



Why Averting Climate Catastrophe Requires Setting Carbon Budgets, Not Targets

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On November 11, 2014, China and the United States announced what was hailed as a breakthrough agreement on climate change. The United States promised reductions in carbon emissions by 2025 to 26% below the 2005 level, and China promised to begin reductions in 2030. Although this was a welcome first move toward commitments by both nations, critics were quick to point out that the targets were lax or vague for dates set far in the future with no enforcement mechanisms.

There is, however, a deeper problem – not just in the U.S. deal with China, but also in promises already made by the European Union, Japan, and other important players. A focus on setting targets for yearly emissions reductions will not work, because *the amount of climate change humanity can expect in the future depends on how much carbon accumulates in the global atmosphere over decades and even centuries*. As I am about to spell out, to avert catastrophic climate change, the world's nations and peoples need to set overall carbon budget limits, not just aim for reductions to particular targeted rates of emission in particular years.

The Logic of Earth's Carbon Budget

The amount of carbon in Earth's atmosphere largely determines the extent to which the sun's radiation is trapped and heats up the planet. Carbon released from burning fossil fuels, mostly in the form of carbon dioxide, largely remains in the atmosphere for decades and then circulates through marine and terrestrial systems resulting in higher atmospheric concentrations for thousands of years. From the point of view of human lifetimes, the carbon people send up into the atmosphere is effectively permanent.

The relevant arithmetic is not about levels of carbon emissions but about sums. In the year 2030, the amount of carbon dioxide and other greenhouse gases in the atmosphere will be the amount that's there today, plus the amount we add next year, plus the year after next, the year after that – until 2030 actually arrives. The amount emitted in 2030 or any other individual year is not the point; the total accumulated is what matters.

This fact is recognized by the United Nations Intergovernmental Panel on Climate Change. In its most recent report, this authoritative body proposed that Earth can survive only a maximum of about 1000 billion tonnes of additional carbon emissions measured in carbon dioxide equivalent terms. (A "tonne" is a metric ton, about 1.1 times a standard U.S. ton.) This maximum is believed to give humanity a two-out-three chance of limiting climate change to two degrees Celsius, which scientists think might be sufficient to avoid the most catastrophic risks for future generations. No one knows for sure, but two degrees Celsius gives us better odds than if temperatures rise above that threshold.

Here is the alarming bottom line: At current rates of carbon emissions across the globe, the world will blow past this budget in less than three decades. To put it simply, according to the Intergovernmental Panel – backed February 11, 2015 <https://scholars.org>

up by nearly every other scientific study or body that has looked at the issue – people on Earth have only a certain number of additional carbon emissions chips to be played if we want to limit the risk of a climate catastrophe for our children and their offspring.

Budgets versus Targets

If humans on Earth have a total carbon emissions budget that nations somehow must learn to live within, just setting targets won't be enough to accomplish the task. A target aims at an emission level in a given year, but doesn't keep total accumulated emissions within the budget.

To see why, imagine a recreational gambler at a casino. He realizes he might risk his family's financial health at the gaming table, so he purchases a certain number of chips and promises to play those and no more. This budget-setting approach can work. Win or lose, when the chips are gone, the gambling adventure is over and it is time to go home with the family finances still intact. But suppose that instead of holding himself to a fixed number of chips, the gambler tells himself he will not bet more than 20 chips between 11 pm and midnight. That promise could have some significance, but it is not nearly as effective as simply setting a firm total of chips to be spent, no matter when. In fact, if the gambler runs up large losses when the night is still young, by 11pm his noble promise may not make any difference at all.

This is exactly how it is with global carbon emissions. Every ton emitted this year, next year and so on counts the same as a ton emitted in an eventual target year. Postponing effective policies until the last moment and then going on a crash diet leads to virtually the same atmospheric carbon concentrations as having no policies at all. Pledges to cut back to a certain emissions level at some future time do not mean very much.

Realistically, the situation is even worse. If countries merely promise to hit particular levels for carbon emissions in a given year or string of years, exceeding such limits resembles a mere "oops" – a disappointment not consequential for meeting the further targets. On the other hand, if countries – alone or together – promise to stay within a total budget for future carbon emissions, each ton emitted above the intended level in a given year has to be offset by one less future ton. In the gambling analogy, if the man loses too many chips between 10 and 11pm, he has that many fewer to risk between 11pm and midnight. Since climate-related pledges to cut back carbon emissions may be even more difficult to live up to than gamblers' resolutions – and similarly lack real enforcement mechanisms – slippage on targets is likely to be the rule.

Setting a Carbon Budget

If the planet needs to hold itself to a total carbon budget, national policies and international agreements must do the same. Divvying up the remaining global pile of carbon chips is difficult, but setting distant targets will not work. The United States should take the lead by proposing its own firm carbon budget, to make policy choices clear – and specify the share of the global budget we claim. This would start an honest discussion of global fairness and cooperation, a discussion we have put off by announcing loose emission targets.. Once Americans know what budget we're trying to adhere to, we can evaluate specific policies like carbon caps, taxes, and other measures according to how well they help us meet the budget at acceptable cost.