The Costs of Delay

HAL HARVEY
Chief executive officer,
ClimateWorks Foundation

SONIA AGGARWAL
former manager of global research
and special projects,
ClimateWorks Foundation

Physics harbour a frightening punch line for the story of climate change: even though the consequences of global warming persist for the very long term, the time available in which to avoid them is very short. Thus a delay — of even a decade — in reducing CO_2 emissions will lock in large-scale, irreversible change. It also increases the risk that the whole climate system will spin out of control.

This message may be alarming, but this is not alarmism. It's physics. And the earth's climate physics have serious implications for political action and technological innovation in the coming decade.

The story has five parts:

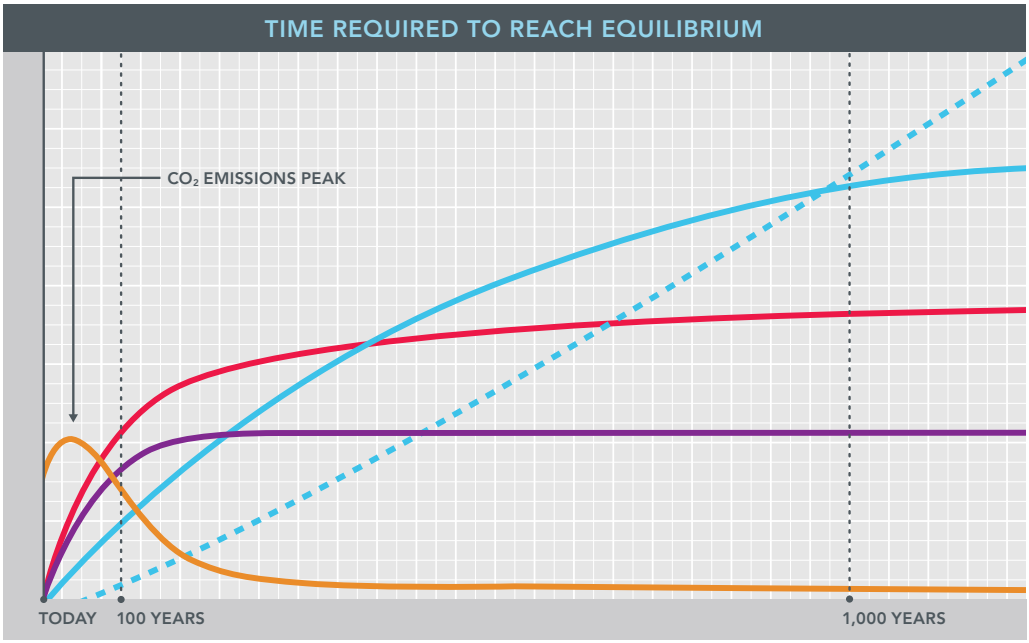
1.
Stabilizing CO_2 at any concentration requires very low emissions

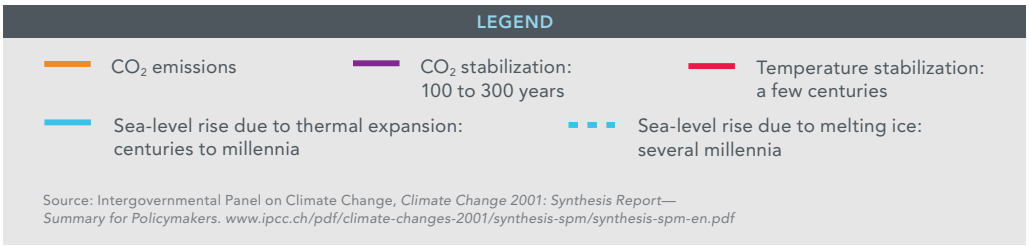
For hundreds of thousands of years prior to the industrial era, such natural processes as plant growth, animal respiration, and soil erosion kept atmospheric concentrations of CO_2 in balance. But burning fossil fuels has introduced as much carbon in the past 50 years as had been sequestered over millions of years, thus upsetting the natural balance. Atmospheric CO_2 concentrations are now nearly double their pre-industrial level.

