OPINION

Copenhagen Accord pledges are paltry

Current national emissions targets can't limit global warming to 2 °C, calculate **Joeri Rogelj**, **Malte Meinshausen** and colleagues — they might even lock the world into exceeding 3 °C warming.

The Copenhagen Accord agreed last December has a stated aim of keeping global warming to below 2 °C, and reviewing a 1.5 °C goal by 2015 . Unfortunately, the national emissions-reduction pledges accompanying this document are insufficient to meet this objective.

We estimate that the present pledges are likely to lead to a world with global emissions of 47.9 gigatonnes to 53.6 gigatonnes of carbon dioxide equivalents ($GtCO_2$-eq) per year by 2020 — about 10–20% higher than today's levels. Even if emissions halve by mid-century, this will still leave the planet with, at best, a flip-of-the-coin chance of meeting the 2 °C goal.

Analyses by the United Nations Environment Programme[1] and the World Resources Institute[2], among others, have come to the same broad conclusion. However, such analyses rarely account for loopholes that could make matters worse. These loopholes include surplus emissions allowances that have been accrued by some countries and land-use and forestry accounting.

The Copenhagen Accord contained blank tables that were to be filled in by 1 February with national pledges of emissions reductions for 2020. As of 13 April, 76 countries, together accounting for about 80% of global industrial emissions, had filled in their pledges (see http://unfccc.int/home/items/5262.php).

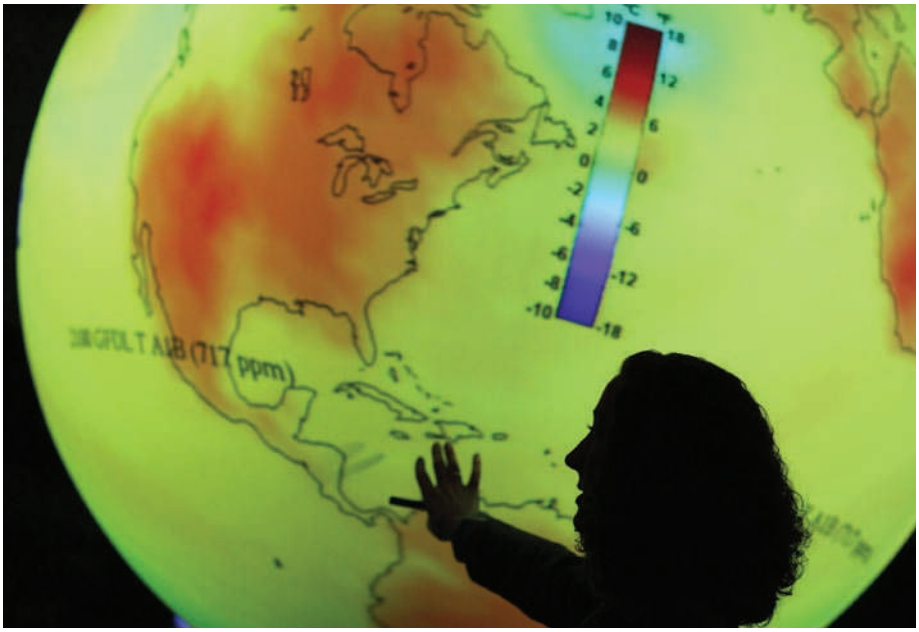
It is amazing how unambitious these pledges are. The European Union offered a range of 20–30% cuts; the 20% figure would lead to smaller annual reductions from now to 2020 than have been accomplished on average over the past 30 years. The United States provided a 2020 target of 17% below 2005 levels, equivalent to just 3% below 1990 levels. By aligning itself with the US target, Canada is the only country that both weakened its ambitions in the course of the negotiations, and effectively argued for an increase of 2020 emission allowances above its current Kyoto Protocol target: 3% above instead of 6% below 1990 levels. The less ambitious end of China's target — to lower its CO_2 emissions per unit of gross domestic product by 40–45% compared to 2005 levels — merely corresponds to business-as-usual development (although it is worth noting that China's domestic five-year plans and investment goals for alternative-energy infrastructure are more ambitious).

