Global Carbon Project
Briefing on key messages Global Carbon Budget 2019

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Important notice: this document is intended as background briefing for the co-authors and journalists covering the release of the Global Carbon Budget 2019. Do not cite or quote until the embargo is lifted.

The Global Carbon Project is an international research project within the Future Earth research initiative on global sustainability, and a research partner of the World Climate Research Programme. It aims to develop a complete picture of the global carbon cycle, including both its biophysical and human dimensions together with the interactions and feedbacks between them. The Global Carbon Budget 2019 is the 14th edition of the annual update that started in 2006.

Data and methods are detailed in the publications cited at the end of this document.

A. Headline results of the global carbon budget 2019

Fossil CO₂ emissions are expected to grow more slowly in 2019 amidst slowly emerging climate policies.

- A slow growth in fossil CO₂ emissions is projected for 2019, at +0.6% (range: −0.2 to +1.5%)\(^1\). The 2019 growth is slower than over the past two years, with +1.5% in 2017 and +2.1% in 2018. A decline in global emissions in 2019 cannot be ruled out given uncertainties in the projection.

  - The lower growth rate in emissions in 2019 is due to different factors, including 1) substantial declines in coal use in the United States and the European Union (EU28), 2) weaker economic growth and lower growth in electricity demand in China, 3) weaker economic growth combined with a strong monsoon in India, 4) weaker economic growth globally.

  - Coal is still the main source of CO₂ emissions, but its emissions are expected to decline −0.9% in 2019 (range: −2.0% to +0.2%). This global decline in coal is due to big drops in the USA (−10.5%) and EU28 (−10%) and weak growth in China (0.8%) and India (2%). The last decade (2009-2018) saw CO₂ emissions from coal grow at only +0.6%.

  - CO₂ emissions from oil use are expected to grow at +0.9% in 2019 (range: +0.3% to +1.6%), driven by growth in China (+6.9%), but with weaker growth in India (+1.5%), EU28 (+0.5%), and a decline in the US (−0.5%). The last decade saw CO₂ emissions from oil grow steadily at +1.4%.

\(^1\) The range provided is for +/− 1SD (see details in the publications at the end).
Natural gas continues to grow strongly in 2019, with natural gas being the fastest growing source of emissions and projected to grow +2.6% in 2019 (range: +1.3% to +3.9%), driven by growth in all regions, including the USA (+3.5%), EU28 (+3.0%), China (+9.1%), and India (+2.5%). The last decade saw CO₂ emissions from natural gas grow steadily at +2.3%. Natural gas was the biggest contributor to the growth in fossil emissions in recent years.

- Climate and energy policies are emerging but are still insufficient to reverse trends in global emissions.

- Policies have been successful to varying degrees in deploying low-carbon technologies, such as solar, wind and electric vehicles. However, low-carbon technologies often add to existing demand rather than displacing technologies that emit CO₂, particularly in countries where energy use is growing.

- Current climate and energy policies are not enough to reverse the trends in global emissions. Continued support for low-carbon technologies need to be combined with policies directed at phasing out the use of fossil fuels.

- CO₂ emissions need to decrease to net zero globally to stop further warming of the planet.

Deforestation fires also drive CO₂ emissions up in 2019.

- This year saw more fires in deforestation zones than most recent years. Preliminary estimate of fire emissions in deforestation areas indicate that emissions from the Amazon will be higher in 2019 than in recent years, but lower than in the 1990s and early 2000s.

The atmospheric CO₂ concentration and the land and ocean carbon sinks continue to grow.

- Atmospheric CO₂ concentration continues to grow by more than 2 ppm per year and is projected to reach 410 ppm averaged over the year in 2019.

- Land and ocean carbon sinks continue to increase in line with emissions, absorbing about 55% of the total anthropogenic emissions. There is no sign of either land or ocean carbon sinks reaching saturation.

B. Global CO₂ emissions findings

Fossil CO₂ emissions².

- Fossil CO₂ emissions are projected to grow slowly in 2019, by +0.6% (range −0.2% to +1.5%), to reach 36.8 billion tonnes of CO₂ (GtCO₂).

  - Emissions growth in the last decade averaged +0.9% per year since 2010, slower than the +3.0% per year of the 2000’s.

- Emissions grew +1.5% in 2017 and +2.1% in 2018, after being flat from 2014 to 2016.

- Emissions in 2019 are likely more than 4% higher than in the year the Paris Agreement was adopted (2015) and 62% higher than in 1990 when the first IPCC report was published.

- Over the last decade, global CO₂ emissions from coal use have fluctuated, in some years offsetting all or part of the steadier growth in oil and natural gas use that has continued unabated.

