Tracking climate mitigation efforts in 30 major emitters

Economy-wide projections and progress on key sectoral policies: **Methodology Annex**

AUTHORS:

Leonardo Nascimento
Takeshi Kuramochi
Niklas Illenseer
NewClimate Institute

Nicklas Forsell
Miroslav Batka
IIASA

Colin Subtil
Nicolas Lancesseur
FTSE Russell

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Authors
Leonardo Nascimento, Takeshi Kuramochi, Niklas Illenseer (NewClimate)
Nicklas Forsell, Miroslav Batka (IIASA)
Colin Subtil, Nicolas Lancesseur (FTSE Russell)

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A.1: Methods Synopsis

In this report, energy and industry GHG emissions projections were developed by NewClimate Institute while land-use emissions projections were developed by IIASA. This Methodological Annex is adapted from Nascimento *et al.* (2021). Key differences include an annex with references to the national policies included in the report and description information for the countries only included in this publication. The main methods are described in detail in other publications (Kuramochi *et al.*, 2018; den Elzen *et al.*, 2019; Fekete *et al.*, 2021; Kuramochi *et al.*, 2021).

Overview of methods used for the emissions projections assessment

Energy and industry emissions projections by NewClimate Institute are largely based on its analyses for, and informed by, the Climate Action Tracker project, which is jointly carried out by NewClimate Institute and Climate Analytics (Climate Action Tracker, 2021). The development of current policies scenario projections often departs from a publicly available "reference" national policy scenario projection for economy-wide or energy-related emissions. The choice of this scenario depends on several factors such as the coverage of policies, detailedness of the projections and its description (sector, gas, policies considered), and key underlying assumptions (such as, GDP and population growth.) These projections are complemented with add-on mitigation impact calculations for recently implemented policies. The calculation steps are policy specific; in some cases, reduction impact values estimated in external sources are applied directly to "reference" scenarios, whereas in other cases more detailed calculations are carried out to estimate their effect. The choice of quantification method is heavily dependent on data availability.

For land-use emissions, IIASA current policies scenario projections are based on the GLOBIOM global land-use model (Frank *et al.*, 2021) and the G4M global forest model (Gusti *et al.*, 2020), both of which have been augmented with the inclusion of current policies. The calculation of the current policy scenario, in most cases, starts from a baseline scenario and then include mitigation impacts of the current policies by applying restrictions (for example land use availability), constraints (for example limiting the use of specific feedstocks) or a carbon price to achieve the fulfilment of quantitative indicator from the selected policy (for example an afforestation target.)

Both IIASA and NewClimate estimates include the effect of COVID-19. For energy and industry emissions, we assumed that emissions intensity over GDP would remain the same as it would under current policies excluding the impact of COVID-19 and that the reduction in emissions is induced by a slowdown in GDP growth. Whenever possible, external estimates for the effect of the pandemic on carbon emissions have also been revied an included in our analysis (Le Quéré *et al.*, 2020). For the land-use emissions, the future impact of COVID-19 was estimated based on the GDP reductions developed by the Dutch Environmental Agency (PBL) (Dafnomilis *et al.*, 2021).

Our method estimates future effect of currently adopted and implemented policies, but the actual effect depends on multiple uncertain factors. These include, but are not limited to, macro-economic drivers, such as economic and population growth, technology cost progressions and natural disturbances. The COVID-19 pandemic adds to this uncertainty. National emissions are affected by both the duration of the restrictive measures and national recovery strategies. Our results indicate emissions trajectories as of the cut-off date of this report (December 2020) and need to be periodically revised to reflect recent developments.

Overview of key underlying assumptions

A number of key features of the methods that are being used for this analysis are as follows:

- For each country that is assessed, recent policy developments are all included and accounted for in the projections. However, a cut-off date as of December 2020 is applied, with a few exceptions, meaning that any policies adopted after this date are not accounted for here. A complete documentation of policies for most countries is provided in Nascimento et al. 2021.

- For each country, historical emissions trends are based on the latest national GHG inventory data submitted by the countries themselves to the UNFCCC. This means that only official data as produced and submitted by the country itself is used for showcasing historical developments. Further details about the historical data sources are provided in Annex A.2.
- Current policy GHG emissions projections are harmonised to historical emissions using a fixed harmonization factor that remains constant over time (offset harmonisation). The harmonisation step thus reconciles the historical emissions data used for this report (i.e. from latest national GHG inventories) with that of the current policy projections by NewClimate and IIASA. The harmonization factor is calculated as the absolute difference in net emissions between the historical and projected data.
- For all Annex I countries, the harmonisation year is 2019 as this is the latest year of the national GHG inventories being submitted by the countries to the UNFCCC. The harmonization year varies between non-Annex I countries depending on the information provided in their National Communications and Biennial Update Reports (BURs). Further information about the harmonisation data and harmonization year is provided in Annex A.2.

A.2: Harmonisation of GHG emissions projections

Historical GHG emissions data sources

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

For historical emissions for non-Annex I Parties, Table A-1 presents an overview of data sources. For many countries, the data was taken from the UNFCCC GHG databases (UNFCCC, 2014), in which the GHG inventory data reported in most recent Biennial Update Reports (BURs) submitted to the UNFCCC were compiled. National Inventory Reports (NIR) and National Communications (NC) were also used for some countries. All values were converted to AR4 whenever presented in another GWP.

It was not always possible to assess the national effect of GWP conversion based on governmental sources because several countries do not report their inventories with sufficient gas split. The dataset provided by the Potsdam Institute for Climate Impact Research (PIK) shows that for the inventory submitted in 2017 by Annex I countries, the emission values become smaller by 1-5% excluding LULUCF and 1-7% including LULUCF when they are converted from AR4 GWPs to SAR GWPs (data years: 1990 to 2015).

For China, LULUCF projections are harmonized to the historical data from the 2014 GHG inventories presented in the Second Biennial Update Report (BUR2) of China (Government of P. R. China, 2018). In the BUR2 report, the LULUCF sink was reported as -1.115 $MtCO_2eq$ for 2014. This constitutes an increase of the LULUCF sink as compared to the 2012 reported estimate of -576 MtCO2eq (Government of P. R. China, 2016) which was used for harmonizing the LULUCF projections for China in our 2019 report (Kuramochi *et al.*, 2019).

