Climate Transparency

Brown to Green Report 2019: The G20 Transition Towards a Net-zero Emissions Economy
Technical Note: Methodology and Data sources

The Brown to Green 2019 report, including the country profiles, assesses the G20 countries' past, present and indications of future performance towards a low-carbon and climate-resilient economy by evaluating mitigation, adaptation and climate-related finance. This technical note lists the sources and methods used to calculate the indicators presented in each country profile in their order of appearance.

Climate Transparency

1. Socio-economic context

1.1 Human Development Index

The Human Development Index (HDI) is a composite index published by the United Nations Development Programme (UNDP). It is a summary measure of average achievement in key dimensions of human development with 1.0 being the highest possible score. A country scores higher when the lifespan is higher, the education level is higher, and GDP per capita is higher. Data presented in the Brown to Green Report 2019 is for 2017.

UNDP (2018). Human Development Indices and Indicators. 2018 Statistical Update. United Nations Development Programme. Retrieved from: http://hdr.undp.org/en/2018-update

1.2 GDP per capita

Gross Domestic Product (GDP) is the value of all final goods and services produced within a country in a given year. GDP per capita is calculated by dividing the GDP of a country with midyear population figures. The Brown to Green Report 2019 uses GDP figures at purchasing power parity (PPP) from 2018, drawn from the World Bank. The figures were deflated applying 2018 US$ deflation.

World Bank (2019). GDP per capita, PPP (current international $). Retrieved from: https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD

World Bank (2019). GDP deflator. Retrieved from: https://data.worldbank.org/indicator/NY.GDP.DEFL.ZS?locations=US

1.3 Population projections for 2030

Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. Population estimates are usually based on national population censuses. Population projections, starting from a base year, are projected forward using assumptions of mortality, fertility, and migration by age and sex through 2050, based on the UN Population Division's World Population Prospects database medium variant. Data presented in the Brown to Green Report 2019 is for 2018, 2030 and 2050.

World Bank (2019). Population Estimates and Projections. Retrieved from: https://datacatalog.worldbank.org/dataset/population-estimates-and-projections

1.4 Ambient air pollution attributable death rate

The burden of disease attributable to ambient air pollution expressed as a death rate (both crude and age-standardized). Ambient air pollution results from emissions from industrial activity, households, cars and trucks. Data presented in the Brown to Green Report 2019 is for 2016.

WHO (2018). Global Health Observatory data repository. Retrieved from: http://apps.who.int/gho/data/view.main.BODAMBIENTAIRDALYS

1.5 Just transition

For the **sources** used for the assessment of individual countries' policies on just transition, please refer to the Annex.

2. Mitigation

2.1 Mitigation: General

The following methods and sources are being used throughout the mitigation section.

2.1.1 Ratings on decarbonisation indicators

The partnership Climate Transparency provides ratings for different decarbonisation indicators. These ratings assess the relative performance across the G20. A high scoring reflects a relatively good effort from a climate protection perspective but is not necessarily 1.5°C compatible. The ratings assess both the 'current level' and 'recent developments' to take account of the different starting points of different G20 countries. The 'recent developments' ratings compare the development of the last 5 available years (often 2013 to 2018).

2.1.2 Policy ratings

The policies evaluated were selected based on relevance for global decarbonisation and data availability, discussions with partners, and the paper Climate Action Tracker (2016): "The ten most important short-term steps to limit warming to 1.5°C".

If a policy is not relevant for a country (e.g. no coal in Saudi Arabia), we do not give a rating but write „not applicable". If there is a considerable lack of implementation that contradicts a positive policy

On endnote 5)	low	medium	high	frontrunner
Renewable energy in power sector	No policy to increase the share of renewables	Some policies	Policies and longer-term strategy/ target to significantly increase the share of renewables	Short-term policies + long-term strategy for 100% renewables in the power sector by 2050 in place
Coal phase-out in power sector	No target or policy in place for reducing coal	Some policies	Policies + coal phase-out decided	Policies + coal phase-out date before 2030 (OECD and EU28) or 2040 (rest of the world)
Phase out fossil fuel cars	No policy for reducing emissions from light-duty vehicles	Some policies (e.g. energy/ emissions performance standards or bonus/malus support)	Policies + national target to phase out fossil fuel light-duty vehicles	Policies + ban on new fossil-based light-duty vehicles by 2035 worldwide
Phase out fossil fuel heavy-duty vehicles	No policy	Some policies (e.g. energy/ emissions performance standards or support)	Policies + strategy to reduce absolute emissions from freight transport	Policies + innovation strategy to phase out emissions from freight transport by 2050
Modal shift in (ground) transport	No policies	Some policies (e.g. support programmes to shift to rail or non-motorised transport)	Policies+ longer-term strategy	Policies + longer-term strategy consistent with 1.5°C pathway
Near zero-energy new buildings	No policies	Some policies (e.g. building codes, standards or fiscal/ financial incentives for low-emissions options)	Policies + national strategy for near zero-energy new buildings	Policies + national strategy for all new buildings to be near zero-energy by 2020 (OECD countries) or 2025 (non-OECD countries)
Retrofitting exis-ting buildings	No policies	Some policies (e.g. building codes, standards or fiscal/ financial incentives for low-emissions options)	Policies + retrofitting strategy	Policies + strategy to achieve deep renovation rates of 5% annually (OECD) or 3% (non-OECD) by 2020
Energy efficiency in industry	No policies	Mandatory energy efficiency policies cover more than 26-50% of industrial energy use	Mandatory energy efficiency policies cover 51–100% of industrial energy use	Policies + strategy to reduce industrial emissions by 75%–90% from 2010 levels by 2050
(Net) zero deforestation	No policy or incentive to reduce deforestation in place	Some policies (e.g. incentives to reduce deforestation or support schemes for afforestation /reforestation in place)	Policies + national target for reaching net zero deforestation	Policies + national target for reaching zero deforestation by 2020s or for increasing forest coverage

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Web: www.climate-transparency.org

rating, this is highlighted with a warning sign. The rating applies only to the policies as they are on paper.

2.1.3 Trend calculation

Trends are calculated using the most recent and five earlier data years, calculating a linear trend out of those values and then calculating a trend ($\frac{y2-y1}{y1}$, y1 being the base year) out of the values of the linear trend in the respective years. In comparison to a trend using only the first and last values of a 5-year period, the trend analysis has the advantage that all other data years within the time period are taken into account, making it less susceptible to noise in the data (e.g. an unusually warm winter affecting emissions).

2.1.4 Sector share of total CO_2 emissions

At the beginning of the sections "power sector", "transport sector", "buildings sector", and "industry sector" there are pie charts displaying direct and indirect emissions (emissions from electricity used) in the respective sector. For buildings and industry, this includes co-generated heat from electricity generation. Enerdata provides the data presented.

Enerdata (2019). Global Energy and CO_2 data: CO2 emissions from industries (Fuel combustion incl. autoproducers); CO2 emissions (sectoral approach); Indirect CO2 emissions from industry; CO2 emissions from public electricity and heat production; Indirect CO2 emissions from transport; CO2 emissions from households (Fuel combustion); Indirect CO2 emissions from households; CO2 emissions from transport (Fuel combustion). Retrieved from: https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html

2.1.5 IPCC 1.5°C Benchmarks

To provide broad guidance on where indicators related to emissions need to be on global pathways to achieve the global 1.5°C limit, global benchmarks were adopted from the IPCC Special Report on 1.5°C, in particular its Summary for Policy Makers (SPM). For some indicators, no relevant statement is included in the SPM and for these, where possible, a suitable benchmark was derived from the sectoral 1.5°C-comnpatible emissions pathways in the public scenario database associated with the IPCC SR1.5 (https://data.ene.iiasa.ac.at/iamc-1.5c-explorer). Finally, if no suitable indicator can be derived from either the SR1.5 or the associated scenario database, a suitable indicator has been adopted from the broader literature as indicated, and not labelled "IPCC".

Country Profile Report page	IPCC statement on global level	Source
Mitigation: big picture (p. 3)	In 2030, global GHG emissions need to be 45% below 2010 levels and reach net zero by 2070.	**IPCC (2018).** Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. World Meteorological Organization, Geneva. Retrieved from:

Country Profile Report page	IPCC statement on global level	Source
		https://www.ipcc.ch/site/assets/uploads/sites/2/2018/07/SR15_SPM_version_stand_alone_LR.pdf - SPM Figure SPM.3b Author's analysis of IPCC public scenario database available at: https://data.ene.iiasa.ac.at/iamc-1.5c-explorer
Mitigation: Energy (1) (p. 4)	The share of fossil fuels globally needs to fall to 67% of global total primary energy by 2030 and to 33% by 2050 and to substantially lower levels without Carbon Capture and Storage.	**Rogelj, J., D. Shindell, K. Jiang, S. Fifita, P. Forster, V. Ginzburg, C. Handa, H. Kheshgi, S. Kobayashi, E. Kriegler, L. Mundaca, R. Séférian, and M.V.Vilariño (2018).** Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press. Retrieved from: https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_Chapter2_Low_Res.pdf - Table 2.6
Mitigation: Energy (2) (p. 6)	Global energy and process-related CO_2 emissions must be cut by 40% below 2010 levels by 2030 and reach net zero by 2060.	**IPCC (2018).** Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. World Meteorological Organization, Geneva. Retrieved from: https://www.ipcc.ch/site/assets/uploads/sites/2/2018/07/SR15_SPM_version_stand_alone_LR.pdf - SPM Figure SPM.3b Authors' analysis of IPCC public scenario database available at https://data.ene.iiasa.ac.at/iamc-1.5c-explorer
Mitigation: Power sector (p. 7)	Coal must be phased out in the EU/OECD no later than 2030, in the rest of the world no later than 2040. Electricity generation has to be decarbonised before 2050, with renewable energy	**IPCC (2018).** Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. World Meteorological Organization, Geneva. Retrieved from: https://www.ipcc.ch/site/assets/uploads/sites/2/2018/07/SR15_SPM_version_stand_alone_LR.pdf - SPM C.2.2

