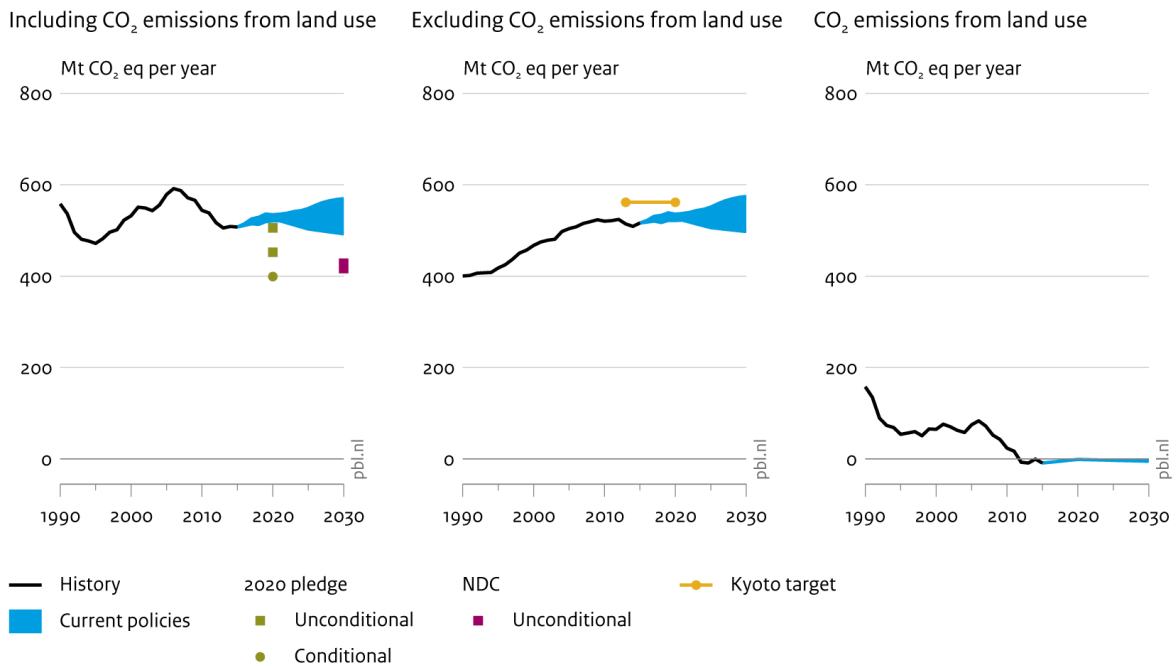
Source: PBL FAIR/TIMER model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

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

Brazil

The main GHG mitigation policies in Brazil include the policies in the LULUCF sector, i.e. the enforcement of the Brazilian Forest Code and efforts to reduce deforestation in the Amazon and Cerrado regions. Even though the annual deforestation rate in the Legal Amazon has risen during the last two years (PRODES 2016), it is expected that successful implementation and enforcement of the proposed measures can lead to long-term reduction of net GHG emissions. Other updates with respect to Kuramochi et al. (2016) include biofuel policy updates and power capacity targets only including capacity that is currently under construction. If all implemented policies are successful, emissions (including those from LULUCF) may reach about 8% below to 11% above 2010 levels by 2030. Our analysis shows that Brazil is likely on track to meet its NDC with currently implemented policies. In its NDC Brazil announced a 45% share of renewables in the energy mix by 2030, and a 75% share of renewables in its electricity supply by 2030, but we don't include these planned policies in our analysis.

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

Indicator	2020 pledge	NDC (21 September 2016)
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	• IPCC guidelines; 100-year GWPs from the Fifth Assessment Report
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
Availability of reference scenarios in the latest UNFCCC submissions	• No	• No
Last available year for GHG inventory reporting	• 2012 (national inventory) • 2015 (2017)	

Table 11: Overview of key climate change mitigation policies in Brazil. Source: (Ministry of Mines and Energy 2012); (Government of Brazil 2008)

| Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	2020 pledge anchored in national law (2010)	• Not specified
Energy supply	10-year National Energy Expansion Plan (2011)	• 16.5 GW wind, 13 GW biomass, 5.6 GW small hydropower[2] and 88.5 GW large hydropower installed by 2025 (currently under construction) • 41.4% renewable share in total primary energy supply by 2022 (45% by 2024)
	National Plan on Climate Change (2008)	• 16% renewable electricity (excl. hydro) by 2020 (supported by renewable energy auctions, Government of Brazil 2007)
Transport	National Plan on Climate Change (2008)	• Not specified
	National Biodiesel Programme (2005)	• Biodiesel share in diesel of 7% from 2015 and 10% from 2019 onwards
	Ethanol Blending Mandate (1993)	• Bioethanol share in gasoline of 25% from 2015 onwards
	Inovar-Auto (2012)	• 30% tax on cars sold between 2013 and 2017, but not for cars meeting 1.82 MJ/km. Expected average fuel efficiency 1.14 MJ/pkm by 2017
Forestry & Agriculture	The Brazilian Forest Code (2012) (+)	• 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
	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 (1996)	• Zero illegal deforestation by 2030 in the Amazon and compensating for greenhouse gas emissions from legal suppression of vegetation by 2030

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

[2] *Not included in PBL TIMER model*

Table 12: Impact of climate policies on greenhouse gas emissions (including LULUCF) in Brazil. Absolute emission levels and emission levels relative to 2010 levels are presented. References for official emission data are provided in Table 3.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates
Absolute: 1,301 MtCO$_2$e	2,070 MtCO$_2$e by 2020	1,975 to 2070 MtCO$_2$e, 52% to 59% by 2020 1,195 MtCO$_2$e, -8% by 2030	1,300 MtCO$_2$e by 2025 1,200 MtCO$_2$e by 2030	1,270 to 1,425 MtCO$_2$e, -3% to 10% by 2020 1,205 to 1,445 MtCO$_2$e, -8% to 11% by 2030
Per capita: 6.6 tCO$_2$e/capita	N/A	9.2 to 9.7 tCO$_2$e/capita by 2020 5.3 tCO$_2$e/capita by 2030	N/A	5.9 to 6.7 tCO$_2$e/capita by 2020 5.3 to 6.4 tCO$_2$e/capita by 2030

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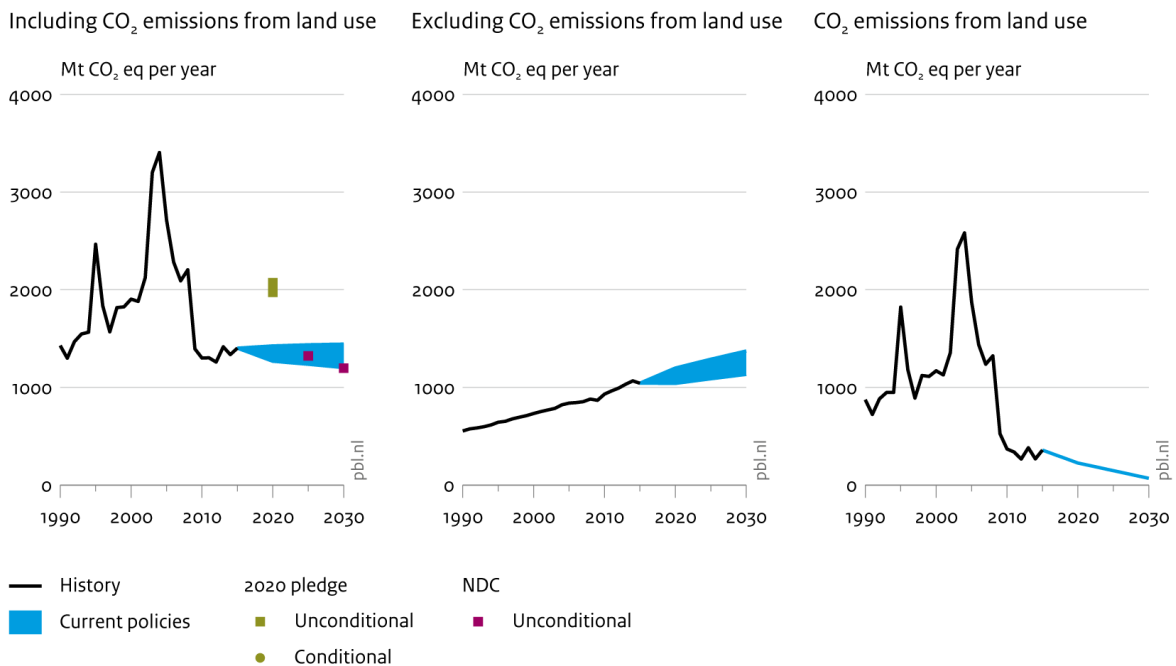
Source: PBL FAIR/TIMER model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 3: Impact of climate policies on greenhouse gas emissions in Brazil (left panel: all gases and sectors, middle panel: excluding land use (i.e. LULUCF) and right panel: only land use). Source: NewClimate Institute calculations based on Climate Action Tracker (CAT 2017) and PBL calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals (REDD-PAC Brazil 2015).

Canada

Canada's fuel efficiency standard for passenger vehicles has the largest projected effect on GHG emissions of any policy, and is harmonised with US standards. Another policy is the carbon standard for newly built coal-fired power plants, but its impact on future GHG emissions may be limited as it does not apply to existing power plants. Under current policies, Canada is projected to emit about 650 to 760 $MtCO_2e$ by 2030 excluding LULUCF (5% below to 11% above 2010 levels) and therefore not meet its NDC (17% below 2005 level). Canada has recently proposed a plan to price carbon pollution that would require individual provinces to either place a direct price on carbon pollution or adopt a cap and trade system. This planned policy was not included in our analysis. Four provinces already have carbon pricing systems in place (considered as current policies).

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

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

Indicator	2020 pledge	NDC (5 October 2016)
Target: unconditional	• 17% GHG reduction by 2030 from 2005 level	• 30% GHG reduction by 2030 from 2005 level
Target: conditional	• N/A	• N/A
Sectoral coverage	• Economy-wide	• Economy-wide
General Accounting method	• IPCC guidelines; 100-year GWPs from 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 • Net-net approach will be used for emission accounting [1] • Excludes emissions from natural disturbances • LULUCF accounting could produce 19 $MtCO_2e$ to 28 $MtCO_2e$ of credits per year (Government of Canada 2014, CAT 2015) [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
Availability of reference scenarios in the latest UNFCCC submissions	• Yes	• Yes

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

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

Table 14: Overview of key climate change mitigation policies in Canada. Source: Government of Canada (2014, 2015)

| Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Energy supply	CO_2 standard for new power plants (2012)	• 420 gCO_2/kWh from 1 July 2015
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) – 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 CEPA) (2008)	• Bio-ethanol share in gasoline of 5% from 2011 onwards • Biodiesel share in diesel of 2% from 2011 onwards
Buildings	EcoENERGY efficiency (2011)	• Supported the implementation of energy codes, among other things, to improve energy efficiency of buildings.[1]
Forestry & Agriculture	The Growing Forward 2 (2013)	• Supports the initiatives to advance environmentally sustainable agriculture [2]

[1] *Quantified in PBL TIMER model as building codes for space heating, which resulted in 0.1 MtCO2 emission reduction by 2020, relative to the SSP2 baseline. The second biennial report estimated the mitigation impact of this policy to be 6.5 MtCO2 by 2020, relative to their baseline (Government of Canada 2015).*

[2] *Policy not quantified in the IIASA LULUCF projections*

Table 15: Impact of climate policies on greenhouse gas emissions (excluding LULUCF) in Canada. Absolute emission levels and emission levels relative to 2010 levels are presented. Note that the official values are based on GWP values from the IPCC 4th Assessment Report. References for official emission data are provided in Table 3.

2010 GHG emissions, excl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates
Absolute: 685 MtCO$_2$e	622 MtCO$_2$e by 2020, 523 MtCO$_2$e by 2030	605 MtCO$_2$e, -12% by 2020 510 MtCO$_2$e, -25% by 2030	768 MtCO$_2$e by 2020, 815 MtCO$_2$e by 2030	670 to 725 MtCO$_2$e, -2% to 6% by 2020 650 to 760 MtCO$_2$e, -5% to 11% by 2030
Per capita: 20.1 tCO$_2$e/capita	N/A	16.1 tCO$_2$e/capita by 2020 12.6 tCO$_2$e/capita by 2030	N/A	17.9 to 19.2 tCO$_2$e/capita by 2020 16 to 18.7 tCO$_2$e/capita by 2030
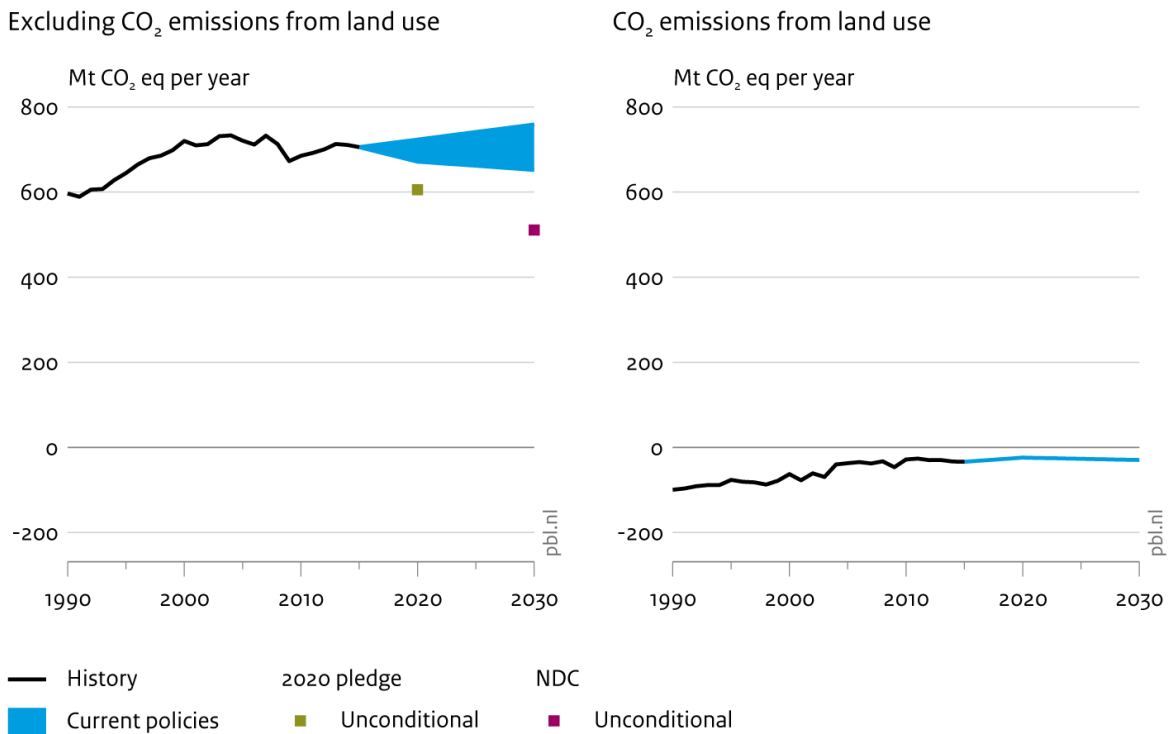
Impact of climate policies on greenhouse gas emissions in Canada

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

Figure 4: Impact of climate policies on greenhouse gas emissions in Canada (left panel: including land use (i.e. LULUCF) and right panel: only land use). Source: NewClimate Institute calculations adapted from Climate Action Tracker (CAT 2017) and PBL calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals.

Chile

By 2030 Chile aims to reduce its GHG emissions intensity per unit GDP by 30% from 2007 levels under unconditional NDC and 35% to 45% under conditional NDC, which is subject international support. Chile is estimated to emit 163 $MtCO_2e$/year by 2030 and 128-151 $MtCO_2e$/year under its unconditional conditional NDC, respectively. Some of its most relevant current policies are the Non-Conventional Renewable Energy Law (NCRE) Law 20698 (20% renewable energy target for 2025) and the Energy Efficiency Action Plan (12% reduction of the final energy demand below BAU by 2020).

Under current policies, GHG emissions in 2030 are projected to be around 185 $MtCO_2e$ excluding LULUCF. We conclude that Chile is not on track to achieve its unconditional NDC target.

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

Indicator	2020 pledge	NDC (submitted 10 February 2017)
Target: unconditional	• N/A	• 30% GHG reduction per unit GDP by 2030, from 2007 levels
Target: conditional	• 20% reduction compared to BAU emission growth trajectory (as projected from year 2007) in 2020; conditional to a relevant level of international support	• Until 35% to 45% GHG reduction per unit GDP by 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 the Fourth Assessment Report
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 related to increased sequestration from native forest management, and 0.9 – 1.2 $MtCO_2e$/year related 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
Availability of reference scenarios in the latest UNFCCC submissions	• No	• Yes, the baseline scenario from the MAPS Chile Project (2014), which incorporates all relevant policy measures up to 2013, was used as reference scenario.

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

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	Energy Efficiency Action Plan (2012)	• 12% reduction of final energy demand below business-as-usual (BAU) by 2020 (as projected from 2010)
Energy supply	Law 20698: Non-Conventional Renewable Energy Law (NCRE) (2013) (+)	• Utilities larger than 200MW to generate 5% of electricity from renewable sources in 2013 with continued increase to 12% in 2020, 18% in 2024 and 20% in 2025. The non-conventional renewable energy sources do not include hydro larger than 40MW.
	Law 20698: Non-Conventional Renewable Energy Law (NCRE) (2013) (+)	• Utilities larger than 200MW to generate 5% of electricity from non-conventional renewable sources in 2013 with continued increase to 12% in 2020, 18% in 2024 and 20% in 2025. The non-conventional renewable energy sources do not include hydro larger than 40MW.
	Energy Plan 2050 (2016)	• Target to generate 60% of electricity from renewable sources (incl. large hydro) in 2035 and 70% in 2050
Transport	Law 20780: "Green tax" second stage[1][2] (+) 2016	• The second stage of the "green tax" mandates: 50% tax increase of NOx emissions by 2016, this is: 10% tax increase for gasoline based vehicles and 40% increase for diesel based vehicles. By 2017, there will be another 50% tax increase for NOx emissions
	Energy Efficiency Action Plan (2012)	• Vehicle labelling system and setting of minimum energy efficiency standards for vehicles to achieve a 12% of energy saving below BAU by 2020
Industry	Energy Efficiency Action Plan (2012)	• Promote energy management systems, energy efficient technologies, and cogeneration to reduce energy consumption
Buildings	Energy efficiency in public buildings (2012)	• 20% of energy savings below BAU by 2020
F-gases	N/A	• N/A
Forestry	National Forest and Climate Change Strategy (+) (2013)	• Recovery of 100,000 hectares of forest land, mainly native species
	Forestation program	• Reforestation of 100,000 hectares of forest

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

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

Table 18: Impact of climate policies on greenhouse gas emissions (excluding LULUCF) in Chile. Absolute emission levels and emission levels relative to 2010 levels are presented. References for official emission data are provided in Table 3.

2010 GHG emissions, excl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	NewClimate estimates	Official data	NewClimate estimates
Absolute: 92 MtCO$_2$e	N/A	100 MtCO$_2$e, 8% by 2020 130 to 165 MtCO$_2$e, 40% to 78% by 2030	N/A	150 MtCO$_2$e, 62% by 2020 185 MtCO$_2$e, 100% by 2030
Per capita: 5.4 tCO$_2$e/capita	N/A	5.4 tCO$_2$e/capita by 2020 6.6 to 8.3 tCO$_2$e/capita by 2030	N/A	8.1 tCO$_2$e/capita by 2020 9.4 tCO$_2$e/capita by 2030

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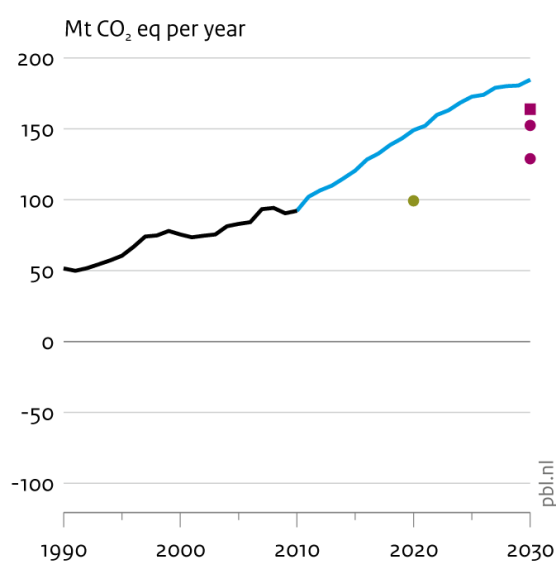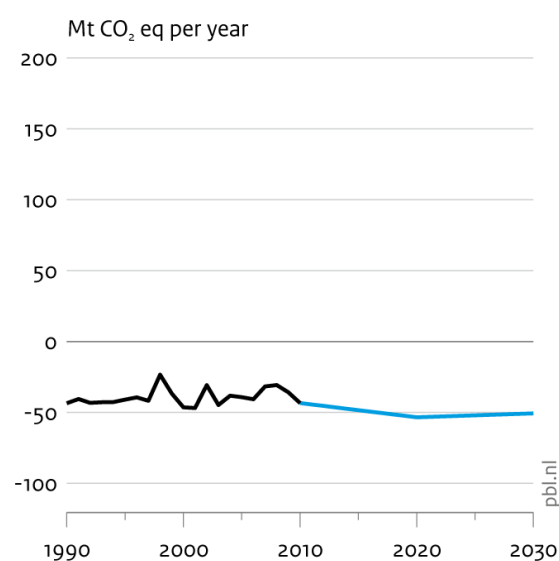
Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 5: Impact of climate policies on greenhouse gas emissions in Chile (left: excluding land use (i.e. LULUCF), right: only land use). Source: NewClimate Institute calculations based on its analysis for Climate Action Tracker (CAT 2017) excluding LULUCF, and IIASA calculations on LULUCF emissions and removals. Please see Appendix (A2) on the consideration of LULUCF for the NDC quantification.

China

China has pledged to peak CO_2 emissions around 2030, to achieve 20% share of non-fossil energy sources in total primary energy consumption by 2030, and to reduce the carbon intensity of its GDP by 60-65% compared to 2005 levels. Our current policies scenario, which take the latest renewable capacity targets into account, as well as a cap on coal consumption, projects that China's policies are more or less in line with what the NDC targets would mean for overall emissions, which will keep rising until 2030 but with a much slower growth rate than in the previous decade, reaching 12.4 to 14.9 $GtCO_2e$/year in 2030. In the lower end of the range shown in the graph, CO_2 emissions have already peaked and slowly decrease toward 2030, based on the assumption that the trend in decreasing coal consumption observed in the last years will continue. The timing of the emissions peak in China is still uncertain: while some are optimistic and say China may have peaked already in 2014 (Green and Stern 2016), others are more pessimistic and consider potentially increasing emissions from energy consumption in spite of a decline of coal (Peters 2017).

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

Indicator	2020 pledge	NDC (submitted 3 September 2016)
Target: unconditional	• 40-45% CO_2 emission intensity reduction by 2020; 15% non-fossil fuels in primary energy consumption and increased forest stock volume	• Peaking CO_2 emissions around 2030; 60-65% CO_2 emission intensity reduction by 2030, compared to 2005 levels; 20% non-fossil fuels in primary energy consumption by 2030 and increased forest stock volume
Target: conditional	• N/A	• N/A
Sectoral coverage	• Not specified	• Not specified
General Accounting method	• Not specified	• Not specified
GHGs covered	• CO_2 only	• CO_2 only
Consideration of LULUCF	• Targets for the land use sector are included • The forest stock in China will be increased by 1.3 billion m^3 by 2020, compared to the 2005 level • Accounting approaches and methodologies are not specified	• Targets for the land use sector are included the INDC • The forest stock in China will be increased by 4.5 billion m^3 by 2030, compared to the 2005 level • 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 target (20% of TPES by 2030) • Gas target (10% of TPES by 2020) • Coal cap (max. 58% of TPES by 2020)
Availability of reference scenarios in the latest UNFCCC submissions	• N/A	• N/A

Table 20: Overview of key climate change mitigation policies in China, Source: (The People's Republic of China 2012, The People's Republic of China 2014a, The People's Republic of China 2014b, State Council 2015). 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)	• Emission trading program to be expanded to nationwide scale by 2017
	13th Five Year Plan (2016-2020)	• Cap on total primary energy use in 2020 at 5.0 billion tce • Decrease CO_2 intensity by 18% between 2015 and 2020
	The Thirteenth Five Year Energy Development Plan	• Limit share of coal to 58% of total energy consumption
Energy supply	Energy Development Strategy Action Plan 2014-2020	• Cap on coal consumption in 2020 at 4.2 billion tce • A 10% target share of gas in primary energy supply in 2020 • 15% non-fossil share in TPES in 2020 • Renewable electricity: 350 GW hydropower excl. pumped storage, 200 GW wind, 100 GW solar, 30 GW biomass, 0.1 GW tidal[4] • 800 million m² 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 power plant standard of 889 gCO_2/kWh by 2020)
Transport	Vehicle fuel economy standards (2005)	• Fuel efficiency of new light duty vehicles: 1.5 MJ/pkm by 2015, 1.1 MJ/pkm by 2020 • Fuel efficiency of new medium duty trucks: 0.19 MJ/tkm to 0.29 MJ/tkm and 0.08 to 0.13 MJ/tkm since 2015
	Biofuel targets	• Ethanol blending mandates 10% in selected provinces
Industry	"Made in China 2025" CO_2 intensity target (2013)	• Manufacturing industries reduce their CO_2 emissions per unit of added value by 22% by 2020 and 40% by 2025 from 2015 levels[1,2]
	Green industry development plan (2016-2020) China 2016	• Decrease energy consumption per value added by 18% between 2015 and 2020.
Buildings	Appliance standards and labelling programme	• Supplemented with subsidies and awareness-raising campaigns*
	National Building Energy Standard	• 30% of newly constructed to meet standards by 2020[5]
Table to be continued on next page		

F-gases	N/A	• N/A
Forestry	Promotion of afforestation and sustainable forest management	• Increasing the forest area by 40 million hectares and the forest stock volume by 1.3 billion m^3 from 2005 levels by 2020.
	Program Plan of Fast Growing and High Yielding Timber Plantations (2001)	• Establishment of at least 15 million hectares of fast-growing, high-yield plantations, of which 5.8 million hectares of fast-growing pulpwood plantations
	Mid and Long-Term Plan for National Forest Management (2011)	• Building young and mid-aged forest tending areas and transformation of low-yield forest area in the range of 35 million hectares [3]