Once emitted, CO_2 remains in the atmosphere for centuries, or even millennia. Every ton introduced is therefore cumulative, and the resulting increases in concentration will persist in the atmosphere for thousands of years — even if emissions are reduced tomorrow. So stabilizing CO_2 concentrations at any level ultimately requires very low emissions.

2.
Carbon "sinks" are disappearing

Until recently, natural "sinks," primarily oceans and plants, absorbed much of the carbon dioxide dumped in the atmosphere. About a quarter of the CO_2 released each year is absorbed by the oceans (making them more acidic) and roughly another quarter by plants. These natural safety valves have masked almost half the impact of our emissions. But as the world emits more CO_2, these sinks are becoming saturated. Although oceans continue to absorb a greater volume of CO_2, they are becoming less efficient sinks, able to take in a shrinking per centage of emissions. This means that even if emissions remain constant, the growth rate of CO_2 concentrations in the atmosphere will soon jump, as this physical forgiveness gives out. Then we will be in deep trouble.





Source: Intergovernmental Panel on Climate Change, *Climate Change 2001: Synthesis Report—Summary for Policymakers. www.ipcc.ch/pdf/climate-changes-2001/synthesis-spm/synthesis-spm-en.pdf*

"Addressing climate change is like turning an ocean liner: Changing course takes time, and no amount of rudder, applied too late, will hit the mark. If the world does not start to reduce emissions now, it will not reach any meaningful CO_2 concentration target."

3.
Many impacts of climate change are irreversible

Due to time lags inherent in Earth's physical systems, climate changes caused by CO_2 emissions will persist — and even grow — for centuries, even after emissions are halted. We are already seeing some effects of increased greenhouse gas levels, but have yet to witness the full impact of the current atmospheric accumulation. This is because the earth's surface temperature does not react instantaneously to rising carbon dioxide levels, largely due to the oceans' tremendous capacity to absorb heat.

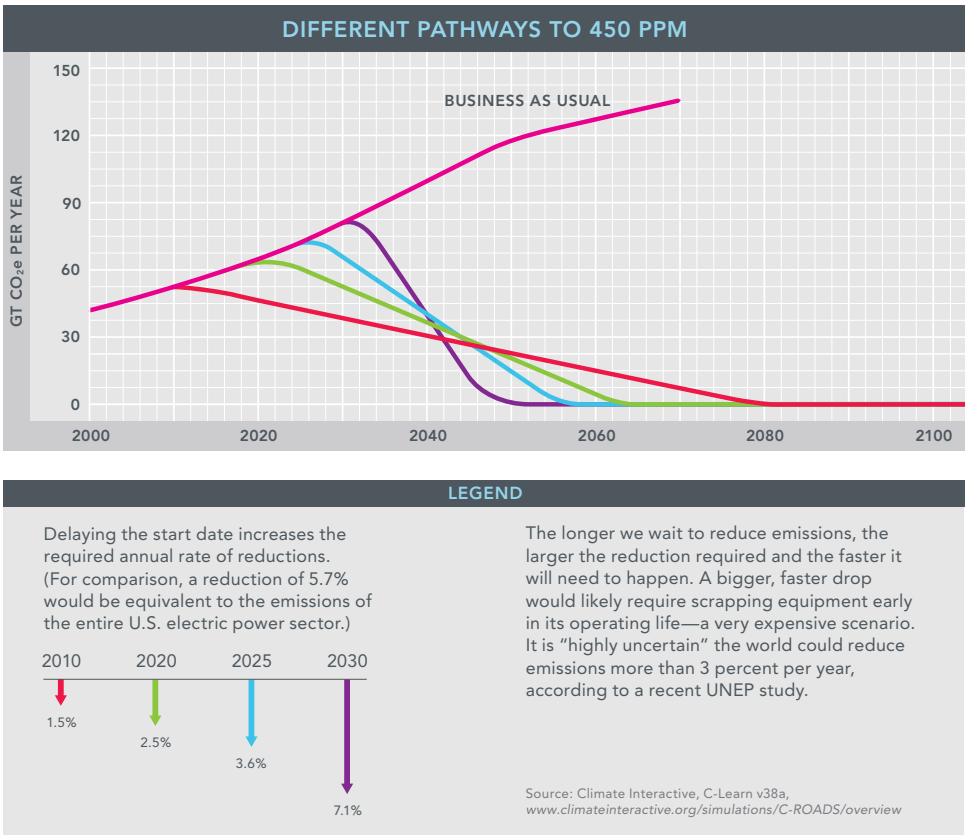
The changes can have serious consequences: permanently altered ecosystems, extinctions, and significantly reduced crop yields. Projections suggest we will lose 18 to 35 per cent of all species due to climate-forced extinctions. Other system changes — from ocean circulation to ice melt — are irreversible for thousands of years, at least.

