

**Brown to Green Report 2018: The G20 transition to a low-carbon economy**  
**Technical Note: Methodology and Data sources**

14 November 2018

The Brown to Green 2018 report, including the country profiles, assesses the G20 countries' past, present and indications of future performance towards a low-carbon economy by evaluating emissions, climate policy performance, climate-related finance and decarbonisation. This technical note lists the sources and methods used to calculate the indicators presented in each country profile in their order of appearance.

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## 1. Background Indicators

### 1.1 Greenhouse gas (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 2015. The data resolves the main International Panel on Climate Change (IPCC) 1996 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 2018 is for 2015. For Argentina and Mexico more recent GHG emission data from national data sources were used. Population data is taken as reported by the World Bank.

**World Bank (2018).** Population total. Retrieved from:

<https://data.worldbank.org/indicator/SP.POP.TOTL>

**Gütschow, J.; Jeffery, L.; Gieseke, R.; Gebel, R. (2018).** The PRIMAP-hist national historical emissions time series (1850-2015). V. 1.2. GFZ Data Services. Retrieved from:

<https://doi.org/10.5880/PIK.2018.003>

Argentina. **Ministerio de Ambiente y Desarrollo Sustentable República Argentina (2017).** Segundo Informe Bial de Actualización de la República Argentina. Retrieved from:

<https://unfccc.int/sites/default/files/resource/2doBUR%20-%20Argentina.pdf>

Mexico. **Instituto Nacional de Ecología y Cambio Climático (2018).** Inventario Nacional de Emisiones de Gases y Compuestos de Efecto Invernadero. Retrieved from: <https://www.gob.mx/inecc/acciones-y-programas/inventario-nacional-de-emisiones-de-gases-y-compuestos-de-efecto-invernadero>

### 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 2018 uses GDP figures at purchasing power parity (PPP) from 2017, drawn from World Bank. The figures were deflated applying 2015/2011 US\$ deflation.

**World Bank (2018).** GDP PPP per capita (constant 2011 international \$). Retrieved from:

<https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.KD>

**World Bank (2018).** GDP deflator. Retrieved from:

<https://data.worldbank.org/indicator/NY.GDP.DEFL.ZS?locations=US>

### 1.3 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 2018 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>

### 1.4 University of Notre Dame Global Adaptation Initiative (ND-GAIN) index

The ND-GAIN Country Index, a project of the University of Notre Dame Global Adaptation Initiative (ND-GAIN), summarises a country's vulnerability to climate change and other global challenges in combination with its readiness to improve resilience.

The vulnerability index consists of six sectoral indicators which are again composed by six sub-indicators, measuring exposure, sensitivity, and adaptive capacity to climate impacts. The Brown to Green Report only shows the exposure sub-indicators. These sub-indicators show the extent to which human society and its supporting sectors are stressed by the future changing climate conditions based on an approximately 2°C scenario.

**ND-GAIN (2017).** Notre Dame Global Adaptation Index 2016. Retrieved from:

<https://gain.nd.edu/our-work/country-index/>

**Table 1: ND-GAIN Exposure components**

Sector	Exposure component
<b>Food</b>	Projected impact of climate change on the actual yields of rice, wheat and maize. Projected change is the percent decrease of the cereal yields from the baseline projection (1980-2009) to a future projection (2040-2069) using RCP 4.5 emission scenario.
	Projection of increased food demand approximated by population growth. The projected population growth is calculated from the population projection by Health, Nutrition and Population Statistics (HNPStats) from 2010 to 2050.
<b>Water</b>	Projected impact of climate change on annual surface runoff, taking into account precipitation, evaporation, transpiration and soil moisture. The projected change is the percent decrease in annual runoff from the baseline projection (1980-2009) to the future projection (2040-2069) using RCP4.5 emission scenario.
	Projected change of climate change impact on annual groundwater recharge. The projected change is the percent decrease of the annual groundwater recharge from the baseline projection (1971-2000) to the future projection (2040-2069) using RCP4.5 emission scenario.
<b>Health</b>	Projected impact of climate change on malnutrition and diarrheal diseases measured by Disability Adjusted Life Years (DALYs). The projected change is the percent increase of DALYs from the historical baseline (2000) to the 2030 estimation using S550 emission scenario.
	Projected change of the hazard of vector-borne diseases. This indicator takes malaria as the type of vector-borne disease measuring its Length of Transmission Season (LTS). The projected change is the percent increase of malaria LTS from the baseline projection (1980-2010) to the future projection in 2050, using RCT4.5 emission scenario.
<b>Ecosystem services</b>	Projected impact of climate change on changes in the biomes occupying a country. The projected change is the fraction of land area within a country that would become a different biome type in the future (2070-2099), by comparing the types of potential biomes in baseline years (1961-1990), using A1B emission scenario.
	Projected impact of climate change impacts on biodiversity in the marine system. The projection is the species turnover (invasion + local extinction) in the future (2050) expressed as a proportion of the initial species richness in 2001-2005 (baseline), using A1B emission scenario.
<b>Human Habitat</b>	Projected impact of climate change on warm periods. The indicator is measured by the warm spell duration index (WSDI), count of days more than (including) 6 consecutive days when the daily maximum temperature exceeds the 90th percentile of daily maximum temperatures in a 5-day window during the baseline period. The projected change is the percent increase of WSDI from the baseline projection (1960-1990) to the future projection (2040-2070), using RCP4.5 emission scenario.
	Projected impact of the climate change on flood. The flood hazard is measured by the monthly maximum precipitation in 5 consecutive days. The projected change is the percent increase of the flood hazard from the baseline projection (1960-1990) to the future projection (2040-2070), using RCP 4.5 emission scenario.
<b>Infrastructure</b>	Projected impact of climate change on hydropower generation capacity, weighted by the dependency on hydropower to approximate the importance of hydropower for a country. The projected change is the percent decrease of the generation capacity from the historical baseline (2005) to the future projection (2050), using A1B emission scenario.
	The proportion of a country's land area adjacent to the ocean and lower than 4 m above sea level, which approximates potential sea level rise by the end of the century (0.32-0.63 m) and the average height of storm surge (2-3 m).

