A short introduction to the Climate Emergency

Carbon dioxide (a.k.a. CO2) and other so called “greenhouse gasses” act like a transparent blanket in the atmosphere, allowing sunlight in, but trapping warmth at night. The metaphorical thickness of the blanket is described by the concentration of CO2 in the atmosphere – or the CO2 equivalent. Before humans started releasing CO2, by clearing large areas of vegetation and burning the ancient stored carbon from fossil fuels, the concentration of CO2 was around 270 ppm. It reached 350 ppm circa 1987 when there was still time for a well designed global ETS to work. Rates of burning fossil fuels and deforestation continued to grow for 22 more years and we now find ourselves in the midst of a silent crisis. At the end of 2009 the CO2 concentration (in Hawaii) was a little over 387 ppm – and rising fast.

How much carbon is humanity "permitted" before we reach unsafe climate levels?

Our best estimate is that an additional 420 Gt of CO2 released through human activity will still allow the atmospheric concentration of carbon dioxide to return to 350 ppm around the end of this century. That should stop further melting of the ice caps during the 22nd century. The Earth’s ice caps are essential to maintain ocean currents and the sorts of climate systems which enable agriculture to feed us. Even under a successful 350 ppm programme, CO2 concentrations are expected to build up to 410 ppm before human emissions become small enough to allow nature to start bringing the concentration in the atmosphere down. For this to happen, we rely on healthy ecosystems, especially in the oceans, to continue removing CO2 from the atmosphere at high rates without “fatigue”, saturation or acidification.

There have been economic studies by Britain’s Lord Stern and Australia’s Ross Garnaut which examine scenarios consistent with CO2 concentration targets of 550 ppm and 450 ppm, but both those “stabilisation levels” carry a high risk of triggering runaway global warming due to “positive feedback” effects inherent the global climate system. A different kind of target, one to limit average global temperature rise to less than 2C above the pre-industrial average, is also considered unsafe by the scientists who worked on calculating the carbon budget required to achieve it. The work of Meinshausen et al. correlates a global carbon budget of 670 Gt released from 2010 to the end of the century with a 75% chance of staying below 2C.

When you hear or read about a “2C target” mentioned in the media, they are usually talking

about a 50-50 chance of staying below this unsafe target. A 50% chance of reaching a less than 50% chance of avoiding fatal catastrophe would remind many people of the term “death wish”, but it allows a much bigger carbon budget and more time for the business as usual of denial.

I have created some mathematical modelling for a few scenarios using figures for Australia, which, if extrapolated to the entire rich world, strongly imply that even with an excellent global agreement producing rapid action starting in Jan 2011, the world will need to emit at least 540 Gt. This figure lies in the middle between the 350 ppm target and the (75% chance of) 2C target. A serious and effective response has been stalled and we are already running more than 5 years late. Therefore, it is right to say the Kyoto Protocol is a disaster. If my estimates are anywhere near the mark, then to get below 350 ppm, humanity will have to find a way to extract more than 120 Gt of CO2 from the atmosphere before 2100. This will certainly require a lot of energy.

Should we think in percentages or gigatonnes?

We should start with the fixed, finite and inescapable figure of a limited carbon budget in gigatonnes of carbon dioxide (Gt-CO2). It is essential that we assume a big picture perspective and consider the fact that this is humanity’s last metaphorical tank of fossil energy and we need to make it last forever. You could also say it is our last wish from the fossil energy genie and the future of humanity is at stake. It is my strongest recommendation that for our last wish we should ask for more wishes – for another energy genie, so our descendants may have the survival options which only energy can provide. Consider that, around 200 years ago, the human population was already as high as it could have been without a new source of energy. Consider also, that a population reduction over a time span of decades rather than centuries means mega-deaths. I strongly believe that our most important duty to the future is to build a clean energy system to replace our dirty old fossil genie. Talk about reduction percentages does not quite focus the mind on the finite nature of our situation to the extent that we ask ourselves, what is the best way to spend our final tank of fossil fuel?

We can talk about percentages, mandatory measurable targets and milestones once we have a specific and effective national climate and energy strategy. When all the Earth’s national strategies have been modified and refined until they add up to less than the global carbon budget, then we will have an “agreed” global trajectory which specifies global emissions in any year. Out of an iterative process involving a series of trial run auctions of the limited global carbon budget, interacting with the changing expectations of governments faced with a realistic world carbon price, we will discover at what price the world expects to meet its global emissions limit.
Goals and milestones should be based on real plans, rather than arbitrary percentage

“reductions” based on vague unjustified assumptions such as exponential decay, instead of linear or stepped trajectories, and other presumptions about cheap offsets or trade in carbon allocations.

What gigatonnage appears to equal what temperature increase?

