

**The Right to Development in a Climate Constrained world:  
The Greenhouse Development Rights framework**

**Sivan Kartha**

**Paul Baer**

**Tom Athanasiou**

**Eric Kemp-Benedict**

April 2009

Submitted as a chapter in *Climate Change - The Perspective of Social Sciences*,  
edited by Martin Voss

# 1 The Greenhouse Development Rights Framework

---

The climate crisis does not come to us alone, but rather amidst worsening social and economic turbulence. Some of this turbulence – the “financial crisis” in particular – is sharp and episodic. but, always, there is the crisis of inequality and poverty – the ongoing development crisis. Given this, any even potentially viable global climate accord must address the crisis of poverty and development. In particular, it must acknowledge and explicitly preserve a right to development or, more precisely, a right to sustainable human development. The bottom line in this very complicated tale is that the South is neither willing nor able to prioritize emissions reductions above the social and economic advancement of its people. And that, therefore, the key to climate protection is the establishment of a international effort-sharing regime in which it is not required to do so.

Thus, the climate negotiations are fundamentally stymied by the effort-sharing question – who should do how much, and when? This impasse derives from the profoundly, bitterly unequal nature of our shared social world, an inequality that matters a great deal in realist as well as moral terms. To tackle the climate crisis effectively requires an emergency global climate mobilization, which must come while billions of people, overwhelmingly but not exclusively in the South, are still struggling to escape poverty.

The centrality of this development crisis to the climate problem cannot be overstated. Nor can its most obvious implication, that the international climate policy impasse will not be broken without a fair global effort-sharing architecture, one that promises a way forward that does not threaten the development of the South. The *Greenhouse Development Rights* framework is, accordingly, designed to protect the right to sustainable human development, even as it drives extremely rapid global emissions reductions. Although it does not begin with a realpolitik-style assessment of negotiating power, the GDR approach ultimately charts out an extremely pragmatic approach. Beginning with the structural logical of the climate impasse, it asserts that a “right to sustainable development” is not only ethically justifiable, but also, fundamentally, a non-negotiable foundation of greenhouse-age geopolitical realism. Its key claim is that, unless the climate regime explicitly preserves such a right, developing country negotiators may quite justifiably conclude that they have more to lose than to gain from any truly earnest engagement with a global climate regime that, after all, significantly curtails access to the energy sources and technologies that historically enabled growth in the industrialized world.

We start by examining the source of the tension between climate protection and development.

## 1.1 The Right to Development in a Climate-constrained world

A warming of 2°C over pre-industrial temperature levels has been widely endorsed as the maximum that can be tolerated or even managed. This is well known throughout Europe. Indeed, the EU is largely responsible for establishing 2°C as a “line in the sand” that must not be crossed. It has also acknowledged, however, that even 2°C is by no means safe, a position that is clearly articulated in the IPCC’s Fourth Assessment Report and reinforced by a steady stream of subsequent studies.

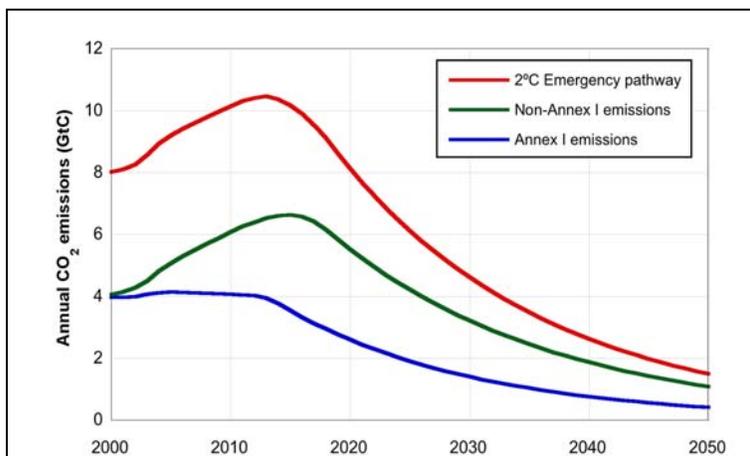
This point must be stressed, for as we approach Copenhagen, , the site of critical 2009 UNFCCC negotiations that will determine the next steps after Kyoto’s first round of commitments. The

negotiations are indeed under terrific pressure to “soften” goals and compromise targets – the better to declare “success” as the negotiations conclude. But the science is telling us, quite unambiguously, that just the opposite is necessary. There is, for example, a significant if not readily quantifiable risk that a warming of even less than 2°C could trigger the irreversible melting of the Greenland and West Antarctic Ice Sheets. And, with a manifest warming of only 0.8°C, we are already seeing effects – such as the precipitous receding of the Arctic sea ice – that are not only dangerous in themselves but also the beginnings of positive feedbacks that, we now know, will further accelerate the warming. Moreover, and significantly, the fact that these feedbacks are already in motion is strong evidence that the overall sensitivity of the climate system is quite high, and that stabilization concentrations that even recently were considered to be manageably safe – 450 ppmCO<sub>2</sub>-equivalent for example – are in fact quite dangerous.<sup>1</sup>

Yet even as the science increasingly underscores how extremely dangerous it would be to exceed 2°C, many people are losing all confidence that we will be able to prevent such a warming, or even a far greater one. This loss of confidence, moreover, is based not on any doubt about our collective scientific and technological abilities, but rather on the sense, now quite widespread, that our societies are not up to the political challenges of climate stabilization.

Our very different conclusion is that the 2°C line can indeed be held, but that doing so demands courageous initiatives and a robust policy architecture, both of which go beyond politics as usual. That, in particular, they demand a sense of shared global purpose and solidarity that can only be rooted in a commitment to poverty alleviation and sustainable development that is as emphatic and non-negotiable as the climate crisis itself. Moreover, and critically, we argue that an honest recognition of just how immensely high the stakes really are, and a straightforward analysis of the global effort-sharing system that will be needed to break the international impasse, are preconditions to the bold thinking and grand initiatives that are needed.

Accordingly, we begin our analysis by following the science, with the goal of clearly identifying an



**Figure 1: The South’s Dilemma.** The red line shows a 2°C emergency stabilization pathway, in which global CO<sub>2</sub> emissions peak in 2013 and fall to 80% below 1990 levels in 2050. The blue line shows Annex 1 emissions declining to 90% below 1990 levels in 2050. The green line shows, by subtraction, the emissions space that would remain for the developing countries. (Note that the Y-axis is in gigatonnes of carbon, not carbon dioxide, and is for CO<sub>2</sub> only. The all greenhouse-gas figure would be about 30% higher.)

adequately precautionary climate objective. We do not argue for a temperature target lower than 2°C, though we would like to, because under current circumstances such a target would not be accepted as policy relevant. But we do define a global emissions objective – a “2°C emergency pathway” – that preserves an honest chance of keeping warming below 2°C, and then set out to straightforwardly articulate the key elements of a climate architecture that can make that pathway politically viable.

Just as critically, since carbon-based growth is no longer a viable option in either the North or the South, we frame the problem as one of

urgently needed decarbonization in a twice-divided world, one sharply polarized between the nations of the North and the nations of the South and, on both sides, between the rich and the poor people within those nations.

A simple thought experiment illustrates the deep structure of the climate problem, and the scope of the challenge. Here, in red, we show a science-based assessment of the size of the remaining global carbon budget, defined by a pathway ambitious enough to be considered a true 2°C emergency pathway. We also show the portion of that budget that wealthy Annex 1 countries would consume even if they undertake bold efforts to virtually eliminate their emissions by 2050 (as shown in blue). Doing so reveals, by subtraction, the alarmingly small size of the carbon budget (shown in green) that would remain to support the South's development.

