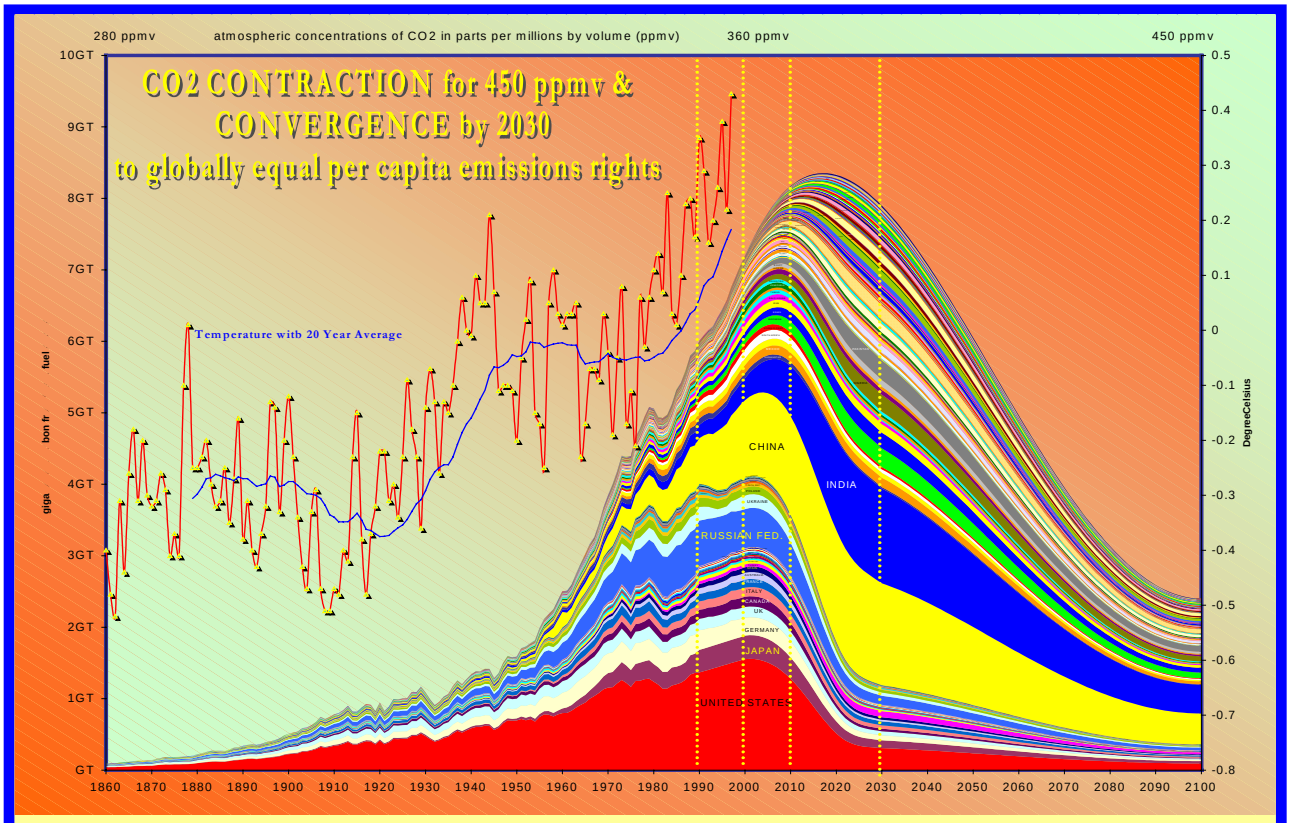
“Contraction & Convergence”



Contraction & Convergence

“. . . the logical conclusion of a rights-based approach.”

IPCC Third Assessment - June 2000

“. . . provides a possible example of a long-term framework to reduce emissions globally in order to achieve the necessary transition to sustainability.”

UNEP Financial Institutions Position Paper at COP-7 UNFCCC - Dec 2001

The Essentials of *"Contraction-and-Convergence"* (C&C)

INTRODUCTION TO C&C 5

ESSENTIAL PROPOSITION OF (C&C) 6

- CONTRACTION 6
- CONVERGENCE 6
- EMISSIONS PERMIT TRADING 6
- SUSTAINABLE GROWTH 6

C&C AND THE UNFCCC 9

UNFCCC ALREADY COMMITS PARTIES TO C&C 9

C&C AND THE US BYRD HAGEL RESOLUTION 10

FURTHER INFORMATION 12

- GLOBAL COMMONS INSTITUTE (GCI) 12
- C&C, THE GLOBAL SOLUTION TO CLIMATE CHANGE 12
- GLOBAL COMMONS NETWORK: 12

APPENDICES

Pro-C&C STATEMENTS BY INDIVIDUALS
http://www.gci.org.uk/consolidation/Individuals_Support_C&C.pdf

Pro-C&C STATEMENTS BY ORGANSIATIONS
http://www.gci.org.uk/consolidation/Organisations_Support_C&C.pdf "

SYNTAX FOR SURVIVAL" (POWERPOINT SLIDES OF C&C)
http://www.gci.org.uk/slideshow/C&CSlideshow.ppt

"Contraction and Convergence (C&C)" - GCI BRIEFING TO the PIU Energy Review - 2001
http://www.gci.org.uk/papers/PIU.pdf

"FRESH AIR - FUTURE CLIMATE POLICY OPTIONS" - 2002 - NEW ECONOMICS
http://www.gci.org.uk/papers/freshair.pdf

"CLIMATE RISK TO GLOBAL ECONOMY" - UNEP FINANCIAL INITIATIVE - 2002
http://www.unepfi.net/cc/ceobriefing_ccwg_unepfi.pdf

C&C PAPER FOR ZEW/SPRINGER VERLAG - GCI - 1998
http://www.gci.org.uk/papers/zew.pdf

"GUESSWORK/FRAMEWORK" - GCI BRIEFING TO IPCC 3RD ASSESSMENT - 2000
http://www.gci.org.uk/papers/guessframe/GUESSFRAME.pdf

C&C EDITORIALS AND INTERVIEW - NEW SCIENTIST - 2001
http://www.gci.org.uk/articles/NewScientistEds.pdf

"The Economics of Genocide" - GCI BRIEFING TO IPCC 2nd ASSESSMENT - 1994
http://www.gci.org.uk/articles/Nairob3b.pdf

"A Recalculation of the Social Costs of Climate Change" - IPCC 2nd ASSESSMENT - 1994
http://www.gci.org.uk/papers/MON_ECO3.pdf

Introduction to C&C

The consequences of global climate change are ultimately incalculable. However, economic losses from natural disasters (80% weather related) are now growing at 12% a year. That is four times the rate of growth in the global economy. Assuming the growth rate of 3% in the global economy continues, these losses will exceed the total value of all human production within two generations on current trends. (See chart page 8).

The research compiled by IPCC also indicates that the future risks are grave and will compound with the underlying trends in unsustainable development. That is why: -

- In December 1999, the heads of the US National Ocean Atmosphere Administration and the UK Meteorological Office stated, *"We are in a critical situation and must act soon."* [1]
- In January 2000, 1,000 Corporate CEOs at the Davos World Economic Forum said, *"Averting climate change is the greatest challenge facing the world,"* asking, *"why has more not been done to avert its devastating trends?"*
- In March 2000, the UK Prime Minister said, *"The process is accelerating. For some parts of the world, particularly the poorer parts, the effects will be catastrophic."* [2]

To avert these devastating trends and bring the process of climate change under control as soon as possible, GCI proposes an international framework for controlling the greenhouse gas (ghg) emissions whilst positively stimulating the growth of renewable energy technologies and their international markets.

This framework is *"Contraction and Convergence"* (C&C) and is outlined on pages 5 and 6. C&C recognises that to avert these trends, climate-efficient commerce must be politically guided, rather than solely reliant on the market, if we are to achieve the objective of the United Nations Framework Convention on Climate Change (UNFCCC) and thus enable future economic and social development to be sustainable. Establishing the C&C framework is at the political and constitutional heart of the UNFCCC process so as to underpin and sustain: -

- The growth of economic opportunity
- The reduction of regional inequity across the world
- The orderly transition from carbon to renewable energy technologies
- The abatement of the exponential rise in catastrophic losses

<u>All these are fundamental to a prosperous financial sector and long-term security.</u>

The case for the Governments and Industry to conjoin with this approach is compelling.

By globally integrating precaution, equity and efficiency, C&C coordinates control to reduce risk exposure at source. It thus defines the political commitment necessary to avoiding dangerous climate change while promoting prosperity by other non-carbon energy based means.

As Appendices One and Two of this document suggest, C&C has wider international support than any other global proposal. Also in the context of creating global emissions permits as tradable property rights, C&C is described in the Policy Section - Working Group Three [3] - of the IPCC Third Assessment Report as, *"taking the rights-based approach to its logical conclusion."*

[1] The Independent 24/12/99
[2] Tony Blair's speech to the CBI/Green Alliance 24th October 2000
[3] Climate Change 2001 – WG3 to IPCC 3rd Assessment – Cambridge University Press

Essential Proposition of C&C

The C&C model[4] formalises the objective and principles of the UNFCCC. It first proposes a reviewable global greenhouse gas (ghg) emissions 'contraction budget' targeted at a safe and stable future level for atmospheric ghg concentrations. The internationally tradable shares in this budget are then agreed on the basis of 'convergence' from now, where shares are broadly proportional to income, to a target date in the budget timeline after which they remain proportional to an agreed base year of global population. Recognising the bigger the budget the greater the risks, decarbonisation is further enhanced if revenue from emission trade is re-invested in zero emissions techniques. This reduces the randomness that has dogged negotiations since 1992 over future emissions commitments/entitlements, as it resolves the conflict between the GDP-led approaches and those emphasizing responsibility for the historic build-up of atmospheric concentrations.

Contraction

On the basis of precaution and guided by scientific advice of IPCC, all governments or regional groupings of governments jointly and severally agree to observe such an atmospheric target. With this it is possible to calculate the total diminishing amount of greenhouse gases that the world can emit for each year in the coming century. Whatever the rate chosen, C&C views this event as a whole as "Contraction".[5]

Convergence

On the basis of equity, convergence means that each year's ration of this global emissions budget can be shared so that each country or group of countries progressively converges on the same allocation per inhabitant by an agreed date, for example by 2030. This recognises the principle of globally equal rights per capita to the 'global commons' of the atmosphere, but achieved by smooth transition.[6] Where countries or groups do have a diversity of natural endowments, C&C acknowledges this too by embracing for example the European Union, which operates as a unit at the inter-national level whilst creating its own convergence arrangements.

Emissions Permit Trading

Only emissions in excess of the total of permits created under C&C are not permitted ('hot-air'). Countries unable to manage within their agreed shares would, subject to the above and appropriate rules, be able to buy the unused parts of the allocations of other countries or regions. Sales of unused allocations would give low per capita emitting countries the income to fund sustainable development in zero-emission ways. High per capita emitting countries gain a mechanism to mitigate the premature retirement of their carbon capital stock whilst also benefiting from the export markets for renewable technologies this restructuring would create. All benefit from more rapidly avoided global damages.

Sustainable Growth

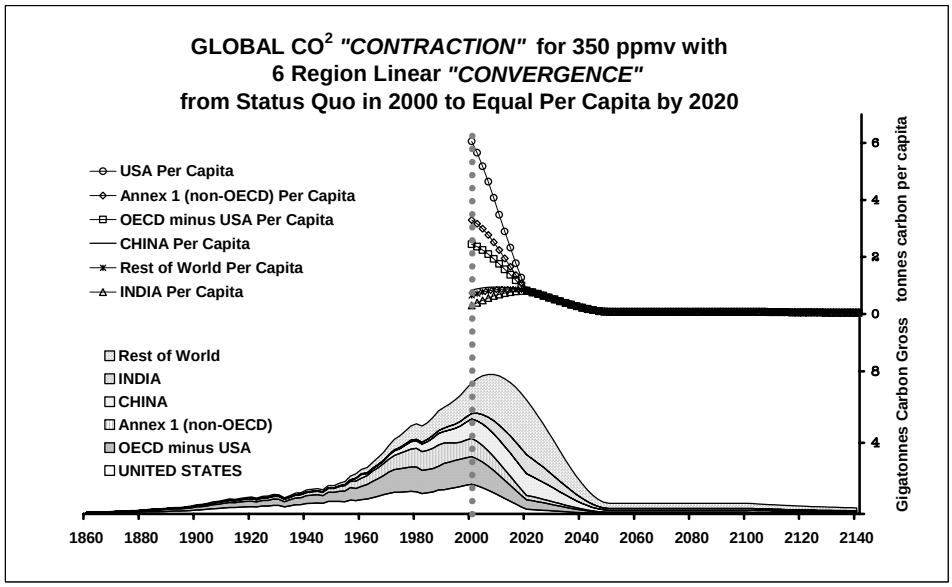
Climate change increasingly augurs potentially catastrophic losses. C&C mitigates this by integrating the key features of global diplomacy and development necessary for long-term prosperity and security. C&C synthesizes the objective and principles of the UNFCCC in a constitutional rather than a stochastic manner, so that the necessary foundation for the transition to a new growth and prosperity is specifically guided by this agreement to the zero carbon energy technologies that make this prosperity with security possible.

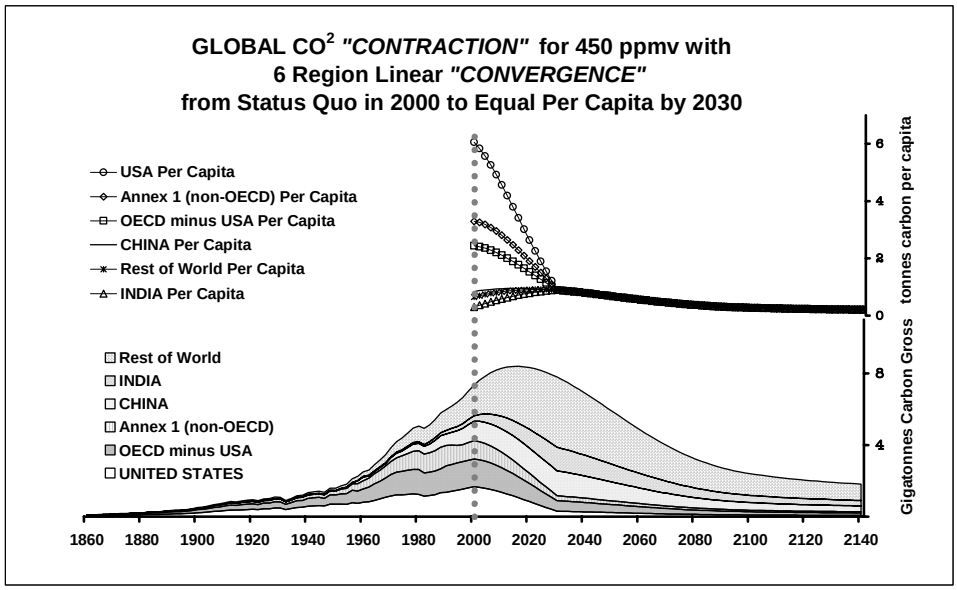
---

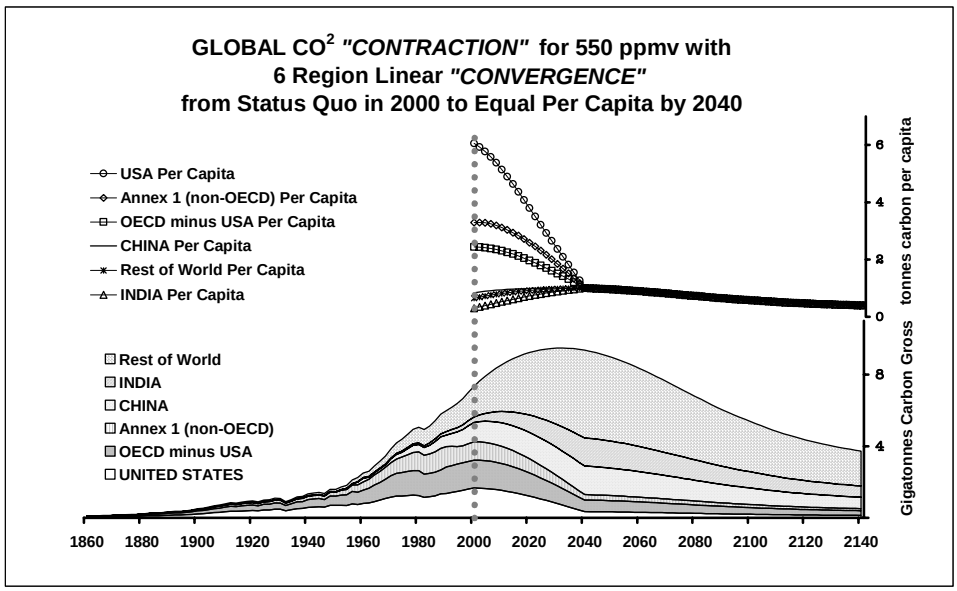
[4] CCOptions will calculate any rates of Contraction & Convergence for all countries' CO_2. 3 example page seven

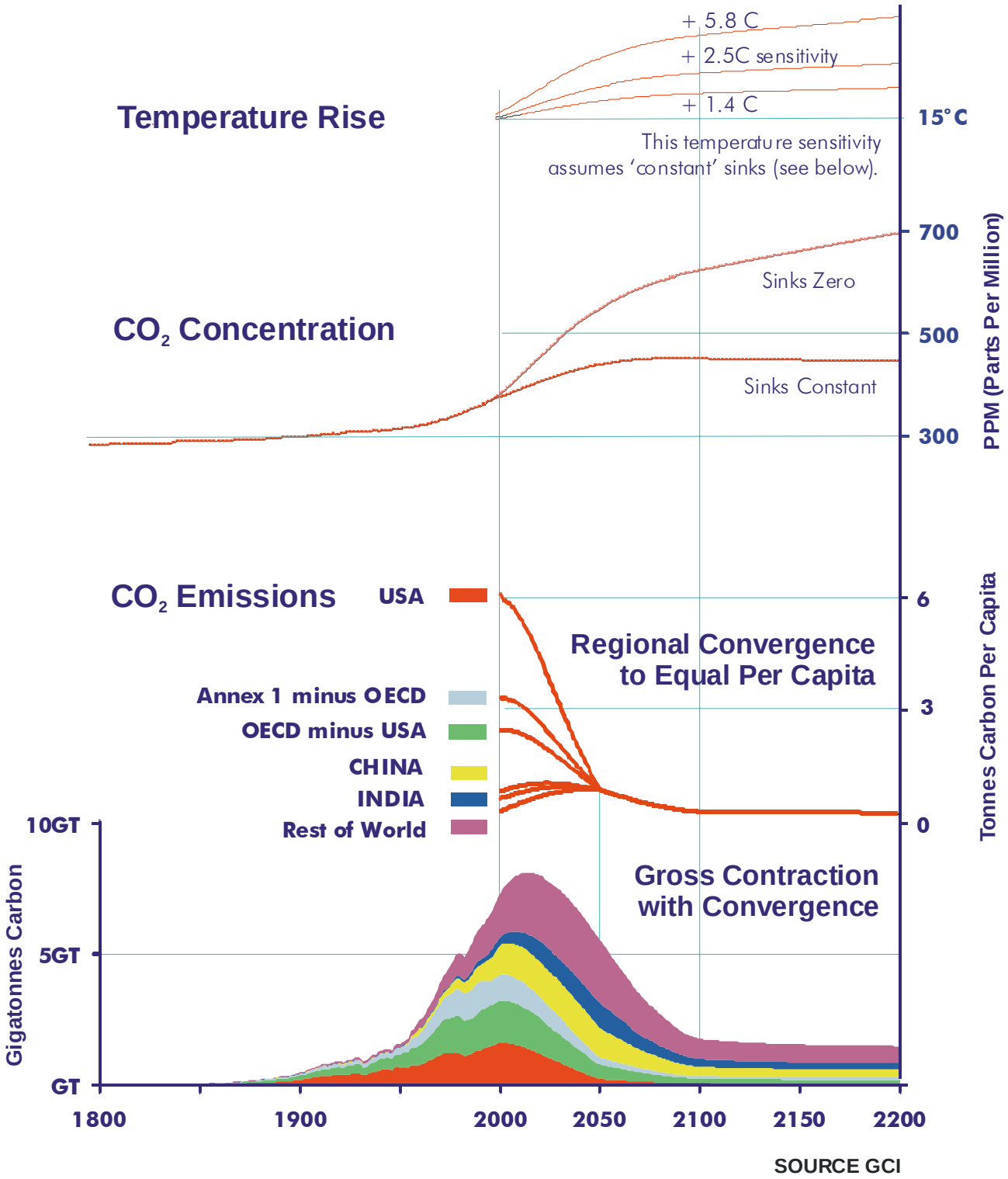
[5] The example on page eight chosen shows global CO_2 emissions reduced to 40% of 1990 output value by 2100 giving a stable atmospheric concentration of 450 parts per million of CO_2 by 2100. Other contraction 'shapes' are possible for the same concentration outcome. Different rates of contraction are possible leading to different concentration outcomes (see page seven) but damages from climate change increase proportional to delay.

[6] The example on page eight shows global pre-distribution of contraction through linear convergence so shares are proportional to international populations by 2050 with figures for population growth frozen from 2050 forwards. Different rates of convergence are possible and different dates of freezing population are possible. Both of these affect the pre-distribution of the tradable emissions entitlements.


GLOBAL CO2 "CONTRACTION" for 350 ppmv with
6 Region Linear "CONVERGENCE"
from Status Quo in 2000 to Equal Per Capita by 2020
USA Per Capita
Annex 1 (non-OECD) Per Capita
OECD minus USA Per Capita
CHINA Per Capita
Rest of World Per Capita
INDIA Per Capita
Rest of World
INDIA
CHINA
Annex 1 (non-OECD)
OECD minus USA
UNITED STATES
Gigatonnes Carbon Gross tonnes carbon per capita
1860 1880 1900 1920 1940 1960 1980 2000 2020 2040 2060 2080 2100 2120 2140


GLOBAL CO2 "CONTRACTION" for 450 ppmv with
6 Region Linear "CONVERGENCE"
from Status Quo in 2000 to Equal Per Capita by 2030
USA Per Capita
Annex 1 (non-OECD) Per Capita
OECD minus USA Per Capita
CHINA Per Capita
Rest of World Per Capita
INDIA Per Capita
Rest of World
INDIA
CHINA
Annex 1 (non-OECD)
OECD minus USA
UNITED STATES
Gigatonnes Carbon Gross tonnes carbon per capita
1860 1880 1900 1920 1940 1960 1980 2000 2020 2040 2060 2080 2100 2120 2140


GLOBAL CO2 "CONTRACTION" for 550 ppmv with
6 Region Linear "CONVERGENCE"
from Status Quo in 2000 to Equal Per Capita by 2040
USA Per Capita
Annex 1 (non-OECD) Per Capita
OECD minus USA Per Capita
CHINA Per Capita
Rest of World Per Capita
INDIA Per Capita
Rest of World
INDIA
CHINA
Annex 1 (non-OECD)
OECD minus USA
UNITED STATES
Gigatonnes Carbon Gross tonnes carbon per capita
1860 1880 1900 1920 1940 1960 1980 2000 2020 2040 2060 2080 2100 2120 2140


Temperature Rise
+ 5.8 C
+ 2.5C sensitivity
+ 1.4 C
15°C
This temperature sensitivity
assumes 'constant' sinks (see below).
CO2 Concentration
700
500
300
Sinks Zero
Sinks Constant
PPM (Parts Per Million)
CO2 Emissions
USA
Annex 1 minus OECD
OECD minus USA
CHINA
INDIA
Rest of World
Regional Convergence
to Equal Per Capita
6
3
0
Tonnes Carbon Per Capita
10GT
5GT
GT
Gigatonnes Carbon
Gross Contraction
with Convergence
1800
1900
2000
2050
2100
2150
2200
SOURCE GCI

C&C and the UNFCCC

UNFCCC already commits Parties to Contraction and Convergence

> *" . . . must achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system* [7] *. . . should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity* [8] *. . . the developed country Parties must take the lead in combating climate change* [9] *. . . (while) the share of global emissions originating in developing countries will grow to meet their social and development needs."* [10]

The Kyoto Protocol is an incomplete response to the UNFCCC because Developing Countries are excluded from the formal regime of emissions control. Nor will the targets selected even begin to achieve atmospheric stabilization of greenhouse gases. A global C&C framework is the logical way to secure global participation in the process and achieve stabilization of atmospheric greenhouse gas concentration.

As the UNEP CEO Topfer recognised in June 97, C&C the logical extension of the Protocol: -

> *"The review system of Kyoto mechanisms can ensure equity. Currently CO2 emissions rights are allocated according to existing emissions patterns with a specified reduction percentage for various countries within a certain period of five years (2008-2012). The redistribution through the Kyoto Protocol could be continued until emissions rights are uniformly distributed on a per capita basis. This will be a critical element to ensure the poor also get rights to utilise the world's environment, or in this limited case, the assimilative capacity of the atmosphere, a global commons resource."*

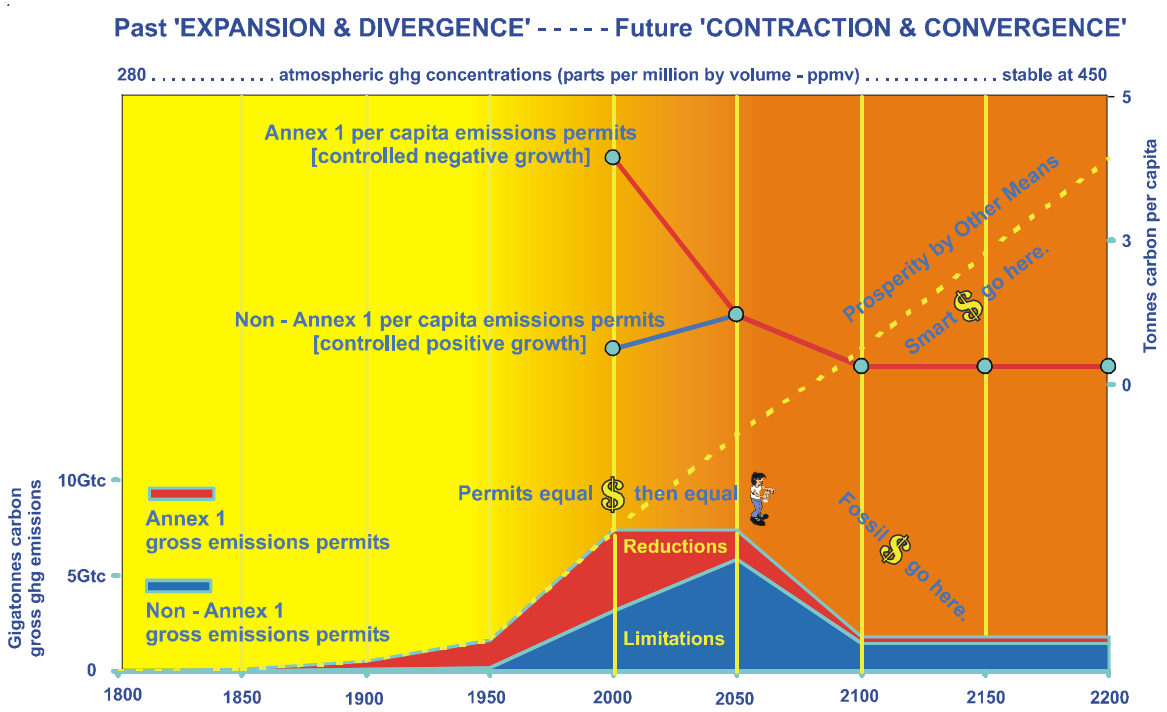
[7] UNFCCC Article 2
[8] UNFCCC Article 3.1
[9] UNFCCC Article 3.1
[10] UNFCCC Article 3.3

C&C and the US BYRD HAGEL Resolution

In July 1997 US Senators Byrd and Hagel tabled a resolution about the US involvement with the Kyoto Protocol. It rehearsed all their objections to what they felt was the 'flawed' character of the Berlin Mandate and the impending Kyoto Protocol.

> *"Now, therefore, be it resolved that: - The US should not be a signatory to any protocol to, or other agreement regarding, the UNFCCC of 1992, at negotiations in Kyoto in December 1997, or thereafter, which would mandate new commitments to limit or reduce greenhouse gas emissions for the Annex I Parties, unless the protocol or other agreement also mandates new specific scheduled commitments to limit or reduce greenhouse gas emissions for Developing Country Parties within the same compliance period."*

The crucial detail in the Byrd Hagel Resolution is in that two defining distinctions are maintained between: - (1a) Annex One Parties (Developed Country Parties) and (1b) Developing Country Parties and (2a) *'limit'* ghg emissions and (2b) *'reduce'* ghg emissions. Limitation of ghg emissions is controlled positive growth of ghg emissions and reductions of ghg emissions is controlled negative growth of emissions. Putting these concepts together in the same compliance period, translates into a formal process of *"Contraction and Convergence".* Annex One Parties will reduce (or contract) their ghg emissions while the Developing Country Parties will limit their ghg emissions (so as to converge with Annex One Country Parties). This will not emerge by accident. It can only emerge by design and consent. For authors and supporters of the resolution, *"Contraction and Convergence"* provides the logical answer.



Overview of trends with and without C&C for 450 ppmv CO_2

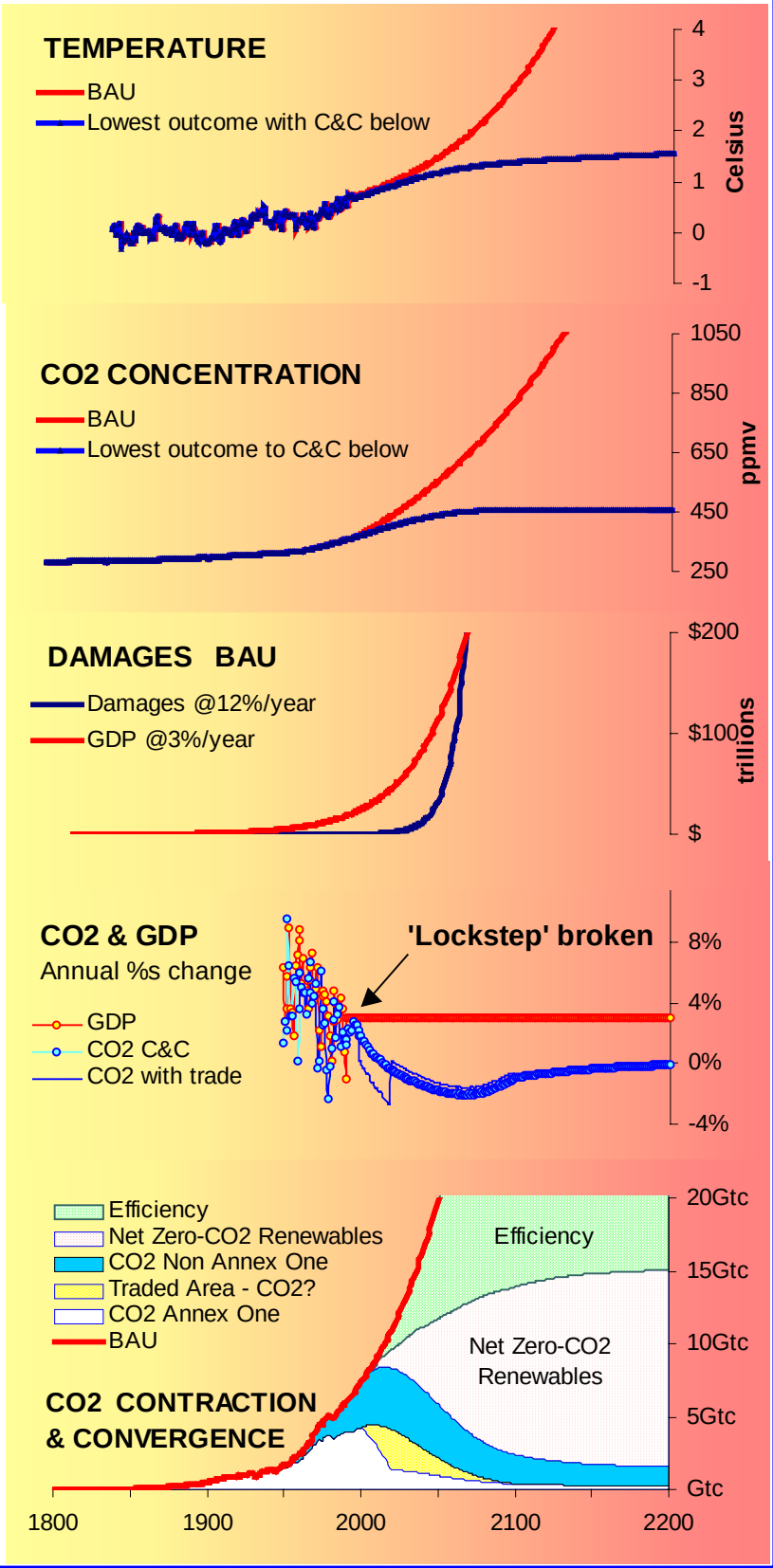
Surface temperature from 1860 until 2000 shows an overall rise of 0.9°C. The future projections are following CO_2 emissions and atmospheric ghg concentrations (in ppmv - parts per million by volume). The red line shows Business-as-Usual (BAU) where the underlying emissions grow at 2%/yr. The blue line shows the lowest possible climate sensitivity - a rise of 1.5°C - assuming a contraction by 2100 of 60% in annual emissions.

Recorded atmospheric CO_2 concentration from 1860 until 2000 shows an increase of 34% over pre-industrial levels. This is a rise both higher and a faster than anywhere in the ice-core sampling back 440,000 years before now. Concentrations are rising as the result of accumulating emissions. In future, the worst case is the red line as BAU. The best case sees this concentration stabilised at 70% above pre-industrial levels due to a 60% contraction in the underlying emissions by 2100.

Damages here are the global economic losses (Munich Re) for the four decades past for all natural disasters projected at the observed rate of increase of 12% a year in comparison to global $GDP at 3%. If the global trends continue BAU, damages will exceed GDP by 2065! The risks will soon rise beyond the capacity of the insurance industry and even governments to absorb. Damages will rise for the century ahead even with emissions contraction, but the rate can be reduced with Contraction, Convergence, Allocation and Trading (C-CAT).

For the past four decades, the output of CO_2 and GDP from global industry have been correlated nearly 100% (known as 'lockstep'). Breaking the lockstep is essential. Future GDP is projected here at 3% a year. Future CO_2 goes to -2% with the retreat from fossil fuel dependency shown below, that limits CO_2 concentrations to 70% above pre-industrial levels, shown above. If the traded area is also converted to zero-emissions supply (below), the carbon retreat might achieve up to - 4% a year.

The red line shows BAU CO_2 emissions. The solid segments show "Contraction, Convergence, Allocation and Trade" [C-CAT] to manage emissions down by at least 60% within a given time frame (2100 here) with an agreed 'contraction budget' (here 680 billion tonnes of carbon). The internationally tradable shares of this budget (here, 100 billion tonnes) result from convergence to equal per capital emissions by an agreed date and population base year (here 2020). If this is invested in zero-emissions technologies, risk and damages are lowered further as the budget is then net of these emissions as well. The renewables opportunity is the difference between C-CAT and BAU. It is worth trillions of dollars per annum - the biggest market in history.



Further Information

Global Commons Institute (GCI) (see below)

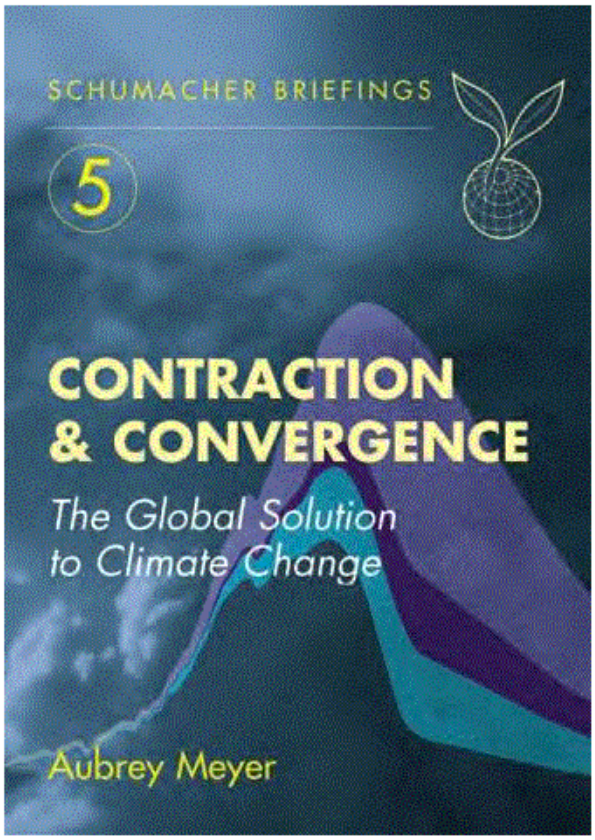
Technical support and information about *"Contraction & Convergence"* and the planning model itself (CCOptions) are available at: - http://www.gci.org.uk

Contraction and Convergence, the Global Solution to Climate Change

Schumacher Briefing No. 5 by Aubrey Meyer - Published during at COP-6, November 2000. Available Now from Green Books price £5: - http://www.greenbooks.co.uk/cac/cacorder.htm

"If you read only one book on climate change, its past and future, politics and solutions, read this one. This is the global picture and the key to a global solution."

Prof Tom Spencer, University of Surrey
President, GLOBE International 1994-99



" . . . brilliant. It reads like a novel. I particularly liked your interpretation of the Tao Te Ching . . . the policy analysis sharp as ever . . . analysis of how the climate negotiations up to and beyond Kyoto went off track is spot on."

Jonathon Loh
Policy Officer WWF International

"Man-made climate change is probably the most serious environmental threat we face. Contraction & Convergence is one way to address the challenge. It is a very powerful idea and we are moving remorselessly in that direction."

Michael Meacher
UK Minister for Environment

"It is clear that urgent action is called for not only by government and industry but also by ourselves. If our lives are to be conducted according to principles of conscience and survival, we cannot continue to evade our responsibility on this portentous issue. I can think of no better investment of time and no more effective means of jolting people out of their complacency on the ramifications of global warming than by reading this remarkable book."

Mayer Hillman
Town & Country Planning

"This then, is the book of the GCI campaign. Read and learn, and marvel."

Dave Bradney
Green Party

Global Commons Network:

Free subscription to Bulletins with news of progress in the emergence of Contraction and Convergence (C&C): - http://www.topica.com/lists/GCN@igc.topica.com/read

Global Commons Institute (GCI), 37 Ravenswood Road, LONDON E17 9LY
Phone 0208 520 4742 Email aubrey@gci.org.uk, Web www.gci.org.uk
Global Commons Network (GCN), Web www.topica.com/lists/GCN@igc.topica.com/read

Statements by Individuals

Compilation of References to the
Contraction and Convergence Policy Proposal
1995 - 2002

1995 4

April - Indian Environment Minister 4

1997 4

Richard Richels (EPRI), Alan Manne (Battelle) 4

October - Dr Song Jian, China State Councilor Climate Change 4

December - Prof Saifuddin Soz, Indian Environment Minister 4

December - Tom Spencer, Chair Euro-Parliament. Foreign Affairs Com. 4

1998 5

October - Tony Blair, Prime Minister United Kingdom 5

October - Sir Robert May, UK Government Chief Scientist 5

November - US Congressman John Porter, Chair GLOBE USA 5

1999 5

April - Michael Meacher UK Minister of the Environment 5

June 9 - David Chaytor MP 5

June - Klaus Topfer, Director UNEP 6

2000 6

February - Ambassador Raul Estrada, Chair Kyoto Negotiations 6

April - Svend Auken, Danish Environment Minister 6

July - Jan Pronk, Chair COP- 6, Environment Minister Netherlands 6

November - Jaques Chirac, President of France - COP6 7

May - Sir John Houghton, Chair IPCC WG1 7

2001 8

June 26 - John Oliver, Lord Bishop of Hereford 8

August - Nyier Abdou, Al Ahram Newspaper 8

August - Julian E Salt, UK Loss Prevention Council 8

September - Kjell Larsson, Swedish Environment Minister 9

October - John Porter, US Parliamentarian Chair GLOBE USA 9

October - Robert Stavins, Director, Environment Economics Program, JFK School of Government, Harvard University 9

November 22 - Michael Meacher, UK Environment Minister 9

November - Olivier Delouze, Belgian Environment Minister 9

October - Michael Meacher, UK Minister of the Environment 9

2002 10
January - Adair Turner, former Director of the CBI 10
February - Marcel M. Berk, Michel G.J. den Elzen. 10
February - Hans H.Kolshus, Cicerone 10
July - John Ritch - Director General World Nuclear Association 11
June 1 - Rodney R. White - Department of Geography & Institute for Environmental Studies, University of Toronto 11
August 18 - Right Reverend John Oliver - Bishop of Hereford 12

1995

April - Indian Environment Minister

"We face the actuality of scarce resources and the increasing potential for conflict with each other over these scarce resources. The social, financial and ecological inter-relationships of equity should guide the route to global ecological recovery.

Policy Instruments such as "Tradable Emissions Quotas", "Carbon Taxes" and "Joint Implementation" may well serve to make matters worse unless they are properly referenced to targets and time-tables for equitable emissions reductions overall. This means devising and implementing a programme for convergence at equitable and sustainable par values for consumption on a per capita basis globally."

1997

Richard Richels (EPRI), Alan Manne (Battelle)

At the Symposium on the Economics of Climate Change:

"We begin with one widely discussed proposal: a transition to equal per capita emissions rights (globally) by 2030," again allowing the expedient of a "prescription" to "solve" what is otherwise insoluble.

October - Dr Song Jian, China State Councilor Climate Change

"When we ask the opinions of people from all circles, many people, in particular the scientists think that 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. Today the per capita consumption is just one tenth of that of the developed countries, one eighth of that of medium developed countries. It is estimated 30-40 years would be needed for China to catch up with the level of medium developed countries."

December - Prof Saifuddin Soz, Indian Environment Minister

"In any discussion, "Contraction and Convergence", the central point is entitlements - equitable per capita entitlements. At Kyoto we had stressed that any discussion on emissions trading ought to be framed in terms of per capita entitlements. Any trading can take place only after the emissions entitlements of the trading partners is defined and legally created - equitably of course. Historical emissions are iniquitous and cannot be the basis of entitlements. Entitlements will define the sharing of the atmosphere on an equitable basis which also brings together all the cooperative mechanisms in the Kyoto Protocol in a common framework."

December - Tom Spencer, Chair Euro-Parliament. Foreign Affairs Com.

"Many of you know the Contraction and Convergence analysis. It offers a framework for an answer. It offers an envelope of equity within which we can trade and barter our way to collective sanity in the coming decades."

1998

October - Tony Blair, Prime Minister United Kingdom

"In the fight against climate change the Contraction and Convergence proposal makes an important contribution to the debate on how we achieve long-term climate stability, taking account of the principles of equity and sustainability."

October - Sir Robert May, UK Government Chief Scientist

"Thank you for the information on "Contraction and Convergence" policy and the efforts by GCI and GLOBE to build up global support for it. These matters are clearly of great importance and I would agree that this approach merits full consideration, including at the senior international political level, along with other ideas contributing to the development of a workable global climate strategy."

November - US Congressman John Porter, Chair GLOBE USA

GLOBE stands for Global Legislators Organisation for a Balanced Environment. It is an international network of Parliamentarians committed to working in a global non-partisan manner for legislation to protect the environment.

"Meaningful progress on confronting the challenge of climate change will only occur when countries from the North and the South are able to collaborate in issues of significant and sustainable development. The GLOBE Equity Protocol - Contraction and Convergence - and its mechanism for financing sustainable development is the only proposal so far which is global, equitable and growth-oriented. It is these issues that were endorsed at the GLOBE International General Assembly in Cape Cod, and form the thrust of our paper (Nov 1998), "Solving Climate Change with Equity and Prosperity."

1999

April - Michael Meacher UK Minister of the Environment

"I do believe that contraction and convergence provides an effective, equitable market-based framework within which Governments can co-operate to avert climate change, and again congratulate you on your campaigning to bring this about."

June 9 - David Chaytor MP

"In many analysts' opinion, a policy of contraction and convergence provides the way out of the logjam. Under such a policy, each nation would be allocated a quota of emissions based on population, and set in the context of agreed environmental limits. Over time, industrial nations would be required gradually to reduce emissions, while developing countries would be permitted gradually to increase theirs, until a point was reached at which the emissions quotas of all countries were relatively equal.

That seems to provide the only practical and principled resolution of the conflicting interests of the developed world and the developing world, based on equal rights for all human beings. I urge the Government to present the case for contraction and convergence as a realistic means of facilitating the ratification of the Kyoto protocol. I commend the research conducted by the Global Commons Institute in developing that model. "

June - Klaus Topfer, Director UNEP

"Convergence - The review system of Kyoto mechanisms can ensure equity. Currently CO2 emissions rights are allocated according to existing emissions patterns with a specified reduction percentage for various countries within a certain period of five years (2008-2012). The redistribution through the Kyoto Protocol could be continued until emissions rights are uniformly distributed on a per capita basis. This will be a critical element to ensure the poor also get rights to utilise the world's environment, or in this limited case, the assimilative capacity of the atmosphere, a global commons resource."

2000

February - Ambassador Raul Estrada, Chair Kyoto Negotiations

"Long before the end of the Framework Convention negotiation, the Global Commons Institute has presented a proposal on "Contraction and Convergence", aimed to reach equality in emissions per capita. We all in this room know the GCI model where contraction is achieved after all governments, for precautionary reasons, collectively agree to be bound by a target of global GHG emissions, making it possible to calculate the diminishing amount of greenhouse gases that the world can release each year in the coming century, subject to annual scientific and political review. The convergence part of the proposal means that each year's global emissions budget gets shared out among the nations of the world so that every country converges on the same allocation per inhabitant by an agreed date. Countries unable to manage within their shares would, be able to buy the unused parts of the allocations of other countries. The entitlement of rights transferred in this trading is legitimised by the per inhabitant criteria. Level of contraction and timing of convergence should be negotiated on the basis of the precautionary principle. Suggestions for emission reductions are well known and convergence should be achieved at medium term to satisfy legitimacy."

April - Svend Auken, Danish Environment Minister

"The approach of "Contraction and Convergence" is precisely such an idea. It secures a regime that would allow all nations to join efforts to protect our global commons from being over-exploited, without the risk that any country would be deprived of its fair long-term share of the common environmental emission space. And it allows for consistent and efficient management of the global emissions that would enable us to strive for constraining global interference with the climate below fixed ceilings, such as the max 2 degrees temperature rise, and the max. 550 ppmv CO2-concentration, recommended by the European council of ministers."

July - Jan Pronk, Chair COP- 6, Environment Minister Netherlands

"Contraction and Convergence" - most equitable . . . easier & cheaper *than alternatives. "*

. . .The debate about broadening participation of developing countries in the global effort to stabilize greenhouse concentrations in the atmosphere at sustainable levels has the tendency to focus first on the most advanced developing countries. Suggestions have been made for commitments for those developing countries in the period after 2012 in terms of increased energy or greenhouse gas efficiency. In other words: not an absolute cap, but a relative efficiency improvement in the production structure of developing countries. This strategy would imply that developing countries gradually start participating, as they achieve a certain level of economic development. That is a reasonable and realistic option. However, it can be argued that such gradual participation would only lead to a slow decline of global emissions, even if current industrialized countries would drastically decrease their emissions. As a result

global average temperature increase would significantly exceed the 2 degrees centigrade limit that could be seen as the maximum tolerable for our planet. There are alternatives for this scenario. Some developing countries have argued for an allowance of equal emissions per capita. This would be the most equitable way to determine the contribution of countries to the global effort. If we agree to equal per capita emissions allowances for all countries by 2030 in such a way that global emissions allow us to stay below the 2 degrees global temperature increase (equivalent to about 450 ppmv CO2), then the assigned amounts for Annex B countries would be drastically reduced. However, due to the fact that all countries would have assigned amounts, maximum use of global emissions trading would strongly reduce the cost of compliance. So, in such a scenario, industrialized countries would have to do more, but it would be cheaper and easier . . . "

November - Jaques Chirac, President of France - *COP6*

"Since 1992, we have fallen too far behind in the fight against global warming. We cannot afford any further delay. That is why, I can confirm to you here, Europe is resolved to act and has mobilized to fight the greenhouse effect. Europe calls upon the other industrialized countries to join with it in this fight. And Europe proposes to the developing countries to join it in a partnership for sustainable development. Let us start thinking about the post-Kyoto period without further ado. Tomorrow, it will be up to us to set forth the rights and duties of each, and for a long time to come. To move forward while respecting individual differences and special circumstances, France proposes that we set as our ultimate objective the convergence of per capita emissions. This principle would durably ensure the effectiveness, equity and solidarity of our efforts."

May - Sir John Houghton, Chair IPCC WG1

"Three widely accepted principles will govern the international agreements needed to meet the threat of climate change. (1) The Precautionary Principle, already clearly embedded in the UNFCCC agreed at the Earth Summit in Rio in 1992. This states that the existence of uncertainty should not preclude the taking of an appropriate action. The reason for such action is simply stated as the stabilisation of the concentrations of greenhouse gases (such as CO2) in the atmosphere in ways that allow for necessary economic development. (2) The Polluter Pays Principle, which implies measures such as carbon taxes or carbon trading arrangements. (3) The principle of Equity, both intergenerational and international - the most difficult to apply. However a proposal of the Global Commons Institute - "Contraction-and-Convergence" (C&C)" - that is being widely discussed applies these principles by allowing eventually for the allocation of carbon emissions to nations on an equal per capita basis while also allowing for emissions trading."

2001

June 26 - John Oliver, Lord Bishop of Hereford

My Lords . . . . .

. . . We need to take to heart the advice of the Royal Commission published last year to put in place a programme which takes account of the legitimate needs and aspirations of the developing countries and works on the principle of contraction and convergence of greenhouse gas emissions.

August - Nyier Abdou, Al Ahram Newspaper

"This point is stressed by Aubrey Meyer, director of the UK group the Global Commons Institute (GCI) and author of -Contraction and Convergence: the Global Solution to Climate Change- *(Green Books). Without a feasible and binding plan for dealing with global warming, Meyer predicts climate change will wreak havoc on the developing world. Talking to the* Weekly, *Meyer noted that population increases will inevitably increase the number of people affected by natural — and, indeed, "unnatural" disasters. "If these occur [in places] where there are already local conflicts over the use of land and other resources — as with storms in Orissa or droughts in the Middle East, for example — these impacts can only aggravate such conflicts."*

.....

"The level of greenhouse concentration in the atmosphere at this time is higher than anywhere in data sets going back half a million years," says GCI's Meyer. "Historically these levels have varied but at significantly lower average value than the levels we have achieved since the industrial revolution began around 200 years ago. It is possible — perhaps probable — that continuing this unrelenting pulse of human emissions will trigger global climatic upheaval." Referring to the claim that it is not clear that anything has indeed gone "wrong," Meyer insists, "The point [Lindzen] makes is simply: if there isn't a problem, don't fix it. However, it is obvious that there is a problem, and that we are all going to be broke if we don't fix it."

August - Julian E Salt, UK Loss Prevention Council

Commenting for the UN Observer,on the risk management of climate change, Julian Salt of the UK Loss Prevention Council and BRE writes,

" . . . . . Contraction & Convergence" would be the driving principle behind the new approach.

Contraction & Convergence targets (upper global cap on emissions and convergence point) would be adjusted according to the latest scientific findings emenating .from the IPCC. The upper carbon cap could be adjusted downwards if the latest findings showed that climate change was increasing at a dangerous rate.

Two new protocols would be created to deal with the issue of sinks (forestry) and new technology (renewables). Carbon credits for enhanced sink capacity and use of renewable energy would be overseen by a Carbon Credit body.

Emissions trading would still exist but initial allocations of credits would be based on the equity principle (population based).

Ideally, the ultimate end time-frame for completion of the "C&C" process would be 2050 or sooner if possible. Emissions contraction should start immediately to be effective. Time is of the essence."

September - Kjell Larsson, Swedish Environment Minister

"On the issue of equity, Sweden strives for a global convergence, meaning that the long term objective of the international community should be a per capita emissions target equal for all countries. The work towards sustainability embraces the right for the poorest countries to continue their development and requires that the developed world contribute to this. In other words the industrialised countries must reduce their emissions in order to enable the least developed countries to develop."

October - John Porter, US Parliamentarian Chair GLOBE USA

"Meaningful progress on confronting the challenge of climate change will only occur when countries from the North and the South are able to collaborate in issues of significant and sustainable development. The GLOBE Equity Protocol - Contraction and Convergence - and its mechanism for financing sustainable development is the only proposal so far which is global, equitable and growth-oriented.

It is precisely these issues that were endorsed at the GLOBE International General Assembly in Cape Cod, and form the thrust of our recently released (Nov 1998) paper, "Solving Climate Change with Equity and Prosperity."

October - Robert Stavins, Director, Environment Economics Program, JFK School of Government, Harvard University

"This (Contraction and Convergence) is a long-term standard that is difficult to find fault with, and has much to recommend it on ethical grounds and in terms of parsimony.

I think it's quite reasonable that the ultimate greenhouse-gas emission standard (i.e. allocation mechanism of targets among countries) toward which the entire community of nations might work over the long term would be one linked with equal per capita emissions assuming that cost-effectiveness could still be achieved through simultaneous provision for international trading or some other mechanism that would facilitate the equating of marginal abatement costs."

November 22 - Michael Meacher, UK Environment Minister

At the UK Environment Council's climate conference for business in London, Michael Meacher was the keynote speaker.

In answering questions from the Loss Prevention Council regarding the relationship between Kyoto Protocol and C&C, Mr Meacher gave a detailed explanation of C&C saying,

'C&C is not 'Plan B', it is 'Plan A-Plus'.

(see announcement at: - http://www.the-environment-council.org.uk/)

November - Olivier Delouze, Belgian Environment Minister

"We are conscious that in the end, we will have to inevitably evolve towards a more equitable partition between the north and south, of the capacity of our common atmosphere to support green house gases, by a gradual convergence of the levels of emissions on a per capita basis."

October - Michael Meacher, UK Minister of the Environment

"I find it an appealing concept. It is obviously absolutely profound in its implications. It is normally known under the title of Contraction and Convergence, in other words the developed countries contract their emissions, which is what Kyoto is all about, and we get convergence with the developing countries as they industrialise and increase their emissions....I do not think it is pie in the sky. It is certainly not just a conceptual philosophy. We are moving remorselessly in that direction"

2002

January - Adair Turner, former Director of the CBI

(His) " . . . . analysis really starts to pack a punch when he turns to the environment. Here, after all, is a case of massive market failure.

Take climate change, which "is likely to impose massive economic costs... The case for being prepared to spend huge resources to limit it is clear," he says, arguing that the cost will be repaid many times over by the avoidance of disaster.

In any case, "the developed world does not have the moral right to increase the risk of flooding in Bangladesh", and, he adds acidly, "European executives worried about the cost of action should perhaps consider it the necessary price for preserving at least some skiing in the Alps."

Long term, says Turner, the only sound strategy is that of 'contraction and convergence' – cutting greenhouse emissions to the point where they are shared equally, worldwide, on a per capita basis."

Article at: http://www.greenfutures.org.uk/features/default.asp?id=905

February - Marcel M. Berk, Michel G.J. den Elzen.

"Options for differentiation of future commitments in climate policy: how to realise timely participation to meet stringent climate goals?"

"Where climate change limits are stringent, a C&C regime seems to provide more incentives for a timely participation of developing countries, and better opportunities for an effective and efficient regime for controlling global GHG emission control than increasing participation."

Netherlands National Institute for Public Health and the Environment (RIVM), P.O. Box 1, 3720 BA Bilthoven, The Netherlands

Paper retrievable at: -http://www.gci.org.uk/papers/berkelz.pdf

February - Hans H.Kolshus, Cicerone

"While the Kyoto Protocol may represent an important political achievement, its expected impact on the climate is marginal at best. The agreement is nowhere near sufficient for stabilizing or reducing the concentration of greenhouse gases in the atmosphere, partly because developing countries have not committed to reducing their emissions in this round. Future climate negotiations must therefore contain more ambitious targets as well as the participation of developing countries. In an attempt to realize this aim, the Global Commons Institute has proposed that emissions entitlements be allocated on a per capita basis....

The method, called "contraction and convergence" (C&C), was first developed by Tony Cooper and Aubrey Meyer in the spring of 1996....

A team from GCI then presented the idea to the second Conference of the Parties (COP 2) in Geneva, in July 1996. Since then, the idea has garnered support from more and more governments and NGOs."

Aticle at: http://www.cicero.uio.no/media/549.pdf

July - John Ritch - Director General World Nuclear Association

". . . . . A serious climate regime – if one is to evolve – must go far beyond Kyoto, by encompassing all nations and by employing some variation of the concept known as "contraction and convergence":

Contraction means that over the century ahead we must plot a path that will reduce overall global emissions by at least 50% – even as populations and economies expand. Convergence means that, in this process, we must accept the principle that every person on Earth is entitled to an equal per-capita level of emissions.

Stated in this stark manner, the goal of 50% contraction seems draconian, while the principle of equal entitlement to emissions seems utopian. In fact, both concepts are eminently practical.

As to contraction, nothing short of a 50% emissions reduction offers any hope of averting catastrophic climate change. This cutback – entailing a 75% reduction in today's advanced economies – accomplishes no more than stabilizing global greenhouse gases at a level over twice that which existed just two centuries ago.

As to convergence, nothing other than the principle of equal entitlement offers a basis for the global consensus on which an effective climate regime must depend. Equal entitlement does not mean equal emissions; it is, rather, the basis for an allocation of rights on which a fair and rational emissions trading system can be built.

A system based on this principle – and, I venture to say, only a system based on this principle – can be designed to produce the sense of equity, the predictability, and the sound economic incentives needed for smooth transition into a clean-energy future. These incentives can work constructively in developed and developing countries alike.

In this schema, the sense of equity and predictability are created at the very outset of the regime. A nation's population size at an agreed point would be the basis for establishing its long-term emissions ceiling, toward which it would be committed to move on a steady path. To facilitate a smooth and economically rational transition toward that goal, emissions trading would enable countries and companies to chart their own best path – selling permits where possible, buying them when necessary. The rate of convergence to a common level would be designed to ensure that, during the long transition, already-industrialized nations as a whole would find it advantageous to purchase emissions permits from countries less developed. This capital flow could serve the common interest in sustainable development by financing clean-energy infrastructure in the developing world.

Building this regime is not beyond human wit. Indeed, its simplicity and feasibility stand in favourable contrast to the chaos, social dislocation, vast expense and human misery that unrestrained climate change could bring – and from which no nation would be immune."

June 1 - Rodney R. White - Department of Geography & Institute for Environmental Studies, University of Toronto

Today I am going to take the position that an essential part of a successful implementation phase for the (Kyoto) Protocol is a progressive reduction in emissions, moving towards equal per capita emissions rights throughout the world.

This position is sometimes called 'contraction and convergence'. It may seem like the other end of the traditional ideological spectrum compared with a position that espouses emissions trading.

Contraction and convergence is based on equity – in the justice sense. It may seem absurdly optimistic. However, I think it has to be part of the plan, so that we can all share a common sense of direction."

http://www.gci.org.uk/papers/SilvLining.pdf

August 18 - Right Reverend John Oliver - Bishop of Hereford

"Contraction and Convergence…is a system whereby everybody in the world, every human being, is given as it were a permit to pollute, and a financial value is put on that. Countries that are polluting more that their fair share at the moment, including in particular the United States would obviously have to buy permits from the poorer countries. That money would help the poor countries in their own development while the process of convergence took place"

http://www.gci.org.uk/Interviews/Hereford.pdf

Statements by Organisations

Compilation of References to the
Contraction and Convergence Policy Proposal
1997 - 2002

1997 4

August - The Africa Group of Nations 4

1998 4

August - The GLOBE Southern Africa Network 4

September - Non-Aligned Movement (NAM) 4

October - European Parliament 4

November - UNCTAD, Elements of a "Buenos Aires Mandate" 5

1999 5

1999 - Christian Aid 5

2000 6

April - Charter 99 Declaration 6

June - Int. Federation of Red Cross & Red Crescent Societies 6

June - Royal Commission on Environmental Pollution (RCEP) 6

2001 8

March 6 - Royal Institute of International Affairs 8

March 20 - UK Liberal Democrats 8

March - UK Chartered Insurance Institute (CII) 9

April - UNA UK 9

May - FoE Finland on Climate Equity 10

June - IPCC Third Policy Assessment 10

July - USS Research Report No 1 10

August - British Telecom 11

August - IPCC Third Policy Assessment 11

September - The Corner House 11

September - The Austrailia Institute 12

October - Tellus Institute 12

October - UK Green Party 13

November - UNEP FI - Statement COP7 13

November - NEF/Jubilee Plus 13

November - British Petrolium 14

November - "Global Public Goods", Swedish Foreign Affairs 14

December - UK Tyndall Centre 14

December - Quakers 15

2002 16
January - SERA - "Socialist Environment and Resources Association" 16
February - Swedish Ministry of Foreign Affairs 2001 16
February - Delhi Sustainable Development Summit 2002 17
February - Dutch Parliament 17
February - Department for Trade and Industry - Inter Agency Group 17
February - Energy Review, UK Cabinet Office Performance & Innovation Unit 17
February - IIED/RING 18
February ...World Bank - Summary of the E-Discussion on the Environment and Poverty 19
March - World Bank Report - "Globalization, Growth & Poverty" 19
April 18 - Christian Ecology Link 19
April 20 - The Foundation for the Economics of Sustainability 20
April 24 - DTQs 21
April 24 - EC Letter 21
April - Sky Trust 21
May - C&C in Heinrich Boell Foundation Report for WSSD 21
June 8 - Tyndall Centre UK - 22
June 8 - Tyndall Centre UK - "The Use of Integrated Assessment: An Institutional Analysis Perspective" 22
June 8 - Uranium Institute 22
June - Wilton Park Conference "Climate Change: What Can Be Done?" 23
July 2 - World Nuclear Association 24
July - Dept For International Development - Select Committee Report 25
July - Unrepresented Nations and Peoples Organisation (UNPO) 25
August - The World Council of Churches (WCC) 25
September - Department of Physical Resource Theory, Chalmers University of Technology, Göteborg University, Sweden 26
September - "New Economy" from the Institute for Public Policy Research (IPPR) 26
September - World Bank 26
October - "UNEP Financial Initiative - on C&C 27

1997

August - The Africa Group of Nations

"As we negotiate the reduction of GHG, the countries of Africa believe that there should be certain principles that need to be clearly defined. A globally agreed ceiling of GHG emissions can only be achieved by adopting the principle of per capita emissions rights that fully take into account the reality of population growth and the principle of differentiation."

1998

August - The GLOBE Southern Africa Network

1 Members of Parliament and Members of the GLOBE Southern Africa Network . . . Support the adoption of a mandate at Buenos Aires to redefine the way in which greenhouse emission cuts are shared between countries under the Kyoto Protocol, following instead the principle of global equity enshrined in the Contraction and Convergence analysis,

2 Specifically work to ensure that all future development of the UNFCCC and its related instruments will be consistent with these interdependent principles of global equity and sustainability;

3 And rebut any recourse to "flexibility mechanisms" that are not derived from the interdependent application of these principles of sustainability and global equity;

September - Non-Aligned Movement (NAM)

In August and September the NAM held a heads of Government conference in South Africa. Combining the logic of "Contraction and Convergence" with the trade Article 17 of the Kyoto Protocol (KP), the NAM agreed the following statement: -

"Emission trading for implementation of (ghg reduction/limitation) commitments can only commence after issues relating to the principles, modalities, etc of such trading, including the initial allocations of emissions entitlements on an equitable basis to all countries has been agreed upon by the Parties to the Framework Convention on Climate Change."

October - European Parliament

This is a formulation of C&C by the Parliament that was carried by 90% of the vote. It reflects inter alia that nearly all European Environment Ministers have also publicly endorsed C&C.

"Calls on the Commission & Member States to take the lead in brokering an agreement on a set of common principles & negotiating framework beyond COP4 based on:

1- agreement to have a worldwide binding limit on global emissions consistent with a maximum atmospheric concentration of 550 ppmv CO2 equivalent,

2- initial distribution of emissions rights according to the Kyoto targets,

3- progressive convergence towards an equitable distribution of emissions rights on a per capita basis by an agreed date in the next century,

4- across-the-board reductions in emissions rights thereafter in order to achieve the reduction recommended by the Intergovernmental Panel on Climate Change (IPCC),

5- an agreement to have a quantitative ceiling on the use of flexibility mechanisms that will

ensure that the majority of emission reductions are met domestically in accordance with the spirit of articles 6, 12 and 17 of the Kyoto protocol; in this context trading must be subject to proper monitoring, reporting and enforcement;

6- an adequately financed mechanism for promoting technology transfer from Annex 1 to non-Annex 1 countries;"

November - UNCTAD, Elements of a "Buenos Aires Mandate"

". . . meaningful participation by key developing countries will loom large in the post-Kyoto period. Much attention will focus on efforts to (a) further define and operationalise the Clean Development Mechanism (CDM) and to (b) agree possible criteria for the participation of developing countries in international emissions trading. Drawing on the Kyoto experience, some possible elements for a mandate regarding participation of developing countries in emissions trading could include the following: -

1 Participation in emissions trading should be on a voluntary basis. (While the trading system can be designed to benefit all developing countries, it seems that the larger industrially advanced, fast-growing developing countries might be the primary beneficiaries of the system).

2 Legally binding limits (for countries that wish to join the emissions trading system) should be based on emissions growth, not on emissions reductions. The principle was recognised during the Kyoto negotiations. Growth limits would enable the developing countries to continue to pursue their industrialisation but on a more environmentally sustainable basis. (In principle, emissions growth in Non-Annex One countries should be compensated for by deeper reductions by Annex One Parties leading to 'Contraction and Convergence' of per capita emissions between both sides).

3 Negotiations could be based on national offers from developing country Parties. Offers by regional groupings such as ASEAN and MERCOSUR should also be considered.

In addition to existing flexibility mechanisms, developing countries should be allowed to introduce 'partial caps' which, for example, could be based on industrial sector limits and coupled with joint implementation in the uncapped sectors, as a form of progressive restriction towards the imposition of a national cap.

1999

1999 - Christian Aid

Who owes who? - Climate change, debt, equity and survival

"The history of the climate talks is one of division between developing countries wanting entitlements to be proportional to population, whilst the industrialised countries want entitlements proportional to the size of their economies' GDP. The path to get from one to the other, from grand fathering' - unequal rights drawn down by historical precedent - to equal per capita shares, is contraction and convergence. Entitlements in this analysis are based on people rather than on economic wealth. "

Full document at: www.christian-aid.org.uk

2000

April - Charter 99 Declaration

Inter alia

" . . . . Declare climate change to be an essential global security interest and establish a high-level international urgent action team to assist the UN Conference of the Parties on Climate Change to set a scientifically based global ceiling on greenhouse gas emissions, to allocate national shares of permissible emissions based on convergence to equal per capita rights, and to work with governments, companies, international agencies and NGOs to cut emissions of greenhouse gases to a sustainable level."

Full list of signatories at: www.charter99.org/charter/signatories.html

June - Int. Federation of Red Cross & Red Crescent Societies

World Disasters Report 2000 Box 7.2 A Climate of Debt" http://www.ifrc.org/

"No one owns the atmosphere, yet we all need it. So we can assume that we all have an equal right to its services – an equal right to pollute. On the basis of the minimum cuts in total carbon dioxide pollution needed to stabilize the climate, estimated by the Intergovernmental Panel on Climate Change to be between 60 to 80 per cent of the pollution levels reached in 1990, and assuming that we all have an equal right to pollute, rich countries are running up a massive climate or 'carbon' debt. By using fossil fuels at a level far above a threshold for sustainable consumption, year after year the carbon debts of rich countries get bigger. Any political solution to climate change will need to be based on reductions in emissions, otherwise known as contraction. As the climate is owned by no one and needed by everyone, we will also have to move towards equally sharing the atmosphere, known as convergence. Collective survival depends on addressing both."

June - Royal Commission on Environmental Pollution (RCEP)

"The Need for an International Agreement", "Contraction & Convergence"

"3. The government should press for a future global climate agreement based on the 'Contraction and Convergence' approach, combined with international trading in emission permits. Together, these offer the best long-term prospect of securing equity, economy and international consensus (4.69)."

4.47 Continued, vigorous debate is needed, within and between nations, on the best basis for an agreement to follow the Kyoto Protocol. Our view is that an effective, enduring and equitable climate protocol will eventually require emission quotas to be allocated to nations on a simple and equal per capita basis. There will have to be a comprehensive system of monitoring emissions to ensure the quotas are complied with. Adjustment factors could be used to compensate for differences in nations' basic energy needs. Those countries which regularly experience very low or high temperatures might, for instance, be entitled to an extra allocation per capita for space heating or cooling.

4.48 A system of per capita quotas could not be expected to enter into force immediately. At the same time as entitling developing nations to use substantially more fossil fuels than at present (which they might not be able to afford), it would require developed nations to make drastic and immediate cuts in their use of fossil fuels, causing serious damage to their economies.

4.49 A combination of two approaches could avoid this politically and diplomatically unacceptable situation, while enabling a per capita basis to be adhered to. The first approach is to

require nations' emission quotas to follow a contraction and convergence trajectory. Over the coming decades each nation's allocation would gradually shift from its current level of emissions towards a level set on a uniform per capita basis. By this means 'grandfather rights' would gradually be removed: the quotas of developed nations would fall, year by year, while those of the poorest developing nations would rise, until all nations had an entitlement to emit an equal quantity of greenhouse gases per head (convergence). From then on, the quotas of all nations would decline together at the same rate (contraction). The combined global total of emissions would follow a profile through the 21st and 22nd centuries that kept the atmospheric concentration of greenhouse gases below a specified limit.

4.50 The upper limit on the concentration of greenhouse gases would be determined by international negotiations, as would the date by which all nations would converge on a uniform per capita basis for their emission quotas, and the intermediate steps towards that. It would probably also be necessary to set a cut-off date for national populations: beyond that date, further changes in the size of a country's population would not lead to any increase or decrease in its emission quota.

4.51 In table 4.1 17 we have applied 'Contraction and Convergence' approach to carbon dioxide emissions, and calculated what the UK's emissions quotas would be in 2050 and 2100 for four alternative upper limits on atmospheric concentration. We have assumed for this purpose that 2050 would be both the date by which nations would converge on a uniform per capita emissions figure and the cut-off date for national populations. If 550 ppmv is selected as the upper limit, UK carbon dioxide emissions would have to be reduced by almost 60% from their current level by mid-century, and by almost 80% by 2100. Even stabilisation at a very high level of 1,000 ppmv would require the UK to cut emissions by some 40% by 2050.

4.52 The UK-based Global Commons Institute has taken the lead in promoting 'Contraction and Convergence', and has developed a computer model that specifies emission allocations under a range of scenarios. The concept has been supported by several national governments and legislators. Some developed nations are very wary of it because it implies drastic reductions in their emissions, but at least one minister in a European government has supported it. Commentators on climate diplomacy have identified contraction and convergence as a leading contender among the various proposals for allocating emission quotas to nations in the long term.

4.53 The other ingredient that would make an agreement based on per capita allocations of quotas more feasible is flexibility of the kind already provided in outline in the Kyoto Protocol. Nations most anxious to emit greenhouse gases in excess of their allocation over a given period will be able and willing to purchase unused quota at prices that incline other countries to emit less than their quota, to the benefit of both parties. The clean development mechanism, which allows developed nations to claim emission reductions by sponsoring projects that reduce emissions in developing nations to levels lower than they would otherwise have been, can also be seen as a form of trading.

4.54 In the longer term trading by companies in emission permits, drawn from national emission quotas determined on the basis of a contraction and convergence agreement, could make a valuable contribution to reducing the global costs of stabilising greenhouse gas concentrations while transferring resources from wealthy nations to poorer ones. Trading needs to be transparent, monitored and regulated, and backed by penalties on nations that emit more than they are entitled to. If it became merely a means of enabling wealthy nations to buy up the emission entitlements of poor countries on the cheap, thereby evading taking any action at home, trading would not serve the cause of climate protection. Nor would it if developing countries that had sold quota heavily went on to emit in excess of their revised entitlements.

2001

March 6 - Royal Institute of International Affairs

After PM Tony Blair's Green Speech, Mr Malhoutra Secretary General of the Rajiv Gandhi Foundation made a speech including the following remarks.

" . . . . the basis of global governance architecture for sustainable development must begin to be addressed.

What principles should determine issues such as entitlements, resource allocations, consumption practices and so on? The climate negotiations have given the issue immediacy. On what basis will drawing rights to global common goods such as atmospheric space be established?

Will developing countries be brought to the table on the principle of equity i.e. convergence of per capita emissions over an agreed period of time?

The impact of global warming will fall much more heavily on developing countries, introducing yet another factor of inequity in the North-South relationship. Climate change is not just about economics and keeping the world safe for corporate and personal capitalism, but about very complex ethical and social justice issues that civil society must address in a proactive manner. Where does the northern NGO community stand on this issue? And why is there not more public anger at the wanton and utterly irresponsible behaviour of industrialized countries? They have ignored the precautionary principle for a very long time and continue to pass the buck.

Nero fiddled while Rome burned: what shall one say of the West when Earth caught fever?"

[Full speech at http://www.gci.org.uk/articles/Malhoutra.pdf].

March 20 - UK Liberal Democrats

From Speech by the Rt Hon Charles Kennedy MP

Leader of the UK Liberal Democrats.

At Green Alliance 20th March 2001

" . . . So I think we have to think differently on climate change. And I want to flag up two areas, that I think we must consider ways of taking more effective action on climate change.

The first area embraces the principle of equity. On a planet where the most precious of commodities, a stable climate, is under threat, emissions could be rationed, through contraction of emissions, and convergence of national use of energy.

That means that every citizen could in the long run have an equal emission quota. There could hardly be a more obvious application of the notion of Universal Human Rights enshrined in the United Nations Charter. There are many different options for implementing a scheme. Quotas could be introduced gradually, and they could be tradeable. But whatever options are adopted, it is a proposal that may well offer the way forward.

The second area I want to flag up, is the role of Europe in climate change. Europe has shown the way before. In 1945, European nations realised that to revive yet also contain Germany there must be a community of equals.

Half a century later the key problem for the planet is climate change and Europe must again lead in the co-operative game. Europe should take the initiative to invite all the major nations and regions to form a Global Climate Community on the basis of commitments to reducing emissions and then ensuring that the emissions of different countries reach a happy medium. Contraction and convergence.

To be useful such an initiative must include from the start, not only Europe but major developing nations such as India. America and some others may not join at first. But they will have a major incentive to join or they will be excluded from the massive emissions market which will develop. Britain is in a unique position to ensure that the project gets off the ground. Britain's own experience and Atlantic and worldwide links could make it a valuable initiator of such a scheme."

full speech at http://www.gci.org.uk/speeches/Kennedy.pdf

March - UK Chartered Insurance Institute (CII)

A report by the Society of Fellows for CII on global climate change sees C&C as: -

"The most realistic way to bring about the required reduction in ghg emissions (which will have the combined effect of reducing the damage imposed on the insurance industry and encouraging the transition to renewable energy) is that proposed in the concept of 'Contraction and Convergence' (C&C). This concept is incredibly simple in its detail. Essentially, everyone has the right to emit an equal amount of pollution (in this case CO2) to the Global Commons (atmosphere). This would operate in much the same way as the envisaged emissions trading scheme to be set up within the Kyoto Protocol. Since economic progress is dependent on energy, the shortfall from 'Business as usual' energy consumption will need to be met from two directions: efficiency gains, and a rapid growth in renewable energy sources. It is clear from this that emissions trading can only be an intermediate stage, since the total volume of emissions must fall.The only blockage to this simple system is the absence of political will to 'step outside the box' instead of conducting a tortuous round of negotiations of the Kyoto Protocol. One way to unblock this impasse is to amass a large enough consensus of stakeholders behind the concept of contraction and convergence, persuading governments to supersede the Kyoto Protocol. The insurance industry is an obvious place to start such a campaign as it has so much to lose and so much to gain. If society continues down the fossil/Kyoto route, future economic losses are likely to become unsustainable: the current rate of increase in damage from natural hazards is 12% pa and the rate is accelerating. Given that the global sum of such losses was $100bn in 1999 (Munich Re, 2000), it would outstrip global GDP (growing at 3% pa) by 2065, if the trends persist. If the insurance industry rallies behind C&C, it not only reduces that risk, but it is well placed to invest in the future renewables market. In fact one could argue that as the insurance companies own the oil companies (through equity ownership), insurers form the only industry that has the collateral and the need to adopt the 'Contraction and Convergence' logic."

April - UNA UK

Resolutions backing Contraction and Convergence were passed at the

56th AGM of the United Nations Association in the UK, 20-22 April 2001.

8.10

"We applaud the government's leadership role in the international climate change negotiations and shared the disappointment at the failure to secure an adequate agreement at the last conference.

We urge Her Majesty's Government to pursue a long-term framework for reducing global CO2 concentrations based on the principle of Contraction and Convergence to equal percapita emissions levels worldwide by a specific date to be negotiated."

*** with the European Union Commission and the Commonwealth to create an alliance of countries committed to cutting CO2 emissions based on Contraction and Convergence;*

May - FoE Finland on Climate Equity

"The Whole Climate" Report, from Friends of the Earth Finland. The "Whole Climate Project" originated in 1999 with the three Finnish NGOs Dodo, FoE and Service Centre for Development Cooperation.

They take up the global equity/survival challenge of climate change and seek to resolve it in terms of environmental space and formulations of contraction and convergence.

Report available only in hard copy from: - http://wwwmaanystavat.fi

June - IPCC Third Policy Assessment

"A formulation that carries the rights-based approach to its logical conclusion is that of 'Contraction and Convergence'. (Chapter 1, 3.2). "The concept of 'Contraction and Convergence' is the entitlement of ghg emissions budget in terms of future emissions rights. Such a global future emissions budget is based on a global upper limit to atmospheric concentration of CO2, for instance 450 ppmv (contraction). This budget is then distributed as entitlements to emit CO2 in the future, and all countries will agree to converge on a per capita emissions entitlement (convergence). Level of contraction and timing of convergence are subject to negotiations." (Chapter 10, 4.5)

July - USS Research Report No 1

Universities Superannuation Scheme

Climate Change, A Risk Management Challenge for Institutional Investors

"Beyond Kyoto - 'Contraction and Convergence'

"It is important to recognise that any agreement can be only the first step in what will be a major journey. It is clear that even if the Kyoto targets are met, global emissions will continue to rise because of rapidly rising emissions in the developing world. Substantial further steps will have to be taken to curb emissions globally. Such cuts will inevitably begin to involve poor countries and at the same time rich countries are likely to have to commit to much more serious emission reductions themselves. As a result further emission reduction agreements are likely covering the period 2012-20 and beyond. Indeed, the IPCC in its first assessment reports in 1990 recommended emissions cuts of at least 60% to stabilise C02 concentrations at 1990 levels and thereby be likely to avoid serious climate disruption. Its subsequent reports have not altered this position. In the longer term, 'Contraction and Convergence' (C&C) is likely to become increasingly supported as a policy option. C&C was initially advocated by a small UK think tank, the Global Commons Institute (www.gci.org.uk), but has since gained widespread and authoritative support, including that of some poor country governments and also the recent Royal Commission on Environmental Pollution report which recommended that, 'the government should press for a future global climate agreement based on the contraction and convergence approach'.

Ironically, while C&C offers a more robust framework than that outlined by Kyoto, and addresses the issue of equity, it also meets the fundamental objection of the US in that it also requires commitments from the developing world. As a global operational framework it also avoids many of the technical problems of Kyoto (such as defining baselines for emissions trading in countries not subject to an overall target, or the extent of international emissions trading that is permissible). However, much will depend on the detail. Done well, C&C could provide a framework for a genuine, equitable, long-term solution to climate change, which reduces political risks and provides businesses and investors with the sort of predictable framework they prefer. But if agreement is hard to reach, C&C might serve to highlight injustices and end up exacerbating tensions. For example, some campaigners have argued for a third 'C': 'compensation' from the rich world for using up the climate's absorptive capacity. Whilst this claim is understandable, such a development could well become an emotive issue that could make agreement far harder to reach."

August - British Telecom

Mathis Wackernagel of the California-based Redefining Progress received a message from Chris Tuppen of BT (British Telecom) that said:

"I think there is lot of benefit that could arise from offering a per capita CO2 budget (eg the contraction and convergence theory of GCI).

But that's not to say that people shouldn't then have a choice in how they spend their CO2 budget. Such an approach would automatically lead to people selecting more energy efficient products and cause companies to change via natural market forces."

August - IPCC Third Policy Assessment

Chapter One section 3.2

"A formulation that carries the rights-based approach to its logical conclusion is that of 'contraction and convergence'.

Chapter Ten section 4.5

"The concept of 'contraction and convergence' is the entitlement of ghg emissions budget in terms of future emissions rights. Such a global future emissions budget is based on a global upper limit to atmospheric concentration of CO2, for instance 450 ppmv (contraction). This budget is then distributed as entitlements to emit CO2 in the future, and all countries will agree to converge on a per capita emissions entitlement (convergence). Level of contraction and timing of convergence are subject to negotiations with respect to the precautionary principle."

September - The Corner House

Corner House UK publication "Democracy or Carbocracy".

"In addition to slighting or ignoring many existing climate-friendly local practices, negotiators' technical advisers have also been slow to acknowledge an important and growing international climate movement. This movement demands both that the discussion of rights in the atmosphere be brought out of the shadows and that a scientifically meaningful programme of aggregate emissions cuts be undertaken. It calls for all countries to agree, in line with evolving wisdom on climate, how rapidly world greenhouse gas emissions should contract each year. It proposes then allocating permits to emit to all countries in proportion to the number of their citizens. Countries unable to keep their emissions in line with their per capita allocations could buy extra ones from those whose emissions were under the limit.

This equitable, flexible "contraction and convergence" framework has been endorsed by many Southern countries including China, India and the nations of the Africa Group; European government ministers including Michael Meacher of the UK, Jacques Chirac of France and Svend Auken of Denmark; insurance industry associations; and organizations ranging from the Royal Commission on Environmental Pollution to India's Centre on Science and Environment and Climate Net-work Africa. Unlike any other proposal on offer, the framework would enable the US's bluff to be called on all three of its objections to the Bonn climate agreement: that it doesn't commit the South to emissions limitations; that it's "unfair"; and that it doesn't address sources of future emissions.63 It would thus advance the discussion in a way which could result in a better future agreement."

It can be found at: - http://www.gci.org.uk/papers/24CARBO1.PDF

September - The Austrailia Institute

"Running From The Storm"

The Development of Climate Change Policy in Australia

> *" . . . . the longer time frame and the more broadly accepted ethical underpinnings of C&C ought to make negotiations less fraught than those leading up to and subsequent to Kyoto.*
>
> *Is contraction and convergence pie in the sky? There is no doubt that it is a radical approach with far-reaching implications for the management of the Earth's common resources. It would redraw the legal and ethical relationships between nations and initiate an era of supranational management of those environmental issues that cross national borders. Difficult, yes; but what is the alternative?"*

by Clive Hamilton, Director of the The Australia Institute (TAI), is published by University of New South Wales Press, September 2001.

October - Tellus Institute

Book: "Halfway to the Future" from Tellus Institute

> *"A good two pronged approach is a constraint on global emissions and a path toward allocation of emission allowances among the nations of the world on an equal per capita basis."*

available at: - http://www.tellus.org/HalfwayToTheFuture.pdf

October - UK Green Party

The Green party of England and Wales strongly endorses the GCI/GLOBE campaign for Conctraction and Convergence (C&C) as the key ingredient in a global political solution to the problem of Climate Change, and urges the UK and other governments use it as the basis for negotiations at the Conference of the Parties organised by the Intergovernmental Panel on Climate Change.

November - UNEP FI - Statement COP7

The UNEP Financial Institutions position paper

> *"4.1.3. Construct a long-term framework to reduce emissions globally in order to achieve the necessary transition to sustainability.*
>
> *The approach of Contraction and Convergence, which the IPCC TAR described as "the logical conclusion" of a rights-based approach,provides a possible example of such a basis."*

It is viewable at: - http://www.gci.org.uk/papers/FINALDRFTUNEPFI.pdf

The financial organisations associated with this are listed at the end.

November - NEF/Jubilee Plus

> *"... the US, committed by its own declaration of independence to human equality, can embrace the contraction and convergence model pioneered by the London-based Global Commons Institute.*
>
> *Contraction and convergence*
>
> *According to Sir John Houghton, chair of the Intergovernmental Panel on Climate Change, global greenhouse emissions need to be reduced by at least 60 per cent in less than 100 years. If governments agree to be bound by such a target, it is possible to calculate for each year over the next century the (diminishing) amount of carbon dioxide and other greenhouse gases the world can release, to stay on target for a 60 per cent reduction. This is the contraction part of the equation.*
>
> *Convergence describes how each year's tranche of the global emissions budget is shared out among the nations of the world. The process is managed to ensure that every country converges on the same per capita allocation of carbon dioxide – the same personal emissions "allowance" – on the same date. The date is negotiable – Houghton suggested 2030.*
>
> *Countries unable to manage within their allocations would, subject to agreed limits, be able to buy the unused parts of the allocations of other, more frugal, countries. Sales of unused allocations would give the countries of the South the income to purchase or develop zero-emission ways of meeting their needs.*
>
> *"Contraction and convergence" provides an effective, equitable and efficient framework within which governments can work to avert climate change. The countries of the North would benefit from the export markets created by restructuring. The whole world would benefit by slowing the rate of damage. Its potential as an antidote to global warming has been widely endorsed, not least by industriessuch as insurance which are in the front line of climate change. Even some of the more progressive fossil fuel producers have acknowledged that it may offer a promising way forward. But "contraction" has a disturbing sound to it – it implies less rather than more. The next chapter explains why less may, in practice, turn out to be more."*

http://www.jubileeplus.org/ecological_debt/Reports/War%20Economy.pdf

November - British Petrolium

In the BP Glossary

"Some have promoted the idea of 'contraction and convergence 'as a long-term strategy for managing global GHG emissions.Contraction refers to a global cap which would be set on worldwide emissions, together with an overall reduction trajectory for the century ahead.Emissions entitlements would be allocated on a per capita basis under the global cap and trading would be permitted.Emissions entitlements would converge over time towards equal per capita emission rights for all countries,so that total emissions allowances to countries are proportional to population. Proponents of the system of contraction and convergence argue that it is equitable (being based on population)and that it would be truly global,involving the participation of all countries."

http://www.bp.com/key_issues/environmental/climate_change/information_centre/glossary_of_terms.asp

November - *"Global Public Goods"*, Swedish Foreign Affairs

"Inter-generational justice also enters the climate change equation. Many of the rationales for taking costly action now in order to tackle a problem whose worst effects may not be felt for many decades, is that we have a responsibility to future generations. Both the 'precautionary principle' and the principle of 'contraction and convergence', which has entered the climate negotiations in recent years, are aimed at addressing these problems. They provide a road map for policy responses, by, in the latter case, establishing ceilings for GHG emissions above which dangerous climate change is likely, and then devising a global carbon budget within which nations have a per capita entitlement to use carbon. Moving towards an optimal and safe level of carbon usage requires that some nations, in the first instance developed countries, would have to contract their use of carbon-intensive activities and others, primarily developing countries, would be entitled to expand their use of fossil fuels to meet basic development needs and so converge towards a per capita entitlement, which applies equally to all countries."

December - UK Tyndall Centre

3.3 Strategic Assessments

"The climate change literature is studded with fragments of scientific evidence as the typical products of disciplinary, methodology-oriented and funding-driven research activities of rather small teams of investigators. Comprehensive surveys exploring, for instance, the climate vulnerability of an entire region or sector are extremely rare. Even the three IPCC Assessment Reports produced so far are not really integrated studies, but carefully edited compositions of thousands of disconnected results emerging from the research machinery in a more or less stochastic manner. What the crucial decision-makers request (and genuinely need), however, are strategic investigations that provide panoramic, but state-of-the art, views of complex issues, preferably condensed in a 10-page summary. The Tyndall Centre is, at present, the only institution in the UK which can generate such assessments that combine vertical integration (through problem and solution orientation) with horizontal integration (through trans-disciplinary capacity). There are many big topics that need to be approached this way, for example the differential vulnerability of the British coastline to sea-level rise and changing extreme-events regimes, the overall potential for slowing global warming offered by large-scale carbon sequestration, or the future design of the national built environment in view of climate change adaptation as well as climate change mitigation policies.

Some of the strategic assessments urgently needed could be initiated, or even drawn up, by special "Tyndall Symposia" convening the essential and representative communities on issues like: 1) nuclear power, 2) geo-engineering, 3) contraction-and-convergence. "

Full text available at: http://www.tyndall.ac.uk/research/research_strategy.pdf

December - Quakers

The Causes of War II

The Friend 14th December 2001

In our 7 December issue of The Friend, Robin Robinson reported on problems that contribute to bitterness and polarisation in the world. This article identifies an opportunity that could change the structure of the world economy and reduce the tendency to greater and greater disparities of wealth.

In less than a year, in September 2002, world leaders will be meeting in Johannesburg for the second Earth Summit. At Rio in 1992 attention focussed on potentially catastrophic environmental changes particularly relating to human effects on the global climate. After years of haggling the Kyoto protocol has eventually been signed this year by 178 nations with only the United States opposing it. A proposal is being considered for Johannesburg that could link climate concerns with our economic system. The Religious Society of Friends should do what it can to support that proposal.

The idea arises out of climate considerations so, before focusing on the truly radical economic implications, it is necessary to understand the climatic background. By definition, humans pollute and in recent years this pollution has been increasing exponentially. In the past, the earth's bio-systems could cope but this is no longer the case. Of particular concern is our effect on the atmosphere through the emission of greenhouse gases (GHGs). All scientists, except a few linked to the oil and coal industries, now agree that the emission of GHGs must be reduced, so a mechanism for rationing has to be found.

The basis for rationing in the Kyoto protocol is called 'grandfathering' – industrial countries are asked to reduce their present emissions by a certain percentage and their allocations can be traded. Grandfathering has two main faults. First, those that have caused most damage in the past have the highest allocation for future emissions, which is obviously unfair. Secondly, nations that are set to emit significantly in future, like India and China, are not part of the protocol.

A new approach being widely discussed is that the ration, the allocation for emission of GHGs, should be on the basis of the population of countries in 1990. To be fair, developing countries should have a much larger per-capita share than industrial countries, because the industrial countries have already caused so much damage; this is the argument being put forward by Brazil. Most others are willing to accept a compromise that the ration from now on should be on an equal-per-capita basis. This has been accepted by negotiators representing a large majority of the world's population including India and China, it has been specifically endorsed by President Chirac and our own Royal Commission on Environmental Pollution.

To repeat: everyone in the world should have an equal allocation for using the world's atmosphere; this would determine a country's allocation for emission of GHGs. And that allocation can then be traded.

In terms of economics, this is a startlingly radical proposal. India is responsible for just 1.6% of global emissions per-capita but its allocation would rise to 16%. The US ration would be 4.3%, not the 26% it emits at present. Incentives would work both ways: India would want to keep its emissions low so that it has more to trade. The US would try to reduce its emissions so that it needed to purchase less. Those would be the incentives for reducing emissions of GHGs globally. But the radical economic mechanism is that money would flow from rich to the poor nations as of right, not as arbitrary agreements on aid. A political formulation is called Contraction and Convergence – contraction *of the amount of GHGs emitted, and* convergence *to an equal-per-capita allocation over a period of years.*

There are plenty of mechanisms that work the other way: Interest charges mean that money flows from the poor who need to borrow to the rich who have funds to lend. All poor countries maintain dollar reserves which represent a massive interest-free loan from the poor to

the wealthy. Trade arrangements, imposed by the west, ensure that the price of commodities, many poor countries' only asset, are driven down relentlessly (in India this year the process is causing an epidemic of suicides). This is the only mechanism of a similar sort that would work in the interests of the poor. (incidentally Islam still accepts the biblical injunction that interest is not allowed and this is at the core of its quarrel with western capitalism).

In some countries, like Britain, the mechanism could work on an individual basis using smart-cards – every time you fill your car with petrol some units would be deducted. The proposal is called Domestic Tradable Quotas and would again flow money from the wealthy to the poor.

The destruction of the World Trade Centre and other suicide action, has forced us to recognise the intense loathing of the dispossessed for the hegemony of the dominant powers. This arrogant exercise of dominance on one side and loathing on the other must lie behind the 'asymmetric warfare' that is destroying any hope of peace. Much of the world is suffering from conditions closely analogous to slavery. These horrors should surely be at the top of Quaker concerns.

The Religious Society of Friends should adopt the concept of equal-per-capita allocation for use of the atmosphere and its formulation as Contraction & Convergence, and urge our government to make this its platform at the Earth Summit next year.

James Wells-Bruges, a member of Redland Meeting, Bristol

2002

January - SERA - "Socialist Environment and Resources Association"

International Climate Change Position (21 01 02)

"SERA recommends to the UK Government:

.....

5. Champion an accelerated round of UN negotiations leading to emissions reductions based on safe, global per capita limits to greenhouse gases (so-called Contraction and Convergence)....."

Available at: http://www.gci.org.uk/papers/globalclimate.pdf

February - Swedish Ministry of Foreign Affairs 2001

"Financing and Providing Global Public Goods; Expectations and Prospects"

"Inter-generational justice also enters the climate change equation. Many of the rationales for taking costly action now in order to tackle a problem whose worst effects may not be felt for many decades, is that we have a responsibility to future generations.

Both the 'precautionary principle' and the principle of 'contraction and convergence', which has entered the climate negotiations in recent years are aimed at addressing these problems. They provide a road map for policy responses, by, in the latter case, establishing ceilings for GHG emissions above which dangerous climate change islikely, and then devising a global carbon budget within which nations have a per capita entitlement to use carbon. Moving

towards an optimal and safe level of carbon usage requires that some nations, in the first instance developed countries, would have to contract their use of carbon-intensive activities and others, primarily developingcountries, would be entitled to expand their use of fossil fuels to meet basic development needs and so converge towards a per capita entitlement, which applies equally to all countries."

Full text at: http://www.ud.se/prefak/files/gpg.pdf

February - Delhi Sustainable Development Summit 2002

Challenges for governments, corporates, and civil society at Rio+10, 8 - 11 February 2002, New Delhi

"The UNFCCC addresses the equity issue through 'common but differentiated responsibility'.

Per capita energy consumption and GHG emissions of developing countries are far lower than that of the industralized world.

In a convergence of emissions at a sustainable level, developing countries can increase emissions to a safe limit while developed ones reduce to the same level."

Full text at: http://www.teriin.org/dsds/dsds2002/day4/plenary8.htm

February - Dutch Parliament

"It is left to the next cabinet (there will be national elections in the Netherlands in spring 2002) to develop a formal position on a preferred option for the future differentiation of commitments, but it closes off in stating that a distribution of global emission space on a per capita basis in the course of the century (2030/2050) seems an obvious choice."

[In Dutch, source: House of Parliament, second chamber, meeting year 2000-2001, doc. no. 27801].

February - Department for Trade and Industry - Inter Agency Group

"The Royal Commission on Environmental Pollution (RCEP) recommends that the Government should press for a future global climate agreement on a contraction and convergence (C&C) approach, allowing also for emissions trading.

It selects one path for achieving stabilisation of CO2 concentrations in the atmosphere at 550ppm that implies a convergence date of 2050. Many other paths to stabilisation at this level could be taken. The Government is keen to establish a dialogue on possible approaches to future target setting.

However, contraction and convergence is only one of a number of potential models, some of which may be more attractive to developing countries and still promote the objectives that we are striving to fulfil."

Full Text available at: http://www.gci.org.uk/UKGovernment/DTIIAG.pdf

February - Energy Review, UK Cabinet Office Performance & Innovation Unit

"The project's outputs will be a key input to the UK Government's future policy on security and diversity of energy supply and on climate change including its response to the Royal Commission on Environmental Pollution (RCEP) report on 'Energy, the Changing Climate.

The UK practices a 'leading' approach to climate change. This approach to climate change implies 3 separate policy timelines: measures to: -

1 comply with agreed targets;

2 prepare for future targets not yet agreed but probably involving not all countries and operating for limited time periods, and

3 prepare for a world of long-term emission limits agreed between all countries, possibly based on the principles of contraction and convergence."

.....

"The centrality of carbon and the climate change issue"

3.69 A "leading" approach to climate change implies three separate policy timelines:

** measures to comply with agreed targets;*

** measures to prepare for future targets not yet agreed but probably involving not all countries and operating for limited time-periods;*

** measures to prepare for a world of long-term emission limits agreed between all countries, possibly based on the principles of contraction and convergence. (16)*

3.70 There is no clear dividing line between these phases.

Post-Kyoto targets affecting the UK could be finalised by 2005 but agreement might take longer, perhaps a lot longer, and the scale of the next targets is uncertain. Likewise, it is possible that we could be in a world of long-term universal targets by 2010.

There is even a remote possibility of moving directly to the final phase from the current position.

3.71 In the same way, it is far from clear what the scale of future targets will be. The RCEP suggested that a 60% reduction for the UK by 2050 would be needed within a contraction and convergence agreement, but the exact figure is very uncertain.

All that is certain, whether we move to a contraction and convergence world, as suggested by the RCEP, or follow the guidance produced by the IPCC about global levels of emission reductions that will be needed to avoid dangerous climate change, is that developed countries will need to make very substantial cuts from current emission levels over the century ahead.

February - IIED/RING

International Institute for Environment and Development (IIED)
with the Regional and International Networking Group (RING)

"Even if the Kyoto Protocol is implemented in full, the impacts of global climate change will start being felt within the next few decades and the most vulnerable communities and countries are those which are already the poorest and least able to adapt to these changes.....

It is time now to refocus on the longer-term objectives of the UNFCCC, particularly its stated goals regarding sustainable development....

WSSD provides an opportunity to re-initiate the discussion on the larger architecture of the future climate regime. The goal of the post-Kyoto phase should be clearly tied to atmospheric stabilization with a defined focus on emissions limitation and a clear sense of the rules for the future entry of developing countries into the regime.

....

In all likelihood this will require moving to per capita emission targets and a 'contraction and convergence' policy scenario."

Available at:

http://www.gci.org.uk/papers/C&CIIEDShort.pdf

http://www.gci.org.uk/papers/C&CIIEDLong.pdf

February World Bank - Summary of the E-Discussion on the Environment and Poverty

Summary of the E-Discussion on the Environment and Poverty Linkages: Week 1 - February 1 – 7, 2002

4. Climate change, greenhouse gas emissions and environment

A binding environmental agreement that effectively and equitably reduces emissions calls for "Contraction and Convergence" (C&C) to be the framework in which this development should take place. The potential of C&C to use a deliberate poverty reduction strategy to arrest dangerous rates of climate change needs to be explored.

The big reinsurance companies (Swiss Re and Much Re) have kept records of estimates of the 'uninsured losses' from 'great weather disasters' over the last 50 years (such as Honduras, Mozambique, Orissa). These show rates of damages exceeding the economic growth rate by a factor of four. This is one reason why the Institutions of the UNEP Financial Initiative have come out in favor of arrangements such as C&C. It would be appropriate for the present discussion to took a look at the potential of this proposition.

Authors' Responses to the Summary of the e-Discussion on Environment and Poverty Links – Week 1

4. Climate change, GHG emission:

Thanks for drawing our attention to the approach for "Contradiction and Convergence" and providing several useful references to sites where this is further discussed. This is the kind of constructive feedback that we hope to get more of! We will pursue those as a team, and discuss how we might discuss this approach in the final version of the paper. In our final summary of the e-Dialog in July, we will come back to the details of this.

Jan Bojö

The World Bank

On behalf of the authors of the Consultation Draft.

March - World Bank Report - "Globalization, Growth & Poverty"

"Global warming requires international collective action. There are many ways of achieving effective restraint. The Kyoto protocol approach is for rich countries to set themselves targets for emissions reductions, and the recent agreement between European nations and Japan to move ahead with the protocol is a positive step forward. Looking further down the road, it is critically important to get at least all of the G-7 involved.

The Global Commons Institute, an NGO, has come up with an innovative proposal for how to do this. The proposal entails agreeing on a target level of emissions by the year 2015 and then allocating these emissions to everyone in the world proportionally. Rich countries would get allocations well below their current level of emissions, while poor countries would get allocations well above. There would then be a market for emission permits.

Poor countries could earn income selling some of their permits; rich and poor countries alike would have strong incentives to put energy-saving policies into place; and private industry would have strong incentives to invent new, cleaner technologies. One of the hopeful things about globalization is how an innovative idea like this can quickly gain currency and support."

April 18 - Christian Ecology Link

Contraction and Convergence:

1. Contraction and Convergence provides a framework within which the world's emissions can be reduced safely and fairly. It proposes that countries agree a safe global greenhouse gas emissions budget and agree a date by which all countries will have the same emissions

rights per capita. Countries unable to reduce their emissions by this date would be able to buy the unused rights of other countries, giving less developed countries the income to fund development in zero-emission ways.

The idea is well accepted as the best way forward by the experts. According to the Royal Commission on Environmental Pollution "The government should press for a future global climate agreement based on the Contraction and Convergence approach, combined with international trading in emission permits. Together, these offer the best long-term prospect of securing equity, economy and international consensus." The recent Third Assessment Report of the IPCC (Intergovernmental Panel on Climate Change) observes "...the formulation that carries the rights-based approach to its logical conclusion is that of Contraction and Convergence."

April 20 - The Foundation for the Economics of Sustainability

Feasta's Proposals for Global Monetary Reform

4. The supply of the new currency should be limited in a way which ensures that the overall volume of world trade is compatible with the most crucial area of global sustainability.

To deliver the maximum level of human welfare, every economic system should try to work out which scarce resource places the tightest constraint on its development and expansion. It should then adjust its systems and technologies so that they work within the limits imposed by that constraint. In line with this, an international currency should be linked to the availability of the scarcest global resource so that, since people always try to minimise their use of money, they automatically minimise their use of that scarce resource.

What global resource do we most need to much use less of at present? Labour and capital can be immediately ruled out. There is unemployment in most countries and, in comparison with a century ago, the physical capital stock is huge and under-utilised. By contrast, the natural environment is grossly overused especially as a sink for human pollutants. For example, the Intergovernmental Panel on Climate Change (IPCC) believes that 60-80% cuts in emissions of one category of pollutants - greenhouse gases, which come largely from the burning of fossil fuels - are urgently needed to lessen the risk of humanity being exposed to the catastrophic consequences of a runaway global warming. Feasta believes that this is the most serious resource threat facing humankind at present, and that, consequently, the basis of the new world currency should be selected accordingly.

***Contraction and Convergence** (C&C), a plan for reducing greenhouse gas emissions developed by the Global Commons Institute in London, provides a way of linking a global currency with the limited capacity of the planet to absorb or break down greenhouse gas emissions. Under the C&C approach which has gained the support of a majority of the nations of the world, the international community agrees how much the level of the main greenhouse gas, carbon dioxide (CO2), in the atmosphere can be allowed to rise. There is considerable uncertainty over this. The EU considers a doubling from pre-industrial levels to around 550 parts per million (ppm) might be safe while Bert Bolin, the former chairman of the IPCC, has suggested that 450 ppm should be considered the absolute upper limit. Even the present level of roughly 360ppm may prove too high though, because of the time lag between a rise in concentration and the climate changes it brings about. Indeed, in view of the lag, it is worrying that so many harmful effects of warming such as melting icecaps, dryer summers, rougher seas and more frequent storms have already appeared.*

Full Report available at: http://www.earthsummit-ireland.org/feastaproposals.htm

April 24 - DTQs

"There are a number of reasons for believing that Domestic Tradable Quotas (DTQs) could play an important role in combating climate change.

DTQs - with their annual reduction in the carbon budget and equal per capita emissions entitlements - are in keeping with the principles of contraction and convergence recently endorsed by the Royal Commission on Environmental Pollution."

See DTQ webpages: - http://www.dtqs.org/summary.htm

April 24 - EC Letter

"Thank you for your letter of 5th February and appended information on the contraction and convergence approach, which I studied with interest.

. . . . . .

The negotiations on the next commitment period will have to start by 2005 and to finish by the end of 2007, In these negotiations, all options to limit and reduce emissions in a fair and equitable way will be discussed. Contraction and convergence is one of the interesting alternatives in this regard."

Jean-Francois Verstrynge

Acting Director-General

DG Environment

European Commission

http://www.gci.org.uk/correspondence/Verstrynge1.pdf

April - Sky Trust

"Who Owns the Sky?" book by Peter Barnes, published by Island Press in 2001. ISBN 1-55963-855-9

On the question of global equity, which I have avoided in this book, ther reader may want to explore the Web site of the London-based Global Commons Institute. GCI is promoting the concept of "contract and converge" as a way to resolve the dispute between rich and the countries about how to share the global atmosphere. Under "con-tract and converge, the per capita emissions of the rich and poor would converge to equality over' say fifty years. During this time, global emissions would contract. But because poor countries per capita emissions are far below the rich countries' (the average American emits six times as much carbon dioxide as the average Chinese person), the poor countries' emissions would actually rise at first. Though considered a radical idea just a few years ago, "contract and converge" is slowly gaining acceptance. www.gci org.uk

May - C&C in Heinrich Boell Foundation Report for WSSD

The Heinrich Boell Foundation published a detailed report on the issues for the World Summit on Sustainable Development (WSSD) taking a clear position in favour of C&C beyond Kyoto.

"The vision of "contraction and convergence" combines ecology and equity most elegantly; it starts with the insight that the global environmental space is finite and attempts to fairly share its permissible use among all world citizens taking into account the future generations as well."

(Contraction &Convergence – The Global Solution to Climate Change, Meyer 2000)

http://www.worldsummit2002.org/publications/memo-mF.pdf

June 8 - Tyndall Centre UK -

"The climate regime from The Hague to Marrakech:Saving or Sinking the Kyoto Protocol?"

Suraje Dessai

4. The Bonn Agreement

"The other 'crunch issue' the Bonn Agreement tackles are the Kyoto mechanisms. Surprisingly, the text's language referring that emissions should be reduced "in a manner conducive to narrowing percapita differences between developed and developing countries" paves the way for a contraction and convergence framework (Meyer, 2001)."

Full report at: - http://www.tyndall.ac.uk/publications/working_papers/wp12.pdf

June 8 - Tyndall Centre UK - "The Use of Integrated Assessment: An Institutional Analysis Perspective"

Simon Shackley and Clair Gough

Box 1 - The Dilemma of Complexity

" . . . . by contrast, the 'Contraction and Convergence' idea developed by the Global Commons Institute has been rather widely adopted (Meyer 2000).

It connects well with the more explicitly political formulation of the climate change issue in equity terms of the North-South divide, and allows for national differences to be acknowledged in the short to medium term.

Its lack of integration (e.g. through not including analysis of the economic costs of mitigation) may be an advantage in its acceptability to policymakers.

Interestingly, the contraction and convergence concept has engendered significant political support as well as attracting support from assessment organisations (e.g. the influential Royal Commission on Environmental Pollution in the UK (2000)) without recourse to a complex numerical model.

Full report at: - http://www.tyndall.ac.uk/publications/working_papers/wp14.pdf

June 8 - Uranium Institute

"The Influence of Climate Change Policy on the Future of Nuclear Power"

Jonathan Cobb at 25th Annual Sumposium 2000

"In order for atmospheric greenhouse gas concentrations to be stabilised at a sustainable level it will be necessary to reduce missions by around 60% from the 1990 level. Advocates of a policy of "convergence and contraction", where developed and developing countries are to be allowed similar levels of emissions on a per capita basis, state that developed countries may have to reduce emissions by 80%."

Full statement at: - http://www.world-nuclear.org/sym/2000/cobb.htm

June - Wilton Park Conference "Climate Change: What Can Be Done?"

