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The Best Way Forward?
——Greenhouse Development Rights as a post-2012 Framework for Coordinated International Action on Climate Change

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Abstract: Dangerous climate change is the greatest threat humanity has ever faced. Our international and national environmental governance systems have so far failed to effectivedeal with it. Global warming is now reaching dangerous levels. The Greenhouse Development Rights Framework provides a way of gaining international agreement to the type of emergency climate protection pathway urgently needed.

Key words: climate change, international environmental governance

Introduction

The paper firstly reviews the most recent evidence which indicates the global climate crisis is even more severe than that outlined by the Intergovernmental Panel on Climate Change (IPCC) Reports in 2007. It then briefly reviews the failure of the International Environmental Governance systems to address the climate change problem. It then outlines the Greenhouse Development Rights Framework (Baer, Athanasiou & Kartha, 2007), as representing the type of radical approach needed to address the extremely complex, multifaceted, wicked problem of climate change.

Dangerous Climate Change

The European Union, the IPCC and the International Climate Change Taskforce propose a temperature cap of 2°C to avoid dangerous anthropogenic interference with the climate system (Spratt, 2007a, p13). These "current proposals to establish caps of 2°C or 3°C as reasonable for avoiding dangerous climate change are not being informed by the likely impacts and the most recent scientific research, but have been shaped by the world of diplomacy, political tradeoffs and compromises driven by narrow, short-term and national needs (Spratt, 2007a, p8)." There is little doubt that an average warming of 3°C would be disastrous and it is clear to minimize the risk of dangerous climate change that the further below an average warming of 2°C that we stabilize the climate the better (Baer & Athanasiou, 2004; Spratt, 2007a).

A recent report that reviews the most recent scientific evidence on setting targets for greenhouse gas reductions reaches the following conclusion.

"The only conclusion to be drawn is that the loss of the Arctic sea ice, in all likelihood at an increase of less than 1ºC in global average temperature compared to pre-industrial levels, unambiguously represents dangerous human interference with the climate; and therefore we already have too much greenhouse gas in the air, and we need to find the means to engineer a rapid massive drawdown of current greenhouse gases to a safe level. It is now not so much a question of "how much more greenhouse gas can we add to the atmosphere?" but "by what means, at what speed and to what extent can we draw down the current levels of greenhouse gases to a safe level? (Spratt, 2007a, p7)."

Open ocean waters absorb almost ten times more solar radiation than sea ice, a phenomenon know as the ice-albedo feedback (Newton, 2007). Scientists have warned for years of the potential negative feedback loop from global warming where melting ice and snow expose more land and ocean, which then absorb more heat from the sun, triggering further warming and snow and ice, melt. There is little doubt, that this occurred in the Artic in the northern hemisphere summer of 2007 (Spratt, 2007b). In view of danger now posed by global warming, the building of another coal fired power station or even a fossil fuel powered plane or automobile, could be viewed as a crime against humanity. Particularly given that scientists have demonstrated that we can power our current and future global economy from renewable energy sources with minimal greenhouse gas emissions (Sorensen, 2004).

We are, therefore, now forced to accept some degree of danger, as totally avoiding the risk of dangerous climate completely is no longer feasible. The focus needs to be on decarbonising the global economy as quickly as possible while continuing to meet or exceed the Millennium Development Goals (UN, 2005).

"We'd all vote to stop climate change immediately, if we only believed that doing so would be so cheap that no country or bloc of countries could effectively object. But we do not so believe. Thus we're forced to start trading away lives and species in order to advocate a "reasonable" definition of "dangerous" (P Baer & Athanasiou, 2004).

There is, however, a major danger that a weaker precautionary approach than that which is required to minimise the risk of dangerous climate change may be taken by politicians in various countries. They may see the huge emission reductions necessary as a danger to business-as-usual and market driven economic growth in their country, which they may see as threatening their re-election prospects. Parts of the fossil fuel industry, through various Business NGOs and "independent" think tanks are still keen to foster this perception despite the planetary emergency caused by their products (Exxonsecrets.org, 2007; Hansen, 2007; Union of Concerned Scientists, 2007).

Failure of International Environmental Governance

In 1988, the Toronto Conference on the Global Atmosphere, hosted by the Canadian Government and attended by many eminent climate scientists and government officials from many countries concluded "humanity is conducting an unintended, uncontrolled and globally pervasive experiment whose ultimate consequences could be second only to a global nuclear war" (Bodansky, 1994, p49). The Conference recommended a 20% reduction in global CO2 emissions from 1988 levels by the year 2005. As this was a global goal and the Conference Statement states that developing countries will need to increase their energy use "significantly" then industrialized countries would need to reduce their emissions by more than 20% to offset these increased emissions (Bodansky, 1994).