## 2. Greenhouse gas (GHG) emissions

### 2.1 GHG emissions and emission trends

This indicator gives an overview of the country's GHG emissions profile and the direction the country's emissions are taking until 2030 under a current policy scenario. The indicator covers all Kyoto gases: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF<sub>6</sub>), and nitrogen trifluoride (NF<sub>3</sub>). The section displays the data in a stacked graph, showing historic emissions in each of the IPCC source categories (energy, industrial processes, agriculture, etc.). Historical emissions were generally taken from PRIMAP; for Argentina and Mexico, data for GHG emissions were taken from national sources to connect to national debates. Historical emissions and removals from forestry are subject to high variability and are displayed separately in this report so as not to lose information on the emissions trends in other sectors. Emissions projections (excl. forestry) under a current policy scenario until 2030 are taken from the Climate Action Tracker, scaled to the historical emissions from PRIMAP.

**Gütschow, J.; Jeffery, L.; Gieseke, R.; Gebel, R. (2018).** The PRIMAP-hist national historical emissions time series (1850-2015). V. 1.2. GFZ Data Services. Retrieved from:

<https://doi.org/10.5880/PIK.2018.003>

Argentina: **Ministerio de Ambiente y Desarrollo Sustentable República Argentina (2017).** Segundo Informe Bial de Actualización de la República Argentina. Retrieved from:

<https://unfccc.int/sites/default/files/resource/2doBUR%20-%20Argentina.pdf>

Mexico: **Instituto Nacional de Ecología y Cambio Climático (2018).** Inventario Nacional de Emisiones de Gases y Compuestos de Efecto Invernadero. Retrieved from: <https://www.gob.mx/inecc/acciones-y-programas/inventario-nacional-de-emisiones-de-gases-y-compuestos-de-efecto-invernadero>

**CAT (2018).** Climate Action Tracker: Assessment of mitigation contributions to the Paris Agreement. Retrieved from: [www.climateactiontracker.org](http://www.climateactiontracker.org)

The **rating** for performance in GHG emissions is taken from the Climate Change Performance Index (CCPI) 2018. The CCPI rates the recent developments of GHG per capita (comparing the 2015 to 2010 level) across 57 countries. The 'current levels' rating evaluates the level of GHG per capita in 2015 in comparison to the 57 countries evaluated in the CCPI. Finally, the CCPI rates the compatibility of the country's current performance with the international goal of limiting global temperature rise to well below 2°C. The rating is based on the need to peak GHG emissions by 2020, and to decline CO<sub>2</sub> emissions to net zero by around 2050. To calculate individual country emission pathways, the CCPI uses the common but differentiated convergence approach. The CCPI evaluates the difference between the individual country pathway and current emissions per capita.

**Germanwatch (2018).** Climate Change Performance Index (CCPI) 2018 – Background and methodology note. Retrieved from: <https://www.climate-change-performance-index.org/the-climate-change-performance-index-2018-background-methodology>

### 2.2 Energy-related CO<sub>2</sub> emissions

CO<sub>2</sub> 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 transport, households, services

and agriculture, industries, and for the generation of electricity and heat. Emissions are calculated according to the 2006 IPCC Guidelines for National GHG Inventories.

**Enerdata (2018).** Global Energy and CO<sub>2</sub> data. Retrieved from:

<https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html>

### 3. Decarbonisation

#### 3.1 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 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 2017 value to the 2012 value. This approach allows taking account of latest available data. However, this is not a standard linear trend approach and does not filter out variances (e.g. due to economic developments or climatic variations) across years, which can lead to significant differences for performance ranking of individual countries.

#### 3.2 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 (2018).** Global Energy and CO<sub>2</sub> data. Retrieved from:

<https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html>

#### 3.3 Share of fossil fuels and ‘zero-carbon fuels’ in energy supply

The category **Fossil fuels** includes oil, gas and coal.

**‘Zero-carbon’ technologies** are energy sources that create no net GHG emissions from fuel combustion. It should, however, be noted that the label ‘zero-carbon’ might be misinterpreted since carbon emissions might occur if considering the entire life-cycle of the technology. For example, indirect emissions (e.g. steel used for the construction of a plant) or emissions from e.g. transporting fuels are not considered. The Brown to Green Report includes nuclear energy, hydropower and new renewables (solar, wind, geothermal, non-residential biomass) under ‘zero-carbon’ fuels. ‘Zero-carbon’ technologies may also include fossil fuel energy when combined with carbon capture and storage technology, but this technology has not yet been implemented in G20 countries and is thus not accounted for in the data.

‘Others’ covers mainly solid fuel biomass from residential use, which is shown separately from ‘zero-carbon’ technologies because of its negative social and environmental impacts.

Enerdata (2018). Global Energy and CO<sub>2</sub> data. Retrieved from:

<https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html>

A country with a small share of fossil fuels, when compared to other G20 countries, receives a very high rating for ‘current level’. Those G20 countries with the highest reduction rate (2012-2017) in the share of fossil fuels in the energy mix receive a very high rating for ‘recent developments’.

