

Annex A - UNEP Emissions Gap Report 2019

A.1 Definitions of scenarios investigated

NDC scenarios (unconditional and conditional): identifies the GHG emissions that each member could emit in the target year (2025 for the US, 2030 for the other G20 members) under the unconditional and, when available, conditional NDCs. Where available, the emission levels reported by the national governments are used as central estimates; alternatively, the emission levels are calculated from base-year or baseline data based on the NDCs and on other official documents submitted by countries to the UNFCCC (e.g. national GHG inventories, national communications, biennial reports and biennial update reports) (see table A - 1). Emission level estimates published in the literature are also considered when official values were not available) (see table A - 1: independent sources).

2. Current policies scenario (official data): identifies the most recent, available official estimates of target year emissions, accounting for the projected emission trends resulting from current climate-, energy- and land-use policies. The sources of country estimates from official documents are provided in table A - 1. We considered scenario projections published in 2017 or later. The modelling base year of the current policy scenario projections differ across reports.

3. Current policies scenario (independent studies): identifies emissions estimates for the target year, accounting for emission projections resulting from the full implementation of current policies based on independent studies. We considered studies that are published in 2017 or later. Emissions projections reviewed here cover main energy and climate policies that were implemented by a cut-off date (depending on the studies) and do not consider prospective policies that were still under consideration or planning as of the cut-off date. Moreover, while studies differ in their approaches for policy impact quantification, they do not automatically assume that policy targets will be achieved when they are enshrined in the form of a law or a strategy document – studies also consider the status of policy implementation and the extent to which the policy plan is supported by measures. These independent analysis of current policy trajectories supplements the official sources described under point two by providing data that targets consistency across countries and political independence.

Table A - 1: Studies used from official data and independent sources to estimate the emissions in the target year under the NDC and under current policies for G20 members. Source: updated from den Elzen et al.

Country	NDC scenario	Current policies scenario	Current policies & NDC scenarios (when official data not available)
	Official data sources 1)	Official data sources	Independent sources (1. global models and 2. national models)
Argentina	Revised NDC (Government of Argentina, 2016)	N/A	1. CAT (Climate Action Tracker, 2019b), JRC (Keramidas <i>et al.</i> , 2018), Uni. Melbourne (Meinshausen and Alexander, 2017) (NDC only) 2. Keesler, Orifici and Blanco (2019)
Australia	N/A	Commonwealth of Australia (Commonwealth of Australia, 2018)	1. CAT, JRC, PBL (Kuramochi <i>et al.</i> , 2018), Uni. Melbourne (NDC only), Climate Interactive (Climate Interactive, 2017) (NDC only) 2. Climate Works Australia (ClimateWorks Australia, 2018)
Brazil	NDC (UNFCCC, 2018)	N/A	1. CAT, JRC, PBL, Uni. Melbourne (NDC only), Climate Interactive 2. COPPE (Rochedo <i>et al.</i> , 2018)
Canada	NDC; Environment and Climate Change Canada (Government of Canada, 2019)	UNFCCC BR data portal (UNFCCC, 2019b)	1. CAT, JRC, PBL, Uni. Melbourne (NDC only), Climate Interactive
China	N/A	N/A	1. CAT, IEA (IEA, 2018) ²⁾ , JRC, PBL, Uni. Melbourne (NDC only), Climate Interactive (NDC only), PNNL (NDC only) (Fawcett <i>et al.</i> , 2015) 2. NCSC (Fu, Zhou and Liu, 2017; Fu, 2018) ³⁾
EU28	European Environment Agency (EEA, 2018)	European Environment Agency European Commission (European Commission, 2018b) UNFCCC BR data portal	1. CAT, JRC, PBL, Uni. Melbourne (NDC only)
India	N/A	N/A	1. CAT, IEA ²⁾ , JRC, PBL, Uni. Melbourne (NDC only), PNNL (NDC only), Climate Interactive (NDC only) 2. Mitra <i>et al.</i> (Mitra <i>et al.</i> , 2017); Dubash <i>et al.</i> (Dubash <i>et al.</i> , 2018)
Indonesia	NDC	N/A	1. CAT, JRC, PBL, Uni. Melbourne (NDC only), Climate Interactive (NDC only)
Japan	NDC	N/A ⁴⁾	1. CAT, JRC, PBL, Uni. Melbourne (NDC only), Climate Interactive (NDC only)
Mexico	NDC; Government of Mexico (Government of Mexico, 2015)	N/A	1. CAT, JRC, PBL
Russia	INDC (UNFCCC, 2017)	UNFCCC BR data portal	1. CAT, JRC, PBL, PNNL (NDC only), Climate Interactive (NDC only)

Country	NDC scenario	Current policies scenario	Current policies & NDC scenarios (when official data not available)
	Official data sources 1)	Official data sources	Independent sources (1. global models and 2. national models)
Saudi Arabia	N/A: Saudi Arabia did not formulate a post-2020 GHG target (UNFCCC, 2018)	N/A	1. CAT (based on KAUST (KAUST, 2014)), JRC
South Africa	NDC	N/A	1. CAT, JRC, PBL, Climate Interactive (NDC only)
Republic of Korea	NDC	N/A	1. CAT, JRC, PBL, Climate Interactive (NDC only)
Turkey	INDC (UNFCCC, 2017)	UNFCCC BR data portal	1. CAT, JRC, PBL
United States	NDC – US Department of State (U.S. Department of State, 2016)	UNFCCC BR data portal	1. CAT, JRC, PBL, Iyer et al. (Iyer et al., 2015), Climate Interactive (NDC only) 2. Chai et al. (Chai et al., 2017); Rhodium Group (Pitt et al., 2019)

N/A: Not available.