In 1990, the IPCC published its First Assessment Report which "predicted that if states continue to pursue "business as usual," the global average surface temperature will rise by 0.3C per decade…a rate of change unprecedented in human history" (Bodansky, 1994, p57) This was despite successful attempts at the final IPCC plenary session, encouraged by the fossil fuel industry through the USA, Saudi and Soviet delegations, at "watering down the sense of the alarm in the wording, beefing up the aura of uncertainty" (Leggett, 2001, p15).

Despite these and many subsequent warnings, our current International Environmental Governance has failed to provide an effective response. By 2007, global greenhouse gas emissions are more than 30% above 1990 levels (IPCC, 2007) and since 2000, CO2 emissions have been increasing at a faster rate (Raupach et al., 2007) and global average temperatures continue to rise (IPCC, 2007).

Given this failure, is there reason to hope that the current negotiations based on the Bali Mandate to be agreed at the Conference of the Parties on the UN Framework Convention on Climate Change (UNFCCC) in December 2007 will be successful? In the lead up to the Conference, Yvo de Boer, Head of the UNFCCC said "Politicians have to act on the information provided by the science" (Willkinson & Skehan, 2007). Politicians have, however, failed to act effectively on the science for almost 20 years.

The early indications are that the proposed Bali Mandate will not deliver sufficient emission reductions to ensure that we avoid more than 2°C of average global warming over pre-industrial levels. The Bali Mandate proposal is for 25-40% reductions by developed countries by 2020. Given that now 50% of global emissions are not from developed countries and these emissions are growing (IPCC, 2007; Raupach et al, 2007), this proposal looks unlikely to get global emissions to begin reducing by 2015, which is the minimum that is required to put the earth on a pathway to avoid dangerous climate change (Baer & Mastrandrea, 2006; Spratt, 2007a).

What is Needed?

The science is quite clear, the more quickly we reduce greenhouse gas emissions the

more likely we are to avoid more serious dangerous climate change. As discussed previously we already have dangerous human interference with the climate. The key issue is how we minimize the risk of more severe dangerous climate change. Our current economy is currently emitting over 100 million tonnes of global warming pollution into the atmosphere every day. The ideal therefore would be to stop all human activities that result in greenhouse gas emissions tomorrow; that would, however, result in social and economic chaos so it is not a feasible option. Given that science shows that we should cut greenhouse gas emissions as much and as quickly as possible, the critical political economy question is how quickly can we cut greenhouse gas emissions without causing social and economic chaos?

Human ingenuity, creativity and problem solving abilities are immense given the opportunity to address a challenge, such as landing a man on the Moon or a robotic vehicle on Mars. To address the climate emergency, we need to create a framework that encourages all nations to cooperate to address the emergency while ensuring that those on the planet who are struggling to find food, clothing and shelter are not adversely affected by the global redirection of the world economy towards rapid decarbonization.

Precautionary Approach – Greenhouse Development Rights

One framework that may be effective in engendering the international cooperation needed to address the climate emergency is the Greenhouse Development Rights (GDRs) framework, as it aims to overcome the inherent critical impasse between the global climate crisis and the global development crisis. Given the most recent scientific reports, its initial target of holding global warming below 2°C will need to be strengthened, resulting in an emergency climate protection pathway that reduces emissions even more steeply than the 2°C emergency pathway in Figure 1. The pathway shown has a 17-36% risk of breaching the critical 2°C limit. It is unlikely to stabilize the climate at well below 2°C; it, however, still requires substantial global emission reductions of up to 6% pa starting in 2015 (Baer, Athanasiou & Kartha, 2007).

In Figure 1, the top line is a ‘Business-as-Usual’ trajectory, which extrapolates the historical approach to energy conservation, renewables, fossil fuel subsidies, pollution controls, etc is based on the IPCC projections. The second top line is a so-called ‘No-Regrets’ trajectory, a projection of the global emissions pathway as it would be if all negative and zero-cost emissions reduction options were successfully captured, this is based on the IPCC SRES B1 Scenario. These represent free and profitable emission reductions, which are large, though far from large enough to bring emissions all the way down to the 2°C emergency pathway, the bottom line.

