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'Safe' climate means 'no to coal'

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Old coal mine
Coal must either modernise or become obsolete, the research implies

About three-quarters of the world's fossil fuel reserves must be left unused if society is to avoid dangerous climate change, scientists warn.

More than 100 nations support the goal of keeping temperature rise below 2C.

But the scientists say that without major curbs on fossil fuel use, 2C will probably be reached by 2050.

Writing in Nature, they say politicians should focus on limiting humanity's total output of CO2 rather than setting a "safe" level for annual emissions.

The UN climate process focuses on stabilising annual emissions at a level that would avoid major climate impacts.

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Myles Allen

But this group of scientists says that the cumulative total provides a better measure of the likely temperature rise, and may present an easier target for policymakers.

"To avoid dangerous climate change, we will have to limit the total amount of carbon we inject into the atmosphere, not just the emission rate in any given year," said Myles Allen from the physics department at Oxford University.

"Climate policy needs an exit strategy; as well as reducing carbon emissions now, we need a plan for phasing out net emissions entirely."

Forty years

The UN climate convention, agreed at the 1992 Rio Earth Summit, commits countries to avoiding "dangerous" climate change, without defining what that is.

The EU proposed some years ago that restricting the rise to 2C from pre-industrial times was a reasonable threshold, and it has since been adopted by many other countries, although some - particularly small islands - argue that even 2C would result in dangerous impacts.

Temperatures have already risen by about 0.7C during the industrial age.

Dr Allen's analysis suggests that if humanity's CO2 emissions total more than about one trillion tonnes of carbon, the 2C threshold is likely to be breached; and that could come within a lifetime.

"It took us 250 years to burn the first half trillion," he said, "and on current projections we'll burn the next half trillion in less than 40 years."

Inherent uncertainties in the modelling mean the temperature rise from the trillion tonnes could be between 1.3C and 3.9C, Dr Allen's team calculates, although the most likely value would be 2C.

Oil change

The "trillion tonnes" analysis is one of two studies published in Nature by a pool of researchers that includes the Oxford group and scientists from the Potsdam Institute for Climate Change Impact Research in Germany.
Drought in California
Impacts such as droughts would increase above 2C, the IPCC believes

The second study, led by Potsdam's Malte Mainshausen, attempted to work backwards from the 2C goal, to find out what achieving it might mean in practice.

It suggests that the G8 target of halving global emissions by 2050 (from 1990 levels) would leave a significant risk of breaching the 2C figure.

"Only a fast switch away from fossil fuels will give us a reasonable chance to avoid considerable warming," said Dr Mainshausen.

"If we continue burning fossil fuels as we do, we will have exhausted the carbon budget in merely 20 years, and global warming will go well beyond 2C."

If policymakers decided they were happy to accept a 25% chance of exceeding 2C by 2050, he said, they must also accept that this meant cutting emissions by more than 50%.

That would mean only burning about a quarter of the carbon in the world's known, economically-recoverable fossil fuel reserves. This is likely to consist mainly of oil and natural gas, leaving coal as a redundant fuel unless its emissions could be captured and stored.

Both analyses support the view of the Stern Review and the Intergovernmental Panel on Climate Change (IPCC) in suggesting that making reductions earlier would be easier and cheaper than delaying.

But according to Potsdam's Bill Hare, a co-author on the second paper, some key governments appear to favour pledging milder cuts in the near term in return for more drastic ones in decades to come.

"We have a number of countries - the US, Japan, Brazil - saying 'we will emit higher through to 2020 and then go down faster'," he said.

"That might be true geophysically, but we cannot find any economic model where emissions can fall in the range that this work shows would be necessary - around 6% per year."

Major intervention

Myles Allen's group has made the argument before that focussing on humanity's entire carbon dioxide output makes more scientific and political sense than aiming to define a particular "safe" level of emissions, or to plot a pathway assigning various ceilings to various years.

Some greenhouse gases, such as methane, have a definable lifetime in the atmosphere, meaning that stabilising emissions makes sense; but, said Dr Allen, CO2 "doesn't behave like that".

"There are multiple levers acting on its concentration and it does tend to accumulate; also models have to represent the possibility of some feedback between rising temperatures and emissions, such as parts of the land turning from carbon sinks into sources, for example."

The Nature papers emerge in a week that has seen the inaugural meeting of President Obama's Major Economies Forum on Energy and Climate, a new version of a body created under President Bush that brings together 17 of the world's highest-emitting countries for discussion and dialogue.

During the opening segment, Secretary of State Hillary Clinton re-affirmed the administration's aim of cutting US emissions by 80% from 1990 levels by 2050 - a target espoused by some other developed countries.

But according to Malte Meinshausen's analysis, even this reduction may not be enough to keep the average global temperature rise within 2C, assuming less developed nations made less stringent cuts in order to aid their development.

"If the US does 80%, that equates to about 60% globally, and that offers only a modest chance of meeting the 2C target," he said.

Last week saw the publication of data showing that industrialised countries' collective emissions rose by about 1% during 2007.