Data harmonisation

The GHG emissions projections under current policies from NewClimate Institute and IIASA were all harmonised to the historical emissions dataset presented in table 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 2019 historical emissions. For non-Annex I countries, the column “Last reported year” in Table A-1 serves as a reference for the harmonisation year.

Table A-1: Data sources for historical GHG emissions in non-Annex I countries (UNFCCC, 2014, 2016, 2017)

Country	GHG emissions excluding LULUCF		LULUCF emissions	
	Source	Last reported data-year	Source	Last reported data-year
Argentina	BUR3	2016	BUR3	2016
Brazil	BUR3, NC4	2016, 2016	NC4	2016
Chile	BUR3	2016	BUR3	2016
China	CO2: PRIMAP database (1990 - 2018) 1) Non-CO2 GHGs: UNFCCC database, BUR2 (for 2014)	2014 / 2018	UNFCCC database, BUR2 (for 2014)	2014
Colombia	BUR2	2014	BUR2	2014
Democratic Republic of the Congo	PRIMAP	2018	EDGAR/FAO	2015
Ethiopia	UNFCCC database, PRIMAP database (2014 – 2017)	2013 / 2017	UNFCCC database	2013
India	UNFCCC database, PRIMAP database (2014 – 2018)	2014 / 2018	UNFCCC database / BUR3	2016
Indonesia	NC3, UNFCCC database, BUR2 (only for 2016)	2016	NC3, UNFCCC database, BUR2 (only for 2016)	2016
Israel	UNFCCC database	2018	NC1	2015
Kazakhstan	UNFCCC database	2018	UNFCCC database	2019
Korea	UNFCCC database	2017	UNFCCC database	2017
Malaysia	BUR3	2016	BUR3	2016
Mexico	National GHG inventory (INECC, 2018)	2017	National GHG inventory (INECC, 2018)	2015
Morocco	UNFCCC database	2016	UNFCCC database	2012
Saudi Arabia	UNFCCC database PRIMAP database (2015 – 2017)	2015 / 2017	UNFCCC database	2010
Singapore	BUR3	2014	BUR4	2016
South Africa	UNFCCC database, BUR3	2014 / 2017	UNFCCC database, BUR3	2017
Thailand	UNFCCC database, NC3, BUR3	2016	UNFCCC database, NC3, BUR3	2016
The Philippines	PRIMAP	2017	EDGAR/FAO	2015

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

A.3: The GLOBIOM and G4M models

Model description

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. The model utilizes globally harmonized and consistent land cover products, such as GLC2000 (Bartholomé and Belward, 2005), as a starting point for land use projections and 2010 and 2020 model outcomes are used to verify the calibration of the model versus real world developments. 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. For further documentation concerning the GLOBIOM and G4M models we refer to the following set of publications Frank *et al.* (2021), Lauri *et al.* (2021) and Gusti *et al.* (2020).

For the countries where the G4M model was applied to assess the current policies projections (Chile, Colombia, Ethiopia, Israel, Kazakhstan, Malaysia, Morocco, Saudi Arabia, Singapore, the Philippines, Thailand and Viet Nam), the G4M was calibrated to historical afforestation and deforestation rates for the period of 2000-2010 as reported by the country to the 2015 FAO Forest Resources Assessment (FAO FRA) (Keenan *et al.*, 2015). The calibration is done in such a way that net forest area change rate (afforestation rate minus deforestation rate) matches that of FAO FRA data. Additional constraints were imposed on minimum afforestation rate, minimum deforestation rate and the trend of net forest area change (a difference between 2000-2005 average net forest area change and 2005-2010 average net forest area change). For the EU and UK, combined GLOBIOM/G4M estimates are being applied and projections are for the UK based on the 2016 EU Reference Scenario (Capros *et al*., 2016) and for the EU based on the 2021 EU Reference Scenario (Capros *et al*., 2021).

Methodology for specific policy instruments and targets

Current policies projections by IIASA have been assessed for the specific country using the GLOBIOM and/or the G4M model. The model that has been used to develop the projection for a specific county is specified in the country chapters. Below follows a generic description of the methodology used for calculating the effect of the policies for the LULUCF sector. In general, climate policies are implemented in GLOBIOM and G4M through a carbon tax or directly in the models by changing parameters or adding constraints in such a way that a target is achieved. Below we list a number of common approaches used to implement specific type of policies:

- **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 $MtCO_{2eq}$ are implemented through a carbon tax in G4M on the forest sectorial emissions and removals. The carbon tax is set at a level that leads to the target level being reached the desired year.
- **Emissions reductions targets,** i.e., a reduction of the net LULUCF emissions by X% or X $MtCO_{2eq}$ 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.

A.4: NewClimate Institute projections (based on the Climate Action Tracker analysis)

Current policies projections

NewClimate Institute analysis follows the calculation steps used in the Climate Action Tracker (Climate Action Tracker, 2021). The starting point for the calculation of current policies emissions projections is a publicly available “reference” policy scenario projections for economy-wide GHG emissions or energy-

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

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

When a scenario with only energy-related 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 (U.S. EPA, 2019). Projections for non-energy CO_2 emissions are most often taken from national governments' submissions to the UNFCCC.

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

Methodology for specific policy instruments and targets

Current policies projections by NewClimate Institute include add-on mitigation impact calculations for recently implemented policies. The calculation steps are policy specific; in some cases, CO_2 reduction impact values estimated in external sources are applied directly to "reference" scenarios for energy-related CO_2 emissions, whereas in other cases more detailed technical calculations are carried out. The choice of quantification method is also heavily dependent on data availability. We present common approaches used to quantify distinct policy types:

- **Renewable energy policies and targets**: CO_2 emissions reductions are calculated based on the energy balance projections underlying the "reference" scenario for energy-related CO_2 emissions. A number of case-specific assumptions are usually made on which fuels would be replaced by the increased renewable energy production.
- **Vehicle fuel efficiency standards**: A simplified stock turnover model is used for a number of countries. Calculations were done using the underlying data from the Global Transportation Roadmap Model of the International Council on Clean Transportation (ICCT, 2012).
- **Building codes**: as with vehicle fuel efficiency standards, a simplified stock turnover model is used for the EU.
- **Emissions trading schemes**: The targeted emission levels are applied to the sectors covered by the scheme. Carbon price levels are not considered in the analysis.
- **Economic measures**: Due to the limitation of bottom-up, spreadsheet-based calculations, NewClimate Institute projections consider economic measures such as carbon tax, feed-in tariff

scheme, direct investments and subsidies only if their mitigation impacts have already been quantified by other institutions.