> **"In the worst case the Copenhagen Accord pledges could permit emission allowances to exceed business-as-usual projections."**

Japan and Norway are the only two developed countries to make sufficient pledges: of 25% and 30–40% below 1990, respectively (see http://www.climateactiontracker.org).

Actual emissions might be even higher. If a country reduces more than its target, this results in surplus allowances that can potentially be 'banked' and used later or sold to other countries. Under the Kyoto Protocol, some countries' targets were so weak that large amounts of surplus allowances have been and will be generated over the 2008–12 period even without any environmental policy effort. We estimate that this adds up to 11 $GtCO_2$-eq of surplus allowances.

A further surplus comes from land use, land-use change and forestry. The rules for the current Kyoto commitment period state that individual countries must account for greenhouse-gas fluxes from afforestation, reforestation and deforestation in their emissions reports, and can choose to include those deriving from forest management (with a cap on accruing emissions allowances), cropland management, grazing-land management and



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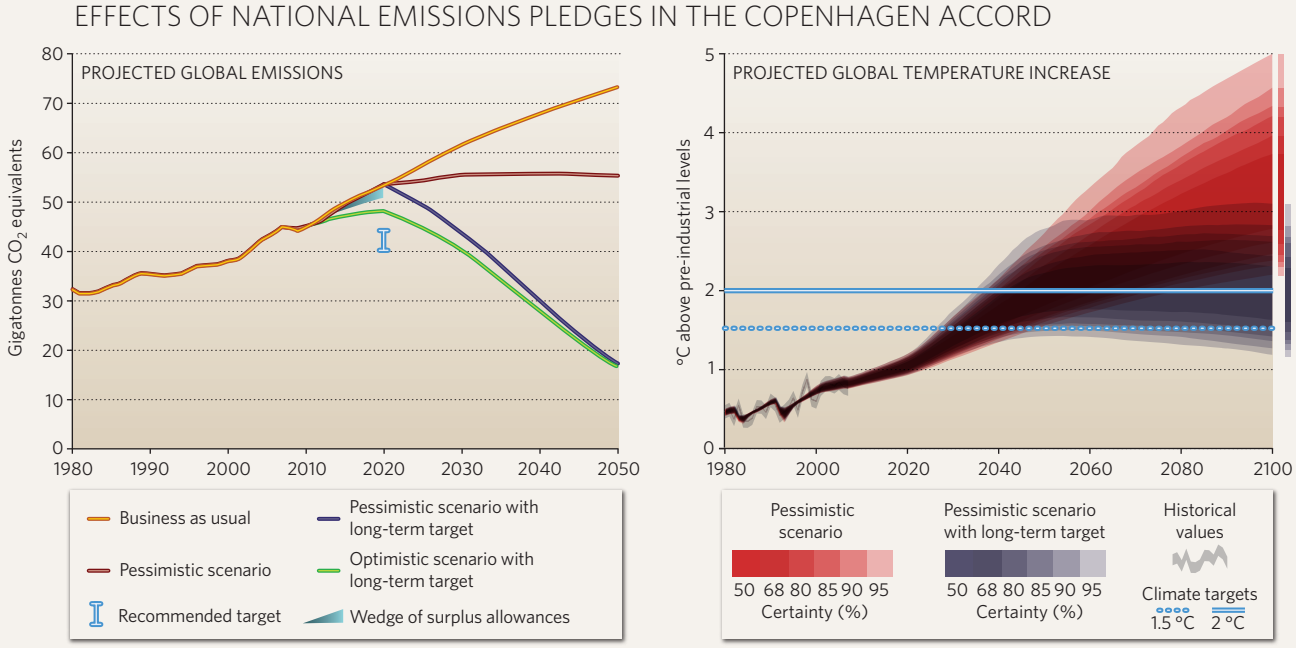
Loopholes of surplus allowances and land-use credits are likely to boost emissions.

