Beware of what you wish for in Copenhagen

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As world leaders board their flights and activists pedal their bicycles towards Copenhagen, insiders acknowledge there is no chance of a legally binding deal, public opinion seems to be becoming ever more skeptical and the carbon price is falling. As General Eisenhower put it at a difficult moment for the US 3rd Army: “Gentlemen, we should regard this as an opportunity.”

The opportunity is for the politicians to reaffirm their commitment to avoid dangerous climate change; to reaccept that this will likely require limiting warming to at most two degrees above pre-industrial temperatures; to accept that the measures they have been talking about so far are likely to prove completely inadequate; and to launch a genuine debate on how it is to be done.

One can imagine a saddle-sore activist grumbling “I didn’t cycle all this way for that!” But a “Global Deal” that pretends to solve the problem but turns out to be a dead-end would be much worse than no deal at all. Consider what “success in Copenhagen” might mean: endless conferences over emission quotas, from which your national negotiators return patting themselves on the back having negotiated a slightly-larger-than-expected quota (remember the Bluefin Tuna). Your government then celebrates their success by sharing these emissions out among their favorite industries and interest groups or auctioning them off for mind-blowing sums of money. It is not surprising that those suspicious of Big Government, like Czech President Vaclav Klaus, recoil in horror.

Yet President Klaus, and his political soul-mates, should also beware of what they wish for. They are probably hoping the Copenhagen talks will collapse in an argument about whether human activity is affecting the climate at all. For years they have focused solely on the scientific question of whether there is anything to worry about, in the teeth of increasingly overwhelming evidence that there is. As a result, they have yet to engage in the political question of what is to be done about it. While they are busy grubbing around in scientists’ hacked e-mails, climate policy is being made elsewhere.

Politicians on the right who do take global warming seriously are too afraid of being lumped together with those who do not to question the “Kyoto process” at all. They express bland support for a global cap-and-trade regime and otherwise stick to platitudes and photo-opportunities.

The problem is that the scientific evidence for what it will take to avoid dangerous climate change makes it increasingly hard to believe that a politically-negotiated cap-and-trade regime will ever get anywhere close. A popular misconception is that, because only about 50% of the carbon we release into the atmosphere actually stays there, if we reduce emissions by 50%, then concentrations will stop rising. So “50%(global-emissions-cut)-by-2050” will solve the problem. Unfortunately, this is not true. The other 50% of the
carbon we release remains in the near-surface ocean and biosphere, with only a very small fraction being removed from the “active carbon cycle” each year. So carbon dioxide accumulates in the system, and a 50% cut in emissions would mean atmospheric concentrations continue to rise, just roughly half as fast as before.

Avoiding dangerous climate change will require us to limit cumulative emissions of carbon dioxide, meaning the total amount we release into the atmosphere over all time, not just the flow of emissions in any given year or commitment period. Surprisingly, this relatively uncontroversial scientific fact is not, to my knowledge, mentioned anywhere in any text under consideration in Copenhagen.

A number of papers have been published this year pointing out the importance of cumulative carbon dioxide emissions: in one, published in April, we estimated that releasing one trillion tonnes of carbon, through fossil fuel combustion, cement manufacturing and deforestation over the entire period of industrialization, past and future, would cause a most likely peak warming of around two degrees. How fast we emit that trillion tonnes makes little difference to peak temperatures. Figure 1 shows three scenarios for carbon dioxide emissions, each of which corresponds to the same cumulative total, but which have very different emission rates in 2020: the long-term temperature response of the climate system is very similar.

This does not, of course, mean that 2020 emissions are irrelevant: the higher we allow emissions to rise in the short term, the faster they have to fall to stay within any given total: the blue curve shows emissions falling at 8% per year from the 2030s onwards, which may well prove technically infeasible. But 2020 emissions matter insofar as they affect the cumulative total: they do not, in themselves, determine the risk of dangerous climate change. This matters, because many short-term fixes to meet a 2020 emission-rate target might have no impact at all on, or even exacerbate, the total amount of carbon dioxide we release over all time.

A second paper, published at the same time and led by Malte Meinshausen of the Potsdam Institute for Climate Impacts Research, estimated that keeping the risk of temperatures exceeding two degrees to less than one-in-four would require a limit of less than three quarters of a trillion tonnes of carbon. So with over half a trillion tonnes of carbon released already, we can release somewhere between half as much again and the same again before we are committed to at least two degrees of warming.