**Table 2: Rating of share of fossil fuel**

	2012 (% of TPES)	2017 (% of TPES)	Rating current (2017)	Recent developments (% change 2012-2017)	Rating recent developments
Argentina	89%	89%	low	-0,04%	low
Australia	94%	93%	very low	-1,06%	medium
Brazil	57%	55%	very high	-2,51%	high
Canada	75%	75%	medium	1,00%	very low
China	91%	89%	low	-2,78%	high
EU	74%	72%	medium	-2,32%	High
France	49%	48%	very high	-2,68%	high
Germany	81%	80%	low	-0,29%	low
India	72%	73%	medium	1,17%	very low
Indonesia	66%	67%	high	2,08%	very low
Italy	82%	80%	low	-1,96%	high
Japan	95%	93%	very low	-2,08%	high
Mexico	91%	90%	very low	-1,17%	medium
Russia	91%	90%	very low	-1,43%	medium
Saudi Arabia	100%	100%	very low	0,00%	very low
South Africa	87%	86%	low	-1,69%	medium
South Korea	81%	80%	low	-1,48%	medium
Turkey	89%	88%	low	-1,44%	medium
United Kingdom	85%	78%	medium	-7,74%	very high
USA	83%	82%	low	-1,59%	medium

The ‘recent developments’ of zero-carbon energy is measured as change in absolute levels (comparing the 2017 share in TPES to the 2012 share in TPES) relative to the absolute level (in 2012). If a country's absolute level of zero-carbon energy 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 3: Rating of share of zero-carbon energy*

	2012 (% of TPES)	2017 (% of TPES)	Rating current (2017)	Recent developments (% change 2012-2017)	Rating recent developments
<b>Argentina</b>	10,53%	10,68%	medium	1,42%	low
<b>Australia</b>	4,50%	5,72%	low	27,17%	high
<b>Brazil</b>	41,02%	42,66%	very high	4,00%	medium
<b>Canada</b>	24,22%	23,91%	high	-1,26%	very low
<b>China</b>	5,05%	8,32%	low	64,74%	very high
<b>EU</b>	23,63%	25,33%	high	7,16%	medium
<b>France</b>	48,39%	49,12%	very high	1,51%	low
<b>Germany</b>	17,71%	17,96%	medium	1,40%	low
<b>India</b>	9,97%	10,14%	medium	1,64%	low
<b>Indonesia</b>	11,90%	13,23%	medium	11,15%	medium
<b>Italy</b>	13,80%	15,76%	medium	14,21%	medium
<b>Japan</b>	5,36%	7,33%	low	36,85%	high
<b>Mexico</b>	5,74%	6,74%	low	17,43%	high
<b>Russia</b>	8,90%	10,20%	medium	14,69%	medium
<b>Saudi Arabia</b>	0,00%	0,00%	very low	-20,86%	very low
<b>South Africa</b>	6,34%	7,42%	low	17,00%	high
<b>'South Korea</b>	18,90%	20,04%	high	6,06%	medium
<b>Turkey</b>	7,61%	10,30%	medium	35,34%	high
<b>United Kingdom</b>	14,31%	20,63%	high	44,12%	very high
<b>USA</b>	16,07%	17,52%	medium	9,02%	medium

### 3.4 New renewables

The indicator 'New renewables' 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). As separate data for small-scale hydropower is not available, this report excludes all hydropower from 'new renewables'.

**Enerdata (2018).** Global Energy and CO<sub>2</sub> data. Retrieved from:

<https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html>

The 'recent developments' **rating** of new renewables is based on the change in absolute levels, (comparing the 2017 share in TPES to the 2012 share in TPES) relative to the absolute level (in 2012). 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 4: Rating of the share of new renewables*

	2012 (% of TPES)	2017 (% of TPES)	Rating current (2017)	Recent developments (% change 2012-2017)	Rating recent developments
Argentina	3,73%	4,23%	low	13,40%	medium
Australia	3,24%	4,53%	low	39,84%	high
Brazil	25,47%	28,89%	very high	13,39%	medium
Canada	4,13%	4,51%	low	9,23%	medium
China	0,78%	1,91%	low	144,77%	very high
EU	6,90%	9,20%	high	33,28%	high
France	3,36%	5,29%	medium	57,44%	high
Germany	7,75%	10,61%	high	36,92%	high
India	7,28%	7,62%	medium	4,60%	medium
Indonesia	11,38%	12,55%	high	10,26%	medium
Italy	8,68%	11,03%	high	27,05%	high
Japan	2,52%	3,55%	low	40,81%	high
Mexico	2,88%	3,66%	low	27,04%	high
Russia	0,33%	0,33%	very low	0,52%	low
Saudi Arabia	0,00%	0,00%	very low	-11,04%	very low
South Africa	4,28%	4,89%	low	14,37%	medium
South Korea	3,24%	5,61%	medium	73,23%	very high
Turkey	1,27%	5,14%	medium	306,31%	very high
United Kingdom	3,65%	8,50%	high	133,28%	very high
United States	4,75%	5,83%	medium	22,71%	medium

### 3.5 Energy use 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 2017, drawn from Enerdata, and population data from World Bank.

**Enerdata (2018).** Global Energy and CO<sub>2</sub> data. Retrieved from:

<https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html>

**World Bank (2018).** Population total. Retrieved from:

<https://data.worldbank.org/indicator/SP.POP.TOTL>

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 2012 to 2017, when compared to other G20 countries.

*Table 5: Rating for energy use per capita*

	2012 (GJ/capita)	2017 (GJ/capita)	Rating current (2017)	Recent developments (% change 2012-2017)	Rating recent development
Argentina	80,40	80,88	high	0,60%	low
Australia	233,55	220,44	very low	-5,61%	high
Brazil	58,97	58,12	very high	-1,45%	medium
Canada	322,96	328,07	very low	1,58%	low
China	87,40	93,80	medium	7,33%	low
EU28	136,66	131,50	low	-3,77%	high
France	160,90	151,48	low	-5,86%	high
Germany	161,89	157,88	low	-2,47%	medium
India	25,55	29,48	very high	15,38%	very low
Indonesia	35,51	38,03	very high	7,08%	low
Italy	113,57	105,74	medium	-6,89%	high
Japan	148,08	141,60	low	-4,38%	high
Mexico	66,48	60,25	very high	-9,37%	very high
Russia	216,16	215,42	very low	-0,34%	low
Saudi Arabia	286,99	283,54	very low	-1,20%	medium
South Africa	110,65	103,17	medium	-6,76%	high
South Korea	225,63	240,37	very low	6,53%	low
Turkey	66,33	78,55	high	18,43%	very low
United Kingdom	127,46	111,11	medium	-12,83%	very high
USA	288,22	283,19	very low	-1,74%	medium

### 3.6 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 (2018).** Global Energy and CO<sub>2</sub> data. 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 2012 to 2017, when compared to the G20 peers.