- **Behavioural changes:** The emissions effect of behavioural changes can be calculated when the effect on activity levels has been assessed. For example, switching from an individual vehicle to a public transport affects transport modal split. This assessment requires additional analysis, that are conducted by other institutions or with the support of bottom-up policy quantification tools (COMPASS toolbox - NewClimate Institute).

Table A-2 presents the URLs and the posted dates of country assessment updates by the Climate Action Tracker project. The emissions projections for non-LULUCF sectors for non-CAT countries were developed as follows:

- Democratic Republic of the Congo: energy-CO_2 emissions projections based on estimates from the International Energy Agency for the Democratic Republic of the Congo (REFERENCE). Other CO2 emissions were assumed to remain constant and represent a very small share of total emissions. We complement emissions projections with non-CO_2 emissions from US EPA (US EPA, 2019).
- Israel: no reference scenario was available for Israel. NewClimate developed two reference scenarios. The first assumes Israel's historical emissions intensity per capita will remain constant and emissions growth is driven by population growth. The second assumes continuation of past emissions trends. The impact of policies quantified in Israel's Third National Communication was subtracted from these two reference scenarios to create the range. The lower range include full implementation of the policies quantified in the NC3 and the upper range excludes the effect of renewable energy related policies due to slow uptake of renewable electricity in the country.
- Malaysia: based on the reference projections from the APEC Energy Demand and Supply Outlook 2019 (APERC, 2019). Emissions range is partially due to distinct harmonisation methods resulting from the differences in historical energy-CO_2 emissions reported by the country compared to APEC projections. This emissions range will likely be reduced once most up to data projections become available. We assume other CO_2 emissions will follow energy CO_2 trends. We complement emissions projections with non-CO_2 emissions from US EPA (US EPA, 2019).

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

Country	URL	Date updated
Argentina	https://climateactiontracker.org/countries/argentina	July 2020
Australia	https://climateactiontracker.org/countries/australia	June 2021
Brazil	https://climateactiontracker.org/countries/brazil	September 2020
Canada	https://climateactiontracker.org/countries/canada	September 2020
China	https://climateactiontracker.org/countries/china	June 2021
Chile	https://climateactiontracker.org/countries/chile	July 2020
Colombia	https://climateactiontracker.org/countries/colombia/	October 2021
Ethiopia	https://climateactiontracker.org/countries/ethiopia	July 2020
European Union	https://climateactiontracker.org/countries/eu	June 2021
India	https://climateactiontracker.org/countries/india	June 2021
Indonesia	https://climateactiontracker.org/countries/indonesia	September 2020
Japan	https://climateactiontracker.org/countries/japan	June 2021
Kazakhstan	https://climateactiontracker.org/countries/kazakhstan	November 2020
Mexico	https://climateactiontracker.org/countries/mexico	September 2020
Morocco	https://climateactiontracker.org/countries/morocco	July 2020
Norway	https://climateactiontracker.org/countries/norway/	July 2020
Republic of Korea	https://climateactiontracker.org/countries/southkorea	July 2020

Country	URL	Date updated
Russia	https://climateactiontracker.org/countries/russianfederation	September 2020
Saudi Arabia	https://climateactiontracker.org/countries/saudiarabia	September 2020
South Africa	https://climateactiontracker.org/countries/southafrica	September 2020
Singapore	https://climateactiontracker.org/countries/singapore/	July 2020
The Philippines	https://climateactiontracker.org/countries/philippines	November 2020
Turkey	https://climateactiontracker.org/countries/turkey	July 2020
Ukraine	https://climateactiontracker.org/countries/ukraine	July 2020
United Kingdom	https://climateactiontracker.org/countries/uk/	June 2021
USA	https://climateactiontracker.org/countries/usa	July 2020
Viet Nam	https://climateactiontracker.org/countries/vietnam/	November 2020

A.5: References for national policies

Table A-3 presents references for all the national policies described for the countries that have been assessed. In some cases, no information concerning the policy is available in English. A link is provided to the original document in another language, which can be translated.

Table A-3: Country policies referenced in the report.