A few details only make the picture starker:

- The efforts implied by this 2°C emergency pathway are heroic indeed. Global emissions peak before 2015 and decline to 80% below 1990 levels by 2050, such that CO<sub>2</sub> concentrations can peak below 420 ppm and then start to fall very rapidly. Yet even this would hardly mean that we were “safe.” We would still suffer considerable climate impacts and risks, as well as an approximately 15-30% probability of overshooting the 2°C line<sup>2</sup>. Thus, this is what the IPCC would refer to as a trajectory that was “likely”, but not “very likely” to keep warming below 2°C.
- The Annex 1 emission path shown here is more aggressive than even the most ambitious of current EU and US proposals. It has emissions declining at more than 5% annually from 2012 onwards, and ultimately dropping to a near-zero level. It's a tough prospect, and if it can be considered politically plausible today, it is just barely so.
- Still, the atmospheric space remaining for developing countries would be extremely constrained. In fact, developing country emissions would have to peak only a few years later than those in the North – still before 2020 – and then decline by more than 5% annually through 2050. And this would have to take place while most of the South's citizens were still struggling out of poverty and desperately seeking a meaningful improvement in their living standards

It is this last point that makes the climate challenge truly daunting. For the only proven routes to development – to water and food security, improved health care and education, secure livelihoods – involve expanding access to energy services, and, consequently, a seemingly inevitable increase in fossil fuel use and thus carbon emissions. From the standpoint of the South, this seems to pit development squarely against climate protection. It is for this reason that developing countries remain unambiguous in their insistence that, as important as it is to deal with climate change, a solution cannot come at the expense of their development.

Things don't have to be this way – after all, clean energy alternatives exist – but the point is that they still exist only in potential, as “alternatives” that have not been seriously pursued. The North has not led the world in developing them, and indeed continues to pursue measures that slow them down (consider fossil fuel subsidies). In any case, these alternative paths are not yet real, not at least for the poor.

That such dismal matters are foremost in the minds of southern negotiators should surprise no one. First, the development crisis has shown itself to be not merely a challenge but an intractable crisis, badly in need of an expansion of resources and political attention. With even the minimal Millennium Development Goals being treated as second-order priorities, and little demonstrated interest in meeting them on the part of the North, the level of international trust is very low indeed.

Second, the impacts of climate change, which the wealthy nations are largely responsible for, are beginning to come down hard, and this will only make the development crisis more acute. And now, third, the South's negotiators have to face the very real possibility that the imperatives of climate stabilization will deprive their countries of access to the cheap fossil energy sources that helped make the wealthy countries wealthy in the first place. Both China and India, as we all know, have long counted on their vast coal reserves to fuel their long-awaited growth.

The situation, to put it gently, invites political impasse.

## **1.2 The Greenhouse Development Rights Framework**

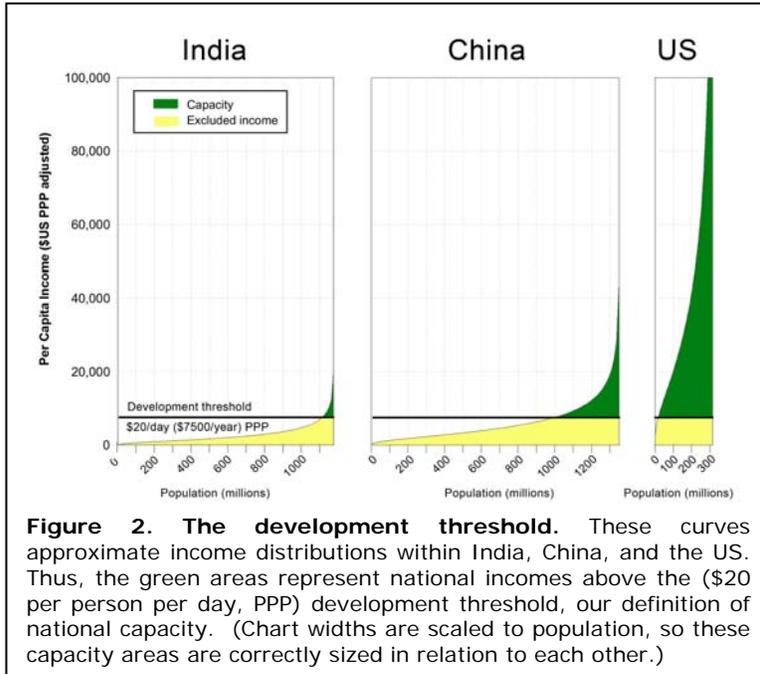
The core of the GDRs approach is the simple proposition that the poor must, at a minimum, be excused from the burdens of the climate transition. This simple concept is then built up into a demonstrably robust effort-sharing framework based on responsibility and capacity – the two equity principles at the core of the UNFCCC's "common but differentiated responsibilities and respective capabilities". Critically, GDRs defines both responsibility and capacity in terms of a *development threshold* – a level of welfare below which people are not expected to share the costs of the climate transition. People below this threshold have survival and development as their proper priorities. As they struggle for better lives, they are not obligated to expend their limited resources to keep society as a whole within its sharply limited global carbon budget. They have, in any case, little responsibility for the climate problem and little capacity to invest in solving it.

People with incomes that exceed the development threshold, on the other hand, are taken as being wealthy enough to begin bearing the burdens of the climate transition – as having realized their right to development and as bearing some fraction of our common responsibility to preserve that right for others. They must, as their incomes rise, assume a steadily rising share of the costs of curbing the emissions associated with their own consumption, as well as the costs of ensuring that, as those below the threshold rise toward and then cross it, they are able to do so along sustainable, low-emission paths. These obligations, critically, are taken to belong to *all* people with incomes above the development threshold, whether they live in the Annex 1 or Non-Annex 1, in the North or in the South.

The level and method by which a development threshold would best be set is clearly a matter for debate, one that we welcome. One matter, though, must be stipulated – the development threshold is emphatically not an "extreme poverty" line, one which is typically defined to be so low (\$1 or \$2 a day) as to be more properly called a "destitution line." For a threshold to reasonably capture the principle of a right to development, it should be set to be at least modestly higher than a global poverty line; it must reflect a level of welfare that is beyond basic needs, though well short of today's levels of "affluent" consumption.

For the purposes of our indicative quantification here, we draw upon recent empirical analyses of the individual income levels and their correlation with indicators of poverty. As it turns out, an income of approximately \$16 per day (PPP adjusted) sets the point at which the classic plagues of poverty – malnutrition, high infant mortality, low educational attainment, high relative food expenditures – begin to disappear, or at least become exceptions to the rule. Taking a figure 25% above this global poverty line (development by any measure must reflect more than a mere escape from poverty) we illustrate the implications of the Greenhouse Development Rights approach based on calculations relative to a development threshold of \$20 per person per day (\$7,500 per person per year). Not coincidentally, this income correlates well with the level at which the southern "middle class" begins to emerge.

Once a development threshold has been defined, logical and usefully precise definitions of *capacity* and *responsibility* naturally follow, and these can be built upon to specify and calculate national obligations for shouldering the climate challenge. Capacity, which we take to mean income that is not demanded by the basic necessities of everyday life, is income that is at least hypothetically available to be “taxed” to support a global climate mobilization; such a tax would not *compromise a fundamental level of welfare*. Honoring a right to development thus means that



**Figure 2. The development threshold.** These curves approximate income distributions within India, China, and the US. Thus, the green areas represent national incomes above the (\$20 per person per day, PPP) development threshold, our definition of national capacity. (Chart widths are scaled to population, so these capacity areas are correctly sized in relation to each other.)

an individual’s capacity must be defined not as *all* of his or her income (as for example in a GDP/capita metric) but rather as their income *excluding income below the development threshold*. And that, in turn, a nation’s aggregate capacity should be defined as the sum of all individual income above the development threshold. Responsibility, by which we mean contribution to the climate problem, can similarly be defined as cumulative emissions (since some agreed starting year) excluding emissions that correspond to consumption below the development

threshold. “Development emissions,” like “development income,” do not contribute to a country’s obligation to act to address the climate problem.

Thus, in the GDRs framework, both capacity and responsibility are defined in individual terms, and in a manner that takes explicit account of the unequal distribution of income within countries. This is a critical and long-overdue move, because the usual practice of relying on national per-capita averages fails to capture either the true depth of a country’s development urgency or the actual extent of its wealth. Indeed, if one looks only as far as a national average, then the richer, higher-emitting minority lies hidden behind the poorer, lower-emitting majority.