*Table 6: Rating of energy intensity of the economy*

	2012 (TJ/million US\$2015)	2017 (TJ/million US\$2015)	Rating current (2017)	Recent developments (% change 2012-2017)	Rating recent developments
Argentina	3,93	4,05	medium	3,18%	very low
Australia	5,18	4,65	low	-10,24%	high
Brazil	3,66	3,90	medium	6,37%	very low
Canada	7,51	7,26	very low	-3,35%	low
China	7,36	5,76	low	-21,79%	very high
EU	3,65	3,28	high	-10,17%	high
France	3,95	3,61	medium	-8,65%	medium
Germany	3,45	3,23	high	-6,37%	medium
India	4,89	4,27	medium	-12,79%	very high
Indonesia	3,61	3,19	very high	-11,45%	high
Italy	2,96	2,77	very high	-6,47%	medium
Japan	3,78	3,39	high	-10,52%	high
Mexico	3,94	3,43	high	-12,79%	very high
Russia	8,84	8,84	very low	-0,04%	low
Saudi Arabia	5,43	5,40	low	-0,44%	low
South Africa	8,43	7,97	very low	-5,39%	medium
South Korea	7,05	6,66	very low	-5,58%	medium
Turkey	3,18	3,12	very high	-1,94%	low
United Kingdom	3,20	2,61	very high	-18,53%	very high
USA	5,36	4,92	low	-8,15%	medium

### 3.7 Carbon intensity of the energy sector

Carbon intensity of a country's energy sector describes the CO<sub>2</sub> 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 (2018).** Global Energy and CO<sub>2</sub> data. 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 2012 to 2017, when compared to the G20 peers.

**Table 7: Carbon intensity of the energy sector**

Country	2012 (tCO <sub>2</sub> /TJ)	2017 (tCO <sub>2</sub> /TJ)	Rating current (2017)	Recent developments (% change 2012- 2017)	Rating recent developments
Argentina	55,55	54,54	medium	-1,82%	high
Australia	74,96	75,67	very low	0,95%	low
Brazil	36,22	35,89	very high	-0,92%	medium
Canada	50,03	51,84	medium	3,63%	very low
China	72,96	71,52	very low	-1,98%	high
EU	51,43	49,95	high	-2,87%	high
France	31,56	31,96	very high	1,28%	low
Germany	58,87	59,39	low	0,88%	low
India	56,25	57,14	medium	1,58%	low
Indonesia	46,36	48,24	high	4,05%	very low
Italy	55,46	50,78	high	-8,44%	very high
Japan	63,10	62,23	low	-1,38%	medium
Mexico	57,53	56,05	medium	-2,57%	high
Russia	53,81	54,47	medium	1,23%	low
Saudi Arabia	57,71	62,77	low	8,77%	very low
South Africa	72,37	75,10	very low	3,77%	very low
South Korea	55,61	53,92	medium	-3,05%	high
Turkey	62,25	63,43	low	1,89%	low
United Kingdom	57,84	48,73	high	-15,76%	very high
USA	56,63	55,04	medium	-2,81%	high