1) References provided only when the NDC emission levels are available in absolute terms.

2) Only CO₂ emissions from energy, therefore augmented with CAT, JRC and PBL estimates to produce economy-wide projections.

3) Augmented with the historical non-CO₂ GHG emissions data from China's First Biennial Update Report on Climate Change (People's Republic of China, 2016), combined with the median estimate of the 2010-2030 non-CO₂ emissions growth rates for China from five integrated assessment models (Tavoni et al., 2014), to produce economy-wide figures.

4) "With measures" scenario from the latest Biennial Report is not included because it is an NDC achievement scenario, which includes planned policies.

A.2 Accounting of LULUCF emissions

Table A - 2: Accounting of LULUCF emissions in the assessment

Country/region	LULUCF accounting (based on Kuramochi et al., 2018)	Official NDC target levels available for LULUCF sector?	Assumptions for LULUCF emissions when studies only report projections excluding LULUCF	
			NDC scenario	Current policies scenario
Argentina	Incl. LULUCF	No	2015 estimate in Kuramochi et al.	2015 estimate in Kuramochi et al.
Australia	Incl. LULUCF	No	2019 inventory (data year: 2017)	2019 inventory (data year: 2017)
Brazil	Incl. LULUCF	No	NDC LULUCF	Minimum and maximum projections from other studies
Canada	Excl. LULUCF with LULUCF credits	No	2019 inventory (data year: 2017)	Minimum and maximum credit projections by CAT (Climate Action Tracker, 2019a)
China	Incl. LULUCF	No	2015 estimate in Kuramochi et al.	2015 estimate in Kuramochi et al.
EU	Excl. LULUCF	No	---	---
India	Incl. LULUCF	No	2015 estimate in Kuramochi et al.	2015 estimate in Kuramochi et al.
Indonesia	Incl. LULUCF	Yes	NDC LULUCF	Others
Japan	Excl. LULUCF with LULUCF credits	Yes	NDC LULUCF (credit estimates)	NDC LULUCF (credit estimates)
Mexico	Incl. LULUCF	No	2015 estimate in Kuramochi et al.	Latest historical LULUCF emissions data
Russia	Excl. LULUCF with LULUCF credits	No	2019 inventory (data year: 2017)	2019 inventory (data year: 2017)
Saudi Arabia	Excl. LULUCF	No	2015 estimate in Kuramochi et al.	2015 estimate in Kuramochi et al.
South Africa	Incl. LULUCF	No	2015 estimate in Kuramochi et al.	2015 estimate in Kuramochi et al.
South Korea	Excl. LULUCF	No	2015 estimate in Kuramochi et al.	2015 estimate in Kuramochi et al.
Turkey	Incl. LULUCF	Yes	NDC LULUCF	2019 inventory (data year: 2017)
USA	Incl. LULUCF	No	2019 inventory (data year: 2017)	2019 inventory (data year: 2017)

A.3 Conversion of GWPs used in country-level GHG emissions projections

In this year's report, all GHG emission figures are expressed using the 100-year global warming potentials (GWPs) from the IPCC Fourth Assessment Report (AR4). Since some studies provide GHG emissions projections using GWPs from the IPCC Second Assessment Report, we converted them into IPCC AR4 GWP terms by applying conversion factors derived from the PRIMAP historical GHG emissions database (Gütschow, Jeffery and Gieseke, 2019) using 2015 historical data ("HISTCR") as well as from Meinshausen and Alexander (2017).

Country	GWP in NDC and national GHG inventories	Conversion factor to AR4 GWP (multiply)	Source
Argentina	SAR	103.8%	PRIMAP-hist_v2.0_11-Dec-2018 based on 2015 data (HISTCR)
Australia	AR4	100%	
Brazil	AR5	98.3%	U.Melbourne factsheet (ver. Nov 2017, comparison of 2015 emissions)
Canada	AR4	100%	
China	SAR	102.4%	PRIMAP-hist_v2.0_11-Dec-2018 based on 2015 data (HISTCR)
EU	AR4	100%	
India	SAR	103.0%	PRIMAP-hist_v2.0_11-Dec-2018 based on 2015 data (HISTCR)
Indonesia	SAR	105.0%	PRIMAP-hist_v2.0_11-Dec-2018 based on 2015 data (HISTCR)
Japan	AR4	100%	
Mexico	AR5	98.8%	U.Melbourne factsheet (ver. Nov 2017, comparison of 2015 emissions)
Republic of Korea	SAR	100.8%	PRIMAP-hist_v2.0_11-Dec-2018 based on 2015 data (HISTCR)
Russia	AR4	100%	
Saudi Arabia	<i>Does not specify</i>	100%	
South Africa	SAR	101.5%	PRIMAP-hist_v2.0_11-Dec-2018 based on 2015 data (HISTCR)
Turkey	AR4	100.0%	
USA	AR4	100.0%	

