

Ireland's role in a climate constrained world

An analysis of Ireland's climate obligations, in the context of the EU's proposed 2020 targets and effort-sharing strategy, and as informed by the Greenhouse Development Rights approach



Tom Athanasiou
Sivan Kartha
Paul Baer
Eric Kemp-Benedict

EcoEquity



1	INTRODUCTION AND SUMMARY.....	3
2	FRAMING THE MOMENT.....	7
3	THE RIGHT TO DEVELOPMENT IN A CLIMATE-CONSTRAINED WORLD.....	9
4	THE GREENHOUSE DEVELOPMENT RIGHTS FRAMEWORK, IN BRIEF.....	14
5	IRELAND’S PROPOSED COMMITMENTS VS. ITS GDRS OBLIGATIONS	18
6	THE EU’S OPENING MOVE.....	26
7	CONCLUSION.....	32
8	APPENDIX 1: THE GREENHOUSE DEVELOPMENT RIGHTS FRAMEWORK.....	34
9	APPENDIX 2: IRELAND’S RESPONSIBILITY AND CAPACITY INDICATOR (RCI)	47
10	APPENDIX 3: EU AND SELECTED COUNTRY DETAILS (PROJECTED TO 2020).....	51
	ACKNOWLEDGEMENTS	54
	REFERENCES	54

1 Introduction and Summary

Soon, in Copenhagen, the climate negotiations will reach a critical milestone. The stakes could not be higher – recent science makes this very clear, and so do recent political and economic developments. Climate change poses a threat to all of us and in particular to the most vulnerable people in the world. And time is running out.

Tackling the climate crisis head on will require a mammoth effort – both in terms of scale of the response the science tells us is necessary, and in the level of international political cooperation that will be required to reach a meaningful accord. Put simply, the climate crisis is extremely grave, so grave that the appropriate response can only be seen as an emergency climate mobilization. Yet such a mobilization, which would be daunting under the best of circumstances, must come instead while billions of people, overwhelmingly but not exclusively in the Global South, are still struggling to escape poverty.

Few people, indeed, have much time to think about the climate negotiations. In Ireland – where recent headlines have turned more around economic crisis than around climate crisis – this is at least as true as it is in other parts of the European Union. Still, if Ireland has not, historically, been a major player in the climate debate, it has indeed played a role in the longer, larger debate about global economic and developmental justice.

Now, all these stories are coming together. The climate negotiations are coming to a crisis, and justice is at its center. The EU is finally revealing its negotiating position, and as this report will argue, it is inadequate. Ireland, as a member of the EU, is implicated. Nor are the issues here at all abstract. The crisis is global, but the stakes are measured in national terms. Ireland, like all countries, must know what domestic actions, and what international commitments, it can reasonably be expected to make. And both its people and its decision makers must be able to judge such expectations against the politics and possibilities of the moment.

What does this mean for Ireland?

Ireland, like all countries, must do its fair share. But how to judge that fair share against the demands of the science, and in the context of the international climate policy impasse? What would it mean for Ireland, a relatively wealthy industrialized country – albeit one that does not currently feel wealthy, to take on a “comparable” effort, in the global battle for climate stabilization?

Ireland’s current obligations were agreed in December 2008, when the European Union set itself an emissions reduction target of 20% by 2020 based on 1990 levels, rising to 30% in the context of an international agreement. Under that EU effort-sharing agreement Ireland’s charge is to reduce its non-ETS emissions by 20% below 2005 levels. Given the substantial increase in Irish emissions between 1990 and 2005 – a dark side of the economic boom – this target, combined with reductions in the ETS and aviation sectors, leads to an overall Irish 2020 target of about 3% above 1990 levels. And if the EU finds success in Copenhagen, and then tightens its overall 2020 target to 30% below 1990 levels by 2020, as it has promised to do, then Ireland’s overall 2020 target would deepen to about 9% below 1990 levels, or, relative to 2005, a reduction target of about 29%¹.

	Reduction in 2020 relative to 2005				Relative to 1990
	Non ETS	ETS	Aviation	Total	Total
Ireland under 20% EU Target	-20%	-21%	-5%	-20%	3%
Ireland under 30% EU Target	-26%	-37%	-5%	-29%	-9%

Table ES1: Ireland's reductions under the EU proposals

These are striking figures, at least when compared to business as usual.

Still, it is important to ask whether they are enough. Will this level of effort, and the European effort-sharing framework within which it is defined, be enough to contribute a fair share of the global effort to tackle climate change, and crucially be enough break the political impasse that has, to this point, prevented real progress in the climate regime? This is the question that this report attempts to answer. Using the Greenhouse Development Rights Framework, an effort-sharing system designed to be as simple as possible while still capturing the intention behind the UNFCCC's foundational principles of "common but differentiated responsibilities and respective capabilities.", the answer we suggest is no.

By incorporating responsibility, the GDR Framework (outlined here briefly, but explained in more detail in the appendices) captures the necessities of the polluter pays principle and establishes incentives for low-carbon development. By incorporating capacity, it respects the obvious truth that climate is an overarching civilizational challenge that will demand major financial resources. By defining both responsibility and capacity with respect to a *development threshold*, it safeguards a meaningful right to development. And, critically, by accounting for intra-national disparities in wealth, it recognizes that that this right adheres to individuals, not countries, and that the relatively wealthy people in poor countries, like their compatriots in the North, should ultimately (if not immediately) share the common obligation to stabilize and protect the global climate. It is, in other words, a sketch of the future, as it must soon come to be, and as such it tells us a great deal about what we must achieve in Copenhagen.

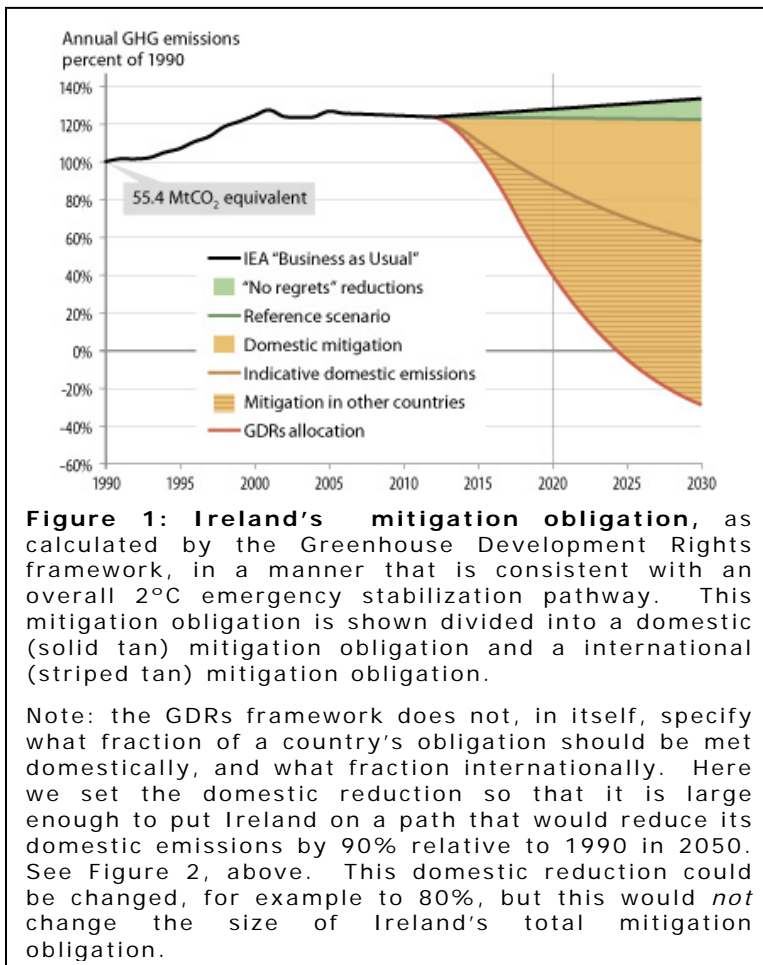
Ireland's proposed commitments vs. its GDRs obligations

The Greenhouse Development Rights framework calculates national obligations as fractions of a global *mitigation requirement* – a science-based requirement that corresponds to an emergency emissions-reduction pathway designed to stabilize the climate system. The starting point for the GDRs analysis is therefore first and foremost what the science says is necessary to stay within the 2 target.

Ireland's mitigation obligations under the GDRs framework are calculated as a share of that global mitigation requirement, based on a combined indicator of its responsibility and capacity called a *Responsibility and Capacity Index*, or RCI. By 2020, Ireland's share of the global RCI reaches roughly 0.26%.¹ Using this share to assign to Ireland its portion of the total global mitigation burden (i.e., sufficient global mitigation to support a high probability keeping warming below 2°C), would give Ireland a 2020 mitigation obligation of 46 MtCO₂-equivalent. (For more on the mitigation requirement, see Figure AP2 and the associated discussion, in the Appendices). Under the GDRs framework, Ireland would have a further obligation to accept 0.26% of the global adaptation burden, though adaptation is not discussed in detail in this brief report.

¹ For details of how the RCI is defined, and exactly how Ireland's RCI is calculated, see the appendices.

Accepting this as Ireland's 'fair share' of the global effort has significant implications for the emission reduction targets required. Figure 1 shows Ireland's emissions allocation (the red line), relative to its reference pathway (the green line).² As is strikingly clear (the size of the tan wedge)



Ireland's GDRs allocation plummets to far below 1990 levels (about 60% below) by 2020, and passes below zero shortly after. This implied level of effort seems quite radical, and indeed it is, by the standards of the normal climate debate.

Nevertheless, mitigation obligations of this size in the wealthy world (and Ireland, despite its recent economic experiences, is quite wealthy by global standards) are necessary if we are to stabilize the global climate system. Obligations of this scale can only be understood as global reduction obligations. More precisely, in the GDRs approach, national mitigation obligations are understood as *two-fold obligations* to, on the one hand, make major domestic reductions and, on the other, make major international reductions.

Ireland, like other northern countries, has such a two-fold obligation, and under a trajectory that's actually consistent with a 2°C target, both sides of it are quite demanding indeed.

The analysis here estimates that Ireland should have a domestic target for 2020 of about 13% below 1990 levels - that is equivalent to a reduction in annual emissions of 20 MtCO₂e - plus an additional obligation to support emissions reductions in developing countries of 26 MtCO₂e. Also Ireland has responsibility to cover its fair share of costs for adaptation to climate change at home and in developing countries.

Presented in this way, Ireland's two-fold GDRs obligation is very explicit, and also very bracing. Indeed, it is large enough to seem entirely implausible by today's standards of political realism. However, the key conclusion of our analysis is that is that obligations of this scale for countries with high capacity and substantial responsibility are, in the final analysis, absolutely necessary to a viable and effective climate regime. It is only by way of such large obligations that a climate regime can effectively bring about two vital outcomes. First, driving ambitious domestic reductions, and thus ensuring that the wealthier countries free up sufficient environmental space for the poorer countries to develop. Second, driving equally ambitious international reductions – enabled by technological and financial support from the wealthier countries – and thus ensuring that this development can occur along a decarbonized path.

What then do we recommend?

Clearly, current targets for Ireland, and indeed the EU, do not represent a 'fair share' of the global effort needed to tackle climate change. We recommend that Ireland take a reality-based approach to the climate negotiations. That it look to the science, and refuse to satisfy itself with partial solutions that will fail to deliver a rapid and sustained decline in GHG emissions, either globally or within its own borders.

That Ireland take a moment to stand in the shoes of the South. Why, after all the broken promises, should the South trust the North to deliver on its commitments, especially when the EU, the most progressive of all the North's blocs, is so intent on conditioning and limiting its offers of support? Why, when prosperity and development have never come without increased GHG emissions, should the South accept an accord in which it, with its lesser responsibility and its vastly greater need, is nevertheless asked to pioneer the low-carbon future.

That Ireland not only stand in the shoes of the South, but negotiate as its partner. That it cross the international divide and insist that capacity and responsibility – simply and transparently – are the best foundations for a global climate accord that is actually intended to succeed. That it openly acknowledge the fears at the root of the climate impasse and help to break them, rather than play the coming discord for short-term and self-defeating advantage. That it acknowledge, even now, in the run up to Copenhagen, that capacity and responsibility, as principles and as indicators of obligation, must be put into play.

That Ireland rise within EU and UN negotiations and straightforwardly offer to pay its fair share of the global burdens of rapid climate transition. That it embrace a future in which economic growth comes by way of accelerated decarbonization and social justice.

That Ireland adopt targets on the scale of the GDRs targets noted above and champion such an approach within the EU and the UN. That it accept its two-fold obligation and thus help to make the climate regime into one that protects and promotes true sustainable development. And that it understand that, if such obligations seem preposterously unrealistic, this is only because each country is waiting for some other to come forward and state the obvious – there is no politically "realistic" solution to the climate crisis, and political reality must itself be transformed.

That Ireland stand with scientific and ethical realism.

2 Framing the moment

2009 is the Copenhagen year. And in it, we all hope, the international climate policy impasse will finally be broken. Or, if this is still too much to ask, perhaps 2009 will at least see us change the rules of the game – the better to win the trust and momentum necessary to move quickly forward. It had best be, for as we all know, the science is not becoming more reassuring as it becomes more precise. Indeed, we now face a climate emergency, and moreover we know it. And this, above, all, is the framing of the Copenhagen year.