Roger Williamson

Report based on Wilton Park Conference WP663 13-17 May 2002:

Contraction and convergence

One candidate for the comprehensive framework and overarching vision for climate change policy is "Contraction and Convergence", advocated by the Global Commons Institute.[1] If this approach were to be adopted, it would require considerably more far reaching commitments than those developed within the Kyoto framework.[2] The key elements of contraction and convergence are outlined as follows by the initiator of the proposal, Aubrey Meyer:

> 'essentially, it has three steps: (1) an international agreement is reached on how much further the level of carbon dioxide (CO2) in the atmosphere can be allowed to rise before the changes in climate it produces become totally unacceptable. Fixing this target level is very difficult, particularly as concentrations are too high already. (2) Once the ultimate overall limits to CO2 concentrations has been agreed, it is a simple matter to use an estimate of the proportion of the gas released which is retained in the atmosphere to work out how quickly we need to cut back on the current global emissions in order to reach the target. This cutting back is the Contraction part of Contraction and Convergence. (3) Once we know by what percentage the world has to cut back its CO2 emissions each year to hit the concentration target, we have to decide how to allocate the fossil fuel consumption that those emissions represent.
>
> *The contraction and convergence approach says that the right to emit carbon dioxide is a human right there should be allocated on an equal basis to all of humankind. This might appeal to a majority of the countries of the world, but the over-consuming countries would have to be allowed an adjustment period in which to bring their emissions down before the Convergence on the universal level.*[3]
>
> *In more detail, the essential proposition of contraction and convergence has four elements.*
>
> *'After the initial agreement by countries for a reviewable global greenhouse gas emissions 'contraction budget' targeted at a precautionary, stable value for atmospheric greenhouse gas concentrations, the internationally tradable shares of this Budget are then agreed on the basis of convergence from the current situation; the shares should be broadly proportional to income. The convergence should be towards a target date in the budget timeline after which they remain proportional to an agreed base year of global population. Revenues from this trade can be directed to the deployment of zero emissions technology.*
>
> *Contraction: on the basis of precaution, all governments collectively agree to be bound by such an atmospheric target. This makes it possible to calculate the diminishing amount of greenhouse gases that the world can release for each year in the coming century. Subject to annual review, this event is the contraction part of the process.*
>
> *Convergence: On the basis of equity, convergence means that each year's ration of this global emissions budget is shared out so that every country progressively converges on the same allocation per inhabitant by an agreed date, for example by 2030. It recognises the need for access rights to the Global Commons of the atmosphere with the fundamental principle of globally equal rights for per capita, to be achieved by smooth transition.*
>
> *Emissions permit trading: Countries unable to manage within their shares would, subject to agreed rules, be able to buy the unused parts of the allocations are other countries. Sales of unused allocations would give the less developed countries the income to fund development in zero-emission ways. Industries in the developed countries would benefit from the export markets this restructuring would create.*
>
> *Sustainable growth: Contraction and Convergence does not place a straitjacket on growth per se by its limitation on fossil fuels. Instead it averts catastrophic losses by promoting the*

development and growth of zero carbon energy technologies necessary for prosperity and sustainable development.[4]

The strength of this model, to quote the IPCC Third Assessment (2000), is that it represents '... the logical conclusion of a rights based approach'. Most of the objections which can be made questioning the practicality of the model are, simultaneously, objections to any scheme radical enough to achieve a long-term stabilisation of greenhouse gas concentrations in the atmosphere. Taking standardised per capita emissions as the basis for calculation fulfils the equity criterion, but raises concerns that populous countries, in particular China and India, will increase their emissions at the same time as developed (OECD) countries have radically to decrease theirs. Proponents of the contraction and convergence thesis contrast it with the current and approach of 'expansion and divergence' which is increasingly recognised as unsustainable. The fundamental dilemma of long-term climate change negotiations is that developed countries, and the main emitters among the industrialising nations of the South (particularly those with large populations including China, India and Brazil) are likely to resist signing up to targets which are sufficiently far-reaching to stabilise greenhouse gas concentrations at a sustainable level but, if these countries do not accept radical proposals for reductions to their emissions, the cumulative effects of global warming will continue. The impacts on all countries, but most obviously among developing countries (whose societies are more vulnerable) will be increasingly severe.

Much of the US opposition to the Kyoto Protocol approach has been focussed around the argument that it is unfair for industrialised countries to have to cut their emissions while industrialising countries are under no such restriction. The Byrd-Hagel Resolution, passed 95-0 in the US Senate in 1997, expresses this concern , but in the framework of seeking a solution to global warming by determining which countries should limit and which should cut their emissions. The approach is consistent with Contraction and Convergence.

July 2 - World Nuclear Association

" . . . . . A serious climate regime – if one is to evolve – must go far beyond Kyoto, by encompassing all nations and by employing some variation of the concept known as "contraction and convergence":

Contraction means that over the century ahead we must plot a path that will reduce overall global emissions by at least 50% – even as populations and economies expand.

Convergence means that, in this process, we must accept the principle that every person on Earth is entitled to an equal per-capita level of emissions.

Stated in this stark manner, the goal of 50% contraction seems draconian, while the principle of equal entitlement to emissions seems utopian. In fact, both concepts are eminently practical.

As to contraction, nothing short of a 50% emissions reduction offers any hope of averting catastrophic climate change. This cutback – entailing a 75% reduction in today's advanced economies – accomplishes no more than stabilizing global greenhouse gases at a level over twice that which existed just two centuries ago.

As to convergence, nothing other than the principle of equal entitlement offers a basis for the global consensus on which an effective climate regime must depend. Equal entitlement does not mean equal emissions; it is, rather, the basis for an allocation of rights on which a fair and rational emissions trading system can be built.

A system based on this principle – and, I venture to say, only a system based on this principle – can be designed to produce the sense of equity, the predictability, and the sound economic incentives needed for smooth transition into a clean-energy future. These incentives can work constructively in developed and developing countries alike.

In this schema, the sense of equity and predictability are created at the very outset of the

regime. A nation's population size at an agreed point would be the basis for establishing its long-term emissions ceiling, toward which it would be committed to move on a steady path.

To facilitate a smooth and economically rational transition toward that goal, emissions trading would enable countries and companies to chart their own best path – selling permits where possible, buying them when necessary.

The rate of convergence to a common level would be designed to ensure that, during the long transition, already-industrialized nations as a whole would find it advantageous to purchase emissions permits from countries less developed.

This capital flow could serve the common interest in sustainable development by financing clean-energy infrastructure in the developing world.

Building this regime is not beyond human wit. Indeed, its simplicity and feasibility stand in favourable contrast to the chaos, social dislocation, vast expense and human misery that unrestrained climate change could bring – and from which no nation would be immune."

Full text at: www.world-nuclear.org/speeches/bnes2002.htm

July - Dept For International Development - Select Committee Report

Setting (greenhouse gas) emissions targets fairly - "82. Both atmospheric stabilisation of greenhouse gases and the entry of developing countries into the climate regime are likely to require a move to per capita emission targets. [243] David Crichton and the Corner House both suggested DFID should consider the 'contraction and convergence' model set out by the Global Commons Institute. [244] Contraction and convergence is based on per capita emissions and offers an opportunity to address issues of equity. With emissions shared on a per capita basis, developed and developing countries could trade surplus emissions rights. [245] Advocates of contraction and convergence point to its inherent equity and its ability to bring together developed and developing countries in a single framework. However, contraction and convergence recognises that emissions from developing countries will grow and does *not* hold back their development in order to rectify damage caused by developed countries." [246]

July - Unrepresented Nations and Peoples Organisation (UNPO)

World Summit on Sustainable Development - Indigenous Peoples, Energy and Climate Change

"18. Balance narrow econometric and technical approaches in the climate negotiations by applying the principles of contraction and convergence, full and effective participation of indigenous peoples and civil society and complementary scientific and indigenous knowledge."

August - The World Council of Churches (WCC)

"Call to Action" to the WSSD,

" . . . . highlights two requirements:

1. Stabilisation of greenhouse gases in the atmosphere at a level that is in accordance with the overall objective of the Climate Convention.

2. A fair distribution of rights and obligations, i.e. establishing per capita emissions rights for all countries as proposed in the 'Contraction and Convergence' scheme.

The goal is to prevent increasing dangerous interference with the natural climate system. The IPCC Third Assessment Report indicates that the six Kyoto greenhouse gases, measured as carbon dioxide equivalents, should not exceed the level of 450-550 ppm.

This leads us to the conclusion that the next commitment period must start building a system for targets related to a specific "secure" greenhouse gas concentration in the atmosphere and an equity burden of the emissions that allows for this. We foresee targets related to per

capita emissions.

Proposals of the Global Commons Institute (United Kingdom) on "Contraction and Convergence" have gained support from churches and Christian development agencies. For high emitters this would lead to a step-by-step approach over the commitment period during which the emissions are reduced, while for the least developed countries and low emitters, a step-by-step approach for the possibility to increase emissions, while at the same time building up and investing in sustainable energy use, could be foreseen."

September - Department of Physical Resource Theory, Chalmers University of Technology, Göteborg University, Sweden

"An allocation approach based on contraction and convergence is suggested in the Paper. The allowances are assumed to follow a linear trend from their present per capita level for industrial regions and the per capita emission by 2012 for developing regions towards an equal per capita allocation by 2050. The per capita emission allowances are then assumed to follow the per capita emission profile towards the stabilization target."

September - "New Economy" from the Institute for Public Policy Research (IPPR)

"Towards a global new deal?- The World Summit on Sustainable Development 2002"

" . . . . perhaps the single most useful action that negotiators could take at WSSD would be to acknowledge explicitly the need for this logic to be applied to the most pressing environmental challenge of all: climate change. The London-based Global Commons Institute, which originated the concept of Contraction & Convergence, has assembled a wide coalition of support for applying the proposal to the area of climate change, which would involve defining a safe upper limit for greenhouse gas concentrations in the atmosphere (which would by definition require all countries to accept emissions targets), and a date by which national emission entitlements would reach per capita equality."

September - World Bank

The Bank's annual World Development Report (WDR) for 2003 published for WSSD.

The WDR 1992 was published in time for the Rio Summit. In this the bank said "grandfathering" emissions rights was "the most feasible option".

In the current report they say . . .

"How can emissions reductions—beyond those that pay for themselves—be financed? This remains the most contentious issue in climate change mitigation. In carbon markets, for instance, the allocation of emission allowances determines who pays for reductions. In the view of many, equal per capita allocation of allowances across the world—perhaps entailing transfers from rich emitters to poor countries—would constitute an equitable allocation. But such an allocation rule, if imposed abruptly, might disrupt the rich emitters' economies and thus would not secure their participation in the scheme. On the other hand, a strong link between past emissions and current allowances, applied globally, would hurt the development prospects of poor nations and thus be unacceptable. Hybrid allocation schemes that blend per capita and "grandfathered" allocations and shift toward the former over time have been proposed as a compromise."

October - "UNEP Financial Initiative - on C&C

A. Meyer: The Kyoto Protocol and the Emergence of Contraction and Convergence as a Framework for an International Solution to Greenhouse Gas Emissions Abatement (1999) in Homeyer and Rennings Manmade Climate Change-Economic Aspects and Policy Options, Physica Verlag.

A MULTIPLE-STRATEGY APPROACH

Governments, singly and collectively through the United Nations Framework Convention on Climate Change (UNFCCC), should adopt four strategies to tackle climate change, and involve all stakeholders in developing and implementing them. The four strategies are:

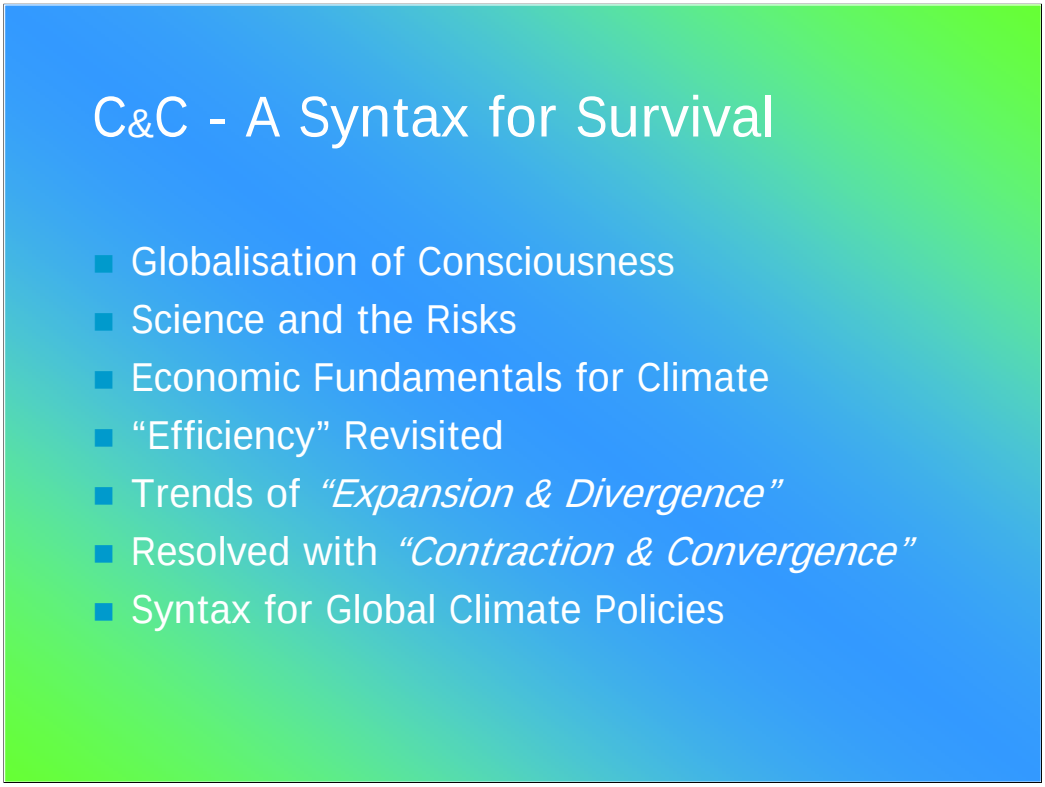
1. Operationalise the Kyoto process as a small but important first step in dealing with the problem of emissions internationally. This will allow all stakeholders to gain practical experience quickly.

2. Develop a range of policies and measures for implementation in national and regional jurisdictions, using a minimum of regulation to harness market mechanisms.

3. Construct a long-term framework to reduce emissions globally in order to achieve the necessary transition to sustainability. The approach of Contraction and Convergence, (see below) which the IPCC TAR described as "the logical conclusion" of a rights-based approach, provides a possible example of such a basis.

4. Promote a strong code of corporate sustainability, for business and the government sector, underpinned by the availability of key information on environmental, social and economic performance.

"Contraction and Convergence" (C&C)[1] which on the basis of precaution advocates the adoption of a "safe" steady-state level for GHG concentrations in the atmosphere. The approach demands that global emissions will contract progressively through a budgeting process to deliver the predetermined "safe" level of GHG concentrations. On the basis of equity and logic, these emission budgets will be distributed so that entitlements converge from today's very different national levels to a figure that is equal per capita for all nations by an agreed date. To satisfy the aim of cost-effectiveness, surpluses or deficits in emissions entitlements would be inter-nationally tradable, ideally redeemable for clean technology."



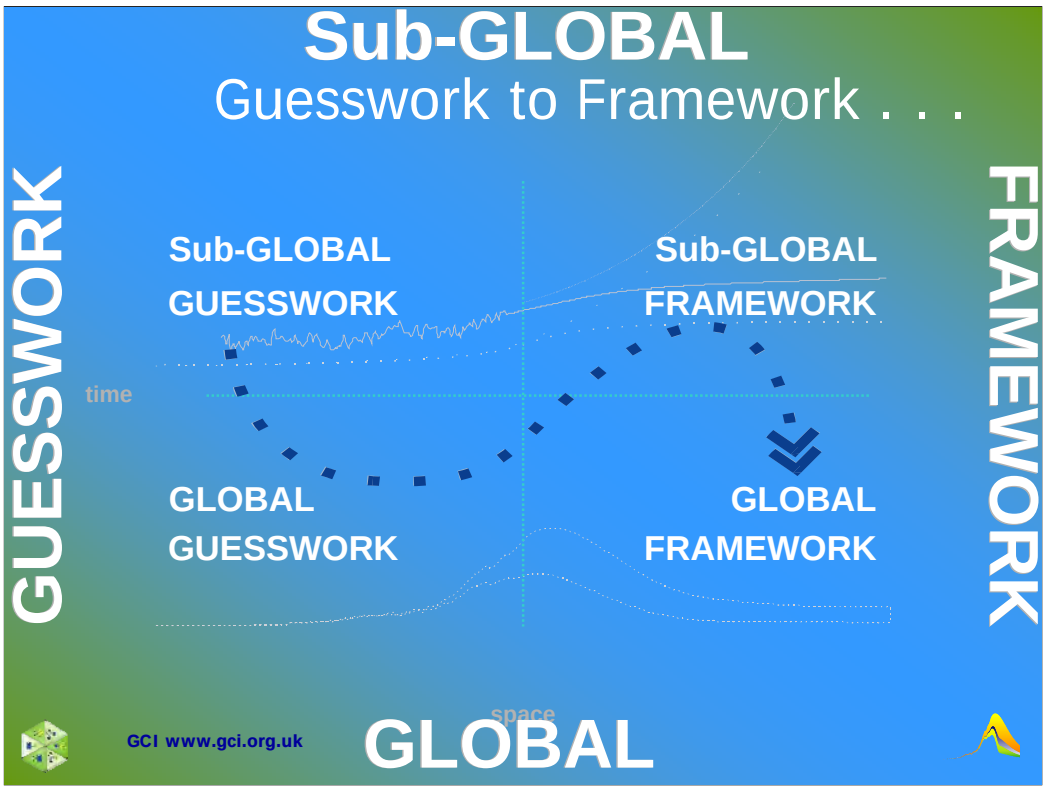
C&C – A Syntax for Survival

- Globalisation of Consciousness Slides 1 - 8
- Climate Science – Rising Risks Slides 9 - 16
- Economic Fundamentals Slides 17 - 22
- "Efficiency" Revisited Slides 17 - 24
- Trends of *"Expansion and Divergence"* Slides 25 - 27
- Resolved with *"Contraction & Convergence"* Slides 28 - 36

More information about C&C available from: -

Global Commons Institute (GCI)
37 Ravenswood Road
LONDON E17 9LY
UK

Ph/Fx	00 44 (0)208 520 4742
e-mail	aubrey@gci.org.uk
GCI	http://www.gci.org.uk/
C&C Book	http://www.greenbooks.co.uk/cac/cacorder.htm
C&C Refs	http://www.gci.org.uk/refs/C%26CUNEPIIIg.pdf
GCN	http://www.topica.com/lists/GCN@igc.topica.com/read



GUESSWORK to FRAMEWORK

The proposition of *"Contraction and Convergence"* (C&C) is a formal global framework for managing the avoidance of dangerous global climate change.

This image is intended to suggest a progression in space and time to C&C, or to a 'globalisation of consciousness'.

The progression along the dark blue dotted line with the arrow-head is defined through the quadrants created by intersecting axes from: -

- 'sub-global' (or local) to 'global' . . . and from: -
- 'guesswork' to 'framework'.

The left-hand side of the graphic loosely represents the past and the right-hand side of the graphic represents the future.

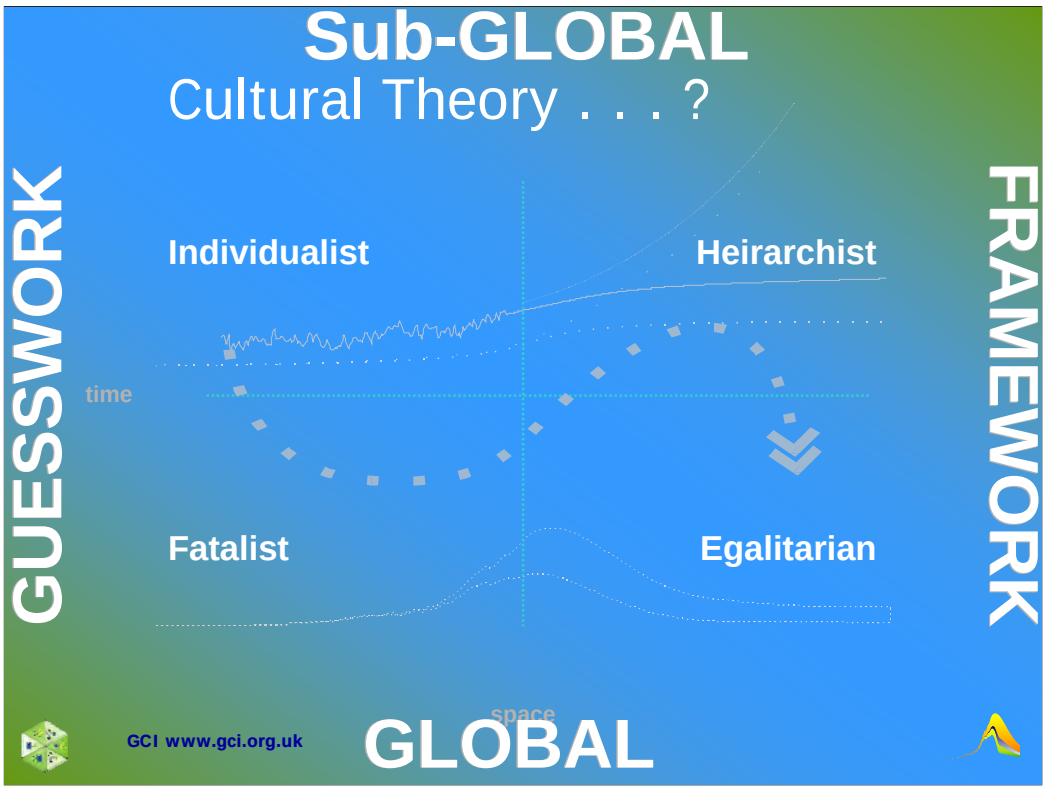
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

The curved traces (greyed-out) going from left to right above and below the central horizontal axis represent (from the bottom up): -

- The past expansion and the future contraction of greenhouse gas (ghg) emissions of CO_2 with developing on top of developed countries and
- The past rise and future rise/stabilisation of ghg concentration in the atmosphere and
- The past rise and future rise/stabilisation of global temperature.

The performance of these climate change indicators is crucial.

They are dealt with in more detail in slides 9 to 11.



CULTURAL THEORY

This image is intended to suggest the same progression to the globalisation of consciousness but through the world-views of the: -

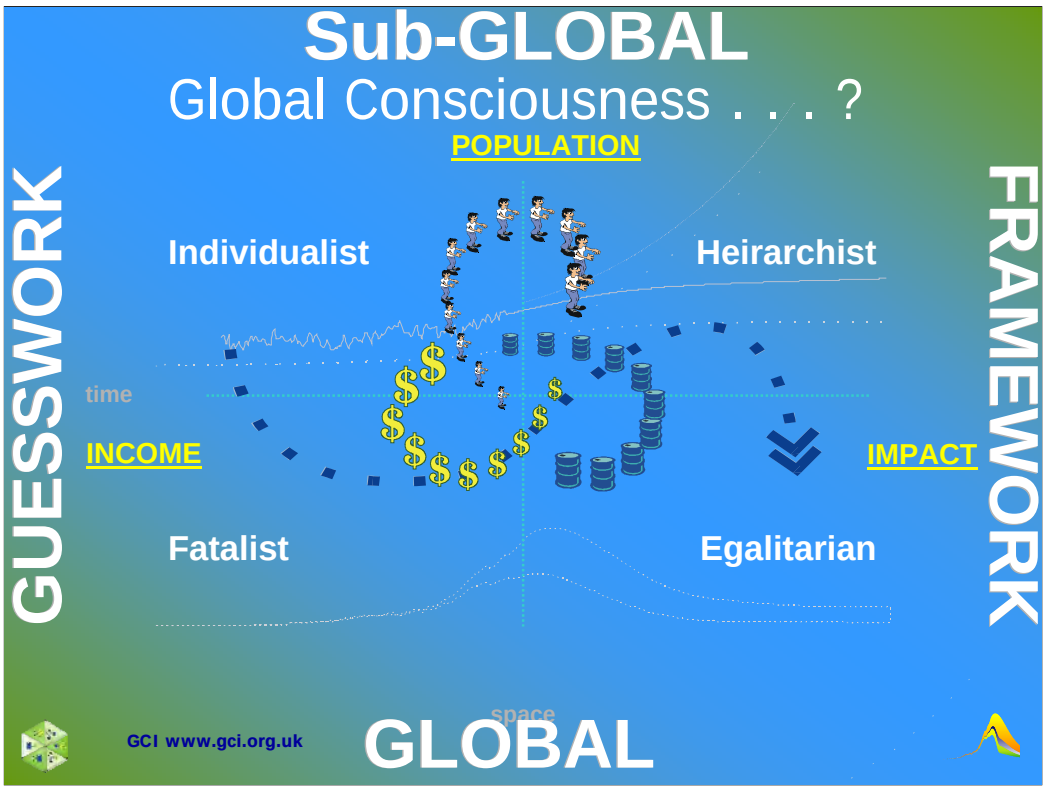
- Individualist: predator, in tactical conditions of 'local guesswork':
- Fatalist: prey, resigned in a state of global 'che sera sera':
- Heirarchist: mediates with 'sub-global policy frameworks':
- Egalitarian: sees 'conception-constitution', or 'global framework'.

This is a progression taking local competitive autarchy into constitutional democracy and then global governance under precautionary limits to global ghg emissions.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Once again, the curved traces (greyed-out) going from left to right above and below the central horizontal axis represent the underlying climate trends.

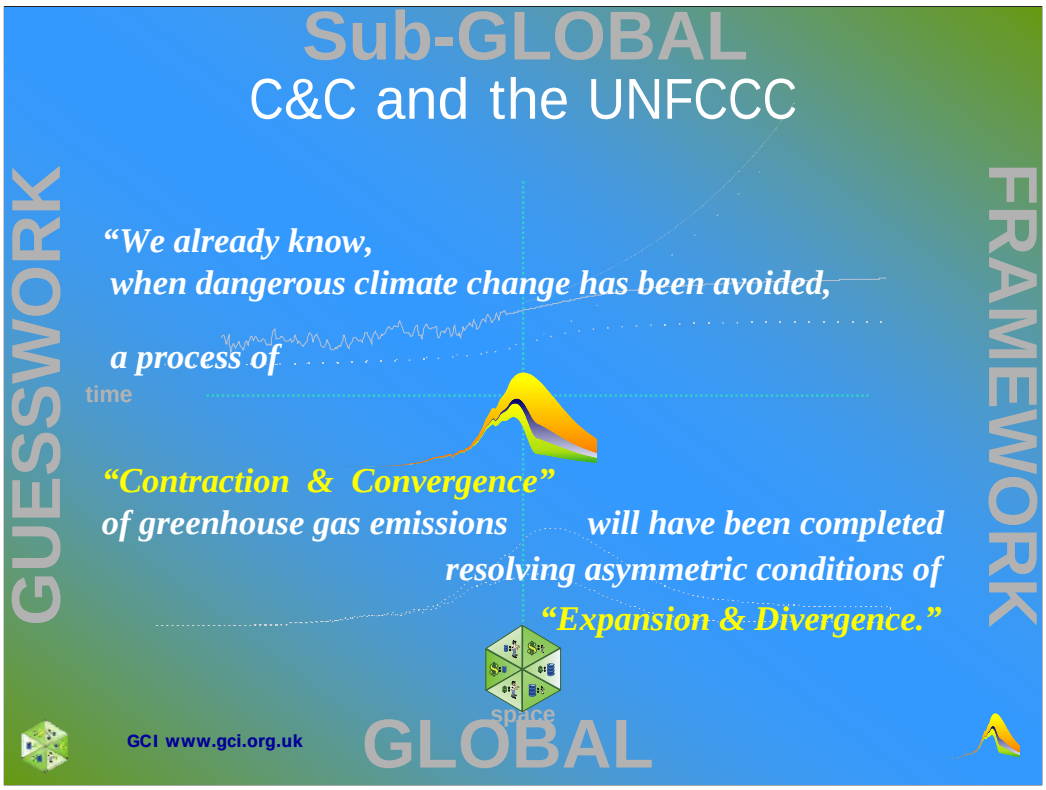
These traces persist throughout most of the presentation to facilitate comparisons between the rates of change in the economy and in the climate system.



GLOBAL CONSCIOUSNESS

This image is intended to suggest: -

- emerging consciousness of the relationships between: -
- Population and
- Income, or 'goods' (shown as dollars=production)
- Impact, or 'bads' (shown as oil-barrels=pollution)
- rising global temperature, ('flow' or rates of change)
- rising atmospheric ghg concentrations, ('stock', or accumulations)
- across environmental space and time, moving from short-term individualistic guesswork to a long-term egalitarian global framework for survival - C&C.



The UNFCCC and *"Contraction & Convergence"*

A secure and prosperous future depends on avoiding dangerous climate change.

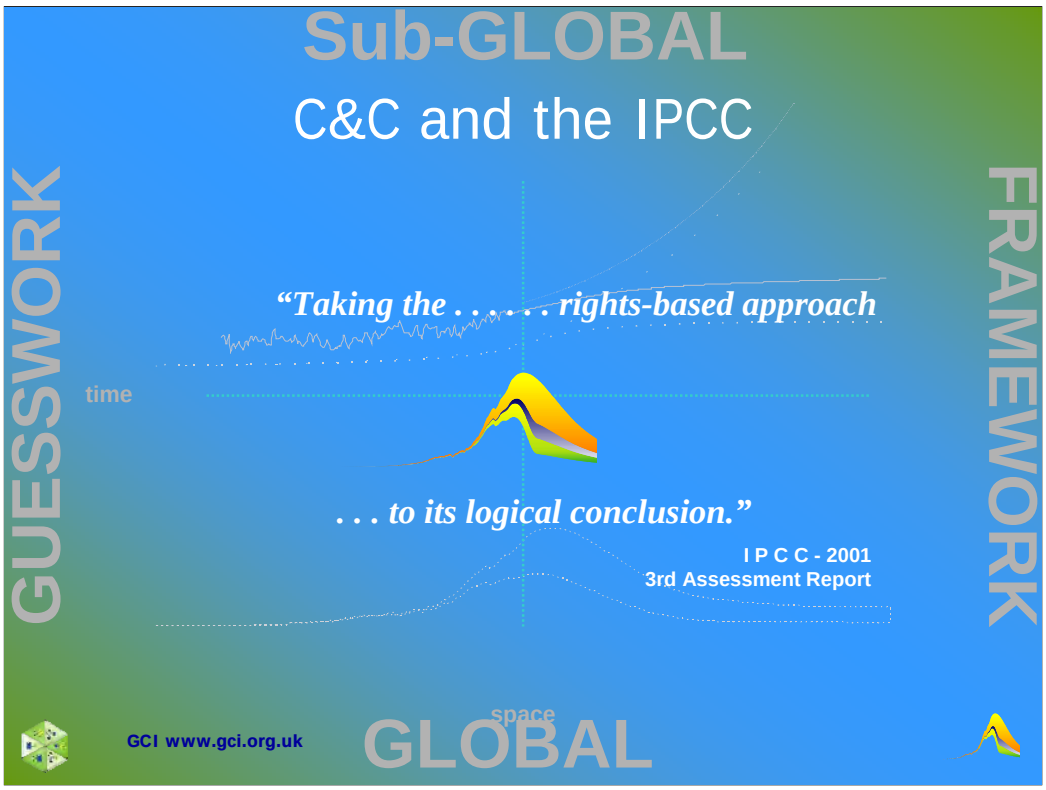
So sustaining income and opportunity depends on limiting the environmental impacts of greenhouse gas emitting sources of energy, such as fossil fuels coal, oil and gas.

Between1990 and 1992, the United Nations Framework Convention on Climate Change (UNFCCC) was created with this purpose.

If this is achieved, the UNFCCC will by definition have been the *"United Nations Framework Convention for Contraction & Convergence"*.

As the next slides show, the science is already clear enough for us to know now that when dangerous climate change has been avoided: -

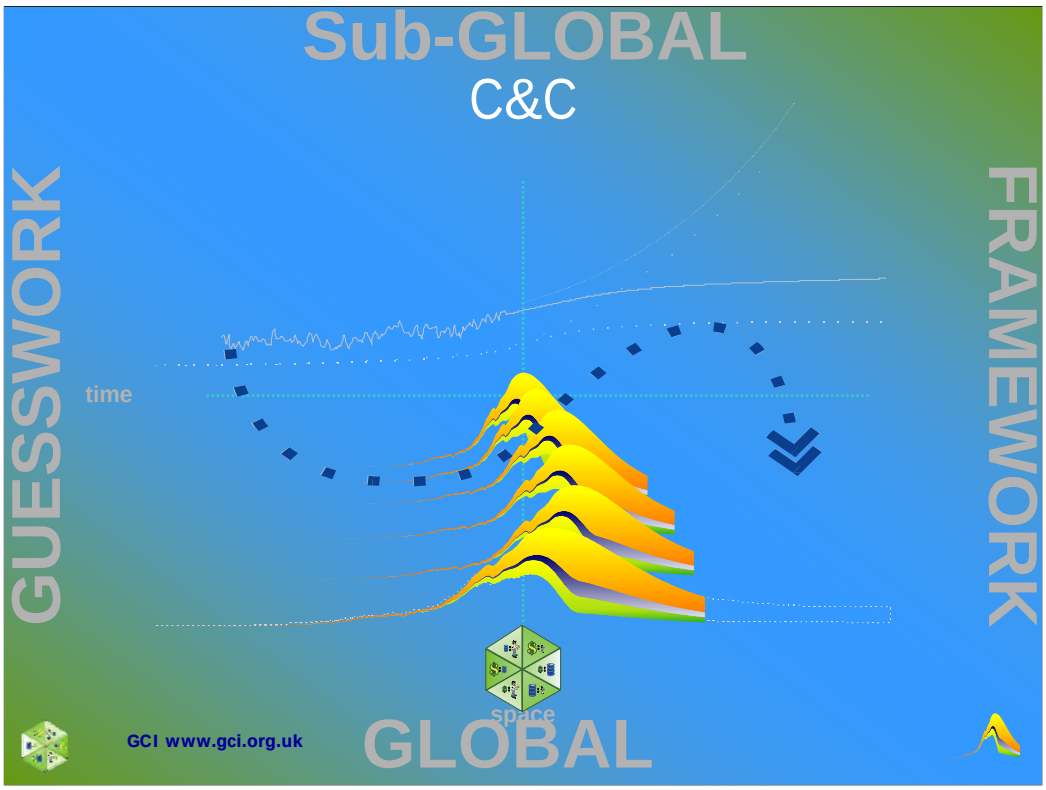
- A global contraction of greenhouse gas emissions in the order of 60 – 80% of current output in some time frame will have been completed, and . . .
- A formal international convergence of shares in this contraction will also have occurred by definition within the contraction planning framework of the UNFCCC .
- That will also have gone some way to resolving the existing asymmetric trends of international "Expansion & Divergence" (See slides 17 – 27).



The IPCC and *"Contraction & Convergence"*

The Intergovernmental Panel on Climate Change (IPCC) has so far produced three "Assessment Reports". The: -

- First Assessment Report (1990) established the scientific basis for human-caused climate change.
- Second Assessment Report (1995) established recognition of the asymmetric human causation and effects of climate change.
- Third Assessment Report (2001) established policy recognition of C&C as, *"taking the rights-based approach to its logical conclusion."*

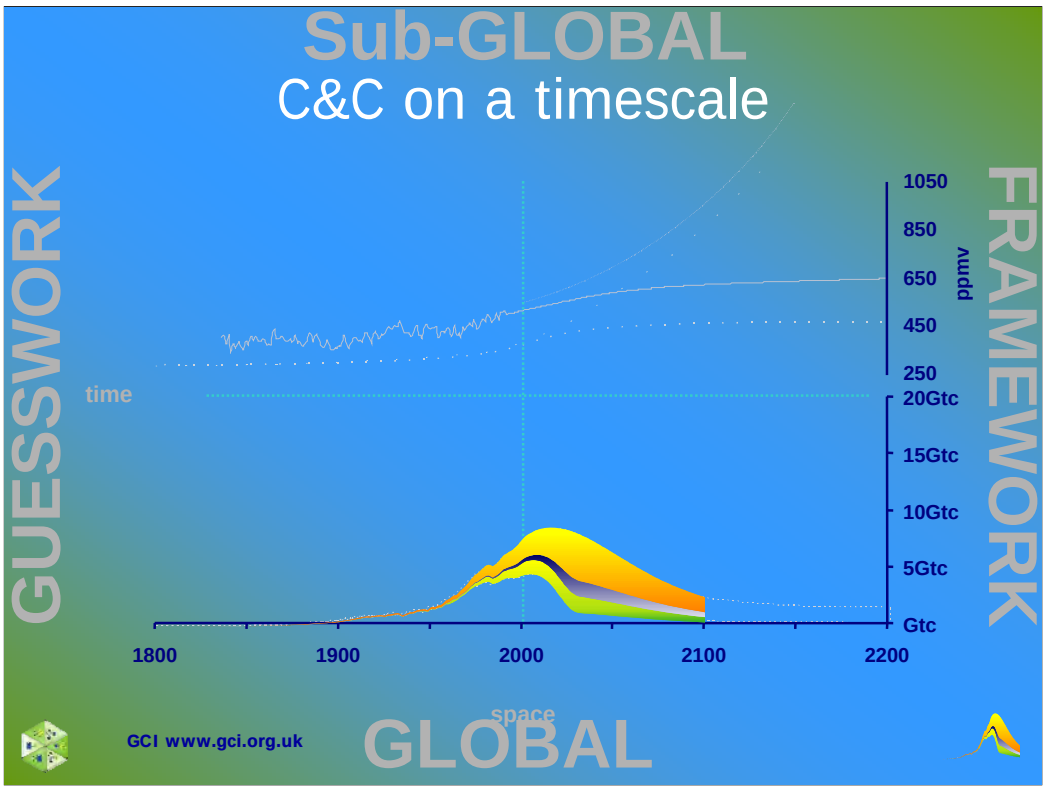


Transition Slide

This slide takes the C&C logo at the centre of the global consciousness slides, to the grid position for examining in more detail the recorded and projected rates of change of:

- Global greenhouse gas emissions
- Global atmospheric CO_2 concentrations
- Global temperature
- Uninsured economic loss estimates
- Economic prognosis

in the next slides (8 – 15).

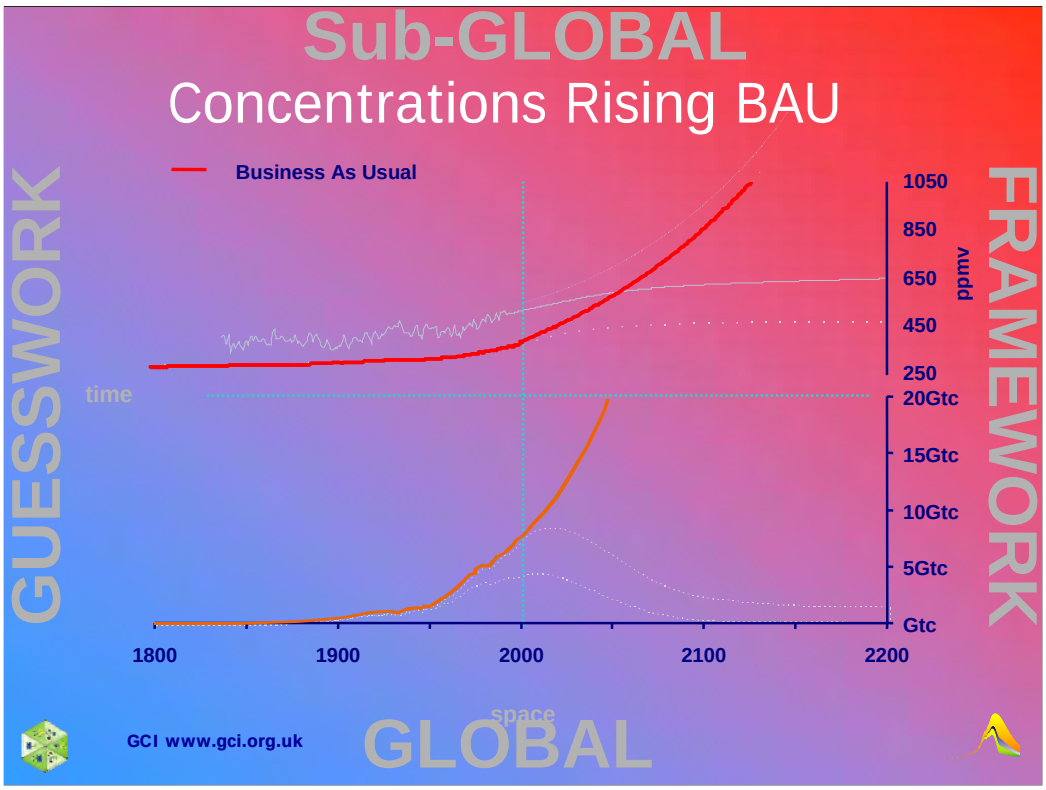


"Contraction & Convergence"

This slide takes the C&C logo at the centre of the global consciousness slides, to a position on the axes of time and weight so as to enable examination with cross-reference the recorded and projected rates of change of: -

- Global greenhouse gas emissions
- Global atmospheric CO_2 concentrations
- Global temperature
- Uninsured economic loss estimates

in the next slides (8 – 15).



Atmospheric CO_2 CONCENTRATION RISING BAU

CO_2 is the most significant greenhouse gas from human sources forcing global climate change. In terms of 'carbon equivalence' with other gases from human sources – such as SO_2 and Nitrous Oxide - it is responsible for between 66% and 75% of human impact.

Following the path of industrialization, recorded global atmospheric CO_2 concentration rose from 1800 until 2000 showing an increase of 35% over pre-industrial levels from 280 parts per million by volume (ppmv) to the present 370 ppmv.

This is a rise both higher and faster than anywhere in the ice-core sampling going back 440,000 years before now, where concentrations have varied at slower rates of change between180 and 280 ppmv.

Because the atmosphere appears to retain a constant 50% fraction of the human emissions, the rising concentrations represent emissions accumulating in the global atmosphere.

In future, the worst case is the red line as Business-as-Usual (BAU), where the underlying emissions continue to grow at 2%/yr, concentrations rise along the upper band exceeding three times pre-industrial CO_2 within the century ahead.

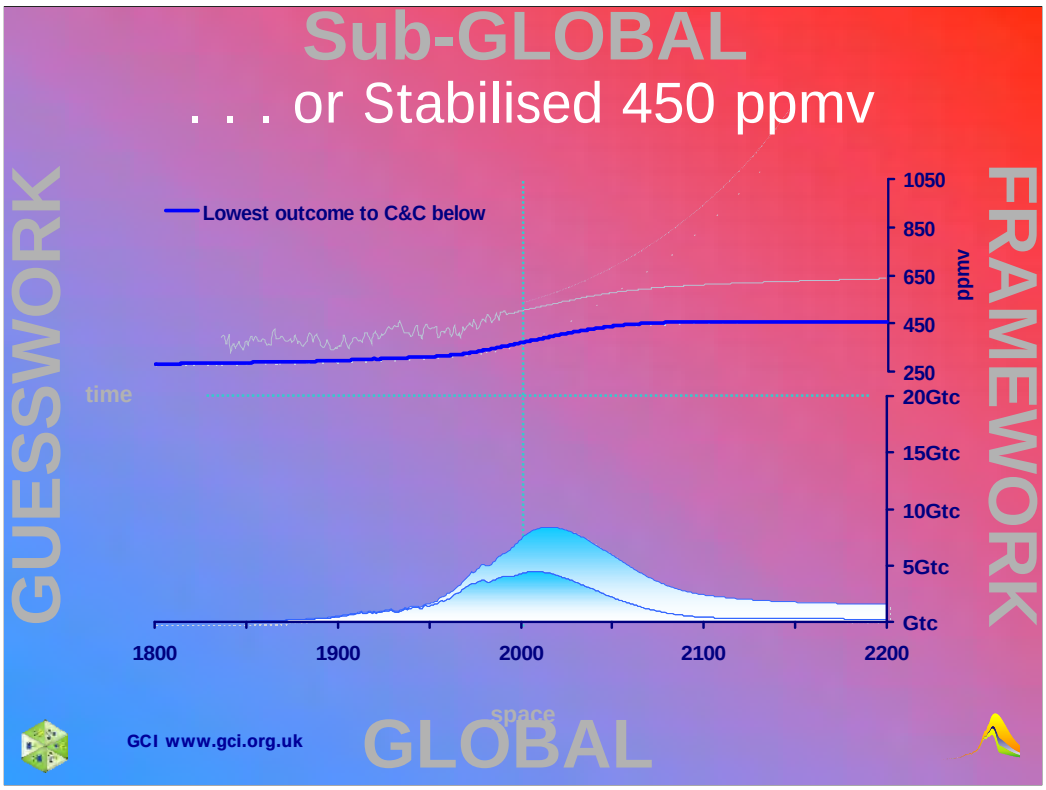
The means that continued BAU in the global economy drives the upper band of the relevant grayed-out traces in the opening slides for: -

- Atmospheric ghg concentration (See this slide)
- temperature (See also slide11)
- CO_2:GDP lockstep (See also slide 12)

And helps to make clear these rates of change relative to the rates of:

- Damages and the effect on GDP growth (Slides 13 to 15).

[Source data IPCC].

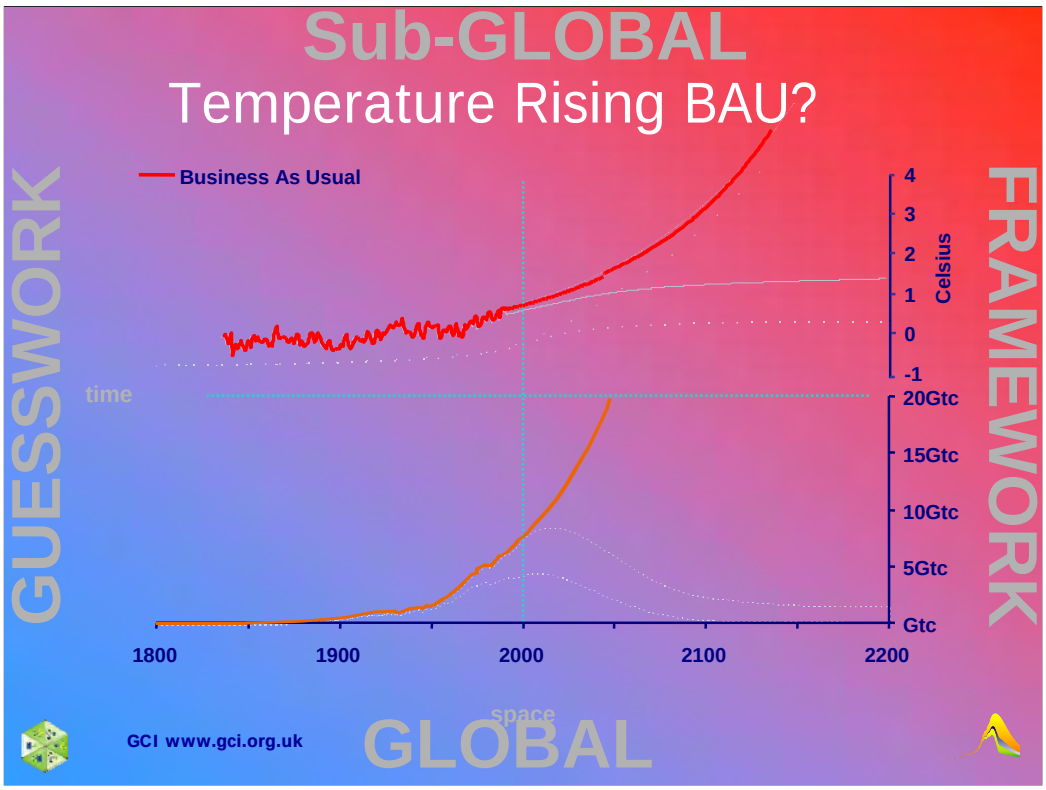


Atmospheric CO_2 CONCENTRATION Stabilised

The blue line shows the lowest possible sensitivity. Rising CO_2 concentration slows and stabilizes at 70% (450 ppmv) above pre-industrial levels.

This is responding to the underlying 60% contraction in emissions by 2100.

[Source data IPCC].



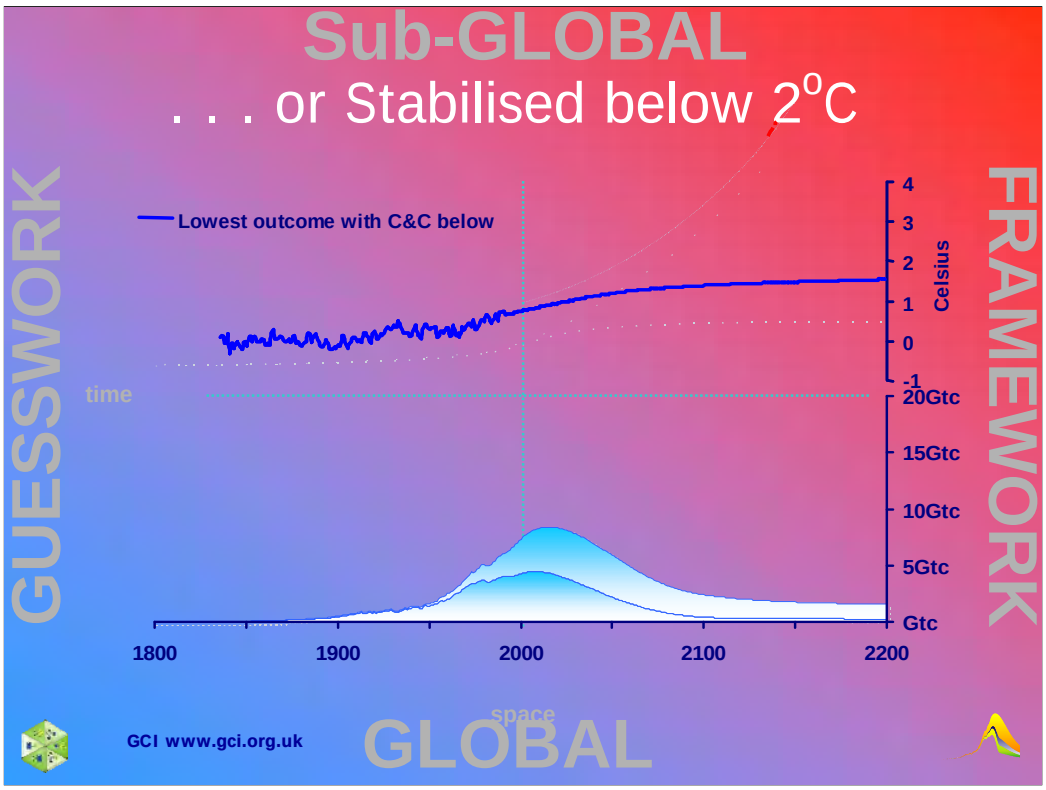
Global TEMPERATURE RISING BAU

Global surface temperature from 1860 until 2000 shows an overall rise of 0.7°C.

Here, future projections are following CO_2 emissions and atmospheric ghg concentrations Business-As-Usual.

The red line shows Business-as-Usual (BAU) for concentrations following the underlying emissions which continue to grow at 2%/yr.

IPCC projects a global rise of up to 6 degrees Celsius and rising by 2100 under this scenario.



Global TEMPERATURE STABILISED below 2°C

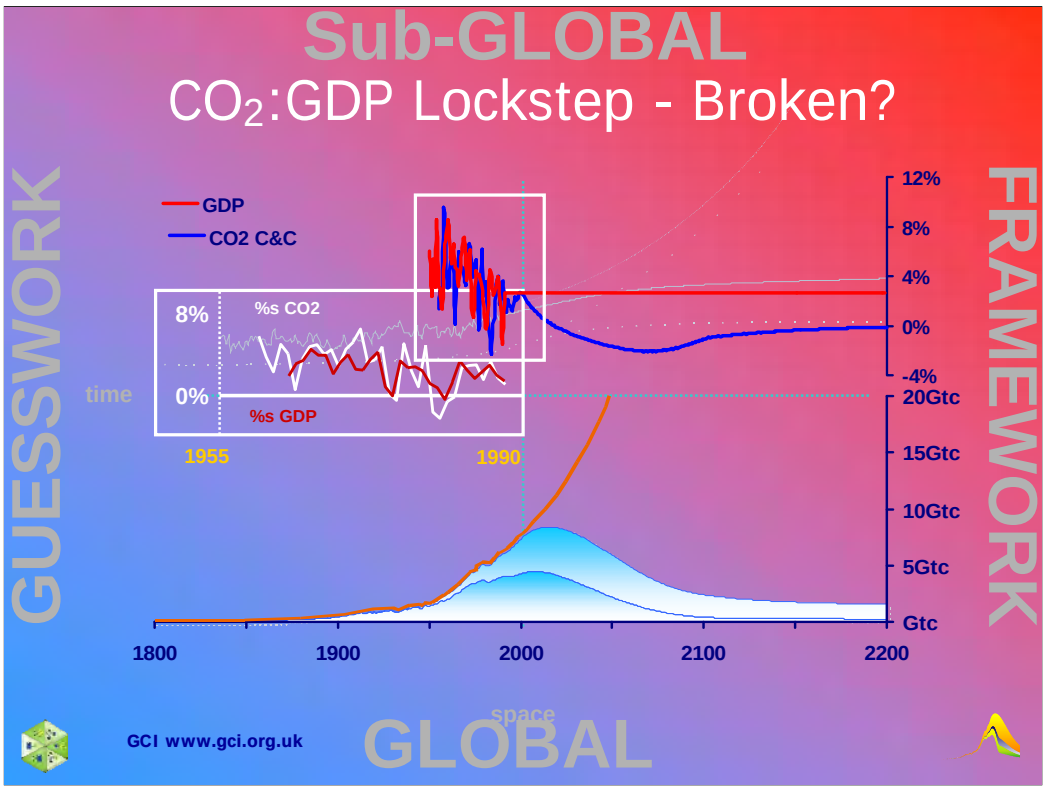
Global surface temperature from 1860 until 2000 shows an overall rise of 0.7°C.

Here, future projections are following CO_2 emissions and atmospheric ghg concentrations with stabilisation of concentrations at 450 ppmv by 2100.

The blue line shows the lowest possible climate sensitivity - a rise of 1.5°C according to the IPCC Science Working Group - where the underlying emissions assume a contraction of 60% by 2100 (with convergence between 2020 and 2100).

The difference between BAU and the C&C formation is the difference between growing chaos and growing control.

[Source data IPCC].



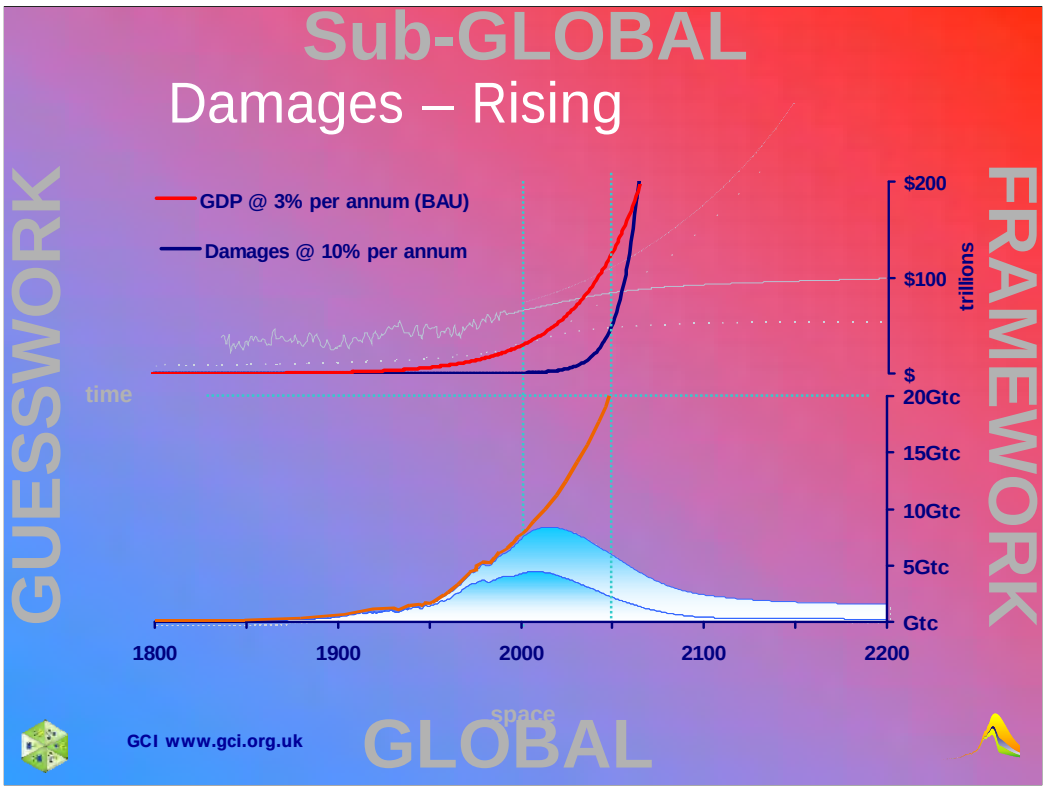
Breaking GDP:CO_2 "Lockstep"

For the past four decades, the output of CO_2 and GWP from global industry have been correlated nearly 100%. This is known as 'lockstep' (Detail in Landscape White Box).

To maintain both growth and a safe climate, breaking this CO_2:GDP lockstep is essential.

Future GDP is projected here at 3% a year. Future CO_2 goes to minus 2% a year here following the retreat from fossil fuel dependency shown in the C&C formation below to limit CO_2 concentrations to 70% above the pre-industrial level.

The quicker we break the lockstep and correct the asymmetric trends of carbon dependency, the greater the likelihood of avoiding dangerous climate damages.



Damages

Past damages here are the 'uninsured economic losses' estimated by Munich Re for the last five decades. The relate to "Great Weather Disasters", with extra weighting for the associated mortality added by GCI. The estimates exclude values that should be ascribed to the considerable mortality that accompanied these events. The trend of the growth rate over this period has risen to a current average of around 12% a year.

GWP is Gross World Product over the decades gone by and this has recorded at an average rate of growth at 3% a year.

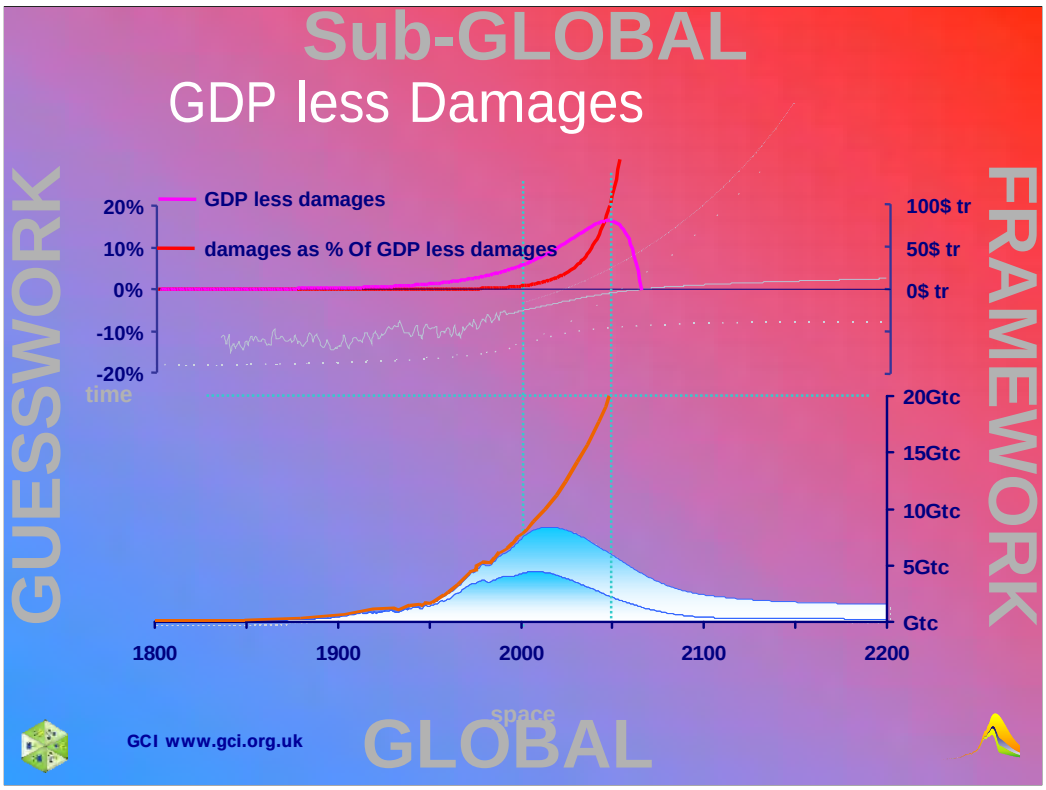
This means that – albeit from a low based figure - the growth in damages has been at over three times the rate of economic growth. If these global trends are projected on the back of emissions Business-as-Usual (BAU), damages appear to exceed GDP by 2065. This is clearly unsustainable. It suggests that, if we do take this path towards this future climate, the risks – let alone the damages - will soon rise beyond the capacity of the insurance industry and even governments to absorb.

It is certain that damages will rise for the century ahead even with emissions contraction. However, this rate can be reduced proportional to the rates of a negotiated framework of Contraction, Convergence, Allocation and Emissions Trade (C-CAT).

Here again the underlying emissions portrayed, show a contraction of 60% by 2100 with convergence between 2020 and 2100. In other words, the difference between BAU and the C&C formation, is the difference between moving into the chaos already prefigured in these data below and organising with the committed purpose of avoiding it.

Great Weather Disasters - (Munich Re-Insurance/UNEP 2001 - $s Billions.)

	1950s	1960s	1970s	1980s	1990s
Events	13	16	29	44	72
Damages	$40	$52	$76	$121	$410



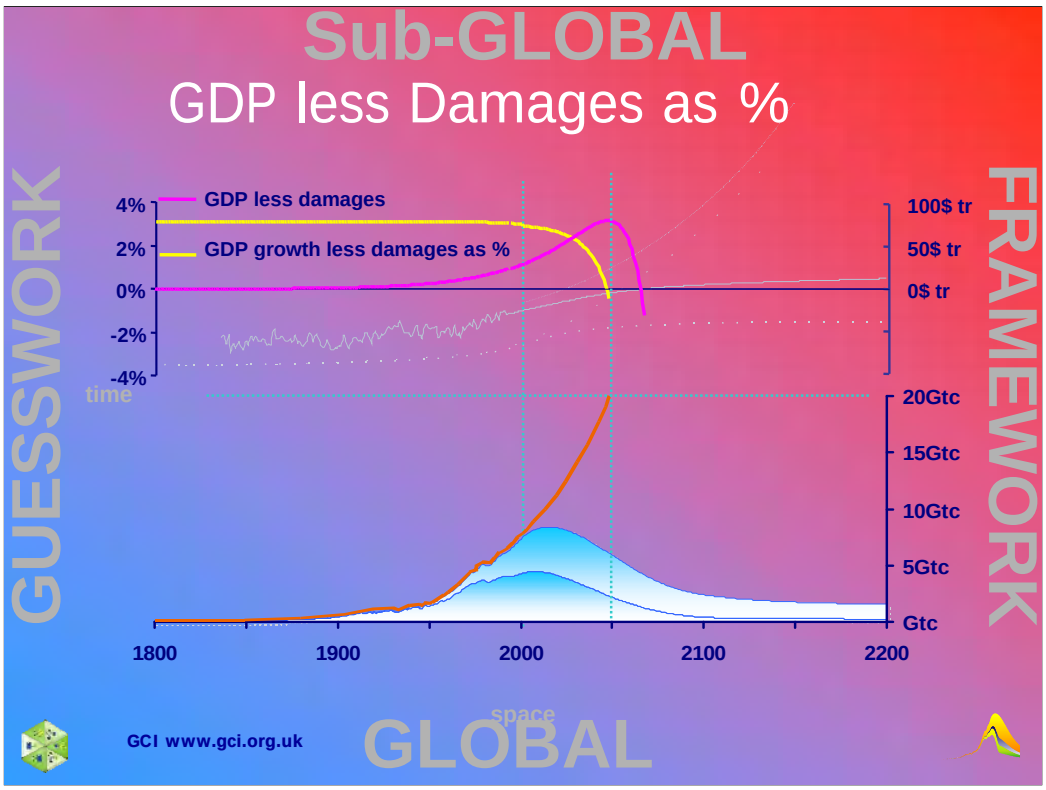
GDP Less Damages

Here the equivalent of the estimates for uninsured economic losses has been subtracted from the GDP figures. This shows that GDP growth rate slows to zero by 2050. This is roughly the point at which damages equal 20% of the depreciated GDP figure.

This figure is the standard average fraction of GDP that is re-invested in growth which suggests that investment for growth would cease to be possible beyond this point as well.

Because of the rates of change in the levels of temperature and atmospheric ghg concentrations visible in the underlying grayed-out imagery, this graphic and the one that follows suggest quite strongly that the contraction rate for 450 ppmv shown may not be fast enough to avoid serious and dangerous rates of climate change.

Other gases have to factored into the equation of temperature forcing by ghgs and the influence of additional positive feedbacks to the rates of change from collapsing sink function in the biota and albedo in the collapsing ice-shelves are increasing proportional to delay in contraction.



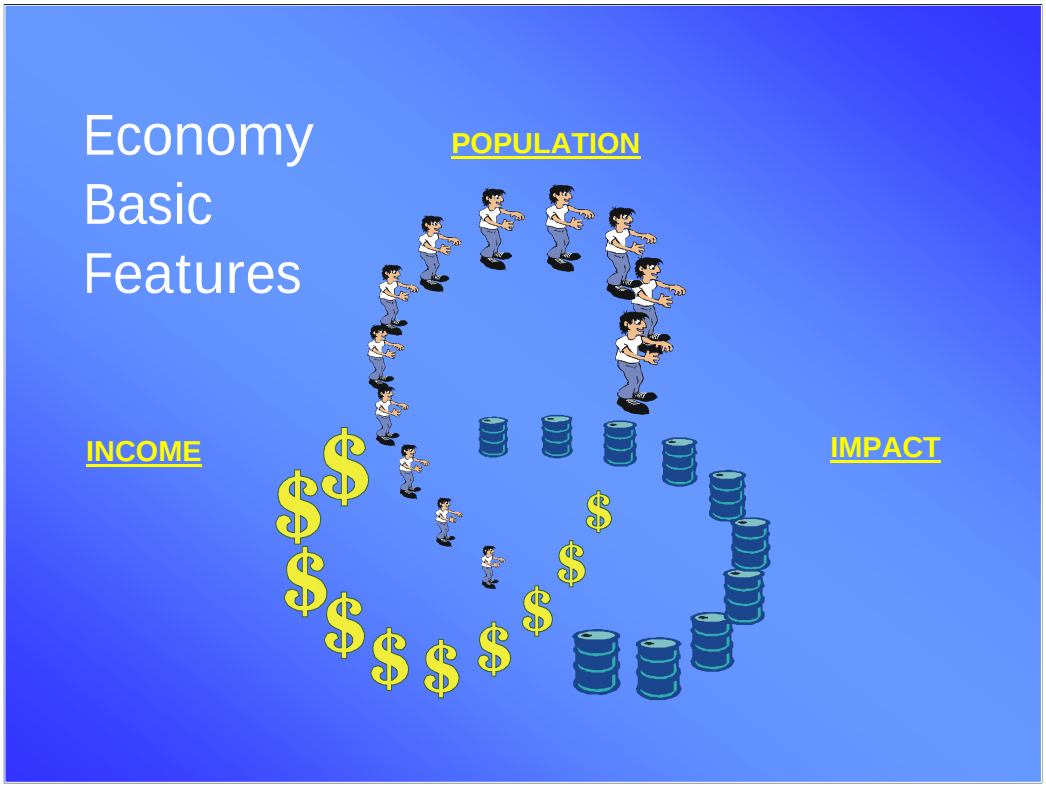
GDP less Damages as a %

Here the equivalent of the estimates for uninsured economic losses has been subtracted from the GDP figures. GDP less damages as a percent growth curve shows that already from now on GDP growth is in a noticeable and steady decline.

Climate Economy – Basic Stock

There are three basic features of the climate economy.

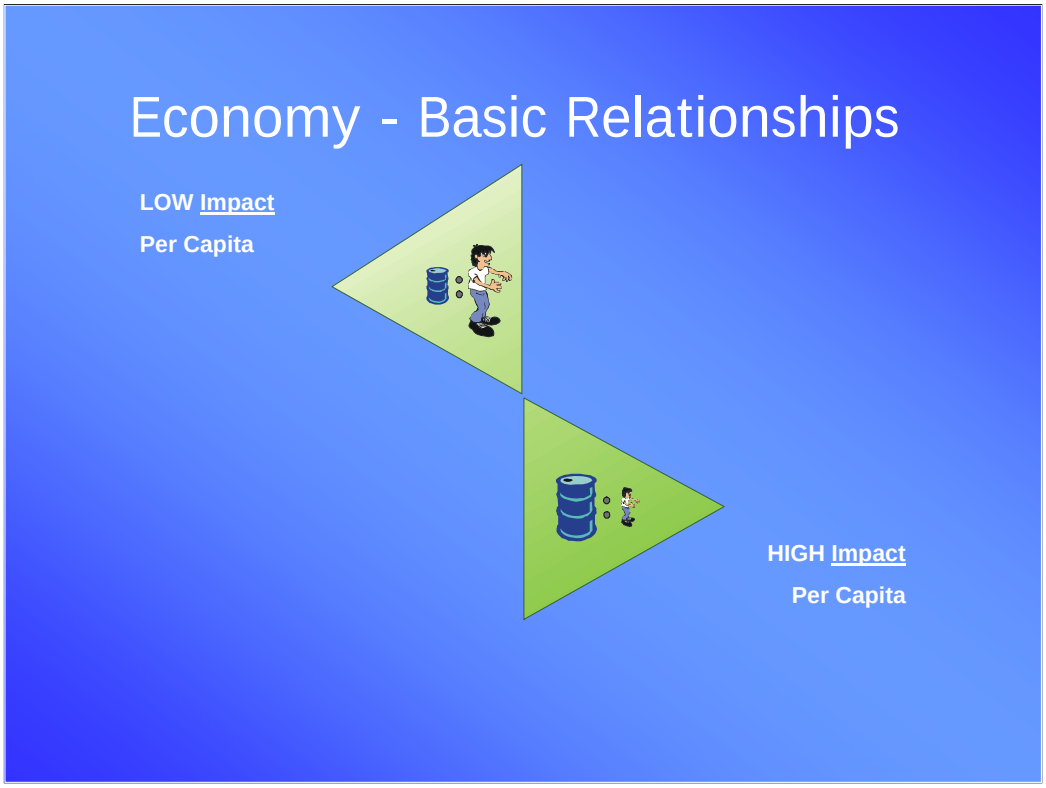
- PEOPLE – population
- INCOME – production measured as $s Gross World Product (GWP)
- IMPACT – pollution [tonnes of carbon (and equivalent) from CO_2 emissions from fossil fuel burning.



Climate Economy – Basic Flow

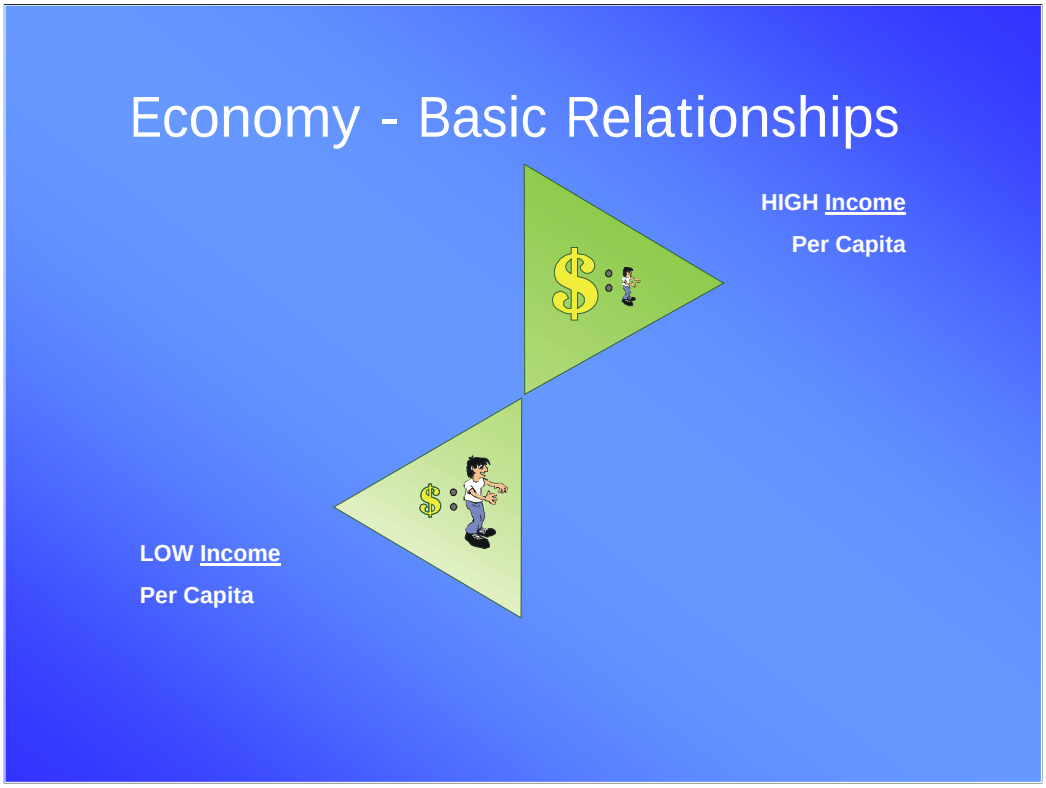
The three basic features of the climate economy are growing. They are also now feeding back to the system as a whole as *"Expansion & Divergence"* (See charts 25 – 27).

Seen in the light of the data on the existing rise in ghg emissions, concentrations, temperature and damages (charts 9 – 16), which Corporate CEOs at the Davos World Economic Summit in 2000 called, *"the devastating trends of climate change",* they had good reason to ask, *"why had not more been done to avert them?"*



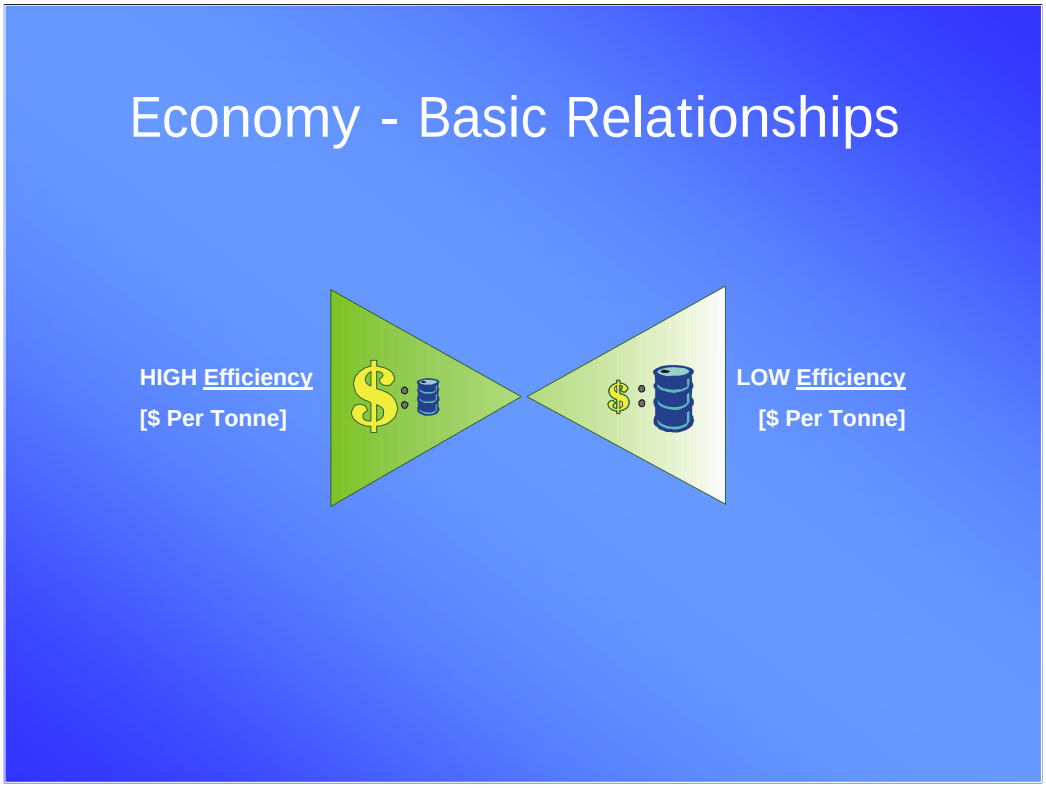
Climate Economy – Basic Relationships

Here, from high to low, are tonnes carbon per capita or IMPACT.



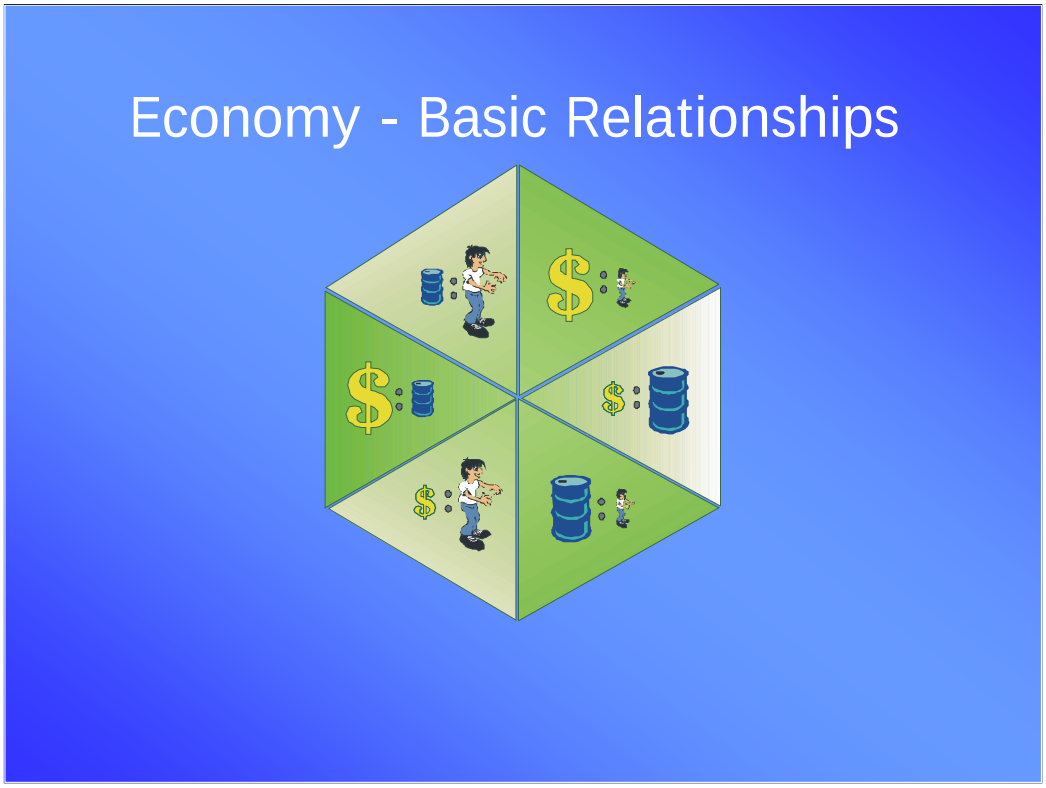
Climate Economy – Basic Relationships

Here, from high to low, are dollars per capita or INCOME.



Climate Economy – Basic Relationships

Here, from high to low, are dollars per tonne or EFFICIENCY.



Climate Economy – Basic Relationships

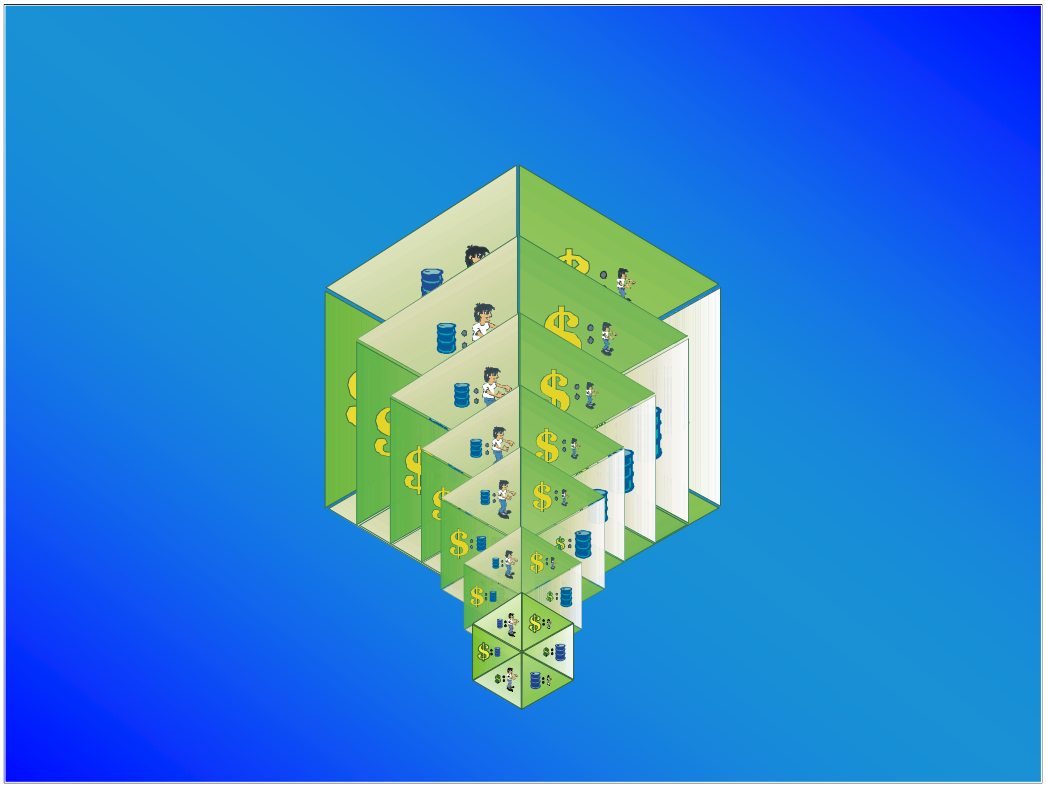
Here are the three basic features of the climate economy integrated in the same model: -

- high to low dollars per tonne or EFFICIENCY
- high to low dollars per capita or INCOME
- high to low tonnes carbon per capita or IMPACT.

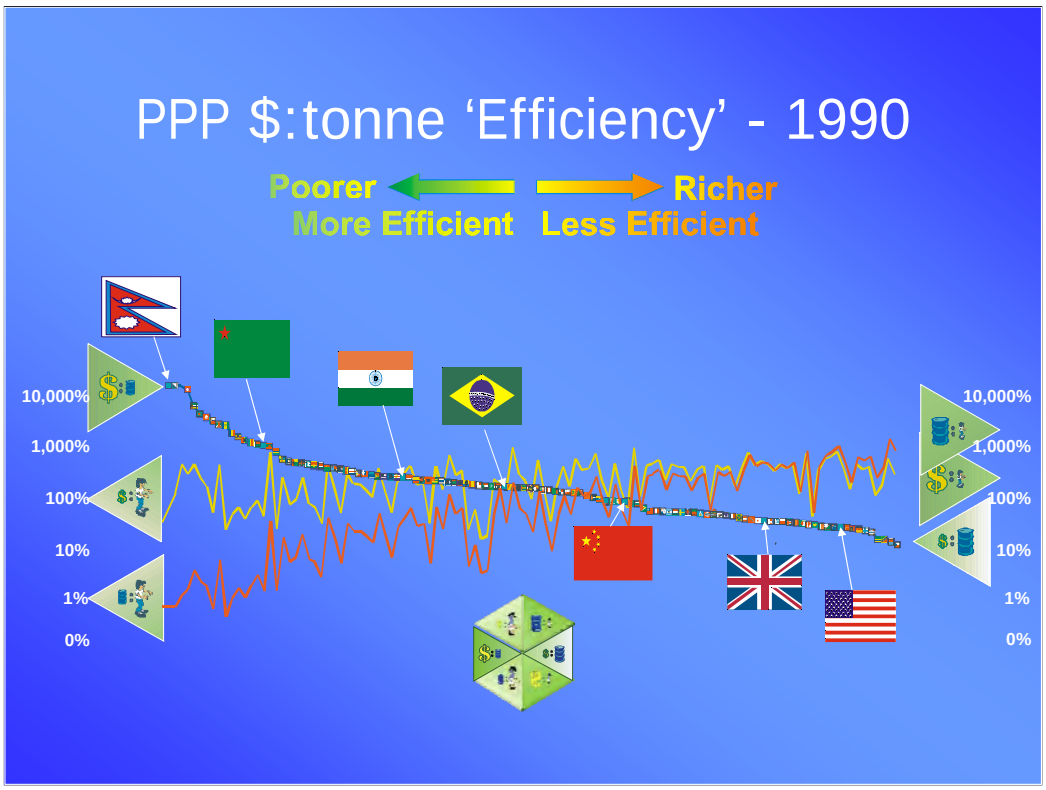
This is the basis for analysing the *"Expansion and Divergence"* which now follows (charts 23 – 27).

What is revealed globally is an inverse relationship between conventionally measured private/public INCOME or Gross Domestic Product (GDP) and EFFICIENCY or this INCOME per unit of IMPACT.

In the context of climate change, those with the money are making the mess and those without are not



Transition to “Expansion and Divergence”



Climate Economy – Inverse Relationship between Wealth and Efficiency

Here are the three basic features of the climate economy assessed for 140 countries for the year 1990.

Six example countries from high efficiency to low efficiency are shown with their flags: - Nepal; Benin; India; Brazil; China; UK; USA.

It is apparent that there is an inverse relationship between wealth and efficiency. The pattern is: -

- high to low dollars per tonne or EFFICIENCY

  accompany
- low to high dollars per capita or INCOME

  and
- low to high tonnes carbon per capita or IMPACT.

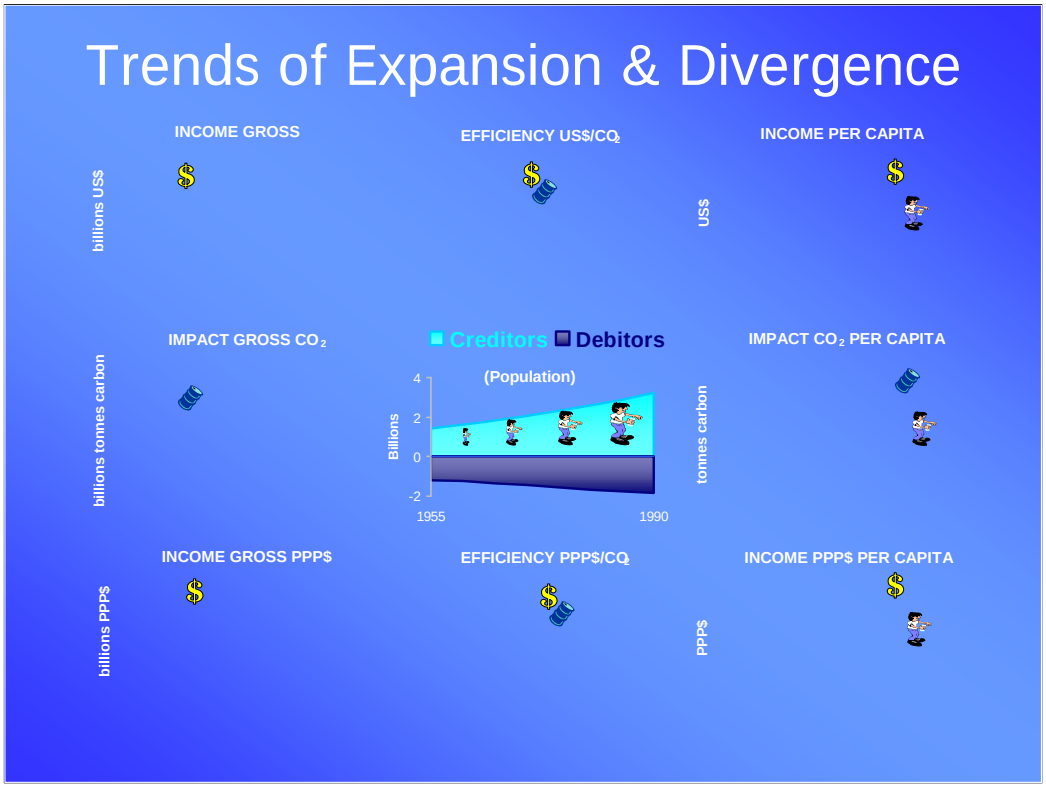
On present values and at present rates of change, the USA will be as efficient as Nepal only in some hundreds of years.

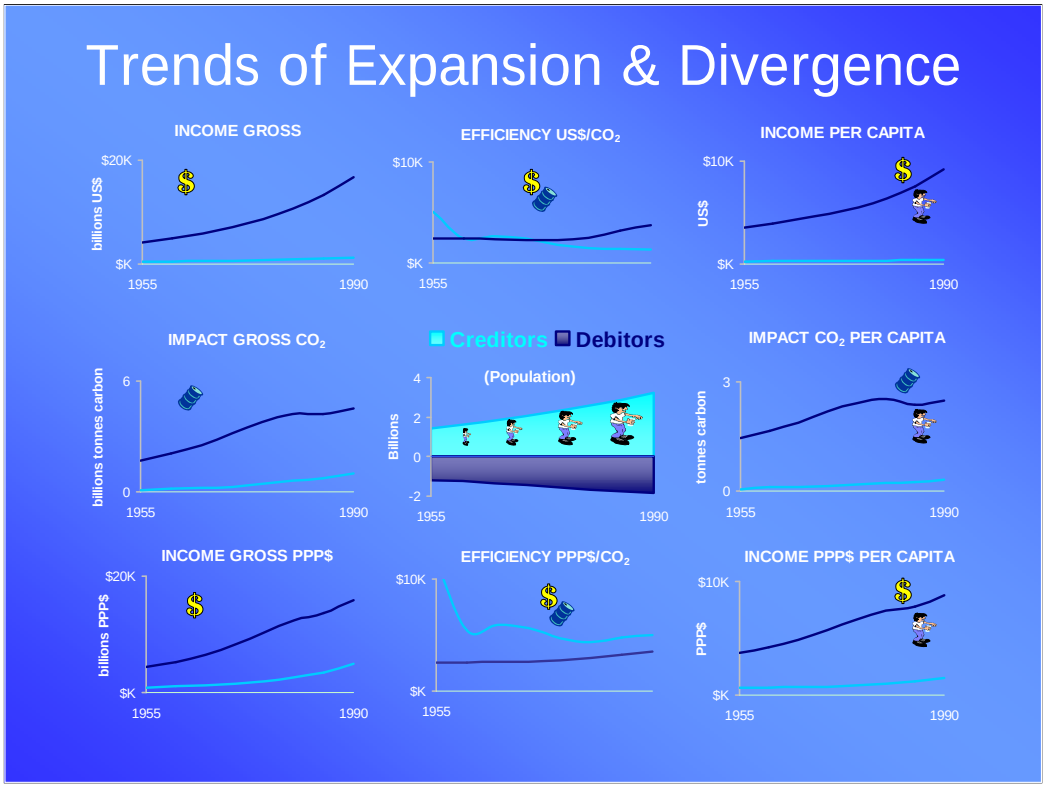
The currency values have been corrected for exchange rate distortions.

Dollar data IMF; PPP data from Pennsylvania State University;

CO_2 data from CDIAC;

Population data from UNSTAT.


Trends of Expansion & Divergence
INCOME GROSS
billions US$
EFFICIENCY US$/CO2
INCOME PER CAPITA
US$
IMPACT GROSS CO2
billions tonnes carbon
Creditors
Debitors
(Population)
Billions
4
2
0
-2
1955
1990
IMPACT CO2 PER CAPITA
tonnes carbon
INCOME GROSS PPP$
billions PPP$
EFFICIENCY PPP$/CO2
INCOME PPP$ PER CAPITA
PPP$



"Expansion and Divergence"

This shows global gross and per capita *"Expansion and Divergence"* in $s Income and CO_2 Impact between 1950 and 1990. Efficiencies as $s:tonne carbon are shown in currency with and without exchange rate corrections (PPP Purchasing Power Parities).

The global average GDP dollars per tonne carbon from fossil fuel burning in 1990 for example was around $3,000 per tonne. The average per capita carbon usage for stable atmospheric concentration of 0.4 tonnes per person per annum (IPCC First Assessment) was converted into a figure called *"sustainably derived income"* (SDI), by reducing the $3,000 by 60%.

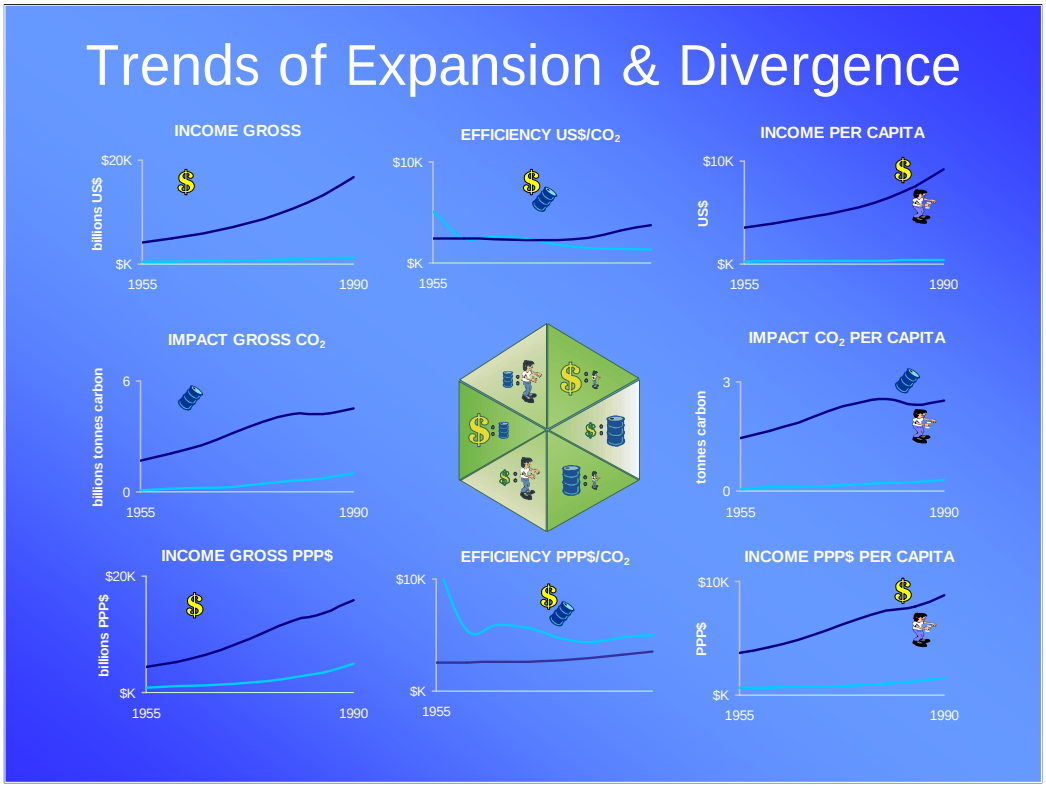
While this global SDI was $1,200 per person per annum, national SDI totals were obtained by multiplying that figure by each countries population for that year. These allocations were then compared with each nation's actual dollar and Purchasing Power Parity (PPP) dollar equivalent income (GDP) to give a *"debit"* or *"credit"* figure.

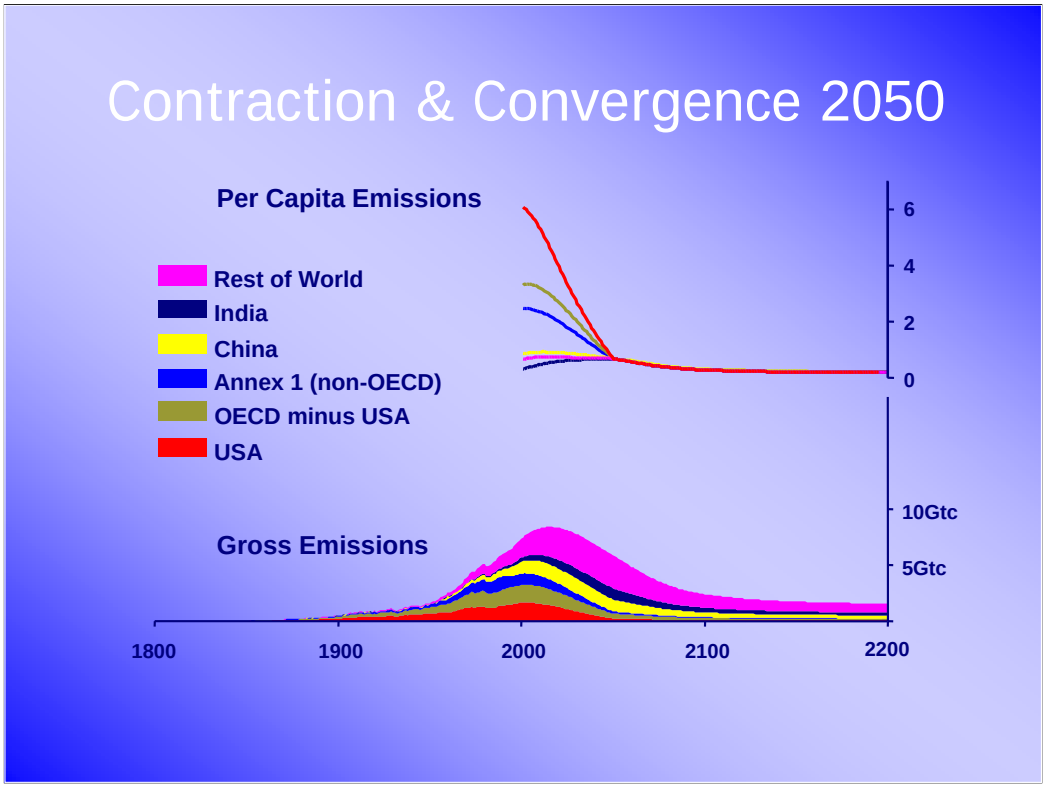
Debit here means in any year the amount by which a nation exceeded its SDI total. *Credit* means in any year the amount by which a nation fell short of its SDI total. *"Debitor"* means in any year the total number of people in the nations that took more than their equitable share of SDI globally. *"Creditor"* means in any year the total number of people in the nations that took less than their equitable share of SDI globally.

To reveal the trends the exercise was carried out for each year 1950 to 1990. They show the total number of countries which were *"creditors"* and *"debitors"* in each year; their respective gross and per capita Impacts; their respective gross and per capita Incomes in $US and $PPP; their respective Efficiency trajectories in $US and $PPP. For simplicity each grouping of countries is aggregated and simply shown as *"creditors"* and *"debitors".*

When all data for all these years is analysed this way the trends that emerge are devastating, *"Expansion and Divergence"*.

This helps to emphasize the systemic requirement for *"Contraction and Convergence".* (More information at: - www.greenbooks.co.uk/cac/cacorder.htm).

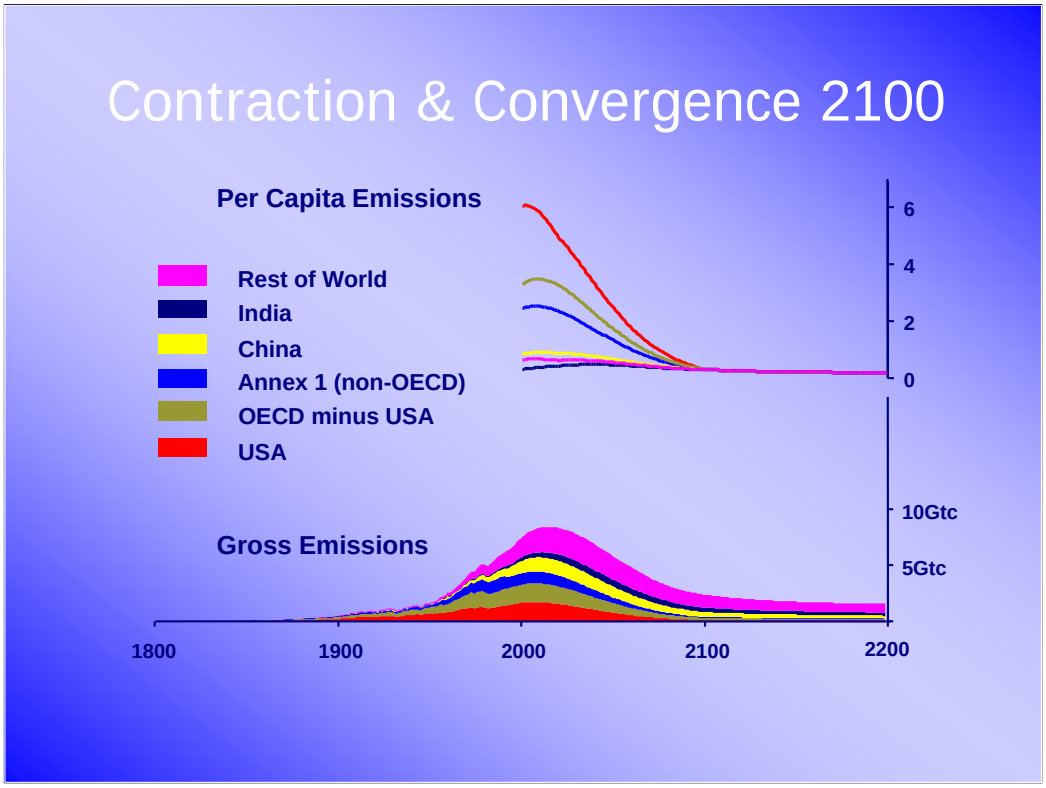

Trends of Expansion & Divergence
INCOME GROSS
billions US$
$20K
$K
1955
1990
EFFICIENCY US$/CO2
$10K
$K
1955
INCOME PER CAPITA
US$
$10K
$K
1955
1990
IMPACT GROSS CO2
billions tonnes carbon
6
0
1955
1990
IMPACT CO2 PER CAPITA
tonnes carbon
3
0
1955
1990
INCOME GROSS PPP$
billions PPP$
$20K
$K
1955
1990
EFFICIENCY PPP$/CO2
$10K
$K
1955
INCOME PPP$ PER CAPITA
PPP$
$10K
$K
1955
1990



Contraction by 2100 with Convergence by 2050

Here are greenhouse gas emissions for the world divided in six regions.

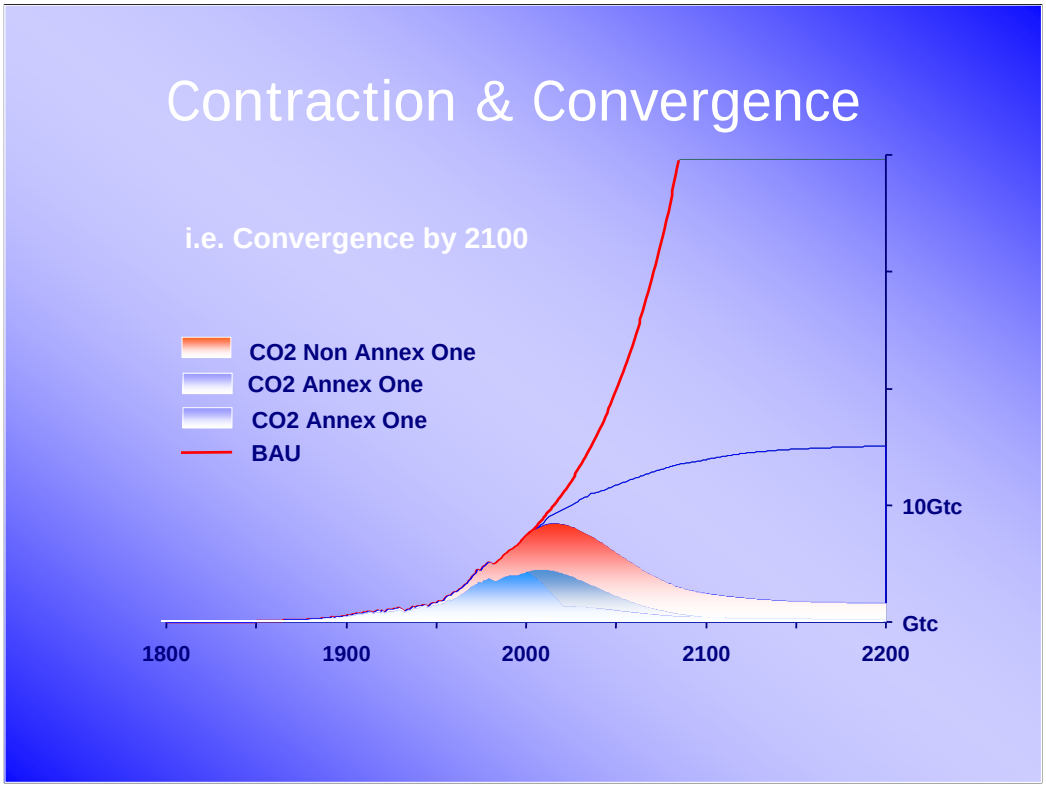
Under Contraction by 2100 for 450 ppmv, entitlements converge to equal per capita by 2050.



Contraction by 2100 with Convergence by 2100

Here are greenhouse gas emissions for the world divided in six regions.

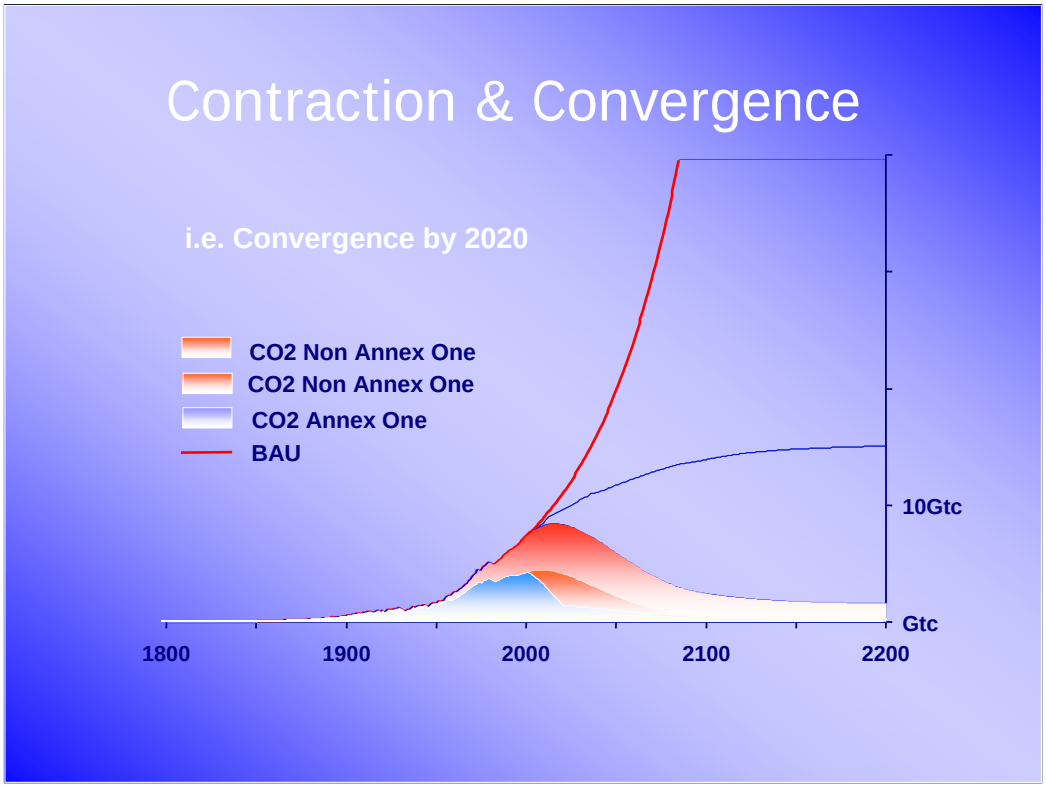
Under Contraction by 2100 for 450 ppmv, entitlements converge to equal per capita by 2100.



Contraction by 2100 with Convergence by 2100

Here are greenhouse gas emissions for the world divided in two regions, the Developed and Developing Countries.