Country Profile Report page	IPCC statement on global level	Source
	the most promising option.	**Rogelj, J., D. Shindell, K. Jiang, S. Fifita, P. Forster, V. Ginzburg, C. Handa, H. Kheshgi, S. Kobayashi, E. Kriegler, L. Mundaca, R. Séférian, and M.V.Vilariño (2018).** Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press. Retrieved from: https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_Chapter2_Low_Res.pdf - Page 97: "By 2050, the carbon intensity of electricity decreases to −92 to +11 gCO_2 MJ^{-1} (minimum–maximum range)…" **Climate Analytics (2016).** Implications of the Paris Agreement for Coal Use in the Power Sector. Retrieved from: https://climateanalytics.org/media/climateanalytics-coalreport_nov2016_1.pdf **Climate Analytics (2019).** Decarbonising South and South East Asia. Retrieved from: https://climateanalytics.org/media/decarbonisingasia2019-fullreport-climateanalytics.pdf
Mitigation: Transport sector (p. 8)	The proportion of low-carbon fuels in the transport fuel mix must increase to about 60% by 2050.	**Rogelj, J., D. Shindell, K. Jiang, S. Fifita, P. Forster, V. Ginzburg, C. Handa, H. Kheshgi, S. Kobayashi, E. Kriegler, L. Mundaca, R. Séférian, and M.V.Vilariño (2018).** Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press. Retrieved from: https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_Chapter2_Low_Res.pdf - Pages 143-144

Country Profile Report page	IPCC statement on global level	Source
		Note: The upper end of the IPCC range was chosen as this figure is derived from more up-to-date scenarios.
Mitigation: Building sector (p. 10)	Global emissions from buildings need to be halved by 2030, and be about 80% below 2010 levels by 2050, mostly through increased efficiency, reduced energy demand and electrification in conjunction with complete decarbonisation of the power sector.	**Rogelj, J., D. Shindell, K. Jiang, S. Fifita, P. Forster, V. Ginzburg, C. Handa, H. Kheshgi, S. Kobayashi, E. Kriegler, L. Mundaca, R. Séférian, and M.V.Vilariño (2018).** Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press. Retrieved from: https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_Chapter2_Low_Res.pdf - Section 2.4.3.2 and Figure 2.22
Mitigation: Industry (p. 11)	Global industrial emissions need to be reduced by 65–90% from 2010 levels by 2050.	**IPCC (2018).** Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. World Meteorological Organization, Geneva. Retrieved from: https://www.ipcc.ch/site/assets/uploads/sites/2/2018/07/SR15_SPM_version_stand_alone_LR.pdf - SPM C.2.2
Mitigation: Forestry (p. 12)	Global deforestation needs to be halted and changed to net CO_2 removals by around 2030.	**IPCC (2018).** Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. World Meteorological Organization, Geneva. Retrieved from: https://www.ipcc.ch/site/assets/uploads/sites/2/2018/07/SR15_SPM_version_stand_alone_LR.pdf - SPM C.2.2 Author's analysis of IPCC public scenario database available at https://data.ene.iiasa.ac.at/iamc-1.5c-explorer
Mitigation: Agriculture (p. 12)	Methane emissions (mainly enteric fermentation) need to decline to 10% by	**IPCC (2018).** Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change,

Country Profile Report page	IPCC statement on global level	Source
	2030 and to 35% by 2050 (from 2010 levels). Nitrous oxide emissions (mainly from fertilizers and manure) to need to be reduced by 10% by 2030 and by 20% by 2050 (from 2010 levels).	sustainable development, and efforts to eradicate poverty. World Meteorological Organization, Geneva. Retrieved from: https://www.ipcc.ch/site/assets/uploads/sites/2/2018/07/SR15_SPM_version_stand_alone_LR.pdf - SPM C.2.2 Author's analysis of IPCC public scenario database available at https://data.ene.iiasa.ac.at/iamc-1.5c-explorer

2.2 Mitigation: Big Picture

2.2.1 GHG emissions per capita

PRIMAP-hist combines several published datasets to create a comprehensive set of GHG emissions pathways for every country and all Kyoto gases covering the years 1850 to 2016. The data resolves the main International Panel on Climate Change (IPCC) 2006 categories (Energy, Industrial Processes, Solvent and Other Product Use, Agriculture, Land-Use Change and Forestry, and Waste). Data presented in the Brown to Green Report 2019 is for 2016. Population data is taken as reported by the World Bank.

World Bank (2019). Population total. Retrieved from: https://data.worldbank.org/indicator/SP.POP.TOTL

Gütschow, J.; Jeffery, L.; Gieseke, R. (2019). The PRIMAP-hist national historical emissions time series (1850-2016). V. 2.0. GFZ Data Services. Retrieved from: http://dataservices.gfz-potsdam.de/pik/showshort.php?id=escidoc:3842934

For Argentina only:

Secretary of Environment and Sustainable Development (2019). Argentine Republic's Third Biennial Update Report (BUR 3). Soon available under: https://unfccc.int/BURs;

Indec (2019). Proyecciones nacionales. Retrieved from: https://www.indec.gob.ar/indec/web/Nivel4-Tema-2-24-84

2.2.2 Total GHG emissions across sectors and CAT 1.5°C range

The Climate Action Tracker (CAT) is an independent scientific analysis that tracks progress towards the globally agreed aim of holding warming well below 2°C, and pursuing efforts to limit warming to 1.5°C. The CAT evaluates progress towards this global goal by quantifying the aggregate effects of current policies and the pledges and targets put forward by 31 countries and the EU, and compares these with the emissions levels consistent over time with the 1.5°C limit.

The '1.5C compatible' benchmark is derived from pathways considered by the IPCC in its Special Report *Global Warming of 1.5°C* (SR1.5). The benchmark is based on those pathways that limit global warming to 1.5°C, or below, throughout the 21st century with no or limited overshoot (<0.1°C). Pathways that do not respect the sustainability and economic constraints on carbon dioxide removal (CDR) identified by the IPCC, which have the effect of limiting bio-energy with carbon capture and storage (BECCS) to below 5 $GtCO_2e$/yr globally in 2050 and agriculture, forestry and other land use (AFOLU) to below 3.6 $GtCO_2$/yr sequestration globally in 2050, have been excluded. The median and inter-quartile ranges (50% ranges) for the relevant pathways are extracted from the IPCC SR1.5 database for total global greenhouse gas emissions. In these pathways, global average temperature increases above pre-industrial are limited to below 1.6°C over the 21st century and below 1.5°C by 2100 (typically 1.3°C). '1.5°C compatible' emissions levels in 2030 are consistent with IPCC SR1.5 Summary for Policymakers (25–30 $GtCO_2e$/year based on Global Warming Potential (GWP) values from the IPCC's Second Assessment Report (SAR)); however, due to CDR constraints are 1 $GtCO_2e$/yr lower for the median and 2 $GtCO_2e$/yr lower for the top end of range.

To determine a country's effort sharing benchmark, the CAT abstains from defining what is 'fair' in favour of a holistic approach that constructs a country's Fair Share range based on the range of fairness estimates available from the literature. The CAT "Effort Sharing" assessment methodology applies state-of-the art scientific literature on how to compare the fairness of government efforts and NDC proposals against the level and timing of emission reductions consistent with the Paris Agreement. The effort-sharing studies in the CAT's database include over 40 studies used by the IPCC (chapter 6 of WG III and Höhne et al. (2013)), plus additional analyses the CAT has performed to complete the dataset. They cover very different viewpoints of what could be considered fair, including considerations of equity such as historical responsibility, capability, and equality.

A country's Fair Share range is divided into three sections: Insufficient, 2°C compatible, and 1.5°C Paris Agreement compatible. Each section corresponds to the temperature outcomes that would result if all other governments were to put forward emission reduction commitments with the same relative ambition level. The "insufficient" to "1.5°C Paris Agreement compatible" range represents the full Fair Share range of a country, excluding the highest and the lowest values of the full sample of equity studies, which represent the outliers for this country. This means that the top and bottom end of the Fair Share range are defined by the second highest/lowest categories. To eliminate extreme outliers for each category, the CAT only considers values within the 10th to 90th percentile of all the values included in that category.

The figures used in this report are drawn from the 1.5°C compatible range. If all governments put forward "1.5°C Paris Agreement compatible" commitments at the most ambitious end of their Fair Share range (minimum fair emissions), warming would be held to well below 2°C and limited to 1.5°C. The "less than zero" emission reductions needed for some countries means that in some interpretations of what is fair, the country in question would have no emission allowances left in 2030 or 2050 and would have to have fully phased out its emissions or compensate its remaining emissions with reductions elsewhere, for example, through supporting emission reductions in other countries.

The CAT methodology is based on assessing a country's fair share contribution towards reducing emissions from fossil fuel combustion, industry, agriculture and waste sources—in effect, on their

contribution towards long-term decarbonisation. It does not consider emissions from the forestry sector (i.e. from Land Use, Land-Use Change and Forestry or LULUCF).

Further information about the CAT effort sharing methodology is available here: https://climateactiontracker.org/methodology/comparability-of-effort/

For France, Italy, Germany and the UK, an EU-wide NDC applies. However, in this section of the report, the national emission reduction targets of these countries were used account instead of their joint NDC. The calculation of these national targets is based on the National Energy and Climate Plans (NECPs) of these countries and their National Communications and Biennial Reports to the UNFCCC. The national targets are as follows:

- Germany: -55% from 1990 levels;
- France: -40% from 1990 levels;
- Italy: 43% below 2005 for ETS sector and 33% below 2005 for non-ETS sector. The calculations of emissions levels implied by this targets are made using the values from the Table 30 of the NECP and mean a reduction equivalent to 38% below 1990 levels excl LULUCF;
- UK: -57% from 1990 levels.

European Commission (2019). National Energy and Climate Plans (NECPs). Retrieved from: https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/governance-energy-union/national-energy-climate-plans

UNFCCC (2019). National Communications and Biennial Reports. Retrieved from: https://unfccc.int/national-communications-and-biennial-reports

Note: these sources are missing on pages 2 and 3 of the respective country profiles.