[1] *Not quantified in PBL TIMER model*

[2] *Not quantified by NewClimate Institute calculations*

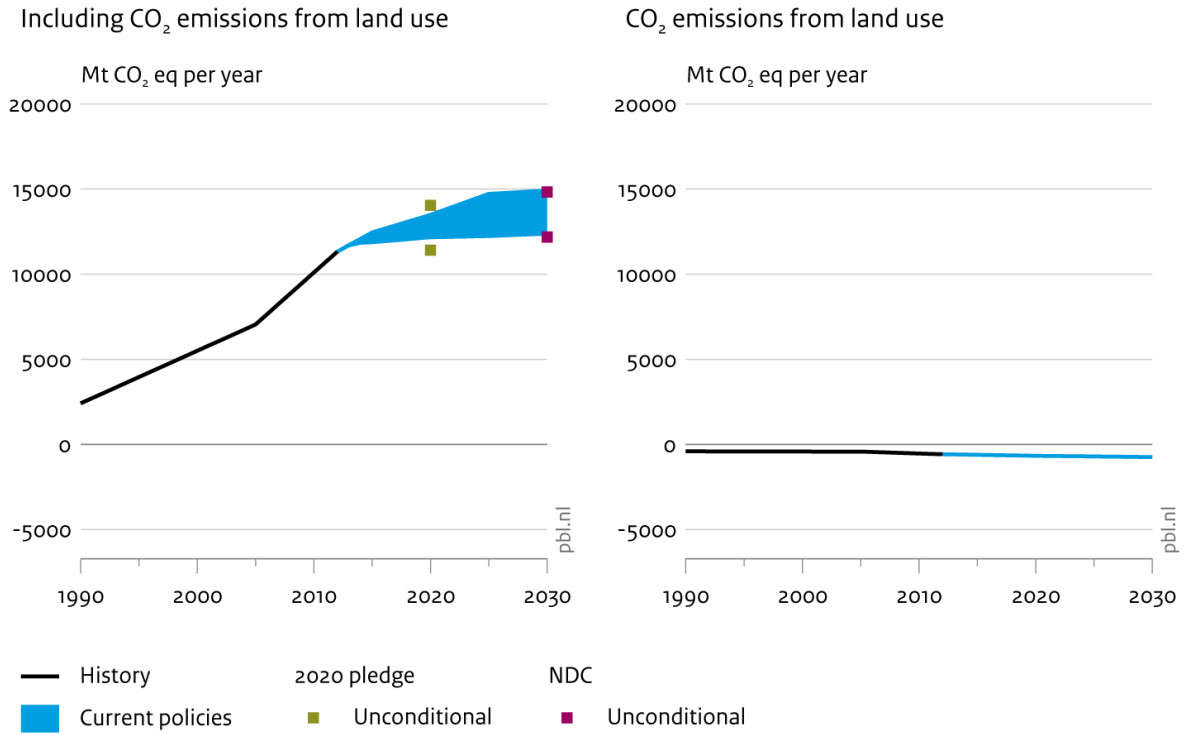[3] *Policy not quantified in the IIASA LULUCF projections*

[4] *NewClimate used capacity targets from 13th FYP: 340 GW hydro, 210 GW wind, 110 GW solar, 15 GW biomass, 58 GW nuclear*

[5] *Implemented by PBL via assuming standard means 439 MJ/m²*

Table 21: Impact of climate policies on greenhouse gas emissions (including LULUCF) in China. Absolute emission levels and emission levels relative to 2010 levels are presented. References for official emission data are provided in Table 3.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	**PBL and NewClimate estimates**	**Official data**	**PBL and NewClimate estimates**
Absolute: 10,100 MtCO$_2$e	14,500 MtCO$_2$e	11,415 to 14,040 MtCO$_2$e, 12% to 34% by 2020 12,180 to 14,830 MtCO$_2$e, 19% to 39% by 2030	N/A	12,170 to 13,485 MtCO$_2$e, 21% to 34% by 2020 12,380 to 14,910 MtCO$_2$e, 23% to 48% by 2030
Per capita: 7.4 tCO$_2$e/capita	N/A	8.0 to 9.9 tCO$_2$e/capita by 2020 8.5 to 10.3 tCO$_2$e/capita by 2030	N/A	8.5 to 9.5 tCO$_2$e/capita by 2020 8.6 to 10.3 tCO$_2$e/capita by 2030

Impact of climate policies on greenhouse gas emissions in China

Including CO$_2$ emissions from land use

CO$_2$ emissions from land use

Mt CO$_2$ eq per year

Mt CO$_2$ eq per year

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

Figure 6: Impact of climate policies on greenhouse gas emissions in China (left panel: all gases and sectors, and right panel: only land use (i.e. LULUCF)). Source: NewClimate Institute calculations (excluding LULUCF) based on its analysis for the Climate Action Tracker (CAT 2017) and PBL Calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals.

Colombia

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

The emissions projections under current policies range at 155 to 215 $MtCO_2e$ in 2030, thus Colombia will overachieve its unconditional INDC target with existing policies. The projections have been revised downward from the 2016 report because BAU projections provided in Colombia's INDC used for the calculations have been harmonised with the recently submitted inventory (last data year: 2012), which led to significant reductions in BAU emission levels in 2020 (ranging from 58 to 69 $MtCO_2e$/year) and 2030 (ranging from 58 to 83 $MtCO_2e$/year).

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

Indicator	INDC (submitted 7 September 2015)
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 the 2nd IPCC Assessment Report
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 still 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) with the objective of contributing the emissions reduction target
Availability of reference scenarios in the latest UNFCCC submissions	• Yes, INDC shows a BAU emissions pathway

Note: Colombia has not set its 2020 pledge.

Table 23: Overview of key climate change mitigation policies in Colombia. Source: (IEA 2013, Colombian Government 2014, Ministry of Environment and Sustainable Development 2016, Ministry of External Relations 2016, NAMA Facility 2016)

| Sector	Policies (marked with "(+)" when mentioned in the INDC document)	Description
Economy-wide	Colombian Low-Carbon Development Strategy (+) (ECDBC) (2012)	• Through the implementation of 8 Sectorial Mitigation Action Plans (SMAPs), approved by the relevant sectorial Ministries, the ECDBC aims to deviate from BAU emissions growth, estimated to be over 60% from current levels by 2030
Energy supply	Law 697: Programme for rational and efficient use of energy and other forms of non-conventional Energy (PROURE) (2010)	• PROURE plans to achieve a 20% and 30% of RE sources by 2015 and 2020, respectively
Buildings	NAMA II Project – For the domestic refrigeration sector (2017-2021)	• GHG emissions reduction of 16.8 MtCO$_2$e over the lifetime of the equipment, and an annual reduction of around 3.8 MtCO$_2$e by 2030, which is a 50% reduction from BAU in the sector
Transport	NAMA I Project – Colombia Transit Development (TOD) (2015)	• Estimated reductions of annual GHG emissions by 3.6 to 5.5 MtCO$_2$e by 2040.
F-gases	N/A	• N/A
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)	• Achieve zero net deforestation by 2020 [1]
	REDD+ Zero Deforestation in the Amazon by 2020 (2009)	• REDD+ consists of 4 phases strategy with a total of 18.5 million USD for planning and implementation [11]

[1] *Policy is not implemented in the IIASA LULUCF projections*

Table 24: Impact of climate policies on greenhouse gas emissions (including LULUCF but excluding net removals from natural forests) in Colombia. Absolute emission levels and emission levels relative to 2010 levels are presented. References for official emission data are provided in Table 3.

2010 GHG emissions, incl. LULUCF	2020 pledge and INDC		Current policies	
	Official data	NewClimate estimates	Official data	NewClimate estimates
Absolute: 181 MtCO$_2$e	235 to 268 MtCO$_2$e by 2030, 29% to 48% by 2030	235 to 270 MtCO$_2$e, 29% to 48% by 2030	N/A	155 to 170 MtCO$_2$e, -16% to -5% by 2020 155 to 215 MtCO$_2$e, -14% to 19% by 2030
Per capita: 3.9 tCO$_2$e/capita	N/A	4.4 to 5.0 tCO$_2$e/capita by 2030	N/A	3.0 to 3.4 tCO$_2$e/capita by 2020 2.9 to 4 tCO$_2$e/capita by 2030

Impact of climate policies on greenhouse gas emissions in Colombia

Including CO$_2$ emissions from land use, excluding net removals from natural forests
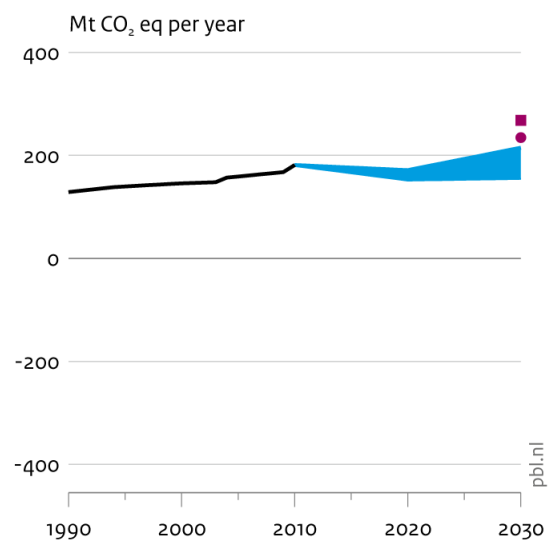
CO$_2$ emissions from land use including net removals from natural forests
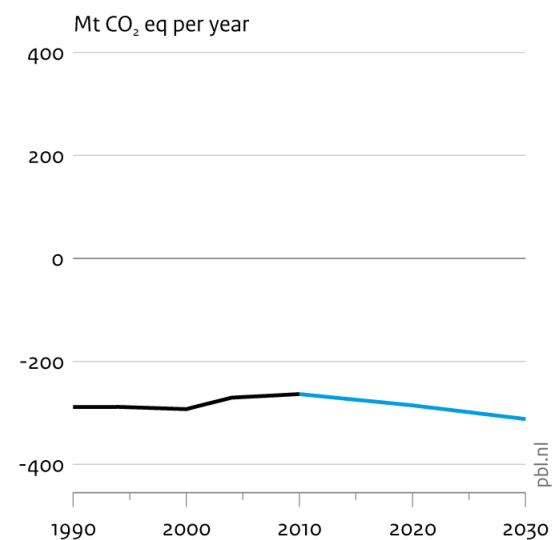
Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 7: Impact of climate policies on greenhouse gas emissions in Colombia (left: including land use (i.e. LULUCF), right: only land use). Source: NewClimate Institute calculations excluding LULUCF and IIASA calculations on LULUCF emissions and removals.

Note: the BAU emission projection in Colombia's INDC excludes removals from natural forests, which accounted for 263 MtCO$_2$e/yr in 2010. Therefore, net removals from natural forests are excluded from the current policies scenario and INDC analysis (figure on the left) but included in the figure on the right.

Democratic Republic of the Congo (DRC)

In its INDC, the Democratic Republic of the Congo (DRC) pledges to reduce emissions by 17% by 2030 compared to a business-as-usual (BAU) emissions scenario, or a 73 MtCO$_2$e/year reduction in absolute terms. The target covers the agriculture, forestry and energy sectors and it is conditional on international financial support. Under its INDC, DRC's GHG emissions including LULUCF would increase from 234 MtCO$_2$e/year in 2010 up to 357 MtCO$_2$e/year by 2030.

Under current policies, DRC's GHG emissions are projected to increase to 455 MtCO$_2$e/year by 2030. This means that DRC is not on track to achieve its INDC in the LULUCF sector. While current peatland emissions in the DRC are reported to be minor, they may become large in the future if concessions are provided for the vast peat land areas and they were to become exploited in an industrial manner (Dargie, Lewis et al. 2017).

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

Indicator	INDC (submitted 18 August 2015)
Target: unconditional	• The INDC is partially conditional, see below
Target: conditional	• 17% reduction compared to BAU emission 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
Availability of reference scenarios in the latest UNFCCC submissions	• The INDC refers to the emissions level under a BAU scenario by 2030 (430 MtCO$_2$e) and provides a graph showing the pathways of the emissions development.

Note: D.R. Congo has not set its 2020 pledge.

Table 26: Overview of key climate change mitigation policies in the Democratic Republic of the Congo (only LULUCF policies were assessed). Source: (REDD-PAC DRC 2016). References for official emission data are provided in Table 3.

| Sector	Policies (marked with "(+)" when mentioned in the INDC document)	Description
Economy-wide	Not assessed	• Not assessed
Energy supply	Not assessed	• Not assessed
Transport	Not assessed	• Not assessed
Industry	Not assessed	• Not assessed
Buildings	Not assessed	• Not assessed
F-gases	Not assessed	• Not assessed
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) (+)	• Increase the national forest cover [1]
	Sustainable timber management (Plan de convergence COMIFAC) (2015)	• Sustainable timber harvests in existing forest concessions following management plans

[1] *Policy not quantified in the IIASA LULUCF projections*

Table 27: Impact of LULUCF policies on greenhouse gas emissions (including LULUCF) in the Democratic Republic of the Congo. Absolute emission levels and emission levels relative to 2010 levels are presented.

2010 GHG emissions, incl. LULUCF	2020 pledge and INDC		Current policies	
	Official data	NewClimate estimates	Official data	NewClimate estimates
Absolute: 234 MtCO$_2$e	357 MtCO$_2$e in 2030, 94% by 2030	355 MtCO$_2$e, 94% by 2030	N/A	365 MtCO$_2$e, 56% by 2020 455 MtCO$_2$e, 94% by 2030
Per capita: 3.6 tCO$_2$e/capita	N/A	3.0 tCO$_2$e/capita by 2030	N/A	4.1 tCO$_2$e/capita by 2020 3.8 tCO$_2$e/capita by 2030

Impact of climate policies on greenhouse gas emissions in Republic of the Congo

Including CO$_2$ emissions from land use

CO$_2$ emissions from land use

Mt CO$_2$ eq per year

Mt CO$_2$ eq per year
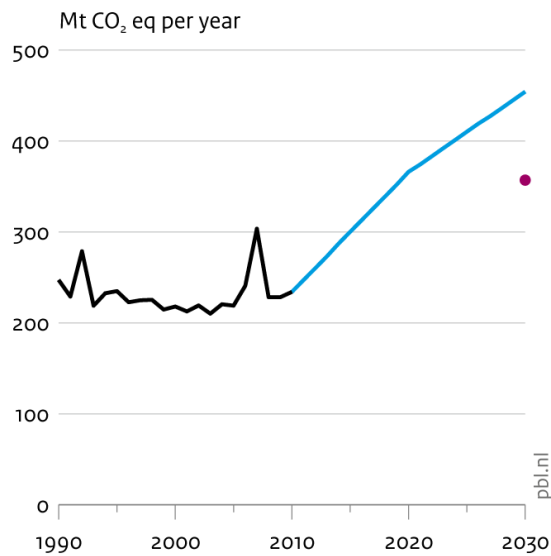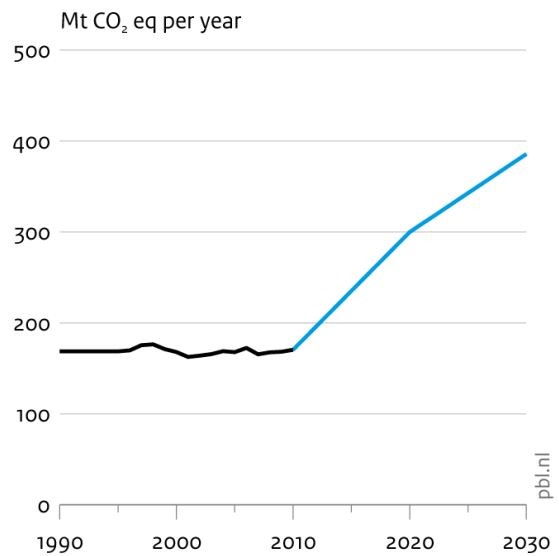
Legend:
— History
— Current policies
INDC
● Conditional

Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 8: Impact of climate policies on greenhouse gas emissions (upper figure: incl. land use (i.e. LULUCF), lower figure: land use only) in the Democratic Republic of the Congo. Source: NewClimate Institute calculations excluding LULUCF and IIASA calculations on LULUCF emissions and removals (REDD-PAC DRC 2016).

Ethiopia

Ethiopia pledged a partially conditional NDC target to reduce GHG emissions by 64% below BAU by 2030, which constitutes a total reduction of at least 255 MtCO$_2$e. The current policies projection mainly considers the Growth and Transformation Plan (GTP) phase I (2010-2015) and some initiatives under the Climate Resilience and Green Economy Strategy.

Ethiopia's GHG emissions are projected to be 235-300 MtCO$_2$e by 2030 (including LULUCF) under current policies. Ethiopia would, therefore, need to implement additional policies to achieve its NDC target. The current policies projections currently do not consider the second phase of the Growth and Transformation Plan (GTP II) (2016-2020) due to uncertainty on how the Climate Resilience and Green Economy Strategy shall is fully implemented until 2025.

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

Indicator	NDC (submitted 9 March 2016)
Target: unconditional	• N/A
Target: partially conditional	• 64% GHG reduction (255 MtCO$_2$e 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$_2$O
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$_2$e from agriculture and 130 MtCO$_2$e from forestry by 2030 as compared to projected BAU levels. These reductions are part of the total reduction target. • Accounting approaches and methodologies are not specified
Use of bilateral, regional and international credits	• Yes. Expected amount not quantified.
Availability of reference scenarios in the latest UNFCCC submissions	• Yes. BAU scenario until 2030 (Federal Democratic Republic of Ethiopia 2015).

Note: Ethiopia has not set its 2020 pledge.

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

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$_2$e (250 MtCO$_2$e 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$_2$e/yr by 2030
Industry	N/A	• N/A
Buildings	N/A	• N/A
F-gases	N/A	• N/A
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 years planning period.

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

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

[3] Excluded due to its uncertain development status.

Table 30: Impact of climate policies on greenhouse gas emissions (including LULUCF) in Ethiopia. Absolute emission levels and emission levels relative to 2010 levels are presented. Official values for 2030 are based on GWP values from the IPCC 4th Assessment Report. References for official emission data are provided in Table 3.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	NewClimate estimates	Official data	NewClimate estimates
Absolute: 169 MtCO₂e	145 MtCO₂e, -18% by 2030	145 MtCO₂e, -15% by 2030	N/A	190 to 200 MtCO₂e, 11% to 19% by 2020 235 to 300 MtCO₂e, 38% to 78% by 2030
Per capita: 1.9 tCO₂e/capita	N/A	1.0 tCO₂e/capita by 2030	N/A	1.7 to 1.8 tCO₂e/capita by 2020 1.7 to 2.2 tCO₂e/capita by 2030

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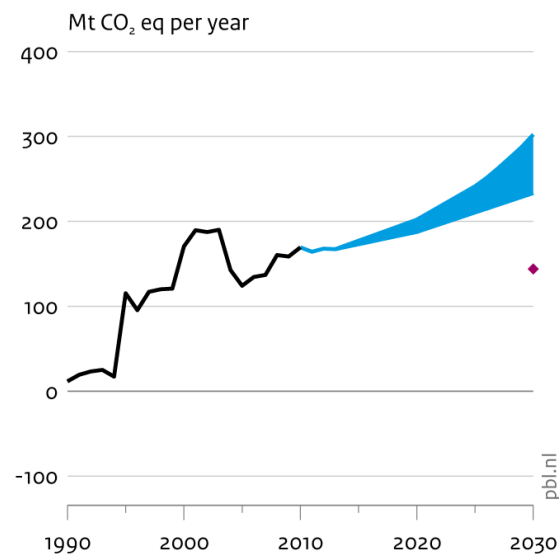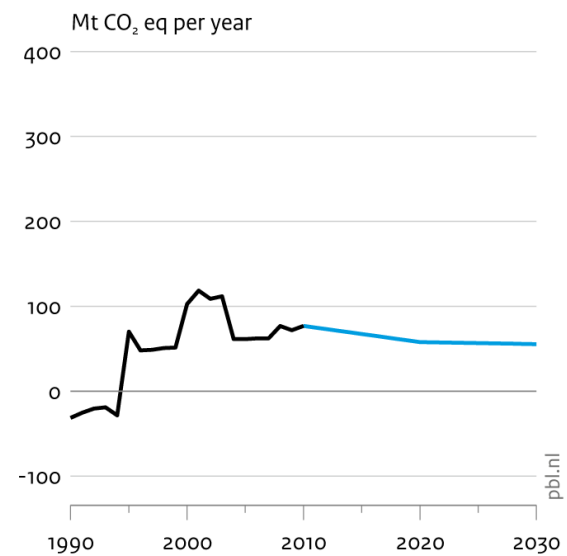
Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 9: Impact of climate policies on greenhouse gas emissions (CO_2, CH_4 and N_2O) including land use (i.e. LULUCF) in Ethiopia. Source: NewClimate Institute calculations excluding LULUCF based on its analysis for Climate Action Tracker (CAT 2017) and IIASA calculations on LULUCF emissions and removals.

European Union

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

Under current policies, the EU is likely to overachieve its unconditional 2020 pledge but is projected to be short of its NDC target. Compared to the 2016 report, the projection range has been revised downward mainly due the revised historical emissions data (about 50 MtCO$_2$e/year lower in 2010, excluding the LULUCF sector) and the revised data harmonisation year. Emissions projections for Annex I countries are harmonised to 2015 inventory emissions (instead of 2010 in the previous report). For the EU the rate of emissions reductions observed between 2010 and 2015 was faster than our model projections for the same period.

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

Indicator	2020 pledge	NDC (5 October 2016)
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$_2$O, HFCs, PFCs, SF$_6$ and NF$_3$	• CO$_2$, CH$_4$, N$_2$O, HFCs, PFCs, SF$_6$ and NF$_3$
Consideration of LULUCF	• Land use sector is not included in the target	• Land use sector is included in the target • A decision on how to include land use is specified to be taken at a later stage [1]
Use of bilateral, regional and international credits	• No	• No
Availability of reference scenarios in the latest UNFCCC submissions	• Yes	• Yes
Last available year for GHG inventory reporting	• 2015 (GHG inventory report submitted to the UNFCCC)	

[1] *A legislative proposal has since then been presented by the European Commission (European Commission 2016)*

Table 32: Overview of key climate change mitigation policies in the EU. Source: (European Parliament 2009b, European Parliament 2009d, European Parliament 2009c, European Parliament 2009a, European Parliament 2012, European Commission 2015, EEA 2016, European Commission 2016)

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy/ state wide	EU ETS Directive (2003/87/EC revised by Directive 2009/29/EC)	• Emission cap on emissions from electricity/heat and industry of 21% below 2005 levels, by 2020
Energy supply	Renewable Energy Roadmap/ Directive (2009/28/EC)	• Target of 20% renewable energy by 2020
	Energy Efficiency Directive (2012/27/EC)	• Target of 20% energy efficiency improvement by 2020
Buildings	Eco-design Framework Directive (Directive 2009/125/EC)	• Specific standards for a wide range of appliances
	Building Energy Efficiency Directive (2012)	• Near zero energy buildings by 2020 (residential) and by 2018 (public)[1]
Transport	Regulation of CO_2 emissions from passenger vehicles (443/2009)	• Emission standard of 95 gCO_2/km, phasing in for 95% of vehicles by 2020 with 100% compliance by 2021
		• Light commercial vehicle standards of 147 gCO_2/km by 2020
	Directive 2009/28/EC Biofuel target	• 10% quota for RE in transport fuels (also electricity)

[1] *NewClimate only quantified the policy for residential buildings*

Table 33: Impact of climate policies on greenhouse gas emissions (excluding LULUCF) in the EU. Absolute emission levels and emission levels relative to 2010 levels are presented. Note that the official values for 2020 and 2030 are based on GWP values from the IPCC 4th Assessment Report. References for official emission data are provided in Table 3.

2010 GHG emissions, excl. LULUCF	2020 pledge and NDC		Current policies	
	Official data [1]	PBL and NewClimate estimate [2]	Official data [1]	PBL and NewClimate estimate [2]
Absolute: 4,700 $MtCO_2e$	4,588 $MtCO_2e$ by 2020 (unconditional) 3,441 $MtCO_2e$ by 2030	3,875 to 4,425 $MtCO_2e$, -18% to -6% by 2020 3,320 $MtCO_2e$, -29% by 2030	4,387 $MtCO_2e$ by 2020 4,229 $MtCO_2e$ by 2030	3,955 to 4,115 $MtCO_2e$, -16% to -12% by 2020 3,465 to 3,870 $MtCO_2e$, -26% to -18% by 2030
Per capita: 9.3 tCO_2e/capita	N/A	7.6 to 8.7 tCO_2e/capita by 2020 6.5 tCO_2e/capita by 2030	N/A	7.7 to 8.1 tCO_2e/capita by 2020 6.8 to 7.5 tCO_2e/capita by 2030

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

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

Impact of climate policies on greenhouse gas emissions in EU28
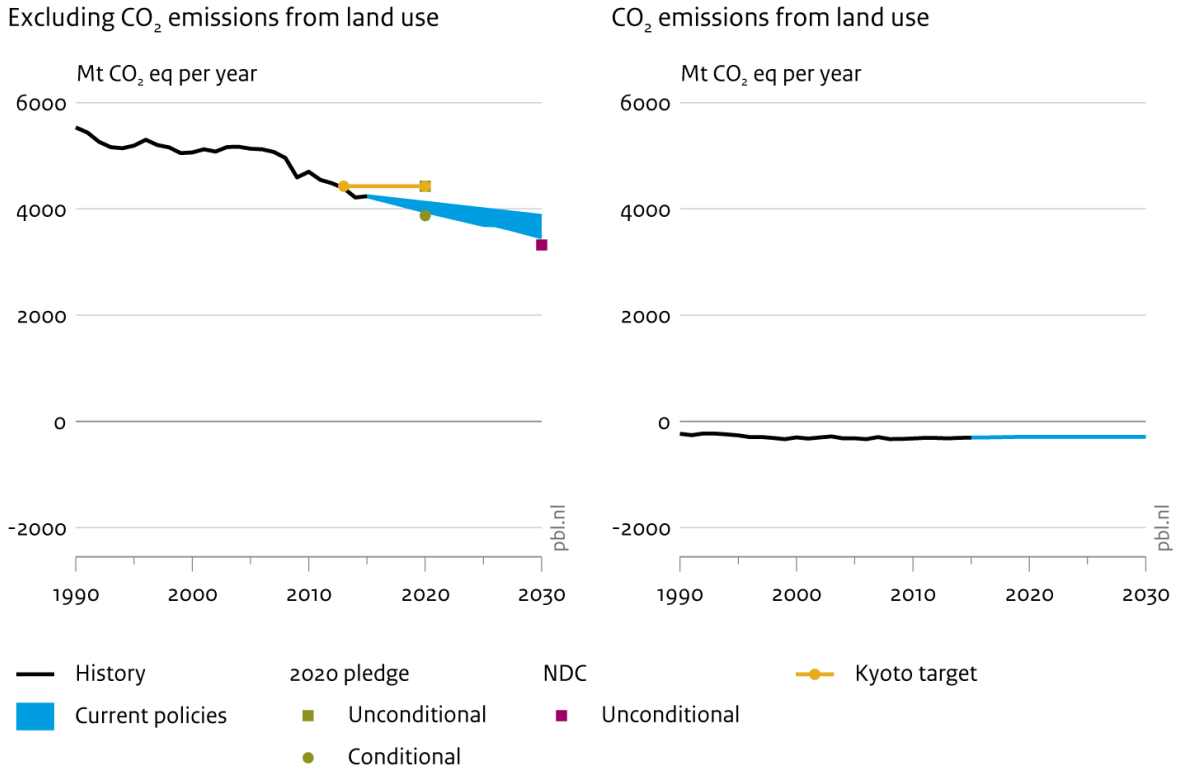
Excluding CO_2 emissions from land use

CO_2 emissions from land use

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

Figure 10: Impact of climate policies on greenhouse gas emissions in the EU (left: excluding land use (i.e. LULUCF), right: only land use). Source: NewClimate Institute calculations based on Climate Action Tracker (CAT 2017) and PBL calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals.

