Contraction & Convergence
and
Greenhouse Development Rights:

A critical comparison between two salient climate-ethical concepts

Diplomarbeit im Studiengang
Landschaftsökologie und Naturschutz

am Botanischen Institut
der
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April, 2009

Contents

Preface

In a way, it is a conundrum to me how it can be that two concepts which have a “realistic” chance to secure the involvement of most countries of the planet in the momentous undertaking of stabilizing the climate receive so little attention by the public, the media, politicians, and scholars. It is a further conundrum to me that I - a university student – am apparently the first person to compare both concepts systematically and comprehensively, less than a year before a global deal on climate change should be agreed in Copenhagen. Why has nobody thought of doing this before?

Be that as it may, my motivation for writing a thesis about such a pressing and delicate issue was to make a positive contribution to a decision-making process that seems to have implications beyond our imagination.

I’m very grateful for the help and support of my supervisor Prof. Konrad Ott. I very much appreciate his advice and ideas throughout the compilation of this thesis. As well, I want to thank my family and friends for their immense patience and understanding during the past months.

List of Acronyms and Abbreviations

AF	Adaptation Fund
AOGCM	Atmosphere-Ocean General Circulation Model
AR4	Fourth Assessment Report
AWG	Ad Hoc Working Group
BAU	Business as Usual
BECCS	Bio-Energy, Carbon Capture, and Geologic Storage
℃	Degree Celsius
C&C	Contraction and Convergence
CCS	Carbon Capture and Storage
CER	Certified Emission Reductions
CDM	Clean Development Mechanism
CH_4	Methane
CO_2	Carbon Dioxide
CO_2-eq	Carbon Dioxide Equivalent
COP	Conference of the Parties to the Climate Convention
COP/MOP	Conference of the Parties to the Climate Convention serving as the meeting of the Parties to the Kyoto Protocol
CPR	Common Property Resource
DNA	Designated National Authority
DRD	Declaration on the Right to Development
EIT	Economy in Transition
ETS	Emission Trading Scheme
EU	European Union
FAR	First Assessment Report
G 77	Group of 77 developing countries
GCI	Global Commons Institute
GDP	Gross Domestic Product
GEF	Global Environment Facility
GCM	General Circulation Model of the Atmosphere

GWP	Gross Word Product
GHG	Greenhouse gas
GDR	Greenhouse Development Rights
Gt	Gigatonne (one billion tonnes)
H_2O	Water vapour
HFC	Hydro-Fluoro-Carbon
IAM	Integrated Assessment Model
ICESCR	International Covenant on Economic, Social, and Cultural Rights
IEA	International Energy Agency
INC	Intergovernmental Negotiating Committee
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
LULUCF	Land use, Land Use Change, and Forestry
LDC Fund	Least Developed Country Fund
MDGs	Millennium Development Goals
MOC	North Atlantic Meridional Overturning Circulation
NEPAD	New Partnership for Africa's Development
N_2O	Nitrous Oxide
NGO	Non-governmental organization
O_3	Ozone
OECD	Organization for Economic Co-operation and Development
PDF	Probability Density Function
PFC	Per-Fluoro-Carbon
ppm/b	parts per million/billion
PPP	Purchasing Power Parity
RCI	Responsibility and Capacity Indicator
R&D	Research and Development
SAR	Second Assessment Report
SF_6	Sulphur Hexafluoride
SRES	Special Report on Emission Scenarios

SPM	Summary for Policymakers
TAR	Third Assessment Report
SBI	Subsidiary Body for Implementation
SBSTA	Subsidiary Body for Scientific and Technological Advice
SCCF	Special Climate Change Fund
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
US	United States of America
VCLT	Vienna Convention on the Law of the Treaties
WAIS	West Antarctic Ice Sheet
WG	(IPCC) Working Group
WMO	World Meteorological Organization

List of Figures

List of Tables

1. Introduction

> *"[Climate change] is the ultimate environmental externality since greenhouse gas emissions at any location or point in time will affect the lives of everyone in the world, at all future times."*
>
> (Pinguelli-Rosa and Munasinghe, 2002)

Since human-caused climate change became recognized at the scientific level, more and more evidence have been accumulating which indicates that this phenomenon represents a global threat of maximum proportions, a challenge beyond anything humanity has managed so far. Over the last years, the scientific literature has been progressively recommending increasingly ambitious action to prevent "dangerous climate change". Compared to the accelerating pace of scientific findings, the awareness that the climate change problem is much more urgent than previously thought grows rather slowly. If the most alarming scientific projections are accepted, humanity will have to make fundamental changes within the next couple of years to avoid large scale irreversible impacts.

At the political level, negotiations are in full progress towards reaching a comprehensive deal for the period beyond 2012, that is, when the Kyoto Protocol expires. Ideally, agreement on an international post-2012 regime should be found by COP 15/MOP 5 in Copenhagen in December 2009. Given their steadily growing share of global emissions, it was obvious from the beginning that a viable solution to the climate change issue will have to involve developing nations, or at least the major emitters among them, in particular China and India. So far, developing countries as a group have resisted any discussion about legally binding emissions reductions commitments. These countries argue that they carry little responsibility for causing the problem, given that the largest share of past and current emissions has originated in developed countries. A further complication for finding agreement arises from the fact that to date developed countries as a group effectively failed to take the lead in emissions abatement and to provide the pledged financial resources to support both mitigation and adaptation measures in developing countries. Many political observers agree that mutual trust needs to be built to realize real progress and to escape the impasse in which the negotiations are trapped. At any rate, developed countries will need to make vast concessions in order to get developing countries on board.

Since the beginning of the 1990s, an approach popularly termed "Contraction and Convergence" has been advocated by some NGOs and many developing country representatives at the sidelines of the climate negotiations. Basically, Contraction and Convergence relies on the ideas that absolute emissions need to be limited and that every human being should be entitled to use the same amount of the resulting global emissions budget. Although Contraction and Convergence has not been successful in breaking into the

mainstream climate negotiations, in recent years, it is receiving more and more support from developed county governments and institutions.

While Contraction and Convergence has long been seen as *the* just global solution to the problem of climate change, relatively recently, another approach, called "Greenhouse Development Rights" has emerged and has been successful in gaining proponents, including, inter alia, a number of European ecumenical groups. It draws on the moral concern that because of the overuse of the atmospheric commons by the world's wealthy minority, the development of the world's poor majority is profoundly constrained. As indicated by its name, the Greenhouse Development Rights approach fundamentally relies on assigning the "right to development" to every individual below a certain income threshold. As such, Greenhouse Development Rights is more ambitious and according to its proponents more equitable than Contraction and Convergence.

In a way, both concepts currently disunite the community of all those that stand up for just global institutions and environmental sustainability with the main points of contention surrounding the questions "*fair or feasible*?" and "*how fair is fair enough?*" As there is currently no other concept with the potential to secure the involvement of most countries of the planet, it has already been argued that adopting neither of them is unacceptable (Attfield, 2008b).

Against this background, the purpose of this thesis is to compare both concepts regarding their adequacy to tackle the problem of global greenhouse gas mitigation. The issue of adaptation to unavoidable climate impacts is largely excluded. The first three chapters are intended to give an overview of the current state of climate change research (Chapter 2), to summarize the relevant political and institutional developments (Chapter 3), and to shed light on the ethical dimension of the climate change negotiations (Chapter 4). From the ethical analysis in Chapter 4, four criteria are derived to guide the comparison between both concepts in Chapter 5. The last part of Chapter 5 contains recommendations on bridging the "North-South divide" and to move forward in a more equitable, sustainable, and peaceful future. Finally, a concluding summary is to be found in Chapter 6.

The treatment of such a broad topic as climate change within a short compass necessarily has to be limited to a qualitative mapping of issues and arguments. Although the comparison of both concepts is to some extent selective and opinionated, I hope that this thesis will be helpful to "clear the air" and to provide some insights for future debates which sit at the conjunction point where the proven path leads into an impasse but another path has not yet been established.

2. Scientific background of climate change research

For the man on the street, including many politicians, the notion of a changing climate is difficult to grasp. In part, this arises from the common confusion between climate and weather. Indicative is the misconception that a cold winter or a cooling spot on the globe disproves the theory of global warming. Generally, climate is defined as average weather, and as such, climate change and weather are closely related, but there are important differences. When weather is averaged over space and time, the fact that the globe is warming emerges clearly from the data. A change in climate can be due to both natural processes ("climate variability") and anthropogenic factors. Finding out to what extent and how these different factors act and interact in climate change processes is one of the key challenges of climate change research.

This chapter is intended to provide a rough overview of the state of knowledge of the science of climate change, including the historical evolution of climate change research as well as linkages to the political dimension. Special attention is given to the projection of future climate change by means of emissions scenarios and the possibility of large scale irreversible impacts.

2.1 Scientific basics of the enhanced greenhouse effect

The so-called greenhouse effect is a natural geophysical process which is empirically and theoretically well established. Incoming, short wave radiation from the Sun is absorbed at the Earth's surface and radiated away in the form of long-wave radiation (infrared).[1] Gaseous molecules which are generally referred to as greenhouse gases (GHGs) are transparent to sunlight but absorb and re-emit in the infrared part of the spectrum. These naturally occurring GHGs which influence the radiative budget positively (i.e. cause warming) are water vapour (H_2O), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and tropospheric ozone (O_3).[2] They keep the Earth's surface and lower atmosphere about 33°C warmer than it would be without them, making life on Earth as we know it today possible.

The "enhanced greenhouse effect" is a result of increases of the concentrations of GHGs in the atmosphere, amplifying the background greenhouse effect. When one tonne of CO_2 is

[1] For the annual mean and the Earth as a whole, the incoming energy and the outgoing energy are more or less balanced. A change in the net energy available to the global atmosphere system is called "radiative forcing": it can be natural or human-induced, and be positive (warming) or negative (cooling).
[2] Besides, some manmade halocarbons and sulphurhexafluoride are also causing warming. Aerosols, tiny particles or droplets in the atmosphere often caused by burning of biomass or fossil fuels, can have a negative radiative effect, causing cooling.

released into the atmosphere, roughly half of it is absorbed by the oceans or the terrestrial biosphere ("sinks") and the other half tonne remains in the atmosphere for a period of between several centuries and several thousand years (Solomon et al., 2007).[3] Acting like a blanket the additional GHGs keep more heat close to the Earth's surface. Compared to the pre-industrial period, atmospheric concentrations of carbon dioxide (CO_2), the chief heat-trapping GHG, have risen from about 275 parts per million (ppm) to around 385 ppm in 2008 (Hansen et al., 2008) and the atmospheric concentrations of methane, the second leading GHG, have more than doubled from about 715 parts per billion (ppb) to 1774 ppb in 2005 (IPCC, 2007). Primarily, this increase is due to combustion of fossil fuels and to a lesser extent caused by land-use changes such as deforestation, industrial and agricultural activities like cement production and animal husbandry.

2.2 From science to politics

For more than a hundred years scientists have been considering the possibility that human activities may change the Earth's climate.[4] However, a broad scientific consensus about the steady rise of atmospheric CO_2 concentration emerged only after direct measurements, which started in the 1950s, provided unambiguous data. During the 1970s, growing computing power facilitated the development of increasingly "realistic" general circulation models (GCM) of the atmosphere which estimated the climatic response to doubling CO_2 emissions and the potentially catastrophic impacts thereof. Becoming increasingly concerned about those findings, scientific and environmental communities organized various conferences during the 1970s and 1980s. Bodansky (1994) points out that those meetings were viewed with suspicion in some governmental circles and that in part the establishment of the Intergovernmental Panel on Climate Change (IPCC) in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) was intended to reassert governmental control and supervision over what was becoming an increasingly prominent political issue.

2.3 IPCC organization and mandate

Being at the interface of science and policy, the IPCC does not directly support new research of climate-related data. Rather, its role is to review and to assess periodically the most recent scientific, technical, and economic information pertinent to the problem of human–induced climate change, its potential impacts and options for adaptation and mitigation.

[3] To compare the radiative forcing of different types of GHGs, scientists introduced the "global warming potential". It is a measure of the relative radiative effect of a given substance compared to carbon dioxide and integrated over a given time horizon. When the emission of a GHG is multiplied by its global warming potential for a given time horizon, the equivalent CO_2 emission (CO_2-eq) is obtained.

[4] On the history of climate change science and politics see e.g. Jäger and O´Riordan (1996) or Bodansky (1994).

In regular intervals, the IPCC provides comprehensive Assessment Reports of the state of knowledge on climate change. So far, four Assessment Reports have been issued in 1990 (FAR), 1996 (SAR), 2001 (TAR), and 2007 (AR4).[5] The substance of all IPCC reports is the responsibility of interdisciplinary writing teams of international experts nominated by governments and international organizations. The rules of the IPCC ensure a rigorous scientific peer-review process, with differing views being reflected in the documents.

The IPCC is open to all member countries of the WMO and UNEP. Its intergovernmental nature is important at all three stages of report development: (a) governments approve the terms of reference or main outline of the reports, (b) they participate in the review of the second draft of the report, and finally (c) they approve the text of the so-called Summary for Policymakers (SPM) line by line. In this way, governments acknowledge that there is enough scientific evidence worldwide to support the document's key conclusions. Any changes in the SPM at the approval stage should be completely consistent with the factual material contained in the full report to be confirmed by lead authors who are present at this stage.

2.4 Observed climatic changes and their effects

"Climate Change 2007", the IPCC's most recent Assessment Report states that the warming of the climate system is unequivocal, as is now evident from observations that verify that an overall rise of global average surface temperatures by approximately 0.7℃ has occurred over the last 100 years from 1906 to 2005. Especially noticeable is the rapid rise at the end of the 20th century with eleven out of twelve years (1995-2006) ranking among the twelve warmest years in the instrumental record of global surface temperature (since 1850). As there is a high correlation between this increase in global temperature and increases in carbon dioxide and other greenhouse gas concentrations during this era, most mainstream climate scientists agree that anthropogenic emissions are a direct cause of the recent anomalous warming.[6]

According to the IPCC (2007), it is *very likely* that cold days/nights and frosts have become less frequent, while at the same time hot days and hot nights have become more frequent.[7]

[5] Each Assessment Report is published in three volumes, one for each of the three IPCC working groups (WGs): (a) on the physical science of the climate system; (b) on impacts, adaptation and vulnerability; and (c) on mitigation.

[6] A correlation is not necessarily causation. A characteristic of Earth sciences is that Earth scientists are unable to perform controlled experiments on the planet as a whole and then observe the results. This is an important point because it is precisely such whole-Earth, system-scale experiments, incorporating the full complexity of interacting processes and feedbacks that might ideally be required to fully verify or falsify the climate change hypotheses (Schellnhuber et al., 2004).

[7] Where uncertainty in specific outcomes is assessed using expert judgment and statistical analysis of a body of evidence, the IPCC uses likelihood ranges to express the assessed probability of occurrence. In AR4, the IPCC (2007) defines the likelihood ranges as follows: virtually certain (greater than 99 percent chance that a result is true); extremely likely (95-99 percent chance); very likely (90–

Changes can also be detected in other important aspects of climate, e.g. precipitation, cloud cover, frequency and intensity of droughts, decreases in snow cover and Northern Hemisphere sea ice extent, thinner sea ice, glacier melt, decreases in permafrost extent, increases in soil temperatures, and average sea level rise. Apart from changes in physical systems, observational evidence shows that many biological and human managed systems are affected, as well. Amongst others, these observations include: organisms shifting their ranges poleward and in higher elevation, earlier timing of spring events such as blooming, earlier spring planting of crops in agricultural and forestry management at Northern Hemisphere higher latitudes, and alterations in disturbance regimes of forests due to fires and pests.[8]

2.5 Future outlook

The question how the climate may change further into the future is highly relevant, taking into account that GHG emissions are still increasing worldwide. Due to joint effort by many climate scientists worldwide, a number of complex and sophisticated climatic models have been developed such as Atmosphere-Ocean General Circulation Models (AOGCMs) which estimate the probability of change of important climate system parameters.[9] Significant progress has been made and projections of future changes can now be assessed at time scales of several decades or longer into the future and at spatial resolutions ranging from global to hundreds of kilometres.

2.5.1 Committed climate change

A fundamental characteristic of the climate system is a great thermal inertia especially of the oceans and ice sheets which require centuries to millennia to adjust to a change of climate forcing. This means that even if the concentrations of GHGs and aerosols were held fixed at today's values, the climate system would continue to respond. In its technical summary, the IPCC AR4 Working Group 1 (Solomon et al., 2007) concluded that committed climate change due to atmospheric composition in the year 2000 corresponds to a warming trend of about 0.1°C per decade over the next two decades, in the absence of large changes in volcanic or solar forcing. A study of Hansen et al. (2005) offers considerable data to suggest a current imbalance of some 0.85 ± 0.15 W/m^2 of extra heating in the Earth-atmosphere

95 percent chance); likely (66–90 percent chance); more likely than not (50–66 percent chance); about as likely as not (33-66 percent chance); unlikely (10 to 33 percent chance); very unlikely (10–1 percent chance); extremely unlikely (less than 5 percent chance); and exceptionally unlikely (less than 1 percent chance).

[8] To the extent that the effects caused by increasing atmospheric concentrations of GHGs are not limited to rising temperatures, the term "climate change" is more appropriate than the term "global warming". See Gardiner (2004) for a discussion of terminological differences.

[9] Climate models used for simulations of future climate are tested by means of simulations of past climate change.

system. If this finding is accepted, it would imply that another 0.6°C or so of warming could be inevitable (Wigley, 2005).

2.5.2 Climate sensitivity and feed backs

A key uncertainty in modeling future states of climate is the equilibrium climate sensitivity, usually defined as the equilibrium change in global mean temperature following a doubling of the atmospheric equivalent carbon dioxide concentration. The overall response of the global climate to radiative forcing is complex due to feedback mechanisms that can either amplify ("positive feedback") or diminish ("negative feedback") the effects of a change in climate forcing. The largest sources of uncertainty remain cloud and water vapour effects. Despite substantial research efforts for more than a decade, the "common wisdom" uncertainty range for the climate sensitivity has hardly changed and in the IPCC's AR4 (2007) it is estimated to be between 1.5-4.5°C with a most likely value of approximately 3°C. The climate sensitivity is very unlikely to be less than 1.5°C whereas values substantially higher than 4.5°C cannot be excluded.

2.5.3 Climate change scenarios

Future emissions and the evolution of their underlying driving forces are highly uncertain. In order to evaluate future climate change impacts it is necessary to make assumptions about plausible future demographic, economic, political, and technological conditions and the corresponding GHG emissions. Alternative GHG emissions scenarios have been devised since the late 1980s to analyze potential long-range developments in a coherent, internally consistent, and plausible way. Scenarios are alternative images of possible future states of the world, with no likelihood ascribed. They are not to be confused with predictions or forecasts.

2.5.3.1 The IPCC Special Report on Emissions Scenarios

In 2000, the IPCC has published the IPCC Special Report on Emissions Scenarios (SRES) which presents four different narrative "storylines" (A1, A2, B1, and B2) from which a range of 40 emissions scenarios has been described. The interpretations and quantifications of one storyline together are called a scenario family. Within each family different scenarios explore variations of global and regional developments and their implications for GHG and sulfur emissions. It is important to note that the scenarios in SRES are all "reference" scenarios, i.e. they do not include any future policies that explicitly address additional climate change initiatives. The SRES scenarios have been used as the basis for the assessment of future climate change in the IPCC's Third and Fourth Assessment Report. It follows a description of the main characteristics of the four SRES storylines and scenario families.

- The A1 storyline describes a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter and in several variations of it, the rapid introduction of new and more efficient technologies. A1 is subdivided into A1F1 (fossil-fuel intensive), A1T (high-technology and non-fossil energy resources), and A1B (balanced across all sources).
- The B1 storyline describes a convergent world, with the same global population as A1, but with more rapid changes in economic structures toward a service and information economy, which is assumed to cause a significant decrease in energy intensity.
- The B2 storyline describes a world with intermediate population and economic growth, emphasizing local solutions to economic, social, and environmental sustainability.
- The A2 storyline describes a very heterogeneous world with high population growth, slow economic development and slow technological change.

The range of possible GHG concentrations under SRES scenarios is very large. The projections show that scenarios with similar combinations of driving forces can lead to very different levels of GHG emissions and that a given level of GHG emissions can be caused by different driving forces. In the fossil fuel intensive scenario A1FI CO_2 emissions are projected to increase steadily and to reach around 950 ppm in 2100. For two of the scenarios (B1 and A1T), increases in CO_2 concentrations will have leveled off by the turn of the century (at about 550 and 600 ppm respectively) and stabilization may be achieved thereafter (see 4.3 on stabilization).

2.5.3.2 Projections of future changes in climate

In its Fourth Assessment Report the IPCC projects the average temperature rise for concentrations derived from the three SRES scenarios B1, A1B, and A2. For the period from 2011 to 2030, compared to 1980 to 1999, the warming rate is affected little by different scenario assumptions or different model sensitivities ranging between +0.64°C and +0.69°C. Only by mid-century (2046–2065), the "choice" of scenario becomes more important for the magnitude of global average warming with values of +1.3°C, +1.8°C and +1.7°C for B1, A1B, and A2, respectively. By late century (2090–2099), differences between scenarios are large: B1: +1.8°C (1.1°C to 2.9°C), B2: +2.4°C (1.4°C to 3.8°C), A1B: +2.8°C (1.7°C to 4.4°C), A1T: 2.4°C (1.4°C to 3.8°C), A2: +3.4°C (2.0°C to 5.4°C), and A1FI: +4.0°C (2.4°C to 6.4°C). However, the world will not warm evenly. Regional differences are projected to be large, with the highest increases in the higher Northern latitudes.

Based on these temperature forecasts, the IPCC WG1 (Meehl et al., 2007) has produced a list of likely negative effects of future climate change, including more frequent heat waves, more intense storms and a surge in weather-related damage, increased intensity of floods and droughts, more rapid spread of disease, loss of farming productivity in many regions,

rising sea levels (between 0.18 m and 0.59 m, depending on scenario) which could inundate costal areas and small island nations, species extinction, and loss of biodiversity.

2.5.3.3 Major and irreversible changes

While warming at the lower end of the respective ranges would likely be *relatively* less stressful, it would still be significant as it is likely to cause considerable irreversible loss of biodiversity and harm to vulnerable ecosystems such as coral reefs and Arctic ecosystems.[10]

In particular, warming at the high end of the temperature range could have widespread catastrophic consequences. These include major and abrupt changes i.e. rapid, nonlinear responses which occur when an environmental threshold (or "tipping point") is crossed and which have a spatial extent ranging from several thousand kilometres to global and persist for several years to decades. Table 1 shows a selection of potential threshold responses and the respective temperature thresholds for their initiation.

Table 1: Properties of potential threshold responses (Source: Keller et al., 2008).[11]

	Threshold for initiation	Ability for timely detection	Possible consequences
Greenland Ice Sheet melting	≈ 1.5 °C[a]	Difficult, as threshold may be close[b]	≈ 7 m sea-level rise[c] Possible MOC weakening[b] Damages depend on melting rate[a]
Coral bleaching	≈1.5 °C[b]	Difficult, as the threshold may be close[b]	Ecosystem changes[c] Food production[c] Tourism[c]
El-Niño Southern Oscillation changes	Deeply uncertain[d]	Difficult[a]	Precipitation and temperature changes[d] Ecosystem changes[d] Food production[d] Flooding[d]
MOC weakening	Very low[b]	Likely feasible[a]	Precipitation and temperature changes[d] Fisheries[d] Terrestrial ecosystems[d]
MOC collapse	≈ 2 to > 5 °C[d]	Very difficult[d]	
West Antarctic Ice Sheet disintegration	≈ 2.5 °C[d]	Very difficult, fingerprints are uncertain and difficult to observe[d]	≈ 5 m sea-level rise[c] Possibly severe[d] Damages depend on melting rate[a]

[a] established but incomplete; [b] competing explanations; [c] well established; [d] exploratory or speculative

In debates on future climate change two major events have figured prominently. These are the potential collapse or shut down of the North Atlantic meridional overturning circulation

[10] According to the IPCC (2007) warming of 1°C above 1990 levels would result in all coral reefs being bleached and 10 percent of global ecosystems being transformed. There is medium confidence that approximately 20 to 30 percent of species assessed so far are likely to be at increased risk of extinction if increases in global average warming exceed 1.5 to 2.5°C (relative to 1980-1999). As global average temperature increase exceeds about 3.5°C, model projections suggest significant extinctions (40 to 70 percent of species assessed) around the globe.

[11] See Keller et al. (2007) for a subset of key references on each threshold response.

(MOC) (1) and the nonlinear response of ice sheets and the corresponding large scale sea level rise (2).

Ad 1) The first issue has received broad public attention as speculations have been circulating that the collapse of the MOC could result in another ice age in Europe. Although the IPCC WG1 (Meehl et al., 2007) states that it is *very likely* that the MOC will indeed slow down during the 21st century, it also highlights the associated cooling would be overwhelmed by the radiative forcing caused by increasing GHGs concentrations. Accordingly, Europe would still experience warming.

Ad 2) The second category of events includes the loss of the Greenland ice sheet and the sudden collapse of the West Antarctic Ice Sheet. Both events would be related with massive sea-level rise, major changes in coastlines and inundation of low-lying areas, with greatest effects in river deltas and low-lying islands.
Possible dynamical responses of the ice sheets as well as possibly large-scale carbon cycle feed backs are still inadequately understood. Therefore, in its AR4, the IPCC (2007) has decided to exclude these factors from the projections of global sea level rise. The upper value of the predicted range (18-59 cm) is thus not to be considered an upper bound for actual sea level rise.[12] Hansen (2007) points out that there are numerous paleoclimatic examples of ice sheets yielding a sea level rise of several metres per century, with forcings smaller than those of high emissions such as A1FI, A2, and A1B.

Greenland

During the past 25 years, Greenland has undergone significant change, in particular, summer melting of ice has increased by more than 50 percent during the past 25 years. Eventually, this could lead to a complete elimination of the Greenland ice sheet if global average warming were sustained for millennia in excess of 1.9 to 4.6°C relative to pre-industrial values. The results of Lowe et al. (2006) suggest that complete or partial deglaciation of Greenland may be triggered for even quite modest stabilization targets. The IPCC WG1 (Meehl et al., 2007) anticipates the continuing contraction of the great ice sheet in Greenland as a source of rising sea levels. If the Greenland ice sheet were to melt completely it would raise global sea levels by around 7 metres, but this would take many hundreds of years to complete.

[12] Hansen (2007) warns that the IPCC provides a specific number for only a portion of the problem because this could be misunderstood by the public. Indeed, there have been commentators denigrating suggestions that business-as-usual (BAU) greenhouse gas emissions may cause a sea level rise of the order of metres.

Antarctica

Scientists have long assumed that the Antarctic ice sheet would make little contribution to sea-level rise over the next one hundred years, with the dominant effect across Antarctica being a modest gain in mass because of greater precipitation. However, a particular issue of concern is the overall stability of the West Antarctic Ice Sheet (WAIS) which rests on bedrock below sea level with the possibility of a runaway discharge. Recent results from satellite altimeters (Vaughan, 2008) show that much of the WAIS appears to be unchanging which suggests that a complete collapse with a resulting 5 metres rise in sea level is rather unlikely within the 100–200 years. However, there exists a significant area of thinning across the Amundsen Sea sector of the WAIS and this area alone contains the potential to raise global sea level around 1.5 metres. Furthermore, the rapidity at which changes appear to be able to propagate up the ice streams indicates that the onset of a pronounced extra Antarctic contribution to sea-level rise could occur within a few decades of initiation.

The nonlinearity of the ice sheet problem makes it impossible to accurately project future sea level change. Until the past few years the contribution of ice sheet disintegration was small, but it has at least doubled in the past decade and is now close to 1 mm/year. Hansen (2007) provides an illustrative example for this nonlinear response, assuming an ice sheet contribution of 1 cm for the decade 2005–15 and a ten-year doubling time. This simple calculation yields a sea level rise of the order of *5 metres* this century. Although Hansen cannot prove that his assumptions are accurate, he is confident that it provides a far better estimate than a linear response for the ice sheet component of sea level rise under high emissions scenarios.[13] Before the AR4 was published, the IPCC indeed has considered to extrapolate the recent accelerated loss of glacial ice far into the future but finally rejected this idea. Hansen (2007) suggests that the IPCC reports are conservative and reticent in drawing out the implications of the peer-reviewed science. He also suggests that this diminishes the effectiveness of communication about potential threats posed by large sea level rise.[14] As this point is of crucial importance, Chapter 4 will turn to it again.

[13] Rahmstorf (2007) presents a semi-empirical approach to project future sea-level rise based on the assumption that the rate of sea-level rise is roughly proportional to the magnitude of warming above the temperatures of the pre–industrial age. On the basis of this proposed linear relationship, sea level is predicted to rise 0.5 to 1.4 m in 2100 above the 1990 level.

[14] Glaciologist Richard Alley, an IPCC lead author said "Lots of people were saying we [, the IPCC authors,] should extrapolate into the future, but we dug our heels in at the IPCC and said that we don't know enough to give an answer." Quoted by Kerr (2007).

3. The political dimension of climate change

By introducing the Intergovernmental Panel on Climate Change, the previous chapter has already touched upon the political dimension of climate change. In a way, the IPCC is at the interface of science and policy. Although the IPCC Assessment Reports are not thought to be policy prescriptive, they are nevertheless very relevant to policy makers. For example, the findings of the IPCC First Assessment Report of 1990 played a decisive role in inducing governments to adopt the United Nations Framework Convention on Climate Change (UNFCCC) which still provides the foundation for international efforts to address climate change. The IPCC Second Assessment Report of 1995 preceded the agreement of the Kyoto Protocol, and the Third Assessment Report of 2001 the Marrakech Accords. The IPCC continues to be a major source of information for the negotiations under the UNFCCC.

Before this chapter describes the climate change regime and the prospects for its future evolution, some insights are provided on the conditions under which the climate negotiations are taking place.

3.1 Background conditions of climate change negotiations

In order to understand the institutional developments in response to the problem of climate change, it is useful to look first at the starting position of different nations and groups of nations with a view to the amount of emissions they contribute historically, currently and projections for future emissions. And second, at the asymmetric distribution of future climate impacts.

3.1.1 Asymmetry of emissions

Historically, industrialized nations dominate the cumulative emissions account. Collectively, industrialized countries account for about 7 out of every 10 tonnes of CO_2 that have been emitted since the start of the industrial era (UNDP, 2007). In addition to CO_2 if other GHGs such as CH_4 and N_2O are factored in, developed countries have up to the present causally contributed 64 percent to the climate change problem (Müller et al., 2007).[15] However, if the relatively uncertain emissions from land use, land use change and forestry (LULUCF) are included, the share of historical emissions attributable to developed countries decreases to only 54.5 percent. This is due to deforestation of tropical rainforests, a problem prevailing in

[15] However, this is not uncontroversial. Representatives from developing countries argue that "survival" or "subsistence emissions" such as CH_4 from rice farming should be treated differently than "luxury emissions" from sports cars (Agarwal and Narain, 1991).

developing countries, is by far the largest source of CO_2 emissions in this context (compare Table 2).[16]

Presently, as shown in Table 2, there are huge disparities between developed and developing countries emissions, both in absolute and in per-capita terms. With average per-capita emissions of 0.2 t CO_2 the share of total emissions caused by least developed countries is negligibly low (1 percent). The top end is marked by high emitting countries such as the United States which in 2004 emitted 20.6 t CO_2 per-capita thereby causing 20.9 percent of global CO_2 emissions. In 2004, the average per-capita CO_2 emissions of OECD countries were about twice the world average (11.5 t CO_2 versus 4.5 t CO_2). The world average in return amounts to about twice the average per-capita emissions of developing countries (2.4 t CO_2 in 2004).