Estimates of fossil fuel reserves are notoriously fickle, but there are thought to be around half a trillion tonnes of carbon left in the ground in the form of useable oil and gas, anything up to three trillion tonnes of coal and half as much again in unconventional fossil fuels like tar sands. So there is no chance of fossil fuels running out before we run out of “space” in the atmosphere to dump the carbon dioxide they generate – which will happen, on current trends, in only 20-40 years (have a look at http://trillionthtonne.org).

Acknowledging this point, the German Climate Advisory Council (WBGU), in a report published in June of this year and summarized in the “Copenhagen Diagnosis” published...
last week, proposed an emissions “budget” for 2010 to 2050 corresponding to a cumulative target of about ¾ of a trillion tonnes of carbon overall. They proposed allocating this budget between countries based on their share of the world population in 2010. Under this budget, the USA would have to reduce its net emissions to zero by around 2020, Germany by 2030 and even China would run out before 2045. In contrast, the USA is currently offering to reduce its emissions to 17% below 2005 levels by 2020: a long way from zero.

Under the WBGU proposal, actual emissions in rich countries like the USA could only continue beyond these dates through the purchase of emission rights from poor countries like India. The scale of wealth transfer through these transactions would be huge, representing a significant redistribution of wealth from rich to poor nations.

As a scientist, I completely agree with the WBGU’s assessment of the need to limit cumulative carbon dioxide emissions, the advisability of staying below the two degrees “guardrail” and the overall carbon budget consistent with this goal. It is important to stress this, because, as a citizen, I view their prescription of how to do so with a horror not far off that of Vaclaf Klaus’.

The problem is that the WBGU’s proposal, like James Hansen’s global carbon tax and Oliver Tickell’s “Kyoto2” global auction of emission permits, represents a massive extension of state power over the lives of individuals and private corporations. Everyone claims that money that is raised through carbon taxes and permit auctions can be used to reduce the burden of taxation elsewhere or simply redistributed to individuals, but it still has to pass through a national or supra-national budget along the way. If this money is under the direct control of politicians, we all know what they will do with it, and if it is placed in an apolitical “climate bank”, how will that banks’ directors be held to account?

We have already seen, in Britain, growing public hostility to even modest measures to combat climate change like the phase-out of energy-hungry light-bulbs. It is often said, quite rightly, that to be effective in preventing dangerous climate change such measures will have to become much more intrusive. An image that is often used is “placing the world on a war footing” because, of course, in war civil liberties can be suspended, rationing introduced and so forth.

Journalists tend to assume that climate change is a team sport, so if you agree with someone on the science then you have to agree with them on everything else. Because, for so long, Kyoto has been the only game in town, if you took climate change seriously, you had to support the Kyoto process – or something even more intrusive. But given the likely impacts of climate change over the next 20 years or so, which are the critical decades for climate change mitigation, I find it very hard to believe the public will stomach the kind of sacrifices that will be needed to solve the problem if they see them purely as government-imposed.

But where are the alternatives? Because most of those opposed to Big Government have spent the past decade in denial that there is any problem at all, there is nowhere for
people like me, who take the problem seriously but don’t like the sound of a Kyoto-style solution, to go. Whose demonstration would I join in Copenhagen? It hasn’t helped that the “alternatives” put forward by opponents of the Kyoto process, like Bjorn Lomborg or the Bush administration, turn out to be laughably ineffective. This feeds the impression that the choice is between signing up to Kyoto or doing essentially nothing. What we need is a genuine debate about alternatives to a global carbon tax or cap-and-trade regime that would be just as effective in avoiding dangerous climate change.

In this week’s issue of *Nature Geosciences*, David Frame, Chuck Mason and I float one such proposal. We call it SAFE (Sequestered Adequate Fraction of Extracted) carbon. We begin, like the WBGU, from the premise that the total amount of carbon we can release into the atmosphere is limited, and there is substantially more underground in fossil fuel reserves.

To prevent dangerous climate change, we need to ensure that the net flow of carbon into the atmosphere converges to zero before we reach the atmospheric capacity, currently estimated to be somewhere between three quarters of a trillion and one trillion tonnes of total carbon emissions. One way of ensuring this would simply be to mandate the fossil fuel industry to sequester (artificially remove from the active carbon cycle) a steadily increasing fraction of the carbon content of the fossil fuel they extract from the ground. How they remove it should, as far as possible, be left up to the industry. It could be sequestered as carbon dioxide underground or, if environmental concerns are met, in the deep ocean. If a cost-effective way can be found of doing so, it might even be converted back into limestone rock. We define a source of SAFE carbon as one in which the sequestered fraction is tied to cumulative carbon emissions such that it rises to 100% before the atmospheric capacity is reached.