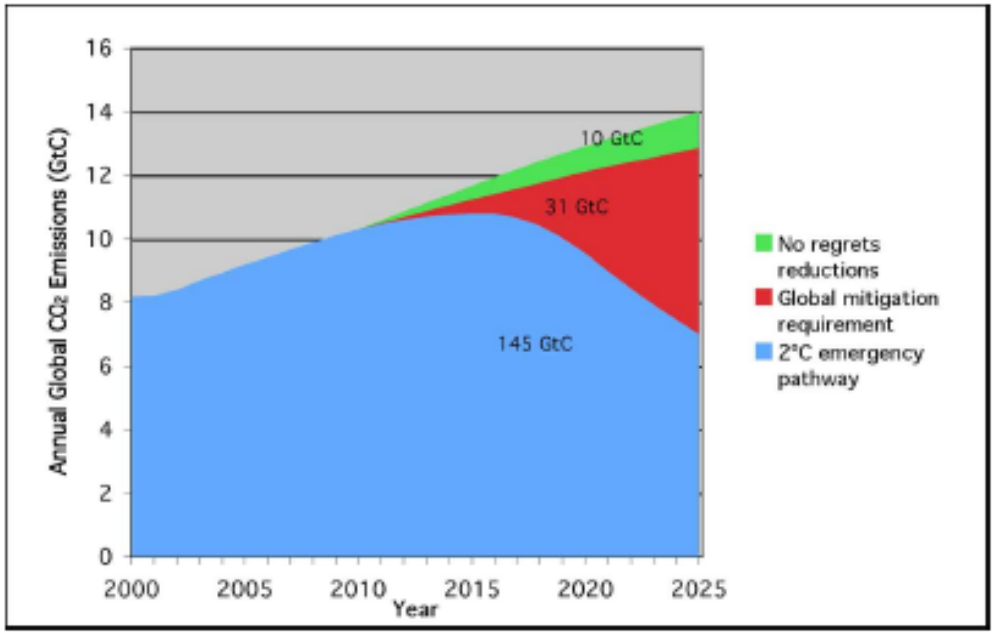

Figure 1: The 'mitigation gap' (middle wedge) between a 'No-Regrets' baseline (bottom of top wedge) and the 2ºC emergency pathway' (bottom of middle wedge) - from (Baer, Athanasiou & Kartha, 2007, p37)

As discussed previously, the most recent scientific evidence is increasingly showing that we need to adopt an even more stringent emission reductions than the 2°C emergency pathway shown, in order to follow an emergency stabilization pathway that will avoid significant risk of dangerous climate change. An emergency stabilization pathway of a 50% reduction of global greenhouse gas emissions by 2025 and a transition to a decarbonised economy by 2050 are targets consistent with setting stretch goals to harness and direct humanity's expertise, knowledge and resources to achieve this task. It can also be viewed as a backcasting approach which enables policy-makers to consider how to get to a desired end-point (Mander et al., 2007; Robinson, 2003).

The GDR provides a framework for implementing an internationally agreed emergency stabilisation pathway of emission reductions while safeguarding the right of all people to reach of dignified level of sustainable human development. This standard of living, which could be described as that of a 'global middle class,' is significantly higher than the global poverty line, but lower than the northern middle-class standard (Baer, Athanasiou & Kartha, 2007).

It does this by recognising the right to development and the corresponding right to be exempt from global emission reductions as belonging to poor people, not to poor countries. Having defined the emergency stabilisation pathway, it then quantifies national responsibility and capacity to act and uses this to calculate national obligations to pay both

the costs of an emergency mitigation program to reduce emissions and to fund strenuous adaptation efforts. This is done for all countries in a manner that take income disparities within countries into explicit account. By so doing, it seeks to secure for the world's poor the environmental space and resources needed for low-carbon development (Baer, Athanasiou & Kartha, 2007).

Capacity to Contribute to Addressing Climate Emergency

The GDR framework allocates to the wealthy and high emitting consumers in the developed and developing world, the costs required to rapidly reduce greenhouse gas emissions and to fund adaptation costs. It does this by identifying the proportion of the country's population that is above the specified development threshold (US$9000 per capita income) and therefore has the capacity to contribute to the measures necessary for the climate emergency. This is illustrated below for three countries, India, China and USA. The US$9000 level of the development threshold is just below the global average per capita income in 2005 (Baer, Athanasiou & Kartha, 2007).

