GHG Mitigation Briefs – April 2017

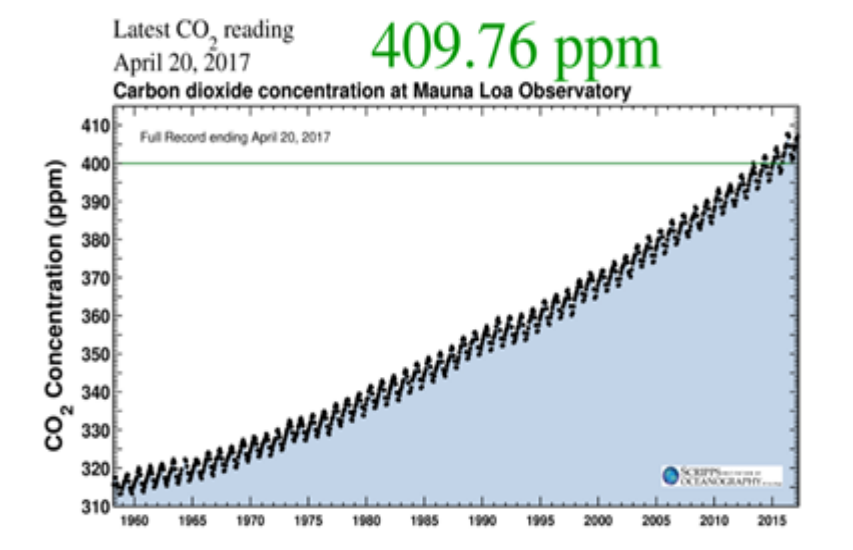
The IEA Greenhouse Gas R&D Programme (IEAGHG) is part of the IEA's Energy Technology Network. Its role is to assess the potential to mitigate greenhouse gas (GHG) emissions from the use of fossil fuels in the power, oil and gas and industry sectors. Further details of the activities of the IEA Greenhouse Gas R&D Programme can be found on our website: **www.ieaghg.org**.

This GHG Mitigation Brief has been prepared to summarise key climate change science, policy and technology developments, identified by IEAGHG, in the last 6 months and aims to provide information for both its members and the broader community. For those requiring further information, the IEAGHG provides more detailed papers and webinars on key issues relating to greenhouse gas mitigation which can be found on its web site (**www.ieaghg.org**). Those directly relevant to this GHG Mitigation Brief some are referenced at the end of the document.

2016 Broke all Records

The World Meteorological Organisation (WMO) annual statement on the State of the Global Climate was published in March 2017[1]. Key headlines from the report are:

- 2016 was the warmest on record – a remarkable 1.1˚C above the pre-industrial period, which is 0.06°C above the previous record set in 2015.
- Globally averaged sea surface temperatures were the warmest on record, global sea levels continued to rise, and Arctic sea-ice extent was well below average for most of the year.
- With levels of CO_2 in the atmosphere consistently breaking new records, the influence of human activities on the climate system has become more and more evident the WMO conclude.



CO_2 Concentrations in Atmosphere Reach 410 ppm

Atmospheric monitoring data from the Mauna Loa monitoring station in Hawai[2] has shown that on April 20th 2017 atmopsheric emissions of CO_2 have reached 410-ppm, the higest recorded to date.

CO_2 emissions remain level for 3rd year in a row

Both the IEA[3] and the Global Carbon Project[4] have reported that energy related CO_2 emissions have not grown significantly for 3 years in a row, which is unprecedented at a time of strong economic growth. However, to meet Paris targets global emissions now need to decrease rapidly, not just continue to stop growing.

The Global Carbon Budget is diminishing rapidly

The emissions data published by the Global Carbon Project has been used to estimate the time left to time left until the for 1.5°C carbon budget is exhausted[4]. At the 2016 level of 39.9bn tonnes of CO_2 emitted there are just four years and one month left in the carbon budget for 1.5˚C. Urgent action to begin reducing emissions is therefore required.

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Achievable pathways to limit global warming to well below 2°C

The recently published Energy Transition Commission report[5] suggests we must reduce current carbon emissions by half by 2040 with further cuts thereafter to achieve the Paris climate objective.

To put the world on a well below 2˚C pathway, we must decarbonize power generation and extend electrification to a wider set of activities in the transport and buildings sectors. Clean electrification (renewables) alone could deliver half of the carbon emissions reductions required to reach 20 Gt of emissions by 2040.

In addition, they suggest that stronger public policy and large-scale investment is now required in the decarbonization of activities like heavy industry which cannot be electrified. Technologies which can achieve this include; bioenergy, hydrogen, and CCS.

Renewables can't do it all[6]

In somewhat of a contrast, a recently published scientific paper has examined the technological challenge in meeting the 2˚C temperature target. The researchers conclude that, whilst the uptake in wind/solar for energy use has been significant, they do not feel that it will be possible for renewables to meet the full demand in energy growth going forward unless the growth in energy use globally declines sharply in coming years. Fossil fuel use they state must decrease significantly soon and must deploy CCS.

What happens when the sea ice is gone?

Scientists have predicted that as early as 2030 the Arctic Ocean could lose essentially all of its ice during the warmest months of the year[7]. This would upend Arctic ecosystems, disrupt many northern communities, and have serious consequences on global climate change. The situation is not irreversible however and if we meet, the 2˚c temperature target about half the artic sea ice may remain.

The Anthropocene Equation[8]

Scientists have developed an equation (the Anthropocene equation) that aims to create an unequivocal statement of the risks industrialised societies are taking at a time when action is vital. The Anthropocene equation homes in on the rate of change of Earth's life support system: the atmosphere, oceans, forests and wetlands, waterways and ice sheets and diversity of life.

For four billion years, the rate of change of the Earth system (E) has been a complex function of astronomical (A) and geophysical (G) forces plus internal dynamics (I): Earth's orbit around the sun, gravitational interactions with other planets, the sun's heat output, colliding continents, volcanoes and evolution, among others.

$$\frac{dE}{dt} = f(H)$$

$$A, G, I \rightarrow 0$$

In the equation, astronomical and geophysical forces tend to zero because of their slow nature or rarity, as do internal dynamics, for now. All these forces still exert pressure, but currently on orders of magnitude less than human impact.

The key conclusion is that the rate of change of the Earth system over the last 40 to 50 years is a purely a function of industrialised societies (H).

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Methane Emissions are Rising[9]

The Global Carbon Project's Global Methane Budget for 2016, shows that unlike CO_2 emissions, methane concentrations in the atmosphere are increasing. This is a significant development because methane is a much more potent greenhouse gas than CO_2 and increases in methane concentrations will offset the impact caused by CO_2 emissions remaining static, or even reducing in the future. Most of the increase in methane emissions is coming from the agricultural sector.

Non-CO_2 GHG Emissions from Aviation[10]

Following on from a global agreement to reduce CO_2 emissions from the aviation sector, a new study has suggested that emissions of non CO_2 GHG emissions also needs consideration as these may have a significant impact on climate change. The study concludes that a lot of further research is needed to quantify these impacts, but that they should not be ignored in the wake of the Paris Agreement.

References

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