These measures of capacity and responsibility can be straightforwardly combined into a single indicator of obligation: a “Responsibility Capacity Index” (RCI). This calculation is done for all Parties to the UNFCCC, based on country-specific income, income distribution, and emissions data. The precise numerical results depend on the particular values chosen for key parameters, such as the year in which national emissions begin to count towards responsibility (we use 1990 as our indicative “responsibility start date,” but a different dates can be defended, and the online GDRs calculator<sup>3</sup> supports dates as early as 1751) and, especially, the development threshold.

Crucially, the GDRs framework lays out a straightforward and transparent operationalization of the UN's official differentiation principles, and that, again, is designed to protect the poor from the burdens of global climate mobilization. Beyond that, the values of specific parameters can be easily adjusted and should certainly be debated; all of them, of course, would have to be negotiated.

GDRs results for representative countries and groups (percent shares)							
	2010					2020	2030
	Population (percent of global)	GDP per capita	Capacity (percent of global)	Responsibility (percent of global)	RCI	RCI	RCI
<b>EU 27</b>	7.3	30,472	<b>28.8</b>	<b>22.6</b>	<b>25.7</b>	<b>22.9</b>	<b>19.6</b>
EU 15	5.8	33,754	<b>26.1</b>	<b>19.8</b>	<b>22.9</b>	<b>19.9</b>	<b>16.7</b>
EU +12	1.49	17,708	<b>2.7</b>	<b>2.8</b>	<b>2.7</b>	<b>3.0</b>	<b>3.0</b>
<b>United states</b>	4.5	45,640	<b>29.7</b>	<b>36.4</b>	<b>33.1</b>	<b>29.1</b>	<b>25.5</b>
<b>Japan</b>	1.9	33,422	<b>8.3</b>	<b>7.3</b>	<b>7.8</b>	<b>6.6</b>	<b>5.5</b>
<b>Russia</b>	2.0	15,031	<b>2.7</b>	<b>4.9</b>	<b>3.8</b>	<b>4.3</b>	<b>4.6</b>
<b>China</b>	19.7	5,899	<b>5.8</b>	<b>5.2</b>	<b>5.5</b>	<b>10.4</b>	<b>15.2</b>
<b>India</b>	17.2	2,818	<b>0.7</b>	<b>0.3</b>	<b>0.5</b>	<b>1.2</b>	<b>2.3</b>
<b>Brazil</b>	2.9	9,442	<b>2.3</b>	<b>1.1</b>	<b>1.7</b>	<b>1.7</b>	<b>1.7</b>
<b>South Africa</b>	0.7	10,117	<b>0.6</b>	<b>1.3</b>	<b>1.0</b>	<b>1.1</b>	<b>1.2</b>
<b>Mexico</b>	1.6	12,408	<b>1.8</b>	<b>1.4</b>	<b>1.6</b>	<b>1.5</b>	<b>1.5</b>
<b>LDCs</b>	11.7	1,274	<b>0.1</b>	<b>0.0</b>	<b>0.1</b>	<b>0.1</b>	<b>0.1</b>
<b>Annex 1</b>	18.7	30,924	<b>76</b>	<b>78</b>	<b>77</b>	<b>69</b>	<b>61</b>
<b>Non-Annex 1</b>	81.3	5,096	<b>24</b>	<b>22</b>	<b>23</b>	<b>31</b>	<b>39</b>
<b>High Income</b>	15.5	36,488	<b>77</b>	<b>78</b>	<b>77</b>	<b>69</b>	<b>61</b>
<b>Middle Income</b>	63.3	6,226	<b>23</b>	<b>22</b>	<b>22</b>	<b>30</b>	<b>38</b>
<b>Low Income</b>	21.2	1,599	<b>0.2</b>	<b>0.2</b>	<b>0.2</b>	<b>0.3</b>	<b>0.5</b>
<b>World</b>	100 %	9,929	<b>100 %</b>	<b>100 %</b>	<b>100 %</b>	<b>100 %</b>	<b>100 %</b>

**Table 1. Percentage shares of total global population, GDP, capacity, responsibility, and RCI for selected countries and groups of countries, based on projected emissions income for 2010, 2020, and 2030. (High, Middle and Low Income Country categories are based on World Bank definitions. Projections based on International Energy Agency *World Energy Outlook 2007*.)**

Still, for all that, our indicative calculations are well chosen and interesting. Looking at just the 2010 numbers, for example, they show that the United States, with its exceptionally large share of the global population of people with incomes above the \$20 per day development threshold (capacity), as well as the world's largest share of cumulative emissions since 1990 (responsibility), is the nation with the largest share (33.1 percent) of the global RCI. And that the EU follows with a 25.7 percent share. And that China, despite being relatively poor, is large enough to have a rather significant 5.5 percent share, which is still less than that of the much

smaller but much richer country of Japan (7.8%). And that India, also large but much poorer, falls far behind China with a mere 0.5 percent share of the global obligation to act.

As Table 1 shows, the global balance of climate obligation changes over time, as differing rates of projected national growth change the global income structure. The projections here predate the global financial crisis, and would have been uncertain even in its absence, but they reflect business-as-usual as modeled by the International Energy Agency, and are thus among the most widely vetted BAU projections available. In any case, the results of these differing rates of national growth are most evident in the projected change in China's share of the total RCI, which nearly triples between 2010 and 2030 (from 5.5% to 15.2%), reflecting China's rapid economic growth, its increase in emissions, and the large number of its citizens whose incomes are projected to rise above the development threshold in the coming two decades.<sup>4</sup>

These figures, again, illustrate the application of the GDRs framework by way of a particular choice of key parameters. Note that for this indicative calculation, the RCI is defined such that all income (and all emissions) above the development threshold count equally. This amounts to a "flat tax" on capacity and responsibility. However, it might well be more consistent with widely shared notions of fairness if the RCI were defined in a more progressive manner. Which is to say that a strong case can be made for a capacity calculation in which an individual's millionth dollar of income contributed far more to their RCI than his or her ten-thousandth dollar of income. A more progressive formulation of RCI would also be more consistent with the "tax schedules" by which the income tax codes of most countries are structured. And it would, naturally, shift more of the global burden to wealthy individuals and wealthy countries.

Still, and regardless of the particulars of any example quantification, the GDRs framework, or any approach to differentiating national obligations that is similarly designed to ensure a meaningful right to development, could potentially reframe the entire differentiation and effort-sharing debate. For one thing, it would allow us to objectively and quantitatively estimate national obligations to bear the burdens of climate protection (obligations to support adaptation as well as obligations to mitigate) and to meaningfully compare efforts and obligations even between wealthy and developing countries. Using the terminology of the Bali Roadmap, it would allow us to flexibly gauge the "comparability of effort" across countries. Another way of putting this is that it would give us tools we need to escape the Annex 1 / Non-Annex 1 divide, which has become a critical obstacle to the progress of the negotiations.

Not that a global effort-sharing system would substitute for the political rapprochement between North and South that we so desperately need. Such a rapprochement that can only come with a significant effort by the North to finally meet its unmet commitments to the South. But now, in the hope that such an effort may finally be on the horizon, it's time to look forward. A new beginning in Copenhagen would still just be a beginning. Even if the post-Copenhagen world saw trust established and decisive action prioritized by all sides, the comparability-of-effort problem would remain, and remain critical, and something like the GDRs framework would be necessary to solve it. After all, in a GDRs style system, debates about whether Saudi Arabia or Singapore should "graduate to Annex 1" would be entirely unnecessary; both would simply be countries with obligations of an appropriate scale, as specified by their RCIs.

That said, however, the real value of the GDRs approach is a deeper one – GDRs defines and quantifies national obligations in a way that explicitly safeguards a meaningful right to sustainable development. By so doing, it takes at face value the developing country negotiators' claim that they can only accept a regime that protects development, and just as importantly it tests the willingness of the industrialized countries to step forward and offer such a regime.