In framing what is required this year, it is helpful to distinguish the long-term from the short. The short-term problem is straightforward enough – the industrialized countries, which committed in 1992 in Rio to lead the way to a post-carbon world, have simply not done so. Their emissions path has not been significantly transformed, and in the US in particular, but also Ireland, emissions have continued along a rapid upward trend. Moreover, the financial and technological support for mitigation and adaptation in developing countries, which was promised in Rio, in Kyoto, and on many occasions since, has simply not arrived. Given this, the North has still to demonstrate its willingness to lead.

The long-term problem is even worse. The climate negotiations are fundamentally stymied by the effort-sharing question – who should do how much, and when? -- and could easily remain at an impasse through Copenhagen and beyond. 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.

In this context, this report will apply the Greenhouse Development Rights framework to evaluate both the adequacy and the realism of European Union climate policy, as it is reflected in the European Commission's recent "Communication" and with particular attention to the implications of the GDRs approach for Ireland, a country that, while small and easily buffeted by economic forces far beyond its control, is nevertheless both wealthy and developed by global standards.

The EC Communication that sets out the European Union (and hence Ireland's) ambition for Copenhagen has its own context – the climate negotiations, as we find them today, seventeen years after Rio, twelve years after Kyoto, and a year and a half after Bali. This is a context far too large and complex to summarize in any brief manner, but, that said, a few essential aspects of the situation can, and should, be clearly and unambiguously laid out:

- First, many people are looking to Copenhagen to break the climate policy impasse. This cannot be done without recognizing that the industrialized countries, which committed in 1997's Kyoto Protocol to chart the way to a post-carbon world, have simply not done so. Despite the time that has been lost, despite all the discord and fragmentation of our rich / poor world, and despite even the economic crisis, the industrialized countries must still lead. The ball is still in their court, and they must play it well if we're to get the game in motion.

- Second, the science makes clear that developing countries must also act, and they must do so bravely and aggressively. Unless they do, there's virtually no chance of the committed global mobilization we so desperately need. In the Bali Action Plan developing countries indicated a willingness to take on mitigation actions, supported and facilitated by measurable, verifiable and reportable support. But here we must be extraordinarily clear - while in the time since Bali a large number of detailed and helpful proposals and initiatives from the South have been put forward, it would be foolish, and even dangerous, to misread their meaning. In particular, we must not allow ourselves to imagine that these indicate a willingness to accept legal commitments to targets and timetables.
- Third, we must be cognizant of this year as part of a longer process. In time, developing countries may take on more legally binding targets. But, critically, this is not a world in which the North kept up its end of the Kyoto bargain, and we should not pretend that it is. The challenge of Copenhagen is to establish trust while acting boldly, and we can accept no trade-offs between these two goals. Indeed, it is only by acting boldly that we can hope to establish trust. And this situation has two very specific and closely related implications. First, the Copenhagen accord must make moral and political sense, it must be one that we can all "take home" to our peoples and our Parliaments, and by so doing enable the short-term policies necessary to bend the global emissions rapidly downward. Second, and here "making moral and political sense" is key, it must set the stage for the transparent, global, and explicitly justice-based accord that will have to follow it.

All this is reasonably well known, though not with sufficient clarity. Perhaps the habit of strategic ambiguity has taken its toll. In any case, we find it useful to be precise and explicit, for as we will argue, there is still a huge gap between reality, as dictated by the science, and realism, as defined by professional politicians. It is a gap that must be closed, and Copenhagen, while it cannot do the whole of the job, can certainly make a new beginning.

2.1 The structure of this report

The structure of this report will be as follows:

- First, it will lay out a brief analysis of the structure of the international climate policy impasse.
- Second, it will briefly introduce the Greenhouse Development Rights framework. This will not be a comprehensive presentation, but only a summary of the GDRs approach to a structuring fair, viable global climate accord.
- Third, it will explain – in quantitative terms – what that GDRs framework implies for the size and nature of Ireland's obligations under a fair global accord, one that is actually designed to support a global climate transition of the necessary size and speed.
- Fourth, it will analyze the EU's opening move in the Copenhagen negotiations, as laid out in the EC's Copenhagen Communication. In particular, it will judge that communication against the overarching necessity for a Copenhagen accord that makes moral and political sense:
- Finally, it will draw a few brief conclusions, with an eye to what all this implies for Ireland.
- In addition, it will offer in its appendices a lengthier and more detailed description of the Greenhouse Development Rights framework, which undergirds the overall analysis offered in this report, as well as a technical exposition of how Ireland's responsibility and capacity indicator was calculated.

3 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 negotiations are under terrific pressure to “soften” goals and compromise targets – the better to declare “success” in December. 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 ppmCO₂-equivalent for example – are in fact quite dangerous.³

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.

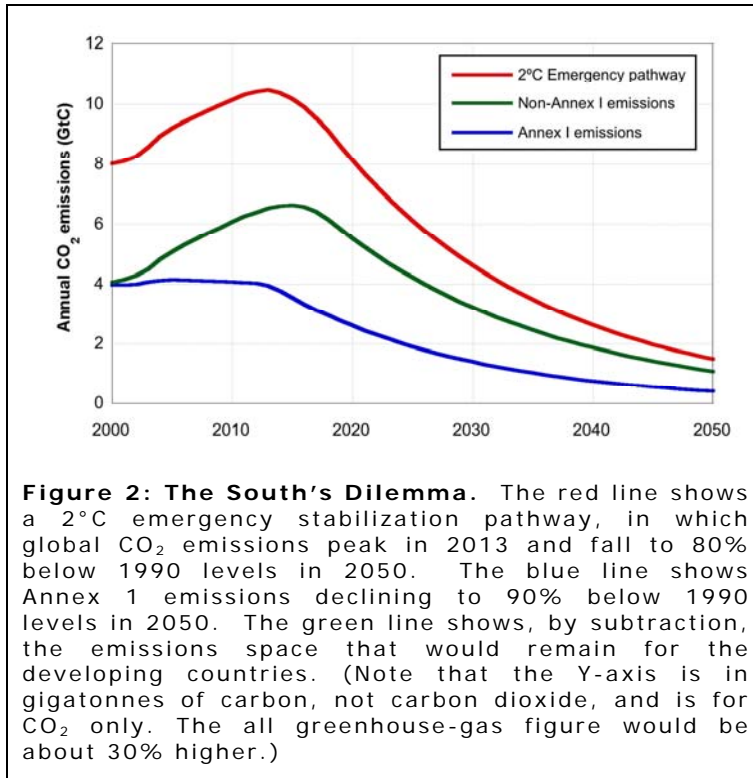
Our very different conclusion is that the 2°C line can indeed be held, but that doing so demands courageous initiatives and a robust policy architecture, both of which go beyond politics as usual. That, in particular, they demand a sense of shared global purpose and solidarity that can only be rooted 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 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.

The South's dilemma



A simple thought experiment illustrates the scope of the political challenge. Here, in red, we show a scientifically realistic 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 CO₂ 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 line⁴. 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.

3.1 A comment on the “Bali Box”

As suggested above, we must be honest about the science and its implications if we are to rise to the climate challenge. In the current negotiations, even the most ambitious figures framing the target setting discussions are not consistent with the global effort that will be required to stay within the 2°C target.

Central to effort-sharing and target-setting discussions that first crystallized in the Vienna and Bali negotiations and have continued into the EC's Communication is the target of “25-40% below 1990 levels in 2020”. This figure comes from the most stringent of the scenario families that were evaluated by the IPCC and termed the Category A scenarios (see Table 1):

Box 13.7 The range of the difference between emissions in 1990 and emission allowances in 2020/2050 for various GHG concentration levels for Annex I and non-Annex I countries as a group^a

Scenario category	Region	2020	2050
<i>A-450 ppm CO₂-eq^b</i>	Annex I	-25% to -40%	-80% to -95%
	Non-Annex I	Substantial deviation from baseline in Latin America, Middle East, East Asia and Centrally-Planned Asia	Substantial deviation from baseline in all regions

Table 1. The first rows of Box 13.7 from Working Group III of the IPCC's Fourth Assessment Report.

There's a lot to say about this table, but two points are crucial. First, the "Category A" scenarios are not "2°C trajectories," and second, the "-25% to -40% numbers are emissions *allocations*, and as such are products of particular effort-sharing approaches.

Elsewhere in IPCC's Fourth Assessment Report an overlapping set of low-emissions studies is categorized somewhat differently as "Category I" (445 to 490 ppm CO₂-equivalent), and it is noted that these correspond to an estimated equilibrium temperature rise of 2°C to 2.4°C, assuming a 3°C "best estimate" climate sensitivity. Furthermore, even emissions pathways that stabilize at 450 ppm CO₂-equivalent, which are expected to have a roughly 50-50% chance of exceeding 2°C warming at equilibrium, have a higher than 50% likelihood of exceeding 2°C if they peak substantially higher than 450 ppm CO₂-e and stay above that level for more than a few years, as indeed most of the Category A / Category 1 scenarios do. Thus, it is simply incorrect to say that the Category A / Category 1 scenarios are "likely" to keep the temperature increase below 2°C.

Equally importantly, the "25 to 40% below 1990 levels" description of Annex 1 targets in the Bali Box bears no direct relationship to the associated global emissions trajectories. The stringency of the Annex 1 reduction target can be traded off against the stringency of the non-Annex 1 target; for any given global target, a higher (or lower) Annex 1 allocation can be matched with a lower (or higher) non-Annex 1 target. The 25-40% range presented in the Bali Box encompasses neither the upper nor lower bound of Annex 1 shares under plausible effort-sharing systems. Notably, the fact that all the studies surveyed calculate a "substantial deviation below baseline" in the allocation given to non-Annex 1 countries by 2020 indicates that one obvious burden-sharing principle – the UNFCCC principle that the Annex 1 countries will bear the full incremental costs of emissions reductions, and thus that the non-Annex 1 countries will get an allocation equal to their baseline growth – has plainly been excluded.

There is much more that could be said here, but in short, the combination of Box 13.7 and the post-Box 13.7 discussion has left the widespread but incorrect impression that to stay below 2°C of warming it is sufficient and equitable for Annex 1 countries to make reductions in the 25-40% range, and for non-Annex 1 emissions to deviate from 15-30% below baseline. The results of an IPCC survey have thus been grossly misinterpreted as an IPCC endorsement of a non-Annex 1 reduction target. As was evident from the response of the non-Annex 1 countries during the Poznan negotiations, this interpretation is far from a consensus position.

All of which needs to be closely noted as we head into the Copenhagen negotiations. For while the Bali Box, in its rollup of 450 CO₂-equivalent scenarios, can be said to be an honest first draft of the emergency emissions pathway we so badly need, Copenhagen will require a second draft, and it should take major steps forward in at least two ways:

- First, the next-generation emergency pathway should not be calculated with respect to a temperature objective (less than 50% chance of keeping warming below 2°C) that is now widely recognized as being unacceptably dangerous.
- Second, a reference emergency pathway should not be so vague when it comes to defining overall global emissions allowances, or indeed in specifying what "substantial deviation from baseline" in the "non-Annex 1" developing world actually means. The ambiguity here allows far too much slippage and bad-faith negotiation, and it is not helpful. What is needed is enough specificity to allow a clear understanding of the effort needed, in terms of the time available before global emissions need to peak, and the rate at which they will have to decline thereafter.

If these ambiguities are left unresolved in the timeframe of the Copenhagen negotiations, we may well end up giving up on strategies that can limit total warming to 2°C. In particular, proposals promising only a post-2020 global emissions peak would dramatically diminish society's ability to gain a 2°C pathway. Indeed, it would condemn us, and our children, to a bitter choice between catastrophic warming on the one hand and, on the other, an extremely disruptive, 11th-hour infrastructural and economic transition with near-zero odds of gaining political acceptance and being implemented in time.

4 The Greenhouse Development Rights framework, in brief

The Greenhouse Developments Rights⁵ approach was designed to highlight the challenges of the extremely rapid emissions reductions that are needed to stabilize the climate system, and to demonstrate the sort of principle-based effort sharing system that will be needed before we can seriously expect to achieve such rapid reductions. It seeks to squarely face, in particular, this fundamental problem: Ultimately, the vast majority of the emission reductions required to “prevent anthropogenic interference with the climate system” must be in the developing world, where most emissions now occur and where emissions are growing most rapidly. At the same time, the development crisis, and beyond it the fundamental aspirations of the developing world, demand a vast expansion of energy services to finally eliminate endemic “energy poverty,” a goal that, in turn, seems inexorably to imply increased carbon emissions.

This is the core of the climate predicament, and the reason why the developing countries insist that, as important as climate stabilization may be, it cannot come at the expense of their development. This, precisely, is the problem that must be solved before any true emergency mobilization can possibly begin.

Although the Greenhouse Development Rights approach does not begin with a realpolitik-style assessment of negotiating power, it ultimately charts out an extremely pragmatic approach. Beginning with the structural logic 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 conclude⁶ 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.

The core of the GDRs approach is thus 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 well-being that is modestly above a global poverty line. Individuals living below this threshold are not expected to bear the costs of addressing the climate problem, and are instead allowed simply to prioritize development.

In turn, the GDRs approach defines and quantifies the burdens appropriate to the world’s relatively well-off population, those living above the development threshold. Critically, it does so for well-off individuals in both in the developing and industrialized countries. It is this minority, after all, that has both the responsibility for the climate crisis and the capacity to solve it, and regardless of where they live, they are the ones who must bear the costs of the transition.