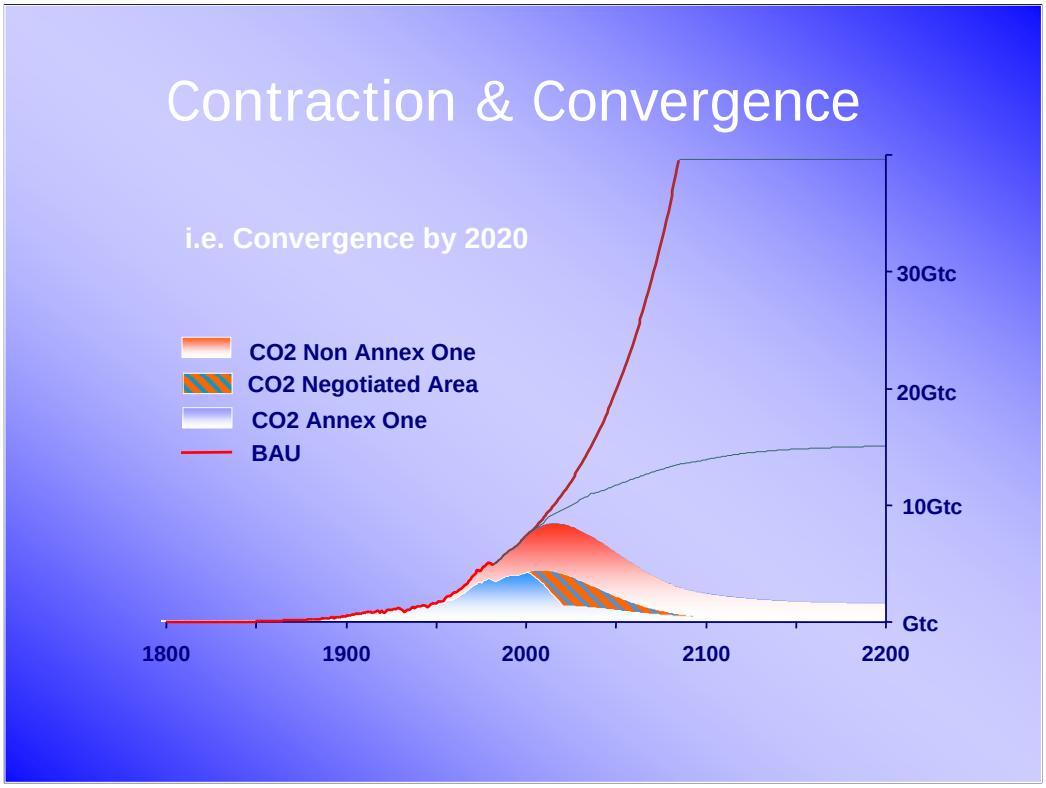
Under Contraction by 2100 for 450 ppmv, entitlements converge to equal per capita by 2100.



Contraction by 2100 with Convergence by 2020

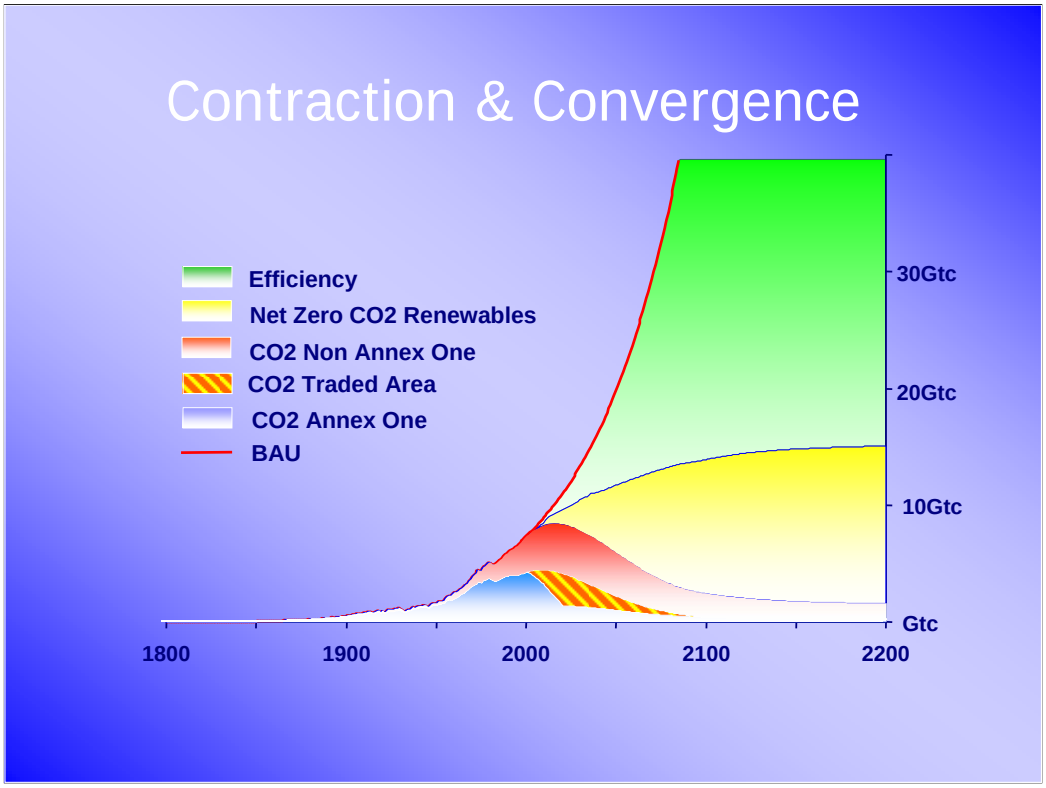
Here are greenhouse gas emissions for the world divided in two regions, the Developed and Developing Countries.

Under Contraction by 2100 for 450 ppmv, entitlements converge to equal per capita by 2020.



Contraction by 2100 with Convergence negotiated by between 2020 and 2100

The negotiation of the rate will resolve between these dates, in other words between the demands of 'Historic Responsibilities' (or the 'Brazilian Proposal') and 'Grandfathering' (or the Dynamic Targets linked to GDP).



Contraction by 2100 with Convergence negotiated between 2020 & 2100

Efficiency is sensibly the global property of avoiding dangerous climate change through recourse to C&C. It is the surplus beyond the constraints of C&C with trade and the development and diffusion of clean replacement technology.

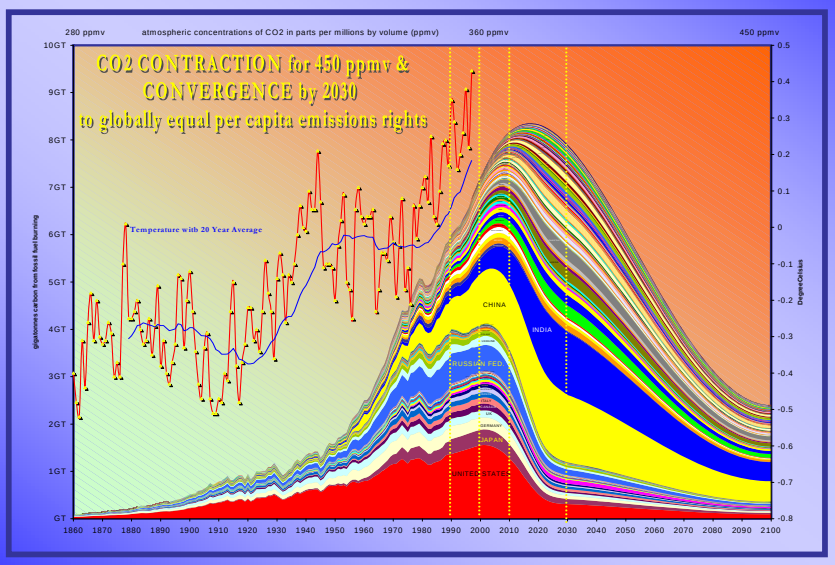
Whatever rate is negotiated the shares created thereby should be internationally tradable, and ideally redeemed for net zero emissions energy technology.

The tradable shares of this budget are the difference between convergence to equal per capita emissions by an agreed date and population base year (here 2020 and 2100 and100 billion tonnes worth of permits). If this is invested in net-zero-emissions energy technology, risk and damages are lowered further as the budget will then be net of these emissions as well.

The investment opportunity in this agenda for renewable energy systems is worth trillions of dollars per annum - the biggest market in history.

Success is survival. Failure is not.

" C & C " – The Classic Image

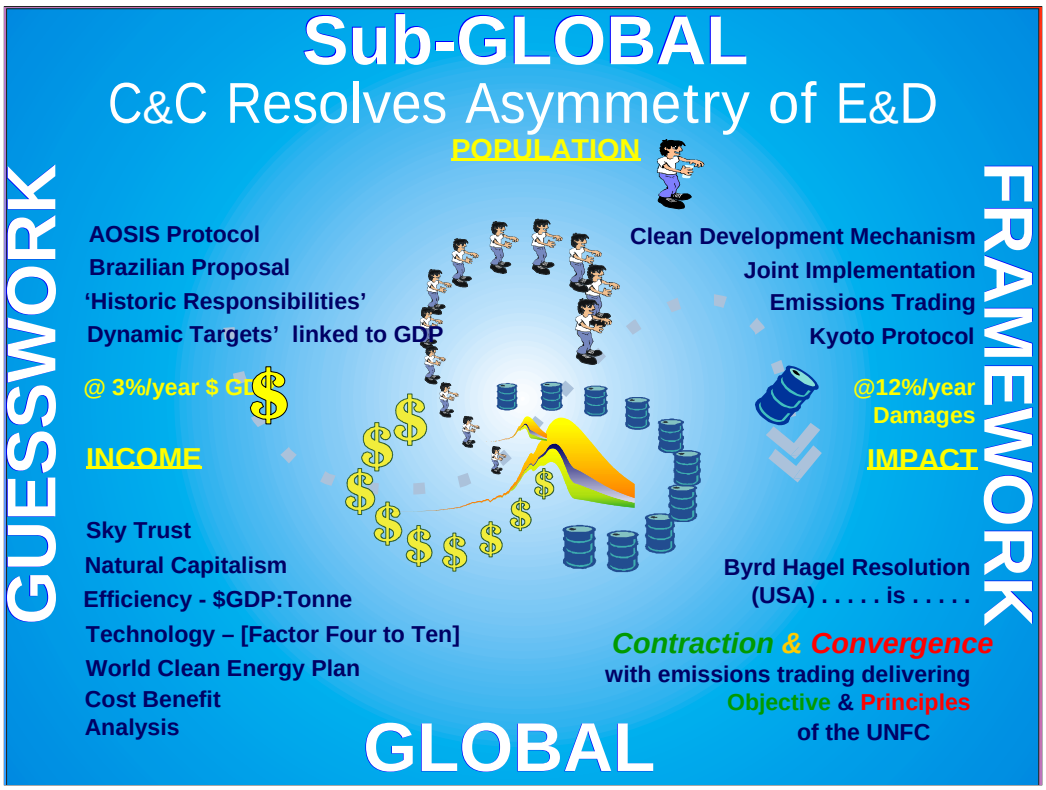


The 'classic' image of *"Contraction & Convergence"* (C&C) created by GCI in 1996. It was 1st presented at the 2nd Conference of the Parties (COP-2) to the UNFCCC. The UNFCCC objective is,*"stabilisation of rising atmospheric greenhouse gas concentration"* . Its principles are *"precaution & equity"*. Together, the objective and the principles become C&C, with rates to be agreed.

On the left, the rise in global temperature, 1860 - 2000. The data (red line) is averaged (20 year, blue line). The rise is 0.07 degrees Celsius (axis on the right). This is partly the result of the emissions from fossil fuel burning by all countries, of the greenhouse gas carbon dioxide. With data from the CO_2 Information Analysis Centre (CDIAC) Oakridge, these are shown on the left axis in gigatonnes (GT) carbon. Countries upwards are from largest to smallest emitter (1990) in 3 groups: - (1) the industrial countries of the OECD (2) the industrial countries of the former Soviet Union (3) the industrialising countries everywhere else. With 186 countries in all, many (e.g. Tuvalu) are too small to be seen. On the right a *projection* of all countries future CO_2 emissions 'entitlements' (2000 – 2100) in a global framework of *"Contraction and Convergence".*

- *Contraction* - by 2100 emissions are 60% less than in 1990. Concentrations of ghg in the global atmosphere are an accumulation of on-going emissions. So emissions must actually fall for rising concentrations to stabilise. The axis for atmospheric CO_2 concentrations is across the top. In 1860 they were 280 parts per million by volume (ppmv). By 2000 they had risen to 360 ppmv. At the rate of contraction shown, they will stabilise at 450 ppmv, helping to stabilise the upward global temperature trend. But, the reddening background reminds us that according to the climate models, temperature and damages will continue to rise throughout, albeit more slowly than without contraction.

- *Convergence* - future emission entitlements converge to equal per capita by the base year 2030. Entitlements are assumed to be tradable within and between countries. Other base years could be set. Other methods of international pre-distribution (emissions capping) are stochastic and so quite unpredictable.



Here is the ideological time-space during which the awareness of climate change policy matures from short-term sub-global guesswork to a full-term global framework.

The objective of the United Nations Framework Convention on Climate Change (UNFCCC) is to stabilise rising concentrations of greenhouse gases (ghg) in the global atmosphere at a level that prevents dangerous climate change.

By definition this requires a global contraction of ghg emissions – principally CO2 from fossil fuel burning – in the order of 60 – 80% within a given timeframe. The sooner the contraction the lower the concentrations, the temperature and the damages.

Within global carbon 'contraction', international convergence of shares will be happening by definition. The only pressing questions are

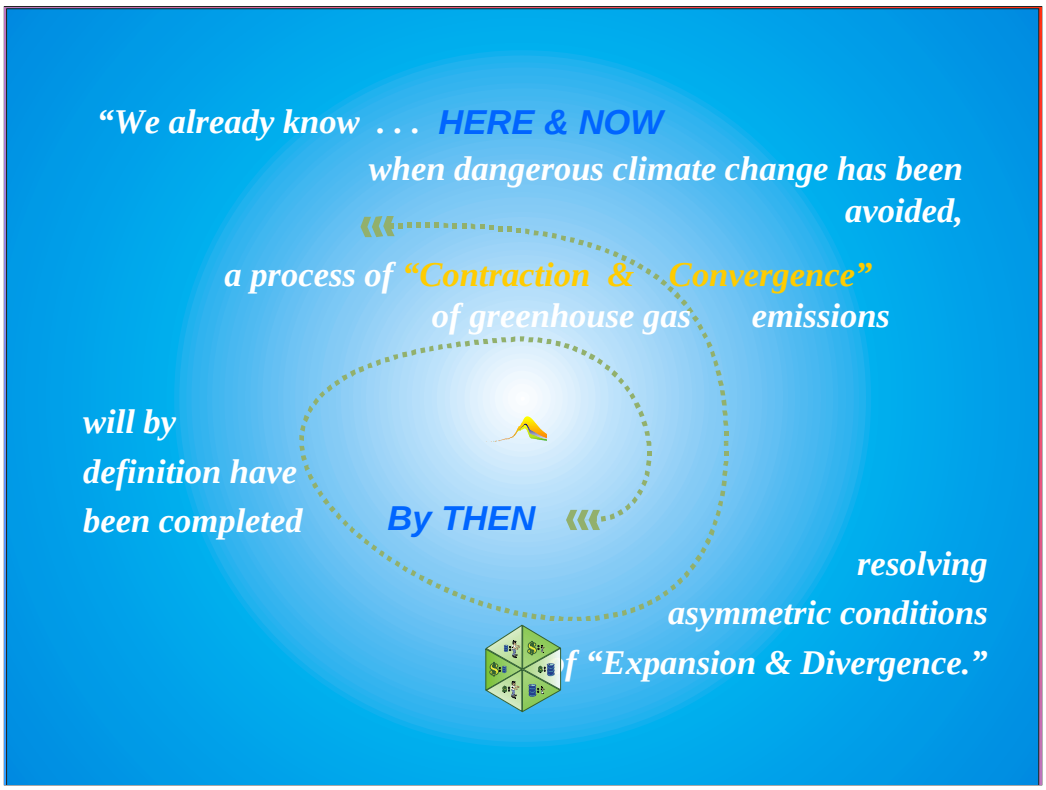
- will this happen by accident or will it happen by agreement and design?
- if the latter, what will the design be?
- how quickly will it be agreed and implemented?

The proposals led so far fall into a syntax of approaches to contraction and convergence. These are shown here on the axes of global to sub-global and guesswork to framework ending with the realisation that the Byrd Hagel Resolution (BHR) is C&C as there is no other way to organise the BHR.

As soon as the need to depress the damage rate below the rate of growth is understood as the overriding imperative, the need for the formal full-term global framework of *"Contraction and Convergence"* (C&C) becomes compellingly self evident.

At the meta-level anything more complex than C&C quickly degenerates into the irreconcilable arguments of presently vested interests and the use of 'uncertainty' as a political filibuster and ecological blackmail. This means the de facto continuation of the trends of *"Expansion and Divergence"* (E&D) - asymmetric, short-term, sub-global, guesswork, a euphemism for impending conflict.

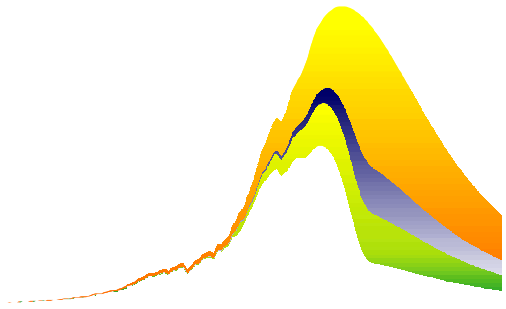
C&C recognises and resolves these dangerous trends of E&D.


"We already know . . . HERE & NOW
when dangerous climate change has been avoided,
a process of "Contraction & Convergence"
of greenhouse gas emissions
will by
definition have
been completed
By THEN
resolving
asymmetric conditions
of "Expansion & Divergence."

"Contraction & Convergence"

(C&C)

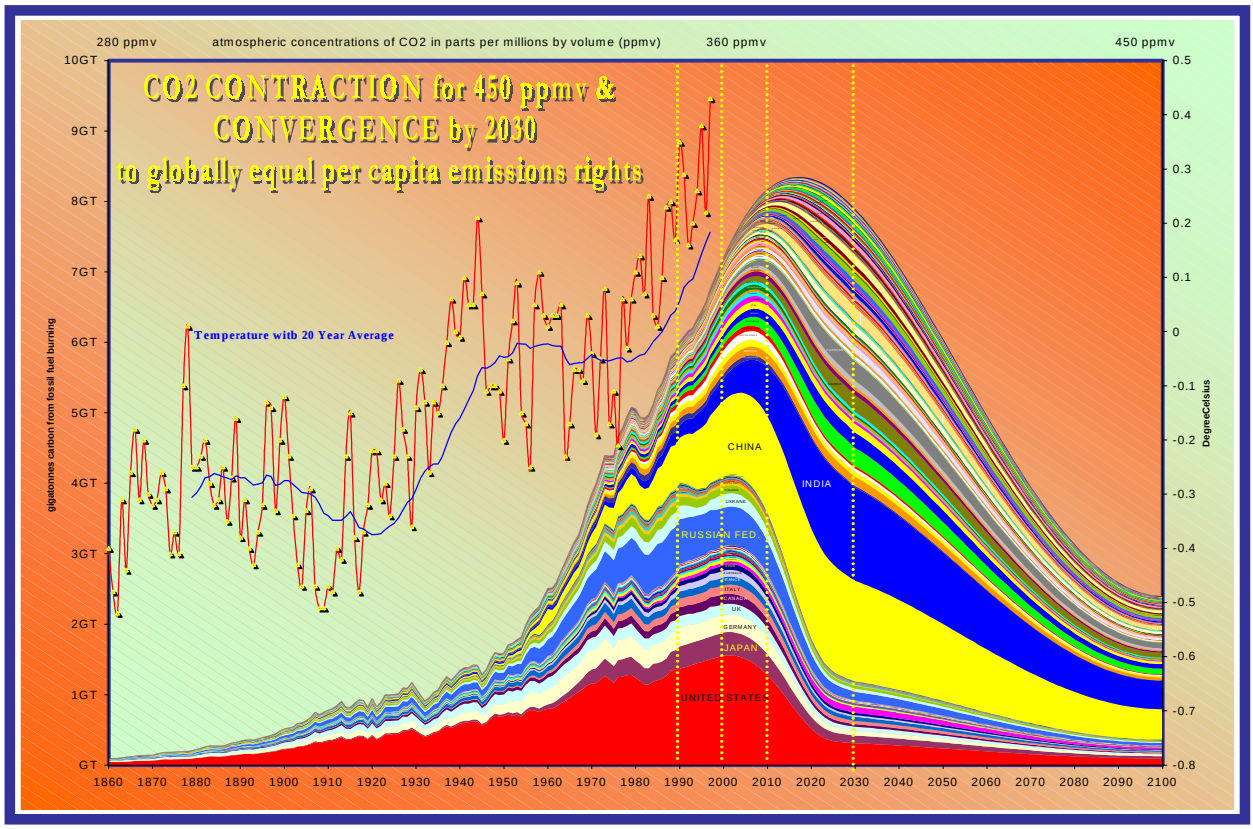
A GCI Policy Briefing
on Climate Change to the
Performance Innovation Unit
for the UK Government
Climate Energy Review



Aubrey Meyer M. Mus. UCT

14/09/2001

'Contraction and Convergence' is an International Framework for UK and Global Energy Policy and avoiding dangerous climate change



ORIENTATION

The Performance Innovation Unit's announcement of a review of UK energy policy observed that: -

> *"The project's outputs will be a key input to the UK Government's future policy on security and diversity of energy supply and on climate change including its response to the Royal Commission on Environmental Pollution (RCEP) report on 'Energy – the Changing Climate'."*

In chapter four of the RCEP report - *"The Need for an International Agreement"* – a key recommendation was for the adoption of *"Contraction and Convergence" (C&C): -*

> *"The government should press for a future global climate agreement based on the contraction and convergence approach, combined with international trading in emission permits. Together, these offer the best long-term prospect of securing equity, economy and international consensus."*

In this document, GCI re-iterates this RCEP recommendation to the PIU and the UK government. As an indication of the weight the RCEP gives to this advice, it is made third in a list of a total of 87 recommendations.

RESPONSE TO PIU PROJECT SCOPING NOTE....4

SIGNIFICANT LINKS 4
SUMMARY 4
THE GROWING SENSE OF URGENCY 5
COMMENT ON STATED SCOPE OF PIU PROJECT 5
ESSENTIAL PROPOSITION OF "CONTRACTION AND CONVERGENCE" (C&C) BY GCI....9
C&C AND THE UNFCCC 11
C&C AND THE KYOTO PROTOCOL....11
C&C AND THE US BYRD HAGEL RESOLUTION - JUNE 1997 11
A VIEW OF THE BENEFITS OF C&C FROM THE FINANCIAL SECTOR....12

APPENDIX ONE - SCENARIOS 13

OVERVIEW OF CLIMATE TRENDS WITH AND WITHOUT C&C 13
THE 'LAGS' IN A 450 PPMV CO_2 SCENARIO....14
THE 'LAGS' IN A 550 PPMV SCENARIO....15

APPENDIX TWO – GUESSWORK FRAMEWORK....16

"CARBON BUDGET" SCENARIOS COMPARED 16
FRAMEWORK - The Precautionary Principle (PP) budget (GeoPolity)....16
GUESSWORK - The Efficiency Gains Only (EGO) budget (JAZZ)....16
FRAMEWORK DELAYED - The Wigley, Richels and Edmonds (WRE) budget 16
'EGO-DECEPTION' WITH THE 'GOOD NEWS' OF 'EFFICIENCY-GAINS ONLY' 18

APPENDIX THREE – SUPPORT FROM KEY GOVERNMENT INDIVIDUALS....20

JAN PRONK, CHAIRMAN OF COP-6, ENVIRONMENT MINISTER NETHERLANDS - JULY 2000....20
KLAUS TOPFER, DIR. UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP) - JUNE 1999....20
DR SONG JIAN, CHINESE STATE COUNCILOR CLIMATE CHANGE & POPULATION - OCT 1997 ...20
US CONGRESSMAN JOHN PORTER, CHAIR GLOBE USA - NOV 1998....21
PROF SAIFUDDIN SOZ MP. INDIAN ENVIRONMENT MINISTER IN KYOTO - DEC 1997....21
JAQUES CHIRAC, PRESIDENT OF FRANCE - COP6 NOVEMBER 2000....21
SIR JOHN HOUGHTON, CHAIR IPCC WG1 - 2000 21
AMBASSADOR RAUL ESTRADA OYUELA, FORMER CHAIR KYOTO NEGOTIATIONS - FEB 2000 ..22

APPENDIX FOUR – SUPPORT FROM KEY INSTITUTIONS....22

UNCTAD - ELEMENTS OF A "BUENOS AIRES MANDATE" - NOVEMBER 1998....22
THE ROYAL COMMISSION ON ENVIRONMENTAL POLLUTION (RCEP) - JUNE 2000....23
UK CHARTERED INSURANCE INSTITUTE (CII) - MARCH 2000 24
USS RESEARCH REPORT NO 1 - JULY 2001 25
EUROPEAN PARLIAMENT - 1998 26
THE AFRICA GROUP OF NATIONS - AUGUST 1997 26
INTERNATIONAL FEDERATION OF RED CROSS & RED CRESCENT SOCIETIES - JUNE 2000....26

APPENDIX FIVE 27

CONTRACTION FORMULA 27
CONVERGENCE FORMULA 27

APPENDIX SIX - REFERENCES....28

GLOBAL COMMONS INSTITUTE (GCI) (SEE BELOW) 28
"CONTRACTION AND CONVERGENCE – THE GLOBAL SOLUTION TO CLIMATE CHANGE"....28
GLOBAL COMMONS NETWORK (GCN): - 28

RESPONSE TO PIU PROJECT SCOPING NOTE

Significant Links

1. This paper by the Global Commons Institute (GCI) is a response to the UK Government's Performance Innovation Unit (PIU) review of energy policy and avoiding dangerous global climate change announced in June 2001.

2. The PIU's announcement of the review observed that: -

> *"The project's outputs will be a key input to the UK Government's future policy on security and diversity of energy supply and on climate change including its response to the Royal Commission on Environmental Pollution (RCEP) report on 'Energy – the Changing Climate'."*

3. The approach GCI puts forward here is to re-state our advocacy of *"Contraction and Convergence"* (C&C) as the most logical way to organise the international effort to avoid dangerous climate change.

4. The C&C approach has evolved over ten years whilst working within international institutions: - especially the Intergovernmental Panel on Climate Change (IPCC) climate science and policy groups, the United Nations Framework Convention on Climate Change (UNFCCC) and various other organisations such as the Royal Commission on Environmental Pollution (RCEP).

5. GCI first formally presented C&C at the 2nd Conference of the Parties to the UNFCCC in Geneva in June 1996. Since then awareness and reference to the model has grown significantly throughout the world.

6. After thorough, prolonged debate, IPCC's 3rd Assessment published this year that the: -

> *" . . . formulation that carries the rights-based approach to its logical conclusion is that of Contraction and Convergence" (C&C)."*

7. After specific interaction with GCI, the RCEP published in June 2000 the report to which the PIU now responds, namely *"Energy – the Changing Climate"* which advised the UK government to: -

> *" . . . press for a future global climate agreement based on the Contraction and Convergence approach, combined with international trading in emission permits. Together, these offer the best long-term prospect of securing equity, economy and international consensus."*

Summary

1. Through their effect on the global atmosphere, historic patterns and future projections of global and UK energy consumption are increasing the trends towards catastrophic damages from global climatic change. No credible uncertainty remains as to whether these trends have actually now been established. Remaining uncertainty about these trends is now only to do with how much damage, how soon and to whom.

2. Achieving security and prosperity for all is therefore now inseparable from the over-arching need for concerted global effort to arrest these trends with precautionary, risk-averse actions within a framework of goal-specific international policy co-ordination.

3. Achieving this framework will not result *'deus ex machina'* from the increasing uncertainties of economic globalisation. Thus far, this globalisation is largely comprised of the random growth and aggregation of economic activity; - in a word 'guesswork'.

4. Achieving a global framework to harness this guesswork in the pursuit and indeed the process of 'sustainable development', is now the key challenge. It requires us to realise the development of the existing international framework for coping with climate change, represented by the UNFCCC, in terms of a precautionary and inclusive, global rights-based agreement – a constitution - that balances the pursuit of prosperity and security in a durable yet flexible way for generations to come.

5. This issue is inseparable from 'rights' and - as the IPCC implies - the logic of situation we are all in leads inexorably to the framework of *"Contraction and Convergence"*.

The Growing Sense of Urgency [1]

The research compiled by IPCC in their 3rd Assessment indicates the future risks of damages rising out of control are grave and will compound with the underlying trends in unsustainable development. That is why: -

- In December 1999, the heads of the US National Ocean Atmosphere Administration and the UK Meteorological Office stated, *"We are in a critical situation and must act soon."* [2]
- In January 2000, one thousand Corporate CEOs at the Davos World Economic Forum said, *"Averting climate change is the greatest challenge facing the world,"* asking, *"why has more not been done to avert its devastating trends?"*
- In October 2000, the UK Prime Minister said, *". . . we have to face a stark fact; neither we here in Britain, nor our partners abroad, have succeeded in reversing the overall destructive trend. The environmental challenge continues to grow and become more urgent. There are alarming changes in our atmosphere, in global temperatures, in weather patterns, in sea levels and in the protective ozone layer. As a result, across the world millions face drought, flooding, disease."* [3]
- In the same month the UK Chartered Institute of Insurers (CII) published a research report which said, *"the current rate of increase in damage from natural hazards is 12% pa and the rate is accelerating. Given that the global sum of such losses was $100bn in 1999 (Munich Re, 2000), it would outstrip global GDP (growing at 3% pa) by 2065, if the trends persist."* [4] [5]
- In March 2001, the UK Prime Minister said, *"The process is accelerating. For some parts of the world, particularly the poorer parts, the effects will be catastrophic."* [6]

Comment on stated Scope of PIU Project

1. The PIU documents project planning for fifty years. This may appear to be long-term but, given the persistent and pervasive properties of global climate change, it is only part-term when what is required is full-term. The UK and the international community cannot meaningfully plan how to respond to climate change unless the scope is both full-term and global. In the fifty years of climate change projected in the PIU figures, Britain and the world will have become more deeply entrenched in the trends of rising atmospheric greenhouse gas concentration, temperature and damages from climate change than we are at present, with these trends potentially casting a shadow over hundreds of years. [7]

---

[1] See Appendix One for overview of trends and generic scenario typology
[2] The Independent 24/12/99
[3] Tony Blair's speech to the CBI/Green Alliance 24th October 2000
[4] CII Research Report March 2000
[5] See Appendix One overview of trends chart three of five-stack page 13
[6] Tony Blair's Green speech 6th March 2001
[7] See Appendix One

2. Moreover, while the PIU correctly stresses that climate change is a global challenge to which global solutions are required, no vision is yet presented by the PIU as to what international arrangements are necessary to ensure that the changes they are tasked with arguing nationally, are meaningful in terms of successful full term global climate protection. In other words it is necessary to realise and deal with the fact that whatever success UK-based solutions may achieve at home, in the absence of global agreement they will increasingly be overwhelmed by failure in the wider systems.

3. The necessary vision for success arises from acceptance that securing the objective of the United Nations Framework Convention on Climate Change (UNFCCC) is sine-qua-non to a sustainable future development process nationally and internationally. This in turn requires a framing a solution that provides to the rapid and orderly international retreat from fossil fuel dependency.

4. At present PIU's project documentation states; -

   - *" . . . the project's conclusions will be a key input to the Government's . . . response to the RCEP report on Energy;*
   - *C02 emissions pose a global challenge . . . likely to rise by between 1-3% per annum globally to 2050 . . . with CO_2 emissions from UK energy consumption likely to rise by between 0.01-0.3% per annum to 2050 . . . deep cuts in greenhouse gas emissions - of the order of 60-80% worldwide - will be needed over the coming decades if the risks of global warming and associated severe impacts are to be avoided;*
   - *the challenge this poses for the UK is recognised by the UKCIP;*
   - *the RCEP says this translates into a 60% reduction in UK emissions by 2050;*
   - *but this needs to be put in a global context where the UK accounts for about 2% of global climate change emissions;*
   - *it will look at energy policy for Great Britain to 2050 with the main aim of setting out the objectives of energy policy developing a strategy that ensures current policy commitments are consistent with longer-term goals;*
   - *that while the challenges are explored in a UK context, they are global challenges to which global solutions will be required."*

5. However, the figures quoted by the PIU result from two key challenges taken by the RCEP, namely what should the: -

   - global rate of emissions contraction be consistent with a safe level of CO_2 equivalent atmospheric concentration?

   - international rate of emissions permits convergence to equal per capita entitlements globally be that is consistent with a logical and realistic pre-distribution of the tradable equity created using the principles of C&C?

6. In other words, the figures used by the RCEP follow directly from the application of C&C as an organising principle for dealing with climate change

7. The relevant reasoning in the RCEP Report reads as follows: -

   - *"4.47 . . . our view is that an effective, enduring and equitable climate protocol will eventually require emission quotas to be allocated to nations on a simple and equal per capita basis.*

   - *4.48 A system of per capita quotas could not be expected to enter into force immediately. At the same time as entitling developing nations to use substantially more fossil fuels than at present (which they might not be able to afford), it would require developed nations to make drastic and immediate cuts in their use of fossil fuels, causing serious damage to their economies.*

- *4.49 . . . Over the coming decades each nation's allocation would gradually shift from its current level of emissions towards a level set on a uniform per capita basis. By this means 'grandfather rights' would gradually be removed: the quotas of developed nations would fall, year by year, while those of the poorest developing nations would rise, until all nations had an entitlement to emit an equal quantity of greenhouse gases per head (convergence). From then on, the quotas of all nations would decline together at the same rate (contraction). The combined global total of emissions would follow a profile through the 21st and 22nd centuries which kept the atmospheric concentration of greenhouse gases below a specified limit.*

- *4.50 The upper limit on the concentration of greenhouse gases would be deter-mined by international negotiations, as would the date by which all nations would converge on a uniform per capita basis for their emission quotas, and the inter-mediate steps towards that. It would probably also be necessary to set a cut-off date for national populations: beyond that date, further changes in the size of a country's population would not lead to any increase or decrease in its emission quota.*

- *4.51 In table 4.1 17 we have applied the contraction and convergence approach to carbon dioxide emissions, and calculated what the UK's emissions quotas would be in 2050 and 2100 for four alternative upper limits on atmospheric concentration. We have assumed for this purpose that 2050 would be both the date by which nations would converge on a uniform per capita emissions figure and the cut-off date for national populations.18 If 550 ppmv is selected as the upper limit, UK carbon dioxide emissions would have to be reduced by almost 60% from their current level by mid-century, and by almost 80% by 2100. Even stabilisation at a very high level of 1,000 ppmv would require the UK to cut emissions by some 40% by 2050.*

- *4.52 The UK-based Global Commons Institute has taken the lead in promoting contraction and convergence, and has developed a computer model which specifies emission allocations under a range of scenarios. The concept has been supported by several national governments and legislators. Some developed nations are very wary of it because it implies drastic reductions in their emissions, but at least one minister in a European government has supported it.20 Commentators on climate diplomacy have identified contraction and convergence as a leading contender among the various proposals for allocating emission quotas to nations in the long term.21*

- *4.53 The other ingredient that would make an agreement based on per capita allocations of quotas more feasible is flexibility of the kind already provided in outline in the Kyoto Protocol. Nations most anxious to emit greenhouse gases in excess of their allocation over a given period will be able and willing to purchase unused quota at prices that incline other countries to emit less than their quota, to the benefit of both parties. The clean development mechanism, which allows developed nations to claim emission reductions by sponsoring projects that reduce emissions in developing nations to levels lower than they would otherwise have been, can also be seen as a form of trading.*

- *4.54 In the longer term trading by companies in emission permits, drawn from national emission quotas determined on the basis of a contraction and convergence agreement, could make a valuable contribution to reducing the global costs of stabilising greenhouse gas concentrations while transferring resources from wealthy nations to poorer ones. Trading needs to be transparent, monitored and regulated, and backed by penalties on nations which emit more than they are entitled to. If it became merely a means of enabling wealthy nations to buy up the emission entitlements of poor countries on the cheap, thereby evading taking any action at*

home, trading would not serve the cause of climate protection. Nor would it if developing countries which had sold quota heavily went on to emit in excess of their revised entitlements."

8. The PIU document fails to reveal this reasoning that led to the figures they are quoting. The RCEP explicitly do reveal the reasoning and the calculus that led to these figures.
9. If this omission persists in the PIU's analysis and output, the figures become misleading and the PIU exercise becomes potentially meaningless or even dangerous.
10. GCI, the RCEP and an increasing number of other agencies, argue that securing a global framework C&C agreement is the only credible and logical way to organise for the achievement of the objective of the UNFCCC along with the aspirations of sustainable development. This framework will enable us to integrate key global, national and local considerations. Similar to those identified in the PIU documentation which are to: -
    - co-operatively set - if competitively meet - the long term targets for the global emissions reductions that are necessary to stabilise rising concentrations of atmospheric CO_2 equivalent, global temperature and damages;
    - resolve or at least reduce the worsening conflicts between local and global perspectives, short, long and full-term considerations and debates arising that attempt to trade-off competitively monetised autarchy with social stability and the imperatives of environmental security objectives;
    - attempt future security and diversity of energy supplies over the long term through the full-term demand-management of the retreat from fossil fuels alongside supply-side measures that encourage the development of renewable technologies, new infrastructure and stable international pricing conditions energy and fuel markets;
    - encourage appropriate international investment and incentives to be able to cope with the supply shocks, including those consequent on incipient oil and gas depletion;
    - resolve or reduce conflicts where the higher energy prices might help to advance environmental objectives will aggravate fuel poverty and potentially reduce competitiveness in production.
11. The PIU indicates that its report will be presented to the Prime Minister by the end of the year. Mr Blair has indicated that he is committed to going to Rio + 10 next year to provide leadership on (inter alia) international climate change policy.
12. Citing the RCEP, Mr Blair has already publicly quoted the unqualified figure of 60% reductions in the UK by 2050, worded so as to imply that the RCEP have advised that this will slow the rate of climate change. [8]
13. However, the RCEP advised the UK government to seek an international *"Contraction and Convergence"* agreement saying that - *in this global C&C context* - the slowing of the causation of climate change might occur.
14. In order not to misrepresent the RCEP, engender misunderstandings and make potentially fruitless attempts to evolve international efforts to avoid dangerous climate change, it is essential this C&C context is argued in the report presented by PIU to Mr Blair, just as it has been done by GCI, in the RCEP report itself and in numerous other reports and fora.
15. To re-iterate: - a C&C agreement has become sine-quo-non to avoiding dangerous climate change and the achievement of sustainable development both locally and globally.

[8] Tony Blair's speech to the CBI/Green Alliance 24th October 2000

Essential Proposition of "Contraction and Convergence" *(C&C) by GCI*

Countries agree a reviewable global greenhouse gas (ghg) emissions 'contraction budget' targeted at an agreed precautionary, stabilised future value for atmospheric ghg concentrations.

The internationally tradable shares in this budget are then agreed on the basis of 'convergence' from now, where shares are broadly proportional to income, to a target date in the budget timeline after which they remain proportional to an agreed base year of global population.

Revenue from this trade could and would best be directed to the development and deployment of zero emissions energy techniques and technologies.

The organizational sequence works as follows: -

Contraction - On the basis of precaution, all governments collectively agree to be bound by such an atmospheric target. This makes it possible to calculate the diminishing amount of greenhouse gases that the world can release for each year in the coming century. Subject to annual review, this total carbon emissions 'budget' is the aspect of the process described as 'contraction'.

Convergence - On the basis of equity and logic, 'convergence' means that each year's ration of this global emissions budget is shared out so that every country progressively converges on the same allocation per inhabitant by an agreed date, for example by 2030.

It recognises access rights to the 'global commons' of the atmosphere on the fundamental principle of globally equal rights per capita, to be achieved by smooth transition.

It also recognises there has been an argument that suggests C&C creates an incentive for population growth. Consequently the model provides a mechanism whereby this argument is answered through setting a base year for population figures in any year of the negotiators choosing.

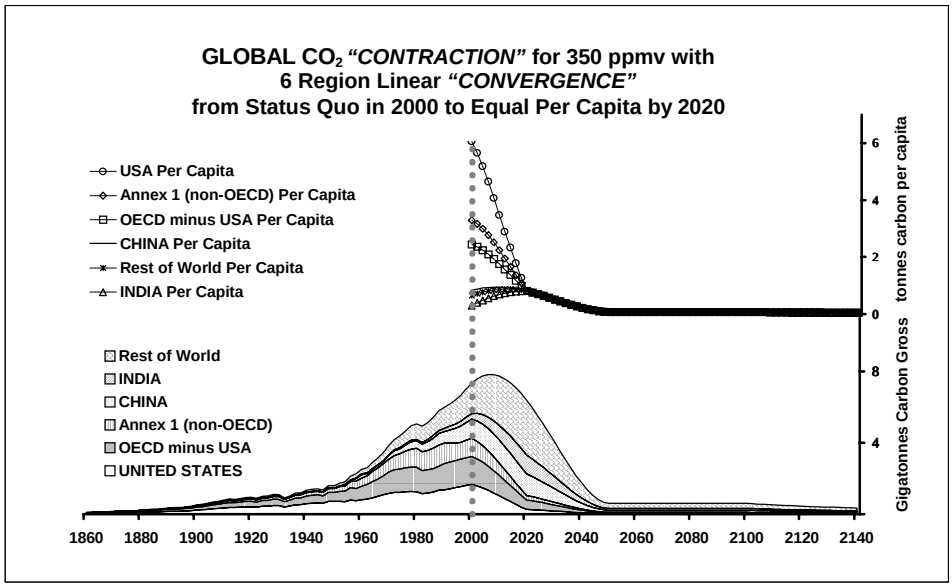
To show that the principles of C&C pre-exist the rates of their application, three examples of contraction and convergence budgets are shown alongside: -

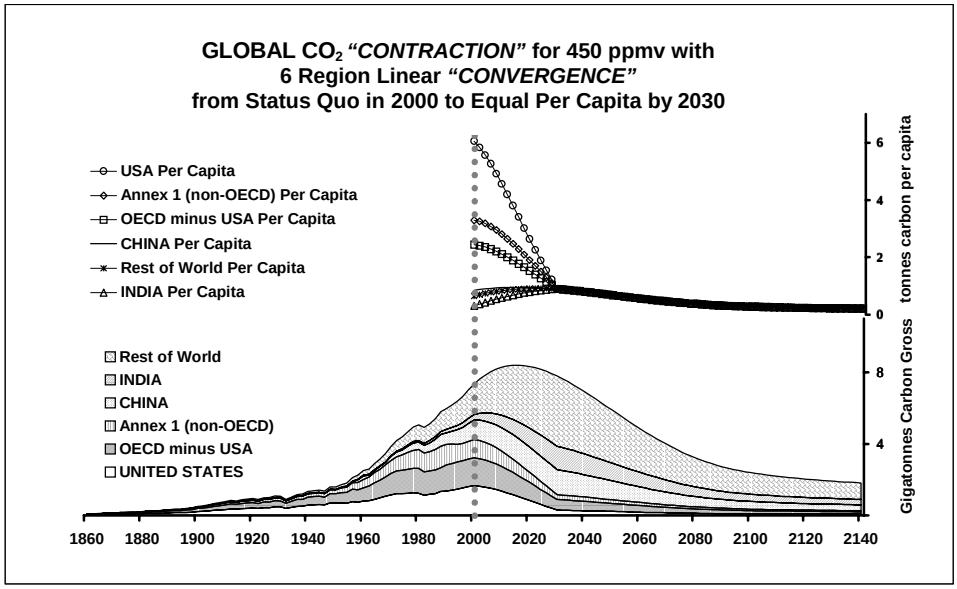
1. the first is the most climate risk-averse and achieves a 90% emissions globally by 2050 in order to stabilise atmospheric CO_2 concentrations back at 350 parts per million by volume (ppmv) by 2100.
2. the second carries higher risks and achieves a 60% emissions globally by 2100 in order to stabilise atmospheric CO_2 concentrations at 450 parts per million by volume (ppmv) by 2100. Potential additional positive feedback. [9]
3. the third carries yet higher risks achieves a 60% emissions globally by 2140 in order to stabilise atmospheric CO_2 concentrations at 550 parts per million by volume (ppmv) by 2150. Potential additional positive feedback. [10]

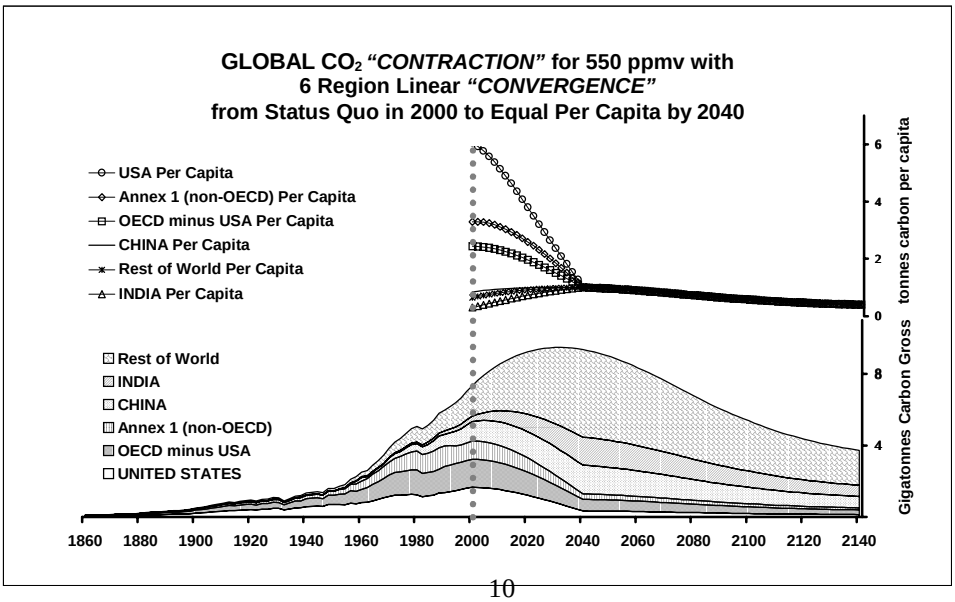
Emissions Permit Trading - Countries unable to manage within their shares would, subject to agreed rules, be able to buy the unused parts of the allocations of other countries. Sales of unused allocations would give less developed countries the income to fund development in zero-emission ways. Industries in developed countries would benefit from the export markets this restructuring would create.

Sustainable Growth - C&C does not place a straightjacket on growth per se by its limitation on fossil fuels. Instead, it averts catastrophic losses by promoting the development and growth of zero carbon energy technologies necessary to achieve prosperity and make development sustainable.

[9] See Appendix One – The Lags in a 450 ppmv scenario
[10] See Appendix One – The Lags in a 550 ppmv scenario


GLOBAL CO2 "CONTRACTION" for 350 ppmv with
6 Region Linear "CONVERGENCE"
from Status Quo in 2000 to Equal Per Capita by 2020
USA Per Capita
Annex 1 (non-OECD) Per Capita
OECD minus USA Per Capita
CHINA Per Capita
Rest of World Per Capita
INDIA Per Capita
Rest of World
INDIA
CHINA
Annex 1 (non-OECD)
OECD minus USA
UNITED STATES
Gigatonnes Carbon Gross tonnes carbon per capita
1860 1880 1900 1920 1940 1960 1980 2000 2020 2040 2060 2080 2100 2120 2140


GLOBAL CO2 "CONTRACTION" for 450 ppmv with
6 Region Linear "CONVERGENCE"
from Status Quo in 2000 to Equal Per Capita by 2030
USA Per Capita
Annex 1 (non-OECD) Per Capita
OECD minus USA Per Capita
CHINA Per Capita
Rest of World Per Capita
INDIA Per Capita
Rest of World
INDIA
CHINA
Annex 1 (non-OECD)
OECD minus USA
UNITED STATES
Gigatonnes Carbon Gross tonnes carbon per capita
1860 1880 1900 1920 1940 1960 1980 2000 2020 2040 2060 2080 2100 2120 2140


GLOBAL CO2 "CONTRACTION" for 550 ppmv with
6 Region Linear "CONVERGENCE"
from Status Quo in 2000 to Equal Per Capita by 2040
USA Per Capita
Annex 1 (non-OECD) Per Capita
OECD minus USA Per Capita
CHINA Per Capita
Rest of World Per Capita
INDIA Per Capita
Rest of World
INDIA
CHINA
Annex 1 (non-OECD)
OECD minus USA
UNITED STATES
Gigatonnes Carbon Gross tonnes carbon per capita
1860 1880 1900 1920 1940 1960 1980 2000 2020 2040 2060 2080 2100 2120 2140

C&C and the UNFCCC

> *" . . . must achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system* [11] *. . . should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity* [12] *. . . the developed country Parties must take the lead in combating climate change* [13] *. . . (while) the share of global emissions originating in developing countries will grow to meet their social and development needs."* [14]

The Kyoto Protocol is an incomplete response to the UNFCCC because Developing Countries are excluded from the formal regime of emissions control. Nor will the targets selected even begin to achieve atmospheric stabilization of greenhouse gases. A global C&C framework is the most logical and effective way to secure global participation in the process and achieve stabilization of atmospheric greenhouse gas concentration.

C&C and the Kyoto Protocol

As the UNEP CEO Topfer recognised in June 97, C&C the logical extension of the Protocol: -

> *"The review system of Kyoto mechanisms can ensure equity. Currently CO2 emissions rights are allocated according to existing emissions patterns with a specified reduction percentage for various countries within a certain period of five years (2008-2012). The redistribution through the Kyoto Protocol could be continued until emissions rights are uniformly distributed on a per capita basis. This will be a critical element to ensure the poor also get rights to utilise the world's environment, or in this limited case, the assimilative capacity of the atmosphere, a global commons resource."*

C&C and the US BYRD HAGEL Resolution - June 1997

In July 1997 US Senators Byrd and Hagel tabled a resolution about the US involvement with the Kyoto Protocol. It rehearsed all their objections to what they felt was the 'flawed' character of the Berlin Mandate and the impending Kyoto Protocol.

> *"Now, therefore, be it resolved that: - The US should not be a signatory to any protocol to, or other agreement regarding, the UNFCCC of 1992, at negotiations in Kyoto in December 1997, or thereafter, which would mandate new commitments to limit or reduce greenhouse gas emissions for the Annex I Parties, unless the protocol or other agreement also mandates new specific scheduled commitments to limit or reduce greenhouse gas emissions for Developing Country Parties within the same compliance period."*

The crucial detail in the Byrd Hagel Resolution is in that two defining distinctions are maintained between: -

1. Annex One Parties (Developed Country Parties) and Developing Country Parties.
2. *'limit'* ghg emissions and *'reduce'* ghg emissions. Limitation of ghg emissions is controlled positive growth of ghg emissions and reductions of ghg emissions is controlled negative growth of emissions.

> Putting these concepts together in the same compliance period, translates into a formal process of *"Contraction and Convergence".* Annex One Parties will reduce (or contract) their ghg emissions while the Developing Country Parties will limit their ghg emissions (so as to converge with Annex One Country Parties). This will not emerge by accident. It can only emerge by design and consent. For authors and supporters of the resolution, *"Contraction and Convergence"* provides the logical answer.

[11] UNFCCC Article 2
[12] UNFCCC Article 3.1
[13] UNFCCC Article 3.1
[14] UNFCCC Article 3.3

A View of the Benefits of C&C from the Financial Sector

The principle aim of the UNEP Financial Institutions movement has been to support sustainable development. This is fully compatible with members' commercial objectives, because the demand for financial services thrives in a sound and foreseeable economic environment, which is what sustainable development provides.

Climate change poses a sustainability challenge to financial institutions (FI's) in three key ways:

1. It will accelerate the damage to assets and economic output from natural disasters. This will reduce the return on assets, and reduce the insurability of many activities.
2. It will create an economic risk for carbon-heavy assets, since mitigating climate change will mean significant curbs on future greenhouse gas emissions.
3. It will provide opportunities to invest in the solutions that will be adopted to channel economic activity towards a carbon-light economy e.g. emissions permit-trading, CDM, AIJ, and more generally, the expansion of technologies in renewable energy and energy efficiency.

Economic damage from natural disasters is rising sharply, and already poses a threat to development in poorer countries, according to the World Bank. The Third Assessment Report of IPCC noted that climate change has only just begun to contribute to this trend, and can be expected to aggravate the trend. This means that even the limited involvement of the insurance industry (currently only about 20% of losses are covered) is likely to diminish, placing a heavy burden on other stakeholders.

Regarding investment in energy-intensive sectors, the risks and rewards are hard to quantify because of the lack of political progress on full-term objectives. Without reliable information about the future value (or liability) of such assets, it is not possible to calculate rates of return. This uncertainty is harmful to financial involvement in these areas.

Business needs a coherent full-term global agreement that provides a framework for economic operations within a context that is sustainable in social and ecological terms. Such a framework will also help to release the pressure from natural catastrophes. Contraction and Convergence is the logical, and indeed the only, well-framed proposal that fills this vacuum.

The present political debate is focused on the details of "Kyoto". This is useful but is ignoring the need for a full-term answer to the problem. And, given the difficulties encountered with the Kyoto Protocol, it would be better to start as soon as possible on framing the full-term approach. A fresh impetus is needed to move on. Given the decadal scale of business planning, and the high stakes involved, the UNEP FI initiative has a legitimate interest in finding a solution.

Consequently, on July 19th 2001, the UNEP FI held a public meeting and a press conference at the United Nations climate negotiations in Bonn. Their message was to promote *'sustainability'* by trying to implement the *'small step of Kyoto'* along with climate friendly *'policies and measures at national level'* and *'the need to establish a long-term framework such as "Contraction and Convergence" (C&C).'*

They said this is so *'because we do all need to know where we are going'* and that *'C&C is such a framework as it is consistent with the principles of the UNFCCC'* and quite *'possibly the framework to take the whole process forward.'*

APPENDIX ONE - SCENARIOS

Overview of climate trends with and without C&C

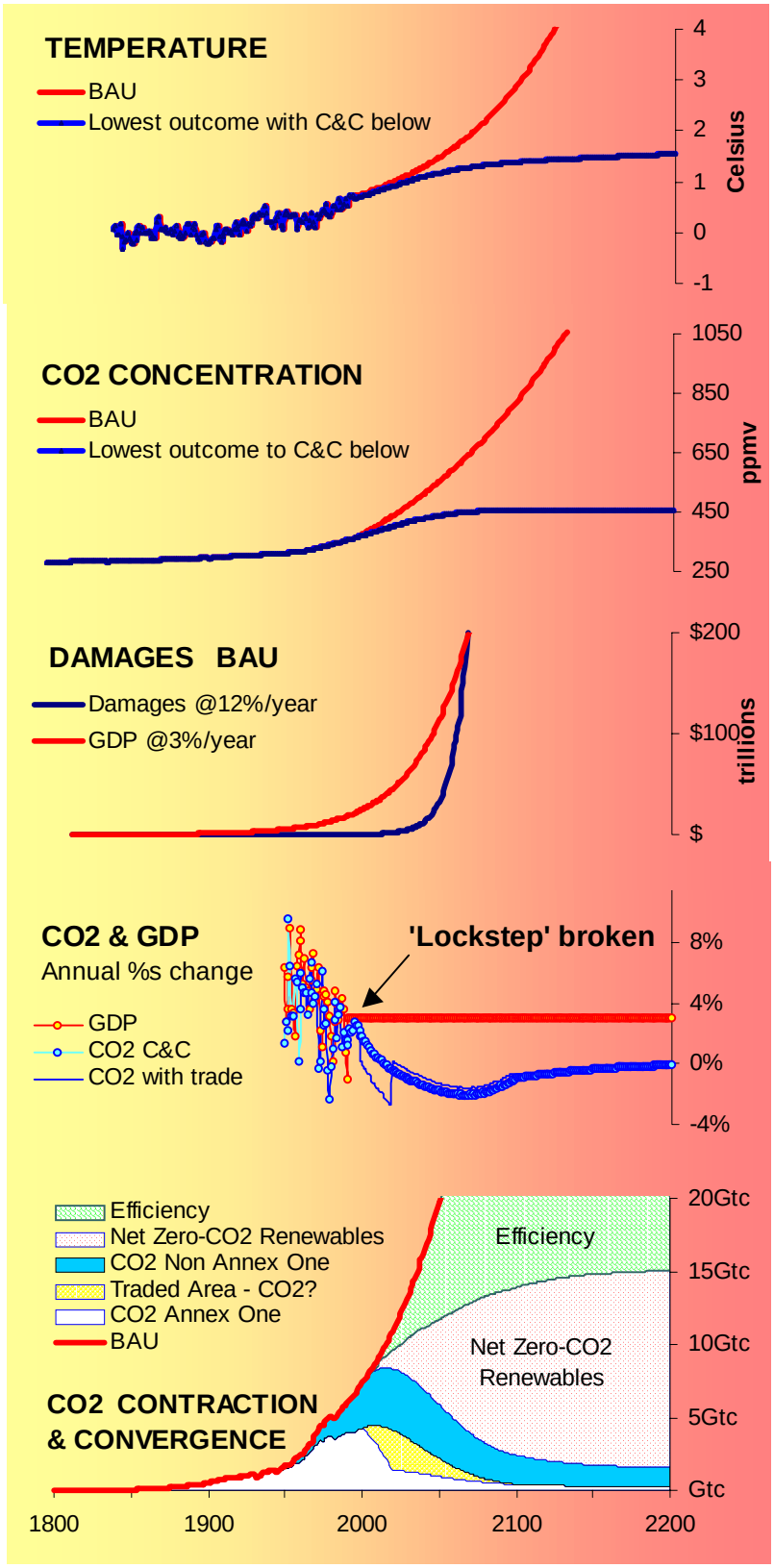
Surface temperature from 1860 until 2000 shows an overall rise of 0.9°C. The future projections are following CO_2 emissions and atmospheric ghg concentrations (in ppmv - parts per million by volume). The red line shows Business-as-Usual (BAU) where the underlying emissions grow at 2%/yr. The blue line shows the lowest possible climate sensitivity - a rise of 1.5°C - assuming a contraction by 2100 of 60% in annual emissions.

Recorded atmospheric CO_2 concentration from 1860 until 2000 shows an increase of 34% over pre-industrial levels. This is a rise both higher and a faster than anywhere in the ice-core sampling back 440,000 years before now. Concentrations are rising as the result of accumulating emissions. In future, the worst case is the red line as BAU. The best case sees this concentration stabilised at 70% above pre-industrial levels due to a 60% contraction in the underlying emissions by 2100.

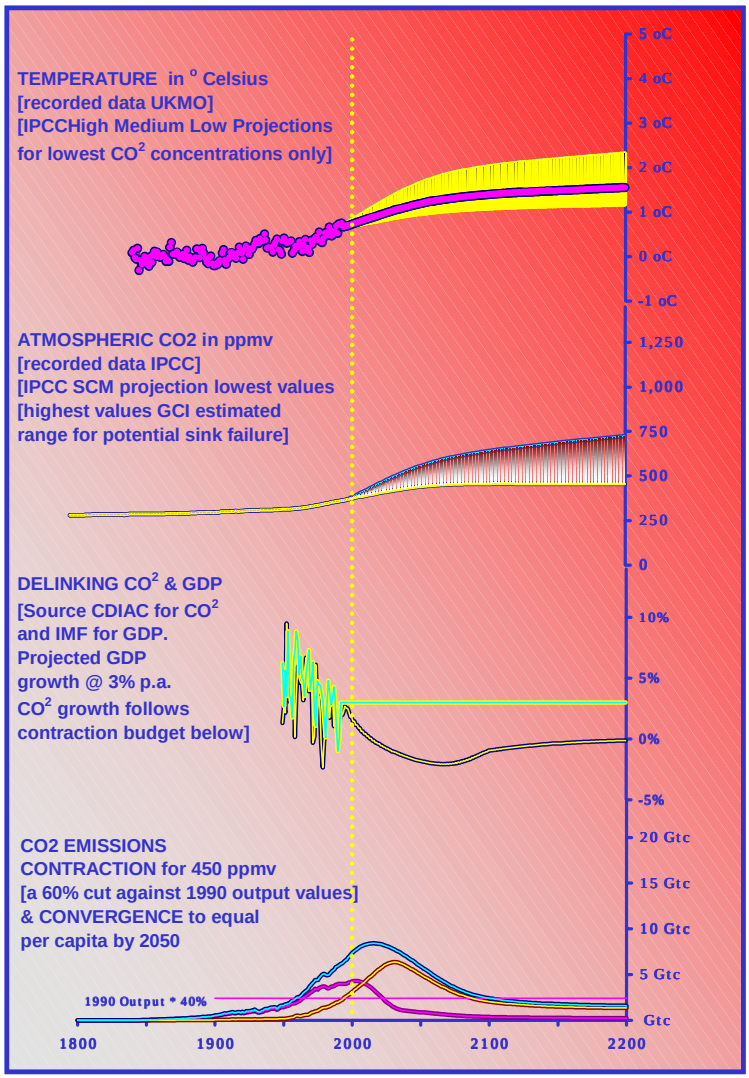
Damages here are the global economic losses (Munich Re) for the four decades past for all natural disasters projected at the observed rate of increase of 12% a year in comparison to global $GDP at 3%. If the global trends continue BAU, damages will exceed GDP by 2065! The risks will soon rise beyond the capacity of the insurance industry and even governments to absorb. Damages will rise for the century ahead even with emissions contraction, but the rate can be reduced with Contraction, Convergence, Allocation and Trading (C-CAT).

For the past four decades, the output of CO_2 and GDP from global industry have been correlated nearly 100% (known as 'lockstep'). Breaking the lockstep is essential. Future GDP is projected here at 3% a year. Future CO_2 goes to -2% with the retreat from fossil fuel dependency shown below, that limits CO_2 concentrations to 70% above pre-industrial levels, shown above. If the traded area is also converted to zero-emissions supply (below), the carbon retreat might achieve up to - 4% a year.

The red line shows BAU CO_2 emissions. The solid segments show "Contraction, Convergence, Allocation and Trade" [C-CAT] to manage emissions down by at least 60% within a given time frame (2100 here) with an agreed 'contraction budget' (here 680 billion tonnes of carbon). The internationally tradable shares of this budget (here, 100 billion tonnes) result from convergence to equal per capital emissions by an agreed date and population base year (here 2020). If this is invested in zero-emissions technologies, risk and damages are lowered further as the budget is then net of these emissions as well. The renewables opportunity is the difference between C-CAT and BAU. It is worth trillions of dollars per annum - the biggest market in history.



The 'Lags' in a 450 ppmv CO_2 Scenario

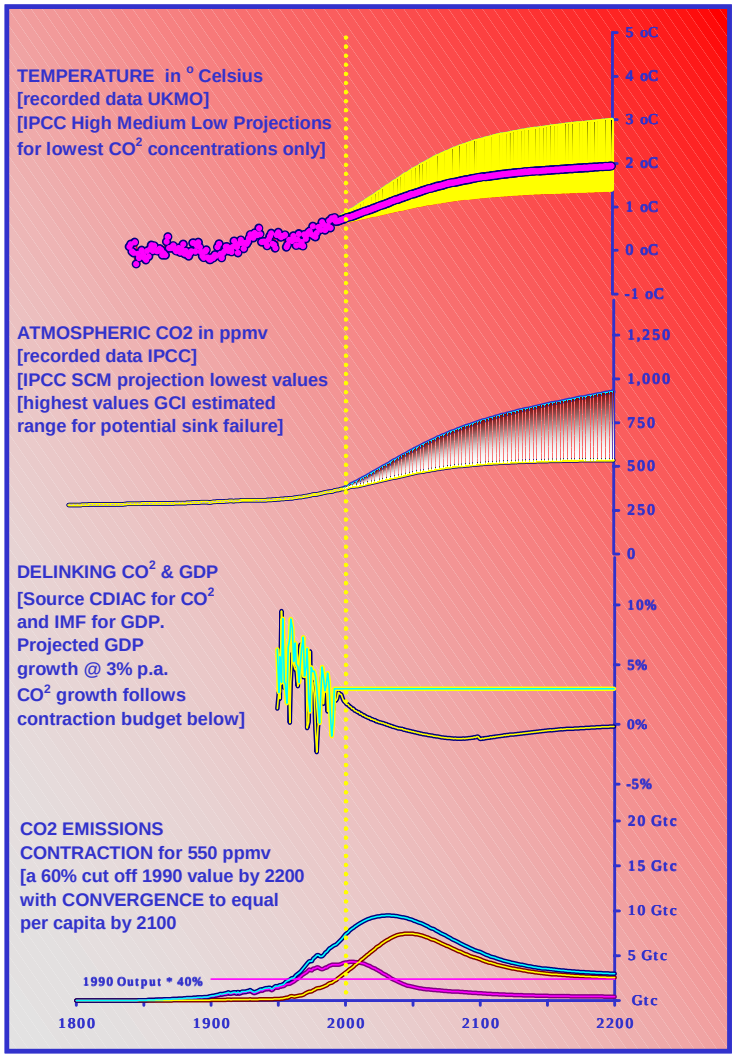


The following graphics make clear the lagged sequential structure of events that are triggered by release of CO_2 emissions from human sources. Only CO_2 is used to portray the case made, as it is only for these emissions that reasonably complete global datasets exist. Human CO_2 emissions, 80% of which come from fossil fuel burning, represent over 70% of the net anthropogenic forcing of global mean temperature. So assuming no sudden surprises, the temperature values recorded are about 30% less than they will be when all the equivalent effect of the other gases such as methane are included. The observed events of the past two hundred years are shown as well on the left-hand half of these graphics. The sequence of recorded events showing the relationship between rising emissions and rising atmospheric concentrations is beyond dispute. UKMO, NOAA and the IPCC accept the functional link via rising concentrations, between rising ghg emissions and rising global mean temperature.

The period 2000 to 2100 shows a 450 ppmv "Contraction" budget for human CO_2 emissions. Annual CO_2 emissions are reduced to 40% of 1990 value by 2100 and remain so until 2200. Here "convergence" between Annex One and Non-Annex One is set to reach globally equal per capita emissions entitlements by 2050. Contraction is pro rata from then onwards. In 1800 atmospheric concentrations of CO_2 were 280 ppmv. By 1998 they reached 263 ppmv. During the emissions contraction, concentrations continue to rise slowing to 450 ppmv by 2100. This assumes the sinks function as before, re-absorbing roughly half of each year's human emissions. If sinks were to fail, concentrations could rise higher on the path shown with an upper limit reaching 750 ppmv by 2200. The temperature curves shown here are linked only to CO_2 and its lowest concentration path. Temperature is set at 0.0^o C in 1800 and 0.7^o C up in 1998. The range continues rising by between 1 and 2.4^o C as late as 2200 (best guess at 1.5^o). Rising sea level at 3 to 10 cm per decade is not shown and continues beyond the stabilisation of temperature**.**

The 'Lags' in a 550 ppmv Scenario

Here, from 2000 to 2100 a 550 ppmv "Contraction" budget for human CO_2 emissions is shown. Annual CO_2 emissions are reduced to 40% of 1990 value by 2200. "Convergence" between Annex One and Non-Annex One is set to reach globally equal per capita emissions entitlements by 2100. Contraction is pro rata from then onwards. During the global contraction of emissions, concentrations continue to rise slowing to 550 ppmv by around 2150. This assumes the sinks function as before, re-absorbing roughly half of each year's human emissions. If sinks were to fail, concentrations could rise higher on the path shown with an uppermost path reaching 950 ppmv by 2200 and rising. Again, the temperature curves shown are linked only to CO_2 and its lowest concentration path. Temperature is 0.0° C in 1800 and 0.7° C up in 1998. The range continues rising by between 1.5 and 3° C as late as 2200 (best guess at 2°). Rising sea level as before is not shown but continues at between 3 and 10 cm per decade and goes beyond the point of stabilisation of temperature.



In the 450 ppmv case the annual rate of contraction reaches over 2% per annum. In the 550 ppmv case the annual rate of contraction reaches just over 1% per annum. GDP in both cases is assumed to grow constantly at an average of 3% per annum. But when we compare the extent of delinking of CO_2 emissions and GDP between the 450 budget and the 550 budget, the general rate of de-linkage (or gain in terms of $s per tonne carbon) is between 4 to 5% per annum. This is unprecedented. Yet in any scenario set on stabilising atmospheric concentrations, this is the scale of achievement required. So short of just trying to adapt to climate change, these efficiency gains have to be made. Moreover, because the higher ppmv scenarios incur more damages from climate, more of GDP will have to be diverted into damage compensation with less for avoiding emissions and de-carbonization strategies. Since we have to execute the solution at a rate that exceeds that at which we create the problem, soonest is best as the higher the concentration path the worse the odds of doing this become.

APPENDIX TWO – GUESSWORK FRAMEWORK

"CARBON BUDGET" SCENARIOS COMPARED

This section compares three ways of looking at the evolution of future global budget of CO_2 emissions from fossil fuel burning.

FRAMEWORK - The Precautionary Principle (PP) budget (GeoPolity)

> This budget assumes the need for early need for a formal constitution of *"Contraction and Convergence"*. In principle the UNFCCC is the United Nations Framework Constitutions for *"Contraction and Convergence"*.
>
> It is consistent with the 'Geopolity' model argued by Shell International in their Report of the World Business Council on Sustainable Development (WBCSD).

GUESSWORK - The Efficiency Gains Only (EGO) budget (JAZZ)

> This budget assumes the complete absence of a political framework and the need for controls. It is consistent with the deregulated 'JAZZ' position espoused in the WBCSD report.

FRAMEWORK DELAYED - The Wigley, Richels and Edmonds (WRE) budget

> This budget assumes the delay in instituting a framework can be made up for later. It was a fudge dreamed up by one climate scientist and two economists who asserted it within the IPCC. The 'scientific' argument is that as long as a given integral of future carbon emissions remains constant, the rate of emissions can be varied with no effect on the ultimate concentration outcome. The 'economic' argument is that it buys time. The truth is that it just subtracts benefits from developing countries and future generations whilst increasing risks in the name of guesswork.
>
> Since the Kyoto Protocol is caught between framework and guesswork, its positioning is 'framework-delayed' with the danger of decaying to pure guesswork.

The levels of atmospheric CO_2 concentrations, temperature rises and dollar per tonne carbon efficiency gains associated with each budget concept are shown as well (colour-coded).

The primary policy level of choice examined here is that between the need for framework and the rejection of framework in favour of guesswork; - in other words between the PP or WRE concepts on the one hand, and the EGO concept on the other. The international debate has already reached this stage and there is a growing acceptance that the framework will be necessary.

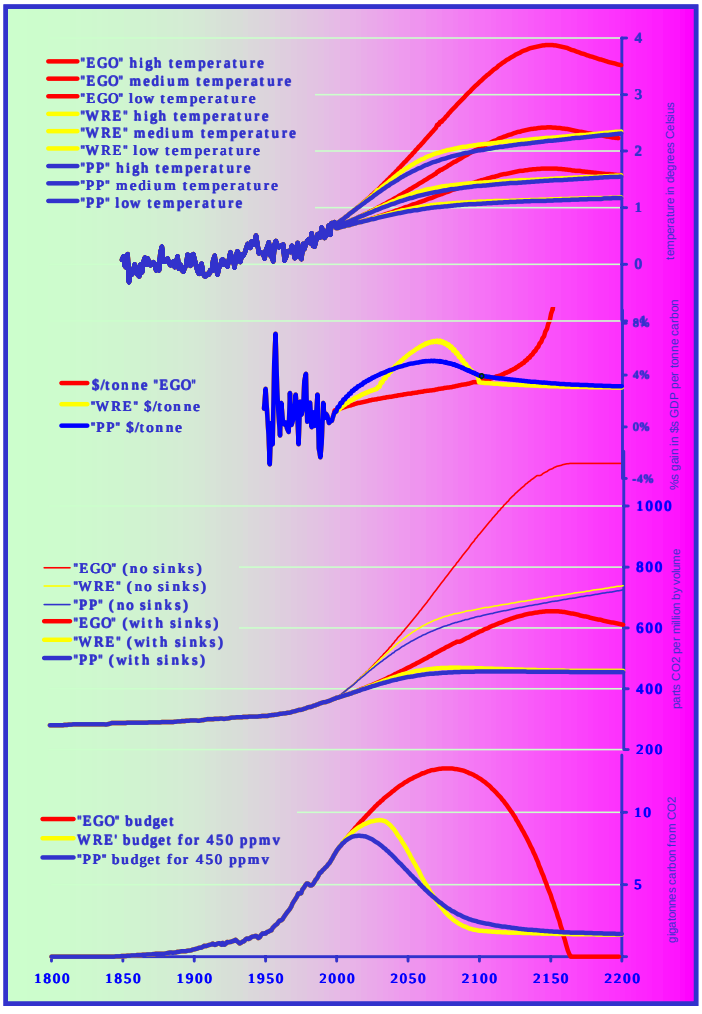
This means that the next choice is between introducing it sooner rather than later, in other words between the PP concept and the WRE concept. The IPCC states that the key determinant for the stabilisation level of concentrations is not so much the emissions trajectory but the total amount emitted between now and the time of concentration stabilisation. If so, we appear to have some flexibility over the timing of reductions.

However, the WRE curves were produced in the belief that it is better to wait for technological improvements to make reductions more cost efficient before embarking on them. It uses a capped emissions trajectory to deliver a given concentration level but keeps the trajectory on a business-as-usual (BAU) path for as long as possible before making sharp reductions since technology should have improved considerably by then, making the necessary reductions cheaper.

The flaw in this argument is that this trajectory will require more rapid reductions and hence much greater economic efficiency gains once we depart from BAU. Assuming a steady annual growth of the economy at 3%, economic efficiency gains measured in CO_2 emissions per unit of GDP would have to improve by up to 7% per annum. Even if this is feasible, the implementation costs will probably outweigh the cheaper technology. Furthermore, capital investments made along the BAU path early on may have to be made redundant before the end of their normal life span. Both sets of curves have a similar emissions trajectory, but the precautionary approach tries to limit the maximum rate of emissions reductions by imposing an early departure from BAU. This reduces the risk of not being able to meet the greater reductions without major economic disruption.

It is widely accepted that even on present technology we can take 'no regrets' measures to reduce CO_2 emissions by up to 30%. If this is the case, there is little point in delaying this action and placing a heavier burden on future generations. Furthermore, it seems that technological efficiency gains and low-emission technology is incentive driven. There have to be clear targets for industry to aim for.

If we decide to follow the WRE curves and find that the rapid reductions down the line are not realistic, we will face an ever-growing struggle to control CO_2 concentrations along the EGO path. This scenario also represents the most optimistic position where a zero emissions economy can be achieved driven by economic efficiency gains alone. Whichever way it is interpreted, the EGO scenario represents a gradual improvement in the rate of economic efficiency gains. Due to the limits of thermodynamics, gains would have to be made through completely new technology such as nuclear fusion as well as massive improvements in current renewable energy. If recovery from delayed action proves impossible because the required technological fixes do not emerge, CO_2 concentrations will rise above 650 ppmv with no stabilisation - let alone reduction - in prospect. This is clearly not an option in accordance with the objective of the UNFCCC.



Scientifically, there may appear to be little to distinguish the PP and the WRE control options in terms of their climatic impact. But just the earlier arrival at 450 ppmv and corresponding temperature rise may take us to thresholds of instability the retreat from which is then dependent on crash control programmes for reduction which will be more costly than the earlier and milder controls of PP.

The PP approach is also more sensible than the WRE and the EGO approach because it initiates best use of present options. It reduces the risks of large-scale unpleasant surprises down-stream and with *"Contraction and Convergence"* in place, encourages compliance because it is both more intra and inter-generationally equitable.

Following this reasoning, pursuit of the EGO approach either by default or design is the least prudent option possible.

'EGO-deception' with the 'good news' of 'efficiency-gains only'

BP- Amoco says that the six and a half billions of tonnes of fossil fuel burnt in 1998 was half a percent less than the year before. The World Watch Institute says that this is uniquely good news. For the first time ever, we are 'slowing global warming' but continuing to generate dollars of economic growth while doing so. We are they said, becoming more 'efficient' and shall therefore have cake and eat it after all. As the table alongside suggests, if the measurement described as 'good news' has happened only three times in 48 years of economic growth shown since 1950, the other 46 were a continuous trend of 'bad news'.

The response to this in the serious media (Financial Times, BBC etc) was enthusiastic and credulous. The divorce heralded was between those long-term stable marriage partners, economic growth and fossil fuel consumption with the planet's climate system and atmosphere being cited as third party.

	TC	GTC	GTC%s	TC/$m	GDP	GDP%s	$s/TC	$s/TC%s	Carbon Fell	GDP grew	Efficiency Grew	Efficiency Grew faster than GDP	Quadruple win	Efficiency versus GDP
1950	1.6	1.60G		239.9	$6,669,445,602,334		$4,168							
1951	1.7	1.70G	106.25%	245.6	$6,921,824,104,235	103.78%	$4,072	97.68%	no	yes	no	no	no	-6.10%
1952	1.8	1.80G	105.88%	239.4	$7,518,796,992,481	108.62%	$4,177	102.59%	no	yes	yes	no	no	-6.03%
1953	1.8	1.80G	100.00%	234	$7,692,307,692,308	102.31%	$4,274	102.31%	no	yes	yes	no	no	0.00%
1954	1.8	1.80G	100.00%	228.8	$7,867,132,867,133	102.27%	$4,371	102.27%	no	yes	yes	no	no	0.00%
1955	2	2.00G	111.11%	236.7	$8,449,514,152,936	107.40%	$4,225	96.66%	no	yes	no	no	no	-10.74%
1956	2.1	2.10G	105.00%	241.1	$8,710,078,805,475	103.08%	$4,148	98.18%	no	yes	no	no	no	-4.91%
1957	2.2	2.20G	104.76%	241.9	$9,094,667,217,859	104.42%	$4,134	99.67%	no	yes	no	no	no	-4.75%
1958	2.3	2.30G	104.55%	239.8	$9,591,326,105,088	105.46%	$4,170	100.88%	no	yes	yes	no	no	-4.59%
1959	2.4	2.40G	104.35%	242.8	$9,884,678,747,941	103.06%	$4,119	98.76%	no	yes	no	no	no	-4.29%
1960	2.5	2.50G	104.17%	241.5	$10,351,966,873,706	104.73%	$4,141	100.54%	no	yes	yes	no	no	-4.19%
1961	2.5	2.50G	100.00%	234.6	$10,656,436,487,639	102.94%	$4,263	102.94%	no	yes	yes	no	no	0.00%
1962	2.6	2.60G	104.00%	233	$11,158,798,283,262	104.71%	$4,292	100.69%	no	yes	yes	no	no	-4.03%
1963	2.8	2.80G	107.69%	235.5	$11,889,596,602,972	106.55%	$4,246	98.94%	no	yes	no	no	no	-7.61%
1964	2.9	2.90G	103.57%	231.9	$12,505,390,254,420	105.18%	$4,312	101.55%	no	yes	yes	no	no	-3.63%
1965	3.1	3.10G	106.90%	230.5	$13,449,023,861,171	107.55%	$4,338	100.61%	no	yes	yes	no	no	-6.94%
1966	3.2	3.20G	103.23%	229.5	$13,943,355,119,826	103.68%	$4,357	100.44%	no	yes	yes	no	no	-3.24%
1967	3.3	3.30G	103.13%	228.9	$14,416,775,884,666	103.40%	$4,369	100.26%	no	yes	yes	no	no	-3.13%
1968	3.5	3.50G	106.06%	227.9	$15,357,612,988,153	106.53%	$4,388	100.44%	no	yes	yes	no	no	-6.09%
1969	3.7	3.70G	105.71%	229.2	$16,143,106,457,243	105.11%	$4,363	99.43%	no	yes	no	no	no	-5.68%
1970	4	4.00G	108.11%	234.1	$17,086,715,079,026	105.85%	$4,272	97.91%	no	yes	no	no	no	-7.94%
1971	4.1	4.10G	102.50%	233.9	$17,528,858,486,533	102.59%	$4,275	100.09%	no	yes	yes	no	no	-2.50%
1972	4.3	4.30G	104.88%	232	$18,534,482,758,621	105.74%	$4,310	100.82%	no	yes	yes	no	no	-4.92%
1973	4.5	4.50G	104.65%	229.3	$19,624,945,486,263	105.88%	$4,361	101.18%	no	yes	yes	no	no	-4.71%
1974	4.5	4.50G	100.00%	224.5	$20,044,543,429,844	102.14%	$4,454	102.14%	no	yes	yes	no	no	0.00%
1975	4.5	4.50G	100.00%	220.4	$20,417,422,867,514	101.86%	$4,537	101.86%	no	yes	yes	no	no	0.00%
1976	4.8	4.80G	106.67%	222	$21,621,621,621,622	105.90%	$4,505	99.28%	no	yes	no	no	no	-6.62%
1977	4.9	4.90G	102.08%	218.7	$22,405,121,170,553	103.62%	$4,572	101.51%	no	yes	yes	no	no	-2.11%
1978	5	5.00G	102.04%	211.8	$23,607,176,581,681	105.37%	$4,721	103.26%	no	yes	yes	no	no	-2.11%
1979	5.2	5.20G	104.00%	216.6	$24,007,386,888,273	101.70%	$4,617	97.78%	no	yes	no	no	no	-3.91%
1980	5.2	5.20G	100.00%	209.3	$24,844,720,496,894	103.49%	$4,778	103.49%	no	yes	yes	no	no	0.00%
1981	5	5.00G	96.15%	198.3	$25,214,321,734,745	101.49%	$5,043	105.55%	**yes**	**yes**	**yes**	**yes**	**yes**	4.06%
1982	4.9	4.90G	98.00%	194.6	$25,179,856,115,108	99.86%	$5,139	101.90%	yes	no	yes	yes	no	2.04%
1983	4.9	4.90G	100.00%	188.6	$25,980,911,983,033	103.18%	$5,302	103.18%	no	yes	yes	no	no	0.00%
1984	5.1	5.10G	104.08%	186.6	$27,331,189,710,611	105.20%	$5,359	101.07%	no	yes	yes	no	no	-4.13%
1985	5.3	5.30G	103.92%	186.5	$28,418,230,563,003	103.98%	$5,362	100.05%	no	yes	yes	no	no	-3.92%
1986	5.5	5.50G	103.77%	186.6	$29,474,812,433,012	103.72%	$5,359	99.95%	no	yes	no	no	no	-3.77%
1987	5.6	5.60G	101.82%	184.2	$30,401,737,242,128	103.14%	$5,429	101.30%	no	yes	yes	no	no	-1.84%
1988	5.8	5.80G	103.57%	183.4	$31,624,863,685,932	104.02%	$5,453	100.44%	no	yes	yes	no	no	-3.59%
1989	5.9	5.90G	101.72%	181.2	$32,560,706,401,766	102.96%	$5,519	101.21%	no	yes	yes	no	no	-1.75%
1990	5.9	5.90G	100.00%	179.3	$32,905,744,562,186	101.06%	$5,577	101.06%	no	yes	yes	no	no	0.00%
1991	6	6.00G	101.69%	180.8	$33,185,840,707,965	100.85%	$5,531	99.17%	no	yes	no	no	no	-1.68%
1992	5.9	5.90G	98.33%	176	$33,522,727,272,727	101.02%	$5,682	102.73%	**yes**	**yes**	**yes**	**yes**	**yes**	1.71%
1993	5.9	5.90G	100.00%	170.4	$34,624,413,145,540	103.29%	$5,869	103.29%	no	yes	yes	no	no	0.00%
1994	6	6.00G	101.69%	167.9	$35,735,556,879,095	103.21%	$5,956	101.49%	no	yes	yes	no	no	-1.72%
1995	6.2	6.20G	103.33%	166.8	$37,170,263,788,969	104.01%	$5,995	100.66%	no	yes	yes	no	no	-3.36%
1996	6.3	6.30G	101.61%	162.9	$38,674,033,149,171	104.05%	$6,139	102.39%	no	yes	yes	no	no	-1.65%
1997	6.3	6.30G	100.00%	157.2	$40,076,335,877,863	103.63%	$6,361	103.63%	no	yes	yes	no	no	0.00%
1998	6.3	6.27G	99.50%	152.6	$41,077,981,651,376	102.50%	$6,553	103.01%	**yes**	**yes**	**yes**	**yes**	**yes**	0.52%

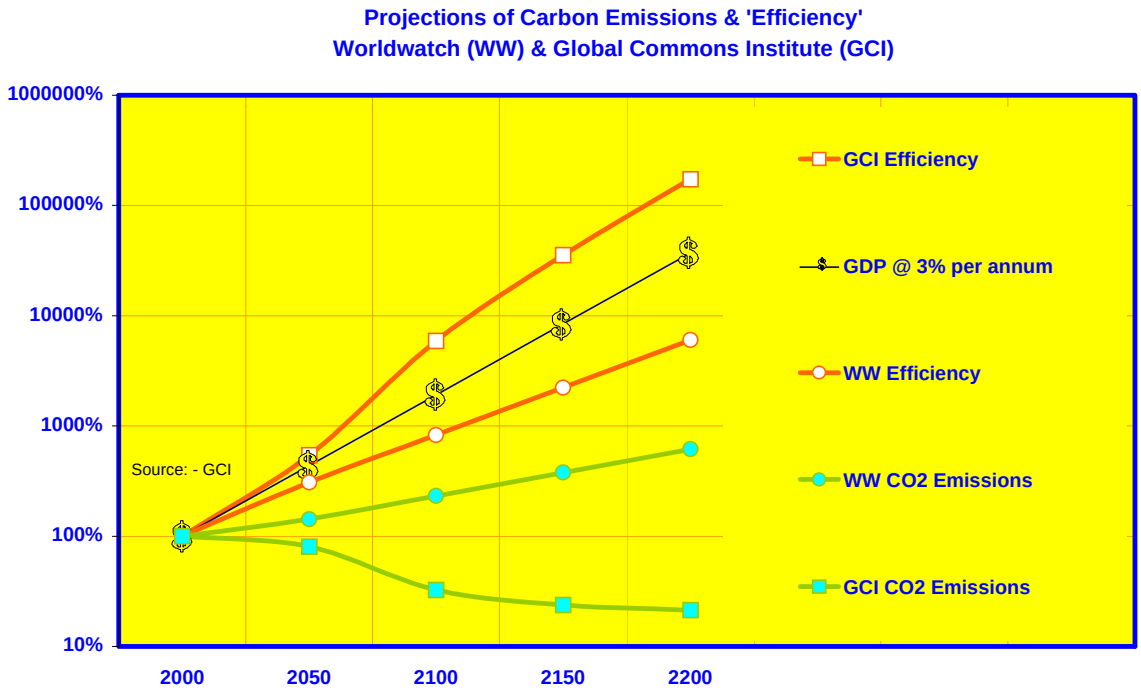
But if the scale of this impending breakdown was better understood, we wouldn't rush to comfort ourselves with such uncritical nonsense. The scale of the issue deserves more serious attention than the World Watch Institute has offered so far. Unfortunately for us all, the emissions of greenhouse gases from fossil fuel burning (principally CO2) accumulate in the atmosphere. That is, once released they go up and stay there for a very long time. And it is this increasing concentration of the gases, which is causing global temperature to rise and the climate to become less stable.

This means that for rising concentrations to merely stabilize, emissions have to fall not by half a percent or even ten percent. Emissions must fall - indeed they must be cut - by 60 to 80% as soon as possible if citing the 'third party' - stabilizing the Earth's climate system - is to be honest and relevant. The requirement for this emissions cut is absolute and imperative. And moreover, the later this cut happens the hotter the planet will become.

Certainly with regard to the Earth's climate, the ability to grow economically - indeed the desirability of doing this - is utterly contingent on understanding this imperative. If the efficiency goal remains defined as merely increasing growth of global income relative to tonnes of fossil fuel consumed, the rising damages from accelerating climate change will nullify the benefits of this growth.

We need to know where we are headed with climate change. Consequently, it would be sensible to specify on a precautionary basis an upper and stable limit to the amount of CO2 in the atmosphere. This is after all the objective of the United Nations Framework Convention on Climate Change (UNFCCC). Then we could usefully redefine this climate-related economic efficiency as income per tonne of CO2 in the global atmosphere. The effect of this would be to provide a tool that over time would show us how well we were slowing the rise of inefficiency in the combined economic and eco-systems.

The bottom chart shows the extent of efficiency gains required to do this (GCI) compared with the World Watch 'good news' repeated year on year (WW).The GCI analysis shows clearly that the growth of these $:tonne efficiency gains must consistently outperform the rate of GDP growth. That is why the C&C agreement must lead. The World Watch's approach is JAZZ and takes us inexorably to a climate hell on earth.



APPENDIX THREE – Support from key Government Individuals

Jan Pronk, Chairman of COP-6, Environment Minister Netherlands - July 2000

"Contraction and Convergence" [*"most equitable . . . easier & cheaper"* than alternatives].

> *" . . .The debate about broadening participation of developing countries in the global effort to stabilize greenhouse concentrations in the atmosphere at sustainable levels has the tendency to focus first on the most advanced developing countries. Suggestions have been made for commitments for those developing countries in the period after 2012 in terms of increased energy or greenhouse gas efficiency. In other words: not an absolute cap, but a relative efficiency improvement in the production structure of developing countries. This strategy would imply that developing countries gradually start participating, as they achieve a certain level of economic development. That is a reasonable and realistic option. However, it can be argued that such gradual participation would only lead to a slow decline of global emissions, even if current industrialized countries would drastically decrease their emissions. As a result global average temperature increase would significantly exceed the 2 degrees centigrade limit that could be seen as the maximum tolerable for our planet.*
>
> *There are alternatives for this scenario. Some developing countries have argued for an allowance of equal emissions per capita. This would be the most equitable way to determine the contribution of countries to the global effort. If we agree to equal per capita emissions allowances for all countries by 2030 in such a way that global emissions allow us to stay below the 2 degrees global temperature increase (equivalent to about 450 ppmv CO2), then the assigned amounts for Annex B countries would be drastically reduced. However, due to the fact that all countries would have assigned amounts, maximum use of global emissions trading would strongly reduce the cost of compliance. So, in such a scenario, industrialized countries would have to do more, but it would be cheaper and easier . . . . . "[July 2000].*

Klaus Topfer, Dir. United Nations Environment Programme (UNEP) - June 1999

> *"Convergence - The review system of Kyoto mechanisms can ensure equity. Currently CO2 emissions rights are allocated according to existing emissions patterns with a specified reduction percentage for various countries within a certain period of five years (2008-2012). The redistribution through the Kyoto Protocol could be continued until emissions rights are uniformly distributed on a per capita basis. This will be a critical element to ensure the poor also get rights to utilise the world's environment, or in this limited case, the assimilative capacity of the atmosphere, a global commons resource."*

Dr Song Jian, Chinese State Councilor Climate Change & Population - Oct 1997

> *"When we ask the opinions of people from all circles, many people, in particular the scientists think that 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. Today the per capita consumption is just one tenth of that of the developed countries, one eighth of that of medium developed countries. It is estimated 30-40 years would be needed for China to catch up with the level of medium developed countries."*

US Congressman John Porter, Chair GLOBE[15] USA - Nov 1998

"Meaningful progress on confronting the challenge of climate change will only occur when countries from the North and the South are able to collaborate in issues of significant and sustainable development. The GLOBE Equity Protocol - Contraction and Convergence - and its mechanism for financing sustainable development is the only proposal so far which is global, equitable and growth-oriented. It is precisely these issues that were endorsed at the GLOBE International General Assembly in Cape Cod, and form the thrust of our paper (Nov 1998), "Solving Climate Change with Equity and Prosperity." [Viewed at: - <http://www.globeusa.org>].

Prof Saifuddin Soz MP. Indian Environment Minister in Kyoto - Dec 1997

"In any discussion, "Contraction and Convergence", the central point is entitlements - equitable per capita entitlements. At Kyoto we had stressed that any discussion on emissions trading ought to be framed in terms of per capita entitlements. Any trading can take place only after the emissions entitlements of the trading partners is defined and legally created - equitably of course. Historical emissions are iniquitous and cannot be the basis of entitlements. Entitlements will define the sharing of the atmosphere on an equitable basis which also brings together all the cooperative mechanisms in the Kyoto Protocol in a common framework."

Jaques Chirac, President of France - COP6 November 2000

“Since 1992, we have fallen too far behind in the fight against global warming. We cannot afford any further delay. That is why, I can confirm to you here, Europe is resolved to act and has mobilized to fight the greenhouse effect. Europe calls upon the other industrialized countries to join with it in this fight. And Europe proposes to the developing countries to join it in a partnership for sustainable development.

Let us start thinking about the post-Kyoto period without further ado. Tomorrow, it will be up to us to set forth the rights and duties of each, and for a long time to come. In order to move forward while respecting individual differences and special circumstances, France proposes that we set as our ultimate objective the convergence of per capita emissions. This principle would durably ensure the effectiveness, equity and solidarity of our efforts.”

Sir John Houghton, Chair IPCC WG1 - 2000

"Three widely accepted principles will govern the international agreements needed to meet the threat of climate change. The first is the Precautionary Principle, already clearly embedded in the UNFCCC agreed at the Earth Summit in Rio in 1992. This states that the existence of uncertainty should not preclude the taking an appropriate action. The reason for such action is simply stated as the stabilisation of the concentrations of greenhouse gases (such as CO2) in the atmosphere in ways that allow for necessary economic development. The second principle is the Polluter Pays Principle, which implies the imposition of measures such as carbon taxes or carbon trading arrangements. The third is the principle of Equity, both intergenerational and international which is the most difficult to apply. However a proposal by the Global Commons Institute that is being widely discussed applies these principles by allowing eventually for the allocation of carbon emissions to nations on an equal per capita basis while also allowing for emissions trading."

[15] GLOBE stands for Global Legislators Organisation for a Balanced Environment. It is an international network of Parliamentarians committed to working in a global non-partisan manner for legislation to protect the environment.

Ambassador Raul Estrada Oyuela, Former Chair Kyoto Negotiations - Feb 2000

"Long before the end of the Framework Convention negotiation, the Global Commons Institute has presented a proposal on contraction and convergence, aimed to reach equality in emissions per capita. We all in this room know the GCI model where ***contraction*** *is achieved after all governments, for precautionary reasons, collectively agree to be bound by a target of global GHG emissions, making it possible to calculate the diminishing amount of greenhouse gases that the world can release each year in the coming century, subject to annual scientific and political review. The* ***convergence*** *part of the proposal means that each year's global emissions budget gets shared out among the nations of the world so that every country converges on the same allocation per inhabitant by an agreed date. Countries unable to manage within their shares would, be able to buy the unused parts of the allocations of other countries. The entitlement of rights transferred in this trading is legitimised by the per inhabitant criteria.*

Level of contraction and timing of convergence should be negotiated on the basis of the precautionary principle. Suggestions for emission reductions are well known and convergence should be achieved at medium term to satisfy legitimacy."

APPENDIX FOUR – Support from key Institutions

IPCC Third Policy Assessment - June 2001

Chapter One, section 3.2: -

"A formulation that carries the rights-based approach to its logical conclusion is that of 'contraction and convergence'.

Chapter Ten, section 4.5: -

"The concept of 'contraction and convergence' is the entitlement of ghg emissions budget in terms of future emissions rights. Such a global future emissions budget is based on a global upper limit to atmospheric concentration of CO2, for instance 450 ppmv (contraction). This budget is then distributed as entitlements to emit CO2 in the future, and all countries will agree to converge on a per capita emissions entitlement (convergence). Level of contraction and timing of convergence are subject to negotiations with respect to the precautionary principle."

UNCTAD - Elements of a "Buenos Aires Mandate" - November 1998

". . . meaningful participation by key developing countries" will no doubt loom large in the post-Kyoto period. Much attention will focus on efforts to (a) further define and operationalise the Clean Development Mechanism (CDM) and to (b) agree possible criteria for the participation of developing countries in international emissions trading. Drawing on the Kyoto experience, some possible elements for a mandate regarding participation of developing countries in emissions trading could include the following: -

1. *Participation in emissions trading should be on a voluntary basis. (While the trading system can be designed to benefit all developing countries, it seems that the larger industrially advanced, fast-growing developing countries might be the primary beneficiaries of the system).*
2. *Legally-binding limits (for countries that wish to join the emissions trading system) should be based on emissions growth, not on emissions reductions. The principle was recognised during the Kyoto negotiations. Growth limits would enable the developing countries to continue to pursue their industrialisation but on a more environmentally sustainable basis. (In principle, emissions growth in Non-Annex One countries should be*

compensated for by deeper reductions by Annex One Parties leading to "Contraction and Convergence" of per capita emissions between both sides).

3. *Negotiations could be based on national offers from developing country Parties. Offers by regional groupings such as ASEAN and MERCOSUR should also be considered.*

In addition to existing flexibility mechanisms, developing countries should be allowed to introduce 'partial caps' which, for example, could be based on industrial sector limits and coupled with joint implementation in the uncapped sectors, as a form of progressive restriction towards the imposition of a national cap.

The Royal Commission on Environmental Pollution (RCEP) - June 2000

Chapter Four, *"The Need for an International Agreement", "Contraction and Convergence"*

*"3. The government should press for a future global climate agreement based on the **contraction and convergence** approach, combined with international trading in emission permits. Together, these offer the best long-term prospect of securing equity, economy and international consensus (4.69)."*

4.47 Continued, vigorous debate is needed, within and between nations, on the best basis for an agreement to follow the Kyoto Protocol. Our view is that an effective, enduring and equitable climate protocol will eventually require emission quotas to be allocated to nations on a simple and equal per capita basis. There will have to be a comprehensive system of monitoring emissions to ensure the quotas are complied with. Adjustment factors could be used to compensate for differences in nations' basic energy needs. Those countries which regularly experience very low or high temperatures might, for instance, be entitled to an extra allocation per capita for space heating or cooling.

4.48 A system of per capita quotas could not be expected to enter into force immediately. At the same time as entitling developing nations to use substantially more fossil fuels than at present (which they might not be able to afford), it would require developed nations to make drastic and immediate cuts in their use of fossil fuels, causing serious damage to their economies.

4.49 A combination of two approaches could avoid this politically and diplomatically unacceptable situation, while enabling a per capita basis to be adhered to. The first approach is to require nations' emission quotas to follow a contraction and convergence trajectory. Over the coming decades each nation's allocation would gradually shift from its current level of emissions towards a level set on a uniform per capita basis. By this means 'grandfather rights' would gradually be removed: the quotas of developed nations would fall, year by year, while those of the poorest developing nations would rise, until all nations had an entitlement to emit an equal quantity of greenhouse gases per head (convergence). From then on, the quotas of all nations would decline together at the same rate (contraction). The combined global total of emissions would follow a profile through the 21st and 22nd centuries which kept the atmospheric concentration of greenhouse gases below a specified limit.

4.50 The upper limit on the concentration of greenhouse gases would be deter-mined by international negotiations, as would the date by which all nations would converge on a uniform per capita basis for their emission quotas, and the inter-mediate steps towards that. It would probably also be necessary to set a cut-off date for national populations: beyond that date, further changes in the size of a country's population would not lead to any increase or decrease in its emission quota.

4.51 In table 4.1 17 we have applied the contraction and convergence approach to carbon dioxide emissions, and calculated what the UK's emissions quotas would be in

2050 and 2100 for four alternative upper limits on atmospheric concentration. We have assumed for this purpose that 2050 would be both the date by which nations would converge on a uniform per capita emissions figure and the cut-off date for national populations.18 If 550 ppmv is selected as the upper limit, UK carbon dioxide emissions would have to be reduced by almost 60% from their current level by mid-century, and by almost 80% by 2100. Even stabilisation at a very high level of 1,000 ppmv would require the UK to cut emissions by some 40% by 2050.

4.52 The UK-based Global Commons Institute has taken the lead in promoting contraction and convergence, and has developed a computer model which specifies emission allocations under a range of scenarios. The concept has been supported by several national governments and legislators. Some developed nations are very wary of it because it implies drastic reductions in their emissions, but at least one minister in a European government has supported it.20 Commentators on climate diplomacy have identified contraction and convergence as a leading contender among the various proposals for allocating emission quotas to nations in the long term.21

4.53 The other ingredient that would make an agreement based on per capita allocations of quotas more feasible is flexibility of the kind already provided in outline in the Kyoto Protocol. Nations most anxious to emit greenhouse gases in excess of their allocation over a given period will be able and willing to purchase unused quota at prices that incline other countries to emit less than their quota, to the benefit of both parties. The clean development mechanism, which allows developed nations to claim emission reductions by sponsoring projects that reduce emissions in developing nations to levels lower than they would otherwise have been, can also be seen as a form of trading.

4.54 In the longer term trading by companies in emission permits, drawn from national emission quotas determined on the basis of a contraction and convergence agreement, could make a valuable contribution to reducing the global costs of stabilising greenhouse gas concentrations while transferring resources from wealthy nations to poorer ones. Trading needs to be transparent, monitored and regulated, and backed by penalties on nations which emit more than they are entitled to. If it became merely a means of enabling wealthy nations to buy up the emission entitlements of poor countries on the cheap, thereby evading taking any action at home, trading would not serve the cause of climate protection. Nor would it if developing countries which had sold quota heavily went on to emit in excess of their revised entitlements.

UK Chartered Insurance Institute (CII) - March 2000

A research report by the Society of Fellows of the CII's report on global climate change describes C&C as: -

"The most realistic way to bring about the required reduction in ghg emissions (which will have the combined effect of reducing the damage imposed on the insurance industry and encouraging the transition to renewable energy) is that proposed in the concept of Contraction and Convergence (C&C). This concept is incredibly simple in its detail. Essentially, everyone has the right to emit an equal amount of pollution (in this case CO2) to the Global Commons (atmosphere). This would operate in much the same way as the envisaged emissions trading scheme to be set up within the Kyoto Protocol. Since economic progress is dependent on energy, the shortfall from 'Business as usual' energy consumption will need to be met from two directions: efficiency gains, and a rapid growth in renewable energy sources. It is clear from this that emissions trading can only be an intermediate stage, since the total volume of emissions must fall.

The only blockage to this simple system is the absence of political will to 'step outside the box' instead of conducting a tortuous round of negotiations of the Kyoto Protocol. One way to unblock this impasse is to amass a large enough consensus of stakeholders behind the concept of contraction and convergence, persuading governments to supersede the Kyoto Protocol. The insurance industry is an obvious place to start such a campaign as it has so much to lose and so much to gain. If society continues down the fossil/Kyoto route, future economic losses are likely to become unsustainable: the current rate of increase in damage from natural hazards is 12% pa and the rate is accelerating. Given that the global sum of such losses was $100bn in 1999 (Munich Re, 2000), it would outstrip global GDP (growing at 3% pa) by 2065, if the trends persist. If the insurance industry rallies behind C&C, it not only reduces that risk, but it is well placed to invest in the future renewables market. In fact one could argue that as the insurance companies own the oil companies (through equity ownership), insurers form the only industry that has the collateral and the need to adopt the C&C logic."

USS [16] Research Report No 1 - July 2001

Climate Change, A Risk Management Challenge for Institutional Investors *"Beyond Kyoto - Contraction & Convergence"* (pp 28 29)

"It is important to recognise that any agreement can be only the first step in what will be a major journey. It is clear that even if the Kyoto targets are met, global emissions will continue to rise because of rapidly rising emissions in the developing world. Substantial further steps will have to be taken to curb emissions globally. Such cuts will inevitably begin to involve poor countries and at the same time rich countries are likely to have to commit to much more serious emission reductions themselves. As a result further emission reduction agreements are likely covering the period 2012-20 and beyond. Indeed, the IPCC in its first assessment reports in 1990 recommended emissions cuts of at least 60% to stabilise C02 concentrations at 1990 levels and thereby be likely to avoid serious climate disruption. Its subsequent reports have not altered this position.

In the longer term, 'Contraction and Convergence' (C&C) is likely to become increasingly supported as a policy option. C&C was initially advocated by a small UK think tank, the Global Commons Institute (www.gci.org.uk), but has since gained widespread and authoritative support, including that of some poor country governments and also the recent Royal Commission on Environmental Pollution report which recommended that, 'the government should press for a future global climate agreement based on the contraction and convergence approach'. Ironically, while C&C offers a more robust framework than that outlined by Kyoto, and addresses the issue of equity, it also meets the fundamental objection of the US in that it also requires commitments from the developing world. As a global operational framework it also avoids many of the technical problems of Kyoto (such as defining baselines for emissions trading in countries not subject to an overall target, or the extent of international emissions trading that is permissible). However, much will depend on the detail. Done well, C&C could provide a framework for a genuine, equitable, long-term solution to climate change, which reduces political risks and provides businesses and investors with the sort of predictable framework they prefer. But if agreement is hard to reach, C&C might serve to highlight injustices and end up exacerbating tensions. For example, some campaigners have argued for a third 'C': 'compensation' from the rich world for using up the climate's absorptive capacity. Whilst this claim is understandable, such a development could well become an emotive issue that could make agreement far harder to reach."

[16] Universities Superannuation Scheme

European Parliament [17] - 1998

"Calls on the Commission & Member States to take the lead in brokering an agreement on a set of common principles & negotiating framework beyond COP4 based on:

1. *agreement to have a worldwide binding limit on global emissions consistent with a maximum atmospheric concentration of 550 ppmv CO2 equivalent,*
2. *initial distribution of emissions rights according to the Kyoto targets,*
3. *progressive convergence towards an equitable distribution of emissions rights on a per capita basis by an agreed date in the next century,*
4. *across-the-board reductions in emissions rights thereafter in order to achieve the reduction recommended by the Intergovernmental Panel on Climate Change (IPCC),*
5. *an agreement to have a quantitative ceiling on the use of flexibility mechanisms that will ensure that the majority of emission reductions are met domestically in accordance with the spirit of articles 6, 12 and 17 of the Kyoto protocol; in this context trading must be subject to proper monitoring, reporting and enforcement;*
6. *an adequately financed mechanism for promoting technology transfer from Annex 1 to non-Annex 1 countries;"*

The Africa Group of Nations - August 1997

"As we negotiate the reduction of GHG, the countries of Africa believe that there should be certain principles that need to be clearly defined.

A globally agreed ceiling of GHG emissions can only be achieved by adopting the principle of per capita emissions rights that fully take into account the reality of population growth and the principle of differentiation."

International Federation of Red Cross & Red Crescent Societies - June 2000

World Disasters Report 2000 Box 7.2 A Climate of Debt" http://www.ifrc.org/

"No one owns the atmosphere, yet we all need it. So we can assume that we all have an equal right to its services – an equal right to pollute. On the basis of the minimum cuts in total carbon dioxide pollution needed to stabilize the climate, estimated by the Intergovernmental Panel on Climate Change to be between 60 to 80 per cent of the pollution levels reached in 1990, and assuming that we all have an equal right to pollute, rich countries are running up a massive climate or 'carbon' debt. By using fossil fuels at a level far above a threshold for sustainable consumption, year after year the carbon debts of rich countries get bigger.

Any political solution to climate change will need to be based on reductions in emissions, otherwise known as contraction. As the climate is owned by no one and needed by everyone, we will also have to move towards equally sharing the atmosphere, known as convergence. Our collective survival could depend on addressing both."

[17] This is a formulation of C&C by the Parliament that was carried by 90% of the vote. It reflects inter alia that nearly all European Environment Ministers have also publicly endorsed C&C.

APPENDIX FIVE

Contraction Formula

The path of the global emissions curve is established by fixing five conditions:

1. Start date for the contraction period;
2. Target date of emissions stabilisation;
3. Rate of change to be zero in target year (i.e. stable emissions);
4. Initial rate of change to be equal to the actual rate of change at that time;
5. The total level of emissions to be set in accordance with a chosen level of atmospheric concentration stabilisation.

These criteria can be satisfied by a quartic equation of the form

$$Y=k+lx+mx^2+nx^3+px^4$$

where Y equals the annual global emissions budget, x is the time variable and the parameters k, l, m, n, p are determined by the five criteria above by a series of multiple equations.

$k = y_0$

$l = r$

$m = 30A - 18y_0 - 12y_1 - 4.5r$

$n = -60A + 32y_0 + 28y_1 + 6r$

$p = 30A - 15y_0 - 15y_1 - 2.5r$

where y_0 and y_1 are the emission levels at the beginning and end of the contraction period respectively, r is the annual increase in emissions at time 0 and A is the cumulative emissions over the contraction period divided by the length of the period in years.