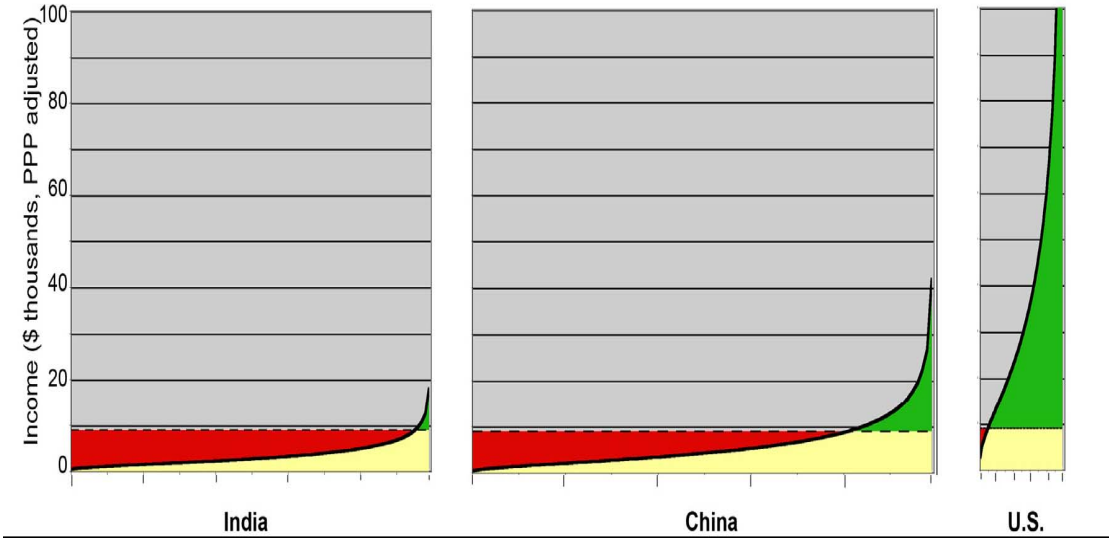

Figure 2: Capacity/Development Need chart for India, China and the US, with$9000 per capita (PPP) development threshold (Baer, Athanasiou & Kartha, 2007, p25)

In Figure 2, the length of the x-axis is proportional to the population. At each point on the x-axis, this curve shows the income of the corresponding percentile (one percent) of the population, measured in US dollars per capita (PPP - Purchasing Power Parity adjusted). The green section representing capacity to fund mitigation and adaptation can therefore be directly compared. It shows that almost all of the US population have the capacity to contribute and also that China also has a significant population with the capacity to contribute. 27% of the world's population in 2005 were above this development threshold

with almost 15% of these living in high-income countries and 11.5% in medium-income countries. Less than 1% were from the low-income countries where 37% of the world's population live (Baer, Athanasiou & Kartha, 2007).

Historic Responsibility

The GDR framework proposes that cumulative per capita CO_2 emissions from fossil fuel consumption since 1990 is a reasonable measure of historic responsibility, largely because emissions made prior to this date were usually (though not always) made in ignorance rather than by deliberate policy. Figure 3 shows this measure of responsibility for selected countries and regions; the left bar is the total national per capita figure (from 1990 to 2005), while the right bar adjusts to account for the exclusion of emissions below the development threshold. The adjustment is straightforward, based on the assumption that (within any given country) emissions are proportional to consumption, which is in turn proportional to income (Baer, Athanasiou & Kartha, 2007).