SUMMARY

- Nations will probably meet only the lower ends of their emissions pledges in the absence of a binding international agreement
- Nations can bank an estimated 12 gigatonnes of CO_2 equivalents surplus allowances for use after 2012
- Land-use rules are likely to result in further allowance increases of 0.5 $GtCO_2$-eq per year
- Global emissions in 2020 could thus be up to 20% higher than today
- Current pledges mean a greater than 50% chance that warming will exceed 3 °C by 2100
- If nations agree to halve emissions by 2050, there is still a 50% chance that warming will exceed 2 °C and will almost certainly exceed 1.5 °C



HISTORICAL DATA: P. BROHAN *ET AL. J. GEOPHYS. RES.* **111,** D12106 (2006)

The pessimistic scenario assumes that nations meet only their lowest stated ambitions, and use all surplus allowances and land-use credits. The optimistic scenario assumes that nations meet their highest stated ambitions, and do not use surplus allowances or land-use credits. The long-term target is to halve emissions from 1990 levels by 2050.

revegetation. We estimate that accounted removals of greenhouse gases under these provisions add an additional 1.0 $GtCO_2$-eq to the banked allowances of Russia, Ukraine and the European Union for 2008–12.

The Copenhagen Accord does not mention whether banked surpluses can be used. Because anything profitable is likely to be pursued, we assume that nations will add these 12 $GtCO_2$-eq on top of their pledged pathways, increasingly relying on them from now until 2020. Optimistically, we assume that no further surplus allowances will be generated after 2012.

Additional emissions

If the land-use and forestry rules remain the same as under the Kyoto Protocol, but with mandatory forest-management accounting and generated allowances capped at 4% of 1990 levels (as a proxy for low-ambition options currently being discussed), this is likely to result in an additional emission allowance globally of 0.5 $GtCO_2$-eq per year. It cannot be guaranteed that the accounted land-use and forestry adjustments reflect real, additional and permanent changes — there is no way to ensure that carbon stored in a planted forest or in agricultural soils will not be subsequently released. Given this, and complications in how land-use and forestry allowances are awarded (ignoring the fact that forests planted on wet soil might be sources rather than sinks of greenhouse gases, for example), these allowances can be considered as adding to industrial emissions in most cases.

To see how the current Copenhagen commitments add up, we totalled estimated emissions under optimistic and pessimistic scenarios, and ran those numbers through a model[3] of climate response to anthropogenic emissions (see graph). The results are, of course, only as good as our emissions assumptions, which, like all assumptions in this area, are subject to debate. We have, for example, corrected for the fact that the sum of national-emissions inventories historically underestimates actual global emissions. The model that we put them into, however, is arguably one of the most reviewed and documented. We thus think that the exercise provides a useful illustration of the problem that lies ahead.

We compiled national-emissions estimates by digging through the details of national pledges to see if they include land-use changes or not, and considering whether they are contingent on other factors. For countries that didn't submit targets to the Copenhagen Accord and for 2050 pledges, we took previous announcements, or, in the absence of any such announcements (Turkey, for example), we assumed a business-as-usual growth scenario[4]. In addition, we assumed that international aviation and shipping will follow the modest announcements made by their respective industry associations[5,6], resulting in emissions of 1.8 $GtCO_2$-eq by 2020.

Many parties have indicated that working towards the stronger end of their pledged ranges, or making any further improvements, is conditional on a global and comprehensive agreement that doesn't currently exist. So the less ambitious ends of these targets are more likely to reflect the real outcome of the Copenhagen Accord.

Our most pessimistic projection assumes that countries hit their lowest stated ambitions, take advantage of surplus allowances and use credits fully. This leaves us with potential 2020 emissions from developed countries of 19.9 $GtCO_2$-eq — or 6.5% above 1990 emissions. That level substantially exceeds projections[4] of what would happen in developed countries if no additional mitigation action was taken by 2020. In other words, in the worst case the Copenhagen Accord pledges could permit emission allowances to exceed our business-as-usual projections. This hardly provides an incentive for developed countries to implement mitigation actions beyond those that were in place before the Copenhagen summit.

To arrive at a global number, we added in emissions from developing countries (accounting for their reduction pledges, we estimate these at 29.4 $GtCO_2$-eq), and the effects of deforestation. For this latter figure we used global estimates[7,8], and subtracted the pledged deforestation reductions by Brazil, Indonesia and other countries, to arrive at 2.5 $GtCO_2$-eq. This gives a total of global emissions of 53.6 $GtCO_2$-eq (when the 1.8 $GtCO_2$-eq contributed by international aviation and shipping is included), which is nearly equal to the

business-as-usual assumption.