Convergence Formula

The variables for a convergence formula are set by three conditions:

1. Start from actual shares at the beginning of the convergence period;
2. All countries to converge to equal per capita shares by the target date;
3. Arithmetic to rely only on actual population data (potentially subject to a cap).

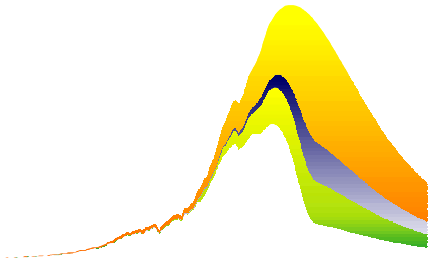
The third point is to avoid complications over controversial population projections. In order to counter the argument of per capita allocations promoting population growth, the population figures can be frozen at any time for the purposes of emissions allocations.

GCI has proposed two alternative formulas:

$s_{y+1} = s_y - (s_y - p_{y+1})^{-a(1-x)}$ (Exponential convergence)

$s_{y+1} = s_y - x\,(s_y - p_{y+1})$ (Linear convergence)

APPENDIX SIX - References



Global Commons Institute (GCI) (see below)

Technical support and information about *"Contraction & Convergence" and* the planning model itself (CCOptions) are available at: -

http://www.gci.org.uk

"Contraction and Convergence – the Global Solution to Climate Change"

Schumacher Briefing No. 5
Published during and launched at COP-6, November 2000.
Available Now from Green Books price £5: -

http://www.greenbooks.co.uk/cac/cacorder.htm

Describes C&C, its history, reactions to it and possible futures.

Global Commons Network (GCN): -

http://www.topica.com/lists/GCN@igc.topica.com/read

Global Commons Institute (GCI), 37 Ravenswood Road, London E17 9LY
Landline 0208 520 4742, mobile phone 0771 282 6406 e-mail aubrey@gci.org.uk - website http://www.gci.org.uk
Global Commons Network (GCN) - website http://www.topica.com/lists/GCN@igc.topica.com/read

FRESH AIR?

OPTIONS FOR THE FUTURE ARCHITECTURE OF INTERNATIONAL CLIMATE CHANGE POLICY

CONTENTS

INTRODUCTION	1
EXECUTIVE SUMMARY	2
THE PROPOSALS	3
THE ELEMENTS OF CLIMATE CHANGE POLICY	4
KYOTO PLUS PROPOSALS	7
THE BRAZILIAN HISTORICAL RESPONSIBILITY PROPOSAL	9
THE UNIVERSITY OF UTRECHT'S TRIPTYCH PROPOSAL	10
ECN AND CICERO'S MULTI-SECTOR CONVERGENCE PROPOSAL	11
DAVID VICTOR'S PRICE CAPS PROPOSAL	12
THE WORLD RESOURCES INSTITUTE'S CARBON INTENSITY PROPOSAL	13
BENITO MÜLLER'S PREFERENCE SCORE PROPOSAL	14
GCI'S CONTRACTION AND CONVERGENCE PROPOSAL	16
CONCLUSION: TOWARDS A WORKABLE POLITICAL COMPROMISE	18
REFERENCES	21

INTRODUCTION

Beginning from the stroke of new year, as they sit down to their evening meal on January 2, a US family will have already used, per person, the equivalent in fossil fuels that a family in Tanzania will depend on for the whole year.

A decade after the UN Framework Convention on Climate Change (UNFCCC) was signed, ranging from the USA to Australia, Canada and across Europe, countries are per person pumping out more carbon dioxide than they were at the time of the Earth Summit. Even worse, Australia has followed the US rejection of the Kyoto Protocol and Canada has placed unacceptable terms on her continued support.

But now something new is in the air. Negotiating the Kyoto Protocol to the UNFCCC dominated the minds of environmentalists for years. But working out what comes next is taking climate policy specialists into uncomfortable new territory.

Global warming, once dominated by scientists and technocrats is spilling over into a larger debate about an emerging constitution for the global economy. Rich and poor countries are divided by fault lines running along the issues of trade, debt, aid, private finance and economic sovereignty.

These are centre stage at meetings of the World Bank and International Monetary Fund, the World Trade Organisation and Group of Seven nations.

Now two separate worlds of debate are starting to come together on one big issue. After years of inactive good intentions, the environment and development communities are being forced into each other's company by a changing climate.

How we share the global commons of the atmosphere and suffer the impacts of climate change will have such an impact on the global economy that it will dwarf orthodox economic development issues. But how should we reconcile the new international commitments to human development with the inescapable demand to stop dangerous climate change?

In this briefing published by the New Economics Foundation, Alex Evans produces the first comprehensive survey of the leading contenders to provide an answer to the greatest challenge faced by the international community.

He interrogates every proposal for whether it delivers 'environmental integrity' in terms of necessary cuts in greenhouse gas emissions, and political feasibility in terms of a getting a global deal before it is too late.

The briefing comes to a conclusion that now seems to resonate with everyone from the insurance industry, to governments and grass roots development organisations. That no solution is either morally acceptable, or practically workable if it fails to accept the logic that everyone has an equal claim to the global commons of the atmosphere.

This briefing takes the reader step-by-step through the various proposals and their strengths and weaknesses. Its conclusion is that equity is more than just a desirable aim – it is absolutely necessary for our survival.

Andrew Simms
Policy Director

EXECUTIVE SUMMARY

This report examines the question of what should follow the Kyoto Protocol in international policy to address climate change. It discusses what a successful climate policy would look like, and assesses eight leading policy proposals.

What makes for a successful climate policy?

Achieving an effective climate policy will require three consecutive steps, which we make a detailed case for in the main report. These are:

Fixed concentration targets: If it's going to be effective, global climate policy must be based on a formal atmospheric concentration target for greenhouse gases (GHGs) in the atmosphere. This is a prerequisite for successful implementation of the 1992 Convention's objective of stabilising atmospheric concentrations of GHGs, and has the added advantage of making the scientific basis for climate change policy explicit. Uncertainty over what is a 'safe' level of GHGs in the atmosphere is no reason not to implement a formal target: it is a rationale for making sure that the initial target level can be modified in the light of new scientific findings. Above all, environmental precaution must be the overriding priority of climate change policy.

Constitutional framework for convergence: Once a global carbon budget has been defined via an atmospheric concentration target, the next question is how to share emissions entitlements between countries. Normal values of 'fairness' are an inadequate guide for climate policy, since there are no objective criteria with which to assess them. Instead, the concept that logically arises is that of **convergence**. Convergence implies a phased coming together of per capita output of GHGs, ultimately reaching a point where the citizens of every country are allocated more or less equal rights of emissions, with total output falling within scientifically-determined sustainable limits. In a global framework of shrinking emissions, countries' shares will gradually converge anyway.

As we shall see, though, the real question is whether this convergence happens by accident or by design. In this report, we argue for the implementation of a global constitutional framework for convergence by an agreed date. This approach offers the best chance of getting developing countries to take part, which has long been one of the most difficult challenges in climate policy.

Agreed timescale: Delay in the implementation of a constitutional framework for climate policy – involving both a concentration target and convergence by an agreed date – is not an option. The urgency of tackling rising GHG concentrations in the atmosphere, and the consequent need to make sure developing countries take part, means that the world has no time to run an experiment on whether evolutionary policy approaches will work. Precaution must come first in such a hazardous situation.

THE PROPOSALS

There is a range of proposals already for tackling climate change. But using the three criteria given above, all but one of them fail to set out an adequate framework for dealing with the problem.

'Kyoto Plus' proposals – a continuation of the existing approach – lack a concentration target, any clear constitutional framework for developing country participation, and a clear idea of where the process ought to be going. They also lack the urgency we need, given an increasingly grim outlook by climate scientists. This approach therefore fails on all three counts.

The **Brazilian Historical Responsibility proposal** has no formal concentration target and excludes developing countries from quantified commitments. It also fails on all three counts.

The **Triptych** proposal could be used with a formal concentration target, although there is no guarantee that it would be used in this way, and it is also not clear how the target – and the emissions allocations that flow from it – would be revised in the light of new scientific findings. Although the approach could be used for full global participation, this is not an integral feature of the design, and in any case no provision is made for guaranteed convergence. Triptych thus passes only the concentration target test.

The **Multi-Sector Convergence approach** could also be used with a concentration target, although again with no guarantees of this happening. The proposal almost includes a constitutional framework for formal convergence in global allocations, but ultimately fails this test because of its provision for country-specific derogations. The MSC approach thus passes only the concentration target test.

David Victor's Price Cap proposal offers poor environmental performance because it has no concentration target and because of the immense potential for carbon 'leakage'. This arises because governments are allowed to print extra permits if the price of carbon goes above a certain level. The proposal also explicitly rules out developing countries taking part at an early stage, and so it fails on all three counts.

WRI's Carbon Intensity proposal has very low environmental credibility because aggregate emissions are so hard to predict. It also excludes developing countries from quantified entitlements. The proposal therefore fails all three tests of a successful climate policy.

Benito Müller's Preference Score proposal can use a formal atmospheric concentration target, and also tries to define a constitutional framework for the full term of climate policy. It would, however, be unlikely to be accepted by developing countries because it perpetuates unequal emission allocations.

The Global Commons Institute's Contraction and Convergence proposal is the only proposal assessed that offers environmental assurance of arriving at a defined atmospheric concentration, equitable allocations as developing countries have explicitly demanded, and the potential for immediate implementation of a full-term framework. It also meets all stated US criteria for participation, and its provisions for trading would accelerate the roll-out of zero emissions technologies and help developed countries to meet their commitments flexibly.

THE ELEMENTS OF CLIMATE CHANGE POLICY

The science of climate change

There is now no serious doubt that man-made climate change is a reality, and one that is going to continue to get worse, ever faster, until effective steps are taken against it.

From 1861 to 2000, global mean surface temperature increased by 0.6°C. Rainfall patterns have changed, with more frequent incidence of heavy precipitation. The El Nino weather phenomenon has also become more "frequent, persistent and intense". Sea levels increased by between 10 and 20 cm from 1900 to 2000.[i]

It is also an object of substantial scientific consensus that human activities are changing the concentrations of atmospheric green house gases (GHGs). These gases – which include carbon dioxide (CO_2), nitrous oxide (NOx), methane CH_4), tropospheric ozone (O_3) and water vapour – occur naturally and help make the planet habitable by trapping solar radiation in the earth's atmosphere. But as industrial output has intensified, so has our contribution to the concentration of GHGs in the atmosphere, trapping more radiation and warming the planet.

This is caused principally by burning fossil fuels, and also by land use patterns in agriculture and changes such as deforestation. There is "new and stronger evidence that most of the observed warming of the past 50 years is attributable to human activities".[ii] Modelling conducted by the UN Inter-governmental Panel on Climate Change suggests that mean annual surface temperature will increase by between 1.4°C and 5.8°C from 1990 to 2100. Sea levels are predicted to rise between 9 and 88 cm by 2100.[iii]

The objective of the 1992 Convention

The international response to climate change first took shape in 1992 with the UN Framework Convention on Climate Change. The Convention, which ultimately led to the Kyoto Protocol, was explicit about what needed to be done to address the problem of climate change. Article 2 of the treaty states that:

"The ultimate objective of this Convention and any related legal instruments … is to achieve, in accordance with the relevant provisions of the Convention, *stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic influence in the climate system."* [iv]

The crucial test of any climate policy – and specifically, the proposals assessed in this report – is therefore its environmental effectiveness, since this is, after all, the whole point of the UNFCCC process, Kyoto included.

Positive feedbacks

The global picture is already gloomy in the eyes of the scientific community. Yet this is before we even consider the potential for 'positive feedbacks' in the climate system: changes that serve to accelerate climate change rather than dampen it down, and hence raise the possibility of a chain reaction in the climate system that could effectively put the problem beyond human control.

As oceans warm, for example, circulation could slow down, undercutting the planet's ability to store heat in deep water. There are other positive feedbacks too.

Meanwhile, rising temperatures could also trigger widespread melting in Arctic tundra, creating wetlands that contribute to the oxidation of organic matter, releasing more CO_2 and CH_4 into the atmosphere.[v]

Another example of a potential positive feedback mechanism is provided by the Hadley Centre, which published findings in 1998 related to the dieback of vegetation in tropical rainforest areas. The study found that rising temperatures will mean that "many regions which currently support tropical forests are predicted to change to savannah, grassland or even desert".

The atmospheric implications of such a change are immense. The Hadley Centre's research found that "vegetation will absorb CO_2 at the rate of some 2–3 GtC per year in the first half of the next century; this compares to current human-made emissions of about 7 GtC per year. After 2050, and as a result of vegetation dieback, this will become a source of about 2 GtC per year, thereby enhancing CO_2 build-up in the atmosphere. This enhancement is not yet included in climate predictions."[vi]

Of course, there are still major uncertainties about predicting positive feedback, which is why they have tended to be left out of the formal IPCC climate modelling process. But many of the individuals and institutions that sit on the IPCC, such as the Hadley Centre, are clear about the hazards posed by positive feedback mechanisms.

The policy implications of this scientific uncertainty are extensive. No scientist can say with any certainty when the atmospheric concentration of CO_2 or other greenhouse gases (GHGs) will tip the balance to induce further climate change. Yet we do know that human emissions of GHGs cause climate change. We also know that the problem is rapidly getting worse, and that it may spiral out of control without warning.

The need for a formal GHG atmospheric concentration target

One central question that arises out of Article 2 of the Convention is whether the objective of stabilising concentrations of GHGs means that a formal concentration target has to be negotiated. As we shall see, the eight policy proposals assessed in this report differ widely on this issue.

Some suggest that such a target should only be introduced later in the process, when there is greater scientific certainty about what level of GHGs would be dangerous. Then there are those who argue that an aspirational concentration target should be borne in mind throughout the process, but not used as a formal basis for policy.

But it is difficult to envisage how the 1992 Convention's objective of stabilising concentrations in the atmosphere stands any chance of being achieved without first going through the process of defining the level at which concentrations should be set. Stabilisation will not happen by accident. In this light, it may be concluded that a formal, binding concentration target is absolutely necessary. This is a position supported by former UNFCCC Executive Secretary Michael Zammit Cutajar, who said in an interview during the reconvened COP6 talks in Bonn that the most important task for policy-makers was to set a concentration target that would "give a sense of direction" to the process.

An atmospheric concentration target would also provide the additional benefit of making clear the scientific basis for climate change policy. With Kyoto, there is no scientific rationale for the reduction target of 5.2 per cent by 1990 levels – a major reason why it has been so easy for parties to dilute this in practice through concessions on carbon 'sinks' and other areas.

The stakes are simply too high to leave climate policy to chance. The longer countries delay implementation of a formal target, the higher concentrations will climb, until eventually the world will discover that stabilisation at 450ppmv or even 550ppmv is no longer a possibility. Kyoto does no more than slow the growth of emissions by a tiny amount. It does not begin to approach actual overall global reductions.

The only way forward is an approach predicated on retreating from carbon dependency. A political, rather than scientific, starting point will condemn the process to a continuation of the "beggar my neighbour" approach to national emissions reductions that typified the Kyoto negotiations.

The only sensible approach is to set an initial concentration target, but allow for annual review of the limit on the basis of the latest science. This could mean that a high initial target, such as 550 parts per million by volume (ppmv), could be ratcheted down in future if later scientific assessments show that the situation is worse than had been thought.

Environmental effectiveness – measured in terms of the ability of a policy to stabilise atmospheric concentrations of GHGs – is in this sense the overriding priority of international climate policy. Political considerations of equity, efficiency and so on must take second place to this priority: there would be little point in implementing a politically feasible approach that isn't up to the environmental job in hand.

The politics of climate change

From the start of the climate change process, the question of how to differentiate commitments between parties – deciding who gets to emit what – has been controversial, particularly when it came to the issue of developing countries taking part. On the one hand, it is difficult to escape the fact that, as IPCC Working Group I chair Sir John Houghton pointed out: "A global problem such as climate change requires a global solution".[vii] Full assurance of global emissions reductions will ultimately, and by definition, need all countries to accept quantitative limitations on their ability to emit GHGs.

At the same time, developing countries have justifiably argued that they have contributed far less to the problem of climate change than prosperous nations. Indeed, developing countries still have lower per capita emissions and lower standards of living, and stand to lose out most from climate change.

Some commentators have used these observations to argue that wealthy industrialised countries have accumulated an 'ecological debt', which is often contrasted with the issue of developing world financial debt.

But it is not only developing countries that have used the equity argument. On March 13 2001, U.S. President George Bush said that "I oppose the Kyoto Protocol because it exempts 80 per cent of the world, including major population centres such as China and India, from compliance, and would cause serious harm to the US economy … there is a clear consensus that the Kyoto Protocol is an unfair and ineffective means of addressing global climate change concerns".[viii]

Another dimension of the equity debate relates to the question of equity in damages for climate change. As IPCC chair Bob Watson recently pointed out: "Climate change is likely to impact disproportionately upon the poorest countries and the poorest persons within countries, and thereby exacerbate inequities in health status and access to adequate food, clean water and other resources."

Some commentators have even suggested that industrialised countries that fail to play an adequate role in climate change mitigation should be taken to court for their actions, although the legal basis for such a challenge is not yet clear.

Clearly, the vexing question of what is equitable is recognised by all sides as a key question in the climate debate. Indeed, equity is highlighted as a central element of climate change policy in the 1992 Convention, along with precaution in the form of stabilising atmospheric GHG concentrations, as we saw in the last chapter. Article 3 of the Convention, which deals with principles governing the process, states that parties should act "on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities".

The Convention also makes special provision for the "specific needs and circumstances of developing country parties" in Article 3.2 as well as for technology transfer and financial assistance in Article 4.

What do we mean by equity?

Equity is almost universally acknowledged as a key element of the debate, but there is much less consensus over what the term actually means. A good starting point is a typology developed by a team of researchers at CICERO in Norway, which includes no less than five different equity principles that might be used[ix]:

1. *Egalitarian:* people have equal rights to use the atmosphere.
2. *Sovereignty:* current emissions constitute a status quo right now.
3. *Horizontal:* actors under similar economic conditions have similar emissions reduction commitments.
4. *Vertical:* the greater the capacity to act or the ability to pay, the greater the economic burden.
5. *Polluter pays:* the greater the contribution to the problem, the greater the burden.

There is, therefore, a wide range of opinion on what constitutes equity in the context of climate change, and at times the entire discussion can seem like a rhetorical library of justifications for any position on how entitlements should be allocated between countries. Yet some general observations can still be made about equity.

One is that, whilst it is difficult to agree on what is equitable, it can be easier to agree about what is manifestly inequitable. This is a theme that will be returned to in the next chapter, when specific the equity dimensions of specific proposals are assessed.

Another is that equity should logically be subordinated in climate change policy to the more fundamental objective of environmental precaution. The over-riding objective of the UNFCCC is, as discussed in the previous section, to stabilise atmospheric concentrations of GHGs. Whilst equity is a crucially important consideration, it is second to environmental effectiveness: a treaty that is equitable but environmentally useless is not worth having.

Finally, there is a critically important dimension of realpolitik to the equity debate in climate change. There are many different versions of equity, none of which will ever be agreed as a universal moral norm. So the challenge is to find a workable equity that can in practice be agreed as a logical compromise between the various competing versions. This position will need to fall somewhere between historical responsibility and ecological debt on the one hand and pure equality of burden on the other.

In essence, climate change policy therefore boils down to the two challenges discussed above – what is a safe level of CO_2 in the atmosphere, and who gets to emit what? We now look at eight proposals that each try, in their own ways, to answer these two crucial questions.

KYOTO PLUS PROPOSALS

The concept
The Kyoto Protocol was agreed in 1997, five years after the original Climate Convention was signed, and following tortuous negotiations that had been underway since 1995. Like the Climate Convention before it, Kyoto mandated emissions reductions – but unlike the Convention, Kyoto's targets were to be legally binding.

The main outcome of Kyoto was that developed (or 'Annex I') countries agreed collectively to cut their emissions to 5.2 per cent below 1990 levels by 2010. But Annex I countries also agreed to share the burden of this reduction: so the European Union agreed a reduction of 8 per cent, the United States 7 per cent, and Japan 6 per cent, for example. Australia, meanwhile, successfully negotiated an increase in its allowed emissions, arguing that its high dependence on its coal industry meant that it deserved more lenient treatment.

Kyoto also left the way open for future emissions reductions beyond its First Commitment Period – the period up to 2010 – and agreed that there should be a review of 'adequacy of commitments' before 2008. At first glance, therefore, one of the most obvious ways to develop climate change policy after Kyoto's First Commitment Period would be simply to have a Second Commitment Period, and so on as envisaged in the original protocol.

One problem defining what is meant here by a 'Kyoto Plus' approach is that so many different options exist beneath that banner. In some scenarios, all developing countries could join for a Second Commitment Period. In others, only richer developing countries would take on quantified targets immediately after 2012. Some scenarios could use defined thresholds for participation where others would not. Some would use efficiency targets as an interim measure for some or all developing countries where others would not. Some approaches would use different typologies again such as the 'must act now / could act now / should act now, but differently' approach proposed by the Pew Centre in the United States.[x]

There is, then, a plethora of options within the 'Kyoto box'. Yet there are common features to all Kyoto Plus scenarios as defined here. One is increasing participation in quantified targets beyond just Annex I (rich industrialised) countries. Such targets would be expressed in terms of a baseline year of emissions, which could be 1990 (as under the Kyoto Protocol) or conceivably some other year – although this would make the process more complicated and this option has not been widely suggested.

Another precedent set by Kyoto is that emissions entitlements are not distributed according to some standard allocation formula – unlike either Contraction and Convergence or Müller's Preference Score approach, both assessed later in this report – but are instead the result of negotiations between countries. This is argued by many of Kyoto's proponents to be the most – or indeed the only – politically realistic way of carrying on with climate commitments.

Kyoto is also noteable for its various flexibility mechanisms, particularly emissions trading, Joint Implementation and the Clean Development Mechanism, as well as the 'bubbling' provisions that allowed the European Union to accept a single emissions reduction target and then share it out between member countries in regional negotiations.

Although efficiency targets could be included as an element of a 'Kyoto Plus' approach, they are not considered in detail in this section since they are generically discussed separately elsewhere in this report in the section on *WRI's Carbon Intensity Proposal.*

Can it work?
Environmental dimensions
Regardless of the precise shape of any Kyoto Plus scenario that might be implemented for the Second Commitment Period and beyond, a number of observations can be made about their environmental integrity.

Simply put, Kyoto's First Commitment Period is inadequate in environmental terms. Its target of 5.2 per cent GHG reductions against 1990 levels, for rich countries only, is a very long way from the cuts of 60 per cent called for by scientists. The discrepancy between these figures is evident even before the modest cuts agreed under Kyoto have been diluted by concessions made at the reconvened COP6 negotiations in Bonn, or the fact that the world's largest emitter has pulled out of the process.

This much is uncontroversial, for even the staunchest of Kyoto's proponents agree that it's no more than a first step. The corollary question is therefore whether cuts made under possible future Kyoto Plus approaches will begin to approach the scale the scientists say is necessary.

Perhaps there is no fundamental reason why the emissions reductions under a Kyoto Plus system might not be ratcheted up later to approach the scale needed for stabilisation of atmospheric concentrations of GHGs. To be sure, full global participation will ultimately be needed, as IPCC chair Sir John Houghton and others have repeatedly argued. But why should fuller participation not be achieved gradually as it becomes politically feasible for developing countries to come on board?

Leaving aside for the moment the issue of political feasibility, which is considered below, there are two compelling environmental reasons why the Kyoto Plus approach is unsatisfactory.

The first is that the cuts agreed under the Kyoto system are not related to the cuts mandated by environmental scientists, but instead represent the most that parties feel prepared to offer given political obstacles. There is no reason to assume that emission cuts agreed in future commitment periods would be any more demanding. Defenders of Kyoto tend to assume that cuts will become more palatable politically as time goes on – yet, as the section on political dimensions below shows, there is little reason to think so.

A science-based approach would start instead by working out the scale of emissions reductions required by using a formal concentration target, and only then turning to political questions of emissions entitlements.

The second critical flaw with gradually increasing participation is that the world hasn't enough time for an experiment to see whether developing countries will unexpectedly reverse their current and very clear opposition

to quantified targets.

It is highly unlikely that developing countries would regard their wealthy counterparts as having 'taken a lead' on combating climate change by the time of the Second Commitment Period, given the very low scale of emissions reductions in the preceding period and the fact that the USA has opted out of the process.

Meanwhile, emissions are continuing to grow globally, and atmospheric concentrations are increasing too. The longer the world pursues an approach of 'wait and see' about full participation in climate commitments, the higher concentrations will climb, until eventually stabilisation at 450ppmv or even 550ppmv is no longer a possibility.

Put simply, there is not enough time to waste on political machinations. It is already three years since the heads of the US National Ocean Atmosphere Administration and the UK Meteorological Office said that: "We are in a critical situation and must act soon."

Political dimensions

As mentioned above, the level of emissions reductions under the Kyoto system derive from political haggling rather than from science. Political feasibility is therefore traded off directly against environmental integrity: the higher cuts are for each country, the less likely the country is to agree. This is not a sound dynamic for the basis of policy in an area of such critical importance as climate change.

The negotiation of Article 3 targets at Kyoto was an undignified mess of horse-trading and racing for derogations. As the Bonn negotiations showed, this scramble for special exceptions did not end in Kyoto. Not only did negotiations revolve around reductions which were very modest indeed, they were also for developed countries only, and even this unremarkable effort may yet fall apart at COP7 when outstanding issues come up for discussion. It doesn't give confidence in a future under a Kyoto Plus system.

If 37 rich countries could barely agree a 5.2 per cent reduction, what evidence is there that more than 180 countries will be able to agree how to distribute cuts of 60 per cent or more in the absence of any clear constitutional framework?

The obvious conclusion to draw is that negotiations will remain in their complex morass of horse-trading unless concrete steps are taken to simplify negotiations, above all by using one standard allocation formula for entitlements. Otherwise every country will come to the table again armed with a comprehensive briefing paper on why it deserves special treatment and a lighter burden than everyone else.

The argument that 'developed countries taking a lead' represents the most politically feasible way towards involving developing countries also rests on flimsy assumptions. The longer their participation in quantified entitlements is delayed, the more of their carbon budget will be used up by the North – and the less surplus they will have to sell on the emissions trading market when they do take on quantified entitlements. Negotiators may try to bridge this difficulty by allowing developing countries to negotiate increases ('hot air') in order to encourage participation. Yet this hot air will come into circulation just as the need for real reductions in global emissions is more urgent than ever.

How much more sane it would be to avoid this situation ever arising by instead giving developing countries quantified entitlements at an earlier stage, with a surplus to sell, by using a standard allocation formula for entitlements derived from a formally defined concentration target. Political horse-trading can only be avoided by having one rule for all countries on how entitlements should be distributed.

For all the reasons outlined above, Kyoto cannot provide an effective framework for an effective climate policy. Its trade-off between environmental integrity and political feasibility is a framework for failure.

THE BRAZILIAN HISTORICAL RESPONSIBILITY PROPOSAL

The concept
Brazil's historical responsibility proposal, which it suggested in the run-up to Kyoto in 1997, would work by assigning entitlements to countries in proportion to their responsibility for past emissions.

The proposal retains the distinction between Annex I (developed) and Non-Annex I (developing) countries: the former would have quantified entitlements, whilst the latter would not. Annex I countries would between them face an overall 30 per cent reduction target against 1990 levels by 2020, with interim targets set at five yearly intervals in the period up to then.

The burden would then be shared between industrialised nations according to how much of the cumulative temperature change to date they are each responsible for. Countries with a longer history of industrialised development would bear a greater share of responsibility than those with shorter histories of industrialisation: so the UK would face a 63.3 per cent reduction by 2010 against 1990 levels whilst Japan's reduction would be just 9.5 per cent.[xi]

The standard unit in this system is not the tonnage of carbon emitted by each country, but instead a measure of the surface temperature change caused by emissions of carbon. Trading of temperature credits would be allowed in order to allow countries flexibility in meeting their targets. Countries that still exceed their entitlements after trading settlement would be liable to pay a penalty of US$3.33 for each additional tonne of carbon into a 'clean development fund' which would be used to finance mitigation and adaptation projects in the South.

Can it work?
Environmental dimensions
The Brazilian proposal uses units of temperature change rather than just carbon emissions, and this is unique among the eight proposals assessed in this report. Some commentators say this helps environmental integrity because it "makes deriving reduction targets from the acceptable level of climate change easy".[xii]

But the proposal also takes no account of the relative impact of other GHGs and the various climate system feedback mechanisms on global warming. Since scientific findings will inevitably have to be modified over time, this presents a problem for the system, which would be very difficult to revise in the light of new science.

The proposed reduction target for developed countries of 30 per cent by 2020 also seems arbitrary, with no obvious link to scientific assessment of the reductions that need to be made in order to avoid further climate change, and it is unclear what would happen after this date.

Above all, a question mark hangs over the proposal's environmental effectiveness because it has no quantified and binding limitations for developing countries, and hence no fully global framework for controlling atmospheric concentrations.

Without that, the proposal is environmentally incomplete: under a system like that, it would be impossible to predict with any certainty the net global emissions of each year or the ultimate endpoint in terms of atmospheric concentrations of CO2 and other GHGs.

Political dimensions
In one sense, the Brazilian proposal is an attractive model of equity that seems to epitomise the Polluter Pays Principle. It also appears address some of the dimensions of the 'ecological debt' argument referred to earlier, although not to the extent of actually compensating developing countries for damages suffered.

In other ways, though, the Brazilian proposal is also inequitable. First, it takes no account of current emission levels: the USA, with double the per capita emissions of the UK, would face only a third of the UK's reduction commitment because of the UK's longer historical process of industrialisation.[xiii]

Second, there are obvious methodological problems with assembling data on historical emissions, which could penalise Annex I countries unfairly. For example, one assessment points to the potentially very inflated figures for historical responsibility than can be arrived at through the technique of 'backcasting' 1950-1990 emissions.[xiv]

Perhaps most fundamentally, the Brazilian proposal assumes that the fairest and most beneficial course for developing countries is for them to stay out of quantified entitlements. Yet this is open to question. Equity in the Brazilian proposal is taken in the sense of punishment or justice for past misdeeds which, whilst perhaps morally appealing to many developing nations, would not give them an equitable share of the new tradable atmospheric assets created under the proposal.

THE UNIVERSITY OF UTRECHT'S TRIPTYCH PROPOSAL

The concept

The Triptych approach, developed by a team at the University of Utrecht and used by the European Union to help decide EU countries' commitments under Kyoto, is a sector-based approach that "accounts for differences in national circumstances such as population size and growth, standard of living, economic structure and fuel mix in power generation".[xv]

The approach can be used in conjunction with a specific overall emissions reduction target. It was used by the EU to allocate their 8 per cent Kyoto reduction target between member countries.

The Triptych approach distinguishes between three discrete sectors in allocating emissions reductions. The three sectors included in the Triptych approach are energy-intensive industry, power generation, and domestic sectors – which as well as household energy use also includes "the commercial sector, transportation, light industry and agriculture". The sectoral analysis is emphasised as "only a tool" to determine national allowances, with no intention actually to establish sectoral commitments. Triptych's treatment of each of these sectors is set out briefly below.

Energy intensive industry

For this sector, the reduction target would take the form of a commitment to reduce the carbon intensity of heavy industry. An illustrative example cut proposed by the authors is that "all countries [would] reduce their specific CO_2 emission (CO_2 emissions per unit of physical product) by 1.5 per cent per year".

The power-producing sector

In this sector, targets would take the form of decarbonisation requirements within fuel mix. The illustrative assumption here is that "all countries reduce their electricity output generated with solid and liquid fossil fuels by 30 per cent each".

The domestic sector

In this sector, the authors believe an approach of per capita convergence would be most suitable. Their illustrative assumption in this case is that 1990 per capita emission levels for all countries would converge to equal per capita rights by 2030, with a convergence level of 3.44 tonnes of CO_2 (or 0.94 tonnes of carbon) per capita.

The aggregate global reductions in the heavy industry and power generation sectors do not imply flat rate reductions that are the same for all countries. The targets for these sectors differ from country to country, and derive from standard mechanisms that take account of growth assumptions, assessments about national development of different generation sources, and so on.

As with many of the other proposals examined in this report, Triptych would allow emissions trading so that countries with 'spare' emissions beneath their targets could sell them to countries in need of extra permits.

Can it work?

Environmental dimensions

As Triptych was originally used in the EU to distribute commitments as a result of a particular emissions reduction target, it could theoretically be used to distribute entitlements that derive from a global concentration target. But there is a potential problem here in that, even if the initial allocation of entitlements is derived from a global concentration target, the system would be slow to revise these entitlements in the light of newly emerging science.

Whilst carbon intensity targets can be problematic in environmental terms (see the later section on the World Resources Institute's carbon intensity proposal), Triptych uses them as part of an analytical mechanism to determine overall national entitlements that are absolute.

The Triptych approach could be used in conjunction with a global concentration target, although it is far from clear how national entitlements would be revised if the science assessment worsened over time.

Political dimensions

The Triptych methodology does try to implement a standard allocation mechanism for entitlements, which might avoid some of the horse-trading and 'race for derogations' that have bedevilled negotiations to date. But it fails because the sector-based allocation system locks in favourable treatment for those countries with larger heavy industry sectors.

This in turn means that, in a global allocation of finite atmospheric property rights, some countries will receive higher per capita rights than others – specifically because Triptych relies not just on per capita allocations, but also on carbon intensity based 'dollar allocations' arising in the heavy industry and power generation sectors.

Triptych's political failure arises from the failure to make adequate distinctions between per capita efficiency and dollar efficiency. Allocations are made not just according to how many people a country has, but also according to how rich it is reinforcing status quo ante inequalities through the creation of a wholly new property right.

It is difficult to see that such an approach would, in a global context, stand a high chance of acceptance by developing countries. Triptych may have fared well in the context of the EU, but global allocations are very different.

ECN AND CICERO'S MULTI-SECTOR CONVERGENCE PROPOSAL

The concept
The Multi-Sector Convergence approach (MSC) is based on three organising principles, according to its authors at two European research institutes (ECN in the Netherlands and CICERO in Norway).[xvi] These are that:

1. It is based on a sectoral analysis of the national economy.
2. It assumes the need for eventual global convergence.
3. It allows for additional allowances to be given to "countries facing specific circumstances".

These principles are then used to define a four-stage approach to defining national entitlements:

1. Distinguishing between different sectors
2. Setting global emission norms
3. Deciding national emission mitigation targets
4. Including allowance factors

The MSC approach aims to be flexible and transparent, but also leaves "ample space for adjustment as a result of prospective climate change negotiations and evolving scientific findings".[xvii] Thus the convergence level, as well as the date, can be open for political negotiation, as well as "country-specific emission factors".

In essence, the approach works as follows. CO_2 equivalent emissions (for CO_2, CH_4 and N_{20}) are calculated for seven sectors: power, industry, transport, households, services, agriculture and waste. It starts from 1990 data and then applies specific mitigation rates to each sector to work out emission allowances – for both sectoral and national levels – for the next budget period. This approach also means at this stage that allowances can be adjusted to take account of specific conditions, and for mitigation rates in rolling over commitments from one budget period to the next.

Can it work?
Environmental dimensions
As with Triptych, it would be possible to arrive at emissions cuts based on a specific, defined atmospheric concentration target. But targeting an atmospheric concentration of GHGs is just one potential application of the MSC approach: it is not an integral design feature of the approach. This implies that it would be equally possible to use the MSC in a manner that did not guarantee environmental integrity, by starting with whatever bottom up cuts and country-specific allowances seemed politically feasible, and working out what sort of atmospheric concentration this would lead to. This might mean a failure to hold environmental integrity as the overriding priority of climate change policy.

Political dimensions
The MSC approach comes closer than most of the other proposals assessed in this report to delivering a politically feasible policy framework for addressing climate change. The system would use a formal framework to define targets, reducing the potential for political horse-trading. Also, as noted earlier in this section, it would 'in principle' set an ultimate objective of convergence at equal per capita rights to the atmosphere.

But although the MSC approach reduces the potential for horse-trading, it doesn't get rid of it altogether. The system's overriding political problem is that – like Triptych – it allows for potential derogations and 'special exemptions' within the formal allocation framework.

In this sense, the MSC approach comes painfully close to managing to close Pandora's Box, only to open it again with a get-out clause for any country that might object to a straightforward convergence by a set date at equal per capita entitlements. Every country could hence be expected to begin an assiduous search for special circumstances that would allow it more advantageous treatment.

The MSC approach is thoughtful, well-intentioned and clearly the result of meticulous research. Yet despite its intention of creating a standard allocation framework for all countries, the approach ultimately fails by trying to make the approach more flexible through provisions for sectoral or national derogations.

DAVID VICTOR'S PRICE CAPS PROPOSAL

The concept

David Victor, a senior fellow at the Council on Foreign Relations in New York, sets out his proposal for a price cap-based approach to international climate change policy in his book *The Collapse of the Kyoto Protocol*.[xviii]

Victor's critique of Kyoto is centred on the institutional architecture of the treaty, and particularly its inclusion of an emissions trading scheme. The problem with such a scheme, he says, is that it is almost impossible to solve the political problem of how emissions entitlements should be allocated between countries. He also argues that emissions entitlements should not be given to developing world countries, and should instead be limited to OECD countries. At the centre of his argument is the assertion that Kyoto's fatal flaw is its failure to address the problem of cost control, a prime concern for many industrialised countries.

Victor's alternative is to propose a system of quantified targets for developed countries that includes emissions trading but also, crucially, sets a cap on the price of emissions permits on the international market:

> "Governments would set targets for emission quantities and create an emissions trading system. At the same time, they would also agree on a maximum price for the tradable permits. Any government that participates in the system could issue and sell new emission permits at the agreed price. If the trading price rises above the target price then firms could purchase new permits from governments at the target price. If the trading price dips below the target price then firms could simply purchase less costly permits on the open market. In effect, the target price would cap the cost of acquiring permits and thus also give firms greater surety about the cost of compliance."

Can it work?

Environmental dimensions

As any economist can attest, price caps tend to create distortions in the normal operation of supply and demand within a market, and something has to give. Unfortunately, in the case of David Victor's proposal, the factor that 'gives' is the scheme's environmental effectiveness.

It is impossible to see how a scheme can be effective if it gives governments the right to print additional emissions permits just at the moment when meeting targets becomes more challenging.

Victor does not duck the issue of concentration targets. He argues that:

> "[T]he Kyoto approach of capping emissions at particular quantities makes sense only if the objective of international efforts to slow global warming is to avert a catastrophe that would be triggered by a certain accumulation of emissions in the atmosphere. Governments would identify the dangerous threshold, cap emissions below the level, and allow trading so that firms could meet the cap at the lowest cost."

This, he allows, was precisely the approach envisaged by the 1992 Convention. Yet, he continues, this approach is unworkable:

> "It is not (yet) possible to identify particular thresholds that would trigger horrible climate changes. Worse, if governments set short-term emission caps too tightly they may force their economies to bear extremely high costs of cutting emissions more rapidly than can be achieved with the orderly turnover of capital stock."

But, as we discussed earlier, this is no reason to avoid setting a concentration target. Indeed, it makes a concentration target all the more necessary – and one that can be revised annually in line with newly emerging science assessments. Victor does not deny that there is a dangerous level of concentrations in the atmosphere – he merely says that we don't know what this level is. This situation calls for a precautionary approach involving the initial definition of a 'best guess' ceiling, not by ducking the issue altogether.

Political dimensions

Victor's solution might well prove politically feasible to implement in the short term, given the indulgent terms that it would offer to those countries accepting targets. Yet there would be no point in implementing a framework that might be politically feasible but could not achieve the environmental objective set by the 1992 Climate Convention.

The longer-term political feasibility of Victor's proposal is also dubious. As outlined above, the framework excludes developing countries from commitments at this stage. Yet this approach merely stores up problems for the future. As discussed in earlier, developing countries have to accept quantified commitments in order to guarantee the environmental integrity of any policy framework: a global problem needs a global solution.

As a final word on the 'allocations issue', it is interesting to note that at one point in his book Victor observes that "in a crisis these problems [of allocations] might be solved". Quite what Victor would term a 'crisis' is not entirely clear, least of all to the people of the South Pacific island state of Tuvalu, who due to rising sea levels have already had to begin planning the evacuation of the entire population to another country. But the unwitting effect of Victor's observation is to add weight to the argument for the political and environmental need for a standard allocation mechanism.

THE WORLD RESOURCES INSTITUTE'S CARBON INTENSITY PROPOSAL

The concept

The World Resources Institute in Washington DC has devised a proposal for voluntary developing country participation based not on absolute caps an GHG emissions, but on targets related to the carbon intensity of national economies – the amount of emissions produced per unit of gross domestic product. The climate policy that President Bush controversially announced for the United States in February 2002 is a variation on WRI's proposal.

WRI's starting point for this proposal is that absolute caps on developing countries' emissions are problematic for a number of reasons, mainly because accurate data on national emissions often doesn't exist, and also because absolute caps on emissions – of the kind accepted by Annex I countries under the Kyoto Protocol – may not be appropriate for countries "experiencing high or volatile rates of economic growth".[xix]

WRI suggest instead the "more realistic and practical framework" of basing participation not on absolute caps but instead on "the emissions that an economy generates per unit of output" – in other words, the economy's carbon intensity. This would avoid the allocation problems of the Kyoto Protocol and the potential for developing country 'hot air' to undermine the integrity of Annex I targets by emissions trading.

Can it work?

Environmental dimensions

Carbon intensity based targets are, according to WRI, "a possible next step, but not the last step". This "possible next step" would "help address the real climate challenge in developing countries, namely decoupling economic development and GHG emissions growth". The case of China, with its declining emissions intensity, is cited as a proof that such a decoupling is possible, together with the observation that as countries develop they tend to move more into lower-emitting service industries more than manufacturing.

But this argument has serious flaws. It is probably true that countries tend to move into service industries and lower their GHG intensity, but this doesn't imply any reduction of net emissions, which is of course the point of any climate change process. It just implies a proportionately larger service sector, and does not even necessarily imply increased energy efficiency in the manufacturing sector. If net emissions continue to rise, then the problem gets worse. This raises the question of why WRI proposed a carbon intensity approach as a 'next step' rather than simply going without further delay to the 'last step' of a concentration target and absolute caps for all countries.

But using environmental integrity arguments about hot air to arrive at a conclusion about carbon intensity targets is profoundly flawed. Even if developing country targets did result in generous hot air allowances, we could at least still predict the aggregate level of global emissions – a factor conspicuously lacking from carbon intensity targets.

Political dimensions

WRI is correct that 'hot air' can be a problem in the absence of a clear allocation formula – as Australia's allowed increase in emissions under the Kyoto Protocol shows clearly. They are also right that adequate incentives must be provided for developing countries to take on quantified entitlements. Yet a better solution to this dilemma would be to have one clear rule for all about how entitlements are pre-distributed.

WRI's approach is also politically problematic because it doesn't solve the problem of the level at which developing country intensity targets should be set. In the absence of any guiding principles, there is every chance that negotiations on the level of intensity targets would themselves be beset by horse-trading and a race for derogations as much as Kyoto, which would dilute an already weak proposal.

Most of all, though, WRI's proposal is problematic politically. Like Kyoto, it would restrict ownership of tradable emissions entitlements to developed countries. Whilst this might seem politically easier in the short term, it will undoubtedly result in huge political difficulties in the longer term when developing countries finally do take on emissions. By that point, a worsening climate outlook could mean that developing countries would have minimal, if any, surplus emissions to sell, drastically lowering incentives for taking part just when it would be environmentally most urgent that they should. In this sense, 'stopgap' options that put off the date when developing countries take part are as problematic politically as they are environmentally.

BENITO MÜLLER'S PREFERENCE SCORE PROPOSAL

The concept

Benito Müller, a senior research fellow at the Oxford Institute for Energy Studies, proposes a policy framework that is proportionate to the status quo (known as 'grandfathered'), and also uses per capita allocations – using ratios to decide on emissions allocations.[xx]

Müller's preference score approach tries to reach a compromise between the two antithetical positions of grandfathering and per capita through a 'voting system' for each of the two allocation proposals.

Once countries have voted for which allocation mechanism they prefer, a weighted arithmetic mean of the accepted base-proposals is used to decide final allocations. An example is shown below.

As the table shows, the system allocates each country a vote – to be cast for either grandfathering or per capita – which is then weighted according to the country's population. The resulting ratio of population 'votes' for each proposal is then used to define the slices of the global carbon 'cake' received by each country.

Under a **pure per capita** system, with this methodology, Non-Annex I countries would receive an allocation of 78 per cent of permits, compared to 22 per cent for Annex I. Under a **pure grandfathered** system, Non-Annex I countries would get 39 per cent of permits whilst Annex I countries would get 61 per cent.

The **synthesis** preference score outcome is produced by weighing Non-Annex I preferences (with 75 per cent of the votes) for a per capita system against Annex I preferences (with 25 per cent of the votes) for a grandfathered system to produce a final allocation of 31 per cent of permits for Annex I countries and 69 per cent for Non-Annex I countries as a compromise option (which is 'three quarters per capita and one quarter grandfathered').

Can it work?

Environmental dimensions

This approach is about allocating a finite global carbon 'cake', so it is reasonable to assume that it could use a formal atmospheric concentration target as the starting point for a definition of total global emissions. Given a concentration target, the preference score achieves the requisite environmental integrity: it addresses the objective of the 1992 Convention of stabilising atmospheric concentrations by deriving allocation from an atmospheric concentration target, thus guaranteeing that an overall global 'contraction curve' is in place – no matter what the starting distribution is or the trading that follows.

Political dimensions

The preference score proposal performs well on environmental integrity, but its political dimensions are more complicated. Müller's proposal achieves compromise through the weighted voting system outlined above. But there is no ultimate end point at which the per capita rights of developed and developing countries converge. Rather, the hybrid compromise situated somewhere between grandfathered and per capita allocations would be maintained indefinitely, which means that inequity would be a permanent feature of the system.

The question then becomes whether this indefinite lock-in of an expedient political deal would be acceptable to developing countries. It may well not be. Status quo emissions reflect current inequalities in international political economy, after all.

This implies that Müller's proposal would lock into atmospheric property rights forever when they may just reflect a passing inequality between North and South. Developing countries have already shown they are very concerned about long-term allocations, so it seems unlikely that they would accept any new atmospheric property rights derived from locking in existing inequalities, even in a slightly watered down form.

Table 1:
'Global Compromise' scenario
Source: Müller 2001a

Annex Ia	**2005 Population** (millions)	**Preference Scores** Per Capita	**Preference Scores** Grandfathering
USA	292	0	292
Japan	127	0	127
EU	378	0	378
EIT	391	0	391
Rest	12	0	12
Non-Annex I			
China	1,304	1,304	0
India	1,082	1,082	0
LDCs	1,569	1,569	0
Rest	944	944	0
Mid. East / N Africa	335	0	335
Total	**6,491**	**4,900**	**1,591**
Preference Score Weights		**0.75**	**0.25**

GCI'S CONTRACTION AND CONVERGENCE PROPOSAL

The concept

The Contraction and Convergence approach was designed by the Global Commons Institute, a London-based think tank.[xxi] Under Contraction and Convergence, all countries would collectively agree a target for a stable atmospheric concentration of carbon dioxide in the atmosphere, such as 450 parts per million. A 'global emissions budget' would then be calculated, derived from the target atmospheric concentration figure. The target would be reviewed annually so that it could be revised with new scientific findings.

Once the 'contraction budget' has been decided, the next question would become how to distribute the entitlements arising within this carbon 'cake' between countries. Under Contraction and Convergence, the allocations of emissions entitlements between countries would converge by a specific date. By that year, entitlements would be allocated in proportion to national population as it was in a specified baseline year. Full emissions trading is also stipulated as a design feature of the concept.

Contraction and Convergence would reduce the complexity of negotiations to two simple variables that would need to be agreed: the target atmospheric concentration of CO_2, and the date at which entitlements would converge at equal per capita allocations. The illustrative figures quoted in this example are shown in the graph on page 17.

Can it work?

Environmental dimensions

As explained above, Contraction and Convergence stipulates an atmospheric concentration target, which as noted throughout the report, is a prerequisite for meeting the 1992 Convention's Article 2 objective of stabilising atmospheric concentrations of CO_2. Contraction and Convergence also stipulates full global participation from the start, which means that all emissions will be covered in a global framework. This is a prerequisite for an atmospheric concentration target to work.

This makes for unquestionable environmental effectiveness, and is in marked contrast to Kyoto's approach of deciding what emissions reductions countries feel able to commit to and only then how much of a cut has thereby been achieved.

Political dimensions

Contraction and Convergence also scores highly on its political dimensions. First, it has the advantage of having one standard allocation formula – the convergence by a specific date at equal per capita emission entitlements for all countries – for defining national emission commitments. This avoids the horse-trading and derogations that have made the Kyoto reductions so inadequate.

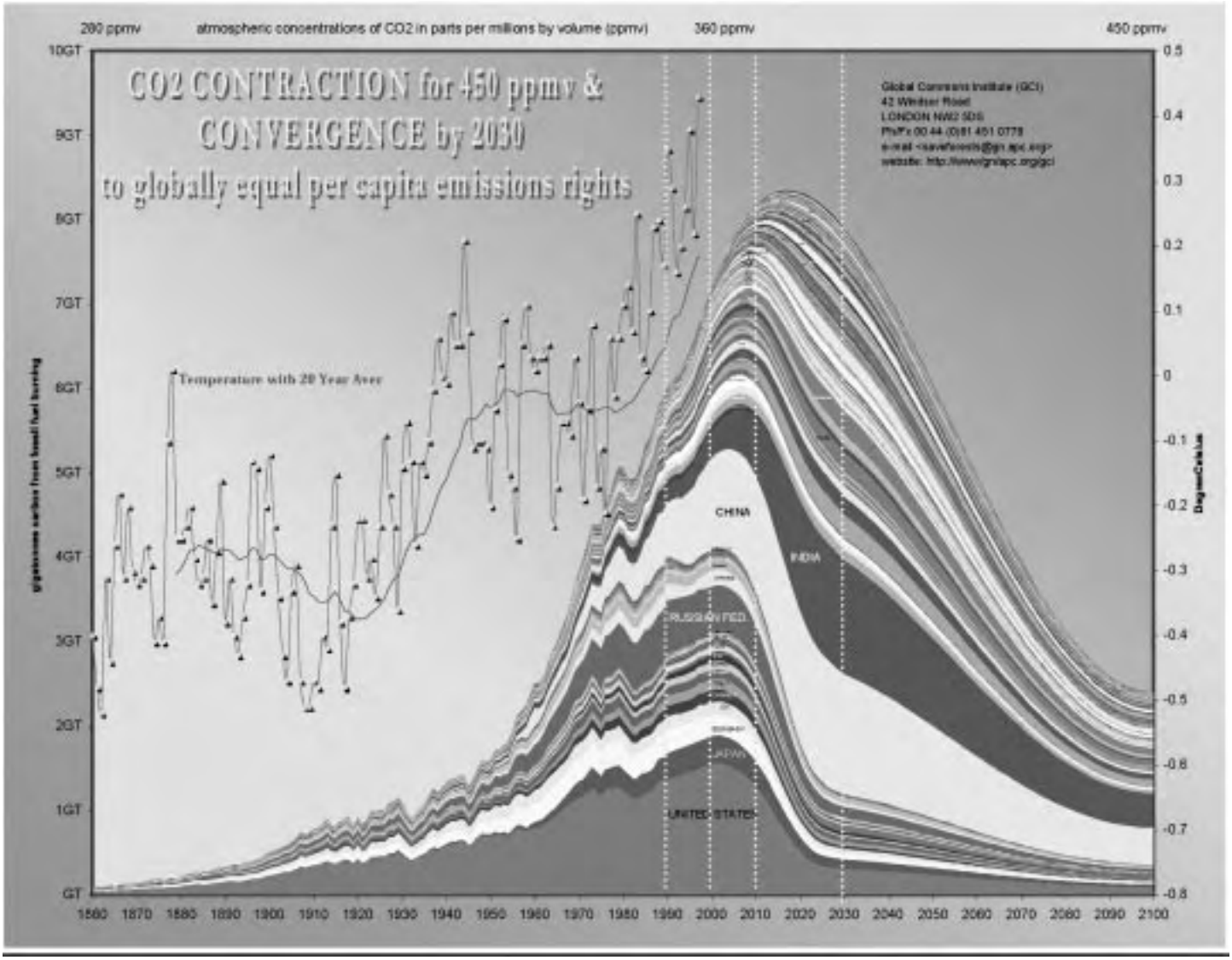
Second, Contraction and Convergence offers clear incentives for involving developing countries early. As explained above, environmental integrity demands a global problem for a global solution. Yet, as discussed earlier, developing countries have consistently refused to take part in a framework that pre-allocates the property rights to this finite carbon budget in a manifestly inequitable way.

By specifying a set date for convergence at equal per capita rights, this approach would give developing countries surplus emission allocations that they could then sell to countries that need extra permits – most of them developed. The problem of 'hot air' would not arise because all trading would take place within the confines of the globally defined carbon budget. The revenue flow from the sale of surplus permits would give developing countries an income flow from climate change policy, which would encourage participation, and would also give these countries an incentive to invest in clean technologies.

Contraction and Convergence and the USA

Interestingly, Contraction & Convergence would also fit with the stated position of the United States. In his statements on climate change, President Bush has consistently set out specific criteria for what sort of treaty the USA would be willing to sign up to, especially emission targets for developing countries and the need for a science-based approach. Contraction and Convergence, with its global participation design and formal greenhouse gas concentration target, is exactly such an approach.

Contraction and Convergence is also fully consistent with the famous 1997 US Senate resolution that stipulated that the USA would not sign up to any treaty that did not include developing countries.



CO_2 Contraction for 450ppmv and convergence by 2030

References: www.gci.org.uk for the model and, www.gci.org.uk/consolidation for current support.

CONCLUSION: TOWARDS A WORKABLE POLITICAL COMPROMISE

International climate change policy can seem hopelessly confusing, with its endless abbreviations, its complex science and its galaxy of arguments about why each country's circumstances are different, and why they should have a lighter burden. Yet it needn't be so.

Once climate policy is led by a formal atmospheric concentration target – which, as concluded earlier, is environmentally indispensable – then it is by definition necessary for all nations, developed and developing, to accept quantified commitments on their emissions. A global concentration target will never be reached unless all parties are on board.

Another inescapable conclusion is that a standard mechanism is needed for distributing emissions entitlements between countries. Kyoto acts as a cautionary tale of what happens without one: negotiations quickly slide into horse-trading and a scramble for special exemptions.

If these two initial assertions are accepted, then it quickly becomes apparent that a Contraction and Convergence approach is the only real option. To see why, consider three different ways in which a global carbon budget can be shared out between the world's countries.

Figure 1 shows one end of the spectrum of possibilities for different commitments beneath a global contraction curve. In this case, convergence is specifically ruled out so that emissions are effectively allocated on a per dollar rather than a per capita basis: in other words, the status quo is deliberately maintained indefinitely. Figure 2 shows the opposite end of the spectrum: entitlements under the contraction curve are allocated on an equal per capita basis as soon as the system goes live: convergence is therefore 'overnight', with no transfer period.

Now, a practical assessment suggests that the developing countries in Non-Annex I would never agree to lock present disparities in emissions into the pre-allocation of tradable emissions entitlements, and do so forever. By the same token, though, it would obviously be equally unacceptable to Annex I countries that they should be expected to converge overnight, with no period of time to implement appropriate policies at the national level. Logic therefore dictates that the political solution lies somewhere between these two polar positions of no convergence or immediate convergence. A compromise is required.

Figure 3 shows one basis on which this compromise could be achieved. In this scenario, national emissions entitlements do indeed converge, but with the compromise element that the convergence takes place not immediately, but over a defined period of time – in this example, by 2030. Negotiators from all countries can therefore work out a compromise based on the date at which eventual convergence will take place.

It might be possible to reach a compromise in a more or less infinite number of ways other than negotiating a formal, binding convergence date. Indeed, the various alternative policy proposals assessed in this report are all examples – to a greater or lesser extent – of other ways of reaching compromise on the allocations issue.

But here Kyoto acts as a cautionary tale. The negotiations revolved around reductions that were very modest indeed. They were for developed countries only, and even this unremarkable effort may yet fall apart at COP7 when outstanding issues come up for discussion, so it doesn't suggest hope for the future under a similar format for negotiations. If 37 rich countries could barely agree a 5.2 per cent reduction, what evidence is there that more than 180 countries will be able to agree how to distribute cuts of 60 per cent or more in the absence of any clear constitutional framework?

The obvious conclusion to draw from this is that negotiations will remain in their current morass unless concrete steps are taken to simplify them, above all by using one standard allocation formula for entitlements. Otherwise each country will come to the table again armed with a comprehensive briefing paper on why they deserve special treatment.

In this sense, there are compelling logical arguments for tackling the problem of different commitments by negotiating just one variable: the date of convergence. The over-riding objective of Contraction and Convergence is not to be 'fair' in itself, or to 'put the world to rights'. It is to set up a constitutional framework to negotiate climate targets that offer some reasonable chance of success, simplifying negotiations to help countries agree. To try to reach compromise instead by allowing country-specific derogations or special exemptions would immediately re-open the Pandora's Box of political squabbles, and effectively condemn the process to failure.

Why delay is not an option

The decision to undertake Contraction and Convergence will require a level of political resolve which hasn't been seen so far in multilateral environmental negotiations. Many will argue that while international policy will in the end need to rest on the principles of Contraction and Convergence, a climate policy like that is unrealistic in the short-term. Would it not be better to opt for an evolutionary approach in the meantime, perhaps along Kyoto lines? Even if such proposals are not the definitive answer to climate change, aren't they at least a step in the right direction?

But this 'softly softly' approach is increasingly untenable. First, atmospheric concentrations of greenhouse gases are rising inexorably, and so is the damage caused by climate change. The longer a fixed target is delayed, the higher atmospheric concentrations will climb. There is therefore a high risk that carrying on prevaricating will rule out any possibility of stabilising concentrations at 450 or even 550ppmv.

Second, positive feedbacks in the climate system could start any time,

Figure 1: Global emissions contraction with entitlements reduced always proportional to initial GDP

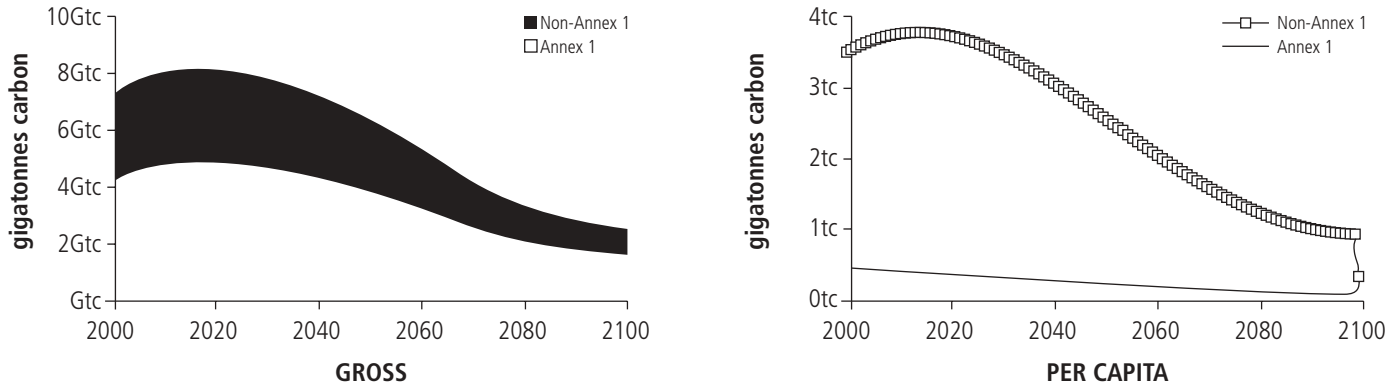


Figure 2: Global contraction with entitlements reduced always proportional to initial population

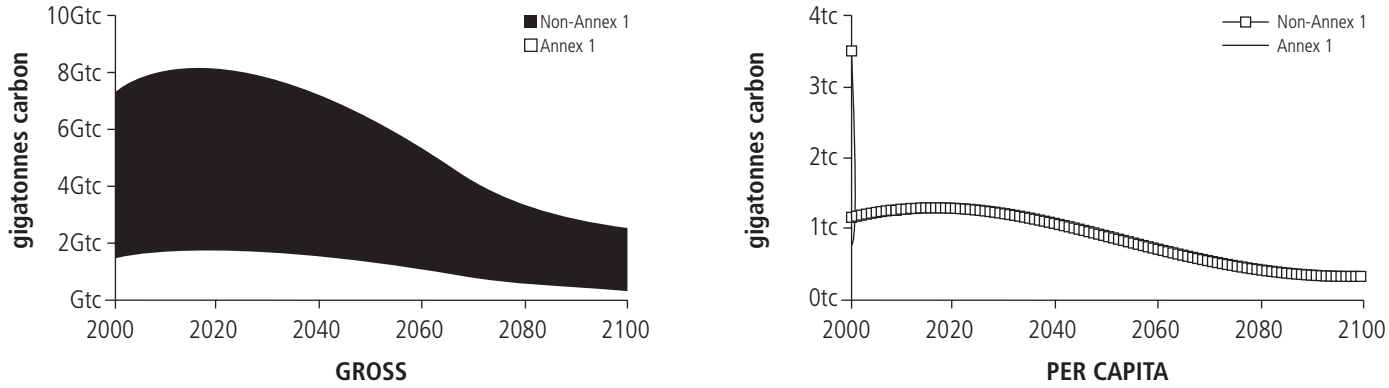
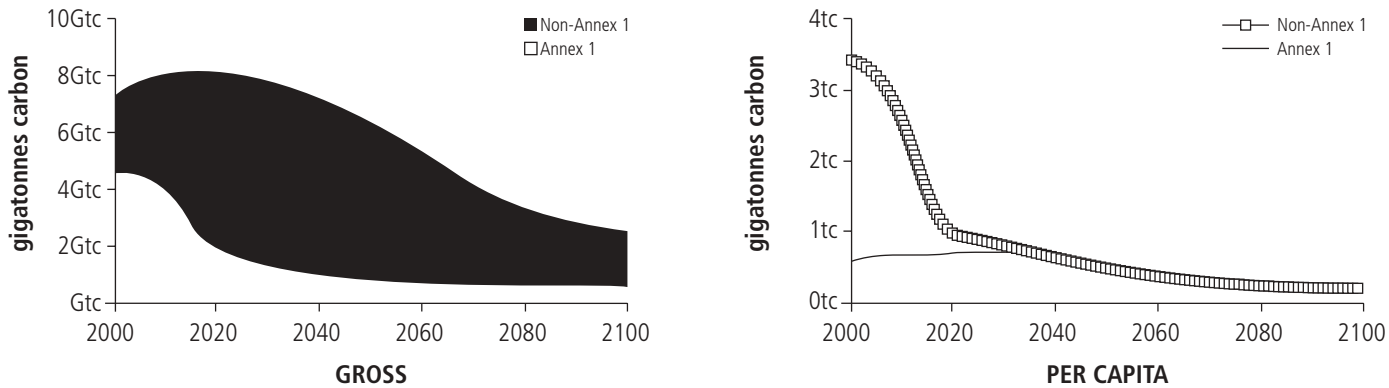


Figure 3: Contraction and Convergence with convergence date of 2030



with the potential for a catastrophe 'runaway greenhouse effect' scenario. Third, we don't know what atmospheric concentration these positive feedbacks will start at. Despite the fact that scientists' understanding of these dynamics is improving all the time, we are still essentially working without a clock, and no-one knows how much time we have left.

The political need for urgency

Environmental drivers are not the only reason why delay is no longer an option. There is also a strong political basis for proceeding with Non-Annex I participation on the terms outlined above sooner rather than later, and for distrusting evolutionary approaches.

As we saw in the discussion on equity earlier, it is often argued that developed countries should take a lead in combating climate change, to be joined in due course by developing countries accepting quantified targets. But, whilst many G77 countries may be happy enough with such an approach for now, the ever-increasing risk of catastrophic climatic events means that they have to take part sooner or later.

Despite all of the uncertainties about climate science, there is every chance that the projections will become worse as the decades go by. As time goes by, it will probably become necessary to make faster and deeper reductions. In other words, the downward slope of the contraction curve will become steeper – and the size of the global carbon budget diminish – just when participation by developing countries in quantified commitments would be most urgent.

In this scenario, therefore, the diminished carbon budget would mean that developing countries would have far lower entitlements – even under an immediate convergence scenario – than they would have done had they been allocated quantified commitments at an earlier stage. A climate policy based from the outset on a constitutional framework for formal convergence would provide the additional benefit of offering developing countries a surplus that could be sold on the international emissions market. In a late participation scenario, on the other hand, the smaller carbon budget would mean that any surplus for developing countries would be far lower – if indeed there was one at all.

The reaction of developing countries to such a situation would be fairly predictable. The surplus emissions they could have owned and sold had, in effect, been used up by Annex I countries, without any payment. Developing countries might reasonably feel that Annex I countries were doing precisely what they had said throughout the climate process that they would not do – 'pulling the ladder up after them'.

The irony of such a scenario would be painful. By persevering with a strategy geared towards making sure developing countries take part, the climate process would have lost any chance of 'taking the lead' after all.

This is the central reason why we have to implement both a managed contraction curve, aimed from its inception at a specific CO_2 concentration in the atmosphere, and a convergence date within this that is capable of being accelerated. The alternative means waiting until feedback kicks in and then having to make sudden, sharp adjustments in the overall emissions profile and dealing with the distributional chaos that would result.

The world has no time to waste on short-term palliatives offered for purposes of political expediency. As the EU Commissioner for the Environment, Margot Wallstrom, said before this year's Bonn talks: "We can negotiate with each other, but we cannot negotiate with the weather." The people of Tuvalu know this truth better than most. Whether the rest of humanity realises it early enough is ultimately a simple matter of choice.

BIBLIOGRAPHY

Agarwal, A. and Narain, S., 1991. *Global Warming in an Unequal World, a case of colonialism* (Delhi: Centre for Science and Environment).

Anderson, D., Clark, C., Foxon, T., Gross, R. and Jacobs, M., 2001. *Innovation and the Environment: Challenges and Policy Options for the UK* (London: Imperial College Centre for Energy Policy and Technology & the Fabian Society).

Axelrod, R., 1997. *The Complexity of Cooperation: Agent-Based Models of Competition and Collaboration.* (Princeton: Princeton University Press).

Baumert, K., Bhandari, R. and Kete, N., 1999. *What might a Developing Country Commitment Look Like?* (Washington DC: World Resources Institute).

Berk, M. and Elzen, M. den, 2001. Options for differentiation of future commitments in climate policy: insights from the FAIR model. Submitted to *Climate Policy.*

Berk, M., Gupta, J. and Jansen, J., 2001. *Options for Differentiation of Future Commitments under the Climate Convention – examples of a comprehensive approach* (Bilthoven: Dutch National Institute of Public Health and Environment (RIVM)).

Böhringer, C. and Welsch, H., 1999. *Contraction & Convergence – Contraction and Convergence of Carbon Emission: The Economic Implications of Permit Trading* (Mannheim: Centre for European Economic Research (ZEW)).

Böhringer, C., 2000. *Contraction and Convergence of Carbon Emissions: An Analysis of the Economic Implications* (Mannheim: Centre for European Economic Research (ZEW)).

Christian Aid, 2000. *The Kyoto Climate Fraud. What's wrong with the Kyoto Protocol? A developing country perspective* (London: Christian Aid).

Claussen, E. and McNeilly, L., 1998. *Equity and Global Climate Change: the complex elements of global fairness* (Arlington: Pew Center on Global Climate Change).

Cooper R., 1998. Toward a Real Global Warming Treaty (The Case for a Carbon Tax). *Foreign Affairs,* March/April 1998.

Corner House, 2001. *Democracy or Carbocracy?* Corner House Briefing 24, September 2001.

Elzen, M. den, Berk, M., Shaeffer, M., Olivier, J., Hendriks, C. and Metz, B., 1999. *The Brazilian Proposal and other Options for International Burden Sharing: an evaluation of methodological and policy aspects using the FAIR model* (Bilthoven: Dutch National Institute of Public Health and Environment (RIVM)).

Evans, A., 2001a. Climate Change: The Way Ahead. *(Paper presented to Pew Center "Equity and Global Climate Change" conference,* Washington DC, 17 April 2001, http://www.pewclimate.org)

Evans, A., 2001b. Why Contraction & Convergence is the Framework to Solve Global Climate Change. Submitted to *Journal of the Commonwealth Human Ecology Council.*

Fromm, E., 1974. *The Anatomy of Human Destructiveness* (London: Pimlico Books).

Groenenberg, H., Phylipsen, D. and Blok, K., 2000. *Differentiating the burden world wide: global burden differentiation of GHG emissions reductions based on the Triptych approach* (Utrecht: University of Utrecht).

Groenenberg, H., 2001. *Differentiation of Commitments.* In Tiempo 38-39, June 2001.

Grubb, M., Vrolijk, C. and Brack, D., 1999. *The Kyoto Protocol: a Guide and Assessment* (London: Royal Institute of International Affairs).

Grubb, M., 2001. A Constructive Scheme Unravelled? – review of The Collapse of the Kyoto Protocol and the Struggle to Slow Global Warming by David Victor. In *Nature* 410, 12 April 2001.

Hadley Centre, 1998. *Climate Change and its Impacts: some highlights from the UK research programme – a first look at results from the Hadley Centre's new climate model.* Hadley Centre paper (www.metoffice.gov.uk/sec5/sec5pg1).

Holden, B. (ed.), 2000. *Global Democracy: Key Debates* (London: Routledge).

Houghton, J., 2001. Global problems require global solutions. *Royal Society News,* May 2001.

Intergovernmental Panel on Climate Change, 2001. *Third Assessment Report* (Cambridge: Cambridge University Press).

Jansen., J., Battjes, J., Sijm, J., Volkers, C. and Ybema, J., 2000. *The Multi-Sector Convergence Approach: a flexible framework for negotiating global rules for national greenhouse gas emission mitigation targets* (Oslo: Center for International Climate and Environmental Research (CICERO)).

Jansen, J., Battjes, J., Ormal, F., Sijm, J., Volkers, C., Ybema, J., Torvanger, A., Ringius, L. and Underdal, A., 2001. *Sharing the Burden of Greenhouse Gas Mitigation: final report of the joint CICERO-ECN project on the global differentiation of emission mitigation targets among countries.* (Oslo: CICERO Working Paper 2001-05.)

Keohane, R., 1984. *After Hegemony: Cooperation and Discord in the World Political Economy* (Princeton: Princeton University Press).

Kete, N., 2001. What's Fair? (*Paper presented to Pew Center "Equity and Global Climate Change" conference,* Washington DC, 17 April 2001, http://www.pewclimate.org).

Lammi, H. and Tynkkynen, O., 2001. *The Whole Climate: Climate equity and its implications for the North* (Turku: Friends of the Earth Finland).

Leggett, J., 1999. *The Carbon War: Global Warming and the End of the Oil Era* (London: Penguin Books).

Meira Filho, Luiz Gylvan and Gonzalez Miguez, Jose Domingos, 2000. *Note on the time-dependent relationship between emissions of greenhouse gases and climate change.* (Technical Note. Ministry of Science and Technology, Federative Republic of Brazil, January 2000.)

Meyer, A., 2000. *Contraction & Convergence: the global solution to climate change* (Bristol: Green Books).

Mintzer, I. and Leonard, J. (eds.), 1994. *Negotiating Climate Change: The Inside Story of the Rio Convention* (Cambridge: Cambridge University Press).

Muller, B., 2001a. Fair Compromise in a Morally Complex World. (*Paper presented to Pew Center "Equity and Global Climate Change" conference,* Washington DC, 17 April 2001, http://www.pewclimate.org).

Muller, B., 2001b. *Rejecting Kyoto: A Study of Proposed Alternatives to the Kyoto Protocol* (London: Climate Strategies).

Nath, K. [then Indian Environment Minister], 1995. Letter to heads of delegation prior to COP1. *In litt.,* Global Commons Institute.

Pearce, F., 2001. Climate talks resume amid gloom. *New Scientist,* 16 June 2001.

Philibert, C. and Pershing, J., 2001. Considering the Options: Climate Targets for All Countries. *Submitted to Climate Policy.*

Phylipsen, G., Groenenberg, H. and Blok, K., 1998. *The EU burden sharing after Kyoto: renewed Triptych calculations* (Utrecht: University of Utrecht).

Ringius, L., Torvanger, A., Holtsmark, B., 1998. *Can multi-criteria rules fairly distribute climate burdens? OECD results from three burden-sharing rules.* CICERO working paper 1998:6, Oslo.

Rose, A., Stevens, B. and Edmonds, J, 1997. *International Equity and Differentiation in Global Warming Policy,* Mimeo, Pennsylvania State University, California Energy Commission and Pacific Northwest Laboratory, 31 July.

Sijm, J., Jansen, J., Battjes, J., Volkers, C. and Ybema, J., 2000. *The Multi-Sector Convergence Approach of Burden Sharing: an analysis of its cost implications* (Oslo: Center for International Climate and Environmental Research (CICERO)).

Simms, A., 1999. *Who Owes Who? Climate change, debt, equity and survival* (London: Christian Aid).

Simms, A., 2001. Global Warming: Sue the US now (*The Guardian,* London, July 25; initially published with author erroneously cited as Stephen Timms)

UNFCCC, 1997. Paper no. 1: Brazil; Proposed

Elements of a Protocol to the United Nations Framework Convention on Climate Change, presented by Brazil in response to the Berlin Mandate, UNFCCC/AGBM/1997/MISC.1/Add.3 GE.97-, Bonn.

UNFCCC, 1998. The Kyoto Protocol to the Convention on Climate Change. Climate Change Secretariat/UNEP, UNEP/IUC/98/2, June 1998.

Victor, D., 2001. *The Collapse of the Kyoto Protocol and the Struggle to Slow Global Warming* (Princeton: Princeton University Press / Council on Foreign Relations).

Watson, R., 2001. Equity and Global Climate Change. *(Paper presented to Pew Center "Equity and Global Climate Change" conference,* Washington DC, 17 April 2001, http://www.pewclimate.org

Appendix: Glossary of Abbreviations

AGBM	Ad-Hoc Group on the Berlin Mandate
Annex I	Developed countries with Kyoto Article 3 targets
Non-Annex I	Developing countries without Kyoto targets
CDM	Clean Development Mechanism
COP	Conference of the Parties (to the UNFCCC)
EITs	Economies in Transition (e.g. Russia, Ukraine)
GCI	Global Commons Institute
GHG	Greenhouse gas
GtC	Gigatonnes of carbon
IEA	International Energy Agency
IPCC	International Panel on Climate Change
JI	Joint Implementation
JUSSCANNZ	Country group including Japan, United States, Switzerland, Canada, Australia, Norway and New Zealand
OECD	Organization for Economic Co-operation and Development
SBSTA	Subsidiary Body for Scientific and Technical Advice
UNFCCC	UN Framework Convention on Climate Change
WRI	World Resources Institute

References

i	Watson 2001; IPCC 2001
ii	Watson 2001
iii	IPCC 2001; Watson 2001
iv	UNFCCC 1993
v	Leggett 1999
vi	Hadley Centre 1998
vii	Houghton 2001
viii	Müller 2001b
ix	Ringius et. al. 1998
x	Claussen & McNeilly 1998
xi	UNFCCC 1997; see also Lammi & Tynkkynen 2001
xii	Lammi & Tynkkynen 2001
xiii	Lammi & Tynkkynen 2001
xiv	Lammi & Tynkkynen 2001
xv	Groenenberg et. al. 2000
xvi	Jansen et. al. 2001
xvii	Berk et. al. 2001
xiiii	Victor 2001
xix	Baumert et. al. 1999
xx	Müller 2001a
xxi	Meyer 2000

Written by: Alexander Evans
Introduction by: Andrew Simms
Edited by: Julian Oram and David Boyle
Published: 2002

Design: bwa

The New Economics Foundation (NEF)
NEF works to construct a new economy centred on people and the environment. Founded in 1986, it is now one of Britain's most creative and effective independent think tanks, combining research, policy, training and practical action. Now the UK research home of the international Jubilee debt campaign, NEF has a wide programme of work on economic globalisation ranging from corporate accountability to climate change.

New Economics Foundation, Cinnamon House, 6-8 Cole Street, London, SE1 4YH, United Kingdom,
Tel: ++ 44 (0)20 7089 2800 Fax: ++ 44 (0)20 7407 6473
www.neweconomics.org
Registered charity number 1055254

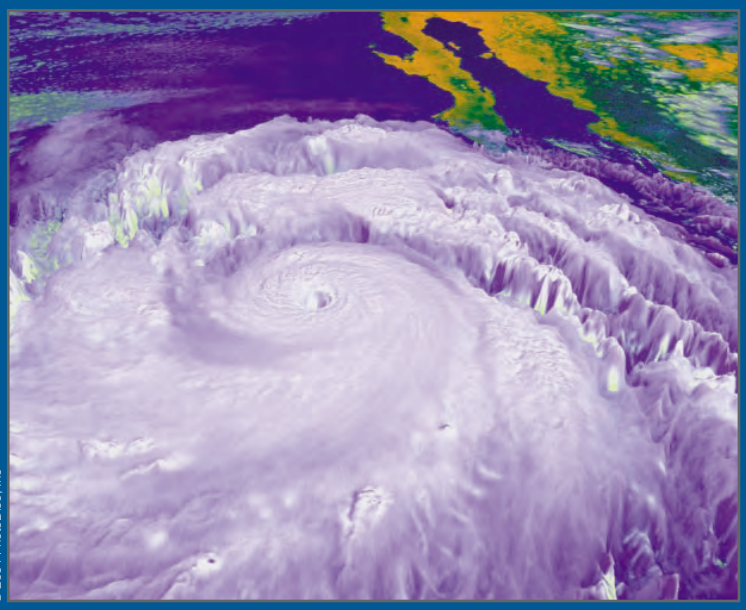
ISBN 1-899407-56-1

new economics FOUNDATION

UNEP **Finance Initiatives**
Innovative financing for sustainability

CEO briefing

A document of the UNEP FI Climate Change Working Group



Climate risk to global economy

Climate change poses a major risk to the global economy. The increasing frequency of severe climatic events, coupled with social trends, has the potential to stress insurers, reinsurers and banks to the point of impaired viability or even insolvency. Worldwide economic losses due to natural disasters appear to be doubling every 10 years and, on current trends, annual losses will reach almost $150 billion in the next decade.

The greenhouse gases (GHGs) which create this problem are long-lived so action is urgently needed. A long-term international political framework for climate stability is essential. The Kyoto Protocol, under which many industrialised nations have pledged to curb their emissions of GHGs by 2012, is an important step but does not go nearly far enough.

To ensure future economic development is sustainable, it must be based on the principles of precaution and equity. This will be achieved more quickly, and with less economic dislocation, by harnessing market mechanisms with a skilful blend of policies and measures.

The financial sector therefore has a key role to play in delivering market solutions to climate change. Examples include GHG emissions trading markets and finance for clean energy technologies. By some estimates, the former could be a $2 trillion/year market by 2012 while the latter could be worth $1.9 trillion by 2020.

Key findings of UNEP's Finance Initiatives study

Four main barriers are holding back financial institutions from a more proactive stance:

- Many are unaware of the gravity of the issue, or see no financial reasons to tackle it.
- Disagreements and delay in reaching a durable framework for international and national policy have discouraged financial institutions from early engagement.
- It is difficult to integrate the climate change issue into financial assessments because of a lack of information on corporate emissions and strategies.
- The uncertain prospects for alternative energy technologies and the early state of the emissions markets have deterred investors.

Recommendations

Financial institutions, associations and professionals should (where relevant to their business strategy):

- become more familiar with the threats and opportunities posed by climate change issues;
- incorporate climate change considerations into all their business processes; and
- work directly with policy-makers on effective strategies for mitigation and adaptation.

Policy-makers should:

- reach consensus on a global framework for climate stability based on precaution and equity;
- accelerate policies and measures that will establish a clear value for GHG emission reductions;
- support awareness raising in the financial sector; and
- work with the financial community to ensure that adaptation and mitigation programmes are fully effective.

UNEP FI should initiate three task forces:

1. An awareness raising task force of senior finance sector executives to inspire individual financial companies to engage on climate change.
2. A project team to develop a quantitative methodology for asset managers that will capture the implications of climate change regulations.
3. A team to develop a project finance methodology that integrates the full range of projects' environmental aspects, including climate change.

Climate Change and the Financial Services Industry

Executive Briefing Paper

1. Introduction

This paper summarises the main findings of a major two-phase study on the financial services sector and climate change for corporate decision-makers at executive board level and for key government policy-makers.

The study shows why climate change is relevant to the financial services industry and explains the need for long-term, market-based, frameworks to foster finance sector participation. It presents an overview of the specific threats and opportunities facing the industry and makes strategic recommendations to policy-makers and financial institutions for early action on this issue. Further, it examines the possible future role of the finance sector in dealing with climate change, the prevailing attitudes of financial services companies in responding to the issue, the various barriers to action and the kinds of activities currently being implemented.

The complete study[1] is available for download at: www.unepfi.net

Market solutions will play a pivotal role in tackling climate change

2. Climate change is a fact

Recently issued scientific reports from the Intergovernmental Panel on Climate Change, among others, have affirmed that most global warming over the past 50 years is attributable to human activities. They have also concluded that:

- the climate may warm faster than previously thought;
- developing countries are most at risk; and
- at some point, sudden and irreversible shifts in global climate patterns may occur.

The greenhouse gases (GHGs) which create the problem – of which carbon dioxide is the best known – persist for many decades. To stabilise atmospheric concentrations at just twice the pre-industrial level would require current emission levels to be cut by 60%. There is, therefore, a growing sense of urgency to act in a meaningful fashion.

Worldwide economic losses due to natural disasters appear to be doubling every ten years and, if current trends persist, annual losses will come close to $150 billion in the next decade. A significant portion of this will be insured. The experience of the insurance industry shows that even small changes (< 10%) in event severity can generate multiple increases in damage.

A pro-active stance by financial institutions will help to reduce the threats they face from climate change while also providing opportunities (see Table 1).

3. Creating a stable climate

Over the short term, the Kyoto Protocol – the 1997 international agreement to curb GHG emissions from industrialised nations – constitutes a vital contribution towards managing the climate change problem, and the associated negotiations have accelerated the creation of climate-friendly markets. However, the actual GHG emission targets in the Protocol are modest, they do not cover all nations and the formulation has led to the disengagement of the USA.

For the long term, the agreement of an international policy based on the principles of precaution, equity and economic efficiency is critical if we are to reduce the risk and engage all parties in the endeavour. A number of approaches have been proposed, including the 'historical' method, under which a nation's future emissions goals would be determined by its past GHG output; the carbon-intensity approach, in which future emissions goals would be indexed to GDP; and "Contraction and Convergence"[2] which would aim to achieve equal *per capita* emissions for all nations by an agreed date. Up to now, however, most of the work under the United Nations Framework Convention on Climate Change (UNFCCC) has been directed at finalising and ratifying the Kyoto Protocol.

Recent studies show that climate change mitigation can be achieved more quickly and with less economic dislocation by harnessing markets with a skilful blend of policies and measures.

Table 1 **Threats and Opportunities for the Financial Services Industry**

Financial Sector	Threat	Opportunity
All	■ New and existing markets become unviable due to potential climate impacts ■ Macroeconomic downturn due to actual impacts ■ Compounding of climate risk across all sectors ■ Unforeseen changes in government policy	■ New markets/products related to mitigation projects/processes ■ New markets/products related to adaptation projects/processes ■ Public/private partnerships for commercially unviable markets
Property/ Casualty Insurance	■ Property damage from weather events, compounded by unmanaged development, resulting in volatile results and liquidity and credit rating problems ■ Increased risk in other lines of business (e.g. construction, agriculture, transport) ■ Insufficient capital	■ Increase in demand for risk transfer and other services as weather risks increase ■ Insurance of mitigation projects (e.g. clean energy) ■ Innovative risk transfer solutions for high risk sectors
Life/Health Insurance	■ Increased risks to human health in some areas	■ Increase in demand for products as human health risks rise
Banking and Project Finance	■ Weather impacts on corporate assets/project returns ■ Unplanned GHG costs to projects/borrowers ■ Reduction in disposable income as climate change costs rise	■ Finance for adaptation projects (e.g. infrastructure) ■ Finance for clean energy projects ■ Enhanced project return from GHG credits ■ Lending for energy efficiency-related projects ■ New markets in high-impact fields (e.g. regulatory risk transfer)
Asset Management	■ Hidden GHG liabilities impair market values of securities ■ Real estate impaired by weather events and increased energy costs ■ Potential absence of property insurance	■ Investment in climate leaders and best-in-sector securities ■ Innovative climate-related theme funds (e.g. renewable energy) ■ Hedge funds investing in GHG credits
Other finance	■ Greater pressure on public purse for disaster relief and infrastructure rebuilding ■ Compounded carbon risks for diversified fund managers (e.g. hedge funds) ■ Potential deterioration of investment viability due to national financial policy responses to climate change	■ Innovative services related to GHG credits markets (e.g. brokerage and trading) ■ Micro-finance, weather derivatives, catastrophe bonds, consultancy

The main market participants (investors, industrial companies and policy-makers) together can create conditions conducive to a low-emission or 'carbon-light' economy *now*, so that when a framework has been agreed, it will rapidly take effect.

4. Role of the financial services industry

Market solutions will play a pivotal role in tackling climate change whatever the international policy framework. Financial institutions will therefore have a key role to play. They can:

- help to structure and monitor an efficient market system by working with securities and exchange regulators, actuaries, accountants and others;
- create other conditions crucial to the formation of an efficient emissions trading system (i.e. a standardised 'commodity'; standardised trade characteristics including monitoring, verification and certification requirements; organised exchanges; clear market prices; adequate supply);
- provide products and services that contribute towards adaptation and mitigation efforts (such as trading, banking and insurance for carbon credits; project finance for 'low-carbon' energy (e.g. renewables); weather derivatives; catastrophe bonds; micro-finance);

- manage their own property risks arising from extreme weather events;
- pursue environmental management leadership in areas such as water consumption, recycling and energy efficiency within their own property portfolio (including tenants); and
- engage with stakeholders to work towards solutions on the climate change issue.

Most mainstream financial institutions are either unaware of the business relevance of climate change or have adopted a 'wait and see' attitude. A few companies, however, have actually developed and operationalised strategies.

Insurance and reinsurance

The view that climate change is of strategic business importance is more prevalent among insurance and reinsurance companies than perhaps any other segment of the financial services industry. However, their polices and strategies vary considerably according to geographic location and line of business. For example, very few insurers have factored in climate change-related risks into underwriting premiums and deductibles, although reinsurers have initiated qualitative sector-level impact analyses.

Commercial banking

In the commercial banking industry, there are widespread pockets of climate change expertise but awareness of the issue by senior executives appears to be low. The key area of concern for these companies is the extent to which climate change and GHG mitigation regulations will affect lending decisions and credit risk management policies. Opportunities are being seized by some commercial banks; for example, in GHG credit trading and energy efficient loans.

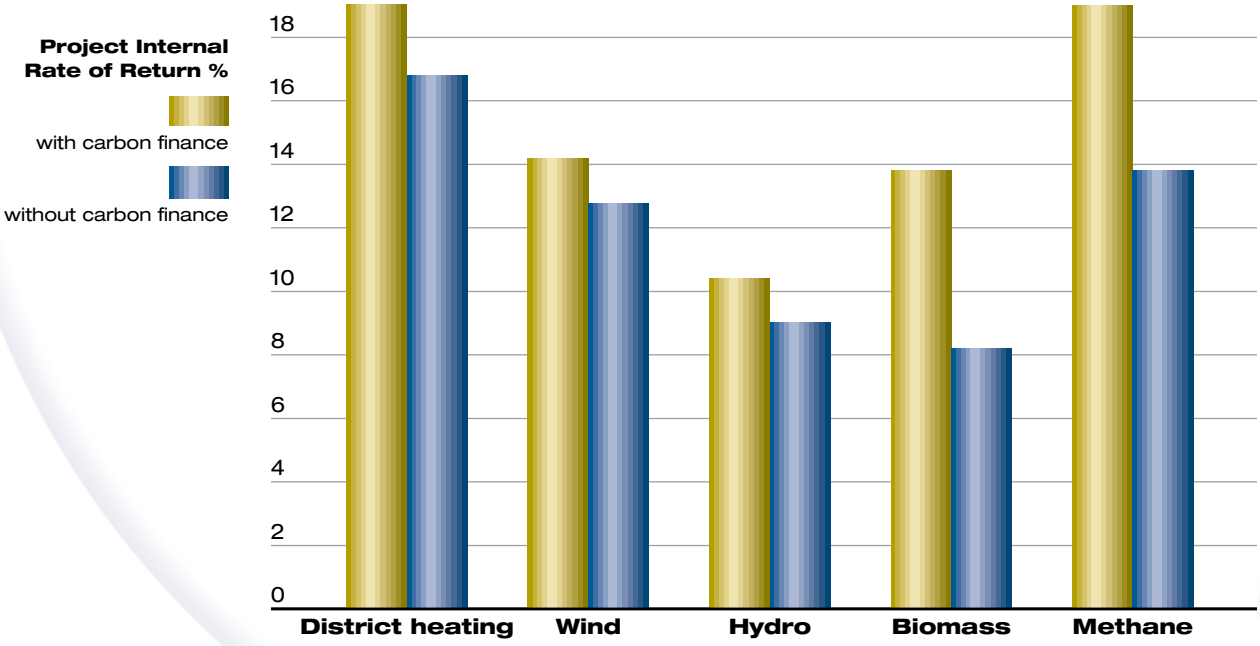
Asset management

For most mainstream asset managers, climate change is not currently understood as an investment risk issue, although a handful have developed new products and new areas of expertise relating to the GHG markets. For those asset managers and pension funds aware of the issue, engagement with affected companies is the preferred course of action, rather than disinvestment. Among socially-responsible fund managers, climate change is used as a screening criterion, but the screens used tend to be very crude.

Project finance

Several project finance and venture capital funds have been launched or announced in the past two years focusing on clean technology and/or carbon finance. At present, however, they are attracting mainly strategic corporate investors rather than institutional investors. The latter generally consider these funds to be too small and inefficient to generate adequate returns and there is limited awareness in mainstream project finance circles of the potential for GHG-related risks and opportunities to affect project economics (see Figure 1).

Figure 1 **Effect of carbon finance at the project level** Source: World Bank Prototype Carbon Fund



Emissions trading markets

The formation of regional emissions trading schemes and various GHG exchanges will soon make emissions trading a reality. However, these markets are still under development and their commercial appeal for financial institutions is not yet clear.

Professional services

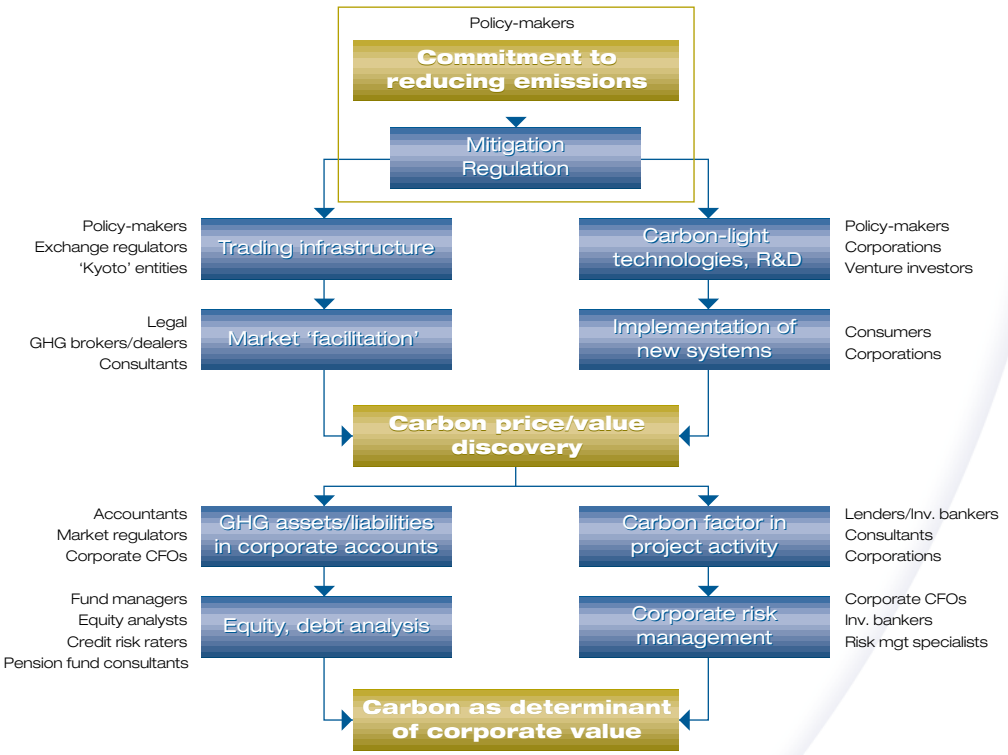
In general, advisors to the financial sector do not appear aware of the implications of climate change to the industry. However, efforts are underway by accounting professionals to develop standardised accounting tools to deal with GHG-related assets and liabilities. Some have also started to inform and educate their corporate clients on potential carbon-related risks. Credit rating agencies, too, are examining how these issues affect the companies they monitor and are exploring new business opportunities in this area.

5. Role of government

Strong government leadership on adaptation and mitigation measures is a prerequisite for market-based solutions in order to provide the financial services industry with the necessary regulatory architecture. Governments should consider:

- making the necessary emissions reduction commitments that put a price on carbon and stimulate demand for products in the emissions trading market (see Figure 2);
- providing a sound basis for making such political commitments, through the funding of scientific research and efforts to educate the public;
- setting a framework to improve the provision of investment-related information on climate change risks (e.g. requirements for pension funds to look at environmental issues or guidance on fiduciary duty and corporate climate-related liability);
- providing long-term political certainty on regulations, to show the financial services industry that climate change warrants the commitment of valuable time and resources; and
- promoting the creation of public/private partnerships in key areas.

Figure 2 **Evolution of carbon as a driver of financial value** Source: Innovest, Inc.



6. Barriers to action

Four types of barrier have prevented the financial sector from earlier engagement with climate change: cognitive; political; analytical; and market operational.

Cognitive barriers

- The mainstream financial world generally regards environmental and social factors like climate change as marginal to companies' bottom-line financial performance.
- Climate change potentially cuts across nearly all financial services' functions, creating a sense of shared responsibility that deters any one group from taking the initiative.
- The lack of a connection between climate change and 'planning-horizon' financial risk, and the currently slow pace of price discovery for carbon, mean the financial sector cannot see any monetary value in climate action.

Political barriers

- There has been considerable delay in creating the political conditions under which international carbon management and climate adaptation measures can be assigned a durable value by financial and insurance companies. For example, a lack of clear targets for renewable energy supplies is a definite impediment to potential investors in this sector.
- There is uncertainty about the commitment of regulators to the consistent establishment and enforcement of long-term binding emissions reduction targets, and about the regulations for emissions trading systems.
- Some developing markets place considerable restrictions on foreign financial institutions.

Analytical barriers

- There is low awareness of climate change among key finance and insurance sector advisors, resulting in insufficient analysis and information being provided.
- Understanding of the financial benefits of other sustainability outcomes that may result from climate-friendly projects is low.
- Poor data availability on corporate climate change strategies makes the analysis of potential company risks very difficult.

Market operational barriers

- Potential investors in clean technologies wish to see specific mechanisms – such as tax incentives, guaranteed prices/market shares, renewable energy certificate trading schemes – giving the technologies a clear commercial advantage.
- Inefficiencies and complexity in the present GHG emissions trading markets are deterring financial institutions from getting more involved.
- Particularly in renewable energy, many projects are small in comparison to the scale of investment funds and therefore appear to have high overhead and transaction costs.

To overcome all these barriers requires detailed analysis to identify the possible solutions and then extensive consultation between the various stakeholders. While it is not possible at this stage to be prescriptive, the following section gives our recommendations on the way ahead.

Action is urgently needed. A long-term international political framework for climate stability is essential

7. Recommendations

Financial services companies – where relevant to their business strategy

All financial services companies

- Raise awareness – within and outside the finance sector.
- Lead by example in corporate environmental management with long-term oriented carbon strategy.
- Incorporate climate change considerations into mainstream business practices:
  - by developing carbon risk management and benchmarking tools; and
  - by providing products and services that support adaptation and mitigation.
- Support less developed countries with micro-finance and micro-insurance initiatives.

General insurance and reinsurance

- Strive for greater clarity on the potential threats and opportunities from altered climate conditions through co-operation with scientific research.
- Adapt existing insurance products to the particular circumstances of the GHG emissions market and clean technology (e.g. engineering performance insurance).

Asset managers, pension funds and financial analysts

- Develop more robust, quantitative tools to assess the potential implications of climate change and GHG regulations on equity prices, corporate earnings and relative sector risk.
- Use these tools to conduct portfolio-wide assessments of risk exposures arising from equity and debt holdings and asset allocation decisions.
- Extend engagement with companies to include climate change-related issues and encourage them to improve disclosure of potential carbon assets and liabilities.
- Search for reasonable and prudent ways to participate in the market for clean technologies and low GHG-intensity products and services.

Investment banks, investment advisors and brokers

- Develop more commercially attractive GHG/Kyoto and clean technology markets by:
  - structuring deals for clean technology projects such that future cash flows can be used up-front;
  - establishing a carbon credit clearinghouse;
  - overcoming high transaction costs and low demand by pooling buyers and sellers of carbon credits and bundling these credits (or the cash flows arising from their sale) separate from the underlying emission reduction projects; and

- developing methods for monetising ancillary sustainability benefits (e.g. biodiversity credits).
- Incorporate 'cost of carbon' into cash flow analyses and calculations of project returns.

Professional advisors

- Develop tools to quantify GHG assets and liabilities.
- Develop harmonised GHG accounting methods by working more closely through accounting standards organisations such as FASB and IASB.
- Ensure that developers of actuarial and accounting standards provide adequate guidance on climate-related risks.
- Develop tax efficient mechanisms for dealing with emissions credits.

Rating agencies

- Develop a better understanding of how GHG-related assets and liabilities affect debt quality and adjust the ratings of corporate and municipal/regional debt issuers.
- Examine new business opportunities from rating the credit quality of counterparties to emissions trades or, alternatively, rating pools of potential buyers and sellers.

Governments and Policy-makers

In order to engage the finance and insurance services sector more fully in addressing the climate change issue, it is recommended that:

Policy-makers

- Grasp the urgency of attaining long-term climate stability in accordance with the UNFCCC.
- Reach consensus on a long-term policy framework for achieving this goal based on the principles of precaution, equity and cost-effectiveness.
- Accelerate the introduction of policies and measures that influence the flow of capital, particularly investment capital from institutional investors, so as to encourage sustainable energy consumption.
- Involve financial institutions in public-private partnerships, and in other ways, to ensure that adaptation and mitigation programmes are fully effective.
- Commit to clear and binding GHG emissions reductions and clarify how they will be met.
- Devise and implement emissions trading systems that link as seamlessly as possible with other GHG markets and involve financial market specialists in the design phase.

Governments in industrialised countries

- Take concrete steps to develop market-based solutions to extend low-carbon technologies and clean technology research.
- Expand renewable portfolio standards and encourage the international trading of renewable obligation certificates as a means of meeting this goal.
- Show securities and exchange regulators the need for greater transparency and disclosure regarding the implications of future climate-related impacts and GHG regulations on the risk profiles of listed companies and of debt or equity issues.
- Provide support for less developed countries by promoting Clean Development Mechanism projects under the Kyoto Protocol and by assisting with the planning for adaptation through specialised bilateral and multilateral means.

Action steps by UNEP Finance Initiatives

To maintain the momentum of this study, UNEP FI should sponsor three multidisciplinary task forces:

- An awareness raising task force of senior finance sector executives to inspire individual financial companies to engage on climate change.
- A project team to develop a quantitative methodology for asset managers that will capture the implications of climate change regulations (e.g. carbon costs).
- A project team to develop a project finance methodology that integrates the full range of environmental aspects.

1 The study *Climate Change and the Financial Services Industry* was commissioned by the United Nations Environment Programme Finance Initiatives (UNEP FI) Climate Change Working Group and written by Innovest Strategic Value Advisors with the guidance of Andlug Consulting.

2 For more information refer to the website of the Global Commons Institute: http://www.gci.org.uk/

UNEP FI

The United Nations Environment Programme Finance Initiatives (UNEP FI) is a unique global partnership between UNEP, the Financial Institutions Initiative (FII) and the Insurance Industry Initiative (III). UNEP FI has 295 member institutions worldwide.

UNEP is headquartered in Nairobi, Kenya. UNEP has six divisions through which it carries out its activities, including the Division of Technology Industry and Economics (DTIE) based in Paris, France. The Economics and Trade Branch (ETB), based in Geneva, Switzerland, is a branch of DTIE. The Finance Initiatives is a unit of the ETB.

UNEP FI Climate Change Working Group members

Andrew Dlugolecki
Director
Andlug Consulting
17 Craigie Place
Perth PH2 OBB
Scotland, UK
Tel +44 1738 626 351
e-mail andlug@hotmail.com

Iris Gold
Vice President
Citigroup
Environmental Affairs
One Court Square
45th Floor, Zone 16
Long Island City, New York 11120
USA
Tel +1 718 248 4698
Fax +1 718 248 4725
e-mail iris.gold@citicorp.com

Maria Teresa Szauer
Director Sustainable Development
Corporacion Andina de Fomento
Caracas, Venezuela
Tel +58 212 209 2111
Fax +58 212 209 2406

Armin Sandhövel
Head, Corporate Sustainability
Corporate Communication
Dresdner Bank AG
Weserstrasse 31, 5. OG
60301 Frankfurt
Germany
Tel +49 69 2 63 55 193
Fax +49 69 2 63 55 152
www.dresdner-bank.com

Dirk P. Kohler
Senior Project Manager
Gerling Sustainable Development
Project GmbH
Representative office Marseilles
Le "Villa d´Este"
15, avenue Robert Schumann
13002 Marseilles
France
Tel +33 4 96 11 68 21
Fax +33 4 96 11 68 29
e-mail dirk.kohler@gerling.de

Thomas Loster
Head, Weather/Climate Risks Research
Geo Risks Research Department
Munich Reinsurance Company
80791 Munich
Germany
Tel +49 (0)89/38 91-52 87
Fax +49 (0)89/38 91-7 52 87
e-mail tloster@munichre.com

Fred Lynds
Head of Environmental Policy
Prudential
Laurence Pountney Hill
London EC4R 0HH
UK
Tel +44 20 7548 3789
Fax +44 20 7548 6140
www.prudential.co.uk

Colin Le Duc
SAM Sustainable Asset Management
Zollikerstrasse 60
8702 Zollikon-Zürich
Switzerland
Tel +41 1 397 10 10
Fax +41 1 397 10 80
e-mail colin@sam-group.com
www.sam-group.com

Thomas Streiff
Head of Group Sustainability Management
Swiss Re
Mythenquai 50/60
8022 Zürich
Switzerland
Tel +41 43 285 6145
Fax +41 43 282 6145
www.swissre.com

Paul Clements-Hunt
Head, UNEP Finance Initiatives
International Environment House
15 chemin des Anémones
1219 Châtelaine, Genève
Switzerland
Tel +41 22 917 8116
Fax +41 22 917 8076
e-mail pch@unep.ch
www.unepfi.net

Design and production:
Rebus, Paris
Printed in France

Study consultants

Martin Whittaker
Managing Director
Innovest Strategic Value Advisors, Inc.
225 East Beaver Creek Road, Suite 300
Richmond Hill, Toronto
Ontario L4B 3P4
Canada
Tel +1 905 707 0876
Fax +1 905 707 9084
e-mail mwhittaker@innovestgroup.com
www.innovestgroup.com

O. Hohmeyer · K. Rennings (Eds.)

Man-Made Climate Change

Economic Aspects and Policy Options

ZEW ECONOMIC STUDIES

Physica-Verlag
A Springer-Verlag Company

ZEW
Zentrum für Europäische Wirtschaftsforschung GmbH
Centre for European Economic Research

Contents

1 Introduction: Economic Aspects of and Policy Options for Climate Protection 1
by Olav Hohmeyer and Klaus Rennings

Part I: What Do We Know about Climate Change ?

2 The Science and Impacts of Climate Change – Conclusions from the Second IPCC Assessment Report 7
by Hartmut Grassl

Part II: Economic Aspects of Climate Change

3 Decision-Making Frameworks for Addressing Climate Change 23
by Gonzague Pillet
4 What is Sustainable Development ? 42
by Graciela Chichilnisky
5 Linking Weak and Strong Sustainability Indicators: The Case of Global Warming 83
by Klaus Rennings and Olav Hohmeyer
6 Discounting of Long Term Costs: What Would Future Generations Prefer Us to Do ? 111
by Ari Rabl
7 Is Adaptation Cheaper than Prevention ? The Applicability of Cost-Benefit Analysis to Global Warming 126
by Peter Hennicke and Ralf Becker
8 Some Critical Remarks on Today's Bottom-up Energy Models 165
by Eberhard Jochem
9 Double Dividend of Climate Protection and the Role of International Policy Coordination in the EU - An Applied General Equilibrium Analysis with the GEM-E3 Model 180
by Klaus Conrad and Tobias F.N. Schmidt

Part III: Policy Options

10 Possible Contributions of Renewable Energies to the Solution of the Global Climate Problem 219
by Helmuth-Michael Groscurth and Sigurd Weinreich
11 What Hope for a Sustainable Energy System ? 236
by Nick Eyre
12 Comment on: Potentials of Joint Implementation Measures 244
by Henning Rentz
13 Assessment of Voluntary Agreements in Environmental Policy - A Neoliberal Perspective 247
by Klaus Rennings, Karl Ludwig Brockmann, and Heidi Bergmann
14 The Political Context for Emissions Trading in the Climate Change Negotiations 282
by Michael Grubb
15 The Kyoto Protocol and the Emergence of *"Contraction and Convergence"* as a Framework for an International Political Solution to Greenhouse Gas Emissions Abatement 291
by Aubrey Meyer

Annex

A1 United Nations Framework Convention on Climate Change 349

A2 The Kyoto Protocol 377

The Kyoto Protocol and the Emergence of *"Contraction and Convergence"* as a framework for an international political solution to greenhouse gas emissions abatement.

The Kyoto Protocol, completed in the early hours of December 11th 1997, at present is no more than a potential breakthrough in the development of effective global policy for the control of atmospheric concentrations of greenhouse gases and the mitigation of human-induced global climate changes. The core issue of the negotiations has been deferred until COP4 in November 1998. The industrial countries have negotiated a compromise that subject to ratification will legally bind them to commitments beyond those in the UNFCCC. But, the ratification of the Protocol by the US still remains contingent on achieving the *"meaningful participation"* of *"key"* developing countries in the abatement regime and the multilateral acceptance of international emissions trading. This is a struggle to define property rights. These key developing countries include India and China and they have made it clear that their acceptance of trading is contingent on the achievement of *"equitable allocations"* of emissions entitlements based on achieving equal per capita entitlements globally. COP issued instructions to the technical bodies attached to the UNFCCC to *"define the relevant principles, modalities, rules and guidelines for emissions trading"* in time for COP4 in November 1998 in Buenos Aires.