Country	Policy	Link to policy document
Argentina	Carbon tax on energy (2017)	(Legislation in Spanish) https://aldiaargentina.microjuris.com/2017/12/29/fue-promulgada-la-ley-de-reforma-tributaria/ (Summary in English) https://www.latamlawblog.com/tag/law-27430/
Argentina	Renewable Energy Law 27.191 setting renewable targets (2016)	(Legislation in Spanish) http://servicios.infoleg.gob.ar/infolegInternet/anexos/250000-254999/253626/norma.htm (Summary in English) https://www.lexology.com/library/detail.aspx?g=8d1fbf01-aad6-48aa-ab93-2e694a2d0051
Argentina	Biofuels Law (2016)	(legislation in Spanish) http://servicios.infoleg.gob.ar/infolegInternet/anexos/255000-259999/259942/norma.htm
Argentina	National plan for the restoration of native forests (2019)	(Legislation in Spanish) https://www.argentina.gob.ar/normativa/nacional/resoluci%C3%B3n-267-2019-325486/texto (Summary in English included NewClimate Report) https://newclimate.org/wp-content/uploads/2020/10/NewClimate_PBL-CLIMA_2020OctUpdate.pdf
Australia	State-level renewable energy targets	https://www.climatecouncil.org.au/resources/states-renewable-energy/
Australia	Emissions Reduction Fund (ERF) (2014)	http://www.cleanenergyregulator.gov.au/About/Pages/Accountability%20and%20reporting/Annual%20Reports/Annual%20Report%202017-18/Emissions-Reduction-Fund.aspx
Australia	Fuel tax (2006, last amendment in 2019)	https://www.legislation.gov.au/Series/C2006A00072
Brazil	10-Year National Energy Expansion Plan (PDE) (2011/2019)	(Legislation in Portuguese) https://www.epe.gov.br/sites-pt/publicacoes-dados-abertos/publicacoes/PublicacoesArquivos/publicacao-422/PDE%202029.pdf (Summary in English) https://www.greenmatters.com/news/2017/07/11/VhGQH/brazil-13-gigawatts-solar-energy-10-years
Brazil	RenovaBIO (2017)	(Legistlation in Portuguese) http://www.planalto.gov.br/ccivil_03/_ato2015-2018/2017/lei/L13576.htm (Executive decree in Portuguese) http://www.planalto.gov.br/ccivil_03/_ato2015-2018/2018/Decreto/D9308.htm (Summary in English) https://www.mayerbrown.com/en/perspectives-events/publications/2018/01/brazil-renovabio---new-biofuel-policy
Brazil	Biodiesel blending mandates (2020-2021)	(Legislation in Portuguese) https://www.gov.br/anp/pt-br/assuntos/producao-e-fornecimento-de-biocombustiveis/biodiesel/biodiesel/especificacao-do-biodiesel (Summary in English) https://www.spglobal.com/platts/en/market-insights/latest-news/oil/081420-brazils-anp-temporarily-reduces-biodiesel-blend-to-10-amid-supply-concerns
Brazil	National Plan on Climate Change (2008)	(Policy document in Portuguese) http://www.mma.gov.br/estruturas/208/_arquivos/national_plan_208.pdf (Summary in English) https://sustainabledevelopment.un.org/index.php?page=view&type=99&nr=7&menu=1449
Brazil	The Brazilian Forest Code (2012)	(Legislation in Portuguese) https://www2.camara.leg.br/legin/fed/lei/2012/lei-12651-25-maio-2012-613076-normaatualizada-pl.pdf (Summary in English) https://www.weforest.org/newsroom/brazilian-forest-code

Country	Policy	Link to policy document
Canada	Zero Emission Vehicle Infrastructure Deployment (2020)	https://www.nrcan.gc.ca/energy-efficiency/transportation-alternative-fuels/zero-emission-vehicle-infrastructure-program/21876
Canada	Greenhouse Gas Pollution Pricing Act (2018)	https://laws-lois.justice.gc.ca/eng/acts/G-11.55/index.html
Canada	Federal Greenhouse Gas Offset System [Under Development]	https://www.canada.ca/content/dam/eccc/documents/pdf/climate-change/pricing-pollution/pricing-pollutionProtocol-Development-GHG-Offset-System-v6.pdf
Canada	Regulations to address methane in the oil and gas sector (2018)	https://www.canada.ca/en/environment-climate-change/news/2018/04/federal-methane-regulations-for-the-upstream-oil-and-gas-sector.html
Chile	National Climate Change Action Plan (2017-2022) (2017)	https://www.ndcs.undp.org/content/ndc-support-programme/en/home/impact-and-learning/library/chile-s-plan-of-action-for-climate-change.html
Chile	Green tax [Law 20780] (2014/2020)	(Legislation in Spanish) https://www.bcn.cl/leychile/navegar?idNorma=1067194&idVersion=2020-02-24&idParte=9509245 (Summary in English) https://spaces.oneplanetnetwork.org/system/files/2.-institutional-infrastructure-for-chiles-green-tax.pdf
Chile	Energy Route 2018-2022 (2018)	http://iamericas.org/oldsite/documents/energy/presentations/Energy_Road_Map_Chile.pdf
Chile	National Action Plan for Sustainable Consumption and Production 2017-2022 (2017)	https://www.oneplanetnetwork.org/initiative/national-action-plan-sustainable-consumption-and-production-2017-2022
China	14th Five-Year Plan [2021-2025] (2021)	https://www.hkstrategies.com/en/chinas-14th-five-year-plan-2021-2025-report/
China	National Action Plan on Climate Change 2014-2020 (2014)	https://climate-laws.org/geographies/china/policies/national-plan-for-tackling-climate-change-2014-2020
China	Revision of Land Administration Law of the People's Republic of China (2019)	(Legislation in Chinese) https://perma.cc/T7V6-CJXG (Summary in English) https://www.loc.gov/item/global-legal-monitor/2020-02-20/china-revised-land-administration-law-takes-effect/
China	15-year plan [2021-2035] to protect ecosystems (2020)	http://english.www.gov.cn/statecouncil/ministries/202006/11/content_WS5ee231adc6d0a6946639bec0.html
Colombia	Resolution No.1988 (2017) & Resolution No.585 (2017)	(Resolution 1988 in Spanish) https://www.uninorte.edu.co/web/sga/normatividad/-/wiki/Main/Resoluci%C3%B3n+1988+de+2017+Ministerio+de+Ambiente+y+Desarrollo+Sostenible (Resolution 585 in Spanish) https://vlex.com.co/vid/resolucion-numero-585-2017-694504213
Colombia	Colombian Low-Carbon Development Strategy (ECDBC) (2012)	(Policy document in Spanish) https://www.minambiente.gov.co/index.php/component/content/article/469-plantilla-cambio-climatico-25#estrategia-colombiana-de-desarrollo-bajo-en-carbono (Summary in English) https://climate-laws.org/geographies/colombia/policies/colombian-low-carbon-development-strategy
Colombia	The National Development Plan of Colombia (2015)	https://www.global-regulation.com/translation/colombia/8177145/why-is-issued-the-national-plan-of-development-2014-2018-%2522all-for-a-new-country%2522.html
Colombia	Resolution to increase the area of protected forest land in the Amazon (2018)	https://news.trust.org/item/20180411192947-crajw/
Democratic Republic of the Congo	Law No. 14/011 (Electricity Sector) (2014)	https://www.climate-laws.org/geographies/democratic-republic-of-congo/laws/law-no-14-011-electricity-sector
Democratic Republic of the Congo	Law No. 14/003 (Protection of the Nature) (2014)	https://www.climate-laws.org/geographies/democratic-republic-of-congo/laws/law-no-14-003-on-protection-of-the-nature
Democratic Republic of the Congo	Law No. 11/022 (Fundamental	https://www.climate-laws.org/geographies/democratic-republic-of-congo/laws/law-no-11-022-fundamental-agricultural-law