India

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

We project that India is likely to overachieve its 2020 pledge roughly on track to achieve its NDC under current policies, but it is not possible to make definitive conclusions because emission projections depend heavily on future economic growth. In December 2016, India published the Draft Electricity Plan, outlying plans for the development of the power sector. This draft plan projects a stabilisation of the coal capacity at 250 GW in the next decade, while it expects renewable energy technologies to expand substantially, to 275 GW by 2026/2027, reflecting a 57% share in total capacity (Central Electricity Authority 2016), compared to the conditional target of the NDC. If implemented, these targets are expected to have a substantial impact on emissions.

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

Indicator	2020 pledge	NDC (2 October 2016)
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)
Availability of reference scenarios in the latest UNFCCC submissions	• N/A	• N/A

Table 35: Overview of key climate change mitigation policies in India (*planned policies in italics*). Source: (MNRE 2009, BEE 2015, Government of India 2015a, Government of India 2015b, Ministry of Consumer Affairs Food and Public Distribution 2015)

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	Clean energy cess (coal tax) (2010)	• Implemented in 2010; currently a tax of INR 400/tonne is imposed on coal, lignite and peat
Energy supply	Renewable energy targets and support schemes (12th Five Year Plan (2013), National Solar and Wind Missions (2010)) (+)	• Previous capacity targets for 2022 to be overachieved (20GW solar, 38.5GW wind, 6.5 GW small hydro) [1] • Budgetary support for solar power under the National Solar Mission [2] • Renewable Purchase Obligations scheme (2003)[2] • Renewable Energy Certificate (REC) mechanism (2011) [2]
	Government Assistance for Small Hydropower Stations (2003), National Solar and Wind Missions (2010)	• 5 GW small hydropower, 10 GW biomass, 100 GW solar power, 60 GW wind power capacity by 2022
	Twelfth Five Year Plan (2012-2017): supercritical power generation	• Base new thermal power plants mainly on supercritical technology from 2017 onwards. Implemented as power plant standard after 2016 for new coal-fired power plants, resulting in 47% efficiency (820 gCO_2/kWh)[3]
	Draft Electricity Plan (2016; planned policy) [4]	• 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 – 130 g CO_2/km by 2017 and 0.9 MJ/pkm – 113 g CO_2/km by 2022, for light-duty vehicles
	Electric vehicle target	• 15% share in new sales by 2020 [5]
	Support for biofuels (2007)	• 5% blending target for ethanol with petrol (no timeline set)
Industry	Energy efficiency in industry (PAT scheme) (2011)	• The first phase was expected to save 6.6 Mtoe (4.8% energy reduction in the industries covered, representing around 60% of primary energy consumption) and to reduce 26 $MtCO_2$e over the 2012-2015 period
Forestry	Green India Mission (2011) [3]	• Increase the forest/tree cover in moderately dense forests: 5 million hectares • Improve forest/tree cover on forest areas: 5 million hectares
Agriculture	National Mission on Sustainable Agriculture (2012) (+) [3]	• Enhancing food security and protection of resources such as land, water, biodiversity and genetics

[1] *Based on: Planning Commission Government of India (2011). The assumptions for current policies projections are described in detail in the Supporting Information.*

[2] *Not quantified separately*

[3] *Policy not quantified in IIASA LULUCF projections.*

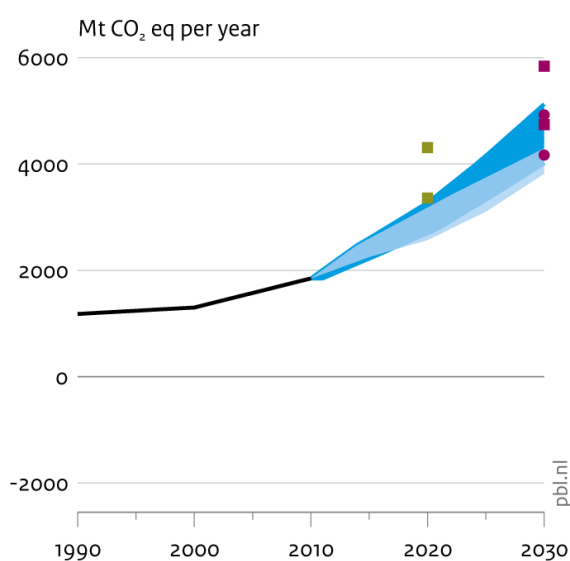[4] *Considered in the planned policies scenario*

[5] *Not considered in NewClimate Institute calculations*

Table 36: Impact of climate policies on greenhouse gas emissions (including LULUCF) in India. Absolute emission levels and emission levels relative to 2010 levels are presented. References for official emission data are provided in Table 3.
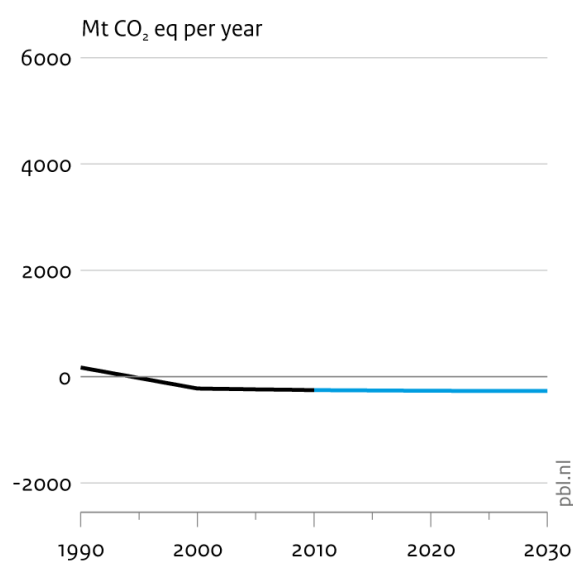
2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies		Planned policies
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates	PBL and NewClimate estimates
Absolute: 1,848 MtCO₂e	3,815 MtCO₂e	3,360 to 4,305 MtCO₂e, 82% to 133% by 2020 4,170 to 5,840 MtCO₂e, 126% to 216% by 2030	N/A	2,700 to 3,275 MtCO₂e, 46% to 77% by 2020 4,015 to 5,125 MtCO₂e, 117% to 177% by 2030	2,570 to 3,180 MtCO₂e, 39% to 72% by 2020 3,820 to 4,295 MtCO₂e, 107% to 132% by 2030
Per capita: 1.5 tCO₂e/capita	N/A	2.4 to 3.1 tCO₂e/capita by 2020 2.8 to 3.9 tCO₂e/capita by 2030	N/A	2.0 to 2.4 tCO₂e/capita by 2020 2.7 to 3.4 tCO₂e/capita by 2030	1.9 to 2.3 tCO₂e/capita by 2020 2.5 to 2.8 tCO₂e/capita by 2030

Impact of climate policies on greenhouse gas emissions in India

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

Figure 11: Impact of climate policies on greenhouse gas emissions in India (including land use (i.e. LULUCF)). Source: NewClimate Institute calculations adapted from Climate Action Tracker (CAT 2017) and PBL Calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals. For reporting reasons, the emission projections excluding LULUCF are not presented, as these are similar to those including LULUCF.

Indonesia

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

As such, Indonesia would likely fall slightly short of meeting its unconditional NDC target under current policies, with overall emission levels ranging from 2,060 to 2,140 $MtCO_2e$/year in 2030.

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

Indicator	2020 pledge	NDC (submitted 6 November 2016)
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; • 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".
Availability of reference scenarios in the latest UNFCCC submissions	• N/A	• N/A

Table 38: Overview of key climate change mitigation policies in Indonesia. Sources: (ADB 2016, Kharina et al. 2016, Republic of Indonesia 2016a, Republic of Indonesia 2016c)

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Energy supply	Renewable energy targets (2014) (+)	• 15%-23% share of renewable energy in primary energy supply by 2025[1]
	National Electricity Plan	• 19% new and renewable energy (including nuclear) by 2025[1] (planned: 25%)
	Electricity Supply Business Plan	• Added electricity capacity by 2019: 2 GW hydro, 0.7 GW geothermal, 0.2 GW solar/wind[2]
Transport	Biofuel targets (2013)	• 15% share of biofuels in all transportation fuels by 2025 (25% biodiesel, 20% bioethanol)[3]
Forestry	Presidential Instruction number 6/2013 on Forest Moratorium [4]	• Restricting oil palm extension to peatland or to primary forest as defined in the Ministry of Forestry land cover map

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

[2] NewClimate additionally includes the target of 25 GW of coal-fired power plants included in the plan. PBL does not prescribe a target for coal, its scenario reaches 19.5 GW in 2019, 3.3 GW additional compared to 2015.

[3] Implemented in PBL TIMER model as 22.5% total biofuel share (only 18% reached)

[4] Unclear whether this policy is included in the NewClimate Institute current policies projection, as information is not available in original data source.
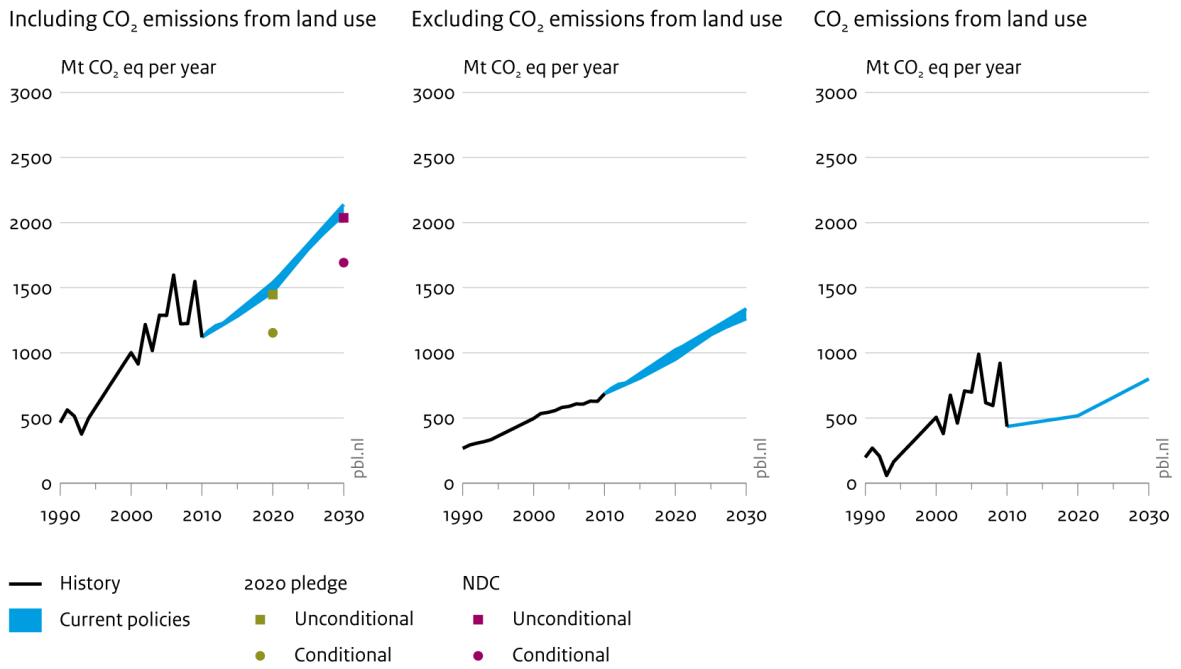
Table 39: Impact of climate policies on greenhouse gas emissions (including LULUCF) in Indonesia. Absolute emission levels and emission levels relative to 2010 levels are presented. References for official emission data are provided in Table 3.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC [1]		Current policies	
	Official data	**PBL and NewClimate estimates**	**Official data**	**PBL and NewClimate estimates**
Absolute: 1,120 MtCO2e [2]	2,050 MtCO2e by 2030 (1700 MtCO2 conditional) [2]	1,155 to 1,445 MtCO2e, 3% to 29% by 2020 1,695 to 2,035 MtCO2e, 51% to 82% by 2030	N/A	1,465 to 1,540 MtCO2e, 31% to 37% by 2020 2,060 to 2,140 MtCO2e, 84% to 91% by 2030
Per capita: 4.6 tCO2e/capita	N/A	4.2 to 5.3 tCO2e/capita by 2020 5.7 to 6.9 tCO2e/capita by 2030	N/A	5.4 to 5.7 tCO2e/capita by 2020 7.0 to 7.2 tCO2e/capita by 2030

[1] Conditional NDC

[2] The 2010 emissions are based on energy-related emissions (IEA, 2012), non-energy-related emissions (EDGAR 4.2) (JRC/PBL 2014) and the 1st Biennial Update Report by Indonesia (Republic of Indonesia 2016b). It should be noted that 2010 estimates of peat oxidation and peat fires have been revised by Indonesia several times. BAPPENAS (2015) presented estimates of 559 MtCO2e, which are much lower compared to 1442 MtCO2e estimated in the Second National communication (SNC) (see sheet 19 of BAPPENAS (2015)). BAPPENAS (2015) has reduced the 2010 net AFOLU emissions estimates from 2,505 (SNC) to 1,460 MtCO2e, and the BAU 2020 projection from 2,949 to 1,804 MtCO2e. BAPPENAS (2015) has a BAU projection of net AFOLU emissions in the range of 2,877 MtCO2e by 2030, which is also used in the NDC submission.

Impact of climate policies on greenhouse gas emissions in Indonesia

Figure 12: Impact of climate policies on greenhouse gas emissions in Indonesia. Left panel: Total emissions including land use (i.e. LULUCF), middle panel: total emissions excluding land use, and right panel: land use emissions and removals only. Source: NewClimate Institute calculations based on its analysis for Climate Action Tracker (CAT 2017) and PBL calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals.

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

Japan

Japan proposes in its NDC to reduce GHG emissions by 26% by 2030 compared to 2013 levels, equivalent to a 25.4 % reduction from 2005 levels and 3% increase from 2010 levels. The main GHG mitigation policies currently implemented in Japan include the renewable feed-in tariff scheme, 2014 Basic Energy Plan, Top Runner Standards programme and the global warming tax.

The lower end of our 2030 projection range meets the NDC target. We conclude that Japan is roughly on track to meet its NDC. Also for 2020, the current policies emissions projections indicate that Japan would overachieve its current pledge (3.8% below 2005 levels by 2020) even with full nuclear phase-out.

The large range of projections is caused by the uncertainty about the future role of nuclear energy, as it is not yet fully clear to what extent this restarting will occur and which energy carriers will replace nuclear electricity capacity.

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

Indicator	2020 pledge	NDC (submitted 3 November 2016)
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 MtCO2e [1]
Other sector-level targets	• N/A	• N/A
Use of bilateral, regional and international credits	• Yes. Expected amount not specified.	• Yes. Cumulative 50-100 MtCO2e through the Joint Crediting Mechanism (JCM).
Availability of reference scenarios in the latest UNFCCC submissions	• No	• No
Other information	• 2020 pledge assumes zero nuclear power generation following the Fukushima nuclear disaster	• N/A

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

Table 41: Overview of key climate change mitigation policies in Japan. Source: (Government of Japan 2013, Kuramochi 2014, Government of Japan 2015, IEA 2015)

| Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	Global warming countermeasures tax (2012)	• An upstream tax of 289 JPY/tCO_2 (around 2.3€) is imposed on fossil fuels on top of existing petroleum and coal tax
Energy supply	2014 Basic Energy Plan[1] and the long-term energy demand and supply outlook (+)	• Renewable electricity (incl. large hydro): at least 13.5% by 2020 and 22-24% by 2030 (supported by FIT scheme), nuclear electricity: 20-22%.
	Renewable Energy Act (feed-in tariff) (2012)	• Electric utility operators required to purchase all electricity generated at designated prices; applicable to most renewable technologies
Buildings	Energy Conservation Act (2007)	• Energy reduction of 1%/year and annual reports to the government by large operators[2] • Energy efficiency standards for buildings and houses larger than 300 m^2
Transport	Top Runner Programme: vehicle efficiency standards (1999)	• 20.3 km/l by 2020
F-gases	Act on Rational Use and Proper Management of Fluorocarbons (2013)	• Stricter control of the entire F-gas chain (GWP targets for equipment types, obligation of F-gas destruction for entities re-using recovered F-gases)

[1] *Due to the large uncertainty regarding the feasibility of the 2014 Basic Energy Plan on 2030 electricity mix, NewClimate Institute performed independent calculations on a possible 2030 electricity mix.*

[2] *Policy not quantified in the IIASA LULUCF model projections*

Table 42: Impact of climate policies on greenhouse gas emissions (excluding LULUCF, excluding credits) in Japan. Absolute emission levels and emission levels relative to 2010 levels are presented. Note that the official values for 2020 and 2030 are based on GWP values from the IPCC 4th Assessment Report. References for official emission data are provided in Table 3.

2010 GHG emissions, excl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates
Absolute: 1,280 $MtCO_2e$	1,399 $MtCO_2e$ by 2020, 1,079 $MtCO_2e$ by 2030	1,365 $MtCO_2e$, 6% by 2020 1,055 $MtCO_2e$, -17% by 2030	N/A	1,120 to 1,195 $MtCO_2e$, -13% to -7% by 2020 1,020 to 1,105 $MtCO_2e$, -20% to -13% by 2030
Per capita: 10 tCO_2e/capita	N/A	10.8 tCO_2e/capita by 2020 8.7 tCO_2e/capita by 2030	N/A	8.8 to 9.5 tCO_2e/capita by 2020 8.4 to 9.1 tCO_2e/capita by 2030
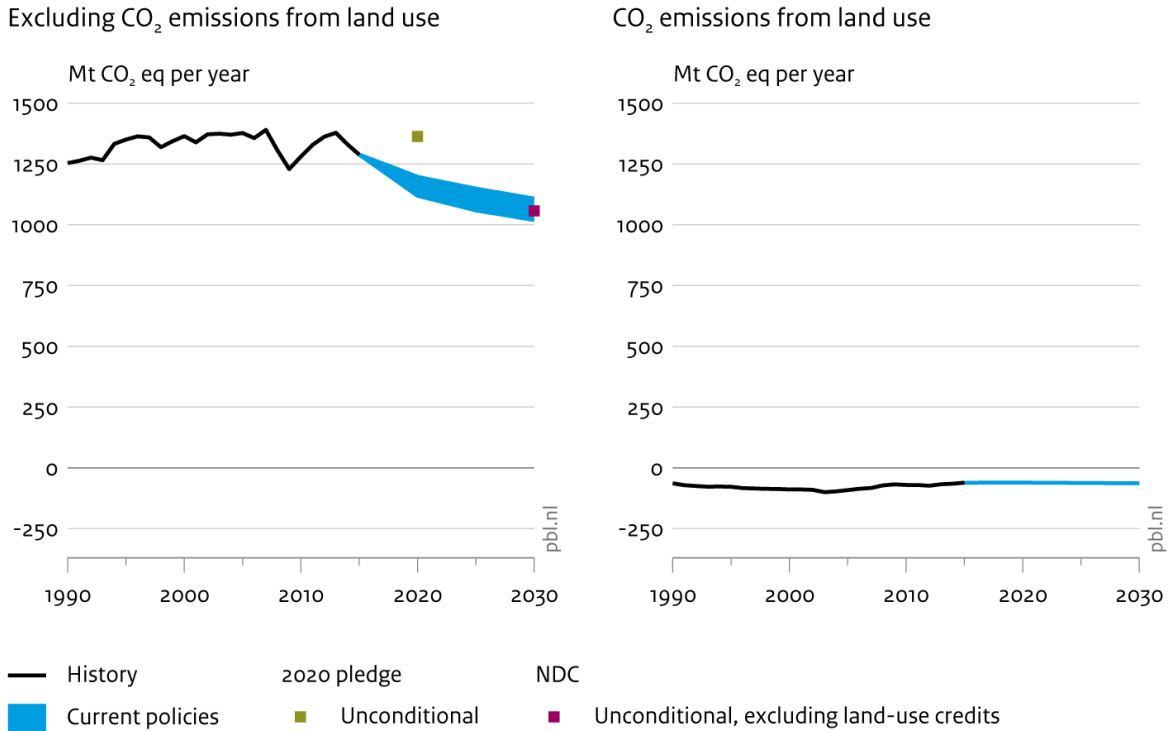
Impact of climate policies on greenhouse gas emissions in Japan

Excluding CO$_2$ emissions from land use

CO$_2$ emissions from land use

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

Figure 13: Impact of climate policies on greenhouse gas emissions in Japan (left: excluding land use (i.e. LULUCF), right: only land use). 2020 and 2030 targets include LULUCF credits (in line with the Kyoto accounting rules) as well as overseas credits. Source: NewClimate Institute calculations based on its analysis for Climate Action Tracker (CAT 2017) and PBL calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals. Please see Appendix (A2) on the consideration of LULUCF for the NDC quantification.

Kazakhstan

Kazakhstan pledged an unconditional NDC target to reduce GHG emissions by 15% below 1990 levels by 2030, and a conditional target to reduce emissions by 25% below 1990 by 2030. The current policies projection includes the Action Plan for the development of alternative and renewable energy in Kazakhstan for 2013–2020. Kazakhstan's GHG emissions are projected to be 400–415 $MtCO_2e$/year by 2030 (including LULUCF) under the current policies projection. Kazakhstan would, therefore, fail to achieve its unconditional NDC target by 2030 (270–305 $MtCO_2e$/year including LULUCF).

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

Indicator	2020 pledge	NDC (submitted 6 December 2016)
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 Fourth Assessment Report
GHGs covered	• N/A	• CO_2, CH_4, N_2O, HFCs, PFCs, SF_6
Consideration of LULUCF	• N/A	• Land use sector is included in the target • Accounting approaches and methodologies are not specified
Use of bilateral, regional and international credits	• N/A	• Option to use market-based mechanisms
Availability of reference scenarios in the latest UNFCCC submissions	• Yes, scenarios 'with measures', 'with additional measures' and 'without measures' are available (UNFCCC 2016)	• Yes, scenarios 'with measures', 'with additional measures' and 'without measures' are available (UNFCCC 2016). The 'without measures' scenario provides the BAU emissions projection under the assumption that no additional measures to reduce GHG emissions are taken. The scenario considers several measures implemented by Kazakhstan before 2015.

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

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

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) (+) [2]	• 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) [3]	• 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) [3]	• 5% of national energy consumption provided by renewable sources by 2024
Energy supply	Support scheme for renewable energy (2014) [2]	• 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
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 (2011)	• Plan to reforest and afforest a total of 5,000 hectares of land
	Carbon sequestration activities [4]	• An increase of the carbon sink through appropriate management

[1] *Kazakhstan's ETS (phase III: 2016-2020) is suspended until 2018 (ICAP 2016). None of the policies in this overview were quantified in PBL's TIMER model.*

[2] *Policy not included.*

[3] *Policy not included (only indirectly via renewable energy capacity deployment under the Action Plan for the development of alternative and renewable energy in Kazakhstan for 2013-2020).*

[4] *Policy not quantified in the IIASA LULUCF model projections.*

Table 45: Impact of climate policies on greenhouse gas emissions (including LULUCF) in Kazakhstan. Absolute emission levels and emission levels relative to 2010 levels are presented. References for official emission data are provided in Table 3.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates
Absolute: 302 MtCO$_2$e	N/A	305 to 330 MtCO$_2$e, 0% to 10% by 2020 270 to 305 MtCO$_2$e, -11% to 0% by 2030	N/A	335 to 345 MtCO$_2$e, 11% to 14% by 2020 400 to 415 MtCO$_2$e, 33% to 37% by 2030
Per capita: 18.4 tCO$_2$e/capita	N/A	16.1 to 17.7 tCO$_2$e/capita by 2020 13.2 to 14.9 tCO$_2$e/capita by 2030	N/A	17.9 to 18.3 tCO$_2$e/capita by 2020 19.7 to 20.4 tCO$_2$e/capita by 2030

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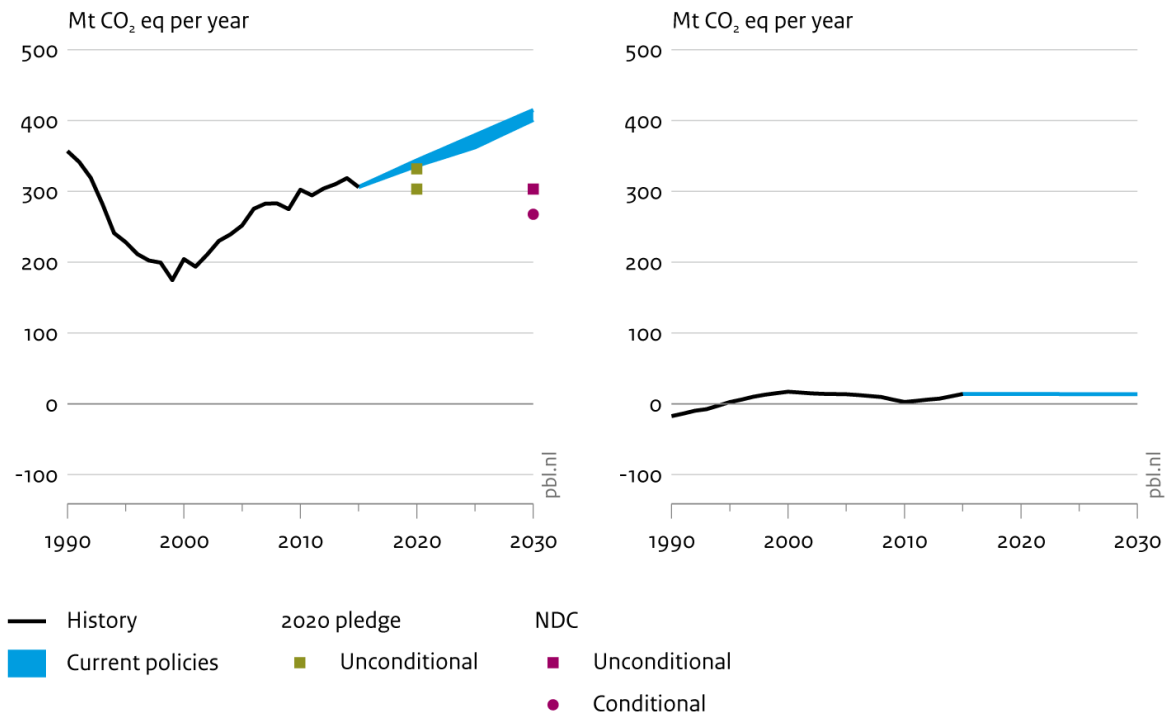
Source: PBL FAIR/TIMER model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 14: Impact of climate policies on greenhouse gas emissions in Kazakhstan (left panel: all gases, including land use (i.e. LULUCF), right panel: only land use emissions). Source: NewClimate Institute calculations based on its analysis for Climate Action Tracker (CAT 2017) and PBL calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals.

Mexico

Mexico aims, in its NDC, to reduce its GHG emissions by 22% (unconditional), and by 36% (conditional) from BAU by 2030. An assessment of the new Energy Transition Law (24/12/2015) that provides a framework for clean energy, energy efficiency and GHG emissions reductions, reveals that this target is less ambitious compared to what was proposed by previous renewable energy laws and the Secretariat of Energy (SENER) projections.