The GDRs approach then proceeds to quantify equitable shares for each nation of the total global effort required to achieve sufficient mitigation and adaptation, based on the capacities and responsibilities of the well-off individuals living within that nation’s borders. This calculation, critically, is not driven by measures of mitigation potential *within* that individual nation, for GDRs is concerned with equitably dividing the *entire* global effort of the climate mobilization. This effort

may be expressed as, say, the costs of actions taken to adapt globally, or the tonnes of reductions required to reach the desired global emission trajectory, which is what we ultimately need to share equitably. If one wants to gauge comparability of effort, it is helpful to be able to express national efforts as shares of some common quantity.

This approach allows us to escape from trap in which we conceive of national climate obligation primarily in terms of obligated domestic reductions, and to focus directly on the real objective, which includes both curbing the emissions of the consuming class and ensuring that, as people in the “underdeveloped world” rise out of poverty, they can do so along sustainable, low-emission, paths, while having access to the adaptation support needed to minimize damage and suffering. The GDRs approach thus implies that those of us with responsibility and capacity, (i.e., those above the development threshold) bear a two-fold obligation. We must commit to deep and prompt reductions in our own domestic emissions, but, in a sense that is just as strict and legally binding, we must also support (through finance and technology) a rapid clean energy transition in the developing world, along with sufficient adaptation. These obligations follow straightforwardly from our relative historical responsibility and wealth, and there is nothing very surprising about their sizes. A quantitative analysis that churns through datasets of country-specific incomes and historical emissions leads, in the end, to results that are quite intuitively obvious.

Figure 3 illustrates this point. Note, critically, that it not only shows Annex 1’s total mitigation obligation, but also shows an *indicative* division of this obligation into a domestic mitigation effort (solid) and an international mitigation effort (striped).

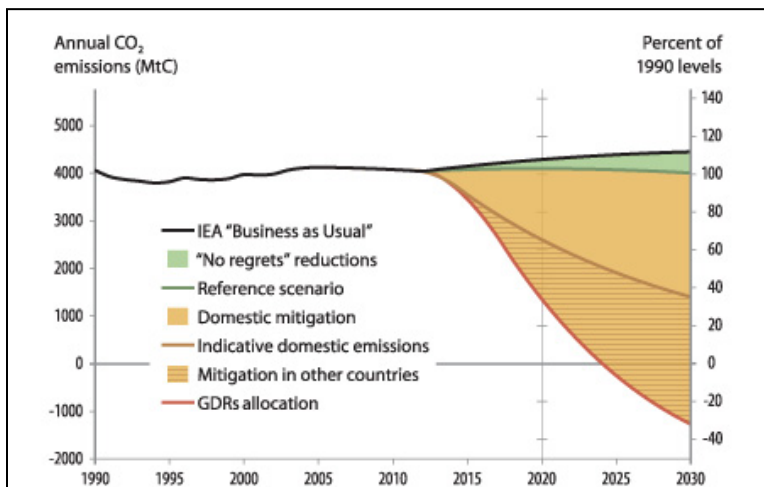


Figure 3: Annex 1 mitigation obligations, as calculated by the GDRs framework in a way consistent with an overall a 2°C emergency stabilization pathway (shown in red). This mitigation obligation is shown divided into a domestic (yellow) mitigation obligation and a (striped) international obligation.

Note: the GDRs framework does not, in itself, specify what fraction of a country’s obligation should be met domestically, and what fraction internationally. Here we set Annex 1 domestic reductions so as to put it on a path that would reduce its domestic emissions by 90% relative to 1990 in 2050. See Figure 2, above.

Figure 3 illustrates this point. Note, critically, that it not only shows Annex 1’s total mitigation obligation, but also shows an *indicative* division of this obligation into a domestic mitigation effort (solid) and an international mitigation effort (striped). In this case, the domestic mitigation effort is defined as matching the rapid decline needed to put the Annex 1 countries on course toward emission levels 90% below 1990 levels by 2050. Thus, by 2020, Annex 1’s domestic emissions are about 35% below 1990 levels. Its international obligations, which are over and above this ambitious domestic effort, reflect an additional mitigation effort of about the same scale. This can be understood as the “MRV” – Measureable, Reportable and Verifiable – support from Annex 1 to non-Annex 1 countries outlined in

the Bali Action Plan that is needed to drive the low-carbon transition in the developing world.⁷

4.1 Effort-sharing in the Copenhagen period

The world follows a complex and varied course. It cannot be fully captured by any top-down, principle-based scheme such as GDRs, which is ultimately and inevitably ahistorical. Given this,

it's no surprise that the GDRs analysis is almost indifferent to the politics that got us to the climate impasse, and to the political accommodations that will be required to get us beyond it. It is, for example, entirely blind to the North-South trust deficit, though that deficit effectively rules out the simplest way forward, which is that countries, whether of the North or of the South, would simply commit to carry their "fair share" of the climate burden, and then proceed, relatively directly, to the practical negotiations that would be necessary to operationalize a fair global regime.

But, in reality, the trust deficit cannot be so easily passed over. Which is to say that the South cannot reasonably be expected to take on legally binding commitments in the Copenhagen period, not even if these commitments are defined in a rigorously principle-based way that genuinely safeguards its right to development. In reality, the South sees any agreement that would legally curtail its emissions as simply too big a risk to take. Nor is this reticence hard to understand. To this point, industrial development has been almost entirely driven by fossil fuels, and why, without the North's demonstrated willingness to help chart out, and indeed pave, an alternative course, should the countries of the South sign away their rights to follow along this proven pathway?

And the North has thus far wholly failed to demonstrate such a willingness. Quite the contrary, given Annex 1's neglect of its Rio promise to return emissions to 1990 levels by 2000 (notwithstanding its unwitting formal compliance by virtue of the Soviet economic collapse), and given the past decade of half-hearted efforts to meet Kyoto commitments (and, in the case of the United States, of entirely shunning them). Ireland is a case in point here, with current emissions levels running at almost twice the level committed to under Kyoto, and furthermore with emissions projected to miss the 2020 target by some 2.7 M tonnes of CO₂-equivalent based on applying all current policy measures and taking into account the impacts of the 'economic shock'⁸. Indeed, the South's distrust of legally binding commitments is directly linked to the North's inattention to its own emission constraints, and equally to 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.

This all constrains the prospects for the Copenhagen period. And it tells us that, above all, the Copenhagen accord must be one in which the Annex 1 countries seize the opportunity, finally and definitively, to "take the lead" (quoting the UNFCCC). In particular, the Copenhagen period is Annex 1's last best chance to earnestly work, through concerted action, to build confidence in the possibility of a fair and adequate global climate transition. For there is still time. Through aggressive and sweeping mitigation initiatives at home, and through good-faith assistance to non-Annex 1 countries seeking financial and technological assistance to mitigate and to adapt, it can still launch the transition to a post-carbon world.

It is equally clear what a Copenhagen phase is *not*. It is not a time for Annex 1 countries to try to minimize their own responsibility by pointing fingers at others, regardless of how many coal-fired power plants those others may be building each week. It is not time for Annex 1 countries to make their own efforts contingent on the efforts of others. It is not a time for Annex 1 countries to plead hardship amidst the current financial crisis, while pressuring much poorer nations to take on binding commitments. Annex 1 must simply reaffirm its acceptance of the "full incremental costs" of climate actions, globally, during the Copenhagen phase. Only this is consistent with the UNFCCC, with Kyoto, and with Bali. And it is the right thing to do.

Which is not, we hasten to add, to excuse the South from earnestly engaging. Not only do the more affluent of the southern countries, such as Singapore and South Korea, have a significant capacity to act, but so does China, despite its very poor majority. Such countries must act, and

unless they do, progress on a global climate response will be stymied. The question is how they must act, and here we are compelled to emphasize one word above all others: *voluntarily*.

We say this despite even our own analysis, which suggest that, by a proper reckoning, the South's obligation to act is sizable, and already amounts to perhaps one-quarter of the global total. So, while legally binding commitments based on a principle-based global differentiation might ultimately be necessary, the time has not yet come. This next period will be one in which the developing countries, though they must act, aggressively and in many ways, will do under agreements that are softer and more implicit than many Annex 1 countries might wish.

5 Ireland's proposed commitments vs. its GDRs obligations

The GDRs framework provides a transparent, principle-based method of calculating appropriate national obligations for every country in the world, developed or not. These obligations are first and foremost approached as a percentage share of a global total, whether that total is a global mitigation requirement measured in tons of carbon, a monetary estimate of the total global costs of mitigation, or the global costs of adaptation.

The current debate over comparability of effort primarily identifies national obligations with national mitigation targets expressed as a percentage reduction below a base year. We show below how the GDRs framework can calculate such targets. The first step is to estimate the global mitigation requirement – that is, the reductions below a projected baseline required to reach a 2°C emergency emissions reduction pathway. The second is to use the responsibility-capacity indicator to calculate each country's share of that global requirement. The third is to define an emission target by subtracting each country's share from its own emissions baseline. In this way, the effective allocation of emissions rights to each country can be straightforwardly calculated and compared with similar reduction targets based on other effort-sharing principles.

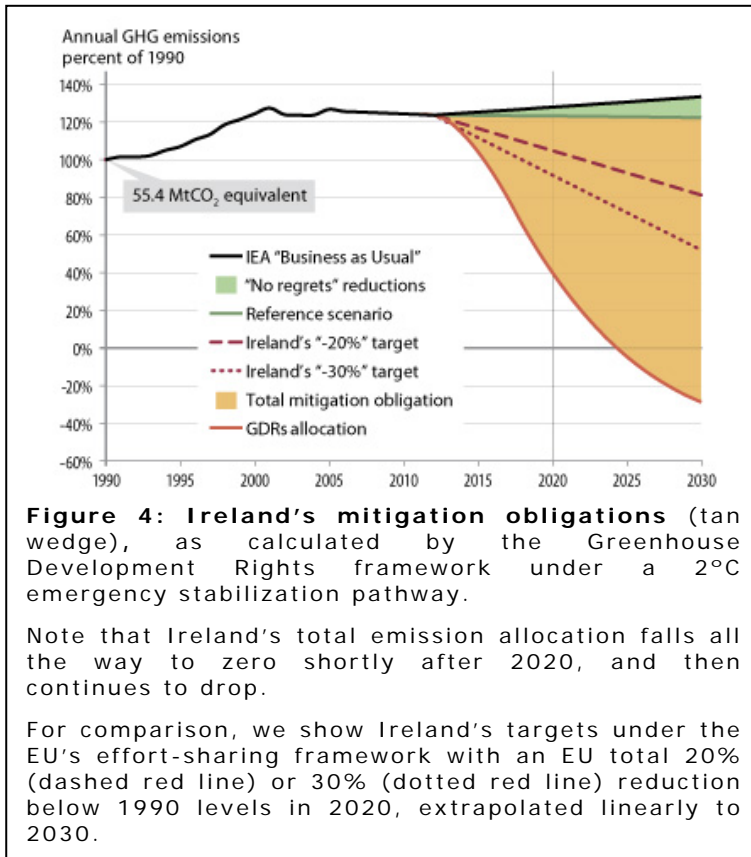
Based on calculations which are detailed in the Appendices, Ireland's share of the global obligation is 0.30 per cent in 2010, which is large compared to its 0.07% share of global population, reflecting Ireland's relative wealth and historical responsibility. Based on our projections of global growth of income and emissions, which are quite uncertain, this share would fall to 0.26% in 2020 and 0.22% in 2030.²

5.1 Ireland's GDR allocation

Figure 4 shows the reduction obligation for Ireland, subtracted from its estimated baseline (the green line).⁹ (The light green "wedge" of "No regrets" emissions reductions do not count towards a country's reduction obligation, because they have negative or zero net costs – see the Appendices for details.) The resulting allocation, shown by the red line, reaches a level of about 60% below 1990 levels by 2020, and is substantially negative shortly after.

² Before going on to translate these numbers into a reduction obligation for Ireland, two points should be noted. First, in spite of our argument in the previous section that the non-Annex 1 countries will not have quantified reduction commitments in the Copenhagen agreement, the following calculations and charts are based on a straightforward implementation of the GDRs responsibility and capacity indicator that allocates a significant share of global obligations to non-Annex 1 countries. That is to say, they anticipate a world in which the political impasse that now bedevils the negotiations has been resolved, and a fair shares, principle-based, global effort-sharing system has thus become possible. Nevertheless, a "transitional" distribution of effort, in which non-Annex 1 countries take on only those challenges that they voluntarily chose to take on, is what we would argue is necessary for the Copenhagen period. In this case, the reduction obligations assigned to Ireland and other Annex 1 countries would be larger than those shown here, so as to accommodate whatever portion of the non-Annex 1 reduction share was not taken on voluntarily.

How does this compare to Ireland's existing targets under the EU's current effort-sharing proposal? The dashed red line corresponds to a total EU 2020 reduction of 20% below 1990 levels, and shows Ireland's corresponding allocation, with effort sharing as described in the EU's



Climate and Energy package. It is equal to a level of 3% *above* its 1990 emissions. The dotted red line corresponds to a total EU 2020 reduction of 30% below 1990 levels, and shows Ireland's corresponding allocation, with effort sharing as described in the EU's Climate and Energy package, under this more stringent target. It is equal to about 9% *below* its 1990 emissions.

The GDRs allocation, in which Ireland's 2020 allocation is 60% below 1990 emissions levels, is obviously a challenging one. For comparison, keep in mind that Ireland's Kyoto target is an emissions level 13% above 1990 in 2012. But radical though the GDRs allocation may seem, it accurately reflects the necessary level of

ambition, if Ireland is to do its fair share under an emissions trajectory that is truly consistent with the 2°C objective.

