

CAN GLOBAL WARMING BE LIMITED TO 1.5C?



The world community has agreed a global warming limit of holding warming below 2C above preindustrial levels.

Small island states and the least developed countries have called for warming to be brought back to below 1.5 by 2100.

The 1.5C warming limit is now under review for consideration next year by the UN's climate body (UNFCCC).

Due to past emissions, and taking into account the most aggressive mitigation strategies, peak mean global warming in the 21st Century can limited close to 1.5C, with warming dropping to below 1.5 by 2100.

This means that the world is unlikely to be able to avoid impacts projected close to 1.5C, including major damage to coral reef systems and the emergence of regular occurrences of unusual heat extremes of over a substantial land area.

This is reflected in the World Bank's "Turn Down the Heat: Confronting the New Climate Normal" report.

This does not mean, however, that long-term warming of 1.5C is locked in, or that achievement of the 1.5C warming limit, as called for by the vulnerable countries, is no longer possible.

As is shown in the report, this message is a call for strong early action and a further warning that time is running out.

Feasible goal

Climate projections based on energy-economic emissions scenarios show that, in the best case, warming will peak close to 1.5C by mid-century before slowly declining to below this level.

With continuing negative emissions post 2100, warming levels would decline further.

Limiting peak warming close to 1.5C by mid-century will still result in significant damage.

At present levels of warming (about 0.8C above preindustrial) the impacts of climate change are already being felt in many regions of the world.

Climate change has left its negative imprint on crop yields, caused marine species to migrate to cooler waters; it has increased heat waves and drought, and placed pressure on water resources and damaged coral reefs.

Even with the most aggressive mitigation action limiting peak warming close to 1.5C, there will be substantial damages in the form of extreme heat events, damages to water resources, and risks to regional food security.

Both the IPCC and the TDTH report show that risks to unique and threatened systems, such as coral reefs, are high at 1.5C and sea-level rise would continue long after 2100.

The example given in the World Bank's press release illustrates the scale of the risk of warming even at 1.5C for unusual heat extremes.

For the three regions covered in this TDTH report and from 2013, unusual heat extremes, currently largely absent, increase to cover 10-60% of land area by the time global warming reaches around 1.5C.

As we showed in the second TDTH report in 2013, unprecedented heat extremes also become very significant in some regions around 1.5C warming.

“Unprecedented extremes” are those that have never occurred, and which would occur, statistically, only every few million years in an unchanged climate, if ever.

The 2C limit

IPCC AR5 WGIII identified many mitigation options to hold warming below 2C (with a likely chance), and with central estimates of 1.5-1.7C by 2100.

The IPCC further shows that “a limited number of studies have explored scenarios that are more likely than not to bring temperature change back to below 1.5C by 2100”.

The scenarios indicating the feasibility of bringing temperatures down below 1.5C are “characterised by (1) immediate mitigation action; (2) the rapid upscaling of the full portfolio of mitigation technologies; and (3) development along a low-energy demand trajectory.” (IPCC WGIII SPM page 17)

According to the IPCC, the costs of reducing emissions to limit warming to below 2C are modest, even before taking into account co-benefits such as energy-security benefits and health improvement due to reduced air pollution.

Annualised reductions of consumption growth are estimated at around 0.06 percent over the century, relative to a baseline of 1.6 to 3% growth per year.

The feasibility of limiting warming to 1.5C and returning it to below 1.5C by 2100 is supported by the wider scientific literature (e.g. Luderer et al. 2013; Rogelj et al. 2013b; Rogelj et al. 2013a), and the IPCC.

Similarly, the recently published UNEP Emissions gap report (UNEP 2014) assessed the literature on 1.5C scenarios.

It confirms that limiting warming to below 1.5C by 2100 is feasible, but strong early mitigation is needed and opportunities are being lost with every decade that emissions rise.

“Only a small number of scenarios meet the 1.5C target with at least a 50 per cent chance, and have least-cost pathways beginning in 2010,” it says.

“An even smaller number of scenarios meet the 1.5C target with at least a 50 per cent chance and have least-cost emissions pathways beginning in 2020 – and therefore, have higher emissions up to 2020.”

“When action is delayed, various options to achieve stringent levels of climate protection are increasingly lost (Luderer et al., 2013b; Rogelj et al., 2013a; Rogelj et al., 2013b).

“One sign of this is that a declining number of models are able to identify feasible emission pathways that stay within a 1.5C or 2C limit with increasing delays (IPCC, 2014).”

Probabilities

In terms of the pathways for keeping warming below 1.5C by 2100, a meta-analysis of the IPCC scenarios shows that in order to keep warming below 2C with *high probability* and to bring temperatures back to 1.5C by the end of the century, CO₂ emissions would need to be zero as early as 2045 and no later than 2065, with negative emissions thereafter.

Total GHG emissions would reach zero as early as 2060 and no later than 2080, with negative emissions thereafter.

Even with a cessation of all emissions, delays in the climate system and abrupt changes in atmospheric, radiative forcing would let warming continue to rise to a best-guess level of 1.2C above pre-industrial, before embarking on a gradual decline (e.g. Schaeffer et al. 2012).

In the very long term, a warming limit of 1.5C requires total greenhouse-gas concentrations – plus the effects of aerosols – to be below a level of 400ppm CO₂eq.

As a sudden cessation of all emissions is unlikely, any mitigation pathway aiming at 1.5°C and below necessarily involves a peak-and-drop concentration profile.

At present we can be confident of holding warming below 2C with aggressive mitigation action. Another decade's delay and we will likely be talking about lock-in to impacts at 2C or above.

Thus, it is clear that while the challenges are high, keeping warming below 1.5C by the end of the century is still feasible.

However, with every decade lost, these challenges rise and will, at some point, become insurmountable with warming locked in to 2C and above.

Source: <http://chimalaya.org/2014/11/25/can-global-warming-be-limited-to-1-5c/>