Under its current policies, Mexico is roughly on track to meet its unconditional NDC target, but to meet their conditional NDC target additional mitigation actions are needed. Our evaluation changed from our 2016 report mainly because of the historical emissions data update and an updated and lower baseline projections.

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

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

Indicator	2020 pledge	NDC (21 September 2016)
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
Availability of reference scenarios in the latest UNFCCC submissions	• N/A	• NDC provides a baseline scenario

Table 47: Overview of key climate change mitigation policies in Mexico. Source: (Cámara de Diputados 2015, IEA 2015)

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Energy supply	Energy Transition Law (2015)	• Provides a framework for clean energy, energy efficiency and greenhouse gas emissions reductions • Sets targets for clean energy of 25% in 2018, 30% in 2021 and 35% by 2024, which is supported by policy instruments, such as power auctions for wind and solar energy (IEA 2016)
	Performance criteria and application for flaring and ventilation of natural gas (CNH.06.001/09)	• Emissions reductions in oil and gas production through decrease in venting of 73 $MtCO_2e$ below BAU in 2020 and 92 $MtCO_2e$ in 2030
Transport	CO_2 emissions standards for light duty vehicles	• Passenger cars: 135 – 180 gCO2/km (depending on vehicle size) • Light duty trucks: 163 – 228 gCO2/km (depending on size)
Forestry	National Forestry Programme 2025 (2001)	• Protected areas according to the payments for Ecosystem Services (PES) scheme for promoting conservation, restoration and sustainable forest use [1]
	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+ projects	• Continued reduction of LULUCF emissions [1]

[1] *Policy not quantified in the IIASA LULUCF model projections*

Table 48: Impact of climate policies on greenhouse gas emissions (including LULUCF) in Mexico. Absolute emission levels and emission levels relative to 2010 levels are presented. References for official emission data are provided in Table 3.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates
Absolute: 665 $MtCO_2e$	N/A	670 $MtCO_2e$, 1% by 2020 625 to 760 tCO_2e, -6% to 14% by 2030	N/A	635 to 675 $MtCO_2e$, -4% to 2% by 2020 740 to 770 $MtCO_2e$, 11% to 16% by 2030
Per capita: 5.7 tCO_2e/capita	N/A	5.0 tCO_2e/capita by 2020 4.2 to 5.1 tCO_2e/capita by 2030	N/A	4.7 to 5.0 tCO_2e/capita by 2020 5.0 to 5.2 tCO_2e/capita by 2030
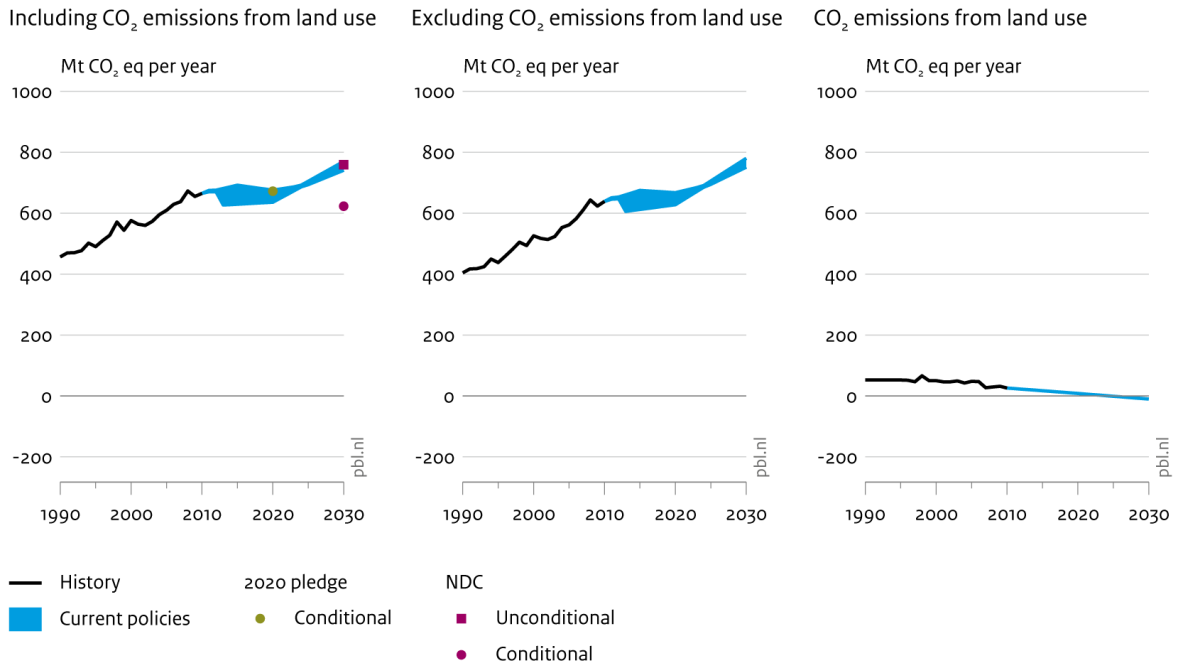
Impact of climate policies on greenhouse gas emissions in Mexico

Figure 15: Impact of climate policies on greenhouse gas emissions in Mexico (upper figure: including land use (i.e. LULUCF), lower figure: excluding land use (left) and only land use (right) separately). Source: NewClimate Institute calculations based on its analysis for Climate Action Tracker (CAT 2017) and PBL calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals.

Morocco

Morocco pledged an unconditional NDC target to reduce GHG emissions by 17% below BAU by 2030, and a conditional target to reduce emissions by 42% below BAU by 2030. The current policies projection considers the National Energy Strategy, including the Morocco Solar Plan, as well as the Morocco Integrated Wind Energy Program. Morocco's GHG emissions are projected to be 165 $MtCO_2e$ by 2030 (including LULUCF) under current policies projections. Morocco would, therefore, would not achieve its unconditional NDC target of 141 $MtCO_2e$ including LULUCF by 2030 under existing policies.

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

Indicator	NDC (submitted 19 September 2016)
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 Fourth 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.
Availability of reference scenarios in the latest UNFCCC submissions	• Yes. BAU scenario until 2030 (Kingdom of Morocco 2015))

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

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	Moroccan Climate Change Policy (MCCP) (2014)	• Overarching coordination and alignment of various sectoral and cross-sectoral national policies tackling climate change
Energy supply	National Energy Strategy (2009, updated 2012) (+) • Morocco Integrated Wind Energy Program (2010) • Morocco Solar Plan (2009) [1] • Morocco Hydro-Electric Plan (continuation of plan started in 1970s) [1]	• Aim for an installed renewable electricity capacity of 42% by 2020 and 52% by 2030 • 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
Transport	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 program for industry, buildings and transport sector (excluding large energy consuming industries)
Buildings	Energy efficiency program in the building sector (2009)	• Minimum requirements for new residential and commercial buildings
	Energy efficiency program for public lighting (2009)	• Instalment of new public lightening technologies
F-gases	N/A	• N/A
Forestry	Preservation and Sustainable Forest Management Strategy (+)	• Afforestation and regeneration of approximately 50,000 hectares of forest per year
	Morocco Green Plan (PMV) (2008) (+)	• Promotion of natural resources and sustainable management [2] • Modernization of the agricultural sector [2]

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

[2] *Policy not quantified in the IIASA model projections*

Table 51: Impact of climate policies on greenhouse gas emissions (including LULUCF) in Morocco. Absolute emission levels and emission levels relative to 2010 levels are presented. References for official emission data are provided in Table 3.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	NewClimate estimates	Official data	NewClimate estimates
Absolute: 105 MtCO$_2$e	99 to 141 MtCO$_2$e by 2030	100 to 140 MtCO$_2$e, -6% to 35% by 2030	N/A	120 MtCO$_2$e, 15% by 2020 165 MtCO$_2$e, 57% by 2030
Per capita: 3.2 tCO$_2$e/capita	N/A	2.4 to 3.5 tCO$_2$e/capita by 2030	N/A	3.3 tCO$_2$e/capita by 2020 4.0 tCO$_2$e/capita by 2030

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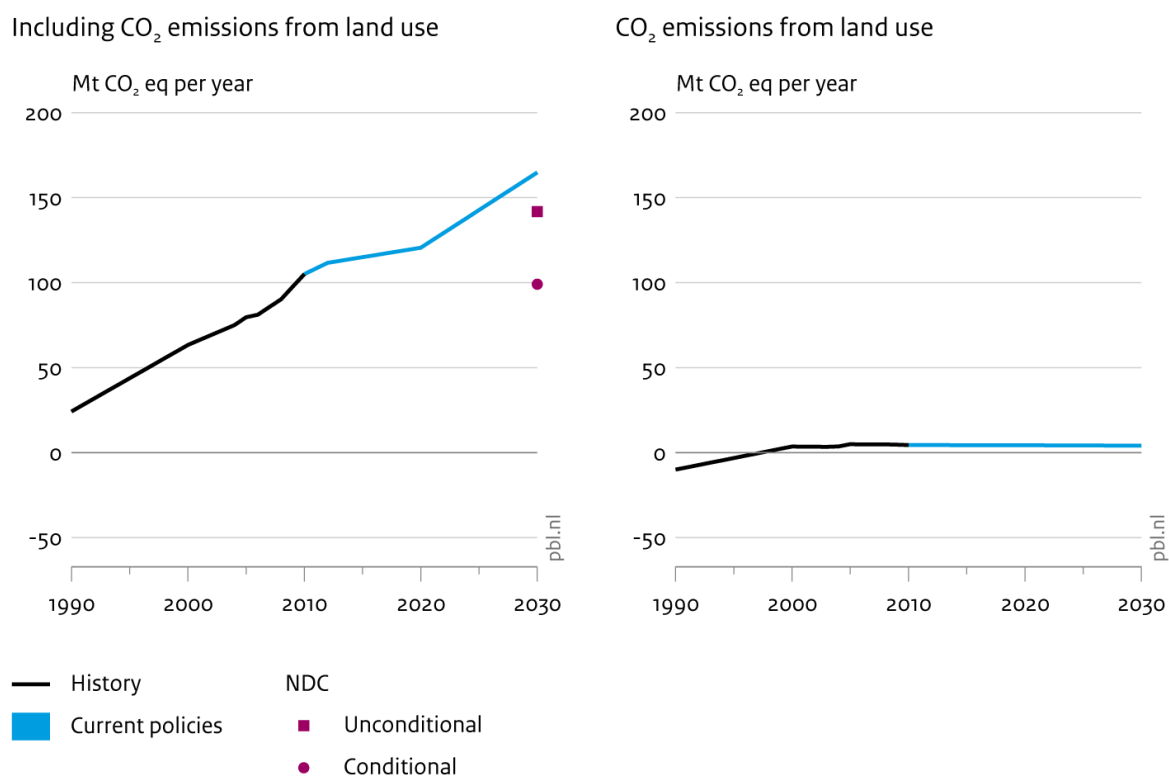
Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 16: Impact of climate policies on greenhouse gas emissions in Morocco (CO$_2$, CH$_4$ and N$_2$O; including land use (i.e. LULUCF)). Source: NewClimate Institute calculations excluding LULUCF based on its analysis for Climate Action Tracker and IIASA calculations on LULUCF emissions and removals.

Philippines

The Philippines' INDC includes a conditional GHG reduction target of 70% below BAU levels by 2030. Calculations for 2030 emissions levels under the INDC show 38% below 2010 levels (excl. LULUCF). The INDC emissions level excluding LULUCF is estimated to be about 95 $MtCO_2e$ in 2030. Under current policies, the Philippines' emissions level is projected to reach 220 $MtCO_2e$ in 2020 and 320 $MtCO_2e$ in 2030, excluding LULUCF.

Although there is uncertainty related to LULUCF emissions and the lack of data on the BAU scenario mentioned in the country's INDC, our projections suggest that the Philippines is not on track to meet its conditional INDC target.

Table 52: Description of The Philippines' 2020 pledge and INDC

Indicator	INDC (submitted 1 October 2015)
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 the Fourth IPCC Assessment Report
GHGs covered	• Not specified
Consideration of LULUCF	• The forest sector is included in the target. Forests are expected to contribute to the GHG emission reduction target • Accounting approaches and methodologies are not specified
Use of bilateral, regional and international credits	• N/A
Availability of reference scenarios in the latest UNFCCC submissions	• N/A

Note: The Philippines has not set its 2020 pledge.

Table 53: Overview of key climate change mitigation policies in the Philippines. Source: (Philippine Institute for Development Studies 2014, Department of Energy 2015b, Department of Energy 2015a, The London School of Economics and Political Science 2015, Asia-Pacific Economic Cooperation 2016)

Sector	Policies (marked with "(+)" when mentioned in the INDC document)	Description
Economy-wide	Energy Efficiency and Conservation Roadmap (EE&C) (2014) Energy Efficiency and Conservation Action Plan (2016)	• 20.2% energy saving by 2030 compared to BAU, from 2005 levels • 3% per year economy-wide improvement in energy intensity compared to BAU • 21 $MtCO_2$ reduction by 2030, compared to BAU • Savings of c.a. 10,665 ktoe (1/3 of current demand) by 2030
Energy supply	Sitio Electrification Program (SEP) of the National Electrification Administration (2012)	• Aims to energize sitios[1] through on-grid electrification • 2015 target: 100% sitios energized; covering at least 648,820 households [2]
	Household Electrification Program (HEP) of the DOE (2012)	• Targets to provide electricity at least 2,000 households every year using renewable energy technologies; 90% households electrified by 2017
	National Renewable Energy Program (NREP) (2012)	• Increase renewable energy capacity of the country to an estimated 15,304 MW by 2030 (almost triple its 2010 level) • The aimed installed capacity by 2030 is broken down as follows: 3,461 MW from geothermal; 8,724 from small hydropower (<50 MW); 316 from biomass; 2,378 from wind; 285 from solar; 71 from ocean.
Transport	EE&C Roadmap (2014) and Action Plan (2016)	• 14.3% energy savings in transport sector compared to BAU by 2020 • 25% energy savings compared to BAU by 2030
Industry	EE&C Roadmap (2014) and Action Plan (2016)	• 8.7% energy savings in industrial sector by 2020 compared to BAU, 15% energy savings by 2030
Buildings	EE&C Roadmap (2014) and Action Plan (2016) • Appliance Standards and Labelling Program • Government Buildings Efficiency Program	• 10% energy savings in commercial buildings by 2020 and 25% by 2030, compared to BAU by 2030 • 6.6% energy savings in residential buildings by 2020 and 20% by 2030, compared to BAU by 2030
F-gases	N/A	• N/A
Forestry	National Greening Program (2011)	• Plant 1.5 billion trees by 2016 covering 1.5 million hectares
	The Philippine National REDD+ Strategy (2010) (+)	• Continued reduction deforestation and forest degradation [3]

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

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

[3] Policy not quantified in the IIASA LULUCF model projections.

Table 54: Impact of climate policies on greenhouse gas emissions (excluding LULUCF) in The Philippines. Absolute emission levels and emission levels relative to 2010 levels are presented. References for official emission data are provided in Table 3.

2010 GHG emissions, excl. LULUCF	2020 pledge and INDC		Current policies	
	Official data	NewClimate estimates	Official data	NewClimate estimates
Absolute: 158 MtCO$_2$e	N/A	85 MtCO$_2$e, -46% by 2030	N/A	220 MtCO$_2$e, 40% by 2020 320 MtCO$_2$e, 104% by 2030
Per capita: 1.7 tCO$_2$e/capita	N/A	0.7 tCO$_2$e/capita by 2030	N/A	2.0 tCO$_2$e/capita by 2020 2.6 tCO$_2$e/capita by 2030
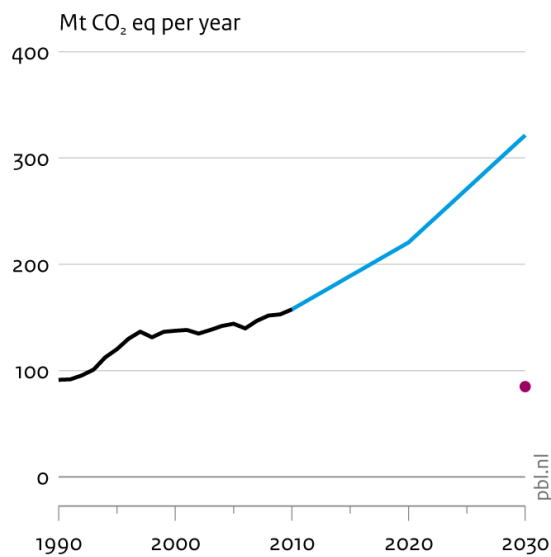
Impact of climate policies on greenhouse gas emissions in the Philippines
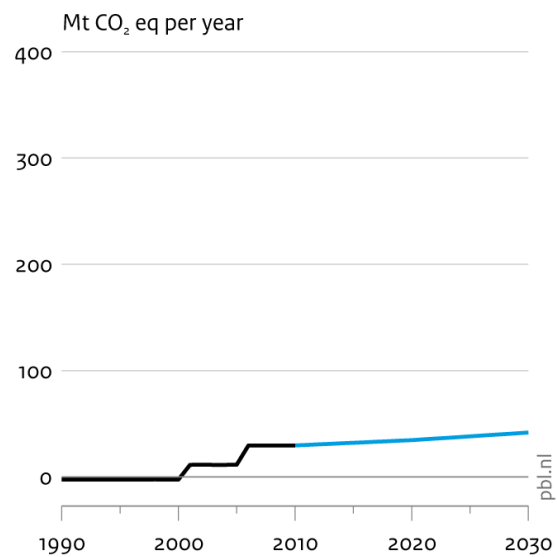
Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 17: Impact of climate policies on greenhouse gas emissions in the Philippines (left: excluding land use (i.e. LULUCF), right: only land use). Source: NewClimate Institute calculations excluding LULUCF based on its analysis for Climate Action Tracker (CAT 2017) and IIASA calculations on LULUCF emissions and removals.

Republic of Korea

The Republic of Korea's NDC aims to reduce GHG emissions by 37% below BAU levels by 2030. The government also pledged internationally to reduce its GHG emissions by 30% below BAU levels by 2020, but this target has been abandoned domestically through the amended Green Growth Act.

Current policies considered here are renewable energy targets for 2020 and 2030 and the national emissions trading system (ETS). According to our assessment, the ETS and the renewable energy targets could result in stabilisation of Republic of Korea's emission levels (excluding LULUCF) at 685 to 730 $MtCO_2e$ by 2020 and 730 to 775 $MtCO_2e$ by 2030. This is a deviation from the historical trend of strongly increasing emissions, and is an important step towards achieving the pledge. However, it is not expected to be sufficient to achieve the pledged emissions levels by 2020 and 2030.

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

Indicator	2020 pledge	NDC (submitted 3 November 2016)
Target: unconditional	• 30% GHG reduction by 2030 from BAU scenario [1]	• 37% GHG reduction by 2030 from baseline scenario
Target: conditional	• N/A	• N/A
Sectoral coverage	• Economy-wide	• Economy-wide (energy, industrial processes and product use, agriculture and waste)
General Accounting method	• Not-specified	• IPCC guidelines; 100-year GWPs from the Second IPCC Assessment Report
GHGs covered	• Not-specified	• CO_2, CH_4, N_2O, HFCs, PFCs and SF_6
Consideration of LULUCF	• Land sector is included in the target • 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
Availability of reference scenarios in the latest UNFCCC submissions	• No	• Yes: baseline scenario for NDC target provided and quantified

[1] *In the amended Green Growth Act (Presidential Decree no.27180, 24 May 2016), the 2020 pledge was abandoned domestically and was replaced by the 2030 NDC target, but to date there is no report that the Republic of Korea abandoned its 2020 pledge made under the UNFCCC.*

Table 56: Overview of key climate change mitigation policies in the Republic of Korea. Source: (Republic of Korea 2012, Hwang 2014, Republic of Korea 2014, Ministry of Trade 2015)

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	Emissions Trading System (2015)	• Emission cap is in line with the 30% reduction below baseline
Energy supply	Renewable energy targets (4th Basic Plan on New and Renewable Energies, 7th Basic Plan for Long-term Electricity Supply and Demand) (2014)	• 11% share of new and renewable energy (NRE) in TPES by 2035 (5% by 2020, 9.7% by 2030); • 13.4% of total electricity supplied by NRE by 2035 (4th Basic Plan on NRE), 11.7% by 2029 (7th Basic Plan for Long-term Electricity Supply and Demand); o 1.8 GW hydropower, 0.8 GW onshore wind, 1 GW offshore wind, 16.6 GW solar power, 0.2 GW biomass, and 0.2 GW waste capacity by 2029
	Renewable portfolio standards (2012)	• 10% supply of NRE in total electricity generation by 2024[1]
Buildings	Renewable energy targets (4th Basic Plan on New and Renewable Energies, 7th Basic Plan for Long-term Electricity Supply and Demand) (2014)	• Budgetary support for one million green homes (which covers various renewable energy resources such as solar PV, solar thermal, geothermal, small wind and bioenergy) by 2020 [2] [3]
Transport	Fuel efficiency standard (2005) (+)	• 140 gCO_2/km (16.7 km/l) by 2015, 97 g CO_2/km (24.1 km/l) by 2020 [3]
	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 included separately*

[2] *Quantified in the PBL TIMER model as a tax on the residential sector, resulting in 19% emission reduction by 2030, in the residential sector and relative to the PBL baseline*

[3] *Not included by NewClimate Institute*

Table 57: Impact of climate policies on greenhouse gas emissions (excluding LULUCF) in Republic of Korea. Absolute emission levels and emission levels relative to 2010 levels are presented. References for official emission data are provided in Table 3.

2010 GHG emissions, excl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates
Absolute: 657 MtCO$_2$e	N/A	545 MtCO$_2$e, -17% by 2020 535 MtCO$_2$e, -18% by 2030	N/A	685 to 730 MtCO$_2$e, 4% to 11% by 2020 730 to 775 MtCO$_2$e, 11% to 18% by 2030
Per capita: 13.3 tCO$_2$e/capita	N/A	10.5 tCO$_2$e/capita by 2020 10.2 tCO$_2$e/capita by 2030	N/A	13.3 to 14.2 tCO$_2$e/capita by 2020 13.8 to 14.7 tCO$_2$e/capita by 2030
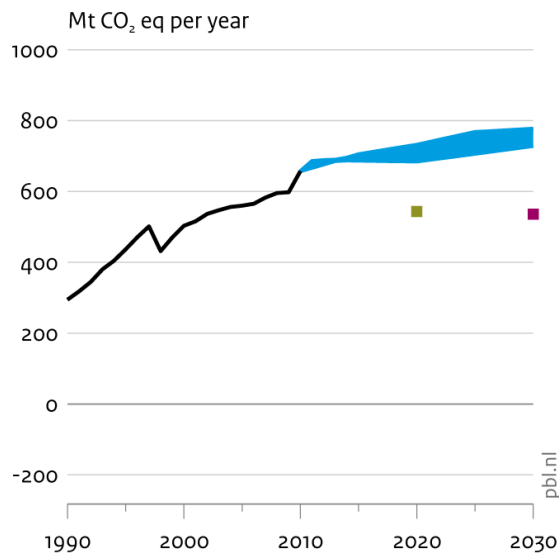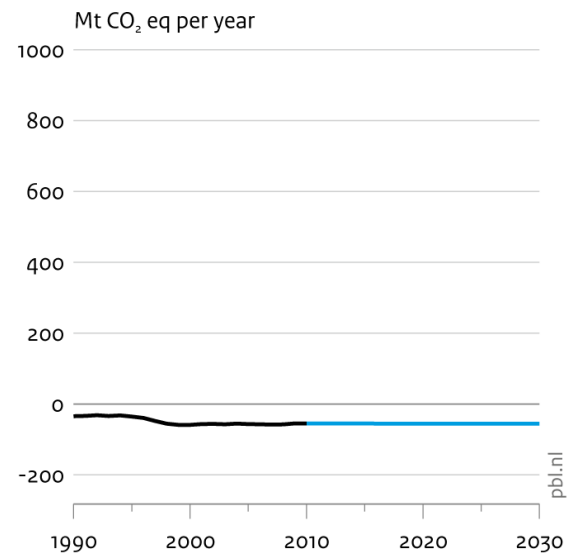
Impact of climate policies on greenhouse gas emissions in Republic of Korea

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

Figure 18: Impact of climate policies on greenhouse gas emissions in Republic of Korea (left panel: excluding land use (i.e. LULUCF), right panel: land use emissions and removals only). Source: NewClimate Institute calculations based on Climate Action Tracker (CAT 2017) and PBL calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals.

Russian Federation

Russia's INDC aims to limit GHG emissions to 70–75% of 1990 levels by 2030. The current policies analysed here include the Russian State Programme's targets for energy efficiency and renewable electricity generation. Russia's gas flaring policy could lead to additional emission reductions, but it is unclear whether this policy will be fully implemented. The current policies are projected to lead to an emission level of 2,550 to 2,575 $MtCO_2e$/year by 2020 (3% to 4% above 2010 levels) and 2,650 to 2,790 $MtCO_2e$/year by 2030 (7% to 13% above 2010 levels), excluding LULUCF. Russia is, therefore, likely to reach its 2020 pledge, and reach the lower end of its 2030 INDC range (2,530 to 3,400 $MtCO_2e$/year).

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

Indicator	2020 pledge	INDC (submitted 1 April 2015)
Target: unconditional	• 15-25% GHG reduction by 2030 from 1990 level	• Limiting anthropogenic greenhouse gases in Russia to 70-75% 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 the Fourth Assessment Report	• IPCC guidelines; 100-year GWPs from the Fourth Assessment Report
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
Availability of reference scenarios in the latest UNFCCC submissions	• Not assessed	• Not assessed

[1] *Russian Federation's INDC states that target is "subject to the maximum possible account of absorbing capacity of forests". We assume that Russia applies a gross-net accounting approach (see Appendix A2 for details). The current policy projection for the LULUCF sector would provide Russia with 690 MtCO2e land-use credits in 2030 (the difference between the historic 1990 LULUCF emissions/removals and the projected 2030 LULUCF levels). The NDC range presented is a combination of a minimum amount of land-use (0 MtCO2e) and maximum (690 MtCO2e) amount of land-use credits for the unconditional targets.*

Table 59: Overview of key climate change mitigation policies in the Russian Federation. Source: (Nachmany et al. 2015)

Sector	Policies (marked with "(+)" when mentioned in the INDC document)	Description
Economy-wide	Energy intensity targets (2008)	• 40% reduction of energy intensity of GDP by 2020, relative to 2007 [1]
Energy supply	Renewable energy targets (2013)	• 2.5% renewable energy in the power sector by 2020 (excluding hydro larger than 25 MW) (supported by regulated capacity prices for renewable energy, Government of the Russian Federation 2013) • 3.6 GW wind, 1.52 GW solar and 75 MW small hydropower[2] capacity by 2020
Industry	Decrease flaring in oil (2009)	• 5% limit on associated gas flaring for 2012 and subsequent years [3]
Forestry	National Strategy of Forestry Development by 2020 (2008)	• Increase in forest intensification and harvest of wood by 5.8% per year compared to 2007

[1] *Checked after implementation of other policies (please refer to the Supplementary Information)*

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

[3] *Not quantified in PBL TIMER model (but the target is met)*

Table 60: Impact of climate policies on greenhouse gas emissions (excluding LULUCF) in the Russian Federation. Absolute emission levels and emission levels relative to 2010 levels are presented. References for official emission data are provided in Table 3.