### 3.8 Sector-specific indicators

<b>Power sector</b>	<ul style="list-style-type: none"> <li>○ <b>Electricity demand per capita (Data for 2017)</b> <b>Enerdata (2018)</b>. Global Energy and CO<sub>2</sub> data. Retrieved from: <a href="https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html">https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html</a></li> <li>○ <b>Emissions intensity of the power sector (Data for 2017)</b> For all G20 countries except Brazil: <b>Enerdata (2018)</b>. Global Energy and CO<sub>2</sub> data. Retrieved from: <a href="https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html">https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html</a> For Brazil: <b>Ministério da Ciência, Tecnologia, Inovações e Comunicações (2018)</b>. Fator medio. Retrieved from: <a href="http://www.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/textogeral/emissao_corporativo_s.html">http://www.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/textogeral/emissao_corporativo_s.html</a></li> <li>○ <b>Share of renewables in the power generation (Data for 2017)</b> For all G20 countries except Mexico: <b>Enerdata (2018)</b>. Global Energy and CO<sub>2</sub> data. Retrieved from: <a href="https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html">https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html</a> Mexico: <b>Ministry of Energy (2018)</b>. Clean Energy Progress Report. Retrieved from: <a href="https://www.gob.mx/cms/uploads/attachment/file/354379/Reporte_de_Avance_de_Energ_as_Limpias_Cierre_2017.pdf">https://www.gob.mx/cms/uploads/attachment/file/354379/Reporte_de_Avance_de_Energ_as_Limpias_Cierre_2017.pdf</a></li> <li>○ <b>Share of population with access to electricity (Data for 2016)</b> <b>World Bank (2018)</b>. Retrieved from: <a href="https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS">https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS</a></li> <li>○ <b>Share of population with biomass dependency (Data for 2014)</b> <b>IEA (2016)</b>. Retrieved from: <a href="https://www.iea.org/energyaccess/database/">https://www.iea.org/energyaccess/database/</a></li> </ul>
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<b>Transport sector</b>	<ul style="list-style-type: none"> <li>○ <b>Transport emissions per capita (Data for 2017)</b> <b>Enerdata (2018)</b>. Global Energy and CO<sub>2</sub> data. Retrieved from: <a href="https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html">https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html</a></li> <li>○ <b>Motorisation rate</b> (data for different years available depending on the country) For all G20 countries except Argentina: <b>Agora Verkehrswende (2018)</b>. Towards Decarbonising Transport – A G20 Stocktake on Sectoral Ambition. 2018 Update (forthcoming) For Argentina: <b>Asociación de Fábricas Argentinas de Compinentes (2018)</b>. Flota circulante en Argentina 2017. Retrieved from: <a href="http://www.afac.org.ar/">http://www.afac.org.ar/</a>; <b>World Bank (2018)</b>. Population total. Retrieved from: <a href="https://data.worldbank.org/indicator/SP.POP.TOTL">https://data.worldbank.org/indicator/SP.POP.TOTL</a></li> <li>○ <b>Modal split in passenger-km per mode</b> (data for different years available depending on the country)</li> <li>○ <b>Modal split in tonne-km per mode</b> (data for different years available depending on the country) For all G20 countries except Brazil and Argentina: <b>Agora Verkehrswende (2018)</b>. Towards Decarbonising Transport – A G20 Stocktake on Sectoral Ambition. 2018 Update (forthcoming) For Brazil: <b>IBGE (2017)</b>. Brazil in figures 2017. Retrieved from: <a href="https://loja.ibge.gov.br/brasil-em-numeros-brazil-in-figures-2017.html">https://loja.ibge.gov.br/brasil-em-numeros-brazil-in-figures-2017.html</a> For Argentina: <b>Ministerio de Ambiente y Desarrollo Sustentable (2017)</b>. Plan Accion Nacional de Transporte Cambio Climatico- Primer Borrador. Retrieved from: <a href="https://www.argentina.gob.ar/ambiente/sustentabilidad/planes-sectoriales/transporte">https://www.argentina.gob.ar/ambiente/sustentabilidad/planes-sectoriales/transporte</a></li> <li>○ <b>Market share of electric vehicles in new car sales</b> (Data for 2017) <b>IEA (2018)</b>. Global EV Outlook 2018. Retrieved from: <a href="https://www.iea.org/gevo2018/">https://www.iea.org/gevo2018/</a></li> </ul>
<b>Industry sector</b>	<ul style="list-style-type: none"> <li>○ <b>Industry emissions intensity</b> (Data for 2015) Energy emissions in industry are taken from Enerdata); industry process emissions are taken from PRIMAP; the gross value added for industry (incl. construction) is taken from Enerdata. <b>Enerdata (2018)</b>. Global Energy and CO<sub>2</sub> data. Retrieved from: <a href="https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html">https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html</a> <b>Gütschow, J.; Jeffery, L.; Gieseke, R.; Gebel, R. (2018)</b>. The PRIMAP-hist national historical emissions time series (1850-2015). V. 1.2. GFZ Data Services. <a href="https://doi.org/10.5880/PIK.2018.003">https://doi.org/10.5880/PIK.2018.003</a> For Argentina: <b>Ministerio de Ambiente y Desarrollo Sustentable República Argentina (2017)</b>. Segundo Informe Bienal de Actualización de la República Argentina. Retrieved from: <a href="https://unfccc.int/sites/default/files/resource/2doBUR%20-%20Argentina.pdf">https://unfccc.int/sites/default/files/resource/2doBUR%20-%20Argentina.pdf</a> For Mexico : <b>Instituto Nacional de Ecología y Cambio Climático (2018)</b>. Inventario Nacional de Emisiones de Gases y Compuestos de Efecto Invernadero. Retrieved from: <a href="https://www.gob.mx/inecc/acciones-y-programas/inventario-nacional-de-emisiones-de-gases-y-compuestos-de-efecto-invernadero">https://www.gob.mx/inecc/acciones-y-programas/inventario-nacional-de-emisiones-de-gases-y-compuestos-de-efecto-invernadero</a></li> </ul>
<b>Building</b>	<ul style="list-style-type: none"> <li>○ <b>Building emissions per capita</b> (Data for 2016) <b>Enerdata (2018)</b>. Global Energy and CO<sub>2</sub> data. Retrieved from: <a href="https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html">https://www.enerdata.net/research/energy-market-data-co2-emissions-database.html</a> Only direct emissions are included (different to last Brown to Green report)</li> </ul>
<b>Agriculture sector</b>	<ul style="list-style-type: none"> <li>○ <b>Agriculture emissions intensity</b> (Data for 2015) <b>Gütschow, J.; Jeffery, L.; Gieseke, R.; Gebel, R. (2018)</b>. The PRIMAP-hist national historical emissions time series (1850-2015). V. 1.2. GFZ Data Services. <a href="https://doi.org/10.5880/PIK.2018.003">https://doi.org/10.5880/PIK.2018.003</a> For Argentina: <b>Ministerio de Ambiente y Desarrollo Sustentable República Argentina (2017)</b>. Segundo Informe Bienal de Actualización de la República Argentina. Retrieved from: <a href="https://unfccc.int/sites/default/files/resource/2doBUR%20-%20Argentina.pdf">https://unfccc.int/sites/default/files/resource/2doBUR%20-%20Argentina.pdf</a> For Mexico : <b>Instituto Nacional de Ecología y Cambio Climático (2018)</b>. Inventario Nacional de Emisiones de Gases y Compuestos de Efecto Invernadero. Retrieved from: <a href="https://www.gob.mx/inecc/acciones-y-programas/inventario-nacional-de-emisiones-de-gases-y-compuestos-de-efecto-invernadero">https://www.gob.mx/inecc/acciones-y-programas/inventario-nacional-de-emisiones-de-gases-y-compuestos-de-efecto-invernadero</a></li> </ul>

Forest

- **Forest area in the country compared to 1990 level (Data for 2015)**  
**FAOSTAT (2016).** Forest land. Retrieved from: <http://www.fao.org/faostat/en/#data/GF>  
Please note that the source provided in the country profiles (PRIMAP 2018) is wrong. This is the correct source.