Country	Policy	Link to policy document
	Agricultural Law) (2011)	
Democratic Republic of the Congo	Proposed Lifting of the Logging Moratorium (2021)	https://redd-monitor.org/2021/07/15/democratic-republic-of-congo-plans-to-lift-logging-moratorium/
Ethiopia	Climate Resilience and Green Economy Strategy (CRGE) (2011)	https://www.undp.org/content/dam/ethiopia/docs/Ethiopia%20CRGE.pdf
Ethiopia	Growth and Transformation Plan II (2016)	https://ethiopia.un.org/en/15231-growth-and-transformation-plan-ii
Ethiopia	Scaling-Up Renewable Energy Program for Ethiopia (SREP Investment Plan) (2012)	https://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/climate-investment-funds-cif/strategic-climate-fund/scaling-up-renewable-energy-program-in-low-income-countries-srep
European Union (27)	EU ETS Directive (2003/2018)	(Original 2003 legislation) http://eur-lex.europa.eu/legal-content/AUTO/?uri=CELEX:32003L0087&qid=1448882749567&rid=1 (2018 ammendment) https://www.europarl.europa.eu/RegData/etudes/BRIE/2018/621902/EPRS_BRI(2018)621902_EN.pdf
European Union (27)	Effort Sharing Legislation [2018/842] (2018)	https://ec.europa.eu/clima/policies/effort/regulation_en
European Union (27)	European Green Deal (2019)	https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en
European Union (27)	EU Farm to Fork Strategy (2019)	https://ec.europa.eu/food/horizontal-topics/farm-fork-strategy_en
India	Clean energy cess (coal tax) (2010)	https://www.cbic.gov.in/resources//htdocs-cbec/excise/cxrules/cx-cec-rules2010.pdf;jsessionid=16ADCD12CA0BD4C3EAF7DE8F1D13B79B
India	National Mission for Enhanced Energy Efficiency (2008)	https://beeindia.gov.in/content/nmeee-1
India	National Electricity Plan (2018)	https://powermin.gov.in/en/content/national-electricity-plan-0
India	Energy efficiency in industry (PAT scheme) (2011)	https://beeindia.gov.in/content/pat-3
Indonesia	National Energy Policy (2014)	https://www.bpdp.or.id/wp-content/uploads/2018/06/PP-79-14-English.pdf
Indonesia	Electricity Supply Business Plan (RUPTL 2019–2028)	https://web.pln.co.id/statics/uploads/2021/08/5b16d-kepmen-esdm-no-39-k-20-mem-2019-tentang-pengesahan-ruptl-pt-pln-2019-2028.pdf
Indonesia	Biofuel targets (2013)	https://www.iea.org/policies/5692-biofuel-blending-ministry-regulation-no-252013
Indonesia	Palm Oil Moratorium (2021)	(Summary of policy) https://thepalmscribe.id/the-palm-oil-moratorium/ (Policy expired in Sep 2021) https://news.trust.org/item/20210924090311-unm3b
Israel	Energy efficiency measures (2015-2016)	(Set of multiple measures, main source is Israel's communication to the UNFCCC) https://unfccc.int/sites/default/files/resource/UNFCCC%20National%20Communication%202018.pdf
Israel	Closure of four coal-fired power plants by 2022 (2016)	(Measure listed in Country's updated NDC) https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Israel%20First/NDC%20update%20as%20submitted%20to%20the%20UNFCCC.docx (Measure included in 3rd National Communication, implementation subject to conditions) https://unfccc.int/sites/default/files/resource/UNFCCC%20National%20Communication%202018.pdf (Announcement) https://today.in-24.com/News/78092.html
Israel	Tax exemptions and expansion of approved quotas for renewables (2016)	(Policy included in 3rd National Communication) https://unfccc.int/sites/default/files/resource/UNFCCC%20National%20Communication%202018.pdf (Announcement) https://www.jpost.com/Business-and-Innovation/Environment/Israel-to-boost-solar-energy-production-469864
Japan	Green Growth Strategy (2021)	https://www.meti.go.jp/english/press/2021/0618_002.html
Japan	Basic Energy Plan (2021)	(Outline of policy document draft in Japanese) https://www.enecho.meti.go.jp/committee/council/basic_policy_subcommittee/2021/046/046_004.pdf (Summary in English) https://electrek.co/2021/07/21/japan-sets-a-new-clean-energy-target-to-nearly-40-by-2030/