2010 GHG emissions, excl. LULUCF	2020 pledge and INDC		Current policies	
	Official data	**PBL and NewClimate estimates**	**Official data**	**PBL and NewClimate estimates**
Absolute: 2,470 MtCO$_2$e	N/A	2,710 to 3,755 MtCO$_2$e, 10% to 52% by 2020 2,530 to 3,400 MtCO$_2$e, 2% to 38% by 2030	2,590 MtCO$_2$e by 2030	2,550 to 2,575 MtCO$_2$e, 3% to 4% by 2020 2,650 to 2,790 MtCO$_2$e, 7% to 13% by 2030
Per capita: 17.3 tCO$_2$e/capita	N/A	18.9 to 26.1 tCO$_2$e/capita by 2020 18.0 to 24.2 tCO$_2$e/capita by 2030	N/A	17.8 to 17.9 tCO$_2$e/capita by 2020 18.8 to 19.9 tCO$_2$e/capita by 2030

Impact of climate policies on greenhouse gas emissions in Russian Federation
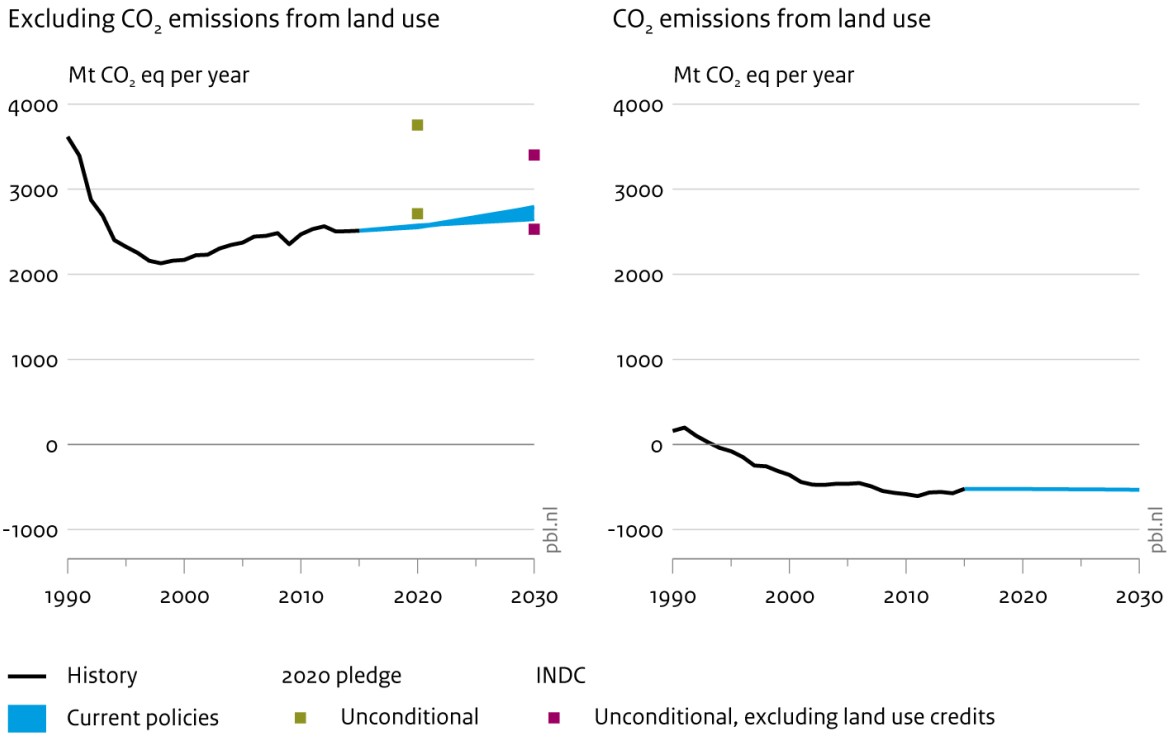
Excluding CO₂ emissions from land use

CO₂ emissions from land use

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

Figure 19: Impact of climate policies on greenhouse gas emissions in the Russian Federation (left panel: excluding land use (i.e. LULUCF), right panel: land use emissions only). Source: NewClimate Institute calculations based on Climate Action Tracker (CAT 2017) and PBL calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals. Please see Appendix (A2) on the consideration of LULUCF for the NDC quantification.

Saudi Arabia

In its NDC submitted on 3rd of November 2016, Saudi Arabia pledged to reduce up to 130 MtCO$_2$e by 2030 through actions that contribute to economic diversification and adaptation. The Saudi government has not yet defined a baseline scenario. In 2013, the government announced its plan to build 54GW of renewable power and 17GW of nuclear power by 2032 to cover 40-45% of future electricity production. In 2015, the government announced an eight-year delay of its implementation.

In 2016, the government further downscaled the target to only 9.5 GW of renewable electricity capacity until 2023 without specifying any additional capacity extension targets for the time after 2023. This downward revision of the renewable electricity target leads to an additional 75-135 MtCO$_2$e/year in 2030. We conclude that Saudi Arabia is not on track to meet its NDC target.

Table 61: Description of Saudi Arabia's NDC

Indicator	NDC (submitted 3 November 2016)
Target: unconditional	• Emissions reduction of up to 130 MtCO$_2$e annually in 2030
Target: conditional	• N/A
Sectoral coverage	• Mostly energy focused
General Accounting method	• Not specified
GHGs covered	• Not specified
Consideration of LULUCF	• Land use sector is not covered by NDC 's emission reduction target
Use of bilateral, regional and international credits	• Not specified
Other sector-level targets	• Not specified
Availability of reference scenarios in the latest UNFCCC submissions	• No
Other information	• Achievement of this goal is not conditional on international financial support, but is contingent on the continuation of economic growth, and "a robust contribution from oil export revenues to the national economy." Additionally, it is stated that technology cooperation and capacity building for NDC implementation will play a key role in the process. • Baseline not yet defined: "dynamic baseline will be developed on a basis of a combination of two scenarios, which are scenarios based on whether more oil is locally consumed, or exported.[1]

Note: Saudi Arabia has no mitigation pledge for 2020.

Table 62: Overview of key climate change mitigation policies in Saudi Arabia. Source: (Al-Ghabban 2013, KSA 2015, Borgmann 2016, Kingdom of Saudi Arabia 2016) .

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	King Abdullah City for Atomic and Renewable Energy (K.A.CARE) (+) (2010)	Aims to develop a substantial alternative energy capacity. Initially aiming to deploy 54GW of renewable electricity by 2032, the target has been revised downward to 9.5 GW by 2023.
Energy	National Renewable Energy Plan (NREP)	Increased share of renewable energy in the total energy mix, targeting the generation of 3.45 GW of renewable energy by 2020 under the National Transformation Program and 9.5 GW by 2023 towards Vision 2030
Transport	Corporate Average Fuel Economy Standards (CAFE) Saudi Arabia (2013)	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.
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

Table 63: Impact of climate policies on greenhouse gas emissions (excluding LULUCF) in Saudi Arabia. Absolute emission levels and emission levels relative to 2010 levels are presented. References for official emission data are provided in Table 3.

2010 GHG emissions, excl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	NewClimate estimates [1]	Official data	NewClimate estimates [1]
Absolute: 525 MtCO$_2$e	N/A	855 to 1,055 MtCO$_2$e, 63% to 101% by 2030	N/A	795 to 810 MtCO$_2$e, 51% to 55% by 2020 1,135 to 1,200 MtCO$_2$e, 116% to 128% by 2030
Per capita: 19.2 tCO$_2$e/capita	N/A	21.7 to 26.7 tCO$_2$e/capita by 2030	N/A	22.9 to 23.4 tCO$_2$e/capita by 2020 28.8 to 30.3 tCO$_2$e/capita by 2030

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

Impact of climate policies on greenhouse gas emissions in Saudi Arabia
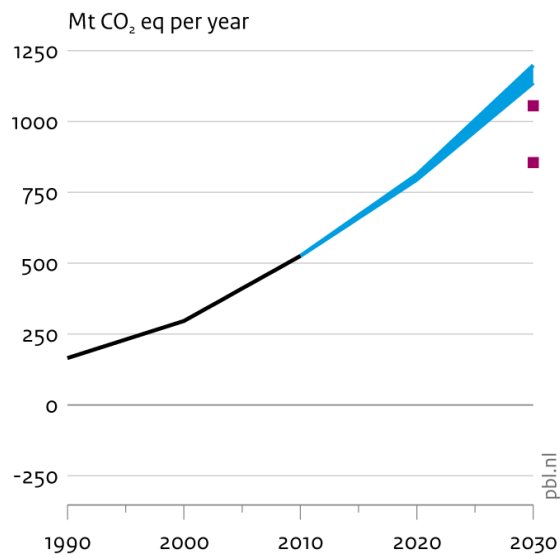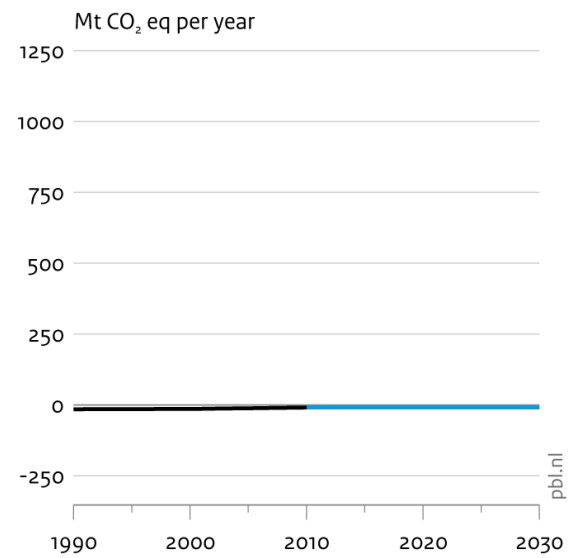
Figure 20: Impact of climate policies on greenhouse gas emissions (excluding land use (i.e. LULUCF)) in Saudi Arabia. Source: NewClimate Institute calculations excluding LULUCF adapted from Climate Action Tracker (CAT 2017) and IIASA calculations on LULUCF emissions and removals.

South Africa

South Africa's NDC submission consists of a peak, plateau and decline (PPD) greenhouse gas emissions trajectory range, with a range of 398–614 MtCO$_2$e by 2025 and 2030, a peak between 2020 and 2025, a plateau for the following decade, and absolute declines thereafter. The current policies projection includes the Integrated Resource Plan for electricity, the most important policy affecting South Africa's GHG emissions. Under current policies, South Africa's GHG emissions are projected to be 645–745 MtCO$_2$e by 2030 (including LULUCF), thus higher than the upper range of the PPD trajectory.

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

Indicator	2020 pledge	NDC (submitted 1 November 2016)
Target: unconditional	• N/A	• 398–614 MtCO$_2$e by 2025 and 2030 (Peak, Plateau and Decline 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 Fourth Assessment Report
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
Availability of reference scenarios in the latest UNFCCC submissions	• Yes: "With Existing Measures (WEM)" scenario developed for South Africa's Greenhouse Gas Mitigation Potential Analysis Report (Department of Environmental Affairs 2014)	• Yes: "With Existing Measures (WEM)" scenario developed for South Africa's Greenhouse Gas Mitigation Potential Analysis Report (Department of Environmental Affairs 2014)

Table 65: Overview of key climate change mitigation policies in South Africa. Source: (Department of Minerals and Energy 2007, Department of Energy South Africa 2011, Government of South Africa 2012, National Planning Commission 2012, Department of Energy South Africa 2013, Department of Environmental Affairs 2014, Republic of South Africa 2015)

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	National Development Plan (2012) (+)	• Among other targets: eliminate poverty, reduce inequality, increase access to water and electricity [1]
	National Climate Change Response Policy (2011) (+)	• Objectives: effectively manage climate change impacts and make a fair contribution to the global effort to stabilise GHG concentrations [1]
Energy supply	Integrated Resource Plan for electricity (supported by REIPP, Renewable Energy Independent Power Producer Programme) (2011) (+)	• Additional renewable electricity generation capacity to be built between 2010 and 2030 in the policy-adjusted plan[2]: 8.4 GW solar PV, 8.4 GW wind (plus 800 MW already committed), 1 GW CSP; resulting total capacity[3] 8.4 GW solar PV, 9.2 GW wind, 1 GW CSP
Transport	Mandatory blending of biofuels under the Petroleum Products Act (Biofuels Industrial Strategy) (2007)	• Concentration for blending: 2%-10% for bio-ethanol and minimum 5% for biodiesel from 2015 onwards[4]
Buildings	National Building Regulation (2011)	• Building codes and standards[5]
Forestry	Long term mitigation scenarios	• Establishment of 760,000 hectares of commercial forest by 2030
	National Forest Act (1998)	• Securing ecologically sustainable development and use of natural resources while promoting justifiable economic and social development [6] • Facilitate improved timber availability and secure supply of timber to ensure sustainability of entire timber value chain [6]
	Strategic Plan for the Development of Agriculture, Forestry and Fisheries (2013)	• Promote conservation of forest biological diversity, ecosystems and habitats, while promoting the fair and equitable distribution of their economic, social, health and environmental benefits [6]

[1] *Not included in current policies scenario*

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

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

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

[5] *Not included by PBL*

[6] *Policy not quantified in the IIASA LULUCF model projections.*

Table 66: Impact of climate policies on greenhouse gas emissions (including LULUCF) in South Africa. Absolute emission levels and emission levels relative to 2010 levels are presented. References for official emission data are provided in Table 3.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates
Absolute: 518 MtCO2e	398 to 614 MtCO2e by 2025-2030	400 to 585 MtCO2e, -23% to 12% by 2020 400 to 615 MtCO2e, -23% to 18% by 2030	N/A	580 to 640 MtCO2e, 12% to 23% by 2020 645 to 745 MtCO2e, 24% to 43% by 2030
Per capita: 10.0 tCO2e/capita	N/A	6.8 to 9.9 tCO2e/capita by 2020 6.2 to 9.5 tCO2e/capita by 2030	N/A	9.9 to 10.9 tCO2e/capita by 2020 10.0 to 11.5 tCO2e/capita by 2030

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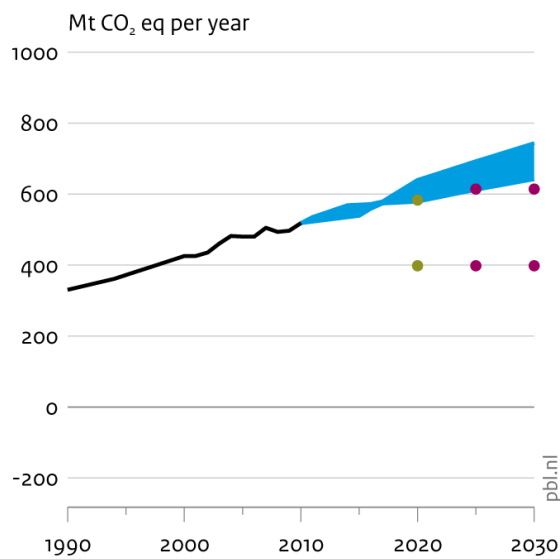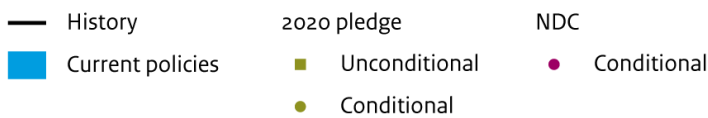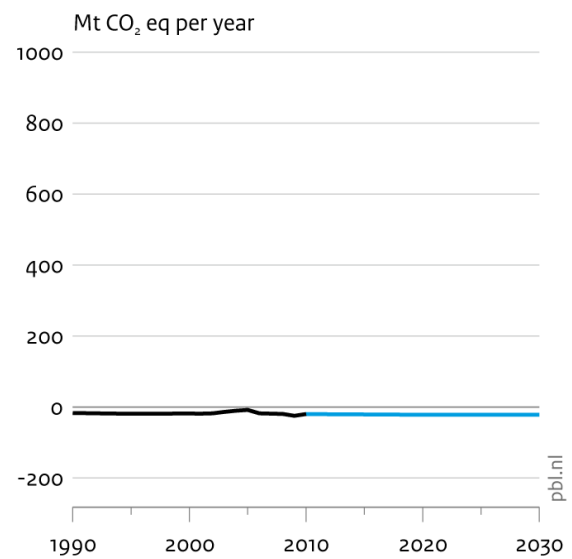
Source: PBL FAIR/TIMER model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 21: Impact of climate policies on greenhouse gas emissions in South Africa (left panel: all gases and sectors, right panel: land use (i.e. LULUCF) emissions and removals only). Source: NewClimate Institute calculations based on Climate Action Tracker (CAT 2017) and PBL calculations excluding LULUCF, and IIASA calculations on LULUCF emissions and removals.

Thailand

Thailand pledged an unconditional NDC target to reduce GHG emissions by 20% below BAU by 2030, and a conditional target to reduce emissions by 25% below BAU by 2030. The current policies projection includes the Thailand Integrated Energy Blueprint, comprising policies on alternative energy development, energy efficiency, smart grid, oil and gas. Thailand's GHG emissions are projected to be 515 $MtCO_2e$ by 2030 (including LULUCF) under current policies projections. Thailand would, therefore, fail to achieve its NDC target by 2030 including LULUCF by 70-100 $MtCO_2e$.

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

Indicator	2020 pledge	NDC (21 September 2016)
Target: unconditional	• N/A	• GHG reduction of 20% by 2030 compared to BAU level
Target: conditional	• 7-20% GHG emission reduction by 2020 below BAU in the energy and transport sectors, conditional on the level of international support	• GHG reduction of 25% by 2030 compared to BAU level, conditional on adequate and enhanced access to technology development and transfer, financial resources and capacity building
Sectoral coverage	• Energy and transport sectors	• Economy-wide, excl. LULUCF
General Accounting method	• N/A	• IPCC inventory methodology not specified; GWP values of the Fourth Assessment Report
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. (Office of Natural Resources and Environmental Policy and Planning of the Kingdom of Thailand 2015b)
Other sector-level targets	• N/A	• 20% share of power generation from renewable sources in 2036
Availability of reference scenarios in the latest UNFCCC submissions	• N/A	• N/A

Table 68: Overview of key climate change mitigation policies in Thailand. Source: (National Economic and Social Development Board of the Kingdom of Thailand 2012, Ministry of Energy of the Kingdom of Thailand 2015b, Ministry of Energy of the Kingdom of Thailand 2015a, Office of Natural Resources and Environmental Policy and Planning of the Kingdom of Thailand 2015a, APERC 2016, Asia Pacific Energy Research Centre (APERC) 2016, Ministry of Energy of the Kingdom of Thailand 2016)

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	Climate Change Master Plan (2015-2050) (2015) (+)[1]	7-20% GHG emission reduction by 2020 below BAU in the energy and transport sectors - 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	Thailand Integrated Energy Blueprint (2015) [1]	
	Alternative Energy Development Plan (2015-36) (2015) (+) and Power Development Plan (2015-36) (+)	Increase of renewable energy shares by 2036 to: 30% of total energy consumption, 20% of power generation (plus additional 15% from imported hydro), 35% of heat generation and 35% of transport fuels
	Energy Efficiency Plan (2015-36) (+)	Reduction of energy intensity per GDP by 30% by 2036, as compared to 2010 baseline, with total savings of 90 TWh by 2036[3]
	Oil Plan (2015-2036)	Support measures to save fuel in the transportation sector and enhance ethanol and biodiesel consumption
	Smart Grid Development Master Plan (2015-36) (+)	Aims for high penetration of renewable energy, mainly mini-hydro and solar PV
Transport	Environmentally Sustainable Transport System Plan (2013-30) (2012) (+)	Improvement of rail infrastructure to reduce annual logistics costs and the annual energy bill by about 2% and 1% of GDP respectively
Industry	Energy Conservation and Promotion Act (1992, amended 2007)	Stabilise share of energy demand for the three most energy-intensive sectors at 40% by 2030
Buildings	Minimum Energy and High Energy Performance Standards (MEPS/HEPS) (2011)	- Mandatory MEPS for air conditioners, refrigerators, self-ballasted compact fluorescent lamps and double-capped fluorescent lamps - HEPS for 28 appliances and types of equipment
	Building energy code (2009)	Reduce electricity use for large commercial buildings by > 50% by 2030 compared with BAU
F-gases	N/A	N/A
Forestry	National Economic and Social Development Plan (2012)	- Several non-quantifiable long-term targets to reduce GHG emissions in the agriculture and land transport sector [2] - 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 [2]

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

[2] Policy not quantified in the IIASA LULUCF model projections

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

Table 69: Impact of climate policies on greenhouse gas emissions (excluding LULUCF) in Thailand. Absolute emission levels and emission levels relative to 2010 levels are presented. References for official emission data are provided in Table 3.

2010 GHG emissions, excl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	NewClimate estimates	Official data	NewClimate estimates
Absolute: 299 MtCO$_2$e	N/A	395 to 440 MtCO$_2$e, 31% to 47% by 2020 415 to 445 MtCO$_2$e, 39% to 48% by 2030	N/A	395 MtCO$_2$e, 32% by 2020 515 MtCO$_2$e, 72% by 2030
Per capita: 4.5 tCO$_2$e/capita	N/A	5.7 to 6.3 tCO$_2$e/capita by 2020 6.0 to 6.4 tCO$_2$e/capita by 2030	N/A	5.7 tCO$_2$e/capita by 2020 7.4 tCO$_2$e/capita by 2030
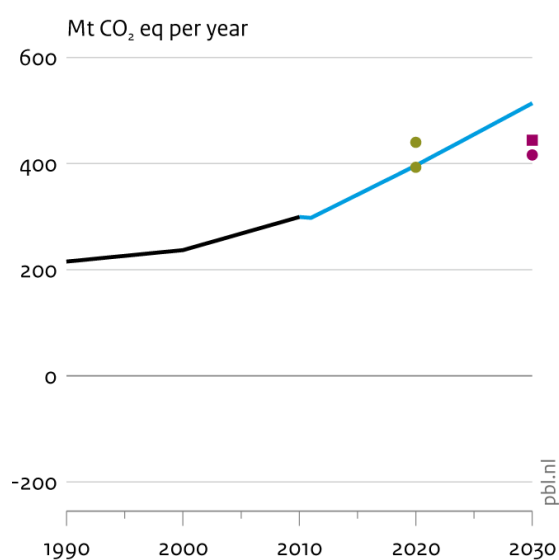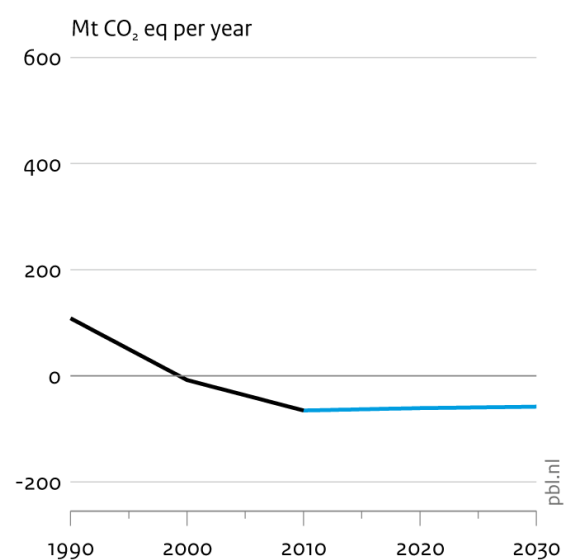
Impact of climate policies on greenhouse gas emissions in Thailand

Source: NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 22: Impact of climate policies on greenhouse gas emissions in Thailand (left: excluding land use (i.e. LULUCF), right: only land use). Source: NewClimate Institute calculations excluding LULUCF and IIASA calculations on LULUCF emissions and removals.

Turkey

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

The current policies projection includes renewable energy and energy intensity targets. If effective policies are implemented to achieve these targets, they could lead to emission levels of 525–1,000 $MtCO_2e$ by 2030 (49% to 183% above 2010 levels). This large range means the INDC could be either easily achieved (based on the current policies projection by PBL), or not met (based on government estimates reflected in NewClimate Institute's projection). Considering that the INDC is on the upper end of the projection range, we conclude that Turkey is roughly on track to meet its INDC.

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

Indicator	2020 pledge	INDC (submitted 30 September 2015)
Target: unconditional	• N/A	• 21% GHG reduction by 2030 from baseline scenario
Target: conditional	• N/A	• N/A
Sectoral coverage	• N/A	• Economy-wide
General Accounting method	• N/A	• IPCC guidelines; 100-year GWPs from the Fourth Assessment Report
GHGs covered	• N/A	• CO_2, CH_4, N_2O, HFCs, PFCs, SF_6 and NF_3
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	• Carbon credits from international market mechanisms will be used to achieve the 2030 target
Availability of reference scenarios in the latest UNFCCC submissions	• N/A	• Yes, INDC refers to a BAU scenario and gives values for the emissions pathway until 2030

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

Sector	Policies (marked with "(+)" when mentioned in the INDC document)	Description
Economy-wide	Energy intensity target (Energy Efficiency Law) (2012)	• Reduce primary energy intensity by 20% by 2023, compared to the 2008 level[1]
Energy supply	Renewable energy target (Law for the Utilisation of the Renewable Energy Resources for the Electricity Energy Production) (2005)	• 13% to 30% share of renewable energy resources in electricity production by 2023 (supported by feed-in tariffs, IEA 2011)
	Renewable capacity target (Renewable Energy Action Plan) (2014)	• 61 GW renewable capacity by 2023: 34 GW of hydro, 20 GW wind, 5 GW solar, 1 GW geothermal, 1 GW biomass[2]
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] Not included separately (but target achieved in PBL scenario)

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

Table 72: Impact of climate policies on greenhouse gas emissions (including LULUCF) in Turkey. Absolute emission levels and emission levels relative to 2010 levels are presented. References for official emission data are provided in Table 3.