Clearly, a mitigation target of this magnitude is meaningful only if it is taken to signify a combined obligation to, on the one hand, make domestic reductions and, on the other, invest in international reductions. The implied *two-fold obligation*, in the context of a 2°C emergency mobilization, is extremely challenging on both sides, as is shown in Figure 5, below.

Figure 5 presents an *indicative* division of Ireland's reduction obligation into a domestic mitigation effort (solid tan) and an international mitigation effort (striped tan). A precise dividing line between these two areas is not specified by the GDR framework, which takes flexibility on this point as essential, to accommodate nationally-specific economic and political factors. In this example, the domestic mitigation effort is defined so as to match the rapid decline needed to put the Annex 1 countries on course toward a target of 90% reductions relative to 1990 levels by 2050. (See Figure 2, above, and the associated discussion). It should be read, then, as an interesting and important example, but it is still only an example – reducing Ireland's domestic obligation would not reduce the size of its total obligation, but indeed would increase the size of Ireland's necessary international effort.

In conformance with the overall global emissions reduction goal, and its share of the global RCI, and our (fairly arbitrarily) indicative case in which A1 reductions drop 90% by 2050, Ireland's 2020

domestic emissions are about 13% *below* their 1990 levels. Its remaining obligation, which is

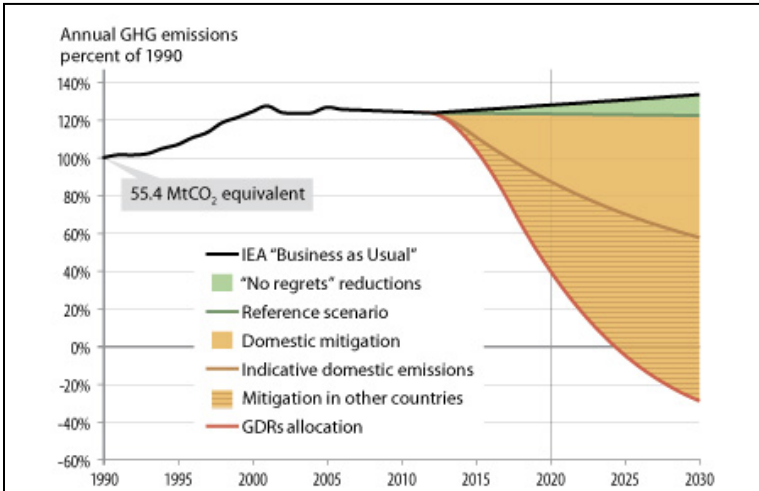


Figure 5: Ireland's mitigation obligation, as calculated by the Greenhouse Development Rights framework, in a manner that is consistent with an overall 2°C emergency stabilization pathway. This mitigation obligation is shown divided into a domestic (solid tan) mitigation obligation and a international (striped tan) mitigation obligation.

Note: the GDRs framework does not, in itself, specify what fraction of a country's obligation should be met domestically, and what fraction internationally. Here we set the domestic reduction so that it is large enough to put Ireland on a path that would reduce its domestic emissions by 90% relative to 1990 in 2050. See Figure 2, above. This domestic reduction could be changed, for example to 80%, but this would *not* change the size of Ireland's total mitigation obligation.

over and above this significant domestic effort, and which can only be discharged internationally, reflects another large mitigation effort, as defined by an overall emissions allocation that is 60% below 1990 levels. In this case, as it happens, domestic reductions come to 20 MtCO₂e and international reductions come to 26 MtCO₂e to be achieved through financing and technology transfer. Thus, about 40% of the total "lift" is domestic, though, again, this number is only illustrative.

This additional international obligation can, in the language of Bali, be thought of as the measureable, reportable and verifiable ("MRV") financing that is needed to support a low-carbon transition in the developing world. Which is to say that Ireland, like all countries with high capacity

and responsibility, has an obligation to both ensure deep domestic reductions and catalyze rapid reductions in developing countries through financial and technological support.³

³ It should be remembered that these calculations depend on certain choices used to define capacity, responsibility, and other matters. One choice that is of political importance is the decision regarding the date at which historical responsibility starts to be counted. The results presented here assume a start date of 1990, but if one wished instead to define historical responsibility in terms of emissions since 1950, say, the result would be a 0.24% share of global obligations for Ireland in 2020 instead of the 0.26% calculated with the 1990 responsibility start-off date. Another choice of political interest is the treatment of the net carbon embodied in imports and exports in determining responsibility. This too would change Ireland's share of global responsibility, and thus its share of the global obligation.

Also these figures reflect an implementation of GDRs that estimates Ireland's domestic and international obligations in terms of tons of reductions. But as we stated at the outset, the core of the GDRs approach is the calculation of a percentage share, a calculation that can also be done in terms of mitigation obligations calculated in monetary terms. Obligations to support adaptation, it should be noted, must *necessarily* be done in monetary terms

This is not to say that support for international mitigation appears only in the GDRs framework. Indeed, since Bali, its absence from any effort-sharing approach would be glaring indeed, and many NGOs, and the EC itself, are now casting about for a language with which to clearly talk about these international obligations. Some speak in terms of Euros, some in terms of tonnes, some in terms of a fraction of a total international effort. One helpful convenience offered by GDRs is a way to discuss these international obligations directly, a way that allows one to directly assess comparability of effort across countries, and the adequacy of the overall package. Table 2 collects proposals for mitigation targets and international assistance.

	2020 domestic mitigation	2020 international mitigation assistance
Ireland under 20% EU Target	3% (including offsets)	not quantified
Ireland under 30% EU Target	-9% (including offsets)	not quantified
WWF (for EU; Ireland's international share not specified)	-30%	-15% (as percentage of EU 1990 emission levels)
Christian Aid (for EU; Ireland's international share not specified)	-40%	25% of global effort
Greenhouse Ireland Action Network	-45%	not quantified
Greenhouse Development Rights	-60% (combined domestic and international)	

Table 2: Ireland 2020 reduction targets under various proposals. Only the GDRs target is completely specified, for only it includes international mitigation.

Presented in this way, Ireland's two-fold GDRs obligation is very explicit, and also very bracing. Indeed, it is large enough to seem entirely implausible by today's standards of political realism. However, the key conclusion of our analysis is that is that obligations of this scale for countries with high capacity and substantial responsibility are, in the final analysis, absolutely necessary to a viable and effective climate regime. It is only by way of such large obligations that a climate regime can effectively bring about two vital outcomes. First, driving ambitious domestic reductions, and thus ensuring that the wealthier countries free up sufficient environmental space for the poorer countries to develop. Second, driving equally ambitious international reductions – enabled by technological and financial support from the wealthier countries – and thus ensuring that this development can occur along a decarbonized path.

5.2 The bottom line

The GDRs emission allocations shown above are daunting indeed, but we can make them more comprehensible by examining their potential implications in terms of cost. To do this, we can look to estimates of the cost of an ambitious climate response, and allocate it among nations in accordance with their RCI.

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.¹⁰ The analysis backing up the EC Communication 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. 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, and 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 costs¹¹.

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), of which Ireland's share (0.26% of the global RCI) would be about \$2.5 billion (€1.9 billion) - this relates to Ireland's responsibility to pay for the combined cost of mitigation and adaptation at home and in developing countries. China's share would be \$98 billion (10.4% of the global RCI), India's about \$11 billion (1.2%), and so on, as shown in Table 3, below.

	National Income (Billion \$)	National Capacity (Billion \$)	National Capacity % GDP	National Obligation (Billion \$)	National Obligation % GDP
EU 27	\$19,327	\$15,563	80.5%	\$ 216	1.12%
EU 15	\$16,752	\$13,723	81.9%	\$ 188	1.12%
EU +12	\$ 2,574	\$ 1,840	71.5%	\$ 28	1.09%
Ireland	\$ 224	\$ 186	82.9%	\$ 2.5	1.10%
United States	\$18,177	\$15,661	86.2%	\$ 275	1.51%
Japan	\$ 5,071	\$ 4,139	81.6%	\$ 62	1.23%
Russia	\$ 2,905	\$ 1,927	66.3%	\$ 41	1.40%
China	\$13,439	\$ 5,932	44.1%	\$ 98	0.73%
India	\$ 5,814	\$ 972	16.7%	\$ 11	0.19%
Brazil	\$ 2,535	\$ 1,376	54.3%	\$ 16	0.64%
South Africa	\$ 706	\$ 422	59.8%	\$ 10	1.42%
Mexico	\$ 1,744	\$ 1,009	57.9%	\$ 15	0.84%
LDCs	\$ 1,549	\$ 82	5.3%	\$ 1	0.06%
Annex 1	\$50,368	\$40,722	80.8%	\$ 652	1.29%
Non-Annex 1	\$44,037	\$18,667	42.4%	\$ 292	0.66%
High Income	\$49,279	\$40,993	83.2%	\$ 655	1.33%
Middle Income	\$41,546	\$18,190	43.8%	\$ 286	0.69%
Low Income	\$ 3,579	\$ 206	5.8%	\$ 3	0.08%
World	\$94,405	\$59,388	62.9%	\$ 944	1.00%

Table 3. 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 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. Ireland's share would drop to \$1.25 billion. And it is also worth noting that, using the EC's 2020 mitigation-only cost estimate of €175 billion (220 billion US dollars), which comes to about 0.23% of projected 2020 GWP, that estimated costs are about half of the 0.5% figure. In this case, Ireland's share would drop to, say, \$572 million (€455 million) in 2020.

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.*

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
Ireland	\$7,500	0.00%	0.00%	\$0	0.00%	0.00%	\$0	0.00%	0.00%	\$0
Ireland	\$15,000	0.66%	0.33%	\$50	1.33%	0.66%	\$100	2.65%	1.33%	\$199
Ireland	\$30,000	0.66%	0.50%	\$149	1.33%	1.00%	\$299	2.65%	1.99%	\$597
Ireland	\$60,000	0.66%	0.58%	\$348	1.33%	1.16%	\$697	2.65%	2.32%	\$1,393
Ireland	\$120,000	0.66%	0.62%	\$747	1.33%	1.24%	\$1,493	2.65%	2.49%	\$2,986
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 4. “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).

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.

Here we show three representative cases: a country with high responsibility relative to its capacity (the US), a country with low responsibility relative to its capacity (Sweden), and Ireland, a country with medium responsibility relative to its capacity. (The details: US cumulative per capita emissions, 1990 to 2020, are projected to be 133 tons of carbon¹², while Sweden’s are projected to be 40 tons and Ireland’s are projected to be 62 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, and Irish per capita emissions of 52 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, an Irish citizen earning \$60,000 a year would pay a climate tax of \$697 a year, or less than \$2 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 when compared to that used by the European Commission. *If you instead use the EC’s global cost estimate, this same citizen would pay a climate tax of about \$175 a year, less than 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 somewhat less than \$8/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, 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.

6 The EU's opening move

Ireland's target was assigned as part of the larger effort-sharing agreement in the EU climate and energy package. It is also now placed against the backdrop of the broader EU position on comparability of effort within Annex 1, and in particular the recently released European Commission Communication *Toward a Comprehensive Climate Change Agreement in Copenhagen* (EC, 2009). With the effort-sharing decision, and especially with this EC Communication, the EU has made its long awaited opening play in the Copenhagen negotiations. In this section, we discuss the emerging EU position, as reflected in the EU climate and energy package, the EC Communication, the EC Staff Working Document that elaborates on it (EC, 2009a; 2009b), the modeling analysis that explores its implications (JRC-IPTS, 2009), and the March 2009 decision of the Council of EU Environment Ministers (Council, 2009).

With the official discussion moving into "full negotiating mode," the numerical and methodological details embodied in the EC Communication and its background documents are being replaced by the more subtle positioning of ministerial and high-level statements. These are, obviously, the meat of the ongoing negotiations, but at the same time it's clear, for example from the March 2009 statements of the Environment Council and the Economic and Financial Affairs Council, that the details of the EC Communication and its supporting documents must be kept close in hand. For example, when the Ministers speak of "capability to pay," it is by recalling the EC Communication that we know the very particular analysis of GDP per capita that they have in mind. It is by the nuances of the Communication that we can understand what is really being said.

While we are critical of the EU's emerging position, the EU must be commended on certain crucial points. It has steadfastly stood by the 2°C objective, and even as crowds of voices are raised to say that it is no longer in reach, the EU has taken a more productive tack. The EC Communication even acknowledges that the emerging science demands an *increase* in ambition, and warns that concentrations may have to be reduced to even "as low as 350 ppmv CO₂ equivalent". This is a brave statement, as is clear to anyone who even vaguely understands its implications with regard to the available global GHG budget, and the extraordinarily ambitious climate regime that will be needed to keep us within that starkly limited budget. That this reference to 350 was unfortunately dropped from the Environment Council statement is testimony only to the weight of political reality. The EU's environment ministers understand the science, and that any climate regime ambitious enough to keep us within the available GHG budget is will be extraordinarily challenging.

Also, in light of this starkly limited global GHG budget, the EC communication treats very seriously the question of an effort-sharing. It recognizes that a repeat of Kyoto, where targets were established through an entirely non-transparent negotiations process unanchored by any explicit set of foundational principles (and commonly known as "horse trading"), is simply not an option. It therefore attempts to lay out an alternative, a seemingly transparent, fair, and principle-based approach to effort-sharing in general and national emission targets in particular. In this effort, however, the EU unfortunately falls far short. Indeed, we argue that the EC approach, in both its design and its probable outcomes, is unlikely to provide the basis for a workable climate regime.