- Coal use accounted for 42% of global fossil CO₂ emissions over the last decade:
  - Emissions from coal use are still below 2012 levels and expected to decline −0.9% (range: −2.0% to +0.2%) this year. The last decade (2009-2018) saw CO₂ emissions from coal grow at only +0.6% on average.
  - In OECD countries, coal use dropped by −25% in the past decade. This drop in coal comes from a mixture of energy and climate policies and economic trends, with the relative price of gas and renewables dropping, displacing coal.

- Oil use accounts for 34% of global fossil CO₂ emissions over the last decade:
  - Emissions from oil use have grown almost unimpeded for several decades, with projected growth of +0.9% (range: +0.3% to +1.6%) this year.
  - Road transport² accounts for 50% of emissions from oil use, growing at +1.8% per year in the last decade (+95 MtCO₂ per year). It is growing in OECD and non-OECD alike. The growth in demand for transport services is outpacing the deployment of electric vehicles. Globally, electric vehicles are adding to the fleet and not displacing existing vehicles.
  - Domestic and international aviation² accounts for around 8% of emissions from oil use (3% of global CO₂ emissions), growing at +2.2% per year in the last decade (+8 MtCO₂ per year). The growth in aviation is much smaller than the growth in emissions from road transport.
  - Emissions from oil use in other sectors (industry, power, other) are mostly flat or decrease slightly globally.

- Gas use accounts for 19% of global fossil CO₂ emissions over the last decade:
  - Emissions from natural gas use have been growing steadily and almost uninterrupted for over half a century, with a projected growth of +2.6% (range: +1.3% to +3.9%) this year; this growth rate is the fastest of any other fossil fuel source in absolute and relative terms.
Gas use emits about 40% less CO\textsubscript{2} than coal per unit energy, but it is not a low-carbon fuel without carbon capture and storage. While emissions are likely to decline when gas replaces coal in electricity production, this is only a short-term solution at best as emissions need to go to zero and not just decline.

Rapid growth in Liquefied Natural Gas (LNG) suggests that natural gas could expand globally much further, a fossil fuel which until recently was largely associated with regional markets only (thru pipes distribution networks).

By sector\textsuperscript{2}, the breakdown of global fossil CO\textsubscript{2} emissions over the last decade of data are:

- 45% from energy production, mainly electricity and heat.
- 23% from other industry (e.g. metals production, chemicals, and manufacturing).
- 19% are from land transport combined with national shipping and aviation.
- 3.5% are from international shipping and aviation.
- The remaining 10% includes additional emissions not included above from sectors such as buildings, agriculture, fishing, and the military.

Total CO\textsubscript{2} emissions.

Preliminary estimate of fire emissions in deforestation areas indicate that emissions from deforestation and other land-use change for 2019 reached 6 GtCO\textsubscript{2}, about 0.8 GtCO\textsubscript{2} above 2018, but with high uncertainty. Although this is our best estimate, we attach low confidence to this number and need to wait until next year and new FAO data to have it confirmed.

- This estimated increase stems partly from elevated fire activity the Amazon, in line with data from the Brazilian Space Agency showing that deforestation in the Brazilian part part of the Amazon has steadily increased since 2008 reaching it highest level in 2019. Levels are still much lower than in the 1990s and early 2000s.
- Fire activity was also unusually large in deforestation zones of Indonesia.

Total CO\textsubscript{2} emissions from human activities (combustion of fossils and land-use change) are set to reach 43.1 GtCO\textsubscript{2} (39.9 to 46.2 GtCO\textsubscript{2}) in 2019.

C. Country fossil CO\textsubscript{2} emissions

- **China.** Chinese emissions are projected to grow +2.6% (+0.7% to +4.4%) in 2019, with coal use expected to rise.
  - China’s emissions continue to grow in 2019, pursuing similar trends as 2017 and 2018, after having experienced slow or negative growth from 2013 to 2016.
Causes are complex and difficult to ascertain, but a big part is probably a tug-of-war between overall slowing GDP growth and exports vs. stimulus-fueled construction and infrastructure investment along with growth in domestic consumption.

Emissions from coal use are expected to grow only modestly, at +0.8% (-0.4% to +2.0%), due to low growth in electricity demand and no growth in coal-fired power generation, but pushed up somewhat by stronger growth in production of cement, steel and other energy-intensive products.

Emissions from oil and natural gas are projected to grow strongly at +6.9% (+4.5% to +9.1%) and +9.1% (+6.5% to +12%), respectively. Although coal is by far the biggest source of fossil CO₂ emissions in China, oil and gas will maybe contribute more to emissions growth this year.

China accounts for about 50% of global coal use. A global peak in coal use is highly dependent on the future use of coal in China, which will depend on structural changes and energy and climate policy in China.

