Recent climate change research points to a growing global crisis

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The latest climate research shows that merely stabilizing carbon dioxide (CO2) emissions at current levels will neither halt the increasing atmospheric concentration of carbon dioxide nor contain the global average temperature. If the targets are to be reached of keeping carbon below twice the recorded pre-industrial level and of keeping global temperature increases below 2 degrees Celsius (2° C), carbon emissions must "peak and decline within the next few decades, and ultimately fall to zero."

The research was published in *Environmental Research Letters* (Steven J. Davis *et al* 2013 January) by a team of researchers from the United States and China.

Since the early 1990s, two values have been associated with stopping global warming. These are keeping atmospheric carbon dioxide concentrations below 450 parts per million (ppm), which generally coincides with keeping the average global temperatures from rising above 2°C beyond what they were at the beginning of the 20th century.

These two values were established by the United Nations Framework Convention on Climate Change (UNFCCC) and are in place to avoid "dangerous anthropogenic interference with the climate system." The current values are CO2 concentrations of 392 ppm and 0.8° C above preindustrial temperatures.

The UNFCCC values have led to the misconception that changes below 2° C are okay, and that carbon emissions below this point are not harmful. This is not the case, as already demonstrated by experience. Global weather patterns are already becoming more extreme and Antarctic ice is already reported to be melting, causing sea levels to rise.

Both are caused by the initial stages of global warming, and will get more severe even before the somewhat arbitrary point of 2° C. These problems are separate from the higher-end consequences such as a massive sheet of Antarctic ice falling into the ocean, raising sea levels by several meters almost instantaneously.

One of the seminal papers detailing steps to stop global warming was published nine years ago in *Science* (Pascala and Socolow August 2004). In that paper, the authors discussed a series of steps, termed "stabilization wedges," to prevent global warming. They set a plan in three stages, to slow the growth of emissions, stop the growth of emissions, and then reduce emissions. Critically, they asserted that all that was necessary over the next 50 years to prevent a 2° C warming was to slow and stop the growth of emissions. Under the 2004 paper, reducing emissions could wait another 50 years.

In the passing years, not one of the benchmarks that were established in 2004 has been achieved. On the contrary, carbon emissions into the atmosphere have accelerated. In 2010 alone, annual global carbon emissions exceeded nine gigatons. At that level, holding emissions constant for 50 years is most likely not enough to avoid an atmospheric carbon dioxide concentration of 500 ppm or a global temperature increase of 2° C.

To show the full scale of what is required to avoid the benchmark of 2° C, Davis *et al* performed simulations with the UK Met Office-coupled climate/carbon cycle model HadCM3L to project mean surface temperatures based on previous estimates of carbon reduction.

Under the 2004 scenario, given more recent carbon concentrations, the simulations revealed that carbon dioxide levels would reach 500 ppm in 2042 and atmospheric warming of 2° C by 2052. A simulation using the assumption that current carbon emissions

stabilize at 2010 levels has a warming effect of 1.92° C by 2060 and a carbon dioxide concentration of 500 ppm by 2049. Even with a halt in the increase of carbon output, substantial warming that surpasses the benchmarks will occur within a half century.

Davis *et al* is among a body of literature that shows that current global warming trends are unsustainable. The most prominent of these is from the 2007 Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change, a body that draws thousands of researches from the climate science community to assess the aggregate effects of climate change, both short- and long-term.

The basics conclusion of AR4 is that, with current global warming trends, the average surface temperature of Earth is likely to rise anywhere from 1.1 to 6.4 ° C, on top of the current temperature, which is already up 0.8 degrees. In other words, the lowest estimate, based on the lowest emissions scenario projected, will have an average global temperature increase of 1.9° C above preindustrial levels.

The next IPCC report will be issued in 2013, and is expected to further confirm these predictions. This is corroborated by intervening studies specifically checking the IPCC predictions. All show that, with current carbon emissions, global warming will continue unabated.

Those same studies also refute the idea that short-term variability could be the causes of current temperature increases. There are three main ways that global temperatures can be influenced outside of greenhouse gases: the El Niño/Southern Oscillation, volcanic activity and the variable energy output of the Sun. The reports clearly show that while seasonal and year-by-year oscillations in the temperature are seen as a result of short-term effects, the long-term effect is a linear trend of rising temperatures and sea levels corresponding with increased carbon dioxide concentrations in the atmosphere.

Building off these reports, Davis *et al* comes to the conclusion that world society would have to cut a total of 775 gigatons of cumulative emissions. It also points out the benchmark of 450 ppm of CO2 concentration is possibly no longer physically feasible even if current carbon emissions stopped immediately. In those scenarios, negative carbon emission—such as capturing carbon from the atmosphere and storing it—are necessary.

It then looks at a variety of carbon emission reduction schemes, considering the best case scenario if minimal carbon emissions are allowed. They found that even if carbon emissions peak at 10.3 gigatons per year in 2020, then decline sharply to 2 gigatons per year in 2060, “the concentration of atmospheric CO2 nonetheless reaches 443 ppm in 2050.” All higher emission scenarios result in concentrations of 500 ppm and higher.

From their research, the authors of Davis *et al* arrive at the conclusion that “50 years of current emissions is not a solution to climate change” and that “the ultimate solution to the climate problem is a complete phase-out of carbon emissions.”

The report is imbued with a necessary urgency. Humanity has the creativity and technology to overcome the challenge global warming poses to modern society. All that stops such developments are the nation-state system and the drive for private profits. As Leon Trotsky noted in 1940, “mankind is suffering from the contradiction between the productive forces and the too-narrow framework of the national state.” The crisis of global warming exemplifies this statement.