First, at the most fundamental level, the effort-sharing approach embodied by the EC Communication is structurally disjoint. In fact, it is a muddle of at least three disparate effort-sharing schemes:

(i) In the first, it applies a popular interpretation of the IPCC Fourth Assessment Report Table 13.7 (the “Bali Box”) to share the global GHG budget between the Annex-1 and non-Annex 1 countries. The result is a proposed reduction target of 27.5% below the 2020 baseline for Annex 1 (30% relative to 1990 emissions), and for non-Annex 1 countries a reduction of 15-30% below the 2020 baseline. The indicative non-Annex 1 reduction level presented in the EC Staff Working Document, is a deviation of approximately 16% from the baseline by 2020, (consisting of a 13% reduction in energy and industrial sectors, and a halving of emissions from deforestation.) As argued in Section 3 above, we do not believe that the Bali Box provides a basis for such a apportioning of effort.

(ii) It next calls upon a set of four quantitative indicators to set emission targets for individual Annex 1 countries. In the background documents to the EC Communication, the further step is taken of proposing analogous indicators to set emission targets for non-Annex 1 countries.

(iii) As a third step, it outlines two options for establishing obligations for developed countries to fund adaptation and mitigation in developing countries.

The result of mixing these three different effort-sharing approaches is a needlessly complex system. This system appears to be principle based, but only from certain angles. It is intermittently transparent, but ultimately obscure. It is deeply, and perhaps by design, ad hoc.

All of which is important to note, because there is no compelling reason why a single effort-sharing methodology, based on a single set of transparently defined and principle-based indicators, would not work at least as well. In particular, a single composite indicator of capacity and responsibility can be used to allocate both the mitigation and adaptation sides of the global climate obligation, either within a restricted subset of nations (i.e. Annex 1) or globally. Alternatively, the same sort of principle-based indicator can be used to determine contributions to any one of a variety of international funding mechanisms. So why did the EU, instead, choose to conflate numerous indicators at multiple levels of analysis? We do not know, but one point at least is clear – by so doing, and contrary to any claims to transparency, the EU has created a system in which it is unnecessarily difficult to gauge the meaning of “comparability of effort.”

Consider next the set of four “key parameters” that the EC Communication presents as its basis for setting fair and comparable Annex 1 emissions targets¹³:

- **“GDP per capita**: reflecting the capability to pay for domestic emission reductions and to purchase emission reduction credits from developing countries;
- **GHG emissions per unit of GDP**: indicating the domestic GHG emission reduction potential;
- **Trend in GHG emissions** between 1990 and 2005: recognising domestic early action to reduce emissions;
- **Population trends** over the period 1990 to 2005: taking into account the link between the size of the population and total GHG emissions.”

These may at first sight seem appropriate indicators, for they are transparent, practical, and directly related to GHG emissions. Moreover, both the EC Communication and its background documents present data to show how these indicators demonstrate quite clearly the broad range

of countries found within not only Annex 1, but non-Annex 1 as well. However, and critically, the EC at no point coherently argues that these indicators usefully represent the equity principles upon which effort-sharing in the climate regime should be based, and in fact there are strong reasons to doubt that this is the case. In particular, this set of indicators is at best only partially consistent with the Framework Convention's fundamental equity principles of "common but differentiated responsibilities and respective capabilities." In particular, if this phrase is understood to refer to countries' responsibility for contributing to climate change, i.e., their historical emissions, it is not captured by any of the four indicators. And even if this phrase is understood to merely refer to countries' *current* (rather than historical) emissions, it is still not adequately captured.

GHG emissions do appear in the context of *GHG per unit of GDP*, which is presented as an indicator of emission reduction potential, as it often is. However, as an indicator of reduction potential, *GHG per unit of GDP* falls short in two ways. First, as the EC Communication itself notes, this indicator is an exclusively domestic measure of potential to reduce, and says nothing about national potentials to enable international reductions, i.e., to contribute to MRV financial support, which constitute an extremely large portion of developed countries' total climate obligations. Here, the appropriate measure would be an indicator of ability to pay. Second, even as a measure of potential for domestic emissions reductions, it is not clear why *GHG per unit of GDP* is a more appropriate measure than *GHG per capita*. If it is, then, two countries, one with twice the emissions and income of another, have an equal potential for domestic reductions, and this is obviously not the case. Rather, to be blunt, *normalizing by GDP has the effect of granting more allowances to wealthier countries*. More particularly, it obscures the potential for the high-emitting, high-consumption lifestyle patterns of wealthier populations to be mitigated by lifestyle changes.

The EC has, of course, identified *GDP per capita* as an indicator of capacity to pay. But while this might seem a reasonable choice, it is inconsistent with how nearly all societies actually interpret capacity to pay when it comes to allocating public costs among private citizens. Setting climate obligations proportional to *GDP per capita*, as presented in the EC Communication, is equivalent to a "flat tax", which is nearly universally seen as being, if not actually regressive, then certainly insufficiently progressive. In other words, it is generally accepted that individuals should bear tax burdens that are more than proportional to their income. Most countries implement such taxes through tax schedules with a zero tax bracket (that protects the limited incomes of the extremely poor from taxation) and by way of tax rates that rise (in percentage terms) as income rises. If the EC were to assign target based on a more progressive definition of capability to pay, it could have dramatic effects on allocation of effort among different countries.

The EC has also used population growth as one of its four indicators, explaining that "Countries with an increasing population will have more difficulties to reduce their emissions than countries with stable or declining populations, assuming per capita income, carbon and energy intensity are all stable." This is a recognition of an essential fact: when a future emission target is expressed with respect to a base year, the relative effort required to meet that target depends critically on the factors which drive emissions trends, and these can vary considerably between countries. Which raises the question of why only population trends are taken into account here, and whether such a partial measure of baseline emission trends is reasonable and fair. Some countries, for example Ukraine and China, have relatively low (or negative) population trends, but might be expected to have high economic-growth and energy-intensity trends, as more people rise out of poverty and gain access to energy services. In general, a more defensible way of ensuring comparability of effort would be to assign targets relative to business-as-usual emission trajectories, rather than any single emissions driver or base year. For example, the EC (and

many others) refer to a 15-30% “deviation from business as usual” when discussing non-Annex 1 emission pathways¹⁴. And, finally, while there are serious difficulties in determining business-as-usual pathways, in the problems associated with base years (see for example Kyoto itself) are worse.

The final indicator presented by the EC is the 1990-2005 emission trend, chosen for the purpose of “rewarding early action by developed countries to reduce emissions”. The intent here is reasonable, and fully consistent with the overall notion of responsibility of nations for historical contributions to the climate problem (and, conversely, to the climate solution). But the particular indicator chosen is nevertheless problematic because does not distinguish between early action to reduce emissions and economic collapse.

The above problems are fundamental, and indicate a failure of both rigor and transparency. Proposed indicators should be clearly derived from the principles they are intended to express, and their justification – in the face of other possible indicators – should be clearly laid out. The EC has done none of this, and the result is a muddle that inspires little trust, particularly with regard to the consistency of its indicators with the core principles of “common but differentiated responsibilities and respective capabilities.”

An equally profound problem arises from the way that these indicators are used. The EC procedure for setting targets does indeed start with the specified four indicators, but it then enfolds them in a shroud of additional, and generally ad hoc, parameterizations. The whole system ends up being a black box that is very weakly linked to the principles that were used to justify the whole exercise in the first place. Table 5 below lists these parameters and their values, the justifications for which do not appear in either the EC Communication or its supporting documentation. Nor is this a complete list, since the target-setting algorithm relies as well on additional parameters to specify the relative weighting of each of these four indicators, and the degree to which a target and an indicator deviate from a linear relationship¹⁵.

ad hoc parameters in the EC model of effort-sharing	
Parameter	Value
1. Aggregate allocation for Annex1	30 % relative to 1990
2. Aggregate allocation for non-Annex1	16 % relative to baseline*
3. Average as a function of GDP per capita	-11.5 %
4. Range as a function of GDP per capita	20 %
5. Average as a function of CO2 per unit of GDP	-11.5 %
6. Range as a function of CO2 per unit of GDP	24 %
7. Average as a function of early action	-8.5 %
8. Range as a function of early action	28 %
9. Average as a function of population growth	2 %
10. Range as a function of population growth	10 %

* See the EC Communication supporting analysis by the JRC-IPTS. Figure includes additional land-use reductions.

Table 5. Various parameters, extracted from the official technical background documents that support the EC Communication, that determine targets using the EC “four indicator” model of effort-sharing.

Needless to say, it is possible to generate entirely different effort-sharing allocations among countries simply by adjusting these parameters. The choice of the averages (which vary from negative 11.5% to positive 2%) and the ranges (which vary from 10% to 28%) entirely determines the relative targets of different countries. Yet, no explanation is given for the particular choice of these all-important parameters. Nor is any explanation given for why the targets deviate from a linear relationship with the indicators in the particular idiosyncratic manner that they do. Eliminating the kink in the population indicator would relax Ukraine's target by approximately 10%, while eliminating the kink in the intensity indicator would relax Australia's by about 10%.

In other words, the target calculated for a particular country depends as much on the arbitrary choice made for each of these parameters as it does on the value of the country's four quantitative indicators. Thus, the specific targets derived by the EC analysis cannot in any way be said to be a straightforward or unambiguous result of the indicator values. The same criticism can be raised about the algorithm (even less completely explained) by which the indicative targets for developing countries are determined (Section 4.2, JRC-IPTS report).

After laying out the four-indicator proposal for target setting, the EC Communication goes on to briefly discuss "Innovative International Funding Sources." These are critical to the EC's vision of a viable Copenhagen agreement, for they are its central response to the core element of the Bali decision, wherein the developed countries committed to providing measurable, reportable, and verifiable financial and technological support for developing country mitigation actions, and improving access to "adequate, predictable and sustainable financial resources and financial and technical support" for mitigation and adaptation (Bali Action Plan, UNFCCC Decision 1/CP.13).

Here it should be said that the EC Communication Staff Working Documents, if not the Communication itself, helpfully reaffirms that "a composite index that reflects responsibility and capability might be the most suitable and political acceptable way forward."¹⁶ This vastly improves upon the disjoint, random, and entirely inadequate manner in which Annex 1 countries fund the existing climate related funds under the UNFCCC and Kyoto Protocol. Adding some concreteness, the EC Communication outlines two options. The first is a quantitative formula, which the EC suggests could be based on national emissions allowances and GDP/capita, as indicators of "polluter pays" and "ability to pay", respectively. For the second option, a percentage of national allowances could be withheld at the international level and auctioned, (as in the "Norwegian proposal") but possibly with the percentage increasing with GDP/capita.

These are both plausible if not ideal approaches, and the EC Staff Working Document expands upon them both, presenting some quantitative examples of the national shares implied by various choices of indicators for different countries.¹⁷ The examples, to be sure, deserve much of the same criticism as the EC's approach to setting reduction targets received just above, but we will not repeat it here.

The main shortcoming of the EC Communication's discussion of funding, and it is an extremely serious one, is simply that the EC remains entirely equivocal regarding the total scale of the financial support that it is willing to provide. In fact, it signals quite strongly that its willingness to provide support is rather limited, and it does this in several ways. First, it explicitly states that all "low-cost" and "net benefit" mitigation options should be borne by developing countries, and asserts that developed countries will provide only "financing beyond the domestic capabilities of the respective developing country." Especially lacking a definition of "domestic capabilities", this is a problematic offer. A similar qualification limits adaptation funding, where the EC Communication specifies that adaptation support would be "to the most vulnerable and poorest" ... "in particular LDCs and Small Island Developing States." While it is important to reach the

most vulnerable and the poorest, the commitments from industrialized countries must go much further than this. This apparent restriction on the eligible recipients of adaptation funding is likely to be taken as a further evasion of Europe's UNFCCC and Kyoto obligations.

For the EC Communication to be taken as a major contribution to a fair Copenhagen agreement, it would have had to make a strong and unambiguous statement about the EU's willingness to provide serious MRV support and adaptation funding. The developing countries have very clearly stated that this is an absolute priority for them, and a condition for significantly stepped up engagement. If anything was hoped for from this EC Communication, it was a strong signal regarding the willingness to support developing country actions. This, unfortunately, has not yet been delivered.

7 Conclusion

“Attending to human rights also means recognizing that as we take steps to address climate change, we must not do so at the cost of the most vulnerable. It is surely possible to repair our environment while still assuring our fellow human beings a path out of poverty and insecurity.”

Mary Robinson

Mary Robinson is of course correct. The only emendation we would make is that is not only “possible to repair the environment while still assuring our fellow human beings a path out of poverty and insecurity,” it is necessary. That there is no politically viable way to address climate change that does not assure them such a path, That, to be blunt, we will go together into the post-greenhouse world, or we will not go at all.

In this context, what shall we say about Ireland? It is, after all, a small country, and it has no very large direct influence over the outcome of the climate debate. Or does it? For Ireland, though small, is still a member of the European Union, and this gives it an open channel by which to magnify its influence. And if it is also in the sudden throes of a global economic crisis that has hit it very hard indeed, this too, perhaps perversely, is an opportunity. Ireland knows, perhaps more acutely than most, that the 21st Century is not going to be a time of blithe, self-satisfied success.

What, in any case, do we recommend?

That Ireland take a reality-based approach to the climate negotiations. That it look to the science, and refuse to satisfy itself with partial solutions that will fail to deliver a rapid and sustained decline in GHG emissions, either globally or within its own borders.