US. US emissions are projected to decrease –1.7% (–3.7% to +0.3%) in 2019, with a large –10% decline in coal use emissions.

Coal is being displaced by gas, and to a lesser extent by solar and wind power. Electricity demand was also low in 2019.

Oil use is projected to decline slightly in 2019, but is still likely to be over 1% higher than in 2017. Growth in 2018 was abnormally high because of above normal home-heating requirements with cold winters (end of winter at the start of 2018 and start of winter at the end of 2018).

Natural gas use continues to grow strongly due to low prices and its increased role in electricity generation.

EU28. EU28 emissions are projected to decline –1.7% (–3.4% to +0.1%) in 2019, with a projected decrease in –10% in coal-based emissions, accelerating a trend of –5.1% per year since 2013.

Electricity generation from coal has dropped by –22% through October compared with 2018, due to a sharp rise in the price of carbon in the EU Emissions Trading Scheme combined with additional policy factors.

Consumption of both diesel and jet kerosene continue to increase, leading to a projected increase in emissions from oil products of 0.5% in 2019.

Natural gas consumption continues to grow, although at a highly variable rate across EU member states.

India. Indian emissions are projected to rise +1.8% (+0.7 to +3.7%) in 2019, considerably lower than in 2018 (+8%).

India’s economy has slowed significantly through 2019, dampening consumption of coal and oil, and production of cement.
The 2019 monsoon year produced above average rainfall, particularly in September. This heavier rainfall led both to flooded coal mines and high hydropower generation.

- **Rest of the World.** Emissions in the rest of the world are projected to rise +0.5% (–0.8 to +1.8%) in 2019.
  - This is the first time the Global Carbon Budget has a projection of coal, oil, and gas in the Rest of the World (and hence globally when combined with China, the US, EU28, and India). The projection is based on projections of economic growth (IMF) and assumed improvements in carbon intensity.
  - CO₂ emissions growth is projected to be low in the Rest of the World due to weaker economic growth in 2019.

- **In a separate analysis published this year,** members of the global carbon budget team showed that the 18 countries that decarbonised the fastest in the decade 2005-2015 generally shared three characteristics:
  - They had stable or declining energy use, from both energy efficiency and energy use.
  - They deployed lots of renewable energy, that replaced fossil energy.
  - They had lots of climate and energy policies.

**D. Atmospheric CO₂ accumulation and carbon sinks**

- Atmospheric CO₂ concentration reached 407.4 parts per million in 2018 on average, and is projected to increase by 2.2 ppm in 2019 (+1.8 to +2.6 ppm) to reach 410 ppm averaged over the year [latest trends here].

- Atmospheric CO₂ concentration in 2019 are 47% above pre-industrial levels.

- The growth rate in atmospheric CO₂ concentration in 2019 is near the average of the past decade because of the return to El Niño neutral conditions, but above the previous decades because of rising CO₂ emissions.

- The increase in atmospheric CO₂ concentration causes climate change and is responsible for most of the warming of +1°C observed so far.

- The land and ocean CO₂ sinks combined continued to take up over half of the CO₂ emitted to the atmosphere. The uptake of CO₂ by the ocean causes ocean acidification.
This media release is part of the Global Carbon Budget 2019, the annual update by the Global Carbon Project. It is based on the analyses published here:


United Nations Conference of the Parties (COP25) Madrid

- Press Conference: 4th December, 10:30-11:00, room MOCHA
- Side-event: 4th December, 16:45-1815, Room 5

Access:

- Data and figures: [http://www.globalcarbonproject.org/carbonbudget](http://www.globalcarbonproject.org/carbonbudget)
- Data interface for exploring data: [http://www.globalcarbonatlas.org](http://www.globalcarbonatlas.org).
- Prior to embargo:
  → ESSD paper and Infographics are available here: [https://drive.google.com/drive/folders/1l9u4Hrm-SWeL3JyRmra_Uz1XY9jA1Y5F?usp=sharing](https://drive.google.com/drive/folders/1l9u4Hrm-SWeL3JyRmra_Uz1XY9jA1Y5F?usp=sharing), and can also be requested for media purposes to communications@uea.ac.uk
    - User name: media
    - Password: fromLSCE2019
  → Plots for most large emitting countries are available here: [https://www.dropbox.com/sh/3fomcomkd0r3419/AAC0XJh_5VEeE0UYvxrApCzza?dl=0](https://www.dropbox.com/sh/3fomcomkd0r3419/AAC0XJh_5VEeE0UYvxrApCzza?dl=0)
- After embargo: ESSD paper is open access available at link above

Social media:

- Facebook [https://www.facebook.com/globalcarbonproject](https://www.facebook.com/globalcarbonproject)
- Twitter: #carbonbudget, @gcarbonproject
Table 1. 2018 fossil CO₂ emissions from top 20 countries including the EU28 (in red) in billion tonnes CO₂ per year, and projection of growth for 2019.