4.
The system can spin out of control

The earth's reactions to changing CO_2 concentrations — altered global weather patterns, ocean temperature and acidity, and ecosystems, to name a few — are not linear. They can snowball, eliminating our ability to influence the outcome.

As warmer temperatures melt sea ice and reduce snow cover in the Arctic, for example, the darker surfaces of the newly exposed ocean and land absorb more heat from the sun than the light-colored ice and snow that previously covered them. This accelerates warming, further reducing snow cover. And the thawing permafrost in the Arctic Ocean is starting to leak large amounts of methane, a powerful greenhouse gas, into the atmosphere. Release of even a fraction of the methane stored in the seafloor could trigger abrupt climate warming — and there is no practical way to contain it. If we are to reduce

© Hyperakt



the risk of such runaway feedback loops, we must rapidly cut greenhouse gas emissions.

5.
Acting now saves money

Most energy-consuming assets — such as buildings, vehicles, factories, and power plants — have long lives that lock in their patterns of energy use for decades. The cheapest way to reduce CO_2 emissions is to ensure that new capital equipment is very efficient and powered by low-carbon sources. It will be enormously costly if the world misses this opportunity, builds inefficient infrastructure, and then has to renovate it. Transforming infrastructure at the same pace as natural capital stock turnover is cheap; forcing such a turnover is very expensive.

Nations must put energy efficiency policies — such as fuel efficiency standards and building codes — in place now, not later. And governments must invest substantially now in research and development to drive down the cost of clean technologies and convert our energy supplies to near-zero sources. If we delay, the cost of reducing emissions sufficiently will shock the global economy.

Given carbon dioxide's persistence in the atmosphere, it is useful to think of emissions in terms of a CO_2 budget, or a maximum volume of cumulative emissions that will allow atmospheric concentrations to stabilize.

If the world is to limit average global warming to 2° C — a threshold most climate scientists describe as a dangerous tipping point — it will need to stabilize atmospheric CO_2 at about 450 ppm. This corresponds to a total CO_2 budget of about 1,000 gigatonnes, or a trillion metric tons, of emissions for 2000–2050. Yet in just the first five years of this century, the world used up nearly 20 per cent of this 50-year carbon dioxide budget; at current rates, the full budget will be depleted in less than two decades.

For more information, including references to peer-reviewed source documents, see "The Costs of Delay" at www.climateworks.org/CostsOfDelay.

Addressing climate change is like turning an ocean liner: Changing course takes time, and no amount of rudder, applied too late, will hit the mark. If the world does not start to reduce emissions now, it will not reach any meaningful CO_2 concentration target.

The longer we wait, the more drastic the cuts — and associated costs — will be. If we delay action for even a decade, CO_2 concentrations are likely to soar right past 450 ppm and unleash dangerous, uncontainable ecological and geophysical responses. If we instead step up to the challenge, pass strong energy policies and invest aggressively in clean energy R&D, we have a fighting chance of containing CO_2 concentrations at 450 ppm — and averting a climate catastrophe.