Since 1990, total as well as per-capita emissions have risen substantially in many developing countries (compare Table 2). The growth in global CO_2 emissions has considerably accelerated in the period 2000 to 2006 (3.1 percent annually) as compared to the 1990s (1.1 percent annually). Van Vurren and Riahi (2008) point out that the main but not exclusive contributor to this is the increasing coal consumption in China. Since 1990, China's share of total CO_2 emissions has risen from 10.6 in 1990 to 17.3 percent 2004 and it is well on track to overtake the United States as the world's largest emitter of CO_2. With 79 percent of the world population, developing countries as a group accounted for 42 percent of energy-related CO_2 emissions in 2004, compared to around 30 percent in 1990. By 2030 developing countries are projected to account for just over half of total emissions (IEA, 2006).

To a certain extent, negotiations are becoming more complex with many middle income countries such as Thailand currently undergoing rapid economic growth. Nevertheless, emissions are still highly concentrated in a small group of countries. Collectively, the top five (China, India, Japan, the Russia, and the US) account for more than half global CO_2 emissions and the top ten emitting countries account for over 60 percent, while the top 30 contribute more than 80 percent of global CO_2 emissions.

3.1.2 Asymmetry of impacts

The distribution of current and historic emissions points to an inverse relationship between the projected spatial distribution of climate change impacts and causal responsibility. Despite not contributing significantly to global GHG emissions it is the poorest countries of the world that are the most vulnerable to the impacts of climate change. Living in rural areas and urban slums on fragile hillsides or flood-prone river banks, these people are highly exposed to

[16] Taking into account just emissions from deforestation, Indonesia, would rank as the third largest source of annual CO_2 emissions (2.3 Gt CO_2) with Brazil ranking fifth (1.1 Gt CO_2) (UNDP, 2007).The problem is compounded by the fact that not only CO_2 is released in the atmosphere but important sink capacity is reduced as well.

climate change impacts. With high confidence, the IPCC WG2 (Parry et al., 2007) projects adverse health impacts to be greatest in low-income countries.

In case of many small islands developing states in the Caribbean and Pacific, their mere survival depends on future sea level rise. For the Maldives, where 80 percent of the land area is less than 1 meter above sea level, even the most benign climate change scenarios point to deep vulnerabilities. The numbers of affected people will be largest in the densely populated and low-lying megadeltas such as the Ganges, the Mekong and the Nile. Global temperature increases of 3–4℃ could result in 330 million people being permanently or temporarily displaced through flooding (UNDP, 2007).

Table 2: The global carbon footprint - selected countries and regions (Source: UNDP, 2007).

	Carbon dioxide emissions[a]								
	Total emissions ($Mt CO_2$)		Growth rate (%)	Share of world total (%)		Population share (%)	CO_2 emissions per capita ($t CO_2$)		CO_2 emissions or sequestration from forests[b] ($Mt CO_2$ / year)
Top 30 CO_2 emitters	1990	2004	1990–2004	1990	2004	2004	1990	2004	1990–2005
1 United States	4,818	6,046	25	21.2	20.9	4.6	19.3	20.6	-500
2 China[c]	2,399	5,007	109	10.6	17.3	20.0	2.1	3.8	-335
3 Russian Federation	1,984[d]	1,524	-23[d]	8.7[d]	5.3	2.2	13.4[d]	10.6	72
4 India	682	1,342	97	3.0	4.6	17.1	0.8	1.2	-41
5 Japan	1,071	1,257	17	4.7	4.3	2.0	8.7	9.9	-118
6 Germany	980	808	-18	4.3	2.8	1.3	12.3	9.8	-75
7 Canada	416	639	54	1.8	2.2	0.5	15.0	20.0	..
8 United Kingdom	579	587	1	2.6	2.0	0.9	10.0	9.8	-4
9 Korea (Republic of)	241	465	93	1.1	1.6	0.7	5.6	9.7	-32
10 Italy	390	450	15	1.7	1.6	0.9	6.9	7.8	-52
11 Mexico	413	438	6	1.8	1.5	1.6	5.0	4.2	..
12 South Africa	332	437	32	1.5	1.5	0.7	9.1	9.8	(.)
13 Iran (Islamic Republic of)	218	433	99	1.0	1.5	1.1	4.0	6.4	-2
14 Indonesia	214	378	77	0.9	1.3	3.4	1.2	1.7	2,271
15 France	364	373	3	1.6	1.3	0.9	6.4	6.0	-44
16 Brazil	210	332	58	0.9	1.1	2.8	1.4	1.8	1,111
17 Spain	212	330	56	0.9	1.1	0.7	5.5	7.6	-28
18 Ukraine	600[d]	330	-45[d]	2.6[d]	1.1	0.7	11.5[d]	7.0	-60
19 Australia	278	327	17	1.2	1.1	0.3	16.3	16.2	..
20 Saudi Arabia	255	308	21	1.1	1.1	0.4	15.9	13.6	(.)
21 Poland	348	307	-12	1.5	1.1	0.6	9.1	8.0	-44
22 Thailand	96	268	180	0.4	0.9	1.0	1.7	4.2	18
23 Turkey	146	226	55	0.6	0.8	1.1	2.6	3.2	-18
24 Kazakhstan	259[d]	200	-23[d]	1.1[d]	0.7	0.2	15.7[d]	13.3	(.)
25 Algeria	77	194	152	0.3	0.7	0.5	3.0	5.5	-6
26 Malaysia	55	177	221	0.2	0.6	0.4	3.0	7.5	3
27 Venezuela (Bolivarian Republic of)	117	173	47	0.5	0.6	0.4	6.0	6.6	..
28 Egypt	75	158	110	0.3	0.5	1.1	1.5	2.3	-1
29 United Arab Emirates	55	149	173	0.2	0.5	0.1	27.2	34.1	-1
30 Netherlands	141	142	1	0.6	0.5	0.2	9.4	8.7	-1
World aggregates									
OECD[e]	11,205	13,319	19	49	46	18	10.8	11.5	-1,000
Central & Eastern Europe & CIS	4,182	3,168	-24	18	11	6	10.3	7.9	-166
Developing countries	6,833	12,303	80	30	42	79	1.7	2.4	5,092
East Asia and the Pacific	3,414	6,682	96	15	23	30	2.1	3.5	2,294
South Asia	991	1,955	97	4	7	24	0.8	1.3	-49
Latin America & the Caribbean	1,088	1,423	31	5	5	8	2.5	2.6	1,667
Arab States	734	1,348	84	3	5	5	3.3	4.5	44
Sub-Saharan Africa	456	663	45	2	2	11	1.0	1.0	1,154
Least developed countries	74	146	97	(.)	1	11	0.2	0.2	1,098
High human development	14,495	16,616	15	64	57	25	9.8	10.1	90
Medium human development	5,946	10,215	72	26	35	64	1.8	2.5	3,027
Low human development	78	162	108	(.)	1	8	0.3	0.3	858
High income	10,572	12,975	23	47	45	15	12.1	13.3	-937
Middle income	8,971	12,163	36	40	42	47	3.4	4.0	3,693
Low income	1,325	2,084	57	6	7	37	0.8	0.9	1,275
World	22,703[f]	28,983[f]	28	100[f]	100[f]	100	4.3	4.5	4,038

NOTES

a Data refer to carbon dioxide emissions stemming from the consumption of solid, liquid and gaseous fossil fuels and from gas flaring and production of cement.

b Data refer only to living biomass—above and below ground, carbon in deadwood, soil and litter are not included. Refer to annual average net emissions or sequestration due to changes in carbon stock of forest biomass. A positive number suggests carbon emissions while a negative number suggests carbon sequestration.

c CO_2 emissions for China do not include emissions for Taiwan, Province of China, which were 124 $Mt CO_2$ in 1990 and 241 $Mt CO_2$ in 2004.

d Data refer to 1992 and growth rate values refer to the 1992–2004 period .

e OECD as a region includes the following countries that are also included in other subregions listed here: Czech Republic, Hungary, Mexico, Poland, Republic of Korea and Slovakia. Therefore, in some instances, the sum of individual regions may be greater than the world total.

f The world total includes carbon dioxide emissions not included in national totals, such as those from bunker fuels and oxidation of non-fuel hydrocarbon products (e.g., asphalt), and emissions by countries not shown in the main indicator tables. These emissions amount to approximately 5% of the world total.

3.2 International legal order and international environmental law

The international political system is commonly described as anarchic in the sense that there is no overarching global government to manage world affairs and enforce international law. Generally, states play the primary and dominant role in the international legal order, both as the principal creators of the rules of international law and the principal holders of rights and obligations under those rules. Notwithstanding economic, social or political differences, states possess equal rights and duties as members of the international community and have the sovereignty, i.e. the exclusive authority, within their territorial boundaries.

International environmental law consists of legally binding rules which provide the basis for cooperation between states and other members of the international community. Sources of binding rights and obligations include bilateral and multilateral treaties,[17] binding acts of international organizations, rules of customary international law, and judgments of international courts or tribunals. Legally binding rules that leave no or little room for discretion have often been referred to as "hard law", as opposed to "soft law". In the field of international law, soft law consists of non-enforceable obligations such as declarations, guidelines, recommendations and resolutions of international bodies (e.g. resolutions of the UN General Assembly). Rules of soft law are either not legally binding or the obligations are flexible or lack specificity. Often, a soft-law approach is used to encourage broader adhesion to a proposal (UNEP, 2007).

The most important sources of environmental soft law are the 1972 Declaration of Principles of the 1972 Stockholm Conference, the 1982 World Charter for Nature, and the 1992 Rio Declaration. The 1972 Stockholm Declaration is regarded as the foundation of modern international environmental law (Pallemaerts, 1994). Responding to the growing consciousness that polluting activities in one state would almost inevitably produce effects in other states or in areas beyond national jurisdiction, the Stockholm Declaration established the fundamental principle of state responsibility for transboundary environmental harm. This principle is juxtaposed and balanced against the principle of state sovereignty. The widely quoted Principle 21 reads as follows:

"States have [in accordance with the Charter of the United Nations and the principles of international law] the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction."

[17] Various terms are used to designate treaties (agreement, convention, covenant, protocol). The rules that apply to written treaties between states are reflected in the 1980 Vienna Convention on the Law of Treaties (VCLT) to which in May 2007 108 States were Parties. Generally, rules in a treaty apply only to states that are Parties to it. However, the VCLT is considered to apply to all states, whether or not they are a Party to that Convention, either because these rules were already in existence prior to the Convention or they have been accepted as rules of customary international law since the adoption of the Convention (UNEP, 2007).

Meanwhile, most scholars regard Principle 21, which was reproduced with only one change in Principle 2 of the 1992 Rio Declaration, as part of customary international law (Pallemaerts, 1994). According to Sands (1994) the significance of Principle 21/Principle 2 lies in its reflection of a broad acceptance of the need to adopt limits, and its role as a basis for the adoption of many other international agreements, not least the climate regime.

3.3 The climate regime and international climate negotiations

3.3.1 Brief history of the climate change regime

In December 1988 the United Nations General Assembly adopted a resolution which referred to climate as a "common concern of mankind".[18] Two years later, in December 1990, another resolution of the General Assembly established an Intergovernmental Negotiating Committee (INC) with the mandate to negotiate a convention on climate change. Within only 15 months the United Nation Framework Convention on Climate Change (UNFCCC, henceforth "the Convention") was completed and was opened for signature at the UN Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1992.[19] The Convention entered into force in 1994 and in 2008 it has been signed and ratified by 191 nations and the European Community. This scale of ratification gives the Convention nearly universal membership.

The complexity of the issues, widely divergent views, and the pressure to reach agreement before the UNCED meant that the INC avoided a number of contentious issues. The result was a limited "framework" text which - fraught with ambiguities - confers wide interpretative discretion on Parties.

3.3.2 A sketch of the Convention

The main provisions of the Convention are outlined under four headings: preamble and objective, principles and categories of Parties, commitments, and institutional arrangements.

3.3.2.1 Preamble and objective

The Convention starts with a lengthy preamble, which, amongst others, recognizes that the energy consumption along with GHG emissions of developing countries will need to grow, as will their "share of global emissions". The Preamble also recognizes "the legitimate priority needs of developing countries for the achievement of sustained economic growth and the eradication of poverty."

[18] For the legal notion of climate as a "common concern of humankind" and its emergence as a concept of international environmental law see Biermann (1999:168).
[19] For a detailed discussion of the climate negotiating history see e.g. Bodansky (1994).

According to Article 2, the Convention's ultimate objective is to stabilize GHG concentrations in the atmosphere "at a level that would prevent dangerous anthropogenic interference with the climate system." While the Convention does not specify this level in terms of a precise number, the objective is nevertheless qualified in that it includes provisions that the stabilization level should be achieved within a time frame allowing for the natural adaptation of ecosystems, ensuring continued food production, and enabling "economic development to proceed in a sustainable manner."

3.3.2.2 Principles and categories of Parties

In Article 3, the Convention stipulates five principles which shall guide the actions of the Parties to achieve the ultimate objective.

The first principle (Art. 3.1) states that "Parties should protect the climate system (…) on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities." This passage reflects the reality that, although climate change is a global issue and must be tackled as such, industrialized countries have historically contributed most to this problem and have greater resources to address its causes and effects. Hence, Article 3.1 calls on industrialized county leadership to combat "climate change and the adverse effects thereof." One application of this provision is that the Convention, on the basis of its annexes, divides the world's states into three categories. Annex I includes a list of the developed countries that were members of the OECD in 1992 plus countries with economies in transition (EITs). Annex II exclusively consists of the OECD members of Annex I. The remainder of countries are mostly developing countries that fall into the category known as "Non-Annex I Parties". Within those categories, further differentiations should be made to take account of the different capacities, specific situations, and vulnerabilities of Parties. Article 3.2 sets out that the needs and special vulnerability of developing countries should be given full consideration.

The third principle (Art. 3.3) refers to the precautionary principle which has precedents in many other international agreements including Principle 15 of the 1992 Rio Declaration. Further, Article 3.3 highlights the need for cost-effectiveness to deliver global benefits at the lowest possible cost and to avoid unnecessary burdens for the economy.

Article 3.4 lays down the right to promote sustainable development and reflects the understanding that sustainable economic growth and development are essential ingredients of successful policies to tackle climate change. In line with this, Article 3.5 calls on Parties to "cooperate to promote a supportive and open international economic system" and to avoid measures that "constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade."

3.3.2.3 Commitments

In accordance with the principle of differentiated responsibilities, the Convention creates different obligations for developing and developed countries.

All Parties to the Convention are subject to general reporting commitments which are rather qualitative than quantitative in nature (Art. 4.1). More precisely, these commitments consist of the compilation of greenhouse gas inventories and the submission of reports ("National Communications") on actions the Parties are taking to implement the Convention. To promote long-term national planning, these actions should be included in national programs. In addition, Article 4.1 sets out commitments relating to scientific cooperation, public information, and education. Performance by developing countries is linked to the degree to which they receive assistance from developed countries (Art. 4.7).

For countries listed in Annex I, the Convention prescribes a specific quantified commitment. According to Articles 4.2(a) and (b), Annex I Parties are required to take policies and measures "with the aim of returning" their GHG emissions to their 1990 levels by 2000. Given the loose phrasing, this provision was never considered more than a mere aspirational or voluntary target.

Commitments on financial aid and technology transfer apply only to OECD countries (i.e. Annex II Parties). In Article 4.3 these Parties undertook to "provide new and additional financial resources" to developing countries to allow them, first, to comply with their general reporting commitments, and second, to meet the agreed-upon incremental costs of adopting measures mitigating or adapting to climate change that are covered by Article 4.1. In addition, Annex II Parties recognized the commitment "to promote, facilitate and finance, as appropriate, the transfer of, or access to environmentally sound technologies and know-how" to EIT Parties and developing countries (UNFCCC 1992, Art. 4.5).

3.3.2.4 Institutional arrangements

In Articles 7 to 10 the Convention establishes a number of institutional and procedural mechanisms. The supreme decision-making body of the Convention is its Conference of the Parties, known informally as the "COP" (Art. 7). It meets annually and reviews the implementation of the Convention, adopts decisions to further develop the Convention's rules, and to negotiate new commitments. In addition, the Convention establishes a secretariat with administrative functions (Art. 8), a Subsidiary Body for Scientific and Technological Advice (SBSTA) (Art. 9), and a Subsidiary Body for Implementation (SBI) (Art. 10). Article 11 defines a financial mechanism through which most of the funding provided by Annex II Parties should be channeled. It was decided to entrust the operation of this financial

mechanism to the Global Environment Facility (GEF), which is not formerly part of the Convention, but subject to direction of the Parties.[20]

3.3.3 Evolution of the Kyoto Protocol

When they adopted the Convention, most governments were aware that its provisions would not be sufficient to tackle climate change in all its aspects. In 1995 at COP 1 in Berlin, a decision known as the Berlin Mandate launched a new round of negotiations to strengthen targets for Annex I Parties. After two and a half years of intensive negotiations, the COP 3 meeting in Kyoto in 1997 adopted the Kyoto Protocol which includes legally binding emission targets for industrialized countries. Because of time constraints, negotiators at COP 3 could not flesh out details of how the Kyoto Protocol should operate in practice. In the subsequent COPs, those rules were hotly negotiated and finally set out in the 2001 Marrakesh Accords (COP 7). The rules were further elaborated at COPs 8, 9, and 10.

The Protocol could only enter into force after enough Annex I Parties had ratified it to encompass 55 percent of that group's carbon dioxide emissions in 1990. This had been realized after the ratification by the Russian Federation in November 2004 and the Kyoto Protocol finally went into effect in February 2005 without the United States and Australia.[21] Since then, the Protocol's "meeting of the Parties" (known as the COP/MOP) meets in conjunction with the COP (Art. 13 of the Kyoto Protocol). Parties to the Convention that are not Parties to the Kyoto Protocol participate in the COP/MOP as observers, without the right to take part in decision-making (Art. 13.2 of the Kyoto Protocol). Key features of the Kyoto Protocol are summarized in the following sections.

3.3.3.1 Emission control targets and assigned amounts

In pursuit of the Convention's objective, Parties included in Annex I to the Convention are expected to reduce their emissions or, in some cases, limit their emissions growths from 1990 levels by the 2008–2012 commitment period (Art. 3.1).[22] During the commitment period, each Annex I Party must ensure that its total GHG emissions do not exceed its allowable level of emissions.[23] The individual allowable targets or "assigned amounts" of Annex I Parties are listed in Annex B to the Protocol, amounting to a collective goal of cutting total Annex I Party emissions by "at least 5 percent below 1990 levels" (Art. 3.1).[24] In addition to conventional mitigation strategies, the Convention allows Annex I Parties to meet their

[20] The GEF was established by the World Bank, UNEP and UNDP in 1991 to fund developing country projects with global environmental benefits, not only in the area of climate change, but also in the fields of biodiversity, protection of the ozone layer, and international waters.
[21] After a change of government, Australia ratified the Kyoto Protocol in late 2007.
[22] Economies in transition Parties may use a different reference year (Art. 3.5).
[23] The Protocol's Annex A lists six main types of GHGs (CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6) and corresponding sources.
[24] The 15 member states of the European Community (prior to the EU expansion to 25 states in May 2004) agreed to redistribute their reduction targets among themselves under a procedure known informally as the "bubble" (UNFCCC 1997a, Article 4).

emission targets by enhancing sink capacity in the LULUCF sector. The list of eligible "sink activities" includes afforestation, reforestation, deforestation (Art. 3.3) as well as forest, cropland, and grazing land management (included by the Marrakesh Accords).

3.3.3.2 Flexibility mechanisms

To facilitate its implementation, the Protocol incorporates an international emissions trading system (Art. 17), as well as two project-based market mechanisms - Joint Implementation (Art. 6), and the Clean Development Mechanism (Art. 12). These innovative mechanisms have been designed to help Annex I Parties meet their targets as cost-effectively as possible. However, Parties must provide evidence that their use of the mechanisms is "supplemental to domestic action" (Art. 6.1(d) and Art. 17) in ways that could help to narrow per-capita differences between developed and developing countries (Marrakesh Accords).

In the context of emissions trading, a country with legally binding emission caps and surplus emission units is allowed to sell that excess capacity to countries that are over their targets. However, as specified in the Marrakesh Accords, the selling country must hold a defined minimum level of emission units, known as the "commitment period reserve", that cannot be traded.

The second flexibility mechanism, Joint Implementation (JI) allows Annex I Parties that do not meet their targets to fund specific projects that reduce emissions, or increase the uptake of GHGs in sinks, in the territory of other Annex I countries.[25] In practice, JI projects are most likely to take place in EIT countries given that there are generally more plentiful opportunities to cut emissions at lower costs.

The third flexibility mechanism is the Clean Development Mechanism (CDM) which works in a similar way as JI. The difference is that CDM projects, which result in certified emission reductions (CER), are confined to non-Annex I Parties and have the additional purpose to promote sustainable development e.g. by encouraging investment in renewable sources of energy. Generally, developing countries do not have emission targets themselves and often lack the capacity required to accurately monitor their emissions. Therefore, compared to JI, the CDM's institutional structure is more complex and its monitoring procedures are more stringent to ensure the creation of real, measurable, and long-term climate benefits that are additional to any that would have occurred without the CDM project.

3.3.3.3 Financial commitments

Especially by the creation of funds, the Marrakesh Accords took some important steps in addressing issues of financial assistance and technology transfer. In order to help developing countries adapt to climate change a new adaptation fund (AF) was established to operate under the Kyoto Protocol. It channels the funds raised by an adaptation levy imposed on

[25] Actually, the term "joint implementation" does not literally appear in Article 6 of the Kyoto Protocol but is often used as a convenient shorthand to denote the second mechanism.

CDM transactions, as well as additional contributions from Annex I countries. Moreover, two other new funds, to be managed by the GEF, were set up under the Convention. A special climate change fund (SCCF) should finance a variety of adaptation and mitigation projects, including economic diversification for countries heavily dependent on income from fossil fuels. Least developed countries should receive special assistance from the least developed country fund (LDC Fund). Both, the SCCF and the LDC Fund rely on voluntary contributions for funding.

3.3.3.4 Legal nature of commitments and compliance

All commitments in the climate change regime are fundamentally voluntary, in the sense that sovereign states cannot be forced to sign them, and can withdraw their adherence. Due to the general phrasing of the requirements and the lack of an accompanying system of enforcement, the provisions under the 1992 Climate Convention are widely considered non-binding pledges. In case of the 1997 Kyoto Protocol, however, not only legally binding emissions targets for industrialized countries are spelled out but also a compliance system has been agreed as part of the 2001 Marrakesh Accords. It consists of a Compliance Committee which will review cases of suspected non-compliance and, if non-compliance is proven, impose penalties through its enforcement branch. If an Annex I Party exceeds its quota, it must make up the difference plus a penalty of 30 percent in the next commitment period, prepare a "compliance action plan", and is banned from selling under emissions trading. The compliance system also includes a facilitative branch which aims to provide advice and assistance to Parties, including an early warning system to help Parties before they fall into non-compliance.

3.3.4 Performance under the Kyoto Protocol

While it is too early to deliver a final verdict on outcomes under the Kyoto protocol, delivery against the targets without land-use changes is not encouraging and raises questions about whether the overall target can be achieved at all (see UNDP, 2007:53). As a group, Annex I country emissions were three percent below 1990 levels in 2004. However, much of this decline is due to the effects of industrial restructuring and economic recession in EIT countries and owes less to energy policy reform. Indeed, non-transition Annex I parties have increased emissions by 11 percent from 1990 to 2004. Since 1999, overall emissions have been on a rising trend. In summary, most 68 countries are off track, but still, large variations in country performance can be noticed. For example, while Canada is now around 35 percent above its Kyoto target range, the United Kingdom has surpassed its Kyoto target of a 12 percent emissions reduction.

Poor performance can also be noticed with a view to funding. Current pledged funding amounts to US$ 279 million for disbursement over several years but total financing to date

has only amounted to around US$ 26 million (UNDP, 2007). In 2007, only 16 countries have so far contributed to the SCCF and the LDC fund, the two international funds that rely on contributions, the US, Australia, and Japan have given nothing so far (Oxfam, 2007).[26]
The bottom line is that both developed country delivery in terms of mitigations and funding has fallen far short of the pledges made but even further short of the level of ambition required.

3.3.5 Prospects for action beyond 2012

Despite all its deficiencies, the Kyoto Protocol itself provides the starting point for discussions on a post-2012 multilateral agreement. These have started formally at COP/MOP 1 in Montreal with the establishment of an open-ended Ad Hoc Working Group of Parties to the Kyoto Protocol (AWG) with the task of negotiating new commitments for Annex I Parties for the period beyond 2012. In 2007, the "Bali Action Plan", adopted at COP 13, established a second AWG on Long-term Cooperative Action under the Convention which, in parallel to the AWG under the Kyoto Protocol, should elaborate a comprehensive deal by COP15/MOP 5 in Copenhagen (2009).

Principally, a future climate regime can be negotiated either in a "bottom-up" or "top-down" manner. So far, the climate negotiations are best characterized as pledge-based ("bottom-up") with countries making commitments at their sovereign discretion. As long as participation is limited to developed countries with similar economic and political power this ad-hoc process is tolerated. However, given the need to include developing countries, ad hoc approaches have been criticized among others because they tend to disadvantage developing countries which usually lack bargaining power.

The alternative approach is to proceed in a "top-down" fashion, that is, the negotiation of objective criteria and overarching principles which, once agreed, would guide the subsequent emission reduction efforts among nations in an orderly fashion.

Assuming that Parties would agree to negotiate the agreement from top-down, the international climate regime could develop into one of two different directions (Berk and Den Elzen, 2001).
The first option is to evolve the present Kyoto regime incrementally by gradually extending absolute emission caps to developing countries based on pre-defined rules for both participation and differentiation of commitments. This kind of regime can be developed into a so-called multi-stage approach by extending the number of stages or levels of participation

[26] According to rather conservative estimates of the World Bank costs of adaptation will range between US$ 10–40 billion annually. Based on new approaches to scaling up costs, Oxfam (2007) estimates adaptation costs to be at least $ 50 billion each year, and far higher if GHG emissions are not cut rapidly.

for groups of countries. The second option is a structural regime change for example towards defining the evolution of emission allowances for all Parties over a longer period.[27]

In any way, the negotiations on an effective post-2012 agreement need to clarify two fundamental issues which so far have been procrastinated by way of "creative ambiguity". The first issue concerns the Convention's ultimate objective and the second issue relates to the question of how to allocate the corresponding effort or "burden".[28] Both issues are developed further in the following chapter which deals with the ethical dimension of climate change.

[27] Other types of structurally different climate regimes might be based on technology standards, common policies and measures or the so-called Triptych approach. Berk and Den Elzen (2001) note that such approaches would be more bottom-up in character, although they could be combined with specific emission targets.

[28] Some guidance is provided by a footnote included in the Bali Plan of Action which refers to a passage in the IPCC's AR4 where emission reductions in the range of 25-40 percent below 1990 levels by 2020 are considered necessary. For a discussion of the Bali Roadmap see Watanabe et al. (2008).

4. The ethical dimension of climate change

While natural and social sciences can lend essential insights, decisions about what people should do in respect of climate change are determined through socio-political processes. These processes involve value judgements, taking into account considerations such as equity, and sustainability, as well as uncertainties and risk. Therefore, climate change is fundamentally an ethical issue in the sense that questions arise about what is right, wrong, and socially acceptable, obligatory and non-obligatory, and when should humans be held responsible for actions that cause environmental harm.

Given its complexity, climate change raises numerous ethical issues including questions about duties to nonhumans which deserve a detailed examination but whose exposition is beyond the scope of this thesis.[29] Instead, this chapter will concentrate on the two main policy decisions necessary to reach agreement on a comprehensive and effective post-2012 climate regime, that is, where to set a global ceiling for GHG emissions and how to allocate the burden of meeting the objective among the world's nations. Actually, the main features of the required agreement are already laid down in the UNFCCC but they are formulated using ambitious language that they need to be specified in order to be operationalized. Against this backdrop, ethics can give normative orientation on how the relevant passages should be interpreted.

This chapter starts with a brief outline of the scope of the climate challenge and proceeds by clarifying the role of ethics within the international climate negotiations. Then, by assuming separability of justice between and within generations, the question of a tolerable atmospheric GHG level will be presented as an intergenerational issue. Conversely, the question of sharing the effort of GHG mitigation will be treated as a problem of intragenerational distributive justice. Finally, four criteria are presented which will guide the comparison in Chapter 5.

4.1 Scope of the challenge

Tackling the issue of climate change is extraordinarily challenging. A combination of several unique features makes climate challenge profoundly different from other environmental problems with which humanity has dealt to date (compare Toth et al., 2001). These features include the following.

[29] For a non-exhaustive list of specific ethical issues and associated questions in contention in global climate change negotiations see Brown et al. (2006).

First, the challenge is of an extraordinarily long-term nature. This implies that in responding to the threat of climate change, current generations will affect the interests of future generations. Once emitted, most greenhouse gases stay in the atmosphere for a long time and accumulate. It is the resulting stock that matters in the long run rather than annual emissions.

Second, climate change is related to virtually all human activities.[30] In one way or the other, every human being contributes to causing the problem although individual contributions vary largely. The sources of climate "pollutants" are spread across all sectors of economic activity and are widely distributed across the planet which, according to Toth et al. (2001), makes the development of narrowly defined technological solutions impossible. So far, enforcing regulation over millions of sources is unprecedented.

Third, tackling climate change entails a huge, complex, multi-level decision-making process ranging from global governmental organizations, nation states, multinational firms, regional governments down to the micro-level of local enterprises and private individuals.

Fourth, there are large uncertainties or in some areas even ignorance regarding the magnitude of future climate change, its consequences and the costs, benefits and implementation barriers of possible solutions. This requires a risk management approach to be adopted in all decision making frameworks that deal with climate change.

Fifth, climate change raises a number of particularly challenging ethical issues about the just distribution of benefits and burdens of climate change options. While climate change is a danger confronting all humanity, it will not have the same impact on different individuals living at different times. Paradoxically, many of those who will be most harmed by climate change have contributed little to causing the problem and many of those who emit the most GHGs are least threatened by adverse climate change impacts. However, today's climatic impacts are not directly caused by today's energy users but rather by the total stock of GHGs that accumulated since the industrial revolution. The full, cumulative impact of current emissions will not be realized until the late 21st century and beyond.

4.2 The relevance of ethics to climate policy

4.2.1 Practical aspects

Often, the relevance of ethics is seen from a rather practical point of few. For example, Muylaert and Pinguelli-Rosa (2002) noticed a recent upsurge of interest in ethics which they

[30] Yamin et al. (2006) highlight that this is a decisive difference to other air-pollution problems. The major source of acid rain is the power generation sector which is clearly under national jurisdiction. Likewise, the production of ozone-depleting substances is confined to a handful of countries.

explain by the growing awareness that in practise value neutrality and impartiality is not possible for scientists, especially in the context of defining what amount of climate change should be considered dangerous. This is because it is generally accepted that from the proposition that a certain problem creates a particular risk, one cannot deduce whether the risk is acceptable without first deciding on certain criteria for acceptability (Brown, 1995). Moreover, Muylaert and Pinguelli-Rosa see a role of ethics in clarifying broad ranging concepts such as democracy, equity, respect for nature, etc., in a way that fosters a better understanding, not of what is right and wrong, but rather of what is structuring the various behaviours.

4.2.2 The relevance of ethics within international relations

Beyond those rather practical aspects, certain scepticism can be noticed over the place of ethics within the negotiations over a post-2012 agreement and within international affairs in general. While ethics fundamentally rests upon taking the interest of others seriously, empirically, often individual state-interests and power prevail.[31] Often, analysts of international affairs explain collective action problems in the language of military power and fundamental material interests ("realism") to which everything else, including moral considerations, is believed to be reducible. However, Henry Shue (1995) points out that ethical judgments are inextricably embedded in "realist" explanations and that "realism" itself functions as an ethical position, tacitly justifying action in accordance with the modern notion of sovereignty.[32] The job of ethical theory, according to Shue (1995:456) is to analyse whether a belief about what a nation is entitled to is soundly grounded, "for at the bottom, the role of ethical considerations is, at least sometimes, to change a judgement about which institutions to build or which policies to implement from what it would have been if one had considered only the interests with which one identifies oneself." Shue (1995:457) argues that national interest should be shaped from the beginning by a commitment to a just international order, "rather than belatedly attempting to promote equity only in whatever residual space remains after national interests are all granted maximal scope. Serious ethics operates at the centre, not the fringe, of conceptions of legitimate interest."