That Ireland take a moment to stand in the shoes of the South. Why, after all the broken promises, should the South trust the North to deliver on its commitments, especially when the EU, the most progressive of all the North’s blocs, is so intent on conditioning and limiting its offers of support? Why, when prosperity and development have never come without increased GHG emissions, should the South accept an accord in which it, with its lesser responsibility and its vastly greater need, is nevertheless asked to pioneer the low-carbon future.

That Ireland not only stand in the shoes of the South, but negotiate as its partner. That it cross the international divide and insist that capacity and responsibility – simply and transparently – are the best foundations for a global climate accord that is actually intended to succeed. That it openly acknowledge the fears at the root of the climate impasse and help to break them, rather than play the coming discord for short-term and self-defeating advantage. That it acknowledge, even now, in the run up to Copenhagen, that capacity and responsibility, as principles and as indicators of obligation, must be put into play.

That Ireland rise within EU and UN negotiations and straightforwardly offer to pay its fair share of the global burdens of rapid climate transition. That it embrace a future in which economic growth comes by way of accelerated decarbonization and social justice.

That Ireland adopt targets on the scale of the GDRs targets noted above and champion such an approach within the EU and the UN. That it accept its two-fold obligation and thus help to make the climate regime into one that protects and promotes true sustainable development. And that it

understand that, if such obligations seem preposterously unrealistic, this is only because each country is waiting for some other to come forward and state the obvious – there is no politically “realistic” solution to the climate crisis, and political reality must itself be transformed.

That Ireland stand with scientific and ethical realism.

This report, at bottom, has been about the principles of capacity and responsibility. But there is also another principle in play in the climate negotiations, one we hope to see more of in the months ahead – the principle of leadership. It has been lacking and – we must confess – it is not too difficult to understand why. The challenges, after all, are great, and Europe is still a work in progress. It is not a state, and decisive joint action may be beyond it.

But Ireland is equipped by its history to understand injustice. And so, perhaps, it is equipped to understand the stakes here, and the gravity of the moment. Perhaps it will be ready, as we come later this year to the drama of Copenhagen, to rise above its national interests and speak for the interests of Europe, for the aspirations of the South, and indeed for the future of humanity as a whole.

Where could such an understanding begin? Perhaps, as John Gormley, Ireland’s Minister of the Environment, suggested last December in Poland, with the obvious truth that, “If the world can spend billions of dollars on armaments, if we can mobilize capital urgently to save the global economy, then surely we can mobilize its resources to help the poorest people of the world adapt to climate change.” And where could it go? Perhaps to the increasingly obvious truth that, in a greenhouse world, prosperity and peace will not flow from politics and economics as usual.

That it’s time, now, for change. For change, and for leadership, and for the ability to see that the pace of events will not soon abate. And that as Nelson Mandela once so sharply noted, “It always seems impossible until it’s done.”

Right now, in truth, it seems impossible. But there is still time.

Tom Athanasiou (EcoEquity), Sivan Kartha (Stockholm Environment Institute), Paul Baer (EcoEquity), and Eric Kemp-Benedict (Stockholm Environment Institute). Contact the authors at authors@ecoequity.org. For more information on the Greenhouse Development Rights framework, see <http://www.ecoequity.org/GDRs>.

8 Appendix 1: The Greenhouse Development Rights Framework

The climate crisis does not come to us alone, but rather amidst worsening social and economy 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 an international effort-sharing regime in which it is not required to do so.

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. To do this, it proceeds in the only possible way, by concretely interpreting the official principles of the UN’s *Framework Convention on Climate Change*, according to which Parties commit themselves to “protect the climate system ... on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities.”

As a first step, the GDRs framework codifies the right to development as 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.

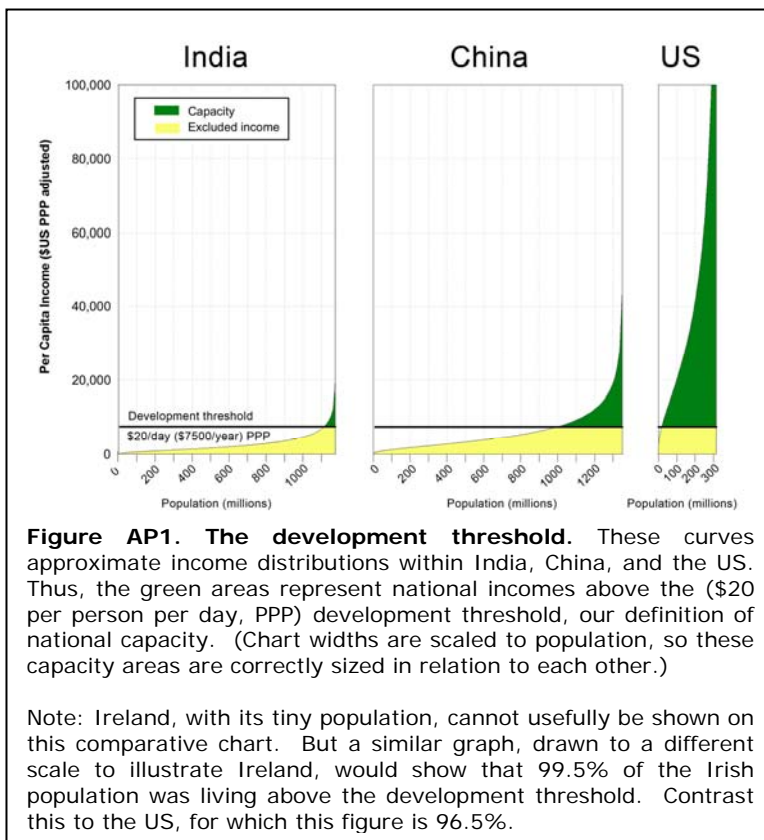
People with incomes that exceed the development threshold, on the other hand, are taken as being wealthy enough to begin bearing the burdens of the climate transition – as having realized their right to development and as bearing some fraction of our common responsibility to preserve that right for others. 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



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 calculator¹⁸ 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
EU 27	7.3	30,472	28.8	22.6	25.7	22.9	19.6
EU 15	5.8	33,754	26.1	19.8	22.9	19.9	16.7
EU +12	1.49	17,708	2.7	2.8	2.7	3.0	3.0
Ireland	0.07	39,205	0.36	0.23	0.30	0.26	0.22
United states	4.5	45,640	29.7	36.4	33.1	29.1	25.5
Japan	1.9	33,422	8.3	7.3	7.8	6.6	5.5
Russia	2.0	15,031	2.7	4.9	3.8	4.3	4.6
China	19.7	5,899	5.8	5.2	5.5	10.4	15.2
India	17.2	2,818	0.7	0.3	0.5	1.2	2.3
Brazil	2.9	9,442	2.3	1.1	1.7	1.7	1.7
South Africa	0.7	10,117	0.6	1.3	1.0	1.1	1.2
Mexico	1.6	12,408	1.8	1.4	1.6	1.5	1.5
LDCs	11.7	1,274	0.1	0.0	0.1	0.1	0.1
Annex 1	18.7	30,924	76	78	77	69	61
Non-Annex 1	81.3	5,096	24	22	23	31	39
High Income	15.5	36,488	77	78	77	69	61
Middle Income	63.3	6,226	23	22	22	30	38
Low Income	21.2	1,599	0.2	0.2	0.2	0.3	0.5
World	100 %	9,929	100 %	100 %	100 %	100 %	100 %

Table AP1. Percentage shares of total global population, GDP, capacity, responsibility, and RCI for selected countries and groups of countries, based on projected emissions and 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.

Ireland, as the GDP per capita figures in Table AP1, above, clearly show, is not a poor country, though its internal economic inequality is moderately high (the Gini co-efficient that we use for Ireland, from a recent edition of the *World Income Inequality Database*, is 32) which can make it feel poor to disadvantaged people. Still, Ireland's per-capita income is higher than the EU15 average. Its share of the global obligation (RCI) is 0.30% in 2010, which is large compared to its 0.07% share of the global population, reflecting its relative wealth and historical responsibility. Its share of global capacity is higher than its share of global responsibility, which reflects a national carbon intensity that is low relative to other industrialized countries.

As Table AP1 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.¹⁹ They are also reflected in the drop of Ireland's 0.30% share of the global 2010 RCI to 0.26% in 2020 and 0.22% in 2030.

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.

8.1 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, or 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.²⁰ The analysis backing up the EC Communication 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. Its more technoeconomic analysis (using POLES) found mitigation costs of €175 billion, or about ¼% of the EC's projected 2020 Gross World Product, and 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 costs²¹.

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), of which Ireland's share (0.26% of the global RCI) would be about \$2.5 billion (€1.9 billion) - this relates to Ireland's responsibility to pay for the combined cost of mitigation and adaptation at home and in developing countries. China's share would be \$98 billion (10.4%), India's about \$11 billion (1.2%), and so on, as shown in Table AP2, below.

	National Income (Billion \$)	National Capacity (Billion \$)	National Capacity % GDP	National Obligation (Billion \$)	National Obligation % GDP
EU 27	\$19,327	\$15,563	80.5%	\$ 216	1.12%
EU 15	\$16,752	\$13,723	81.9%	\$ 188	1.12%
EU +12	\$ 2,574	\$ 1,840	71.5%	\$ 28	1.09%
Ireland	\$ 224	\$ 186	82.9%	\$ 2.5	1.10%
United States	\$18,177	\$15,661	86.2%	\$ 275	1.51%
Japan	\$ 5,071	\$ 4,139	81.6%	\$ 62	1.23%
Russia	\$ 2,905	\$ 1,927	66.3%	\$ 41	1.40%
China	\$13,439	\$ 5,932	44.1%	\$ 98	0.73%
India	\$ 5,814	\$ 972	16.7%	\$ 11	0.19%
Brazil	\$ 2,535	\$ 1,376	54.3%	\$ 16	0.64%
South Africa	\$ 706	\$ 422	59.8%	\$ 10	1.42%
Mexico	\$ 1,744	\$ 1,009	57.9%	\$ 15	0.84%
LDCs	\$ 1,549	\$ 82	5.3%	\$ 1	0.06%
Annex 1	\$50,368	\$40,722	80.8%	\$ 652	1.29%
Non-Annex 1	\$44,037	\$18,667	42.4%	\$ 292	0.66%
High Income	\$49,279	\$40,993	83.2%	\$ 655	1.33%
Middle Income	\$41,546	\$18,190	43.8%	\$ 286	0.69%
Low Income	\$ 3,579	\$ 206	5.8%	\$ 3	0.08%
World	\$94,405	\$59,388	62.9%	\$ 944	1.00%

Table AP2. 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 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. Ireland's share would drop to \$1.25 billion. And it is also worth noting that, using the EC's 2020 mitigation-only cost estimate of €175 billion (220 billion US dollars), which comes to about 0.23% of projected 2020 GWP, that estimated costs are about half of the 0.5% figure. In this case, Ireland's share would drop to, say, \$750 million (€596 million) in 2020.

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.*

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
Ireland	\$7,500	0.00%	0.00%	\$0	0.00%	0.00%	\$0	0.00%	0.00%	\$0
Ireland	\$15,000	0.66%	0.33%	\$50	1.33%	0.66%	\$100	2.65%	1.33%	\$199
Ireland	\$30,000	0.66%	0.50%	\$149	1.33%	1.00%	\$299	2.65%	1.99%	\$597
Ireland	\$60,000	0.66%	0.58%	\$348	1.33%	1.16%	\$697	2.65%	2.32%	\$1,393
Ireland	\$120,000	0.66%	0.62%	\$747	1.33%	1.24%	\$1,493	2.65%	2.49%	\$2,986
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 AP3. “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).

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.

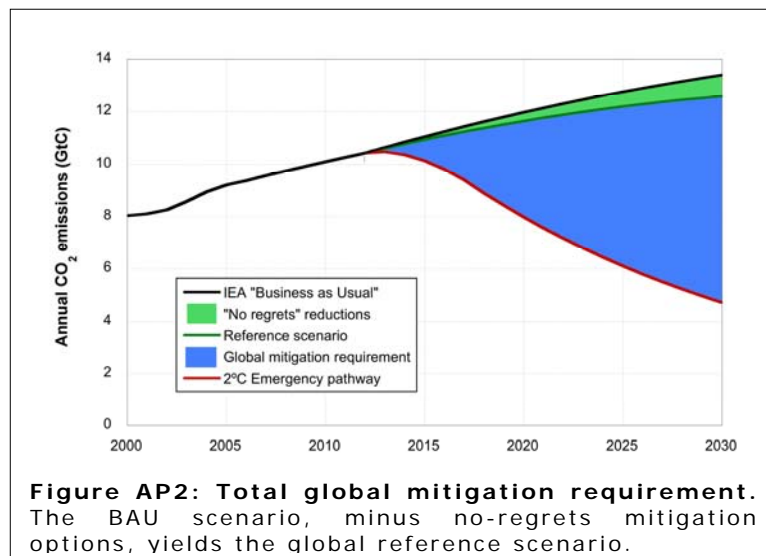
Here we show three representative cases: a country with high responsibility relative to its capacity (the US), a country with low responsibility relative to its capacity (Sweden), and Ireland, a country with medium responsibility relative to its capacity. (The details: US cumulative per capita emissions, 1990 to 2020, are projected to be 133 tons of carbon²², while Sweden's are projected to be 40 tons and Ireland's are projected to be 62 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, and Irish per capita emissions of 52 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, an Irish citizen earning \$60,000 a year would pay a climate tax of \$697 a year, or less than \$2 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 when compared to that used by the European Commission. *If you instead use the EC's global cost estimate, this same citizen would pay a climate tax of about \$175 a year, less than 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 somewhat less than \$8/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, 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.