## 4. Climate policy performance

### 4.1 Compatibility of climate targets with the Paris Agreement

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 rating system evaluates the emissions levels resulting from mitigation commitments against effort sharing benchmarks for each country, thereby enabling a transparent way of comparing NDCs with the many interpretations of what is ‘fair’. Using this approach, CAT abstains from defining what is fair but covers a holistic inclusion of very different viewpoints of what could be fair, including considerations of equity such as historical responsibility, capability and equality. It takes into account results from studies that are compatible with the former 2°C goal, as well as the 1.5°C limit in the Paris Agreement, to cover the full range of perspectives and historical developments of the long-term temperature goals. The rating evaluates the emissions level (excluding Land Use, Land-Use Change and Forestry) implied in the NDCs and is based on the assumption that all other governments follow a similar ambition level.

**CAT (2018).** Climate Action Tracker: Assessment of mitigation contributions to the Paris Agreement. Retrieved from: [www.climateactiontracker.org](http://www.climateactiontracker.org)

### 4.2 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](http://www4.unfccc.int/ndcregistry/Pages/Home.aspx)

### 4.3 Policy evaluation

Climate Transparency developed a rating system to assess a country’s policy performance (see table below). The selection of policies draws on the Climate Action Tracker (2016) listing ten policies that are essential pre-conditions for the longer-term transformation required to stay below the 1.5°C limit. The selection of policies does not represent a complete picture of what is necessary.

**CAT (2016).** Climate Action Tracker: The ten most important short-term steps to limit warming to 1.5°C. New Climate Institute, Climate Analytics, Ecofys. Retrieved from: [http://climateactiontracker.org/assets/publications/publications/CAT\\_10\\_Steps\\_for\\_1o5.pdf](http://climateactiontracker.org/assets/publications/publications/CAT_10_Steps_for_1o5.pdf)

The scoring categories are as follows: the ‘frontrunner’ score requires a 1.5°C compatible policy; ‘high’ requires significant action and a long-term vision; ‘medium’ requires some action; and ‘low’ shows no action. A more detailed description is shown in the table below.

**Table 8: Scoring categories for policy evaluation**

	<b>Low</b>	<b>Medium</b>	<b>High</b>	<b>Frontrunner</b>
<b>GHG emissions target for 2050 or beyond</b>	No emissions reduction target for 2050 or beyond	Existing emissions reduction target for 2050 or beyond	Existing emissions reduction target for 2050 or beyond and clear interim steps	Emissions reduction target to bring GHG emissions to at least net zero by 2050
<b>Long-term low emissions development strategy</b>	No long-term low emissions strategy	Existing long-term low emissions strategy	Long-term low emissions strategy includes interim steps and/or sectoral targets	Long-term low emissions strategy towards full decarbonisation in the second half of the century; includes interim steps and/or sectoral targets, plus institutions and measures in place to implement and/or regularly review the strategy
<b>Renewable energy in power sector</b>	Allianz Monitor 2018 Category 1.2 (targets) and 2 (policies), average 0-25	Allianz Monitor 2018 Category 1.2 (targets) and 2 (policies), average 26-60	Allianz Monitor 2018 Category 1.2 (targets) and 2 (policies), average 61-100	Allianz Monitor 2018 Category 1.2 (targets) and 2 (policies), 61-100 plus 100% renewables in the power sector by 2050 in place
<b>Coal phase-out</b>	No consideration or policy in place for phasing out coal	Significant action to reduce coal use implemented or coal phase-out under consideration	Coal phase-out decided and under implementation	Coal phase-out date compatible with 1.5°C
<b>Phase-out of fossil fuel light duty vehicles (LDVs)</b>	No policy or emissions performance standards for LDVs in place	Energy/emissions performance standards or support for efficient LDVs	National target to phase out fossil fuel LDVs in place	Ban on new fossil-based LDVs by 2025/30
<b>Near zero-energy new buildings</b>	No policy or low emissions building codes and standards in place	Building codes, standards or fiscal/financial incentives for low emissions options in place	National strategy for near zero-energy buildings (at least for all new buildings)	National strategy for near zero-energy buildings by 2020/25 (at least for all new buildings)
<b>Low-carbon new industry installations</b>	No policy or support for energy efficiency in industrial production in place	Support for energy efficiency in industrial production (covering at least two of the country's sub-sectors (e.g. cement and steel production))	Target for new installations in emissions-intensive sectors to be low-carbon	Target for new installations in emissions-intensive sectors to be low-carbon after 2020, maximising efficiency
<b>Net zero deforestation</b>	No policy or incentive to reduce deforestation in place	Incentives to reduce deforestation or support schemes for afforestation /reforestation in place	National target for reaching zero deforestation	National target for reaching zero deforestation by 2020s or for increasing forest coverage

The rating for ‘**Renewable energy in power sector**’ draws on the Allianz Climate & Energy Monitor 2018 (forthcoming). Category 1.2 of the Allianz Monitor evaluates whether a country’s renewable energy mid-/long-term target is compatible with the Paris Agreement, taking into account the current share of renewable energy and the need for a decarbonised power sector by 2050. Category 2 evaluates the policy environment for renewables, looking at the level of support to achieve cost parity of renewables, and at measures to ensure certainty of investment. The rating in the Brown to Green Report is based on the average of Category 1.2 and Category 2.

**New Climate, Germanwatch, Allianz (2018).** Allianz Climate & Energy Monitor 2018 (forthcoming).

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

#### 4.4 Climate Change Performance Index (CCPI) experts' policy evaluation

The CCPI experts' policy evaluation assesses a country's performance in national climate policy, meaning its performance in establishing and implementing a sufficient policy framework at national level, as well as international climate diplomacy. The CCPI policy scores are based on assessments by national climate and energy experts.

**Germanwatch (2018).** Climate Change Performance Index (CCPI) 2018 – Background and methodology note. Retrieved from: <https://www.climate-change-performance-index.org/the-climate-change-performance-index-2018-background-methodology>.