2010 GHG emissions, incl. LULUCF	2020 pledge and INDC		Current policies	
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates
Absolute: 353 MtCO$_2$e	N/A	930 MtCO$_2$e, 163% by 2030	N/A	435 to 530 MtCO$_2$e, 24% to 50% by 2020 525 to 1,000 MtCO$_2$e, 49% to 183% by 2030
Per capita: 4.9 tCO$_2$e/capita	N/A	10.5 tCO$_2$e/capita by 2030	N/A	5.2 to 6.3 tCO$_2$e/capita by 2020 6.0 to 11.3 tCO$_2$e/capita by 2030

Impact of climate policies on greenhouse gas emissions in Turkey

Including CO_2 emissions from land use
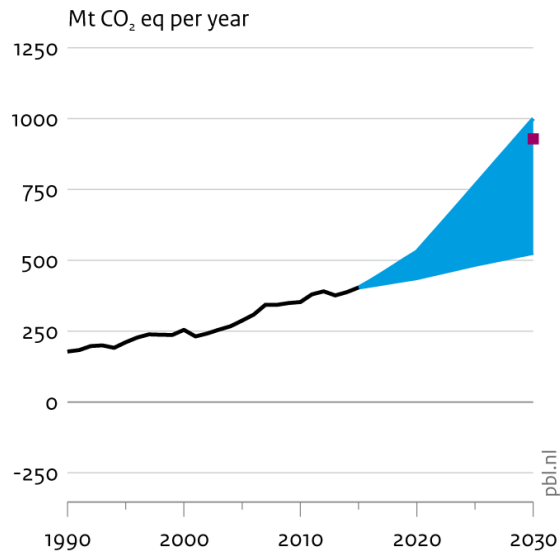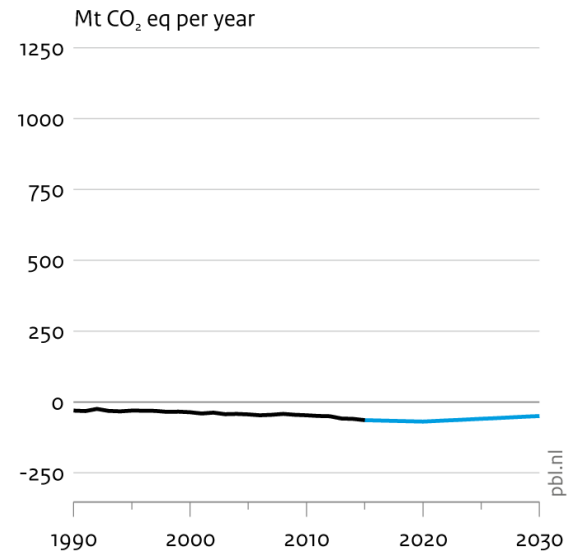
CO_2 emissions from land use

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

Figure 23: Impact of climate policies on greenhouse gas emissions in Turkey (left panel: including land use (i.e. LULUCF), right panel: land use emissions only). Source: NewClimate Institute calculations adapted from Climate Action Tracker (CAT 2017) and PBL projections excluding LULUCF, and IIASA calculations on LULUCF emissions and removals. NewClimate calculations are based on a government-published reference scenario, which assumes a strong economic growth of 4% from 2020 onwards compared to a current rate of 2%, resulting in rapidly increasing GHG emissions up to 2030.

Ukraine

Ukraine's NDC aims to limit GHG emissions to less than 60% of the 1990 levels by 2030. The NewClimate Institute's current policies projection was based on the 'with measures' scenario from Ukraine's Sixth National Communication, most importantly accounting for the National Renewable Energy Action Plan 2020. No current policies were included in the PBL projection because of the political circumstances as well as administrative and bureaucratic barriers in Ukraine, leading to uncertainties about the policy implementation status.

The current policies projections still suggest that Ukraine is on track to achieve its NDC (525 $MtCO_2e$/yr by 2030), with estimated emission levels of 355–390 $MtCO_2e$/year by 2030 (5% decrease to 5% increase from 2010 levels), including LULUCF.

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

Indicator	2020 pledge	NDC (submitted 19 September 2016)
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 the Second Assessment Report	• IPCC guidelines; 100-year GWPs from the Fourth Assessment Report
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 development and implementation of market mechanisms, but the 2030 GHG target does not account for this participation.
Availability of reference scenarios in the latest UNFCCC submissions	• "With measures" scenario from Ukraine's Sixth National Communication (NC6) (Government of Ukraine, 2013)	• "With measures" scenario from Ukraine's Sixth National Communication (NC6) (Government of Ukraine, 2013)

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

Sector	Policies[1] (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	National Renewable Energy Action Plan 2020 (2014)[2]	• 20% reduction of CO_2 emissions per final consumption of fuel by 2035 from 2010 levels (5% by 2020, 10% by 2025, 15% by 2030) • 11% share of renewable energy sources in gross final energy consumption by 2020 to achieve 78080 ktoe in heating and cooling, electricity and transport
Energy supply	Green Tariff (renewables feed-in-tariff) (2015 amendment)[2]	• 5% premium for 30% of domestic equipment • 10% premium when using 50% of domestic equipment
Transport	Law on Alternative Liquid and Gaseous Fuels (2012 amendment)	• Gradual increase in the share of production and use of biofuels and blended motor fuels of: 5% by 2013; 5% by 2014-2015; 7% by 2016; 10% by 2020
Industry	Corporate income tax exemptions for Renewable Energy Sector (2011)	• Reduction of 80% in corporate profit tax for 5 years for the sale of equipment that operates on renewable energy sources and/or that is used for producing alternative fuels
Forestry	Enhancement of forest cover	• Increase of the forest area up to 17% of total land cover by 2020
	State Programme "Forest of Ukraine" (2009)	• Target of 429,000 hectares of afforestation and 231,000 hectares of reforestation by 2030

[1] Policies that are implemented after 2013 were not explicitly considered in the current policies scenarios due to the lack of data and the uncertainty on their implementation status. PBL did not quantify any of the policies in this overview.

[2] Not included in NewClimate calculations.

Table 75: Impact of climate policies on greenhouse gas emissions (including LULUCF) in Ukraine. Absolute emission levels and emission levels relative to 2010 levels are presented. References for official emission data are provided in Table 3.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates
Absolute: 370 MtCO$_2$e	N/A	755 MtCO$_2$e, 104% by 2020 525 MtCO$_2$e, 42% by 2030	448 MtCO$_2$e by 2020 525 MtCO$_2$e by 2030	285 to 320 MtCO$_2$e, -23% to -13% by 2020 355 to 390 MtCO$_2$e, -5% to 5% by 2030
Per capita: 8.1 tCO$_2$e/capita	N/A	17.3 tCO$_2$e/capita by 2020 12.7 tCO$_2$e/capita by 2030	N/A	6.5 to 7.4 tCO$_2$e/capita by 2020 8.6 to 9.4 tCO$_2$e/capita by 2030

Impact of climate policies on greenhouse gas emissions in Ukraine

Including CO$_2$ emissions from land use   CO$_2$ emissions from land use
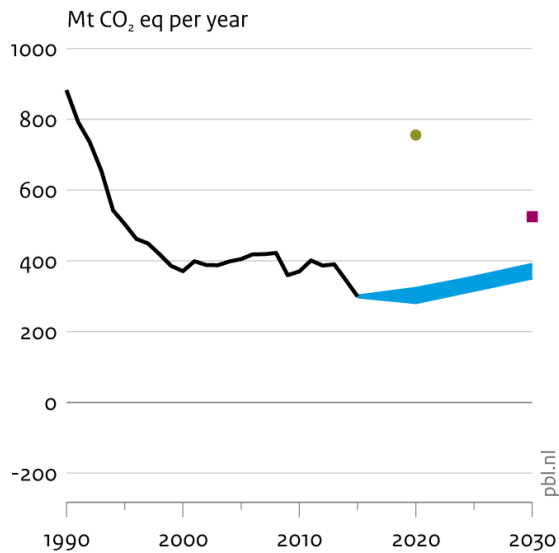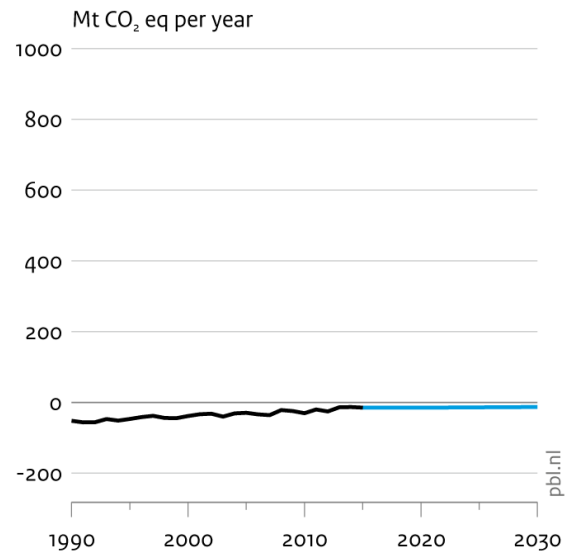
Source: PBL FAIR/TIMER model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 24: Impact of climate policies on greenhouse gas emissions in Ukraine (left panel: all gases and sectors, right panel: land use (i.e. LULUCF) emissions and removals only). Source: NewClimate Institute calculations adapted from Climate Action Tracker (CAT 2017) and PBL calculations excluding LULUCF, and IIASA projections on LULUCF emissions and removals.

United States of America

The United States of America submitted its NDC to reduce its GHG emissions by 26-28% from 2005 levels (20-24% from 2010 levels) by 2025, and ratified the Paris Agreement in September 2016. The government also sets a 2020 pledge of a 17% reduction from 2005 levels (13% from 2010 levels). However, on June 1st, 2017, President Donald Trump announced that the United States would withdraw from the Paris Agreement and cease implementation of the NDC. On August 4th, 2017, the United States notified the UN Secretary-General that it intends to "exercise its right to withdraw" from the Paris Agreement, which will first be possible in 2019. The main federal level mitigation-related policies implemented to date include the Clean Air Act, vehicle fuel efficiency standards (CAFE), and the Clean Power Plan (the legal status of which is under dispute in the courts). There are also various state or regional-level policies such as renewable portfolio standards (RPS) and regional emissions trading schemes.

PBL and NewClimate calculations indicate that the United States is not on track to meet its 2020 and 2025 NDC targets with existing policies. Excluding the impact of the Clean Power Plan, 2020 emission levels are projected to be 5 to 7% below 2010 levels, and 2025 emissions levels are projected to be 5 to 13% below 2010 levels. NewClimate and PBL estimates that including the Clean Power Plan would result in 200-250 MtCO₂e/year lower emissions in 2025. In either case, the NDC target would not be reached unless additional measures were implemented.

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

Indicator	2020 pledge	NDC (submitted 3 September 2016)
Target: unconditional	• GHG reduction in the range of 17% by 2020 below 2005 levels	• 26-28% GHG reduction by 2025 from 2005 levels
Target: conditional	• N/A	• N/A
Sectoral coverage	• Economy wide	• Economy wide
General Accounting method	• IPCC guidelines; 100-year GWPs from 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 • 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
Availability of reference scenarios in the latest UNFCCC submissions	• Yes: Current Measures scenario presented in the 2nd Biennial Report reflects the impacts of only existing policies and measures	• Yes: Current Measures scenario presented in the 2nd Biennial Report reflects the impacts of only existing policies and measures

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

Table 77: Overview of key climate change mitigation policies in the United States. Source: (Executive Office of the President 2013, United States of America 2014, IEA 2015, United States of America 2015, N.C. Clean Energy Technology Cente 2016, NewClimate Institute 2016)). State-level policies are presented in Supporting Information.

Sector	Policies (marked with "(+)" when mentioned in the NDC document)	Description
Economy-wide	Clean Air Act (1963) (+)	• Act governed by the EPA that is implemented through actions such as the Clean Power Plan (CPP)
Energy supply	Clean Power Plan (CPP) (2014) (+) [1]	• CPP aims to reduce emissions from the power sector by 32% below 2005 levels by 2030 • CO_2 standard for new and existing power plants
	Reduction in CH_4 emissions from oil and gas production	• 40% to 45%, from 2012 levels, by 2025[4] • Specific standards for oil and gas production
	Blueprint for a Secure Energy Future	• Reduce oil imports 50% by 2020[4]
Transport	Efficiency standards light commercial vehicles (CAFE) (+)	• 34.1 mpg (14.9 km/l) by 2016, 55 mpg (23.2 km/l) by 2025
	Efficiency standards heavy-duty trucks	• Differentiated standards per truck type
	Renewable fuel standard (2015)	• Volume of renewable fuel required to be blended into transportation fuel from 9 billion gallons in 2008 to 36 billion gallons by 2022
Buildings	Better buildings Challenge (commercial buildings)	• Help American commercial and industrial buildings become at least 20% more energy efficient by 2020[2]
	Energy Star Tax credits for buildings	• Tax credits for energy efficiency products and solar energy systems
	Building Energy Codes Program	• Efficiency codes are adopted at a state level
	Federal Appliance standards	• Appliance standards for a large number of appliances [2]
Industry	Curbing emissions of hydrofluorocarbons (HFCs) (+)	• Mix of actions to reduce HFCs use and encouraging the use of alternatives
Forestry	Forest Ecosystem Restoration and Hazardous Fuels Reduction Programs (2000)	• Mix of actions to increase forest resilience, reduce wildfire, and increase the area of set aside forests [3]

[1] *The legal status of the CPP is uncertain. The analysis by NewClimate and PBL considered cases with and without CPP.*

[2] *Not quantified in PBL TIMER model*

[3] *Policy not quantified in the IIASA LULUCF model projections*

[4] *Not quantified in NewClimate calculations.*

Table 78: Impact of climate policies on greenhouse gas emissions (including LULUCF) in the United States. Absolute emission levels and emission levels relative to 2010 levels are presented. Note that the official values for 2020 and 2030 are based on GWP values from the IPCC 4th Assessment Report. References for official emission data are provided in Table 3.

2010 GHG emissions, incl. LULUCF	2020 pledge and NDC		Current policies	
	Official data	PBL and NewClimate estimates	Official data	PBL and NewClimate estimates
Absolute: 6,085 MtCO$_2$e	5,344 MtCO$_2$e by 2020	5,365 MtCO$_2$e, -12% by 2020 4,655 to 4,785 MtCO$_2$e, -23% to -21% by 2025	5,451 to 5,597 MtCO$_2$e by 2020 5,379 to 5,672 MtCO$_2$e by 2025	Without Clean Power Plan 5,665 to 5,770 MtCO$_2$e, -7% to -5% by 2020 5,320 to 5,790 MtCO$_2$e, -13% to -5% by 2025 With Clean Power Plan 5,660 to 5,755 MtCO$_2$e, -7% to -5% by 2020 5,070 to 5,590 MtCO$_2$e, -17% to -8% by 2025
Per capita: 19.7 tCO$_2$e/capita	N/A	16.2 tCO$_2$e/capita by 2020 13.6 to 13.9 tCO$_2$e/capita by 2025	N/A	Without Clean Power Plan 17.1 to 17.4 tCO$_2$e/capita by 2020 15.5 to 16.9 tCO$_2$e/capita by 2025 With Clean Power Plan 17.1 to 17.4 tCO$_2$e/capita by 2020 14.8 to 16.3 tCO$_2$e/capita by 2025

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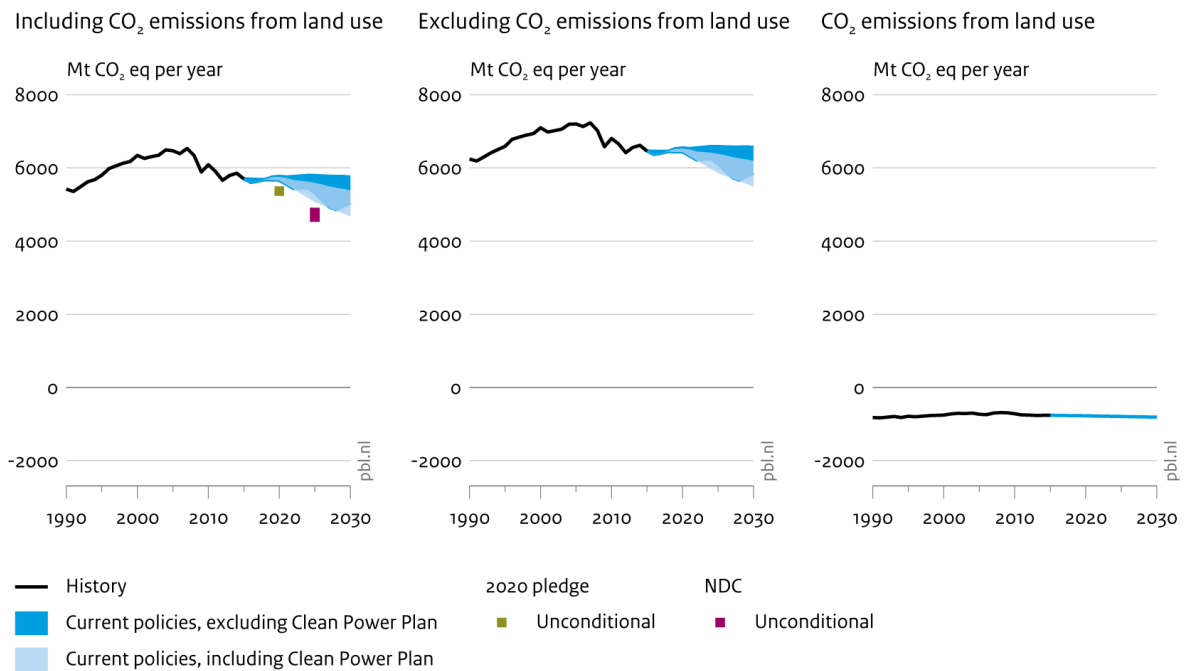
Source: PBL FAIR/TIMER model; NewClimate Institute calculations; IIASA GLOBIOM/G4M model

Figure 25: Impact of climate policies on greenhouse gas emissions in the United States (upper figure: all gases and sectors, including land use (i.e. LULUCF), lower figure: excluding land use (left) and only land use (right) separately). Source: NewClimate Institute calculations based on its analysis for Climate Action Tracker (CAT 2017) and PBL calculations excluding LULUCF, and IIASA projections on LULUCF emissions and removals.

References

ADB (2016). Indonesia Energy Sector Assessment, Strategy and Road Map. Manila, the Philippines, Asian Development Bank.

Al-Ghabban, A. (2013). Saudi Arabia's Renewable Energy Strategy and Solar Energy Deployment Roadmap, King Abdullah City for Atomic and Renewable Energy. . Retrieved from: https://www.irena.org/DocumentDownloads/masdar/Abdulrahman%20Al%20Ghabban%20Presentation.pdf.

America's Pledge. (2017). "Press Release: California Governor Jerry Brown and Michael Bloomberg Launch "America's Pledge"." Retrieved 14 July, 2017, from https://www.americaspledgeonclimate.com/.

APERC (2016). World Energy Demand and Supply Outlook 6th edition. Tokyo, Japan, Asia Pacific Energy Research Centre, Institute of Energy Economics, Japan.

Asia-Pacific Economic Cooperation. (2016). "Philippine Energy Efficiency Roadmap 2014-2030." Retrieved 27 May, 2016, from http://aperc.ieej.or.jp/file/2016/4/28/Philippines_Compendium_2015_-_Final.pdf.

Asia Pacific Energy Research Centre (APERC). (2016). "APEC Energy Demand and Supply Outlook 6th Edition: Economic Reviews." Retrieved 4 August, 2016, from http://aperc.ieej.or.jp/file/2016/5/10/APEC_Outlook6th_VolumeII_EconomyReviews.pdf.

Australian Government. (2016). "Australia's emissions projections 2016." Retrieved 28 August, 2017, from http://www.environment.gov.au/climate-change/emissions-projections.

Australian Government (2015a). Australia's abatement task: tracking to 2020. http://www.environment.gov.au/climate-change/publications/factsheet-emissions-projections-2015-16, Department of the Environment, Australia.

Australian Government (2015b). Australia's emissions projections 2014 –15, Department of Environment, March 2015. http://www.environment.gov.au/climate-change/publications/emissions-projections-2014-15, Department of the Environment, Australia.

Australian Government. (2015c). "Carbon Farming Initiative project transition into the Emissions Reduction Fund." Australian Government, Department of the Environment and Energy. Retrieved 3 November, 2016, from http://www.environment.gov.au/climate-change/emissions-reduction-fund/carbon-farming-initiative-project-transition.

Australian Government (2016). Tracking to Australia's emissions reduction targets. http://www.environment.gov.au/system/files/resources/9437fe27-64f4-4d16-b3f1-4e03c2f7b0d7/files/fact-sheet-tracking-emissions.pdf, Department of the Environment and Energy, Australia.

BAPPENAS (2015). Sekretariat RAN-GRK, Available at: http://ranradgrk.bappenas.go.id/rangrk/component/content/article/92-bahasa/informasi-sektoral/193-hasil-indc.

BEE. (2015). "Deepening &Widening of PAT scheme and Provisions of EC Act Applicable to DCs." Bureau of Energy Efficiency. Retrieved 27 April, 2016, from https://beeindia.gov.in/sites/default/files/Milind_Deore_widening_Deepening.pptx.compressed_0.pdf.

Blok, K. (2007). Introduction to Energy Analysis. Amsterdam, The Netherlands, Techne Press.

Bond, T. C., S. J. Doherty, D. W. Fahey, P. M. Forster, T. K. Berntsen, O. Boucher, B. DeAngelo, M. G. Flanner, S. J. Ghan, B. Karcher, D. Koch, S. Kinne, Y. Kondo, U. Lohmann, P. K. Quinn, M. C. Sarofim, M. G. Schultz, M. G. Schulz, C. Venkataraman, H. Zhang, S. Zhang, N. Bellouin, S. Guttikunda, P. K. Hopke, M. Z. Jacobson, J. Kaiser, Z. Klimont, J. P. Schwarz, D. Shindell, T. Storelvmo, S. G. Warren and C. S. Zender (2013). "Bounding the role of black carbon in the climate system: A scientific assessment." J. Geophys. Res. **118**: 1-173.

Borgmann, M. (2016). "Potentially Game-Changing Saudi Arabian Government Restructuring Bolsters 9.5 GW Renewable Energy Target by 2023." Retrieved 24 October, 2016, from http://www.apricum-group.com/saudi-arabia-announces-9-5-gw-renewable-energy-target-new-king-salman-renewable-energy-initiative/.

Braliyev, A. (2007). "Statement in the 15th session of the United Nations Commission on Sustainable Development." Retrieved 4 August, 2016, from https://sustainabledevelopment.un.org/content/documents/kazakhstan_9may.pdf.

Cámara de Diputados (2015). Ley De Transición Energética. http://www.diputados.gob.mx/LeyesBiblio/pdf/LTE.pdf Congreso General de los Estados Unidos Mexicanos.

Capros, P., A. De Vita, N. Tasios, P. Siskos, M. Kannavou, A. Petropoulos, S. Evangelopoulou, M. Zampara, D. Papadopoulos and C. Nakos (2016). EU Reference Scenario 2016 - Energy,

Transport and GHG Emissions - Trends to 2050. https://ec.europa.eu/energy/sites/ener/files/documents/20160713%20draft_publication_REF2016_v13.pdf, European Commission.

CAT (2015). Climate Action Tracker, http://climateactiontracker.org/.

CAT. (2017). "Climate Action Tracker: Rating Countries." Climate Action Tracker. Retrieved 28 July, 2017, from http://climateactiontracker.org/countries.html.

CD-LINKS. (2017). "CD-LINKS Project." Retrieved 28 August, 2017, from http://www.cd-links.org/.

Central Electricity Authority. (2016). "Draft National Electricity Plan." Retrieved 31 July, 2017, from http://www.cea.nic.in/reports/committee/nep/nep_dec.pdf.

Colombian Government. (2014). "For the regulation of the integration of Non-conventional Renewable Energy to the National Energy System." Retrieved 4 August, 2016, from https://www.minminas.gov.co/documents/10180//23517//22602-11506.pdf.

Dargie, G. C., S. L. Lewis, I. T. Lawson, E. T. A. Mitchard, S. E. Page, Y. E. Bocko and S. A. Ifo (2017). "Age, extent and carbon storage of the central Congo Basin peatland complex." Nature 542(7639): 86-90.

de Boer, H. S. and D. van Vuuren (2017). "Representation of variable renewable energy sources in TIMER, an aggregated energy system simulation model." Energy Economics 64: 600-611.

Decree of the President of the Republic of Kazakhstan. (2013). "Concept for transition of the Republic of Kazakhstan to Green Economy. Approved by Decree of the President of the Republic of Kazakhstan on May 30, 2013, #557." Retrieved 1 August, 2016, from http://gbpp.org/wp-content/uploads/2014/04/Green_Concept_En.pdf.

den Elzen, M., A. Admiraal, M. Roelfsema, H. van Soest, A. F. Hof and N. Forsell (2016a). "Contribution of the G20 economies to the global impact of the Paris agreement climate proposals." Climatic Change 137(3): 655-665.

den Elzen, M. G. J., H. Fekete, A. Admiraal, N. Forsell, N. Höhne, A. Korosuo, M. Roelfsema, H. van Soest, K. Wouters, T. Day, M. Hagemann and A. F. Hof (2015). Enhanced policy scenarios for major emitting countries. Analysis of current and planned climate policies, and selected enhanced mitigation measure. Bilthoven, the Netherlands, http://www.pbl.nl/sites/default/files/cms/publicaties/pbl-2015-enhanced-policy-scenarios-for-major-emitting-countries_1631.pdf, PBL Netherlands Environmental Assessment Agency.

den Elzen, M. G. J., H. Fekete, N. Höhne, A. Admiraal, N. Forsell, A. F. Hof, J. G. J. Olivier, M. Roelfsema and H. van Soest (2016b). "Greenhouse gas emissions from current and enhanced policies of China until 2030: Can emissions peak before 2030?" Energy Policy 89: 224-236.

Department of Energy. (2015a). "Philippine Energy Plan 2012-2030." Retrieved 27 May, 2016, from http://www.doe.gov.ph/policy-and-planning/philippine-energy-plan

Department of Energy. (2015b). "Philippines Energy Efficiency and Conservation Action Plan 2016-2020." Retrieved 27 May, 2016, from http://www.doe.gov.ph/doe_files/pdf/05_Energy_Efficiency/philippines_energy_efficiency_action_plan2016-20.pdf.

Department of Energy South Africa (2011). Integrated Resource Plan for Electricity 2010-2030 - Revision 2 - Final Report. http://www.doe-irp.co.za/content/IRP2010_promulgated.pdf, Department of Energy.

Department of Energy South Africa (2013). Integrated Resource Plan for Electricity (IRP) 2010-2030 - Update Report 2013. http://www.doe-irp.co.za/content/IRP2010_updatea.pdf, Department of Energy.

Department of Environmental Affairs (2014). Mitigation Report - South Africa's Greenhouse Gas Mitigation Potential Analysis. Pretoria, Department of Environmental Affairs, Government of South Africa & Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ) GmbH.

Department of Environmental Affairs Republic of South Africa. (2011a). "Explanatory note: Defining South Africa's Peak, Plateau and Decline Greenhouse Gas Emission Trajectory. SA Government Position on Climate Change " Retrieved 31 October, 2015, from http://www.climateaction.org.za/cop17-cmp7/sa-government-position-on-climate-change.

Department of Environmental Affairs Republic of South Africa (2011b). South Africa's Second National Communication under the United Nations Framework Convention on Climate Change, Available at: http://unfccc.int/resource/docs/natc/zafnc02.pdf [Accessed 14 October 2016].

Department of Minerals and Energy (2007). Biofuels Industrial Strategy of the Republic of South Africa. http://www.energy.gov.za/files/esources/renewables/biofuels_indus_strat.pdf(2).pdf, Department of Minerals and Energy.

EEA (2016). Total greenhouse gas emissions trends and projections (published 21 June 2016, last modified 30 October 2017). Retrieved 31 October, 2017, from https://www.eea.europa.eu/data-and-maps/indicators/greenhouse-gas-emission-trends-6/assessment

Energy Community Secretariat. (2015). "Annual Implementation Report 2014/2015." Retrieved 31 May, 2016, from https://www.energy-community.org/portal/page/portal/ENC_HOME/DOCS/3872267/23B450386A075E64E053C92 FA8C0F69F.PDF.