<table>
<thead>
<tr>
<th>Country</th>
<th>2018 CO₂ emissions (bi tonnes CO₂/yr)</th>
<th>2018 percent of total (excluding bunkers)</th>
<th>2018 emissions per capita (tonnes CO₂/person/yr)</th>
<th>2018 Growth (percent)</th>
<th>2019 projected growth (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>10.1</td>
<td>26%</td>
<td>7.0</td>
<td>2.3%</td>
<td>+2.6% (+0.7 to +4.4%)</td>
</tr>
<tr>
<td>USA</td>
<td>5.4</td>
<td>14%</td>
<td>16.6</td>
<td>2.8%</td>
<td>−1.7% (−3.7% to +0.4%)</td>
</tr>
<tr>
<td>EU28</td>
<td>3.4</td>
<td>8.9%</td>
<td>6.7</td>
<td>−2.1%</td>
<td>−1.7% (−5.1% to +1.8%)</td>
</tr>
<tr>
<td>India</td>
<td>2.7</td>
<td>6.8%</td>
<td>2.0</td>
<td>8.0%</td>
<td>+1.8% (−0.7% to +3.7%)</td>
</tr>
<tr>
<td>Russia</td>
<td>1.7</td>
<td>4.4%</td>
<td>11.7</td>
<td>3.9%</td>
<td>n/a</td>
</tr>
<tr>
<td>Japan</td>
<td>1.2</td>
<td>3.0%</td>
<td>9.1</td>
<td>−2.2%</td>
<td>n/a</td>
</tr>
<tr>
<td>Germany</td>
<td>0.76</td>
<td>2.0%</td>
<td>9.1</td>
<td>−4.9%</td>
<td>n/a</td>
</tr>
<tr>
<td>Iran</td>
<td>0.72</td>
<td>1.9%</td>
<td>8.8</td>
<td>5.0%</td>
<td>n/a</td>
</tr>
<tr>
<td>South Korea</td>
<td>0.66</td>
<td>1.7%</td>
<td>12.9</td>
<td>2.8%</td>
<td>n/a</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>0.62</td>
<td>1.6%</td>
<td>18.4</td>
<td>−1.9%</td>
<td>n/a</td>
</tr>
<tr>
<td>Indonesia</td>
<td>0.61</td>
<td>1.6%</td>
<td>2.3</td>
<td>5.3%</td>
<td>n/a</td>
</tr>
<tr>
<td>Canada</td>
<td>0.57</td>
<td>1.5%</td>
<td>15.3</td>
<td>−0.5%</td>
<td>n/a</td>
</tr>
<tr>
<td>Mexico</td>
<td>0.48</td>
<td>1.2%</td>
<td>3.8</td>
<td>−3.1%</td>
<td>n/a</td>
</tr>
<tr>
<td>South Africa</td>
<td>0.47</td>
<td>1.2%</td>
<td>8.1</td>
<td>1.0%</td>
<td>n/a</td>
</tr>
<tr>
<td>Brazil</td>
<td>0.46</td>
<td>1.2%</td>
<td>2.2</td>
<td>−1.4%</td>
<td>n/a</td>
</tr>
<tr>
<td>Turkey</td>
<td>0.43</td>
<td>1.1%</td>
<td>5.2</td>
<td>0.7%</td>
<td>n/a</td>
</tr>
<tr>
<td>Australia</td>
<td>0.42</td>
<td>1.1%</td>
<td>16.9</td>
<td>0.8%</td>
<td>n/a</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>0.38</td>
<td>1.0%</td>
<td>5.6</td>
<td>−2.2%</td>
<td>n/a</td>
</tr>
<tr>
<td>Poland</td>
<td>0.34</td>
<td>0.9%</td>
<td>9.1</td>
<td>2.1%</td>
<td>n/a</td>
</tr>
<tr>
<td>Italy</td>
<td>0.34</td>
<td>0.9%</td>
<td>5.6</td>
<td>−3.1%</td>
<td>n/a</td>
</tr>
<tr>
<td>France</td>
<td>0.34</td>
<td>0.9%</td>
<td>5.2</td>
<td>−2.5%</td>
<td>n/a</td>
</tr>
<tr>
<td>Global totals (incl. bunkers)</td>
<td>36.8</td>
<td></td>
<td>4.8</td>
<td>2.1%</td>
<td>+0.6% (−0.2% to +1.5%)</td>
</tr>
</tbody>
</table>