Figure 2a shows how we suggest the sequestered fraction should increase with cumulative emissions to reach 100% before we release the trillionth tonne. Politicians could argue about the exact shape of the curve, but there isn’t much to argue about: in the end, we have to connect the lower left corner (half a trillion tonnes emitted, sequestered fraction zero) to the upper right corner (a trillion tonnes emitted, sequestered fraction 100%).

If everyone were to use SAFE carbon, it does not matter for the climate how much we consume: the red curves in figures 2b and 2c show two very different scenarios for future fossil fuel consumption, but if sequestration rates increase as dictated by panel 2a, atmospheric emissions (blue curves) end up almost identical. If, like the WBGU, we assume that non-fossil greenhouse gas emissions are controlled through separate measures, this would prevent dangerous climate change, with no new taxes or restrictions on anyone’s consumption. Doesn’t that sound attractive?

Of course, there is a price to pay: carbon capture and sequestration is expensive, and no one really knows how expensive it will be because no one is yet doing it at any scale. Making carbon SAFE could easily double the cost of fossil energy over the next 30 years.
But if an industry knows it has to do something as a price of continuing in a profitable business, they are generally quite good at finding the cheapest way of doing it. At present, our approach to carbon capture and sequestration is a handful of government-sponsored “pilots”, which are far from guaranteed to identify the most cost-effective approaches. Since the pipes, ports and mines through which fossil carbon comes into Europe are very easy to monitor, the European Union could request its fossil fuel suppliers to supply it with SAFE carbon within a decade, and invite our trading partners to do the same.

Under a SAFE carbon regime, consumers would have to pay more for fossil energy. But they would be paying directly for the cost of ensuring that their consumption does not cause dangerous climate change, not for a carbon tax or emission permit that is explicitly intended to change their behavior. I, for one, would prefer this, since I don’t want to go through life worrying about whether I have changed my behavior enough.

It may well be that, once the cost of making carbon SAFE is included in the price, consumers decide to switch to nuclear or renewable energy or even to take shorter hot showers. But that, as Margaret Thatcher would say, should be up to them.

SAFE carbon would cost much the same for everyone, rich and poor. Why then would a country like India ever agree to use it? But we don’t need India as a whole to use SAFE carbon: we simply need Indian industry, which wants to sell us stuff, to adopt it. Poor subsistence farmers, wherever they are, make very little contribution to climate change. And they certainly deserve help: it would make perfect sense, as part of an agreement for everyone to use SAFE carbon from now on, for those responsible for the bulk of cumulative emissions to date to agree to pay the lion’s share of the cost of adaptation.

Many activists heading for Copenhagen would see SAFE carbon as a lost opportunity for redistributing global wealth and generally using climate policy to right all the wrongs they see in the world. But if a policy is worth doing, it is worth doing in its own right: in asking climate policy to achieve too much, we risk it achieving nothing at all.
**Figure 1: it's the total, stupid.** Three scenarios for carbon dioxide emissions (left panel), each corresponding to a cumulative total emissions of one trillion tonnes of carbon, and most likely temperature response (right panel). The impact of emitting a trillion tonnes faster or slower is dwarfed by uncertainty in the response (grey shading).

**Figure 2: SAFE Carbon Futures.** Under a policy that avoids releasing, for example, more than one trillion tones of carbon in total, the sequestered adequate fraction of extracted (SAFE) carbon needs to approach 100% as the cumulative carbon emissions approach this total (a). This automatically gives similar atmospheric emissions (blue lines, panels b and c) under very different scenarios for future fossil fuel consumption (red lines), but requires very different levels of total sequestration (grey regions). (A1T-R based on A1T scenario, corrected to A1 to 2010 plus a 25% increase in the rate of growth of renewable energy after 2020 and a doubling of nuclear capacity between 2050 and 2100.)

German version appeared in the Frankfurter Allgemeine Zeitung, December 7th:
http://www.faz.net/s/RubC5406E1142284FB6BB79CE581A20766E/Doc~E2C1B117E24EE4783A05AFD5816ADA5E0~ATpl~Ecommon~Scontent.html

based on Allen, Frame & Mason, Nature Geosciences, December, 2009:
http://www.nature.com/ngeo/journal/v2/n12/full/ngeo709.html