8.2 The GDRs framework and national reduction targets



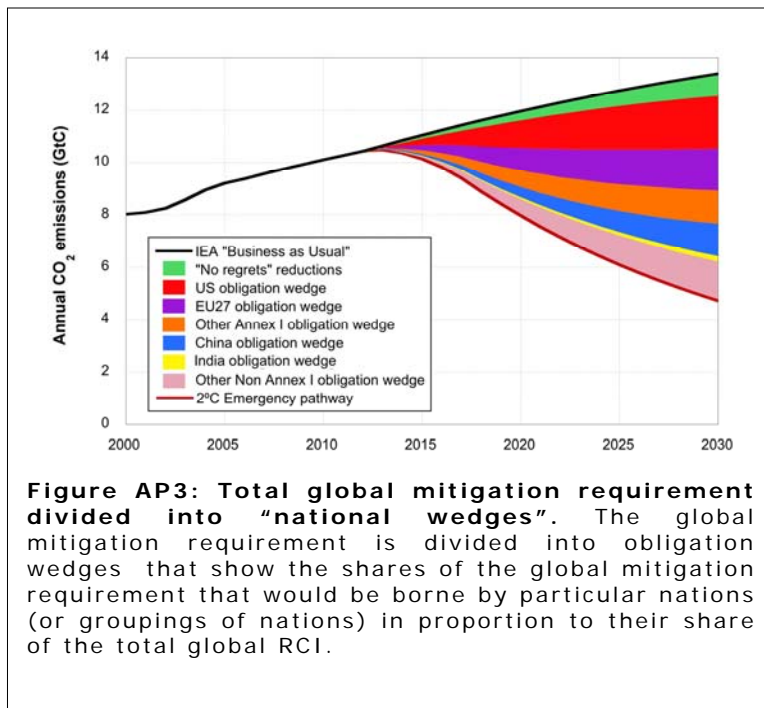
Another perspective on effort sharing, one that is central to the ongoing negotiations, expresses post-2012 obligations in terms of emission reduction obligations and Kyoto-style national targets. To illustrate it, we start by comparing a global "business-as-usual" trajectory to the rapidly dropping 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 AP2 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).²³ 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 CO₂ only; a similar proportional reduction in all GHGs would imply a roughly 30% larger mitigation requirement, about 4800 GtC-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 AP3, 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.

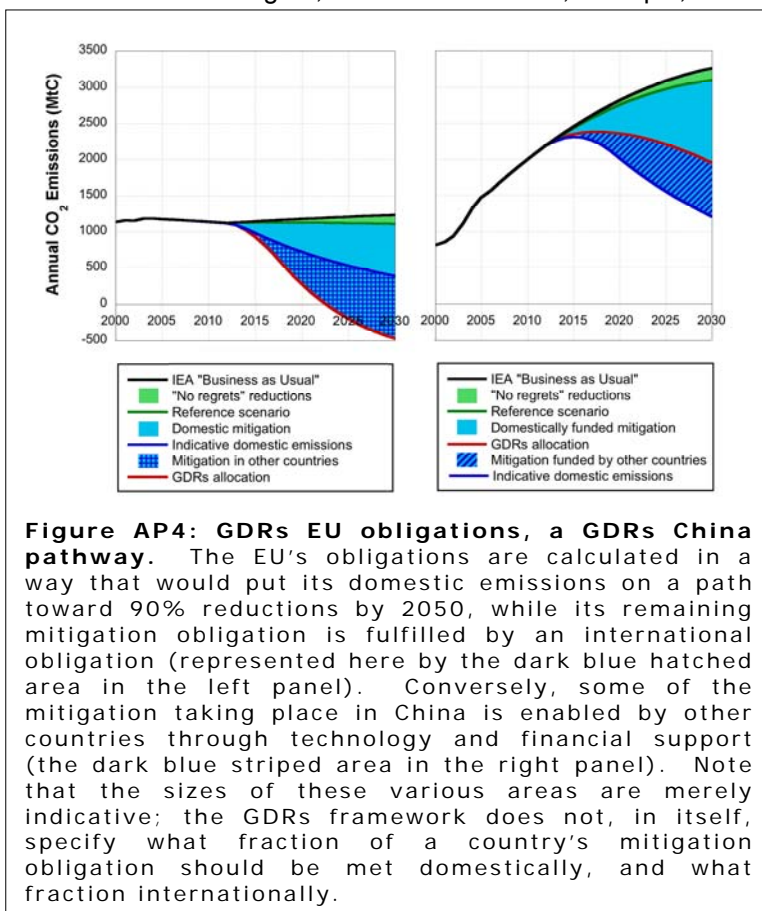
If this mitigation obligation were interpreted literally and achieved entirely through domestic



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.”²⁴

On its left side, Figure AP4 (below) 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 be 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”²⁵.

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.

8.3 Recap: differentiation and sequencing

We have argued that the climate challenge requires a simple, transparent, and compelling effort-sharing framework, one that's robust enough to be universally applicable, and to make sense even when comparing wealthy, middle income, and poor countries, each with skewed, and often highly skewed, income distributions. Such a framework must be built upon the principles of “common but differentiated responsibilities and respective capabilities,” and, crucially, it will have to explicitly preserve a coherently defined right to sustainable development. These are the qualities that a differentiation scheme must have if it is to be more than a mere policy abstraction, if it is to serve as the backbone of a viable climate protection architecture. Without such a framework, the emergency climate mobilization we so urgently need will remain stalled amidst endless disagreement over who should do what, and when, and how.

We have further argued that the GDR framework embodies the necessary characteristics, although we would not presume that our particular quantitative results – relying as they do on the datasets now available, and our particular choice of various parameters – are in any sense the last word. But we do argue that differentiation is absolutely unavoidable, and that – once it is fully deliberated and vetted – a scheme that is structurally akin to the one outlined here will be needed if we're to break the impasse that prevents a global emergency mobilization.

However, the world follows a complex and varied course. It cannot be fully captured by any top-down, principle-based scheme such as GDRs, which is ultimately and inevitably ahistorical. Given this, it's no surprise that the analysis above minimizes the politics that got us to this impasse, and the political accommodations that will be required to get us beyond it. It neglects, in particular, a global lack of political will and a North-South trust deficit that effectively rule out the simplest way forward, in which the North and the South each legally commits to carry its “fair share” of the climate burden.

To be sure, the main problem is simply that the scale of the required action appears overwhelming. Looking at either the United States or the China trajectories above, or that of any other country, the implied effort is barely imaginable given today's meager political willingness to solve the climate problem. This is not a result of the particular effort-sharing approach in question, but rather a simple consequence of the stringency of the emergency transition now upon us. Were we to run the same analysis with a much weaker temperature target, the results would be rather less daunting. That is to say, the scale and urgency of the action required now is largely a consequence of our lethargic response to the climate challenge thus far. In particular, with the Annex 1 countries having entirely neglected their Rio promise to stabilize emissions at

1990 levels by the year 2000, and after the past decade of half-efforts to meet their Kyoto commitments (and, in the case of the United States, of entirely shunning them), the climate challenge has grown much more severe than it might have.

But even if the scale of the required action were more modest, the South would still be unlikely to accept legally binding commitments. Indeed, it would be so even if those commitments were defined in a principle-based way that safeguards its right to development, such as way presented here. It is not simply that the South is stubbornly waiting for the North to fulfill its formal UNFCCC responsibility to “take the lead” in combating climate change. It is that the South sees any agreement that would curtail its emissions as simply too big a risk to take at this point. Fossil fuels have driven development up to now, and the countries of the South are not about to sign away their right to follow along this proven pathway, not without the North’s demonstrated willingness to help chart out, and indeed pave, an alternative course. The South’s distrust of legally binding commitments is directly linked, therefore, to the North’s inattention to its own emission constraints, and equally to the North’s repeated failure to meet its UNFCCC and Kyoto commitments to provide technological and financial support for mitigation and adaptation in the South.

None of this, however, excuses the South any longer from the obligation to earnestly engage. This is the case not only in the more affluent of the southern countries, such as Singapore and South Korea, but also in China, which though suffering a relatively low average per-capita income, nevertheless has a significant capacity to act. Such countries must act, and unless they do, progress on a global climate response will be stymied. The question is how they must act, and here we are compelled to emphasize one word above all others: *voluntarily*.

And we say this despite even the results of our own analysis, which suggest that a GDR-based reckoning of the South’s obligation is sizable, amounting already to perhaps one-quarter of the global total. We do so for the obvious reason that a legitimate Copenhagen phase simply cannot push legally-binding mitigation commitments onto the non-Annex 1 countries. The course of the negotiations thus far, and the failure of the North to demonstrably “take the lead,” has made this the simple political reality. Indeed, there may not be a single non-Annex 1 country, of any wealth or size, that is prepared to accept legally-binding commitments. Nor, it is important to note, is this what is asked of them by the Bali decision, which calls only for “nationally appropriate mitigation actions by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building, in a measurable, reportable and verifiable manner.”

So, while legally binding commitments based on a principle-based global differentiation might ultimately be necessary, we will, in this next Copenhagen period, have to accept a variety of types of actions, some of them softer and more implicit than we might perhaps wish. Among the Annex 1 countries, commitments should carry the force of law, and take the clear, unambiguous form of legally-binding quantified emission targets as well as legally binding commitments to financial and technological support. But for the developing world, we will have to allow considerable flexibility.

Such flexibility does not mean that efforts of countries of the South will not be measured, and compared. If South Korea, Singapore, and the United Arab Emirates do not appear to be doing at least as much as – or indeed, more than – the much poorer countries of Annex 1, such as Ukraine and Belarus, they would obviously be seen as free-riding. Moreover, they would be undermining any claim that principle-based differentiation is an important ingredient of a robust effort-sharing agreement for the future. In particular, they would be undermining their own claim

that the wealthy Annex 1 countries must finally accept their disproportionate but fair share of the global obligation to act.

So while Copenhagen will not focus on global differentiation, it should make bold progress in the sequence of steps toward it. Specifically, we would argue that the elaboration of principle-based measures of effort, like the RCI we have introduced above, would be an important indicator of success in Copenhagen. If the current round of negotiations succeeds, we will know this in part because a coherent and public conversation about fair shares of the global effort will have come into far greater prominence, and given credence to the use of explicit quantitative indicators for assessing national performance with respect to such fair shares.

9 Appendix 2: Ireland's Responsibility and Capacity Indicator (RCI)

A national RCI is a function of four nationally-specific data elements, plus a global development threshold.⁴ The four national elements are:

1. Per-capita income,
2. Cumulative per-capita CO₂ emissions,
3. Gini coefficients (a measure of intranational inequality),
4. Population.

Two of these – per-capita income and per-capita emissions – are in turn derived from projections for national income, national emissions, and population.

While each country's RCI, in absolute terms, depends solely on data about that country (and the development threshold), in practice, the RCI is almost always used to allocate a national share of some global obligation – to mitigate, to contribute to a global fund, to pay for adaptation, etc. This is to say that *what really matters to Ireland is its fraction of the global RCI*, and this fraction will, necessarily, depend on data about other countries as well as data about Ireland.

The distribution of global RCIs is also dependent on the global “development threshold,” which defines a level of well-being that is modestly above a global poverty line. Individuals living below this threshold are not expected to help bear the costs of addressing the climate problem, on either the mitigation or adaptation side.

9.1 Data and data sources

The RCI database includes all 192 countries that are members of the UNFCCC, plus Taiwan, Iraq, and the West Bank and Gaza. Data for China and Hong Kong, which are typically reported separately in most income and emissions databases, are combined.

Income

Most historical income data comes from the World Bank's *World Development Indicators Online*, which contains data for national income in PPP (Purchasing Power Parity) adjusted terms for almost all of the 195 countries in the GDRs database. For a few others the CIA World Factbook is used.

⁴ This appendix does not explain the reasoning behind the RCI, nor why these elements are appropriate to its calculation. For a detailed discussion of these matters, see Appendix 3, or the latest edition of the Greenhouse Development Rights book, downloadable at www.ecoequity.org/GDRs.

Income projections are based on projected growth rates from the International Energy Agency's *World Energy Outlook 2007*, applied to reported 2006 income. The projected growth rate for Europe, which is applied to Ireland, is about 3% annually in 2005 and declines to about 2.1% by 2030. Note that this is relatively low compared to the recent (2003 to 2007) growth rate of GDP for Ireland.

Projected income is then dynamically adjusted to take account of the expected change in PPP conversion factors. A statistical relationship between MER (market exchange rate) and PPP-based income is used to adjust the PPP conversion rate as national incomes converge or diverge from the projected per capita income of the US economy, which is the reference case for PPP calculations.

CO2 emissions

Historical estimates (through 2006) of CO₂ emissions from fossil fuel use and cement manufacturing are taken from the data set of the United States Energy Information Agency. Emissions between 2007 and 2012 are based on an assumption that overall Annex 1 emissions decline slightly over that period, as would be consistent with Kyoto parties meeting their targets and US emissions stabilizing. Baseline emissions are projected after 2012 based on projected growth rates from the International Energy Agency's *World Energy Outlook 2007*, applied to reported 2005 emissions. Per-capita emissions are calculated from national emissions and historical/projected population. Note that these figures do not account for the global recession which began in 2008 and has worsened in 2009; however, they also do not reflect the much higher than expected growth rates in larger developing countries between 2000-2006, which leads (as discussed in Sheehan 2008) to a much higher non-Annex 1 – and thus global – emissions baseline.