Energy in Central and Eastern Europe. (2014). "Energy Strategy of Ukraine through 2035. White Book of Ukrainian Energy Policy." Retrieved 31 May, 2016, from http://www.enercee.net/fileadmin/enercee/images-2016/Ukraine/Energy_strategy_2035_eng.pdf.

Ethiopia Rural Energy Development and Promotion Centre (EREDPC). (2007). "National Biogas Programme, Ethiopia: Brief Programme Profile." Retrieved 4 August, 2016, from http://www.bibalex.org/Search4Dev/files/284294/116537.pdf.

European Commission. (2016, 25 October, 2016). "Land use and forestry in the EU." Retrieved 31 October, 2016, from http://ec.europa.eu/clima/policies/forests/lulucf/index_en.htm.

Executive Office of the President. (2013). ""The President's Climate Action Plan." Washington, D.C., USA. (26 June): 21." Retrieved 4/16/2014, from https://obamawhitehouse.archives.gov/sites/default/files/image/president27sclimateactionplan. pdf.

FAO. (2015). "Climate change and forestry legislation in support of REDD+." Food and Agriculture Organization of the United Nations. . from http://www.fao.org/fileadmin/user_upload/legal/docs/lpo_92.pdf.

Federal Democratic Republic of Ethiopia - Ministry of Water and Energy. (2012). "Scaling - Up Renewable Energy Program Ethiopia Investment Plan (Draft Final). ." Retrieved 4 August, 2016, from http://www.epa.gov.et/Lists/News/Attachments/17/SREP%20Ethiopia%20Investment%20Plan %20-%20Version%20for%20External%20Review%20-%20January%202012.pdf.

Federal Democratic Republic of Ethiopia. (2010). "Growth and Transformation Plan." Retrieved 4 August, 2016, from https://www.imf.org/external/pubs/ft/scr/2011/cr11304.pdf.

Federal Democratic Republic of Ethiopia. (2011). "Ethiopia's Climate-Resilient Green Economy. Green economy strategy." Retrieved 4 August, 2016, from https://www.undp-aap.org/sites/undp-aap.org/files/Ethiopia%20CRGE%20Strategy%20Final.pdf.

Federal Democratic Republic of Ethiopia. (2015). "Ethiopia's Second National Communication to the United Nations Framework Convention on Climate Change (UNFCCC)." Retrieved 4 August, 2016, from http://unfccc.int/resource/docs/natc/ethnc2.pdf.

Federal Democratic Republic of Ethiopia. (2016). "Growth and Transformation Plan II (GTP II) (2015/16-2019/20)." Retrieved 24 October, 2016, from http://dagethiopia.org/new/docstation/com_content.article/100/gtpii__english_translation__final __june_21_2016.pdf.

Federative Republic of Brazil. (2015). "Intended Nationally Determined Contribution towards achieving the objective of the United Nations Framework Convention on Climate Change." UNFCCC. Retrieved 31 October, 2016, from http://www4.unfccc.int/submissions/INDC/Published%20Documents/Brazil/1/BRAZIL%20iNDC %20english%20FINAL.pdf.

Girod, B., D. P. van Vuuren and S. Deetman (2012). "Global travel within the 2°C climate target." Energy Policy **45**.

Government of Argentina. (2015). "Tercera Comunicación Nacional del Gobierno de la República Argentina a las Partes de la Convención Marco de las Naciones Unidas sobre Cambio Climático." Secretaría de Ambiente y Desarrollo Sustentable de la Nación. Retrieved 4 August, 2016, from http://unfccc.int/resource/docs/natc/argnc3s.pdf

Government of Argentina (2016). Primera Revisión de su Contribución Determinada a Nivel Nacional, http://www4.unfccc.int/ndcregistry/PublishedDocuments/Argentina%20First/17112016%20ND C%20Revisada%202016.pdf.

Government of Australia (2017). National Inventory Report 2015 Volume 1, Commonweath of Australia 2017.

Government of Brazil. (2007). "Decreto No 6.048, De 27 de Fevereiro de 2007." Retrieved 13 October, 2016, from http://www.planalto.gov.br/ccivil_03/_Ato2007-2010/2007/Decreto/D6048.htm.

Government of Canada (2014). Canada's Sixth National Report on Climate Change, http://ec.gc.ca/cc/16153A64-BDA4-4DBB-A514-B159C5149B55/6458_EC_ID1180-MainBook_high_min%20FINAL-s.pdf.

Government of Canada (2015). Canada's Second Biennial Report on Climate Change. http://unfccc.int/files/national_reports/biennial_reports_and_iar/submitted_biennial_reports/app lication/pdf/canadas_2nd_biennial_report.pdf., Government of Canada.

Government of Canada (2016). Canada's Second Biennial Report on Climate Change, Environment and Climate Change Canada, , https://www.ec.gc.ca/ges-ghg/02D095CB-BAB0-40D6-B7F0-828145249AF5/3001%20UNFCCC%202nd%20Biennial%20Report_e_v7_lowRes.pdf.

Government of Canada. (2017). "Canada's 2017 Nationally Determined Contribution Submission to the United Nations Framework Convention on Climate Change." UNFCCC. Retrieved 1 September, 2017, from http://www4.unfccc.int/ndcregistry/PublishedDocuments/Canada%20First/Canada%20First%20NDC-Revised%20submission%202017-05-11.pdf.

Government of Chile. (2013). "Action Plan for Energy Efficiency 2020." Ministry of Energy. from http://www.amchamchile.cl/UserFiles/Image/Events/octubre/energia/plan-de-accion-de-eficiencia-energetica2020.pdf & http://www.kallman.com/shows/iftenergy_2012/pdfs/Energy-for-the-Future-Chile's-National-Energy-Strategy-2012-2030-English.pdf.

Government of Chile. (2015). "Intended National Determined Contribution (INDC) for Paris Agreement 2015." from http://www4.unfccc.int/submissions/INDC/Published%20Documents/Chile/1/Chile%20INDC%20FINAL.pdf.

Government of India (2015a). First Biennial Update Report to the United Nations Framework Convention on Climate Change. Government of India, Ministry of Environment, Forest and Climate Change.

Government of India (2015b). India's Intended Nationally Determined Contribution: Working Towards Climate Justice. .

Government of Japan. (2013). "Japan's 6th National Communication to the UNFCCC." from http://unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/nc6_japan_webversion.pdf.

Government of Japan. (2015). "Japan's National Greenhouse Gas Emissions in Fiscal Year (FY) 2013 (Vol. 2013). http://www.env.go.jp/press/files/en/591.pdf." from http://unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/nc6_japan_webversion.pdf.

Government of Japan. (2016). "Japan's Second Biennial Report Under the United Nations Framework Convention on Climate Change, Available at: http://unfccc.int/files/national_reports/biennial_reports_and_iar/submitted_biennial_reports/application/pdf/japan_br2_revised.pdf."

Government of Russia. (2014). "First Biennial Report of the Russian Federation." UNFCCC, Bonn, available at: http://unfccc.int/files/national_reports/biennial_reports_and_iar/submitted_biennial_reports/application/pdf/1br_rus_unoffical_translation_eng.pdf Retrieved 12 December, 2014.

Government of Russia. (2015). "Second Biennial Report of the Russian Federation." UNFCCC, Bonn, available at: http://unfccc.int/resource/docs/2016/trr/rus.pdf. 2015.

Government of South Africa (2012). National Climate Change Response White Paper. Pretoria, Government of South Africa.

Government of the Republic of Kazakhstan. (2015). "Intended Nationally Determined Contribution. Submission of the Republic of Kazakhstan." UNFCCC. Retrieved 4 August, 2016, from http://www4.unfccc.int/Submissions/INDC/Published%20Documents/Kazakhstan/1/INDC%20Kz_eng.pdf.

Government of the Russian Federation. (2013). "Decree No. 449 on the Mechanism for the Promotion of Renewable Energy on the Wholesale Electricity and Market " Retrieved 13 October, 2016, from http://www.iea.org/media/pams/russia/Russia_Decreeno449_MechanismforthePromotionofRenewableEnergyontheWholesaleElectricityandMarket.pdf.

Government of Ukraine. (2013). "Sixth National Communication." UNFCCC. from http://unfccc.int/files/national_reports/annex_i_natcom/submitted_natcom/application/pdf/6nc_v7_final_[1].pdf.

Government of Brazil (2008). National Plan on Climate Change Brazil, Executive Summary. Decree No. 6263. I. C. o. C. Change. Brasília, Brazil, http://www.mma.gov.br/estruturas/208/_arquivos/national_plan_208.pdf

Government of Brazil (2010). DECREE No. 7390, 9 December 2010, http://www.planalto.gov.br/ccivil_03/_Ato2007-2010/2010/Decreto/D7390.htm

Government of Mexico (2012). Programas para mitigar el cambio climático, Available at: http://www2.inecc.gob.mx/publicaciones/libros/685/programas2.pdf [Accessed 10 November 2015].

Grassi, G., M. G. J. den Elzen, A. F. Hof, R. Pilli and S. Federici (2012). "The role of the land use, land use change and forestry sector in achieving Annex I reduction pledges." Climatic Change **115**(3): 873-881.

Green, F. and N. Stern (2016). "China's changing economy: implications for its carbon dioxide emissions." Climate Policy: 1-15.

Gusti, M. and G. Kindermann (2011). An approach to modeling landuse change and forest management on a global scale. Proceedings, 1st International Conference on Simulation and Modeling Methodologies, Technologies and Applications (SIMULTECH 2011).

Gütschow, J., L. Jeffery, R. Gieseke and R. Gebel (2017). "The PRIMAP-hist national historical emissions time series (1850-2014). V. 1.1. GFZ Data Services. http://doi.org/10.5880/PIK.2017.001."

Havlík, P., H. Valin, M. Herrero, M. Obersteiner, E. Schmid, M. C. Rufino, A. Mosnier, P. K. Thornton, H. Böttcher, R. T. Conant, S. Frank, S. Fritz, S. Fuss, F. Kraxner and A. Notenbaert (2014). "Climate change mitigation through livestock system transitions." PNAS **111**(10): 3709-3714.

Hwang, I.-H. (2014). South Korea's National Basic Plan for New and Renewable Energies. EDMC Energy Trends. Tokyo, Japan, Institute of Energy Economics, Japan. https://eneken.ieej.or.jp/data/5842.pdf [accessed 1 November, 2016].

ICAP. (2016). "Kazakhstan ETS suspended until 2018 " Retrieved 6 July, 2016, from https://icapcarbonaction.com/en/news-archive/387-kazakhstan-ets-suspended-until-2018.

ICCT (2012). Global Transportation Roadmap. Model Documentation and User Guide: ICCT Roadmap Model Version 1-0, The International Council on Clean Transportation.

IEA. (2011, 27 October, 2015). "Renewable Energy Law 2010." Retrieved 13 October, 2016, from http://www.iea.org/policiesandmeasures/pams/turkey/name-24961-en.php.

IEA. (2013). "Programme for Rational and Efficient Use of Energy and Other Forms of Non-Conventional Energy (Resolution 180919) " IEA/IRENA Joint Policies and Measures database. Retrieved 4 August, 2016, from http://www.iea.org/policiesandmeasures/pams/colombia/name-38072-en.php?s=dHlwZT1yZSZzdGF0dXM9T2s,&return=PG5hdiBpZD0iYnJlYWRjcnVtYiI-PGEgaHJlZj0iLyI-SW50ZXJuYXRpb25hbCBFbmVyZ3kgQWdlbmN5Jnp3bmo7PC9hPjxzcGFuPiAmZ3Q7lDwvc3Bhbj48YSBocmVmPSIvcG9saWNpZXNhbmRtZWFzdXJlcy8iPlBvbGljaWVzIGFuZCBNZWFzdXJlczwvYT48c3Bhbj4gJmd0OyA8L3NwYW4-PGEgaHJlZj0iL3BvbGljaWVzYW5kbWVhc3VyZXMvcmVuZXdhYmxlZW5lcmd5LyI-UmVuZXdhYmxlIEVuZXJneTwvYT48c3BhbiBiGFzcz0ibGFzdCI-PC9zcGFuPjwvbmF2Pg.

IEA (2015). World Energy Outlook 2015. Paris, France, International Energy Agency.

IEA. (2016). "Renewable Energy - Renewable Policy Update." Retrieved 13 October, 2016, from https://www.iea.org/media/pams/repolicyupdate/REDRenewablePolicyUpdateNo920160405.pdf

http://www.cenace.gob.mx/Docs/MercadoOperacion/Subastas/36%20Extracto%20del%20Fallo%20de%20la%20Primera%20Subasta%20de%20Largo%20Plazo%20SLP%20-%201%20-%202015%20v2016%2004%2001.pdf.

IEA/IRENA. (2016). "Joint Policies and Measures database." International Energy Agency. Retrieved 19 May, 2016, from http://www.iea.org/policiesandmeasures/pams/chile/

International Carbon Action Partnership. (2016). "ETS Detailed Information Ukraine." Retrieved 31 May, 2016, from https://icapcarbonaction.com/en/?option=com_etsmap&task=export&format=pdf&layout=list&systems[]=74.

Iversen, P., D. Lee and M. Rocha (2014). Understanding land use in the UNFCCC. Climate and Land Use Alliance.

JRC/PBL. (2014). "Emission Database for Global Atmospheric Research (EDGAR) version 4.2FT2012 " Joint Research Centre of the European Commission/PBL Netherlands Environmental Assessment Agency. from http://edgar.jrc.ec.europa.eu/index.php.

Keenan, R. J., G. A. Reams, F. Achard, J. V. de Freitas, A. Grainger and E. Lindquist (2015). "Dynamics of global forest area: results from the FAO Global Forest Resources Assessment 2015." Forest Ecology and Management **352**: 9-20.

Kharina, A., C. Malins and S. Searle (2016). Biofuels Policy in Indonesia : Overview and Status Report. http://www.theicct.org/sites/default/files/publications/Indonesia Biofuels Policy_ICCT_08082016.pdf, ICCT: 1-13.

King Abdullah University of Science and Technology (2014). Appraisal and Evaluation of Energy Utilization and Efficiency in the Kingdom of Saudi Arabia. Volume 2: Energy Efficiency Audit: Case Studies, http://www.kaust.edu.sa/assets/downloads/kicp-annual-strategic-study-appraisal-and-evaluation-of-energy-utilization-and-efficiency-in-the-ksa%202014-volume1.pdf.

Kingdom of Morocco - Ministry Delegate of the Minister of Energy Mines Water and Environment. (2013). "La nouvelle Stratégie Energétique Nationale. Bilan d'étape." Retrieved 4 August, 2016, from http://taqaway.net/sites/default/files/uploads/documents/doc98.pdf.

Kingdom of Morocco - Ministry Delegate of the Minister of Energy Mines Water and Environment. (2014). "Moroccan Climate Change Policy." from http://www.4c.ma/medias/MCCP%20-%20Moroccan%20Climate%20Change%20Policy.pdf.

Kingdom of Morocco (2015). Intended National Determined Contribution (INDC). http://www4.unfccc.int/Submissions/INDC/Published%20Documents/Morocco/1/Morocco%20INDC%20submitted%20to%20UNFCCC%20-%205%20june%202015.pdf, UNFCCC.

Kingdom of Morocco. (2016a). "Premier Rapport Biennal Actualisé du Royaume du Maroc." Retrieved 4 August, 2016, from http://unfccc.int/resource/docs/natc/marbur1.pdf.

Kingdom of Morocco. (2016b). "Troisième Communication Nationale a la Convention Cadre des Nations Unies sur les Changements Climatiques." Retrieved 4 August, 2016, from http://unfccc.int/resource/docs/natc/marnc3.pdf.

Kingdom of Morocco Ministry of Equipment and Transport. (2010). "Stratégie nationale de développement de la compétitivité logistique. Synthèse de la stratégie et du Contrat-Programme 2010 - 2015." Retrieved 4 August, 2016, from http://www.orientalinvest.ma/telechargementfichiers/logistique/Doc1FR.pdf.

Kingdom of Saudi Arabia. (2016). "Vision 2030." Retrieved 24 October, 2016, from www.vision2030.gov.sa/download/file/fid/417.

KSA (2015). The Intended Nationally Determined Contribution (INDC) of the Kingdom of Saudi Arabia under the UNFCCC. Retrieved from http://www4.unfccc.int/submissions/INDC/Published%20Documents/Saudi%20Arabia/1/KSA-INDCs%20English.pdf.

Kuramochi, T. (2014). GHG Mitigation in Japan: An Overview of the Current Policy Landscape. Washington, Working Paper. Washington, DC: World Resources Institute. Available online at wri.org/publication/ghg-mitigation-policy-japan

Kuramochi, T., N. Höhne, S. Gonzales-Zuniga, F. Hans, S. Sterl, M. Hagemann, E. Hernandez Legaria, M. G. J. Den Elzen, M. Roelfsema, H. Van Soest, N. Forsell and O. Turkovska (2016). Greenhouse gas mitigation scenarios for major emitting countries: Analysis of current climate policies and mitigation pledges (Update: November 2016). Cologne, Germany, NewClimate Institute.

Loynes, K. (2016). Australia and the Doha Amendment: a quick guide. http://parlinfo.aph.gov.au/parlInfo/download/library/prspub/4971944/upload_binary/4971944.pdf, Parliament of Australia.

MAPS Chile (2014). Opciones de mitigación para enfrentar el cambio climático: resultados de Fase 2. Santiago, Chile, Ministerio del Medio Ambiente.

Ministry of Consumer Affairs Food and Public Distribution. (2015, 22 December, 2015). "Ethanol blending targets scaled up from 5% to 10% to improve the liquidity position of sugar mills." Press Information Bureau, Government of India, Ministry of Consumer Affairs, Food & Public Distribution. from http://pib.nic.in/newsite/PrintRelease.aspx?relid=133773

Ministry of Energy (2014). Energy Agenda. A challenge for the country, progress for everyone. Chile Ministry of Energy.

Ministry of Energy and Natural Resources (2009). Electricity Energy Market and Supply Security Strategy Paper. Ankara, Ministry of Energy and Natural Resources.

Ministry of Energy and Natural Resources (2014). National Renewable Energy Action Plan for Turkey. Ankara, MInistry of Energy and Natural Resources.

Ministry of Energy of Argentina. (2016). "Ministry of Energy Database: Generación Eléctrica - Centrales de Generación." Retrieved 28 July, 2017, from http://datos.minem.gob.ar/dataset/anuarios-de-energia-electrica.

Ministry of Energy of the Kingdom of Thailand. (2015a). "Oil Plan (2015-2036)." Retrieved 4 August, 2016, from http://www.eppo.go.th/images/POLICY/ENG/oil_plan2558.pdf.

Ministry of Energy of the Kingdom of Thailand. (2015b). "Thailand Power Development Plan 2015-2036 (PDP2015)." Retrieved 4 August, 2016, from http://www2.eppo.go.th/power/PDP2015/PDP2015_Eng.pdf.

Ministry of Energy of the Kingdom of Thailand. (2016). "Thailand Integrated Energy Blueprint. EPPO Journal, (Special Issue 2016)." Retrieved 4 August, 2016, from http://www.eppo.go.th/images/Infromation_service/journalissue/ISSUE-SPECIAL2559.pdf.

Ministry of Energy of the Republic of Kazakhstan. (2015). "The Second Biennial Report of the Republic of Kazakhstan submitted in accordance with the Decision 1/CP.16 of the Conference of the Parties to the United Nations Framework Convention on Climate Change." United Nations

Framework Convention on Climate Change. Retrieved 28 July, 2016, from http://unfccc.int/files/national_reports/biennial_reports_and_iar/submitted_biennial_reports/application/pdf/br-text_eng_kz.pdf.

Ministry of Energy of the Republic of Kazakhstan. (2016). "The Second Biennial Report of the Republic of Kazakhstan CTF submission workbook,,." UNFCCC. Retrieved 28 July, 2016, from http://unfccc.int/files/national_reports/biennial_reports_and_iar/submitted_biennial_reports/application/pdf/kaz_2016_v2.0_resubmission.pdf.

Ministry of Environment. (2015). "Second stage of green tax implementation in 2016." Government of Chile. Retrieved 19 May, 2016, from http://portal.mma.gob.cl/en-2016-comienza-segunda-etapa-de-implementacion-de-impuestos-verdes/.

Ministry of Environment. (2016). "National Action Plan of Climate Change (2017-2022)." Government of Chile. from http://portal.mma.gob.cl/wp-content/uploads/2016/04/Anteproyecto-PANCC-2017-2022-FINAL-2016-04-18.pdf.

Ministry of Environment and Sustainable Development. (2016). "National Plan for Adaptation to Climate Change." Retrieved 4 August, 2016, from https://www.minambiente.gov.co/images/cambioclimatico/pdf/Plan_nacional_de_adaptacion/1._Plan_Nacional_de_Adaptación_al_Cambio_Climático.pdf.

Ministry of Environment and Urbanization (2010). Climate Change Strategy 2010-2020. Ankara, Ministry of Environment and Urbanization.

Ministry of Environment and Urbanization (2011). National Climate Change Action Plan. Ankara, Ministry of Environment and Urbanization.

Ministry of Environment and water resources of the Republic of Kazakhstan. (2013). "The III-VI National Communication of the Republic of Kazakhstan to the UN Framework Convention on Climate Change." Ministry of Environment and water resources of the Republic of Kazakhstan, United Nations Development Program in Kazakhstan, Global Environment Facility. Retrieved 4 August, 2016, from http://unfccc.int/files/national_reports/annex_i_natcom_/application/pdf/kaz_nc3,4,5,6_eng.pdf.

Ministry of External Relations. (2016). "Convention of UN against desertification –CNULD-." Retrieved 4 August, 2016, from http://www.ideam.gov.co/documents/11769/153422/20121210_Convención_Naciones_Unidas_Lucha_contra_Desertificación_Cancilleria.pdf/b8332e85-6719-4bbf-b7eb-56c6722bb249.

Ministry of Mines and Energy (2012). Plano Decenal de Expansão de Energia 2020. Brasília, Brazil, Ministério de Minas e Energia, Empresa de Pesquisa Energética.

Ministry of the Environment and Sustainable Development. (2015). "Inventario general de GEIs en Argentina." Retrieved 4 August, 2016, from http://ambiente.gob.ar/tercera-comunicacion-nacional/

Ministry of Trade, I. a. E., , (2015). The 7th Basic Plan for Long-term Electricity Supply and Demand (2015 – 2029). MOTIE Notice #2015-403, July 24, 2015. Seoul, Republic of Korea, Ministry of Trade, Industry and Energy.

MNRE (2009). National Policy on Biofuels. http://mnre.gov.in/file-manager/UserFiles/biofuel_policy.pdf, Ministry of New and Renewable Energy, Government of India.

N.C. Clean Energy Technology Cente (2016). Database of State Incentives for Renewables & Efficiency - DSIRE. Retrieved April 10, 2016, from http://www.dsireusa.org/.

Nachmany, M., S. Fankhauser, J. Davidová, N. Kingsmill, T. Landesman, H. Roppongi, P. Schleifer, J. Setzer, A. Sharman, C. Stolle Singleton, J. Sundaresan and T. Townshend (2015). Climate change legislation in Russia. An excerpt from The 2015 Global Climate Legislation Study - A Review of Climate Change Legislation in 99 Countries. Retrieved from http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2015/05/RUSSIA.pdf.

NAMA Facility. (2016). "Projects: Colombia Transit-oriented Development (TOD)." Retrieved 4 August, 2016, from http://www.nama-facility.org/projects/colombia-i.html.

National Economic and Social Development Board of the Kingdom of Thailand. (2012). "The Eleventh National Economic and Social Development Plan (2012-2016)." Retrieved 4 August, 2016, from http://portal.mrcmekong.org/assets/documents/Thai-Law/11th-National-Economic-and-Social-Development-Plan-2012-2016.pdf.

National Environmental Commission. (2010). "National Climate Change Action Plan 2008-2012." from http://www.mma.gob.cl/1304/articles-49744_Plan_02.pdf.

National Forest Corporation and Ministry of Agriculture. (2012). "Law 20.283 on native forest recovery and forestry development. ." from http://www.conaf.cl/wp-content/files_mf/1368741650LibroLey_Bosque_NativoReglamentos.pdf.

National Planning Commission (2012). Our future - make it work. National Development Plan 2030 - Executive Summary, National Planning Commission, Republic of South Africa.

NCCS (2013). "National Climate Change Strategy. 10-20-40 Vision. Mexico: Federal Government of Mexico."

NewClimate Institute. (2016). "Climate Policy Database." Retrieved 10 April, 2016, from http://www.climatepolicydatabase.org.

OECD (2013). Australia. Taxing Energy Use: A Graphical Analysis. http://www.keepeek.com/Digital-Asset-Management/oecd/taxation/taxing-energy-use/australia_9789264183933-5-en#page1, OECD Publishing.

Office of Natural Resources and Environmental Policy and Planning of the Kingdom of Thailand. (2015a). "Thailand's First Biennial Update Report under the United Nations Framework Convention on Climate Change." Retrieved 4 August, 2016, from http://unfccc.int/resource/docs/natc/thabur1.pdf.

Office of Natural Resources and Environmental Policy and Planning of the Kingdom of Thailand (2015b). Thailand's Intended Nationally Determined Contribution (INDC). Bangkok, Thailand: http://www4.unfccc.int/Submissions/INDC/Published%20Documents/Thailand/1/Thailand_INDC.pdf., Office of Natural Resources and Environmental Policy and Planning. .

Peters, G. (2017). "Have Chinese CO2 emissions really peaked?" Climate Home. Retrieved 20 August, 2017, from http://www.climatechangenews.com/2017/03/31/chinese-co2-emissions-really-peaked/.

Philippine Institute for Development Studies. (2014). "Cost Efficiency and Effectiveness of the Sitio and Household Electrification Program. Good governance dialogues: A forum on open government and the national budget Environment." Retrieved 27 May, 2016, from http://www.gov.ph/governance/wp-content/uploads/2015/04/ZBB-Electrification-Open-Govt-Forum.pdf.

Planning Commission Government of India (2011). Low Carbon Strategies for Inclusive Growth: An Interim Report. Interim Report of the Expert Group on Low Carbon Strategies for Inclusive Growth, New Delhi, India, http://moef.nic.in/downloads/public-information/Interim%20Report%20of%20the%20Expert%20Group.pdf.

Planning Commission Government of India (2014). The Final Report of the Expert Group on Low Carbon Strategies for Inclusive Growth. Interim Report of the Expert Group on Low Carbon Strategies for Inclusive Growth, New Delhi, India, http://planningcommission.nic.in/reports/genrep/rep_carbon2005.pdf.

PRODES. (2016). "Monitoramento da Floresta Amazônica Brasileira por Satélite." Retrieved 28 August, 2017, from http://www.obt.inpe.br/OBT/assuntos/programas/amazonia/prodes.

REDD-PAC Brazil (2015). Modelling Land Use Changes in Brazil: 2000-2050, http://www.redd-pac.org/reports/lucc_brazil_folder.pdf.