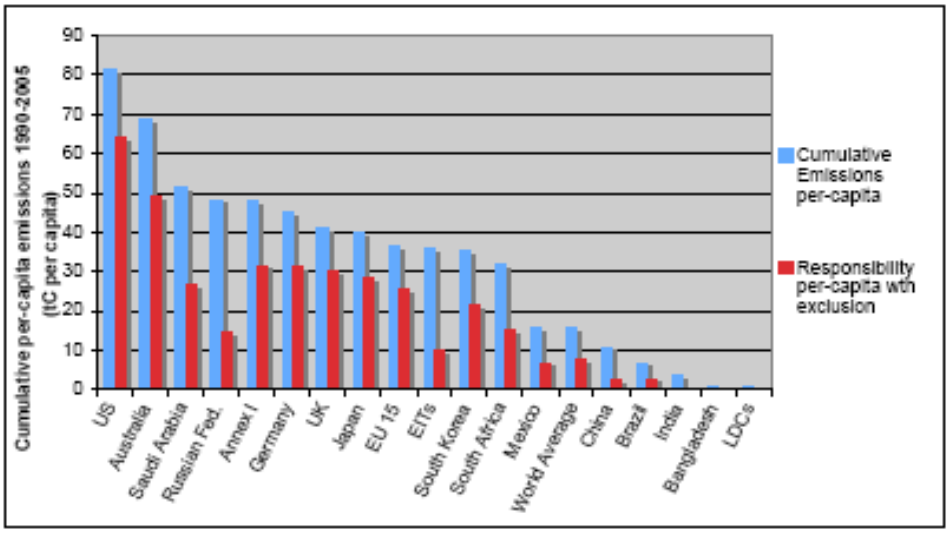

Figure 3: Cumulative per capita CO_2 emissions from fossil fuel combustion, 1990-2005 (left hand column); 'responsibility' adjusted to account for the exclusion of emissions below the development threshold (right hand column) from (Baer, Athanasiou & Kartha, 2007, p27)

This then raises the question of how capacity and responsibility should be combined into a single obligation indicator, which can then drive the allocation of the global responsibility to each country.

The Responsibility and Capacity Indicator (RCI)

The GDR framework's RCI is developed in order that among countries with the same capacities but different responsibilities, the country with greater responsibility has the greater obligation. It also ensures that among countries with the same responsibility but different capacities, the one with the greater capacity must have the greater obligation. There are many formulae, which have this property. The preferred approach uses one that multiplies responsibility and capacity, in a way that allows different weights to be given to each:

$$RCI = R^a \cdot C^b$$

It specifies that the weights a and b sum to 1, which confers the property that, as the paired weights go from a=1 and b=0 towards a=0 and b=1, the RCI goes from being exactly equal to responsibility (*R*) to being exactly equal to capacity (*C*). Perhaps more importantly, the sum of the RCIs calculated for parts (say nations within a region) is equal to the RCI of the whole, which means that RCI calculations behave appropriately whether you're looking at countries, fractions of countries, or multi-country regions(Baer, Athanasiou & Kartha, 2007).

In the reference case, the GDR Framework uses a = 0.4 and b = 0.6, which weights capacity somewhat higher than responsibility. Again, this is just one of many possible choices, but it is based on the belief is that it is less fair to make a poor nation with high emissions pay more than it is to make a rich country with low emissions pay more.

Table 1. Global percentage shares of population, income, capacity, cumulative emissions, responsibility, and RCI for selected countries and groups of countries (Baer, Athanasiou & Kartha, 2007, p29)

	% Share of global population	% Share of global income	% Share of global capacity	% Share of cumulative emissions 1990-2005	% Share of global responsibility	% Share of global RCI
United States	4.6	20.3	32.1	24.0	38.1	35.0
EU (27)	8.9	22.6	29.7	18.5	23.4	27.2
UK	0.9	3.3	4.8	2.5	3.6	4.4
Germany	1.3	4.0	5.5	3.7	5.2	5.5
Russia	2.2	2.5	1.5	6.9	4.1	2.3
Brazil	2.9	2.6	2.1	1.3	1.0	1.6
China	20.4	14.5	6.8	14.1	6.7	6.9
India	17.1	6.2	0.4	4.1	0.3	0.4
South Africa	0.7	0.8	0.8	1.4	1.4	1.0
LDCs	8.4	1.4	0.1	0.4	0.0	0.0
All high income	15.5	53.9	79.0	51.8	76.7	78.4
All middle income	47.8	36.5	20.4	41.3	22.9	21.1
All low income	36.6	9.6	0.6	6.9	0.4	0.5

One notable feature of these results is that the US has the largest share of global capacity, the largest share of global responsibility, and the largest share of combined RCI. However, this result is extremely important that by any reasonable standard of common but differentiated responsibilities (as agreed under the UNFCCC), the United States would have to pay the largest share of the global climate 'bill.' But, despite the fact that the American people have come to accept the need for concerted action to stabilize the climate, that action is still conceived in almost entirely domestic terms. Indeed, when it comes to preparing the ground for US international obligations, the American climate movement has largely failed, having barely begun to even explain the necessities of emergency global action to its people (Baer, Athanasiou & Kartha, 2007).

Calculating national bills for climate change mitigation and adaptation

The overall global cost of mitigation and adaptation is hard to estimate, however, the following table gives an estimated cost per 1% of GWP (Gross World Product) that is required to fund the combined cost of mitigation of and adaptation to climate change. If 2% of GWP is required the cost would be double this, 3% of GWP triple this etc.