4.2.3 An ethical framework

Putting ethical considerations at the centre of international affairs entails, according to Shue (1995) that nations take the interests of other nations into account while, but not after,

[31] For example, Ott and Sachs (2002) observed that during the negotiations of the UNFCCC and the Kyoto Protocol, especially Northern negotiators have been more concerned with diplomatic manoeuvres and legal technicalities than with questions of ethics and equity.

[32] Shue (1995:455) claims that the explanatory task of the theorist of international affairs and the normative task of the theorist of international ethics are distinguishable even though not separate in the sense that the explanations of the former rest upon often tacit assumptions about what is reasonable or justified, while the normative arguments of the latter rest upon often tacit pictures of how nations do and could in fact behave.

conceiving their own interests. This would require a turn from pure bargaining based on self-interest versus arguing on moral grounds. In this context, it has been proposed that a discourse ethical approach (Habermas, 1983) may be of relevance as a procedural ethical framework for public debates on issues regarding climate policy (Ott et al., 2004).

Beginning in the 1970s, discourse ethics (or "communicative ethics") was developed and advanced by the New Frankfurt School, especially by Jürgen Habermas and Karl-Otto Apel. Today, it is one of the most prominent contemporary moral theories in German-speaking philosophical communities (Krebs, 1997). Discourse ethics is a modern variant of Kantian ethics in that an actual dialogue with others replaces Kant's monological reflection on the categorical imperative.

Habermas (1990:93) states the central principle ("principle D") of discourse ethics as follows:

"Only those norms can claim to be valid that meet (or could meet) with the approval of all affected in their capacity as participants in a practical discourse."

Accordingly, discourse ethics does not prescribe the morally right as such but rather introduces a formal procedure – practical discourse – where the validity of rightness claims is determined by reasoned discussion. As a norm must be accepted by all affected individuals ("principle of universalisation"), only those norms can gain validity that embody a common or general interest. In this way, discourse ethics rules out any strategic or particularistic bargaining.

On a practical level, discourse ethics has the advantage of being a structural analogue to the political arguing process. It may thus provide a critical yardstick for evaluating processes of consensus formation about public policy decisions (Kettner, 1993). In the context of climate change, discourse ethics can serve as a procedural ethical framework that facilitates serious international debate about divergent values. While the notion of accommodating widely divergent values, priorities, and perspectives across individuals and societies seems challenging, it is not necessarily bound to fail. The ratification of the Convention by 191 countries and of the Kyoto Protocol by 155 countries highlights the fact that a measure of consensus exists among states as regards basic values, the nature of the problem structure and practical responses to climate change.

Whatever climate policy, if any, will be agreed, ultimately this will have far reaching consequences for every single nation. Therefore, every nation should participate in the process of climate policy formation. However, the world is a heterogeneous place with nations having different amounts of political, social and economic power. Against this backdrop, discourse ethics may be helpful in providing the basic requirements of procedural fairness. According to discourse ethics, fair participatory procedures are characterized by, among others, openness of result ("principle of non-paternalism"), equal position of all parties, absence of coercion, neutrality of the facilitator, the right to present culturally bounded perspectives on the problem at stake, and an equal chance for all parties to

question and challenge such perspectives. As procedural fairness is pivotal in both issues examined in this chapter, this subject will be taken up again below.

4.3 A global ceiling for GHG emissions

4.3.1 Legal and political starting point

The starting point for any discussion on a global ceiling on GHG concentrations is laid down in Article 2 of the Climate Convention according to which atmospheric GHG concentrations are to stabilize "at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a timeframe sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."

The problem is that, as long as it is framed in this way, the ultimate stabilization objective cannot be operationalized because it lacks precision in decisive parameters such as quantity and timeframe. Ott et al. (2004) point out that actually specifications in key parameters are a constitutive characteristic of any political objective and that therefore specifying dangerous levels should be a common interest of the Parties, which is expressed by their membership to the Convention and its ratification.

Nevertheless, it must be noted that apart from a very brief set of discussions that took place in the run up to Kyoto, issues about the long-term objective of the Convention have not been given discussion time in the COP process (Yamin et al., 2006). Moreover, many governments have not yet adopted a concrete position with a view to Article 2. One exception is the EU Council which already in 1996 spoke for a climate target that reads

"(…) the Council believes that global average temperatures should not exceed 2 degrees above pre-industrial level and that therefore concentration levels lower than 550 ppm CO_2 should guide global limitation and reduction efforts (…)."[33]

While positioning of individual actors is probably a first step it the right direction, the global scale of the climate problem entails that an agreement on defining a level of danger has to be reached collectively. Ultimately, the political and legal authority to interpret and further elaborate the provisions of the Convention rests with its supreme decision-making body, the Conference of the Parties.

4.3.2 The challenge of defining dangerous

Any attempt to put the Convention's ultimate objective in terms of concrete GHG concentration levels needs to interpret the term "dangerous" and how this term is related to risk. Generally, risk is defined as probability times consequences. An action would be called

[33] This climate target has been adopted at the 1939th Council meeting, Luxembourg, 25 June 1996. See Commission of the European Communities (2005).

"dangerous" if it is expected to cause unacceptable impacts, in term of harm or injury, that is, if the product of its consequences times the likelihood of its occurrence is considerable. Reconciling collective notions of probability is in many cases much easier than reconciling collective notions of harm or injury. In this context, Tol and Yohe (2006:292) make a useful distinction arguing that "for an action to be called dangerous the probability of harm should not be too large; otherwise it would simply be deemed silly, stupid or irresponsible. The probability should also not be so small that it is inconsequential – the lower threshold probability depends on the harm potentially caused."

What harm or injury means for an individual is relatively easy to determine. However, as Article 2 does not specify "dangerous for whom", any attempt to its specification implicitly requires addressing the question of what harm means at a collective level.[34] The point here is that notions of harm fundamentally depend on differences in perception and value judgements, that is, in the given context, how bad would be a certain climatic impact.

Ultimately, assessing the risk of different GHG concentrations is an ethical issue. However, given the intricacies of climate change, risk assessment can only be conducted on the basis of scientific expertise. The objective of the following section is to highlight the challenges such an integrative interdisciplinary process entails and to summarize the scientific findings deemed important to make an informed decision.

4.3.3 Scientific input in climate policy formation

4.3.3.1 Giving advice in a situation of persistent uncertainty

In the process of risk assessment, scientists play an important role by laying out the elements of risk in terms of consequences and probabilities.

Generally, it is less problematic for scientists to determine the potential characters, magnitudes and interrelations of consequences related to a given atmospheric GHG level. Here, two steps are essential. First, the identification of links between various GHG stabilization levels and the resulting global mean temperature change, and second, the identification of links between levels of temperature change and key vulnerabilities.

The real challenge is to assign probabilities. The anthropogenic caused increase of GHGs in the atmosphere is a large scale experiment without precedent in earth history. As scientists are unable to perform controlled experiments on the planet as a whole and then observe the results (see Footnote 6) uncertainty about the ultimate outcome of this "once in eternity" experiment is an integral part of the climate change problem. Therefore, it is impossible to estimate objective probabilities analytically.

[34] Yamin et al. (2006) note that the scale at which impacts are assessed is indeed critical for determining what may be a "dangerous" level of climate change. It may be that at finer scales, almost any change in climate would be considered dangerous.

However, from a policy formation perspective, there is a certain incentive to frame the problem in terms of risk because situations of risk are comparatively easier to manage than situations of uncertainty. This demand can be handled through qualitative statements such as that mitigation will reduce the risk of both global mean and regional changes and the risk of abrupt changes in the climate system (Ronger et al., 2007). Another more controversial way is to assign *subjective probabilities* which rather represent expert judgments about likelihood than some objective property of the world. In the context of scientific advice on climate policy this is done on a regular basis e.g. in terms of weighting climate sensitivity values (Risbey, 2007).

The bottom line is that climate change poses deep intellectual challenges at the interface of pure and policy relevant science. Per se, science is value neutral but in the current situation, there is a pressing need to present and communicate scientific information to decision-makers, stakeholders, and the general public which cannot be done without making subjective assumptions. Although good practice warrants that the level of assumption underlying subjective elements be parsimonious, Schneider and Lane (2006) believe that qualified assessment of clearly admitted subjective probabilities would improve climate change impacts assessment.

4.3.3.2 Scientific support for defining dangerous climate change

Determining what constitutes “dangerous anthropogenic interference with the climate system” in accordance with the three qualifying provisions of Article 2 of the UNFCCC (ecosystem adaptive capacity, food production, and sustainable economic development) which should be met along the path towards a stabilized level of atmospheric greenhouse gas concentrations, necessarily involves value judgements. However, science can support informed decisions on this issue, for example, by providing ecological and social indicators to be considered in the decision making process.

The scientific literature identifies a number of criteria for judging which vulnerabilities might be labelled “key”, including magnitude, timing, persistence/reversibility, potential for adaptation, distributional aspects, likelihood, and “importance” of the impacts (IPCC, 2007). Key vulnerabilities may be associated with many climate-sensitive systems, including food supply, infrastructure, health, water resources, coastal systems, ecosystems, global biogeochemical cycles, ice sheets, and modes of oceanic and atmospheric circulation.

In its Third Assessment Report, the IPCC (2001a) lists five possible categories of serious concerns as a framework to consider key vulnerabilities. These are: risks to unique and threatened systems; risks associated with extreme weather events; the distribution of impacts (i.e. equity implications); aggregate damages (i.e. market economic impacts); and risks of large-scale singular events.

A figure, known as the “burning embers diagram” (Smith et al., 2001) which serves to illustrate those “reasons for concern” shows that the most potentially serious climate change

impacts (depicted in red colours) typically occur after only a few degrees Celsius of warming. While this approach is intended to synthesise information on climate risks and key vulnerabilities and to "aid readers in making their own determination about risk" (IPCC, 2007), it does not prescribe where to draw the line between still tolerable and unacceptable climate change, that is, it is still up to policy-makers to consider what weight they may wish to give to particular types of impacts.[35]

It is widely held that the definition of a dangerous outcome may be best met if climate change results in the crossing of a threshold which is widely perceived as unacceptable (Yamin et al., 2006). Oppenheimer (2005) argues that a plausible entry point for the discussion on dangerous outcomes is provided by extreme, irreversible outcomes, such as the deglaciation of Greenland or West Antarctica because the "consequences of ice sheet loss are greater in scope and slower to reverse than other proposed markers of danger (loss of coral reefs, transition of Amazonia to grassland, people exposed to life-threatening hazards, etc.)."

Basically, there is a certain consensus in the scientific literature that a temperature increase of 2°C above pre-industrial levels cannot be assumed to be free of potentially large-scale adverse impacts (Meinshausen, 2006). Definitely, this information has influenced policy judgements such as the EU target of limiting temperature increase to 2°C above pre-industrial levels (Lorenzoni et al., 2005). Nevertheless, thresholds for adverse impacts can possibly be crossed even before global mean warming reaches the 2°C level. For example, Hansen et al. (2007) argue for a limit of 1.7°C relative to pre-industrial time (corresponding to 1°C global warming relative to 2000) aiming to avoid practically irreversible ice sheet and species loss (compare also Table 1).[36]

4.3.3.3 Stabilization scenarios

In response to specific policy targets, such as the EU 2°C target, explicit stabilization scenarios have been developed.[37] The scientific literature reports many potential stabilization levels for atmospheric CO_2 concentrations ranging, mostly from 450 to 700 ppm of CO_2 (Den

[35] Nevertheless, concrete scientific guidance is expressly requested by some politicians. Yamin et al. (2006) report that at the Exeter Conference Prime Minister Blair exhorted that scientists should identify a level that is "self-evidently too much".

[36] Crucially, Hansen et al. (2008) conclude that the recommendation given in 2007 is obsolete and that humanity must aim for an even lower level of GHGs (see also 4.3.4.3 below).

[37] In this context, it is important to recall that the IPCC SRES (2000) scenarios presented above (see 2.4.3.1) have been assigned neither probabilities nor do they include the implementation of any additional climate policy. They were designed as a response to the weaknesses of precedent scenarios. In 1990, for the First Assessment Report, modelling teams developed four scenarios: "business as usual" (BAU), and three with increasing levels of climate policies. The lowest scenario which was designed to lead to stabilization of carbon dioxide concentrations at "less than a doubling of pre-industrial concentrations" was criticized because it was perceived inappropriate for the IPCC to develop normative scenarios (Munasinghe and Swart, 2005). As well, it was recognized that a "business–as-usual" or "best guess" scenario is not meaningful, since societal development is inherently unpredictable and projections and forecasts would be very speculative.

Elzen and Meinshausen, 2006). New literature since the IPCC's TAR (2001) often focuses on multi-gas stabilization scenarios which formulate GHG concentration targets in terms of CO_2 equivalent. Among those more recent publications, a few studies have become available in which more ambitious targets are investigated.

Generally, stabilization of greenhouse gas stocks requires a balance between current emissions and absorption. Currently, the Earth's natural ecosystems (both land and sea) absorb roughly half of the annual anthropogenic emissions of CO_2, but with further warming, absorptive capacity is projected to decline. Thus, in order to reach any stabilization level, ultimately global emissions of CO_2 have to be reduced by at least 50 percent. By then, a given stabilization level can be achieved through different emissions pathways. Depending on whether emissions peak rather early or late, emissions have to decline more gradually or more rapidly afterwards. Basically, the more stringent a target, the earlier emissions have to peak. Table 3 which is based on the Fourth Assessment Report of the IPCC Working Group 3 (Fisher et al., 2007) shows properties of different emissions pathways for alternative ranges of CO_2 and CO_2-eq stabilization targets including the likely range of global mean temperature increase above pre-industrial levels.

Table 3: Properties of emissions pathways for alternative ranges of CO_2 and CO_2-eq stabilization targets (Source: Fisher et al., 2007).

Multi-gas concentration level (ppmv CO_2-eq)	Stabilization level for CO_2 only, consistent with multi-gas level (ppmv CO_2)	Number of scenario studies	Global mean temperature C increase above pre-industrial at equilibrium, using best estimate of climate sensitivity[c)]	Likely range of global mean temperature C increase above pre-industrial at equilibrium[a)]	Peaking year for CO_2 emissions[b)]	Change in global emissions in 2050 (% of 2000 emissions)[b)]
445-490	350-400	6	2.0-2.4	1.4-3.6	2000-2015	-85 to -50
490-535	400-440	18	2.4-2.8	1.6-4.2	2000-2020	-60 to -30
535-590	440-485	21	2.8-3.2	1.9-4.9	2010-2030	-30 to +5
590-710	485-570	118	3.2-4.0	2.2-6.1	2020-2060	+10 to +60
710-855	570-660	9	4.0-4.9	2.7-7.3	2050-2080	+25 to +85
855-1130	660-790	5	4.9-6.1	3.2-8.5	2060-2090	+90 to +140

4.3.3.4 Prospects of meeting the EU temperature target

Although objective probabilities cannot be assigned for the realization of specific emissions scenarios, the possibility exists to derive the likelihood that a certain GHG concentration level is consistent with a given equilibrium temperature through the analysis of climate sensitivity probability density functions (PDFs). It is important to repeat that those PDFs represent subjective probability, that is to say, they represent judgments about likelihood, rather than some objective property of the world (see 4.3.3.1).[38] Because of the complexity of the climate

[38] Baer and Mastrandrea (2006) explain this as follows: "When we say 'the likelihood that the climate sensitivity is over 4.5ºC is 10 per cent', we do not mean that one out of every ten times we double atmospheric CO_2 the result will be a warming greater than 4.5º (…).There *is* a 'fact of the matter', we are just uncertain what it is due to the limits of our knowledge. Quantifying this uncertainty as, say, a 10 per cent probability, is a way of

system, there is a wide range of reasonable estimates of the likely probability distributions for the climate sensitivity and other parameters such as current aerosol forcing. In their attempt to constrain the climate sensitivity uncertainty by observations, different scientists interpret the evidence differently resulting in a range of different PDFs reported in the literature. Using more than one of these PDFs to estimate the risks associated with any policy scenario will result in different estimates of the likely temperature consequences of an emissions trajectory, and thus the risk estimates must be presented as ranges (Baer and Mastrandrea, 2006).

In a frequently cited article, Meinshausen (2006) analyses a set of 11 published climate sensitivity PDFs in order to assess the likelihood that a given stabilization level will meet the EU target of limiting global average temperature increase to 2°C above the pre-industrial level. In Table 4 the resulting probabilities of exceeding 2°C warming are broken down for different CO_2-eq stabilization levels.

Table 4: Probability of exceeding 2° C warming above pre-industrial levels in equilibrium for different CO_2-eq stabilization levels (Source: Meinshausen, 2006).

CO_2eq stabilization level (ppm)	350	400	450	475	500	550	600	650	700	750
Upper Bound	31%	57%	78%	90%	96%	99%	100%	100%	100%	100%
Mean	7%	28%	54%	64%	71%	82%	88%	92%	94%	96%
Lower Bound	0%	8%	26%	38%	48%	63%	74%	82%	87%	90%

Meinshausen's results show clearly that a 550 ppm CO_2-eq stabilization level, as proposed by the EU Council, is not in line with a climate target of limiting global mean temperature rise to 2°C above pre-industrial levels. Using the IPCC WG1 terminology (see footnote 7), the likelihood of exceeding 2°C at 550 ppm CO_2-eq could be categorized as very high, ranging between 63 percent and 99 percent for the different climate sensitivity PDFs. Only at levels around 400 ppm CO_2-eq or below could the probability of staying below 2°C be termed likely (probability of exceeding 2°C between 8 percent and 57 percent with a mean of 28 percent).

Given that recent assessment indicates that probably atmospheric GHG concentrations have already reached about 450 ppm of CO_2-eq (Ekman et al., 2008), stabilization at low levels such as 400 ppm CO_2-eq became infeasible without temporarily overshooting and peaking at higher levels. More recently, an increasing body of literature reports such overshooting scenarios which, according to Izrael and Semenov (2006), give additional, somewhat more realistic, stabilization scenarios to be considered in the development of climate policy. Den Elzen and Meinshausen (2006) note that due to the inertia of the climate system overshooting pathways may reduce the risk of overshooting a given temperature target. However, researchers have also identified significant drawbacks, for example, the additional

saying that 'based on the evidence, we think it is about as likely the climate sensitivity is over 4.5ºC as is that we will roll a 10 on the next roll of a 10-sided dice" (italics in original).

transient warming induced by overshoot stabilization profiles may exceed temperature thresholds for irreversible, abrupt nonlinear climate changes or impacts (e.g. species extinctions), which will persist long after the temporary threshold exceedance (Izrael and Semenov, 2006).

4.3.3.5 Technological options and uncertainty regarding technological advance

It is widely held that technological progress represents an essential part of a potential solution to the climate challenge with respect of (a) prospects for mitigation of dangerous human-induced climate change and (b) potentials for adjustment to expected adverse climate impacts. Therefore the potential advent of new and advanced technologies is a critical factor in assessing the risk of a given GHG stabilization target.

Currently, the following range of technology options exists for reducing GHG emissions and enhancing sinks and reservoirs (Moomaw et al., 2001):

- Energy efficiency improvement.
- Decarbonization of the energy system

– increasing the use of low or zero carbon energy sources (gas, nuclear, biomass, wind, solar)

– applying CO_2 capture and storage.

- Biological carbon sequestration and/or reducing deforestation emissions.
- Reducing other greenhouse gases from industry, agriculture, waste.

There is a relative consensus that the attainability of low stabilization targets (below 450 ppm CO_2) depends on using a comprehensive technology portfolio (Fisher et al., 2007).[39]

However, it is rather controversial, whether contemporary known technologies achieve the momentous global undertaking or whether fundamentally new options, such as fusion, that are still technically not feasible, might be required (Schellnhuber et al., 2006). In the end, the question of whether a given target can be met with current technology comes down to uncertainty in the value of climate sensitivity. Edmonds and Smith (2006) examine energy technology implications of limiting the change in mean global surface temperature to 2°C relative to pre-industrial temperatures. An important finding of their analysis is that for a climate sensitivity of 3.5°C or greater, it may be impossible to limit temperature change below 2°C, while for values of 1.5°C and less it may be a trivial matter requiring little deviation from a reference IPCC SRES emissions path until after the middle of the century.

4.3.3.6 Economical aspects

Besides scientific investigations of critical thresholds for key vulnerable elements, critical values for GHG concentrations and global surface temperature have also been obtained through cost-benefit analysis of mitigation cost and residual damage to climate and socio-

[39] According to the IPCC Working Group 3 (Fisher et al., 2007), the attainability of stabilization targets below 450 ppm CO_2 also depends on the readiness of advanced technologies, in particular the combination of bio-energy, carbon capture and geologic storage (BECCS).

economic systems. Such analysis has been facilitated by the development of integrated assessment models (IAMs) which provide a comprehensive framework for assessing the possible economic losses due to climate change (damage function) and for estimating the costs to slow or delay climate change (cost function).[40] In order to calculate the social costs of GHG emissions, all climate change damages are expressed in monetary terms and discounted resulting in an aggregated present value as a social welfare measure. Crucially, this procedure is based on a host of important but often implicit assumptions and value judgments. These include amongst others: the choice between willingness to pay and willingness to accept; the difficulties involved in transferring benefits across individuals, social groups, and geographical regions; the use of equity weights for income distribution; and the question of regionally differentiated versus uniform per-unit damage values (Toth, 1999).

By weighing avoided climate impacts against net mitigation costs, economically efficient climate policies can be identified (e.g. Nordhaus, 1994; Tol, 2003). However, the credibility of such comprehensive cost-benefit analysis has often been questioned in the literature (e.g. Jacoby, 2004; Ott and Döring, 2004). Amongst others, critical issues include the aggregation of different kinds of impacts, methods for incorporating uncertainty about future outcomes, and the choice of an appropriate social discount rate. Ott et al. (2004) point out that modifications in basic assumptions (such as damage function, rate of discount, etc.) can prove almost any climate policy "economically optimal".[41]

Although values cannot be objectively aggregated, economics can nevertheless contribute useful information by showing how a predetermined GHG level that is deemed to be consistent with Article 2 of the UNFCCC can be reached efficiently, that is, at lowest possible costs. An alternative to cost-benefit analysis is given by so-called "sustainability" or "tolerable windows" approaches. They highlight the incommensurable nature of climate change impacts and leave it up to policy-makers to assign values to different types of impacts (see e.g. Grassl et al., 2003).

4.3.4 Ethical guidance

The previous section summarized the scientific input necessary to make an informed decision on what constitutes dangerous interference with the climate system. This section outlines ethical aspects that have to be considered in the political decision-making process.

[40] See Toth (1999) on the question of how to incorporate fairness and equity issues into integrated assessment of climate change.

[41] Discounting is important in economic analysis of policies in order to reflect the opportunity cost of capital. Different assumptions about interest rates lead to different cost/benefit ratios for action to mitigate climate change. Amongst others, the choice of a different interest rates explains why the Stern Review (2006) states that any delay in reducing emissions "would be costly and dangerous" while Nordhaus' analysis supports a slow "ramp up" of climate policy action (Nordhaus, 2006). For a discussion of social discount rates applied to climate policy see Dasgupta (2008).

4.3.4.1 Issues regarding procedural fairness

From a discourse ethical point of view, all competent speakers whose interests are or will be affected by regulations adopted to resolve a given issue should have a chance of participating in the public debate, either directly or indirectly through elected representatives.

However, in the particular context of determining an absolute emissions ceiling the problem is that on the one hand, people are presently already suffering from climate impacts due to increased GHG concentrations who have never given their consent.[42] On the other hand, due to the thermal inertia of the climate system, most of the impacts of our present actions are going to fall on future rather than present generations (see e.g. Gardiner, 2006; Singer, 2006; Davidson, 2008). According to Ott (2004) there is a broad consensus among ethicists that obligations to future generations have to be recognized. Arguments that deny obligations towards members of future generations ("no-obligation"-arguments) are unsound (Schröder et al., 2002:153 et seqq.). However, practically, it is impossible for future generations to participate directly in the climate discourse and to give free and informed consent whether they accept the risk of increased GHG concentrations. As a possible way out of this problem proxy or surrogate participants could step into their argumentative place in the discourse (Kettner, 1993) or Rawls' veil of ignorance method could be applied (Ott et al., 2004). Arler (2001) points out that we cannot avoid trying to put ourselves in the position of future generations, given the amount of knowledge about consequences which is possible to obtain, and asking which values we ourselves find most reasonable, and which kinds of goods we find attractive enough to make up for the projected bad impacts.

4.3.4.2 Applying the precautionary principle

The problem of setting a long-term emissions target to prevent harm of future generations is complicated by the huge uncertainty surrounding scientific and technological information.

Basically, there are several criteria which can be applied to global environmental risk assessment. Ott et al. (2004) argue that in the context of setting a limit on global GHG concentrations, the choice of criteria of risk evaluation should be independent from one's personal degree of risk aversion. The study concludes that the application of most ethical theories comes to the result that it is better to err on the side of caution.
This conclusion is in line with the precautionary principle explicitly enshrined in Article 3.3 of the Climate Convention. By ratifying the Convention, nations have consented to be bound by this principle which requires decision-makers to take cost-effective precautionary measures in response to threats of serious or irreversible damage or harm, without delay on account of

[42] For example, McCarthy (2006) reports that more Britons are suffering from allergic reactions due to rising temperatures.

lack of full scientific certainty. In order to apply the precautionary principle effectively, the following three aspects are worth considering.

(1) Both adaptation and mitigation are interrelated in the sense that the more GHGs are mitigated the less climatic change is projected the less adaptation will be necessary. However, given the current imbalance in the Earth-atmosphere system, a certain amount of adaptation will be necessary in order to cope with the impacts that cannot be avoided anymore. The lower the mitigation effort the higher the risk that adaptation does not prove successful and that people may be harmed.

(2) A fundamental complication arises from the dynamic and complex nature of climate change and the changing state of scientific knowledge. A target such as 450 ppm CO_2 which a couple of years ago was deemed "reasonably safe" from a precautionary perspective, may seem today, under the latest scientific evidence, obsolete and even irresponsible.

(3) Another important aspect noted by Yamin et al. (2006) is that the scientific rigor and independence of the IPCC is coming under strain because the political stakes for countries are so high and many fear that future scientific findings might catalyze momentum for new commitments. Indicative is the exclusion of possible dynamical responses of ice sheets from the IPCC AR4 projections of global sea level rise (see 2.4.3.3). Accordingly, it seems warranted to treat even the scientific findings put forward by the IPCC with precaution.

4.3.4.3 Setting a precise global target

All major ethical systems strongly condemn behaviour that poses serious risks to human life, health, the ability to make a living, community, and the natural environment (Brown et al., 2006) and various ethical systems converge in the conclusion that atmospheric levels of GHGs should be stabilized at low stabilization levels (Ott et al., 2004). Brown (2008) points out that since current atmospheric levels of GHG concentrations are already harming or putting people and ecosystems at risk, it will be difficult to justify GHG concentrations higher than current levels on ethical grounds. Given that some scientists, in particular Hansen et al. (2008), on the basis of paleoclimatic data, consider even today's GHG concentrations as too high already to preserve Earth in a state similar to that "on which civilization developed and to which life on Earth is adapted" and given the immense uncertainty and the gigantic stakes, a precautionary approach can only lead to the conclusion that GHG concentrations should be stabilized at the lowest possible levels.

Practically, it seems reasonable to follow a recommendation made by Meinshausen (2006) and to distinguish between a peaking target and a stabilization target. According to Meinshausen, the peaking level seems to be more important than the stabilization level in determining whether a given temperature target will be achieved or not.[43] If this view is

[43] Meinshausen (2006) points out that if emissions peaked at 475 ppm CO_2-eq before stabilizing at 400 ppm CO_2-eq this would not translate into a comparable peak in global mean temperatures but still,

accepted, then it would be important for decision makers to put an extra focus on the peaking concentrations instead of the ultimate stabilization level. Baer and Mastrandrea (2006:25) argue that if it turned out to be "possible to achieve emissions reductions adequate for stabilisation, there would be no obvious reason not to continue reductions and reduce CO_2 below its peak level."

Principally, peaking is only possible at levels above the current level of 385 ppm CO_2. At what level global GHG concentrations can peak depends on how fast annual global emissions can be brought down to the level where they equal the global sink capacity. Here it comes down to the question of feasibility, that is, on evaluating the capacity of the global socio-economic system to change in such a profound manner. This question will be addressed in Chapter 5 of this thesis. For now, in the context of providing ethical *guidance,* it seems appropriate to exclude the issue of feasibility recalling that over the course of history some ethics has always been utopian in the sense that it has been concerned with providing ideals towards which humanity could steer. The ideal can be seen in the lowest emissions trajectory currently *thinkable*, which as far as I can see, is presented in Hansen et al. (2008).

Based on paleoclimatic evidence, Hansen et al. argue that atmospheric CO_2 concentrations need to be reduced from current 385 ppm to at most 350 ppm. According to Hansen et al. this ambitious target can be achieved if coal use is phased out by 2030 except where CO_2 is captured and sequestered. Hansen et al. claim that, depending on the magnitude of oil and gas reserves, atmospheric CO_2 can be kept to a peak amount of ~400 to 425 ppm if such a sine qua non of coal emissions phase-out was achieved. Moreover, Hansen et al. define a scenario which, based on improved agricultural and forestry practices, returns CO_2 below 350 ppm late this century. In particular, Hansen et al. suggest reforestation and the application of biochar ("terra preta") which - produced in pyrolysis of residues from crops, forestry, and animal wastes - can be used to restore soil fertility while storing carbon for centuries to millennia. As a supplementary option, Hansen et al. recommend to consider large-scale technologies for artificial CO_2 air capture.

4.4 Fair burden sharing

Many scholars of political science consider equity as a necessary prerequisite for overcoming barriers currently blocking progress in international negotiations on a climate change agreement and for facilitating wide participation.[44] However, as Victor (1999) points out, there is little evidence that equity concerns mattered much in the success of negotiating

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the initial peak at 475 ppm CO_2-eq – rather than the 400 ppm CO_2-eq stabilization level – seems to be the decisive factor that determines whether a 2°C target will be achieved or not.

[44] Indicative for this view are the IPCC's assumptions that "countries are unlikely to participate fully unless they perceive the arrangements to be equitable" and "governments will find it easier to comply with international obligations if their citizens feel that the obligations and benefits of compliance are distributed equitably" (Banuri et al., 1996:83).

and implementing numerous earlier treaties. He concludes that even for cases in which fairness seems to play some role, willingness to pay had a stronger role.
Irrespective of those diverging views, from a normative perspective, equity considerations ought to be a part of international environmental deliberations because equity is an important end in itself.

4.4.1 Legal basis and definitions

As with the question of setting a global ceiling on GHG concentrations, the starting point for adequately addressing the question of how to allocate the corresponding effort is provided by principles codified in the Framework Convention on Climate Change. According to Article 3.1 of the UNFCCC "[t]he Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common and differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead of combating climate change and the adverse effects thereof".
Kokott (1999:173-4) notes that by taking into account the differentiated responsibilities and respective capabilities of the Parties the Convention seems to modify the classical international law principles of the formal equality of states in favour of a more "equitable" approach. In order to further concretize the states' duties in the field of climate protection it seems therefore useful to clarify the meaning of the term "equity".
Following on Flexner (1987), the IPCC WG3 (Banuri et al., 1996:83) defines equity as the "quality of being fair and impartial" or "something that is fair and just".[45] This, of course, begs the question of what precisely is fair and just. Often, both terms are used synonymously referring to the notion that individuals ought to receive the treatment that is proper and fitting for them, but there are also debates on their different meanings. According to Albin (1995) principles of justice exist prior to and independently of any phenomenon to be judged whereas fairness consists of individual perceptions of what is reasonable under given circumstances, often in reference to how a principle of justice regarded as pertinent should be applied.