For Argentina, in addition to CAT 2019, Argentina's third Biennial Update Report (BUR) by the **Secretary of Environment and Sustainable Development 2019** was used as a source. It is not yet published as of November 2019 but will soon be available on the UNFCCC website: https://unfccc.int/BURs

2.2.3 Nationally-determined contribution (NDC)

The tables give an overview of the main content of a country's NDC submitted to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat – or 'intended NDC' (INDC) when the country has not yet handed in its final NDC. The report provides a mere summary of the targets and actions mentioned in the NDCs and does not provide an evaluation.

UNFCCC (2018). NDC Interim Registry. Retrieved from: www4.unfccc.int/ndcregistry/Pages/Home.aspx

For France, Italy, Germany and the UK, both the EU-wide NDC and their national emission reduction targets are listed. The calculation of the national targets is based on the National Energy and Climate Plans (NECPs) of these countries and their National Communications and Biennial Reports to the UNFCCC.

European Commission (2019). National Energy and Climate Plans (NECPs). Retrieved from: https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/governance-energy-union/national-energy-climate-plans

UNFCCC (2019). National Communications and Biennial Reports. Retrieved from: https://unfccc.int/national-communications-and-biennial-reports

2.2.4 Long-term strategy

The tables give an overview of the main content of a country's long-term strategy submitted to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat. The report provides a mere summary of the targets and does not provide an evaluation.

UNFCCC. Communication of long-term strategies. Retrieved from: https://unfccc.int/process/the-paris-agreement/long-term-strategies

2.3 Mitigation: Energy

2.3.1 Energy mix

Total primary energy supply (TPES) is the sum of energy production, energy imports and stock variations minus energy exports and international bunkers. Other reports sometimes consider total final consumption, which is TPES minus losses in energy conversion. From a climate perspective it is, however, more important how much fuel is fed into the system and combusted, and not how much energy is consumed by end users.

'Others' covers mainly solid fuel biomass from residential use, which is shown separately because of its negative social and environmental impacts.

All energy data shown in the Brown to Green Report is from Enerdata and excludes non-energy use values, i.e. fuels that are used as raw materials.

Enerdata (2019). Global Energy and CO_2 data: Primary consumption of coal and lignite; Primary consumption of oil; Primary consumption of natural gas; Primary consumption of nuclear; Biomass final consumption of residential; Primary consumption total; Total consumption of renewables. Retrieved from: https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html

For Argentina only:

Secretaría de Energía (2018). Argentina's National Energy Balance. Retrieved from http://datos.minem.gob.ar/dataset/balances-energeticos;

CAMMESA (2019). Informe Mensual del Sector Eléctrico, Julio. Retrieved from: http://www.cammesa.com/linfomen.nsf/MINFOMEN?OpenFrameSet

2.3.2 Carbon intensity of energy supply

Carbon intensity of a country's energy sector describes the CO_2 emissions per unit of total primary energy supply. It gives an indication on the share of fossil fuels in the energy supply, the choice of fuel (e.g. gas is less carbon intensive than coal) and on the efficiency of generation.

Enerdata (2019). Global Energy and CO_2 data: CO2 per toe consumed (CO2 from fuel combustion). Retrieved from: https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html

A country with a very low level of carbon intensity, when compared to other G20 countries, receives a very high **rating** for 'current level'. A very high rating for 'recent developments' signals a high reduction from 2013 to 2018 when compared to the G20 peers.

Table 1: Carbon intensity of the energy sector

	2013 (tCO2e/TJ)	2018 (tCO2e/TJ)	Rating current level (2018)	Trend (2013- 2018)	Rating trend
Argentina	52.85	52.94	medium	-0.37%	low
Australia	74.37	72.77	very low	-1.67%	medium
Brazil	37.48	34.49	very high	-9.37%	high
Canada	49.54	47.37	high	-3.24%	medium
China	75.20	71.46	very low	-4.29%	high
EU	50.80	48.95	high	-3.17%	medium
France	31.75	29.71	very high	-3.23%	medium
Germany	59.22	58.13	low	-1.34%	low
India	56.48	58.51	low	2.54%	very low
Indonesia	47.86	49.65	high	1.82%	low
Italy	52.81	50.42	high	-4.94%	high
Japan	63.91	63.20	low	-0.98%	low
Mexico	56.36	56.61	low	2.15%	very low
Russia	53.50	52.38	medium	-2.61%	medium
Saudi Arabia	60.98	61.04	low	2.99%	very low
South Africa	76.50	73.32	very low	-4.12%	high
South Korea	55.30	54.81	medium	-0.59%	low
Turkey	59.63	62.31	low	2.94%	very low
United Kingdom	57.07	49.18	high	-14.74%	very high
USA	55.83	54.14	medium	-3.40%	medium

2.3.3 Solar, wind, geothermal and biomass development

This indicator covers solar, wind, geothermal and non-residential biomass. It excludes unsustainable renewable sources such as large hydropower or traditional biomass used in the residential sector (mainly fuel wood used for cooking).

Enerdata (2018). Global Energy and CO_2 data: Total primary consumption; Primary production of solar electricity; Share of wind in primary consumption; Share of geothermal electricity in primary consumption; Share of Biomass in TPES (excl. traditional biomass (mainly solid fuel biomass for residential use)). Retrieved from: https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html

For Argentina only:

Secretaría de Energía (2018). Argentina's National Energy Balance. Retrieved from http://datos.minem.gob.ar/dataset/balances-energeticos;

CAMMESA (2019). Informe Mensual del Sector Eléctrico, Julio. Retrieved from: http://www.cammesa.com/linfomen.nsf/MINFOMEN?OpenFrameSet

The 'Trend' rating of the indicator "Solar, wind, geothermal and biomass" is calculated using the trend of the share of these renewables sources in TPES from 2013 to 2018. If a country's absolute level of new renewables is at a low level, a rather small absolute change could be reflected as a high relative change and positive rating, even if absolute change is small compared to other countries.

Table 2: Rating of the share of solar, wind, geothermal and biomass in TPES

	2013 (% of TPES)	2018 (% of TPES)	Rating current level (2018)	Trend (2013- 2018)	Rating trend
Argentina	4%	4%	low	19.85%	medium
Australia	4%	5%	low	34.93%	medium
Brazil	26%	30%	very high	17.87%	low
Canada	5%	5%	low	-2.74%	very low
China	1%	3%	very low	136.34%	very high
EU	8%	10%	high	26.80%	medium
France	4%	6%	medium	41.10%	high
Germany	9%	13%	high	38.30%	high
India	7%	9%	medium	19.72%	medium
Indonesia	11%	13%	high	15.52%	low
Italy	10%	11%	high	3.54%	low
Japan	3%	5%	medium	61.33%	high
Mexico	3%	4%	very low	11.98%	low
Russia	1%	1%	very low	14.65%	low
Saudi Arabia	0%	0%	very low	-17.13%	very low
South Africa	4%	4%	low	13.78%	low
South Korea	5%	8%	medium	70.78%	very high
Turkey	2%	7%	medium	257.07%	very high
United Kingdom	5%	10%	high	104.86%	very high
USA	5%	6%	medium	17.99%	low

2.3.4 Energy supply per capita

Total Primary Energy Supply (TPES) per capita displays the energy supply in relation to a country's population. The level of energy use per capita is closely related to economic development, climatic conditions and the price of energy. There are enormous differences in the level of energy use per capita between low- and middle-income economies, and high-income economies.

The Brown to Green Report uses TPES data from 2018, drawn from Enerdata, and population data from World Bank.

Enerdata (2019). Global Energy and CO_2 data: Total consumption per capita (incl. non conv.). Retrieved from: https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html

World Bank (2019). Population total. Retrieved from: https://data.worldbank.org/indicator/SP.POP.TOTL

For Argentina only:

Secretaría de Energía (2018). Argentina's National Energy Balance. Retrieved from http://datos.minem.gob.ar/dataset/balances-energeticos;

Indec (2019). Proyecciones nacionales. Retrieved from: https://www.indec.gob.ar/indec/web/Nivel4-Tema-2-24-84

For 'current level', a very high **rating** implies one of the lowest levels of energy use per capita in the G20. For 'recent developments' a very high rating implies a high reduction from 2013 to 2018, when compared to other G20 countries.

Table 3: Rating for energy use per capita

	2013	2018	Rating current level (2018)	Trend (2013- 2018)	Rating trend
Argentina	81.84	78.29	high	-3.77%	medium
Australia	228.65	222.08	very low	-1.93%	medium
Brazil	60.59	57.59	high	-6.99%	high
Canada	323.93	340.05	very low	3.75%	low
China	89.81	95.09	high	4.55%	low
EU	134.86	130.43	medium	-1.46%	medium
France	161.77	150.55	low	-5.97%	medium
Germany	164.88	150.37	low	-6.62%	high
India	26.08	29.17	very high	10.74%	very low
Indonesia	35.54	39.34	very high	9.47%	very low
Italy	108.09	106.61	medium	0.77%	low
Japan	149.51	140.26	low	-5.44%	medium
Mexico	65.70	57.98	high	-10.58%	very high
Russia	209.82	231.19	very low	10.63%	very low
Saudi Arabia	267.56	258.84	very low	-6.48%	high
South Africa	104.49	101.37	medium	-4.88%	medium
South Korea	225.42	248.04	very low	10.86%	very low
Turkey	64.61	75.32	high	19.24%	very low
United Kingdom	124.63	110.45	medium	-10.10%	very high
USA	290.80	288.35	very low	-2.44%	medium

2.3.5 Energy intensity of the economy

TPES per unit of GDP describes the energy intensity of a country's economy. This indicator illustrates the efficiency of energy usage by calculating the energy needed to produce one unit of GDP. A decrease

in this indicator can mean an increase in efficiency but also reflects structural economic changes.