Country	Policy	Link to policy document
Japan	Renewable Energy Act (feed-in tariff) (2012)	http://www.japaneselawtranslation.go.jp/law/detail_main?ia=03&vm=02&id=2573
Kazakhstan	Law on the transition to green economy (2016)	https://www.jdsupra.com/legalnews/law-on-the-transition-to-a-green-13580/
Kazakhstan	Law about Support of Use of Renewable Sources of Energy [Law 165-4] (2009)	https://www.ecolex.org/details/legislation/law-no-165-iv-on-support-of-the-use-of-renewable-energy-lex-faoc096053/
Kazakhstan	Law on Energy Saving (2011)	https://cis-legislation.com/document.fwx?rgn=53341
Malaysia	Green Technology Master Plan 2017-2030 (2017)	https://policy.asiapacificenergy.org/sites/default/files/Green%20Technology%20Master%20Plan%202017-2030.pdf
Malaysia	11th Malaysia plan 2016-2020 (2015)	https://climate-laws.org/geographies/malaysia/policies/11th-malaysia-plan-2016-2020
Malaysia	National Policy on Climate Change (2012)	http://www.ukm.my/myc/pdf/workshop/DAY%20ONE_SESSION1/Prof%20Pereira_for%20NRE.pdf
Malaysia	Malaysian Forestry Policy (2021)	https://www.frim.gov.my/pm-launches-malaysian-forestry-policy-at-kbg-frim/
Mexico	Emissions Trading Scheme (2018)	https://www.gob.mx/cms/uploads/attachment/file/505745/Brochure_SCE-ENG.pdf
Mexico	Energy Transition Law (2015)	(Legistlation in Spanish) http://www.diputados.gob.mx/LeyesBiblio/pdf/LTE.pdf (Summary in English) https://climate-laws.org/geographies/mexico/laws/energy-transition-law
Mexico	Electric Industry Law (LIE, (+)) (2014/2021)	(Legistlation in Spanish) http://www.diputados.gob.mx/LeyesBiblio/pdf/LIElec_110814.pdf (Summary in English) https://www.mayerbrown.com/files/Publication/15cb6f04-748b-4836-a607-26c65997c1c1/Presentation/PublicationAttachment/0f38ad29-4abf-442b-aef9-319d68469310/UPDATE-AnalysisElectricityLaw_0814.pdf (2021 ammendments) https://www.gtlaw.com/en/insights/2021/3/amendments-to-mexicos-electric-industry-law
Mexico	National Forestry Programme – PRONAFOR (2014)	(Policy document in Spanish) https://www.gob.mx/cms/uploads/attachment/file/262728/16pe_nacional_forL2016.pdf
Morocco	2030 National Climate Plan (2019)	https://newclimate.org/wp-content/uploads/2020/10/NewClimate_PBL-CLIMA_2020OctUpdate.pdf
Morocco	National Energy Strategy (2009/2012) & Morocco Integrated Wind Energy Program (2010) & Morocco Solar Plan (2009) & Morocco Hydroelectric Plan.	(National Energy Strategy) http://documents1.worldbank.org/curated/en/964331541085444404/pdf/Morocco-Energy-Policy-MRV.pdf (Integrated Wind Energy Program) https://www.gvip.io/p/the-moroccan-integrated-wind-energy-project (Morocco Solar Plan) https://www.dmsprojects.net/morocco/projects/masen-moroccan-solar-plan-noor-overview/PRJ00015840 (Morocco Hydroelectric Plan) https://www.hydropower.org/country-profiles/morocco
Norway	Climate Action Plan (2021)	https://www.regjeringen.no/en/aktuelt/heilskapeleg-plan-for-a-na-klimamalet/id2827600/?fbclid=IwAR2Vu6zCnuMEcfs_04--bKX1s9YYITzfuj3F2g1ebltlA4_qtDaoYp-aEB0
Norway	National Transport Plan 2018-2029 (2017)	https://www.regjeringen.no/contentassets/7c52fd2938ca42209e4286fe86bb28bd/en-gb/pdfs/stm201620170033000engpdfs.pdf
Norway	Climate Change Act (2017)	https://lovdata.no/dokument/NLE/lov/2017-06-16-60
Philippines	The Climate Change Act (2010)	https://www.officialgazette.gov.ph/2009/10/23/republic-act-no-9729/
Philippines	Renewable Energy Act (2008)	https://www.officialgazette.gov.ph/2008/12/16/republic-act-no-9513/
Philippines	Energy Efficiency and Conservation Act (2021)	https://www.dilg.gov.ph/issuances/mc/Guidelines-in-Implementing-RA-No-11285-or-the-Energy-Efficiency-and-Conservation-Act-and-its-IRR/3207
Philippines	Lifting of the Mining Permit Ban (2021)	https://www.officialgazette.gov.ph/2021/04/14/executive-order-no-130-s-2021/
Russian Federation	Federal Law on Saving Energy and Increasing Energy Efficiency Increase [Law 261-F3] (2009)	http://www.fao.org/faolex/results/details/en/c/LEX-FAOC093408/

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Russian Federation	Renewable energy targets (Governmental resolution No. 512-r of 2013, 2015 amendment to the Decree No. 1-r of 2009)	https://www.irena.org/publications/2017/Apr/Renewable-Energy-Prospects-for-the-Russian-Federation-REmap-working-paper
Russian Federation	Energy intensity targets (2008)	https://www.unescap.org/sites/default/files/D_Russia_NadezhdinEEPresentation_1.pdf
Russian Federation	System of Green Project Financing (2021)	https://www.tellerreport.com/news/2021-07-20-the-cabinet-of-ministers-approved-the-goals-and-main-directions-of-green-financing.SyGKalGE0d.html
Saudi Arabia	Saudi Arabia's Vision 2030 (2016/2019)	https://www.vision2030.gov.sa/
Saudi Arabia	Saudi Green Initiative (2021)	https://www.saudigreeninitiative.org/
Saudi Arabia	Fossil fuel price reform (2017)	https://www.erpecnewslive.com/article/877/saudi-arabia-considers-rise-in-retail-fuel-prices-in-2017
Singapore	Climate Impact X Initiative (2021)	https://www.sgx.com/climate-impact-x-cix
Singapore	Million Tree Campaign (2020)	https://www.nparks.gov.sg/treessg/one-million-trees-movement
Singapore	Climate Action Plan (2016)	https://storage.googleapis.com/cclow-staging/2n0z3c4lx5xtbk4d9e7ixn5nvzph?GoogleAccessId=laws-and-pathways-staging%40soy-truth-247515.iam.gserviceaccount.com&Expires=1633417595&Signature=eA48%2FFoGSS195yANcdtAwuds%2FAu%2BP%2Fr2xjgX9UgVC8hWnsGtfBnPcoYc78nX%2BjbCsk4NfdSQaiqNXwYDbt1EkKYb9htRvqblpBCI8ZLJwLH99l9%2FZfTzrOqt1lPnELYJ%2BF4zCLpzeE6v8j2Hl4e61um7BPQee8YLYd9rtAcBYn%2B8wf8XX%2BDWeoZCPGQz5gTAbqYiGkwP01LlVe4uBiBLK3z9L9gLS%2FA%2FkmGwA80NqOSbp9Acd8n5bO1EO0C4YnlxarivTgd3yL43VrZey17QHya69sf%2FesF5yqRnNkFE08tnlipBLyRSKnmAUUupIFbgOlpb%2Bhndr26qPC%2BU8ef2xg%3D%3D&response-content-disposition=inline%3B+filename%3D%22f%22%3B+filename%2A%3DUTF-8%27%27f&response-content-type=application%2Fpdf
Singapore	National Climate Change Strategy (2012)	http://www.fao.org/faolex/results/details/en/c/LEX-FAOC178015/
South Africa	National Development Plan (2012)	https://www.gov.za/issues/national-development-plan-2030
South Africa	Integrated Resource Plan for electricity (2011/2019)	https://www.egsa.org.za/wp-content/uploads/2019/10/IRP-2019_corrected-as-gazetted-18-October-2019-No.-42784.pdf
South Africa	Petroleum Products Act (Biofuels Industrial Strategy) (2007)	http://www.energy.gov.za/files/esources/petroleum/petroleum_bio.html
South Korea	Emissions Trading System (2015)	https://icapcarbonaction.com/en/?option=com_etsmap&task=export&format=pdf&layout=list&systems[]=47
South Korea	Renewable energy targets/3rd Energy Master Plan (2019)/8th Basic Plan for Long-term Electricity Supply and Demand (2017)	(Third Energy Master Plan) https://policy.thinkbluedata.com/sites/default/files/Third%20Energy%20Master%20Plan.pdf (8th Basic Plan) https://policy.asiapacificenergy.org/sites/default/files/8th%20Basic%20Plan%20for%20Long-term%20Electricity%20Supply%20and%20Demand%20%282017%20-%202031%29.pdf
South Korea	Fuel efficiency standard (last update 2014)	(Policy document in Korean) https://www.law.go.kr/LSW/admRulLsInfoP.do?admRulSeq=2100000009634 (Summary in English) https://www.transportpolicy.net/standard/south-korea-light-duty-fuel-economy-and-ghg/
South Korea	2nd Comprehensive Plan for Improvement of Carbon Sinks (2018)	https://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2019/09/8925.pdf
South Korea	2nd Comprehensive Plan for Wood Use (2019)	(Policy document in Korean) http://m.biomassenergy.kr/core/anyboard/download.php?boardID=www14&fileNum=2082