Table 2: Total national income and national capacity (calculated with $9000 development threshold), along with national and individual 'bills'(calculated on the basis of the number of people above the $9000 development threshold) based on a total global obligation (combining mitigation and adaptation costs) of 1% of GWP(All figures 2005 US dollars, PPP-adjusted)

(Baer, Athanasiou & Kartha, 2007, p31)

	Total income (billion $ PPP adjusted, 2005)	Total capacity (billion $ PPP adjusted, 2005)	Percent of global RCI	Bill at 1% of GWP ($ billion PPP adjusted)	Average individual bill at 1% of GWP ($PPP/person)
United States	12,420	9,827	35.0	214	796
EU (27)	13,823	9,071	27.2	166	357
United Kingdom	2,001	1,464	4.4	27	461
Germany	2,430	1,693	5.5	34	420
Russia	1,552	464	2.3	14	190
Brazil	1,566	627	1.6	10	191
China	8,865	15	6.9	42	144
India	3,779	128	0.4	2.2	53
South Africa	502	241	1.0	6.2	383
LDCs	853	17	0.0	0.2	34
All High Income	32,941	24,146	78.4	479	517
All Mid. Income	22,271	6,250	21.1	129	172
All Low Income	5,873	169	0.5	2.9	56
World	61,091	30,570	100.0	611	353

Note: UK and Germany are included in the EU27 figures in addition to being shown separately.

The wide range of these individual bills reflects the widely different degrees of "per person" responsibility and capacity in different countries. These figures make no assumptions about the fraction of any national obligation that could reasonably be discharged domestically, as opposed to internationally. A range of institutional, political and governance mechanisms would be necessary were such obligations to be codified in international law, collected, and actually channeled toward mitigation and adaptation activities.

Military budgets of the world's major economies represent 2% of GWP and global consumer expenditure on "luxuries" as opposed to necessities is even higher. A spending of a similar or even higher level is justified to defend the world against the danger of climate change. The GDR framework gives an approach on how the global costs of mitigation and adaptation could be reasonably fairly shared.

National Greenhouse Gas Emission Targets

As is shown below, based only on fossil fuel emissions, USA and China are critical to any effective agreement to reducing global greenhouse gas emissions.

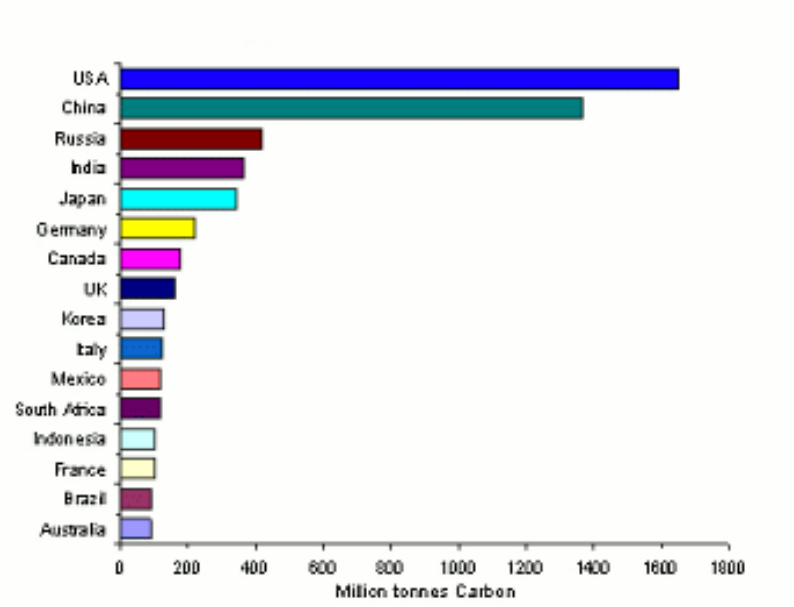

Figure 4: Fossil Fuel Carbon Emissions in 2004

Note: The rankings of some countries change when emissions associated with land-use change, particularly deforestation, are included: by this measure, Indonesia and Brazil would join the USA and China in the top ten emitters (Worldwatch Institute, 2007).

The example of the United States

Figure 5 shows a similar calculation to the global reductions shown earlier for the United States America. But instead of showing a reduction wedge that thickens to 6% per year (reflecting the global rate in the climate emergency trajectory), it shows an even more ambitious USA domestic reduction trajectory that reduces national emissions to 90% below 1990 levels in 2050. Even this ambitious '90% by 2050' trajectory would only satisfy a portion of the USA's total obligation, the rest of which would have to be satisfied by funding international reductions (Baer, Athanasiou & Kartha, 2007).