### **1.3 Operationalizing a GDRs effort-sharing framework**

How might such obligations be operationalized? Consider two complementary examples, each a stylized version of the more complex mechanisms that would emerge in real negotiations. The first is a single grand international fund through which all mitigation and adaptation would be financed – such as, say, a greatly expanded version of the Multinational Climate Change Fund proposed by Mexico or the “Financial Mechanism for Meeting Financial Commitments under the Convention” proposed by the G77 and China. Here, the RCI could serve as the basis for determining each nation’s obligatory financial contribution to the fund.

Whatever the operationalization, cost would of course be a major issue. And when it comes to estimating the total scale of global mitigation and adaptation costs, there is, of course, tremendous uncertainty. This is not the place to discuss cost estimates in any depth, except to note that they span a fairly wide range. The Stern Review, for example, surveyed a range of modeling analyses and found mitigation costs rising up to the order of 1% of Gross World Product by 2050. Stern has subsequently revised this estimate upward as he has come to advocate more stringent targets.<sup>5</sup> On another front, the analysis backing up the extremely important European Commission “Copenhagen Communication” (EC, 2009) provided two alternative results. Its macroeconomic analysis (using the GEM-E3 model) concluded that the mitigation scenario would suffer in 2020 a 1.0% GWP cost relative to the baseline, while its more techno-economic analysis (using POLES) found mitigation costs of €175 billion, or about ¼% of the EC’s projected 2020 Gross World Product. This latter figure is more or less comparable with the other bottom-up analyses, such as like the recent well-publicized McKinsey study, which estimate around \$200 billion to \$400 billion for global costs<sup>6</sup>.

In the face of such variance, we find it useful to admit that one cannot know the cost of stabilizing the global climate, and to instead conduct a thought experiment in which we take the 2020 global funding requirement as being exactly 1% of the projected Gross World Product. It is a useful figure to start with, as it is well within the range of published estimates of the cost of a global climate transition, though it is four times larger than the size of the EC’s technoeconomic estimate, equal to the EC’s macroeconomic estimate, and half as large as Stern’s revised estimates.

Given an assumed total global climate transition costs of 1% of GWP, (or \$944 billion in 2020 in our projection), one can ask how a GDR allocation would allocate those costs. The US, with 29.1% of the global RCI, would be obligated to pay about \$275 billion. Similarly, the EU’s share would be about \$216 billion (22.8% of the global RCI). China’s share would be \$98 billion (10.4%), India’s about \$11 billion (1.2%), and so on, as shown in Table 2, below.

	National Income (Billion \$ )	National Capacity (Billion \$)	National Capacity % GDP	National Obligation (Billion \$)	National Obligation % GDP
<b>EU 27</b>	\$19,327	\$15,563	80.5%	\$ 216	1.12%
<b>EU 15</b>	\$16,752	\$13,723	81.9%	\$ 188	1.12%
<b>EU +12</b>	\$ 2,574	\$ 1,840	71.5%	\$ 28	1.09%
<b>United States</b>	\$18,177	\$15,661	86.2%	\$ 275	1.51%
<b>Japan</b>	\$ 5,071	\$ 4,139	81.6%	\$ 62	1.23%
<b>Russia</b>	\$ 2,905	\$ 1,927	66.3%	\$ 41	1.40%
<b>China</b>	\$13,439	\$ 5,932	44.1%	\$ 98	0.73%
<b>India</b>	\$ 5,814	\$ 972	16.7%	\$ 11	0.19%
<b>Brazil</b>	\$ 2,535	\$ 1,376	54.3%	\$ 16	0.64%
<b>South Africa</b>	\$ 706	\$ 422	59.8%	\$ 10	1.42%
<b>Mexico</b>	\$ 1,744	\$ 1,009	57.9%	\$ 15	0.84%
<b>LDCs</b>	\$ 1,549	\$ 82	5.3%	\$ 1	0.06%
<b>Annex 1</b>	\$50,368	\$40,722	80.8%	\$ 652	1.29%
<b>Non-Annex 1</b>	\$44,037	\$18,667	42.4%	\$ 292	0.66%
<b>High Income</b>	\$49,279	\$40,993	83.2%	\$ 655	1.33%
<b>Middle Income</b>	\$41,546	\$18,190	43.8%	\$ 286	0.69%
<b>Low Income</b>	\$ 3,579	\$ 206	5.8%	\$ 3	0.08%
<b>World</b>	\$94,405	\$59,388	62.9%	\$ 944	1.00%

**Table 2. GDP, capacity, and obligation, projected to 2020.** These figures assume that the total cost of the global climate program is 1% of GWP, projected as \$944 billion in 2020.

These figures are, again, based on the assumption of a total annual global cost, for both mitigation and adaptation, of 1% of GWP. If they turned out, instead, to be 0.5% of projected 2020 GWP rather than a full 1%, national obligations would come to only half of these figures. It is also worth noting that, over in Europe, the debate currently turns around the European Commission's 2020 mitigation-only cost estimate of €175 billion (220 billion US dollars). This comes to about 0.23% of projected 2020 GWP, and thus implies estimated costs that are about half of the 0.5% figure.

What does this tell us? Well, consider that the Greenhouse Development Rights framework could be operationalized in many ways – as a global cap and trade system, as an auction-based system, as a fund-based system, or even as a system of internationally harmonized taxes. All approaches would have their advantages and their disadvantages. And it does seem that, in ruminating about costs, and trying to understand what they mean in concrete terms, thinking in terms of a global tax is particularly useful. In this case, the RCI, in effect, would serve as the basis of a modestly progressive global “climate tax” – not a carbon tax, but a capacity and responsibility tax. And the size of this tax could be expressed in individual terms, by simply assuming that it is passed down to taxpayers at various levels of (2020) income, according to their individual RCIs, *thus ensuring that effort sharing within nations exactly parallels effort sharing among nations.*

Please understand that we are not advocating a global climate tax. But we very much do believe that the system by which the effort associated with the climate transition is apportioned, between

and within countries, must be progressive. And thinking in terms of a tax table allows us to apply the moderately progressive effort-sharing system that is GDRs at the individual level, and thus to see what the “unrealistic” global emergency climate stabilization program that we advocate would actually cost individuals.

Under such circumstances, individuals below the development threshold, who contribute nothing to their nation’s obligation, would similarly pay nothing toward fulfilling that obligation. In effect, their “climate tax” would be zero. Which is to say that, in 2020, the roughly two-thirds of the world’s population that falls below the development threshold (assuming for simplicity that intranational income distributions remain as they are today, though of course they will change) would be exempt from paying any climate tax, enabling them to prioritizing the attainment of a basic level of welfare. The remaining population (the top third of the global population), which is projected to control 85% of the world’s income in 2020, would cover the total global mitigation and adaptation cost.

Country	income	Total costs: 0.5% of GWP			Total costs: 1.0% of GWP			Total costs: 2.0% of GWP		
		marginal tax rate	average tax rate	annual tax	marginal tax rate	average tax rate	annual tax	marginal tax rate	average tax rate	annual tax
US	\$7,500	0.00%	0.00%	\$0	0.00%	0.00%	\$0	0.00%	0.00%	\$0
US	\$15,000	0.88%	0.44%	\$65	1.75%	0.87%	\$131	3.50%	1.74%	\$261
US	\$30,000	0.88%	0.66%	\$197	1.75%	1.31%	\$393	3.50%	2.62%	\$786
US	\$60,000	0.88%	0.77%	\$459	1.75%	1.53%	\$918	3.50%	3.06%	\$1,836
US	\$120,000	0.88%	0.82%	\$978	1.75%	1.63%	\$1,956	3.50%	3.26%	\$3,912
Sweden	\$7,500	0.00%	0.00%	\$0	0.00%	0.00%	\$0	0.00%	0.00%	\$0
Sweden	\$15,000	0.58%	0.29%	\$43	1.15%	0.58%	\$87	2.30%	1.15%	\$173
Sweden	\$30,000	0.58%	0.44%	\$131	1.15%	0.87%	\$261	2.30%	1.74%	\$522
Sweden	\$60,000	0.58%	0.51%	\$303	1.15%	1.01%	\$606	2.30%	2.02%	\$1,212
Sweden	\$120,000	0.58%	0.54%	\$648	1.15%	1.08%	\$1,296	2.30%	2.16%	\$2,592

**Table 3. “Climate tax” for various income levels.** The marginal tax rate, average tax rate, and total annual bill are shown, under three different assumptions about the total costs of the emergency climate mitigation and adaptation costs (0.5%, 1.0%, and 2.0% of Gross World Product).