Enerdata (2019). Global Energy and CO_2 data: Energy intensity of GDP at purchasing power parities. Retrieved from: https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html

World Bank (2017). The World Bank's Open Data initiative. Retrieved from: http://data.worldbank.org/indicator/

A very high **rating** for 'current level' implies one of the lowest levels of energy intensity in the G20. A very high rating for 'recent developments' signals a high reduction from 2013 to 2018, when compared to the G20 peers.

Table 4: Rating of energy intensity of the economy (current; trend)

	2013	2018	Rating current level (2018)	Trend (2013- 2018)	Rating trend
Argentina	4.20	4.31	medium	1.39%	very low
Australia	5.29	4.88	low	-6.95%	medium
Brazil	3.93	4.06	medium	3.10%	very low
Canada	7.66	7.71	very low	-0.03%	low
China	7.53	5.88	low	-23.17%	very high
EU	3.90	3.43	high	-10.55%	high
France	4.32	3.83	medium	-10.47%	medium
Germany	3.84	3.31	high	-11.91%	high
India	5.02	4.17	medium	-18.18%	very high
Indonesia	3.69	3.39	high	-9.22%	medium
Italy	3.16	3.00	very high	-3.69%	medium
Japan	4.02	3.57	medium	-10.76%	high
Mexico	4.01	3.32	high	-16.28%	very high
Russia	8.21	8.90	very low	9.71%	very low
Saudi Arabia	5.40	5.31	low	-4.36%	medium
South Africa	8.47	8.31	very low	-3.59%	medium
South Korea	6.92	6.76	very low	-1.62%	low
Turkey	2.98	2.97	very high	1.21%	low
United Kingdom	3.31	2.75	very high	-15.71%	very high
USA	5.68	5.19	low	-9.92%	medium

2.3.6 Energy-related CO_2 emissions by sector

CO_2 emissions from energy account for the highest share of total GHG emissions in most countries. They are emissions resulting from fuel combustion (coal, oil and gas) in sectors electricity and heat, transport, buildings, agriculture, industries and other emissions from the energy sector (e.g. the emissions of transforming coal into coke). Emissions are calculated according to the 2006 IPCC Guidelines for National GHG Inventories.

Enerdata (2019). Global Energy and CO_2 data: CO_2 emissions from fuel combustion (sectoral approach); CO_2 emissions in energy sector (Fuel combustion); CO_2 emissions from industries (Fuel combustion incl. autoproducers); CO2 emissions from households, services, agriculture (Fuel combustion); CO_2 emissions from transport (Fuel combustion); CO_2 emissions from industrial process. Retrieved from: https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html

For Argentina only:

Secretaría de Energía (2018). Argentina's National Energy Balance. Retrieved from http://datos.minem.gob.ar/dataset/balances-energeticos;

Secretary of Environment and Sustainable Development (2019). Argentine Republic's Third Biennial Update Report (BUR 3). Soon available under: https://unfccc.int/BURs

2.4 Mitigation: Power sector

2.4.1 Status of decarbonisation

Power sector	○ **Power Mix (Data for 1990-2018)** **Enerdata (2019).** Global Energy and CO_2 data: Electricity production; Nuclear electricity production; Electricity production from oil; Electricity production from natural gas; Electricity production from coal, lignite; Share of renewables in electricity production (incl hydro). Retrieved from: https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html For Argentina only: **Secretaría de Energía (2018).** Argentina's National Energy Balance. Retrieved from http://datos.minem.gob.ar/dataset/balances-energeticos; **CAMMESA (2019).** Informe Mensual del Sector Eléctrico, Julio. Retrieved from: http://www.cammesa.com/linfomen.nsf/MINFOMEN?OpenFrameSet ○ **Shares of renewable sources in total electricity mix (Data for 2018)** **Enerdata (2019).** Global Energy and CO_2 data: Electricity production from renewable biomass and waste; Offshore wind electricity production; Onshore wind electricity production; Solar electricity production; Geothermal electricity production; Hydroelectric production. Retrieved from: https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html ○ **Emissions intensity of the power sector (Data for 2013-2018)** **Enerdata (2019).** Global Energy and CO_2 data: CO_2 emissions of the electricity production. Retrieved from: https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html For Argentina only: **Secretary of Environment and Sustainable Development (2019).** Argentine Republic's Third Biennial Update Report (BUR 3). Soon available under: https://unfccc.int/BURs; **CAMMESA (2019).** Informe Mensual del Sector Eléctrico, Julio. Retrieved from: http://www.cammesa.com/linfomen.nsf/MINFOMEN?OpenFrameSet For Brazil only: **Brazilian Ministry of Science and Technology (2019).** Fator médio - Inventários corporativos. Retrieved from: https://www.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/textogeral/emissao_corporativos.html ○ **Share of renewables in power generation (Data for 2018)** **Enerdata (2019).** Global Energy and CO_2 data: Share of renewables in electricity production (incl hydro). Retrieved from: https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html For Argentina only: **CAMMESA (2019).** Informe Mensual del Sector Eléctrico, Julio. Retrieved from: http://www.cammesa.com/linfomen.nsf/MINFOMEN?OpenFrameSet

2.5 Mitigation: Transport sector

2.5.1 Status of decarbonisation

Transport sector

- **Fuel mix in transport (Data for 1990-2018)**

  Enerdata (2019). Global Energy and CO_2 data: Total energy final consumption of transport; Oil products final consumption of transport; Natural gas final consumption of transport; Electricity final consumption of transport; Coal final consumption of transport; Biofuels final consumption of transport. Retrieved from: https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html

- **Transport emissions per capita (Data for 2018)**

  Enerdata (2019). Global Energy and CO_2 data: CO_2 emissions from transport (Fuel combustion). Retrieved from: https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html

  World Bank (2019). Population total. Retrieved from: https://data.worldbank.org/indicator/SP.POP.TOTL

- **Motorisation rate (data for different years available depending on the country)**

  Agora Verkehrswende (2018). Towards Decarbonising Transport – A G20 Stocktake on Sectoral Ambition. Retrieved from:

  https://www.agora-verkehrswende.de/en/publications/towards-decarbonising-transport-2018/

  For South Africa only: **Statistics South Africa (2019).** General Household Survey 2018. Retrieved from: http://www.statssa.gov.za/publications/P0318/P03182018.pdf

  For China only: **National Statistic Bureau (2018).** Statistical Bulletin on National Economic and Social Development (*note: this is the correct source, the differing source on p. 9 of the Chinese country profile is incorrect).*

- **Market share of electric vehicles in new car sales (Data for 2018)**

  IEA (2019). Global EV Outlook 2019. Retrieved from: https://www.iea.org/gevo2019/

- **Modal split in passenger transport (Data for different years available depending on the country)**

  Agora Verkehrswende (2018). Towards Decarbonising Transport – A G20 Stocktake on Sectoral Ambition. Retrieved from:

  https://www.agora-verkehrswende.de/en/publications/towards-decarbonising-transport-2018/

  For Argentina only: **Argentinian Ministry of Environment and Sustainable Development; National Climate Change Cabinet (2017).** Acción Nacional de Transporte y Cambio Climático. Versión I - 2017. Retrieved from: https://www.argentina.gob.ar/ambiente/sustentabilidad/planes-sectoriales/transporte

  Note: Data for the city of Buenos Aires only

- **Modal split freight in transport (Data for different years available depending on the country)**

  Agora Verkehrswende (2018). Towards Decarbonising Transport – A G20 Stocktake on Sectoral Ambition. Retrieved from:

  https://www.agora-verkehrswende.de/en/publications/towards-decarbonising-transport-2018/

  For Argentina only: **Argentinian Ministry of Environment and Sustainable Development; National Climate Change Cabinet (2017).** Acción Nacional de Transporte y Cambio Climático. Versión I - 2017. Retrieved from: https://www.argentina.gob.ar/ambiente/sustentabilidad/planes-sectoriales/transporte

  Note: Data for the city of Buenos Aires only

  For South Africa only: **Havenga, J.H.; Simpson, Z.P.; King, D.; de Bod, A. and Braun, M. (2016).** Logistics Barometer South Africa 2016. Stellenbosch University.

- **Emissions from domestic and international aviation per capita (Data for 2016)**

  IEA (2018). CO2 emissions from fuel combustion 2018. Retrieved from: https://webstore.iea.org/co2-emissions-from-fuel-combustion-2018

	This indicator adds up emissions from domestic aviation and emissions from international aviation bunkers in the respective country.

2.6 Mitigation: Building sector

2.6.1 Status of decarbonisation

Building sector	○ **Building emissions per capita (Data for 2018)** **Enerdata (2019).** Global Energy and CO_2 data: CO_2 emissions from households (Fuel combustion); Indirect CO_2 emissions from households. Retrieved from: https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html Direct and indirect (electricity) emissions are included. **World Bank (2019).** Population total. Retrieved from: https://data.worldbank.org/indicator/SP.POP.TOTL ○ **Final energy use per m² residential buildings** **ACEEE (2018).** The 2018 International Energy Efficiency Scorecard. Retrieved from: https://aceee.org/research-report/i1801 ○ **Final energy use per m² commercial buildings** **ACEEE (2018).** The 2018 International Energy Efficiency Scorecard. Retrieved from: https://aceee.org/research-report/i1801

2.7 Mitigation: Industry sector

2.7.1 Status of decarbonisation

Industry sector	○ **Industry emissions intensity (Data for 2016)** Energy emissions in industry are taken from Enerdata; industry process emissions are taken from PRIMAP (2018); the gross value added for industry (incl. construction) is taken from the World Bank (2019). **Enerdata (2019)**. Global Energy and CO_2 data: CO_2 emissions from industries (Fuel combustion incl. autoproducers). Retrieved from: https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html **Gütschow, J.; Jeffery, L.; Gieseke, R. (2019).** The PRIMAP-hist national historical emissions time series (1850-2016). V. 2.0. GFZ Data Services. Retrieved from: http://dataservices.gfz-potsdam.de/pik/showshort.php?id=escidoc:3842934 **World Bank (2019).** Industry (including construction), value added (constant 2010 US$). Retrieved from: https://data.worldbank.org/indicator/NV.IND.TOTL.KD ○ **Carbon intensity of cement production (Data for 2015)** Cement emissions intensity (kg CO_2 / t product). CO_2 emissions related to cement production divided by total cement production includes scope 1 (direct energy-related and process emissions) and scope 2 (i.e. related to electricity consumption) emissions. **CAT (2019).** Assessment of mitigation contributions to the Paris Agreement. Retrieved from: www.climateactiontracker.org - based on Global Cement database: https://www.wbcsdcement.org/GNR-2016/ For South Africa only: Excl. electricity emissions. **Department of Environmental Affairs Republic of South Africa (2019).** South Africa's Third Biennial Update Report to the UNFCCC (*note: this source is correct, it is incorrectly missing on p.11 of the South African country profile)*. ○ **Carbon intensity of steel production (Data for 2015)**

	Steel emissions intensity (kg CO_2 / t product). CO_2 emissions per tonne of steel produced Includes scope 1 (direct energy-related and process emissions) and scope 2 (i.e. related to electricity consumption) emissions **CAT (2019).** Assessment of mitigation contributions to the Paris Agreement. Retrieved from: www.climateactiontracker.org - based on World Steel Association: https://www.worldsteel.org/ For South Africa only: Excl. electricity emissions. **Department of Environmental Affairs Republic of South Africa (2019).** South Africa's Third Biennial Update Report to the UNFCCC (*note: this source is correct, it is incorrectly missing on p.11 of the South African country profile)*.