4.4.2 Framing the problem

With regard to the question of how to share the burden of meeting a predefined stabilization target, economic advice is univocal: under the assumptions of perfect competition, a mitigation scheme that allows for universal emissions trading will be cost-effective irrespective of the initial distribution of emission permits.[46] Accordingly, as long as the question of "who carries the costs" from that of "where should mitigation be undertaken" can

[45] This definition refers to common language. From a philosophical perspective, a generally accepted definition of justice does not exist (Harris, 1999).
[46] This is because according to economic theory such a scheme will lead to an equalizing of the marginal costs of emissions reduction across all sources and generate the same costs no matter which burden-sharing rule is applied.

be separated, there is no efficiency–equity trade-off and no obstacle to considering equity issues within climate change while emphasizing cost-effectiveness.

At the present time there are a diversity of viewpoints on what an equitable climate regime should look like. Several nations and groups of nations have offered different proposals on how to operationalize Article 3.1 of the UNFCCC. In most cases, thereby promoted definitions of equity tend to fit particular circumstances and align with perceived material interests. For example, Ringius et al. (2000:19) remark that "it is hardly by accident that Japan refers to emissions per capita and per unit of GDP, while Russia finds the notion of emissions per unit of territory a more attractive option."

The scientific literature lists several alternative "equity principles/criteria" (for a selection see Table 5 below). As the burden-sharing problem can be framed in different ways, it is useful to distinguish between "outcome-based", "allocation-based", and "process-based" equity principles (Rose et al., 1998).

Table 5: Alternative equity criteria for climate change policy (Source: Rose et al., 1998).

Criterion	Basic Definition	General Operational Rule
Allocation-Based		
Sovereignty	All nations have an equal right to pollute and to be protected from pollution	Cut back emissions in a proportional manner across all nations
Egalitarian	All people have an equal right to pollute or to be protected from pollution	Allow emissions in proportion to population
Ability to Pay	Mitigation costs should vary directly with national economic well-being	Equalize abatement costs across nations (gross cost of abatement as proportion of GDP equal for each nation)[a]
Outcome-Based		
Horizontal	All nations should be treated equally	Equalize net welfare change across nations (net gain or loss as proportion of GDP equal for each nation) [b]
Vertical	Welfare gains should vary inversely with national economic well-being; welfare losses should vary directly with GDP	Progressively share net welfare change across nations (net gain (loss) proportions inversely (directly) correlated with per capita GDP) [b]
Compensation	No nation should be made worse off	Compensate net losing nations
Process-Based		
Rawls' Maximin	The welfare of the worst-off nations should be maximized	Maximize the net benefit to the poorest nations
Consensus	The international negotiation process is fair	Seek a political solution promoting stability
Market Justice	The market is fair	Make greater use of markets

[a] Gross cost refers to abatement cost only and does not include benefits or permit transactions.

[b] Net welfare change (gain or loss) is equal to the sum of mitigation benefits – abatement costs + permit sales revenues - permit purchase costs.

The first group of principles define equitable burden-sharing in terms of principles for the initial distribution of emission allowances or the allocation of emission burdens. Principles falling under this category include egalitarian, sovereignty, and ability-to-pay.

In contrast, the second group of principles focuses on the expected outcome resulting from any distribution of commitments, including, amongst others, horizontal, vertical, and compensation principles. Usually, the outcome of emission reduction efforts is examined with a view to the distribution of costs and benefits either in terms of investment costs or welfare effects. Outcome-based approaches necessarily depend on complex economic models which are highly contested and hardly transparent to policy-makers (Berk and Den Elzen, 2001).

The third group of principles apply to the process for deciding how to distribute emission burdens such as "market justice", political consensus, and Rawls' maximin principle.

Rose et al. (1998) show that from each equity principle an operational rule can be derived which can be modelled mathematically to examine the relative welfare implications of alternative distributional criteria. Critically, Rose et al.'s analysis is representative of the more policy-oriented literature on the "burden-sharing issue" which starts with already formed conceptions of justice or equity and proceeds with a technical discussion regarding implementation issues.[47] While this type of literature is descriptive in the sense that it examines the implications of alternative policy options, it does not provide ethical guidance in the sense of prescribing what option would be morally right to choose.

4.4.3 Ethical guidance

In order to adequately address issues of equity in the discussion on sharing the burden of GHG mitigation among nations, principles of distributive justice as well as issues of procedural fairness need to be considered.

4.4.3.1 Distributive justice

Aristotle characterizes distributive justice with the dictum "what is just is what is proportional, and what is unjust is what violates the proportion" (Nicomachean Ethics: Bk V: Ch.3). Theories of distributive justice prescribe principles in proportion to which benefits and burdens should be distributed within communities. Often the concern is with distributing goods or bads, but frequently the goal is to fairly distribute entitlements or obligations in using and protecting environmental resources. In what follows, recognized principles of distributive justice are outlined and put in context of the climate policy debate.

[47] Further examples of this type of literature are Ringius et al. (2000); Höhne et al. (2003); Ashton and Wang (2003).

4.4.3.1.1 Principles of distributive justice

Most traditional theories of distributive justice take the principle of equality as their baseline.[48] This corresponds to the basic intuition that if there are no relevant differences between the parties, it is fair to treat everybody equally as long as there are no good reasons to do otherwise. It is also the simplest way of distribution to give every person an equal entitlement or an equal share of a common resource.

In the context of the international climate-policy debate, the concept of equality corresponds to an equal per-capita (or "egalitarian") distribution of emission entitlements. To justify egalitarian concepts, proponents sometimes refer to precedents in international law such as the United Nations Charter or the Universal Declaration of Human Rights.

Much of the philosophical literature on distributive justice has been concerned with justifying deviations from equality (Kverndokk, 1995). While it is widely recognized as a formal requirement of justice that equal cases be treated equally, the burden of proof lies on those who argue for an unequal distribution. Generally, there seems to be a widespread understanding that different cases can only be treated differently if there are relevant moral grounds for doing so, that is, a distribution of goods should not be based on morally arbitrary criteria such as natural endowments (e.g. nationality, race, gender, social class, etc.) which are beyond human control and therefore assumed unacceptable as a standard for distribution (Kverndokk, 1995). With a view to their prominence and their significance for both concepts compared in Chapter 5, the following distributive criteria are presented below: positive or negative contributions, need/ability, and previous usage.

4.4.3.1.2 Morally relevant criteria to justify deviations from equality

One common criterion to justify deviations from equality is based on positive ("desert") or negative contributions to a common goal (Arler, 2001). By taking past emissions into account, this criterion could be used to justify an unequal allocation according to differences in responsibility for causing the GHG emissions that have accumulated in the atmosphere. This is in line with the "polluter-pays" principle, a well-established international law norm. According to this principle, countries that have released emissions beyond a certain threshold would be requested to remedy the damage, for example, through higher cuts or payments in proportion to the burdens they put on the global community.

Need and ability are further criteria in proportion to which unequal distributions can be justified. Accordingly, better-off parties need to shoulder a comparatively heavier burden than less well-off parties. In the climate change context, this criterion would require those countries with the highest capacity to solve the problem to accept special responsibilities, irrespective of their historical contribution or any potential advantage they have gained from

[48] Important exceptions are utilitarianism and Nozick's theory (Kverndokk, 1995).

GHGs emitting activities. On the other side, developing countries which have trouble to meet the basic needs of their citizens would be more or less relieved from their burdens.

Another distributive criterion is previous usage. The main argument used to support this criterion is that as long as there are no reasons for reallocations strong enough to be accepted by all affected parties, those who have used a certain good for a long time without any legal objections from others, should not be forced to change their customary practice. In the greenhouse context, it is argued by Grubb et al. (1992) that current emissions ("status quo") offer a "natural focal point" because they represent what countries would emit in the event of a complete negotiation failure. Accordingly, if a need for reduction is accepted, status quo would be the baseline for further regulations, so that, for example, all countries reduce their emissions with the same percentage. Many environmental agreements, such as the Kyoto Protocol or the Montreal Protocol depart from status quo levels. One implication of this approach is that countries which have the largest emissions would keep their rights either in absolute or in relative terms.

4.4.3.2 Distributive justice, social relations, and fair procedures

Wissenburg (1993) points out that since Aristotle's Ethica Nicomachea it is a broadly accepted axiom in the theory of distributive justice that the existence of some sort of social arrangement is a necessary precondition for the application of any distributive criteria.
On the one hand, there would be no demand for distributing anything without persons being part of a social relationship. On the other hand, fairness is seen as integral to the establishment and maintenance of social relations from the local to the global level.
Basically, there are two perspectives on interpreting trans- and international relations, communitarianism and cosmopolitanism.[49] Each perspective is associated with different obligations regarding distributive justice. According to the communitarian viewpoint, people have moral obligations only to members of their own community or at most their own country.[50] For radical cosmopolitans only individuals matter; the communities to which those individuals belong should have no moral significance in a scheme of global justice. Harris (1999:11-2) argues that in the process of globalization, the distinctions between communitarian and cosmopolitan perspectives have become less salient and that both perspectives converge in the environmental issue area in the sense that the environmental change catalyses the creation of a "global community" analogous to domestic communities with persons feeling more and more sympathy towards persons living beyond their own national community.

[49] See e.g. Arler (1997). The so-called "realist" tradition is excluded here.
[50] This is based on the observation that, basically, the closer to us someone is both in geographical and emotional terms, the more we know of another person, the more willing we are to contribute to his or her well-being. Aristotle notes that "friendship" (understood as a non-hostile relationship) and justice are coextensive concepts and that we do not have the same kinds of obligations to enemies, fellow citizens, comrades and family members. See Aristotle (1998: 1159b–1160a).

Distributing the burden of GHG mitigation is a process that necessarily has to take place at the international level. Arler (2001) argues that in the end it depends on our understanding of the global partnership what criteria is reasonable for the distribution of burdens and benefits. For example, the use of simple equality as a distributive criterion requires understanding the global partnership on climate change at least in terms of a minimalistic political friendship. Interpreting the global partnership in an even stronger form would justify the application of criteria such as need and ability. If this was the case, the climate problem could not be treated in isolation from other issues.

Under a discourse ethical perspective, fair procedures are a basic requirement for any distributional criteria gaining normative validity. As sharing the burden of meeting the predetermined stabilization target is an issue affecting, in one way or the other, everybody currently alive, procedural justice requires first and foremost equal access to the negotiation process as a precondition for wide participation. However, due to funding constraints, developing countries' scholars, officials and activists are insufficiently represented in the present debate (Yamin et al., 2001). It is suggested to strengthen developing countries' capacity to participate in negotiations through training for negotiators and policy-makers to understand complex circumstances as well as increased attention to financial support and investment.

4. 5 Criteria for the assessment of climate policy proposals

This section briefly considers criteria which should be met by any proposal for a future climate regime including "Contraction & Convergence" and "Greenhouse Development Rights" the two concepts discussed in Chapter 5. Although other criteria may also be important, I have selected the following four common assessment criteria because I considered them to be the most critical in evaluating concepts for future emission reduction options. They are as follows:

1. environmental effectiveness,
2. equity,
3. political acceptability,
4. political feasibility.

The first two criteria arise directly from the previous ethical analysis. The third and fourth criteria, can be understood as a concession to "reality" in the sense that a proposal without any chance of being *realized* in the foreseeable future can neither be just nor environmental effective. Therefore, any proposal for a future climate regime *should* have at least modest prospects of being realized timely under the current political and institutional conditions.

At the end of the day, a modest agreement that is ratified and implemented is of greater value than an ambitious proposal that fails e.g. for political or practical reasons (Skodvin, 2007). Below, each of the inter-related criteria is discussed in turn.

4.5.1 Environmental effectiveness

First of all, any proposal for a climate regime has to be assessed in terms of its environmental effectiveness, that is, to what extent it is instrumental towards preventing or at least limiting dangerous interference with the climate system. To be consistent with the ultimate objective of stabilizing atmospheric GHG concentrations any proposal must provide for stringent emissions targets resulting in large reductions of net global GHGs. All other criteria are subordinate to this criterion in that there is no use of having a perfectly just and feasible agreement if it does not have the slightest chance of putting the world on a safe emissions reductions pathway.

Although the ambition of a given proposal is an important contributor to environmental effectiveness, it may not necessarily be decisive. Other factors affecting the environmental effectiveness of a given climate policy proposal include whether it accounts for changes in scientific understanding, how easy and how fast it can be implemented effectively, to what extent it stimulates technological change and changes in public attitudes, awareness and learning, to what extent it encourages long-term participation and how it provides for compliance.

The assessment of this criterion will concentrate on the certainty a proposal provides that it will result in environmental effectiveness. Here, the factual time constraint is of paramount importance. As carbon concentrations have been increasing on average by nearly 2ppm annually over the last decade (Van Vuuren and Riahi, 2008), low stabilization targets become increasingly difficult to reach with every single year passed without decisive mitigation action. Mignone et al. (2008) argue that starting effective emissions reductions can be postponed at most, one or two decades depending on the marginal rate of substitution between future mitigation and present delay.[51] According to Hansen et al. (2008) continued growth of GHG emissions, for just another decade, practically eliminates the possibility of near-term return of atmospheric concentration beneath the tipping level for catastrophic effects.

4.5.2 Equity

Given the legal default, equity has to be part of a proposal for a future climate agreement. The previous analysis (see 4.4.3.1) showed that distributive justice allows for the consideration of several morally relevant criteria. Although most criteria point more or less in

[51] Mignon et al. (2008) find that a decline in emissions of 1 percent annually beginning today would place the peak atmospheric concentration near 475 ppm and that when mitigation is postponed, options disappear at the rate of ~9 ppm annually meaning that delays of more than a decade will likely preclude stabilization below a pre-industrial doubling (~550 ppm). Principally, constraints on the future decline rate of emissions can be relaxed, however, when the balance is shifted too far towards the future the marginal rate of substitution between future mitigation and present delay becomes prohibitively large meaning that some amount of postponement cannot be fully offset by simply increasing the intensity of future mitigation.

the same direction, namely that the developed nations should bear the largest share (Singer, 2006), there is still a certain leeway about the specific requirements under the UNFCCC.

In "A Theory of Justice" John Rawls (1971:302-3) argues that in the original position, free and rational persons ignorant of details about their personal characteristics, their life prospects, their social status, and their conception of the good would agree to the principle that economic inequalities should be allowed only when the least-advantaged member of society is better off than would be the case under alternative arrangements.[52] While Rawls sees the so-called "difference principle" as determining a fair distribution of the benefits and burdens produced by social cooperation within self-contained national communities, both Beitz (1979) and Pogge (1989) propose that Rawls's difference principle should be applied globally arguing that national origin is equally morally arbitrary to a distributive scheme as e.g. race and gender.

Per se, a concept for solving the *climate* crisis must not necessarily simultaneously solve other problems such as unequal welfare distribution or global poverty. Various possibilities exist to address those issues separately.[53] Therefore, to be judged equitable, a proposal on a future climate regime does not need to maximize the position of the least well off as demanded by a global version of Rawls's difference principle. Nevertheless, a concept designed to solving the climate crisis must conform to the universal norm not to damage or harm people. As poor people are already harmed under the global economic system (Pogge, 2004), the minimum requirement a proposal on a future climate regime must fulfil is that it should not further deteriorate the situation of the already worst-off. This is in line with Henry Shue who argues that "(…) whatever justice may positively require, it does not permit that poor nations be told to sell *their* blankets in order that rich nations may keep *their* jewellery" (Shue, 1992, p. 397, italics in original).

Conversely, if it turns out that a concept has the potential of limiting climate change effectively while at the same time making progress towards reaching other goods, this concept should be preferred, all things being equal, to a concept which "only" solves the climate crisis.

4.5.3 Political acceptability

In climate policy negotiations equity is usually claimed both for its substantive and instrumental value. Equity is desirable in itself, and it is desirable as it helps realize other desirable objectives, such as achieving a viable compromise and ensuring broad and long-

[52] Crucially, the "difference principle" is lexically subordinated to the principle that everyone should enjoy as much civil liberty as possible so long as others can enjoy similar liberties and the principle of "fair equality of opportunity".

[53] For example Kverndokk (1995) suggests that in order to achieve a more equal welfare distribution other environmental problems could be reduced, the debt crisis solved or development assistance disbursement increased.

term participation in a future climate regime. In this vein, equity is an important contributor to the political acceptability of a given proposal.

To be effective, a policy proposal must be both political acceptable *and* feasible. A proposal may be acceptable to all parties, but infeasible due to its complexity or on account of practical obstacles (Torvanger and Ringius, 2002:224). Conversely, a potentially feasible approach may not necessarily be acceptable. At the international level, agreements are usually adopted by consensus. Under those conditions, every key actor in principle has veto power to oppose a proposal if, for whatever reasons, the proposal is perceived as not acceptable.[54]

The assessment of this criterion is relatively straightforward in case that a country openly supports or rejects a given concept or similar versions thereof. If there is no open statement, the assessment becomes more speculative and even ambiguous to the extent that it is in some cases unclear whether a given country which should accept a concept e.g. for reasons of consistency indeed could accept the concept under any circumstances. A good starting point is provided by the relative burden a concept puts on different countries or groups of countries. As individual parties must ratify the negotiated agreement, national cost considerations will be critical because any proposal which may be perceived as posing unproportional burdens to some countries, while favouring others, risks facing political opposition.[55] It will be assumed that a country that benefits in financial terms will accept a proposal provided that there are no conditionalities attached to those resources which can be assumed to be unacceptable e.g. on the basis of previous statements. If a country does not benefit in financial terms, the questions will be addressed whether there is evidence why this country could accept the proposal for reasons other than immediate material self-interest.

4.5.4 Political feasibility

Compared to the above discussed criteria, it is more complex to delineate the feasibility of a given climate policy proposal. Although feasibility can be considered with regard to several dimensions, the assessment will be framed in terms of political feasibility. As factors are strongly interrelated, economic and technical aspects are inevitably included as well.[56]

[54] Skodvin (2007) points out that in this situation, policies have to meet the requirement of Pareto improvement in order to be politically acceptable.

[55] Keohane et al. (1998) argue that distributional considerations may even be more important than aggregate cost effectiveness when policymakers evaluate an instrument.

[56] The relationship between technical, economic and political feasibility can be described as follows. While technical feasibility refers to the extent to which the required technology to implement a particular solution is actually available; this very availability depends upon the amount of funds mobilized for research and development (R&D). A critical factor is the maximum annual rate of emission reductions (Kallbekken and Rive, 2006). This rate depends on not only on deployment and diffusion of new technologies but also on the inertia of the socio-economic system especially with a view to the replacement of inefficient capital stock and questions of individuals` lifestyles. Whether or not it comes to increased investment in R&D, premature retirement of existing capital investments or changes in individual consumption patterns can in principle be influenced through respective policies.

As indicated above, the criterion of political acceptability is intrinsically related to the criteria of political feasibility which refers to the extent to which policies can be negotiated and implemented successfully (Skodvin, 2007).[57] Analogous to the political acceptability of a particular proposal for a future climate regime, its negotiability is constrained by the unanimity rules usually demanded at the international level. Whether a proposal can be negotiated depends on a number of factors of which the following four are considered crucial.

a) Simplicity

Making decisions among 191 Parties under conditions of unanimity is a time consuming undertaking. Thus, it should be expected that a proposal would be advantageous if it is relatively simple and requires only a low number of separate decisions by international bodies.

b) Moderate requirements on data and tools

Quantitative data and empirical indicators should be reliable and verifiable as well as comparable and widely available (Torwanger and Ringius, 2000). If data such as internationally approved indicators and statistics is not available, there should be the opportunity that it can be collected and verified in the future. Often proposals use empirical indicators and quantitative data as input for calculating individual mitigation obligations. It should be expected that calculation methods that are relatively simple to make operational would be superior to those that are more complex.

c) Compatibility with the UNFCCC and Kyoto architecture

Despite considerable deficiencies regarding questions of details necessary for their effective implementation, both the Convention and the Kyoto Protocol have been successful in achieving international agreement on a range of issues essential to any future climate regime. Since many developed countries have already made a substantial investment in the Kyoto process including the emissions trading mechanism, a proposal's continuity with that process would be a point in its favour. As time is constrained to negotiate a completely new architecture, it is important for a proposal to benefit from the international negotiations that have taken place to date. Any future regime should be compatible with the existing structure of the Convention and where feasible, build on the gains made through the Kyoto negotiations (Höhne et al., 2003:34).

d) Flexibility, cost-effectiveness, and economic predictability

Apart from the dynamic flexibility which allows for revision and incorporation of new scientific information, flexibility in terms of the location, timing and type of mitigation action is considered as an essential contributor to guarantee the economic effectiveness of a future climate regime. Most economists agree that market-based approaches such as emissions

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Thus, the whole affair has come full circle because whether such a policy can be adopted and implemented effectively is a question of political feasibility.

[57] In evaluations of climate policy proposals, this criterion is also referred to as technical or operational requirements, compare Torwanger et al.(2004); Torvanger and Ringius (2000); and Höhne et al. (2003).

trading and taxes are best to minimize aggregate costs of achieving a given environmental goal (Aldy et al., 2003). These approaches not only provide mitigation flexibility by allowing market participants to seek out and utilize low-cost reduction options but also dynamic flexibility because they have a form that can be scaled up or down, becoming more stringent or lax as circumstances change.

However, from a political standpoint, economic predictability may be as or more important than economic efficiency (Bodansky, 2003). The main problem with absolute targets such as those included in the Kyoto Protocol is that the ease of meeting them depends highly on unpredictable variables such as rates of economic and population growth and of technological change. Options for providing more economic predictability exist such as expressing targets as a function of GDP or caps on the maximum price in an emissions trading system but these may also impair environmental effectiveness. The bottom line is that an approach should be as flexible and predictable as possible while still guaranteeing a maximum degree of environmental effectiveness.

The second dimension of political feasibility deals with implementing a proposal once it has been negotiated and adopted successfully. Factors relevant to implementation include the following:

e) Institutional capacity

Institutional realities will inevitably constrain the implementation of any comprehensive international climate regime. Although international institutions may be important in terms of coordination, most implementation will take place at the national level through national law. Therefore, commitments adopted internationally need to be capable of domestic legal application. Establishing institutions from scratch may turn out to be complex and time consuming. Given rapidly rising emissions and the urgent need to facilitate and coordinate substantial emissions reductions, it should be expected that proposals that are well adapted to existing legal and bureaucratic structures have a high degree of institutional feasibility.[58]

f) Ensuring compliance

In the case where Parties are not living up to their commitments, a climate regime must provide for mechanisms facilitating compliance. Generally, perspectives for enforcing compliance in a world of sovereign states are rather challenging to construct. Along these lines, “hard” enforcement mechanisms such as financial penalties and economic or trade sanctions have been proposed (Gupta et al., 2007). Although these may be effective if only a limited number of economically weak countries fail to comply, it is difficult to imagine how imposing trade sanctions could be an option if several especially, economically powerful

[58] It may also be important to integrate the future climate regime in the portfolio of other international institutions, e.g. Bretton Woods. The creation of a web of institutions tackling climate change and related issues would have the advantage of enhancing collective strength as well as preventing that any shortcoming in one institution leads to the collapse of the whole system (Gupta et al., 2007:791).

countries have no chance of meeting a target, as it is currently the case with the Kyoto commitments.
In this context, it seems reasonable to expect that a proposal ideally provides sufficient incentives for compliance without resort to the questionable deterrent effect of “hard” enforcement mechanisms.

4.5.5 Trade-offs and inter-linkages

It is important to emphasize that the above outlined criteria are very much inter-linked in the sense that even potential conflicts between them exist. For example, an environmental ambitious concept may have reduced political acceptability or feasibility. A highly equitable and acceptable concept which accommodates several country specific circumstances as well as different equity principles may not yield the desired environmental benefits and may turn out to be practically unfeasible. It is quite likely that coming to an agreement on a future climate regime will involve challenging trade-offs between values which may all appear critical such as environmental integrity, cost-effectiveness or fairness. In cases where everything valuable is not attainable together, Shue (1995) argues that the choice of the values and interests which the international order will respect and those which it will sacrifice should at least be made consciously. A proposal which satisfies all of the above criteria to their full extent may not be available. Reaching a comprehensive agreement entails balancing the trade-offs among various factors in a way that is acceptable to as many parties as possible.

5. Comparison between Contraction & Convergence and Greenhouse Development Rights

In line with the overall purpose of this thesis, this chapter endeavours to carry out a comprehensive comparison between "Contraction and Convergence" (C&C) and "Greenhouse Development Rights" (GDRs), two salient proposals for a future climate regime. Generally, it has to be kept in mind that the subsequent comparison is a subjective task to the extent that it involves estimating ex ante how well a proposal is likely to perform.

Further, it has to be clarified that both concepts have different levels of precision and ambition. More specifically, the authors of the GDRs approach explicitly focus on the individual and contend that the climate crisis can only be tackled in combination with the development issue and that the GDRs approach has the potential to accommodate both issues at a single blow. The authors of C&C primarily focus on nations and do not maintain to solve the development issue as well.[59] Therefore, the assessment of the GDRs approach will be more extensive because it has to be clarified to what extent it lives up to what it promises.

This chapter proceeds as follows. First, each concept will be described in full detail, including any assumptions. Second, each concept as described and intended will be formally evaluated with respect to the criteria outlined in Chapter 4. Finally, the concepts will be directly compared resulting in an appraisal of the most preferable approach with a view to "solving" the climate issue.

5.1 Contraction and Convergence

Contraction and Convergence (C&C) is the most well-known of the equal per-capita rights or egalitarian approaches which are debated as potential post-Kyoto regimes under the UNFCCC.[60] Indeed, in political and research circles, equal per-capita approaches have virtually become synonymous with the "Contraction and Convergence" approach. C&C was first proposed in 1990 by the nongovernmental Global Commons Institute (GCI) and its founder and principal, Aubrey Meyer (Meyer, 2000).[61] The following will not go into details of

[59] More explicitly, the authors of C&C point out that they developed this approach "to create a sustainable basis on which to resolve (…) [the] inequity", due to "the worsening asymmetry, or "Expansion and Divergence" [E&D] of global economic development" (GCI, 2009a).

[60] The idea of equal per capita entitlements is older than the Climate Convention. Baumert et al (2002) cite Bertram et al. (1989); Grubb (1989); Epstein and Gupta (1990); Smith and Ahuja (1990); Smith et al. (1990); Agarwal and Narain (1991); and Bertram (1992), as some of the progenitors of the idea.

[61] Further details on the Contraction & Convergence approach can be found at the web site of the Global Commons Institute; http://www.gci.org.uk/

possible variations of the "C&C" approach,[62] but limit itself to the basic concept promoted by the GCI, as it is described in "GCI Briefing: "CONTRACTION & CONVERGENCE" (GCI, 2009a).

5.1.1 Description

At the outset, it has to be noted that "Contraction and Convergence" is not a prescription per se, but rather a way of demonstrating how a global prescription could be negotiated and organised (Meyer, 1999:305). Implementing the concept of C&C in its original form would involve two steps. As a first step, countries would need to specify Article 2 of the UNFCCC in terms of a long-term global stabilisation level for atmospheric GHG concentrations ("Contraction"). Effectively this would create a global "budget" of GHG emissions which could be adjusted in the future to respond to improved scientific information. As a second step, countries would need to stipulate a "convergence date", at which time the emissions allocated to each country should complete a linear transition from status quo to equal per-capita entitlements ("Convergence"). During the transition period, a yearly global carbon budget is devised which "contracts" gradually over time whereby the per-capita entitlements of the developed countries decrease while those of most developing countries increase. After reaching convergence, all countries would contract their emission entitlements equally until the requisite global emissions budget is reached. Figure 1 provides an instructive example for an emissions contraction budget corresponding to 450 ppm CO_2 converging on shares equal to population by 2030.

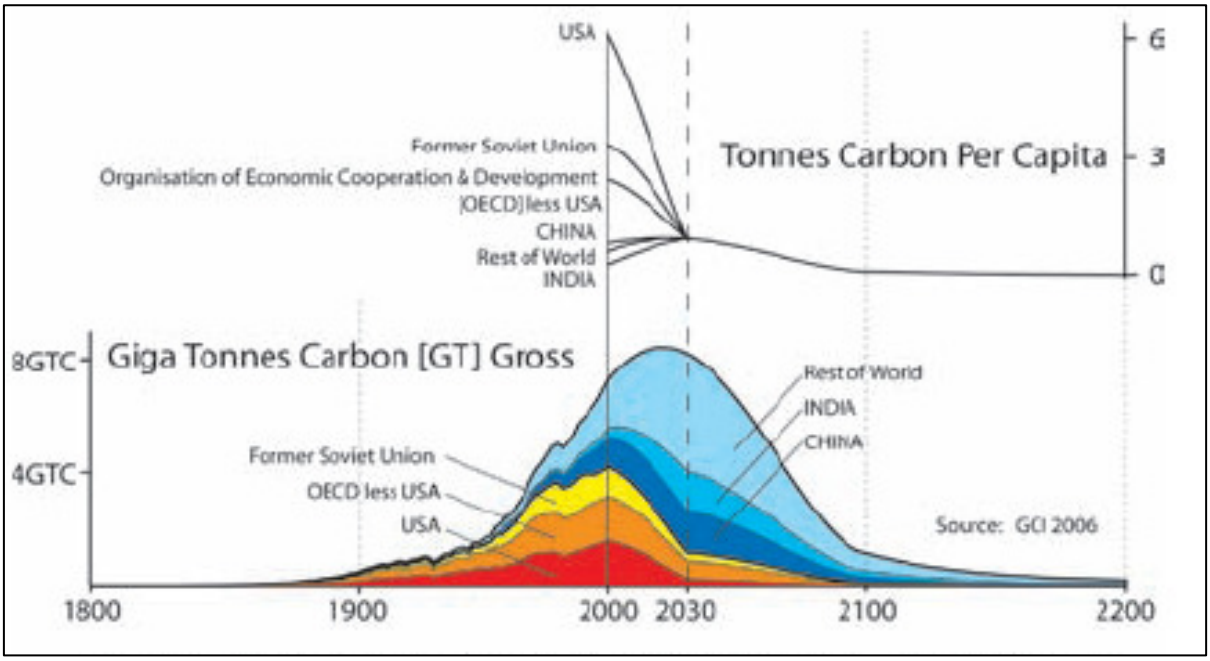

Figure 1: "Convergence" of per-capita emissions entitlements by 2030 and "Contraction" of gross emissions for 450 ppm CO_2 (Source: GCI, 2008).

[62] Most notably is the "Common but Differentiated Convergence" approach developed by Höhne et al. (2005).

As promoted by the GCI, the C&C approach intents all parties to participate with quantified emissions targets under the global cap after the first commitment period of the Kyoto Protocol. It is suggested that negotiations principally should take place between regions of the world such as the European Union, the Africa Union, the US, etc., with further negotiations held within regions to determine the precise amount of national emission budgets (akin to the EU bubble in the Kyoto Protocol). A further integral feature of the concept of C&C is its assumption of universal inter-regional, international and intranational emissions trading allowing an adjustment between those states or other legal entities that have surplus permits to sell and those without enough. To make the proposal complete, the GCI recommends that a "cut-off" year is agreed which defines the population basis for allocating the emission entitlements.

5.1.2 Assessment with regard to the predefined criteria

5.1.2.1 Environmental effectiveness

Although the GCI suggests an ultimate target no higher than 450 ppm CO_2-eq, C&C is principally neutral regarding the specific long-term target to be agreed.