Here we compare the United States, a country with famously high responsibility relative to its capacity, and Sweden, a country with low responsibility relative to its capacity. (The details: US cumulative per capita emissions, 1990 to 2020, are projected to be 133 tons of carbon, while Sweden’s are projected to be 40 tons. Reporting these numbers for 2010, a more tractable projection, yields US cumulative per capita emissions of 105 tons, Swedish cumulative per capita emissions of 34 tons.)

Note that, although each incremental dollar of income or ton of emissions is taxed at the same rate (as in a “flat tax”), income and emissions below the development threshold are explicitly excluded, and therefore the whole system is modestly progressive. And note especially that when you compare individuals with the same level of income, across countries with different levels of responsibility, their overall “tax” is not the same. The tax for individuals at the same income level varies (being highest for the US and lowest for Sweden), reflecting the fact that this is a capacity- and responsibility-based *climate tax*, not simply an income tax, nor a carbon tax.

The size of this tax is not onerous. Consider the medium case above, in which we estimate the total costs of stabilizing the climate as being 1% of GWP in 2020. As you can see, a US citizen

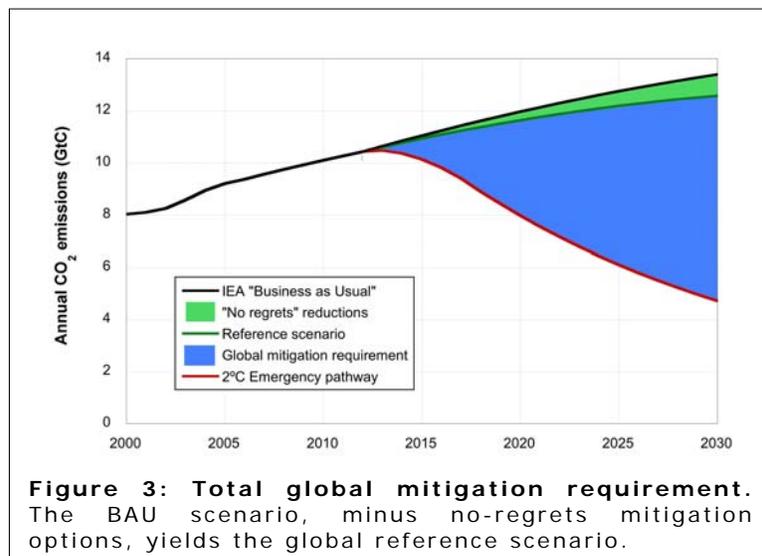
earning \$60,000 a year would pay a climate tax of \$918 a year, or \$2.50 a day. This is not a large sum, and, again, keep in mind that this is based on a global cost estimate that is quite high. If you instead use the European Commission’s now influential global cost estimate (see above), this same citizen would pay a climate tax of about \$200 a year, *about half a dollar a day*. If we are instead extremely pessimistic, and we assume that even Stern’s revised estimate is low by a factor of two, and that total global costs will be an unthinkable 4% of GWP, then this individual would be asked to contribute about \$10/day. Still a small price to pay to save the planet.

This analysis has two clear implications, that fair effort sharing is of great pragmatic significance, and, by definition, any fair effort-sharing system must take intra-national income distribution into proper account. Even if the costs of a rapid climate transition are assumed to be quite high (even higher than the case of 2% of GWP shown in the Table 3), and *even* if these costs are deemed to be solely the obligation of the minority of people with incomes above a \$7,500/year development threshold (less than one third of the global population today) they would still be quite bearable. The rich and the relatively well-off can easily afford to shield the poor from the costs of combating climate change. They can, in other words, afford to honor a meaningful right to development.

### 1.4 The GDRs framework and national reduction targets

Another perspective on effort sharing, one that is central to the ongoing negotiations, expresses post-2012 obligations in terms of emission reduction obligations and Kyoto-style national targets. To illustrate it, we start by comparing a global “business-as-usual” trajectory to the rapidly dropping 2°C emergency pathway, a comparison that allows us to straight-forwardly calculate the total amount of mitigation needed globally in any given year.

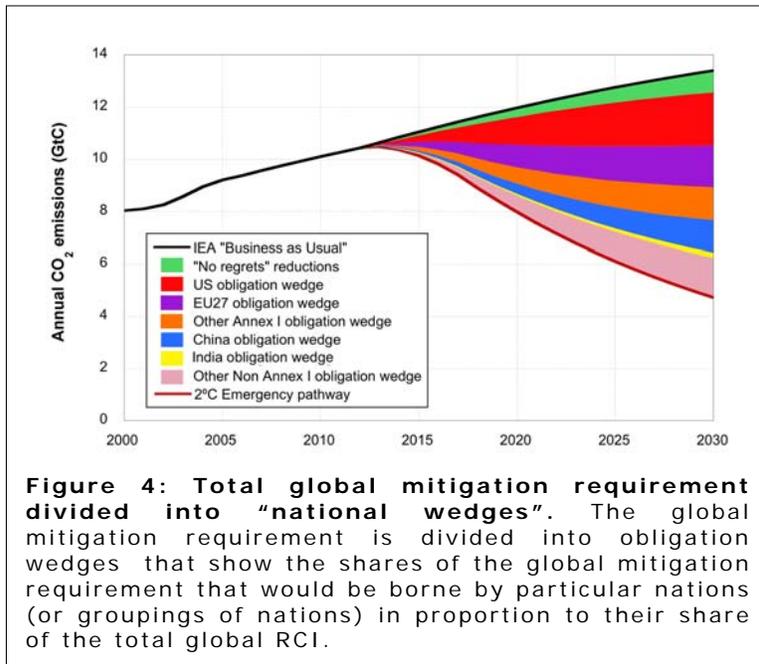
Figure 3 shows this rapidly growing gap divided between “no regrets” reductions (green), which have zero or net negative costs, and the much larger “global mitigation requirement” (blue).<sup>7</sup> As



shown, the global mitigation requirement, excluding the no-regrets opportunities, grows to approximately 3.7 GtC in 2020. (Note that these calculations and the discussion that follows are based on estimates for CO<sub>2</sub> only; a similar proportional reduction in all GHGs would imply a roughly 30% larger mitigation requirement, about 17.6 GtCO<sub>2</sub>-equivalent in 2020).

In the GDRs framework, national emission reduction obligations are defined as

shares of the global mitigation requirement, as allocated among countries in proportion to their RCI. This is illustrated in Figure 4, which shows this allocation into national obligations with, to give a few prominent examples, the US’s share (29.1%) of the total mitigation requirement appearing as the large red wedge, the EU’s share (22.8%) as the large purple wedge, and China’s share (10.4%) appearing as the smaller but still significant blue wedge. Thus, for example, the EU’s mitigation obligation is (22.8% of the 3.7 GtC global mitigation requirement in 2020) is about 850 GtC.