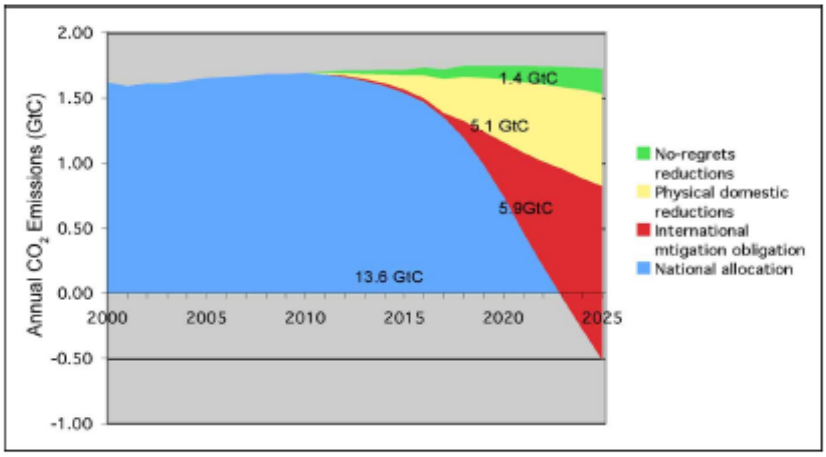

Figure 5: USA allocation under GDRs reference case, with domestic physical reductions (yellow wedge) defined to reduce USA emissions by 90% by 2050 (Baer, Athanasiou & Kartha, 2007, p41).

The example of China

The complement to the situations illustrated above for the USA is China, the world's second largest national emitter of greenhouse gases. Due to the much lower RCI calculated (shown in Table 1) its national mitigation obligations are smaller than the 6% per annum reductions required globally by the emergency 2ºC trajectory.

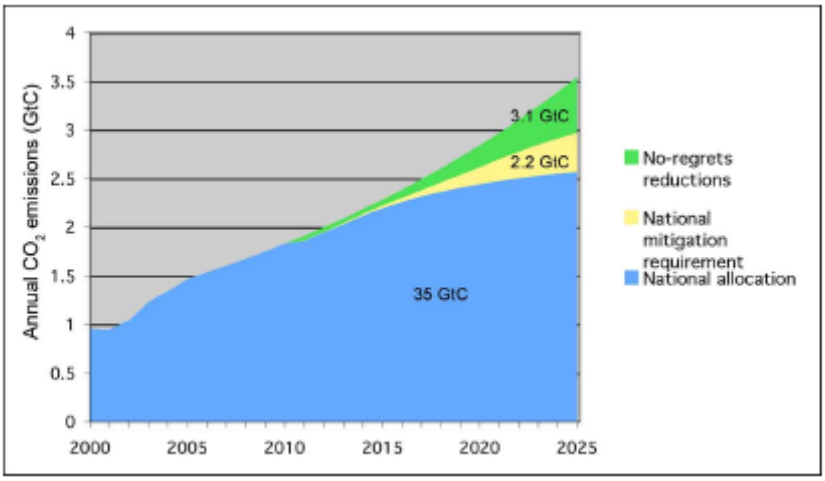

Figure 6: Allocation under GDRs framework reference case for China (Baer, Athanasiou & Kartha, 2007, p43)

Here, again, the green wedge represents no-regrets reductions. The 'Business-as-Usual' trajectory (the top of the green wedge) is taken as an extrapolation of China's historical emissions growth, a choice that seems appropriate given its atypical rate

and recent momentum, though the bottom of China's no-regrets wedge, and thus its area, is still based upon the B1 emissions trajectory. But note that China's (yellow) mitigation obligation, calculated as it is on the basis of China's RCI, is not particularly large, despite the projected continuation of China's unusually rapid economic growth.

Finally, in Figure 7 below, we see what GDRs seek to achieve – a hypothetical instance in which a large amount of additional emissions reductions (the red wedge) are made within China, but financed by wealthy countries in need of offsets. These reductions are absolutely necessary, for China's emissions are large, and making full use of its mitigation potential is essential if we are to keep within the climate emergency trajectory. Fortunately, under the GDRs framework, there is a strong incentive for China to reduce beyond its national obligation by, in effect, selling mitigation potential to wealthy and middle-income countries such as those in the EU and the USA that need it to fulfill their mitigation obligations. Or, to put it another way, in a cap and allocate system, China would, in principle, be able to sell reductions at an international price that is greater than its marginal cost, and, by so doing, earn the revenue needed to finance its own required reductions, at least partially and perhaps wholly (Baer, Athanasiou & Kartha, 2007).