The answer is found in probability curves representing the uncertainty related to our degree of ignorance. What chance of success or degree of certainty would you like in this answer? CO2 itself or “equivalents” also complicate the question. What is it that you really want to know?

What percentage cuts would different nations need to undergo, and in what timeframe?

100% cuts by 2035 for the whole world. Nations will choose their own trajectories within the global carbon budget depending on how much carbon allocations they are willing to pay for or wish to sell above or below the per-capita allocations of their own populations.

How do we get there - via carbon trading, a carbon tax, or something else?

A world carbon price and a global emissions tragectory will come out of the trial auctions of the global carbon budget and every nation will be committed to its own trajectory and transition strategy. A global recycled carbon tax – (that is, a global carbon tax with 100% dividend, a.k.a. an “untax”) will be implemented ramping to the recommended price over 5 years. The economic value of the global carbon budget is the equal property of every person, living and expected to live during the next 30 years, so the revenue must be distributed equally to all. Meanwhile, every government implements emergency measures and drives massive public and private investment to replace their old fossil energy systems with clean alternatives. This redirection of productive effort will cause shortages of some items, but full employment for the (25 yr) duration of the transition is assured. As the rich economies complete the transition to zero carbon, they will be paying off their carbon debts to the developing nations and also have excess production capacity for clean energy infrastructure – going cheap. Many developing nations will pursue clean development at that time. When today’s rich and poor countries have been developed according to the wishes of their people, with clean energy sources, maximum recycling, minimum ecological footprints, and stable populations, then we will have sustainable human economies at last. But it won’t be as easy as it might have been if we had only started a decade ago.

By how much can developing countries like India or China increase their emissions?

Within a finite global budget associated with a finite global trajectory, if any population's emissions decrease at a slower rate than the global envelope, then emissions must decrease faster somewhere else. Any increase in the rate of emissions by one group will require even more rapid reductions by others.

Contraction & Convergence relies on the assumption that countries with high per capita emissions will reduce them much faster than the global envelope, thus making room for increases by other countries. Putting it another way, it is essential that the required global rate of emissions reduction is less demanding than the rate at which rich countries can transform their economies. Unfortunately, time wasting has collided with climate science and this critical assumption is now almost certainly false. The global carbon budget is now so tight that we will be lucky if the developed economies can transform themselves fast enough to merely duplicate or match the necessary global trajectory.

The profound implication is that emissions will have to decrease everywhere at least as fast as the overall global trajectory, no matter how low current emissions happen to be! Obviously, this is unjust and a major impediment to global cooperation – unless adequate compensation opens the way for clean development for those who voluntarily forgo developing with a carbon economy. The rich can pay the poor, or else they can try to pay themselves if they really can slash emissions fast enough, or else they may choose to go without energy, but, unless they have to pay according to a just system where every person is treated equally, the poor will not cooperate with another theft of resources by greedy rich people. It is difficult to starve yourself and your family to death so that some fat foreigner can fly in a jet plane. It is simply not possible for the poor to decrease their emissions, or even to stop increasing their emissions, just because the rich want to use them for themselves. The rich have to make a much better offer – one based on equity and justice.

The global budget for getting down to 350 ppm by 2100 is 420 Gt-CO2 and humanity emitted 34 Gt-CO2 in 2008. At that rate, the global budget would last 12 years and 4 months – then nothing at all. More realistically, a linear descent would last 24.7 years so that human induced emissions would have to reduce to zero before 2035. To allow some "emissions space" for developing countries to decline more slowly, let alone have temporary increases, the rich nations would have to become carbon neutral much sooner than 2035. How much sooner and why would they try? Why would poor nations cooperate? This is the next issue of denial after global warming itself.

From a global justice perspective, the 420 Gt-CO_2 budget allows for 60 tonnes per capita when shared amongst 7 billion people. Depending on how we count imports and exports, that would last Australians between 2 and 3 years, then there'd be nothing left at all. A rapid linear descent trajectory would have to reach zero emissions in 4 to 6 years. That is just impossible, so it is already too late for the high emitting wealthy nations to avoid using up other people's emissions allocations.

Australians currently produce emissions at roughly 5 times the average global rate, so, if we are to match the shape of the global per capita trajectory and ramp down to zero before 2035, we would have to buy, beg, borrow or steal another 240 tonnes of CO_2 emissions allocations per person from the rest of the world. If we steal them, as past proposals have attempted to, then there will be no global agreement for action and human culture fails the evolutionary test. But if we pay for them, our poorer cousins will cooperate and pursue clean development instead of continuing with deforestation and burning coal, oil and whatever.

There are many layers of denial – and every stage delays action. At the end of all the wishful thinking is also a moral choice which reminds us why ethics remains an essential tool for the survival of our species. Sooner or later, our survival depends on good will, trust and cooperation.