If this mitigation obligation were interpreted literally and achieved entirely through domestic reductions, it would imply reductions of nearly *140% below 1990 levels – minus 500 MtC – by 2030*. Obviously, this is impossible. In fact, for mitigation obligations of this magnitude to make sense, countries must not be expected to meet them entirely through domestic reductions. Thus, whatever is not accomplished domestically would need to fulfill internationally, by way of reductions in other countries that are “supported and enabled by technology,

financing and capacity-building, in a measurable, reportable and verifiable manner.”<sup>8</sup>

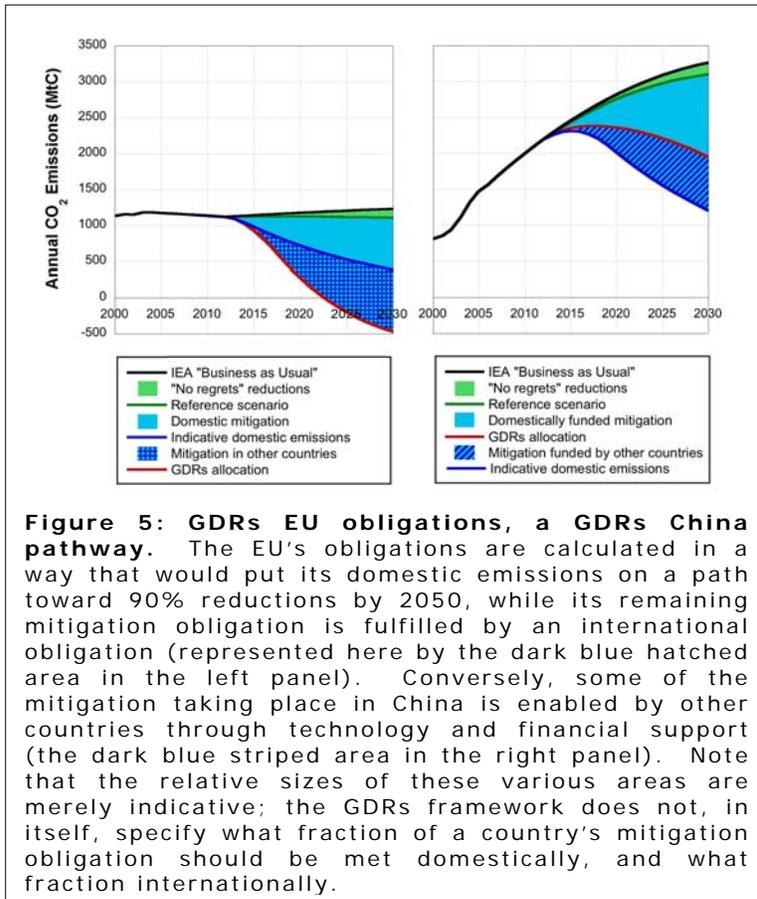
On its left side, Figure 5 shows the total EU mitigation obligation with an indicative division into a domestic (light blue) mitigation obligation and an (dark blue hatched) international mitigation obligation. The domestic mitigation effort is here defined so as to match the rapid decline needed to put the EU on course toward 90% domestic reductions relative to 1990 levels by 2050.

This makes for a stringent, and thus illustrative, example, one in which the EU achieves physical domestic reductions by 2030 of more than 60% below 1990 levels. But note two things. First, this level of domestic reductions is merely indicative. There is nothing about the GDRs framework that, in itself, dictates what fraction of a country’s total mitigation obligation would be discharged domestically. Rather, we assume that national preferences for domestic vs. international mitigation would vary with national circumstances, and that the final balance would depend on tradeoff between cost efficiency and political acceptability. Second, and critically, even this ambitious rate of domestic reductions satisfies well less than half of the EU’s total mitigation obligation. The remainder, amounting to nearly 900 MtC of reductions in 2030, must be discharged in other countries. In total, assuming domestic reductions of more than 60%, the EU would still obligated to make international reductions greater than 70% of its 1990 emissions.

Moreover, this very demanding result is by no means an anomaly or methodological quirk, but rather a direct outcome of the principles underlying the GDRs framework. Like any country with high capacity and responsibility, the EU is assigned a very large obligation – large enough to necessitate extremely ambitious reductions both domestically and internationally.

China, in contrast, would be obligated to reductions of about 1100 MtC in 2030 (light blue shading), all of which could be made domestically. At the same time, another substantial quantity of reductions within China, about 750 MtC in 2030 is our estimate, (blue striped shading), would be enabled and supported by other countries with higher capacity and responsibility.

These examples illustrate a robust and striking conclusion. The national mitigation obligations of the countries with high capacity and responsibility greatly exceed the reductions they could conceivably make at home. In fact, their mitigation obligations will typically come to exceed even



their total domestic emissions. Which is to say that, under a GDRs effort-sharing framework, countries with high capacity and responsibility ultimately receive “negative allocations”<sup>9</sup>.

Obligations of this scale may seem simply implausible by today's standards of political realism, even for countries with high capacity and responsibility. Nevertheless, they are, in the final analysis, quite unavoidable. It is only through explicit obligations of this magnitude that a climate regime can effectively bring about its two essential outcomes. First, by driving ambitious domestic reductions, these obligations ensure that the wealthier countries free up sufficient environmental space for the poorer countries to develop.

Second, by driving equally ambitious international reductions, enabled by technological and financial support from the wealthier countries, they ensure this development occurs along a decarbonized path.

These examples thus show, with startling clarity, that a major commitment to North-South cooperation – including large financial and technological transfers – is an inevitable part of any viable climate stabilization architecture. This situation reflects the actual nature of national obligations and the obvious truth of the greenhouse world: even if the wealthy countries reduce their domestic emissions to zero or near-zero levels, they must still, in addition, enable large emissions reductions in countries that lack the capacity (and responsibility) to reduce emissions as much as an emergency 2°C mitigation pathway requires, without significant assistance from others.

It is only by accepting their *two-fold obligation* that the wealthy countries can enable a climate regime that is genuinely consistent with the right to development.

### 1.5 Effort-sharing in the Copenhagen period

History follows a complex and varied course, and its complexities cannot be captured by any top-down, principle-based scheme like GDRs. Given this, the GDRs effort-sharing analysis, in itself, necessarily neglects any satisfying discussion of the processes that got us to the climate impasse in the first place, and the political innovations that will be required to get us beyond it.

GDRs, most immediately, is blind to the North-South trust deficit. And this is true even though this deficit effectively rules out the simplest path forward. On such a path, all countries, whether of the North or the South, would simply commit to carry their “fair share” of the global climate burden, and then proceed, more-or-less directly, to the practical negotiations necessary to operationalize such an accord.

This, unfortunately, is not likely to happen in Copenhagen. And it’s important to understand that the obstacles before it are not particular to principle-based systems like GDRs, but rather of pressing and general importance. This is because, in the first instance, the North-South trust deficit has an objective basis in global economic and political history and, more particularly in the unmet promises of Rio and Kyoto. And because, in consequence, the South cannot reasonably be expected to take on legally binding commitments in the Copenhagen period, not even if these are defined in a principle-based manner that genuinely safeguards its right to development.

Nor can the South’s reticence be put down to a negotiating strategy. Rather, it simply sees any agreement that would legally curtail its emissions as being unacceptably dangerous, at least for the moment. Moreover, this view is not hard to understand. To this point, after all, industrial development has been almost entirely driven by fossil fuels, and why, without the North’s demonstrated willingness to help chart, and indeed pave, an alternative course, should the countries of the South sign away their rights to follow along this proven pathway?

The real problem, then, is that developed countries have wholly failed to demonstrate such a willingness, and this despite their legal obligation, which they accepted in Rio in 1992, to “take the lead in combating climate change and the adverse affects thereof” (UNFCCC, Art. 3.1). More precisely, the developed countries have simply not delivered on their commitment to return their emissions to 1990 levels by 2000. To be sure, Europe has managed formal compliance, but this was delivered only unwittingly by the Soviet economic collapse, and the limited nature of this success is underscored not only by the utter non-compliance of the US and Canada, but also by the half-hearted efforts which the Europeans – the North’s climate policy leaders – have been able to assemble in the face of their own anti-compliance lobbies. To be sure, progress is being made in both the US and the EU, but it is coming late, it is far from decisive, and it does not suffice to refute the view, widespread in the South, that any willingness to accept legally binding commitments would put it at the mercy of a northern bloc that is far more attentive to its own local realisms than to the global necessities of climate-constrained development.