#### 4.5 Just transition

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

## 5. Financing the transition

### 5.1 Approaches to implementing the recommendations of the Task Force on Climate-related Financial Disclosure

The Task Force on Climate-related Financial Disclosures (TCFD) was prompted by the G20's Financial Stability Board in 2015. High-profile from the outset, it was established by the Bank of England governor and the Financial Stability Board chair Mark Carney and is chaired by Michael Bloomberg. The Task Force was established from the recognition that climate risks are financial risks and that financial markets lack information about their exposure to such risks of sufficient quality and quantity to ensure appropriate allocation of capital. As such, the TCFD was asked to develop voluntary recommendations to guide consistent and useful climate-related disclosures. Its final recommendations were released in June 2017 where it was suggested that organisations disclose climate-relevant financial information in their mainstream annual filings according to national disclosure requirements. It structured its recommendations around four areas: governance, strategy, risk management and metrics and targets. Further, it recommended that the disclosures include forward-looking climate-related scenario analyses.

This indicator reports the degree to which national regulatory agencies of G20 members have made the recommendations of the TCFD relevant to their national contexts. In the case of the European Union (EU), it necessarily goes beyond this 'national' definition to the member countries. The analysis is a desktop review of TCFD-compliant initiatives across the G20 member states, complemented by stakeholder engagement to validate the relevant TCFD-compliant initiatives. Voluntary recommendations provided by industry associations and existing reporting schemes are noted to be out of the scope of the report, although recognized as important. In certain circumstances (for example Article 173 in France), the review considered existing regulations to be in scope if they closely aligned with the TCFD recommendations. All data is current as of 30 April 2018, 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.

**University of Cambridge Institute for Sustainability Leadership (CISL) (2018).** Sailing from different harbours: G20 approaches to implementing the recommendations of the Task Force on Climate-related Financial Disclosures. Cambridge, UK: the Cambridge Institute for Sustainability Leadership. Retrieved from: <https://www.cisl.cam.ac.uk/resources/publication-pdfs/cisl-tcf-d-report-2018.pdf>.

## 5.2 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 2018. 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 Argentina and Saudi Arabia. The estimates include support towards production and consumption of fossil fuel subsidies, as well as general 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 2016. Trends in the time period 2007 to 2016 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 United States Internal Revenue Service (IRS) website. The exception is Indonesia where currency exchange rates were taken from the Oanda average exchange rate tool, as rates were not available on the IRS website.

The subsidy data for Argentina and Saudi Arabia are 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, which is 2016. Trends are also presented for the time period 2014-2016.

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).<sup>1</sup> As another

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<sup>1</sup> See: UK Parliament (2017a) 'Fossil Fuels: Tax Allowances: Written question - 63181', 6 February 2017. (<http://www.parliament.uk/business/publications/written-questions-answers-statements/written-question/Commons/2017-02-06/63181/>). UK Parliament (2017b) 'Fossil Fuels: Subsidies: Written question - 63284', 6 February 2017. (<http://www.parliament.uk/business/publications/written-questions-answers-statements/written->

example, Indonesia’s government reports US\$7.0 billion in fossil fuel subsidies in 2016 compared to the OECD’s estimate of US\$8.8 billion the same year (using Oanda annual average exchange rates); due to different approaches in the different categorisation of fossil fuel subsidies versus electricity subsidies. 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-IEA (2018).** OECD-IEA Fossil Fuel Support and Other Analysis. Retrieved from:

<http://www.oecd.org/site/tadffss/data/>

For Indonesia: **Audit Board of the Republic of Indonesia (2017).** Audit Report on Financial Report.

Retrieved from: [http://www.bpk.go.id/assets/files/lkpp/2016/lkpp\\_2016\\_1495619163.pdf](http://www.bpk.go.id/assets/files/lkpp/2016/lkpp_2016_1495619163.pdf)

Exchange rates taken from IRS website at: <https://www.irs.gov/individuals/international-taxpayers/yearly-average-currency-exchange-rates> and <https://www.oanda.com/currency/average>

GDP values taken from the World Bank’s World Development Indicators databank at:

<http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators#>

### 5.3 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 2017. Trends for countries in the time period 2007 to 2017 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.

**Table 9: Subnational emissions trading schemes (planned or implemented) in the analysis**

Country	Scheme
Brazil	Rio de Janerio; Sao Paulo
Canada	Alberta; British Columbia; Manitoba; Northwest Territories; Ontario (phased out mid-2018); Quebec; Nova Scotia; Saskatchewan; Newfoundland; New Brunswick; Prince Edward Island; Nunavut; Yukon
China	Beijing; Tianjin; Hubei; Chongqing; Guangdong; Shenzhen; Shanghai; Fujian; Sichuan

question/Commons/2017-02-06/63284/) UN (United Nations). (2015) ‘Sustainable development knowledge platform’. New York: UN (<https://sustainabledevelopment.un.org/sdgs>).

<b>Japan</b>	Tokyo; Saitama
<b>US</b>	California; Oregon; Washington; RGGI member states (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont)

A number of G20 countries had no carbon pricing schemes in place in the time period 2007 to 2017. Of these countries, Argentina, Brazil, South Africa and Turkey are considering or implementing explicit carbon revenue schemes from 2018 onwards, and these plans are outlined in the country reports. India, Indonesia, Russia, Australia and Saudi Arabia are, however, not currently planning to introduce any explicit carbon pricing schemes<sup>2</sup>; and, in order to provide further details their country data is supplemented with data on implicit carbon pricing from the OECD (2018) report on effective carbon rates. This was done to show that whilst not all countries have explicit schemes, they may still tax emissions.

**I4CE (2018).** Carbon pricing across the world: how to efficiently spend growing revenues? Retrieved from: <https://www.i4ce.org/download/carbon-pricing-across-the-world-how-to-efficiently-spend-growing-revenues/>.

**OECD (2018).** Effective carbon rates 2018. Retrieved from: <http://www.oecd.org/tax/effective-carbon-rates-2018-9789264305304-en.htm>.