The GDRs framework calculates responsibility in terms of cumulative emissions. But note that it also supports projections of responsibility into the future, for which emissions data is not available. Thus, in projections if not historical cases, responsibility diverges from emissions. Because wealthy countries are assumed to be supporting emissions reductions internationally, it is not emissions but the annual allocation of emissions rights which accumulates as "responsibility". That is to say, when a country's emissions allocation declines to zero and below, its responsibility ceases to increase and begins to decline.

Gini Coefficients

Gini coefficients for the majority of countries in the GDRs database are taken from the World Income Inequality Database. For countries which have reliable national or supranational sources (e.g., US Census Bureau, EU Europa database) newer Ginis are used where available. For some countries other sources are used, and for those for which no published figures are available, Gini coefficients are estimated on the basis of comparable countries.

For Ireland, the figure used in the GDRs database is 32, from a 2004 survey reported in the WIID database. Gini coefficients are assumed to remain the same going forward – not because they are expected to remain the same, but because there is no reliable statistical pattern to the change in Gini coefficients over time. (There is a strong current correlation between per capita income

and inequality as measured by Gini coefficients, with rich countries having on average significantly lower inequality than poor countries, but recently inequality has been increasing in countries across the income spectrum from the US to China.)

Population

Current and historical population is taken from the World Bank's *World Development Indicators Online*. Data is available for almost all of the 195 countries in the GDRs database. For a few others the CIA World Factbook is used. Projections are based on the growth rates implied by the UN Population Division's Medium Variant from their last report, applied to the most recent (2006) data.

9.2 Calculating the RCI from the GDRs dataset

Because there are some moderately complex calculations involved in deriving the RCI, the actual work is done by a computer program – the “GDRs Calculator” – that is written in the programming language R by Eric Kemp-Benedict of the Stockholm Environment Institute in Boston, Massachusetts. The calculator is online at <http://www.ecoequity.org/GDRs/Calculator/>

Central to the calculation is the commonly used assumption that national income distributions can be modeled as lognormal distributions. The lognormal distribution has been shown to provide a reasonable approximation of measured income distributions. With this assumption, any national income distribution can be modeled with just a Gini Coefficient and the per-capita income.

Using this assumption, the capacity and responsibility for each country for each year can be calculated from the underlying dataset, and then combined into the RCI. Capacity for a given year is defined as the sum of the income of all individuals in the country, excluding the total income of everyone under the (\$7500) development threshold, and, for people making more that \$7500 annually, counting only income above that threshold. Responsibility is calculated in a similar manner, assuming that emissions are linearly proportional to income (that is, assuming that all individuals have the same ratio of emissions to income); that is, all emissions are excluded for those whose incomes are under the development threshold, and emissions equivalent to \$7500 of consumption at the national average carbon intensity are excluded for those with income over the threshold. Unlike the calculation of capacity, however, responsibility is calculated on a cumulative basis, starting from 1990, so that Responsibility in (say) 2015 is the sum of responsibility calculated in this way for each year from 1990-2015. Capacity and Responsibility are then normalized as a percentage of the global total, and combined into a single Responsibility and Capacity Indicator by taking the average. (Note that one could also choose to weight one more heavily than the other).

It should also be noted that, because the RCI is based on the projected allocation, and the allocation is a function not just of the RCI but also of the assumed national BAU emissions baselines, no regrets baselines, and the global target trajectory, the RCI itself is sensitive to the emissions baselines and targets.

9.3 Special considerations for this report

Two adjustments have been made to the standard GDRs calculations for this report. First, the national baselines and allocations have been estimated in terms of all greenhouse gases (GHGs), to conform with the terms of the national and especially Annex 1 policy discourse; whereas the standard GDRs approach, as reflected, for example, in the Greenhouse Development Rights book (Baer et al, 2008), uses only CO₂ due to the unavailability of reliable all-GHG measurements and projections for developing countries. Second, projections of emissions between 2006 and 2012 have been adjusted to reflect more detailed individual country projections, taken (in the case of Ireland) from national information, or (for other countries) from the European Environment Agency's 2008 GHG emissions report.

It should be noted that projections through 2012 define emissions levels as levels prior to afforestation and use of Kyoto mechanisms, since doing so best approximates actual domestic emissions as they will be in 2012. It should also be noted that while these projections, in all GHG terms, are used in the figures, the database which drives the RCI calculator has not been changed; thus there is a small discrepancy between the reported RCI and that which would be implied by the more detailed, all-gas projections.

Finally, the conversion between CO₂ and all GHGs was made on the basis of an estimate from the World Resources Institute's Climate Analysis and Indicators Tool v. 6.0, which estimates that worldwide non- CO₂ emissions are equal to about 30% of CO₂ emissions in 2005; thus the annual mitigation requirement is simply assumed to be 1.3 times the value for CO₂ only.

9.4 Calculating the Irish RCI

Following the description above, the table below indicates the calculation of the RCI for Ireland from 2000 through 2030.

Year	Per Capita Income (\$PPP)	Population (millions)	Per Capita Emissions (MtCO ₂ -e)	Cumulative Per Capita Emissions (MtCO ₂ -eq)	Share of population over development threshold	Share of global capacity	Share of global responsibility	Share of global RCI
2000	32,140	3.81	18.1	128	99.6	0.350	0.21	0.28
2005	37,887	4.16	16.9	184	99.4	0.400	0.23	0.23
2010	39,205	4.58	15.1	227	99.5	0.360	0.24	0.24
2015	41,481	4.86	14.3	221	99.6	0.340	0.23	0.28
2020	43,799	5.11	13.9	275	99.7	0.310	0.21	0.26
2025	46,197	5.34	13.6	259	99.8	0.290	0.2	0.24
2030	48,613	5.54	13.4	230	99.8	0.270	0.18	0.22

10 Appendix 3: EU and selected country details (projected to 2020)

	income	population above dev't threshold	capacity	responsibility share	capacity share	RCI share	national obligation to pay	Average obligation to pay	reference emissions	GDRs allocation**
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 threshold	% 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	2.85	3.10	2.97	1.09	300	82	45
Austria	46,728	100	84	0.36	0.56	0.46	1.10	514	118	17
Belgium	43,689	100	83	0.61	0.66	0.64	1.27	556	95	23
Bulgaria	23,601	96	68	0.18	0.19	0.18	1.05	259	104	75
Cyprus	37,089	100	80	0.04	0.04	0.04	1.21	450	214	99
Czech Republic	36,386	100	79	0.57	0.49	0.53	1.36	495	82	38
Denmark	46,639	100	84	0.28	0.37	0.32	1.18	549	88	7
Estonia	31,107	98	76	0.07	0.05	0.06	1.44	459	52	30
Finland	41,757	100	82	0.28	0.31	0.30	1.24	518	113	39
France	40,850	100	82	1.97	3.64	2.80	1.00	409	97	1

** Note that this is an emission allocation expressed as a **percent of 1990** levels, not a mitigation obligation expressed as a **percent reduction below 1990** levels.

	income	population above dev't threshold	capacity	responsibility share	capacity share	RCI share	national obligation to pay	Average obligation to pay	reference emissions	GDRs allocation **
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 threshold	% relative to 1990	% relative to 1990
Germany	44,082	100	83	4.43	4.99	4.71	1.25	551	78	16
Greece	40,870	99	82	0.49	0.63	0.56	1.15	471	121	30
Hungary	31,625	100	76	0.24	0.39	0.31	0.97	309	91	33
Ireland	43,799	100	83	0.21	0.31	0.26	1.11	486	123	40
Italy	39,361	99	81	2.26	3.15	2.70	1.10	438	105	20
Latvia	25,313	93	71	0.02	0.06	0.04	0.78	212	43	11
Lithuania	26,869	95	72	0.05	0.10	0.08	0.86	246	43	13
Luxembourg	84,236	100	91	0.06	0.07	0.07	1.38	1160	91	16
Malta	34,312	99	78	0.01	0.02	0.02	1.05	364	152	59
Netherlands	47,798	100	84	0.87	1.14	1.00	1.18	566	97	14
Poland	24,796	93	70	1.17	1.09	1.13	1.16	309	89	50
Portugal	27,672	91	74	0.26	0.37	0.32	1.00	305	144	45
Romania	17,864	90	59	0.27	0.36	0.32	0.83	165	69	44
Slovakia	28,286	100	74	0.15	0.19	0.17	1.05	300	71	33
Slovenia	41,273	100	82	0.07	0.11	0.09	1.07	441	122	37
Spain	35,781	99	79	1.49	2.23	1.86	1.05	378	148	38

	income	population above dev't threshold	capacity	responsibility share	capacity share	RCI share	national obligation to pay	Average obligation to pay	reference emissions	GDRs allocation **
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 threshold	% relative to 1990	% relative to 1990
Sweden	42,517	100	82	0.26	0.57	0.41	0.95	404	86	-14
United Kingdom	41,899	99	82	2.71	3.71	3.21	1.13	476	87	13
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
South Africa	14,010	51	60	1.42	0.71	1.07	1.42	395	188	139
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

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¹ Personal communication, Jakob Graichen (Öko-Institut e.V.), 3 March 2009. Please note these are approximate targets, which do not include a deduction for the “solidarity” adjustment that transfers EU ETS allowances from the wealthier EU member states to the poorer ones. A definitive effort-sharing scheme for the EU’s 30% target has not been released, so the numbers presented here are based on personal communications between Graichen and numerous EU member state representatives, along with his own informed assumptions.

² The “Reference Scenario” is based on a combination of the International Energy Agency’s “Energy Outlook 2007” emissions baseline, and an estimate of no-regrets emissions reductions in turn based on McKinsey and Company and IPCC estimates. See Baer et al 2008 for details.

³ For more on this point, see the IPCC’s AR4 and updates to the science found, for example, in David Spratt & Philip Sutton, *Climate Code Red: the Case for Emergency Action*, especially chapter 5, “The Quickening Pace.” (Scribe Publications, Melbourne, 2008). See www.climatecodered.net.

⁴ For details, see Baer and Mastrandrea (2006) and Meinshausen (2006).

⁵ The reader will find a more complete explanation in the Annex, along with quantitative results.

⁶ The statement issued by the “G5 countries” (Brazil, Mexico, India, South Africa and China) after 2008’s G8 meeting in Japan is particularly notable, for it contains this: “Negotiations for a shared vision on long-term cooperative action at the UNFCCC, including a long-term global goal for greenhouse gases (GHG) emissions reductions, must be based on **an equitable burden sharing paradigm that ensures equal sustainable development potential for all citizens of the world and that takes into account historical responsibility and respective capabilities as a fair and just approach.** It is essential that developed countries take the lead in achieving ambitious and absolute greenhouse gas emissions reductions in accordance with their quantified emission targets under the Kyoto Protocol after 2012, of at least 25-40 per cent range for emissions reductions below 1990 levels by 2020, and, by 2050, by between 80 and 95 per cent below those levels, with comparability of efforts among them.” (Emphasis added. See <http://www.twinside.org.sg/title2/climate/info.service/climate.change.20080702.htm>).

⁷ Note again that these figures are for CO₂ only, and measured in megatons of carbon. Both Annex 1 emissions and the necessary global mitigation would be somewhat larger if **all** greenhouse gases were counted.

⁸ See figures published by the EPA, 13 March 2009, *Ireland’s Greenhouse Gas Emission Projections 2008-2020*

⁹ The estimated emissions to 2012 are based on a recent estimate from the Environmental Protection Agency that emissions in 2012, projected last year to be 72 MtCO₂-equivalent in 2012, might be 4.6% less due to the ongoing global recession. Projections to 2020 are based on growth rates from the International Energy Agency’s *World Energy Outlook* (2007).

¹⁰ 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.

¹¹ Andrew Pendleton, *Fairness in global climate change finance*, Institute for Public Policy Research, London, forthcoming

¹² To convert to tons of carbon dioxide rather than carbon, multiply by 3.7. This figure accounts for CO₂ from fossil fuel combustion and cement manufacturing only; all-GHG figures would be somewhat higher.

¹³ Note that in the March 2 statement of the EU environment ministers, these principles are repeated, though in pointedly more general terms. For example "*GHG emissions per unit of GDP*: indicating the domestic GHG emission reduction potential" becomes "the GHG emission reduction potential."

¹⁴ The EC's supporting analysis considered population growth from 2005 to 2020 when calculating non-Annex 1 country targets. Since non-Annex 1 targets were defined relative to business-as-usual, which already takes into account population trends, it is actually redundant to use population trends as a determinant of reduction targets.

¹⁵ This deviation appears visually as a "kink" in the line with different slopes on either side, as seen in Figure 7 of the EC Staff Working Document (Part 2).

¹⁶ Commission Staff Working Document, Part 1, Executive Summary, p. 11.

¹⁷ Staff Working Document, table 22, Part 1.

¹⁸ www.ecoequity.org/GDRs/Calculator

¹⁹ 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.

²⁰ 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.

²¹ Andrew Pendleton, *Fairness in global climate change finance*, Institute for Public Policy Research, London, forthcoming

²² To convert to tons of carbon dioxide rather than carbon, multiply by 3.7. This figure accounts for CO₂ from fossil fuel combustion and cement manufacturing only; all-GHG figures would be somewhat higher.

²³ 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.

²⁴ The Bali Action Plan, Decision 1/CP.13 para 1(b) ii.

²⁵ 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.