GCI argues that *"Contraction and Convergence"* is the approach that can break through this deadlock and welcomes the fact that major parties and interest groups in this dispute have already acknowledged that they take this approach seriously and that it has growing support throughout the world. As a leading economics commentator Peter Jay has noted, *"… unless there is some recognition that eventually no one group of human being can expect to have an internationally recognised right to consume more of the world's limited capacity to absorb greenhouse gas emissions than any other group, it is hard to see how a globally enforceable policy can be built by consent.*" And in the words of the President of GLOBE International, *"Contraction and Convergence is not simply the right way to solve the problem, it is the <u>only</u> way to solve the problem."*

CHALLENGE FROM IPPC CLIMATE SCIENCE

The First Assessment Report (FAR - 1990) of the Intergovernmental Panel climate Change (IPCC) noted that atmospheric concentrations of CO2 were 25% higher (350 ppmv) than pre-industrial (280 ppmv) and rising faster and higher than anytime in the previous 160,000 years. An extremely strong correlation between rising CO2 concentrations and human CO2 emissions [mainly from fossil fuel burning] was observed from around 1800 forward. The IPCC also observed circumstantial links to rising global mean temperature and stated that immediate minimum 60% to 80% cuts in human CO2 [1]emissions were necessary if atmospheric concentrations of CO2 were to be stabilised just at 1990 levels (see chart 1). Since then, IPCC has stated that the balance of evidence suggests that there is a discernible human influence on the climate system. They also suggested the damages consequent on no abatement and further global temperature increase as being between serious and potentially catastrophic, regionally and even globally. Since 1990 there has been much investigation into what constitutes atmospheric greenhouse gas concentrations levels that do not dangerously affect the climate system. According to carbon cycle and global climate modelers, the time frame foreseen for achieving at least 60% cuts in emissions is between 50 and 200 years, depending on the ultimate atmospheric CO2 concentration goal.

[1] GCI recognises the relevance of other ghgs, but also that industrial CO2 emissions account net for over 70% of the human influence on climate change. Moreover we are primarily advocating the policy concept *"Contraction and Convergence"* for negotiating the shared ownership of greenhouse gas emissions entitlements globally. This depends on having reasonable global datasets and so far these only exist for industrial CO2 emissions.

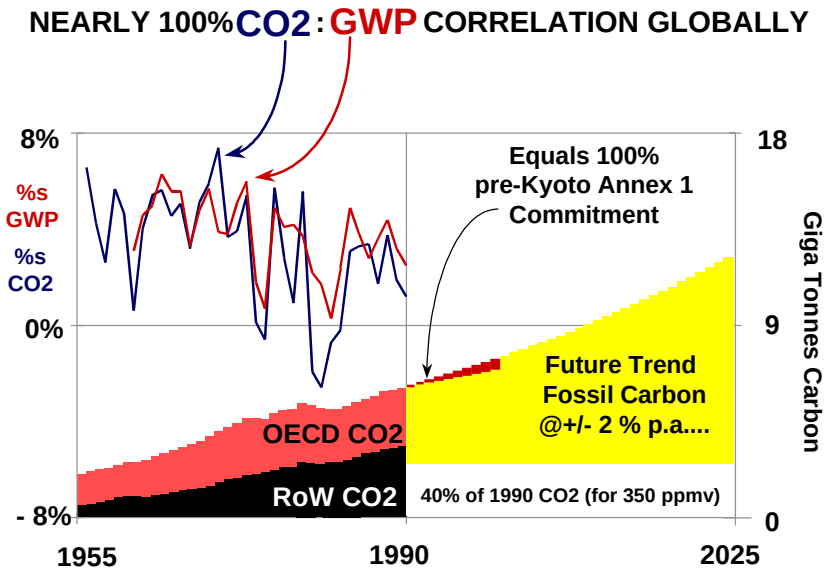
There is a real concern however, that even going to 450 ppmv (60% cuts in emissions over roughly one hundred years) may result in serious ecological and consequent socio-economic damages. The IPCC has published data derived from climate models that attempt to demonstrate the quantitative links between greenhouse gas emissions and accumulated atmospheric concentrations. (These are summarized in Appendix A).

GLOBAL SOLUTIONS ARE CONSTITUTIONAL

At the very least, sensible contingent planning requires that if the global community is to demonstrate both technically and politically that the worst of the potential damages from human-induced global climate change can be avoided, it will have to demonstrate that the cuts in emissions can be achieved. There will be a twin compromise. The rate of cutting emissions must rapid enough to halt the rise of atmospheric greenhouse gas concentrations below levels that dangerously affect the climate system. However, it must also be gradual enough to give time for non-fossil alternative energy sources and energy saving measures to be introduced so as not to precipitate an economic crisis. Moreover, the whole operation will have to be planned for inclusivity under continuous political and scientific review. Not only is it appropriate to insist that *"a global solution is required for a global problem"* as the US has repeatedly done, it is also necessary to actually come up with a global solution. This unavoidably means having to recognise and acknowledge that a global solution is by definition, constitutional. It will be the result of having first had to determine the principles upon which the rules for globally sharing finite resources will be founded and applied. In the case of climate change, this means determining the principles and rules for sharing a future global carbon budget that is also consistent with the twin compromise above The political struggles at Kyoto have brought the need for this unprecedented imperative into focus more sharply than before.

Deliberate limitation of CO2 emissions from industrial activity is certainly contentious. Dollar GDP from the formal economy has so far been very closely correlated with CO2 from fossil fuel burning (see Chart 1) and anything less than the positive growth of dollar GDP is regarded as a primary signal of macroeconomic failure. Consequently now achieving a delinking of GDP and CO2 emissions must be a primary feature of any future economic planning. Moreover, CO2 emissions and GDP are both historically and currently, very unevenly generated and distributed throughout the global economy. In simple language, it is those who have made the money who have also made the mess in the atmosphere. This is now increasing instability in global politics as well as in the global climate system, where the increasing risks of environmental adversity are increasing the risks of attendant social and political conflict. The issue of how to determine the "differentiated responsibilities" in any global programme required to achieve the necessary levels of emissions abatement is thorny and has confounded the UNFCCC negotiations all the way from INC1 in Washington in 1991 to COP3 in Kyoto in December 1997. The argument is fundamental, but is quite novel for being truly "global". Everybody regardless of levels of wealth and development is implicated, some as alleged perpetrators but all as probable victims.

CHART 1



NO PROBLEM, NO REGRETS, NO SOLUTIONS WITHOUT DEVELOPING COUNTRIES

Since 1990 we have been through three periods of argument about whether human-induced climate changes were occurring. The initial period of *"no problem"* gave way to a period of *"no regrets"* (perhaps there's a problem so do what makes sense for reasons of economic efficiency). In reality this all seems to have reflected a wish to postpone any genuine engagement with the real issues. For example John Knaess, the head of the US delegation to the Second World Climate Conference, insisted that *"simple sophomore physics reveal that the problem is real"* (greenhouse gases trap heat so more greenhouse gases trap more heat) and that the only questions were *"how much"* and *"how soon"*. It bears some reflection as to why it took seven years until June 1996 at COP2, for the US government to attempt to get behind emissions abatement policy consistent with the acceptance of human-induced climate change as a reality. It seems probable that the real argument has always been about how to compute and then most particularly *share* the future sustainable "Global Carbon Budget". Post-Kyoto we are all now openly being called to account on this point. So, since COP2 we have been in the third period called *"no solutions without developing countries"*. For the last eighteen months the call from across the board in the US has been that there has to be, *"meaningful participation by developing countries"* because *"global problems require global solutions."* This was in spite of the Berlin Mandate with its focus on developed country commitments only.

A STRUGGLE TO ASCERTAIN PRINCIPLES GOVERNING GLOBAL DISTRIBUTION

The period of tactical denial could well have related to the battle between two competing socio-economic arguments that were advanced at the outset for determining the international distribution of future CO2 emissions entitlements in the carbon budget. These were flat-rate emissions cuts globally with budget shares, or emissions entitlements, proportional either to GDP or to population. Application of each argument leads to very different distributions of entitlements globally. For example the USA in 1990 had approximately 4% of global population but emitted 25% of CO2 emissions with a GDP share to match. In the same year India had approximately 15% of global population but emitted 3% of CO2 emissions with a GDP share to match. It is no surprise therefore to find the US favored flat-rate cuts applied to shares proportional to initial GDP figures, while India favored shares proportional to population. In the World Bank's Development Report of 1992 the arguments were applied, the consequences were analysed and the inverse distributional results were compared. They noted distribution from shares equal on a per capita basis accumulated between 1950 and 1990, gave an overall negative share to developed countries stating simplistically that for that reason the alternative seemed the more feasible approach.

CHART 2 – Entitlements reduced always proportional to initial GDP

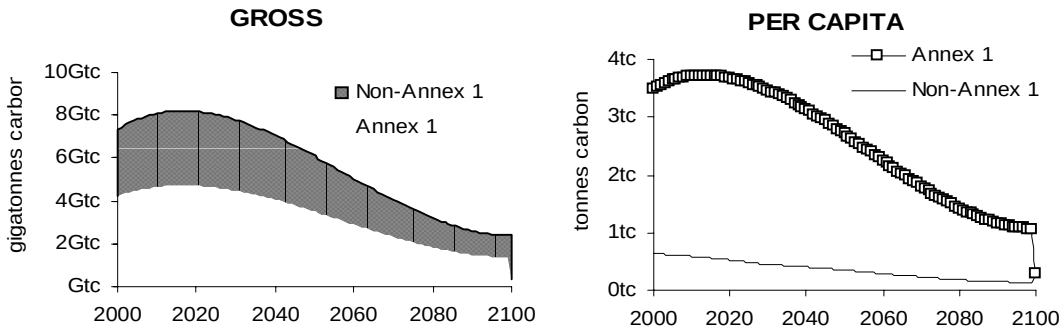
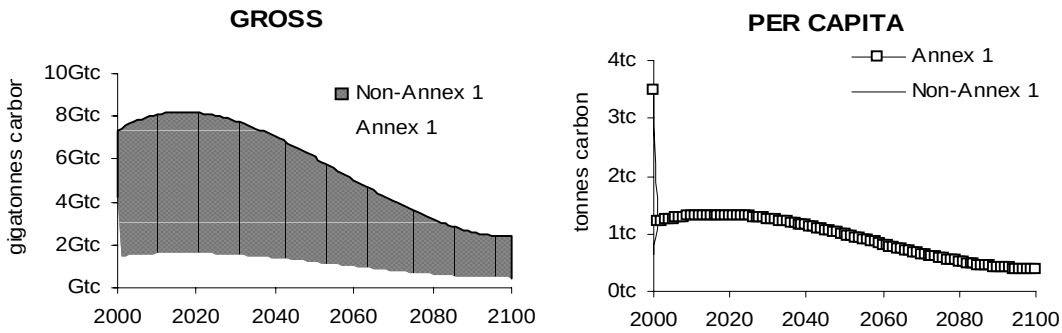


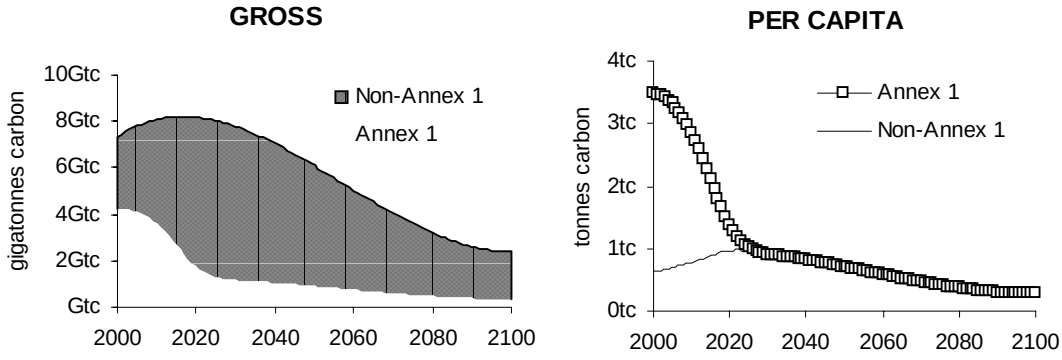
CHART 3 – Entitlements reduced always proportional to initial population



However, what the arguments have in common is that they are "pro rata" arguments where entitlements would be the result of applying a central organising principle to distribution out of necessity, simply to enable the collective contraction to be computed. The point here is that you have to make some assumption other than business-as-usual about distribution if you want to deliver the purpose of the UNFCCC, pre-eminently to deliver overall contraction of greenhouse gas emissions. Over the full period of achieving the 60% cuts in global emissions, this is unavoidably a negative-sum-game on emissions for everyone. And it is self-evident that without the application of a central organising principle to the determination of future allocations of emissions entitlements, the negative-sum-game of global carbon contraction will be unachievable. Business-as-usual and the now globally competitive character of market forces tend to engender deregulation and an erosion of democratic politics. If this culture is assumed for the management of greenhouse gas emissions, the future global carbon budget and its distribution will simply be the "invisible hand" in its malignant guise. It will be the ad hoc result of each party to the negotiations continuing the attempt to maximise its shares of the budget at the expense of all its competitors. Consequently, the future global carbon budget will expand indefinitely as the global aggregate of reluctance to clean up causing dangerously raised levels of atmospheric greenhouse gas concentration. In other words it will be the ever more visible and aggressive hand of climate change and the painful damages it will bring. This will continue unless and until there is a multilateral willingness to accept the application of a central organising principle to the determination of future international shares of what globally is a deliberately conceived and managed budget for carbon *contraction*. Put another way, more and more people now seem to accept that two hundred countries times two hundred arguments will never achieve the level of international agreement required to secure 60% cuts in emissions globally. What should also be self-evident is that the defining character of such arrangements will be based on some universally recognisable principle of equity simply to secure the necessary multilateral acceptance of Quantified Emissions Limitations Reductions Objectives (QELROS). If so it would then be recognised that any efficiencies that are achievable will be derived from - rather than give rise to - the primacy of the equity based arrangements. In other words principle and practice are inseparably linked and the old adage is true: *"principle without practice is useless and practice without principle is dangerous."*

So far, the most frequent argument of many Western economists has been that sustainable future CO2 emissions entitlements should be distributed between countries proportional to GDP precisely because of the close correlation between CO2 and GDP. Contrarily, most developing countries have argued that sustainable future CO2 emissions entitlements should be distributed between countries proportional to population because the global atmosphere and climate system are a "global commons", the sustainable use of which should be the equal responsibility of all members of the global community. If the commons belongs to anybody, it belongs to everybody. Both themes are embedded in the language of the United Nations Framework Convention on Climate Change (UNFCCC). Moreover, while the "basis of equity" is recognised in the UNFCCC in the context of international per capita emissions paths which are historically disparate, "cost-effectiveness" of global emissions abatement measures is also called for, which is portrayed as pursuing the "global benefit" (of avoided emissions) at least possible cost.

CHART 4 shows that these conflicting positions can be resolved through *"Contraction and Convergence"*. We start proportional to GDP and deliberately move to being proportional with population (here by 2030).



But so far they have been polarised to an intractable seeming deadlock. Those who see entitlements as being proportional to GDP not only get the bulk of entitlements, they have also seen themselves as the main providers of entitlements in any market that may emerge where entitlements are tradable internationally. In other words if there was emissions trading and we were following the World Bank's *"most feasible"* case (see above), India

would purchase entitlements from the USA. The US Mineworkers Association put out material making this case in the run up to COP3 in Kyoto. Contrarily, because at least 50% of any year's emissions continue to reside in the atmosphere over very long time frames, countries with low per capita consumption have argued that they are innocent of causing climate change historically, currently and even into the medium term future. The Brazilian proposals to COP3 for example attempted to define responsibility for observed global temperature rises by computing national proportions of blame as a function of nationally accumulated historical emissions. The result of this analysis shows that countries such as Brazil remain "blameless" well into the future. Bach Koomey and Krause did a related exercise in a report for the Dutch Government ("Energy Policy in the Greenhouse" – Earthscan 1989) where "blame" was linked to nationally accumulated historical per capita emissions. The result of this particular analysis demonstrated that if equal emissions entitlements were the currency for resolving the problems of global abatement, the industrial countries are already indebted to developing countries to the extent of total bankruptcy. There have been many other attempts at straightening out distributional methodology for the allocations of future emissions entitlements. They usually involve more or less complex combinations of weighted indicators such as carbon intensity of emissions, per capita GDP and per capita emissions (proposed by the Norwegians) and emissions per unit of export (favoured by coal-rich Australia). This has usually been applied to time frames well short of stabilising greenhouse gas concentrations and often to only sub-global country groupings such as the Annex One of the UNFCCC for example. Moreover, special exceptions have been achieved as well where for example the US has successfully negotiated that emissions associated with UN-backed military operations should not be added to the accounts of the countries undertaking the operations.

Faced with this degree of intractable complexity and quarreling, some commentators have pooh-poohed the need for a central organising principle altogether. Some are non-contrarians suffering from real anxieties about climate change and a process which seems fundamentally unwilling to really engage in the politics beyond denial, self-exemption and exclusivity. Often they have expectations based on accepting the continued operations of unfettered markets and link these to programs conceived in the mould of "Joint Implementation". Others suggest a general disposition towards "adaptation to" rather than "mitigation of" climate changes is a more realistic way of "submitting to" the future. This occasionally tends – probably not co-incidentally – to accompany the at least residually contrarian views of human-induced climate change, where the need for carbon contraction per se is still questioned. The adversities of climate change are seen as being on a scale from exaggerated to non-existent and the extent of human-causation of climate changes either as over-emphasized or invented and overwhelmingly irrelevant. There is also a line of reasoning which says that with or without climate change, the ability of humans to devise and operate to anything political that has a component of central planning is "ideological" and therefore undesirable and probably ineffective or unachievable in practice anyway.

"FAIRNESS" – AMBIGUITIES, STEREOTYPES AND CONFLICTS

What this reveals is that without a clearly perceived need for carbon contraction, the issue of "fairness" remains as ambiguous as ever it was. "Haves" defend unequal distribution as "fair" because rewards should be proportional to factors such as competence, initiative and sustained effort. "Have-nots" usually defend redistribution towards equal distribution as "fair" pointing to structural disadvantage usually in the context of the traditional arguments between capital and labour. In essence the "North/South" argument is no different from this albeit at a global level.

Distributional fairness, in circumstances where the increasing gap between "haves" and "have-nots" is structurally resisted, is probably easiest identified with the application of welfare economics as at least a necessary buffer against the social distortions of unmitigated market-forces. Distributional fairness, in circumstances where the increasing gap between "haves" and "have-nots" is seen as requiring reversal and even closure, probably embraces everything between the tendency to philanthropy on the one hand and the tendency to say *"when's it my turn?"* on the other. Some people (usually characterised as coming from the left and often but not always in the constituency of "have-nots") appear to be for distributional fairness. And some people (usually characterised as coming from the right and often but not always in the constituency of "haves") appear not to be. These inverse policy attitudes about "fairness" tend to centre on the distribution of socially created and privately partitioned wealth measured as GDP or the "benefit" of income alone. Seen this way arguments concerning "distributional fairness" would seem to have no altered prospects of relevance or realisation one way or the other now than in the past. Although globally the have-nots consistently have been and remain the majority, the "haves" dominate the political decision-taking related to distributional fairness. The resultant status quo embeds a trade-off between these left/right tendencies, stabilised by a well-established legal framework for continuity in property rights with much attendant academic and theoretical work explaining and justifying the "political economy" of this status quo.

In global terms, this framework has not been subjected to any pressures that seriously challenge its sustainability and therefore its legitimacy until the present and the advent of human-induced global climate changes. But in the economics of the global commons everything changes. The rules which developed for the distribution and protection of the socially "created wealth" cannot simply be transposed to encompass the "received wealth" of the commons. The commons are the nearest thing we could identify with providence itself. This is wealth we did not create nor could we. As Tim Wirth of the US State Department said on the subject last year in his lecture at Kew Gardens, *"the economy is a wholly owned subsidiary of the environment."* With this understanding of subsidiarity and the very global scale of the problem, it is not foolish us to look for new principles of wealth protection and security and distribution related to establishing property rights in the global commons.

BEWARE THE NUMERAIRE AND THE ECONOMICS OF RELUCTANCE

An eminent contributor to the climate change debate – Professor William Nordhaus of Yale University – introduced ideas for "The Economic Management of the Global Commons". However his have relied mainly on neo-classical assumptions in favour of using "Global Cost-Benefit Analysis" for this task. He and many other economists contributing to the IPCC's Second Assessment Report (SAR) maintained that the whole question of what to do about climate change is answerable through recourse to analysis of this kind. Their early results were collated in the SAR published in 1996. The results tended to portray the costs of damages from climate changes as being less than the costs of the actions for emissions abatement necessary to avoid these damages. Bluntly, it was cost effective to go along with climate change, not to resist it. The whole exercise seemed to have the character of a self-fulfilling prophecy in favour of business-as-usual. In effect it was polluters contentiously tending to put a high price on abatement and a low price on damage. The clearest example of the latter being the cash evaluation of global mortality at CO2 doubling where crudely fifteen dead Chinese equaled one dead American, despite one living Chinese emitting about one tenth of the industrial CO2 of one American. It was also despite the even more skewed history of the emissions of industrial CO2 and the fact that at least half the emissions in any year accumulate there with a residence time of about 100 years. (The US alone with an average 3% of global population over the last century and a half remains responsible for just under 35% of accumulated industrial CO2 emissions to date). In fact all damage evaluation resorted to the snap-shot convention of expressing units of damage as cash values proportional to the average levels of local income. The predictable result was that damages of all kinds in developing countries were devalued relative to the equivalent unit of damage in a developed country. So in spite of the prediction that there would be roughly five times as much damage in developing countries as in developed countries, the overall cash value assigned to the damages in developing countries was about half that of the value of the damages predicted to occur in developed countries. And all this was contributing to a global cost/benefit comparison that broadly suggested that it was cheaper to adapt to the damages from climate changes than to prevent them. Unsurprisingly it was characterised as the economics of genocide in the Indian press.

These analytical results attracted much criticism in the fora of the United Nations such as the United Nations Framework Convention on Climate Change (UNFCCC). These fora had been created especially to mediate and resolve the international policy conflicts of human-induced climate change, not to exacerbate them. The attempt to mediate some of the dispute that followed in the IPCC itself is recorded in the Summary for Policy Makers of Chapter 6 of the Working Group Three contribution to the IPCC SAR. (It is reproduced as Appendix B). The period seems in retrospect to have been one of "stressful learning". Perhaps a more relaxed and robust attitude is now possible with regard to the need to test a whole array of relevant assumptions. Some at least of these will inevitably underpin the next round of analysis and its assessment in the IPCC's Third Assessment Report (TAR) due for completion some time after the year 2000. It seems crucial in the preparations for the TAR that the economic assumptions related to the assignment of property rights in the global commons are reassessed. This is relevant because "meaningful participation" in the UNFCCC of developing countries is one of the conditions the US attaches to its ratification of the Kyoto Protocol.

It is fair to point out that much of the economic analysis reflected in the SAR was conceived during the earlier period of "no regrets". During this period, climate change as a human-induced problem was generally downplayed, alongside the continuing efforts of climate contrarians who were attempting to demonstrate that there was actually "no problem" at all. Their efforts continue at this time in an increasingly implausible way. However, at that time uncertainties to do with the climate changes were clearly more about whether the problem really existed than with concerns about actually *under*-reading the dangers of climate change and potential catastrophes. For example the most of the potential for biogeochemical feedbacks was omitted from the climate models because of their complex non-linearity. Much of this potential would contribute to the upward forcing of global temperature if the mechanisms become active. Large releases of the greenhouse gas methane from beneath tundra and icecaps as they melt will increase warming. Little understood but globally crucial CO2 sinks

in the boreal forests and elsewhere could easily switch off as the temperature rises. Increased water vapour in the atmosphere as a result of ocean warming will compound the warming effect. The range of increased temperature predicted by the models (e.g. with a best-guess 2.5 degrees Celsius rise at CO2 doubling) are inadequate because the models could only in effect assign a zero value to these factors. The quantitative results acquired have nonetheless achieved the status of "received wisdom" simply by virtue of the frequent reference made to them. When uncertainty is cited in this context it has been of the "even-handed" kind, which positions the results as being between either too high or too low. The quantitative absence of feedbacks in the models results clearly give results that err on the side of caution however.

Faced with these dimensions of complexity, it is not surprising that economics has been struggling to redefine itself in the face of global ecological imperatives. Even Professor Nordhaus by 1997 had loosened his neo-classical belt a little. In a paper for the IPIECA conference last year he commented as follows, *"Once we open the door to consider catastrophic changes, a whole new debate is engaged. If we do not know how human activities will affect the thin layer of life-supporting activities that gave birth to and nurture human civilization and if we cannot reliably judge how potential geophysical changes will affect civilization or the world around us, can we use the plain vanilla cost-benefit analysis (or even the premium variety in dynamic optimization models). Should we no be ultraconservative and tilt towards preserving the natural world at the expense of economic growth and development? Do we dare put human betterment before the preservation of natural systems and trust that human ingenuity will bail us out should Nature deal us a nasty hand?"* Having asked the questions he asserts a preference for the reasoned judgement of natural and social scientists over the judgement of philosophers and politicians. But he acknowledges the *"massive uncertainties"* and suggests that *"coping with climate change is a worthy challenge for us all."* This is all a far cry from his suggestion a few years back when he suggested that climate change was of no consequence to the US as they had air conditioning and shopping malls. Later he suggested that spotted-owl-equivalents would do just as well as money for the numeraire in the global cost benefit analyses of climate change. It was the one moment of mirth in the period of "stressful learning"; - no one at the UN could understand how 15 dead Chinamen equaled one dead Englishman if a spotted owl equaled a spotted owl. Economics is sometimes more daft than dismal.

So what do social scientists – and most particularly the neoclassical economists - now suggest is the solution to the international distributional struggle? How do we establish the pattern of the ownership of the entitlements to consume a future global carbon budget that is finite and contracting by around 60% so as to be consistent with the objective of the UNFCCC? Is the role of politicians simply to relay the wisdom of social scientists to the negotiations at the UN and so deliver the climate treaty? It certainly hasn't worked so far. And critically the US is seeking the general acceptance of the international tradability of pollution permits and the assigning of property rights in the global commons is essential to the exercise. Simply trading margins off the existing trends of pollution in the globally inequitable status quo will not bring about the reductions to which the developed countries are now legally committed. Nor particularly will it encourage the involvement of the developing countries on whose participation the process and its success so obviously depends and whose participation in an unavoidable way depends on the issue of distributional fairness globally. As the end-game of Kyoto clearly demonstrates, China, India and the Africa Group of nations are making *"equitable allocations"* and the acceptance of linking Contraction to Convergence a precondition of their acceptance of emissions trading and their involvement in any global solution. This not an invitation to have another century of neoclassical economics. It is about limits. Its more than a worthy challenge, it is wholly unprecedented in human affairs. Just as capitalism surrounded and contained communism, now the massive uncertainties of climate change engendered by them both, surround and contain them both. Discovering the way forward is a challenge more rigorous than merely worthy.

CLOSING FALSE DICHOTOMIES CAN OPEN THE WAY TO COMMON SENSE

Given disputes over early efforts, (the "descriptive" acceptance of CO2 property rights proportional to GDP, mortality evaluation being made proportional to income and so on), the allegedly left/right relationship of what is presented as "prescriptive" as against "descriptive" should be re-evaluated in a common sense way. The free-market model is described as being free choice in action and largely unfettered by prescription. People vote with their dollars every time they make a purchase in this market. And this market described as GDP, also currently describes the human causation of climate change. Here is a descriptive example of the distribution of dollars globally in the global free-market in 1990. One third of global population responsible for 90% of fossil fuel emissions had 94% of the dollar-equivalent purchasing power, while the other two thirds responsible for 10% of fossil fuel emissions had the remaining 6% of the dollar-equivalent purchasing power. Notwithstanding, the SAR economists from the wealthy group describing this market with cost-benefit analysis revealed that it was

cheaper to adapt to climate change than not. One consequence was that the dollar vote of Bangladesh for example was not big enough to weight the cost/benefit ratio towards prevention and away from adaptation. The analysis claimed to be merely descriptive and free of prescription, but for the Bangladeshis it was a prescription about learning to adapt to rising sea level. The distinction between what is descriptive and prescriptive is not as clear as the convenience of cost/benefit analysis requires. In the now altered circumstances of human-induced climate change, it is a false dichotomy. Being in any way rational and particularly having recourse to measurements of any kind whatsoever, is being both by definition. Heisenberg clarified that.

This doesn't mean we should all try and seek immediate nescience. And nor does invite a continued tendency to tolerate the unfortunate free-market requirement for the liquidation of people who haven't got any money. What common sense requires is a re-appraisal of our collective prospects freed from some of the absurdities above. It is not wrong to openly contemplate our prospects in terms of a requirement for negotiated prescriptivity in global solutions to global problems.

This re-appraisal may have already begun. At the meeting of IPCC WG3 in Oslo in August 1997, the Energy Modeling Forum (EMF) at Stanford University introduced specifications for modelers that for the first time included the device of a "prescriptive" requirement on the future distribution of global emissions entitlements. It was inter alia that the future costs and benefits of climate change control measures be evaluated in the context of carbon budgets which had been internationally distributed on the basis of a deliberate convergence to equal per capita shares globally by various predetermined dates. One of the core group members, Richard Richels, made the sanguine point that no economist can come up with sensible numbers for the international distribution of the costs of climate change policy *"until the economists had been given the rules of distribution"*. In the absence of agreement yet at the political level at the UNFCCC, the EMF had discontinued the pattern of "descriptive-only" distributional assumptions, as continued in the SAR, and admitted the expedient of at least theoretically prescribing a variety of formal convergence-based examples of distribution. Elsewhere on the theme of "Burden Sharing", in the IPIECA "Symposium on The Economics of Climate Change" (1997) he and his colleague Alan Manne, were even more specific. *"We begin with one widely discussed proposal: a transition to equal per capita emissions rights (globally) by 2030,"* again allowing the expedient of a "prescription" to "solve" what is otherwise insoluble.

It is worth emphasizing that there are three key decisions here. One is that an assumption has been made that "prescriptivity" is unavoidably part of the process. Two is that the "prescriptivity" is the result of the application of a central organising principle. Three is that the choice of central organising principle (the convergence to equal per capita) is one which has been *"widely discussed"* which could be read as evidence of the reasonableness of the idea and that these economists share that judgement about that reasonableness.

GCI's CAMPAIGN FOR EQUITY AND SURVIVAL

We have actively advocated the linking of carbon contraction to percapita convergence of emissions entitlements globally for many years. We see this as the practical expression of recognising the global link between equity and survival. It is not equity just for its own sake but the equity of necessity. And we have also pleaded the wisdom or more probably just common sense of recognising the lack of any viable alternatives to this undoubted political novelty. Consequently GCI welcomes the positive attention being given to these ideas by these academics, and also now many bureaucrats, politicians, diplomats and other NGOs.

Our attempt to make a positive contribution to this debate has been not just to pose the need for *"Contraction and Convergence"*. We have also provided and promulgated a planning model with a central organising principle for distributional equity that can demonstrate many scenarios for the generation of integrated global accounts for emissions entitlements. In these, after the given initial distribution of CO2 emissions entitlements, they are progressively distributed under any chosen (and even revisable) global cap so that the available entitlements become more proportional to population each year. This creates a pattern of international convergence to any chosen future date, from which point forward international emissions entitlements would contract pro rata on an equal per capita basis as determined by the global cap and any revision thereof. *"Contraction and Convergence"* is not a prescription per se, it is way of demonstrating how a global prescription could be negotiated and organised.

At the First Conference of the Parties (COP1) in April 1995, the Indian Government, drawing on GCI's equity-focused contributions to the IPCC WG3 sections of the SAR, proposed a solution to future global carbon budgeting. It is significant that this happened at a time when the terms of the Berlin Mandate were being drawn up. While the mandate foresaw only strengthened commitments on greenhouse gas (GHG) abatement for the

Industrial Countries of Annex One – that is with no GHG abatement commitments being contemplated for the developing countries of Non-Annex One – it is significant that the Indian Environment Minister declared: - *"We face the actuality of scarce resources and the increasing potential for conflict. Protecting the world's environment requires that development be sustainable. It also implies the implementation of a programme for convergence at equitable and sustainable par values for the use of environmental space on a per capita basis globally. In our view equal rights to carbon usage is fundamental to the convention."* (This is *"Contraction and Convergence"*). *"Policy instruments such as tradable emissions, carbon taxes and joint implementation may well serve to make matters worse unless they are properly referenced to targets and timetables to be observed by those responsible for the damage to the atmosphere and biosphere. The social, financial and ecological inter-relationships of equity should guide the route to global ecological recovery."*

Since COP1 in March 1995: -

(1) GCI has generated the model *"Contraction and Convergence"* Options [CCOptions] to facilitate negotiation in these terms of *"Contraction and Convergence"* approach (see Annex C) and
(2) And propagated the international uptake of this approach and the use of the model, through extensive outreach and international travel and attendance at international negotiations under the UNFCCC and related IPCC workshops,
(3) The European Parliament adopted a resolution for the United Nations General Assembly Special Session (UNGASS) in June 1997 explicitly based on the approach.
(4) The US government tabled a draft protocol 1997 in at the AGBM in April 1997. It enables *"Contraction and Convergence"* to be agreed so for this reason we supported the US draft.
(5) The Chinese, Indian and US Governments all have the CCOptions model with technical support as a result of their requests to GCI to provide it.
(6) The Byrd-Hagel resolution was passed through the US Senate also enabling *"Contraction and Convergence"* with much debate recognising the need for controlled growth of emissions entitlements in developing countries in the medium term alongside the need for real reductions in developed countries.
(7) The Africa Group of Nations adopted *"Contraction and Convergence"* as its position for the negotiations at COP3) in Kyoto (see Appendix C) and re-iterated this call during the final plenary session.
(8) IPCC WG3 adopted modeling specifications that included per capita convergence paths under different contraction scenarios acknowledging the normative character of this and its novelty within IPCC.
(9) The Chinese State Councilor with responsibility for Climate Change and Population policy (Dr Song Jian) has publicly affirmed (October 5th 1997) his government's position in per capita terms which are precisely and explicitly consistent with *"Contraction and Convergence"* (see Appendix D).
(10) GLOBE International adopted principles explicitly based on this approach. GLOBE also made the following proposal to a plenary session of the Third Conference of the Parties (COP3) in Kyoto. *"Let the Conference of the Parties resolve to agree to negotiate a legally binding "Equity Protocol" establishing the principle that the apportionment of global emissions entitlements be deliberately converged to a point of equal per capita shares."* (Full speech is Appendix E)
(11) Representatives of the AFLCIO, UNCTAD and the Chicago Board of Trade have publicly expressed support for *"Contraction and Convergence" as* a viable basis on which to negotiate the allocations necessary for emissions trading.
(12) The prestigious science journal "Nature" produced a special edition for Kyoto endorsing the approach.

"Contraction and Convergence" is ever more widely seen as a way of overcoming the negotiating impasse between the United States of America, the other Annex One Countries and the Non Annex countries. Potentially it resolves USA's insistence on emissions trading and "globality", where "all" or "key" developing countries must be pre-figured for abatement commitments if the general Kyoto settlement, is to achieve the necessary ratification, whilst meeting the developing countries requirement for "equitable allocations".

The test of whether global emissions trading is relevant or irrelevant is not merely "avoided emissions at least cost." Stated thus, it is not indexed to the objective of the UNFCCC. The test is stabilisation of atmospheric greenhouse gas concentrations at levels that avoid disruption of the global climate system at least cost. Here "cost" means both damage cost (regardless of whether these costs are or can be monetised or not) and emissions abatement cost required for this. However, effecting the "relevant" trade plan is contingent on establishing globally inclusive QELROs and GCI asserts is not possible without *"Contraction and Convergence"*. Thus pursuing "relevant" emissions trade commands by definition convergence as well as reducing the costs of contraction. This way gives the triple win. The first and second parties, the trading partners, win but because of the equitable distribution so do the third parties. In other words all parties and the planet win because through *"Contraction and Convergence"* with trade climate change is avoided at least cost globally.

GLOBAL EQUITY DAWNS AT KYOTO's DARKEST HOUR

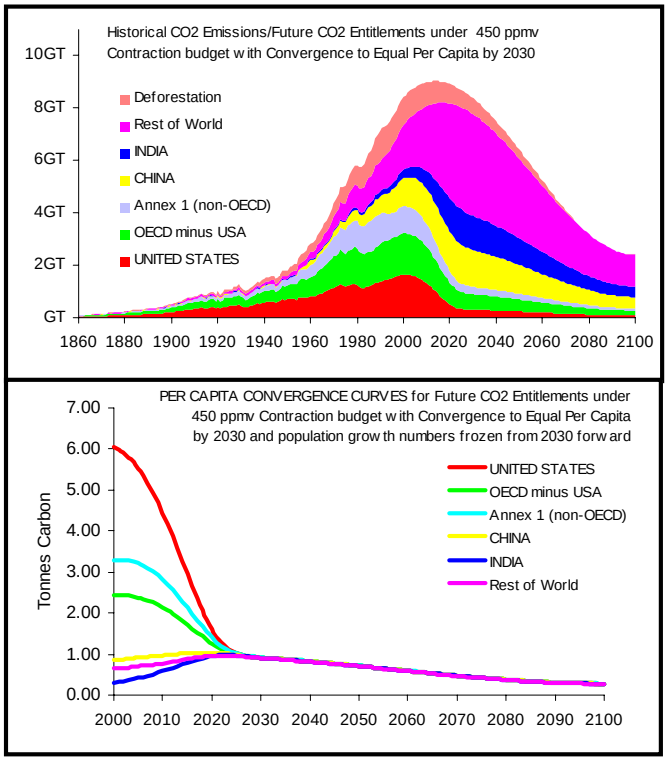
At the end of the Kyoto negotiations, the entire debate came to centre on the issues of trade and the assigning of property rights in the future carbon budget. By definition, emissions trading cannot occur until the principle of property rights has been agreed and the entitlements have been assigned and ratified.

At 3.00am when the negotiations were already into injury time, the paragraph in the draft Kyoto Protocol relating to trade came up for acceptance. The US re-iterated their insistence on the acceptance of emissions trading. The governments of China and India, contrary to people's expectations, did not rebut the idea. Instead they responded by saying that acceptance of trade depended on the issue of "equitable allocations" of emissions entitlements. The Africa group of countries intervened, re-iterating that this was why they wanted "*Contraction and Convergence*". The US replied by saying that they were attentive to the call for *"Contraction and Convergence"* but felt it was too soon. This underlined the remarks made at the GLOBE International workshop in Bonn in October 1997 by US Ambassador Mark Hambley to an international gathering of Parliamentarians, that the idea is being taken seriously in Washington. They have said since it is the only game in town.

The meeting broke for half an hour. On resumption, Chairman Estrada read out a prepared text (now known as article 16 bis). In effect the COP issues instructions to SBI and SBSTA to elucidate during 1998 the rules, principles, modalities etc relating to trade, in time for COP4 in Buenos Aires in November 1998. (A simple GCI module of global emissions trading consistent with the objective of the UNFCCC is suggested in Appendix F).

In order to make progress and avoid another effective deferment at COP4, the most urgent task for 1998 is to have these principles and rules developed in terms of the logic of *"Contraction and Convergence"* and to promote the widest uptake, acceptance and application of this approach. (The GCI Draft Protocol for *"Contraction and Convergence"* is attached in Appendix G). (The *"Contraction and Convergence"* model is described in Appendix H. The model can be down loaded from GCI's website at www.gn.apc.org/gci with a technical description of all its features). The model will compute (1) any budget with (2) any integral with (3) any take off slope and (4) any landing slope for (5) any number of countries or (6) groupings thereof with (7) linear convergence or (8) any rate of exponential convergence to (9) any chosen target date with (10) the option to "freeze" population growth beyond a chosen date. Moreover (11) each budget can be revised "in progress".

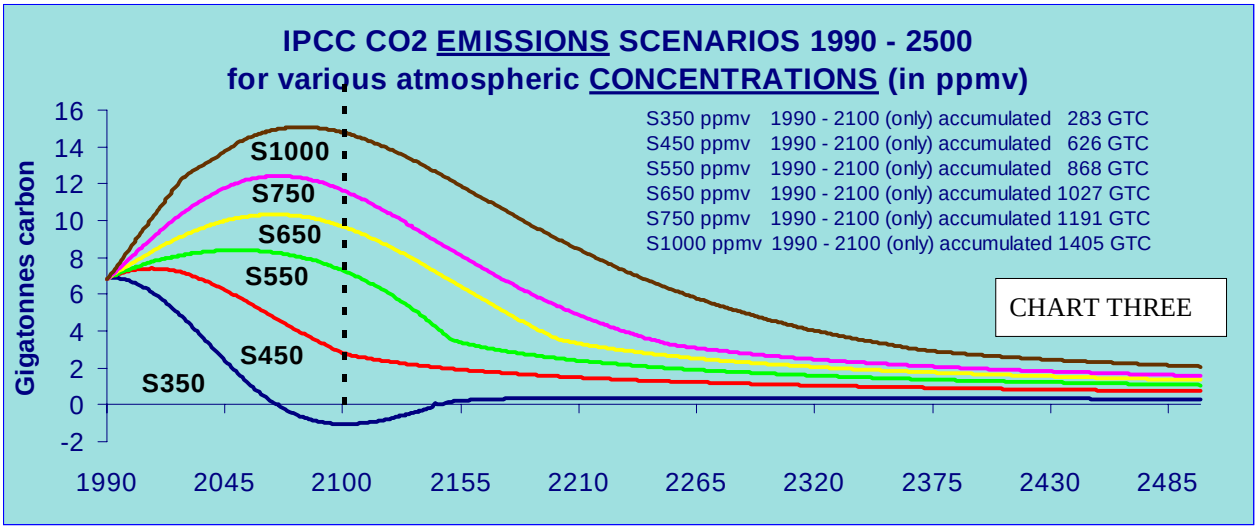
CHARTS 5 & 6 below show gross & per capita *"Contraction and Convergence"* for the world in 6 regions. The contraction profile is from 2000 for an outcome of atmospheric CO2 concentrations at 450 ppmv by 2100. The convergence pattern is from given levels at 2000 to equal per capita shares globally by 2030. Here it is achieved exponentially with population growth included until that date.



APPENDIX A

Consideration of IPCC CO2 Scenarios for Carbon Emissions

IPCC have published scenarios for different atmospheric GHG concentration levels resulting from different CO2 emissions scenarios, as in the graph below. The scenarios run through years 1990 to 2500 and are expressed in gigatonnes carbon (GTC) from CO2 annually on the left-hand axis. The accumulated emissions (integrals), between 1990 and 2100 only, are summarised in the top right hand corner of the graphic. These are also expressed in GTC. The atmospheric CO2 concentration curves are not shown, but in each case stabilisation occurs after the respective emissions contraction path of each has completed.



Integrals quoted in the right-hand corner of the graphic are obtained from the data supplied by IPCC. They are different from the integrals published by IPCC in their table, which follows. IPCC's published ranges for accumulated emissions against atmospheric concentration curves are in the table below.

atmospheric concentration of CO2 expressed in parts per million by volume (ppmv)	ranges of accumulated CO2 emissions expressed in gigatonnes carbon (GTC)
350	**300 to 430**
450	**630 to 650**
550	**870 to 890**
650	**1030 to 1190**
750	**1200 to 1300**

APPENDIX B

POLICY MAKERS' SUMMARY SOCIAL COSTS OF CLIMATE CHANGE
Chapter 6 Summary for Policy Makers IPCC WG3 SAR

The literature on the subject in this section is controversial and mainly based on research done on developed countries, often extrapolated to developing countries. There is no consensus about how to value statistical lives or how to aggregate statistical lives across countries. Monetary valuation should not obscure the human consequences of anthropogenic climate change damages, because the value of life has meaning beyond monetary value. It should be noted that the Rio Declaration and Agenda 21 call for human beings to remain at the centre of sustainable development. The approach taken to this valuation might affect the scale of damage reduction strategies. It may be noted that in virtually all of the literature discussed in this section 1). the developing country statistical lives have not been valued equally at the developed country value 2). other damages in developing countries are also not equally valued at the developing country value. Because national circumstances, including opportunity costs, differ, economists sometimes evaluate certain kinds of impacts differently amongst countries.

The benefits of limiting greenhouse gas emissions and enhancing sinks are (a) the climate change damages avoided and (b) the secondary benefits associated with the relevant policies. Secondary benefits include reductions in other pollutants jointly produced with greenhouse gases and biological diversity conserved. Net climate change damages include both market and non-market impacts as far as they can be quantified at the present and, in some cases, adaptation costs. Damages are expressed in net terms to account for the fact that there are some beneficial impacts of global warming as well which are however, dominated by the damage costs. Non-market impacts, such as human health, risk of human mortality and damage to ecosystems, form an important component of available estimates of the social costs of climate change. The literature on monetary valuation of such non-market effects reflects a number of divergent views and approaches. The estimates of non-market damages, however, are highly speculative and not comprehensive.

Non-market damage estimates are a source of major uncertainty in assessing the implications of global climate change for human welfare. While some regard monetary valuation of such impacts as essential to sound decision making, others reject monetary valuation of some impacts, such as risk of human mortality, on ethical grounds. Additionally there is a danger that entire unique cultures may be obliterated. This is not something that can be considered in monetary terms, but becomes a question of loss of human diversity for which we have no indicators to measure economic value.

The assessed literature contains only a few estimates of the monetised damages associated with doubled CO2 equivalent concentration scenarios. The estimates are aggregated to a global scale and illustrate the potential impacts of climate change under selected scenarios. Aggregating individual monetised damages to obtain total social welfare impacts implies difficult decisions about equity amongst countries. Global estimates are based upon an aggregation of monetary damages across countries (damages which are themselves implicit aggregations across individuals) that reflect inter-country differences in wealth and income - this fundamentally affects the monetary valuation of damages. Taking income differences as given implies that an equivalent impact in two countries (such as an equal increase in human mortality) would receive very different weights in the calculations of global damages.

To enable choices between different ways of promoting human welfare to be made on a consistent basis, economists have for many years sought to express a wide range of human and environmental impacts in terms of monetary equivalents, using various techniques. The most commonly used of those techniques is an approach based on the observed willingness to pay for various non-market benefits. This is the approach that has been taken in most of the assessed literature.

Human life is an element outside the market and societies may want to preserve it in an equal way. An approach which includes equal valuation of impacts on human life wherever they occur may yield different aggregate global estimates than those reported below. For example, equalising the value of a statistical life at a global average could leave total global damage unchanged but would increase markedly the share of these damages borne by the developing world. Equalising the value at the level typical in the developing countries would increase the monetised damages several times, and would further increase the share of the developing countries in the total damage estimate.

Other aggregation methods can be used to adjust for differences in the wealth or incomes of countries in the calculations of monetary damages. Because the estimates of monetary damage tend to be a higher percentage of national GDP in low-income countries than for high-income countries, aggregation schemes, which adjust for wealth or income effects, are expected to yield higher estimates of global damage than those estimated in this report.

The assessed literature quantifying total damages from 2 to 3 degrees Celsius warming provide a wide range of point estimates for damages given the presumed change in atmospheric greenhouse gas concentrations. The aggregate estimates tend to be a few percent of world GDP, with in general, considerably higher estimates of damage to developing countries as a share of their GDP. The aggregate estimates are subject to considerable uncertainty, but the range of uncertainty cannot be gauged from the literature. The range of estimates cannot be interpreted as a confidence interval given the widely different assumptions and methodologies in the studies. As noted above, aggregation is likely to mask even greater uncertainties about damage components.

Regional or sectoral approaches to estimating the consequences of climate change include a much wider range of estimates of the net economic effects. For some areas, damages are estimated to be significantly greater and could negatively affect economic development. For others, climate change is estimated to increase economic production and present opportunities for economic development. For countries having a diversified industrial

economy and an educated and flexible labour force, the limited set of published estimates of damages are of the order of one to a few percent of GDP. For countries having a specialised and natural resources based economy (e.g. heavily emphasizing agriculture or forestry), and a poorly developed land-tied labour force, the limited set of published estimates of damages are several times larger. Small islands and low-lying coastal areas are particularly vulnerable. Damages for possible large-scale catastrophes, such as major changes in ocean circulation, are not reflected in these estimates. There is little agreement across studies about the exact magnitude of each category of damages or relative ranking of the damage categories. Climate changes of this magnitude are not expected to be realised for several decades and damages in the interim could be smaller. Damages over a longer period of time might be greater.

IPCC does not endorse any particular range of values for the marginal damage of CO2 emissions, but published estimates range between $5 and $125 (1990 US) per tonne of carbon emitted now. This range of estimates does not represent the full range of uncertainty. The estimates are also based on models that remain simplistic and are limited representations of the actual climate processes in being and are based on earlier IPCC scientific reports. The wide range of damage estimates reflects variations in model scenarios, discount rates and other assumptions. It must be emphasized that the social costs estimates have a wide range of uncertainty because of limited knowledge of impacts, uncertain future technological and socio-economic developments and the possibility of catastrophic events or surprises.

(1) The value of a statistical life is defined as the value people assign to a change in the risk of death among a population.

(2) The concept of willingness to pay is indicative, based on expressed desires, available resources and information of a human being at a certain point in time. The values may change over time. Also other concepts, such as willingness to accept compensation for damage, have been advanced, but not yet widely applied in the literature and the interpretation and application of willingness to pay and other concepts to the climate problem may evolve.

(3) Due to time lags between findings in the natural sciences, their use in determination of potential physical and biological impacts, and subsequent incorporation into economic analysis of climate change, the estimates of climate change damages are based mainly on the scientific results from the 1990 and 1992 IPCC reports.

(4) See the Assessment Reports of Working Groups One and Two.

APPENDIX C

TEXT OF THE AFRICA GROUP OF NATIONS STATEMENT TO THE AUGUST 1997 AGBM

Mr. Chairman - Let me begin by adding the Africa Group support for the statement made by the Chairman of the Group of G-77 speaking on behalf of the G-77 and China. Speaking on behalf of the Africa Group, I wish to commend you on the manner in which you have presided over the negotiations in the AGBM process. This has been an extremely difficult session of meetings. However, what is crucial is to try to evaluate whether of not the Parties have made any real headway in trying to strengthen the commitments under Article 4.2 (a) and (b) and advance the implementation of Article 4.1 as was mandated to us by the Berlin Mandate.

We shall pack our bags and return home with a sense of concern about the pace of progress that has been made. Unfavourable climatic conditions will continue to plague our economies, our crops will continue to fail, national external debts will remain a problem to us and our basic social infrastructure will continue to suffer as a result of the impacts of climate change. Yet the Annex One Parties - in particular those parties that have chosen to refrain from giving us their numbers - will go home smiling, celebrating their success in holding back the negotiation process.

We are grateful to those Parties who have given us their proposals and we look forward to evaluating these proposals in order to assess the impacts they will have on our socio-economic infrastructures. Some of our countries are already in the process of implementing activities to address the problem of greenhouse gas emissions (GHG) emissions. We wait in anticipation for Annex One countries to show the necessary commitment. As we negotiate the reduction of GHG, the countries of Africa believe that there should be certain principles that need to be clearly defined.

First: There must be limits on all GHGs if the danger to our climate is to be averted. The IPCC scientific assessment report provides us with the basis for global consensus on such limits. The contrary view therefore does not enjoy much emotional, political or indeed scientific support.

Second: A globally agreed ceiling of GHG emissions can only be achieved by adopting the principle of per capita emissions rights that fully take into account the reality of population growth and the principle of differentiation.

Third: Achievement of a safe limit to global GHG emissions can be achieved by reducing the emissions of Annex One while at the same time ensuring that there is controlled growth of future emissions from Non-Annex One countries, reflecting our legitimate right to sustainable economic growth. We strongly believe that this will take us along a path to responsible climate management that allows us to reach our goal of defining a mutually agreed point of convergence and sustainable development. Such a convergence Mr. Chairman must ensure that we maintain a global ceiling on emissions to prevent dangerous interference with the climate system.

Fourth: When we look at time frames, we believe that insufficient commitment by Annex One countries will only result in delaying our influence on the climate system. If this course is maintained, then we will all suffer and the burden will be even greater for humanity in general. The burden for any future mitigation efforts on those of who have not been historically and currently responsible for creating the problem will be greater.

Mr. Chairman we recognise that per capita emissions rights, as a form of differentiation is not an easy goal. It calls for deliberate actions to attain reduction targets over time by Annex One Parties and sustainable growth in the Non-Annex One Parties. To do this Africa would need predictable financial resources, technology transfer, education, training and public awareness, systematic observation and research. We look forward to renewed co-operation with other Parties in implementing our commitments under Article 4.1.

Mr. Chairman, we must focus our attention on the most appropriate, reasonable and acceptable time frame for action. There is an over-riding pre-requisite. The time frame can not be too far away into the future if we are to avoid at all costs the dangers that global climate change poses. The current scientific evidence indicates that Africa faces decline in water resources, agricultural production and economic performance. It is therefore for this reason that we wish to register the seriousness with which we view the effective implementation of the Convention and future agreements emanating from it.

Finally Mr. Chairman, we would request that the Secretariat take note of the views expressed in this statement on behalf of the African Group of Nations and Parties to the Convention. We look forward to meaningful targets and timeframes for consideration at the next session of the AGBM. - I thank you. (Mrs. Karamanzira - Zimbabwe).

APPENDIX D

EXTRACT FROM SPEECH BY DR SONG JIAN (STATE COUNCILLOR WITH RESPONSIBILITY FOR CLIMATE CHANGE AND POPULATION) AT THE CLOSING CEREMONY OF THE CHINA COUNCIL FOR INTERNATIONAL CO-OPERATION ON ENVIRONMENT AND DEVELOPMENT (OCT 5TH 1997)

We fully understand the worldwide campaign to battle the climate change spearheaded by the European Union and Nordic Countries. The voice of small island states also brooks no ignorance. According to the United Nations Framework Convention on Climate Change (UNFCCC) and the Berlin Mandate, China bears no responsibility for reducing greenhouse gas emissions. When we ask the opinions of people from all circles, many people, in particular the scientists think that 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. Today the per capita consumption is just one tenth of that of the developed countries, one eighth of that of medium developed countries. It is estimated 30-40 years would be needed for China to catch up with the level of medium developed countries. No one is entitled to prohibit families from using refrigerators or those who live or work in such a high temperature of 40 degrees Celsius from enjoying air-conditioning. However the Chinese people and government do have realized their due responsibilities for the global climate change and committed to make efforts to lower down the increase rate of greenhouse gas emissions in the following way: -

1. To control the growth of population and stop China's population from growing within thirty years. This is the decisive guarantee of protecting climate and the environment.
2. To put the exploitation of hydroelectric power resources on the top priority, and to explore other renewable energy sources, develop clean coal technologies and reduce the emissions of unit energy consumption.
3. To continue the campaign of afforestations, plant more trees, attend pasture lands, develop ecological agriculture, protect ecological environment and preserve and strengthen the ability of sinks for absorbing carbon dioxide from the atmosphere. The forest coverage is planned to be doubled to exceed thirty percent of the total territory of the country in the 30-40 years to come.
4. To raise extensively the efficiency of energy utilisation, develop new and less energy-consuming industries and reduce the consumption for per unit of GDP.

In all these fields, the scientific and industrial communities of China shall try the best to make their own contributions, and at the same time, we need international co-operation. I hope that all the members and the experts of the working groups could put forward opinions and creative suggestions.

APPENDIX E

Kyoto, 9 December 1997

SPEECH BY TOM SPENCER, MEP TO THE PLENARY SESSION OF THE UNFCCC.

I had the honour to address COP1 in Berlin. I had the impertinence to suggest that future meetings be held on the great Antarctic iceberg as a way of dramatising the urgency of our task. Kyoto is much more pleasant than an iceberg, but the urgency has intensified.

The nature of the challenge of climate change is now clear. It is not scientific. It is not technological - we are an adaptive species. As John Prescott said yesterday, the challenge is political, and I would add, it is intellectual, institutional, and ethical. After a week of debate about important details, I suggest that the time is right for a statement of even more important principle, After years of debate, about "efficiency" I suggest that your results cannot be brought to success without a statement about equity. The "sense of the Senate" resolution made the fair political point that they could not ratify a treaty, that was not seen to be fair by the American people, A treaty would have to include meaningful participation by developing countries. I would say to my friends in Congress that you cannot ask for that involvement on the basis of efficiency alone, You must specify that the nature of that involvement will be equitable. I am not a Government. I speak this morning only for an organisation of environmentally- committed parliamentarians from 47 countries. With all the humility appropriate to a non-negotiator, may I suggest a text to this great gathering of negotiators.

Many of you know the Contraction and Convergence analysis. It offers a framework for an answer. It offers an envelope of equity within which we can trade and barter our way to collective sanity in the coming decades.

Let us make a start in this direction. Let the Conference of Parties resolve " to agree to negotiate a legally binding "Equity Protocol" establishing the principle that the apportionment of global emission entitlements be deliberately converged to a point of equal per capita shares at a date to be agreed."

I invite the Government of Japan to propose such a text, which is in line with their policy statement at AGBM7. I invite the European Union, whose efforts entitle it to take a leadership role, to propose such a text. I invite the United States, which rightly takes its stand on the basis of a "global solution to a global problem" to draw the logical conclusion of its own approach, and to propose such a text.

And in response: May I invite the Africa Group whose statement in August led the way to respond to such a text. May I invite the AOSIS states whose very survival depends on our collective success to back such a proposal. May I invite the Governments of China and India to seize this opportunity of an equity protocol that would entrench in our process the principle they have correctly and courageously fought for.

In life the right thing to do is the right thing to do. It is occasionally true in diplomacy that an ethically just answer is also the only available way out of an impasse.

ANNEX F

The Ideas behind Contraction and Convergence

Fundamental Assumptions

1/ Survival and IPCC Scenarios

In accordance with the FCCC and best scientific evidence as reported by the IPCC and elsewhere, we assume that total anthropogenic emissions of CO2 over the 110-year period 1990-2100 must be in line with those set out in IPCC working group 1's 1994[1] and 1995[2] reports under the 'S350' or 'S450' scenarios.

We regard S350 as a necessary target to give a reasonable degree of belief that large-scale damage to the world economy, human lives and natural ecosystems can be averted. We also used the S450 scenario as an upper limit for consideration; under which there is a chance that damage, though serious, will be containable.

The S550 and higher scenarios we ignore, as it is clear that going for those presents a high probability that positive feedback loops, admittedly underrepresented in the modeling underlying the IPCC scenario calculations, will lead to catastrophic failure of ecosystems and of human societies. Additionally, when a chart of an S550 scenario is examined for the period of the 21st century, rather than for the much longer period used in the IPCC reports, it is clear that, even ignoring these feedbacks, S550 is virtually equivalent to business-as-usual for a large chunk of that century. In other words, adopting it is little different from a do-nothing approach.

Finally we note that, if an aim of 550ppm were agreed, and later it was desired on the basis of new evidence to change policy and aim for 350ppm instead, it would be almost impossible to do so after about 2005. Cutting back from a 450ppm target to 350, on the other hand, could be done up to about 2015.
The CCOptions workbook enables the validity of these assertions to be checked.

2/ Contraction

To implement the above, and based on data reported in [1] and [2], we select a target value for CO2 emissions to stabilise at and a target year to stabilise in. We select the target value as the highest value, up to a maximum of 40% of the start-year value, which yields a curve that does not dip below the target value. We select the target year to be as far into the future as looks workable. For an S350 scenario we suggest 2050; for an S450 scenario 2070. To compute CO2 allocations one needs also to make assumptions about future population growth. In (7) below we set out precisely how we have dealt with this issue. Our algorithm enables a schedule of total global emissions to be laid out which adds up to a desired total over the 110-year period and is normally chosen to be in line with tables presented in [1] and [2]. Given the assertion in [1] that the total climate impact of a pattern of CO2 emissions depends to a first approximation only on the total emissions, and not on the temporal pattern of those emissions, we have a reasonable basis for our assertion that our scenarios can legitimately be represented as S350 and S450 scenarios.

Scenarios where stabilisation occurs after 2100 can be represented by entering a global emissions decline rate for the year 2100. CCOptions does not attempt to look forward beyond 2100.

Note that there is no necessity to stick to 350/450/550 as targets. 400ppm might be a practically negotiable target; from which a change of plan to 350ppm looks to be possible until about 2025.

3/ Convergence

To enable international negotiations to have some chance of success, these emissions need to be allocated by countries in a way that is both achievable and is seen by all to be fair. To that end we specify that the per-capita emissions converge from their present diverse values to a standard world value, to be the same for each country, in a 'convergence year' set as 2045. 2045 is chosen because partly because using it gave a good balance between what is achievable and what can be seen to be fair. Equally importantly, 2045 is chosen because it is the United Nations' centenary year; and it seems a fruitful idea to invest that year with being the target date for achieving this limited but significant measure of international equity.

Note that there is no algorithmic need for the convergence year to be earlier or later than the contraction year. It might make for ease of negotiation to set them to be the same; but at this stage that seems an unnecessary restriction to us.

4/ Consistency with Rio Commitments

We have assumed that the 'Annex1' countries as defined in the 1992 FCCC will meet their commitment to return emissions to their 1990 levels by 2000. Even if they do not meet them, future allocations should be on that basis, otherwise the IPCC and the UN will be undermined. Modification of the model to be consistent with the Kyoto commitments is in hand, but will make only a minor impact on the process overall.

5/ Algorithms

The approach is a three-stage process, with an initial stage that extrapolates from the most recent year for which actual CO2 emissions data is available up to 2000, the scope of the pre-Kyoto FCCC commitments. Contraction and convergence proper are then started in 2000; a global contraction profile being determined first, and then a separate convergence criterion applied.

5.1/ The Initial Stage

As laid out in (4) above, we assume that Annex1 countries' emissions return to their 1990 values by 2000. For definiteness we assume that emissions from 1995 to 2000 retrace backwards the actual trajectories from 1990 to 1995. We have also had to estimate emissions for 1995, as data is only available from the UN as far as 1994 (as of May 1997). For the other countries for the remainder of the 90s decade we linearly extrapolate the trend of growth from the latest available figures.

5.2/ The Contraction Stage

For this we fit a quartic curve of the form
$z = k+ly+my^2+ny^3+py^4$
where z is the total global industrial CO2 emissions; y is the year and the parameters k,l,m,n and p are jointly determined by the following five conditions:
i: z is set for the start year of 2000 as explained in (5.1) above.
ii: z is set at the contraction target value for the contraction target year as explained in (2) above.
iii: dz/dy was set to a target value for this target year (i.e. we assume that the emissions decline rate reaches a target -- commonly zero -- at that time).
iv: dz/dy is set to 1.5% in 2000, reflecting the actual global increase in that year implied by the method described in (5.1). In the workbook, this is an adjustable parameter.
v: The area under the curve, calculated by integration of the above formula, corresponding to the total global emissions over the 110-year period, was set as explained in (2) above.
These conditions yield a set of 5 simultaneous linear equations which are solved to compute the actual values of k,l,m,n, and p.
An allowance of 50GT in total is subtracted from the 110-year target taken from [1] or [2] to take account of deforestation emissions. As even the present annual emissions rate appears to be uncertain to within at least 50% or so; and the total amount of carbon in global forests is orders of magnitude less than that in unburnt fossil fuels, we think it both justifiable and politically helpful to make this very crude approximation. The actual figure of 50GT is towards the optimistic end of the range (30GT to 90GT) used in the six IS92a-f scenarios which were set out in IPCC WG1's 1992 report [3]. We are in the process of adding in also an allowance for 'bunker fuels' – fuel used in civil air and sea transport, which are not allocated to countries and have been excluded from most calculations up to now. We plan to treat these, like deforestation, as a world overhead, and do not suggest allocating them to countries. We suggest that reductions be projected to proceed at the same rate as total global industrial emissions. For similar reasons we have not taken account at all of other greenhouse gases. These shortfalls could easily be addressed in the future when or if accurate and acceptable data becomes available.
An option is also available to enter a preset profile of global emissions from 2000 to 2100 as a set of numbers. CCOptions then applies its convergence algorithm.

5.3/ The Convergence Stage

This, the process to allocate %shares of global emissions to all the worlds' countries, is a little more complex. The ideas behind our algorithm are:
i/ to start out with 'actual' shares in 2000, as derived by the methods described above;

ii/ to converge all the shares on to actual proportions of global population in the convergence year, which, as we have explained we strongly urge be set to 2045. But the population figures used are subjected to a cap as set out in (7) below.
iii/ the actual degree of convergence allocated in each year to depend on the (potentially capped) population only for that and earlier years. This means that if these procedures were in use, the actual allocations for any given year would only depend on data then available, not on forecasts of population in some year that is then in the future.
The formula used is $s_{y+1}=s_y-(s_y - p_{y+1})\exp(-a(1-t))$
where s_y is the emissions share of a country in year y, p_y is its share of the global population (subject to the cap) in year y, t is the fractional time elapsed between 2000 and the target year (t=0 for 2000 and t=1 at the convergence year of, say, 2045), and a is an arbitrary parameter that determines the rate of convergence.
In the workbook a is adjustable. The higher the value the more the convergence happens towards the end of the convergence period, and vice-versa. Choosing a=4 gives an even balance.
This is intended to be the simplest formula that achieves the aims i-iii above.
An option has been added to converge linearly instead of using the above formula.

6/ Allocations

The actual industrial CO2 emissions allocations are then made by multiplying the global total value derived from the contraction process by each country's shares derived from the convergence process.

7/ Population Assumptions

We have used UN median figures for forecast population growth by country.
We have then used a cap on population growth for the purposes of allocation of emissions rights. This was done by notionally freezing population numbers (only) for years beyond a 'population cutoff year' at the values for that year. Note there is no assumption being made about what populations will or should be beyond the cutoff year; merely that population growth after that year should not accrue additional emissions rights. In the workbook the year is adjustable. We hold it necessary to adopt some such cap criterion, as otherwise the system will be construed as giving national governments a positive incentive to encourage their populations to grow to obtain an increasing share of emissions rights.

8/ The CCOptions Workbook

The above ideas on contraction and convergence have been actualised in a Microsoft Excel workbook, CCOptions; which is available free from the GCI web site. Excel version 5 or later is required.
CCOptions models CO2 emissions allocations from the present up to 2100, married with CDIAC data for historical CO2 emissions.

The user is presented with a panel of parameters which are adjustable within limits; and whenever new values are typed in, graphs of countries' emissions are regenerated for the time-span from 1860 to 2100. Some of these graphs have been used to support well-received presentations at various climate-change conferences from COP2 in Geneva in July 1996 on.

As well as the base C&C computation, the workbook also includes a feature to investigate what could happen if policy were to switch from a 400ppm initial target, say, to a 350ppm target at some future date. This is done by having a 'Phase two' for contraction, with user-settable start year, target 110-year CO2 emissions, and target annual emissions. The convergence process is unaffected by this.

For a brief explanation of how to use the workbook see separate document, available from the web site.

References

[1]CLIMATE CHANGE 1994 Radiative Forcing of Climate Change *and* An Evaluation of the IPCC IS92 Emission Scenarios. Cambridge University Press for the IPCC. 1995
[2]CLIMATE CHANGE 1995 The Science of Climate Change, Summary for Policymakers *and* Technical Summary of the Working Group I report. IPCC. 1996.
[3]CLIMATE CHANGE The IPCC 1990 and 1992 Assessments. WMO/UNEP June 1992.

APPENDIX H

1. Contraction of Global CO2 Emissions (e.g. by 2100 as shown for 450 ppmv)

Stabilisation of atmospheric CO2 concentrations – according to the ultimate objective of the UNFCCC – requires cuts in human emissions of CO2 in the order of 60%. This level of reductions requires a long-term budget framework with a sequence of short-term controls under constant scientific and political review.

By definition, the solution to the global problem of human-induced climate change must be a *global* solution. On a differentiated basis, all countries must be involved if the solution is to be achievable.

2. Convergence to Equal Per Capita Entitlements by a negotiated date (e.g. shown 2030)

Adherence to a globally contracting CO2 budget over several generations requires unprecedented international co-operation. The international distribution of future emissions entitlements inevitably needs to be determined on the basis of equity between the peoples of all nations. This suggests a process, which corrects the historically and currently polarised patterns of consumption globally.

We know of no method for doing this that has any chance of achieving this co-operation other than a negotiated convergence to equal per capita emissions entitlements globally.

3. International Emissions Allocations

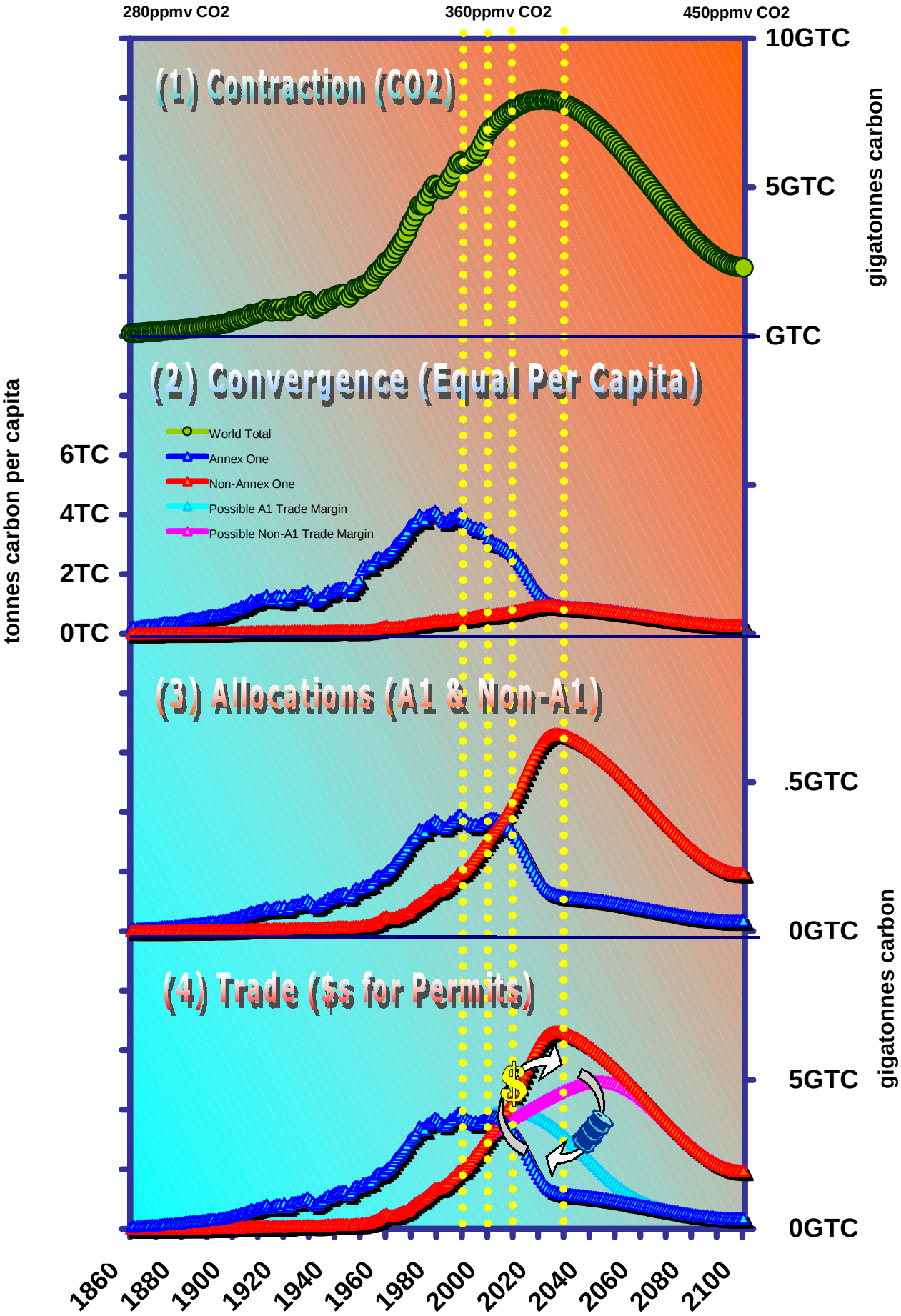
The combination of the global emissions budget and global convergence of international emissions paths gives allocations to all countries. Countries move from their current levels of emissions along trajectories determined by the combination of the *"Contraction and Convergence"* (C&C) curves.

The example shown here (450 ppmv by 2100 with Convergence by 2030) is consistent with the short-term goals of the Berlin Mandate. Annex One contracts by 15% by 2010 while Non-Annex One countries grow collectively at an average of 3% per annum until 2030.

4. Trade of Emissions Permits

National allocations are for emissions permits that can be traded. Contraction rates in developed countries can be reduced through the purchase of permits from developing countries. The resultant cash-flow could be directed to non-fossil energy based development (leap-frogging) in developing countries, while also giving a general incentive to CO2 emissions avoidance because of the value of permits.

All this provides that global emissions abatement can be achieved at least cost, thus meeting the requirements of global efficiency in a globally equitable and sustainable manner.


280ppmv CO2
360ppmv CO2
450ppmv CO2
(1) Contraction (CO2)
10GTC
5GTC
GTC
gigatonnes carbon
(2) Convergence (Equal Per Capita)
World Total
Annex One
Non-Annex One
Possible A1 Trade Margin
Possible Non-A1 Trade Margin
tonnes carbon per capita
6TC
4TC
2TC
0TC
(3) Allocations (A1 & Non-A1)
.5GTC
0GTC
(4) Trade ($s for Permits)
$
5GTC
0GTC
gigatonnes carbon
1860
1880
1900
1920
1940
1960
1980
2000
2020
2040
2060
2080
2100

APPENDIX G

CONTRACTION AND CONVERGENCE

Draft Proposals for a Climate Change Protocol

Contents:...

Overview

Part I: Core tasks to achieve "Contraction and Convergence":

1. Recognise the prevention of dangerous climate change as an essential global security interest
2. Agree Danger Indicators
3. Decide CO2 concentration target and timetable
4. Set annual global CO2 emission budgets according to contraction formula.
5. Calculate relative national shares of the global budget according to a convergence formula
6. Allocate national CO2 emissions quotas
7. Establish criteria and mechanisms for quota management

Part II: Proposals for contraction and convergence

A. Draft proposals for control of greenhouse gas emissions.

2.1. Set up a system for CO2 emissions trading
2.2 Require International Airline and Shipping companies to purchase CO2 emission quotas.
2.3. Consider national targets for anthropogenic emissions of other greenhouse gases
2.4. Agree potential Sanctions, Penalties, and Compensation

B. Draft proposals on climate damages

2.5. Monitor climate damages
2.6. Plan for emergencies
2.7. Consider options for damage compensation and historic debt

C. Draft proposals on Policies and Measures to aid implementation.

2.8. Establish financial mechanisms to aid implementation
2.9 Establish mechanism for development and transfer of sustainable technologies
2.10 Phase out fossil fuel subsidies
2.11 Require consistency in international policy making
2.12 Establish a forum for local governments

D. Proposals on research and education

2.13. Enhance education, training and awareness
2.14 Strengthen climate research particularly into feedback processes
2.15 Examine responsibilities of trans-national corporations and finance

Documents available separately on request
Appendix A: contraction formula
Appendix B: convergence formula
Appendix C: cumulative credit/debit formula
Definition of terms

Overview

The Prevention of dangerous climate change is now an essential global security interest. Recognising this interest, this GCI draft document sets out some key tasks necessary for a protocol to stabilise greenhouse gas concentrations at a level that would prevent dangerous anthropogenic interference with the climate system.

Pre-eminently, this requires a rapid "*Contraction*" of all human CO_2 emissions globally. Moreover, unprecedented international co-operation will be required to achieve this. Such a "*comprehensive approach*" is only likely to be adopted by most if not all nations, if it is linked to the simultaneous task of "*Convergence*" towards an equitable and sustainable level of emissions on a per capita basis globally.

This inter-linked configuration of "*Contraction and Convergence*" is fundamental to GCI's view of the entire climate change dilemma and its solution. GCI has crafted such an approach, which provides the basis for this document. Part One of the document presents the core tasks of this approach. The first proposal develops the well-established concept of national security interest to include dangerous climate change as a *global* security interest. This emphasizes the urgency of this issue and has practical implications for the decision making process and technology development and transfer. The next six proposals spell out practical steps from agreement of danger indicators through to a mechanism for the management of national quota allocations according to a scientific assessment, a contraction formula and a convergence formula.

Additionally, the document presents further proposals for a protocol. These have been drafted in response to events at the Second Conference of Parties (COP2) to the Framework Convention on Climate Change in Geneva in July 1996. While we received remarkably wide-ranging support for our proposals for "*Contraction and Convergence*", many questions were raised about the detailed implications of such an approach.

These further proposals are an attempt to map out some of these implications and are set out in Part Two. The first set concern emissions trading, air/shipping bunker fuels, other greenhouse gases and measures to deter non-compliance. The next set outlines the assessment of and compensation for climate damages, past, present and future. The next four points outline measures to aid implementation, including funding and technology transfer. The final three are concerned with education and research.

At COP2, the US Government stated that all protocols currently on the table were "*unrealistic and unachievable*". This effectively sank the AOSIS Protocol proposed by the island-states most vulnerable to climate change. However, many states considered that our "*Global Commons Initiative*" for contraction and convergence was the most plausible basis for a comprehensive long-term protocol.

We, therefore, invite all far-sighted governments to consider incorporating all or part of these proposals into their submissions to the Secretariat by 15th October 1996 for discussion at the next AGBM meeting in Geneva this December, and as the basis for a draft protocol by March 1997 in time for consideration at COP3 in Kyoto. Please always bear in mind that this is a draft document and that we would greatly welcome your opinion and expertise in developing these proposals into a viable protocol.

I. Core tasks for achieving "Contraction and Convergence"

1: Recognise the prevention of dangerous climate change as an essential global security interest.

The reduction of greenhouse gas emissions shall be regarded as an essential global security interest for humanity.

RATIONALE AND POLICY IMPLICATIONS

This proposal generalises the accepted concept of "essential security interest" to the whole of humanity. The gravity of global climate change is greater than the essential security interests of any nation and fundamental to the maintenance of international peace and security during the coming century. This justifies the urgent development of measures proposed in this protocol and places a duty on governments to regard climate change as an international emergency. This also means that action may be taken to secure the use of sustainable technology for the benefit of humanity in much the same way as governments may protect the use of military technology under the Security Exceptions for intellectual property rights as set out in Article 73 of Annex 1C of the Final Act of the Uruguay Round of Multilateral Trade Negotiations as well as national security legislation.

---

2. Agree danger indicators

Agree a list of specific, quantifiable indicators to define "dangerous anthropogenic interference to the climate system" as stated in Article 2 of the Framework Convention. The indicators shall be listed in the protocol and their quantitative values shall be reviewed annually by SBSTA with advice from IPCC. The values should reflect the precautionary principle and take account of the time lag between emissions and climatic changes. The indicators shall be applicable on any geographical scale to include local damages induced by global climate change.

CoP shall commission detailed recommendations for suitable indicators and their appropriate values. The following suggestions are put forward as a starting point:

a) relative sea level rise to a threatening level at any location;

b) increased coastal erosion that forces evacuation of inhabited land or loss of wetlands;

c) global mean surface temperature rise or significant regional temperature changes over a given time period;

d) an annual increase in the number of tornadoes or tropical cyclones in any region beyond current natural variability;

e) a significant reduction in permafrost area, resulting in release of natural methane;

f) significant changes in regional or sub-regional precipitation resulting in prolonged droughts or frequent flooding;

g) an increase in bush and forest fires above natural variability;

h) loss of marine and terrestrial ecosystems and species;

i) substantial prolonged reduction in marine primary production (plankton, algae);

j) a significant contraction of either polar ice cap and / or glaciers;

k) a major prolonged change in ocean circulation, such as the north Atlantic current or El Nino / Southern Oscillation;

l) a spread attributable to climate change of any human, animal or plant disease;

m) direct impact of climate change on human health;

n) economic damages attributable to climate change.

These danger indicators should be reviewed on a regular basis by IPCC as new scientific evidence becomes available and revised by the CoP when prudent to do so.

RATIONALE AND POLICY IMPLICATIONS

This Task puts key scientific indicators for dangerous climate change at the centre of the protocol. The "definition of adverse climate change" (FCCC Article. 1, 1) and "dangerous anthropogenic interference with the climate system" (Article. 2) need to be set out in the form of specific danger indicators based on best scientific advice and the precautionary principle (Article 3).

Each indicator should reflect a distinct impact resulting from climate change and should be defined in quantifiable terms on a global, regional and subregional scale. Where possible they should indicate both the danger threshold and potentially dangerous rates of change. The choice of indicators should take into account the considerable time lag between greenhouse gas emissions and subsequent climatic response.

The prospect of breaching any one of the indicators should be sufficient to require preventative action, on the grounds of the precautionary principle, even though it may only affect one area of the world directly. On the basis of equity, damages must be avoided on a local scale since many of the most vulnerable countries are neither responsible for global warming nor in a position to adapt to the harmful effects. Local climate-change-induced damages may not be traded off against the pursuit of global economic growth, because it is impossible to sensibly create a consensus around the quantification of such damages in terms of rising risks of ecological and political instability (see also II.A.1).

---

3. Decide CO2 concentration target and timetable

A stabilisation target and timetable shall be agreed for atmospheric CO2 concentrations. The target should be set by applying the precautionary principle to avoid the danger indicators agreed under Section I.1 (above). This target shall initially be 350 ppmv to be achieved by the year 2100 . The target shall be reviewed every five years by IPCC as new scientific evidence becomes available and revised by the CoP if the danger indicators clearly show that it is prudent to do so.

Rationale and policy implications

Dangerous changes in the climate system are a result of specific greenhouse gas concentrations in the atmosphere, so it is necessary to set a specific ceiling on the amount of CO2 in the atmosphere. In absence of better scientific understanding of climatic feedback processes (listed in section II.D.2), the initial target of atmospheric CO2 stabilisation at 350ppmv by the year 2100 is chosen such that the system remains close to the bounds of our present knowledge. This can be achieved by following a future emissions scenario in which the cumulative CO2 emissions are similar to those of IPCC S350.
When reviewing this target, IPCC should take into account predicted changes in the concentration of other greenhouse gases (considered further in section II.A.3).

---

4. Set annual global CO2 emissions budgets according to a "contraction" formula

The Conference of the Parties shall set a net global anthropogenic carbon emissions budget for each year throughout the period of contraction to meet the stabilisation objective as defined in I.3 above. This shall be calculated according to a mathematical formula which defines an emissions scenario that leads to stabilisation of emissions at around 2045. The formula may be reviewed annually five years in advance to take account of revisions to the stabilisation target set under proposal 3 as well as changes in natural sinks and sources based on scientific advice of the IPCC.

Rationale and policy implications

Stabilisation of CO2 concentrations requires a global ceiling on emissions which contracts over time until they reach the target of 350 ppmv. The "contraction" formula would define a realistic emissions scenario which avoids both unachievable annual emissions reductions and temporary net negative emissions in the future. The formula should refer to all anthropogenic sources and sinks of CO2, i.e. changes in emissions resulting directly from human activity, including anthropogenic changes of natural sinks and sources. Natural "equilibrium" sources and sinks should be considered in the science behind the emissions scenario, but should not be included in this global anthropogenic emissions budget.

The formula will need to be reviewed annually to take account of changes both to the concentration target and of actual sinks and sources of CO2. However, in order to reduce uncertainty for both planning and trading purposes each annual review will adjust the budgets five years in advance.

Implementation will require setting up a Scientific Panel drawn from the SBSTA and approved by the CoP to agree the formula and recommend annual CO2 budgets.

The target date of 2045 is suggested because it lies within the window for realistic contraction and coincides with the centenary of the United Nations.

For the purpose of illustration only, a sample "contraction" formula is available from GCI.

---

5. Calculate relative national shares of the global budget according to a "convergence" formula.

Each country shall be allocated an annual, relative share of the global emissions budget (set according to section I.4 above) using a consistent formula to calculate the proportion for each country for each year. The allocation shall be set such that national shares move gradually from present emissions levels to equal per capita emissions levels by a fixed "convergence" year (e.g. 2045). Provision shall be made for bunker fuels for shipping and air transport (see II.A.2).

RATIONALE AND POLICY IMPLICATIONS

This task gives effect to the principle of equity set out in Article 3.1 of the FCCC while recognising that equal per capita allocations would be neither acceptable nor feasible for Annex I countries if implemented immediately. The formula therefore provides a predictable and viable method of achieving a convergence to equity. National shares would be based initially on current emissions levels, or for Annex 1 countries, those levels already specified by commitments under the UNFCCC , and would then converge to the same per capita level by the target date of 2045. After this relative shares would remain constant.

Calculation with the convergence formula will use the UN median population estimates. These population statistics may be reviewed if necessary at the request of a majority of the CoP.
However, after a fixed year (e.g. the convergence date) population figures could be frozen.

The relative national shares are independent of the annual scientific reviews, although the actual allocations of emissions (allocated in section I.6) will of course vary according to the global budget agreed. Annual shares would be calculated for all countries, whether or not they are Parties to the Protocol, and shall be set out in an Annex to the protocol as tables.

For the purpose of illustration only, a sample "convergence" formula is available from GCI.

The establishment of fixed national emissions budgets will encourage investment in appropriate technology and allow for the possibility of orderly emissions trading, but this depends crucially on having finite net CO2 budgets calculated according to a formula that produces a predictable level of
permissible emissions from the present to the stabilisation date, to achieve the concentration target set in Section I.3 above.

---

6. Allocate national CO2 emissions quotas.

National emissions quotas shall be calculated for each year by multiplying each country's relative share set by the convergence formula (agreed according to Section I.5) by the annual global emissions budget (set by the "contraction" formula agreed according to Section I.4). These quotas shall be measured in tonnes of carbon.

RATIONALE AND POLICY IMPLICATIONS

The national allocations are described as 'quotas' rather than entitlements or rights to emit CO2 in order to emphasise that the atmosphere and climate system are a global commons which cannot be appropriated by any state or person but whose use must now be shared by common consent. The formula approach provides for the most effective way of establishing a consistent and equitable allocation of emissions quotas.

---

7. Establish criteria and mechanisms for quota management

Establish a mechanism for the international management of quota allocation, accounting and verification based on criteria consistent with these proposals. The quotas shall cover "net anthropogenic emissions" resulting from human activities, including reduction of natural sinks minus deliberate natural sinks enhancement.

RATIONALE AND POLICY IMPLICATIONS

The allocations would refer to "net anthropogenic emissions" of CO2. This is defined as all emissions resulting from human activities, including reduction of natural sinks minus deliberate natural sinks enhancement. However, this should exclude changes in natural sources and sinks caused directly by global climate change. This definition encourages sustainable forestry, for example, but avoids crediting the existing natural resource endowment of each country. We recognise that some countries have deliberately retained such resources whilst others have already diminished them, therefore this will be accounted for in the task concerning historic debt (section II.B.3). Natural sink enhancement will only be credited within national boundaries, not within any global commons. For example, credit will not be given for enhancement of the CO2 sink into the ocean.

The proposed mechanisms would also arbitrate in case of dispute over budgeting anthropogenic sources and sinks.

It is not necessary to allow for crediting of sink enhancement or emissions reduction within other countries, known as Joint Implementation, since this can effectively be achieved through the emissions quotas trading system (section II.A.1).

This proposal completes the procedure for applying "contraction and convergence".

II. Draft proposals to achieve contraction and convergence

A. Related tasks for control of greenhouse gas emissions

---

1. Set up a system for emissions trading

Establish mechanisms for real-time emissions trading between parties to the Protocol under strict conditions of contraction and convergence. Trading shall be restricted to a proportion of the annual emissions quotas, defined as permits, and limited to one year in advance. The mechanism should be transparent and avoid financial feedbacks that would undermine the ultimate aim of the Convention and its protocols.

RATIONALE AND POLICY IMPLICATIONS

The criteria for a trading regime should set out the basis on which possible trading regimes will be assessed. These will inevitably need to balance the different interests and needs of parties to the Convention. In deciding on a suitable mechanism, parties should consider the work already done by UNCTAD in this area and continue to involve it in the development thereof.

A trading regime would initially be developed under the SBI which would continue to supervise the process for CoP. However, once agreed, emissions trading would require a set of robust institutions capable of acting on behalf and under the supervision of CoP. Trading must be open, transparent, efficient and well regulated. The regulatory bodies must also ensure that TEPs are not bought or sold under coercion of any kind.

Emissions trading would also address the issue of "carbon leakage" to countries with relatively lower emissions. This would particularly be the case if purchasing rights of permits were extended to TNCs.

As the mechanism comes into effect, Joint Implementation will no longer become an issue as the trade will help to redress emission imbalances, while the incentive to invest in climate friendly technology remains by releasing quotas for trade.

The mechanism must also ensure that trading is developed primarily as an efficient means of reducing emissions and must not compromise future generations on the principles of inter-generational equity. The implications of this international trade on intra-national equity will also need to be examined and addressed. The increased value of emission quotas from international trade must not detrimentally affect the disadvantaged in national societies. 'Contraction and convergence' applies within countries as well as between them.

Given the historic link between growth of monetary GDP and CO2 emissions, there is a danger that trade in CO2 quotas and any other increase in financial activity as a result of this Protocol will simply increase global purchasing power leading to an increase in CO2 emissions. This would be contradictory to the purpose of the Convention. Another danger is that trade in Emissions Quotas increases inter-national financial liquidity to produce inflation or other instability, as occurred following the OPEC oil price rises. These dangers might be addressed by the creation of a carbon-free "green currency". A study of the potential of carbon-free currency should be commissioned for consideration by CoP in future.

Moreover, existing purchasing power disparities between developing and developed countries can only be aggravated by creating a trade mechanism which continues to exploit the arbitrary advantage enjoyed in the international markets of economies based on hard currencies. This is especially relevant in view of the fact that it ignores the much higher efficiencies of soft currency based economies when national dollars-per-ton efficiencies are adjusted for purchasing power parity (PPP).

---

2 Require International Airline and Shipping companies to purchase CO2 emission quotas.

CO2 emitted by all aircraft or shipping must be accounted for within the global emissions budget by requiring international transport companies to purchase emissions permits.

RATIONALE AND POLICY IMPLICATIONS

Currently, aircraft on international flights, or shipping in international waters, can purchase untaxed fossil fuel which is not included in any national carbon account. Air transport in particular is one of the fastest growing sectors of global CO2 emissions, and must be constrained in a similar manner to other carbon intensive economic activities. Fiscal measures which might achieve this, such as an international tax on bunker fuels, would require a global authority to predict and control demand. On the other hand, if airline or shipping companies have to purchase emissions permits the market will ensure a "level playing field" with land-based transport.

This measure will also ensure that all emissions are constrained within the contraction / convergence global budget (sections I. 3,4,5), whilst the price of the quotas is passed on to the consumer of the transport, rather than becoming the responsibility of governments.

It may be possible to extend this option to purchase emissions quotas to other Trans National Corporations (TNCs). This would have the advantage of discouraging "leakage" or carbon-intensive production to countries where emissions are cheaper, since the TNCs could purchase emissions quotas from countries with a surplus, without needing to relocate.

----

3. Consider national targets for anthropogenic emissions of other greenhouse gases

Draw up a timetable for agreeing constraints on concentrations of greenhouse gases other than CO2, with specific targets for each gas, as scientific knowledge of their biogeochemical cycles becomes sufficiently reliable. The allocation of budgets should be based on the same task of equity as used above for CO2, whilst giving special consideration to each country's need to exploit its natural resources and agriculture.

RATIONALE AND POLICY IMPLICATIONS

Concentrations of greenhouse gases other than CO2 are rising fast and must be brought under the FCCC. Gases with similar sources and atmospheric lifetimes may be grouped together and some substitution of these may be possible within the national budgets. Some international trading of emissions quotas may also be considered. However, agreement on one greenhouse gas should not be delayed whilst awaiting better knowledge of the other greenhouse gases.

Greenhouse gases other than CO2 fall into two main categories:

For wholly man-made gases such as most CFCs, HCFCs and SF6, an early agreement could be reached. Production of some of these gases is already constrained under the Montreal Protocol for protection of stratospheric ozone. Their major sources and sinks are already sufficiently quantifiable. National budgets for these gases should be allocated using the same principles of "contraction and convergence", allowing for trading if necessary, as outlined for CO2 in Sections I.2 through to I.5 above. Some of these gases have long lifetimes, and therefore their Global Warming Potential relative to each other is effectively independent of the time horizon used. These gases could be substituted within national budgets.

However, on the basis of inter-generational equity and long-term sustainability, production of the very long-lived gases should be tightly constrained and phased out as soon as possible. If a time horizon were agreed, the global emissions budget for the shorter-lived gases could be linked to that for CO2 by means of their Global Warming Potential (defined by IPCC).

Methane (CH4) and Nitrous Oxide (N2O) are significant greenhouse gases produced by a mixture of anthropogenic and natural sources. The sources and sinks are still poorly defined. Methane emissions are rapidly increasing both as a result of changing agricultural practice (cattle, irrigation) and leakage from natural gas installations. However, Methane has a short atmospheric lifetime and therefore it is not helpful to define a Global Warming Potential relative to CO2. To account for the greater potency of Methane as a greenhouse gas, international standards of best practice should be agreed for industry and agriculture. Financial penalties collected when these standards are breached, could be used to fund the development and transfer of improved technology to reduce Methane emissions.

Nitrous Oxide has a longer lifetime than Methane but makes a smaller contribution to current global warming, and is less well understood. More research is urgently needed on the cycles of both of these gases.

---

4 Devise potential sanctions, penalties, and compensation.

Request the Secretariat to draw up options for a system of proportional progressive sanctions and penalties for non-compliance with the protocol, taking account of experience of international, regional and national legal instruments and the review of selected non-compliance, dispute resolution and implementation review procedures (FCCC/CP/1995/Misc.2) prepared by the interim secretariat.

Income raised from penalties could contribute to measures to aid implementation and relieve damages, as listed in Section II.B.3 below.

RATIONALE AND POLICY IMPLICATIONS

There are at present no incentives to comply with the FCCC or the protocol. By contrast, the 1994 GATT agreement contains extensive procedures for dispute settlement, including conciliation, mediation, arbitration, establishment of panels, rights of third parties, remedies, and compensation.
Penalties should be in proportion to excess emissions of greenhouse gases, and considerably higher than the current purchase price of tradable emissions entitlements or investment benefits from the excessive CO2 emissions.

The virtue of a tough system of penalties is that it will encourage compliance and reduce the likelihood of it being used.

B. Tasks on climate damages

---

1. Monitor climate damages

Require Parties to prepare an inventory of damages and damage trends, both past and present, directly attributable to climate change. These should include human health and mortality, economic impacts, loss of habitats, species and biodiversity, impact on agriculture, and coastal erosion.

RATIONALE AND POLICY IMPLICATIONS

Damage due to climate change has already begun and estimates of possible future damage, casualties and refugees have been made. The aim of this measure is to compile a comprehensive database of damages which would provide both a benchmark for the danger indicators proposed in proposal 2 above.

Research on climate-related damages should be funded by an international programme whose emphasis should be on impacts to developing countries.

Data on damages should be presented in their original units rather than using monetised values. Such values based on the method of "willingness to pay" imply rights by income which is fundamentally inequitable. International aggregation of damage data for the purpose of a global cost-benefit analysis is not appropriate, since the majority of damages will be inflicted on developing countries whereas most of the CO2 emissions, and hence mitigation costs, are currently the responsibility of the industrialised countries.

---

2 Plan for emergencies

Require all parties to draw up contingency provisions for future emergencies which may arise from climate change, such as flooding, drought, crop failure or disease.

RATIONALE AND POLICY IMPLICATIONS

Damage due to climate change has already begun and estimates of possible future damage, casualties and refugees have been made. These should be updated regularly as a basis for arranging emergency relief and compensation payments. Liability for compensation payments is considered in Section II.B.3.

Contingency plans should be also prepared for the potential relocation of entire populations from small island states and low-lying regions to the territory of Annex 1 countries.

---

3. Consider options for damage compensation and historic debt.

Request that the Secretariat prepare a study of options for damage compensation due to climate change based on best practice in insurance and national compensation schemes, and for historic debt in relation to emissions by Annex I countries prior to 1990, for consideration at CoP4.

RATIONALE AND POLICY IMPLICATIONS

Insurance companies and governments are currently making large scale payments in respect of damages caused by asbestos, radiation and other anthropogenic causes. European and US law also include provision for civil, statutory and criminal liability for environmental damage. Countries and companies which emit CO2 above the danger level should be under no illusion that they can avoid paying for damage caused by excess CO2 emissions, thus increasing incentives to comply with the Convention and Protocol. Careful consideration needs to be given to historic emissions when foreseeability of damages could not reasonably have been expected and the precedents under tort thus become less relevant. The argument of historic debt, nevertheless, still holds as developing countries will, in future, not have the option of unrestrained emissions on which developed countries based their historic growth.

For these reasons, Annex 1 Parties should be required to make provision for climate change related damages in their national budgets and planning mechanism.

CO2 has a long lifetime in the atmosphere, and historic data shows that a constant fraction of emissions has remained airborne, although there is no guarantee for this fraction to remain constant in the future. Therefore, to a first approximation, a country's responsibility for global warming depends on its cumulative emissions integrated over time. Industrialised countries have thus accumulated an historic debt compared to developing countries. Applying the principle of per-capita equity to historic data, it is possible to create a formula for calculating cumulative debits or credits, which might be used for allocating damage liability.

An international panel should be set up by SBSTA to resolve disputes over damage claims; this should include advice from both climate scientists and insurance experts.

For the purpose of such calculations, estimates of cumulative emissions of CO2 should include historic deforestation and other land use changes. Some countries have preserved much of their natural forest resources, whereas others have exploited them and consequently have more land on which to replant new forests. For consistency in accounting, it is necessary to include this form of historic debt if national emission entitlements are to be based on net anthropogenic emissions (i.e. including changes in natural sources and sinks).

C. Tasks on Policies and Measures to aid implementation

---

1. Establish financial mechanisms to aid implementation

The SBI shall establish mechanisms by which money can be reliably collected and distributed for global programmes to implement the Convention. Decisions on spending shall be made through a fair and transparent mechanism accountable to CoP.

Funding is required for the following:

Climate Research (see section II.D.2)
Education, training and awareness (see section II.D.1).
Monitoring climate damage (see section II.B.1).
Technology Transfer (see section II.C.2).
Activities currently funded by the GEF
Administration of the CoP and the Secretariat
Administration of emissions trading (see section I.7 and II.A.1)
Emergency Relief and Damage Compensation (see section II.B.2 and II.B.3)

Funding sources may include:

A tax on trading of emissions entitlements (as in section II.A.1)
Penalties for non-compliance (as in section II.A.4)
According to cumulative historic debt (as in section II.B.3)

RATIONALE AND POLICY IMPLICATIONS

Activities which are critical to the success of implementing the Convention, should be able to rely on secure funding. This is already required for the Financial Mechanism under Art. 11 of the FCCC, and the commitments set out in Art. 4 c, d and h. However, present arrangements are unsatisfactory as funds are reliant on the goodwill of a few Parties which then control their use. Binding mechanisms must be set up to enable money to flow directly from the cause of the climate change problem (i.e. greenhouse gas emissions) towards funding its solution. This would encourage a reduction in CO2 emissions, although the main mechanism for achieving this should remain the allocation of emission entitlements according to Contraction (section I.3) and Convergence (section I.4).

Liability to pay compensation for damages should be linked directly to cumulative historic debt as outlined in section II.B.3.

---

2. Establish mechanism for development and transfer of sustainable technologies

The development, diffusion and use of the most sustainable technologies, practices and processes which minimise greenhouse gas emissions shall be regarded as an essential global security interest as defined in section I.1. To this end, a mechanism should be established under the protocol to aid the development within and transfer to developing countries of sustainable technologies.

The transfer of outdated or second-hand, carbon-inefficient technology should be controlled and preferably prohibited.

RATIONALE AND POLICY IMPLICATIONS

Explicit measures and positive incentives are urgently needed to stimulate the development and transfer of the most climate-friendly sustainable technology. Such technology should:

(a) be carbon efficient or based on renewable energy sources
(b) be an appropriate scale for the local community which it serves
(c) be independent of expensive supplies or repairs from distant companies.
(c) not damage the local environment (as do, for example, large hydropower schemes)
(d) not entail unacceptable risk (as do nuclear power stations)

Measures to stimulate the development and diffusion of climate-friendly technology would include

(a) establish a technology transfer fund (paid for according to section II.C.1)
(b) fund research, development and diffusion of sustainable technologies, particularly in developing countries
(c) create an international inventory of climate-friendly technology
(d) promote best practice and sharing expertise between countries
(e) identify gaps and opportunities in national and multilateral technology programmes
(f) limit the period for which patents on relevant technologies may be held without being exploited for the benefit of humanity

A substantial transfer of outdated, carbon inefficient technology from developed to developing countries is currently widespread. This has the effect of prolonging the detrimental contribution of this machinery or technology on global carbon emissions.

---

3. Phase out fossil fuel subsidies

Agree mechanisms to phase out all subsidies for fossil-fuels. Transitional procedures and financial support shall be made available to developing countries in order to achieve a smooth transition and avoid penalising the poor.

Rationale and policy implications

Subsidies for the use of fossil fuels both increase global warming and distort the efficient allocation of resources through markets. Definitions of subsidies should be carefully established and the needs of the poor fully taken into consideration.

---

4. Require consistency in international policy-making

Set up an international task force to ensure that all international agencies, treaties and agreements actively contribute to reducing CO2 emissions as an essential global security interest. This should be backed by a resolution to the United Nations General Assembly to require all international agencies, treaties and agreements take the climatic implications of their actions fully into account and to support the implementation of the UNFCCC and its protocols.

RATIONALE AND POLICY IMPLICATIONS

There is a danger that trade liberalisation under the 1994 GATT agreement, investment by the World Bank and economic measures by the IMF and central banking system as well as actions by other agencies increase CO2 emissions or otherwise undermine the objectives of the FCCC. The aim of this
task is to ensure that all international decision-making takes full account of the Climate Convention. A precedent for this task was established by the Ministerial Declaration on the Contribution of the World Trade Organisation to Achieving Greater Coherence in Global Economic Policymaking of 15 December 1993.

---

5. Establish a forum for local governments

Recognising the important contribution local governments make in implementing climate friendly policies and technologies at a local level, an international forum on climate change for local governments should be established with rights of representation as an observer to CoP under Art. 7 (6). The role of this forum would be to allow sharing of experiences and making relevant policy recommendations to national governments and CoP. This body could also discuss issues of intra-national equity arising from the restraint of carbon emissions.

RATIONALE AND POLICY IMPLICATIONS

A considerable proportion of sustainable policies and technologies are most effectively implemented at a local level and local governments can, therefore, play an important role in emissions reductions. The exchange of information on a local level would complement the transfer of technology on a national level as outlined in Section 2.9. The forum would also be the ideal organ to voice any problems of intra-national inequities arising from national and international implementation of the protocol and specifically the trade mechanism.

D. Tasks on research and education

----

1. Enhance education, training and awareness

Require all Parties to increase their commitment to education, training and public awareness of climate change under Article 6. This should encourage an holistic perspective emphasising the links between local and global processes, both natural and economic, and convey the full scale of the climate change problem as a survival issue. This must be underpinned by better understanding of the basic science of climate change.

Commission a feasibility study to establish options for an international system of greenhouse gas labelling to provide immediate public awareness of the extent to which a particular product or service contributes to emissions of CO2 or other greenhouse gases and to create incentives to reduce carbon consumption.

Require parties to report annually to the CoP on the following matters:

(a) the extent and nature of education, training and public awareness undertaken;
(b) organisation, finance and target audience thereof;
(c) independent evaluation of the effectiveness of such education and training;
(d) results of an independent poll of public awareness of climate change, its effects and measures needed to reduce emissions to a sustainable level;
(e) progress on greenhouse gas labelling
(f) actions to curb promotion of carbon consumption.

RATIONALE AND POLICY IMPLICATIONS

Most countries have done relatively little to fulfil their commitments under Article 6 of the UNFCCC. Raising awareness of the way in which fossil fuels and other products increase global warming has a significant role in motivating individuals, companies and countries to reduce such consumption. If all goods and services carried a conspicuous and unambiguous statement of the CO2 or other greenhouse gases emitted by their production and disposal, this would enable people to make more informed choices. Public awareness and education on global warming is in constant competition with the advertising power of the air, car and fossil fuel industries. In view of the gravity of climate change, serious consideration should also be given to measures which curb the promotion of activities responsible for carbon emissions, similar to those currently applied to alcohol, tobacco, pharmaceuticals and other drugs. There is much public confusion over the science and impacts of climate change. This should be tackled both as a core part of school curricula, and as specifically tailored training programmes for employees, stressing measures for alleviating impacts of their field of work on global climate change, and vice versa.

---

2. Strengthen climate research, particularly into feedback processes

Increase research into physical, biogeochemical, social and economic climatic feedback processes. Such research requires international consistency to ensure that the different processes can be combined in integrated models, whilst also encouraging researchers to investigate new processes. This should be co-ordinated principally through the International Geosphere Biosphere Programme (IGBP) and World Climate Research Programme (WCRP). IPCC and SBSTA (when calculating the emissions ceiling according to section I.2) should attempt to take account of the cumulative risk from low-probability positive feedbacks. When IPCC presents predictions or scenarios of global climate changes, there should also be less emphasis on global average temperature trends, and more on regional differences, particularly regarding the sulphate aerosol effect.

RATIONALE AND POLICY IMPLICATIONS

There are particular dangers that the effects of climate change may trigger uncontrollable feedback loops that accelerate global climate change further than would be expected from current IPCC predictions, and exacerbate regional anomalies. Some known examples of such natural climatic feedback processes are listed below:

a) Clouds: Different levels of clouds can have opposite effects on climate, since they both trap terrestrial radiation and reflect solar radiation. Clouds and water vapour also transport much latent heat. Thus it is difficult to resolve the feedbacks. Clouds may also be seeded by sulphate aerosols, both natural and anthropogenic.
b) Ice sheets: Polar warming may increase ice melt, but also increase snowfall. This affects:
 * Global albedo (proportion of sunlight reflected to space)
 * Sea level
 * Local ocean salinity and albedo and hence circulation and ecology
c) Ocean circulation:
 * Arctic warming or increased freshwater input to the North Atlantic (ice melt, rainfall) could halt deep water formation, weaken the North Atlantic Current, and thus make NW Europe much colder.
 * Increased frequency of El Nino circulation in the Pacific affects climate world-wide.
d) Ocean ecology: Changes in phytoplankton ecology might be caused by:

*increased stratification of the water column, due to surface warming. would reduce nutrient (Nitrate, Phosphate, Iron) supply from bottom waters.
* increased nutrient runoff from rivers due to changing land-use.
* increased UV-B flux due to stratospheric ozone loss.
The effect of this might be to change:
* the export of Carbon from surface water to deep water by the "biological pump".
* the alkalinity of surface water due to calcifying algae. Calcification puts CO2 back into the atmosphere.
* the production of greenhouse gases (N2O, CH4, other hydrocarbons)
* the production of Dimethyl Sulphide which (as sulphate aerosols) seeds clouds over the ocean and thus significantly influences global albedo
* ocean fish stocks
e) Terrestrial ecology: warming and drying in high latitudes may cause:
* release of greenhouse gases CH4 and N2O from melting permafrost
* release of CO2 from peat bogs, if drying allows aeration.
* increased forest fires and subsequent CO2 release
* reduced snow cover, particularly if forest replaces tundra, with consequent change in albedo.
The "CO2 fertilisation effect" may cause:
* increased CO2 uptake by terrestrial vegetation
* changes in evapotranspiration and hence local rainfall and groundwater.
Vegetation changes will affect albedo and also surface roughness which affects wind.
f) Flooding of coastal wetlands by rising sea level, particularly in the tropics, may cause substantial release of CH4 and N2O.

There is presently much confusion among policymakers about the cooling effect of sulphate aerosols produced by fossil fuel combustion. It should be stressed that the aerosol effect is short-lived and local, whereas the arming by CO2 is long-lived and global. Such differences are obscured by an emphasis on global average temperature trends, which should be remedied within IPCC.