REDD-PAC DRC (2016). Modelling Future Land Use Changes in the Democratic Republic of Congo: 2000-2030. http://redd-pac.org/reports/DRC-E.pdf, REDD-PAC.

Republic of Indonesia (2016a). First Nationally Determined Contribution. Republic of Indonesia, Jakarta, Government of Indonesia.

Republic of Indonesia. (2016b). "Indonesia first Biennial Update Report (BUR) under the United Nations Framework Convention on Climate Change. ." Retrieved 31 July, 2017, from http://unfccc.int/resource/docs/natc/idnbur1.pdf.

Republic of Indonesia (2016c). Rencana usaha penyediaan tenaga listrik pt perusahaan listrik negara (persero) tahun 2016 S.D. 2025. Jakarta, Indonesia, Menteri energi dan sumber daya mineral Republik Indonesia.

Republic of Kazakhstan. (2009). "Law of the Republic of Kazakhstan About Support of Use of Renewable Sources of Energy." Retrieved 1 August, 2016, from http://www.windenergy.kz/files/1236749650_file.pdf.

Republic of Kazakhstan. (2012). "Law of the Republic of Kazakhstan About energy saving and energy efficiency raise (No. 541-IV)." CIS-Legislation. Retrieved 1 August, 2016, from http://cis-legislation.com/document.fwx?rgn=53341.

Republic of Korea (2012). Korea's Third National Communication under the United Nations Framework Convention on Climate Change. Low Carbon, Green Growth. Government of South Korea, Available at: http://unfccc.int/resource/docs/natc/kornc3.pdf

Republic of Korea (2014). First Biennial Update Report of the Republic of Korea, Seoul, South Korea: Greenhouse Gas Inventory & Research Center of Korea. Available at: http://unfccc.int/resource/docs/natc/rkorbur1.pdf.

Republic of Korea. (2015). "Intended Nationally Determined Contribution." UNFCCC. Retrieved 2016, 1 November, from

http://www4.unfccc.int/submissions/INDC/Published%20Documents/Republic%20of%20Korea/1/INDC%20Submission%20by%20the%20Republic%20of%20Korea%20on%20June%2030.pdf.

Republic of Korea. (2016). "Submission by the Republic of Korea: Intended Nationally Determined Contribution." UNFCCC. Retrieved 28 July, 2017, from http://www4.unfccc.int/ndcregistry/PublishedDocuments/Republic%20of%20Korea%20First/INDC%20Submission%20by%20the%20Republic%20of%20Korea%20on%20June%2030.pdf.

Republic of South Africa. (2015). "South Africa's Intended Nationally Determined Contribution (INDC)." UNFCCC. Retrieved 12 July, 2016, from http://www4.unfccc.int/submissions/INDC/Published%20Documents/South%20Africa/1/South%20Africa.pdf.

Republic of Turkey Ministry of Environment and Urbanization (2016). Sixth National Communication of Turkey. Ankara, Turkey.

Roelfsema, M., M. G. J. den Elzen, N. Höhne, A. F. Hof, N. Braun, H. Fekete, R. Brandsma, J. Larkin and H. Böttcher (2014). Are major economies on track to achieve their pledges for 2020? An assessment of domestic climate and energy policies. Energy Policy. **67:** 781-796.

Schinke, B. and J. Klawitter. (2016). "Background Paper: Country Fact Sheet Morocco. Energy and Development at a glance 2016. Middle East North Africa Sustainable ELECtricity Trajectories (MENA-SELECT)." Retrieved 4 August, 2016, from https://www.bicc.de/fileadmin/Dateien/pdf/press/2016/Country_Fact_Sheet_Morocco_Background.pdf.

Scott, E. (2015). "Renewable energy target slashed, wind farm commissioner to be established " The Sydney Morning Herald. Retrieved 3 November, 2016, from http://www.smh.com.au/environment/energy-smart/renewable-energy-target-slashed-wind-farm-commissioner-to-be-established-20150623-ghvxl3.html.

SEEG. (2017). "The System Study Greenhouse Gas Emissions Estimates (SEEG). ." Retrieved 21 July, 2017, from http://seeg.eco.br/en/.

Skalský, R., Z. Tarasovičová, J. Balkovič, E. Schmid, M. Fuchs, E. Moltchanova, G. Kindermann and P. Scholtz (2008). "Geo-bene global database for bio-physical modeling v. 1.0. Concepts, methodologies and data." The GEO-BENE database report.

State Agency on Energy Efficiency and Energy Saving of Ukraine. (2014). "National Action Plan for Renewable Energy up to 2020." Retrieved 1 June, 2016, from http://saee.gov.ua/en/documents.

State Council. (2015). "Made in China 2025(中国制造2025). Published 8 May, 2015. http://www.gov.cn/zhengce/content/2015-05/19/content_9784.htm."

Stehfest, E., D. P. Van Vuuren, T. Kram and L. Bouwman (2014). Integrated assessment of global environmental change with IMAGE 3.0. Model description and policy applications. The Hague, PBL Netherlands Environmental Assessment Agency. Available via http://www.pbl.nl/sites/default/files/cms/PBL-2014-Integrated_Assessment_of_Global_Environmental_Change_with_IMAGE_30-735.pdf.

Supreme Council of Ukraine. (2015). "Law of Ukraine on Alternative Fuels." Retrieved 31 May, 2016, from http://zakon1.rada.gov.ua/laws/show/1391-14.

The London School of Economics and Political Science. (2015). "The Global Climate Legislation Study. Grantham Research Institute on Climate Change and Environment." Retrieved 27 May, 2016, from http://www.lse.ac.uk/GranthamInstitute/legislation/countries/philippines/.

The People's Republic of China (2012). The second national communication on climate change of the People's Republic of China., National Development and Reform Commission, http://unfccc.int/resource/docs/natc/chnnc2e.pdf.

The People's Republic of China (2014a). Energy Development Strategy Action Plan (2014 – 2020). http://www.gov.cn/zhengce/content/2014-11/19/content_9222.htm.

The People's Republic of China (2014b). National Action Plan on Climate Change (2014 – 2020), http://www.sdpc.gov.cn/gzdt/201411/W020141104591413713551.pdf.

The Representative of the United States of America to the United Nations (2017). Reference: C.N.464.2017.TREATIES-XXVII.7.d (Depositary Notification). United Nations, https://treaties.un.org/doc/Publication/CN/2017/CN.464.2017-Eng.pdf

U.S. Department of State (2016). 2016 second biennial report of the United States of America, Under the United Nations Framework Convention on Climate Change, US Department of State, Washington, DC, https://unfccc.int/files/national_reports/biennial_reports_and_iar/submitted_biennial_reports/application/pdf/2016_second_biennial_report_of_the_united_states_.pdf.

UN DESA. (2015). "World Population Prospects, the 2015 Revision." United Nations - Department of Economic and Social Affairs. Retrieved 2 November, 2016, from https://esa.un.org/unpd/wpp/.

UNEP. (2015). "The Emissions Gap Report 2015: A UNEP Synthesis Report." from http://www.unep.org/emissionsgapreport2015/.

UNFCCC (2015a). Adoption of the Paris Agreement. Proposal by the President. Draft decision -/CP.21. Conference of the Parties. Twenty-first session, Paris, 30 November to 11 December 2015, FCCC/CP/2015/L.9/Rev.1, United Nations Framework Convention on Climate Change.

UNFCCC (2015b). Biennial Reports, http://unfccc.int/nationalreports/biennialreportsandiar/submittedbiennialreports/items/7550.php .

UNFCCC (2015c). Intended Nationally Determined Contributions (INDCs), http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx.

UNFCCC. (2016). "2nd Biennial Report CTF submission workbook." UNFCCC. Retrieved 28 July, 2016, from http://unfccc.int/files/national_reports/biennial_reports_and_iar/submitted_biennial_reports/application/pdf/kaz_2016_v2.0_resubmission.pdf.

UNFCCC. (2017a). "Greenhouse Gas Inventory Data - Detailed data by Party." Retrieved 31 July, 2017, from http://di.unfccc.int/detailed_data_by_party

UNFCCC. (2017b). "National Inventory Submissions 2017. Common Reporting Format." UNFCCC. Retrieved 28 July, 2017, from http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/10116.php.

UNFCCC. (2017c). "Submitted Biennial Update Reports (BURs) from Non-Annex I Parties." United Nations Framework Convention on Climate Change. Retrieved 30 August, 2017, from http://unfccc.int/national_reports/non-annex_i_natcom/reporting_on_climate_change/items/8722.php.

UNFCCC. (2017d). "Submitted National Communications from Non-Annex I Parties." United Nations Framework Convention on Climate Change. Retrieved 11 September, 2017, from http://unfccc.int/national_reports/non-annex_i_natcom/items/10124.php.

UNFCCC. (2017e). "Time Series - Annex I." United Nations Framework Convention on Climate Change. Retrieved 11 September, 2017, from http://di.unfccc.int/time_series.

United States of America (2014). Sixth National Communication of the Unites States of America: First Biennial Report of the United States of America. First Biennial Report of the United States of America., http://unfccc.int/national_reports/non-annex_i_natcom/reporting_on_climate_change/items/8722.php.

United States of America (2015). U.S. Cover Note, INDC and Accompanying Information. Retrieved April 10, 2016, from http://www4.unfccc.int/submissions/INDC/Published Documents/United States of America/1/U.S. Cover Note INDC and Accompanying Information.pdf.

US EPA. (2012). "Global Anthropogenic Non-CO2 Greenhouse Gas Emissions: 1990-2030: Revised Version 2012." Office of Atmospheric Programs Climate Change Division, U.S. Environmental Protection Agency Retrieved 9 December, 2013, from http://www.epa.gov/climatechange/Downloads/EPAactivities/EPA_Global_NonCO2_Projections_Dec2012.pdf.

Van Vuuren, D., B. Van Ruijven, B. Girod, V. Daioglou, O. Edelenbosch and S. Deetman (2014). Energy Supply and Demand. Integrated Assessment of Global Environmental Change with IMAGE 3.0 - Model description and policy applications. E. Stehfest, D. Van Vuuren, T. Kram and L. Bouwman. The Hague, PBL: 71-152.

van Vuuren, D. P., E. Stehfest, D. Gernaat, J. Doelman, M. van den Berg, M. Harmsen, H. S. de Boer, L. Bouwman, V. Daioglou, O. Edelenbosch, B. Girod, T. Kram, L. Lassaletta, P. Lucas, H. van Meijl, C. Müller, B. van Ruijven, S. van der Sluis and A. Tabeau (2017). "Energy, land-use and greenhouse gas emissions trajectories under a green growth paradigm." Global Environmental Change 42: 237-250.

van Vuuren, D. P., B. van Ruijven, M. Hoogwijk, M. Isaac and H. J. M. de Vries (2006). TIMER 2.0: Model description and application. Integrated modelling of global environmental change. An overview of IMAGE 2.4. A. F. Bouwman, T. Kram and K. Klein Goldewijk. Bilthoven, the Netherlands, Netherlands Environmental Assessment Agency (MNP).

WRI. (2016). "CAIT Indonesia Climate Data Explorer - PINDAI." Retrieved 31 October, 2016, from http://cait.wri.org/indonesia?lng=en.

WRI. (2017). "Paris Agreement Tracker." 2017, from http://cait.wri.org/indc/#/ratification.

Appendix

A1: Harmonisation of GHG emissions projections under current policies to the historical emissions data

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 2015 historical emissions. For non-Annex I countries, emissions projections were harmonised to 2010, with exceptions of China (2012) and Brazil (2015).

A2: Quantification of 2020 pledges and (I)NDCs

As with the historical emissions data, AR4 GWPs are used for NDCs from Annex I Parties whereas SAR GWPs are used for NDCs from non-Annex I Parties. Although it is preferable to convert all official NDC values expressed in AR4 GWP terms into SAR GWP terms to allow for a fair comparison between current policies emissions projections and NDC targets, this is not possible because most NDC documents do not provide enough data on the breakdown of the target emissions by gas to allow for such a conversion.

In this report, NewClimate Institute and PBL estimates of 2020 pledges and NDCs are quantified in SAR GWP terms using either the historical emissions data presented in Table 2, BAU emissions projections provided in the NDC, or other national submissions to the UNFCCC also expressed in SAR GWP terms.

For Annex I countries and Ethiopia, official NDC values (expressed in GWPs of choice by the Parties) and the estimates from NewClimate Institute and PBL are presented side by side without harmonising GWPs.

Methodology in more detail:

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

1. **Base year target**: economy-wide absolute reduction from historical base year emissions. INDCs/NDCs report on an absolute reduction from historical base year emissions. The base year chosen varies, with 1990, 2005 and 2010 being the most common. This category covers from the selected 25 countries of this report: Australia, Brazil, Canada, the European Union, Japan, Kazakhstan, the Russian Federation, Ukraine, and the United States.
2. **Baseline or BAU target**: emission reductions relative to a baseline or business-as-usual projection (specified in the INDCs/NDCs). The mitigation component of the INDCs/NDCs specifies the business-as-usual emission projection. The type of emission reduction relative to a baseline or business-as-usual projection has been chosen for many INDCs/NDCs, and in this report for: Argentina, Colombia, Democratic Republic of the Congo, Indonesia, Mexico, Morocco, Republic of Korea, Thailand and Turkey.
3. **Baseline or BAU target (not specified):** emission reductions relative to a baseline projection (not specified). Same as under point 2, but here, for the INDCs/NDCs, baseline or business-as-usual emission 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 PBL business-as-usual projections.

For Saudi Arabia, we assumed a baseline based on recent national CO_2 emissions projections (King Abdullah University of Science and Technology 2014).

4. **Intensity target**: emission reductions relative to GDP as the main type of mitigation. Chile is the only country that falls in this category.

5. **Intensity and non-GHG target**: emission intensity target and non-GHG target. China and India aim for emission intensity improvements, a target for non-fossil fuels in primary energy consumption/power capacity, and for China, a target year for the peaking of emissions.

6. **Trajectory and fixed-level target**: South Africa has a trajectory target stating the emission ranges for 2025 and 2030. Several countries, such as Ethiopia, put forward a fixed-level target, specifying the $MtCO_2e$ that they intend not to exceed in a given year.

7. **Submitted actions (cannot be quantified)**: finally, many countries include mere qualitative descriptions of mitigation actions in their INDCs/NDCs, or specific targets for sub-sectors, such as for the implementation of renewable energy. As such targets complicate a precise quantification, we have not analysed them here. This group of countries covers about 6% of the global emissions of 2010, and none of the selected countries.

The calculation of the NDC projection for the countries for all groups except group 5 is straightforward. China and India are the only G20 economies from group 5 that have proposed a combination of targets, which are less straightforward in the calculation, and highly depend on model parameterization. The targets include non-fossil energy targets, forest targets, and emission intensity targets (i.e., improvements of the ratio of emissions to GDP). For the PBL calculations, their combined effect was calculated using the PBL TIMER energy model (Van Vuuren et al. 2014) for energy- and industry-related emissions and the IIASA GLOBIOM/G4M land use model (Havlík et al. 2014) for the land use, land-use change and forestry (LULUCF) emissions (see den Elzen et al. 2016a, and for further details for China, den Elzen et al. 2016b). The NDC projection for China of PBL is also harmonised to 2012 emissions, which leads to a higher projection. For NewClimate calculations, we refer to Climate Action Tracker (CAT 2017).

Accounting method chosen for quantification

Table A-1 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[3] (den Elzen et al. 2016a).

This report identified three countries that apply the gross-net accounting approach[4] (Chile, Japan and Russian Federation). These countries expect the LULUCF sector to be net carbon sink in the target year, thus treating the LULUCF sector as a source of carbon credits. For these countries, our NDC target estimates account for the expected amount of carbon credits.

For countries that explicitly mentioned in their NDCs that emissions and removals from the LULUCF sector are excluded, the LULUCF sector is excluded from the calculation of the NDC target (Republic of Korea, the Philippines, Saudi Arabia and Thailand). There are also countries that state that emissions and removals from the LULUCF sector is included in their NDC, but refrain from specifying how exactly

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[3] 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.

[4] 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.

to include them in the NDC calculations (Canada and the European Union). For these two sets of countries we assumed neither accounting approaches and exclude the LULUCF sector from the calculations of NDC target.

Table A-1: Overview of NDC configuration per country

Country	Target type	LULUCF sector is included in the NDC	Approach for NDC quantification by authors		
			Reference emissions include LULUCF	LULUCF treated separately	LULUCF accounting method applied
Argentina	Baseline specified	Yes	Yes	No	Net-Net
Australia	Base year	Yes	Yes	No	Net-Net
Brazil	Base year	Yes	Yes	No	Net-Net
China	Intensity and non-GHG	Yes	Yes	No	Net-Net
Colombia	Baseline specified	Yes	Yes	No	Net-Net
DRC	Baseline specified	Yes	Yes	No	Net-Net
Ethiopia	Baseline specified	Yes	Yes	No	Net-Net
India	Intensity and non-GHG	Yes	Yes	No	Net-Net
Indonesia	Baseline specified	Yes	Yes	No	Net-Net
Kazakhstan	Base year	Yes	Yes	No	Net-Net
Mexico	Baseline specified	Yes	Yes	No	Net-Net
Morocco	Baseline specified	Yes	Yes	No	Net-Net
South Africa	Trajectory	Yes	Yes	No	Net-Net
Turkey	Baseline specified	Yes	Yes	No	Net-Net
Ukraine	Base year	Yes	Yes	No	Net-Net
USA	Base year	Yes	Yes	No	Net-Net
Canada	Base year	Yes	No	No	None
Republic of Korea	Baseline specified	No	No	No	None
The Philippines	Baseline not specified	No	No	No	None
Saudi Arabia	Trajectory	No	No	No	None
Thailand	Baseline specified	No	No	No	None
European Union	Base year	Yes	No	No	None
Chile	Intensity	Yes	No	Yes	Gross-net
Japan	Base year	Yes	No	Yes	Gross-net
Russian Federation	Base year	Yes	No	Yes	Gross-net

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

Current policies projections

The NewClimate Institute analysis follows the calculation steps used in the Climate Action Tracker (CAT 2017). The starting point for the calculation of current policies emissions projections is a publicly available "baseline" policy scenario projections for economy-wide GHG emissions or energy-related CO_2 emissions. For most countries, we use one of the sources below or a combination or two to show a range:

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

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

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

When a scenario with only energy-related CO_2 emissions was used as basis, emissions projections for other GHGs were gathered from various sources to ensure complete coverage of all emissions sources. For non-CO_2 GHG emissions, the US EPA report on global anthropogenic GHG emissions (2012) were used for several countries. Projections for non-energy CO_2 emissions are most often taken from national governments' submissions to the UNFCCC.

For all publicly available emissions projections we used for the analysis, we examined whether important policies implemented to date and planned policies with a high degree of certainty of implementation in the near future are included. If a recently implemented policy with a considerable expected mitigation impact potential is not covered, the impact of that policy is accounted for by carrying out separate "add-on" calculations based on the information from various sources. Moreover, where considered relevant, strong implementation barriers such as for example political resistance or technical difficulties are taken into account in projecting the effect of specific policies or targets, by assuming that only a fraction of the target is achieved.

Methodology for specific policy instruments and targets

Current policies projections by NewClimate Institute include add-on mitigation impact calculations for recently implemented policies. The calculation steps are policy specific; in some cases CO_2 reduction impact values estimated in external sources are applied directly to "baseline" scenarios for energy-related CO_2 emissions, whereas in other cases more detailed technical calculations are carried out. However, below is a generic approach to different policy types:

Renewable energy targets: CO_2 emissions reductions are calculated based on the energy balance projections underlying the "baseline" scenario for energy-related CO_2 emissions. A number of case-specific assumptions are usually made on which fuels would be replaced by the increased renewable energy production.

Vehicle fuel efficiency standards: A simplified stock turnover model is used for a number of countries. Calculations were done using the underlying data from the Global Transportation Roadmap Model of the International Council on Clean Transportation (ICCT 2012).

Building codes: as with vehicle fuel efficiency standards, a simplified stock turnover model is used for the EU.

Emissions trading schemes: The targeted emission levels are applied to the sectors covered by the scheme. Carbon price levels are not considered in the analysis.

Economic measures: Due to the limitation of bottom-up, spreadsheet-based calculations, NewClimate calculations consider economic measures such as carbon tax, feed-in tariff scheme and subsidies only if their mitigation impacts have already been quantified by other institutions.

Table A-2 presents the URLs and the posted dates of country assessment updates by the Climate Action Tracker project.

Table A-2: Country assessments by Climate Action Tracker referenced in this report.

Country	URL	Date updated
Argentina	climateactiontracker.org/countries/argentina/2017.html	9 May 2017
Australia	climateactiontracker.org/countries/australia/2017.html	6 July 2017
Brazil	climateactiontracker.org/countries/brazil/2017.html	17 May 2017
Canada	climateactiontracker.org/countries/canada/2017.html	17 May 2017
Chile	climateactiontracker.org/countries/chile/2017.html	Forthcoming
China	climateactiontracker.org/countries/china/2017.html	15 May 2017
Colombia	Not assessed by Climate Action Tracker	N/A
Democratic Republic of the Congo	Not assessed by Climate Action Tracker	N/A
Ethiopia	climateactiontracker.org/countries/ethiopia/2016.html	2 November 2016
European Union	climateactiontracker.org/countries/eu/2017.html	22 May 2017
India	climateactiontracker.org/countries/india/2017.html	15 May 2017
Indonesia	climateactiontracker.org/countries/indonesia/2017.html	Forthcoming
Japan	climateactiontracker.org/countries/japan/2017.html	9 May 2017
Kazakhstan	climateactiontracker.org/countries/kazakhstan/2016.html	2 November 2016
Mexico	climateactiontracker.org/countries/mexico/2016.html	2 November 2016
Morocco	climateactiontracker.org/countries/morocco/2017.html	Forthcoming
The Philippines	climateactiontracker.org/countries/philippines/2016.html	2 November 2016
Republic of Korea	climateactiontracker.org/countries/southkorea/2017.html	10 May 2017
Russian Federation	climateactiontracker.org/countries/russianfederation/2017.html	11 May 2017
Saudi Arabia	climateactiontracker.org/countries/saudiarabia/2017.html	10 May 2017
South Africa	climateactiontracker.org/countries/southafrica/2017.html	Forthcoming
Thailand	Not assessed by Climate Action Tracker	N/A
Turkey	climateactiontracker.org/countries/turkey/2017.html	17 May 2017
Ukraine	climateactiontracker.org/countries/ukraine/2016.html	2 November 2016
United States of America	climateactiontracker.org/countries/usa/2017.html	2 June 2017

A4: The IMAGE model

For the PBL analysis, we used the integrated assessment model (IAM) IMAGE 3.0 (Stehfest et al. 2014) to assess the impact of national current policies. The IMAGE model is well suited for such an assessment given the relatively high degree of detail with which this model represents the activity levels in the different sectors and its focus on a physical description of activities (allowing a rather straightforward interpretation of the implemented policies).

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

Methodology for specific policy instruments and targets

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

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

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

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

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

Power plant standards (i.e. the CO_2 emissions per unit generated electricity) applying to new power plants are implemented as such in TIMER. In essence, the implementation of a standard results in no new installation of technologies with emissions intensity above the standard. Power plant standards applying to existing stock are implemented through a carbon tax on the energy supply sector.

Feed-in-tariffs is an energy-supply policy focused on supporting the development of new renewable power generation. The most common feed-in-tariffs policy provides a fixed rate per kilowatt hour (US$/kWh) for the electricity produced for a guaranteed period of time (Blok 2007). A feed-in-tariff cannot be implemented as such, but are translated to target shares for renewable energy, often by assuming these tariffs support a strategic policy document. Such a document would, in itself, not be defined as current policies, but classifies when it is supported by policy instruments such as feed-in tariffs.

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

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

A **biofuel target s**ets a mandatory minimum volume or share of biofuels to be used in the total transportation fuel supply. Biofuel targets are also included using the TIMER transport model. Cars in TIMER drive on one fuel (except for electric and H_2 cars), so biofuel blending is modelled by fixing the ratio of biofuel cars and liquid fuel cars. However, the biofuel target input variable that can be set applies to the biofuel share of the total new fleet in a specific year, i.e. including electric and H_2 cars, and only applying to new cars. Therefore, this parameter was set to such a level that it results in the desired biofuel share for the total liquid car fleet.

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

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

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

A5: The GLOBIOM and G4M models

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

More specifically, the GLOBIOM model is a global recursive dynamic partial equilibrium model of the forest and agricultural sectors. The model is based on a bottom-up approach where the supply side of the model is built-up from the bottom (land cover, land use, management systems) to the top (production/markets). The agricultural and forest productivity is modelled at the level of grid cells of 5 x 5 to 30 x 30 minutes of arc (Skalský et al. 2008), using biophysical models. The demand and international trade is represented at the level of 35 regions covering the world. Besides primary products, the model has several final and by-products for the different sectors, for which processing activities are defined. The model computes market equilibrium for agricultural and forest products by allocating land use among production activities to maximize the sum of producer and consumer surplus, subject to resource, technological, demand and policy constraints. The level of production in a given area is determined by the agricultural or forestry productivity in that area (dependent on suitability and management), by market prices (reflecting the level of demand), and by the conditions and cost associated to conversion of the land, to expansion of the production and, when relevant, to international market access. Trade is modelled following the spatial equilibrium approach, which means that the trade flows are balanced out between different specific geographical regions. Trade is furthermore based purely on cost competitiveness as goods are assumed to be homogenous. This allows tracing of bilateral trade flows between individual regions.

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

For the countries where the G4M model was applied to assess the current policies projections (Argentina, Australia, Canada, Chile, China, Colombia, Ethiopia, India, Japan, Kazakhstan, Mexico, Morocco, Republic of Korea, Russia Federation, Saudi Arabia, South Africa, Thailand, Turkey, United States of America, and Ukraine), the G4M was calibrated to historical afforestation and deforestation rates for the period of 2000-2010 as reported by the country to the 2015 FAO Forest Resources Assessment (FAO FRA) (Keenan et al. 2015). The calibration is done in such a way that net forest area change rate (afforestation rate minus deforestation rate) matches that of FAO FRA data. Additional constraints were imposed on minimum afforestation rate, minimum deforestation rate and the trend of net forest area change (a difference between 2000-2005 average net forest area change and 2005-2010 average net forest area change).

Methodology for specific policy instruments and targets
Current policies projections by IIASA have been assessed for the specific country using the GLOBIOM and/or the G4M model. The model that has been used to develop the projection for a specific county is

specified in the country chapters. Below follows a generic description of the methodology used for calculating the effect of the policies for the LULUCF sector. In general, climate policies are implemented in GLOBIOM and G4M through a carbon tax or directly in the models by changing parameters or adding constraints in such a way that a target is achieved.

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

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

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

Harvest intensity targets, i.e. an increase of the forest harvest rate by X% or X m^3, can be prescribed in GLOBIOM or G4M applying constraints directly in the models.

Forest carbon stock targets, i.e. an increase of the forest carbon stock, or the current carbon sink, by X% or X $MtCO_2e$ are implemented through a carbon tax in G4M on the forest sectorial emissions and removals. The carbon tax is set at a level that leads to the target level being reached the desired year.

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

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