2.8 Mitigation: Forestry

2.8.1 Annual gross tree cover loss by dominant driver (Data for 2001-2017)

Global Forest Watch (2019). Global annual tree cover loss by dominant driver. Retrieved from: https://www.globalforestwatch.org/dashboards/global

For Brazil only: **INPE (2019).** Monitoramento do Desmatamento da Floresta Amazônica Brasileira por Satélite. Retrieved from: http://www.obt.inpe.br/OBT/assuntos/programas/amazonia/prodes

2.9 Mitigation: Agriculture

2.9.1 Emissions from agriculture by source (Data for 2016)

FAO (2019). FAOSTAT – Agriculture Total. Retrieved from: http://www.fao.org/faostat/en/#data/GT

For Argentina only: **Secretary of Environment and Sustainable Development (2019).** Argentine Republic's Third Biennial Update Report (BUR 3). Soon available under: https://unfccc.int/BURs

3. Adaptation

3.1 Adaptation policies

3.1.1 NDC adaptation summary

See 2.2.3

3.1.2 National adaptation strategies

The national adaptation strategies of the G20 countries were retrieved mainly through national websites. The Climate legislation and litigation database from the LSE and the Grantham Research Institute on Climate Change and the Environment (http://www.lse.ac.uk/GranthamInstitute/countries/) and the Climate-ADAPT platform (https://climate-adapt.eea.europa.eu/) served as initial sources of information which were then complemented by additional google searches.

For the **sources** used for the assessment of individual countries' policies, please refer to the Annex.

3.2 Adaptation needs

3.2.1 Global Climate Risk Index

The Germanwatch Global Climate Risk Index is an analysis based on one of the most reliable data sets available on the impacts of extreme weather events and associated socio-economic data. The

Germanwatch Climate Risk Index 2019 is the 14th edition of the annual analysis. Its aim is to contextualize ongoing climate policy debates – especially the international climate negotiations – with real-world impacts during the last year and the last 20 years. The index analyses to what extent countries and regions have been affected by impacts of weather-related loss events (storms, floods, heat waves etc.).

The Climate Risk Index for 1998-2017 was used for this indicator, the numbers presented are average figures for this 20-year period:

- Annual average fatalities (absolute numbers and per 100 000 inhabitants) and the rank of the country of the 181 countries worldwide.
- Annual average loss in US$ PPP and per unit GDP (%) and the rank of the country out of the 181 countries worldwide.

Germanwatch (2019). Global Climate Risk Index 2019 – Who suffers most from extreme weather events? Weather-related loss events in 2017 and 1998 to 2017? Retrieved from: https://www.germanwatch.org/sites/germanwatch.org/files/Global%20Climate%20Risk%20Index%202019_2.pdf

3.2.2 Exposure to future impacts at 1.5°C, 2°C, and 4°C

Country-level data describing the impacts of climate change at different levels of global temperature increase for the G20 countries were used for these indicators. It uses the same data, methodology and indicators (with minor exceptions noted below) as used in Arnell et al. (2019). Arnell et al. (2019) focuses on the global and regional scales. All the indicators characterise physical hazard and natural resources, and are calculated at the $0.5x0.5^0$ scale. The indicators are weighted by area, rather than calculated just over grid cells with more than 1000 people as it is described in Arnell et al. (2019). The number of days with maximum temperatures greater than 35°C was not included in Arnell et al. (2019) but were provided for the BTG report.

There are some caveats with the results (summarised in Arnell et al., 2019). These are even more significant at the national scale: (i) the indicators are designed to allow comparisons between regions and countries and therefore entail simplifications. More appropriate indicators may/should be used at the national scale; (ii) the indicators are calculated using global data sets, which may differ from national data sets and could therefore contain uncertainties. The hydrological indicators (change in runoff, flood and drought) only represent changes within a country, and do not incorporate the effects of changes in upstream countries. There is also variability in impact within a country, which is not shown in the national-scale averages.

Table 5: Summary of the proxy impact indicators used in the country profiles

Indicator	Description
WATER	

% of area with increase in water scarcity	% of region with a decrease / increase in average annual runoff more than twice the standard deviation of 30-year average runoff
% of time in drought conditions	Proportion of time spent in hydrological drought (Standardised Runoff Index: Shuckla & Wood, 2008)
ENERGY DEMAND	
Cooling degree days	Cooling degree days, using a threshold of 18°C
Heating degree days	Heating degree days, using a threshold of 18°C
HEAT & HEALTH	
Heatwave frequency	Likelihood (%) that a year will contain a heatwave, with maximum temperature greater than the 98th percentile of the warm season temperatures for at least two days
Days above 35°C	Average annual number of days with maximum temperature greater than 35°C
AGRICULTURE	
Reduction in crop duration	Average annual change in crop growth duration. Crop growth duration is based on the time taken to accumulate the reference period average growing season accumulated thermal time (ATT: Challinor et al., 2016). Weighted by maize, winter wheat, spring wheat, soybean and rice area
Hot spell frequency	Likelihood (%) that a year will contain a damaging hot spell, defined as at least five days during the 30-day reproductive phase with temperatures above a threshold: maize 36^{O}C, wheat 34^{O}C, soybean 39^{O}C and rice 36^{O}C (thresholds from Challinor et al., 2016 and Lou, 2011). Weighted by maize, winter wheat, spring wheat, soybean and rice area
Reduction in rainfall	Likelihood (%) that growing season rainfall is less than the standard deviation of growing season rainfall. Weighted by maize, winter wheat, spring wheat, soybean and rice area

For the Brown to Green report, the data was normalized across world minimum and maximum values for each indicator. To determine the ranking scale, equal quantile distribution was applied to get the ranges for all five categories (very low, low, medium, high, very high).

WATER

Runoff decreases

Very low	Low	Medium	High	Very high
≥ 0	≥ 0.015789	≥ 0.068421	≥ 0.140789	≥ 0.393421

Hydrological drought

Very low	Low	Medium	High	Very high
≥ -0.047782	≥ 0.027304	≥ 0.112628	≥ 0.201365	≥ 0.365188

HEAT & HEALTH

Heatwaves frequency

Very low	Low	Medium	High	Very high
≥ 0.195089	≥ 0.549795	≥ 0.731241	≥ 0.856753	≥ 0.956344

Note: Based on this scale and the definition of 'heatwave frequency' used by Arnell et al. (2019) (see table above), this indicator should be interpreted as 'extreme topical heatwave frequency'.

Days above 35°C

Very low	Low	Medium	High	Very high
≥ 0	≥ 0.005203	≥ 0.027055	≥ 0.120708	≥ 0.417274

AGRICULTURE

Reduction in crop duration: Maize

Very low	Low	Medium	High	Very high
≥ 0.897426	≥ 0.776838	≥ 0.720221	≥ 0.6125	≥ 0.430515

Hot spell frequency: Maize

Very low	Low	Medium	High	Very high
≥ 0	≥ 0.010101	≥ 0.088023	≥ 0.252525	≥ 0.375180

Rain reduction: Maize

Very low	Low	Medium	High	Very high
≥ 1.296748	≥ 0.703252	≥ 0.703252	≥ 0.471545	≥ 0.369919

Reduction in crop duration: Rice

Very low	Low	Medium	High	Very high
≥ 0.996178	≥ 0.941529	≥ 0.912994	≥ 0.883185	≥ 0.796051

Hot spell frequency: Rice

Very low	Low	Medium	High	Very high
≥ 0	≥ 0	≥ 0.000553	≥ 0.029867	≥ 0.819690

Rain reduction: Rice

Very low	Low	Medium	High	Very high
≥ 0.387097	≥ 0.480287	≥ 0.577061	≥ 0.602151	≥ 0.706093

Reduction in crop duration: Soybean

Very low	Low	Medium	High	Very high
≥ -0.059322	≥ -0.251271	≥ -0.369915	≥ -0.516525	≥ -0.815678

Hot spell frequency: Soybean

Very low	Low	Medium	High	Very high
≥ 0	≥ 0	≥ 0	≥ 0.0018801	≥ 0.242257

Rain reduction: Soybean

Very low	Low	Medium	High	Very high
≥ -0.059322	≥ 0.224576	≥ 0.449153	≥ 0.618644	≥ 0.665254

Reduction in crop duration: Wheat

Very low	Low	Medium	High	Very high
≥ -0.101132	≥ -0.217925	≥ -0.304717	≥ -0.365472	≥ -0.605472

Hot spell frequency: Wheat

Very low	Low	Medium	High	Very high
≥ 0	≥ 0.0095	≥ 0.035	≥ 0.11655	≥ 0.385

Rain reduction: Wheat

Very low	Low	Medium	High	Very high
≥ 0.173585	≥ 0.469811	≥ 0.5471670	≥ 0.590566	≥ 0.683019

Based on **Arnell et al. (2019).** Global and regional impacts of climate change at different levels of global temperature increase, *Climatic change*.