As promoted by the GCI, the C&C approach provides for reviews at regular intervals to account for improved scientific understanding. Especially in the case that first a less ambitious target was chosen, those periodic adjustments of the rates of contraction and convergence would be essential to safeguard environmental effectiveness. Despite the additional financial uncertainty such a reviewing provision creates, the general concept agreed at the outset would be kept. Countries would have a general long-term certainty over the conditions under which they would have to participate and could plan accordingly.

Deriving the global emission path from a long-term environmental goal and sharing the resulting emissions budged among countries according to well-defined criteria has two decisive advantages. First, when countries commit to a specified emissions pathway, periodic renegotiations of emissions targets in the sense of the Kyoto Protocol's "commitment periods" become redundant. Generally, repeated negotiations expose a country to incentives that bias its performance in one period to enhance its negotiating position in the following period (Kolstad, 2005).[63] This creates incentives for poor performance which are detrimental for environmental effectiveness. Second, as C&C allocates emissions allowances with a view to equalizing per capita entitlements, it sidesteps to a certain extend the difficult issue of business as usual forecasting. However, C&C does not entirely avoid the morass of business as usual (Baumert and Kete, 2002:20). At least before joining a C&C agreement, individual countries would be concerned about assessing the reduction efforts required by a particular target as well as associated costs and benefits.

[63] This dynamic incentive problem is also known as the "ratchet effect" (Kolstad, 2005).

Another key feature of the C&C approach affecting environmental effectiveness is its strong reliance upon emissions trading. Principally, C&C is conceptually flexible to incorporate any GHG from any source into the trading scheme (Baer and Athanasiou, 2007). Ideally, to maximize environmental effectiveness, the emissions pathway would be specified in terms of CO_2-eq emissions. From a theoretical point of view, a comprehensive emissions trading scheme has important advantages but potential disadvantages regarding its practical implementation should not be underestimated. Theoretically, emission trading provides a relatively high degree of environmental certainty. Based on the global target ("cap") a fixed volume of allowances is issued which corresponds to the quantity of emissions approved to reach the target. Ideally, emissions trading schemes ensure that all those emissions that would be emitted beyond the fixed volume of allowed emissions are reduced or avoided. However, any trading failure would be to the detriment of the environmental effectiveness of the regime. Amongst others, complete monitoring and penalties for excess emissions set at levels substantially higher than the prevailing permit price are considered critical elements to create appropriate incentives for compliance (Gupta et al., 2007). However, issues of concern related to trading in general are not solely a challenge for C&C. This also holds for concerns that potential excess emissions allowances ("hot air") could undermine the environmental integrity of the trading system. The significance of "hot air" will be discussed more detailed under the heading of "political acceptability" (see 5.1.2.3).

Given the factual time constraint to initiate emissions reductions as soon as possible, the conceptual simplicity of the C&C approach could be a decisive advantage. There are two reasons why it can be expected that negotiating a global climate regime based on C&C can be managed within *relatively* little time. First, it is a simple and clear concept which decision makers at the international as well as at the domestic level can be expected to grasp without further training. Second, as C&C in its simplest version only requires agreement on the level of stabilization and the date of convergence it can be expected to be negotiable within *comparatively* little time. Even if C&C was negotiated successfully, it would still need to be urgently implemented. All things being equal, it can be expected that a rather simple system will be easier and faster to integrate into the legal and administrative system of the participating countries. Under the heading of "political feasibility" this issue is followed up (see 5.1.2.4).

5.1.2.2 Equity

A key characteristic of the C&C approach is that it defines the problem of controlling global GHG emissions as a resource sharing problem. More specifically, C&C considers the limited assimilative capacity of the Earth's atmosphere with regard to GHGs as a global commons to which each human being, in principle, is equally entitled because "if the commons belong to anybody, it belongs to everybody" (Meyer, 1999:297).

However, egalitarian approaches, and C&C in particular, have been criticised on the grounds that egalitarian principles are not generally applied to the sharing of environmental resources (see e.g. Ashton and Wang, 2003:69; Heyward, 2007:521). Therefore, it is crucial to start by considering whether the atmospheric sink for GHGs is or should be conceptualised as a global commons (or "global common property resource"). As a second step, it will be discussed whether it is equitable to distribute entitlements to use the atmospheric sink for GHGs on a per-capita basis.

5.1.2.2.1 Is the atmospheric sink for GHGs a global commons?

Generally, the term "commons" denotes a social arrangement under which property or resources are held in common (Vogler, 2001). It is characterized by socially regulated access and exploitation through institutionalised co-operation between users. While at a localised level there are many historical examples of long standing successful and sustainable commons management through common property resource (CPR) regimes, experience with "global commons" is rather limited (Ostrom, 1990; cited in Vogler, 2001). Global commons are nonappropriated (not necessarily nonappropriatable) areas and resources lying beyond the territorial jurisdiction of any single country comprising, amongst others, Antarctica, the oceans, seabed resources, the moon, and "outer space" (McNicoll, 1999).[64]

There are important differences to open access resources which are owned by no one and therefore prone to overexploitation and degradation. Despite the title, Garrett Hardin's "The Tragedy of the Commons", a 1968 seminal *Science* article, describes the problems of an unregulated "open access" regime. To remedy this situation, Hardin does not consider the option of self-management by a community but recommends either privatisation or the imposition of some form of central authority to enforce restrictions on users and to provide a public good.

To the extent that the provisions for Annex B countries under the Kyoto Protocol may be disregarded, the atmospheric sink for GHGs can still be described as one of de facto open access where every person can dispose of GHG emissions at own discretion. Although with a view to the ultimate stabilization objective, the UNFCCC implicitly limits the absolute amount of GHGs to be released into the atmosphere, it does not provide a prescription whether at all, (let alone how exactly) the respective rights to use a certain amount of the atmospheric sink for GHGs should be distributed. However, not least the establishment of a global emissions trading scheme is contingent on having first quantified and allocated the allowances to emit a certain amount of GHGs within a certain time frame.

[64] Some of the global commons have formally been declared by the UN to be part of the "common heritage of mankind" or "res communis humanitatis" (McNicoll, 1999).

As (long as) there is no global government to regulate access and enforce restrictions, the atmospheric sink for GHGs could either be privatized or managed as a global common property resource.

In case of a privatization, there would be scope to grant free property rights on the basis of past usage and custom along the times of a "first in time, first in right" rule analogous to squatter's rights on an open land frontier. This would entail the application of the "grandfathering rule", that is, emissions allowances are derived from historic emission levels. Indeed, irrespective of some minor modifications, this is the preferred solution by already existing trading schemes which are rather regional in scope, such as the European Union Emission Trading Scheme (EU ETS). However, at a global level, both moral and practical reasons indicate that such an approach is neither equitable nor feasible. From a moral point of view, an allocation based on status quo levels can hardly be seen equitable because this would discriminate all those countries that have historically emitted far less than industrialized countries. Such an allocation would have the counter intuitive consequence that poor countries, in order to develop, would have to buy emissions allowances from rich countries, in particular from the US. Grubb et al. (1992) argue that such an approach would imply that past pollution would be rewarded by the right to continue indefinitely. At a rather practical level it has to be asked whether the atmospheric sink for GHGs has actually the respective characteristics for being privatized. Generally, a resource can only be privatized if it can be appropriated effectively (McNicoll, 1999). There would be no use in owning a private good if it was extremely costly or even impossible to exclude other potential beneficiaries from using it. While the airspace up to the point at which the legal regime of outer space begins is part of the territorial sovereignty of a given state, the atmosphere extends over the whole planet. All gases, once released into the atmosphere tend to mix homogeneously. Ott (2008) points out that it is not adequate to zone the atmosphere (as zoning oceans) or to model it as distinct "bubbles". Practically, the atmosphere can be accessed by every person and from every place in the world. Thus, in some respects, it constitutes the ultimate "public good", that is to say, if resources are expended on improving air quality, it is impossible to exclude people from enjoying the benefits (Vogler, 2001). McNicoll (1999:429) points out that "(…) an incidental consequence of the entrenchment of a world of sovereign states in the postcolonial era has been the effective precluding of unilateral privatizations of global common[s] (…). Even Antarctica, the subject of some latter-day territorial claims, has reacquired quasi-commons status under the 1959 Antarctica Treaty, with the claims held in abeyance." As today's prospects for the privatization of global resources beyond any state's sovereignty are in general rather dim and as long as there is no world government, the only remaining possibility to manage the atmospheric sink for GHGs is a global common property regime.

5.1.2.2.2 How equitable are equal per capita entitlements?

If it is accepted that the atmosphere and its property of being a sink for GHGs is a global commons belonging to whole humanity, the simplest way to proceed is to accord each human being an equal entitlement to consume a uniform proportion of the GHG emissions the global atmosphere can cope with. Although within the C&C concept, those entitlements should be traded, it is important to notice that this trading does not establish individual property rights. Ott and Sachs (2002:171) point out that the permit price is paid not for owning a piece of the atmosphere in perpetuity, but for obtaining a user right for a certain predetermined period of time.

Generally, applying the egalitarian principle for sharing user rights to a global commons is in line with the presumption in favour of equality and therefore with the starting point of most traditional theories of distributive justice. Under this presumption the burden of proof lies on those who argue for an unequal distribution of emission entitlements (Kverndokk, 1995). Accordingly, a deviation from an equal allocation could only be justified by moral arguments which could find the approval of all affected.

It has already been mentioned that negative contributions to a common goal is a recognized criterion to justify claims to an unequal allocation (see 4.4.3.1.2). According to this rationale the cumulative historical emissions of a given country that still remain in the atmosphere has to be seen as its unrequited "carbon or natural debt".[65] However, there are basically two arguments against applying the polluter pays principle *historically* (Smith, 1996). The first argument is of rather practical nature and refers, amongst others, to incomplete information on historic emissions of all greenhouse gases, their sinks, rates of atmospheric transformation as well as shifting political boundaries. Besides, as argued by Grubb et al. (1992), emissions of CO_2 in the past have created positive externalities and through trade respective benefits have often been spread beyond the source country. The political argument highlights the fact that past generations acted out of ignorance and that thus their descendants should not be penalized.[66] However, limited liability because of ignorance is only granted up to the date when the agent could have reasonably been expected to know about what it is he or she is doing or bringing about (see e.g. Müller et al., 2007). Moreover, it can be argued that people currently living in industrialized countries still directly benefit from their ancestors' actions and that it is thus appropriate to expect them to accept the corresponding liabilities (Bhaskar, 1995).

[65] Smith (1996:427) defines "natural debt" as the amount of greenhouse gases remaining in the atmosphere in any one year due to a nation's emissions. It is build up by borrowing assimilative capacity from the future, through the release of greenhouse gases faster than they can be naturally removed.

[66] This argument is related to Aristotle's conception of responsibility. Accordingly, moral responsibility ("blame") attaches lonely to voluntary actions, i.e. actions done (1) not under compulsion, and (2) with the knowledge of the circumstances. See also Aristotle (1998: III.1-5, 1110a -1111b4).

By referring to the criterion of need and ability, it has been argued that equal per capita emissions entitlements neither account for the social quality of emissions that is, distinguish between “luxury” and “survival” emissions (Shue, 1993) nor for differences in national circumstances such as geographical/climatic conditions, population density or the structure of economy and energy supply, each of which contributes significantly to variations of emissions among countries. Deviations based on “reasonable needs” can well be justified on ethical grounds and the inclusion of respective adjustment factors has already been proposed. As promoted by the GCI, C&C does not account for country-specific needs and circumstances per se, but it is suggested that global negotiations at the UNFCCC should principally take place among regions of the world, leaving negotiations between countries primarily within their respective regions.

To the extent that countries of a given region already actively cooperate, it can be assumed that the specific needs and special circumstances of individual countries will be recognized respectively. In case of the European Union, finding agreement on an internal effort sharing system with special provisions for Member States with lower per-capita incomes worked relatively well. Beyond the European Union, it is a matter of fact that comprehensive cooperation between countries of a given region is the exception rather than the rule. Nevertheless, I argue that, at least from a precautionary perspective, the relationships between neighbouring countries irrespective of their state of development should be improved for limiting human suffering and managing the challenges ahead. This is because even under relatively favourable climatic scenarios, it can be assumed that in a few decades part of the world’s nations would be in a permanent state of emergency. As peoples in the Middle East are already fighting under current conditions, increased water-stress will most likely exacerbate this conflict unless relationships are progressively improved. Moreover, it is not certain whether hostile peoples will warn each other of an imminent danger or help each other in case of emergency. It is projected that in a few decades most of the oil and gas will be used up and whether appropriate technological solutions are found and sufficiently deployed is uncertain. If in addition “run away” feedbacks are triggered with multi-meter sea level rise etc., there is a certain danger that the whole Western civilization will collapse, with developed countries being unable to mediate between conflicting parties and to provide humanitarian aid to the same extent as today. The point here is not to deny the imperative of global or North-South cooperation; it is only to stress that at least with a view to worst case scenarios there should be an extra focus on developing solidarity between countries of specific geographical regions. A natural disaster becomes an even worse human disaster if people deprived of their homes, their livelihood, their friends, and loved family members have no place to go.

5.1.2.2.3 Other equity issues

Two more equity issues must be considered. An important point disregarded so far concerns the fact that the way C&C is designed, it does not start off with equal per capita allocations but with a transition period of unspecified length that begins with status quo ("grandfathered") per-capita entitlements. Obviously, the precise date by which the transition towards convergence will be completed is an important equity lever. Whatever the precise date nations agreed in the end, it would be legitimate to the extent that it results from an open discourse as defined above.

From an ethical perspective, a transition period and therefore the deviation from an immediate equal per-capita allocation it entails can be justified on the basis of the principle of need. Presuming that nations agree to a "reasonably low" stabilization level and that no revolutionary technology is found within in the near future, trading in emissions rights will not be sufficient to continue high-emitting lifestyles and the maintenance of the corresponding infrastructure. It must be assumed that changing "their" infrastructure and the lifestyles of "their" citizens will be an *enormous* challenge for high emitting countries.

Let's start with lifestyles. Virtually every human action causes GHG emissions meaning that high emitting individuals will have to organize a considerable part of their daily routine in a completely different way. Moreover, they will have to change dreams and plans they already made for the future because some options may simply not be realizable any more. The challenge for high-emitting countries right now is presuming they are liberal, they have no perfect control over the way their citizens organize their life. In democratic states, rigorous laws can only be enacted if a considerable proportion of the population is already persuaded that abandoning an emission intensive action is the right thing to do. Another complication is that, in principle, many energy demanding activities such as eating meat, driving cars, flying, etc. do not have to be forbidden completely but only reduced drastically. Even if economic instruments such as taxes make high energy activities more expensive, it is not certain whether people will change their behaviour because either they do not want to substitute or because they have their individual reasons why they cannot substitute right now. This is most obvious with a view to transportation need. For example, imagine a high emitting family living isolated in the American country side. They are used to driving long distances to reach their work place, to take their children to school, to go shopping, to see a doctor, to see their friends, etc. Even if right now petrol prices were increased considerably, the family would still *need* to drive long distances because there is simply no work, no school, no doctor, no shopping centre, and maybe even no friend in their neighbourhood. If there was an immediate transition to low emissions entitlements the survival of this family may not be threatened but their level of development, let alone their "well-being" would be significantly

reduced. The government may initiate information campaigns to influence individuals' behaviour, but this influence is no control.

With a view to the presently existing infrastructure in high emitting countries, it can be expected that a considerable part of it will be totally useless in a decarbonized world. If anything seems to be highly certain from today's perspective then in the future transportation will no longer be available to the extent that it is today. For what reason do people need a shopping mall in the middle of nowhere, if people cannot get there and if the goods they would buy could not be brought there? As it is the logic of globalization that things are made where it is cheapest, many high-emitting high-price countries no longer have the infrastructure to produce "low-tech" items as food, clothes, shoes, furniture, etc. to the extend demanded by their citizens. It can be expected that if there was a sudden transition highly individualized and specialized countries would be in high trouble to maintain the basic supply of their citizens.

As the majority of people in developing countries still lead a low carbon low impact lifestyle, they do not need such a transition period because they do not need to fundamentally change every aspect of their life. Based on those considerations, I argue a transition period per se is justified from an ethical perspective.[67]

The other equity issue concerns the "population question". As promoted by the GCI a population base-year should be agreed. This would have the implication that every additional person born after this year would not be considered when it comes to distribute emissions entitlements. From an ethical perspective, such a feature is critical because, obviously, the year of birth is beyond human control and therefore a morally arbitrary factor. According to Kverndokk (1995) morally arbitrary factors are unacceptable as a standard for an unequal distribution unless equality in other or more important fields is advanced. To show this will be difficult because every human being, regardless of age and culture needs to cause emissions to survive. Anyway, it would be practically impossible to exclude all persons born after a certain date because the properties of the atmospheric sink are such that nobody can be excluded from using it.

5.1.2.3 Political Acceptability

When assessing the acceptability of C&C it has to be kept in mind that C&C per se only specifies a certain procedure. It neither prescribes the convergence date nor the contraction budget. For example, the GCI suggests a convergence year between 2020 and 2050 and a stabilization target no higher than 450 ppm CO_2-eq, but principally different parameters can be selected as well. Basically, slower convergence favours higher per capita emitters, and

[67] Similarly, Ott and Sachs (2000) argue that industrialized countries may be entitled to a "bonus" for a first mover disadvantage.

vice versa.[68] As well, it holds that the more stringent the stabilization target, the higher the permit price required to achieve it, and vicing versa (Newell and Hall, 2009). Therefore, it is not clear whether a government that officially endorses C&C would accept a regime based on C&C under any convergence date and any contraction budget.

In the following, the extent to which the per-capita emissions of a country or group of countries deviate from the convergence level is taken as a starting point for assessing whether a given country will support C&C.

5.1.2.3.1 Acceptability of C&C for developing country Parties

Basically, all those countries with currently very low per-capita emissions levels would be allocated more emission allowances than necessary to cover their emissions ("hot air"). As trading those emissions allowances would result in a resource flow, it can be taken for granted that that those countries will support C&C. Indeed, India and African countries which happen to be the major beneficiaries of a C&C regime are also its major proponents.[69]

A critical point, however, is that current per capita emissions differ greatly not only between developed and developing countries but also among developing countries. The implication is that already under stabilization targets of 450 or 550 ppm CO_2 many developing countries would have to decrease emissions below their business as usual path (Höhne et al., 2003).
A recent study by Höhne and Moltmann (2008) finds that for convergence by 2050 in combination with a stabilisation target of about 450 ppm CO_2-eq, a convergence level of about 2 t CO_2-eq per capita is necessary. If such C&C regime was adopted, average per-capita emissions in 2020 would have to be around 4 t CO_2-eq. This is below the current world average which was 4.5 tonnes for CO_2 alone in 2004 (UNDP, 2007). Höhne and Moltmann point out that especially "those developing countries above or close to the average (e.g. Argentina, Brazil, Venezuela, Mexico, South Africa, South Korea, Namibia, Thailand, China) will soon (e.g. 2020) be constrained and will not receive excess allowances."
It would lead to far to discuss whether each of those developing nations has a reason to participate in a C&C regime, beyond the prospects of being allocated vast amounts of "hot air". Although it would be optimal with a view to environmental effectiveness to reach universal participation, C&C would also be viable if say, a country such as Thailand does not participate from the very beginning. Nevertheless, this logic does not hold for China, because

[68] See Den Elzen et al. (2008) for an assessment of regional cost estimates under the C&C approach for achieving stabilisation at 450 and 550 ppm CO_2-eq respectively. This paper also includes an analysis of the impact of different convergence years on regional costs.
[69] The Indian government was one of the first to officially adopt the equal per-capita entitlements approach; at COP 1 in 1995, calling for "implementing a program for convergence at equitable and sustainable par values for consumption of fossil fuel on a per capita basis." This was followed by the Africa Group of Nations, which presented the C&C proposal in 1997, calling for "reducing the emissions of Annex I" and ensuring a "controlled growth of future emissions of non-Annex I" while being guided by the overall principle objective of "per capita emission rights" (see GCI, 2009b).

a treaty not acceptable to China, given its growing emissions, seems to have little chance of protecting the climate system.

It has already been argued that it would be desirable to negotiate the emissions targets of individual nations among their geographical regions. Although (Höhne et al., 2007: iv) list this option under the heading of "weaknesses of C&C", I argue that redistributing allowances to accommodate national concerns between countries within one region can be seen as the most effective way to maximize the acceptability of an environmentally ambitious regime.

In the case of China, Harris (2005: 79) points out that from the beginning of the international climate negotiations China has successfully built strong solidarity with other developing countries from which it enjoys presently wide support. He highlights that in addition to building solidarity with developing countries, China wishes to enhance its relations with developed countries and elevate its prestige in the international community by creating the "image of a responsible major power" through the climate change issue.
I argue that if China is currently cooperating with other developing countries including its South East Asian "neighbours" such as the Philippines to elaborate common positions (see e.g. Harris, 2003:27), it may be expected that the thereby created solidarity is sufficient for East Asian countries to distribute a common emission target in a way that is acceptable for every nation, including China.[70] The point here is that the low-emitting countries of the region have no power to influence the international negotiations in the same way as China. So if a C&C regime became implemented in part because of Chinese concessions, it can be assumed that countries such as Indonesia and the Philippines which will then find themselves in a situation where they are entitled to financial resources beyond anything they have received so far from the international community will be happy to forgo part of their "hot air" either because of simple gratitude or because they already sense that in a world with a changing climate one cannot have enough friends.
Davidson et al. (2003) report in the case of Africa a growing understanding of the importance of regional cooperation for managing the challenges Africa is facing. This is reflected in the adoption of the New Partnership for Africa's Development (NEPAD) in 2001. A large and growing force of opinions maintains that regional co-operation, with a view to eventual integration, is the optimal approach to future development in Africa (see e.g. UNEP, 2003). Davidson et al. see the enormous opportunities of a regional emphasis especially with a view to the transport sector, electricity provision and housing. The point here is that if African countries have already started to think about cooperation in those areas, they may be able to distribute the vast amount of excess emissions allowances they would receive under a C&C

[70] At Cop 3 in 1997 China's state counsellor Dr Song Jian expressed China's position as follows: "When we ask the opinions of people from all circles, many people, in particular the scientists, think the emissions control standard should be formulated on a per capita basis. According to the UN Charter, everybody is born equal, and has inalienable rights to enjoy modern technological civilization." Quoted by GCI (2008).

regime in a way that is also acceptable for higher emitting countries, foremost South Africa, but also e.g. Algeria, Namibia, and Egypt.

In the case of Latin America, Brazil, Mexico, and Argentina have recently made proposals explicitly based on C&C at COP 14 in Poznan.[71] Although the level of effort those countries will have to achieve critically depends on the chosen stabilization target, those statements indicate a general openness to support a regime based on C&C.

On the basis of narrowly defined self-interest in terms of excess emissions allowances and official statements, it can be expected that most developing countries would accept a C&C regime with a moderate stabilization target. On the above evidence, there is also reason to assume that even an environmentally ambitious C&C regime may be acceptable for some higher emitting developing countries in the context of regional cooperation.

5.1.2.3.2 Acceptability of C&C for developed country Parties

Despite the vast financial transfers developed countries would have to provide under a climate regime based on C&C, some developed nations have already officially indicated their support. These are all members of the European Union, foremost the UK, Germany, and France.[72] Aslam (2002: 203) points out that those countries do come out as relative beneficiaries due to their relatively low per capita emissions (about half the per-capita emissions of the United States; see Table 2). The same logic holds for Japan who has advocated in its proposals at various COP meetings long term convergence towards equal per-capita entitlements as one of the two indicator options to choose from (Ringius, 2000). Although it can be argued that, for reasons of consistency, the European Union should accept any C&C regime, it must be recalled that already the EU target of limiting global warming to 2°C is inconsistent with the thereby proposed limit of 550 ppm CO_2

With regard to high emitting developed countries that would carry the brunt of the wealth transfer and which have so far made no official statements regarding C&C, the assessment of the potential acceptability of C&C is more speculative. In both Australia and the United States, recent national elections have fundamentally changed the political landscape. Australia's ratification of the Kyoto Protocol in December 2007 indicates a general openness to climate cooperation, at least at the political level. In a recent report to the Australian government, C&C has been discussed favourably (Garnaut, 2008).

In case of the United States, the point can be made that if Barack Obama has been elected as President, it may be expected that his voters should not be fundamentally opposed to the

[71] Brazil: http://www.businessgreen.com/business-green/news/2231998/emerging-giants-small-islands
Mexico: http://www.gci.org.uk/briefings/Mexico_High_Level_Segment_Poznan.pdf
Argentina: www.ambiente.gov.ar/archivos/web/UCC/File/sep08_AWG-LCA_Submission.pdf

[72] See for example Royal Commission on Environmental Pollution (RCEP, 2000), the German Advisory Council on Global Change (Grassl et al., 2003), and the EU Parliament (2005).

ideas for which he stands such as human rights and equality among people of different races. According to this logic, it can be assumed that a considerable portion of the American citizens should accept the idea behind Contraction and Convergence that is the equality of all human beings.[73] However, given the enormous amount of financial transfers as well as the radical changes needed, it is not clear whether the US, as a whole, could accept an agreement based on a very stringent contraction budget.

The fact that economies in transition have so far shown themselves cooperative can be explained by the "hot air" they had been allocated under the Kyoto Protocol. Under a climate regime based on C&C, this incentive would not be given. With a view to their relatively high per capita emissions but relatively low financial capacity and given the current political tensions e.g. between Russia and the Ukraine or Georgia, a regional approach would be challenging, as well. Nevertheless, the ability to participate in emissions trading may provide an incentive to participate in a global climate regime e.g. Depledge (2002) sees this as the main motivation for Kazakhstan's bid to accede Annex I in 1999.

Before closing, it is worth addressing the concern that per capita allocations would reward population growth and that giving such an incentive would not be acceptable for developed countries (see e.g. Grubb et al., 1992; Kverndokk, 1995).[74] Therefore, entitlements should be allocated based on the population numbers of a fixed historical date. Grubb et al. (1992: 319) point out that the use of a fix population base year "could also reduce the scale of implied resource transfers – together with the associated political objections in major industrialized countries – given the greater population growth rates in most developing countries." However, whether a population base year would enhance the acceptability to *all* developed countries must be doubted. In a report to the Australian government (Garnaut, 2008:30), it is argued that a population base year would be inequitable for those developed countries with high levels of population growth due to immigration such as Australia and Canada.[75]

[73] Another reason why the "idea" behind C&C may be acceptable to the US relies on the fact that Contraction and Convergence conforms to the requirements outlined in the 1997 Byrd-Hagel Resolution (Meyer, 2000).

[74] This argument can be easily countered by pointing out that population growth is determined by far more fundamental economic and social determinants (see e.g. Baer and Athanasiou, 2007; Aslam, 2002; Garnaut, 2008).

[75] Garnaut (2008:39) states that "Australia's ongoing population growth means that Australia will find it easier to cut in per capita rather than absolute terms. Population growth considerations are centrally important to equitable distribution of the adjustment burden between Australia and other developed countries."

5.1.2.4 Feasibility

As specified above, under the criteria of feasibility it will first be examined to what extent a climate regime based on C&C can be negotiated and second, to what extent it can be implemented after having been negotiated successfully.

Negotiability

a) Simplicity

It is uncontested that simplicity and transparency is an important advantage of the C&C approach.[76] As already discussed under the heading of environmental effectiveness, C&C has the advantage that in its simplest version, it only requires agreement on two issues globally, the level of stabilization and the date of convergence.

b) Moderate requirements of data and tools

Basically, a regime based on C&C requires data about emissions and population numbers of all nations. With regard to data on GHGs emissions, both Annex I and Non-Annex I Parties have accepted to submit to the UNFCCC Secretariat reports (known as "national communications") on emissions and removals of greenhouse gases (GHGs). However, only Annex I Parties must supplement their national communications with detailed greenhouse gas inventories of anthropogenic emissions by sources and removals by sinks. While Annex I Parties are requested to submit their fifth national communication by the 1st January 2010, by May 2008, 134 out of 150 non-Annex I Parties had submitted their initial national communications and only Mexico, the Republic of Korea and Uruguay have also submitted their second national communication (UNFCCC, 2008).

With a view to population data, an obstacle is that in many developing countries the birth of many children is not officially registered. Moreover, infant mortality poses practical difficulties. In countries such as Sierra Leone, Angola, or Niger every forth child does not survive the age of five (UNDP, 2007). However, given appropriate funding, those obstacles are not insuperable, that is, it should be principally possible to establish respective up-to-date data bases in every country.

c) Compatibility with the UNFCCC and Kyoto architecture

Contraction & Convergence is largely compatible with the guiding principles established by the UNFCCC, especially in that it sets an absolute stabilization target and encourages developed countries to take the lead. If the targets of individual countries are negotiated among regions, C&C would provide a certain leeway to incorporate and consider the particular circumstances of individual countries. The extent to which C&C fulfils the principle that developing country emissions need to grow depends on the agreed stabilization target.

[76] Even Athanasiou and Baer (2007) admit that simplicity is one of the principle virtues of Contraction Con&vergence.

As C&C is explicitly based on emissions trading it is compatible with the reporting and mechanisms established by the Kyoto Protocol. According to Aslam (2002:192) C&C "has the design capacity to carry the Kyoto baggage and does not necessarily demand a revolutionary revamping of the current architecture, but rather a gradual amalgamation toward eventual equal per-capita entitlements."

d) Flexibility, cost-effectiveness, and economic predictability

Given its reliance on global emissions trading, C&C scores well with regard to flexibility in terms of the location, timing and type of mitigation action. According to economic theory full international emissions trading can reach a given environmental target at least cost. Critically, at least cost does not necessarily entail that costs will be low. Indeed, a disadvantage of the trading approach is that, although it provides a high certainty that the environmental target is met, it provides no certainty about the permit price at any point in the future.

Implementabilty

e) Institutional capacity

In order to implement C&C, a global emissions trading system would need to be set up. Currently, national and regional schemes are operating or are under active consideration in the EU, Australia, New Zealand, Japan, Canada, and in a number of US states (AETF, 2009). Critically, those schemes are designed with a view of being theoretically compatible with the EU ETS. Therefore, it can be assumed that under respective political parameters it should at least be *principally* feasible to implement the institutions for a comprehensive carbon trading scheme in all developed countries.

Based on current institutional conditions in developing and even more in least developed countries, prospects for establishing institutions capable of effective monitoring and coordination seem rather challenging.[77] Principally, it may be possible to build upon experiences already made under the CDM mechanisms. However, effectively, this possibility is very limited because so far, 75 percent of all CDM projects have been hosted in four countries only: India, Brazil, China and Mexico (Holm Olsen, 2007). In contrast, Africa, the Middle East, Europe, and Central Asia comprise only 4.3 percent of all CDM projects (UNEP Risø Centre, 2009). Jung (2005) states that in order to establish well-functioning and efficient Designated National Authorities (DNA) as prerequisite for hosting CDM projects, there is a need for expert knowledge inside the government on rules and modalities governing the CDM. Although the continuation of the CDM is not necessary under a C&C regime (Höhne et al., 2007: iv) it can be assumed that those conditions also apply to the establishment of institutions for emissions trading and monitoring. One possible reason why e.g. African

[77] One common view is that economic incentive programmes require fully developed market economies to be effective (IPCC, 2001) which in turn are believed to be dependent on transparency, accountability and participation in political decision-making. However, Ribeiro (2008) points out that there is no proven correlation between democracy and market economy.

countries have been marginalized in the CDM process is that many of them have not even a stable government, let alone adequate expert knowledge on emissions trading. Nevertheless, I argue that the way C&C is designed it *may* help some of those countries to escape their "deadlock". Especially those developing countries with very low per-capita emissions would receive enormous financial resources. As under the C&C concept there are per se no conditionalities attached to those resources, the prospects of receiving them and the improved future living conditions they dangle may help to unite the citizens of nations divided e.g. by ongoing or past civil wars (such as Sierra Leone, Liberia, Zimbabwe, Timor Leste, Sri Lanka, etc.). That is, the prospects of those resources may function as an incentive to conduct reforms necessary to establish the "minimum" institutions required to participate in global emissions trading scheme.[78]

f) Ensuring compliance

As C&C is based on allocating to all countries the amount of emissions they are entitled to produce in order to ensure that the overall stabilization target is met, it can be assumed that all countries of good faith will adapt their "development plans" to the requirement of the overall resource constraint.[79] So far, many countries have failed to meet their targets because of increased economic growth based on business as usual. However, as C&C is not based on BAU, it can be assumed that if countries do not meet their targets they have difficulty to change their economic structure or they have difficulties because of changing national circumstances be they of climatic, social or political character. In any case, it is reasonable to assist these countries because if countries do not assist each other to overcome those obstacles, how should they cooperate in case of emergency?