---

3. Study the responsibilities of trans-national corporations and finance

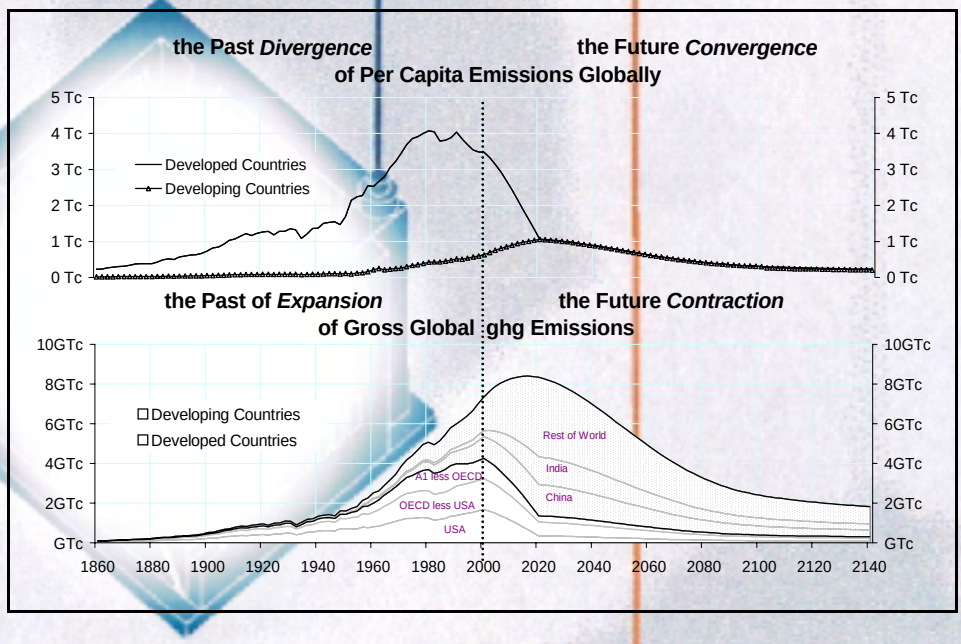
Set up two working groups to examine the role of international finance and transnational corporations respectively in relation to CO2 emissions, in order to report on
(a) the extent to which their activities contribute to or abate global warming
(b) differential responsibilities between corporate sectors
(c) examples or models of good practice in regulation, incentives, statutory or voluntary codes, reporting requirements or other measures for encouraging corporations and investment fund managers to cut CO2 emissions
(d) the contribution or otherwise of small and medium businesses to global warming
(e) recommendations for specific measures to enhance the contribution of investment finance and transnational corporations to stabilising CO2 emissions

RATIONALE AND POLICY IMPLICATIONS

Representatives of transnational corporations are active participants in the climate change negotiations and major players in both sustainable and carbon energy industries. The majority of world trade and a substantial proportion of global production is conducted by transnational corporations, while international financial flows are the driving force in trade and industry throughout the world, often more powerful than governments. The aim of these two study groups would be to examine the specific role of these two major types of economic agents to identify measures to enhance their contribution to stabilising greenhouse gas emissions.

?

Jazz



?

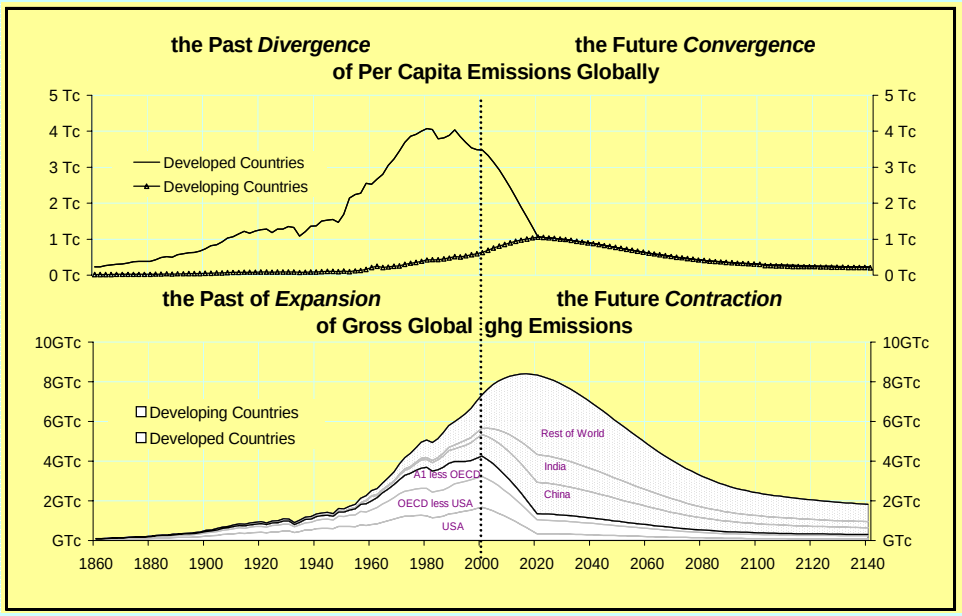
Geo-Polity

FRAME-WORK or GUESS-WORK?
'JAZZ' and 'Geo-Polity' or just-JAZZ?

Academics in **IPCC Third Assessment Report Working Group 3** can explain and answer this fundamental question. The politicians already have.

"I do believe that 'contraction and convergence' provides an effective, equitable market-based framework within which governments can co-operate to avert climate change." **Michael Meacher MP, Environment Minister UK**

"That global partnership to avoid the danger of climate change requires that we start to discuss the arrangements for sharing of both responsibilities and entitlements, based on the principles of precaution and equity, that best defend the aspirations and security of all nations for the future. The approach of 'Contraction and Convergence' is precisely such an idea."
Svend Auken MP, Environment Minister Denmark



These thoughts are addressed to those preparing Working Group Three (WG3) of the Intergovernmental Panel on Climate change (IPCC) Third Assessment Report (TAR).

They are supplied by: -

Name:	Aubrey Meyer
Organization:	Global Commons Institute (GCI)
Area of Expertise:	Precautionary Global Climate Change Mitigation Policy Development
Phone:	00 44 (0)181 451 0778
Fax:	00 44 (0)181 830 2366
E-mail	aubrey@gci.org.uk

FRAMEWORK or GUESSWORK? 'JAZZ' & 'GEO-POLITY' or JUST JAZZ?

IPCC THIRD POLICY ASSESSMENT - GENERAL SYNTHESIS REMARKS ABOUT DRAFT...4
Inconsistency internally....4
Inconsistency with the UNFCCC....4
Paradigm shift from 'no-regrets' 4
To the . . . . Precautionary Paradigm....4
'Bolin Dictum'....4
GLOBAL ORIENTATION....5
JAZZ, FROG and Geo-Polity....5
THIRD ASSESSMENT REPORT (TAR) STRUCTURE....6
Some Specific Suggestions....6
SPECIFIC COMMENTS....7
EQUITY - Resolving the epistemological conflict....7
Correcting titles & images - 'Framing the Problem, Framing the Solution'....8
'Past Expansion and Divergence' - 'Future Contraction and Convergence'....8
PUBLISHED IMAGERY....9
INTERNATIONAL 'EFFICIENCY/INEFFICIENCY' COMPARISON....12
WORDING for REASONING BEHIND "CONTRACTION AND CONVERGENCE"....15
CONTRACTION, CONVERGENCE, ALLOCATION & TRADE, A SIMPLE FORMULATION 16
THE USA AND "CONTRACTION & CONVERGENCE"....17
SUGGESTED WORDING for "CONTRACTION AND CONVERGENCE"....18
'CURRENT CIVIL SOCIETY' SUPPORT for "CONTRACTION & CONVERGENCE" 19

APPENDIX - SUPPORT DURING THE 1990s....23

INDIAN GOVERNMENT ESSAY A "GLOBAL SOLUTION" AT COP1....23
THE BYRD HAGEL GLOBAL SOLUTION....23
THE AFRICA GROUP RESPOND....24
THE USA: - "IT'S THE ONLY GAME IN TOWN."....25
CHINA - "EMISSIONS CONTROL STANDARD FORMULATED ON A PER CAPITA BASIS"...25
COP3 - THE "KYOTO PROTOCOL" (ARTICLE 17) - GLOBAL OR SUB-GLOBAL?....26
"CONTRACTION & CONVERGENCE" DAWNS AT KYOTO'S DARKEST HOUR;....26
PROGRESS WITH "CONTRACTION AND CONVERGENCE" IN 1998....27
GLOBE INTERNATIONAL....27
THE G-8 BIRMINGHAM....27
THE UK GOVERNMENT....28
THE BONN UN CLIMATE NEGOTIATIONS IN JUNE....28
GLOBE INTERNATIONAL GENERAL ASSEMBLY (GIGA)....28
NON-ALIGNED MOVEMENT (NAM)....28
THE GLOBE SOUTHERN AFRICA NETWORK (9 OF THE 16 SADC COUNTRIES)....28
ENVIRONMENTAL JUSTICE NETWORK FORUM (EJNF) SOUTH AFRICA....29
EARTH ACTION....29
EUROPEAN PARLIAMENT....29
FOURTH CONFERENCE OF THE PARTIES (COP4) BUENOS AIRES....30
GEO-POLITY - REFERENCES FOR FORMAL "CONTRACTION AND CONVERGENCE"....31
SIR JOHN HOUGHTON IN THE ECONOMIST - THE WORLD IN 2000....32

IPCC Third Policy Assessment - General synthesis remarks about draft

Inconsistency internally

So far, the IPCC TAR WG3 mitigation policy drafts have no internal consistency. In their present state they will may evolve to create confusion for the future authors of the 'Summaries for Policy Makers' and then for the policy makers themselves.

Inconsistency with the UNFCCC

There is no obvious consistency with the already agreed global: -

1. objective and
2. principles of
   - ❖ precaution and
   - ❖ equity

in the United Nations Framework Convention on Climate Change (UNFCCC).

Paradigm shift from 'no-regrets' . . . .

The fundamental failing at this point in the drafts concerns the failure to explicitly recognise the generically different attitudes that exist towards the existence of the objectives and principles of the UNFCCC.

The dominant perceptions and policy approaches during the 1990's were: -

1. 'contrariansim',
2. 'no regrets' - do it if it makes sense anyway, maybe there's no problem, and
3. 'look & learn' or 'make-it-up-as-you-go-along' or hedging & guess-work.

To the . . . . Precautionary Paradigm

IPCC Working Group One scientists are now clearly on the record affirming the: -

> *'critical situation'* we are in with a *'rapidly changing climate'*, and that we *'must act soon'*. (Ewins and Baker. 24 12 1999 - The Independent, UK).

This affirms the need for action in a precautionary framework, not more guess-work.

'Bolin Dictum'

Former IPCC chairman 'Bert Bolin's Dicutm' was: -

> *"Where differences of approach and perception exist, IPCC's job is to reveal these and to explain them,"* (WG3 SAR Montreal May 1993).

This recognised the sensible way to deal with contentious issues in the IPCC debates.

This dictum has not yet been applied with regard to the most basic difference of approach to the problem of climate change and how to mitigate it. This is the most serious problem in the drafts at this time.

In this paradigm shift, the global policy relationship between: -

- ❖ 'evolution' and random guess-work and a
- ❖ 'constitution' or evolution within a precautionary frame-work

must be addressed in the TAR.

Global Orientation

JAZZ, FROG and Geo-Polity

We can face this critical situation with a frame-work, or guess-work or chaos.

The scenarios 'Geo-Polity' 'JAZZ' and 'FROG', (see http://www.wbcsd.ch/scenarios/) or 'stories-of-the-future' of the World Business Council for Sustainable Development address this. This material was published under the name of TAR/WG3/SRES Lead Author Gerald Davis of Shell International in late 1997.

To some extent these have informed conceptualization of the draft WG3 Special Emissions Scenarios (SRES) which is the 'non-policy' document. They do not yet inform the content or the conceptualization of the TAR/WG3 itself, which is where mitigation policy and any conflicts about these are supposed to be explained. To help policy makers face this paradigm shift, this omission should be redressed.

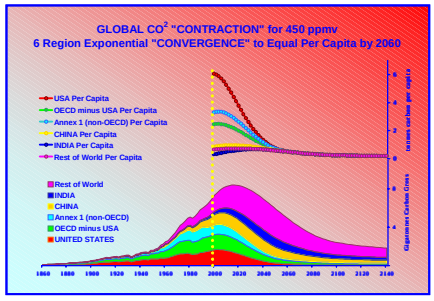
In the light of the warnings from the scientists, the questions arising are these.

1. JAZZ - Do we merely act 'aspirationally' in the culture of 'markets' and 'increased efficiency' (JAZZ) without targets and timetables even as per Kyoto?
   This is the position of David Victor of the CFR, TAR author and Kyoto antagonist (http://www.gristmagazine.com/grist/heatbeat/debates011700.stm).
   
   It is the cultural habit and habitat of some 'progressive' big business and its lobbyists. This position, like the one that follows, effectively defaults to antagonism to the UNFCCC as well as the Kyoto Protocol.

2. FROG - (First Raise our Growth) - Do we just carry on regardless, acting as usual, with contrarianisms, hedging and disagreements until it is too late to do anything effective? This position is advocated by the Global Climate Coalition by default.
   

3. Geo-Polity - Do we now act collectively and rationally on the already agreed basis of precaution and equity, as the objective of the United Nations Framework Convention on Climate Change (UNFCCC) requires us to do (with GEO-Polity or Global Environmental Organisation)?
   

This position is advocated by the European parliament for example: - (http://www2.europarl.eu.int/omk/omnsapir.so/pv2?PRG=CALEND&APP=PV2&LANGUE=EN&TPV=DEF&FILE=980917).



4. A fourth question arises as to the 'mix' of these three, where for example Kyoto is a mosaic of one, two and three that - in failure - defaults to either one or two, but without three.

Third Assessment Report (TAR) Structure

Some authors suggested that general discussion around these points at this stage of the evolution of the drafts (February 2000) was as helpful as - even more helpful than - specific proposals line-by-line for textual alternative wording. So here are: -

Some Specific Suggestions

1. This meta-level choice about the future and how to address it - defaults or design - should be spelled out using the WBCSD story lines.
2. Chapters ONE (Scope) TWO (Mitigation Policy) & TEN (Decision-Taking Framework) are the chapters where consistency with the UNFCCC needs to be explained in terms of the choices above.
3. It is from these chapters and the establishment of consistency here with the UNFCCC and the precautionary paradigm that the general internal consistency of the report as a whole needs to be referenced.
4. There is so much discursive and reductionist material in the report at this time, that in parts it appears to take on the character of repudiating WG1 and the UNFCCC. It is diversity as diversion.
5. It is important to keep clear at a headline level that most argue that the objective of the UNFCCC is unachievable without the precautionary imperative of global carbon contraction and the diplomatic imperative of the equity of convergence.
6. And while informal understanding of the need to manifest contraction and convergence by some default, in the view of some represents a possible scenario for being consistent with the UNFCCC . . . . . .
7. formal *"Contraction and Convergence"* represents the basis of being consistent with the UNFCCC on a precautionary basis by design in the view of others.
8. Jazz [as guess-work] and Geo-Polity [as frame-work] should be used to highlight the difference of the informal and the formal way of understanding *"Contraction and Convergence"*
9. Formal *"Contraction and Convergence"* is a widely know global policy concept which is written up not only in peer-reviewed literature (Refs. supplied by the TSU), but also passed as parliamentary resolutions over the last ten years. It represents a rigorous and pre-defined application of the objective and principles of the UNFCCC.
10. So chapters ONE, TWO and TEN of TAR WG3 drafts should reflect the literature that reflects this approach too. For the purposes of internal consistency, the product of this review should be available to authors of the other chapters of the report.

Specific Comments

Equity is the basis of the UNFCCC. The TAR section on 'Equity' [Chapter 1, Page 18, Line 5 onwards], should try to ensure that the language has shared meaning in the inter/intra-national/generational matrix posed [p19 Line 4 onwards].

EQUITY - Resolving the epistemological conflict

Equity has related, varied and in some ways contradictory usage in English.

1. Justice - Natural, Human, Constitutional & Legal i.e. perennial properties (ontology) and the common good.
2. Fairness - Social and Ethical i.e. distributional rights and universal/religious responsibilities - effectively in this context 'rights-by-people'.
3. Shares - Cash-convertible fractions of capital as property rights, or equity as shares of 100% - effectively in this context 'rights-by-income'.
4. Collateral - total of owned cash-convertible fractions of capital, less debts i.e. equity as 100%.

Because of rising atmospheric CO2 concentrations, the global climate crisis represents a condition of increasing negative global ecological equity.
This reflects the incurred conflict in the above uses of the term equity.

Formal *"Contraction and Convergence"*, resolves this conflict, affirming a global 'epistemology of equity' following D. Meadows (The Economist 1995) - as cited in Lovins 1999, as follows: -

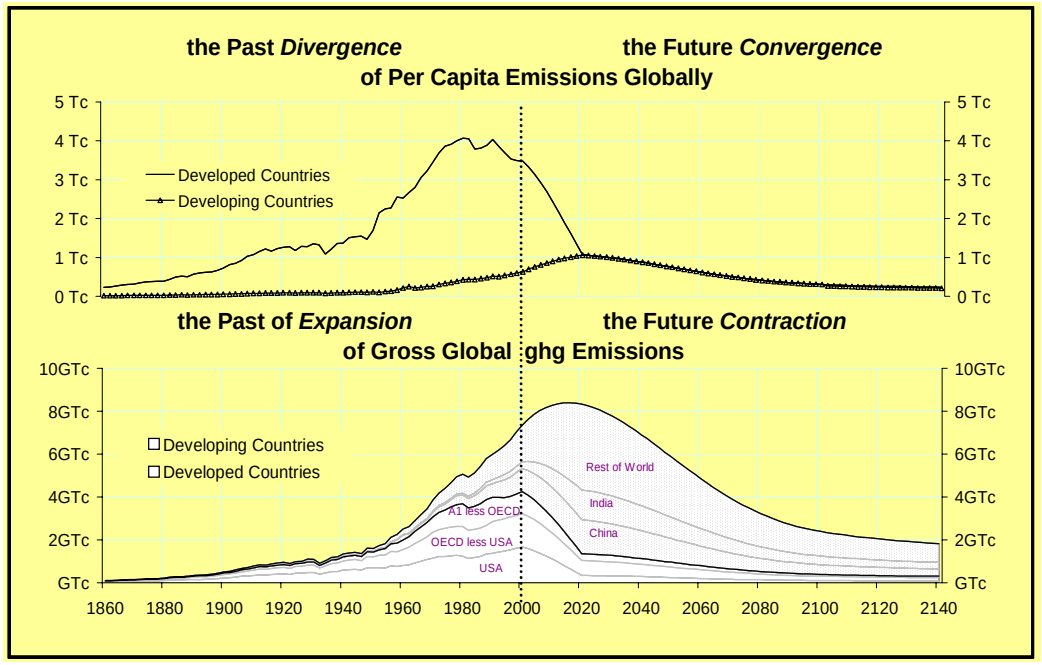
1. The precautionary (pre-determined) emissions 'contraction budget' is the basic collateral for climate stability (natural capital) or the 100% 'green' equity.
2. Since emissions shares globally are currently proportional to income [$s per tonne carbon], the present distribution represents a randomly unsustainable and socially inequitable dominance of 'blue' or commercial equity
3. A global solution to this will only be achievable based on a 'constitution' which agrees to a deliberate convergence by an agreed date to a pre-distribution of this 100% as emissions 'commitment/entitlements' that become proportional to people or 'red' equity within the 100% collateral available.

Expansion and divergence have dangerously embedded these divergent meanings of equity. This growing conflict between the blue, red and green dimensions of equity is deepening the overall condition of negative ecological equity or accelerating loss of natural capital in the form of climate stability. This divergence must be corrected if arrangements and planning for ecological recovery are to be useful and effective.

The present thesis of blue equity and its antithesis with red equity must be re-synthesized within the green equity, i.e. with a controlled decrease of negative global ecological equity or what becomes the *"United Nations Framework Constitution for Contraction & Convergence"(UNFCCC).* The UNFCCC and its objective are based on the principles of 'Precaution' (emissions contraction) and 'Equity' (emissions convergence) where 'Efficiency' (emissions trading) is not a principle as such and therefore cannot sensibly be cast in the role of leading the entire process. It is only meaningful in the context of contraction and convergence, i.e. seen simply as a performance indicator and understood as a *derivative* of the above. On its own it is not an end, so it cannot be 'the means'.

Correcting titles & images - 'Framing the Problem, Framing the Solution'

Chapter 1, Page 4, Line 10 onwards, the following should be resolved in the section presently called *'Framing the Problem'*. Using the title *"carbon trajectories for stabilisation at 450 ppmv,"* authors have introduced contraction and convergence imagery at the outset (called fig 1.1). This early introduction is sensible as the TAR WG3 is fundamentally about mitigation [i.e. about 'solutions' not just about rehearsing problems], and contraction and convergence is about solutions.



'Past Expansion and Divergence' - 'Future Contraction and Convergence'.

So the first suggestion is that this section could sensibly be called and imaged as, *'Framing the Problem, Framing the Solution' or 'Past Expansion and Divergence, Future Contraction and Convergence'* with an image such as above to represent this.

However, the imagery and the subsequent language used to address it, are problematical. Moreover, they - so far - fail to represent the published literature, imagery and political agreements based on contraction and convergence.

With regard to the present image in the draft: -

1. It is arbitrary in its derivation - i.e. it has no source.
2. It appears to have been semi-randomly generated. Its computation is obscure. The implication is that it was 'modeled' but is unclear as to what the integrating assumptions are. In other words, it is entirely unclear as to why the curves are behaving as they do - i.e. so actually achieve an overall contraction consistent with a 450 ppmv outcome - other than in some apparently accidental way.
3. Specifically, it appears to represent the discourse about the contraction and convergence 'trajectories' of Annex One and Non-Annex One that appear later in chapter one (between lines 11 and 55 on page 23 in section 1.4 - 'Alternative Development Pathways'). This 'binary adversarial' approach is politically unrealistic and a sub-optimal recognition of the opportunities in formal *"Contraction and Convergence"*.

This goes to the fundamental question in this report. What is the future with regard to humanity in general and its/our influence on global climate change, and why will this future be whatever it turns out to be? Will it be led by negativistic anti-precautionary guess-work (JAZZ) or a positivistic precautionary framework (Geo-Polity)?

So far the whole TAR WG3 draft report seems largely trapped in the negativistic literature of the 'economics of resistance', written during the 1990s. In other words it draws on the discourse which was generated at a time when the generic character of the (largely but not only, 'economic') commentary regarding policy responses to global climate change was in the 'no-regrets' mode of thinking and not in the 'precautionary' mode.

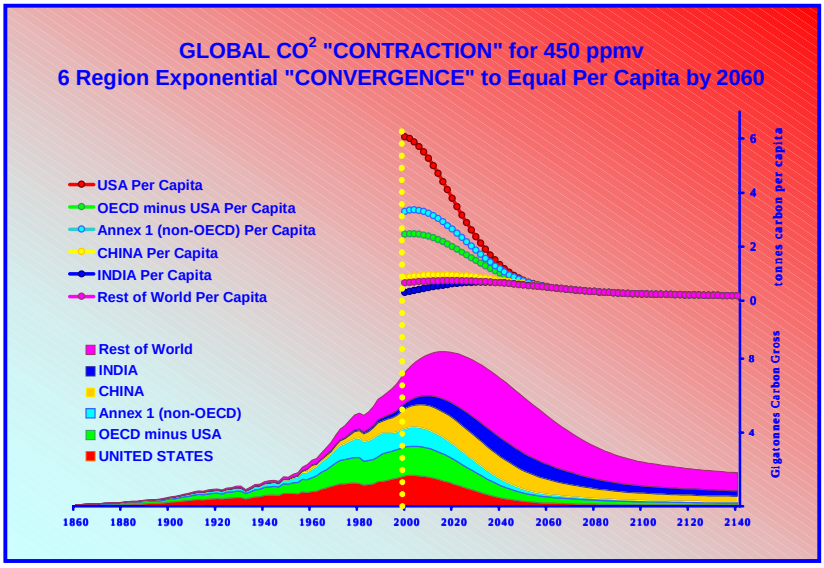
Clearly the situation has now changed. Scientists in IPCC WG1 (Ewins, Baker) have taken initiatives in public (23 12 1999) using language regarding the urgency of responding in a precautionary way to human-induced global climate changes.

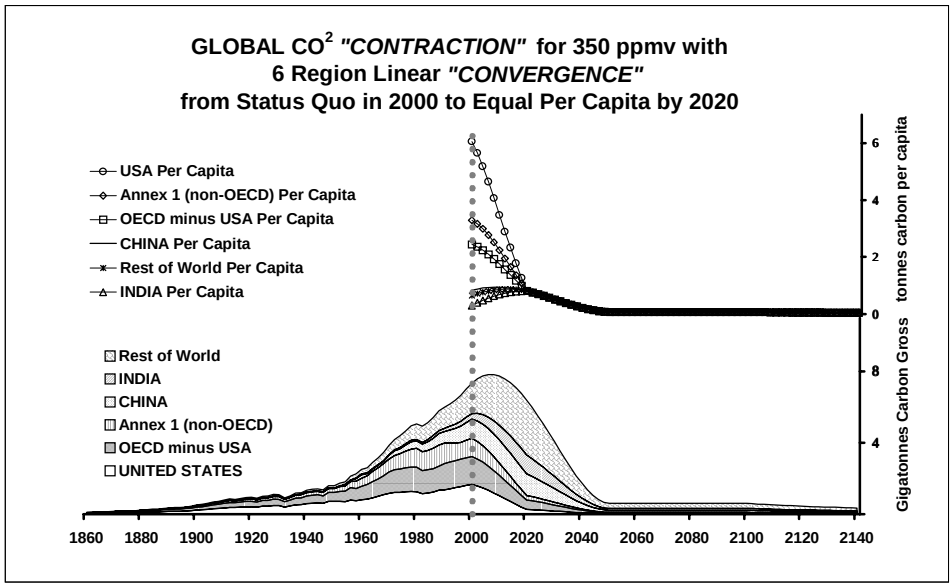
It is vital that the TAR and especially its 'scene-setting' chapter - The scope of the Assessment' - responds to these changed circumstances by drawing on the literature and imagery that has responded to - or indeed anticipated - these changed circumstances.

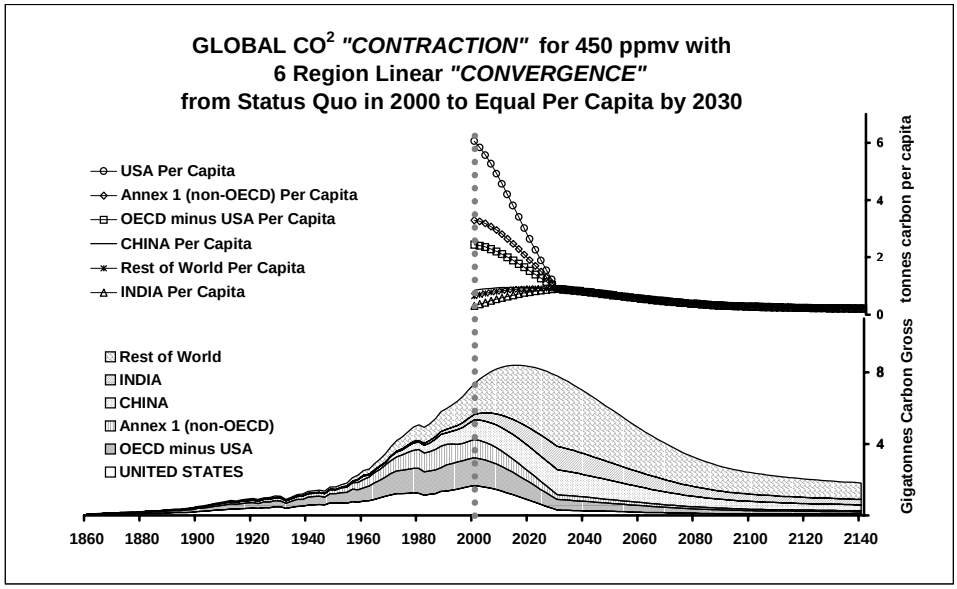
We propose that the imagery used at present is either accompanied by or preferably replaced by published imagery from specifically computed contraction and convergence budget runs (see http://www.gci.org.uk/ccweb/test/cac.html) such as those which follow since they demonstrate clearly: -

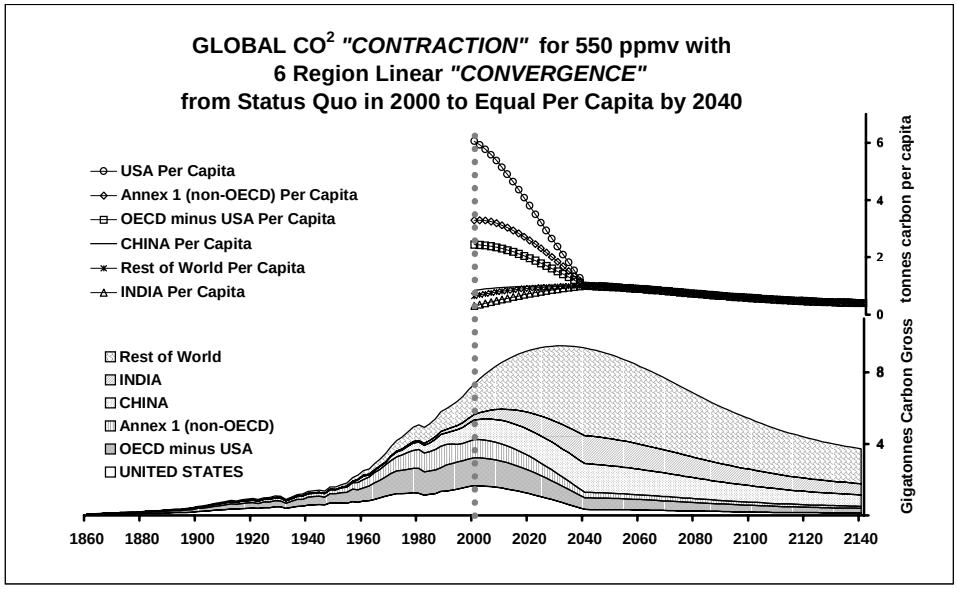
1. the 100% 'contraction' budget or equity or collateral (the global budget) computed consistent with a pre-specified outcome value (in the e.g. chosen here and the TAR drafts with the IPCC SAR 450 ppmv integral), and the
2. the derived equity of per capita 'convergence ', from initial shares [that are proportional to income] to future shares [that are proportional to population or a base year thereof], showing different rates of convergence, and the
3. shares of this equity (as shares of the 100%) to emphasize that it is emissions 'rights' that are so created that are also tradable if desired.

Published Imagery

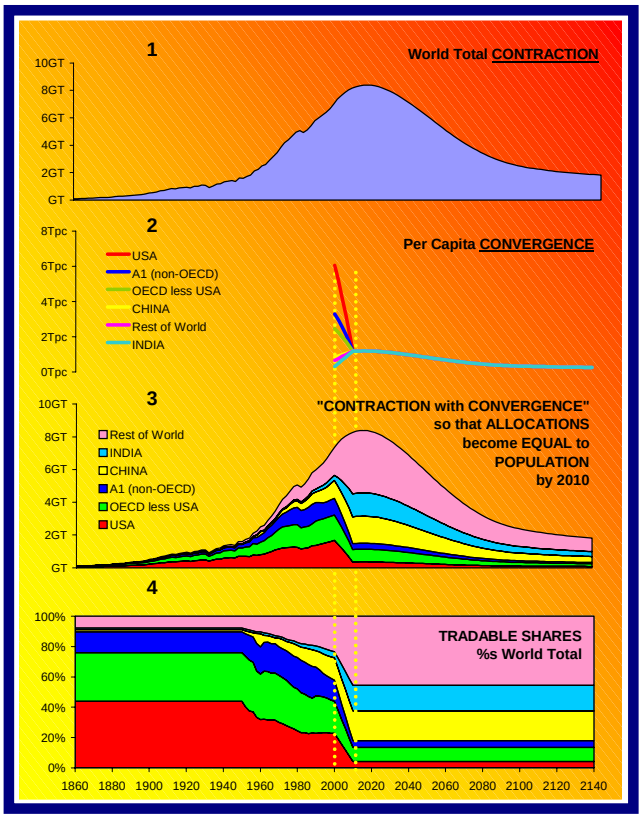


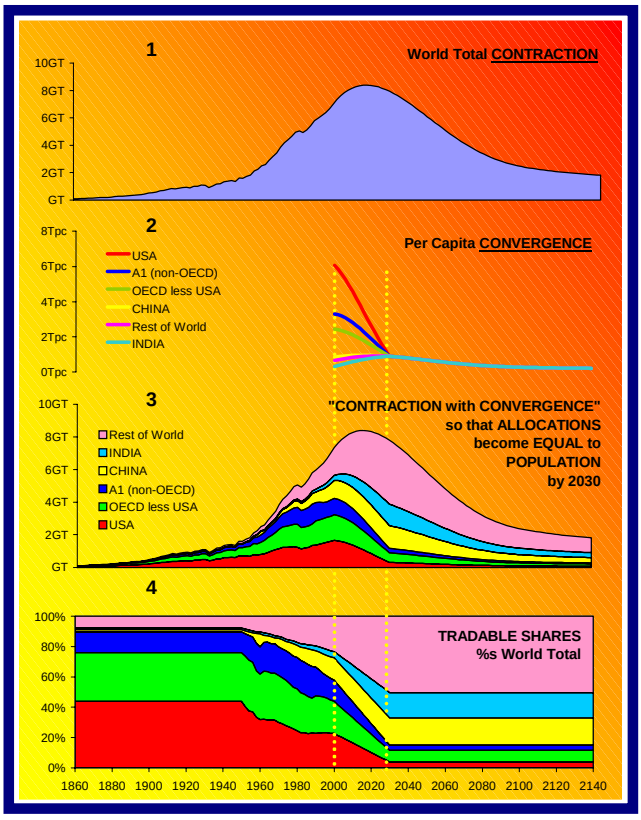

GLOBAL CO2 "CONTRACTION" for 350 ppmv with
6 Region Linear "CONVERGENCE"
from Status Quo in 2000 to Equal Per Capita by 2020
USA Per Capita
Annex 1 (non-OECD) Per Capita
OECD minus USA Per Capita
CHINA Per Capita
Rest of World Per Capita
INDIA Per Capita
Rest of World
INDIA
CHINA
Annex 1 (non-OECD)
OECD minus USA
UNITED STATES
Gigatonnes Carbon Gross tonnes carbon per capita
1860 1880 1900 1920 1940 1960 1980 2000 2020 2040 2060 2080 2100 2120 2140

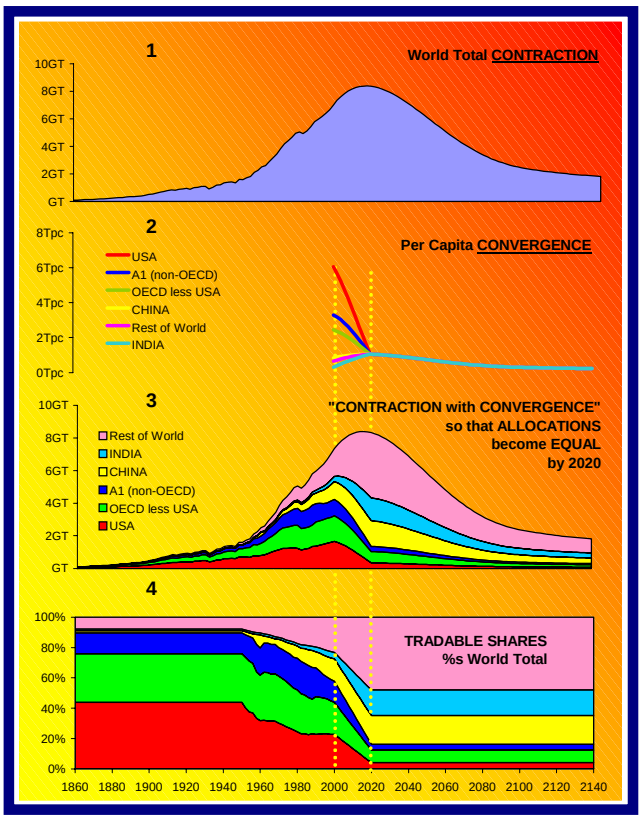

GLOBAL CO2 "CONTRACTION" for 450 ppmv with
6 Region Linear "CONVERGENCE"
from Status Quo in 2000 to Equal Per Capita by 2030
USA Per Capita
Annex 1 (non-OECD) Per Capita
OECD minus USA Per Capita
CHINA Per Capita
Rest of World Per Capita
INDIA Per Capita
Rest of World
INDIA
CHINA
Annex 1 (non-OECD)
OECD minus USA
UNITED STATES
Gigatonnes Carbon Gross tonnes carbon per capita
1860 1880 1900 1920 1940 1960 1980 2000 2020 2040 2060 2080 2100 2120 2140

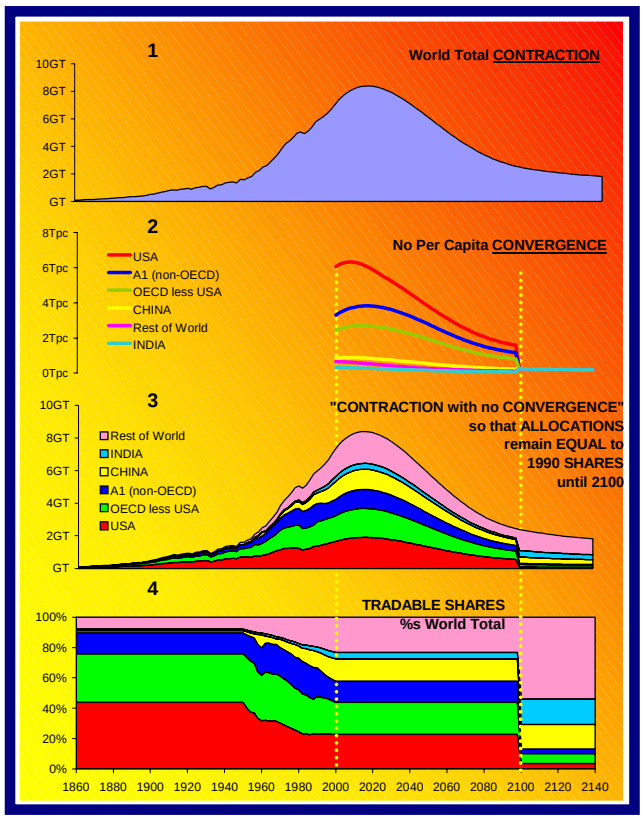

GLOBAL CO2 "CONTRACTION" for 550 ppmv with
6 Region Linear "CONVERGENCE"
from Status Quo in 2000 to Equal Per Capita by 2040
USA Per Capita
Annex 1 (non-OECD) Per Capita
OECD minus USA Per Capita
CHINA Per Capita
Rest of World Per Capita
INDIA Per Capita
Rest of World
INDIA
CHINA
Annex 1 (non-OECD)
OECD minus USA
UNITED STATES
Gigatonnes Carbon Gross tonnes carbon per capita
1860 1880 1900 1920 1940 1960 1980 2000 2020 2040 2060 2080 2100 2120 2140

In the use of such imagery it is important to stress the independently variable and revisable rates of *"Contraction and Convergence"* that are possible.

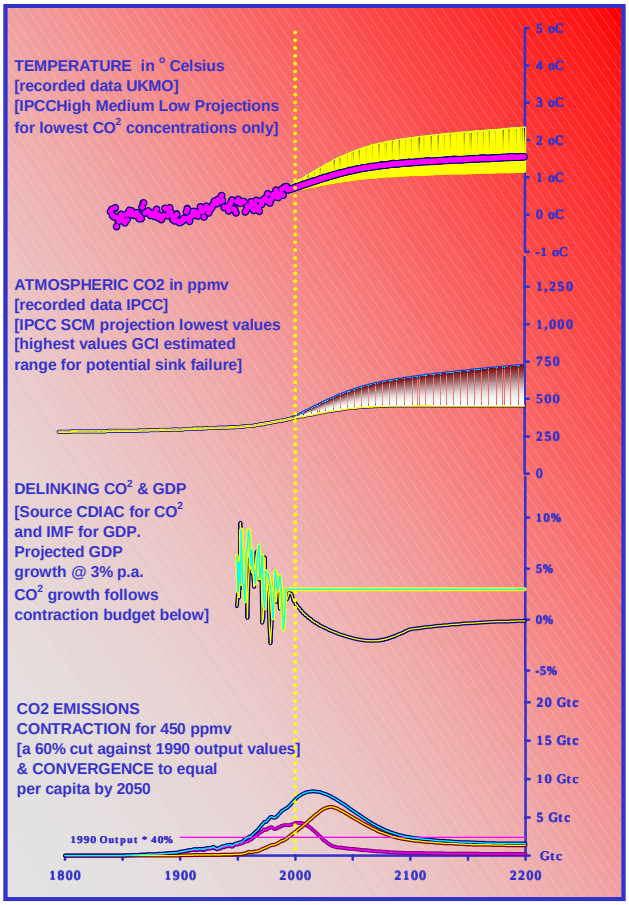


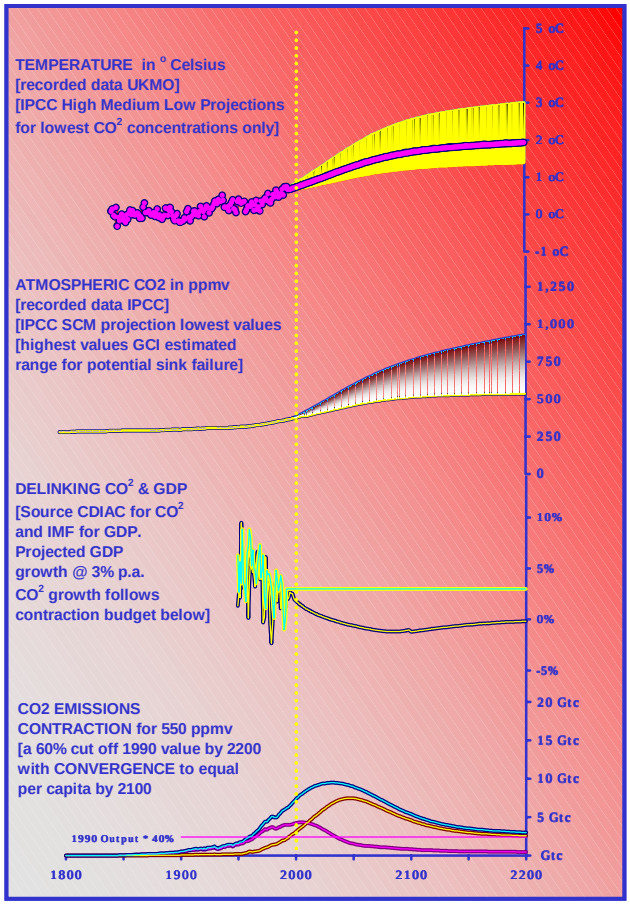






Linking these images to projections of temperature and concentrations is also required. Moreover, if the section page 4 line 18 section 1.1.1 continues to dwell on 'Emissions and Economic Growth', then it would be appropriate to have composite imagery that potrays CO2:GDP delinkage as well. The following images were published by GLOBE International in 1997.





International 'Efficiency/inefficiency' comparison

Composite imagery that includes comparative representation of international GDP:CO2 (or 'efficiency/inefficiency') de/linkage is required as well. The reality that the biomass-based economies are more effiecient that the fossilmass-based economies has been obscured by propaganda coming from the industrial countries.

Indicators are: -

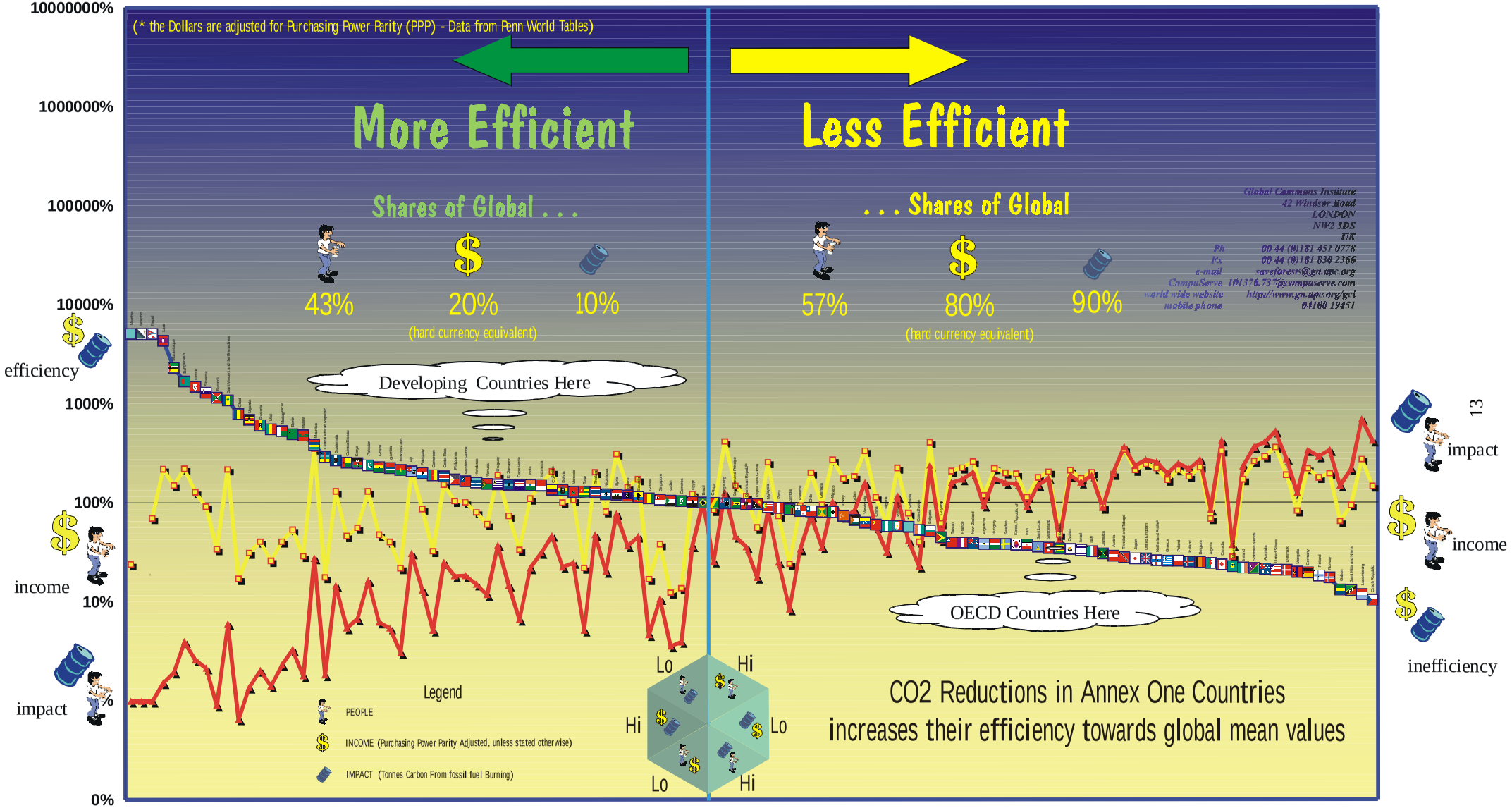
- per capita impact (as tonnes of carbon from fossil fuel consumption)
- per capita income (as national currency units adjusted for international purchasing power disparities or exchange rate distortions)
- 'carbon-efficiency' as the number of dollars per tonne

The ratio between averages for per capita income and carbon impact, go from: -

- Low per capita income/impact at high efficiency at one end to
- High per capita income/impact at low efficiency at the other.

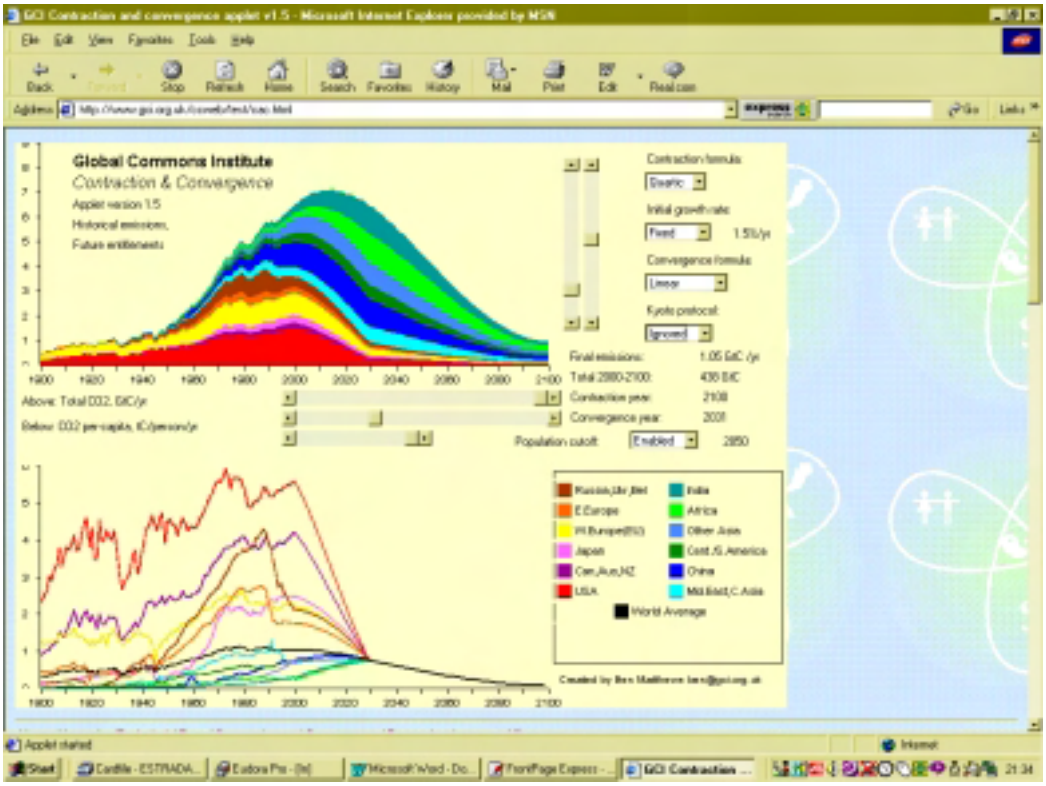
The next graph shows this on a comparative international scale: - this dollar/tonne carbon 'efficiency' decreases proportional to the increase in 'wealth'.

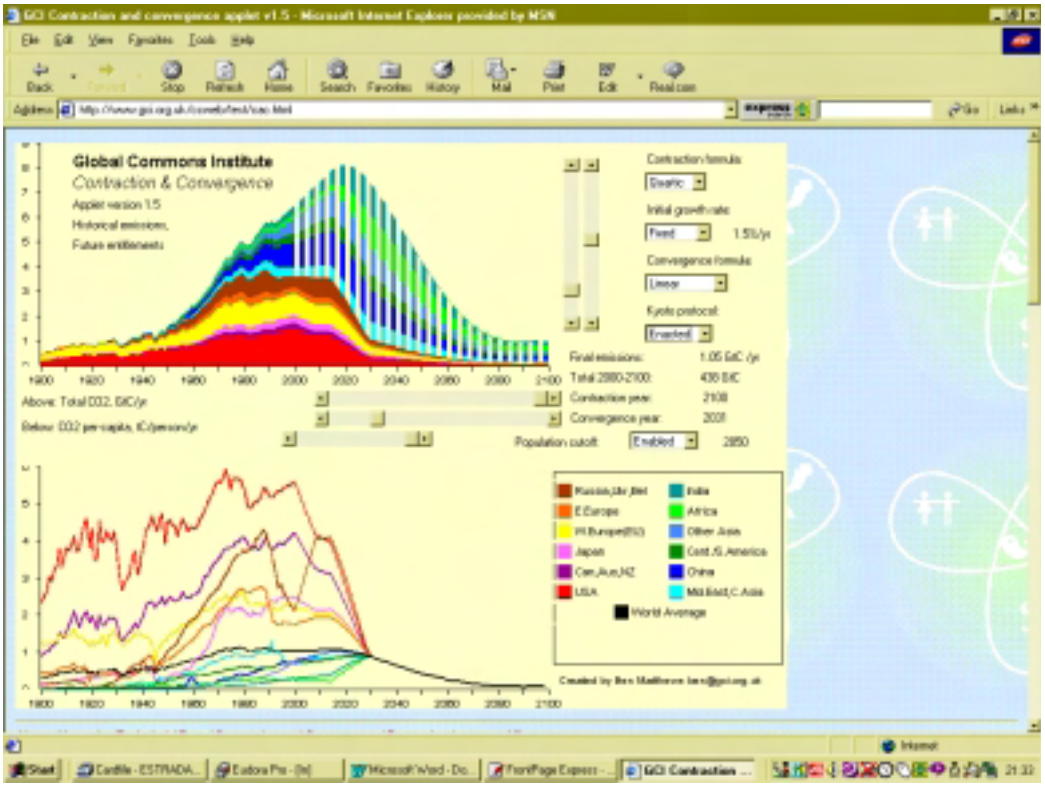
$s*/tonne carbon EFFICIENCY RANKINGS for 1990



This graphic compares the dollar/tonne "EFFICIENCY" $ for 120 countries in 1990.
Dollars (INCOME) are adjusted to "Purchasing Power Parity" (PPP). Tonnes (IMPACT) are of carbon from CO2 from fossil fuel burning.
INCOME per capita is shown on the yellow line. $ IMPACT per capita is shown on the red line.
EFFICIENCY $ is the ratio between INCOME and IMPACT and international rankings are shown in the line of flags.
The trend in the graphic shows that poor countries are much more efficient than rich countries.

Ultimately it would be sensible to draw policy maker's attention to inter-active C&C imagery of the following kind: - **APPLY *"Contraction and Convergence" at* http://www.gci.org.uk/ccweb/test/cac.html.** This version of the model will shortly have 'responses' to ghg emissions budgets and variable land/sea sink functions set by the user for atmospheric ghg concentrations and temperature with an attempt to portray threshold events to 'nasty surprises'.





WORDING for REASONING BEHIND "Contraction and Convergence"

1. *"Contraction and Convergence"* responds to human caused global climate change as 'a global security interest' that must now be handled on a precautionary global basis.

2. *"Contraction and Convergence"* is a formal and internally consistent framework for sharing greenhouse gas emissions on a global basis that is, consistent with the *already agreed* Objective and Principles of the United Nations Framework Convention on Climate Change (UNFCCC).

   These key features of the UNFCCC and of *"Contraction and Convergence"* are sequenced as follows:

   - The global Objective: - the stabilisation of ghg concentrations in the global atmosphere at a non-dangerous level.
   - The global organising Principles of:
     - *Precaution* and
     - *Equity*
   - The globally *efficient* emissions trading process enabled through the above.

3. The *"Contraction and Convergence"* framework puts the future evolution of climate mitigation policies within a universally consistent set of procedures for internationally distributing future ghg emissions entitlements, as the UNFCCC objective, principles and trading require [see following page]. In other words it provides shared language with shared meaning that integrates these key features within a Constitution.

4. All other types of approach, however sub-globally and locally logical they might seem, cannot be effective at a global level. The endemically random character of the 'evolutionary sub-global' approach will always make specification as well as achievement of its objective impossible, so disabling the UNFCCC.

5. Scientist and politicians have re-emphasised that, as atmospheric concentrations of greenhouse gases continue to rise, the probability of rapid non-linear events - their term for nasty and uncontrollable surprises - in the behaviour of the global climate system increases. Emissions have therefore to be controlled and reduced globally so as to slow their rising accumulation in the atmosphere as rapidly as possible.

6. So great are the hazards presented by global warming that the choice between the evolution of policies and measures with or without the formal framework of *"Contraction and Convergence"* amounts to deciding between control and chaos.

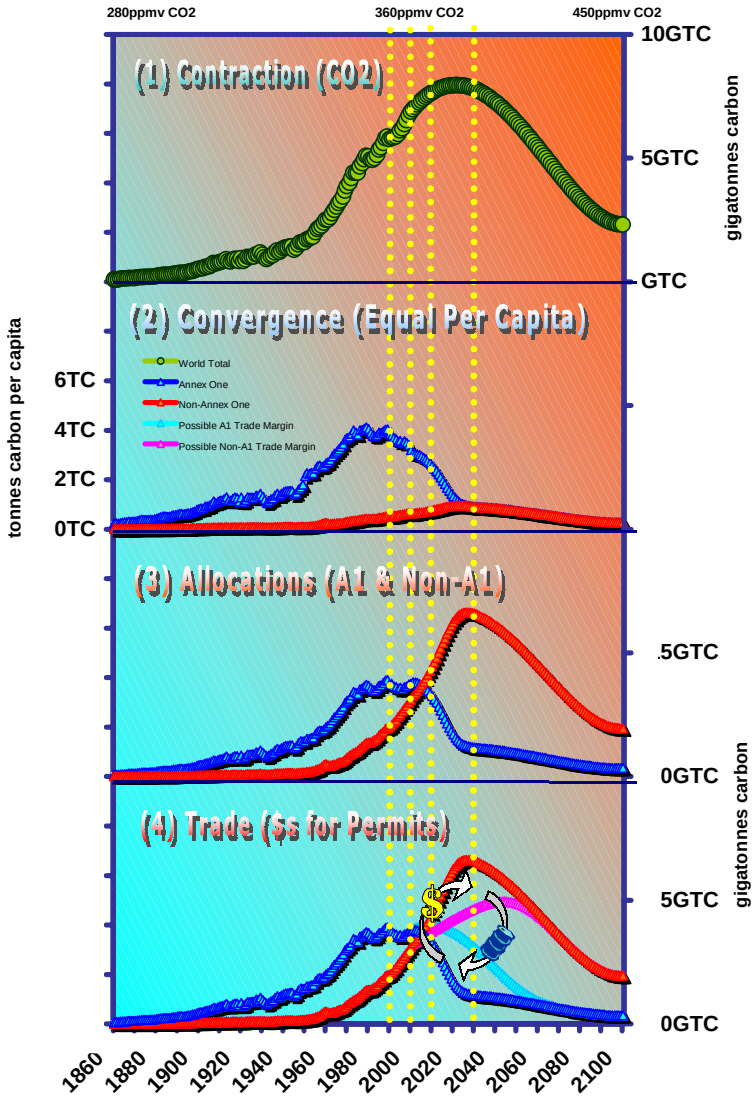
7. However difficult a road it might seem, *"Contraction and Convergence"* could - if adopted with international emissions trading - be the means that enable humanity to escape from its present vicious circle into the virtuous cycles of sustainability.

8. *"Contraction and Convergence"* is moreover, consistent with almost every policy statement on reducing the effects of climate change to have been issued in the past decade by signatories to the UNFCCC. It is therefore the key concept that enables these statements to acquire effective meaning [see following pages].

"Contraction, Convergence, Allocation & Trade"- A Simple Formulation

Simply illustrated, here is a global model with two zones and one greenhouse gas, industrial CO^2. Zone One is the Annex One group of the UNFCCC. Zone Two everybody else.

(1) This example has a **Contraction** budget calculated for the goal of stabilising atmospheric concentrations of CO^2 at 450 ppmv by 2100. This means a total emissions budget of 640 billion tonnes of carbon from CO^2 under a global curve progressively limiting and reducing the annual output of global emissions to 2.3 billion tonnes by 2100, or 40% of the value in 1990.



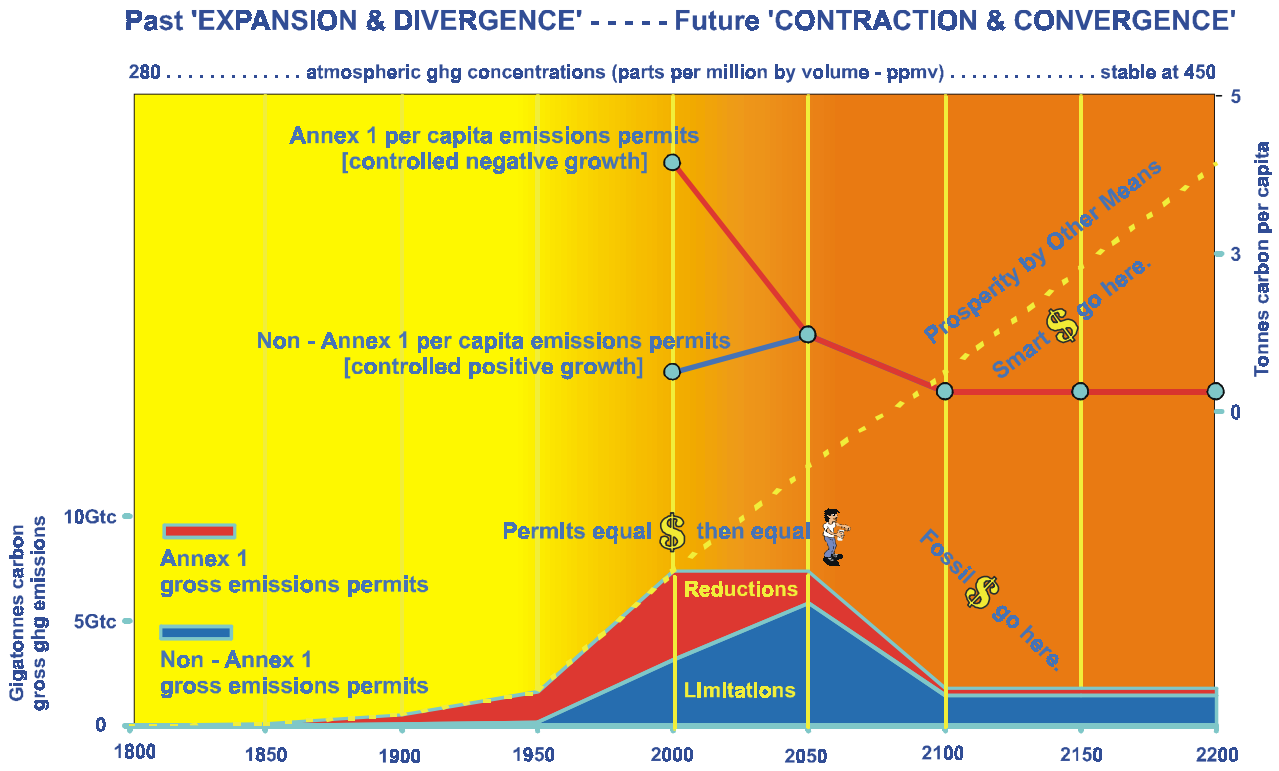
(2) **Convergence** to equal per capita entitlements globally is set to complete by 2030 exponentially.

(3) The **Allocation** of the emissions entitlements is the product of the contraction budget and the convergence rate.

(4) Once the first three steps are secure the option of the global **Trade** of the entitlements can be exercised. Only with the global cap secure could it be claimed that this trade would be indexed to the control of atmospheric greenhouse gas concentrations.

In other words without the global calculus of *"Contraction and Convergence"* the trade will be unbounded and useless and probably dangerous.

THE USA and "CONTRACTION & CONVERGENCE"



The US has affirmed:

1. That 'a global solution' to the 'global problem' of climate change is needed.
2. The objective of the UNFCCC [stabilisation of ghg concentration in the global atmosphere] is ghg emissions 'contraction' by definition [here 2000 - 2100].
3. That all countries must be involved in emissions control [here 2000 - 2200].
4. That a 'central organising principle' is applied to distribution (initially this was 'all countries will reduce ghg emissions by x% pro rata' [here 2050 - 2200]
5. The 'Byrd Hagel Resolution', where this central organising principle was modified to combine 'Reductions' [controlled negative growth] with 'Limitations' [controlled positive growth] giving 'convergence' [here 2000 - 2050].
6. That the 'commitments/entitlements' arising from this controlled 'contraction and convergence' must be 100% tradable.
7. That inter-emissions-budget-period borrowing must be allowed.

CONCLUSION

As there is no other way to combine all their requirements, *other than with anti-precautionary guess-work*, it is logical *minima* to observe that the US proposals are not in conflict with *"Contraction and Convergence"* to equal per capita tradable entitlements globally by an agreed date under a predefined global cap. It is also logical to ask what else is intended if not this?

The IPCC Third Assessment Report (TAR) should ask this question

SUGGESTED WORDING for "Contraction and Convergence"

The statement below is circulating for support. Current list appended.

A statement by Michael Meacher, the UK Environment Minister, has recognised the arguments above. He recently told the Royal Geological Society that, *"the future of our planet, our civilisation and our survival as a human species . . . may well depend on [our responding to the climate crisis by] fusing the disciplines of politics and science within a single coherent system."*

"Contraction and Convergence" is such a system. It is the 'logical approach'. As Sir John Houghton, Chair of the Intergovernmental Panel on Climate Change Sciences (IPCC) recently told the British Association for the Advancement of Science, global greenhouse gas emissions must be reduced by more than 60% in less than a hundred years merely to stabilise their rising concentrations in the atmosphere. Even this value would be 70% higher than any time past. So faster reductions to a lower value are desirable because this lowers the risks of dangerous surprises in the global climate changes taking place.

"Contraction" - For precautionary reasons, all governments must collectively agree to be bound by such a target. This makes it possible to calculate the diminishing amount of carbon dioxide and the other greenhouse gases that the world can release for each year in the coming century while staying within this target. Subject to annual scientific and political review, this is the contraction part of the process.

"Convergence" - On the basis of equity, the convergence part means that each year's ration of this global emissions budget gets shared out among the nations of the world so that every country converges on the same allocation per inhabitant by an agreed date. This rate of convergence is negotiable but 2030 was the date Sir John suggested. The convergence method recognises that most people globally expect a 'pre-distribution' of the rights to 'global commons' of the atmosphere that observes the principle of globally equal rights per capita.

Once agreed, countries unable to manage within their shares would, within limits, be able to buy the unused parts of the allocations of other, more frugal, countries. Sales of unused allocations would give the countries of the South the income to purchase or develop zero-emission ways of meeting their needs. The countries of the North would benefit from the export markets this restructuring would create. And the whole world would benefit by the slowing the rate at which damage was being done. Bilateral emissions trade and related deals between UNFCCC Parties, would not form part of the negotiations in that forum.

Because *"Contraction and Convergence"* is an effective, equitable, efficient and flexible framework in which governments can co-operate to avert climate change, even some fossil fuel producers have begun to demonstrate positive interest in the concept.

Further, as Jubilee 2000 and Seattle have shown, governments and powerful interests are helped to change by coherent co-ordinated pressure from civil society.

'CIVIL SOCIETY' SUPPORT for "Contraction and Convergence"

Aubrey Meyer	Global Commons Institute (GCI)
Richard Douthwaite	Author of the Growth Illusion. Ireland
Mayer Hillman	Senior Fellow Emeritus Policy Studies Institute. UK
Titus Alexander	Chair Westminster UNA/Charter 99
Tom Spencer	Secretary General GLOBE Council
David Chaytor MP..	Chair GLOBE UK All Party Group
Andrew Simms	Global Economy Programme. New Economics Foundation
Annikki Hird	Student Cincinnati Ohio USA
George Monbiot	Journalist UK
J N von Glahn	Chairman. Solar Hydrogen Energy Group
Nick Robins	Director. Sustainable Markets Group IIED
John Whitelegg	Eco-Logica Ltd
Nicholas Hildyard	The Corner House. UK
Helen N Mendoza	Haribon Foundation and SOLJUSPAX. Philippines
Sam Ferrer	Green Forum Philippines
Ramon Sales Jnr.	Philippine Rural Reconstruction Movement
Larry Lohmann	The Corner House. UK
Prof Daniel M. Kammen	Energy and Society. Director. Renewable and Appropriate Energy Laboratory (RAEL) Energy and Resources Group (ERG) University of California Berkeley. USA
Hans Taselaar	ESD. Assoc. for North-South Campaigns. Netherlands
Anil Agarwal	Director Centre for Science & Environment. New Delhi. India
Dr Frances MacGuire	Climate Change Policy Coordinator Friends of the Earth (England Wales and Northern Ireland)
Matthias Duwe	Student. SOAS. London. UK
Krista Kim	Student. UC Berkeley. CA US
Agus Sari	Executive Director Pelangi. Indonesia
Patrick Boase	Chairperson. Letslink. Scotland
Joerg Haas	Germany
Tony Cooper	MA DipStat MBCS CEng GCI
Thomas Ruddy	Chairperson and editor "Computers and Climate"
Paul Burstow	UK
Mark Lynas	Co-ordinator. Corporate Watch. UK
Philippe Pernstich	Global Commons Institute
Rohan D'Souza	Yale University. USA
Boudewijn Wegerif	Project Leader. Monetary Studies Programme
Jyotic Parikh	Senior Professor Indira Gandhi Institute of Development Research India. National Project Coordinator. Capacity Building Project. UNDP Chairperson. Environmental Economics Research Committee EMCaB. Worldbank IPCC TAR Lead Author
Aniko Boehler	Chairperson. Senso Experience & Projects
Marc van der Valk	Barataria. Netherlands
Charlotte Pulver	UK
Charlotte Rees	UK

Paul Ekins	Forum for the Future. UK
Lara Marsh	Tourism Concern UK
Angie Zelter	Reforest the Earth. UK
Peter Doran	Foyle Basin Council (Local AGenda 21 Derry)
Paul Swann	Global Resource Bank
Adam Purple	Zentences
Martin Piers Dunkerton	Director Paradise Films UK
Alan Sloan	GRB Ecology Department UK
John Thomas	Energy Spokesperson Calderdale Green Party UK
Rick Ostrander	Relax for Survival USA
Christopher Harris	US
Carol Brouillet	Founder- Who's Counting Project. CA US
John Pozzi	Acting Manager Global Resource Bank
Icydor Mohabier	Georgia State University US
Christopher Harris	US
David Thomas	UK
Christopher Keene	Globalisation Campaigner Green Party of England and Wales
Piet Beukes	Industrial Missionar. ICIM South Africa
John Devaney	International Co-ordinator, Green Party of England and Wales
Jama Ghedi. Abdi Msc&MA	Gawan Environmental Centre. Somali NGOs
Julie Lewis	Centre for Participation. New Economics Foundation
Juliet Nickels	UK
Dr Caroline Lucas MEP	Member of European Parliament. Green Party
Dr David Cromwell	Oceanographer. UK
Prof. Colin Price	Environmental and Forestry Economics. Uni Wales. Bangor
Patrick McCully	International Rivers Network Berkeley. California USA
Samantha Berry	Post-graduate student (PhD)
Caspar Davis	Victoria. BC Canada
David J. Weston	Monetary Reform Group UK
Joseph Mishan	Stort Valley FOE local group
Ryan Hunter	Center for Environmental Public Advocacy. Slovak Republic
Dr. Elizabeth Cullen	Irish Doctors Environmental Association
Tom Athanasiou	Writer. USA
Jamie Douglas Page	UK
Rosli Omar	SOS Selangor. Malaysia
Michal Kravcik	People and Water. Slovak Republic
Daphne Thuvesson	Trees and People Forum. Editor/Forests Trees & People Newsletter. SLU Kontakt Swedish Uni. Agricultural Sciences
Chris Lang	Germany
Sarmila Shrestha	Executive Secretary. Women Acting Together for Change
Narayan Kaji Shrestha	Volunteer. Women Acting Together for Change
Wong Meng-chuo	Co-ordinator. IDEAL Malaysia
Amanda Maia Montague	international spiritual activist
Soumya Sarkar	Principal Staff Writer. The Financial Express
Sujata Kaushic	Editor Wastelands News. SPWD. NEW DELHI

Xiu Juan Liu	Department of Geography Uni of Sydney NSW 2006 Australia
Ross Gelbspan	Author 'The Heat Is On' and Pulitzer Prize-winning journalist
Barry Coates	Director World Development Movement UK
Aubrey Manning	UK
Andy Thorburn	Composer. Pianist and seed potato inspector. Scotland
Mike Read	Mike Read Associates. Australia
Shalmali Guttal	Focus on the Global South. India
Jennie Richmond	Policy Officer Christian Aid
Lavinia Andrei	Co-ordinator Climate Action Network Central & E. Europe
Dr. Ing. Joachim Nitsch	German Aerospace Center; 'System Analysis & Tech Assessment'
Karla Schoeters	Co-ordinator Climate Network Europe
Sibylle Frey	Researcher UK
Dr Ben Matthews	Global Commons Institute
Wolfgang Sachs	Wuppertal Institite Germany. IPCC TAR WG3 Lead Author
Bernd Brouns	University of Lüneburg Germany
Jindra Cekan. PhD	American Red Cross. Washington DC USA
Rohan D'Souza	Postdoctoral Fellow. Agrarian Studies Program Yale University
John Tuxill	School of Forestry and Environmental Studies. Yale University
Olav Hohmeyer	Prof. Dr. University of Flensburg
Grant Harper	Victoria. Australia
Frances Fox	Asst. Manager. Global Resource Bank
Ernst von Weizsaecker. MP (SPD)	President. Wuppertal Institute for Climate. Environment & Energy. Germany
Marci Gerulis	Graduate Student. Boston. Massachusetts. USA
András LUKÁCS	President Clean Air Action Group. Budapest. Hungary
Srisuwan Kuankachorn	Director. Project for Ecological Recovery. Bangkok. Thailand
Devinder Sharma	journalist and author New Delhi. India
Ryan Fortune	journalist. Cape Times. Cape Town. South Africa
Emer O Siochru	Fdn for the Economics of Sustainability (FEASTA) Ireland
Anne Ryan	National University of Ireland. Maynooth
David O'Kelly	Fdn for the Economics of Sustainability (FEASTA) Ireland
Youba Sokona	Exec. Secr. Internat Relations of ENDA-TM. Dakar. Senegal
Jia Kangbai	Managing Editor. The Progress Online. Sierra Leone
James K. Boyce	Economics Dept Uni Massachusetts Amherst. MA USA
Judit.Halasz	Green-Women. Hungary
Dr.Saleemul Huq	Executive Director Bangladesh Centre for Advanced Studies
Dr. Jean-Michel Parrouffe	Association Québécoise des Énergies Renouvelables
Guy Dauncey	Author Victoria. Canada
Dr. Alex Casella	Prof.& Director of Energy Studies. University of Illinois
Michael R. Meuser	Clary Meuser Research Associates. Santa Cruz. CA USA
Arthur H. Campeau Q.C.	Ambassador for Environment and Sustainable Development
Professor Jack Dymond	Oregon State University
Donald L. Anderson	Biologist.USA (Maine)
Douglas G. Fox. Ph.D.	Pres Fox & Associates. Fr. President. Air & Waste Management Association & Chief Scientist. USDA-Forest Service USA

Clive Hamilton	Executive Director. The Australia Institute
Yves Bajard, D.Sc.	Secretary, National Centre for Sustainability, Victoria, BC, Canada
Winona Alama	South Pacific Regional Environment Programme (SPREP)
Fatu Tauafiafi	Information and Publications Officer, South Pacific Regional Environment Programme (SPREP)
Maria Lourdes 'Pinky' Baylon	University of Cambridge UK
Ying Shen	student of environmental chemistry Oklahoma City, US
Susan Engelke	student Sacramento, California, US
Pierre-Jean Arpin	France
Dr. Muawia H. Shaddad	Sudanese Environment Conservation Society
Christer Krokfors	University of Uppsala, Finland
Jesus Ramos-Martin	MSc Ecological Economics Keele University, UK
Lelei LeLaulu	Counterpart International
John Vandenberg	Resource Planning & Development Commission, Tasmania, Aust.
Pervinder Sandhu	ART
Paul Gregory	Researcher
Eleanor Chowns	Co-Ordinator GLOBE UK
Jurgen Maier	Forum Umwelt & Entwicklung, Germany
Grace Akumu	Executive Director Climate Network Africa
Robert Engelman	Vice President for Research, Population Action International
Tim O'Riordan	Associate Director, C-SERGE, UK
Ted Trainer	Author 'Developed to Death', Austrialia
Barry Budd	Australia
Tim Lenton	Centre for Ecology and Hydrology, UK
Tony Whittaker	retired solicitor, founder member Green Party
Lesley Whittaker	writer, consultant and member of Devon County Council, founder member Green Party
Freda Sanders	research psychologist and finance director, founder member Green Party
Dr. Michael Benfield	ethicist, development consultant and investor, founder member Green Party
Oras Tynkkynen	climate campaigner, Friends of the Earth Finland
Prof David Crighton	Environmental Consultant to the Association of British of Insurers
Teddy Goldsmith	Editor The Ecologist Special Issues
Simon Retallack	Deputy Editor, The Ecologist Special Issues
Ian Meredith	Canadian Association for the Club of Rome
Emilio Sempris	Coordinator. National Climate Change Program (Panama)
Michael Roth	Queensland Transport. Australia
Carrie Sonneborn	Australian Cooperative Research Centre for Renewable Energy. Western Australia
Ali Bos	Postgraduate student. Canberra. Australia
Sungnok Andy Choi	Student - The Graduate Institute of Peace Studies
James Robertson	Asia-Pacific Network for Global Change Research. Japan
Thomas Bernheim	Expert Federal Planning Bureau. Belgium
Julian Salt	Project Manager, Natural Perils, Loss Prevention Council UK

APPENDIX - SUPPORT

Indian Government essay a *"Global Solution" at COP1*

Already recognising the ultimate flaw in the Berlin Mandate, the Indian Government made this statement at the end of the First Conference of the Parties (COP1).

> *"We face the actuality of scarce resources and the increasing potential for conflict with each other over these scarce resources. The social, financial and ecological inter-relationships of equity should guide the route to global ecological recovery. Policy Instruments such as "Tradable Emissions Quotas", "Carbon Taxes" and "Joint Implementation" may well serve to make matters worse unless they are properly referenced to targets and time-tables for equitable emissions reductions overall. This means devising and implementing a programme for convergence at equitable and sustainable par values for consumption on a per capita basis globally."*

The BYRD HAGEL Global Solution

In July 1997 US Senators Byrd and Hagel tabled a resolution about the US involvement with the Kyoto Protocol. It rehearsed all their objections to what they felt was the 'flawed' character of the Berlin Mandate and the impending Kyoto Protocol.

Their fundamental objection was to the 'global apartheid' in the UNFCCC between the Developed Country Parties of Annex One who were to observe commitments to control their ghg emissions, and all the Developing Country Parties who were not required to observe such commitments. The Resolution, adopted with a vote of 95 in favour and 0 against, clearly allows *"Contraction and Convergence"*.

"Now, therefore, be it Resolved that: -

> *(1) the US should not be a signatory to any protocol to, or other agreement regarding, the United Nations Framework Convention on Climate Change of 1992, at negotiations in Kyoto in December 1997, or thereafter, which would mandate new commitments to limit or reduce greenhouse gas emissions for the Annex I Parties, unless the protocol or other agreement also mandates new specific scheduled commitments to limit or reduce greenhouse gas emissions for Developing Country Parties within the same compliance period."*

The crucial detail in the Byrd Hagel Resolution is in paragraph 1A. Two defining distinctions are maintained. The first is between the Annex One Parties and the Developing Country Parties. The second is between 'limit' ghg emissions and 'reduce' ghg emissions. Limitations of ghg emissions is controlled positive growth of ghg emissions and reductions of ghg emissions is controlled negative growth of emissions.

If we put these concepts together *"within the same compliance period"*, the paragraph can only translate into a process of formal *"Contraction and Convergence"*. Annex One Parties will reduce (or contract) their ghg emissions while the Developing Country Parties will limit their ghg emissions (so as to converge with Annex One Country Parties).

Technically, not just rhetorically, there has to be a 'convergence factor' to do this. It won't happen by accident. The authors and supporter of this resolution have to face the unavoidable question, *"what is this convergence factor?"*

The AFRICA GROUP respond

Recognising the mounting dangers the Africa Group of Nations took a clear initiative at the August 1997 negotiating session of the Ad Hoc Group of the Berlin Mandate (AGBM7). The group defined and presented the global solution now formally known as *"Contraction and Convergence"* to the final plenary session.

"As we negotiate the reduction of GHG, the countries of Africa believe that there should be certain principles that need to be clearly defined.

1. *There must be limits on all GHGs if the danger to our climate is to be averted. The IPCC scientific assessment report provides us with the basis for global consensus on such limits.*

2. *A globally agreed ceiling of GHG emissions can only be achieved by adopting the principle of per capita emissions rights that fully take into account the reality of population growth and the principle of differentiation.*

3. *Achievement of a safe limit to global GHG emissions can be achieved by reducing the emissions of Annex One while at the same time ensuring that there is controlled growth of future emissions from Non-Annex One countries, reflecting our legitimate right to sustainable economic growth. We strongly believe that this will take us along a path to responsible climate management that allows us to reach our goal of defining a mutually agreed point of convergence and sustainable development. Such a convergence Mr. Chairman must ensure that we maintain a global ceiling on emissions to prevent dangerous interference with the climate system.*

4. *When we look at time frames, we believe that insufficient commitment by Annex One countries will only result in delaying our influence on the climate system. If this course is maintained, then we will all suffer and the burden will be even greater for humanity in general. The burden for any future mitigation efforts on those of who have not been historically and currently responsible for creating the problem will be greater.*

Mr. Chairman, we must focus our attention on the most appropriate, reasonable and acceptable time frame for action. There is an over-riding pre-requisite. The time frame can not be too far away into the future if we are to avoid at all costs the dangers that global climate change poses. The current scientific evidence indicates that Africa faces decline in water resources, agricultural production and economic performance. It is therefore for this reason that we wish to register the seriousness with which we view the effective implementation of the Convention and future agreements emanating from it."

They carried this position through to the very end-game of COP3 in December that year, with vivid and literally dramatic results in the final session establishing the Kyoto Protocol, seeding the statement of the Non-Aligned Movement (NAM) (see below) in those very moments.

The USA: - "It's the only game in town."

During mid 1997 and at the request of US government personnel, a series of private policy briefings on *"Contraction and Convergence"* took place in Government agencies in Washington comprising the US climate policy community (EPA, AFLCIO, State Dept. and the Energy Dept.). They were fully briefed on the flexibility of the model.

The application of the principle of graduated "Contraction" of the global ghg emissions budget over time to a pre-set goal of atmospheric ghg concentrations, enables any future carbon budget to be computed and subsequently revised to control concentrations.

The application of the principle of "Convergence" to equal per capita shares globally to a pre-set date within the budget and the budget period to a pre-set population year enables any rate of international convergence to be negotiated and revised blending control with consent.

The US were also advised that this flexibility should be read in conjunction with the flexibility sought in respect of the extent to which the resultant ghg allocations would be internationally tradable as emissions permits. Assuming such flexibility from *ab initio* enables the *"Contraction and Convergence"* rates to be negotiated without having to mimic and modify baseline trend emissions as in principle the global ghg emissions budget was convertible for cash.

Senior bureaucrats conceded that if the Chinese could be persuaded to play *"Contraction and Convergence"* the US would have to play. It was the only game in town.

China - "Emissions control standard formulated on a per capita basis"

During August 1997 Chinese policy makers were given the equivalent briefing and by October 1997 the Chinese appeared to have been persuaded to signal a tentative readiness to play C&C. In doing this they spelled out more specifically their views for the mid-term than had previously occurred. They in effect declared potential pathways for *"Contraction and Convergence"*.

Dr Song Jian (the State Councilor with responsibility for Climate Change and Population) made the following statement at the closing ceremony of the China Council for International Co-operation on Environment and Development.

"When we ask the opinions of people from all circles, many people, in particular the scientists think that 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. Today the per capita consumption is just one tenth of that of the developed countries, one eighth of that of medium developed countries. It is estimated 30-40 years would be needed for China to catch up with the level of medium developed countries."

COP3 - The "Kyoto Protocol" (Article 17) - global or sub-global?

The Kyoto Protocol (KP) was tabled at Third Conference of the Parties (COP3) in Japan in December 1997. It attempted to fulfil the Berlin Mandate for a "sub-global" solution, the main tension over 'globality' unanswered. Emissions reduction commitments were attached to the industrial country group only. In spite of the Africa Group position many developing countries continued to resist any talk of parallel (voluntary) commitments from them because of the history of deep inequity and mistrust.

However, the flaws in this "sub-global" strategy were revealed. The developing country group was persuaded by the northern environmental lobby to project an aggressively one-sided and unrealistic long-term scenario for global arrangements on emissions restraint. In exchange for nothing, the developing country group would prescribe ever-deeper ghg emissions reductions for the developed country group only for the next fifty years or more. In their growing frustration with the US and the US insistence on 'globality ', the NGOs argued that this would be seen as *"developing countries taking the lead"*.

The sub-global strategy also complicated the position of those developing countries that had been taking climate friendly measures including some control of ghg emissions. Their complaint became that these actions were not even being recognised let alone 'credited'. This was true but transactional credit required the finite accounts of globality.

Moreover, as the issue of the international tradability of ghg emissions entitlements progressed, an increasing number of countries recognised the logic of the Africa Group proposals for *"Contraction and Convergence"*. Not only did the principles answer the US demand for a global solution, they did so in a manner that enabled revenues from international emissions trading to accrue to developing countries for sustainable development in potentially significant amounts.

While the US appeared not to have won their insistence on 'globality' they had won their case for tradability. This led directly to what the US called a "near-death experience" at the very end of the negotiations; major G-77 players suddenly turned the tables at the last minute.

"Contraction & Convergence" Dawns at Kyoto's Darkest Hour;

At the end of the Kyoto negotiations, the entire debate came to centre on the issues of trade and the assigning of property rights in the future carbon budget. By definition, emissions trading cannot occur until the principle of property rights has been agreed and the entitlements have been assigned and ratified.

At 3.00am when the negotiations were already into injury time, the paragraph in the draft Kyoto Protocol relating to trade came up for acceptance. The US re-iterated their insistence on everyone's acceptance of emissions trading. The governments of China and India, contrary to people's expectations, did not rebut the idea.

Instead they responded by saying that acceptance of trade depended on the issue of "equitable allocations" of emissions entitlements on a per capita basis. Moreover the Africa Group of Nations intervened, re-iterating that this was why they had advocated "Contraction and Convergence". The US replied by saying that they heard the call for "Contraction and Convergence" but suggested this wasn't the moment to try and integrate such a comprehensive structural methodology.

However, that US response underlined the remarks made in Washington in July 1997 and reaffirmed at the GLOBE International workshop in Bonn in October 1997 by US Ambassador Mark Hambley to an international gathering of Parliamentarians, that the idea is being taken seriously in Washington. Like many others since, they have said it is the only game in town. The global equity argument was finally being won on the floor of the COP.

The COP meeting was arrested for half an hour. On resumption, Chairman Estrada read out a prepared text (now known as Article 17). In effect the COP issued instructions to SBI and SBSTA to elucidate during 1998 the rules, principles, modalities etc relating to trade, in time for COP4 in Buenos Aires in November 1998.

Progress with "Contraction and Convergence" in 1998

During 1998 the campaign to secure *"Contraction and Convergence"* made real progress. As a result of the last-minute developments in Kyoto the whole debate has swung round towards the clearest recognition yet the logic of *"Equity and Survival*". International arrangements are now being created to share ownership of the global atmosphere at sustainable and equitable rates of use.

But at present these still exclude eighty percent of the world's population as a result of pursuing 'sub-global' solutions. This is daft and many people are now recognising this and that the *"Contraction and Convergence"* argument and imagery remains the clearest and simplest exposition of a 'global solution'. With the international distribution of literally thousands of graphics of the programme during 1998, the year has been largely about developing support for the concept rather than developing the concept itself. In future both are necessary. We need to project the argument in ways that are responsive to the situations and conflicts that are coming towards us in the real-political process.

GLOBE International

Early last year GLOBE International prepared an exposition of *"Contraction and Convergence"* for use by GLOBE at the G-8 in Birmingham. At the time this was very widely distributed in political circles in Britain, internationally and in UN agencies such as the IPCC with consistently good feedback since then.

The G-8 Birmingham

During GLOBE's preparations for this Mr. Meacher - The UK Minister of the Environment - was persuaded to publicly support GLOBE's advocacy of *"Contraction and Convergence"*. At a GLOBE event in the UK House of Commons in May he made a key-note address which endorsed the intellectual and campaigning work of GCI and GLOBE and the of *"equity and logic"* upon which the *"Contraction and Convergence"* model is based.

> *"As I have said it is our view that the time has come for a serious review under the Convention of the commitments of all countries, that reflects the economic and development needs of developing countries. "Contraction and Convergence" should be clearly one of the ideas on the table in such a review. It has the attraction of equity and logic - but equally raises huge political and practical issues which need to be considered carefully."*

John Gummer (the ex Minister) was in the chair and did so too. Sir John Houghton, the former head of the Met Office in Bracknell and the Chairman of the IPCC Science working group was there as well and has become an advocate of the scheme for the same reasons. Negotiators from the Africa Group and India were keynote speakers at this event and both decisively re-iterated that *"Contraction and Convergence"* was the basis of their international political strategy. GLOBE did not succeed in getting the G-8 to adopt it in their statement.

The UK Government

Since that time repeated advocacy of the scheme has been pressed on Tony Blair and his cabinet by growing list of parliamentarians here and in Europe. Tony Blair has put on record that they regard it as an important contribution to the debate about climate change. Several debates about the issues in general and the proposals in particular have occurred during this year on the floor of the UK House of Commons.

The Bonn UN climate negotiations in June

Also in June, while still leading the EU at the UN climate negotiations, the UK delegation almost specified, *"Contraction and Convergence"* as their negotiating strategy with the US on the one side and the G-77 and China on the other.

> *"Agreeing simultaneously on long-term global stabilisation objectives, on principles for securing convergence of emission levels, and on emissions targets for an enlarged number of Parties, may be the necessary ingredients of the next step in the development of the Convention process."*

GLOBE International General Assembly (GIGA)

In August the GIGA adopted a statement with the following wording in.

> *"Support the adoption of a mandate at Buenos Aires to redefine the way in which greenhouse emission cuts are currently shared between countries, following the principle of equity enshrined in the Contraction and Convergence analysis, and urge the summit of the Non-Aligned Movement countries meeting in Durban, RSA, to persist in demanding an equitable approach as a precondition for their participation in COP4 at Buenos Aires."*

Non-Aligned Movement (NAM)

In August and September the NAM held a heads of Government conference in South Africa. Combining the logic of *"Contraction and Convergence"* with the trade Article 17 of the Kyoto Protocol (KP), the NAM agreed the following statement: -

> *"Emission trading for implementation of (ghg reduction/limitation) commitments can only commence after issues relating to the principles, modalities, etc of such trading, including the initial allocations of emissions entitlements on an equitable basis to all countries has been agreed upon by the Parties to the Framework Convention on Climate Change."*

The GLOBE Southern Africa Network (9 of the 16 SADC countries)

> *Members of Parliament and Members of the GLOBE Southern Africa Network . . . Support the adoption of a mandate at Buenos Aires to redefine the way in which greenhouse emission cuts are shared between countries under the Kyoto Protocol, following instead the principle of global equity enshrined in the Contraction and Convergence analysis,*

1. *Specifically work to ensure that all future development of the UNFCCC and its related instruments will be consistent with these interdependent principles of global equity and sustainability;*
2. *And rebut any recourse to "flexibility mechanisms" that are not derived from the interdependent application of these principles of sustainability and global equity;*

Environmental Justice Network Forum (EJNF) South Africa

During many visits in different parts of the country to persuade grass-roots groups, trade unionists, environmental groups and bureaucrats to adopt *"Contraction and Convergence"* EJNF made the following declaration: -

> *EJNF commits itself to campaign in support of the "Contraction and Convergence" proposals that specifically embody the principles of global equity and sustainability.*
> *This means that EJNF will advocate that the apportionment of future international greenhouse gas (ghg) emissions entitlements shall be the result of a deliberate convergence process to a point of equal per capita shares globally by a date to be negotiated by the United Nations Framework Convention on Climate Change (UNFCCC)."*

Earth Action

During the latter part of the year the Earth Action grouping had a mass mail-out globally with thousands of copies the *"Contraction and Convergence"* graphic and documentation going to policy makers, parliamentarians and activist groups.

European Parliament

A few days after the NAM and GLOBE Southern Africa statements were adopted, the European Parliament adopted a resolution on climate change that clearly embedded the global constitutional principles for the long-term management of global climate change using *"Contraction and Convergence"*. The resolution, led by the Environment Committee, was intensely debated and finally adopted with a 90 percent majority in favour.

> *". . . . . calls on the Commission and the Member States to take the lead in brokering an agreement on a set of common principles and a negotiating framework beyond Buenos Aires;*
>
> *. . . . . re-iterates and re-emphasises once again its view that a set of common*
> *principles will have to be based on, inter alia:*
>
> 1. *agreement to have a worldwide binding limit on global emissions consistent with a maximum atmospheric concentration of 550 ppmv CO2 equivalent,*
> 2. *initial distribution of emissions rights according to the Kyoto targets,*
> 3. *progressive convergence towards an equitable distribution of emissions rights on a per capita basis by an agreed date in the next century,*
> 4. *across-the-board reductions in emissions rights thereafter in order to achieve the reduction recommended by the Intergovernmental Panel on Climate Change (IPCC),*

5. *an agreement to have a quantitative ceiling on the use of flexibility mechanisms that will ensure that the majority of emission reductions are met domestically in accordance with the spirit of articles 6, 12 and 17 of the Kyoto protocol; in this context trading must be subject to proper monitoring, reporting and enforcement;*
6. *an adequately financed mechanism for promoting technology transfer from Annex 1 to non-Annex 1 countries;"*

Fourth Conference of the Parties (COP4) Buenos Aires

At the end of the two weeks of negotiations at COP4, the European Union and European Commission issued a press release that included the following: -

"The Conference adopted a Buenos Aires Plan of Action, including deadlines on a number of important issues, such as: -

1. *financial mechanisms*
2. *further work on policies and measures*
3. *development and transfer of technologies*
4. *rules for governing the Kyoto mechanisms*

and a solid promise to discuss a number of particular concerns to the EU - such as supplementarity, ceilings, long term convergence and equity."

Geo-Polity - References for formal "Contraction and Convergence"

Since formal *"Contraction and Convergence"* has been entirely omitted from the TAR so far, here are SOME references for some peer-reviewed published literature from: -

1. ZEW (ISBN 3-7908-1146-7 Physica Verlag, Heidelberg, New York),
2. GCI (http://www.gci.org.uk),
3. CSE (http://www.cseindia.org),
4. The Africa Group (AGBM7),
5. GLOBE General Assembly statements 97,98,99 (http://www.globeint.org),
6. European Parliament (http://www2.europarl.eu.int/omk/omnsapir.so/pv2?PRG=CALEND&APP=PV2&LANGUE=EN&TPV=DEF&FILE=980917)
7. RIIA/Chatham House (The Kyoto Protocol - Earthscan 1999)
8. Christian Aid: "Who Owes Who?" [http://www.christian-aid.org.uk/f_reports.htm]

The line taken in these references is that this the formal approach of Geo-Polity, alone makes the JAZZ dimension relevant and some of the growth expectations in the FROG model realistic. Thus formal *"Contraction and Convergence"* represents an enabling framework of geo-polity for JAZZ.

That the above are closely consistent with the: -

1. statement of the Government of France to AGBM2.
2. position of the Government of Japan at AGBM5. [http://www.unfccc.de/resource/docs/1996/agbm/10.pdf]
3. statement of the Governments of France and Spain at AGBM6 for the EU [http://www.unfccc.de/resource/docs/1997/agbm/02.pdf]
4. position of the Africa Group of Nations at AGBM7. [See p 26 this doc. http://www.unfccc.de/resource/docs/1997/agbm/05.htm - para 26]
5. sum of US global climate policy statements over the last ten years. [See page 15 this document - "The US and Contraction & Convergence"].
6. position of the countries of the Non-Aligned Movement (NAM Summit August/September Durban South Africa1998).
7. statement in the UK Parliament by the Right Honorable Michael Meacher MP UK Minister of the Environment [see page 25 this briefing document]
8. position taken in Danish Ministry's Energy Futures and in Energy 21 from 1995 and 1996, and the recent statement by Sven Auken the Danish Minister of the Environment. [see page 25 this briefing document].
9. all the resolutions taken by GLOBE International (The international Parliamentarians network) calling for an international policy framework for global climate security since 1996 [see http://www.globeint.org] and also [http://www.globeusa.org/globeusa/pamphlet.html]
10. Indian Government submission to SBSTA/SBI (22/10/99) [http://www.unfccc.de/resource/docs/1999/sb/misc10.pdf]
11. resolution of the European Parliament: - [http://www2.europarl.eu.int/omk/omnsapir.so/pv2?PRG=CALEND&APP=PV2&LANGUE=EN&TPV=DEF&FILE=980917]
12. resolution of the Environmental Justice Network Forum [EJNF] South Africa (1998). [see page 26 this briefing document].
13. statement of the Atmospheric Equity Group of South East Asia [http://ws101.cisti.nrc.ca/ceesp/pub/towards.htm]
14. multi-signatory statement of the Global Commons Network (from Dec '99) [http://www.gci.org.uk/indlet.html]

Sir John Houghton in The ECONOMIST - THE WORLD IN 2000

As things hot up

Global warming will preoccupy the next generation, predicts Sir John Houghton, of the Intergovernmental Panel on Climate Change.

One hundred years ago Claude Monet painted scenes of London through its smoggy atmosphere. That was local pollution. What is relatively new and more worrying is global pollution—that is pollution emitted by people locally that has global effects. The first example to emerge was damage to the earth's ozone layer. International action was promptly taken through the Montreal Protocol to phase out the use of the chemicals responsible. Although full recovery of the ozone layer will now happen, it will take at least a century.

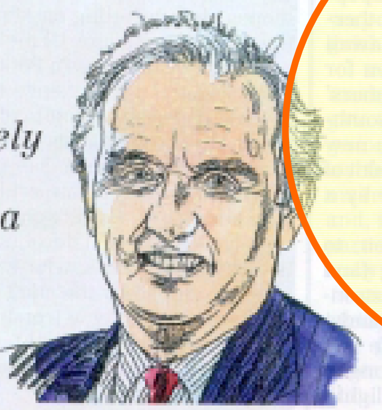
Another example is pollution that leads to global warming and climate change. Carbon dioxide and other "greenhouse" gases such as methane are released into the atmosphere through the burning of fossil fuels (coal, oil and gas) and also through deforestation. These gases absorb "heat" radiation emitted by the earth's surface that would otherwise be lost to space, so maintaining the surface and the lower atmosphere at a warmer level than normal.

The amount of carbon dioxide in the atmosphere has already increased by over 30% since 1750 and, if no action is taken to stem the increase, it will reach double its pre-industrial value during the second half of the 21st century. As a result, the average rate of warming of the climate is expected to be greater than at any time during the past 10,000 years. This is not of itself necessarily bad; some communities will experience a net benefit. But many ecosystems as well as humans will find it difficult, if not impossible, to adapt.

Although there is a lot of uncertainty concerning the detail, the basic science underlying global warming and climate change is well understood. It is not in question. Hundreds of scientists from over 50 countries have contributed as authors or reviewers to the assessments of the Intergovernmental Panel on Climate Change (IPCC). Because of the uncertainties it is easy either to exaggerate the possible impacts to calamitous proportions or to suggest that too little is known to justify any action. What the IPCC has done is explain clearly what is known together with the major uncertainties. Then, taking account of all relevant scientific data, best estimates have been provided of climate change and its impact over the next century. Here are a few of the IPCC's main findings and an outline of the agenda for the years ahead.

First, largely because of the thermal expansion of ocean water and the accelerated melting of glaciers, sea levels are likely to rise by approximately half a metre by 2100. Therefore, sea defences in many coastal regions will need to be improved, albeit at considerable cost. However, adaptation is just not possible for countries with large river deltas such as Bangladesh, Southern China and Egypt, and for many island states in the Pacific.

"The sea level is likely to rise by about half a metre by 2100."



A second major result of global warming will be, on average, a more intense hydrological cycle leading to impacts on water distribution and availability. In many areas heavy rainfall will tend to become heavier while some semi-arid areas will receive less rainfall. There will be more frequent and more intense floods or droughts, especially in sub-tropical areas. Since, in many places, water is rapidly becoming a critical resource and since floods and droughts are the natural disasters that already cause most deaths, misery and economic damage, these could represent the most damaging impacts of global warming. When combined with the rise in sea levels, a recent study has estimated that this could lead to 150m environmental refugees by 2050.

Three widely accepted principles will govern the international agreements needed to meet this threat. The first is the "Precautionary Principle", already clearly imbedded in the UN Framework Convention on Climate Change agreed at the Earth Summit in Rio in 1992. This states that the existence of uncertainty should not preclude the taking of appropriate action. The reason for such action is simply stated as the stabilisation of the concentrations of greenhouse gases (such as carbon dioxide) in the atmosphere in ways that allow also for necessary economic development. The second principle is the "Polluter Pays Principle", which implies the imposition of measures such as carbon taxes or carbon trading arrangements. The third is the "Principle of Equity (both Intergenerational and International)" which is the most difficult to apply. However, a proposal of the Global Commons Institute that is being widely discussed applies the second and third principles by allowing eventually for the allocation of carbon emissions to nations on an equal per capita basis while also allowing for emissions trading.

The action agreed at Kyoto in 1997 is a first step. Necessary post-Kyoto action, however, will be more demanding. The rate of increase of global emissions must first be substantially slowed; then there must be reductions in these emissions to well below 1990 levels before the end of the next century. Many of the required technologies to bring about these reductions are already available, but they require adequate resources for investment and development. Studies show that the necessary action may cost around 1% of the total world product, much less than the likely cost of damage and adaptation if there is no action.

If human communities are to be fulfilled and creative, they not only need goals related to their economic performance but also moral and spiritual goals. Care for the overall health of the planet is such a goal. It demands action by scientists to provide better information about likely climate change, by governments to set the necessary frameworks for change, by business and industry to seize the opportunities for innovation and the introduction of new technologies, and by all world citizens to support the action being taken and contribute to it.

NewScientist

EDITORIAL

10 March 2001

Give us a plan

We know we can beat climate change. Just one thing is missing

SHI PENGFEI is bemused. His country, China, leads the world in installing wind turbines—a technology UN scientists said this week is vital for fighting global warming. More than 100,000 farmers run their own wind generators in Inner Mongolia. And Shi, who works for China's State Power Corporation, wants to harness Mongolia's winds to power Beijing. There is World Bank cash, Inner Mongolia wants to sell, but Beijing, a city choking on coal fumes, won't buy.

Why has the wind gone out of the industry's sails? Local political wrangling has stopped China meeting its national targets for installing turbines. Shi's problem is mirrored in the latest report this week from the Intergovernmental Panel on Climate Change (see p 12).

The report looks at fixes for global warming and says that "known technological options" could help the world to prosper while preventing greenhouse gas concentrations rising higher than twice pre-industrial levels. The IPCC argues that progress in fuel cells and wind turbines has been far faster than anyone imagined. Great news, except that the panel also argues that politicians don't yet know how to implement the technologies.

Those Chinese wind turbines typify the problem. China is not the main generator of greenhouse gases. But any plan for saving the world's climate must let countries like China—which has the world's largest coal reserves—get rich on other energy sources. How do we make it happen?

Here is one blueprint. First world governments agree on a ceiling for greenhouse gas levels in the atmosphere—say, twice pre-industrial emissions. Then emissions entitlements are calculated for every country to ensure we keep below the ceiling. Setting these targets will depend on governments "converging" on a formula based on national populations. To minimise disruption, overpolluters could buy spare permits from "underpolluters".

Such a system, called "contraction and convergence", would be fair and economically efficient, and create incentives for clean energy technologies. Its backers include France's Jacques Chirac and Britain's Royal Commission on Environmental Pollution. But not the IPCC's policy wonks. Their summary for policy makers ignores this eminently sensible blueprint. The authors, fighting shy of saying anything "political", do not even clearly back a ceiling on greenhouse gas concentrations.

This is madness. Clearly, the IPCC can't endorse one blueprint. But it should lay out the options. And contraction and convergence is only one. This report is the third in recent weeks from the IPCC's various working groups. The first two, on the science and impacts of climate change, courageously explain the risks the world runs. This third one fails to take up the challenge.

All is not lost. In September, the three IPCC groups will complete a "synthesis" report on their work. They must take this chance to put things right, and spell out clearly how the world should head off climate catastrophe. Once politicians can see the method and the benefits, Shi can get back to work.

Bad move, Mr Bush

7 April 2001

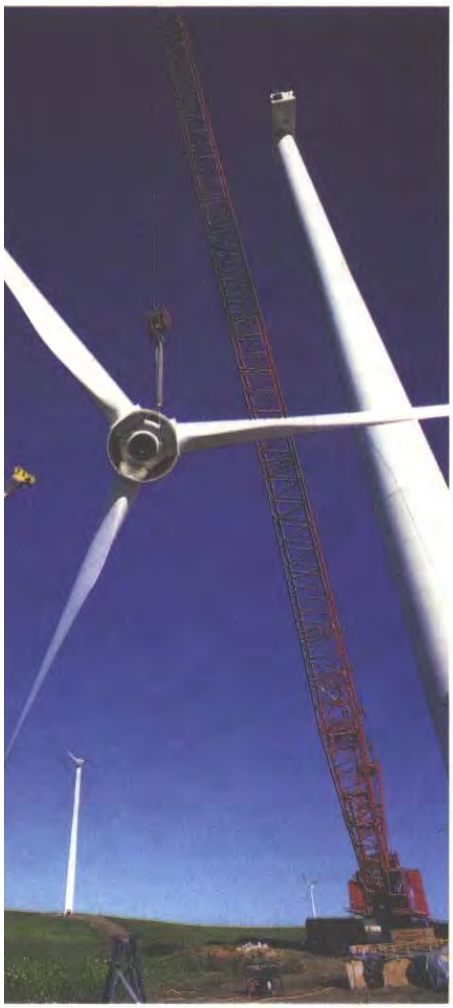
The alternatives to Kyoto may be even harder to swallow

GEORGE BUSH is right about one thing: the Kyoto Protocol is a flawed treaty. But for Europeans looking on in horror as he tries to destroy it, one thing really sticks in the craw. Most of the flaws were put there by US negotiators trying to make the treaty palatable to business. Now, having made this rumpled bed with its mass of complicated "flexibility mechanisms", they refuse to lie in it.

Bush insists that he is not against action on global warming—only the Kyoto formula. So, putting disbelief and frustration to one side, maybe we can help him. We wrote here a month ago about a plan called "contraction and convergence". It works like this. Initially, the world sets a ceiling on the maximum acceptable concentration of a greenhouse gas. Then it sets out a realistic timetable for keeping global emissions below that ceiling. Finally, it apportions to nations the rights to make those emissions according to their populations. Over 50 years, we could cut the global entitlement to perhaps half a tonne of carbon per person per year—about half what it is today. If nations want to emit more than this, they would have to buy permits from countries with emissions to spare.

Most greens have traditionally rejected this formula as too idealistic. They preferred the Kyoto process, in which industrialised countries picked a figure and then haggled. But things are different now. And, oddly enough, contraction and convergence meets the main criticisms that Bush and fellow critics make about Kyoto. First, it includes developing countries, which get emissions entitlements like everyone else. Second, it meets most criteria of economic efficiency. Countries shopping around for emission permits will make every dollar count. Third, unlike Kyoto, it is scientifically coherent, as it is aimed at stabilising greenhouse gas concentrations in the air.

Every American is responsible for about 5 tonnes of carbon emissions a year, so this formula will still cost the US dear. But if Bush is serious about global warming, he should be thinking along these lines.



Corbis

Shattering the greenhouse

We have the technology to halt global climate change, so let's use it

POLITICIANS may have lost the plot on how to halt climate change. But technologists are forging ahead with a host of innovations that could halt the rise in greenhouse gas levels, says a UN panel of climate change experts in a report published this week.

The Intergovernmental Panel on Climate Change says that technical innovation has been faster than anticipated five years ago, when it made its last assessment. Wind turbines, hydrogen fuel cells, efficient car engines and the technology to bury carbon dioxide underground could become practical ways to cut greenhouse gas emissions.

But critics believe that the IPCC has failed to give governments firm advice on how to make the new technologies work. They fear that the report, called *Climate Change 2001: Mitigation* will contribute to the political inaction that has followed last November's failed Kyoto Protocol talks on curbing climate change.

This is the third major report from the IPCC in the past few weeks. Meeting in Accra, Ghana, the panel of experts from over 100 countries assessed technical and policy options for halting the droughts, floods and extreme weather predicted by the two previous reports.

In an upbeat assessment, they said that "known technological options" could, if widely adopted, stabilise CO_2 concentrations in the atmosphere in the range of 450 to 550 parts per million. This is between 60 and 100 per cent higher than pre-industrial levels. In the past, IPCC members have often suggested 750 ppm as a more achievable target.