Data based on: https://link.springer.com/article/10.1007/s10584-019-02464-z

3.2.3 Shares of national crop production in 2017

The **Food and Agriculture Organization (FAO)** is a specialized agency of the United Nations that leads international efforts to defeat hunger. **FAOSTAT** is a database from the FAO and provides free access to food and agriculture data for over 245 countries and territories and covers all FAO regional groupings from 1961 to the most recent year available.

The data on national crop production from maize, rice, soybean and wheat for 2017 (the most recent year available) were extracted from **FAOSTAT**, together with the overall national crop production. The pie charts available in the report are based on this data.

Retrieved from: http://www.fao.org/faostat/en/#data/QC

4. Finance

4.1 NDC finance summary

See 3.2.2

4.2 Finance: Financial policy and regulation

This indicator utilises an existing dataset on green macro-prudential regulation, which contains information on the mandate of a country's central bank, the type of green regulation (the instrument used) and the degree to which it is implemented (under discussion, voluntary, mandatory).

Central banks and financial regulators are important as they can set market rules that shift investments, often driven by short-term yields, to long-term sustainable solutions. They can support the direction of finance towards green projects through, for example, priority lending. They can also encourage the incorporation of climate risks in investment decisions, including through banking stress

tests and improving standards of due diligence for banks and financial institutions to consider climate risks.[1]

We aggregate data into the following sets of instruments:

Green financial principles: This indicates political will and awareness of climate change impacts, showing the existence of a general discussion at the policy level about the need for aligning prudential and climate change objectives in the national financial architecture.

The following indicators were rated on a spectrum of (i) Mandatory (i.e. enforced legally required actions); (ii) Voluntary (including 'comply or explain'; or (iii) Under Discussion. Where the presence of instruments was unclear, or none were identified, they were considered (iv) Not Identified.

- **Disclosure requirements and risk assessment:** Disclosure of climate-related risks allows investors to thoroughly learn the risks to which specific banking institutions are exposed. Here the green/brown taxonomy of financial assets plays a crucial role.
- **Climate-related risk assessment and climate stress-test:** Risk assessment and stress-testing are forms of supervisory review that evaluate the resilience of the financial system to adverse shocks. Climate-related stress tests can identify the extent to which a financial institution is exposed to emission-intensive or non-climate resilient assets.
- **Liquidity instruments:** Liquidity regulations smooth the maturity mismatch between assets and funding sources to protect banks against liquidity crises. Existing liquidity regulations tend to favour carbon-intensive assets. By setting a lower Stable Fund Ratio, liquidity requirements could encourage low-carbon investments.
- **Lending limits, and credit caps and floors:** Lending limits limit banks' exposures to a specific type of sectors' activities and loan categories. They can limit the exposure to carbon-intensive investments or those that are not resilient to climate impacts. Related are minimum credit limits towards green loans or caps on brown loans.
- **Differentiated reserve requirements:** Reserve requirements set the minimum amount of reserves that must be held by a commercial bank as a counterpart to customer deposits and notes. They could be differentiated to allow lower reserve requirements for green sectors, thus aligning banks' profitability with a sustainability policy target.

All data is current as of February 2019, though it is acknowledged that this is rapidly changing policy space and policy movement in the intervening period could make the results out of date.

4.3 Finance: Fiscal policy levers

4.3.1 Fossil fuel subsidies

The fossil fuel subsidies data presented in the Brown to Green Report is taken from the OECD/IEA joint fossil fuel subsidies database, released in 2019. The OECD inventory collates information on the amount of subsidies provided by governments in the form of tax breaks and budgetary support. The OECD data include country information for all G20 countries, except Saudi Arabia. The estimates include support towards production and consumption of fossil fuel subsidies, as well as general

[1] D'Orazio and Popoyan (2019) Fostering green investments and tackling climate-related financial risks: Which role for macroprudential policies?, Ecological Economics, Volume 160, June 2019, Pages 25-37

services (supporting both production and consumption). The inventory is used in the Brown to Green Report because it provides a 'bottom-up' way of quantifying subsidies by collating government information on individual policy measures, and in this way, helps identify specific opportunities for reform. The results in this report are presented in US$ billions and are taken from the latest year for which data is available, which is 2017. The results are also broken down into three end uses: coal, petroleum, natural gas, and fossil fuel-powered electricity. Trends in the time period 2008 to 2017 are also presented for countries. The original data provided by the OECD is in national currencies, and in the Brown to Green Report have been converted to common currency using exchange rates from the OECD database.

The subsidy data for Saudi Arabia is from the IEA database because no OECD data are available. The IEA uses a different methodology for calculating subsidies, called the 'price-gap' approach. This approach compares average end-user prices paid by consumers with reference prices that correspond to the full cost of supply. It covers a sub-set of consumer subsidies, and does not include production subsidies. The differences between OECD and IEA methodology can result in significant variations in the calculated total amount of subsidies. The results are presented in US$ billions and are taken from the latest year for which data is available on the database (2017). Trends are also presented for the time period 2010-2017.

The Brown to Green Report also expresses country annual provisions of fossil fuel subsidies, captured by the OECD/IEA joint fossil fuel subsidies database, per unit of GDP. This allows some comparability between the G20 countries in the provision of fossil fuel subsidies. GDP values (in US$) were taken from the World Bank's World Development Indicators.

It is worth noting that estimates on fossil fuel subsidies can differ across sources, therefore OECD may not necessarily reflect government perceptions on the level of fossil fuel subsidies. The OECD data is, however, useful in providing a comparable tool for G20 countries, from a methodological perspective. For example, the UK denies it provides any fossil fuel subsidies (under its own definition). Moreover, independent estimates have often found measures and resulting subsidies that are not included in the OECD database. It is worth noting that electricity subsidies themselves are not necessarily 'brown' expenditures, as decarbonisation of countries will require significant investments in electricity infrastructure. OECD calculates the support to fossil fuel-powered electricity by doing pro-rata calculations of the total support to electricity, multiplied by the share of fossil fuels in electricity generation.

OECD-IEA (2019). OECD-IEA Fossil Fuel Support and Other Analysis. Retrieved from: http://www.oecd.org/site/tadffss/data/

GDP values taken from the World Bank's World Development Indicators databank at: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators#

4.3.2 Carbon revenues

The carbon revenue data presented in the Brown to Green Report is taken from the Institute for Climate Economics (I4CE) carbon revenues data for G20 countries. The I4CE data collates information

on the amount of carbon revenues generated by explicit carbon pricing schemes. This includes explicit carbon taxes and emissions trading schemes, both national and subnational in nature; but it does not include implicit schemes, that is the taxation of emissions through policies other than explicit carbon pricing policies (e.g. VAT on petrol). It is used in the Brown to Green Report because it provides a 'bottom-up' way of quantifying carbon revenues, and in this way, helps to identify the country's ambitions in carbon pricing now and in the future (including data on schemes currently under consideration but not yet implemented). The results are presented in US$ billions and are taken from the latest year for which data is available, which is 2018. Trends for countries in the time period 2008 to 2018 are also presented.

The Brown to Green Report also expressed country annual provisions of carbon revenues, captured by I4CE, per unit of GDP. This allows for some comparability between the G20 countries in carbon revenues. GDP values (in US$) were taken from the World Bank's World Development Indicators.

I4CE (2019). Global Carbon Account 2019. Summary retrieved from: https://www.i4ce.org/wp-core/wp-content/uploads/2019/05/i4ce-PrixCarbon-VA.pdf (data available upon request)

4.3.3 Carbon pricing gap

Effective carbon rates (ECR) are the total price that applies to CO_2 emissions from energy use as a result of market-based policy instruments. They are a sum of carbon taxes, specific taxes on energy use and the price of tradable emission permits.

The most recent 2018 OECD ECR report is based on the tax rates from the 2015. The report does not present average effective carbon rates (as per the previous iteration of the report in 2015). This is because the average ECR can be heavily influenced by a small share of emissions (e.g. oil products in several sectors) being priced at a significant rate. Therefore, the report instead presents the share of emissions in each country that are priced at EUR 30 or higher, using the *carbon pricing gap* approach.

The *carbon pricing gap* is a measure of the difference between the carbon pricing rate in the country and a benchmark rate of EUR 30 per tonne of CO_2 (a low-end estimate of the damage that emissions cause). If the ECR on all emissions was at least as high as the benchmark (EUR 30), the gap would be zero; if the ECR was zero throughout, the gap would be 100%.

OECD (2018). Effective Carbon Rates (2018). Retrieved from: https://www.oecd.org/tax/effective-carbon-rates-2018-9789264305304-en.htm

4.4 Finance: Public finance

4.4.1 Public finance for coal (domestic and international)

The public finance data presented in the Brown to Green Report is taken from Oil Change International's Shift the Subsidies database (2019), which includes information provided by public finance institutions, from the Infrastructure Journal Global database (IJ Global, 2019), and in the Natural Resources Defense Council's (NRDC) 'Power shift' report database (Chen and Schmidt, 2017). The Shift the Subsidies database collates information on public finance to power by G20 public finance institutions, domestically and internationally, in the form of loans, grants and guarantees. The

estimates show the amount of financing for coal production (including exploration), for its transportation, and for coal-fired power production. The Oil Change International database is used in the Brown to Green Report because it provides a 'bottom-up' way of quantifying public finance by collating information on individual projects, and in this way, is able to be very precise about the amount of financing provided. The results presented are in US$ billions and are taken from the latest years for which data is available, 2016 to 2017. As public financing is intermittent in nature, we use annual averages for the time period 2016 to 2017. This is calculated as the total amount of public finance provided for any relevant coal project whose financing was agreed in 2016 and 2017, divided by two (i.e. across the two years), to obtain annual average annual values.