Country	Policy	Link to policy document
Thailand	Climate Change Master Plan (2015-2050) (2015)	https://climate.onep.go.th/wp-content/uploads/2019/07/CCMP_english.pdf
Thailand	Energy Efficiency Plan 2015-2036 (2015)	http://www.egat.co.th/en/images/about-egat/PDP2015_Eng.pdf
Thailand	Alternative Energy Development Plan and Power Development Plan (2015; 2018 rev. 1)	(Policy document in Thai) https://www.thaienergy.org/assets/files/pdp2018-pdf.pdf (Summary in English) https://www.nationthailand.com/in-focus/30360098
Turkey	Energy Efficiency Law (2012)	https://www.ilo.org/dyn/natlex/docs/ELECTRONIC/94599/111048/F-1870188604/Clean+Version-Final-Renewable+Energy++Energy+Ef.pdf
Turkey	Energy Efficiency Action Plan (2018)	https://www.ebrd.com/news/2018/ebrd-welcomes-turkeys-national-energy-efficiency-action-plan.html
Turkey	11th Development Plan (2019)	https://stip.oecd.org/stip/policy-initiatives/2019%2Fdata%2FpolicyInitiatives%2F25311
Turkey	Renewable capacity target (Renewable Energy Action Plan) (2014)	https://www.ebrd.com/news/2015/ebrd-supports-turkeys-shift-to-renewable-energy.html
Ukraine	National Renewable Energy Action Plan 2020 (2014)	https://saee.gov.ua/documents/NpdVE_eng.pdf
Ukraine	Green Tariff (renewables feed-in-tariff) (2015 amendment)	(2009 legislation in Ukranian) http://w1.c1.rada.gov.ua/pls/zweb2/webproc4_1?pf3511=55219 (Summary of 2015 ammendment)https://www.dentons.com/en/insights/alerts/2015/june/9/milestone-law-amending-feed-in-tariff-in-ukraine
Ukraine	Energy Strategy of Ukraine until 2035 (2017)	https://razumkov.org.ua/uploads/article/2017_NES%202035_RazumkovCentre_Ukraine_September%202017_description.pdf
Ukraine	National Transport Strategy 2035 (2017)	(Policy document in Ukranian) http://publications.chamber.ua/2017/Infrastructure/UDD/National_Transport_Strategy_2030.pdf
Ukraine	National Action Plan for Environmental Protection (2021)	(Policy document in Ukranian) https://zakon.rada.gov.ua/laws/show/443-2021-%D1%80#Text
United Kingdom	Climate Change Act (2008/2019).	(Original legislation) https://www.legislation.gov.uk/ukpga/2008/27/contents (2019 ammendment) https://www.legislation.gov.uk/ukdsi/2019/9780111187654
United Kingdom	Ten Point Plan for a Green Industrial Revolution (2020)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/936567/10_POINT_PLAN_BOOKLET.pdf
United Kingdom	Climate Change Levy (2001/2018).	(Original legislation) https://www.legislation.gov.uk/uksi/2001/838/contents/made (2018 ammendment) https://www.legislation.gov.uk/uksi/2018/118/contents/made
United Kingdom	Environmental Bill (2021).	https://bills.parliament.uk/bills/2593
United States	Bipartisan Budget Act (2018)	https://www.congress.gov/bill/115th-congress/house-bill/1892/text
United States	Renewable Fuel Standards (2015)	https://www.epa.gov/renewable-fuel-standard-program/overview-renewable-fuel-standard
United States	Methane waste prevention rule (2016)	https://www.blm.gov/programs/energy-and-minerals/oil-and-gas/operations-and-production/methane-and-waste-prevention-rule

References

APERC (2019) *APEC Energy Demand and Supply Outlook – 7th edition (Vol II)*. Tokyo, Japan: Asia Pacific Energy Research Centre, The Institute of Energy Economics, Japan. Available at: http://aperc.ieej.or.jp/file/2010/9/24/Outlook_Volume_II_4E.pdf.

Bartholomé, E. and Belward, A. S. (2005) 'GLC2000: a new approach to global land cover mapping from Earth observation data', *International Journal of Remote Sensing*, 26(9), pp. 1959–1977. doi: 10.1080/01431160412331291297.

Climate Action Tracker (2021) *Climate Action Tracker: Country Assessments: update July 2020 - July 2021*, *Country Assessments*. Available at: https://climateactiontracker.org/countries/ (Accessed: 31 March 2021).