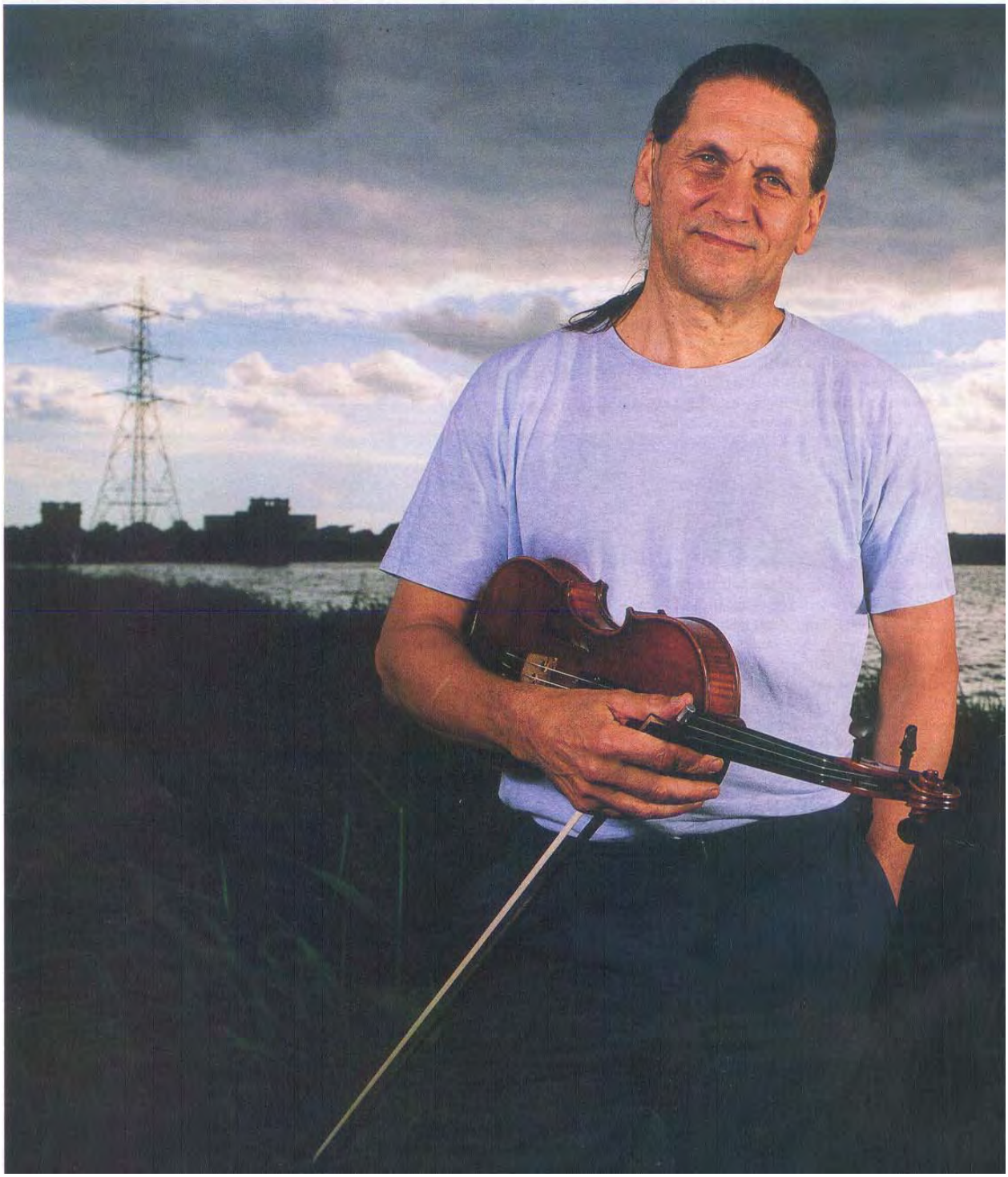
"The potential for technology innovation leading to clean energy and other climate-change solutions is extraordinary," said Klaus Toepfer, director of the UN Environment Programme, a sponsor of the IPCC. "Governments need to unleash this potential."

However, critics of the report, including senior scientists within the IPCC, say that its authors have been "vague and evasive" in their recommendations. They believe that the world should adopt a firm "ceiling" for CO_2 levels in the air—say, 450 or 550 ppm. This would allow governments to cut their emissions to stay below the ceiling.

"It is increasingly obvious that a stable atmospheric concentration target must be set. This needs to be conveyed urgently to policy makers," they said last week in a letter to Bert Metz, who co-chaired the report's working group. The letter's chief author, Aubrey Meyer of the London-based Global Commons Institute, said the report noted that the cost of meeting a target of 450 or 550 ppm would be substantially greater than for a 750 ppm target. But it failed to assess the likely benefits of a tougher target, such as fewer floods and droughts.

Meyer also attacked the report for suggesting that more scientific information was needed about "climate change processes and impacts" before governments set long-term targets. This cautious language contrasts with the much tougher tone of the panel's two other previous reports, which both stress growing certainty about the causes, pace and impacts of climate change. **Fred Pearce**

More at: http://www.ipcc.ch/



With the Kyoto Protocol on the verge of collapse, the search is on for a formula to get us off the hook of global warming. One of the main contenders is a proposal by a professional violinist with no scientific training. **Aubrey Meyer** has entranced scientists and enraged economists and many environmentalists with his idea, but it is winning high-profile backers, such as China and the European Parliament. He says it embraces science, logic, fairness, even art. Could it yet save the world? **Fred Pearce** gets to the bottom of it

Calling the tune

How did a musician get into the high politics of global warming?
I had been a practising musician and composer for 20 years. In 1988, I wanted to write a musical about Chico Mendes, the assassinated Brazilian rainforest campaigner. I began to explore rainforest politics and was overwhelmed by a sense of tragedy. I could not understand why anyone would want to murder a butterfly collector. Soon afterwards I joined the Green Party, where four of us formed the Global Commons Institute in London to fight to protect the planet's shared resources—the forests, the atmosphere and so on. We scraped together money from supporters, and I've never stopped since.

Did you have any background in science?
I didn't have any background in maths or science. My only real contact with numeracy until GCI got going was the kind of kinetic numeracy of music, its structure, and the discipline which goes with that.

You developed the formula called contraction and convergence. What is that?
At the early conferences on fighting climate change I saw this hideous charade being played out in which the politics was divorced from the science. The UN's Intergovernmental Panel on Climate Change said we needed a 60 per cent cut in emissions of greenhouse gases to halt global warming. But the politicians had no plan even to stabilise emissions, let alone cut them. So I did some simple calculations. To do what the IPCC wanted meant reducing global emissions to an average 0.4 tonnes of carbon per person per year. That was the contraction part. It seemed to me that the only politically possible way of achieving that was to work towards national entitlements based on size of population. Today, some nations are emitting 20 times more per head than others. The US, for example, emits 5.2 tonnes per head, Britain 2.6 tonnes, India 0.2 tonnes. This means that India could double its emissions while the US would have to come down by more than 90 per cent. That is the convergence part. Clearly no country is going to be able to make those changes immediately, but the beauty of the system is that it allows them to trade in emissions permits.

Other people, like Anil Agarwal, the Indian environmentalist, had similar ideas at that time. Why did yours stick?
Yes, Anil had got very angry when some leading American environmentalists tried to suggest that India, which has one of the world's lowest per capita emissions, was one of the leading causes of global warming because of its large population. But the case against such crazy views wasn't getting anywhere—we needed a new language. I had become fascinated with the graphics capabilities of computers as I saw them as the visual equivalent of musical communication, a universal language. So at GCI we produced large colour graphics showing how countries could converge towards equal per capita emissions while bringing overall emissions down by 60 per cent. You could argue about the rate of the contraction and convergence, of course—whether it should take 20 or 50 years—but basically we had synthesised the whole problem and the whole solution onto a single graphic (www.gci.org.uk). For musicians, mathematicians, scientists, it was, frankly, beautiful. I took 300 of these graphs to a climate meeting and put them outside the conference door. They went in 30 seconds. I think contraction and convergence cuts to the chase. It flushes all the politicians out of their hidey-holes.

Why did it take a musician rather than scientists to come up with it?
Many scientists have taken to it, but perhaps it needed a musician to produce it. Maybe the idea is not intellectual in the usual scientific sense. It has rules but it is also active, and it embraces creativity. It has harmony, rhythm and form. And it embeds an ethic—of equity and survival. We musicians spend a lot of time on repetition and variation. I kept taking variants of these graphics to UN climate meetings.

But it sounds rather idealistic. It may be a fair carve-up of the atmosphere, but the world doesn't really work fairly, does it?
Initially, fairness was just what we were pushing for. I remember quizzing a woman economist at the World Bank on her cost-benefit analysis of cutting greenhouse gas emissions. I pointed out that small island states like the Maldives would almost certainly disappear under her plan. She said: "What's all the fuss about small island states? They will just be compensated; and we can send lifeboats." She had no sense of the depth of disregard for real people contained in that. But the truth is that the rich are as vulnerable as the poor to climate change. So while the fairness of contraction and convergence is a powerful argument, I personally don't think it is the key. The stronger argument is the purely logical one. It doesn't solve all our problems at a stroke, but it creates the framework in which we can solve them. If people disagree, then the challenge for them is to think of something better.

Presumably, the big environmental groups embraced the idea.
Far from it. Many have refused to talk to us or even acknowledge our existence.

How come?
I think they took a judgement at the start of the climate debate that the enormity of what we faced was so devastating that you couldn't spring it on ordinary people all at once. And they didn't want to frighten the

politicians with grand strategies. They thought contraction and convergence would do that. Instead, they called for sharp cuts in the emissions of developed countries only. It may have been politically correct, but the approach was random and timid.

Greenpeace, timid?
Yes. They were part of this timid approach. They avoided facing the global dimension of the problem. It was tokenism.

But broadly that was the route taken by the Kyoto Protocol. So the timid approach worked, didn't it?
Well, I'd say that the timid approach is why we are in the mess we are in today. The US has ripped it up.

You have annoyed the economists, too.
They annoyed me. The analysis produced by the mainstream economists suggested that this problem was insoluble; that it was too expensive to save the planet. This is because their work conceals daft and immoral assumptions not only about the expendability of natural resources but also of human beings. Climate change is not an economic problem. It is an organisational problem to do with protecting the real atmosphere, the only one we have. It is not good enough for them to just nod at the scientists and say: "Thank you, now we'll tell you how the world works."

What response do you get from scientists?
They really do make an effort to remain calm and neutral in their judgement. Many see that contraction and convergence tries to mirror that objectivity by attempting to respond directly to what scientists say is the situation. But many identify with us in a moral as well as a logical sense. They are also human beings. They have children and think about the future.

Politically, your ideas have not got far yet. By criticising the Kyoto Protocol, have you played into the hands of its opponents, like President George W. Bush?
Bush acknowledges the problem is real and serious and like everyone else he has to face this. Kyoto is probably better than the chaos that is now on the cards, but the odds for getting this deal are dwindling. Anyway, as I see it, the protocol is Plan A. At best, it will moderate increases in emissions a bit—until 2012. So, regardless of what happens to it, there has to be a Plan B. The real question is whether contraction and convergence follows on from the protocol or picks up the pieces when it falls apart.

Who backs it today?
The European Parliament, China, the non-aligned movement, many African nations, the Red Cross, Britain's Royal Commission on Environmental Pollution and Jacques Chirac have all said they support the idea in principle. Many economists say they have no real quarrel with it, provided it allows countries to trade their emissions entitlements. If the revenues from trade are spent on renewable energy, it will bring the efficiency gains that the economists are so keen on. And it will allow the poorest countries with the low emissions to sell their spare entitlements for profit.

What about the US government?
Some senators already support it. It is the only practical proposal that does what they've asked for, namely simultaneous emissions controls on all countries. It promotes economic efficiency through emissions trading and enables progressive American firms to get involved and make money. That's certainly what I would tell George W. Bush.

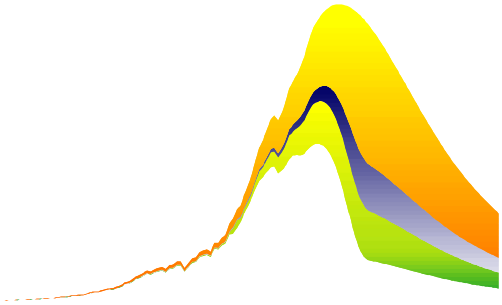
That makes you sound like an arch-capitalist, rather than the communist you have sometimes been labelled. How come the Chinese like it?
False dichotomy. The Chinese came on board, at least tentatively, when they realised I was talking about distributing emissions rights. They liked the idea of equal rights rather than equal restrictions. But this is high politics. The US Energy Department got very interested when I said I was going to Beijing. They said: "You'd better watch your back because you're gonna be watched." I got quite nervous. I'm not a diplomat, I'm just a musician. But the idea is not leftist, or even rightist. The morality you can take or leave, but the logic is inescapable.

But don't developing countries have the right to tell the rich countries that they created the problem and should solve it?
So far, most developing countries have indeed united around that message. That may be morally valid, but it is a disastrous strategy for them as well as for the rich world. The carrot for them in adopting contraction and convergence, apart from saving the climate, is that in return for controlling emissions they could get paid to convert their economies to run without fossil fuels.

So your formula meets the needs of both the US and the developing world?
Yes. It's a framework for the retreat from our dependency on fossil fuels. The way I see it, the world starts a race to get out of carbon rather than a race to get into it.

Contraction & Convergence by Aubrey Meyer is published by Green Books

GCI - *"equity and survival . . . . . "*



15/12/02

Bert Metz
Co-Chair IPCC WG3
RIVM - PO Box 1, 3720 BA Bilthoven
The Netherlands

Dear Bert

Summary for Policy Makers (SPM) IPCC WG3 Third Assessment

Well done on coming near to the completion of the drafting process of climate mitigation policy. I can confirm how difficult this has been for all involved. I am sure you must be relieved to be nearing the end of this ambitious but arduous undertaking.

The upwardly revised projections of temperature increases from Working Group One and the recently sharpened warnings of increasing damages coming from Working Group Two, confirm the trends of climate change as *"devastating"* and do indicate that, *"we are in a critical situation and must act soon."* http://www.gci.org.uk/Refs/C&CUNEPIIIb.pdf [WEF 2000 CEOs & Ewins/Baker 1999].

It is now therefore the grave responsibility of Working Group Three, the Policy Working Group, to provide from the available literature, all substantive guidance to policy makers that holds the potential to be globally effective against the yet further and potentially uncontrollable acceleration of human-triggered global climate change.

In the light of this, it is therefore encouraging to find that *"Contraction and Convergence"* is presented in the Third Assessment as, *"taking the rights based approach to its logical conclusion."* Since quite obviously all approaches to global climate policy are inherently 'rights-based', this means that C&C effectively represents the logical conclusion of them all. It is afterall - and as we have argued throughout the decade gone by - the meta-logical precautionary framework for action under the UN Treaty if the climate problem is to be solved.

And it is within this that the otherwise uncertain and unguided sequence of decision-taking on mitigation policies and measures needs to occur. Efficiency and prosperity will be the result of setting a global ghg concentration target [and hence contraction budget] based on precaution with subdivision based on the equity and logic of a global timetable of convergence within this. The reverse proposition is simply more randomness and drift, dangerous and quite obviously absurd.

There is now long-term frustration that there appears still to be resistance to this point amongst some authors, as it is increasingly obvious to most people that a stable atmospheric concentration target must be set - indeed the report affirms this - and that this is not going to be set or met by accident.

This logical point is fundamental. It is clearly in the literature you cite and it - if briefly - is reflected in its citation in the report. This needs now to be conveyed - urgently - to policy makers in the report's summaries.

And on behalf of all the advocates of C&C cited in the Reference document I am asking you to take the steps necessary to bring this out. Failing this, a residual character of randomness and drift in the summary will continue to dissipate the process that the IPCC exists to inform. None of us would want the IPCC reports or their summaries to be ridiculed for being vague or evasive on this point in this increasingly critical climate. Such an outcome is irresponsible, unnecessary and dangerous.

For your further information on the extent of support that is consistently growing for the 'logical conclusion', I include here (in the post) a further compilation of published technical, institutional - now commercial (the insurance sector) as well as political - support and advocacy for the C&C proposition. I am sure you will agree, this support is compelling for being so considerable.

With warm regards
Yours sincerely

Aubrey Meyer
Director
GCI

Global Commons Institute (GCI), c/o 32 Carisbrooke Road, London E17 7EF
mobile phone 0771 282 6406 e-mail aubreygci@aol.com - website http://www.gci.org.uk
Global Commons Network (GCN) - website http://www.igc.topica.com/lists/GCN/prefs/info.html

Julian Salt
Loss Prevention Council
Buildings Research Establishment UK

Roger Higman
Friends of the Earth International
Senior Campaigner (Climate and Transport)
Friends of the Earth (E,W+NI),
26-28 Underwood Street,
London, N1 7JQ

Fanuel Tolo
Climate Network Africa.

Matthew Coyne
Policy Adviser
Department for Environment
Transport & Regions UK

James Bruges
UK

Tammo Oegema
Senior Economist at IMSA
Amsterdam, The Netherlands
GCN member

Richard Starkey
Senior Research Fellow
Centre for Corporate Environmental Management (CCEM)
University of Huddersfield, UK

Andrew Simms
Global Economy Programme
New Economics Foundation
Cinnamon House, 6-8 Cole Street
London SE1 4YH
England, UK

Marc van der Valk
Barataria

Nur Masripatin
Ministry of Forestry
Jakarta
Indonesia

Mayer Hillman
Policy Studies Institute
UK

Dr David Cromwell
Southampton Oceanography Centre, UK

Mike Read & Associates
P O Box 901
Castlemaine
Victoria 3450
Australia

Tom Athanasiou,
EcoEquity, USA

Joy Pagano
UK
Professor Daniel M. Kammen
Director, Renewable and Appropriate Energy Laboratory
Energy and Resources Group
University of California, Berkeley
USA

William C.G. Burns, Senior Associate
Pacific Institute for Studies in Development, Environment, and Security
654 13th St., Preservation Park
Oakland, CA 94612 USA

Reggie Norton
Justice and Peace Group UK

John Gordon
Former Director
Global Environment Research Council UK

Paul McConnell
Coordinator
Climate Action Network UK

Sergio C Trindade
SE2T International, Ltd.
1A Dickel Road
Scarsdale, NY 10583-2117 USA

Victoria E. Long
Graduate Student,
University of British Columbia,
Canada

Andrew McLaughlin. Ph. D.
Professor of Philosophy
Lehman College
City University of New York USA

Stuart Liederman

Geri DeStefano, PhD
Vancouver, BC

Alfred Lambremont Webre, JD, MEd
Vancouver, BC

Caspar Henderson
Senior Policy Officer
Consumers' Association, UK
Senior Correspondent
Green Futures magazine, UK

Robert Randall
The RainForest ReGeneration Institute
1727 Massachusetts Avenue NW
Washington, D.C. 20036 U.S.A.

Prof. Eduardo Viola
Department of International Relations
University of Brasilia
C.P. 04359
Brasilia, DF 70919-970
Brazil

Hans Taselaar,
Director INZET, Amsterdam, NL
Association for North-South Campaigns

J N von Glahn
Chairman Designate
Solar Hydrogen Energy Group

Rosli Omar, Phd
Save Our Sungai (SOS)
Selangor, Malaysia

Elizabeth Cullen (Dr.)
Co-chair Irish Doctor's Environmental Association

Derk Segaar
Project Manager Climate Change
INZET, Amsterdam, NL
Association for North-South Campaigns

Matthew Paterson
Keele University

Neil E. Harrison, Ph.D.
Executive Director
The Sustainable Development Institute

Helen N. Mendoza, Ph.D.
Philippine Network on Climate Change

Gordon Gissing
Retired research engineer
Hill View
Clunbury
Craven Arms SY7 0HE
Shropshire UK

Carol Brouillet
The Who's Counting? Project
California, USA

John Vandenberg
Town Planner
Tasmania

John Dougill.

András LUKÁCS
President
Clean Air Action Group
Budapest
Hungary

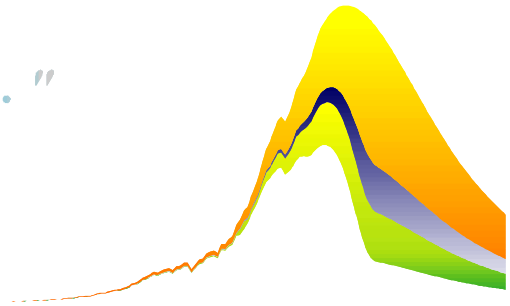
Lera Miles, PhD student
Centre for Biodiversity and Conservation
School of Geography, University of Leeds
Leeds LS2 9JT, U.K

Jeremy Faull
Ecological Foundation UK

Prof Colin Price
University of Wales
Bangor
Gwynedd

Prof PJM Phelps
Chairman of ZEAL.
South Africa

GCI - "equity and survival . . . . . "



23/05/2001 17:27

Robert T Watson
Chairman IPCC
The World Bank Environment Department
Room MC 5-119
1818 High Street NW
Washington DC 20433
USA

Dear Bob

RESOLVING FALSE DICHOTOMY IN PREFACE TO IPCC TAR SYNTHESIS

Thank you for your letter of the 30th of April. I note your advice that I address my concern to the relevant Technical Support Unit (TSU) with a copy to you. GCI's concern relates to text in the preface to the Synthesis Report. Since TSU personnel tell me that you are the author of that preface, I am addressing this letter to you with copies to them.

I affirm our appreciation of IPCC and its Third Assessment Report (TAR). TAR is an important advance in the understanding of the causes and effects of climate change. Much credit is due.

However, we remain concerned with the need to protect the credibility of IPCC as a whole and that, guided by this, the primary objective of the UNFCCC is to avoid dangerous global climate change as a whole. This means coordination. Attempting to secure this objective in a disaggregated way is self-defeating if attempts are not guided by and index-linked to the global precautionary decision already taken to establish the UNFCCC and frame - not guess - the route to its global objective.

Consequently, the wording in the opening paragraph of the preface to the Synthesis of the TAR is misleading. If, as you say, the TAR *"recognizes that there is no single global decision-maker and socio-political future, but rather that there are multiple decision-makers and multiple possible future worlds, each with their own plausible and consistent paths,"* the central challenge to decision-makers - to consciously reconcile their efforts in an effective common account - is lost.

As is, the remark seems to project a perpetual future dichotomy between the singular global atmosphere and the disaggregated plurality of global decision takers tasked from now on with its protection. I don't believe this meaning is intended; yet your statement conveys it and appears even to rebut the role and effort towards global governance already established in the UNFCCC.

Would it not be better for the TAR synthesis to reveal at the outset that this dichotomy must be resolved? It is surely false if the rising atmospheric concentration of greenhouse gas equivalent is to be stabilized at some point in future time at a pre-determined level that prevents dangerous global climate change, by global organizational intent and design, rather than by accident.

If you don't reveal this, an implication persists that the default is back to accident, and potentially even to feeding the worsening odds we are already faced with. Multiple scenarios will merge in the growing singularity of no choice and no rights in the global wrong of unstoppable climate change.

IPCC WG3 says contraction and convergence takes the rights-based approach to its logical conclusion recognizing that to trade global emissions rights, they must first be established. Analysts and policy makers are increasingly guided by this logic for fear of the accident that awaits us without it. This framework/guesswork choice faces us now. IPCC's synthesis should reveal not conceal this.

Yours sincerely

Aubrey Meyer

Global Commons Institute (GCI), 37 Ravenswood Road, London E17 9LY
Landline 0208 520 4742, mobile phone 0771 282 6406 e-mail aubrey@gci.org.uk - website http://www.gci.org.uk
Global Commons Network (GCN) - website http://www.topica.com/lists/GCN@igc.topica.com/read

GCI submission to the Intergovernmental Panel on Climate Change Working Group Three (WG3) "The Economics of Genocide"

and to the First Conference of the Parties (COP1) to the United Nations Framework Convention on Climate Change (UNFCCC)

Global Commons Institute (GCI),
42 Windsor Road, London NW2 5DS,
Ph +44 181 451 0778, Fx 830 2366, e-mail saveforests@gn.apc.org

This is the text of a letter re COP 1
from: - Kamal Nath Indian Environment Minister
and Head of Indian Delegation to COP 1 to his
COP counterparts prior to COP 1.

24 03 1995

Dear

With the first "Conference of the Parties" to the Climate Change Convention approaching, I would like to share a few thoughts with you on the critical issues which remain unresolved. We in India are very concerned that there has been no significant progress at all towards the stabilising (leave alone the reduction) of atmospheric concentrations of greenhouse gases, despite the lofty commitments made at Rio. On the contrary, decisive scientific evidence continues to disturb us with serious warnings about where the global community is now headed.

The inconclusive discussions about Joint Implementation and Adequacy of Commitments reveal increasing differences of opinion about the resolve of developed countries to meet even their existing commitments under the Convention. In my judgement, the present impasse became inevitable when the alleged cost- effectiveness of Joint Implementation was sought to be based on absurd and discriminatory Global Cost/Benefit Analysis (G-CBA) procedures propounded by economists in the work of IPCC Working Group III. The scale of bias which underpins the technical assessment intended to provide the basis for policy discussions at the CoP can be gauged from the proposed unequally valued mortality costs associated with global climate changes, and the avoidance of using the Purchasing Power Parity (PPP) system of overall damage costs. These are by no means the only issues about which we feel concerned, but they are pertinently representative examples.

We unequivocally reject the theory that the monetary value of people's lives around the world is different because the value imputed should be proportional to the disparate income levels of the potential victims concerned. Developing countries have no - indeed negative - responsibility for causing global climate change. Yet they are being blamed for possible future impacts, although historical impacts by industrialised economies are being regarded as water-under-the-bridge or "sunk costs" in the jargon of these biased economists.

To compound the problem, global damage assessments are being expressed in US dollar equivalent. Thus the monetary significance of damages to developing countries is substantially under-represented. Damage to human beings, whether in developed or developing countries, must be treated as equal, and cannot be translated in terms of the existing currency exchange rate systems.

Faced with this, we feel that this level of misdirection must be purged from the process. The distributional issue of unequal rights-by-income versus equal-rights-per-capita must be resolved to enable fruitful discussions about possible protocols to the Convention, proportionality of commitments and financial mechanisms.

This is of immediate concern to us with regard to the AOSIS proposal. We are wholly sympathetic to it and we want to support it, along with all Parties to the Convention as it is clearly aimed at the global common good. But there are attempts to modify the AOSIS proposal to an extent where it contradicts the very essence of the Rio consensus and nullifies the spirit in which developing countries entered into negotiations to frame the Climate Change Convention. We strongly reject any suggestions of encumbering developing countries with obligations under the Protocols, that they do not have under the Convention.

The implications of faulty economic assumptions are manifold. When they are corrected to reflect a true and just position, then, and only then would any talk of Joint Implementation and Adequacy of Commitments become meaningful. It is impossible for us to accept that which is not ethically justifiable, technically accurate or politically conducive to the interests of poor people as well as the global common good.

I am sure you appreciate these issues which are causing India and several other developing countries much concern. We do not want to be driven to a situation where dialogue itself becomes directionless. The Rio process gave rise to several environmental Conventions. If the logic now being propounded in relation to Climate Change, also enters the interpretation of the other Conventions, the gains which accrued to developing countries at the Earth Summit will have reversed all the gains of Rio - the chief one of which was a universal recognition of the principle of equity, and the inalienable rights of all human beings to the fruits of development and ‘environmental space’ on an equitable basis.

I have instructed the officials of the Indian delegation to the CoP to further elaborate on these issues and discuss them with the officials of your delegation. I trust that you too will instruct the officials of your delegation accordingly, and I look forward to hearing from you on this.

With best wishes and regards

Yours sincerely

KAMAL NATH

Minister for Environment and Forests Government of India

CONTENTS

1. Preliminary Points regarding CO2, Climate and Geo-Politics

a) Constant Airborne Fraction (CAF)
b) Temperature Rise
c) Breakdown of CO2 Output, OECD & Rest Of World - 1860-1990

2. Why is CO2 such an *ECONOMIC* issue?

a) 90% of the World's Formal Energy Supply comes from Fossil Fuel Burning
b) 80% of global CO2 emissions come from fossil fuel burning
c) GDP:CO2 correlation remains globally unbroken at this time.

3. IPCC 60% CO2 cut requirement (IPSO FACTO).

a) "Intergovernmental Panel's Stabilisation Output For Atmospheric Concentration Threshold Over Time" (IPSO FACTO).

4. Understanding and Responding to *"The Unequal Use of the Global Commons"*

A GCI paper commissioned by Intergovernmental Panel on Climate Change (IPCC) Working Group Three (WG3) on *"Economic and other Cross-Cutting Issues"* for their Workshop on *"Equity and Social Considerations of Climate Change"* in Nairobi July 1995.

a) Preamble - CO2 GDP relationship unbroken sub-globally - OECD and Rest of World (ROW)
b) "Equity is the Solution"
c) Applying Equity
d) Data used in this Assessment
e) Calculations made this Assessment
f) GCI's conceptual model - the basis of equitable Assessment
g) Regime 1 - IMPACT Carbon Usage Assessment
h) Regime 2 - US$ INCOME Assessment - based on Global Efficiency
i) Regime 3 - PPP$ INCOME Assessment - based on National Efficiencies
j) Tables of Country Creditor/Debitor Ratings under the three regimes
k) Conclusions - "Spotted Owls and fighting the 'Economics of Genocide'"

5. GCI revalues the Global Cost/Benefit Analysis Global (G-CBA) done by IPCC Working Group Three

6. Protest Letter against 10:1 Life Evaluation by Economists in IPCC and international signatory list

7. GCI Climate Statement concerning equal rights on emissions and UK/EU parliamentary signatory list

8. Press Cuttings

9. Information regarding Global Commons Institute (GCI)

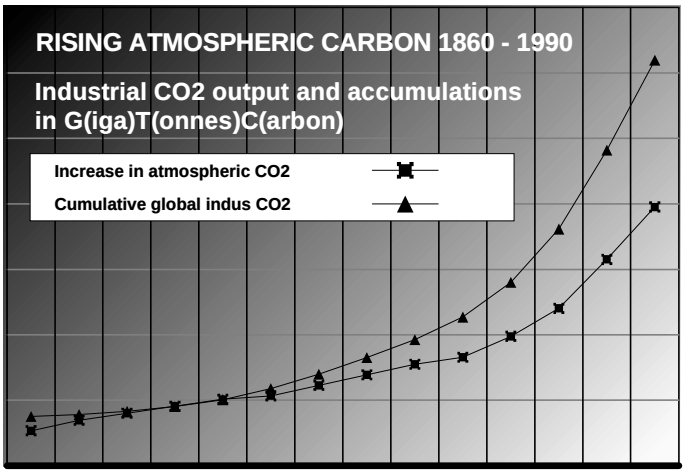
a) What is GCI?
b) What is GCI's current mission
c) Acknowledgements regarding external support for GCI's Operations

10. Some Recommendation for GCI

PRELIMINARY POINTS REGARDING CO2, CLIMATE AND GEO-POLITICS

a) - Constant Airborne Fraction (CAF)

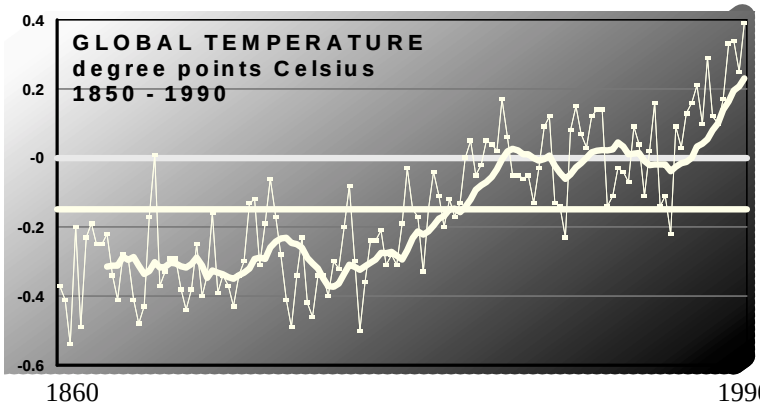
left hand axis in graphic measures gigatonnes carbon running from zero at the bottom to 280 at the top.



1860 1990

As the two curves in the above graphic demonstrate, a constant fraction of CO2 emissions to the atmosphere remained "airborne". This was at least true during the period 1860 - 1990. This is the so-called "Constant Airborne Fraction" (CAF). However, given the possibility of enhanced positive feedback in the future, the fraction may not remain constant. In the face of continued industrial emissions and declining terrestrial sink-capacity, it will probably increase.

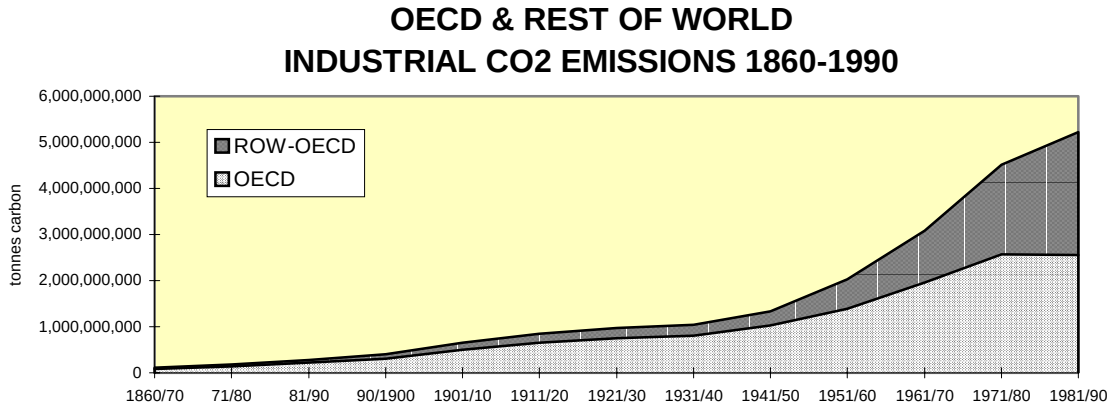
b) - Temperature Rise - 1850 - 1990



1860 1990

The above graphic uses global mean temperature data published by CDIAC to demonstrate a corresponding mean rise of 0.6 degrees Celsius for the period 1860 - 1990.

c) - Breakdown of CO2 Output, OECD & Rest Of World - 1860-1990



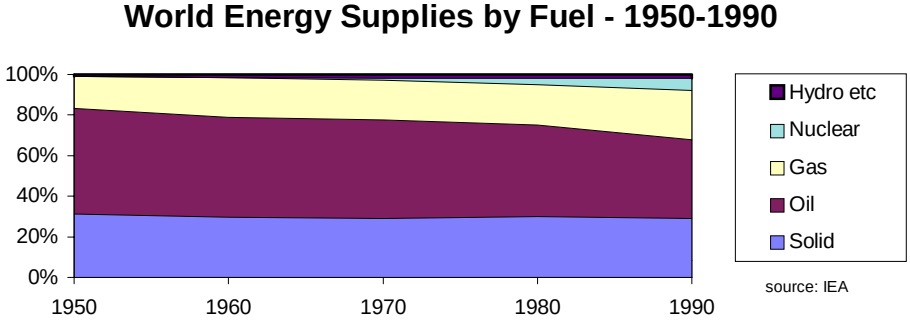
Before 1950, the OECD countries were responsible for more than 90% of Industrial CO2 emissions. During this period economic and population growth rates in these countries rose sharply, unlike the rest of the world where trends remained largely unaffected by industrialisation.

Only within the last four decade have CO2 emissions from (what is now) the other 80% of the global population - Rest Of World (ROW) - reached approximate gross output parity. But the OECD now represents just under 20% of world population with nearly 70% of gross global monetary wealth purchasing power amassed in hard-currency. It also has more than 60% of voting power within global financial institutions such as the International Monetary Fund (IMF).

WHY IS CO2 SUCH AN ECONOMIC ISSUE?

a) - 90% of the World's Formal Energy Supply comes from Fossil Fuel Burning

Economic activity in industrial culture is almost entirely supported by an energy supply generated by fossil-fuel burning. This in turn causes the release of carbon dioxide (CO2) to the atmosphere and the enhanced greenhouse effect.

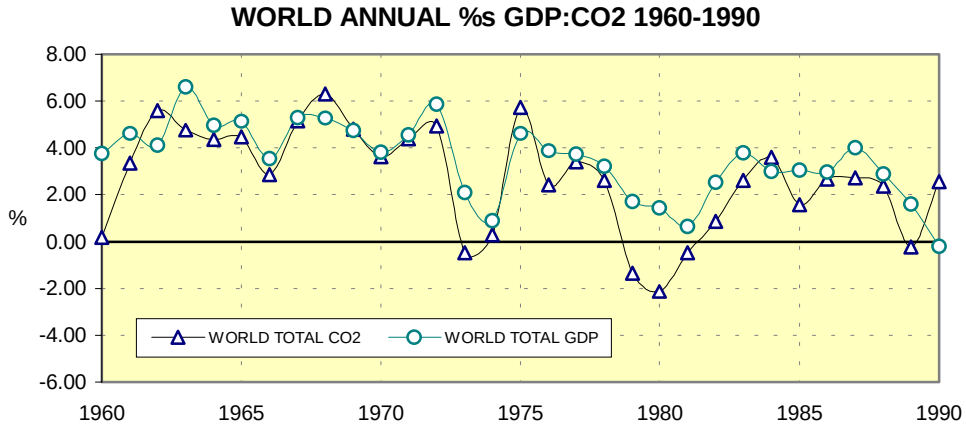


b) - 80% of global CO2 emissions come from fossil fuel burning

Non-fossil sources of CO2 emissions are either from non-human or from "renewable sources". Whilst these renewable resources (eg biomass) are not always renewably used, fossil sources are invariably non-renewable and non-renewably used. Moreover, the vast scale of fossil fuel usage and the commitment of transnational vested interests to this model, precludes any meaningful scale of biomass offset activity, especially given the emerging scale of the climate change problem.

c) - GDP:CO2 correlation remains unbroken at this time globally and sub-globally.

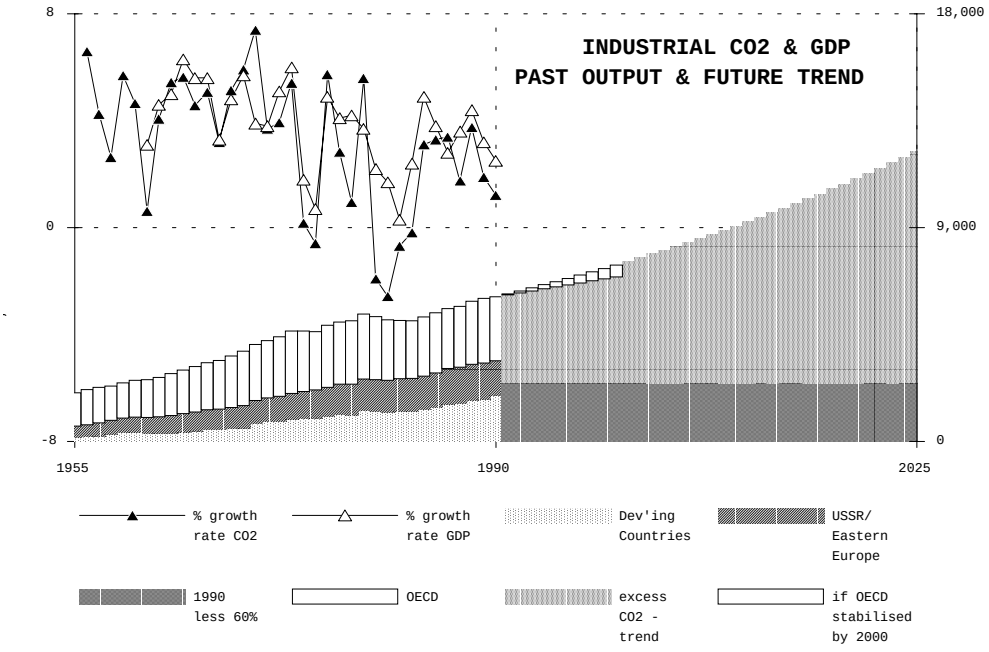
But the most intractable aspect of the climate change problem is the close relationship between industrial CO2 output and the generation of Gross Domestic Product (GDP). This relationship has been globally closely correlated throughout the post-war period, as the following charts demonstrate. (See OECD & ROW CO2:GDP correlation in section hereafter).



IPCC 60% CO2 CUT REQUIREMENT

"**I**ntergovernmental **P**anel's **S**tabilisation **O**utput
For **A**tmospheric **C**oncentration **T**hreshold **O**ver Time" (**IPSO FACTO**).

In their First Assessment Report (pub. 1990), the IPCC Working Group One (the Science Group) stated that in order for the then existing concentrations of CO2 in the atmosphere to be stabilised at that level [not reduced], the annual output of CO2 emissions from human activities would need to be immediately reduced by a minimum of 60% to 80%. We call this "**IPSO FACTO**" (**I**ntergovernmental **P**anel's **S**tabilisation **O**utput **F**or **A**tmospheric **C**oncentration **T**hreshold **O**ver Time). The IPCC did not say this *"had to be done"*. On the other hand IPCC did not say it *"didn't have to be done"* either. They simply established this bench-mark (see black segment right-hand side of graphic below). A 2% reduction of global CO2 emissions annually was initially suggested by the IPCC. It was only a proposal. There was intense pressure from vested interests in the OECD countries and their economists, not to do this. The cut was portrayed as a threat to their economic well-being. The proposal was put aside and it has not been implemented. In the context of the INC/COP and the Climate Change Convention, industrial countries now have an *"aim"* merely to stabilise their CO2 emissions (not atmospheric concentrations) at 1990 levels by year 2000. Collectively and at best this would be no more than 3% off the projected global CO2 emissions output trend (see white segments right-hand side of graphic below), but they are not meeting this aim. And this, in the Climate Change Convention, is in the context of making a commitment to *"sustained economic growth"*.
COP meets for the first time in the context of actual gross emissions, distribution and trends linked to abatement aims/commitments, GDP linkages , and compared with IPCC 60% cut requirement as presented in the graphic below.

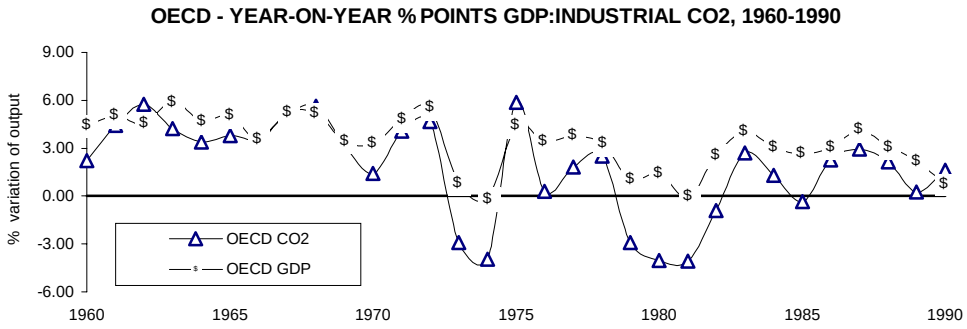


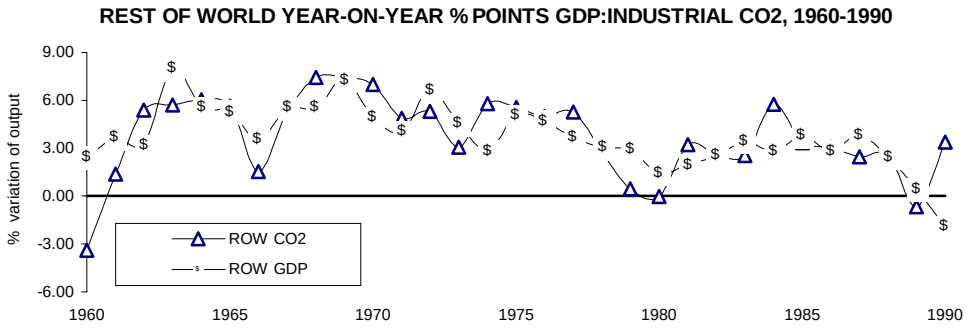
"THE UNEQUAL USE OF THE GLOBAL COMMONS"

A paper for the IPCC WG3 workshop on *"Equity and Social Considerations"*, Nairobi, 18-23 July, 1994.
Global Commons Institute (GCI), 42 Windsor Road, London NW2 5DS, UK,
Ph +44 (0)81 451 0778, Fx +44 (0)81 830 2366, e-mail: saveforests@gn.apc.org.

PREAMBLE

We take as our starting point the Intergovernmental Panel on Climate Change (IPCC) judgement in 1990 that a minimum 60% cut in global CO2 emissions was necessary to achieve an immediate stabilisation of atmospheric CO2 levels (IPSO FACTO - see above). Not to comply with this requirement as rapidly as practicable would: - (a) take unnecessary risks with the planet's life-support systems and (b) threaten huge numbers of people present and future *who have had no part in causing the problem.* We also note (c) the "Constant Airborne Fraction" (CAF, c. 60% of any year's CO2 output is retained in the atmosphere - see IPCC First Assessment Report) (d) the 83% of industrial CO2 output accumulated by the industrial countries since 1860 (see GCI "GDP:CO2=BAU:IOU") (e) the global formal economy being still at least 90% dependent on energy from fossil fuel burning (for all of these see earlier sections) and (f) the close relationship between CO2 and GDP globally and regionally (see the 2 charts below).





We next make a judgement which is both ethical and practical - and we call on other analysts working in this field to make the ethical positions and values inherent in their work as explicit as we do. In our judgement, the most valid starting point in assessing how to minimise the adverse effects of global climate change is to recognise that each human individual has an equal entitlement to such carbon usage as can safely be allowed to continue. This does not reflect the current pattern of relationships between nations, as the assessments in this paper will show. However, we believe an unprecedented degree of co-operation will be required to realise any package of policies and procedures capable of fending off a climate disaster.

Equal rights to carbon usage, and to the GDP income that derives from it, is a principle that embodies in practical terms the right to the local enjoyment of shared and interdependent global ecosystems - in the worst case the right to personal survival. We know of no other guiding principle which would command the unprecedented level of agreement now required within the international community. This agreement will be essential if a common language is to be developed which can be used to describe the problem of global climate change in terms of it's socio-economic causes as well as its environmental symptoms, and address solutions on an urgent timescale. If an approach based on this principle is not adopted, the likely scenarios for the future range from environmental blackmail and counter-blackmail, to massive and cruel economic sanctions, through to the use of naked force. None of which preclude the possibility, or even the probability, of large-scale ecological dysfunction globally.

EQUITY IS THE SOLUTION

We believe that any proposed solutions to the problems [which both cause and proceed from global climate change] which are not equitable will not work. In a very real and fundamental way, *equity is the solution* - ie, properly valuing each other and the planet. A failure to understand and apply this is a failure to appreciate the double-jeopardy in which humanity is now situated. We face the actuality of scarce resources (sink capacity etc) and the increasing potential for conflict with each other over these scarce resources. We do not imagine the solutions that emerge will be based exclusively on the principle of rights to equal carbon usage. However, the analytical tools that we are developing and making available are based on the principle of equal rights to carbon usage, and the results our that our work reveal can be used as a network of reference points. Anyone who wishes to diverge from or ignore the principle can then describe what they propose, and this can be judged against our results. It would then be for the international community, through a reformed and better advised negotiating process, to decide whether or not the degree of divergence proposed was socially and ecologically viable.

APPLYING EQUITY

The social, financial and ecological inter-relationships of equity should guide the route to global ecological recovery. Policy Instruments such as *"Tradable Emissions Quotas", "Carbon Taxes"* and *"Joint Implementation"* may well serve to make matters worse unless they are properly referenced to targets and time-tables for equitable emissions reductions overall. This means devising and implementing a programme for convergence at equitable and sustainable par values for consumption on a per capita basis globally. This means that rights to income are accompanied by responsibilities for the impacts associated with the generation of that income, which effectively rewards efficiency. It has always seemed of fundamental relevance to us that while the problems consequent on global climate changes will most probably affect everyone, the cause of global climate change has been the activities of a few. This is the political issue, central to global ecological recovery. The structural and restructuring implications of this are considerable, but the detail of this is beyond the scope of this paper. This paper *simply* presents a factual retrospective assessment of the relevant data ascertaining who - in the context of *"equal per capita rights"* - the *"debitors"* and *"creditors"* were, and the size and trends of their respective credits and debits..

DATA USED IN THIS ASSESSMENT

The data which we take as a starting point for the calculations presented here are all publicly available.
For 189 countries and for the period 1950 - 1990 we used: -

a) National Population Figures: are taken from UN statistics,
b) GDP in US Dollars (USD): at constant 1985 prices are extrapolated from the Penn World Tables 5.5 (with guidance from the PWT5 authors). Because there was a lot of conversion involved occasionally involving huge exchange rate fluctuations, for the quota calculations only, each country's USD curve was exponentially smoothed across the period. Because data was lacking for a few smaller countries for the first decade, these gaps were filled in with exponential regression. Also, because data for a few smaller countries was lacking altogether, another source of data (CHELEM - 1980 constant USD) was used rebased to 1985 constant dollars.
c) GDP in Purchasing Power Parity Dollars (PPP): at constant 1985 prices are taken from the Penn World Tables 5.5. Because data was lacking for a few smaller countries for the first decade, these gaps were also filled in with exponential regression. And, because data for a few smaller countries was also lacking altogether, another source of data (CHELEM - 1980 constant PPP) was used appropriately rebased to 1985 constant dollars.
d) Industrial CO2 emissions: in tonnes of carbon are from Carbon Dioxide Information Analysis Centre (CDIAC). These data cover emissions from oil, coal and gas combustion and also from the manufacture of cement.

CALCULATIONS MADE IN THIS ASSESSMENT

The schematic diagram overleaf represents the basis of GCI conceptual thinking for the three assessments. Then, with the above data for input, we made a series of fundamentally simple calculations, for every nation and for every year from 1950 to 1990. We emphasise that these calculations are based on freely available and uncontentious data and are simple to make. If they appear complex, it is purely because of the volume of data being handled and the use of data-management computer software to group the results in various ways and to produce a variety of graphical "debitor/creditor" representations of consumption trends. The actual countries listed as creditors and debitors are listed out separately as well. In this paper we present three assessment regimes.[1] The increasingly unequal consumption patterns between debitors and creditors are revealed as stark. In that this looks at the existing data for the past against the stated criteria for equitable and sustainable consumption, we regard this as a factual presentation of what actually happened over the last forty years. Some implications are drawn from this in the commentary on the quota regimes which follow and in the conclusions at the end of the paper.

[1] GCI's data-management and modelling software is also available on application.

GCI'S CONCEPTUAL MODEL - THE BASIS OF EQUITABLE ASSESSMENT

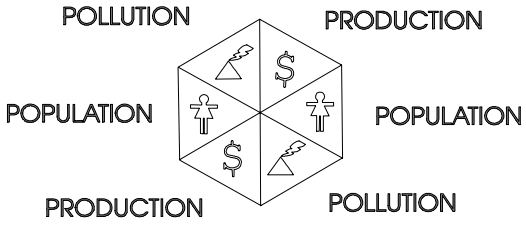
In GCI's basic model of the political economy of the global commons, there are 3 primary features: -

People

Production = Income

Pollution = Impact

These intersect with each other and the biosphere and correspond with social, financial and ecological equity, as follows: -



giving rise to three basic variable scales of relationship, as follows: -

low - per capita income - high

low - per capita impact - high

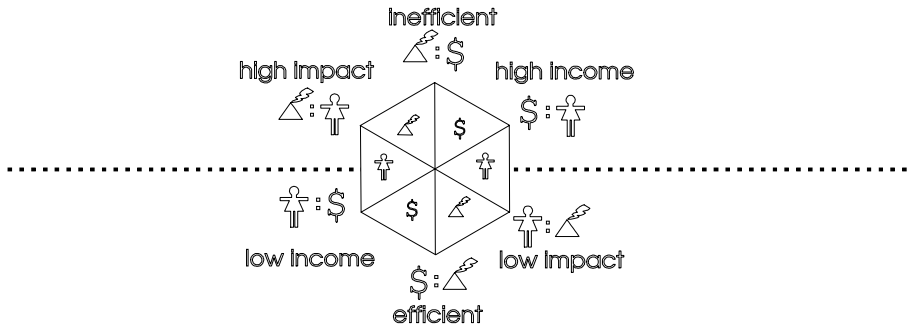
efficient - inefficient

As we demonstrate in the detailed analysis which comprises the rest of this paper, this matrix reveals a pattern of inversality between: -

- high-income/high impact/inefficient individuals *("debitors")*
- low-income/low-impact/efficient individuals *("creditors")*

over-consuming and living unsustainably

"DEBITORS"



"CREDITORS"

under-consuming but living sustainably

REGIME 1 - CARBON USAGE (IMPACT) ASSESSMENT

How its Done and Why

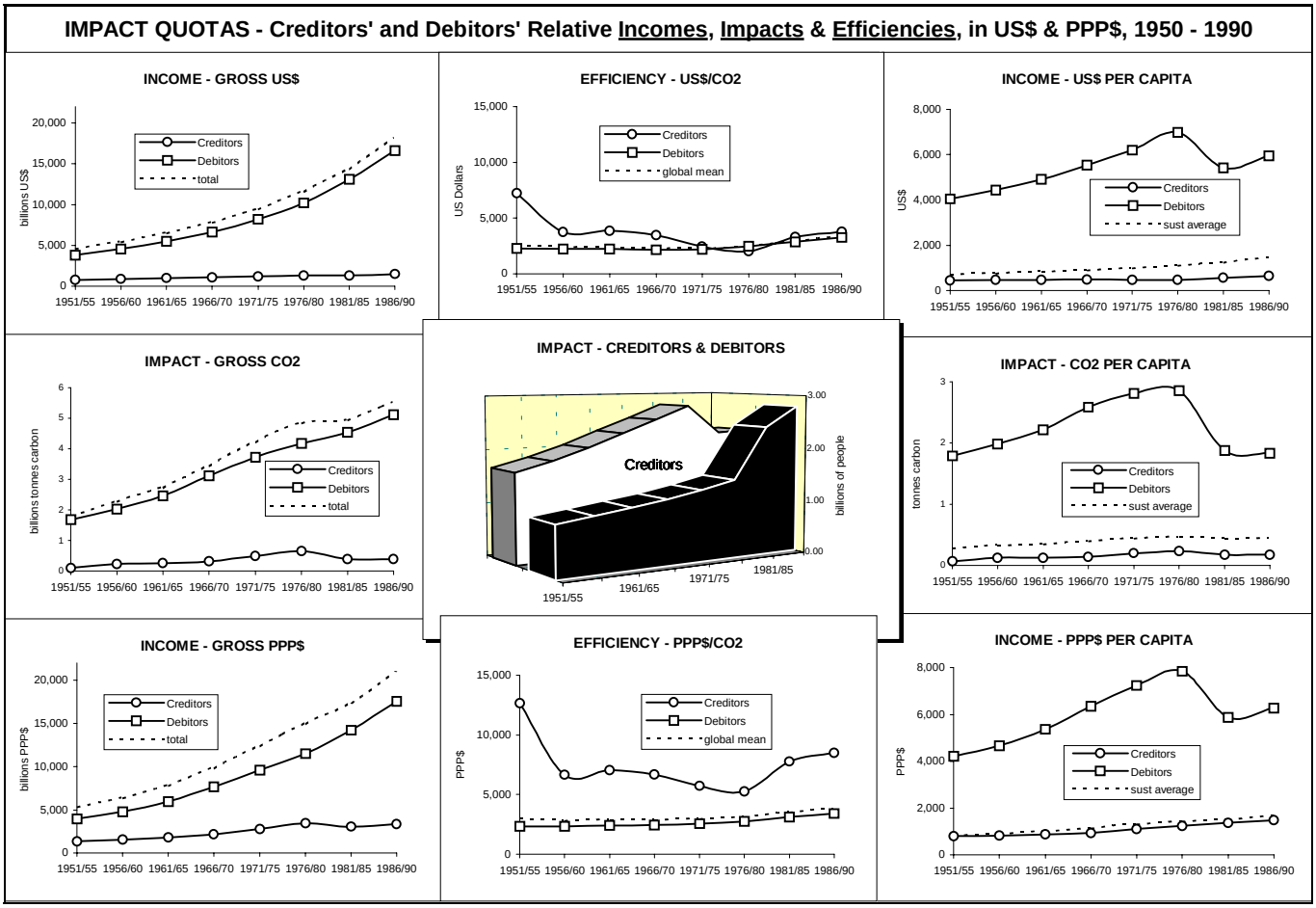
This calculation allocates *"globally allowable carbon usage"* (ie 40% of each year's actual global usage) to each nation on the basis of their populations, and compares this allocation with their actual usage to give a *"debit"* or *"credit"* figure.

- *"Debit"* means the amount by which a nation took more than its equitable share of the carbon usage which could be safely allowed to continue in any year globally.
- *"Credit"* means the amount by which a nation took less than its equitable share of the carbon usage which could be safely allowed to continue in any year globally.
- *"Debitors"* are the total number of people in the nations which took more than their equitable share of the carbon usage than could safely be allowed to continue in any year globally.
- *"Creditors"* are the total number of people in the nations which took less than their equitable share of the carbon usage than could safely be allowed to continue in any year globally.
- *"Efficiency"* means the ratio of GDP (in USD or PPP$) to carbon from CO2 from fossil fuel burning.

Across the period 1950 - 1990, we also then calculated and compared: -

- the total number of *"creditors"* and *"debitors"* in each year
- their respective gross and per capita Incomes in both USD and PPP$ and
- their respective gross and per capita Impacts and
- their respective Efficiency trajectories in both USD and PPP$

The curves for these are traced in the composite graphic below. The country's rankings are identified two pages forward.



Some of the Results

1. Until the early 1980s, there was a clear majority of *creditors* over *debitors* (see centre graphic page 3). However, when per capita emissions in China went above the *Sustainable Equitable Global Per Capita Impact Threshold* (SEGPCIMT) in 1982, the country switched from being an *"Impact Creditor"* to being an *"Impact Debitor"*. This explains why the relative numbers of *debitors* and *creditors* changed in this quota regime.
2. The *gross* combined Impact (see middle graphic left hand column page 3) of *debitors* and *creditors* rose at over 2% per annum across the period split approximately 10:1 between *debitors* and *creditors* throughout.
3. The average *per capita* Impacts (see middle graphic right hand column page 3) of *debitors* and *creditors* rose across the period until 1982, split approximately 10:1 throughout. China crossing SEGPCIMT caused both averages to fall thereafter. The average *per capita* Impact of the creditors was never more than half SEGPCIMT.
4. The *gross* combined USD Income (see graphic top left hand corner page 3) values of the *debitors* and the *creditors* rose across the period and was split at more than 10:1 throughout.
5. The average *per capita* USD Income (see graphic top right hand corner page 3) of *creditors* rose across the period until the early 1980's. The average *per capita* USD Income of *creditors* remained constant across the period overall and was never more than half the value of *"sustainably derived income"* (SDI - explained in regime 2). The split between *creditors* and *debitors* was on average 10:1 throughout.
6. The average USD Efficiency of *creditors* and *debitors*, initially favouring *creditors*, converged over the period, with the global average rising slightly towards the end of the period. (See centre graphic top row page 3).
7. The *gross* combined PPP Income values of the *debitors* and the *creditors* rose on average across the period and was split at less than 10:1 throughout. (See graphic bottom left hand corner page 3).
8. The average *per capita* PPP Income (see graphic bottom right hand corner page 3) of *debitors* rose across the period until the early 1980's. The influence of China crossing SEGPCIMT caused the average to fall thereafter. The average *per capita* PPP Income of *creditors* rose across the period overall at the value of *"sustainably derived income"* (SDI). The differential split between *creditors* and *debitors* was roughly 10:1 until the early eighties at which time the *debitor* average fell causing temporary convergence.
9. The average PPP Efficiency (see centre graphic bottom row page 3) of *creditors* and *debitors*, was always higher with the *creditors*, but converged over the period until the early 1980s. The global average rose slightly throughout the period with *debitors* always below this average.

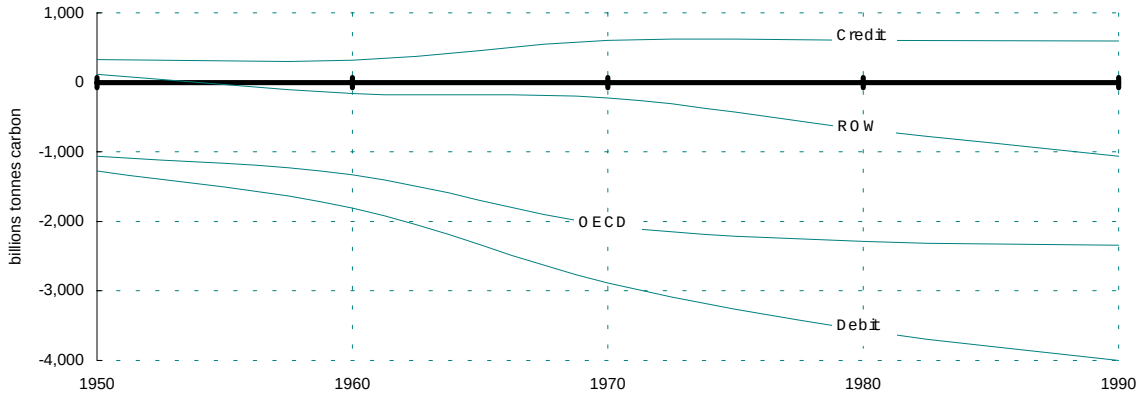
The combined picture shows that the *debitors'* high *per capita* Income goes with high *per capita* Impact at low Efficiency values and that the *creditors'* low *per capita* Income goes with low *per capita* Impact at high Efficiency values. This is the basis of GCI's contention that - in the context of *"understanding and responding to the unequal use of the global commons"* - debitors live unsustainably and creditors live sustainably. Debitors do this by over-consuming global climate resources, both at the expense of and subsidised by, the creditors who do the opposite. In GCI's view the "credit" in any of these quota regimes represents a subsidy from the *"creditors"* to the *"debitors"*.

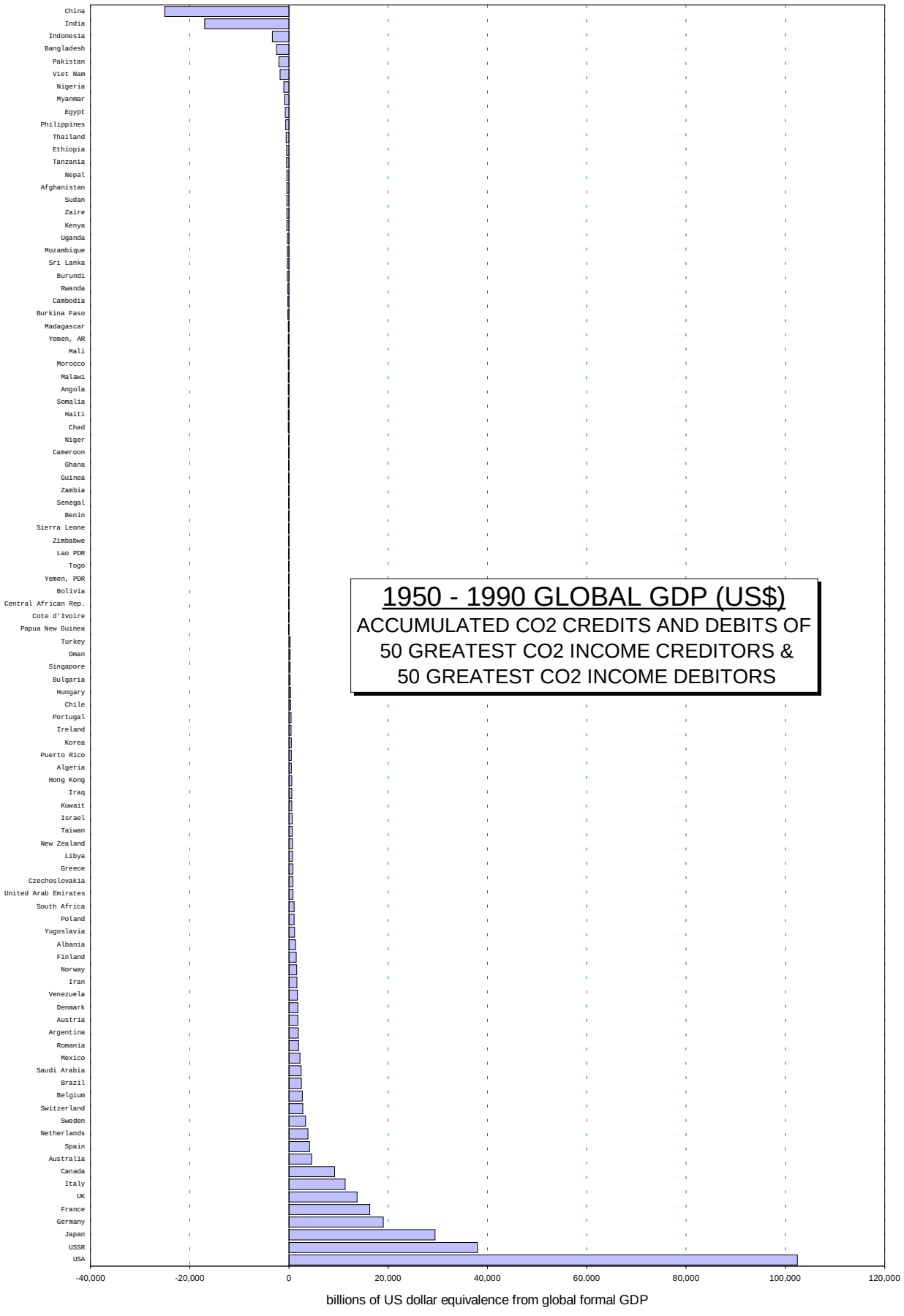
Across the period 1950 - 1990 we also calculated and compared the curves traced in the graphic below: -

- the global total credit/debit curves for CO2-Impact and
- the credit/debit curves of the OECD countries and the Rest Of World (ROW).

Had creditors accessed their full equitable share across the period, the debit curve would have been deeper by the amount registered as credit. It is this credit amount which represents the subsidy from the creditors to the debitors.

OECD & Rest Of World (ROW) COMPARED TO TOTAL CO2 IMPACT CREDIT/DEBIT




1950 - 1990 GLOBAL GDP (US$)
ACCUMULATED CO2 CREDITS AND DEBITS OF
50 GREATEST CO2 INCOME CREDITORS &
50 GREATEST CO2 INCOME DEBITORS
China
India
Indonesia
Bangladesh
Pakistan
Viet Nam
Nigeria
Myanmar
Egypt
Philippines
Thailand
Ethiopia
Tanzania
Nepal
Afghanistan
Sudan
Zaire
Kenya
Uganda
Mozambique
Sri Lanka
Burundi
Rwanda
Cambodia
Burkina Faso
Madagascar
Yemen, AR
Mali
Morocco
Malawi
Angola
Somalia
Haiti
Chad
Niger
Cameroon
Ghana
Guinea
Zambia
Senegal
Benin
Sierra Leone
Zimbabwe
Lao PDR
Togo
Yemen, PDR
Bolivia
Central African Rep.
Cote d'Ivoire
Papua New Guinea
Turkey
Oman
Singapore
Bulgaria
Hungary
Chile
Portugal
Ireland
Korea
Puerto Rico
Algeria
Hong Kong
Iraq
Kuwait
Israel
Taiwan
New Zealand
Libya
Greece
Czechoslovakia
United Arab Emirates
South Africa
Poland
Yugoslavia
Albania
Finland
Norway
Iran
Venezuela
Denmark
Austria
Argentina
Romania
Mexico
Saudi Arabia
Brazil
Belgium
Switzerland
Sweden
Netherlands
Spain
Australia
Canada
Italy
UK
France
Germany
Japan
USSR
USA
-40,000
-20,000
0
20,000
40,000
60,000
80,000
100,000
120,000
billions of US dollar equivalence from global formal GDP

REGIME 2 - US$ INCOME ASSESSMENT (BASED ON GLOBAL EFFICIENCY).

How its Done and Why

This calculation converts each nation's allowable carbon usage into a *"sustainably derived income"* (SDI), on the basis of the global annual average figure for the efficiency of carbon usage (ie units of GDP produced on average per unit of CO2 emitted). This allocation is then compared with each nation's actual income (GDP) to give a *"debit"* or *"credit"* figure.

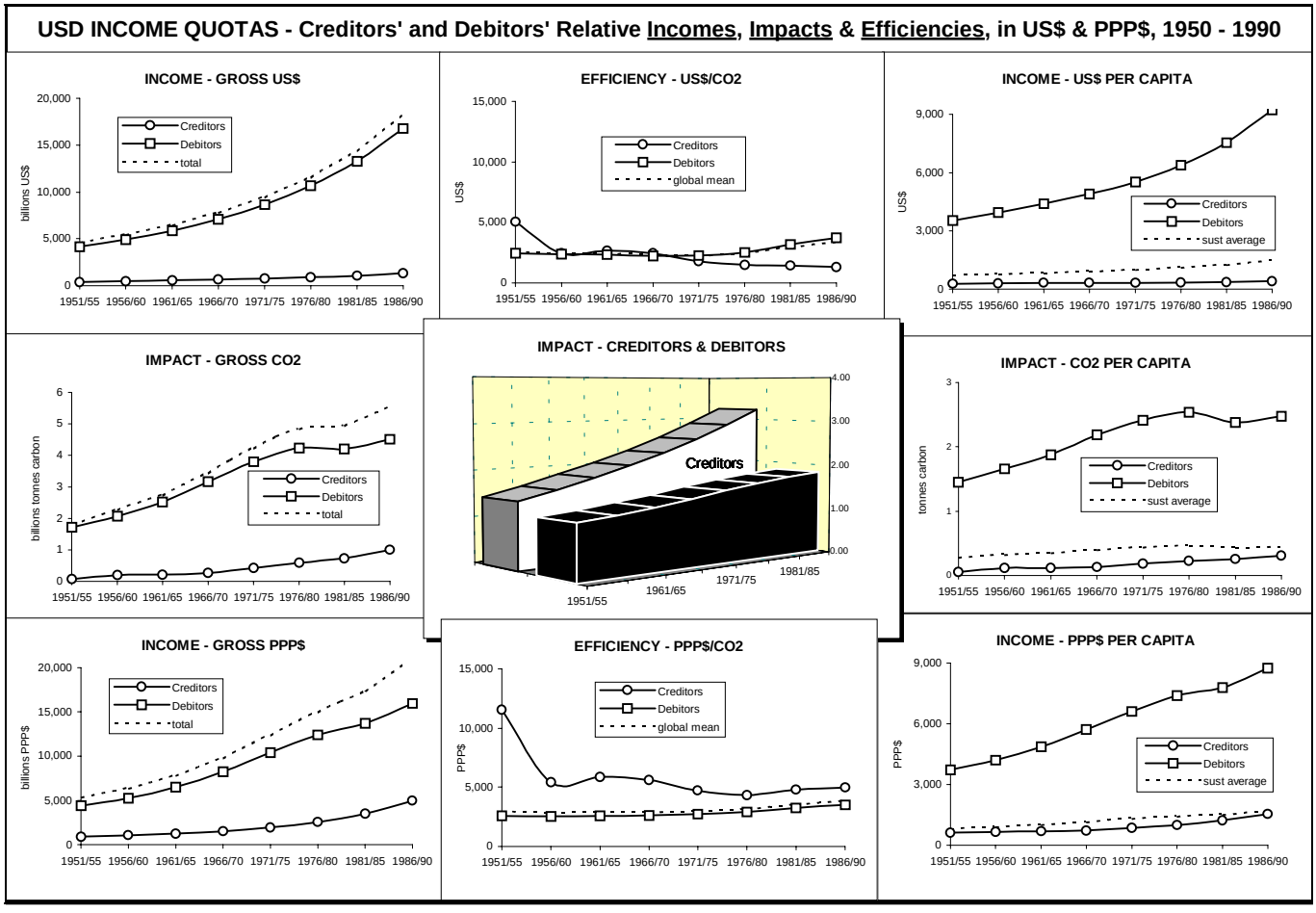
- *Debit* in this case means in any year the amount by which a nation exceeded its equitable share of SDI globally.
- *Credit* in this case means in any year the amount by which a nation fell short of its equitable share of SDI globally.
- *"Debitor"* means in any year the total number of people in the nations which took more than their equitable share of SDI globally.
- *"Creditor"* means in any year the total number of people in the nations which took less than their equitable share of SDI globally.

Because this calculation is based on the global average efficiency of carbon usage, nations capable of burning carbon at an average efficiency greater than the global average *"lose out"* on sustainably derived income under this system. This point is addressed in the PPP$ efficiency regime which follows.

Across the period 1950 1990, we also then calculated and compared: -

- the total number of *"creditors"* and *"debitors"* in each year
- their respective gross and per capita Impacts
- their respective gross and per capita Incomes in both USD and PPP and
- their respective Efficiency trajectories in both USD and PPP

The curves for these are traced in the composite graphic below. The country's rankings are identified two pages forward.



Some of the Results

1. There was an increasing majority of USD Income *creditors* over *debitors*. reaching 2:1 by 1990.
2. The *gross* combined CO2 Impact (USD) (see middle graphic in left hand column on page 5) of *debitors* and *creditors* rose at over 2% per annum split approximately 10:1 overall.
3. The average *per capita* Impacts (see middle graphic in right hand column page 5) of *debitors* and *creditors* rose throughout the period split on average 10:1 throughout. The average *per capita* Impact of the *creditors* was decreasingly less than SEGPCIMT.
4. The *gross* combined USD Income (see graphic in top left hand corner page 5) of the *debitors* and the *creditors* rose across the period split at increasingly more than 10:1 throughout.
5. The average *per capita* USD Income (see graphic top right hand corner page 5) of *debitors* rose across the entire period. The average *per capita* USD Income of *creditors* remained constant overall at increasingly less than half the value of *"sustainably derived income"* (SDI). The maldistribution between *creditors'* and *debitors'* Income seriously increased throughout.
6. The average USD Efficiency (see top graphic in middle column page 5) of *creditors* and *debitors*, initially favouring *creditors*, reversed over the period, with *debitors* following the slightly rising global average towards the end of the period and *creditors* declining below the global average.
7. The *gross* combined PPP Income (see graphic in bottom left hand corner page 5) values of the *debitors* and the *creditors* rose on average and the less than 10:1 initial split continued throughout.
8. The average *per capita* PPP Income (see graphic bottom right hand corner page 5) of *debitors* rose while the average *per capita* PPP Income of *creditors* rose only to the threshold value of SDI. The split between *creditors'* and *debitors'* Income was less than 10:1.
9. The average PPP Efficiency (see bottom graphic in middle column page 5) of *creditors* was always higher than the *debitors*. The global average rose slightly throughout the period with *debitors* always just below this average.

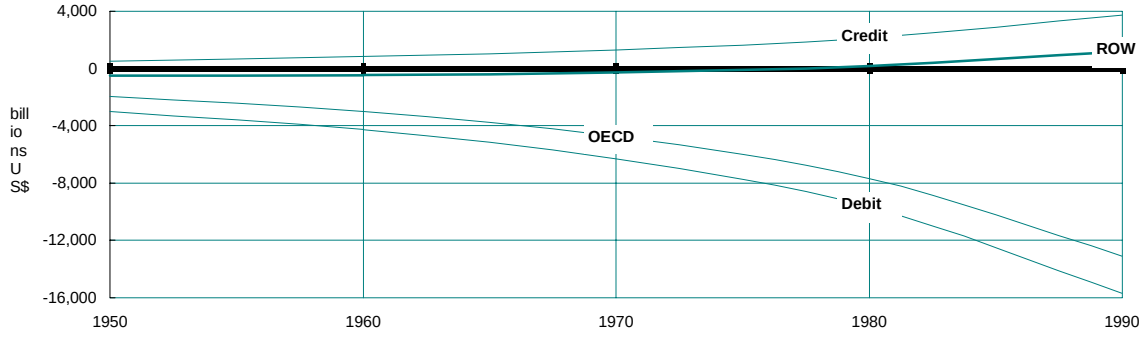
The combined picture - at least in PPP$ - shows that the debitors' high *per capita* Income goes with high *per capita* Impact at low Efficiency values and that the creditors' low *per capita* Income goes with low *per capita* Impact at high Efficiency values. The most striking point about this regime is that by the end of the period, two thirds of global population are creditors sharing 6% of global USD GDP, whilst the other one third are debitors sharing 94% of global USD GDP. It is in this context that *"CO2 emissions trading"* and *"Joint Implementation"* have been proposed in the name of *"cost-effectiveness"*. However, while the US dollar remains the dominant currency in the enforced "global" market, the adverse systemic influence of this increasing maldistribution of global purchasing power and globally unequal consumption patterns would appear to invite conflict rather than the co-operation required by the suggested trading arrangements. Moreover, it cannot plausibly be argued in the context of ecological economics that such trade will be "cost-effective". In cash terms, the magnitude of the exiting debit outweighs the available credit by a factor of 4:1. A failure to re-establish ecological credit proportional to this overhang, simply commits the global system to a process of adapting to increasing risks and rising costs. As such, "cost-effective" (as used by the economists) in reality means *not* "benefit-effective"; - ie, it is *not* delivering "global benefit", it is delivering increased global cost or disbenefit (violating the requirements of the climate convention).

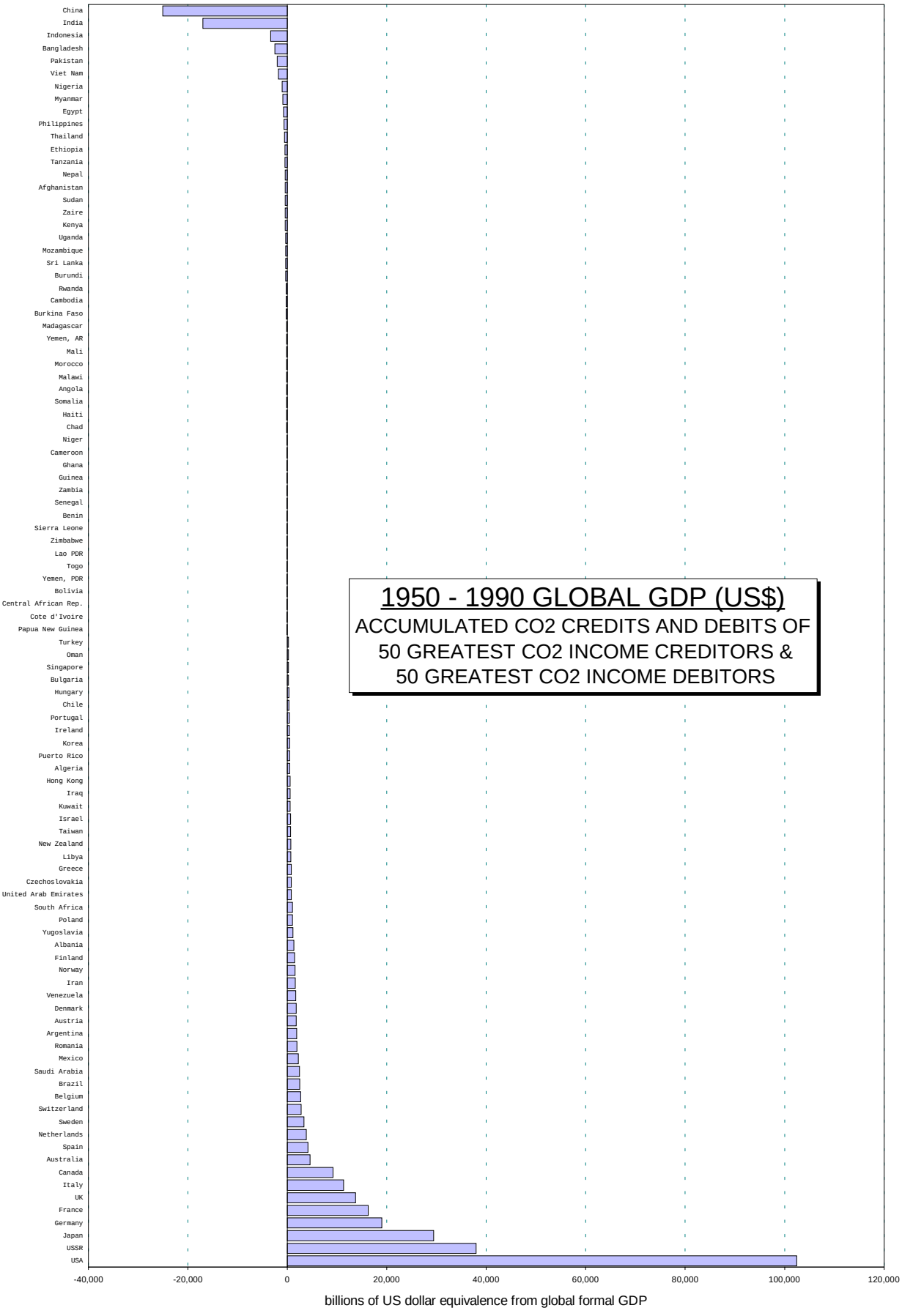
Across the period 1950 - 1990 we also calculated and compared the curves traced in the graphic below: -

- the global total credit/debit curves for USD Income and
- the credit/debit curves of the OECD countries and the Rest Of World (ROW).

OECD countries, with 19% of global population, were responsible for 99% of the accumulated USD Income debit.

OECD & Rest Of World (ROW) COMPARED WITH TOTAL US$ INCOME CREDIT/DEBIT




1950 - 1990 GLOBAL GDP (US$)
ACCUMULATED CO2 CREDITS AND DEBITS OF
50 GREATEST CO2 INCOME CREDITORS &
50 GREATEST CO2 INCOME DEBITORS
China
India
Indonesia
Bangladesh
Pakistan
Viet Nam
Nigeria
Myanmar
Egypt
Philippines
Thailand
Ethiopia
Tanzania
Nepal
Afghanistan
Sudan
Zaire
Kenya
Uganda
Mozambique
Sri Lanka
Burundi
Rwanda
Cambodia
Burkina Faso
Madagascar
Yemen, AR
Mali
Morocco
Malawi
Angola
Somalia
Haiti
Chad
Niger
Cameroon
Ghana
Guinea
Zambia
Senegal
Benin
Sierra Leone
Zimbabwe
Lao PDR
Togo
Yemen, PDR
Bolivia
Central African Rep.
Cote d'Ivoire
Papua New Guinea
Turkey
Oman
Singapore
Bulgaria
Hungary
Chile
Portugal
Ireland
Korea
Puerto Rico
Algeria
Hong Kong
Iraq
Kuwait
Israel
Taiwan
New Zealand
Libya
Greece
Czechoslovakia
United Arab Emirates
South Africa
Poland
Yugoslavia
Albania
Finland
Norway
Iran
Venezuela
Denmark
Austria
Argentina
Romania
Mexico
Saudi Arabia
Brazil
Belgium
Switzerland
Sweden
Netherlands
Spain
Australia
Canada
Italy
UK
France
Germany
Japan
USSR
USA
-40,000
-20,000
0
20,000
40,000
60,000
80,000
100,000
120,000
billions of US dollar equivalence from global formal GDP

REGIME 3 - PPP$ INCOME ASSESSMENT (BASED ON NATIONAL EFFICIENCY).

How its Done and Why

This calculation shows income (GDP) data expressed in *"Purchasing Power Parity"* (PPP) dollars. PPP$ delink national currencies from their US$ exchange rates, and value them instead for domestic purchasing power. This is more realistic basis for comparing economies internationally. [It is accepted as such by the IMF and other such institutions].

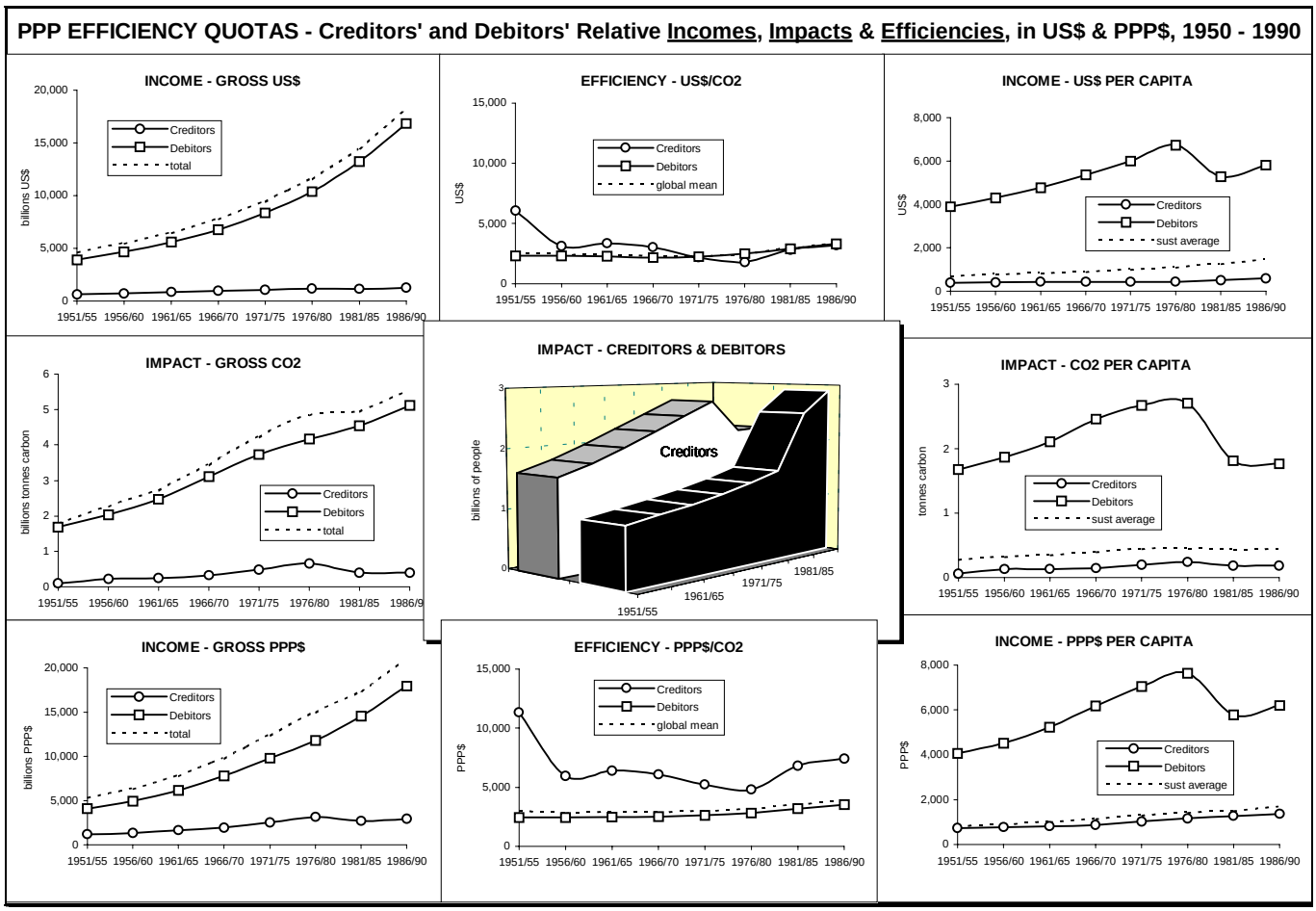
This calculation converts each nation's allowable carbon usage into a sustainably derived income (SDI), on the basis of the *national* (not global) figure for the efficiency of carbon usage (ie units of GDP produced on average per unit of CO2 emitted). This allocation is then compared with each nation's actual income (GDP) to give a *"debit"* or *"credit"* figure.

Because this calculation is based on the *national* efficiency averages of carbon usage, nations currently burning carbon at an average efficiency greater or less than the global average are respectively rewarded or penalised. The league table of countries is different from the league table arising out of the earlier impact and US$:CO2 income allocation regime (compare columns 1, 2 and 3 on pages 9 and 10).

Across the period 1950-1990, we also then calculated and compared: -

- the total number of *"creditors"* and *"debitors"* in each year
- their respective gross and per capita Impacts
- their respective gross and per capita Incomes in both USD and PPP and
- their respective Efficiency trajectories in both USD and PPP

The curves for these are traced in the composite graphic below. The country's rankings are identified two pages forward.



Some of the Results

1. As with the Impact, until the early 1980s, there was a 2:1 majority of *creditors* over *debitors* (see centre graphic page 7). However, with reference to the comparative country rankings pages 9 and 10, it will be seen that the order of countries in the league tables varies considerably between these three allocation regimes.
2. As before, the *gross* combined Impact (see middle graphic in left hand column page 7) of *debitors* and *creditors* rose at over 2% per annum across the period. The initial differential was approximately 10:1 and this split increased over the period.
3. The average *per capita* Impacts (see middle graphic in right hand column page 7) of *debitors* and *creditors* rose throughout the period until about 1980 and was split approximately 10:1 throughout. Thereafter both these averages fell. At the end of the period the average *per capita* Impact of the *creditors* was decreasingly less than half the value of SEGPCIMT.
4. The *gross* combined USD Income (see graphic in top left hand corner page 7) of the *debitors* and the *creditors* rose across the period and was split at increasingly more than 10:1 throughout.
5. The average *per capita* USD Income (see graphic in top right hand corner page 7) of *debitors* rose across the period until the early 1980's. The average *per capita* USD Income of *creditors* remained constant at less than half the value of SDI. The split between *creditors'* and *debitors'* Income widened overall.
6. The average USD Efficiency (see top graphic in middle column page 7) of *creditors* and *debitors*, initially favouring *creditors*, reversed over the period, with *debitors* following the slightly rising global average and *creditors* recovering slightly towards the end of the period.
7. The *gross* combined PPP Income (see graphic in bottom left hand corner page 7) of the *debitors* and the *creditors* rose on average for most of the period. But the initial split widened throughout.
8. The average *per capita* PPP Income (see graphic bottom right hand corner page 7) of *debitors* rose until the 1980s at which point it fell as the number of debitors increased. The average *per capita* PPP Income of *creditors* rose across the period at the SDI threshold value. The differential split between *creditors'* and *debitors'* Income diverged overall with temporary convergence towards the end.
9. The average PPP Efficiency (see bottom graphic in middle column page 7) of *creditors* and *debitors*, was always higher with the *creditors*, but converged and then diverged over the period. The global average rose slightly throughout the period with *debitors* always slightly below this average.

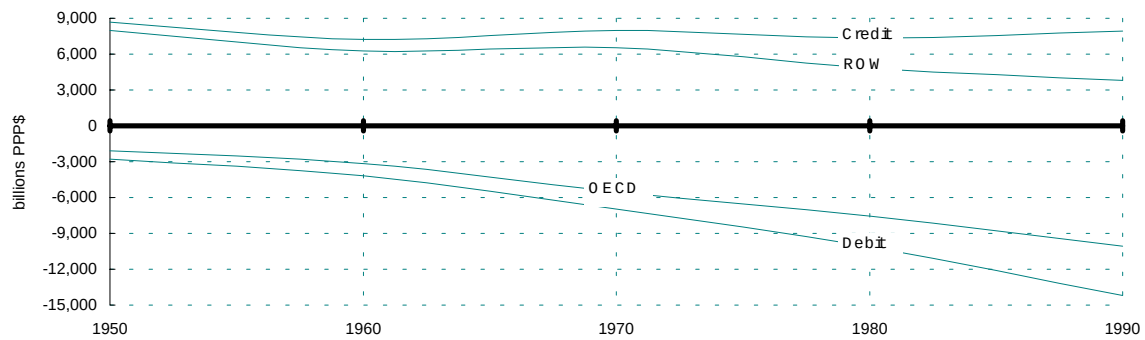
The combined picture shows that the *debitors'* high *per capita* Income goes with high *per capita* Impact at low Efficiency values and that the *creditors'* low *per capita* Income goes with low *per capita* Impact at high Efficiency values. The point about this quota regime is that using the domestic purchasing power (PPP$) of the countries is a more realistic way of measuring their relative wealth and their provision of global benefit or disbenefit. Using PPP$ from the outset of the calculations is a more realistic way of measuring their relative socio-ecological efficiencies (PPP$:CO2) and it is these efficiencies which should be rewarded.

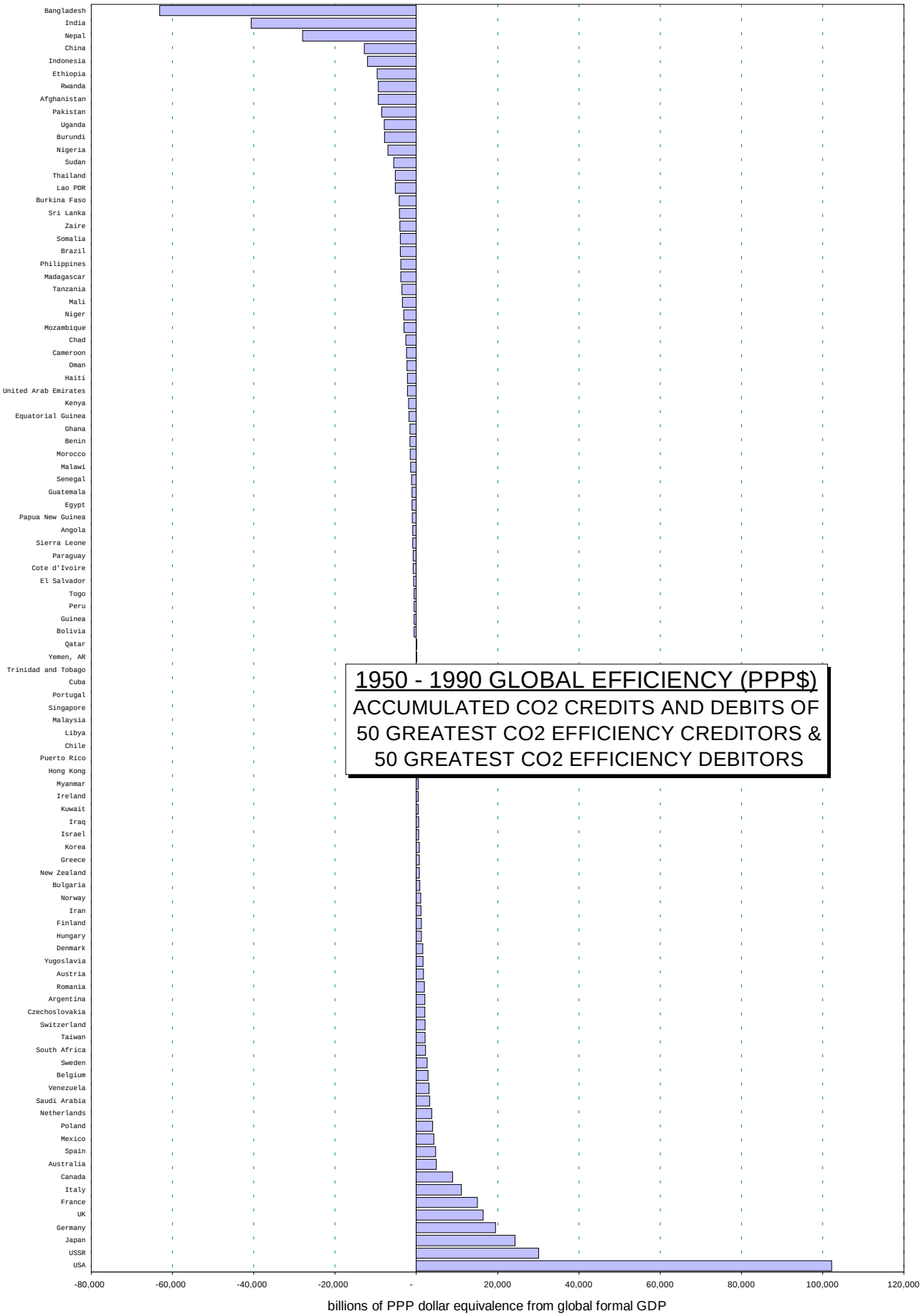
Across the period 1950 - 1990 we also calculated and compared the curves in the graphic below.: -

- the global total credit/debit curves for PPP$ Efficiency and
- the credit/debit curves of the OECD countries and the Rest Of World (ROW).

OECD countries, representing 19% of global population, were responsible for 1635% % of accumulated USD Income debit. The ROW provided an accumulated 1735% of accumulated credit.

OECD & Rest Of World (ROW) COMPARED TO TOTAL PPP$ EFFICIENCY CREDIT/DEBIT




1950 - 1990 GLOBAL EFFICIENCY (PPP$)
ACCUMULATED CO2 CREDITS AND DEBITS OF
50 GREATEST CO2 EFFICIENCY CREDITORS &
50 GREATEST CO2 EFFICIENCY DEBITORS
Bangladesh
India
Nepal
China
Indonesia
Ethiopia
Rwanda
Afghanistan
Pakistan
Uganda
Burundi
Nigeria
Sudan
Thailand
Lao PDR
Burkina Faso
Sri Lanka
Zaire
Somalia
Brazil
Philippines
Madagascar
Tanzania
Mali
Niger
Mozambique
Chad
Cameroon
Oman
Haiti
United Arab Emirates
Kenya
Equatorial Guinea
Ghana
Benin
Morocco
Malawi
Senegal
Guatemala
Egypt
Papua New Guinea
Angola
Sierra Leone
Paraguay
Cote d'Ivoire
El Salvador
Togo
Peru
Guinea
Bolivia
Qatar
Yemen, AR
Trinidad and Tobago
Cuba
Portugal
Singapore
Malaysia
Libya
Chile
Puerto Rico
Hong Kong
Myanmar
Ireland
Kuwait
Iraq
Israel
Korea
Greece
New Zealand
Bulgaria
Norway
Iran
Finland
Hungary
Denmark
Yugoslavia
Austria
Romania
Argentina
Czechoslovakia
Switzerland
Taiwan
South Africa
Sweden
Belgium
Venezuela
Saudi Arabia
Netherlands
Poland
Mexico
Spain
Australia
Canada
Italy
France
UK
Germany
Japan
USSR
USA
-80,000
-60,000
-40,000
-20,000
-
20,000
40,000
60,000
80,000
100,000
120,000
billions of PPP dollar equivalence from global formal GDP

	IMPACT DEBIT/ORS & CREDIT/ORS		USD INCOME DEBIT/ORS & CREDIT/ORS		PPP EFFICIENCY DEBIT/ORS & CREDIT/ORS		
	CO2 - millions tonnes		Income - billions		Efficiency - billions		
1	USA	39,495	USA	102,440	USA	102,272	1
2	USSR	22,672	USSR	37,978	USSR	30,178	2
3	German	8,996	Japan	29,468	Japan	24,385	3
4	UK	5,700	German	19,002	German	19,51	4
5	Japan	5,056	France	16,296	UK	16,497	5
6	France	3,233	UK	13,75	France	15,02	6
7	Canada	3,078	Italy	11,26	Italy	11,10	7
8	Poland	2,879	Canada	9,179	Canada	8,941	8
9	Italy	1,866	Australia	4,543	Australia	4,921	9
10	Czechoslovakia	1,78	Spain	4,156	Spain	4,740	10
1	South Africa	1,459	Netherlands	3,806	Mexico	4,305	1
12	Australia	1,423	Sweden	3,357	Poland	4,028	12
13	Belgium	1,039	Switzerland	2,796	Netherlands	3,885	13
14	Romania	1,033	Belgium	2,703	Saudi Arabia	3,289	14
15	Netherlands	979	Brazil	2,504	Venezuela	3,114	15
16	Spain	787	Saudi Arabia	2,463	Belgium	2,874	16
17	Mexico	768	Mexico	2,176	Sweden	2,681	17
18	Bulgaria	592	Romania	1,974	South Africa	2,255	18
19	Sweden	558	Argentina	1,892	Taiwan	2,209	19
20	Hungary	531	Austria	1,81	Switzerland	2,194	20
21	Iran	462	Denmark	1,756	Czechoslovakia	2,130	21
22	Argentina	457	Venezuela	1,740	Argentina	2,072	22
23	Yugoslavia	450	Iran	1,642	Romania	2,029	23
24	Denmark	443	Norway	1,51	Austria	1,779	24
25	Austria	370	Finland	1,436	Yugoslavia	1,734	25
26	Korea	307	Albania	1,323	Denmark	1,593	26
27	Finland	296	Yugoslavia	1,11	Hungary	1,259	27
28	Switzerland	254	Poland	1,096	Finland	1,241	28
29	Norway	215	South Africa	1,045	Iran	1,234	29
30	Greece	200	United Arab Emirates	819	Norway	1,12	30
31	Kuwait	193	Czechoslovakia	794	Bulgaria	892	31
32	United Arab Emirates	190	Greece	786	New Zealand	798	32
33	Ireland	15	Libya	719	Greece	784	33
34	Singapore	143	New Zealand	697	Korea	758	34
35	Libya	135	Taiwan	688	Israel	550	35
36	New Zealand	129	Israel	635	Iraq	536	36
37	Israel	126	Kuwait	600	Kuwait	512	37
38	Luxembourg	11	Iraq	542	Ireland	504	38
39	Iraq	11	Hong Kong	538	Myanmar	470	39
40	Netherlands Antilles	11	Algeria	499	Hong Kong	414	40
41	Cuba	98	Puerto Rico	490	Puerto Rico	406	41
42	Puerto Rico	89	Korea	473	Chile	404	42
43	Trinidad and Tobago	86	Ireland	427	Libya	352	43
44	Qatar	77	Portugal	371	Malaysia	322	44
45	Chile	72	Chile	361	Singapore	320	45
46	Malaysia	60	Hungary	285	Portugal	303	46
47	US Virgin Islands	48	Bulgaria	277	Cuba	277	47
48	Portugal	47	Singapore	271	Trinidad and Tobago	237	48
49	Bahrain	44	Oman	268	Yemen, AR	209	49
50	Hong Kong	44	Turkey	240	Qatar	166	50
51	Algeria	36	Malaysia	207	Luxembourg	137	51
52	Brunei	31	Qatar	186	Bahrain	11	52
53	Oman	27	Uruguay	11	Lebanon	77	53
54	Bahama	26	Colombia	11	Brunei	61	54
55	Mongolia	21	Luxembourg	11	Iceland	57	55
56	Gabon	19	Bahrain	10	Cyprus	52	56
57	Jamaic	18	Trinidad and Tobago	100	Central African Rep.	52	57
58	Lebanon	15	Lebanon	90	Bahama	49	58
59	Albania	14	Iceland	84	Uruguay	48	59
60	Syria	14	Peru	83	Guadeloupe	46	60
61	New Caledonia	13	Cuba	80	Netherlands Antilles	41	61
62	Iceland	13	Gabon	64	Jamaic	36	62
63	Turkey	13	Brunei	61	New Caledonia	30	63
64	Cyprus	12	Syria	51	Gabon	30	64
65	Guam	10	Panam	48	Surinam	22	65
66	Surinam	9	Cyprus	46	US Virgin Islands	19	66
67	Uruguay	7	Bahama	46	Bermuda	16	67
68	Greenland	3	Martinique	41	Mongolia	16	68
69	Malta	3	Costa Rica	39	Malta	15	69
70	Bermuda	3	Netherlands Antilles	39	St	9	70
71	Martinique	2	Jamaic	38	Martinique	9	71
72	Antigua & Barbuda	2	Reunion	37	St Vincent & Gr.	7	72
73	Panam	2	New Caledonia	35	Barbados	6	73
74	Barbados	1	Guadeloupe	33	French	5	74
75	Western	1	Mongolia	29	Western	4	75
76	Guyana	1	Barbados	18	French	4	76
77	French	1	Bermuda	18	Antigua & Barbuda	3	77
78	Falkland Islands	1	Malta	17	Gibraltar	1	78
79	Nauru	1	Surinam	14	Seychelle	1	79
80	Cayman	1	Fiji	7	Guyana	0	80
81	Christmas Island	1	Mauritius	5	Panam	0	81
82	French	0	Western	5	Albania	-	82
83	Leeward Islands	0	Gibraltar	5	Br Virgin Islands	-	83
84	St Pierre and Miquelon	0	Western	4	Cambodia	-	84
85	Br Virgin Islands	0	Tunisia	3	Cayman	-	85
86	Western	0	Dominica	2	Christmas Island	-	86
87	Gibraltar	0	Antigua & Barbuda	2	Cook Islands	-	87
88	Korea, DPR	-	Seychelle	1	Falkland Islands	-	88
89	St	-	Belize	1	Faroe Islands	-	89
90	Montserrat	- 0	St Lucia	1	Greenland	-	90
91	Niue	- 0.1	Christmas Island	0	Guam	-	91
92	Seychelle	- 0.3	Korea, DPR	0	Korea, DPR	-	92
93	Kiribati	- 0.6	Leeward Islands	0	Leeward Islands	-	93
94	St Kitts Nevis Anguilla	- 0.6	St	0	Macau	-	94
95	Belize	- 0.6	St Vincent & Gr.	0	Montserrat	-	95

96	Faroe Islands	-	0.6	Niue	0	Nauru	-		96
97	Dominica	-	0.9	St Pierre and Miquelon	0	Niue	-		97
98	Sao Tome & Principe	-	1	Nauru	0	St Pierre and Miquelon	-		98
99	Grenada	-	1	Grenada	0	Viet Nam	-		99
100	St Lucia	-	1	Br Virgin Islands	0	Western Sahara	-		100
101	Tonga	-	1	Montserrat	0	Yemen, PDR	-		101
102	Vanuatu	-	1	St Kitts Nevis Anguilla	0	Sao Tome & Principe	-	2	102
103	St Vincent & Gr.	-	1	Kiribati	-1	St Kitts Nevis Anguilla	-	3	103
104	Maldives	-	2	Falkland Islands	-1	Kiribati	-	5	104
105	Solomon Islands	-	2	Cayman Islands	-1	Belize	-	7	105
106	Macau	-	2	Djibouti	-1	St Lucia	-	8	106
107	Djibouti	-	3	Vanuatu	-1	Maldives	-	8	107
108	Reunion	-	3	Faroe Islands	-2	Grenada	-	8	108
109	Cook Islands	-	3	Greenland	-2	Tonga	-	9	109
110	Cape Verde	-	4	Tonga	-2	Vanuatu	-	11	110
111	Jordan	-	4	Sao Tome & Principe	-2	Zimbabwe	-	16	111
112	Equatorial Guinea	-	4	Swaziland	-2	Dominica	-	22	112
113	Fiji	-	4	French Guiana	-2	Solomon Islands	-	25	113
114	Swaziland	-	4	Solomon Islands	-2	Djibouti	-	29	114
115	Zimbabwe	-	4	Nicaragua	-3	Botswana	-	40	115
116	Comoros	-	5	US Virgin Islands	-4	Reunion	-	41	116
117	Guadeloupe	-	5	Guam	-4	Swaziland	-	44	117
118	Botswana	-	6	Maldives	-4	Cape Verde	-	54	118
119	Gambia	-	7	French Polynesia	-5	Fiji	-	57	119
120	Mauritius	-	8	Congo	-5	Comoros	-	74	120
121	Guinea Bissau	-	9	Cape Verde	-6	Colombia	-	76	121
122	Colombia	-	12	Guyana	-6	Jordan	-	76	122
123	Congo	-	12	Jordan	-6	Gambia	-	99	123
124	Costa Rica	-	12	Equatorial Guinea	-6	Guinea Bissau	-	119	124
125	Mauritania	-	15	Paraguay	-7	Algeria	-	130	125
126	Bhutan	-	16	Comoros	-8	Syria	-	139	126
127	Liberia	-	19	Cook Islands	-9	Costa Rica	-	174	127
128	Nicaragua	-	20	Dominican Republic	-10	Congo	-	179	128
129	Ecuador	-	25	Botswana	-10	Mauritius	-	183	129
130	Tunisia	-	25	Guatemala	-12	Turkey	-	185	130
131	Central African Rep.	-	28	Ecuador	-14	Tunisia	-	213	131
132	Yemen, PDR	-	28	Macau	-15	Zambia	-	227	132
133	Dominican Republic	-	30	Gambia	-15	Nicaragua	-	233	133
134	Togo	-	30	Guinea Bissau	-18	Liberia	-	239	134
135	Paraguay	-	31	Mauritania	-30	Dominican Republic	-	302	135
136	Honduras	-	33	El Salvador	-31	Bhutan	-	330	136
137	Papua New Guinea	-	35	Liberia	-35	Honduras	-	361	137
138	Zambia	-	38	Bhutan	-39	Ecuador	-	382	138
139	Sierra Leone	-	38	Honduras	-41	Mauritania	-	417	139
140	El Salvador	-	42	Papua New Guinea	-46	Bolivia	-	509	140
141	Benin	-	43	Cote d'Ivoire	-47	Guinea	-	514	141
142	Lao PDR	-	44	Central African Rep.	-50	Peru	-	515	142
143	Bolivia	-	46	Bolivia	-54	Togo	-	544	143
144	Senegal	-	58	Yemen, PDR	-55	El Salvador	-	652	144
145	Chad	-	59	Togo	-57	Cote d'Ivoire	-	732	145
146	Guinea	-	61	Lao PDR	-67	Paraguay	-	769	146
147	Peru	-	61	Zimbabwe	-76	Sierra Leone	-	858	147
148	Guatemala	-	63	Sierra Leone	-78	Angola	-	880	148
149	Haiti	-	64	Benin	-81	Papua New Guinea	-	988	149
150	Niger	-	65	Senegal	-81	Egypt	-	1,025	150
151	Cote d'Ivoire	-	68	Zambia	-86	Guatemala	-	1,076	151
152	Angola	-	69	Guinea	-101	Senegal	-	1,171	152
153	Somalia	-	71	Ghana	-103	Malawi	-	1,416	153
154	Malawi	-	72	Cameroon	-107	Morocco	-	1,460	154
155	Mali	-	86	Niger	-107	Benin	-	1,554	155
156	Cameroon	-	89	Chad	-126	Ghana	-	1,616	156
157	Burkina Faso	-	99	Haiti	-128	Equatorial Guinea	-	1,822	157
158	Cambodia	-	99	Somalia	-148	Kenya	-	1,870	158
159	Yemen, AR	-	102	Angola	-149	United Arab Emirates	-	2,166	159
160	Madagascar	-	109	Malawi	-167	Haiti	-	2,202	160
161	Rwanda	-	113	Morocco	-172	Oman	-	2,288	161
162	Burundi	-	120	Mali	-189	Cameroon	-	2,396	162
163	Ghana	-	122	Yemen, AR	-189	Chad	-	2,580	163
164	Mozambique	-	126	Madagascar	-196	Mozambique	-	3,002	164
165	Saudi Arabia	-	129	Burkina Faso	-207	Niger	-	3,109	165
166	Morocco	-	152	Cambodia	-258	Mali	-	3,392	166
167	Sri Lanka	-	166	Rwanda	-269	Tanzania	-	3,459	167
168	Kenya	-	169	Burundi	-288	Madagascar	-	3,810	168
169	Uganda	-	176	Sri Lanka	-296	Philippines	-	3,823	169
170	Venezuela	-	182	Mozambique	-300	Brazil	-	3,902	170
171	Nepal	-	192	Uganda	-362	Somalia	-	3,940	171
172	Egypt	-	197	Kenya	-371	Zaire	-	4,044	172
173	Afghanistan	-	204	Zaire	-391	Sri Lanka	-	4,123	173
174	Taiwan	-	214	Sudan	-394	Burkina Faso	-	4,213	174
175	Sudan	-	221	Afghanistan	-424	Lao PDR	-	5,100	175
176	Tanzania	-	222	Nepal	-425	Thailand	-	5,146	176
177	Ethiopia	-	251	Tanzania	-489	Sudan	-	5,554	177
178	Zaire	-	301	Ethiopia	-512	Nigeria	-	6,967	178
179	Thailand	-	331	Thailand	-593	Burundi	-	7,827	179
180	Philippines	-	377	Philippines	-642	Uganda	-	7,845	180
181	Brazil	-	384	Egypt	-716	Pakistan	-	8,508	181
182	Myanmar	-	457	Myanmar	-922	Afghanistan	-	9,321	182
183	Viet Nam	-	530	Nigeria	-1,048	Rwanda	-	9,348	183
184	Nigeria	-	639	Viet Nam	-1,829	Ethiopia	-	9,579	184
185	Pakistan	-	826	Pakistan	-2,036	Indonesia	-	12,016	185
186	Bangladesh	-	1,117	Bangladesh	-2,513	China	-	12,782	186
187	Indonesia	-	1,352	Indonesia	-3,337	Nepal	-	27,958	187
188	China	-	2,331	India	-17,030	India	-	40,635	188
189	India	-	6,161	China	-25,044	Bangladesh	-	63,145	189

CONCLUSION - Spotted Owls and Fighting the Economics of Genocide

These allocation exercises show the scale of worsening maldistribution of resources globally since the war. The trend was increasingly inequitable and unsustainable. OECD countries - although they do not yet admit to it officially - are now on the defensive about this state of affairs. Their principal tactic has been to blame developing countries for future impacts, rather than accept responsibility for the past and present impacts of the industrial countries. No-one is advocating hair-shirt politics. However, it is unrealistic for the industrial countries to promote the future as an extension of the present unless this includes a willingness to become accountable over the massive structural advantage which they have developed globally whilst running up this global environmental debt on everyone's account.