There are some data caveats that are important to note. Due to limited transparency on the support provided by public finance at the project-level, the database is an underestimate of the total amount of support provided. The data also omits most finance delivered through financial intermediaries (because the volume of finance for specific energy activities ultimately delivered through those intermediaries is often unclear). For the same reason, the datasets omit significant volumes of MDB development policy finance. Given a lack of transparency, other important multilateral institutions in which G20 governments participate are not covered in this report, for example, the Development Bank of Latin America (CAF), Asian Infrastructure Investment Bank, New Development Bank, Islamic Development Bank, the sub-regional MDBs, and other non-MDB multilateral financial institutions. There is a general lack of transparency in the public finance institutions in Argentina, Indonesia, Mexico, Russia and Turkey, which is likely to lead to underestimates in public financing to power.

As one exception, for India, data was instead obtained from a recently published paper which reviews various national data sources and presents aggregate support (Worrall et al., 2018). For more details, see the India country study and data sheets, available at odi.org/g20-coal-subsidies/india. This means that we are able to report a more accurate picture of the total amount of finance provided in India. However, it also means that country comparisons must be made with caution, as the level of data coverage and reporting varies greatly between countries.

Table 6: List of public finance institutions included in Oil Change International's Shift the Subsidies database

Country	Public finance institutions
Argentina	Banco de Inversión y Comercio Exterior (BICE), Government of Argentina
Australia	Export Finance and Insurance Corporation, Clean Energy Finance Corporation, Australian Renewable Energy Agency
Brazil	Brazilian Development Bank (BNDES), Banco de Brasil, Banco de Desenvolvimento de Minas Gerais, Banco do Nordeste do Brasil, Banco Regional de Desenvolvimento do Extremo Sul, Caixa Economica Federal
Canada	Export Development Canada (EDC), PPP Canada, Business Development Bank of Canada (BDC), Sustainable Development Technology Canada (SDTC)
China	Agricultural Bank of China, Bank of China, Bank of Communications, China CITIC Bank, China Construction Bank, China Development Bank, China Export and Credit Insurance Corporation, China Silk Road Fund, Export-Import Bank of China, Industrial and Commercial Bank of China
France	Agence Francaise de Development (AFD), BPI France / Compagnie Française d'Assurance pour le Commerce Extérieur (Coface), Proparco, Caisse des Dépôts (CDC) Group

Germany	Deutsche Investitions und Entwicklungsgesellschaft (DEG), Euler Hermes, KfW Bank, KfW-Export Finance (IPEX) Bank
India	No data on coal for the majority gov't owned banks for the most recent year assessed in this study. *Note: The India country brief instead relied on recently-published aggregate data from Worrall et al, 2018 which reviewed various national data sources. For more details, see the India country brief and data sheets.*
Indonesia	Bank Mandiri, Bank Negara Indonesia, Bank Rakyat Indonesia, Bank Tabungan Negara, Indonesia Eximbank, Indonesia Infrastructure Finance, Indonesia Infrastructure Guarantee Fund, Sarana Multi Infrastruktur. *Note: Limited data was identified for Indonesia, but this is most likely an issue regarding transparency and data availability. It is almost certain some of these banks have been involved in recent coal transactions but the OCI database was unable to quantify these.*
Italy	This data collection is completed for Cassa Depositi e Prestiti (CDP), Servizi Assicurativi del Commercio Estero (SACE).
Japan	Japan International Cooperation Agency (JICA), Japan Bank for International Cooperation (JBIC) and Nippon Export and Investment Insurance (NEXI), Japan Oil, Gas and Metals National Corporation (JOGMEC)
Mexico	Banobras, Nafinsa, Bancomext
Russia	VTB Bank, Vneshcombank, Sberbank, Government of Russian Federation, EXIAR
Saudi Arabia	National Commercial Bank, Public Investment Fund, Saudi Fund for Development, Saudi Industrial Development Fund
South Africa	Development Bank of Southern Africa (DBSA), Industrial Development Corporation of South Africa (IDC), Export Credit Insurance Corporation of South Africa (ECIC)
South Korea	Export–Import Bank of Korea (KEXIM), K-Sure, Korea Development Bank (KDB), Korea Information Certificate Authority (KICA), Korea Finance Corporation (KFC) *Note: Post-2013 KFC no longer existed as it had merged with KDB.*
Turkey	Halkbank, Ziraat Bankasi, Vakifbank *Note: While no public finance for coal was identified, this is most likely because of the lack of transparency and it is very likely that these institutions do provide financing for coal given its prominence in Turkey's energy policy.*
UK	Royal Bank of Scotland (RBS), Department for International Development (DFID), Commonwealth Development Corporation Group (CDC), Department for Business, Innovation and Skills (BIS)
US	Export-Import Bank (ExIm), Overseas Private Investment Corporation (OPIC)

Chen, H. and Schmidt, J. (2017). Power shift: shifting G20 international public finance from coal to renewables. New York: Natural Resources Defense Council www.nrdc.org/resources/power-shift-g20-international-public-finance-from-coal-to-renewables

Oil Change International (2019). Shift the subsidies database. Available upon request from: http://priceofoil.org/shift-the-subsidies/

Worrall, L., Whitley, S., Garg, V., Krishnaswamy, S. and Beaton, C. (2018). India's stranded assets: how government interventions are propping up coal power. Working Paper 538. London: Overseas Development Institute. Retrieved from: www.odi.org/publications/11185-india-s-stranded-assets-how-governmentinterventions-are-propping-coal-power

4.4.2 International concessional public finance provision to developing countries

Annex I and II Parties are required to provide information on financial resources provided to non-Annex I Parties through their National Communications as well as their Biennial Reports (BR) and Common Tabular Format (CTF) Tables. Most developed countries have submitted three Biennial Reports, the last round being in 2018 (the next in 2020).[2] As such, the data on the climate finance provided to developing countries to support climate change mitigation and adaptation actions are sourced from this biennial Reporting of developed country Parties to the UNFCCC.

We present data for only those countries that are listed as Annex I of the UNFCCC and are therefore formally obliged to provide climate finance. While not obligated, Russia has provided data in its reporting to the UNFCCC as an Annex I country (Turkey is also an Annex I country, but has not submitted data). It is also worth noting that there is climate finance provision that is not captured in common tabular format in biennial update reports and thus is not presented here. China for example, reports the provision of bilateral climate finance but not in a format or over a time period that allows comparison with other countries. South Korea, while a non-Annex II country, is an OECD DAC member and therefore reports bilateral climate finance to the OECD-DAC. In 2015 and 2016 it reported $0.5 and $0.3 million in climate-related development finance in 2015 and 2016 respectively. A number of other countries have contributed to multilateral climate funds on a voluntary basis and these south-south flows have been captured in the explanatory country profile text as far as possible.

The total financial contributions reported in the third biennial reports (BR3s) consist of climate-specific contributions through **bilateral channels** and through **multilateral climate change funds**, split into four categories: mitigation or adaptation, cross-cutting or other. The multilateral climate change funds included are those listed in paragraph 17(a) of the "UNFCCC biennial reporting guidelines for developed country Parties" in decision 2/CP.17, i.e. The Global Environment Facility, the Least Developed Countries Fund, the Special Climate Change Fund, the Adaptation Fund, the Green Climate Fund and the Trust Fund for Supplementary Activities and, other multilateral climate change funds as referred in paragraph 17(b) of the "UNFCCC biennial reporting guidelines for developed country Parties" in decision 2/CP.17 (see page 34, https://unfccc.int/sites/default/files/resource/docs/2011/cop17/eng/09a01.pdf).

Flows are measured at the point of commitment to specific climate projects or programmes. The theme of the climate finance is dictated by the reporting of the country to the UNFCCC. It is classified as mitigation, adaptation, cross-cutting or other. The definitions of these categories vary by country (and institution), however (see UNFCCC 2016, Annex D, Table D1). Germany includes mobilised finance through KfW in its reporting to the UNFCCC. The figure in the country profile is adjusted to make figures more comparable with other G20 countries. Germany's thematic breakdown is based on the full amount, including this KfW mobilised finance, however, since data availability is not sufficient to disaggregate by theme. Similarly, the EU reports also EIB figures in their reporting, and for comparison only the EU contributions are reported here, again while recognizing the important contribution.

[2] See https://unfccc.int/sites/default/files/resource/inf8.pdf for a compilation and summary presented to the COP.

Reporting further includes a **'core' or 'general'** contribution category that includes support provided to multilateral institutions, including regional development banks, that Parties cannot specify as being climate-specific support (e.g. to the core budget of the World Bank or UNDP, UNEP). This allows us to capture some of the climate finance that countries provide through the MDBs. It is noted however, that MDBs can borrow funds,[3] which means their development finance commitments can exceed the funds provided by their shareholders. Each MDB has a number of developed and developing country shareholders that contribute capital (paid-in capital), as well as committing to provide additional funds in certain circumstances (callable capital).[4] Concessional finance provided by MDBs is funded mainly by developed country contributions and retained earnings, while non-concessional finance is funded mainly with money borrowed from capital markets.[5] While the core/general contributions reported by Annex II Parties in BRs went mostly to MDBs, MDB outflows are significantly greater than the government contributions (or inflows) reported in this data. Thus, while the inclusion of core-general funding in country profiles improves our understanding of MDB contributions it still omits magnitudes of funding from MDBs to support climate action in developing countries.

Country Biennial Report submissions to the UNFCCC. Retrieved from: https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/national-communications-and-biennial-reports-annex-i-parties/third-biennial-reports-annex-i

4.4.3 Bilateral climate finance contributions

The numbers published in the country profiles refer to bilateral, concessional, public climate finance delivered annually in the period 2015-16 to developing countries. It includes climate finance reported as committed directly by donors in their biennial reporting to the UNFCCC. Only bilateral data is taken from country reports and not the multilateral nor the core general contributions that countries report to the UNFCCC. This is done to avoid double counting with the multilateral climate change funds. Flows are measured at the point of commitment to specific climate projects or programmes.