Dafnomilis, I. *et al.* (2021) 'Targeted green recovery measures in a post-COVID-19 world enable the energy transition', *Nature Portfolio*. doi: 10.21203/rs.3.rs-667715/v1.

den Elzen, M. *et al.* (2019) 'Are the G20 economies making enough progress to meet their NDC targets?', *Energy Policy*, 126, pp. 238–250. doi: 10.1016/j.enpol.2018.11.027.

Fekete, H. *et al.* (2021) 'A review of successful climate change mitigation policies in major emitting economies and the potential of global replication', *Renewable and Sustainable Energy Reviews*, 137, p. 110602. doi: 10.1016/j.rser.2020.110602.

Frank, S. *et al.* (2021) 'Land-based climate change mitigation potentials within the agenda for sustainable development', *Environmental Research Letters*, 16(2), p. 024006. doi: 10.1088/1748-9326/abc58a.

Government of P. R. China (2016) 'First Biennial Update Report on Climate Change of the People's Republic of China', in *Unfccc*. The People's Republic of China , p. 141,142. Available at: http://unfccc.int/files/national_reports/non-annex_i_parties/biennial_update_reports/submitted_burs/application/pdf/chnbur1.pdf.

Government of P. R. China (2018) *The People's Republic of China Second Biennial Update Report on Climate Change*. Available at: https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/23146085_China-BUR2-1-China_BUR2_English.pdf.

Gusti, M. *et al.* (2020) 'The Effect of Alternative Forest Management Models on the Forest Harvest and Emissions as Compared to the Forest Reference Level', *Forests* . doi: 10.3390/f11080794.

Gusti, M. and Kindermann, G. (2011) 'AN APPROACH TO MODELING LANDUSE CHANGE AND FOREST MANAGEMENT ON A GLOBAL SCALE', in *Proceedings of 1st International Conference on Simulation and Modeling Methodologies, Technologies and Applications (SIMULTECH-2011)*. SCITEPRESS, pp. 180–185. doi: 10.5220/0003607501800185.

Havlík, P. *et al.* (2014) 'Climate change mitigation through livestock system transitions', *Proceedings of the National Academy of Sciences of the United States of America*, 111(10), pp. 3709–14. doi: 10.1073/pnas.1308044111.

ICCT (2012) *Global Transportation Roadmap Model Version 1.0*. Available at: http://www.theicct.org/global-transportation-roadmap-model.

Keenan, R. J. *et al.* (2015) 'Dynamics of global forest area: Results from the FAO Global Forest Resources Assessment 2015', *Forest Ecology and Management*, 352, pp. 9–20. doi: 10.1016/J.FORECO.2015.06.014.

Kuramochi, T. *et al.* (2018) *Greenhouse gas mitigation scenarios for major emitting countries. Analysis of current climate policies and mitigation commitments: 2018 update*. NewClimate Institute, PBL Netherlands Environmental Assessment Agency and International Institute for Applied Systems Analysis. Available at: https://newclimate.org/2018/12/05/greenhouse-gas-mitigation-scenarios-for-major-emitting-countries-analysis-of-current-climate-policies-and-mitigation-commitments-2018-update/.

Kuramochi, T. *et al.* (2019) *Greenhouse gas mitigation scenarios for major emitting countries. Analysis of current climate policies and mitigation commitments: 2019 update*. NewClimate Institute, PBL Netherlands Environmental Assessment Agency and International Institute for Applied Systems Analysis.

Kuramochi, T. *et al.* (2021) 'Greenhouse gas emission scenarios in nine key non-G20 countries: An assessment of progress toward 2030 climate targets', *Environmental Science & Policy*, 123, pp. 67–81. doi: https://doi.org/10.1016/j.envsci.2021.04.015.

Lauri, P. *et al.* (2021) 'Material substitution between coniferous, non-coniferous and recycled biomass – Impacts on forest industry raw material use and regional competitiveness', *Forest Policy and Economics*, 132, p. 102588. doi: https://doi.org/10.1016/j.forpol.2021.102588.

Nascimento, L. *et al.* (2021) *Greenhouse gas mitigation scenarios for major emitting countries. Analysis of current climate policies and mitigation commitments: 2021 update*. NewClimate Institute, PBL Netherlands Environmental Assessment Agency and International Institute for Applied Systems Analysis (IIASA).

Le Quéré, C. *et al.* (2020) *Supplementary data to: Le Quéré et al (2020), Temporary reduction in daily global CO2 emissions during the COVID-19 forced confinement (Version 1.2).* Global Carbon Project. Available at: https://doi.org/10.18160/RQDW-BTJU (Accessed: 11 December 2020).

U.S. EPA (2019) 'Global Anthropogenic Non-CO2 Greenhouse Gas Emissions: 2015e2050, Report EPA-430-R-19-010.' Washington DC, USA: Office of Atmospheric Programs Climate Change Division, U.S. Environmental Protection Agency.

UNFCCC (2014) *Greenhouse Gas Inventory Data - Detailed data by Party. Assessed 14 November 2014*. Bonn, Germany: United Nations Framework Convention on Climate Change.

UNFCCC (2016) 'Submitted biennial update reports (BURs) from non-Annex I Parties'. United Nations Framework Convention on Climate Change. Available at: http://unfccc.int/national_reports/non-annex_i_natcom/reporting_on_climate_change/items/8722.php.

UNFCCC (2017) 'Submitted National Communications from Non-Annex I Parties, http://unfccc.int/national_reports/non-annex_i_natcom/items/10124.php'. Bonn. Germany: United Nations Framework Convention on Climate Change. Available at: http://unfccc.int/national_reports/non-annex_i_natcom/items/10124.php.

US EPA (2019) *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2017*. United States Environmental Protection Agency. Available at: https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2017 (Accessed: 13 August 2019).

NewClimate Institute
Waidmarkt 11a
50676 Cologne
Germany

International Institute for Applied Systems Analysis (IIASA)
Schlossplatz 1
2361 Laxenburg
Austria

FTSE Russell
10 Paternoster Square
London
EC4M 7LS
United Kingdom