

Long term strategy needed for reducing greenhouse gases

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Carbon dioxide will continue to rise even if current national and international targets for reducing emissions are met, scientists warn. But, they say, strong action taken now – such as the 80% target recently announced by the UK government – will continue to have benefits a long time into the future.

A group of scientists led by the University of Bristol have, for the first time, combined the outcomes of proposals by the G8 countries and the UK Government's Stern Review with the latest knowledge of climate change feedbacks relating to the carbon cycle (the way carbon moves between the oceans, atmosphere and land).

Their findings, published in *Environmental Research Letters*, show that short-term cuts alone will not solve the problem and that policy makers

need to plan for hundreds of years into the future.

Jo House, from the Natural Environment Research Council's QUEST programme at the University of Bristol, led the research. She says, "To be able to predict the climatic impact of various levels of emissions we need to know, and account for, what happens to the greenhouse gases once they enter the atmosphere. Gases such as methane or nitrous oxide only remain in the atmosphere for a few years or decades. Carbon dioxide is a different matter as a portion of emitted gas stays in the atmosphere for thousands of years.

"Furthermore, as the climate changes, a larger proportion of the carbon dioxide will remain in the atmosphere. Carbon dioxide is taken up by land and ocean sinks, which become less effective as the climate warms, leading to even greater warming for a given level of emissions – this is known as climate feedback. Our calculations demonstrate the level of emissions reduction we need to achieve to limit climate change to below what is considered 'dangerous'."

Working alongside colleagues from the NERC Centre for Ecology and Hydrology, the Met Office Hadley Centre and the University of Exeter, Jo House ran computer models to see what would happen under the G8 plans to cut global emissions by 50% by 2050. The models show that under this scenario, unless emissions cuts continue beyond 2050, atmospheric carbon dioxide concentrations will continue to rise rapidly.

By 2100 the models suggest that carbon dioxide concentrations could be as high as 590 parts per million (ppm) – more than double the level of 280ppm that persisted for thousands of years before the industrial revolution, and significantly higher than today's level, caused by the burning of fossil fuels and deforestation, of 386ppm. By 2300 the worst-case scenario shows that carbon dioxide levels could be 980ppm with an accompanying rise in global temperature of 5.7°C. (The European Union

has taken the stance in international climate negotiations that climate change should be limited to 2°C to avoid “dangerous impacts”.)

Using the Stern Review proposal, of cutting emissions by 25% by 2050 and continuing to make cuts down to 80% towards the end of the century, the models show a more hopeful future. In this case the carbon dioxide levels would become almost stable, at levels of between 500 and 600ppm by 2100, although they would creep up further into the future if greater cuts were not made. In this case the temperature by 2100 ranges between 1.4 and 3.4 °C depending on the model used, and by 2300 it is also almost stable with a maximum of 4.2 °C.

The Stern Review concluded that, to avoid the worst impacts of climate change, the concentrations of all greenhouse gases should be limited to what is equivalent to between 450 and 550ppm of carbon dioxide concentration.

House and her colleagues say that making cuts in other greenhouse gases is no good if the longer term problem of atmospheric carbon dioxide is ignored.

“To achieve long-term stabilisation of carbon dioxide levels at around 550ppm will require cuts in global emissions of between 81% and 90% by 2300, and even more beyond that time. We applaud the government’s new plans to cut UK emissions by 80% by 2050. This is a realistic assessment of the scale of the problem and the action needed,” says House. “Our research confirms that bringing other countries on board to meet a global target of 80% reductions towards the end of the century will virtually stabilise carbon dioxide levels, but a much longer-term strategy is still needed to reduce future emissions even further.”

She adds, “Tackling the problem of global warming seems even more daunting when climate change feedbacks are taken into account, but we

shouldn't feel despondent and give up on the challenge. It should encourage us to carry on making cuts in emissions, however small they seem to start with, because whatever we do now will have a beneficial long-term legacy.”

Source: University of Bristol

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