Moreover, the problem extends beyond the North’s inability to restrain its own emissions growth. It also reflects the North’s repeated failure to meet its UNFCCC and Kyoto commitments to provide technological and financial support to the processes of mitigation and adaptation in the South. In particular, and unambiguously, the (Annex II) developed countries agreed in 1992 (UNFCCC, Art. 4.3)<sup>10</sup> to “provide such financial resources, including for the transfer of technology, needed by the developing country Parties to meet the agreed full incremental costs of implementing measures” including, inter alia, to:

“Formulate, **implement**, publish and regularly update national and, where appropriate, regional programmes containing measures to mitigate climate change by addressing anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, and measures to facilitate adequate adaptation to climate change.” (UNFCCC, Art. 4.1(b))

and

“Promote and cooperate in the development, application and diffusion, including transfer, of technologies, practices and processes that control, reduce or prevent

anthropogenic emissions of greenhouse gases not controlled by the Montreal Protocol in all relevant sectors, including the energy, transport, industry, agriculture, forestry and waste management sectors;" (UNFCCC, Art. 4.1(c))

The UNFCCC further underscores that the provision of necessary funding "shall take into account the need for adequacy and predictability in the flow of funds and the importance of appropriate burden sharing among the developed country Parties" (UNFCCC, Art. 4.3), and it emphasizes that developing country action is contingent on the availability of developed country funding:

"The extent to which developing country Parties will effectively implement their commitments under the Convention will depend on the effective implementation by developed country Parties of their commitments under the Convention related to financial resources and transfer of technology and will take fully into account that economic and social development and poverty eradication are the first and overriding priorities of the developing country Parties." (UNFCCC, Art. 4.7)

Yet, notwithstanding the fact that these same agreements were reiterated in the Kyoto Protocol (Article 11.2(b)), the amount of financial support for mitigation, adaptation, and technology transfer delivered over the past seventeen years has been entirely inadequate, and straightforwardly insufficient to support any honest argument that the developed countries have made good faith efforts to fulfill their UNFCCC and Kyoto Protocol financing and technology-transfer commitments.

All of which has implications. It tells us, for example, that the Copenhagen phase must, above all, be one in which the Annex 1 countries finally and definitively fulfill their UNFCCC commitment to "take the lead." The Copenhagen period, in fact, is Annex 1's last best chance to do so, and thus to create confidence, through concerted action, in the feasibility of a successful global climate transition. To meet that promise, however, Annex 1 will have to contrive aggressive and sweeping mitigation initiatives at home, and good-faith assistance to non-Annex 1 countries seeking financial and technological assistance to mitigate and to adapt. There is, in other words, still time for the North to fulfill its commitment to lead, but not much, and failure to seize the Copenhagen opportunity will almost certainly put a 2°C path out of reach.

This look back to the UNFCCC also tells us what the Copenhagen phase is *not*. It is not a time in which the Annex 1 countries can hope to minimize their own responsibility by pointing fingers at others, and this is true regardless of how many coal-fired power plants those others may be building. Nor is it time for the Annex 1 countries to make their own efforts contingent on the efforts of others. Nor for them to plead the hardships of the current financial crisis, while pressuring much poorer nations to take on binding commitments. Rather, Annex 1 should now, simply and straight-forwardly, affirm its acceptance of the "full incremental costs" of climate actions, globally, for the duration of what we might call the Copenhagen transition. Only by doing so can it act in a manner consistent with the UNFCCC, Kyoto, and Bali and, by so doing, allow us to decisively break the impasse.

None of this, we hasten to add, is to say that the developing countries can defer decisive actions of their own. The simple fact is that the more affluent of the southern countries, such as South Korea, have a significant capacity to act. As does China, despite its very poor majority. And such countries must indeed act if progress in Copenhagen is not to be critically stymied. The question is how they must act, and the answer is that, for the moment, they must do so in a manner conditioned by the realities of a global impasse that has *not yet been broken*. They must, more precisely, do so *voluntarily*.

We say this despite even our own analysis, which suggests that a principle-based accounting of “common but differentiated responsibilities and respective capabilities” would assess the South’s obligation to act as being sizable, already amounting to perhaps one-quarter of the global total. But we have reluctantly concluded that, while a global system of legal commitments based on a principle-based differentiation will be necessary in time, that time has not yet come. The North must move first. Moreover, the South, though insisting on a contingent, step-by-step way forward, should not be seen as obstinately holding onto an outdated and legalistic interpretation of the UNFCCC and the Kyoto Protocol, as if in the service of a self-serving strategy of indefinite free-riding. The issue, rather, is the South’s entirely understandable wariness, in the face of simultaneous climate and a development crises and in the absence of convincing evidence that both poverty and carbon-based growth can simultaneously be left behind. The North, it may fairly be said, has for seventeen years now shown a comparable level of wariness, and this despite its much less compelling circumstances.

For just this reason, the Annex 1 nations must now decisively take the lead. Which is not the same as forever bearing the “full incremental costs” of the climate transition, which was never the intention of the UNFCCC’s framers. This is clear from the UNFCCC preamble, which recognizes a “need for developed countries to take immediate action... as a *first step* towards comprehensive response strategies at the global, national and, where agreed, regional levels”. Also, the UNFCCC uses the term “developed countries” in many contexts without the qualification “included in Annex 1,” most significantly in Article 3.1, where it appears in combination with the critical phrase “common but differentiated responsibility and respective capabilities,” clearly suggesting that the primary differentiation among countries implies something beyond a static Annex 1 / non-Annex 1 divide.

And indeed, one can observe this differentiation already occurring, specifically with the offer made by developing countries in Bali to pursue “nationally appropriate mitigation actions in the context of sustainable development” (Bali Action Plan, Para. 1.(b)(ii)). And this offer has been backed up by noteworthy initiatives from politically powerful developing countries like South Africa, Mexico, South Korea, and China. Which is to say that we should recognize and even applaud the *de facto* differentiation demonstrated by these proposals, rather than fixating on demands for *de jure* differentiation inscribed as legally binding emission commitments.

That said, it is essential now to move forward with a robust and public discussion of equitable, transparent, principle-based, quantifiable, *global* differentiation. This is true for two distinct reasons. First, and despite southern fears of the global differentiation debate, it is quite reasonable for the Annex 1 countries to want reassurance that they will not *forever* be expected to alone bear the costs of the climate transition, even as non-Annex 1 countries overcome their underdevelopment and rise in economic and political power. And, critically, by publically discussing the future necessity of principle-based global differentiation, we make it possible for Annex 1 countries to see the Copenhagen phase of the negotiations, wherein they are being asked to bear the brunt of the global costs, as a legitimate but nevertheless bounded transitional period.

Second, and critically – especially amidst the economic and financial crisis – an open discussion of global differentiation is absolutely necessary to making a clear, morally compelling, and politically persuasive case for why the Annex 1 countries are obliged to make the global effort that is now being asked of them. For even if we ignore Annex 1’s seventeen year history of non-performance, and even if we grant the rapid rise in the developing world’s emissions and incomes, it remains the case that Annex 1 countries bear the vast majority of responsibility for the climate problem, and the vast bulk of the capacity to respond to it. And this must be widely and

publicly understood if we in the North are ever to generate the political will necessary to step forward and make the climate transition feasible.

## **1.6 Conclusion**

Copenhagen will not focus on global differentiation, it can and should make bold progress in the journey toward a transparently fair and thus potentially viable global climate regime. Specifically, the elaboration of principle-based measures of effort, like the RCI we have introduced above, would be an important indicator of success in Copenhagen. In fact, if the Copenhagen negotiations succeed, we will know this in part because a coherent and public conversation about fair shares of the global effort has come into far greater prominence around the world, and in the process given credence to the use of explicit quantitative indicators for assessing national performance with respect to such fair shares.

The Greenhouse Development Rights framework is not designed to be fair because fairness is good, but to be fair because it is necessary. Ultimately a fair deal is essential if global cooperation to protect the climate is to be sustained. Fairness need not mean mathematically precise and meticulously quantified burden-sharing formulas, but it does have to mean a wide-spread perception of fairness. And, most clearly, if the world's poor majority do not perceive the climate regime to give them a fair shot at development, they will abandon it and it will fail.

No one knows what will be the costs of addressing the climate crisis, but the necessary speed of mitigation means the costs are not likely to be negligible, just as the inevitability of climate harm means adaptation costs will be significant. If costs do indeed rise into the range of hundreds of billions to trillions of dollars annually – dwarfing the cost of all other global public goods – the costs will be paid fairly, or not at all.