[78] Probably this process would have to be facilitated by respective development programs that focus on the progressive realization of human rights.

[79] The possibility that countries of bad faith agree to targets which they are not interested to meet is excluded here. Not least in adopting the UNFCCC, countries agreed to cooperate. It is moreover reasonable to insinuate good faith because if countries distrust each other from the beginning cooperation will be even more complicated.

5.2 Greenhouse Development Rights

The Greenhouse Development Rights Framework is a proposal for a comprehensive climate regime which was developed by Paul Baer and Tom Athanasiou (Eco-Equity) in collaboration with Sivan Kartha (Stockholm Environment Institute USA) and with the support of the charity Christian Aid. Paul Baer and Tom Athanasiou are the cofounders and coordinators of EcoEquity, a Californian organization focusing on global environmental justice. Not so long ago, Baer and Athanasiou used to be strong supporters of C&C themselves, campaigning for "a fair, global, second-generation climate treaty based on equal per capita rights to the atmospheric commons" (Athanasiou and Baer, 2002:175). Accordingly, Greenhouse Development Rights (GDRs) is a relatively recent proposal which was first presented as a broad outline at COP 10 in Buenos Aires in 2004. The first full "reference version" was published in 2007 (Baer et al., 2007). The authors highlight that the basic intention of Greenhouse Development Rights is to be a "reference framework". Its purpose is to provide a standard of comparison or a "reality check" against which to gauge the efforts implied by actual proposals. On the one hand the authors do not think that the GDRs will be operationalized as a package any time soon, but on the other hand, they believe that "something like GDRs" will ultimately be necessary to avoid a climate catastrophe (Baer and Athanasiou, 2007).

Unless otherwise noted, the following information on the GDRs approach is drawn from the latest, i.e. the second edition of "The Right to Development in a Climate Constrained World" (Baer et al., 2008) which was published in November 2008 before COP 14 in Posznan.[80]

5.2.1 Description

The GDRs reference framework is explicitly designed as an "emergency mobilization program" i.e. as a response to recent scientific findings which suggest that much more stringent action than previously thought would be required to have a "relatively high" probability of holding global warming below the 2°C temperature threshold. In this context, the objective of GDRs is to secure a viable portion of the scant remaining atmospheric carbon budget for developing countries to enable them to meet and surpass ambitious developing goals. This is realized by ascribing the "right to development" to all individuals regardless of their nationality whose income is below a specified "development threshold". These, by definition, poor individuals are not expected to contribute to the global effort of emission reduction but instead are allowed to make development their first priority. On the other hand, individuals with income above the development threshold are thought of having "arguably" realized their own "right to development" and being responsible and capable of preserving that right for others. More specifically, they face the obligation of sharing the effort of funding the whole emergency program including the costs of curbing the emissions

[80] For changes between the first and second edition see pages 9-11 in Baer et al. (2008).

associated with their own consumption, the costs of bringing everyone below the development threshold up to that level along a sustainable, low-emission pathway, in addition to the cost of adaptation to unavoidable climate change and compensation for climate damages. The precise amount of each well-off individual's "fair share" of the global mitigation and adaptation burden is calculated on the basis of an indicator that combines the principles of responsibility and capacity (RCI). Baer et al. suggest defining capacity as per capita income over $7,500 PPP (which at the same time marks the development threshold). They have selected this value because of its consistency with the income level where poor people begin to enter the lower levels of the global consuming class. For the responsibility component of the RCI, Baer et al. appoint cumulative per capita emissions since 1990, excluding emissions that correspond to consumption below the development threshold.

Although the GDRs framework focuses on individuals and takes explicit account of the unequal distribution of income and emissions within countries, it recognizes the fact that a global climate agreement is ultimately between nations and that in the end the cost of the climate transition will be allocated at a national basis. Accordingly, a model of national income distribution based on the Gini[81] coefficient is used to estimate the aggregated national capacity of a given country. This is defined as the sum of all individual income of the inhabitants of a country in excess of the development threshold (see figure 2). In a similar way, the aggregated national responsibility is defined as cumulative emissions since 1990 excluding emissions that correspond to consumption below the development threshold.

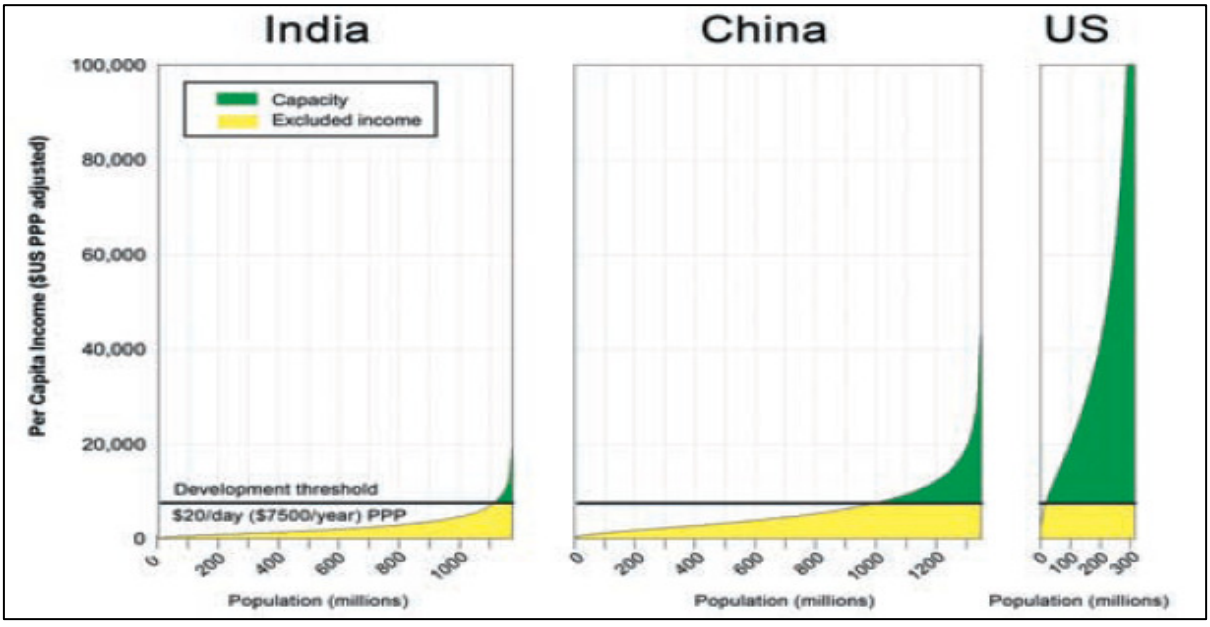

Figure 2: Distribution of income within India, China, and the US. Capacity is defined as income above the $20 per person per day PPP development threshold (Baer et al., 2008:50).

[81] Corrado Gini (1884-1965), Italian statistician and demographer who developed the theory of dispersion and the concentration ratio which is frequently applied to assess equity.

Operationalizing GDRs

Although Baer et al. stress that the mitigation side of GDRs can in principle be implemented in several alternative ways,[82] the following assessment will focus on the two options which are described in detail in the GDRs framework: an international "cap and auction" or "cap and allocate" system based on tradable allowances and a global "climate tax". Both options will be described in turn.

Basically, implementing a cap and allocate system based on the GDRs approach would require four steps. First, for each country a national reference trajectory has to be negotiated. Depending on a country's specific circumstances, it has to capture more or less of its negative- and zero-cost mitigation opportunities relative to its business as usual trajectory. Second, in a bottom-up manner, national reference trajectories are aggregated to a global reference trajectory of which the 2°C emergency pathway is subtracted. This yields the global mitigation requirement which, in a third step, is allocated among countries in a way that each country receives a national mitigation obligation in proportion to its national RCI (see Figure 3).

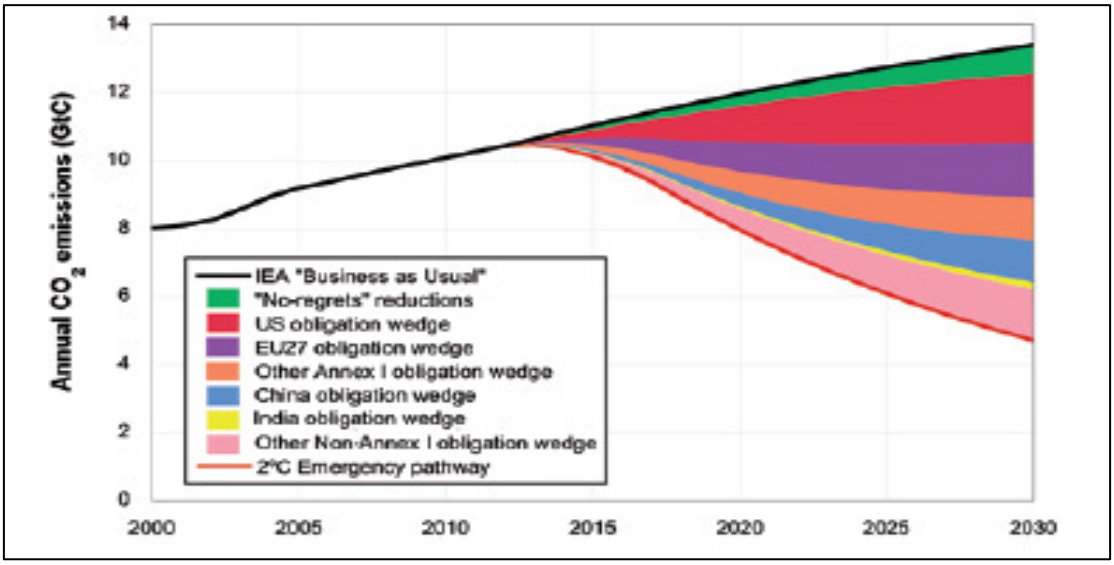

Figure 3: The global mitigation requirement divided into "national obligation wedges" on the basis of the RCI (Source: Baer et al., 2008:70).

Fourth, national emissions allocations and the corresponding allotment of permits are calculated by subtracting each country's national mitigation obligation from its predetermined national trajectory. A key point of the GDRs approach is that it assigns each country tradable allowances irrespective of the volume of reductions that are economically and physically available within its national boundaries. This way, countries with high capacity and

[82] Suggested alternatives for implementing GDRs include "progressive taxes of various kinds, trade-related levies, auctions, rebates, sectoral agreements, multilateral funds, IPR concessions and other new and as-yet unnamed financing mechanisms" (Baer et al., 2008:66).

responsibility have a dual obligation which can only be met by strenuous domestic action and the financing of decarbonisation abroad. Indicatively, Figure 4 the shows internationally discharged reduction obligation of the US with blue hatching. The mitigation in China that is funded by other countries is shown with blue stripes.

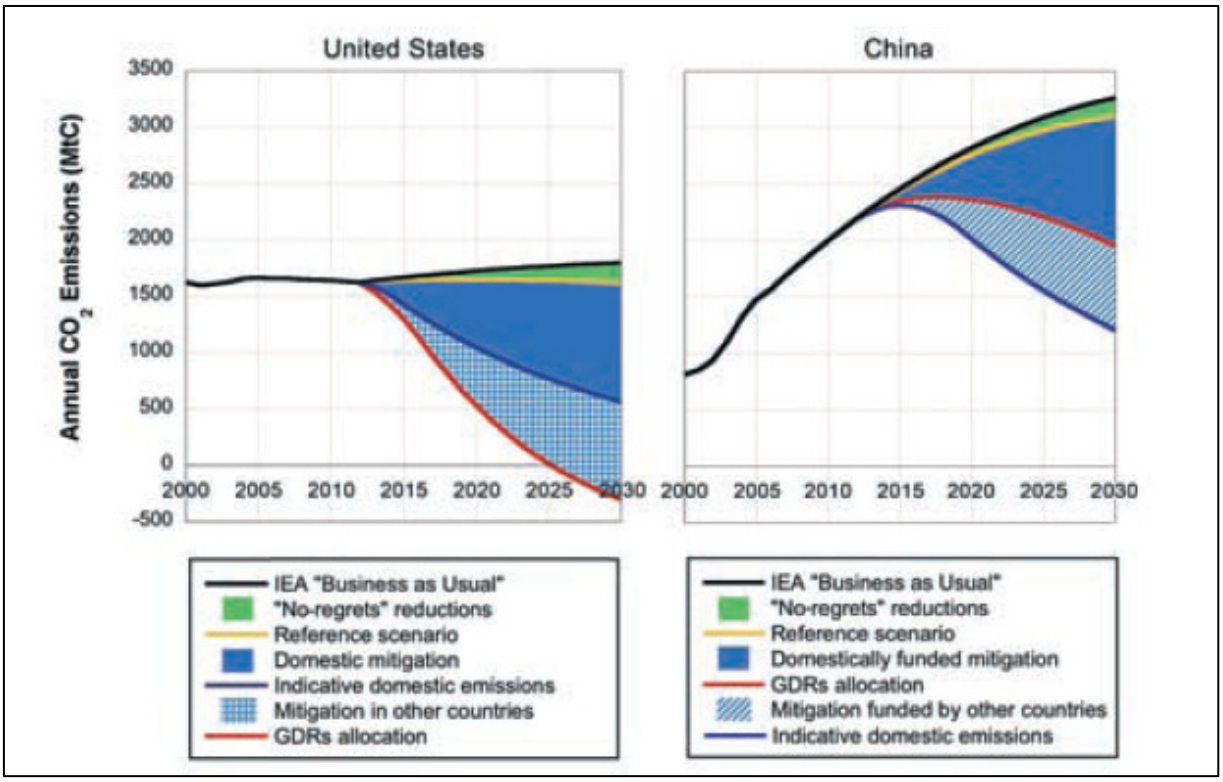

Figure 4: US (left) and Chinese (right) business-as-usual trajectory, reference trajectory, mitigation obligation, and emissions allocation (Source: Baer et al., 2008:22).

As a second option to operationalize the GDRs framework, Baer et al. describe a single grand international fund to manage and allocate the financial resources required for the climate transition.[83] The determination of the precise annual payments would relay on regular estimates about the expected amount of global mitigation costs. Here, the RCI would serve as the basis for determining each nation's obligatory financial contribution in a given year. This way, the RCI would also determine the annual magnitude of revenue a "climate tax" in a given country would have to rise. Ideally, also within a country, the financial obligation would be allocated as per the GDRs effort-sharing framework. That is, individuals with income below the development threshold would be exempted from paying the tax while individuals with income above the development threshold would have to pay progressively more.

[83] Baer et al. note that similar funds have been proposed by Mexico (the Multinational Climate Change Fund) or the G77 and China.

5.2.2 Assessment with respect to the predefined criteria

5.2.2.1 Environmental effectiveness

A key characteristic of the GDRs reference framework that it is extraordinarily ambitious in that it explicitly specifies a "2°C emergency pathway" which has absolute emissions peaking in 2013 and dropping thereafter with a maximum rate of more than 5 percent per year, resulting in reductions of 80 percent below 1990 levels in 2050. Atmospheric GHG concentrations peak at about 420 CO_2 ppm (corresponding to 480 ppm CO_2-eq) and by 2100 return to 400 ppm CO_2-eq or below (compare Table 6 below).[84]

Table 6: Properties of the "2° emergency pathway" (Source: Baer et al. 2008:115).

Emissions peak year	Annual emissions rate at peak year	2050 CO2 emissions relative to 1990	Maximum rate of reductions	Chance of exceeding 2°C	Estimated peak concentration ppm (CO_2/CO_2-eq)
2013	10.5 GtC	80% below	5.6%/yr	14–32%	420/480

Explicitly, Baer et al. refer to the latest evidence provided by Hansen et al. (2008) as outlined in Subchapter 4.3.4.3. From a precautionary point of view, the "heroic efforts" the GDRs emergency pathway demands are totally justified. However, with regard to environmental effectiveness, it must be asked with what degree of certainty GDRs can be expected to result in those very stringent reductions.

5.2.2.1.1 Concerns about the reliance on business as usual

Elsewhere, Baer and Athanasiou (2008) point out that a 400 ppm CO_2 stabilization target can be associated with a carbon budget of only about 400 gigatonnes of carbon (GtC) +/- 50GtC, for the whole century. A critical feature of the GDRs approach is that it does not allocate this precautionary carbon budget but a budget that is based on individual country's BAU projections.

This is most obvious if the GDRs framework was implemented as a global cap and allocate system. Each country would be required to put forward its national reference trajectory which Baer et al. define as the country's BAU trajectory, including some or all "no-regrets" options. Every national reference trajectory should be subjected to the scrutiny of international negotiations.

But if GDRs was implemented as a "climate tax", global annual mitigation costs would have to be estimated. In order to calculate the opportunity costs of abatement, assumptions must be made of what would happen if climate-friendly actions were not taken, that is to say, under a business as usual scenario. Baer et al. do not specify whether global mitigation costs

[84] Although the RCI is calculated on the basis of CO_2 emissions only, it is obvious that Baer et al. intent all types of GHG emission to be included in the emergency mobilization program.

should be calculated at a global level or whether they should be calculated in a bottom-up manner by aggregating national cost estimates. Even if a top down approach was chosen, it can be taken for granted that each country has to be consulted about its national development aspirations in order to produce acceptable outcomes.
With a view to the overall environmental effectiveness of the GDRs framework such a procedure is precarious for the following reasons.

First, at a general level, it must be recognized that “business as usual” as such does not exist since societal development is unpredictable (see Footnote 37). National reference trajectories will therefore reflect the preferences of a country about the evolution of factors which are difficult to control such as economic growth, energy demand, energy efficiency, and technological progress.

Second, related to this general uncertainty, the reliance on BAU scenarios creates an incentive for each country to pretend that its own baseline emissions are larger than its true emissions measured ex-post. Overestimations of national emissions will achieve relative benefits in terms of less-stringent emission targets and lower abatement costs (Bohm, 1999). Therefore, the definition of a baseline scenario has a strategic dimension and can hardly be defined as an “objective” evaluation of future economic and environmental cycles and trends (Toth et al., 2001).

Third, it is questionable the extent that this incentive can be corrected by subjecting national reference trajectories to international scrutiny. Philibert and Pershing (2001) point out that it will be difficult to contest if a country expects its GDP will grow at 10 percent each year because even if it appears hardly feasible, it also appears very much desirable. For their indicative calculations, Baer et al. rely on the recent World Energy Outlook 2007 (IEA, 2007) global energy scenario which extrapolates BAU trends in energy demand, energy conservation, renewables, fossil fuel subsidies, pollution controls, etc. While extrapolation might be justified at a global level for indicative purposes, it will not be adequate for many individual countries. Such an approach may even be unacceptable for countries that experience an enduring recession such as many economies in transition countries.

Fourth, if “business as usual” is understood as development that would take place if no international cooperation on climate and development was initiated, it is difficult to see how the GDRs approach should be applied for developing and especially least developed countries. What can be reasonably assumed as “business as usual” in a country such as Liberia or Zimbabwe? For many countries, common sense indicates that it is rather unlikely that the way they are organized will eventually ensure that their citizens’ income rises above the development threshold that Baer et al. define. Although this point does not directly influence the environmental effectiveness of GDRs, it is nevertheless a conceptual drawback worth noting at this point.

Fifth, if present trends cannot or should not be extrapolated, a minimum amount of planning has to be done to prepare a BAU trajectory. The citizens of every country will need to consider what they would like to happen if there was no emissions constraint.[85] The problem with such an approach is that plans, once prepared, tend to be realized more easily than alternatives which may not have been thought yet.[86]

For example, let's assume in an open and participatory process the citizens of country A decide in 2010 that under BAU conditions they would construct new coal fired power plants because the country has huge coal reserves and, after all, its energy sector has been steadily growing for the last decades. Depending on international scrutiny, two cases can be distinguished.

In the case that country A's plan is accepted by the international community it is likely that country A will indeed construct the coal fired power plants because plans are already made and alternatives such as wind turbines or solar panels are more expensive. In order to fulfil its international obligations country A may plan a retrofit with carbon capture and storage (CCS) technology between 2020 and 2030, that is, once this technology according to today's knowledge is mature (Azar et al., 2006) and cost effective. Till then, other mitigation opportunities should be exploited. However, what if the power plant is already operating and it turns out that CCS is not feasible because of unforeseen technical difficulties or public resistance against transportation and storage? What if CCS is put in place but the CO_2 stored in the reservoirs starts to leak?[87]

In the second case, the international community disapproves of country A's reference trajectory. Now it may be expected that all people of country A which have a substantial interest in constructing the coal fired power plants (mining industry, power industry, etc.) plead for the realization of the plans already made. The point is that if country A's plan finds disapproval for reasons such as fundamental resource constraints or concerns about possibly absent technological advance, the society of country A will find itself in a situation where it should not develop the way it wants but in a different way it has not imagined yet. As it is difficult to do something one has never imagined before, the society of country A will probably continue to do what they used to do and already planed for.

In both cases, the very preparation of BAU trajectories increases the risk of missing the turn towards a low-emission path.

To the extent that BAU caused climate change, it is questionable whether the strategy to solve the problem should be explicitly based on BAU or whether structurally different approaches will be necessary. In this regard, it is useful to follow Jänicke (2004) and to

[85] Alternatively, the BAU trajectory could be prepared centrally without consulting civil society. In that case its legitimacy would be questionable.

[86] For the importance of integrating the climate constraint into long-term urban management see e.g. Alber (2007).

[87] On the problem of leakage see e.g. Ha-Duon and Keith (2003).

distinguish between the path of ecological modernization which relates to technical, system-compliant solutions to environmental problems and ecological restructuring. Jänicke argues that incremental improvements in ecological efficiency are not sufficient to ensure long-term environmental stabilisation because these improvements are easily set-off by subsequent growth processes (e.g. specific emission reductions subsequently neutralised by increasing road traffic).[88] The alternative would be ecological restructuring, an approach which affects systems of behaviour in order to address the cause of the problem. Jänicke (2007:205) underscores that "(…) most structural solutions involve no marketable technologies and thus cannot use the inherent logic of the economic system as their driving force. Rather they rely on political-social mechanisms and capacities being set up over a long time, which require a different and disproportionately greater effort [than system compliant solutions]."
The problem with Baer et al.'s reliance on BAU is that this approach impedes the exploration of alternatives, to do business differently, and to change environmentally harmful behaviour.

5.2.2.1.2 The risk of creating an entitlement to lead a consuming class life

In the same vein, it must be doubted whether it is in line with environmental effectiveness to define the "right to development" in terms of an entitlement to the resources necessary for a consuming class life. In order to justify the precise level at which the development threshold is set Baer et al. refer, amongst others, to a recent Mc Kinsey study (Albett et al., 2007) on the rise of India's consumer market. On the basis of their research, the authors of this study believe that "(…) India has now entered a virtuous long-term cycle in which rising income lead to rising consumption, which in term, creates more business opportunities and employment, further fuelling GDP and income growth (p.27)." The key characteristic of a cycle is that it has per definition no end. As long as it is not certain whether technological improvements can supply the energy and resources needed for total humanity to adopt and sustain a consuming class lifestyle, initiating such an endless process carries an enormous environmental risk.

Baer et al. believe that "(…) the necessary mitigation measures could be implemented without compromising any sustainable development priorities, providing only that countries are willing to pass on the costs to their consuming classes, rather than their poor." However, even with vast redistribution ("income recycling"), it may simply be *physically* impossible, let alone consistent with Baer et al.'s emergency pathway, to offer, say, 9 billion people a consuming class life. The virtuous cycle could easily turn into a *vicious circle*.

Once the entitlement is created, people will start to make concrete plans e.g. based on the expectation that they would be able to carry out certain activities, such as driving around in

[88] This relates to the "rebound effect" found in studies on energy efficiency (see e.g. Frondel, 2004). Accordingly, the expected reductions in energy use do not occur because the extra real income provided by the improvement in efficiency leads to more energy use.

automobiles. Even if it turns out that saving the climate will require a fundamentally different lifestyle, it may be difficult to dissuade those people from realizing their plans.

5.2.2.1.3 Prospects of preserving the time constraint

Beyond Baer et al.'s reliance on BAU and the consuming lifestyle, the question must be addressed whether a regime based on the GDRs approach can be negotiated, adopted and sufficiently implemented to see emissions peak in 2013.

In order to operationalize the GDRs framework countries would need to agree upon a number of matters including, the emergency trajectory, the precise level of the development threshold, the year when responsibility should start, the formula to calculate the RCI, and the respective weights of capacity and responsibility. It can be expected that all those questions would be addressed in a rather principle-based manner without major reference to specific national circumstances. Although Baer et al. point out that "the latitude for meaningful negotiation is not extremely broad," there is a certain risk that the latitude may already be broad enough to find agreement before 2013.

If countries indeed managed to find agreement on the GDRs burden-sharing architecture, they still would need to submit and scrutinize the individual BAU estimates including their "no-regrets" reductions opportunities. Baer et al. (2008:69) explicitly note that the precise fracture of any countries no-regrets opportunities that might plausibly be achieved through domestic efforts alone will have to be determined on a country-by-country basis. This will need to be achieved in a manner that takes into account differing national circumstances with regard to non-cost related barriers (e.g., structural, institutional, financial, and technological barriers) that prevent countries from achieving all their no-regrets reductions.[89]

I seriously doubt whether it will be possible for each of the 191 Parties to the UNFCCC, to understand their respective structural, institutional, financial, and technological barriers and to scrutinize 191 national trajectories duly before 2013. Moreover, Baer et al. note that both BAU and no-regrets trajectories would presumably be updated over successive commitment periods to account for technological advances, changes in capacity and responsibility, and other relevant changes. It can be expected that those factors will change very rapidly, not

[89] For indicative purposes, Baer et al. draw on results from an influential McKinsey study (Enkvist et al,. 2007) which based on recent "business as usual" trajectories of the IEA (2007), identifies the relative costs of different mitigation opportunities. In the first version of GDRs (Baer et al., 2007), Baer et al. argued that, in principle, every individual nation should be responsible for fully exploiting its own "no regrets" reduction opportunities. In recognition of non-cost-related barriers to achieving no-regrets reductions, the second edition of the GDRs framework obliges Annex I countries to achieve 100 percent and Non-Annex I countries 50 percent of their respective no-regrets potential. However, Baer et al. concede that this constitutes only a crude estimation, ultimately, the precise fracture of any countries no-regrets opportunities that might plausibly be achieved through domestic efforts alone will have to be determined on a country-by-country basis.

least because of climate change. The danger is now, that if a country is busy keeping pace with evaluating rapidly changing circumstances in all the other 190 countries it may even forget to live up to its own national mitigation obligation. Frustration over one country not fulfilling its obligations is likely to negatively affect the motivation of all the other countries thereby threatening the overall environmental effectiveness.

5.2.2.2 Equity

Before assessing the GDRs framework with a view to the equity criterion, it is important to recall that this concept has been designed as a response to deficiencies that Baer et al. identified in the C&C framework. Although Baer and Athanasiou (2007) do not reject the idea that the global sink for GHG emissions is a global commons, they argue that instead of equality of emissions rights the focus should be on developmental equity. Basically, they justify their deviation from equal per-capita emission rights with the need to take into account the historical advantage of developed countries ("responsibility") as well as variations of national circumstances with a view to the ability to pay for mitigation and adaptation ("capacity"). Both principles are combined in the responsibility and capacity indicator which is applied to share the costs of the climate transition rather than the right to consume a part of a collective resource.

Crucially, Baer et al. base the claim that GDRs is an equitable and acceptable effort-sharing proposal on the "right to (sustainable) development" as an organizing principle. The right to such development is seen as being possessed by "poor" individuals below the development threshold which, based on the principle of need, are exempted from any obligation to pay for climate mitigation. By development, Baer et al. (2008:38-9) "do not mean economic growth as such" but they refer specifically to "human development, a difficult notion that we may perhaps define as the satisfaction of fundamental needs in a manner that frees people from the vulnerability and deprivation of poverty and makes possible a decent level of security and well-being."

Although it is definitely legitimate for Baer et al. provide their own definitions, a proposal for an international climate regime based on a "right to development" cannot be considered in isolation of the ongoing international debate including the legal status, the conceptualization, and the corresponding obligations of such a right.[90]

This section is organized around the following considerations. First of all, it will be clarified, how the "right to development" is declared and defined at the international level and to what extent the GDRs approach is consistent with the official version of the "right to development".

[90] Interestingly, Baer et al. do not explicitly refer to the more general debate on the "right to development". On page 38 Baer et al. state that "this right [to development] must be declared and protected, despite even the pressures of the climate crisis." However, there *is* already a Declaration on the Right to Development; it just needs to be implemented.

The next step will be to examine, whether the GDRs version of the "right to development" – if ideally implemented, can be justified from a philosophical point of view. Then, it will be discussed whether GDRs treats individuals in an equitable way if GDR was ideally realized with the RCI applied at the individual level. The last step will examine to what extent GDR is still equitable if implemented at the national level with individual countries organizing their own burden sharing procedures.

5.2.2.2.1 The "right to development" as officially declared

The emergence of the "right to development" has to be seen in the context of decolonization and the North-South debate on the New International Economic Order during the 1970s. Developing country representatives used the "right to development" to express their claim against developed countries for a restructuring of the international economic system (Sengupta, 2006). Although attempts to reform the international economic institutions proved unsuccessful (Eide, 2006), the "right to development" stayed on the international agenda culminating in the adoption of the Declaration on the Right to Development (DRD) by the United Nations in 1986. Article 1(1) of DRD defines the "right to development" as "an inalienable human right by virtue of which every human person and all peoples are entitled to participate in, contribute to, and enjoy economic, social, cultural and political development, in which all human rights and fundamental freedoms can be fully realized." Development as such is defined in the Preamble of the DRD as "a comprehensive economic, social, cultural and political process, which aims at the constant improvement of the well-being of the entire population and of all individuals on the basis of their actions, free and meaningful participation in development and in the fair distribution of benefits resulting there from."

Although Article 1 of the DRD states that the "right to development" is an inalienable human right, being a soft law document, the declaration lacks the legal effect of a treaty. Therefore, this pronouncement says little about the controversies regarding the content of the "right to development" or about ways in which it relates conceptually to other human rights. Marks (2006:74) suggests that based on the UN Charta and other existing treaties, in particular the International Covenant on Economic, Social, and Cultural Rights (ICESCR), it is nevertheless possible to speak of "legal obligations" for both developed and developing countries in the sense of a duty to international assistance and cooperation. However, in reality, the scope of assistance developed countries are obliged to supply is controversial.[91] For example, it is contended whether developed countries have a legal obligation to implement the Millennium Development Goals (MDGs).[92] Marks (2006:75) points out that in his report on the

[91] Here, Sen (2006) provides useful guidance. He argues that what is obligatory is not any specific externally given level of assistance, but a commitment to participate in a process, which includes an exercise of social ethics, within each country and across borders.

[92] The MDGs have been adopted by 189 countries at the United Nations Millennium Summit in September 2000. They are a set of eight goals and targets for combating poverty, hunger, disease, illiteracy, environmental degradation, and discrimination against women (see UNDP, 2003).

implementation of the MDGs, the UN Secretary-General (UN, 2003) provides no indication of whether or how the "right to development" could have a role in the MDGs.