#### 5.4 National and international public finance in the power sector

The public finance to power data presented in the Brown to Green Report is taken from Oil Change International's Shift the Subsidies database (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 include 'brown financing' described as financing to oil, gas, or coal production or exploration, for the transmission of fossil fuel power, or that provide incentives to fossil fuel development and investment more generally; and, 'green financing' described as financing to low carbon energy sources with a low impact on the local environment and populations, as well as energy efficiency and renewable energy projects (including small- and medium-scale hydro), and incentives for clean energy development and investment more generally. There are also estimates of 'grey financing': these include some clean or renewable sources (e.g. nuclear, large-scale hydro, biofuels and biomass) that can have significant impacts on the local environment and populations, and other electricity infrastructure projects that cannot necessarily be linked to brown or green power sources. The Oil Change International database is used in the Brown to Green Report because it provides a 'bottom-up' way of quantifying carbon revenues by collating information on individual projects, and in this way, helps identify specific opportunities for reform. The results presented are in US\$ billions (unless specified otherwise) and are taken from the latest years for which data is available, 2013 to 2015. As public financing is intermittent in nature, we use annual averages of brown, green and grey financing for the time period 2013 to 2015.

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<sup>2</sup> It is also worth noting: whilst Australia has generated carbon revenues in the time period 2007-2017, the national carbon tax introduced in 2012 was phased out in 2015. Currently, there are plans to introduce another carbon pricing scheme, whether nationally or subnationally.

Country annual average provisions of public finance to brown, green and grey power projects, are also expressed as a proportion (%) of absolute public financing to power. The aim is to introduce some comparability between the G20 countries in public finance to brown, green and grey power.

There are some data caveats that are important to note. The data 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, India, Indonesia, Mexico, Russia and Turkey, which is likely to lead to underestimates in public financing to power.

**Table 10: List of public finance institutions included in Oil Change International's Shift the Subsidies database**

Country	Public finance institutions
<b>Argentina</b>	Ministry of Federal Planning; Ministry of Economy and Finances
<b>Australia</b>	Australia Renewable Energy Agency; Export Finance and Insurance Corporation; Clean Energy Finance Corporation; Government of New South Wales
<b>Brazil</b>	Brazilian Development Bank; Banco do Brasil; Superintendencia do Desenvolvimento do Nordeste; Banco do Nordeste do Brasil; Caixa Economica Federal; Banco de Desenvolvimento de Minas Gerais.
<b>Canada</b>	Export Development Canada; Business Development Bank of Canada; Government of Canada; PPP Canada
<b>China</b>	The China Development Bank; Industrial and Commercial Bank of China; Export-Import Bank of China; Bank of China; Agricultural Bank of China; China Construction Bank; Bank of Communications; China Export and Credit Insurance Corporation; China CITIC Bank; Bank of Shanghai
<b>Germany</b>	Kreditanstalt fur Wiederaufbau (KfW); IPEX-Bank; German Investment & Development Corporation; Euler Hermes
<b>India</b>	The State Bank of India; Bank of India; SBI Capital Markets; Export-Import Bank of India; India Infrastructure Finance Company; Power Finance Corporation; United Bank of India; Canara Bank; Syndicate Bank; State Bank of Mysore; Indian Bank, Union Bank of India; Indian Overseas Bank; Punjab National Bank; Bank of Baroda; Andhra Bank; Uco Bank; Allahabad Bank; IDBI Bank; Infrastructure Development Finance Company; Indian Renewable Energy Development Agency; Industrial Finance Corporation of India; Life Insurance Corporation of India; Oriental Bank of Commerce; State Bank of Hyderabad; State Bank of Travancore; Bank of Maharashtra; Central Bank of India; Dena Bank; Punjab & Sind Bank; State Bank of Bikaner and Jaipur; State Bank of Patiala; Jammu & Kashmir Bank; Rural Electrification Corporation; Corporation Bank; Vijaya Bank
<b>Indonesia</b>	Indonesia Infrastructure Finance; Indonesia Infrastructure Guarantee Fund; Bank Mandiri; Sarana Multi Infrastruktur; Indonesian Eximbank; Government of Indonesia
<b>Italy</b>	Servizi Assicurativi del Commercio Estero; Cassa depositi e prestiti

<b>Japan</b>	Development Bank of Japan; Japan Bank for International Co-operation; Japan International Cooperation Agency; Japan Oil Gas and Metals National Corporation; Nippon Export and Investment Insurance
<b>Mexico</b>	Banco Nacional de Obras y Servicios Publicos; Banco Nacional de Comercio Exterior; Nacional Financiera
<b>Russia</b>	Export Insurance Agency of Russia; Gazprombank, Government of the National Russian Federation; Russian Development Bank; Russian Direct Investment Fund; Russian National Wealth Fund; Sberbank and Vneshtorgbank
<b>Saudi Arabia</b>	Ministry of Finance; National Commercial Bank; Public Investment Fund; Saudi Fund for Development
<b>South Africa</b>	Development Bank of Southern Africa; Export Credit Insurance Corporation; Industrial Development Corporation of South Africa; Public Investment Corporation Limited
<b>South Korea</b>	Economic Development Cooperation Fund; Export-Import Bank of Korea; Korea Development Bank; Korea Finance Corporation; Korea International Cooperation Agency; Korea Trade Insurance Corporation
<b>Turkey</b>	Ziraat Bankasi, Halkbank; Vakifbank
<b>UK</b>	CDC Group; Department for Business Innovation and Skills; Department for International Development; Royal Bank of Scotland, UK Export Finance; UK Green Investment Bank
<b>US</b>	Export-Import Bank of the United States; Overseas Private Investment Corporation; US Department of Energy

**Oil Change International (2017).** Shift the subsidies database. Retrieved from:

[http://priceofoil.org/shift-the-subsidies/.](http://priceofoil.org/shift-the-subsidies/)

### 5.5 Contributions through the major multilateral climate funds

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 (6<sup>th</sup> 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 11: 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 focus	Least Developed Countries Fund (2002)	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 (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>.

### 5.6 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.

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>.

## Annex

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