## Selected country details (projected to 2020)

	income	pop above dev't	capacity	responsibility share	capacity share	RCI share	national obligation to pay	Average obligation to pay	reference emissions	GDRs allocation <sup>1</sup>
Country	\$PPP per capita	% of national population	% of GDP	% of global total	% of global total	% of global total	% of GDP	\$ per person above dev't	% relative to 1990	% relative to 1990
EU 15	41,424	99	82	16.70	23.11	19.91	1.12	468	96	16
EU +12	25,981	95	71	2.94	3.10	3.02	1.11	305	82	44
United States	53,671	96	86	31.85	26.37	29.11	1.51	841	119	41
Japan	40,771	100	82	6.24	6.97	6.61	1.23	504	104	26
Russia	22,052	95	66	5.38	3.24	4.31	1.40	326	77	53
China	9,468	41	44	10.74	9.99	10.36	0.73	169	443	381
India	4,374	14	17	0.72	1.64	1.18	0.19	58	391	363
Canada	45,778	99.7	84	2.94	2.36	2.65	1.49	685	143	65
Brazil	11,519	44	54	1.15	2.32	1.73	0.64	170	227	120
Mexico	14,642	59	58	1.39	1.70	1.54	0.84	207	169	99
LDCs	1,567	2	5	0.05	0.14	0.10	0.06	58	310	294
Annex 1	38,425	94	81	69.49	68.57	69.03	1.29	529	101	38
Non-Annex 1	6,998	26	42	30.51	31.43	30.97	0.66	180	319	258
High Income	44,365	98	83	69.74	69.02	69.38	1.33	602	126	45
Upper Middle	17,438	73	62	14.12	11.74	12.93	1.08	256	116	79
Lower Middle	7,419	30	37	15.93	18.89	17.41	0.54	132	325	277
Low Income	2,022	3	6	0.22	0.35	0.28	0.08	51	189	182
World	12,415	38	63	100 %	100 %	100%	1 %	330	170	108

<sup>1</sup> Note, this is an emission allocation expressed as a **percent of 1990** levels, not a mitigation obligation expressed as a **percent reduction below 1990** levels.

## Acknowledgements

---

The authors would like to acknowledge support in various forms from the Heinrich Böll Foundation, the Stockholm Environment Institute, the Climate for Development Programme of the Swedish International Development Cooperation Agency, Christian Aid and its sister organizations, Oxfam, the Town Creek Foundation, the Rockefeller Brothers Fund and the Climate Policy Research Program (CLIPORE) of Mistra.

## References

---

- Baer, Paul, Tom Athanasiou and Sivan Kartha, (2008). “The Greenhouse Development Rights Framework: The Right to Development in a Climate Constrained World” published by Heinrich Böll Foundation, Christian Aid, EcoEquity and the Stockholm Environment Institute. Available online at [www.GreenhouseDevelopmentRights.org](http://www.GreenhouseDevelopmentRights.org).
- Baer, Paul and Mike Mastrandrea, *High Stakes: Designing emissions pathways to reduce the risk of dangerous climate change*. London, 2006: Institute for Public Policy Research. <http://www.ippr.org>.
- Council of the European Union, 2009. Council Conclusions on the further development of the EU position on a comprehensive post-2012 climate agreement, (Contribution to the Spring European Council) , 2928th Environment Council meeting , Brussels, 2 March 2009.
- EC, 2009. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Towards a comprehensive climate change agreement in Copenhagen, issued in Brussels on 28 January, 2009. COM(2009) 39 final.
- EC, 2009a. Staff Working Document, part 1. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Towards a comprehensive climate change agreement in Copenhagen - Extensive background information and analysis, issued in Brussels on 28 January, 2009. COM(2009) 39 final
- EC, 2009b. Staff Working Document, part 2. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Towards a comprehensive climate change agreement in Copenhagen - Extensive background information and analysis, issued in Brussels on 28 January, 2009. COM(2009) 39 final
- Enkvist, Per-Anders, Tomas Naucclér, and Jerker Rosander. 2007. “A Cost-curve for Greenhouse Gas Reduction.” *The McKinsey Quarterly* 2007(1): pp 35-45.
- Hansen, James, “Huge sea level rises are coming – unless we act now,” *New Scientist*, 28, July, 2007.
- Hansen, J., M. Sato, P. Kharecha, R. Berner, V. Masson-Delmotte, M. Pagani, M. Raymo, D.L. Royer, J.C. Zachos. 2008. “Target atmospheric CO<sub>2</sub>: Where should humanity aim?” *Open Atmospheric Science Journal*. ([arXiv:0804.1135v2](https://arxiv.org/abs/0804.1135v2) [physics.ao-ph])
- International Energy Agency. 2007. *World Energy Outlook 2007*. Paris: OECD/IEA.
- IPCC, 2007: *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment, Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 996 pp.

- JRC/IPTS, 2009. Economic Assessment of Post-2012 Global Climate Policies Analysis of Greenhouse Gas Emission Reduction Scenarios with the POLES and GEM-E3 models. Joint Research Center-Institute for Prospective Technological Studies. Authored by: Peter Russ, Juan-Carlos Ciscar, Bert Saveyn, Antonio Soria, Laszlo Szabó, Tom Van Ierland, Denise, Van Regemorter, Rosella Virdis.
- Lenton, T. M., Held H., Kriegler, E., et al (2008): “Tipping Elements in the Earth's climate system,” Proceedings of the National Academy of Sciences. 105 (6): 1786-1793. Cambridge.
- Mace, M.J. (2005), Funding for Adaptation to Climate Change: UNFCCC and GEF Developments since COP-7, RECIEL 14 (3).
- Meinshausen, M. “On the Risk of Overshooting 2°C.” *Avoiding Dangerous Climate Change*, H J Schellnhuber, W Cramer, N Nakicenovic, T Wigley and G Yohe, Cambridge, UK, Cambridge University Press, 2006.
- UNFCCC, 2006. “Background paper on Overview of Possible Institutional Options for the Management of the Adaptation Fund” prepared for the UNFCCC Workshop on the Adaptation Fund, Edmonton, Canada, 3 – 5 May 2006.

---

<sup>1</sup> For more on this point, see the IPCC's 4<sup>th</sup> assessment report (IPCC, 2007).

<sup>2</sup> For details, see Baer and Mastrandrea (2006) and Meinshausen (2006).

<sup>3</sup> [www.ecoequity.org/GDRs/Calculator](http://www.ecoequity.org/GDRs/Calculator)

<sup>4</sup> The projected figures here are by no means definitive. For example, the share of the RCI that is here being attributed to China is not yet adjusted to include the carbon that is “embodied” in Chinese exports. Some significant fraction of this carbon would be better posted against the accounts of the nations that import and consume these exports, and soon they will be. And, as noted in the text above, a more “progressive” definition of the RCI would similarly shift the distribution of obligations further toward the relatively wealthier countries.

<sup>5</sup> See the Stern Review (2006) and, for Stern's 2008 revisions, his *Key Elements of a Global Deal on Climate Change*. London: The London School of Economics and Political Science.

<sup>6</sup> Andrew Pendleton, *Fairness in global climate change finance*, Institute for Public Policy Research, London, forthcoming

<sup>7</sup> The business-as-usual scenario in this analysis is taken from the International Energy Agency (IEA, 2007); the size of the no-regrets reductions potential is derived from McKinsey Company analysis (Enkvist et al., 2007), and the emergency pathway is the same as that which was presented far above in Figure 3.

<sup>8</sup> The Bali Action Plan, Decision 1/CP.13 para 1(b) ii.

<sup>9</sup> Incidentally, this kind of negative allocation can never arise under Contraction and Convergence style trajectories, wherein high-emitting countries are only required to transition from their high grandfathered allocations down toward the global per-capita average. Greenhouse Development Rights, it should be said, evolved from Contraction and Convergence, the most well-known of the per-capita rights approaches.

<sup>10</sup> See Mace (2005) and UNFCCC (2006) for a comprehensive treatment of adaptation funding commitments in particular.