A.4 Overview of long-term strategies submitted to the UNFCCC

Table A - 3: Submission status of long-term strategies to the UNFCCC by G20 members as of 1 September 2019 (UNFCCC, 2019a)

Country/ region	Status	2050 emissions reduction targets or indicative emission levels	Other notes
Argentina	Not submitted	N/A	Argentina has confirmed it is working on an LTS. Little public detail on the content available yet (see e.g. Energía Estratégica, 2019; Government of Argentina, 2019)
Australia	Not submitted	N/A	On the state level, various net zero greenhouse gas emissions targets exist for e.g. 2045 or 2050 (Parliament of Victoria, 2017; Australian Capital Territory, 2018; COMMIT project, 2019).
Brazil	Not submitted	N/A	
China	Not submitted	N/A	China has committed to submitting its LTS by 2020 (Darby, 2019)
Canada	Submitted 17/11/2016	80 per cent below 2005 levels (149 MtCO _{2e} /year by 2050)	See e.g. COMMIT fact sheet (COMMIT project, 2019) for more information
European Union	Draft published	On 28 November 2018, and following an invitation from the European Council (heads of government), the European Commission presented its strategic long-term vision for a prosperous, modern, competitive and climate-neutral economy by 2050 (European Commission, 2018a). The document contains scenarios between 80 per cent below 1990 level in 2050 and net zero GHG emissions by 2050.	<p>Following submission of the long-term vision by the European Commission, discussion on the final strategy to be submitted to the UNFCCC is now taking place in the European Parliament and Council.</p> <p>In June, the EU heads of government invited both the European Commission and the ministerial sectoral Councils to advance work on the transition to climate neutrality, stating that they will finalise their guidance before the end of the year with a view to the adoption and submission of the EU's long-term strategy to the UNFCCC in early 2020.</p> <p>The incoming Commission president Ursula von der Leyen has stated that she supports the idea of aiming for net zero GHG emission by 2050 (Schiermeier, 2019).</p>

Country/ region	Status	2050 emissions reduction targets or indicative emission levels	Other notes
France	Submitted 28/12/2016, resubmitted 18/04/2017	75 per cent reduction of GHG emissions by 2050, compared to 1990, with detailed sector targets.	In June 2019, the net-zero emission target by mid-century and measures to achieve it was adopted (French Ministry for the Ecological and Solidary Transition, 2019)
Germany	Submitted 17/11/2016, resubmitted 26/04/2017	Climate Action Plan: a final target of 80 to 95 per cent GHG emissions reductions by 2050, compared to 1990, augmented with concrete measures.	
India	Not submitted	N/A	
Indonesia	Not submitted	N/A	
Italy	Not submitted	N/A	
Japan	Submitted 26/06/2019	Aims to accomplish a “decarbonised society” ambitiously as early as possible in the second half of this century, while boldly taking measures towards the reduction of GHGs emissions by 80 per cent by 2050”.	
Mexico	Submitted 16/11/2016	“Our GHG emissions reduction goal is to reduce 50 per cent of national GHGs by 2050 below our emissions in 2000.”	
Republic of Korea	Not submitted	N/A	The Republic of Korea is shaping its 2050 low-emission development strategy through nationwide consensus on the low carbon transition in a substantial way. As the core of public-private partnership on this work, 'Low Carbon Society Vision Forum' was launched in March 2019 with participations of representatives from industries, academics, civil society and youth. The forum will present its proposal of 2050 low-emission development strategy by the end of this year. The strategy will be finalized based on this proposal with further fine-tuning and then be submitted to the UNFCCC secretariat at the earliest possible juncture with the deadline of 2020.
Russia	Not submitted	N/A	

Country/ region	Status	2050 emissions reduction targets or indicative emission levels	Other notes
South Africa	Draft published	A draft document was released in December (Department of Environmental Affairs, 2018). The document summarises South Africa's long-term vision as: "Putting South Africa on a low-carbon growth path while making a fair contribution to the global effort to limit the average temperature increase." No quantified target is provided in the document.	
Saudi Arabia	Not submitted	N/A	
Turkey	Not submitted	N/A	
United Kingdom	Submitted 17/04/2018	At least 80 per cent reduction by 2050, relative to 1990 levels (as per the Climate Change Act).	In June 2019, the UK passed laws that requires the country to achieve net zero GHG emissions by 2050 (REF - BEIS), following the recommendations from the Committee on Climate Change (Committee on Climate Change, 2019). The CCC, established under the 2008 Climate Change Act, advises the UK government on climate policy.
United States	Submitted 16/11/2016	80 per cent below 2005 levels (including LULUCF)	While the strategy is officially submitted, the federal government is not implementing it.

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