5.2.2.2.2 Prospects for the implementation of the "right to development" as officially declared

Basically, any attempt to design appropriate development policies to implement the "right to development" requires the definition of development in operational terms. While the original conception of development was limited to the economic dimension and mainly identified with growth of per-capita real income, the DRD is premised on the broad notion of human development, acknowledging the intrinsic and mutually reinforcing links between development and human rights. A key characteristic of the human development approach is that in addition to indicators in terms of commodities, it includes indicators of human development in terms of achievements (capabilities and functionings) such as life expectancy, infant survival, and adult literacy.[93]

The practical challenge of defining development as a multifaceted process is the construction of an overall numerical indicator. This is because when a process is given the status of an inalienable human right; the means (the realization of human rights) become as important as the ends (Aguirre, 2008:104).

Basically, different human rights have different characteristics; while some are either violated or realized, others are realized progressively. Arjun Sengupta (2006:31) the former UN Independent Expert on the Right to Development indicates that

"(…) to convert a vector [in which each element is a human right] into a scalar or index would require a process of averaging or weighing the various elements that would be open to fundamental objections. However, expressing the right to development as a vector of all the rights would make it possible to establish whether there has been an improvement in the realization of the right to development; it would not, of course, allow comparisons to be made between the achievements of two or more countries, or even within the same country over time. The only way to do this is to build a consensus through open public discussions about the relative importance of different levels of achievement."

It can be concluded that only once such an open public discussion among countries has occurred it will be possible to define an overall indicator and to compare countries in an acceptable way.

[93] Sen who had inspired and later elaborated the human development approach, defines development as a process of enhancing human capabilities in the sense of an extension of freedoms and the realization of rights. The capability of a person is reflected in the various combinations of functionings that he or she can achieve. According to Sen, it reflects a person's freedom to choose among different ways of living.

5.2.2.2.3 Consistency of the GDRs approach and the officially declared "right to development"

The authors of GDRs explicitly talk about development as human development but they do not specifically refer to the notion of a rights based development process. Indeed, they do not even talk about a process but rather define development in terms of achievements.

"By (…) [postulating the right to development] we imply not a right to economic growth as such, but rather the right to a modest yet dignified level of well-being (Baer et al., 2008: 41)."[94]

Nevertheless, it can be concluded from this context that Baer et al. consider an improvement of the realization of civil and political rights, in addition to economical rights, an essential component to reach such a "modest but dignified level of well-being".[95]

According to the authors of the GDRs framework the extent to which this level of well-being is realized depends on whether a specified income threshold is surpassed. Baer et al. (2008:42) openly concede that "(…) this option suffers a number of obvious problems. Income, after all, is a simplistic and one-dimensional indicator that quite inaccurately reflects sustainable human development. It prioritizes a certain mode of development – economic growth – while obscuring the importance of human rights, political enfranchisement, liberty, social capital and community resilience, health, education, environmental and physical security – all of which are essential to a decent standard of human wellbeing."

Nevertheless, Baer et al. (2008:42) use income as a universal indicator and justify this approach with the following three reasons.

"First, income is highly correlated with important indicators of well-being, and this particularly at the income levels that span the low- and middle income countries, where there is an indisputable linkage between income and basic indicators such as infant mortality, life expectancy, malnourishment, and educational attainment. Second, income does indeed reflect the capacity to pay for mitigation and adaptation, especially once a country is wealthy enough for basic needs to be met. Third, income is a

[94] One problem with this definition is that human rights, at least as officially declared, are based on the inherent dignity of all members of the human family. If every human person has *inherent* dignity, a right to development that entitles every person to a dignified life is redundant in that every person has this dignity already because of being a member of the human family irrespective of being above or below a fictional income threshold.

[95] The following text passages in Baer et al. (2008) support this conclusion:

- "(…) adaptation investments must, for fundamental reasons, be implemented through democratically controlled funds that rely heavily on the involvement of civil society (p. 112)."
- "A true emergency climate stabilization program would also require far-reaching changes in agricultural and land-use practices (…) are possible, but only if there is a real commitment to the grassroots empowerment that is essential if any genuinely positive future is to emerge for the poor communities (…) (p. 42)."
- "[Member of an agricultural household] will have far better chances (…) if they enjoy relatively intact social networks, if they can hold policymakers accountable (p. 43)."

helpful proxy for consumption, and hence for the distribution of carbon emissions within a country, and hence for responsibility."

First of all, it has to be clarified that, strictly speaking, only the first argument is a logical justification why income should be a legitimate indicator for development. The second and third argument justify why income should be used to calculate the RCI. These arguments are circular to the extent that they already assume that GDRs is accepted as an effort sharing framework. The following will discuss each of those three arguments in detail.

Ad 1) Even if a certain correlation between income and indicators of well-being can be detected, it has to be recognized that a correlation is not necessarily a causation. Defining human development in terms of income only will prima facie disadvantage all those countries and individuals for whom this correlation does not hold. This is obvious especially in the case of women rights. Ueyama (2007) points out that the relationship between the level of income and the degree of gender inequality is still controversial. For example, Saudi Arabia is twentieth in the indicative ranking of countries based on the calculated RCI (see Baer et al., 2008:62). According to the GDRs logic, all those Saudi Arabians earning more than $7,500 PPP per year have realized, in Baer et al.'s own words, "the right to a productive, fulfilling and dignified life." However, given that Saudi women continue to suffer from severe discrimination in the workplace, home, and the courts, and from restrictions in their freedom of movement and their choice of partners (Human Rights Watch, 2006), I doubt whether these women, however well-off they may be in material terms, lead a productive, fulfilling, and dignified life.
As high income does not necessarily guarantee respect for women rights, I also suspect a gender bias when the lower limit for poverty is set at $16 per day. Baer et al. justify this level by referring to empirical analysis by Lant Pritchett (2003, 2006) who argues that the upper bound of "global poverty" should be set no lower than the standard shareholding countries of the World Bank use for their own citizens.
In order to defend the reliability of purchasing power adjusted incomes as an indicator of living standards across countries Pritchett examines physical indicators of well-being, in particular child mortality. In Pritchett (2006) he refers to two studies (Gwatkin et al., 2000; Filmer and Pritchett, 2001) which find that infant mortality among the richest 20 percent of households in all examined countries with average GDP per capita below the $2 a day is more than 10 times the average among the poorest in OECD countries and more than three times the OECD average in countries with GDP per capita of less than $10 a day. Because Pritchett (2003:20) cannot bring himself to argue that "another family losing a child to death (…) does not mean they are "poor" because they live in a community where other people are poor" he argues for an absolute international standard of poverty and against making "making "poverty" entirely a concept relative to one's community." However, Pritchett does not consider the possibility that child mortality may depend on the status of women in a given society. Especially in South Asia and Sub-Saharan Africa, the correlation of income growth with the

reduction of the antifemale bias in childhood mortality is controversial (Ueyama, 2007). In contrast to earlier studies Ueyama (2007) finds indeed that income growth is significantly associated with the reduction of the anti-female discrimination in South East Asia,[96] but not in Sub-Saharan Africa. In other words, according to this study increasing the income of Sub-Saharan families would not necessarily be translated in a decrease of the death of female infants.

A detailed analysis of this point seems warranted but would lead too far. The point here is to show that if in some societies the death of a girl does not represent the same conscious "loss of well-being" than in others, the claim that income has to be increased in order to free people from the plagues of poverty losses its moral force.[97] As humanity already agreed that every person has the right to life, those social traditions must be transformed. However, this is a question of *social* change and *not exclusively* of income increase.

Ad 2) Income does reflect the capacity to pay for mitigation but the question is whether every kind of mitigation can be "bought" in a straightforward way. Particularly, in the case when mitigation is related to radical changes in life-long practices and behaviour, financial resources may not be the only decisive factor.[98] This is because for some carbon intensive goods and services, the way they figure in people's lives, the price elasticity of demand is rather inelastic meaning that people simply do not want to substitute even if the price increases considerably. In that way, the capacity to mitigate is more related to a general openness to change than to financial resources.

Ad 3) At a general level, a certain link between income and emissions is undeniable. The more income a person earns the more he or she can buy and consume carbon intensive goods. However, in a world of globalization, there is a great variety of lifestyles. Even if externalities caused by GHG emissions were perfectly internalized, it is questionable whether the relationship would hold that the more expensive a good, the more emission are associated with its consumption. That is not least because many immaterial goods and services have a price, without causing extra emissions. In high income countries, labour-intensive goods tend to be more expensive than the imported industrially produced alternative, e.g. local, organically grown vegetables versus imported and intensively grown food. Assuming that the more income a person has the more emission he or she causes, the higher his or her responsibility will be prima facie unfair to all those "rich" but environmental

[96] For instance, Cowan and Dhanoa (1983, as cited in Ueyama, 2007) showed that in India anti-female discrimination in food consumption is more severe in privileged families than in the poorest families.

[97] It can be assumed that also other indicators Pritchett (2003) uses to justify an absolute poverty standard are gender biased, in particular child education. Why should a rich family allow their female children to finish primary education if they see no value in women being educated at all?

[98] This appraisal is based on a case study reported in WRI (2008:142-57). Niger is the setting for an unprecedented, farmer-led "re-greening" movement of major proportions. Two important finding of this study are that (1) sometimes costly technology is less important than patience and persistence, and, (2) tradition and fear are powerful forces that must be accommodated.

conscious people. If income is taken to reflect historical responsibility, the question needs to be addressed in what manner today's income relates to past emissions. For example, should a person that just happens to immigrate and work in the US be hold responsible for the US emissions since 1990 although this person has been living at subsistence level till then? As the point of individual responsibility is considered critical, it will be discussed again in the following section.

5.2.2.2.4 Is the GDRs approach – as intended to be ideally implemented- ethically justifiable?

Irrespective of the concerns pertaining to the justifiability of operationalizing human development in terms of income only, the question must be asked whether and how a right to "a modest yet dignified level of well-being" can be justified from a philosophical point of view.

In accordance with Article 1 of the DRD, Sengupta (2006) specifies the "right to development" as a collective right, which is enjoyed individually, by the citizens of a country, but which is to be exercised collectively so that it can be enjoyed by all citizens together. Although there is debate about whether non-state actors, in particular transnational corporations, have responsibilities to respect and contribute to the implementation of the "right to development", mainstream debate on human rights law remains state-centric in the sense that the state is recognized as the only duty-holding party for rights assurance under international law (Andreassen, 2006).

In contrast, the way Baer et al. want to operationalize the "right to development", ignores the collective dimension altogether. Theoretically, irrespective of nationality, every individual below the income threshold is a rights holder, every individual above a duty holder.

Ideally, the GDRs effort sharing architecture should be applied universally, without restriction by particular states or local laws. The philosophical rationale behind such an approach is cosmopolitanism, a concept which has both a moral and a political dimension (see also 4.4.3.2). Moral cosmopolitanism considers the human person as the ultimate unit of moral concern, each human being having equal dignity and worthiness for all, even those with the most remote affinity (Pogge, 2008: 175).[99] Dahbour (2005) notes that such a moral outlook is a precondition for political cosmopolitanism which seeks to design global governing institutions that will supercede, preempt, or dominate smaller, autonomous communities.

[99] More precisely, Baer et al.'s version of operationalizing the right to development is similar to what Pogge (2008:176) calls "interactional cosmopolitanism" according to which other individuals and collective agents are directly responsible for the fulfilment of human rights. "Interactional cosmopolitanism" is opposed to "institutional cosmopolitanism" where institutional schemes are responsible, while individuals have a shared indirect responsibility for the justice of any practice.

Realizing the GDRs approach in terms of a cosmopolitan democracy would constitute an enormous challenge which can be illustrated indicatively with regard to the problem of scale.

From a practical point of view, it can be argued that to date there is no world government and it is difficult to imagine one being implemented within, say, the next two or three decades, that is, in time to manage the climate problem. Moreover, Dahbour (2005) argues that already large states are only problematically democratic due to the elitist character of most forms of political representation and the monopoly of power held by party systems in such states. He goes on asking how much more this will be the case for global democratic institutions – especially if they are stable and effective forms of governance.

From a discourse ethical perspective, the notion of a "global community of law" suffers considerable problems. The discourse principle prescribes that collectively binding decisions are justified to the extent that all affected persons could, in principle, give their free assent to them, following an open, inclusive decision making process. Given that, in one way or the other, at least all currently living persons would be directly affected by the implementation of a GDRs regime; it is difficult to see how a practical discourse can be organized to safeguard legitimacy.

Another serious problem with radical conceptions of cosmopolitanism is that beyond the satisfaction of basic needs, values and notions of what constitutes the good life differ considerably among political, moral, and religious cultures. Therefore, proponents of cosmopolitanism such as Singer (2002:194) limit positive duties of assistance to enable the minimum needs of everyone for "enough to eat, clean water to drink, shelter from the elements and basic health care" to be met, or, such as Pogge (2008:138-139) frame obligations in terms of "negative duties not to wrong (unduly harm) others."

The problem with the development threshold specified in the GDRs framework is that it is deliberately set "at a level of welfare that is beyond basic needs (Baer et al., 2008:16)" and "consistent with national estimates (in China and India specifically) of the income level where poor people begin to enter the lower levels of the global consuming class. Which is to say, the level where they begin to have some small amount of discretionary income (Baer et al., 2008:10)." Although Baer et al. (2008:43) stress that this level has been chosen "in terms of the trade-off that we actually face – at what point should poorer people begin to help pay the costs of the climate transition, so that wealthier people can pay less" the "Greenhouse Development Right" comes down to a universal claim to be a member of the global consuming class.[100] However, there are three reasons indicating that such an approach is problematic.

[100] On page 28 Baer et al. state that "[p]eople above the development threshold (…) must bear the costs of not only curbing the emissions associated with their own consumption, but also of ensuring that – as those below the threshold rise toward and then above it (…)."

First of all, it presumes a very narrow understanding of well-being and the acceptance of income as the only measure of success and ability. While what we call ‘‘poor’’ people may generally, prefer to be better off in terms of real income, they may not prefer this above all other things (if they had the choice). The point is that people have different preferences and therefore make different trade-offs. For example, consider on the one hand an economically well-off person that works in a very hard and disciplined manner and trades-off everything for enhancing her career and increasing her income, doing overtime, forgoing vacation and family. On the other side, there is a person with an income below the development threshold preferring to spend her time fulfilling other kinds of life goals, e.g. religious, intellectual, meditative, artistic, sportive or whatever. Assuming that both persons are free and able to make their own decisions, the demand for a heavy involuntary financial transfer from the first to the second person does not seem acceptable, let alone necessary. It might even decrease the level of *well-being* of the first person with her exclusive focus on material achievements much more than it might increase the level of well-being of the second person.[101] Narveson (2004) argues that we should not just assume that the very ‘‘poor’’ in various parts of the world, as measured by real income reckoned in Western terms, are thereby miserable. He states that if those people are having enjoyable lives we should not feel free to disrupt their ways of life by imposing ours on them.

Second, it can be assumed that raising the approximately 70 percent of the global population that according to Baer et al. have less than $7500 PPP annually will be a permanent project, that is, from now we cannot determine when the duty of assistance will be satisfied. Perhaps because of fundamental resource constraints on a finite planet, it may not be possible to offer each and every person a consuming class life. According to Rawls (1999:117-119) the duty to assist burdened societies applies only temporarily and in accordance with the “principle of transition”. Far from granting every person the right to a consuming class life, Rawls sees the duty of assistance limited to helping a burdened state to achieve a working liberal or decent government that is “able to determine the path of their own future for themselves.”

Third, developing countries are currently experiencing rapid population growth caused by declining mortality rates while still high fertility rates. In contrast, industrialized countries have far lower fertility rates close to or even below the replacement level resulting in a relative constancy or even withering away of the absolute population size (McNicoll, 1999). Rawls (1999:117-118) points out that in case societies are decent and liberal, it is unacceptable to demand a redistribution from a society which has a higher per-capita income because of low population growth to a society with lower per-capita income caused by higher population growth.

[101] For similar examples see Rawls (1999:117) and Arler (2001:13).

5.2.2.2.5 Would GDRs - if ideally implemented - treat individuals in an equitable way?

If GDRs was realized perfectly, the economic situation of every individual below the development threshold, the right holders, would gradually improve. At any rate, GDRs would not deteriorate the economic position of the worst-off parties and therefore fulfil the minimum requirement for a climate regime to be equitable as outlined in the criteria section above. The question that remains to be clarified is whether GDRs is equitable from the standpoint of any duty holding individual.

According to the GDRs framework, the total income individuals earn above the development threshold would be available to be "taxed" according to the calculated RCI. In principle, the way responsibility and capacity is defined worldwide must be fair for and acceptable to any "rich" person. This, however, must be doubted given the extreme varieties of individual circumstances. Individuals may have legitimate reasons why they *need or deserve* more income. Especially problematic, however, is the application of the responsibility principle at the individual level in present and historic terms.

Basically, it is clear that individuals have a causal responsibility for the emissions related to their consumption.[102] Assuming, counterfactually, that income would perfectly reflect the caused emissions, there would still be the question of whether "rich" people can be hold morally accountable for the amount of emissions they cause and the emissions they caused in the past. Classically, Baer et al. justify their approach of defining responsibility by "knowledge" and "intention". Arguing that "responsibility" based on knowing about the problem should start in 1990 - when the first report of the IPCC made the risks widely and publicly evident - is commonplace and seems to be justifiable at a state level. However, at an individual level it is far from obvious whether a given person from 1990 onwards, knew about the problem, let alone was intellectually capable of understanding the risks at stake. What if a person was born in 1990 and began to develop an understanding of the problem, say at the age of 12 in 2002. Should this person, now earning more than the indicative income threshold be made personally accountable? This person would have not even had the possibility to vote for a government which would have potentially adopted a respective law for compelling people to change their behaviour. Another point is the principle of intent. Maybe, a "rich" person, after knowing about the risk, considerably changed her life, for example by moving closer to her workplace, becoming vegetarian, forgoing overseas trips, and so on. How, with hindsight, can it be detected whether an individual's change in lifestyle was really with the intent to reduce GHG emissions? If a person indeed radically changed her life for

[102] The fact that the GDRs framework limits responsibility to carbon dioxide emissions is critical as well. Although CO_2 is the largest single contributor to the increased radiative forcing, other types of GHGs cannot be neglected when it comes to causal responsibility. As Baer et al. (2007:68) indicate that they do not intend to preclude alternative formulations, this point is not further elaborated.

that purpose, would it be just for her to have the same financial responsibility as her neighbour next door who still continues a profligate life?

What seems obvious is that a principle-based, global effort-sharing framework, at least the way presented by GDRs, cannot accommodate the specific circumstances of all duty holding individuals.

5.2.2.2.6 Is the GDRs framework still equitable if operationalized at the national level?

Especially with a view to the principle of sovereignty, Baer et al. (2008:60) anticipate that "a multilateral environmental agreement cannot force this particular allocation of costs, or any other one, onto its signatory states." The question of whether GDRs is still equitable when it is left to individual countries to organize their intranational burden sharing will be first addressed at a general level and second with a view to the "worst-off" individuals.

The Gini coefficient

From a practical point of view, the way GDRs uses the Gini coefficient to capture inequality must be questioned. The Gini coefficient is a numeric measure of inequality that reveals the difference between a uniform distribution and the actual distribution of a resource. It ranges between 1 (complete inequity) and 0 (perfect equality).
The authors of GDRs define inequality explicitly at an *individual* level, by using per capita income and the Gini coefficient as input in a continuous log-normal distribution of income.[103] In order to calculate per capita income Baer et al. divide the GDP of a given country by the total population of that country in 2005. That is, GDP is distributed evenly among all members of society regardless of age or gender. For reasons of consistency, the Gini coefficient is again generated at an individual level. Accordingly, the most equal country will be a nation with both women and men earning a uniform income, old persons drawing a pension of the same amount as the working people's income and parents being given for each of their children a family allowance corresponding to the uniform income they themselves earn.

The decisive point is that such an approach is not able to capture that most individuals live in *families with a common household.* Within these households, children usually (and in some cases even old people) do not have an own income. In some nations especially women may decide not to earn their own income but to care for the household including children and old people. If this is a deliberate choice, women will not perceive it as a kind of inequality if their partner earns the whole family income and they earn nothing material but maybe just appreciation of another nature. However, the way GDRs is conceptualized counts income inequalities at the household level as something that has to be remedied although it is far

[103] Compare with the technical appendices in Baer et al. (2007).

from obvious whether this kind of inequality is perceived as such and compromising the dignity and well-being of the different household members.

On the other hand, if the GDRs approach would use a Gini coefficient related to the household level, it will not be able to capture individual inequality. This is because although many people live within households it must not necessarily be the case that within a given household the family income is distributed in a way every single household member perceives to be equitable.[104] This is especially a question of gender inequality in male-dominated societies. Sen (2006) points out that it may even be a mistake to make the entitlement of a wife to be consulted in family decisions a legal requirement. He argues that social change in male-dominated societies has to be sought in other ways.

The case of Unfairland – implications on the living conditions of the least well-off

In order to determine the potential implications on the worst-off individuals it is useful to consider the example of Fairland and Unfairland. Baer et al. (2008:52) present it as follows.

"In both [Fairland and Unfairland], the per-capita income is $5,000, but Fairland has a completely equal distribution of income (everyone makes $5,000), while in Unfairland, 99 percent of the population has an income of $1,000 and the other 1 percent has an income of $401,000. Now, clearly, the wealthy 1 percent of Unfairland's population has far more discretionary income, and is far more able to support discretionary efforts (like, say, a climate mobilization) than the poor 99 percent, for such support only means small reductions in their luxury consumption."

As Fairland obviously has already a system in operation that distributes available financial resources in an equal per-capita manner, it may be assumed that, if Fairland as a nation will receive financial support from the international community, this support will be subject to this overall distributing system. Even if the international support is to be distributed in an unequal way, it *may* be expected that this unequal distribution in Fairland will take place in a way that does not deteriorate absolute living conditions relative to status quo, that is, after the international resources are allocated, no member of Fairland will earn less than the previous $5000.[105]

Although Unfairland's "poor" have a higher development need than Fairland's "relatively less poor" people, the logic of the GDRs framework is such that Unfairland will have a much higher national obligation, because of the huge amount of income Unfairland's rich earn above the development threshold. Obviously, for the GDRs approach to fulfil the minimum

[104] See Ueyama (2007) on intrahousehold resource allocation and gender bias within the household as potential causes of poverty.
[105] This assumption is simplistic. The arrival of vast amounts of money may as well disrupt the social cohesion upon which the equal resource sharing tradition is based.

equity criteria, the wealthy of Unfairland must absorb the capacity based tax and not pass it on their poor compatriots.

The question whether this will, or even should, happen is far from obvious. It is a key characteristic of the GDRs reference framework that it does not consider the social conditions under which financial inequality occurs. Basically, it is useful to distinguish two cases, in both of which the GDRs approach is problematic.

First, we may assume that Unfairland's citizens are living harmoniously together. Unfairland's poor may have totally different priorities than their rich compatriots, maybe they are indigenous people without any relation to finance, maybe they have a religious belief where they deliberately renounce material things, etc. The decisive point is that, Unfairland's poor neither consider this situation as being unfair nor themselves to be worse-off than their "rich" compatriots. In those settings a compulsory financial transfer from the materially rich to the materially poor may be at least useless if not even damaging by imposing the notion that well-being necessarily depends on financial resources.

However, especially in the case that Unfairland's poor lack their basic needs and live in real misery, it is indeed likely that they consider themselves as being worse-off than their rich compatriots.[106] If this was the case, the question that needs to be asked is why Unfairland's rich do not feel any solidarity and simply help by transferring a small amount of their "luxury income" to their compatriots. Reasons may differ among various "Unfairlands", perhaps, rich and poor have a different cultural background, speak different languages, the rich may be living in closely guarded privileged suburbs or even abroad so that they do hardly come in touch with their suffering compatriots. So, assuming that this unfair situation lasts already for a relatively long time and that there are mechanisms in place favourable for preserving Unfairland's rich financial privilege, the question is *why* Unfairland's rich should *now* redistribute their wealth as requested by the GDRs effort sharing framework if they have never done this before. Contrary to the harmonious version of Unfairland described above, it is far more likely that in this particular constellation the poor may be frustrated, angry, perhaps even aggressive and violent. Maybe Unfairland's rich are afraid that once they improve Unfairland's poor living conditions incrementally, the poor will come and take revenge for all the suffering they had to endure. Crucially, this constellation creates a deadlock, similar to the one hindering any progress between North and South at the global level. If the GDRs framework now imposes to Unfairland an even higher obligation compared to Fairland, with still this climate of fear and aggression, it is rather unlikely that Unfairland's

[106] However, this must not necessarily be the case. The best example is India. A country where still – though officially abolished - the caste system determines people's lives. A Hindu faithful "untouchable" that lives in misery may still not consider her situation as unjust but to be part of the divinely ordained natural order. On India's caste system and complex equality see Walzer (1992: 59).

rich will happily pay the bill but find ways to avoid it. In this case, GDRs is not likely to improve the situation of the worst-off members, thereby violating the minimum requirement for passing the equity criterion.

5.2.2.3 Political Acceptability

Despite Baer et al.'s focus on the individual, a proposal for a global climate and development regime must be acceptable for sovereign and self-determining states which, at least under the current world order, are the primary legitimate actors recognized in international legal documents. Here, the potential financial burden GDRs imposes on different countries and groups of countries provides an instructive starting point.

5.2.2.3.1 Financial burdens for developed countries under the GDRs framework

The fundamental complication for assessing the costs of the GDRs reference framework is that presently no scientific study exists that is based on an emissions pathway as ambitious as the 2°C emergency pathway Baer et al. chose as their reference pathway.

If the GDRs framework was implemented as a global "climate tax" the determination of the precise annual payments would be based on regular estimates about the expected amount of global mitigation costs. For their indicative calculations, Baer et al. (2008:57) refer to Stern (2006) who estimates annual costs for stabilization between 500 and 550 ppm CO_2-eq to be about 1 percent of GWP (which was US$ 56 trillion in 2005). As Baer et al. think that the majority of the economic models overstate costs relative to the mitigation objectives they are modelling, Baer et al. identify 1 percent of GWP as a "reasonable" number to calculate indicative annual bills for each nation and the average obligation per person above the development threshold respectively. Although Baer et al. admit that there is little assurance of any specific upper bound to the costs of a true emergency program and that total costs may in the end be several percent, they claim to demonstrate "a critical, even decisive fact: Even if the costs of such a[n emergency] program were large, the world's wealthier citizens could easily bear them. They would not be impoverished by saving the climate. In fact, they could do so with only relatively modest reductions in their luxury consumption (p. 29)." With a view to the overall acceptability of GDRs to "rich" individuals, I argue that Baer et al. miss an important point which is again related to the question of what people value most in their life. If people exclusively focus on maximising profit, it is not that much their profit in absolute terms that they value but the steady *increase*. So, if Baer et al. only want to take part of this increase, which compared to the absolute amount of wealth, may be tiny, the costs in terms of subjective well-fare loss may be much higher than the monetary costs.

In case the GDRs framework was implemented as a global cap and allocate system, its extraordinary ambitious mitigation efforts would be realised by giving wealthier and higher-emitting countries negative allocations in terms of the "dual obligation" to, not only make

major domestic cuts, but also to pay for decarbonization in poorer countries. For example, already in 2030 the mitigation obligation of the European Union and the United States would be approximately around minus 140 percent and 125 percent respectively.[107] The magnitude of those obligations is dimensions higher than those currently considered in the US by the Obama government (return to 1990 levels by 2020 before falling 80 percent by 2050) and the EU pledge to return to 20 percent below 1990 levels by 2020 and to 30 percent below 1990 levels in case other developed nations agree to similar commitments. Those targets and the financial effort they imply, in return, are again dimensions higher than those achieved in the past.[108]

5.2.2.3.2 Is GDRs realistic?

In recognition of this apparent discrepancy between their ideal and "reality", Baer et al. (2008) argue that their approach is nevertheless realistic because (1) "[t]he virtue of the Greenhouse Development Rights approach is that it heeds [the] imperative [not to harm and not to erect further barriers to the progress of the poor]; indeed, it is because it does so that we can claim that the GDRs approach is in fact realistic, in the new sense demanded by the logic of the greenhouse age (pp. 91-2)" and (2) "it is extremely unlikely that the working consensus needed in the North – a consensus to pay its "fair share" of the world's total mitigation and adaptation costs – could ever emerge if the wealthy minority in India and China and other developing nations are not also paying their fair shares. This is, if not a fact, a hypothesis of such obvious and powerful resonance that it can almost be taken as a fundamental axiom of global climate politics (p. 23)."

The first argument has already been examined in the previous section which concluded that especially in the case of the disharmonious version of "Unfairland" it cannot inevitably be taken for granted that the GDRs framework would not worsen the overall well-being of the poor. The second argument is critical as well. Towards the end of their paper, the authors of GDRs rather unwillingly admit that "[t]he question is how [the south] must act, and here we are compelled to emphasize one word above all others: *voluntarily* (p.86, italics in original)." However, the question is whether Baer et al. themselves believe that those voluntary actions will be in line with their "axiom" in a way that GDRs can still be called realistic. If not, their argument lacks the necessary foundation. The authors of the GDRs approach need to explain why developed nations should initiate financial transfers dimensions higher than those they are currently considering in a situation where developing countries have made voluntary pledges

[107] There exists a report on the distribution of emission allowances under the GDRs framework (Höhne et al., 2008) but its usefulness is limited. The lowest stabilization target reported therein is 450 ppm CO_2-eq whereas Baer et al.'s "2° emergency pathway" should return to 400 ppm CO_2-eq by 2100. Despite those less ambitious parameter, Höhne et al.'s calculations find that the EU obligations would still amount to a reduction of minus 100 percent by 2030.

[108] On the pages 80-82 Baer et al. consider to formalize the terms by which countries with dual obligations divide their efforts in a way that Northern countries should be compelled to make domestic reductions of at least the same scale as those required globally. It can be assumed that such restrictions will not increase the overall palatability of GDRs for developed countries.

with regard to the facts that, first, there is no certainty whether developing countries will fulfil those pledges and, second, there is no absolute control to make sure that "at the end of the day" only rich people in developing countries will pay.

5.2.2.3.3 Acceptability of GDRs to developing country Parties

Irrespective of Baer et al.'s understanding of "the logic of the greenhouse age" it must be discussed whether the way GDRs is (a) designed and (b) intended is sufficiently acceptable for Southern countries to pledge those voluntary actions. Baer et al. point out that they have abandoned C&C because of its inability to provide "developmental equity" under more stringent emissions targets (see e.g. Baer et al., 2008: 104). They have elaborated the GDRs framework as a response to developing country negotiators' claims that they can only accept a regime that protects the "right to development".

Basically, the way the GDRs framework is *designed* – with its main focus on income transfers – is similar to the way many developing countries still understand the "right to development", namely, as an entitlement to a transfer of resources in their favour – through aid, debt relief, terms of trade, and more equitable globalization. Nevertheless, it can be presumed that Baer et al., when responding to developing countries negotiators, have not listened attentively enough. From the very beginnings of this discourse in the 1960s, the developing countries' claim to a "right to development" has *always* been combined with a claim to the full national sovereignty to exploit their own resources pursuant to their own environmental and developmental policies (Sengupta, 2006).[109] The obligations which GDRs imposes on developing countries concern the defaults that first costs should be passed on "rich" citizens in proportion to income and second that the allocation of the arriving financial resources should be subject to a specified decision-making process. In Baer and Athanasiou (2007:33) the second default is described as follows:

"Such obligations, we think, would necessarily involve the specification of "eligible" categories of investment. These would of course need to be defined in an open and democratic way, one in which not just governments, but also civil society organizations, would participate. The key would seem to be an open peer-reviewed process (…) that would be explicitly designed as an alternative to paternalistically conceived and imposed "conditionalities." Such a process would be outcome focused, but it would also be informed by "on the ground" social-political realities."

