

Time to act

Without a solid commitment from the world's leaders, innovative ways to combat climate change are likely to come to nothing.

It is not too late yet — but we may be very close. The 500 billion tonnes of carbon that humans have added to the atmosphere lie heavily on the world, and the burden swells by at least 9 billion tonnes a year (see page 1117). If present trends continue, humankind will have emitted a trillion tonnes of carbon into the atmosphere well before 2050, and that could be enough to push the planet into the danger zone. And there is no reason to think that the pressure will stop then. The coal seams and tar sands of the world hold enough carbon for humankind to emit another trillion tonnes — and the apocalyptic scenarios extend from there (see page 1104).

Nations urgently need to cut their output of carbon dioxide. The difficulty of that task is manifest: emissions have continued to rise despite almost two decades of rhetoric, diplomacy and action on the matter. But that unhappy fact should not be taken as a licence for fatalism. Governments have a wide range of pollution-cutting tools at their command, most notably tradable permit regimes, taxes on fuels, regulations on power generation and energy efficiency, and subsidies for renewable energy and improved technologies. These tools can work if applied seriously — so citizens around the world must demand that seriousness from their leaders, both within their individual nations and in the international framework that will be discussed at the United Nations Climate Change Conference in Copenhagen this December.

As essential as it is, however, simply agreeing to cut emissions will not be enough. The fossil fuels burned up so far have already committed the world to a serious amount

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of climate change, even if carbon emissions were somehow to cease overnight (see page 1091). And given the current economic turmoil, the wherewithal to adapt to these changes is in short supply, especially among the world's poor nations. Adaptation measures will be needed in rich and poor countries alike — but those that have grown wealthy through the past emission of carbon have a moral duty to help those now threatened by that legacy (see page 1102).

The latest scientific research suggests that even a complete halt to carbon pollution would not bring the world's temperatures down substantially for several centuries. If further research reveals that a prolonged period of elevated temperatures would endanger the polar ice sheets, or otherwise destabilize the Earth system, nations may have to contemplate actively removing CO₂ from the atmosphere. Indeed, the United Nations Intergovernmental Panel on Climate Change is already developing scenarios for the idea that long-term safety may require sucking up carbon, and various innovators and entrepreneurs are developing technologies that might be able to accomplish that feat (see page 1094). At the moment, those technologies seem ruinously expensive and technically difficult. But if the very steep learning curve can be climbed, then the benefits will be great.

More radical still is the possibility of cooling the planet through some kind of ‘geo-engineering’ that would dim the incoming sunlight (see page 1097). The effects of such approaches are much more worrying than those of capturing carbon from the air, however. The cooling from geoengineering would not exactly balance the warming from greenhouse gases, which would cause complications even if the technology itself was feasible — something for which the evidence has been circumstantial, at best.

But discussions about the possibilities offered by geoengineering could also lull the world's leaders into complacency — if they lead them to believe that the technology

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will provide an escape hatch if the climate ever does reach a tipping point. This does not mean that the discussions should be avoided, but rather that the speculations need to be backed up with a solid body of research. Moreover, geoengineering research should be framed not as a hope for *deus ex machina* fixes to sudden global deterioration, but as a palliative cushion for the worst excesses of the peak years that are inevitable even after emissions start to be cut. A world slightly shaded from the Sun while its carbon levels are brought down by means of active capture would be a strangely unnatural place — but not necessarily a bad one, compared with the alternatives.

Research on local and regional interventions to cool Earth should be undertaken now — ideally in a way that provides basic information to climate researchers. Most sciences are in the habit of poking that which they study to gauge its response. Climate researchers lack such a tradition, and might have something to gain by starting

one up. The attention to far-off goals, however, must not obscure short-term opportunities. In addition to cutting CO₂ emissions, global leaders should curb the release of other substances warming the climate, notably methane and soot, also known as ‘black carbon’. Tackling such pollutants will bring other benefits, too, such as reducing the respiratory problems associated with cooking over smoky fires and with high levels of tropospheric ozone.

With so many challenges still to be faced, the climate problem may seem insurmountable. But there is still time left to act, and there is hope to be found in human ingenuity. Humans have a long history of finding new ways to tackle problems, and new ways to circumvent the worst. Without commitment from the highest levels, such ingenuity is likely to come to naught. But with such a commitment, and with a worldwide determination to make a serious cut in emissions, there is much that can usefully, and invigoratingly, be done. ■

Authorship policies

We are clarifying the duties of lead authors and making author-contribution statements mandatory.

The *Nature* journals encourage authors to treat their data and their collaborators with the respect that their communities demand. High-profile journals have a duty to reinforce the trends towards greater transparency and to help scientists to fulfil their responsibilities as researchers and authors. We are therefore introducing small but important changes in our policies to reflect these goals.

In a previous Editorial (*Nature* 450, 1; 2007), we asked for feedback about whether we should require senior or corresponding authors to sign a statement that they had taken some specific ‘integrity insurance’ steps before the manuscript was submitted. Some applauded this idea, but most were not in favour. (Some of the feedback can be seen at <http://tinyurl.com/ddjsxa>). Major doubts were expressed about the ability of corresponding authors to take on such responsibility given the diversity of collaborations. The belief was also expressed that such signed statements would too often be worthless box-ticking exercises. Although we regretfully accept these realities, we believe that we should go further in spelling out the responsibilities of co-authors, and in requiring an implicit acceptance of them.

Accordingly, we have modified the *Nature* journal policy on authorship, which is detailed on our website (<http://tinyurl.com/dkgbf8>). For papers submitted by collaborations, we now delineate the responsibilities of the senior members of each collaboration group on the paper. Before submitting the paper, at least one senior member from each collaborating group must take responsibility for their group’s contribution. Three major responsibilities are covered: preservation of the original data on which the paper is based, verification that the figures and conclusions accurately reflect the data collected and that manipulations to images are in

accordance with *Nature* journal guidelines (<http://tinyurl.com/cmmrp7>), and minimization of obstacles to sharing materials, data and algorithms through appropriate planning.

Corresponding authors have multiple responsibilities, but we now make it clearer that the author list should include all appropriate researchers and no others, and that the order has been agreed to by all authors. They are expected to have notified all authors when the manuscript was submitted, they are the point of contact with the editor and they must communicate any matters that arise after publication to their co-authors.

Another change is that we have strengthened our policy for statements of authors’ contributions. This policy was first introduced nearly 10 years ago (*Nature* 399, 393; 1999) to make the credit due to individual co-authors more explicit. Since then, authors of *Nature* papers have had the opportunity to include in their papers a statement that details each author’s role in the published work. Over the past 10 years, the proportion of authors who choose to include this has risen dramatically.

This acceptance, and discussions with authors who have chosen not to include such a statement, has led us to change our policy. Rather than ‘strongly encouraging’ such statements, we now require them for publication of original research papers in *Nature* and the *Nature* research journals. The detail provided can vary tremendously (<http://tinyurl.com/39mmyw>) and authors are left to structure them as they see fit. We insist only that no author be left out.

To ensure that authors are familiar with these changes, we will shortly require the corresponding author to confirm that he or she has read the *Nature* journal policies on author responsibilities (<http://tinyurl.com/dkgbf8>) and is submitting the manuscript in accordance with those policies. ■

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