In a more optimistic scenario, we assume that nations meet the ambitious end of their stated pledges without using surplus allowances and land-use credits. This gives 15.7 $GtCO_2$-eq for developed countries in 2020 — 15.6% below 1990 levels. Even in this scenario, with a major effort to reduce deforestation and lower emissions growth from the developing countries (to 28.6 $GtCO_2$-eq, with deforestation supplying an extra 1.8 $GtCO_2$-eq), global 2020 emissions levels would still be 47.9 $GtCO_2$-eq. Although this is significantly lower than business-as-usual, it is still far above an emissions pathway that could realistically reach the 2 °C target.

S. ENGELHARDT/GREENPEACE

Nations must commit to more than the lowest common denominator.

Both of these numbers — a 6.5% increase or a 15.6% decrease of developed-country emissions from 1990 levels — miss the IPCC range of a 25–40% reduction in emissions by these countries. This illustrates the massive deficiency of the Copenhagen Accord.

Long-term thinking

The chances of keeping global warming below a 2 °C rise also depend on long-term targets, which are strikingly absent from the accord. Just hours before the end of the negotiations, the draft agreement still contained 2050 reduction targets: a global reduction of 50% below 1990 emissions levels, and an aggregate developed-country reduction of at least 80%. These sentences were eliminated from the final draft.

> **"48 gigatonnes of carbon dioxide equivalents in 2020 is not on track — it is racing towards a cliff and hoping to stop just before it."**

If nations proceed on the basis of the few pledges they have made for 2050, the Copenhagen Accord will almost certainly miss its own 2 °C goal. Our model shows a greater than 50% chance that warming will exceed 3 °C by 2100.

If, on the other hand, nations agree to halve global emissions by 2050 from 1990 levels, then global industrialized emissions will need to decline on average 3.0–3.5% (compared to 2000 levels) in each year between 2020 and 2050 for the cases analysed above. Such reductions would require unprecedented political will to drive the necessary technological and economic innovation. For comparison, building all new power plants 100% emission-free would result in only a 0.7% annual reduction in global emissions until 2050. Even with halved emissions by 2050, the temperature increase would be limited to only 2 °C with at best a 50:50 chance due to high cumulative emissions.

The only way to achieve the 2 °C limit without betting on extreme reduction rates is to increase cuts before and by 2020. Specifically, in line with IPCC findings, with a 30% reduction below 1990 levels for developed countries and a 'substantial deviation' of 20% below business-as-usual levels for developing countries, it is possible to lower post-2020 reduction rates to less than 2.5% per year relative to 2000 levels. In this case, 2020 emissions levels are 40–44 $GtCO_2$-eq, depending on the assumed business-as-usual scenario.

Most analyses are in rough agreement about the future emissions levels implied by the Copenhagen Accord. However, there is a stark difference between studies about what emissions levels should be considered '2 °C compliant'. Sometimes, emissions levels of 48 $GtCO_2$-eq or higher in 2020 are misunderstood as synonymous with being on the right track[1,9,10]. Closer inspection of such pathways reveals that extremely ambitious rates of emissions reductions are in some cases assumed, such as a decade of 5% annual reductions from 2021 onwards. Such pathways lull decision-makers into a false sense of security that emissions trends can continue upwards for the next decade without any ramifications. On the contrary, pulling off 5% annual reduction rates post-2020 would necessitate radical policy interventions now.

A 48-$GtCO_2$-eq level in 2020 is not on track — it is equivalent to racing towards a cliff and hoping to stop just before it. In our view, 2020 emission levels exceeding 44 $GtCO_2$-eq should come with a warning label.

The prospects for limiting global warming to 2 °C — or even to 1.5 °C as more than 100 nations demand — are in dire peril. Many countries have acknowledged and called for what is required: a global and comprehensive agreement, with a robust and legally binding structure that provides the necessary investment environment for the private sector and the basis of trust between countries to reassure all that everybody is doing their fair share. The Copenhagen Accord is not that. Given that the negotiation mandates were extended, the possibility remains that countries can commit to more than the lowest common denominator — if not by the next summit in Mexico this year, then by further meetings in 2011. It is imperative that they do so. ■

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Further reading accompanies this article online at go.nature.com/2ChcyJ.