Under its current administration, the US has not submitted a third biennial report to the UNFCCC. This reduces the bilateral figures for the G20 as a whole and hinders multi-year comparison. It is noted that a lack of reporting is not the same as the US providing $0 million.

Germany includes mobilised finance through KfW in its reporting to the UNFCCC. The figure reported is therefore adjusted to make figures more comparable with other G20 countries. But this contribution is recognized. Germany's thematic breakdown is based on the full amount, including this KfW mobilised finance, however, since data availability is not sufficient to disaggregate by theme. Similarly, the EU reports also EIB figures in their reporting, and for comparison only the EU contributions are reported here, again while recognizing the important contribution.

[3] An MDB can borrow on favourable terms, in part because some of the bank's developed country shareholders have excellent credit ratings, and also because the developing country recipients of MDB finance have a strong track record of repayment. An MDB can then lend funds to its developing country clients on more favourable terms than they would get from other lenders.
[4] Unlike shareholders of a private firm, a bank's shareholders receive no dividends or interest on their capital.
[5] MDBs are allowed to do this, largely as it can rely on callable capital if it needs to repay debt.

The theme of the bilateral climate finance is dictated by the reporting of the country to the UNFCCC. It is classified as mitigation, adaptation, cross-cutting or other. The definitions of these categories vary by country (and institution), other, however, where used, generally refers to finance supporting REDD+ (see UNFCCC 2016, Annex D, Table D1).

The summary report presents data for only those countries that are listed as Annex II of the UNFCCC and are therefore formally obligated to provide climate finance. While not obligated, Russia has provided data in its reporting to the UNFCCC. It is also worth noting that there is bilateral finance provision that is not captured in common tabular format in biennial update reports and thus is not presented here. China for example, reports the provision of bilateral climate finance but not in a format or over a time period that allows comparison with other countries. South Korea, while a non-Annex II country, is an OECD DAC member and therefore reports bilateral climate finance to the OECD-DAC. In 2015 and 2016 it reported $0.5 and $0.3 million in climate-related development finance in 2015 and 2016 respectively.

Country Biennial Report submissions to the UNFCCC. Retrieved from: https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/national-communications-and-biennial-reports-annex-i-parties/third-biennial-reports-annex-i.

4.4.4 Multilateral climate funds contributions

The numbers published in the country profiles refer to the G20 annual average contributions via the multilateral climate funds in 2015 and 2016 to developing countries. It is generated by attributing the resources approved by each fund's governing board/committee for projects in 2015 and 2016 to individual donors based on the percentage of each funds resources that their pledges represented at the end of 2017. Data is included for the following climate funds: Adaptation for Smallholder Agriculture Programme; Adaptation Fund; Clean Technology Fund; Forest Carbon Partnership Facility; Forest Investment Program; Global Environment Facility (6th Replenishment, Climate Mitigation Focal Area only); Green Climate Fund; Least Developed Countries Fund; Partnership for Market Readiness; Pilot Program for Climate Resilience; Scaling-up Renewable Energy Program; Special Climate Change Fund and the UNREDD Programme (see Table 11).

The theme of the multilateral climate fund finance is dictated by the nature of the fund and can be split into adaptation, mitigation and to projects that deliver both mitigation and adaptation actions, so called 'cross-cutting'. It should be noted that such a thematic categorization can go against those of the countries that provide finance, e.g. while REDD+ was designed as a mitigation mechanism, many contributors consider adaptation benefits can also be delivered and may consider such projects cross-cutting. Unlike other funds, the GCF supports adaptation, mitigation and crosscutting objectives. For the GCF, the approved amounts in 2015 and 2016 are first broken down into the theme as determined in the project design, and each countries contribution established as a proportion of this thematic amount.

The country reports include developing countries that have contributed to the multilateral climate funds. However, the summary report only ranks those countries that are signatories to Annex II of the UNFCCC and therefore formally obligated to provide climate finance under the Convention.

Figures for finance delivered through multilateral climate funds are sourced from Climate Funds Update, a joint ODI/Heinrich Boell Foundation database that tracks spending through all major climate funds.

Table 7: Multilateral climate change funds

	Fund	Objectives and structure
Mitigation focus	Global Environment Facility (Trust Fund 6)	The Global Environment Facility (GEF) aims to help developing countries and economies in transition to contribute to the overall objective of the United Nations Framework Convention on Climate Change (UNFCCC) to both mitigate and adapt to climate change, while enabling sustainable economic development. The GEF is intended to cover the incremental costs of a measure to address climate change relative to a business as usual base line.
	Clean Technology Fund	The Clean Technology Fund (CTF), one of two multi-donor Trust Funds within the Climate Investment Funds (CIFs), promotes scaled-up financing for demonstration, deployment and transfer of low-carbon technologies with significant potential for long-term greenhouse gas emissions savings.
	Scaling-Up Renewable Energy Program	The Scaling-Up Renewable Energy Program in Low Income Countries (SREP) is a targeted program of the Strategic Climate Fund (SCF), which is one of two funds within the Climate Investment Funds (CIF) framework. The SREP was designed to demonstrate the economic, social and environmental viability of low carbon development pathways in the energy sector in low-income countries. It aims to help low-income countries use new economic opportunities to increase energy access through renewable energy use.
	Partnership for Market Readiness	The Partnership for Market Readiness (PMR) is a partnership of developed and developing countries administered by the World Bank, established to use market instruments to scale up mitigation efforts in middle income countries. Although initially geared towards promoting market readiness for the anticipated emergence of international carbon markets, this approach has become more flexible, providing grants and technical support for proposals for implementation of market tools that contribute to mitigation efforts.
	Forest Carbon Partnership Facility	The Forest Carbon Partnership Facility (FCPF) is a World Bank programme and consists of a Readiness Fund and a Carbon Fund. The FCPF was created to assist developing countries to reduce emissions from deforestation and forest degradation, enhance and conserve forest carbon stocks, and sustainably manage forests (REDD+).
	Forest Investment Programme	The Forest Investment Program (FIP) is a targeted program of the Strategic Climate Fund (SCF) within the Climate Investment Funds (CIF). The FIP supports developing countries' efforts to reduce deforestation and forest degradation (REDD) and promotes sustainable forest management that leads to emission reductions and the protection of carbon reservoirs. It achieves this by providing scaled-up financing to developing countries for readiness reforms and public and private investments, identified through national REDD readiness or equivalent strategies.
	UNREDD Programme	The UN-REDD Programme aims to generate the necessary flow of resources to significantly reduce global emissions from deforestation and forest degradation in developing countries. The immediate goal is to assess whether carefully structured payments and capacity support can create the incentives to ensure lasting, reliable and measurable emission reductions while maintaining and improving other ecosystem services as well as the economic and social values that forests provide.
Adaptation	Least Developed	The Least Developed Countries Fund (LDCF) was established to meet the adaptation needs of least developed countries (LDCs). Specifically, the LDCF has financed the preparation and implementation of National Adaptation Programs of Action

	Countries Fund (2002)	(NAPAs) to identify priority adaptation actions for a country based on existing information.
	Special Climate Change Fund (2002)	The Special Climate Change Fund (SCCF) addresses the specific needs of developing countries under the UNFCCC. It covers the incremental costs of interventions to address climate change relative to a development baseline. Adaptation to climate change is the top priority of the SCCF, although it can also support technology transfer and its associated capacity building activities.
	Adaptation Fund (2009)	The Adaptation Fund supports concrete adaptation projects and programmes in developing country Parties to the Kyoto Protocol, in an effort to reduce the adverse effects of climate change facing communities, countries and sectors. The Fund is financed through both governments and private donors, and from a 2% share of proceeds from Certified Emissions Reductions (CERs), issued under the Kyoto Protocol's Clean Development Mechanism (CDM).
	Adaptation for Smallholder Agriculture Programme	The Adaptation for Smallholder Agriculture Programme (ASAP) aims to channel climate and environmental finance to smallholder farmers, scale up climate change adaptation in rural development programmes and mainstream climate adaptation into the work of the International Fund for Agricultural Development (IFAD).
	Pilot Programme for Climate Resilience	The Pilot Program for Climate Resilience (PPCR) is a targeted program of the Strategic Climate Fund (SCF), which is one of two funds within the Climate Investment Funds (CIF) framework. The PPCR aims to pilot and demonstrate ways in which climate risk and resilience may be integrated into core development planning and implementation by providing incentives for scaled-up action and initiating transformational change.
Cross cutting focus	Green Climate Fund	In the context of sustainable development, the Green Climate Fund aims to promote the paradigm shift towards low-emission and climate-resilient development pathways by providing support to developing countries to limit or reduce their greenhouse gas emissions and to adapt to the impacts of climate change, taking into account the needs of those developing countries particularly vulnerable to the adverse effects of climate change.

Climate Funds Update (2017). Climate Funds Update: The latest information on climate funds – data dashboard. Retrieved from: http://www.climatefundsupdate.org/data

Annex

Sources for policy assessments:

Argentina:

Recent policy developments and key opportunities	**PV Magazine (2019).** Argentina 'mini' renewables auction moves forward. Retrieved from: https://www.pv-magazine.com/2019/05/31/argentina-mini-renewables-auction-moves-forward/ **MercoPress (2019).** Argentina awards 18 offshore oil exploration areas; UK companies take 7 areas, some next to Falklands. Retrieved from: https://en.mercopress.com/2019/05/18/argentina-awards-18-offshore-oil-exploration-areas-uk-companies-take-7-areas-some-next-to-falklands **Rystad Energy (2018).** 'Will the vast potential of Argentina's Vaca Muerta shale play ever be unlocked? Retrieved from: https://www.rystadenergy.com/newsevents/news/press-releases/Will-the-vast-potential-of-Argentinas-Vaca-Muerta-shale-play-ever-be-unlocked/
Just transition	**TUCA (2014).** PLADA: Development platform of the Americas. Retrieved from: http://www.world-psi.org/sites/default/files/documents/research/en_plada_doc.pdf
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