It seems as if Baer and Athanasiou are ignoring the possibility that presently existing "social-political realities" in some countries may not be as open and democratic as they presume. In case of the disharmonious version of "Unfairland" as described above, I argue that it is

[109] Accordingly, Article 1(2) of the 1986 Declaration on the Right to Development reads: "The human right to development also implies the full realization of the right of peoples to selfdetermination, which includes, subject to the relevant provisions of both International Covenants on Human Rights, the exercise of their inalienable right to full sovereignty over all their natural wealth and resources."

impossible that such a culture already exists because if it existed the situation in "Unfairland" could not be that unfair because the claim of the poor majority to the fulfilment of their basic needs would have to be recognized in a participatory democracy.

If a democratic culture does not exist in "Unfairland", it must be assumed that the representatives this county sends to international negotiations do not really represent the interests of all people living in "Unfairland". And most certainly these negotiators are not representative of the 99 percent of the population living in misery but rather of the 1 percent controlling all the resources. If the GDRs framework demands that the other 1 percent should share their wealth, and the international representatives of "Unfairland" represent the interests of the wealthy 1 percent, it is difficult to imagine why those representatives would accept GDRs. Beyond the limitations of the illustrating example of "Unfairland", the fact that so far no developing country officially supports GDRs supports the above considerations.

To the extent that it can be assumed that Baer et al. *intend* GDRs to realize *human* (as opposed to economic) development, the acceptance of the "right to development" as declared in the DRD provides some evidence for the acceptance of the GDRs framework the way it is intended.

In any way, to be a legitimate operationalization of the declared "right to development", the GDRs framework would have to be supplemented with provisions that ensure the progressive realization of all human rights and fundamental freedoms. However, if modified in such a way, it may become even less acceptable for some developing countries. In 1999, the countries of Algeria, Bhutan, China, Cuba, Egypt, India, Iran, Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka, Sudan and Viet Nam have argued that "(…) the "rights" based approach to development undermines human rights by creating conditionalities to "development" which is itself a basic human right."[110] In other words, those countries claim a right to economic development that trumps all other human rights (Aguirre, 2008).

5.2.2.3.4 Acceptability of GDRs as intended to developed country Parties

As well, it is questionable whether developed countries would accept to make the corresponding financial transfers a legal obligation, to which an international development and climate regime based on the GDRs framework would effectively amount to. It is telling that in 2003 the United States, together with Australia and Japan, cast negative votes; and Canada, Korea, and Sweden abstained in the context of a developing countries request "to prepare a concept document establishing options for the implementation of the right to development

[110] Letter from the delegations of Algeria, Bhutan, China, Cuba, Egypt, India, Iran (Islamic Repubic of), Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka, Sudan and Viet Nam, UN Doc. E/CN.4/1999/120, para. 103(c), (cited in Aguirre 2008:118).

(…) [as] an internationally legal standard of a binding nature."[111] Marks (2006:71) points out that "[c]ountries that spend considerable amounts of their taxpayer's money on development in line with the right to development do not welcome being told that they have legal obligations to do so." The question is whether this will change.

5.2.2.4 Political Feasibility

In order to assess whether a climate regime based on the GDRs framework is politically feasible, it will first be discussed the extent to which it can be negotiated and second, to what extent it can be implemented thereafter.

Negotiability

a) Simplicity

The basic idea upon which GDRs is based, that is the specification of a global income threshold across countries, is easy to understand. However, with a view to the discussions above, the definition of this threshold may be extremely challenging as income is not a perfect indicator for human development. Moreover, applying the Gini coefficient at the individual level entails definitional difficulties particularly relating to intrahousehold resource allocation. The next critical element is the year from which on responsibility should be calculated and the problem that income is not perfectly correlated with emissions. Even if nations have managed to agree on capacity and responsibility they still would have to negotiate a formula including respective weights to calculate the RCI. For people that lack the respective mathematical skills, it may be both difficult to understand the concept underlying the Gini coefficient as well as the formula to calculate the RCI. Transparency is further reduced by BAU projections and the assessments of "no-regrets" options.

b) Moderate requirements on data and tools.

As outlined in the reference framework, the GDRs approach requires four data elements for each country to calculate the RCI: population, per capita income, Gini coefficient and per capita cumulative emissions.[112] To assign national obligations, either the annual global mitigation cost must be estimated or national BAU trajectories including "no-regrets" options have to be provided. Both options require a considerable amount of data on the present and potential future development of each individual country. As this data is based on a future that has not happened yet, its reliability and acceptability is reduced.

[111] This resolution (2003/83) was adopted by the Commission on Human Rights on August 25, 2003 (cited in Marks, 2006:69).

[112] While it may principally be feasible to collect data on the first three components, it may be impossible to get verifiable data on per capita cumulative emissions, if GHG emissions types other than CO_2 should be included. As those emissions and their removal by sinks are considerably more uncertain (Bodansky, 2003) it may be impossible to provide acceptable data in retrospect.

c) Compatibility with the UNFCCC and Kyoto architecture.

The GDRs approach is to a large extent compatible with the principles established by the UNFCCC. The emergency trajectory specified in the GDRs framework has a relatively high likelihood of being consistent with the ultimate objective of "avoiding dangerous climate change". The RCI can be seen as consistent with the unspecified principle of "common but differentiated responsibilities and respective capabilities". By reducing their own emissions and paying for the decarbonisation of developing country economies, developed countries "take the lead in combating climate change". As developing country emissions are allowed to grow according to their BAU scenarios, the principle is preserved "that the share of global emissions originating in developing countries will grow to meet their social and development needs". To the extent that the GDRs reference framework seeks to impose conditions on the development of individual countries, it is not fully compatible with the nation's "sovereign right to exploit their own resources pursuant to their own environmental and developmental policies". The way GDRs is designed, it only accounts for national circumstances related to income and cannot seize any individual needs which are unrelated to income. To the extent that the GDRs framework specifies the option of a "cap and allocate" system it is consistent with the market-based approach taken by the Kyoto Protocol.

d) Flexibility, cost-effectiveness, and economic predictability

As Baer et al. consider successive commitment periods, the possibility is given to use those renegotiations to account for changes in scientific knowledge as well as technological advances, changes in capacity and responsibility, and other relevant changes. Whether the GDRs approach is implemented as a tax or a trading scheme has different economic implications. If implemented as a "cap and allocate system" the 2°C emergency pathway could be reached in a cost effective manner. However, there would be considerable uncertainty about the absolute price of a permit to emit along a pathway that endeavours to reduce GHG emissions by more than 5 percent per year. If the GDRs framework would be implemented as a tax based on the RCI, there would be certainty over the costs that need to be incurred as long as the RCI is not changed and cost estimates stay the same. However, tax systems have the disadvantage that they cannot guarantee that the given environmental goal, that is, reducing emissions by more than 5 percent annually, will be met.

Implementabilty

e) Institutional capacity

If GDRs was implemented as a cap and allocate system, institutions would need to be established capable of trading and monitoring emissions as well as a "centralized financial authority the governmental or multilateral body that conducts the auction (Baer et al., 2008:80)." While institutions for trading and monitoring emissions are already implemented or at least in consideration in most developed countries, the latter would need to be established from scratch.

Baer et al. (2008:80) state that "effective and broadly participatory social and environmental safeguards must be built into all carbon-finance systems – international and domestic. (…). Any mechanisms that serves to channel large financial flows will be difficult to get right, and however they are structured, a great deal of civil society and governmental involvement and oversight will be necessary if they are to be both fair and effective."

The point here that Baer et al. do not take into account is that the concept of civil society is inextricable linked to a "functioning" democracy, as opposed to a democracy that is officially declared. If a country currently lacks democratic structures, a democratic culture would have to be established in the first place to have the "citizens" of this country wield any control over their government and the allocation of financial resources or burdens. Imposing from outside "participatory social and environmental safeguards" risks not only be resisted by sovereign states but is fundamentally at odds with the "idea" of democracy because as Saward (1993:65) points out "(…) democracy is a method of decision-making where decisions are made *by* the people and not in any sense *for* them" (italics in original). In this regard, GDRs will not even be helpful to introduce a democratic culture in non-democratic states because how should the inhabitants of those states understand the "essence of democracy" if they are from the beginning constraint in their decision-making by external conditions which should not be questioned?

f) Ensuring compliance.

As already discussed under the heading of the environmental effectiveness, the reliance on BAU entails a high risk that individual nations fail to meet their targets because they are not directly compelled to change the emission causing behaviour and to factor in the emissions constraint at every planning level. I argue that no *liberal* government has the power to impose conditions on its citizens' every day decisions *as far reaching as* those required to decarbonise by more than 5 percent per year *as long as* the citizens still think in a BAU way. According to Dobson (1990:140) "political change will only occur once people think differently, or, more particularly, that sustainable living must be prefaced by sustainable thinking." A nation of good faith may sincerely want to change and to decarbonise, but fail because of "BAU thinking". It will be extremely difficult to ensure compliance under a GDRs regime because *if even* those nations of good faith risk missing their targets, how should they impose sanctions on those that intentionally miss their target to free ride? How should we identify within a community of nations those nations that fail despite good faith and those because of bad faith? And could we assume that every individual of a bad faith nation really acts in a bad faith manner? If only the "wealthy and powerful" acted in bad faith, would it be still fair to impose sanctions on this country if this would entail that also those of good faith would have to suffer?

5.3 Which concept has a higher potential to solve the climate issue?

When comparing the concepts of C&C and GDRs a fundamental point is that both approaches have different levels of ambition. Baer et al. pretend that first, the climate and development crisis are fundamentally linked because first "there is no road to "development," however conceived, that does not *greatly* improve access to energy services (p. 35, italics added)" and second, that the GDRs framework, the way it is designed, has the potential to solve both the climate and development challenge at a single blow. As C&C per se, "only" wants to solve the climate crisis, it would have to be supplemented respectively to account for the development crisis (Attfield 2008a; 2008b). Following this logic, the GDRs approach would be superior to C&C. However, this argumentation rests on flawed assumptions.

With a view to the first argument, it has to be clarified that while virtually nobody would challenge that there is a "development – climate nexus", it is controversial whether access to energy services has to be greatly improved in order to ameliorate mass destitution e.g. in the sense of meeting the MDGs. On the basis of an empirical analysis of the interaction of climate and development policy Michaelowa and Michaelowa (2007:15) find the following:

"It is a fact that highly developed societies have higher energy consumption – and thus greenhouse gas emissions – than those on a low development level. However, there is no linear correlation between human development and energy use. Generally, development indicators can improve rapidly from low levels with only small increases in per capita energy use. Only when countries reach an intermediate level of development, energy use starts to grow rapidly while improvement in development indicators slows down (…). This seems to suggest that reaching the MDGs would not necessarily entail high increases in greenhouse gas emissions (…)."[113]

With a view to the second argument, it has already been shown in Section 5.2.2.2 that the GDRs approach is unable to guarantee for development if development is understood as anything beyond economic growth. To account for human development and especially for the realization of women rights, the GDRs framework would have to be supplemented respectively. Consequently, in this respect, the GDRs approach is not superior to C&C because both concepts would have to be supplemented to account for human development however conceived.[114]

[113] On the basis of the second MDG (universal primary education) Michaelowa and Michaelowa (2007: 11) illustrate their argument as follows "(…) obviously we can construct an impact chain from electrification of a community, which results in improved learning, lower drop out rates, and finally in higher enrolment. But the most efficient way to achieve universal primary education is certainly not via electrification of rural schools and households. Other measures, such as an increased supply of teachers, a reduction of repetition rates or the provision of school meals will be far more effective."

[114] In this regard, I disagree with Attfield (2008a; 2008b) who fails to realize that GDRs based on income as an indicator cannot guarantee for *human* development. See Subchapter 5.2.2.2.2 on the difficulties of defining an alternative development indicator.

Now, the following will assess which of the two concepts has a higher potential to solve the climate challenge. As a proposal for a future climate regime only makes sense to the extent that it fulfils the criterion of environmental effectiveness, the ultimate verdict which of both concepts is preferable must be made on the basis of this criterion. To varying degrees, the fulfilment of the other criteria is a precondition (or a means) to this end. Therefore, starting with feasibility, the following comparison will proceed to discuss the predefined criteria in the inverse order. The focus is on the question as to which approach scores better with regard to the respective criteria.

5.3.1 Which concept is more feasible?

Not least because of its reliance on BAU, GDRs is definitely more complicated and less transparent than C&C. In order to make the GDRs approach fully operational, every commitment period, data about BAU scenarios and no-regret opportunities from every country would have to be processed. Torwanger and Ringius (2000:3) point out that large amounts of data will increase both the complexity of a proposal and may create opportunity for selfish manipulation by actors. In the case of poor countries with negative long-term trends, it will conceptually be infeasible by relying on BAU scenarios to meet and surpass ambitious development goals.

With a view to the established legal architecture, C&C has the advantage that theoretically any kind of circumstances could be taken into account if C&C was negotiated in a region based manner, GDRs fails to incorporate circumstances beyond historic responsibility and current financial capacity such as e.g. differences in climatic conditions or dependence on fossil fuel production, use and exportation. To the extent that the GDRs reference framework seeks to impose conditions on the development of individual countries, it is at odds with the nations' "sovereign right to exploit their own resources pursuant to their own environmental and developmental policies".

In some respects, the GDRs approach has the advantage of being both operationalizable as a tax and a trading system. However, as trading is already established as the preferred option under the Kyoto Protocol, the advantage of this flexibility is diminished.

The main reason, however, why I argue that GDRs is infeasible is that GDRs presumes democratic structures to an extent that do not exist at the moment. The way GDRs is designed would not even be conducive to establish those structures.

5.3.2 Which concept is more acceptable?

For developed nations, both proposals entail enormous financial transfers beyond anything that have so far been made. The argument presented by Baer et al. why it is nevertheless realistic that under a GDRs regime developed countries would affect those transfers does not hold further scrutiny. Features of the GDRs approach that are in line with developing countries' negotiating positions include the explicit account of developed countries'

responsibility for causing the problem and the "right to development" being at centre stage. However, to the extent that the GDRs framework imposes conditions on developing countries, it conflicts with their claim to exploit their own resources at their own sovereign discretion. As C&C per se does not impose conditions it seems to be more acceptable than the GDRs approach, at least for developing countries with very low per-capita emissions which under any carbon budged would be entitled to enormous financial resources. It is telling that although EcoEquity promotes GDRs for some time at COP/MOP meetings, so far no developing country government has officially commented on GDRs. In contrast, numerous developing countries have explicitly endorsed C&C. For example, India's Prime Minister Dr. Manmohan Singh has reaffirmed in 2008 that for India "the only equitable basis for a global compact on climate change" is "[*l*]*ong term* convergence of per capita emissions (italics added)". Crucially, "long-tem convergence of per-capita emissions" indicates support for a transition period of unspecified length. Although Singh states that the Indian people has "a right to economic and social development and to discard the ignominy of widespread poverty" he does not claim an unequal per-capita allocation in India's favour based on this right nor does he oppose "long-tem convergence of per-capita emissions" because of the "historical advantage acquired by the developed countries, who enjoyed decades of unrestrained emissions (Baer et al., 2008:104)". Accordingly, the current Indian current positioning seems to be more in line with C&C than with GDRs.

Another reason why C&C may be more acceptable is that within intra-regional negotiations, it provides leeway for individual solutions between countries which are not directly related to climate change. On the basis of several case studies in East Asia, Harris (2005:12) concludes that environmental foreign policy is *often not* about the environment and that the degree to which history influences environmental foreign policy should not be underestimated. Harris gives the following example:

"China, for example, has been (at least until recently) virtually obsessed with its treatment by foreign powers in past centuries. One of its primary goals when joining and implementing environmental accords – and, indeed, other international agreements – is to avoid the humiliation it experienced during the 19th and 20th century. (…). In the case of Japan, war history shapes much of its foreign policy, including its environmental foreign policy and the responses to that policy by other countries in East and Southeast Asia. Japan's environmental aid to other countries in the region is, to a significant degree, an effort to atone for (or appear to atone for) the way it treated neighbouring countries during the first half of the 20th century, and its neighbours expect it to be this way. In short, wars and colonialism of a century ago can be the central determinants of current policies on, for example, financial assistance for sustainable development in East Asia."

The point here is that under a GDRs regime where countries pay to and receive from a centralized institution, such bi- or minilateral solutions which are perceived as fair because of reasons beyond current financial capacity and responsibly for emissions are not feasible. To

the extent that all former colonized countries may still feel humiliated, it is the more unlikely that those countries would accept a proposal which imposes conditions on their development.

5.3.3 Which concept is more equitable?

To the extent that the atmospheric sink for GHG emissions can be conceptualized as a global common property resource, a uniform allocation of the per-capita entitlements to this resource is in line with the starting point of most theories of distributive justice. Both proposals accept this point. In case of C&C, the deviation in favour of presently high emitting countries that is due to the transition period can be justified on the basis of the principle of need. Depending on the agreed stabilization target, developing countries will have different amounts of emissions allowances. If the targets of individual nations are negotiated within regions, the possibility is given that the special circumstances of individual nations and their worst-off inhabitants will be accommodated in a way that does not deteriorate their current living conditions. From an ethical perspective, it remains to be clarified whether developed countries deserve less than equal per-capita emissions entitlements because of their historic responsibility for causing the climate problem or whether they need more because their infrastructure and lifestyle is inadequate in a world that has to be decarbonised as soon as possible.

In case of GDRs, the justifiable claim that developed countries should be liable for the emissions they historically caused is accounted for by introducing the “right to development”. The way Baer et al. define the “right to development” in the GDRs framework is not consistent with the “right to development” as officially declared. By using income as a universal indicator, GDRs is not capable to guarantee that every person above the income threshold has indeed reached “a modest yet dignified level of well-being”, that is, the state to which Baer et al.’s definition of the “right to development” entitles every person. The cosmopolitan structure of the GDRs framework causes considerable problems with a view to legitimacy. Although, if realized ideally, the GDRs approach improves the living conditions of the worst-off in financial terms, it would not necessarily be fair to any duty holding individual. If the GDRs framework was realized at the national level – the most likely case under the current political conditions - there would be first of all a general obstacle related to the Gini coefficient and intrahousehold resource allocation. As the GDRs approach does not take into account the social causes of financial inequality, it may even deteriorate the living conditions of the worst-off individuals in “unfair” countries. Based on those considerations, I conclude that, a deviation from an equal per-capita allocation of emissions entitlements based on the GDRs approach cannot be justified on ethical grounds.

5.3.4 Which concept has a higher environmental effectiveness?

The GDRs reference framework relies on an extremely ambitious emergency trajectory designed with regard to maximize the probability of holding the 2°C threshold. This feature constitutes no principal superiority to C&C because being conceptually neutral to the specific long-term target, the same "2°C emergency pathway" could principally be realized under a C&C framework, if nations accepted to do so.

Compared to C&C, a regime based on GDRs would carry a higher risk to miss the turn towards a low-emission path. I consider the following reasons as decisive.

- *GDRs is more complicated and therefore more time consuming to negotiate.*

  Negotiating a climate treaty based on GDRs requires agreement on a large number of matters and the continuous processing of data on business as usual and "no-regrets" options. There is a higher risk that the time constraint cannot be held. See also 5.2.2.1.3; 5.2.2.4 (a), (b); and 5.3.1.

- *GDRs is more challenging to implement.*

  Compared to C&C, GDRs requires more extensive institutional capacities. GDRs relies on democratic structures such as participatory decision-making and civil society organizations which currently do not exist in many developing countries. Imposing a democratic culture on peoples with different values and traditions may not be feasible within a short time frame. See also 5.2.2.4 (e); and 5.2.2.3.3.

- *With its intranational focus, GDRs risks to be dismissed by developing countries.*

  The authors of GDRs calculate national obligations on the basis of income disparities within nations. Depending on how unequal income is distributed intranationally, most nations irrespective of their development status have to pay their share of the global mitigation burden. To the extent that persistent income inequality is supported by the existing political structure, it is questionable whether the political elites, especially in undemocratic countries, will agree to a regime that challenges their power position. See also 5.2.2.3.3; and 5.3.2.

- *Defining the "right to development" in terms of income only, risks to be resisted by developed countries.*

  Many developing countries still understand the "right to development" as an entitlement to a transfer of resources without any conditions attached. An international consensus on the "right to development" could only be found after development was framed in terms of a process that progressively realizes all human rights and fundamental freedoms. A

climate proposal based on a "right to development" defined in terms of income only, is likely to be resisted again by developed nations. See also 5.2.2.2.1; and 5.2.2.3.4.

- *As GDRs rests on ethical questionable assumptions, it has a higher risk to be resisted by nations and individuals who feel that they are treated unfairly.*

Baer et al. justify their use of income as a universal indicator for development by a correlation of income with indicators of well-being. This approach is critical because it will prima facie disadvantage all those countries and individuals for whom this correlation does not hold. In particular at the individual level it is also critical that both capacity to mitigate and responsibility for emissions are reduced to income in order to calculate the RCI (see also 5.2.2.2.3; and 5.2.2.2.5). Justifying a right to the resources necessary to lead a consuming class life is problematic, not least as it presumes a very narrow understanding of well-being and the acceptance of income as the only measure of success and ability. See also 5.2.2.2.4; and 5.3.3.

- *By defining the "right to development" as an entitlement to lead a consuming class life, GDRs risks to launch a vicious circle leading to endlessly increasing energy demand.*

As long as there is such a strong link between energy consumption and greenhouse gas emissions it represents an immense danger to promise everybody the resources necessary to lead a consuming class life. Even with vast redistribution, energy-efficient equipment, and renewable energy sources, a lifestyle that relies on the ever-increasing consumption and accumulation of resources may not be sustainable for the global population under a stringent emissions budget. See also 5.2.2.1.2.

- *Given its reliance on business as usual, GDRs carries a very high risk not to comply with the emissions constraint.*

GDRs does not directly allocate the emissions budget necessary to hold the emergency pathway but relies on individual country's BAU projections. In this way, GDRs does not require countries to factor in the resource constraint at every level of planning. In relying on business as usual GDRs impedes the change of environmentally harmful behaviour and the exploration of sustainable alternatives (see also 5.2.2.1.1).

From the comparative analysis, C&C emanates as the *preferable* concept. However, the point can be made that even if C&C sores better it is still as "unrealistic" as GDRs because both concepts simply demand too much. Accordingly, the question would not be what concept is better if implemented but rather what concept has better chances to influence the ongoing negotiations in a way that results in the end in the most ambitious regime possible

under the current "realities". The next section addresses this question and gives recommendations on how to move forward.

5.4 Which concept is preferable to move forward?

5.4.1 Building trust

Currently many people believe that distrust is blocking the progress needed. Indicative is an interview of developing country delegates reported in Höhne et al. (2003). Being asked about their willingness to future commitments, the delegates stressed that first, trust has to be built that the developed countries will implement the existing commitments, that is, that the promised emission reductions are met and the promised financial support for developing countries is provided. One recommendation Höhne et al. provide is that Annex I countries have to build trust by action. Critically this recommendation is repeated in the 2008 GDRs reference framework. Baer et al. (2008:24-5) describe the necessary trust building period as follows:

"In this context, there is only one alternative to continued impasse: a brief but relatively formal trust-building period (…). Such a trust-building period must start as soon as possible – the remaining years of the Kyoto Protocol's first commitment period must inevitably be seen as part of it – and it should not drag on farther than, say, an additional three years. (…)This trust-building period should not be thought of as more time lost, for the simple reasons that action, and preparation for further action, are the only really viable foundations for trust-building. During this period, then, both the North and the South would have to take bold steps, and thus build the political foundations of a subsequent era of much more unified and ambitious action. What kind of action? (…). Regarding the North, anything less than explicit and legally-binding commitments – both to ambitiously pursue domestic reductions and to greatly scale up support for mitigation and adaptation in developing countries – would be seen as a failure to seriously invest in repairing the trust deficit."

I think in arguing this way Baer et al. miss an important point. This is because, it has to be duly recognized that trust is a feeling which per se, only individual sentient beings are capable to experience. As such, it does not make sense to say the South should trust the North and vice versa because, obviously, *the South and the North* are no persons capable of feeling emotions but collectives of individuals. As only individuals can feel, the trust building must take place at the level of individuals, that is, among 6.7 billion people. Such a process, I guess, is likely drag on farther than three years after the Kyoto Protocol's first commitment period.[115]

[115] Even if people in developing countries and foremost in Africa may trust Barack Obama, they may not necessarily trust the *American people*. Why not? Because events that happened in the past still influence today's feelings. Compare Harris' findings on China and Japan above (5.3.2).

Beyond that, I recommend that if we want to understand the conditions under which individuals trust or distrust each other, psychological advice will be more appropriate than for example economic theory or political realism which only take into account self-interested behaviour and individual preference satisfaction.

A recent social-psychological study by Earl and Siegrist (2008) on the relation between trust and fairness in environmental risk management supports earlier findings that both trust and fairness have a within-group nature, that is, people tend to trust and treat fairly members of their groups, while they distrust and treat unfairly persons who are nonmembers (Hogg, 2007). The key finding of Earl and Siegrist's study (2008:1409) is that "any approach to cooperation between conflicting sides to morally charged risk management issues should begin, not by implementing fair procedures or marshalling factual arguments, but by establishing trust based on morally important, commonly held values." Thus, the way they suggest to resolve emotionally charged conflicts starts with group formation, that is, competing sides should be induced to redefine themselves as members of a single, inclusive group that still preserves the particularity of its constituent subgroups.

To the extent that psychological findings can be transferred to the climate change issue, I recommend the promotion of C&C because the "idea" of C&C is much more conducive to the promotion of global trust than the "logic" upon which GDRs is based. This is because, GDRs explicitly stresses *differences* within and between countries, between rich and poor, between North and South. In contrast, C&C fundamentally relies on the idea that all humans (and indeed all living organisms) are part of an all-inclusive community simply because nobody can be excluded from the atmosphere. So if all people accepted the idea of an all-inclusive group from which *nobody* can be excluded, regardless of income, status, race, gender, age, religion, intelligence, visual appearance, behaviour, criminal record, etc., and if the psychological findings are reliable, C&C has good chances to create a global atmosphere of trust which is the precondition for global fairness. So, once all people respect each other as being equally members of the same inclusive group and feel solidarity towards each other, rich people may voluntarily start to redistribute their income in favour of those that have less but need more to satisfy their basic needs and to realize their individual conception of the good life. In the end, the claim that all people need to get the same share of the global commons may even become subordinate, in the sense that the idea may become tolerable that different people need different amounts of emissions and income to be happy.

5.4.2 On the language of war and peace

Strikingly, a considerable part of the literature on climate change uses the metaphor of fighting against or winning the war against climate change. Mackey and Li (2007) criticise this analogy pointing out that "after all, in such a war who is the enemy but ourselves? (…) The global warming problem can only be solved through partnership and the cooperation of all sectors and

nations." Crucially, there is an obvious contradiction between fighting and cooperating, people that actively fight against each other cannot cooperate at the same time.
In a critical way, the literature on GDRs includes many passages explicitly framed in the language of war and aggression, e.g.:

- It will not be enough for the wealthy countries to embark on an aggressive program of domestic reductions, not even if it is an *extremely* aggressive one (Baer et al., 2007:40, italics in original).
- [W]e may soon find, with the brunt of the impacts falling on poor and innocent people around the world, that it counts a great deal, not only morally but politically as well. As matters worsen, the rich and the responsible will not be able to stand safely aloof (Baer et al., 2007:17).
- Already-existing technologies – if implemented and disseminated with war-mobilization urgency (…) (Baer et al., 2008:33).
- [The] *dual obligation* (…) includes *both* aggressive domestic action *and* the financing of further reductions abroad (Baer et al., 2008: 68, italics in original).
- [I]t is likely that the North will not be able to come forward with enough short-term climate-related actions to effectively signal its readiness to finally act – aggressively and in good faith (Baer et al., 2008:86).

I understand that being constantly confronted with wilful ignorance, stubbornness, muzzling of scientists, cover-up and suppressing of essential information, etc., can be very frustrating for all those that are involved in the campaign for environmental sustainability and a fair global climate treaty. Nevertheless, it is important to recognize that a world where people fight against each other is the least able to manage the climate challenge. Baer et al. (2008:80) argue that "whatever we do, some people will be hurt during the greenhouse transition." In this context, an expression of Indian philosophy quoted in Aubrey Meyer's briefing on Contraction & Convergence (2000:14) seems of relevance: *"The pain that has not yet come can be avoided."*

In a way, it is beyond human control to prevent the fact that some people will indeed be hurt by all the climatic impacts that are projected in the coming decades. However, it is very well under human control how many people will be hurt in the process of implementing a climate emergency program. I claim that the climate transition can only be managed in a world so peaceful and caring that the interests, needs, and feeling of every single individual are recognized and real efforts are made to ensure that *nobody* is hurt. Consider that in a hot and dry world *only one hurt individual* is capable to set in fire thousands of trees planted in war-mobilization urgency. All aggressive action and the suffering those actions cause may turn out having been adduced in vain, just gone in the hot wind and of no earthly use.

6. Conclusion

Climate change is a complex and multi-dimensional issue. In order to assess the gravity of the situation, I have provided an overview of the present state of climate change research, including recent findings on the threat of major and irreversible changes. In a crucial way, there are interactions between the scientific and political dimension. On the one hand, scientific findings influence the political decision-making process; on the other hand, the political system influences the nature of scientific findings which reach the public. The latter may have fatal consequences as it prevents an effective communication about the danger of much more imminent large scale catastrophes. From an ethical perspective, these risks, even if only few scientists openly talk about them, have to be taken seriously. The most alarming scientific projections indicate that the present global GHG concentration of 385 ppm CO_2 is already in the dangerous zone (Hansen et al., 2008). According to those scientists humanity will have to make fundamental changes within the next couple of years if it wants to preserve Earth in a form that can support life as we have known it. Given the immense uncertainty and the gigantic stakes, a precautionary approach can only lead to the conclusion that GHG concentrations should be stabilized at the lowest possible levels. In particular, this demands that humanity phases out coal use over the next 20-25 years and adopts improved agricultural and forestry practices.

In sharp contrast to the urgency demanded to initiate those changes, global climate negotiations are trapped in a continued impasse. Stabilizing the climate will not be possible without the involvement of developing countries. The proponents of both concepts which have been compared in this thesis argue that their respective concept has a chance of securing developing countries' support and to be or to illuminate the necessary global solution.

The analysis showed clearly that C&C is the preferable concept with a view to tackling the problem of global greenhouse gas mitigation. This is not least because it conceptually avoids "business as usual" thinking, planning and forecasting. If implemented, C&C has a higher chance to establish a global atmosphere of trust and to facilitate the building of a more balanced global economic order based on sustainability, creativity, and equity.

Nevertheless, I acknowledge that even if C&C has a higher potential to tackle the climate problem, it may not be able to solve the climate problem as long as it is not supplemented with fundamental reforms to address other grievances, foremost the "human development crisis". Although GDRs has been designed with the intention to account for this deficiency, it fails to guarantee for human development given its exclusive focus on income inequality and its fading out of social realities. Since some goods and values are incommensurable, GDRs cannot simply be improved by choosing another indicator for development or well-being. As I have tried to show, making progress towards meeting human development goals as well as towards tackling the climate issue is not exclusively a question of income increase but at

least to an equal extent a question of changing deep-rooted traditions, lifelong behaviours, and attitudes.

At any rate, the climate negotiations cannot be detached from the larger context of centuries of humiliation, exploitation, massacring and a global institutional order which – built upon the colonial injustice and imposed on former colonized peoples – contributes up to the present day to the underfulfillment of human rights and the persistent existence of massive and severe poverty (see Pogge, 2008). With this historical record and under those dire present conditions, how can “the South” reasonably be expected to trust “the North”?

Addressing the current grievances is an ethical imperative. When it comes to trust-building, I believe that resolving and confessing to the past crimes is important as well, since how should the people living in the South trust that this time everything will be different if the North does not even apologize for all the suffering? Meeting the obligations we have towards future generations requires that we bridge the divide between North and South that has been engendered by past generations. By no means an easy undertaking, there is no other way around the abyss. Building trust is the only way humanity can escape the deadlock of the climate, development, and economic crisis. Whether humanity will manage the transition towards sustainability depends on our individual and collective decisions.

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