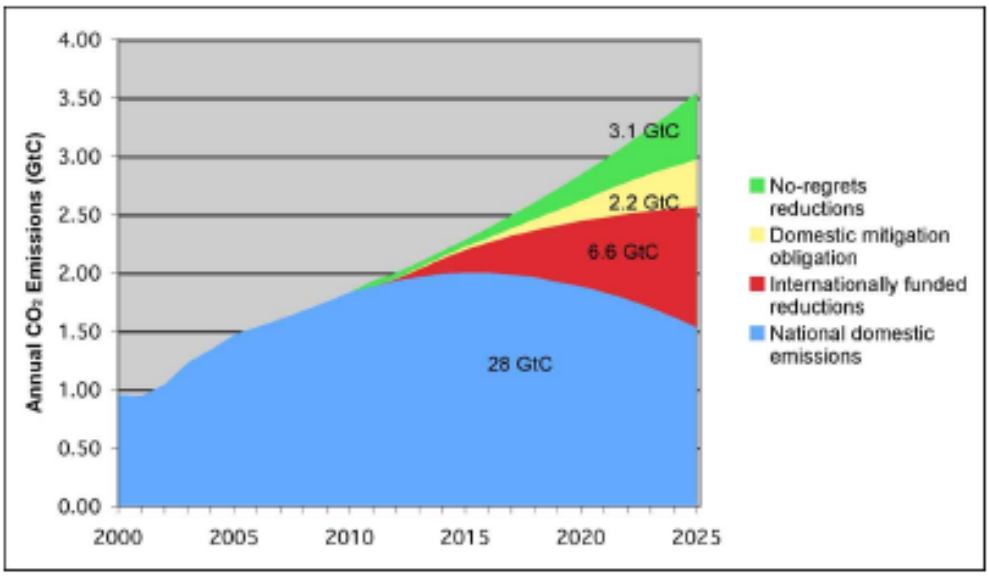

Figure 7: Plausible emissions trajectory for China under GDRs reference case if international purchases lead to 6% annual rate of reduction (Baer, Athanasiou & Kartha, 2007, p43)

The GDRs framework is, regrettably, outside the spectrum of proposals now being negotiated for a post-2012 regime. But at the same time, it is clear to put in place an effective international climate change regime that will reduce greenhouse gas emissions as quickly as needed will require honesty and boldness. In this context, the GDRs framework can serve as a useful standard of comparison − a 'reference framework' that clearly marks

out a set of essential core elements, elements that must be a critical part of any even potentially successful international post-2012 climate regime (Baer, Athanasiou & Kartha, 2007, p43).

Could it work?

As outlined previously, we need rapid reductions in greenhouse gas emissions to begin as soon as possible if we are to minimise the risk of dangerous climate change. Given that the problem has mainly been caused by the fossil fuel emissions of the developed world, it is reasonable that the developed countries cover most of the costs of moving the world to a decarbonised economy and funding adaptation to the global warming already caused.

Given that this will require massive investment in energy efficiency, renewable energy technologies and other technologies in all countries of the world the challenge will be to get the political leaders of the developed countries to accept the responsibility to fund the transition not only domestically but also in the developing world.

Appropriate governance mechanism will also be required to ensure that the funds are effectively spent on reducing greenhouse gas emissions and appropriate adaptation. Many problems have already occurred with the projects funded under the Clean Development Mechanism of the Kyoto Protocol (Carbon Trade Watch, 2005).

We also are likely to have to finally acknowledge that there are limits to economic growth and re-direct the global economy from GWP to global happiness and quality of life in order to achieve Ecologically Sustainable Development. These will therefore represent the type of radical changes to our current system of international political economy required to avoid dangerous climate change.

Conclusion

The GDRs framework represents the type of ambitious approach that is necessary to gaining international agreement to implement the emergency climate program necessary to avoid dangerous climate. It compares favourably with other frameworks proposed for the post-2012 period, particularly in terms of environmental justice issues for the global poor and it therefore provides a viable framework for substantially reducing the risk of dangerous climate change. The problems with having it adopted are more political and governance issues rather than technical feasibility. This or a similar radical approach to changing the international political economy is also required to move humanity towards Ecologically Sustainable Development.

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