EXPLORING NET ZERO

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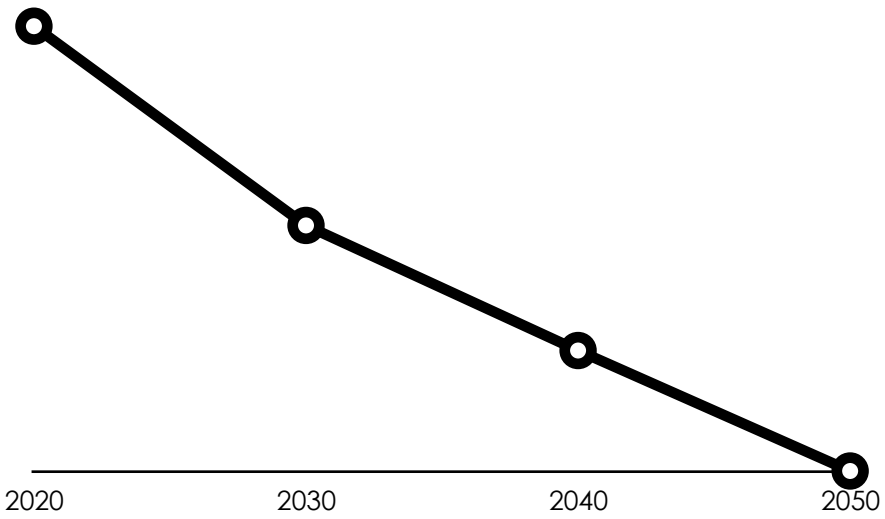

Net zero: why 1.5°C?

In the Paris Agreement, governments committed to keep global warming 'well below 2 degrees Celsius', and 'make efforts' to keep it below 1.5°C. These replaced the previous politically-agreed target of 2°C.

Overall, stabilising global warming at 1.5°C results in a lower level of impacts and reduced risks compared with stabilising at 2°C. The evidence was distilled in the Intergovernmental Panel on Climate Change's Special Report on the 1.5°C target, published on 8 October 2018.

Adoption of the 2015 Paris Agreement has spurred scientists and economists to investigate the benefits of holding global warming at the 1.5°C level in terms of reduced impacts, as compared with the previous target of 2°C.

In general, science concludes that damaging impacts increase with the extent of global warming. However, the increase is not necessarily linear; doubling the temperature rise may more than double the scale of a given impact. In addition, higher levels of warming raise the risk of passing 'tipping-points' which can either lead to irreversible impacts or amplification of climate change.

Rising temperatures increase the risk of dangerous wildfires. Image: Quarrie Photography, creative commons licence

The extent of warming in countries and regions can be a lot more than the global average. For example, global warming of 2°C is projected to increase the warmest temperatures in the Mediterranean by 3°C, and the coldest Arctic temperatures by 5.5°C. The 1.5°C goal also implies a slower rate of warming, which would give societies and nature more time to adapt.

Weather

Scientists expect to see more extremes of temperature at 2°C of global warming than at 1.5°C – for longer periods, more frequently, and with higher peaks. Three times more people are likely to be exposed regularly (at least once every five years) to severe heatwaves at 2°C than at 1.5°C (14% vs 39%); delivering the 1.5°C target would mean that 1.7bn fewer people are exposed.

In Europe, summers as hot as 2003, which brought tens of thousands of excess deaths, are expected to occur three years in five under 2°C of warming, two years in five at 1.5°C. For central England, the hottest summers seen so far are expected to happen every third year at 1.5°C, every second year at 2°C.

In general, climate change is expected to increase incidence of heavy rainfall. Incidence is forecast to be significantly higher at 2°C than at 1.5°C in countries around the Arctic and at high altitude. By contrast, limiting warming to 1.5°C is forecast to bring droughts of lower severity to the Mediterranean and North Africa than would occur at 2°C. In the UK, the maximum amount of rain falling in one day is projected to be higher at 2°C than at 1.5°C, implying a higher risk of flooding.

Climate change is known to have increased the likelihood of many individual extreme weather events including the 2018 Northern European heatwave, 2017's Hurricane Harvey and the 2015 storms in Cumbria. In general, higher rates of global warming would be expected to drive a higher increase in extreme weather events, though this has not been quantified.

Climate change has increased the likelihood of extreme weather events like flooding. Image: alh1, creative commons licence

Ocean

Limiting global warming to 1.5°C rather than 2°C is projected to result in about 10cm less of sea-level rise by the end of the century. That would mean that in 2100, 10 million fewer people would be at risk of coastal flooding from extreme sea level events under 1.5°C of warming as compared with 2°C. The lower target also reduces the risk that either the Greenland or West Antarctic ice sheet

will be destabilised, leading to sea-level rise of several metres. The global warming threshold for triggering runaway melting is not known precisely, but one credible estimate for Greenland is 1.6°C.

The extent of ocean acidification and de-oxygenation are also expected to be lower at 1.5°C than at 2°C, though this has not been precisely quantified. This would be expected to reduce impacts on ocean life.

Food, water and health

Keeping global warming to 1.5°C is forecast to result in about half as many people facing water scarcity as at 2°C. The number of people exposed to severe levels of heat in Southern Asia and Eastern Africa is forecast to increase by a factor of 4 at 1.5°C of global warming, and a factor of 16 at 2°C.

Globally, yields of major crops are likely to decline with increasing temperature – 6% per degree Celsius for wheat, 7.4% for maize, smaller amounts for rice and soybean – indicating greater food security at 1.5°C than at 2°C. Adaptation, including by genetically engineering new crop strains, might compensate for yield falls. Reduced changes in the ocean are expected to pose a lower risk to fisheries.

Nature

Both the smaller extent and slower speed of climate change associated with the 1.5°C target are forecast to result in a smaller threat to nature. However, in some cases it would still be severe. About 70-90% of coral reefs are expected to experience severe degradation at 1.5°C of global warming, increasing to 99% at 2°C.

For many species of plants and animals, parts of their normal home range are set to become uninhabitable because of increasing heat or other climate change impacts. A study of some 115,000 plant and animal species found that more than twice as many will lose half of their traditional range at 2°C of global warming than at 1.5°C.

Because regional temperature changes can be larger than the global average, regions such as the Mediterranean may experience conditions at 2°C unseen in the period since the last Ice Age, with unknown consequences for nature there.

Economic growth

Projections of climate change impacts on economic growth, and the costs and benefits of cutting emissions, are always highly uncertain. With that caveat, evidence indicates that limiting warming to 1.5°C rather than 2°C reduces the global cost of damages by about 25%.

Globally, 2ºC of warming is projected to affect economic growth significantly, such that average GDP per capita would be 5% lower in 2100 at 2ºC than at 1.5ºC. A number of countries in the Tropics are projected to see annual growth fall by 2% under 2ºC of warming, but no significant change at 1.5ºC.

Climate change has human and economic costs. Image: US Air Force, creative commons licence

Overshoots and risks

The IPCC discussed two types of pathway for stabilising global warming at 1.5ºC from 2100:

- those that always keep below this temperature
- those that overshoot it, with the temperature then being reduced towards the end of the century with substantial use of negative emissions.

Overshoot pathways carry greater risks of triggering potentially irreversible events such as runaway ice-sheet melt or species extinctions.

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