Overall, this is not a complicated debate. The resources in question are global common property and vital to survival. The well-being of all people now and into the future depend on the integrity of these resources being maintained. There is a simple choice to be made; - either we *accept* that everyone has an equal right to be here and to share the benefits of these resources or we *reject* that everyone has equal rights in this. This is choosing for equity and survival or for increasing inequity and loss of sustainability. It is that simple.

As a matter of principle and of prudence, GCI accepts and affirms that everyone has an equal right to be here. We base our modelling and analysis on that acceptance, and present our analysis as an affirmation of that right. We note that rights to income should be accompanied by responsibilities for its impacts, which effectively rewards efficiencies. Contrarily, the Global Cost/Benefit Analysts (now in the IPCC Working Group Three (WG3)) do no affirm the equal right to be here. They appear not even to accept it either. Certainly - at least by default - they are rejecting this right, as the analysis presented by them so far, suggests that rights increase proportional to income. Advised by these very people, the World Bank has openly promoted the idea that the right to emit carbon dioxide should be proportional to income for example.[2] The policy measures for the mitigation of emissions proposed by many of these economists preparing material for WG3[3] are based on this formula of *"rights-by-income"*. Mitigating emissions is presented by these analysts as a *cost*, and the "damages-avoided" by mitigating emissions are presented by them as the *benefit*.

As intended, all this sounds professional and innocent. But it is conceptually skewed, factually inaccurate and politically devious. In reality it is a velvet glove for the iron fisted insistence on business-as-usual. At worst it is the economics of genocide. Faced with this fist, we should recognise how its grip is exerted; - the exercise fundamentally depends on the analysts converting all the costs and all the benefits associated with climate changes to *cash values*. One immediate example of this is the need to give cash values to the human lives which are going to be lost (a "damage cost"). In their analysis, if the overall damage costs are calculated as high (and higher than the cost of mitigating emissions), this makes the costs of mitigation bearable, and wins the case for mitigating the emissions. If, on the other hand, the damage costs are low (and below the costs of mitigating emissions), the case has been made for business-as-usual, and the damage costs (including the loss of life) become bearable. Clearly the damage cost (cash valuation) that is put on a human life in this context is crucial.

The key question which now also arises is this: - are all human lives *equally* valuable or not? Moreover, should economists employed by the nations responsible for causing the problems of climate change, have the job of valuing the lives which are going to be lost? And even more to the point, should they value the lives of the people who are not responsible for creating the climate changes, as less valuable than the lives of those responsible? Surely we all have a fundamentally equal right to be here: surely each person is equally valuable in this fundamental way? So far the global cost/benefit analysts say no, this is not the case.

[2] World Development Report 1992, page 165

[3] measures such as carbon taxes, tradable-emissions-permits and joint-implementation

Take for example the (UK-government-funded) *Centre for the Social and Economic Research of the Global Environment* (C-SERGE) based in the UK. David Pearce is one of its directors and he is also the IPCC's convening lead author on "Social Costs". C-SERGE has already published a valuation of the lives to be lost. In a recent research paper it stated that the cash value of a "statistical life" in the EC or the USA is $1,500,000 per head, but in "poor" countries such as China, it is only $150,000.[4] [The disparate figures are derived from peoples' ability-to-pay for damage insurance]. In global cost/benefit analysis, this means therefore these economists discard a real Chinese life ten times more easily than a real life in the EC or the USA. This an example of how you keep the damage costs below the emissions mitigation costs. You just quietly devalue the lives of the people who aren't in the EC and the USA and hope nobody questions "business-as-usual" with genocide written into the bottom-line. This approach is now formally embedded in the text of IPCC's Second Assessment Report (SAR) in the section prepared by the Western economists dominant in Working Group Three (WG3) on "Economic and other Cross-Cutting Issues". This approach is one of the great scandals of our times. It has now been dubbed "the Economics of Genocide" in some of the world's major media and an international protest campaign over this has been growing since it was launched by GCI in June 1994. (See overleaf)

The Godfather of these economists, William Nordhaus, has stated that *"the economic perspective in global cost/benefit analysis attempts to condense the complex set of impacts over, space, time and sectors by summarising them in a scalar measure of value . . . the fact that the scalar is in monetary units is not really crucial: it could be in spotted-owl equivalents."* [5] For GCI this is evidence of confusion in the reasoning of these economists at this fundamental level. On the one hand they say that monetary units are not crucial [spotted-owl equivalents will do just as well as money] and on the other hand they say that monetary units are crucial [peoples varied ability-to-pay - in money - determines their rights and their relative worth].

The question that haunts their confusion is this: why if one spotted owl equals one spotted owl, doesn't one human equal one human? In the twisted logic of global cost/benefit analysis, it turns out that people do not have an equal right to survive even though spotted owls do. This is another way of saying that people do not have an equal right to be here in the first place; your rights are proportional to your income. In terms of achieving sustainable development globally, this is nonsense. For practical as well as ethical purposes, each human being is - and must be recognised as - the fundamentally equal unit for measuring sustainability and this is the irreducible level of decision-taking.

At sub-global levels of 'economic' debate, this kind of wrangle is of a familiar vintage. It is the substance of the traditional left/right arguments where those without the money make "equity-for-equity's sake" (principle) arguments, whilst those with the money make "efficiency-for efficiency's sake" (practicality) arguments. Whatever the rights and wrongs of this approach, equity and efficiency are seen as being traded off against each other between the left and the right. Much of the history of our political economy is a story about this false dichotomy.

At a global level this kind of economic discrimination is simply suicidal. It is discriminatory on a greater scale than before. But it is also dangerous and different in a manner which is without precedent. First there is nowhere else to go. There isn't a global carpet under which the waste, the pollution and the "poor" can be swept and then ignored. The causes and the influence of these things in the system needs to fundamentally inform the analysis under-taken. This is true because large numbers of people are not going to accept being made the discards of a sub-system which values itself 10:1 over everyone else, let alone a system which hasn't demonstrated sustainable consumption patterns since industrialisation began.

The "Conference of the Parties to the Climate Convention" cannot succeed in its task if these issues are not faced head on. The 'Economics of Genocide' must be rejected now and for always.

[4] "Global Warming Damage Costs: Some Monetary Estimates" by Samuel Fankhauser (with input from Pearce and Nordhaus). Working Paper GEC 92-29 from C-SERGE, the UK's Centre for the Social and Economic Research of the Global Environment.
[5] Prof William D Nordhaus in a letter to GCI dated 28 2 94.

The Results of Changing Two Bases of Valuation in the Global Cost/Benefit Analysis (G-CBA) done by IPCC Working Group Three (WG3)

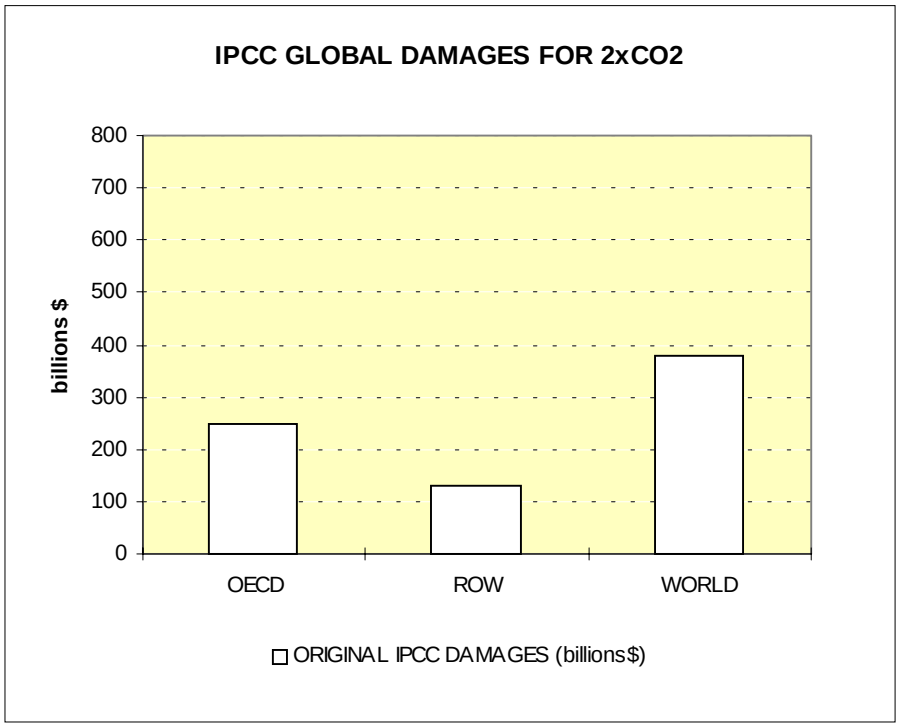
GCI was contacted by the Chair of WG3 during the final lead authors meeting in Paris (22-24/3/95) to say that the PPP point raised here had been won as a result of this paper being submitted and would be assimilated (whatever that means. However, the equal versus unequal life evaluation controversy remained unresolved within the group.

* *

The Intergovernmental Panel on Climate Change (IPCC) is due to publish its Second Assessment Report (SAR) later this year. IPCC Working Group Three (WG3) now deals with *"Economic and other Cross-Cutting Issues"*. Its contribution to the Report is intended to assist policy formulation at the *"Conference of the Parties"* (COP) in Berlin 27/3/95 - 8/3/95.

The approach adopted by the economists in this Group has been conceived in terms of a Global Cost/Benefit Analysis (G-CBA). Using this approach, the Group estimates that annual global damage costs will be 1.5% - 2.5% of Gross World Product (GWP), if atmospheric CO2 concentrations go to twice pre-industrial levels.

The Group also estimates that the distribution of these damages between the Organisation for Economic Co-operation and Development (OECD) and the Rest of World (ROW) will be OECD 65% and ROW 35%.



Two separate but related features of this G-CBA invite re-appraisal. These are: -

1. IPCC's failure to use Purchasing Power Parity (PPP) for comparative assessments of overall damage costs (excluding loss of human life ie mortality costs) and
2. IPCC's unequally valued mortality costs associated with global climate change.

1. Purchasing Power Parity (PPP)

At present, the total global damage assessment is as an aggregate of all individual country damage assessments converted to US$ at market exchange rates.

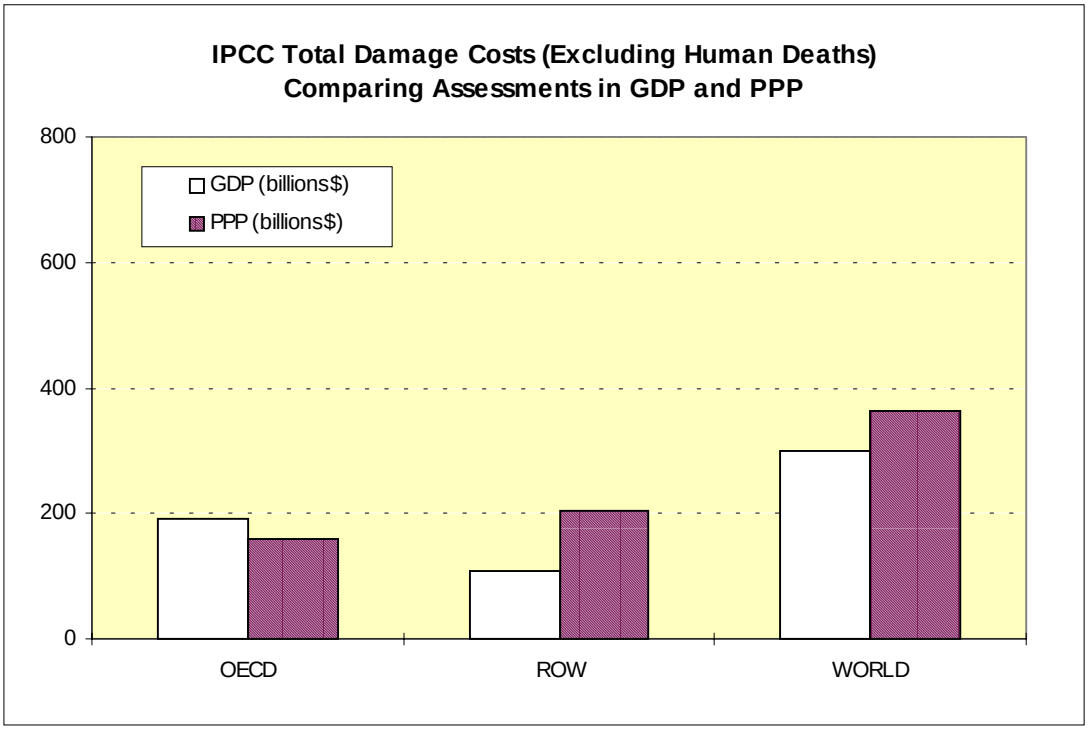
This is misleading and would only make sense if the OECD countries intend to pay for all damages, a liability not accepted by them. So in developing countries, the monetary significance of their damage costs to them (and proportionately in the global account for the purposes of international comparative assessment) is substantially under-represented because the amounts in question are devalued through the currency exchange rate system. The burden on the damage to non-OECD countries would be more realistically represented if the figures were revalued at PPP equivalence.

If the IPCC calculation is redone using PPP to evaluate all the damages (except the human deaths - see comments later), the distribution of the damage is shown to fall much more harshly on the ROW and the total amount of damage increased.

	IPCC Total Damage Costs (but excl human deaths)	
	GDP (billions$)	PPP (billions$)
OECD	192	159
ROW	107	203
WORLD	299	362
	% of total damage excl deaths	% of total damage excl deaths
OECD	64	44
ROW	36	56
WORLD	100	100

- OECD damages fall from 64% to 44% of the total
- ROW damages rise from 36% to 56% of the total
- global annual damages rise above the original figure by $63 billion or 22%

-



2. Unequally Valued Mortality Costs

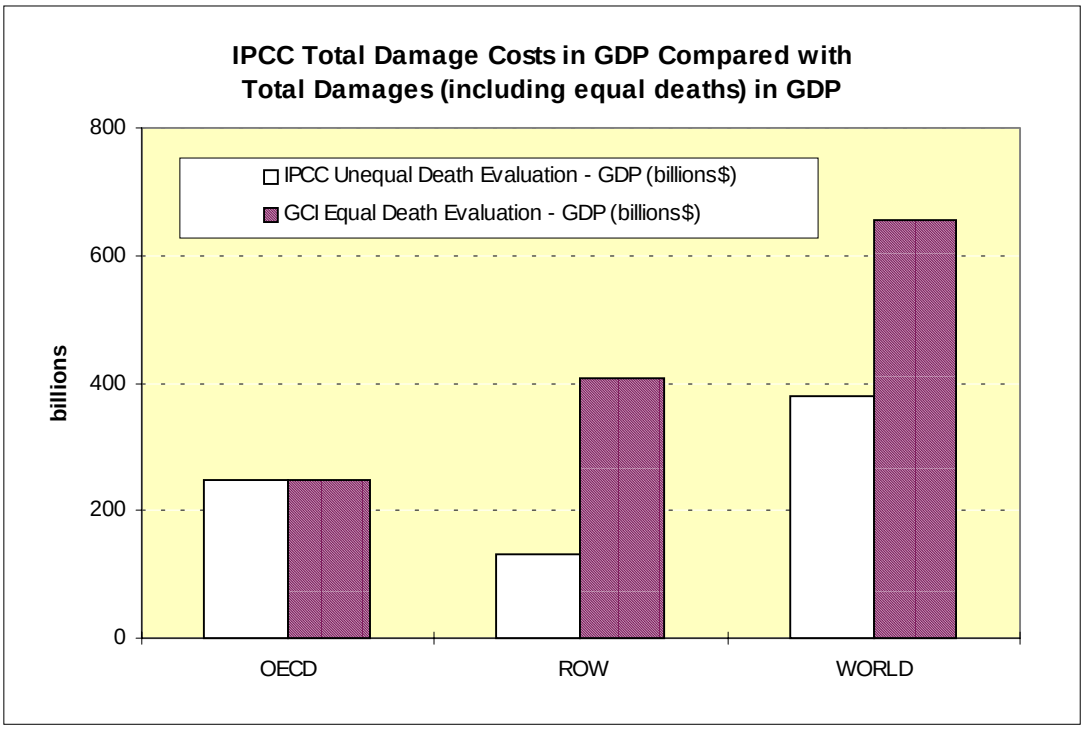
IPCC recognises many people will die each year as a result of global climate changes. Most of these deaths will be in developing countries. Economists have to put a cash figure on these deaths in order to perform the G-CBA. They value people's lives around the world differently because of the disparate income levels of those directly affected. Consequently the lives of people in the poor countries are valued at one tenth the value of people in the wealthy countries. Deaths in the USA and the EU are costed at $1.5 million per head. In the poorer countries they are put at $150,000 per head.

This approach is controversial and may compromise the IPCC in general. So far, the poorer countries have no responsibility for causing global climate change. In fact many authorities argue that low-energy consuming countries are providing an environmental subsidy to energy-intensive ones. Yet it is in these low-energy consuming countries that the majority of deaths will occur.

If WG3's figures are recalculated using the US value of $1.5 million for all deaths, the results are show below.

	IPCC Total Damage Costs GDP (billions$)	Total Damage Costs (incl equal death evaluation) GDP (billions$)
OECD	249	249
ROW	132	407
WORLD	381	656
	% of total damage excl deaths	% of total damage incl equal deaths
OECD	65	38
ROW	35	62
WORLD	100	100

- OECD damages fall from 65% to 38% of the total
- ROW damages rise from 35% to 62% of the total
- global annual damages rise above the original figure by $275 billion or 72%



So contentious is the question of unequal life-evaluation that a sign-on protest against it started last June. Many professional people North and South including some IPCC lead authors became co-signatories. This protest has already attracted considerable international media interest.

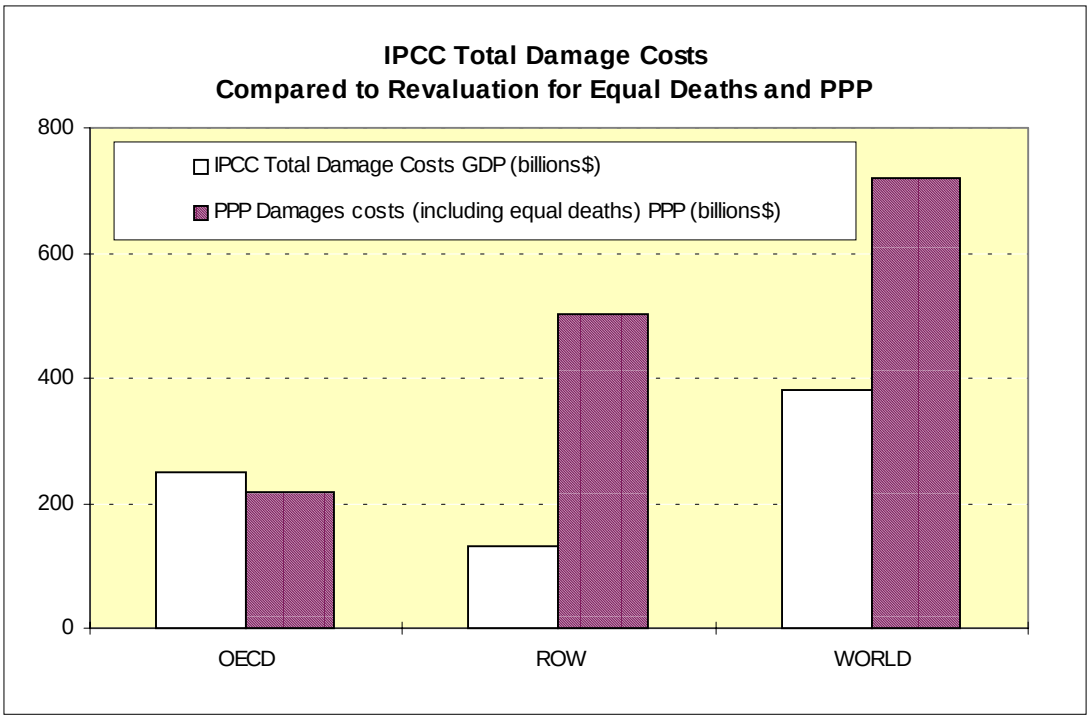
3. Combining PPP and Equal Lives and Comparing the Results with IPCC

If changes for both equal life evaluation and PPP are made together, the overall level of damage costs of global warming rise substantially and the distribution of these are shown to fall very much more heavily on the Rest of World (ROW) than in the original IPCC estimate.

	IPCC Total Damage Costs GDP (billions$)	PPP Damages costs (including equal deaths) PPP (billions$)
OECD	249	217
ROW	132	503
WORLD	381	720
	% of total damage excl deaths	% of total damage incl equal deaths
OECD	65	30
ROW	35	70
WORLD	100	100

- OECD damages fall from 65% to 30% of the total
- ROW damages rise from 35% to 70% of the total
- global annual damages rise above the original figure by $339 billion or 89%

IPCC's total damages of 2% of GWP rise to 3.2% when these revaluations are performed.



It is entirely probable that policy-makers from developing countries will refuse the existing results of IPCC's Global Cost/Benefit Analysis (G-CBA). The margin of error is too great. Any policy measures conceived under the original formulation are bound to treated with suspicion and even hostility, and the IPCC's credibility could be impaired.

UPDATE SIGNATORY LIST ON PROTEST LETTER AGAINST UNEQUAL LIFE EVALUATION BY CLIMATE CHANGE ECONOMISTS IN INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC)

Below is a sign-on letter which GCI has been circulating. Since June, many people and organisations around the world have co-signed this in protest against the actions of some economists now working in the Intergovernmental Panel on Climate Change or IPCC's Working Group Three (WG3) on "Economic and other Cross-Cutting Issues".

These (mostly OECD) economists have now established the following ideas in the drafts of the IPCC's Second Assessment Report (SAR): -

(a) There will a huge number of deaths as a result of human-induced global climate changes.
(b) These need to be given a cash value (a "damage cost").
(c) The cash value of people's lives around the world is different.
(d) This is because of their differing abilities to pay for damage insurance.

Consequently, the lives of people in poor countries should be substantially discounted in the Global Cost/Benefit Analysis (G-CBA) being conducted by IPCC.

The poorer countries have least - or indeed no - responsibility for causing the problems of climate change. They also cover the regions of the globe where most of the associated deaths will occur. They are also the countries now most blamed for "future impacts".

We do not feel that this aspect of the IPCC's analysis is ethically justifiable or politically prudent. We therefore ask you and all your colleagues please to consider becoming co-signatories to the attached letter. Signature collection will also continue until the 1st "Conference of the Parties" (COP) ie the UN Climate Change negotiations in Berlin next March.

"DEFEND THE VALUE OF LIFE"

Please co-sign THIS letter to the Conference of the Parties & the IPCC

"Protecting the world environment requires that development be sustainable.

"Some time ago main-stream economists explicitly set out to capture the sustainable development agenda for the economics profession.

"In this pursuit and with much public money, they invented the technique they call "global cost/benefit analysis" (G-CBA). Global warming and the cost and benefits of climate change are now assessed by them in these monetary terms. And this assessment is being aggressively pushed by the economists in the UN's Inter-governmental Panel on Climate Change (IPCC).

"Part of this exercise, they assert, entails giving cash values to human lives. They accept there are going to be hundreds of thousands of deaths worldwide as a result of global climate changes.

"A recent research paper from the UK-Government-funded C-SERGE, the UK's "Centre for the Social and Economic Research of the Global Environment", (C-SERGE Director David Pearce is also the convening lead author in IPCC on "Social Costs" and has now formally lodged this approach in the IPCC text - and it has survived the peer review) states that the cash value of a "statistical life" in the EC or the USA is $1,500,000 per head, but in ("poorer countries" such as) China it is only $150,000. In G-CBA, this means that, as an economist, you help capture the sustainable development agenda for your profession by discarding a real Chinese life ten times more easily than a real life in the EC or the USA.

"Ironically, these lives are now at risk as a result of damage to the global environment for which citizens in the EC and the USA have been and are at least ten times more responsible per head than citizens in China. There is, of course, a foreign policy cost associated with this since the population of the EC and the USA is outnumbered 10-1 by everyone else.

"The need to value human rights as equal, is prudent as well as perennial."

Aubrey Meyer
Global Commons Institute (GCI)

Tony Cooper
Global Commons Institute (GCI)

Richard Douthwaite
Global Commons Institute (GCI)

Tim Rickman
Global Commons Institute (GCI)

Joy Pagano
Global Commons Institute (GCI)

Dan Davenport
Global Commons Institute (GCI)

Dave Bradney
Global Commons Institute (GCI)

Nigel Dower
Aberdeen University Dept Philos Politics & Int. Relations

Antoine Sendama
Africa Water Network

Sadachari Singh Tomar
Agri Energy and Power Institute Bhopal India

Bruce McFarling
MA Economics (University of Tennessee)

Mustafa Pultar
Prof. Faculty of Art, Design, Architecture, Bilkent University, Ankara, Turkiye

Arthur R Barrit
Associated Labour Unions, Philippines

Peter Kiwummulo
Association of Socio Economic Progress Uganda

Nirmada Das
ASTRA Indian Institute of Science

N Ganguli
ASTRA Indian Institute of Science

S Lokras
ASTRA Indian Institute of Science

U Shrinivasa
ASTRA Indian Institute of Science, Chairman

Victor Anderson
Author Alternative Economic Indicators

Brian Grant
National Party of Canada, Pacific Region

Tom Athanasiou

Sheelagh O'Reilly
Bangor University, Centre for Arid Zone Studies
Research Fellow

Dr. David T. Smernoff
Bay Area Action California

Louise Say
Bradford University Peace Studies

M C Mapako
Biomass User's Network Technical Director

Marielle Savard,
British Columbia University, Canada

Malachi O Orondo
CCDU Kenya Director

Professor Graciela Chichilnisky
Director, Project on Information and Resources Columbia University

Helle Rasmussen
Copenhagen Business School

Leif Bloch Rasmussen,
Copenhagen Business School

Neelam Sethi
Cornell University

Dora Ann Lange Canhos
Base de Dados Tropical Fundacao "Andre' Tosello"
Brazil

Milind Kandlikar
Carnegie Mellon Uni, Dept of Engineering & Public Policy

D Taylor
Centre for Low Input Agriculture, South Africa, Director

Koshy Cherail
Centre for Science and Environment, New Delhi, India

Dr Paul Redfern
Centre for the Study of Global Governance LSE UK

Cynog Dafis
Ceredigion & Pembroke North MP

Caree Simmons,
Drury College

John Hontelez
Chairman Friends of the Earth International

Paul Spray
Christian Aid UK

Stan Jones,
University of Oregon, USA

Dennis Berg,
Environmental Studies, CSU, Fullerton

Christine Harold

Tova Perlmutter

John Mead
Christian Ecology Link

Grace Akumu
Climate Network Africa (Kenya)

MK Pillai
Coir Board India

Art Farley
Computer and Information Science Uni Oregon USA

Per Flensburg
Copenhagen Business School

Helle Rasmussen
Copenhagen Business School

Birgitte Bush
Copenhagen Business School

Leif Bloch Rasmussen,
Copenhagen Business School

Chris Cuomo
Cornell University Science and Technology Studies

Ulrich Loenig
Edinburgh University Centre for Human Ecology - Dir.

Miles Litvinoff
Earthscan Action Handbook Author

Shelley Braithwaite
Earth Action Resource Centre

Jonathon Bevan
Earth Repair Charter

Dan Hinckley
Earthweb Project USA

Dr John Whitelegg
Ecologica Ltd Lancaster UK

Nicholas Hildyard
Ecologist Magazine

Wagaki Mwangi
EcoNews Africa

Adrian Berwert
Environmental Economist Zurich

Eugene P. Coyle
Energy Analyst San Francisco, California

Stephen Law
Environmental Monitoring Group, South Africa

MK Sharma
Educational Media Research Centre, India

K R Baskar
EMRC - MK University Madurai S India

S Rayamarihandan
EMRC - MK University Madurai S India

S Manukandan
EMRC - MK University Madurai S India

N Murthipandi
EMRC - MK University Madurai S India

M Ramkeerthi
EMRC - MK University Madurai S India

John Gowdy,
Professor of Economics, Rensselaer Polytechnic Inst Troy, New York

S V Bajay
Energy Planning Co-Ordinator University of Campinas Brazil

Youba Sokona
Environment and Development in the Third World, IPCC WG3 Lead Author, Mali

Chris Chetsanga
Environment and Remote Sensing Institute, Zimbabwe

Rob Sinclair
Environment Liaison Centre International

Heinz Greijn
Environment Liaison Centre International

Jim Berreen
Environment Speaker Green Party UK

W Fred van Raaij
Erasmus University Rotterdam

Martin Hogan
Essex University

Musiliu O Ashiru
Forestry Research Institute Nigeria

AB Oguntala
Forestry Research Institute Nigeria

Charles Secrett
Friends of the Earth UK Director

John Whiting
Global Commons Trust UK

John Gordon
Global Environmental Research Centre

Iris Marion Young,
Professor Graduate School of Public & International Affairs University of Pittsburgh

Titus Alexander
Stop Global Apartheid

Mike Feinstein
Green Party California

Patrick Samphire
Green Party Colchester

Alan Francis
Green Party Euro-candidate Beds and Milton Keynes

John Morrisey
Green Party Executive UK

Penny Kemp
Green Party Executive UK

Susan Miles
Green Party Executive UK

Penny Shepherd
Green Party Executive UK

John Morris
Green Party Executive UK

Miriam Kennett
Green Party Executive UK

Alex Begg
Green Party Executive UK

Ron Bailey
Green Party Executive UK

Darren Johnson
Green Party Executive UK

Jan Clark
Green Party Executive UK

David Taylor
Green Party Executive UK

Kit Brown
Midlothian Green Party

Ian Morrice
Midlothian Green Party Treasurer Scottish Green Party

Patricia McKenna
Member European Parliament, Comhaontas Glas Eire

Richard Howitt
Member European Parliament Labour Essex South

Nel van Djik
Member European Parliament, Groen Links, Netherlands

Stan Newens
Member European Parliament, London Central

Peter Crampton
Member European Parliament, Humberside, UK

Veronica Hardstaff
Member European Parliament, Lincolnshire & Humberside South, UK

J Poehlmann
Green Party Germany

Jan Bojer Vindheim
Green Party Norway

Peter Doran
Green Party of Northern Ireland Region

Frank de Jong
Green Party of Ontario, leader

Mike Woodin
Green Party Oxford City Council

Mike Woodin
Green Party Oxford City Council

Claes Roxbergh
Green Party Sweden

Gosta Lynga
Green Party Australia

Ian McKenzie
Green Party Australia

Leeza Dobbie
Green Party Australia

Brendan Fuller
Green Party Australia

Karen Alexander
Green Party Australia

Piers Allbrook
Green Party Australia

Fran Thompson
Green Party Australia

Susie Chapman
Green Party Australia

Deb Foskey
Green Party Australia

Malcolm Lewis
Green Party Australia

Loise Crossley
Green Party Australia

Dr Richard Lawson
Health Speaker Green Party UK

Oleg Cazanov
Independent Ecology-Political Movement Russian Fed

Moha Rafi
India

P J Paul
Indian Institute of Science

R Prakas
Indian Institute of Science

K S Jagaduh
Indian Institute of Science

V Guyathu
Indian Institute of Science

M Girish
Indian Institute of Science

K J Dinesh
Indian Institute of Science

Mahesh Natarajan
Indian Institute of Science

Donald Winslow
Indiana University Department of Biology

Phil Ferraro
Institute for Bioregional Studies

Thomas Pattern
Institute of Education London University

Thomas Schulze
Institute for Energy Economics & the Rational Use of Energy University Stuttgart

Dennis Palmini,
Professor of Economics Uni Wisconsin-Stevens Point

Axel Dorscht
Institute for Social Research, Ottawa, Canada

Daphne Wysham
Institute for Policy Studies Washington

V Balu
International Energy Initiative Director Bangalore

M Ramachandran
IREDA New Delhi India, Manager

Andrew Samuels
Jungian Analyst

B R Jagan
Karnataka Power Corporation, India

Peter Newell
Keele University, Dept of international Relations

Atiti Okwambitsa
KENGO Protection Offi cer

Gilbert Arum
Kenya Energy & Environment Organisations

Dominic Walubengo
Kenya Energy & Environment Organizations

M S Ramaprashad
KIEST India

Sarah Hemstock
King's College London

Frank de Jong
Leader Green Party of Ontairo

Melanie Jarman
Llyods and Midland Boycott Campaign

Suchit Nanda
Live Wire BBS Bombay India

Mark Norman
Macclesfield Green Party

R S Rajan
Madras

Piers Stephens
Manchester University Philosophy Department

Mark Thorp
Manchester University Academic Affairs Officer

Harry Lesser
Manchester University Snr Lecturer Philosophy Department

Douglas McArthur
Manchester University Snr Lecturer French Department

Peter Dorman
James Madison College, Michigan State University

Blair Sandler,
Lorax Political Ecology Study Group California USA

Dr. Laura Punnett,
Dept. of Work Environment, Univ. Mass. Lowell, USA

Oduor Ong'wen
Multilateral Development Bank

Manuel Cervantes
National University of Nicargua Managua

Simon Zadek
New Economics Foundation UK

Martin Saning'o
Olkonerei Pastoralist Survival Project Tanzania

Mike Smith
Oxford University Philosophy Dept

Sharad Lele
Pacific Institute Berkeley USA, Doctor

Julio K Prime
Panama

Dr Julian E Salt
Peace Studies Dept University of Bradford

S K Arthikeyan
PMT PVT Ltd

Jon Scott
Prof & Chairman Atmospheric Sc. Univ. at Albany New York

Ian Douglas
Prof School of Geography Manchester University

Ian Ramsey
Rainforest Action Group Scotland

Angie Zelter
Reforest the Earth

Brendan Hill
Reforesting Scotland

Andy Wightman
Reforesting Scotland

Alastair McIntosh
Reforesting Scotland Development Director

Tim Lenton
Robinson College Cambridge University

Jose Nicolas
Rural Enterprise Development Fdn Philippines

M K Raja
Samrat Engineering

Peter Lauchmonen
Sarvodaya Development Organisation, Zimbabwe

Wanda S. Ballentine
Save Our Ozone

Keekok Lee
Snr lecturer Philosophy Department Manchester Uni

N H Ravindranath
Snr Sc Officer Indian Institute of Science

R Marston
Sterling University Dept of Environmental Science Dr

Gerald Leach
Stockholm Environment Institute

Toby Champion
Sussex University

Martin Khor
Director Third World Network

Buhler Reea
Umwelt und Energie, Dorfli

Arnaldo Walter
University of Campinas Brazil

Stan Jones,
University of Oregon, USA

David Barkin
Professor of Economics
Universidad Autonoma Metropolitana Unidad Xochimilco, Mexico City

Chris Tilly
Assoc Professor economist Dept of Policy and Planning
University of Massachusetts

John Barkham
University of East Anglia Snr lecturer Sch of Environment Sc.

Electo Silva Lora
University of Oriente Cuba

Alan Long
VEGA UK

George Monbiot
Visiting lecturer Green College Oxford UK

Ann Heidenreich
World Council of Churches

Tom Wakeford
York University Biology Department UK

Ernst von Weizsacker
Wuppertal Institute President

Mechtild Schmedders
Wuppertal Institute

Christopher Manstein
Wuppertal Institute

Marcus Stewen
Wuppertal Institute/University of Mainz

Nese Yawuz
Wuppertal Institute

Meike Kolsch
Wuppertal Institute

Thomas Merten
Institut Arbeit und Technik

Lorenz Kneser
Wuppertal Institute

Hans Peter Durr
Max Planck Institut fur Physik

Annegret Falter
VDW

Ulrich Albrecht
Freie Universitat Berlin

Andreas Buro
JW Goethe Universitat Frankfurt

Johns Behrmann
Max Planck Institut

Heinrich Schiemann
Pensionene des ZDF

Constanze Eisenbart
VDW

Roland Vogl
Staatshanglenland Brandenburg

Helga Ehlers
Freie Journalisten

HE Gumlich
TU Berlin

Bernd Hamm
Universitat Trier

Olaf Joachim
Universitat Bonn

Ulrich Bartosch
Universitat Regensburg

HJ Fischbeck
EV Akademie Mulheim

Christiane Busch Luty
Universitat der Bundeswehr, Munchen

Charles Levenstein, Ph. D.
Professor of Work Environment Policy University of Massachusetts Lowell

Fotine Fahouris
Member WWF Greece
Robert Rubin
Wolfgang Rehm
VIRUS Vienna

Bernhards Wiebel
Ruhr Universitat, Bochum

Zia van der Veen

Dr Warren Andrew Chang

David Carter

Odette Berger

Andrew Ridell

Peter Alcock

Ian Boote

Graham Reid

Gurinder Shahi

S Iniyan

Patrick Mann
Organic Farmer

Jacqueline Florek,
Issues Specialist, USA

George Silva

Ramona McCoy

Blair Irvine

Nancy Glass

Markku Oksanen

Heikki Patom

Kenneth Scott (USA)

Toni Vidan
Zelewa Arcia Zagreb

Andrea Ersek
Zelewa Arcia Zagreb

Marin Kiriwck
Zelewa Arcia Zagreb

Kristina Markowic
Zelewa Arcia Zagreb

Maja Bogunovic
Zelewa Arcia Zagreb

Eva Kaufmann
VIRUS Vienna

Karl Brandnek
VIRUS Vienna

Ernst Lamar
Endery Vienna

Maria Bayer
Siemensk Vienna

Michaela Hoffman
Siemensk Vienna

Michael F Herder
Vienna

Tomas Cerny
Vienna

Marcus Windhaber
Gymnasium Vienna

Ivoneta Diethart

Bernhard Baumann
Vienna

Evelyn Magletner
Vienna

Angelica Tesak
Vienna

Jet van Hailsma
ASEED Holland

Chrissa Pearson
Prague

Stephanie Howard
Prague

Erika Welge
Kulturne Socialni Centrum Prague

Hellmuth-Christian Stuven
Denmark

Brian Grant

Claire Gilbert
Blazing Tattles

late arrivals

Anand Patwardhan
Department of Engineering and Public Policy
Carnegie Mellon University

Ellen Schmidt
Greenpeace International Climate and Energy Campigner

ORIGINAL GCI CLIMATE STATEMENT AND SIGNATORIES

"We the undersigned acknowledge with concern that climate change through enhanced global warming is a real and growing threat and is caused by the emissions of long-lived greenhouse gases from human activities.

"The IPCC advises that to stabilise atmospheric concentrations requires a reduction of emissions to less than 40% of current levels.

"On average each person in the world contributes 1.65 metric tonnes of carbon and equivalents each year. 40% of this figure ie 0.66 MTCE thus represents each individual's output threshold to forcing future climate change.

"Currently (1990) 53% of the people in the world produce greenhouse gas emissions at or below this threshold figure, and their emissions contribute only 90% of the non-forcing total. They therefore provide the equivalent of a 10% "credit" (subsidy) which is taken up by the rest of the world.

"This inequity is particularly unacceptable at a time when the majority of people are struggling to meet basic human needs. it is also unacceptable as the forcing emissions total is derived largely from unsustainable, luxury-based activities in countries one of whose governments has still refused even the principle of setting targets for CO2 stabilization let alone reduction.

"We believe that all people present and future, should have rights-to-life and sustainable livelihoods which are free from the threat and the reality of human-induced climate disruption.

"We stress that the responsibility for taking corrective action and reducing bad practice lies with those who created and who continue to exacerbate this global crisis. We demand that their response should be immediate and without prevarication, and should take special action over this issue of social inequity."

Ann Clywd
Shadow Minister Overseas Development UK

Sir Richard Body
Conservative MP (UK)

Tony Benn
Labour MP

The Rt Hon Paddy Ashdown
leader of the Liberal Democrats UK

Simon Hughes MP
Lib/Dem Environment Speaker

Charles Kennedy
President of the Liberal Democrat Party UK

Margaret Ewing MP
Leader of the Scottish National Party

Ken Livingstone MP
UK Labour Party

Bryan Gould MP
UK Labour Party Shadow Environment Speaker

Dr David Clark
UK Labour Party Shadow Food and Agriculture Speaker

Clare Short MP
UK Labour Party

Hermann Scheer
Bundestag MP

Michael Meacher
UK Labour Party Shadow Spokesman Social Security

Jim Wallace MP
UK Lib/Dem Party Chief Whip

Sir Russell Johnson
Lib/Dem Speaker on Europe

Lord Bonham Carter
Lib/Dem Speaker on Overseas Development

Lord Stoddart of Swindon (Labour Peer) Former Lord Commissioner for the Treasury and Front Bench Opposition spokesman on Energy in the Lords

Baroness Eward Biggs
opposition spokesman for ODA House of Lords UK

Wilfried Taelkemper
Vice President European Parliament

Dyfdd Wigley MP (Now Lord)
Plaid Cymru

Dyffd Ellis Thomas MP
Plaid Cymru

Rosie Barnes MP
Social Democratic Party

Bowen Wells
Conservative MP

Ken Collins
MEP Chair of European Parliament Environment Committee

James Glynn Ford
Member European Parliament

Kim Howells MP
UK Labour Party

Terry Lewis
UK Labour Party

Joyce Quinn MP
UK Labour Party

Tom Pendry MP
UK Labour Party

Joan Ruddock MP
UK Labour Party

Jeremy Corbyn MP
UK Labour Party

Jim Cousins MP

UK Labour Party

Hemmo Muntingh
Member European Parliament

Paul Lannoye
Member European Parliament

Jon Owen Jones
UK Labour Party

M Watson
UK Labour Party

Joan Lestor
UK Labour Party

R Waring MP
UK Labour Party

Dawn Primarolo MP
UK Labour Party

Anne Campbell
UK Labour Party

Jean Corston MP
UK Labour Party

Alice Mahon MP
UK Labour Party

Kevin Hughes MP
UK Labour Party

Mike Hall MP
UK Labour Party

Andrew Miller MP
UK Labour Party

Dale Campbell Savours MP
UK Labour Party

Ieuan Jones MP
UK Labour Party

Cynog Dafis
Plaid Cymru

South North Development Monitor - SUNS
Fri Mar 24 16:44:36 1995

'Genocidal' economic analysis on climate change

Geneva Mar 23 (Chakravarthi Raghavan) -- The Intergovernmental Panel on Climate Change (IPCC) which with its expertise in an area involving some hard science helped to establish its reputation and credentials to speak for the public interest, seems in danger of
losing its credentials for dialogue as a result of its incursions into the softer science of economics where theories and models and 'facts' come out to suit particular ideologies.

The view appears to be gathering strong among Southern policy makers that it would be impossible to 'dialogue' with groups, claiming pseudo-scientific expertise, to shift the burden on the South.

At issue is the report being prepared on its behalf, in a Working Group III, on the potential economic damages to nations and peoples, as a result of global warming.

Last year, at a workshop in Nairobi, Southern and Northern NGOs joined hands to denounce this working group which they said had been taken over by the OECD economists and their attempts to put "value" on lives of humans across the globe, and on the damages in non-human terms.

In a report yet to be approved by the IPCC and presented as part of its assessment to be given at the end of this year, but with some preliminary views to be conveyed to the first Conference of Parties of the Framework Convention on Climate Change, beginning next week
at Berlin, the economists assumed, in terms of mortality costs, the value of one human life in North America (US and Canada) and the EU to be $1.5 million per head and that in the developing countries of the South at 150,000 per head.

In other words, ten Southern lives are equal to that of one in the North.

The UN's Intergovernmental Negotiating Committee (INC) which had been meeting to prepare for the COP meeting nor the Climate Change secretariat have so far taken note of these officially.

One of the diplomats involved suggested that with the COP and the intergovernmental bodies of the COP envisaging their own scientific panel etc, the IPCC has been trying to find a continuing role, but has allowed itself to be hijacked by these economists whose views
seem to be an echo of the former World Bank Chief economist, and now US Treasury's No 2, Summers, who propounded the view about allowing the export and siting of toxic and dirty industries to the South.

The special working group of the Intergovernmental Panel on Climate Change (IPCC), WG3 on "Economic and other Cross-Cutting Issues", met in Paris this week to put the finishing touches on the analysis which will be submitted at next week's international talks on climate change in Berlin. According to the latest reports, the WG3 is trying to take on the purchasing power parity valuations instead of the exchange rate, but its critics say it does not change their overall criticism.

The IPCC report will be published in August or September as part of the update to the original IPCC report first published in 1990.

"Their analysis amounts to genocidal economics," says Aubrey Meyer of the London-based Global Commons Institute. "The implications of this are that there are too many Bangladeshis and, if they drown, who cares..." says Meyer.

Meyer has prepared, with easy graphics to catch the eye of policy-makers, an analysis of the WG3 approach, and providing a different projection based on a more equitable approach, and this is under study by several of the Environment Ministers from the South.

Meyer also faults the tradable permits approach used by UNCTAD, and faults it for avoiding the 'equity issue' of responsibility for the past and who should cut the consumption and pay.

Some of the Environment ministers from the South are taking a common position to make clear that if this is the approach, it will be difficult for them (or for the COP and the Climate Change secretariat of the future) to engage in a dialogue with the IPCC and its neo-classical economists trying to safeguard the North and its industries against environmental measures to reduce their consumption and spewing of Greenhouse gases, but attempt to shift the burden on to the South.

The GCI has mobilised a letter writing campaign by the NGOs, but has also had discussions with key environment ministers of the South on the dangers of the IPCC-WG3 approach.

The original IPCC report concluded that the planet's surface is warming as a result of the accumulation in the atmosphere of artificial gases, like carbon dioxide and methane, that trap heat from the sun. The scientists estimated that emissions of these gases would have to be cut back by at least 60 percent to reverse this "greenhouse effect".

At the Earth Summit in Rio de Janeiro in 1992, 100 countries signed an agreement to cut back their emissions of greenhouse gases to 1990 levels by the year 2000.

The IPCC economic analysis was commissioned by the Centre for Social and Economic Research of the Global Environment (C-SERGE) to seven economists, including Samuel Fankhauser of Germany, William Cline of the United States and David Pearce of Britain -- who have
adopted an approach conceived in terms of a Global Cost/Benefit analysis (G-CBA).
With this approach, excluding human costs, they estimate the annual global damage costs to be 1.5% to 2.5% of the Gross World Product, if the atmospheric Carbon dioxide (CO2) concentrations reach twice the pre-industrial levels. It then distributes this damage in the proportion of 65% for the OECD countries and 35% for the Rest Of
World (ROW).

As Indian Environment Minister Kamal Nath has pointed out, in a letter he has apparently sent to several of his colleagues from the South, the entire approach overlooks the fact that the current CO2 burdens in the atmosphere is entirely or mainly due to the activities of the industrial countries, since their industrialisation, in their reckless consumption of the 'global commons' and now trying to preserve the status quo by throwing the responsibility on the ROW and in particular the developing countries. Nath has advised his Northern and Southern colleagues that India would have nothing to do with the IPCC-WG3 approach, and that this would vitiate the entire negotiations at the COP.

Meyer points out that the WG3 approach fails to use Purchasing Power Parity (PPP) for comparative assessment of overall damage costs, excluding human life or mortality costs and its "unequally valued" mortality costs associated with global climate change.

He points out that at present the total global damage assessment is an aggregate of all individual country damage assessments converted in US dollars at current market exchange rates. This he says is misleading and would only make sense if the OECD countries intend
to pay for all damages -- a liability not accepted by them.

Hence, in developing countries, the monetary significance of the damage costs, and proportionately in the global account for purposes of international comparative assessment, is substantially under-represented because the amount in question is devalued
through the currency exchange rate system.

Thus, damage to Vietnamese or Bangladeshi food crops are given a lower dollar amount than damages to the same crops in Canada, even though they provide the same nutritional value to human beings.

The burden on the damage to the non-OECD countries, he says, would be more realistically represented if the figures were valued in PPP terms.

By redoing the IPCC (non-mortality) calculations using the PPP terms, the distribution of the damage falls more heavily on the ROW. Instead of the 64% damage for the OECD, estimates on PPP terms reduces it to 44%, while that of ROW goes up from 35% to 56%.

Meyer notes that the IPCC recognises many people will die each year as a result of the global damage and that most of these deaths will be in the developing countries.

In trying to put a cash value on these deaths (as the economists do for the G-CBA exercise), they value people's lives differently because of the disparate income levels of those affected directly.

Lives of people in ROW are valued at one-tenth of value of lives of people in the wealthy countries. Each life in the US or Europe is valued at $1.5 million, while that in the South is put at $150,000.

This approach itself, Meyer says, is controversial and compromises the IPCC approach.

The poorer nations of the South have had no responsibility for causing the CO2 and GHG overloads of the atmosphere and causing global climate change.

Many argue that the poor countries of the South, with their low-energy consumption, are now providing an environmental subsidy to the energy-intensive rich countries.

But the largest number of the climate change related deaths will be in the poor countries.

Recalculating the WG3 figures on the PPP basis, Meyer says that the OECD damages total fall from 65% to 38% of the total and the ROW damages rise from 35% to 62% of the total.

The global annual damages rise above the IPCC-WG3 figure by $275 billion annually -- or by 72%.

The contentious nature of the unequal life-evaluation has resulted in a sign-on campaign against the IPCC and its WG3 since last June, with many professionals from the North and the South including many IPCC lead authors becoming co-signatories, says Meyer.

If changes for both equal life evaluation and PPP are made together, the overall level of damage costs of global warming rise substantially and the distribution of this falls much more heavily on the ROW than the original IPCC approach says Meyer.

The global annual damages rise above the IPCC original figure by $339 billion or 89%. The ROW damage rises from 35% to 70% of the total while that of the OECD falls from 65% to 30% of the total. The IPCC's total damages of 2% of the Gross world product rises to
3.2% when these revaluations are performed.

Proponents like Fankhauser say the critics have misunderstood the logic of his argument. "Economists do not value lives. What they do estimate is people's appreciation of a risk-free environment. It has nothing to do with the worth of life as such," he wrote recently in a reply to the Ecologist article.

But Daphne Wysham of the Washington-based Institute for Policy Studies says that the 300,000-person death toll fails to take account of possible increased starvation due to global warming- induced crop failure. A total of between 135 and 900 million people could die as a result of global warming by the year 2030, she estimates. Most of the victims will be in the Third World.

"(Fankhauser's) figure is an extrapolation of U.S. Environmental Protection Agency data -- which apply only to the United States and tend to regard phenomena like heat-induced death and hurricane casualties as the major kinds of mortality," Wysham says in the Ecologist, a British magazine.

Fankhauser says he was criticised for using different values for goods in different countries, but the values used by him were in fact identical, in the sense that they were identical fractions of income. "But to use absolute values would completely disregard observed facts. Chinese are not willing to sacrifice ten times as much for environmental goods as Europeans," he argues.

But Meyer says that this is missing one of the most important aspects of global warming. "It is the industrialisation of Europe and America that has created the accumulation of greenhouse gases. But the people who will suffer are those in the poor countries."

Also, it is fine for an European, after having achieved a level of living, to begin looking to improve the quality on environmental goods, while in the Third World nations the food and basic needs are the first "environmental goods" needed, if properly understood.

Meyer notes that the argument of the rich "is the most sickening form of self-fulfilling prophecy. They are saying, in effect, that since those who created the problem, gained more wealth, they have more rights to determine who dies," he said.

INDIA REJECTS ECONOMICS OF U.N. CLIMATE CHANGE PANEL

by Jaya Dayal

UNITED NATIONS, Mar 24 (IPS) - India's environment minister has repudiated the findings of a U.N.-convened panel of economists on climate change as biased against developing countries.

In a letter made available to IPS Friday, India's Minister for Environment and Forests, Kamal Nath, faults the "absurd and discriminatory global cost/benefit analysis procedures propounded by economists in the work of IPCC Working Group Three."

The two-page letter was sent to environment ministers and senior government officials of more than 10 industrialised countries including Australia, Britain, Canada, France, Germany, Japan, Russia, Sweden and the United States.

In addition, the letter was sent to more than 16 developing countries including Brazil, China, Egypt, Indonesia, Kenya, Malaysia and Singapore.

The Intergovernmental Panel on Climate Change (IPCC), a U.N. body responsible for co-ordinating scientific and economic efforts to stem the effects of global warming, is due to publish its Second Assessment Report (SAR) later this year.

IPCC Working Group Three has been asked to provide economic analysis for policy formulation at the first Conference of Parties (CoP) to the 1992 Climate Change convention slated for Berlin beginning next Tuesday.

The approach adopted by the economists in this group has been conceived in terms of global cost/benefit analysis (G-CBA). Using this approach, the group estimates that if atmospheric carbon dioxide concentrations increase to double pre-industrial levels,
annual damage costs will be 1.5 to 2.5 percent of gross world product.

The group estimates that the distribution of these damages between the wealthy, industrialised Organisation for Economic Co-operation and Development (OECD) nations and the rest of the world will be OECD, 65 percent, and the rest, 35 percent.

But according to the London-based Global Commons Institute (GCI), a non-governmental organisation monitoring the working group, the G-CBA rests on shaky and discriminatory ground.

Key among the faulty assumptions used by the working group, says GCI, is the differing values applied to the lives of human beings in the South and the North.

In his letter, Nath says "the scale of bias which underpins the technical assessment intended to provide the basis for policy discussions at the CoP can be gauged from the proposed unequally valued mortality costs associated with global climate change."

GCI director Aubrey Meyer explains that the working group has assigned a cash value of 1.5 million dollars per human life in the industrialised North against 150,000 dollars in the developing South.

"In global cost/benefit analysis, this means that you discard a Chinese life 10 times more easily than a life in the European Community or the United States," he said.

GCI figures that if the working group's numbers are
recalculated using the 1.5 million dollar value for all deaths, OECD damages fall from 65 to 38 percent of the total while ROW damages rise from 35 to 62 percent.

"We unequivocally reject the theory that the monetary value of people's lives around the world is different" Nath says in his letter. "We feel that this level of misdirection must be purged from the negotiation process."

So contentious is the question of unequal life-valuation that a protest against it started last June. Since then many economists, environmentalists and development professionals in the South and the North have signed on.

Nath argues in the letter that any basis for dealing with the costs of climate change should not be formed along the current lines of "unequal rights by income," but "equal rights per capita."

"Developing countries have no -- or indeed negative --
responsibility for causing global climate change," he states.

"The implications of faulty economic assumptions are
manifold," Nath warns, adding, until "they are corrected to reflect a true and just position, then and only then would any talk of joint implementation and adequacy of commitments become meaningful."

At the final round of talks here before next week's meeting in Berlin, industrialised countries -- under pressure from their fossil-fuel and energy industries -- attempted to shift the burden of climate change by pushing joint implementation schemes.

These schemes, the European Union and United States argue, would provide cost-effective opportunities for rich countries to limit their greenhouse gas emissions by financing projects in other nations.

Joint implementation projects would be financed by
industrialised countries or their big businesses. In exchange, these countries would receive credits for fulfilling their commitments under the convention.

But some developing countries argue that the industrialised countries' rush towards joint implementation projects is a simply a way to divert attention from politically difficult economic
decisions at home.

Nath noted that the early discussions on joint implementation in February "reveal increasing differences of opinion about the resolve of developed countries to meet even their existing commitments under the convention."

Geneva 25 Mar (TWN/Chakravarthi Raghavan) --

India has expressed its concern over the biased and discriminatory Global Cost/Benefit Analysis procedures of the IPCC economists and its use as a basis for policy discussions at the Conference of Parties (CoP) of the UN Framework Convention on Climate Change (FCCC)
opening in Berlin on Monday.

In letters to other Environment Ministers, developed and
developing, the Indian Environment Minister Kamal Nath has said that the bias imported into the discussions by the WG3 approach must be "purged, and the distributional issue of unequal-rights-by-income versus equal-rights-per-capita must be resolved to enable fruitful discussions at the CoP about possible protocols to the Convention, proportionality of commitments and financial mechanisms."

The letter to the Environment Ministers of the developed countries cautions them of a situation developing (as a result of the WG3 approach) that would make further "dialogue directionless".

His letter to the G77 Ministers has stressed the need for them to adequate co-ordinate their positions at the CoP.

The Berlin meeting is the first Conference of Parties on the UN Framework Convention on Climate Change and is to review the Adequacy of the Commitments under the Convention.

It has before it a proposal on behalf of the Association of Small Island States (AOSIS) for a protocol to cut back the Greenhouse Gas, and in particular Carbon di Oxide (CO2) emissions.

This proposed protocol called for Annex A parties to undertake the cutbacks, but some recent proposals or amendments to this are said to call for obligations by some of the major and more populous developing countries.

In the FCCC, and at the Rio Earth Summit, the Annex A Parties to the Convention undertook to provide national assessment reports, which are to be reviewed and assessed about their adequacy. Separately, at other fora, the ICs have taken a general commitment to return their emissions in 2000 to the levels of 1990. But the national reports from these countries suggest that several would
not achieve even these.

The IPCC in preliminary views and assessments provided to the Intergovernmental Negotiating Group (INC) which has been preparing for the CoP-1 show that even the return to 1990 levels would not be enough to mitigate the adverse effects of Climate Change and there has to be some sizeable cutbacks.

The Annex A Parties which accepted at Rio, and in the framing of the Convention, their major responsibility for the present situation and need to cutback have since been doing some backsliding, and under the concept of Joint Implementation and other proposals, are trying to shift some, if not a major portion of the responsibility to some of the major Third World economies, like China, India, and a few others -- with low per capita GHG and CO2 emissions, but in absolute terms would be increasing their
emissions as they industrialise and develop.

The OECD dominated neo-classical economists in the IPCC-WG3 (on Economic and other Cross-Cutting Issues) have been trying to provide a scientific basis for this shifting of responsibilities, by a so-called economic assessment of the damages to the OECD economies and the Rest of the World (ROW).

Kamal Nath's letter to his fellow Ministers from the South and North is in relation to this.
In his letter referring to the crucial unresolved issues, Kamal Nath has expressed India's serious concern that no "significant progress" has been at all made towards stabilising, leave alone reduction of atmospheric concentrations of greenhouse gases, "despite the lofty commitments made at Rio".

"On the contrary, decisive scientific evidence continues to disturb us with serious warnings about where the global community is now headed," Kamal Nath says.

"The inconclusive discussions (at the INC) about Joint
Implementation and Adequacy of Commitments reveal increasing differences of opinion about the resolve of developed countries to meet even their existing commitments under the Convention. In my judgement, the present impasse became inevitable when the alleged

cost-effectiveness of Joint Implementation was sought to be based on absurd and discriminatory Global Cost/Benefit Analysis procedures propounded by economists in the work of the IPCC Working Group III (IPCC-WG3).

"The scale of bias which underpins the technical assessment intended to provide the basis for policy discussions at the CoP can be gauged from the proposed unequally valued mortality costs associated with global climate changes, and the avoidance of using the Purchasing Power Parity system of overall damage costs. These are by no means the only issues about which we feel concerned, but they are pertinently representative examples".

(According to the latest reports from Paris, the authors of the WG3 report, at their final meeting last week, appear to have accepted the need for making assessments using the PPP rather than the market exchange rates as they had done. However this is only one aspect of a bias they are now trying to correct, and does not meet the fundamental objections to the WG3 approach, namely, its ignoring the equity issues and the past historical responsibilities of the OECD economies for the damages caused by them to the global environment and their responsibility to undertake the remedial measures.)

In his letter, Kamal Nath continues: "We unequivocally reject the theory that the monetary value of people's lives around the world is different because the value imputed should be proportional to the disparate income levels of the potential victims concerned. Developing countries have no -- or indeed negative -- responsibility for causing global climate change. Yet they are being blamed for possible future impacts, although historical impacts by industrialised economies are being regarded as water-under-the-bridge, or 'sunk-costs' in the jargon of these biased economists.

"To compound the problem, global damage assessments are being expressed in US dollar equivalent. Thus the monetary significance of the damages to developing countries is substantially under-represented. The damages caused to human beings, whether in developed or developing countries must be treated equally and cannot be translated in terms of currency exchange rate systems.

"Faced with this," the Indian Minister continues, "we feel that this level of misdirection must be purged from the negotiating process. The distributional issue of unequal-rights-by-income versus equal-rights-per-capital must be resolved to enable fruitful discussions about possible protocols to the Convention, proportionality of commitments and financial mechanisms."

"This is of immediate concern to us with regard to the AOSIS proposal," Kamal Nath continues. "We are wholly sympathetic to it and we would like to support it, along with all Parties to the Convention, since it is clearly aimed at the global common good. But there are attempts to modify the AOSIS proposal to an extent where it contradicts the very essence of the Rio Consensus and nullifies the spirit in which developing countries entered into negotiations to frame the Climate Change Convention. We strongly reject any suggestion of encumbering developing countries with obligations under Protocols, that they do not have under the Convention.

"The implications of faulty economic assumptions are manifold. when they are corrected to reflect a true and just position, and only then, would any talk of Joint Implementation and Adequacy of Commitments become meaningful," says Kamal Nath. "It is impossible for us to accept that which is not ethically justifiable, technically accurate or politically conducive to the interests of poor people as well as the global common good".

In an appeal to the developed country Environment Ministers, Kamal Nath says: "I am sure that you appreciate these issues which are causing India and several other developing countries much concern. We do not want to be driven to a situation wherein dialogue itself becomes directionless. The Rio process gave rise to several environmental Conventions. If the logic now being propounded in relation to Climate Change, also enters the interpretation of the other Conventions, we will have reversed all the gains of Rio -- the chief of which was a universal recognition of the principles of equity, and the inalienable right of all human beings to the fruits of development and 'environmental space' on an equitable basis."

INFORMATION CONCERNING GLOBAL COMMONS INSTITUTE (GCI)

a) - What is GCI?

The Global Commons Institute (GCI) is an independent group of people, mostly based in the UK. GCI's aims are the protection of the Global Commons. The group is currently working on the economic and political aspects of global climate change.

GCI was founded in 1990 after the Second World Climate Conference, and has been an officially recognised and highly active participant in the Intergovernmental Panel on Climate Change (IPCC) and Intergovernmental Negotiating Committee for a Framework Convention on Climate Change (INC-FCCC) processes.

b) - What is GCI's current Mission?

The pursuit of economic growth and extended private property arrangements is now global in scale and intent and is driving the global community over thresholds of global ecological stability. GCI exists to explore and explain this. It also seeks to assist the counter-process - namely, finding effective and equitable arrangements for scaling down these socio-economic and industrial impacts on the global commons.

In this general context, GCI specifically focuses attention on; -

- the risk that current economic and industrial practices, may cause an irreversible enhancement of the greenhouse effect
- how the skewed distribution of the benefits of the practices, aggravates tensions between over-development and under-development in both North and South
- how the political consequences of this skewed distribution will themselves aggravate adverse global environmental consequences
- what actions are necessary to reduce these risks and how they could be equitably and lastingly shared by nations and by people.

c) - Acknowledgements regarding external support for GCI's Operations

GCI's contribution to the Intergovernmental Panel on Climate Change (IPCC) and the INC/COP has been possible as a result of voluntary donations from several concerned private and unaffiliated individuals, to whom we express our appreciation.

We also express our appreciation to the IPCC Bureau for their efforts to organise the IPCC's "*Second Assessment Report* (SAR) and their invitation to GCI to formally present ideas in that context.

Recommendations for GCI

African Centre for Technology Studies - Kenya

"You raise very interesting, challenging and controversial issues in the dilemma of the Framework Convention on Climate Change. The way you address "Global Benefit" is impressive. I agree with you that the concept - as understood by the financial lending institutions - is neither exhaustive nor participatory. The effort you make to generate some statistics is very appealing. With no doubt the points you raise on institutional reform and equity are important and require serious attention. Institutional frameworks of the IMF and OECD among others need to be counter-checked in order to conform to the commitments of the Convention. Will you make a presentation to ACTS in Nairobi?"

Patrick Karani, -
Climate and Africa Project
African Centre for Technology Studies (ACTS)
Nairobi

African National Congress - South Africa

"We thank you for your information about the GCI campaign. We are eagerly following your work and find the information very useful. A new democratic South Africa will be keenly interested in environmental issues and we are confident that your institute will play an important role in assisting us to deal with environmental issues in South Africa and internationally. Please continue to keep us informed about your activities."

Aziz Pahad, - Deputy Head ANC Department of International Affairs.

Air and Waste Management Association - USA

"On behalf of the Conference Organising Committee, we are pleased to inform you that your abstract has been accepted for platform presentation at the Global Climate Change Conference - Science and Policy Implications - in Phoenix April 1994. In response to the 'call for papers' we received over 200 very good abstracts which made the selection process very difficult which in turn, has enabled us to arrange an exciting technical conference programme."

C V Mathai, -
Air and Waste Management Association Conference Committee.

Bariloche Foundation - Argentina

"I would like to congratulate you for the (Benefit/Disbenefit) research done and for its wide distribution. I would ask you to send us, as soon as possible, the complete version of your work."

Carlos E Suarez, -
Institute of Energy Economics, Lead Author on IPCC WG3 Second Assessment Report.

Biomass User's Network - King's College UK

"I recommend the Global Commons Institute as lead authors in the IPCC working group 3. I have been very impressed by the quality of GCI's work in developing comprehensive methodologies for conducting "benefit/disbenefit analysis", which seems the most appropriate first step in the development of genuinely sustainable solutions and policy formulation."

Dr Frank Rosillo Calle, - Biomass User's Network, King's College.

C-SERGE - UK

"GCI hi-jacked the conference. As result of their interventions, we ended up discussing things we otherwise would not have had to discuss."

David Pearce, - Director C-SERGE about GCI impact on first meeting of IPCC Working Group Three in Montreal."

Canadian Club of Rome

"Congratulations on your excellent letter to Guardian weekly. I wish you well as you urge global action."

Dr J Rennie Whitehead, - Canadian Club of Rome.

Climate Network Africa - Kenya

"Your intervention made it worth my coming here (UN climate negotiations). Thank God someone is calling a spade a spade."

Grace Akumu, - Co-Ordinator Climate Network Africa.

Commonwealth Human Ecology Council - UK

"Congratulations."

Zena Daysh, Executive Vice Chairman of Commonwealth Human Ecology Council (CHEC), acknowledging the influence of the GCI analysis and the success of the GCI strategy at the Partnerships for Change Conference Manchester. (The UK Government's conference had just supported a call for the GCI crafted CHEC statement to be adopted by the main conference).

Earth Council - Costa Rica

"I sincerely hope that we can stay in close contact and explore avenues of co-operation. The three documents you sent are particularly relevant for us in the design of the Earth Report. The information of "global benefit and disbenefit" and related themes for eg offers a very useful analytical approach as well as the trends of global industrial CO2 impact, GDP income and efficiency. The GCI abstract for the US Global Climate Conference offers a very interesting methodological framework for a systematic analysis. We would very much appreciate if you could continue providing these very useful documents and information on the trends of sustainable development."

Alicia Barcena - Executive Director Earth Council, Costa Rica.

Embassy of Western Samoa - Belgium

"Congratulations on your success co-organising the Commonwealth Partnerships Conference. I am truly stunned by the extent to which GCI's ideas were incorporated into the conference statements. Your analysis is clear, rigorous and very useful to us. We want to keep in touch with you."

H E Ambassador Afamasaga Toleafoa, - Ambassador of W Samoa to the EC.

Environment Ministry - India

"I had occasion to discuss with the Global Commons Institute, various important issues related to Climate Change and the Montreal Protocol during my visits abroad. Their outspoken views and in-depth knowledge in economic nalysis of the issues relating to equity, costs, benefits, disbenefits would go a long way in bringing out these important aspects in clear terms. Such analysis projected in the IPCC reports would certainly help the conference of the parties in arriving at an objective decision. I strongly recommend their names as lead authors for working group 3. I also will support any funding proposal they may care to submit.

Mr. Kamal Nath, - Chairman, Montreal Protocol Treaty negotiations, Indian Environment Minister.

Environment Ministry of Hungary

"You GCI people are very brave."

Tibor Farago Ministry of Environment Hungary, - at the IPCC, Working Group 3

European School - Belgium

"I feel that it is worth a concerted effort to finance the Global Commons Institute. GCI makes an important contribution balancing the key players from business, industry and government."

Jane Knott, - European School Brussels

Indira Gandhi Institute - India

"Thank you very much for keeping me informed about your work. Its nice to have your support in this battle."

Dr (Mrs) Jyoti Parikh, -
Lead Author on IPCC WG3 Second Assessment Report - Indira Gandhi Institute.

IPCC Bureau - Geneva

"We would like to invite you (to the IPCC Workshop on Equity and Social Considerations - Nairobi, 18/23 7 94) to make a presentation entitled 'Unequal Use of the Global Commons: Consumption Patterns as Causal Factors in Global Change'. We know that with your widely recognised expertise in this field, you would make an important contribution to the work of the IPCC. It is very much hoped that you will respond positively to this invitation"

Bert Bolin, Chair - Intergovernmental Panel on Climate Change (IPCC)
James P Bruce and Hoesung Lee Co-Chairs - IPCC Working Group Three (WG3)

IPCC Working Group Three - Geneva

"While it is our normal practice is to encourage authors of relevant articles to contact lead authors directly, I have asked the IPCC WG3 Technical Support Unit to send the GCI "Global Benefit/Disbenefit" paper to the WG3 lead authors. It does present the data on CO2 emissions, in relation to economic and demographic factors in an interesting way, that further reinforces the work of WG3 lead authors Parikh, Goldemburg Reddy and Mintzer."

James P Bruce: -
Co-Chair IPCC Working Group Three (WG3)

Joint International Monetary Fund/World Bank Library - USA

"Please may we order the full 'Equity and Survival' series of GCI publications."

Korea Institute for Human Settlements - Korea

"It was a great pleasure to receive your paper - "Equity and Survival - Who provides global benefit; who causes global disbenefit?" This paper will be very useful for my section."

Sung Woong Hong, - Korea Research Institute for Human Settlements.
Lead Author on IPCC WG3 Second Assessment Report.

Malaysian Embassy - UK

"We intend to disseminate the information in your booklet as widely as possible."

Riza Selahettin, - Malaysian High Commissioner's Office, London.

Movement for Compassionate Living - UK

"I feel your work could make a significant difference to our chances of survival, in view of the environmental crisis."

Kathleen Jannaway, - Movement for Compassionate Living, Surrey UK

Network Foundation for Social Change - UK

"We're very pleased your organisation is around doing what it is doing. Its a very interesting approach you are taking. We are very pleased to support you financially."

Network Foundation for Social Change.
.

OECD Environment Directorate - Paris

"Your intervention here was braveand not the sort of thing we are used to hearing here. I agreed with everything you said."

Gerard Dorin, - Head Administrator of the OECD Environment Directorate,
at the OECD "Economics of Global Climate Change Conference"

OECD Resources Allocation - Paris

"GCI should be very pleased with the influence they have already had on the economists at IPCC's Working Group 3."

Peter Sturm, - OECD Economist, Head of Division "Resource Allocation"

Organization for Latin American Energy Users - Ecuador

"Your texts are excellent reference sources for orienting the Latin American and Caribbean region's policies and strategies. We would appreciate you keeping us informed about your publications, database and other important initiatives in this area of mutual interest, and wish you continuing success in your work"

Gabriel Sierra, - Executive Secretary, Organization Latin American Energy Users.

Oyani Christian Rural Services - Kenya

"We formally request a copy of your publication "Equity and Survival - Climate Change, Population and the Paradox of Growth." This document is vital to this agency as a resource material on our awareness education on climate change and population growth - matters which globally affect mankind. Please will you inform us on all your priority areas and provide any relevant documentation. May God bless you in your service to his people."

Rev Peter A Indalo, - Programme Director, Oyani Christian Rural Services, Kenya.

Peace Studies - University of Bradford UK

"A quite excellent analysis and superb graphics. I'm impressed yet again by the concise way in which you tackle the subject in hand. I only hope it has the same impact on the UN Climate negotiations!"

Dr Julian Salt, - Department of Peace Studies. University of Bradford.

Saudi Arabian Delegation for IPCC WG3

"With regard to the intervention by the Global Commons Institute, my delegation wishes to support every word of what they have just said."

Mohammed S al Sabban, - Head of Saudi Arabian Delegation to the IPCC - concerning the GCI rebuttal of the case made by the World Bank representative for measuring the incremental costs for protecting the global environment.

Scientists for Global Responsibility - Cambridge UK

"Thank you for the GCI materials. They are both useful and interesting. I am hoping you can speak at the Second "Science for the Earth" forum in Cambridge. Your perspective on the role played by economists in addressing global environmental problems would be interesting. We like the questions you pose."

Tim Lenton, - Scientists for Global Responsibility.

"GCI are the best campaigners for non-industrialised people that we know."

Tom Wakeford, - Scientists for Global Responsibility.

South Centre - Geneva

"The paper on climate change, population and growth is most interesting. It will be very useful for our future work on post-UNCED strategies for the South."

Branislav Gosovic, - Director, the South Centre

TATA Energy Research Institute - India

“I did hear from the Intergovernmental Panel on Climate Change Working Group Three secretariat about your paper on “Global Benefit”. I think you should be very pleased at the response, because you have very effectively made the point that you intended.”

Dr R K Pachauri, - Director TATA Energy Research Institute, India.
Lead Author on IPCC WG3 Second Assessment Report.

The ECOLOGIST - UK

"We strongly recommend to you the Global Commons Institute as lead authors for your report on the socio-economic framework for decision-taking concerning the economics of climate change. GCI includes a network of authors who are both literate and numerate in this debate. They have been involved with these matters at the UN and beyond over several years. They have built up a considerable reputation doing cross-cutting socio economic analysis. This has had a clear focus on benefits and disbenefits and who it is who provide these and who suffer these. This effort has been successfully challenging short-sighted economic theory still typical of the pro-growth lobby in the industrial countries. GCI has successfully been providing a focus for those who express a more globally responsible view. Support for their work is considerable and widespread."

Nicholas Hildyard and Larry Lohman, - the Ecologist Magazine.

UNESCO Catalunya - Spain

"We are very pleased to endorse the Global Commons Institute as lead authors for the IPCC working group 3 workplan."

Dr Felix Marti and Dr Josep Puig, -
UNESCO Catalunya and Grace Akumu, Co-Ordinator Climate Network Africa.

University of East Anglia - UK

"Your papers are a real treasure. I enjoyed the graphs enormously."

Prof. Tim O'Riordan, - University of East Anglia Environmental Sciences Department and Associate Director CSERGE.

University of Nigeria

"You are so well-informed, so coherent, so intellectually challenging, so honest and so effective; - if only we had more people like you doing what you are doing."

Chris Ugwu, - University of Nigeria
at the UK Partnerships for Change Conference, Manchester.

Wuppertal Institute - Germany

"The Global Commons Institute is one of the few places in the world giving the necessary emphasis to a radical questioning of short-sighted economic theory. GCI's approach is rational and compassionate. Their voice must be heard & should be further elaborated in the international debate on global warming & other global ecological challenges. Their papers are stimulating. The characterisation of countries' socio-economic efficiencies particularly, is quite original. It would be highly desirable to have them on board for future work on equity in the IPCC context."

Dr Ernst von Weizacker, - Director Wuppertal Institute for Energy, Climate and Transport, Germany.

WWF-UK

"The principles of international equity that are embodied in sustainable development require that the industrialised countries recognise the global impact of their consumption patterns, and provide development opportunities for poorer countries. Recent papers provided new perspectives on the importance of the international dimension . The Global Commons Institute have highlighted the accumulated debt in terms of over-use of the atmosphere, and calculated an estimated debt value that vastly exceeds the financial debt owed by the South."

Barry Coates, - Policy Development
WWF-UK - to UK Climate Action Network Conference on Transport & Global Warming

I have read several times GCI's submission to IPCC WG3. I have always been sympathetic to per-capita emissions allocation, but have never seen such a clear and persuasive explanation of why such an allocation is needed both for ethical and practical reasons. Also, I liked very much your point that climate policy analysts should make explicit the ethical positions and values inherent in their work. So much of the debate on tradable emissions quotas and JI avoids the crucial issue of allocation.

I also agree with you that the Climate Action Network should discuss this issue more.

My group is participating in a newly formed network of East Asian NGOs (Atmosphere Action Network for East Asia (AANEA)) working on atmospheric issues. I want everyone in this network to read your paper, because we as a network need to develop a common position on the issue of equity, and your paper is the best base for discussions I know.

Dwight Van Winkle,
Citizens Alliance for Saving the Atmosphere (CASA),Osaka, Japan

Atmosphere Action Network for East Asia (AANEA)
A new network for regional cooperation

Current AANEA member organisations:

China:	Friends of Nature
Hong Kong:	The Conservancy Association
	Hong Kong Environment Centre
Japan:	Citizens Alliance for Saving the Atmosphere and the Earth (CASA)
	Japan Acid Rain Monitoring Network
	The Japan Air Pollution Victims Association
	Peoples Forum 2001, Global Warming Study Group
Mongolia:	Mongolian Association for Conservation of Nature and Environment (MANCE)
Russia:	Geographical Society
	The Wildlife Foundation
South Korea:	Center for Environment and Development, Citizens Coalition for Economic Justice (CCEJ)
	Green Korea
	Korean Federation of Environmental Movements
Taiwan:	Climate Action Network Taiwan
	Taiwan Environmental Protection Union

"We offer great thanks for coming to the Fourth IRNES (Interdisciplinary Research Network on Environment and Society) Conference and delivering such a stimulating and powerful talk. Your presentation was the highlight of the whole conference in terms of its clarity, directness and passionate delivery. I really think you made people think that evening. GCI could not have a more eloquent and dedicated advocate than yourself."

Peter Newell
Co-Organiser IRNES conference 1995.

A Recalculation of the Social Costs of Climate Change

Aubrey Meyer and Tony Cooper
Global Commons Institute (GCI)[a]
September 1995

Acknowledgements

The authors gratefully acknowledge the assistance of many people in the production of this article: Curtis Bohlen, John Adams, Chakravarthi Raghavan, Ian Douglas, Helena Paul, Peter Bunyard, Colin Price, Richard Douthwaite, Titus Alexander, Jim Berreen, Paul Ekins and Bill Hare and Alan McGowen. In addition Sam Fankhauser and Richard Tol sent us extensive comments on an earlier draft, which were also very useful. Responsibility for the contents however, rests solely with the authors

BACKGROUND

If governments agree to slow the pace of global warming during the next decade, it will largely be due to the efforts of the Intergovernmental Panel on Climate Change (IPCC). The IPCC was established in 1988 by the United Nations Environment Programme (UNEP) and the World Meteorological Organisation (WMO) to assess the science of climate change in order to provide a basis for international and national policy-making The IPPC's First Assessment Report (1990) defined cuts in greenhouse gas emissions of between 60% and 80% as immediately necessary to stabilise greenhouse gas concentrations in the atmosphere with a view to halting global warming.

Since 1990 the IPCC has been preparing a Second Assessment Report (SAR) which it hopes to publish by the end of this year. The report is authored by three working groups.

- Working Group I is reviewing the science of how the earth's climate system functions and how this might change as a result of human activities.

- Working Group II is assessing published work on the health and other effects of climate change and on the measures which could be adopted in sectors such as agriculture, energy production, industry and transportation to minimise those effects.

- Working Group III is preparing a technical assessment of the state of knowledge of the *"socio-economics of climate change mitigation"* and *"other cross-cutting issues"*, a phrase which was intended to signal a full sociological assessment of the issues at hand.

Working Groups I and II are well advanced with their reports, drafts of which have been circulated for comment in academic circles and in part on the Internet. There have been no major disagreements about these drafts' content and conclusions. The draft report by Working Group III (WG3), however, ran into severe criticism when its section on the "Social Costs" of climate change was discussed at a WG3 meeting in Geneva in July 1995.

In this paper we outline the concerns raised about WG3's social costs assessment and recalculate those social costs in the light of these criticisms.

[a] The Global Commons Institute (GCI), 42 Windsor Road, London NW2 5DS, UK.
Ph: +44(0)181 451 0778. Fx: +44(0)181 830 2366. e-mail: saveforests@gn.apc.org
GCI is an independent group of people, mostly based in the UK. GCI's aim is the protection of the Global Commons. The group is currently working on the economic and political aspects of global climate change.

A FLAWED REPORT

The difficulties of placing a monetary value on the damage which is likely to be caused by global warming are legion. The costs are long-term, highly uncertain and in some cases unknowable in advance, even in principle. For many types of damage such as species extinction, the assignment of a monetary value makes little sense, and some economists go part way to acknowledging this by distinguishing between 'tangible' and 'intangible' costs.

In spite of this, the WG3 team for the "Social Costs" of climate change attempted to put a cost figure on the damage global warming might do, basing their estimates largely the work of Fankhauser[1] and Tol,[2] - both members of the group - who built on earlier work by two other members of the group - Cline[3] and Pearce[4] - together with that by Nordhaus[5] and Titus.[6]

The team's summary assessment of the global damages consequent on climate change is that monetary losses will equal to 1.5% to 2% of Gross World Product (GWP).[b] This is an estimate for a single, unspecified, year - the year when CO_2 equivalent[c] concentrations will have doubled. They assume that this doubling will happen in around 2050 or 2060.[d]

The team also make the following assumptions: -

1. the global economy will have progressed from the present to the year 2050 on a "business-as-usual" path;
2. global mean temperature will have risen by the "mean" figure of 2.5°C by that year,
3. it is useful to give policy-makers a "snap-shot" of that single year's damages, ie one divorced from a cumulative assessment of damages for the period between the present and 2050.

This figure of 1.5% to 2% of GWP is significantly lower than that reached by some other analysts - most notably Hohmeyer and Gaertner in their 1992 report to the European Union.[7] Their study estimated *accumulated* damage costs of potentially $900 trillion by 2030; that is, well beyond 100% of GWP by that year and therefore up to two orders of magnitude greater than the figures reported in the WG3 draft.

WG3 also estimated regional damage costs as being equivalent to 1% to 1.5% of GNP in OECD countries and between 2% and 9% of GNP in countries outside the OECD. These regional losses were derived exclusively from the work of Fankhauser and Tol.

In our view, both the global and regional ranges of damage figures currently drafted in WG3 contain errors, are unjustified and should be replaced. Using Fankhauser's raw damage figures as the starting point for developing our arguments, we conclude that the expected extent of global damage for the year 2050 as a result of warming is highly uncertain but probably lies in a range between 12% and 130% of GWP. Within this, for the OECD region, the range is from 0.6% to 17% of Gross Regional Product (GRP), while for the Rest of World (RoW) (those countries outside the OECD) it is from 25% to 250% of GRP. This represents *accumulated* losses between 1990 and 2050 of between $50 and $600 trillion. We consider even these estimates are on the low side, as we have made many conservative assumptions and made only very limited allowance for surprises.

To address the range of temperatures which may plausibly obtain in 2050, we have made assumptions about how damage costs vary with temperature change. Clearly such variation will not be *linear* and we have assumed an S-shaped relationship, so that costs rise very slowly with the first increment of temperature change and approach a limiting value at temperature rises above 30°C. We do not consider that the present state of knowledge justifies building a more complex model. Details are given in Appendix A.

---

[b] "Gross World Product" (GWP) is defined as the market value of all the goods and services sold throughout the world.

[c] "equivalent" means other greenhouse gases counted as well, but with their global warming effect converted to "CO_2 equivalence" - see IPCC WG1, the 1990 Assessment Report.

[d] For the sake of being definite, we focus on the specific year 2050 - see later for a more detailed rationale.

A PRELIMINARY SUMMARY OF CONTESTED ASSUMPTIONS

The gulf between our figures and those in WG3's current draft report can be explained in large part by our having employed different assumptions and methods to those used by WG3. The areas of dispute are summarised below and then in more detail in subsequent sections.

1 - "Willingness To Pay" versus "Willingness To Accept Compensation"

WG3 assumes "Willingness-To-Pay" (WTP) as an acceptable method of assessing damages costs. We argue that "Willingness-To-Accept Compensation" (WTAC) is a more sensible method.

2 - 2050 equals CO_2 doubling?

WG3 compute damages for the single year of CO_2 doubling, that is the year in which global mean temperatures will be 2.5°C higher than pre-industrial. We argue that it is most useful to policy makers to focus the assessment on a particular year and the period leading up to that year. This is more useful than focusing on the "moving target" of when CO_2 doubling may or may not occur. We suggest that 2050 should be used, a date within the range expected by the IPCC. However, we also argue that by 2050, various factors may well have increased CO2 and equivalent greenhouse gas concentrations in the atmosphere to more than double the pre-industrial levels and that global mean temperature is consequently likely to be higher than the stated 2.5°C.

3 - IPCC must not publish wrong arithmetic

WG3 authors calculated regional GNP losses by dividing damages corrected for "Purchasing Power Parity" (PPP) by GDP figures which have not be corrected for PPP. We argue that this procedure is arithmetically wrong and also now seen to be wrong. Even in terms of the authors' own assumptions, it seriously misrepresents the proportional damages *in* and *between* different regions of the world. Results based on this procedure must not be published by the IPCC, and regional losses must be recalculated using sound methods.

4 - No "climate sensitivity", "feedbacks" or "uncertainties" allowed for in stated bottom-line result for damages

WG3 assumes that neither "climate sensitivity",[e] "feedbacks" or other uncertainties need be portrayed in its bottom-line results. We argue that the IPCC WG3 must reflect the full range of "uncertainties" and "sensitivity" in the bottom-line figures it publishes in its final report, and in its Summary for Policy-Makers (SPM).

5 - Uncertainties should not equal zero

WG3 also assumes that in key areas where there are uncertainties over the complexity of imminent warming factors (such as positive feedbacks and sulphate aerosol removal) these can be given a value of zero in the assessed damages. We argue that they must be represented by numbers greater than zero.

6 - Significant damage categories should not be omitted

Deaths due to malaria and malnutrition have unrealistically been omitted from the WG3 draft assessment. We argue that these must be assessed and included in the report.

What follows sets out these arguments in more detail.

[e] "Climate Sensitivity" is he IPCC's 1990 range of temperature outcomes at 'CO_2 doubling' ie 1.5°C to 4.5°C, with a 'best-guess' mean of 2.5°C. But a number of "positive feedbacks" - while mentioned in this report - were omitted from the numerical assessments of temperature rise and climate sensitivity.

1 - "WILLINGNESS-TO-PAY" VERSUS "WILLINGNESS-TO-ACCEPT COMPENSATION"

Working Group Three's damage estimates are based on the "Willingness-To-Pay" (WTP) method of assessing damage costs. WTP leads to discriminatory differential estimates in cost rates between the OECD and the rest of the world, most notably differential estimates of the value of a "statistical life".
It would have been more correct to use the "Willingness-To-Accept Compensation" (WTAC) method.

"Willingness to Accept Compensation" is regarded as the "*conceptually correct*"[8] procedure in Cost-Benefit Analysis - that is, it assesses costs in terms of what losers are willing to accept as compensation for any inflicted disbenefit. Willingness to Pay (WTP) is appropriate only for benefits. By describing potential payments for the avoidance of climate-change damage costs as "benefits", the WG3 authors give dubious plausibility to the use of WTP. In reality, however, there will be in a broad view no benefits from climate change, only different kinds of costs or disbenefits borne by different groups of people.[f]

WTA naturally results in very much higher damage costs than WTP, since the amount that people are willing to accept as compensation for major losses is not constrained by their income and - most people being poor - is many times greater than what they are willing and able to pay to prevent undesirable impacts on their lives. The use of WTP also leads naturally to the adoption of *differential* 'statistical' life evaluation, sometimes known as "Values of Statistical Lives" (VOSLs). This has been the subject of much heated debate. We state here our position.

Valuing Life and Statistical Lives

There is an extensive literature on whether it is admissible to give human life a monetary value, and, if admissible, what value life has. Some reject the idea out of hand. Nonetheless, in certain industries, it has become an accepted management tool. A good overview from the perspective of the oil industry can be found in Fleishman[9] who concludes that a valuation in the range of £500,000 to £5 million is appropriate (approximately $750,000 to $7.5 million).

The concept of "statistical" life has been introduced into the debate *not* because person A is being asked how much he or she is willing to pay or to accept for himself/herself or for person B to be definitely killed, but because of attempts to place a value on how to much to pay or accept for a relatively low probability - normally less than 1% - of any particular individual being killed. To do this, one essentially values the life at, say, $1.5 million, and multiplies by the (low) probability of an individual dying as well as by the total population size involved. If the probability of an individual being killed reaches a sufficiently high level, the whole process of valuation is rejected and the life is effectively regarded as having infinite value. According to Fleishman, there is little agreement as to how great a risk is acceptable in this sense, because it all depends on society's perception of the value of the risk-creating activity.

Major problems arise when one life is valued at more than another,[10] as is done by Fankhauser and Tol. Following Hohmeyer and Gaertner, we argue that no differentiation by nationality, race or gender should be adopted, on grounds both of straight forward ethics and of practical international politics. This is regardless of whether the life is "statistical" or not. If differential values arise logically from a theory such as WTP, that merely demonstrates the inapplicability of the theory.

The ethical argument suggests a method of valuation based on how much someone is willing to pay can only be used as an input to some kind of averaging process. The highest value we might consider is Tol's OECD value of $3 million, the lowest Fankhauser's world average of $350,000. Advocates of differential statistical life evaluation seem to think that because the risk of death is being costed rather than the certainty of death, the equity argument is nullified. We disagree strongly. In addition, using WTP, they find a single global value unrealistic. Thinking in terms of WTA, however, makes such a value quite plausible, provided that an OECD-derived value is used.[11] Following Fankhauser, we use $1.5 million.

Differential discount rates by region have also been advanced to make the "present value" - that is, the "discounted" value of future lives - different. This too is unethical and unacceptable. The "present value" of a Chinese life in 2050 must be treated as the same as the "present value" of an American life in 2050.

[f] This is not to deny that some areas may benefit from a more benign local climate, but such effects are minor in the regional and global view.

Parity-Unit-Damage-Valuation (PUDV)

If one accepts the equal life valuation argument above, the next step is to extend the same principle to the rates for valuing all the other kinds of damage costs. In the Hohmeyer and Gaertner analysis, this was done explicitly for agricultural land values and implicitly for most other impacts. The case for doing so is presented below. While we feel the case is strong, it admittedly lacks the absolutely imperative character of equal life valuation. It can be justified prescriptively or descriptively.

Prescriptive Justification

For every identified cause of damage, a lower figure is given by Fankhauser for the impact on the Third World. To take but one example: the loss of a hectare of Chinese wetland is assessed as bearing a cost of just 10% of that of an OECD hectare. One of the stated reasons for differentiation, in this case, is the assigning of a much higher value to the loss of recreational use in the OECD than in the South. We find this ethically indefensible. Once wetland has gone, it has probably gone for many decades or centuries, if not for ever. Why should the future Chinese be assumed not to need wetlands as much as future Americans, whether for recreation or for livelihoods? Clearly from an ethical standpoint, one country's hectare of wetland should be treated as worth the same as any other country's, and similarly for all the other damage categories. (We list the categories in Appendix C).

This leads to the question of whether to value all hectares of wetland, and other resources at risk, at a rate calculated on the basis of first-world damage costs, or on some global average basis. We argue that the former could be considered the appropriate basis on the following grounds:

1. Working to a WTA-based assessment could be expected to give results much nearer to the OECD norms than to the values assumed by Fankhauser.

2. Costs assessed for the First World are more easily available than those for the Third World, because of the wider availability of statistical data. This is apparent in Fankhauser's book, where there are extensive references to academic costing estimates of First World damages, but very few of Third World ones

3. The differences within the areas OECD and Less Developed Countries (LDCs) - even within Fankhauser's breakdown of each of these into 3 sub-regions - are of the same order of magnitude as those between them. There are many groups outside the OECD, probably numbering some hundreds of millions of people in total, who are at or above the median OECD standard of living. The OECD excludes the entire Pacific rim, excepting Japan. And within the OECD itself, there is probably even greater diversity, with both large countries (e.g. Turkey) and large groups of the people (e.g. southern Italians, Native Americans) probably living at a standard not far from the Third World mean.

4. The damage in question is mostly being caused by past and present First World consumption patterns, so use of First World compensation rates is appropriate.[12]

Descriptive Justification

Fankhauser uses a methodology which effectively assumes that in the year 2050 the international breakdown of world GWP will be the same as it was in 1988. By definition, this means that the existing average income disparity between the OECD and the LDCs will remain unaltered. Others, including Nordhaus[13] and Greenpeace,[14] posit a significant degree of income convergence between the OECD and the LDCs. Such convergence is also a widely-shared policy goal. On this latter view, damage valuation, even on a WTP basis, would likewise converge and adoption of the current OECD values as a world average for 2050 becomes more plausible.

2 - 2050 EQUALS CO2-DOUBLING?

Fankhauser's damage costs are calculated for a single year - which could be 2050 or 2060 - when it is assumed that the levels of CO_2 and equivalents will have doubled in the atmosphere and global mean temperature will be 2.5°C above pre-industrial. Using this date as a reference point, he then expresses the damages in 1988 monetary values, thus giving a "snapshot" of potential future damage costs due to global warming for one year only.

"The time of CO_2 doubling" has become an accepted benchmark for discussions in the climate-change field; apparently for reasons of ease of computation and comparison. However, this approach *de*-emphasises those factors, both natural and anthropogenic, that might well speed up or retard the time of doubling. It also diverts the focus of attention from the much more serious longer-term hazards, as was noted by Cline.[15]

The IPCC in its reference scenarios IS92 a,b,e and f forecast dates of doubling between 2050 and 2075.[16] Fankhauser has assumed that the instant of doubling would probably be around 2050 to 2060; Cline and Hohmeyer and Gaertner assumed around 2030. The latest results from the Hadley Centre[17] forecast a 0.2°C (approximately) per decade rise in temperature, reaching 1.8°C above pre-industrial levels by 2050, the end date of their published charts. Extrapolating from these figures would suggest 2085 as the date by which CO_2 levels will have doubled, with 2.5°C the most likely temperature rise due to CO_2 doubling. However the Hadley Centre forecasts that doubling will be reached at 2050 assuming there is no further increase in sulphur emissions.

These sulphur emissions come mainly from power stations, and we suggest that it is only prudent to make the stronger assumption that they decrease, rather than merely fail to increase. There are already international agreements to cut back on these emissions to check acid rain, and such action is quite likely to intensify. We suggest therefore, that it as advisable for climate change impact planning to expect that the existing aerosol cooling effect will in fact be further reduced.

Thus the fashion for concentrating on a time of CO_2 doubling of about 2050 or 2060 seriously misleads the debate. On current trends, there is a real risk that CO_2 concentrations may double much earlier. With rigorous policy measures, CO_2 doubling could perhaps be avoided.

To face this very considerable policy challenge of averting climate change, what policy makers need to know is not just the range of best-guess damage estimates for the year of CO_2 doubling from a group of Cost/Benefit Analysts. What policy makers need to know is what the range of *accumulated* damage is that is likely to occur across a firmly defined period of time. In other words, 2050 is only a suitable calendar reference point for policy makers, if the intention is to assess damages up to and including that point, recognising the non-linearity of climate change in its evolution to this point (and beyond) and the consequently vast unpredictability of damages within this time-frame.

The present "snap-shot" of 1.5% to 2.0% of GWP possibly being adopted into the Social Costs chapter of IPCC WG3 is spuriously precise and more generally, raises questions about the appropriateness of cost-benefit-analysis (CBA) as a policy tool for making decisions about climate change (see below).

3 - WRONG ARITHMETIC

The distribution of the cost estimates between the OECD and the rest of the world is unsound. Crucially, the method adopted by Fankhauser and Tol for calculating these estimates expressed as percents of GDP likely to occur in the LDCs, is based on what we and many others see as a basic arithmetical error. This error has a substantial influence on the present distributional results in the Social Costs assessment.

Because the Gross National Product (GDP) of individual countries is measured in the country's own currency, international comparisons require the use of a set of conversion factors. The set used universally, until very recently, was the Trading Exchange Rates (TERs).[g] This rates an Indian rupee at the number of dollars that it can buy on the *international* money exchanges. However, the TER typically fails to reflect, by a wide margin, the *local* purchasing power of that rupee.

For an average basket of goods and services, the bulk of which are produced locally, most LDC currencies are worth double the TER values. Some are worth five times more. So in the last few years tables have been

[g] our terminology.

published and adopted by among others the World Bank and the IMF giving Purchasing Power Parity (PPP) values for countries' currencies and for their GDPs.

These tables were perhaps not available to Nordhaus, Titus and Cline when they did their pioneering costings of climate change some years ago. They were, however, available to WG3 and, according to Fankhauser, Tol and Pearce, the damage costs - at least for the LDCs - are indeed corrected for PPP.

The arithmetic mistake then arises when PPP-corrected damage costs for the non-OECD countries are divided by their uncorrected TER GDP totals to deduce the percentage of GRP losses which are quoted. Although we have been told that this is the procedure adopted, it is nowhere explained in the text, though there is a footnote now in Summary for Policy-Makers (SPM) which refers to this. The effect of the erroneous arithmetic is to give quotable LDC damage percentages of GRP up to five times higher than they should have been. This gives a false credibility to the WTP-based assessment where in the figures currently quoted in the draft in billions of dollars are $180 for the OECD and $89 for the Rest of World (ROW). When the arithmetic is done correctly, the LDC percentage losses as a whole are approximately halved.[h] In our judgement it would be wholly inappropriate for IPCC to agree to the publication - in its name - of data which is derived from a method which is known - and admitted - to be wrong.[i]

4 - CLIMATE SENSITIVITY, AEROSOLS AND FEEDBACKS

Some potential positive feedback effects (including several identified by another IPCC working group, Working Group I - see Appendix C) were not taken into account in the literature reviewed by WG3, largely because they were not represented in most or all of the climate models. We argue that an allowance for the feedback mechanisms identified in WG1 must be made. In addition, the effects of removing certain pollutants from the atmosphere must also be taken into account. For example, an additional warming effect will occur if human-made sulphate aerosols are no longer present in the atmosphere in their present concentrations as a result of necessary efforts to curtail acid rain. Sulphate aerosols have a cooling effect and thus represent latent, committed warming, which will become actual very quickly once they are removed from the atmosphere. The effect of these aerosols is now being built into global circulation models; but this was not done in sufficient detail in the earlier models on which Fankhauser's and the others' cost estimates were based, because the WG1 report[18] quantifying the effect was only published recently. This could also bring forward the time of CO_2 and equivalent doubling.

Also, the uncertainty described by IPCC Working Group 1 for the temperature rise to be expected from a given CO_2 increase - normally referred to as the “climate sensitivity” - is seriously underplayed in the

---

[h] Just how big a difference the erroneous calculation can make is shown by the following example. Dr Fankhauser, calculated the damage likely to be done by global warming in China at CO_2 doubling expressed in 1988 local purchasing power terms as $16,700,000,000 which he (and the chapter) said are equivalent to 4.7% GDP losses. China's GDP in 1988 was $356,359,000,000 at current international exchange rates but $2,431,222,000,000 in terms of domestic purchasing power. In other words, if both damage and GDP are both expressed in domestic purchasing power, (the correct procedure) the losses are only 0.7% of China's 1988 GDP. Our estimates of LDC damages are summarised in Table A and are vastly higher.

[i] Before the Geneva meeting, GCI asked the IPCC Bureau that the error be acknowledged and that the authors correct it. The authors refused to do this, and still refuse. However, after the Geneva meeting in a posting to ecol-econ (the internet conference where much of this has been debated), Dr Tol (one of the economists who authored the mistake) made the following comment. *"The PPP correction reflects a slip in the literature which amazingly survived many reviews, including the IPCC's."* But he went on to say, *"IPCC cannot correct the literature, but in the present wording the slip is clear for all to see."*
GCI asserts that: 1. We are talking about a major error, not a slip. 2. It is not clear for all to see with or without the footnote. 3. The data in question is exclusively in the IPCC-assessed literature of the three authors Tol, Fankhauser and Pearce who are also lead authors for the IPCC: it is therefore completely within their power to correct. 4. It is not IPCC's role to knowingly reproduce wrong data of any kind.
Paul Ekins (economist at Birkbeck College) comments as follows. *"Of course, you can divide anything you like by anything you like . . . . . The question is what you then call the resulting ratio. If you divide PPP damage by non-PPP GDP, then you get 'PPP damages per unit of non-PPP GDP'. This does not seem to me to pass his test of a sensible ratio. What you do not get is a percentage damage, which is the ratio I would have thought one was looking for, and the one which is most often quoted."*

present WG3 results. *The crucial summaries and tables ignore it.* In addition, there are many other significant sources of uncertainty - indeed every factor under consideration is uncertain. Nonetheless, the costings are presented as point estimates, with no quantifiable indication by error bars, confidence intervals or otherwise of the range of uncertainty that accompanies them, although the text stresses the uncertainty *qualitatively*. It is stressed in the text of the SAR that the estimate of 1.5% to 2.0% of GWP is not an *uncertainty* estimate but simply a *range*, comprising the "best guesses" of the various authors. *This distinction is likely to be lost on many readers and policymakers.*

5 - FOCUS ON UNCERTAINTY

Every aspect of potential climate change impacts is beset with uncertainty. We feel it is of the greatest importance to represent this adequately within any summary results. There are different types of uncertainty, which can be classified as follows:

a. Uncertainty about base conditions:

For example, economic growth rates; CO_2, SOx and other emissions; population growth rates. In our own analysis we assume that economic growth and CO_2 emissions follow a trajectory along the lines of the IPCC's IS92a scenario. CO_2 emissions are very closely linked to economic growth, as so much economic activity is dependent on fossil fuels. However, sulphur emissions come from point sources and are therefore separately controllable. And we consider it is now important to explicitly take account of that, independently of IS92a.

b. Uncertainty about how much emitted CO_2 stays in the atmosphere.

There is no guarantee current carbon sinks will continue to absorb, as they do now, about half of worldwide CO_2 emissions. There is also great uncertainty about sources, sinks and atmospheric concentration changes in the minor greenhouse gases such as methane and nitrous oxide. We do not address these points here, though there is certainly scope for unpleasant surprises.

c. Uncertainty about the impact of increased CO_2

There is uncertainty about the impact of increased CO_2 (and other greenhouse gas) concentrations in the atmosphere on the climate. This is the climate sensitivity, identified by the IPCC in 1990 and confirmed by their 1992 and 1994 reports. It is the proposition that the global average warming to be expected from CO_2 and equivalent doubling is most likely to be 2.5°C, but might be between 1.5°C and 4.5°C.

d. Uncertainty greater about the impact of sulphate emissions on the climate.

Since the effects of sulphate emissions are localised, they are much harder for climatologists to model. Only recently, in 1995 publications by the Hadley research Centre and others, have they have been quantified in any useful way.

e. Positive Feedback.

Several positive feedback mechanisms are likely to exist which could mean that, once temperatures begin to rise, factors will come into play beyond those which have been explicitly modelled and this will cause temperature to rise faster than the GCMs (General Circulation Models) predict. These factors bring forward in time the expected instant of CO_2 doubling and therefore bring forward the time of the expected temperature rise or damages. And they do increase the damages we should expect at our chosen time of 2050, and the damages to be expected per tonne of emitted CO_2. Just because they are not well understood or quantified does not mean that the positive feedbacks should be ignored, as the almost universal focus on costs at the time of doubling has ensured.[j]

f. Damage Costs.

Finally, there is uncertainty in the magnitude of each of the damage categories identified by Fankhauser. Most significantly, the damage costs are extremely sensitive to the surmised death

[j] There are similarly possible negative feedbacks, but the biggest of these, the carbon fertilisation effect, is allowed for in most or all GCMs.

rate, which has been predicted largely on the basis of a study by Kalkstein[19] into the effects of a 4°C rise on the inhabitants of fifteen US cities, and a series of extrapolations.

We combine these uncertainties using simple statistical methods, also explained in Appendix A. The main effect of the excessive simplicity in our statistics is likely to be to lead us to state incorrectly low combined uncertainty values, due to the assumptions of independence which we make.

6 - ADDITIONAL DAMAGE CATEGORIES

Fankhauser does not assume that the dozen or so damage categories he uses (see Appendix C) are a reliable guide to all the untoward impacts of climate change. Nevertheless that is how his work and that of WG3 may well be interpreted. Many areas of expected damage are omitted - i.e. costed at zero - due to inadequate knowledge. For example, he only costs deaths due to heat stress and storms, not to disease or other indirect effects, though the text of Chapter 6 of the SAR asserts that indirect health effects *"could far exceed direct effects"*. The very considerable *"costs of acclimatisation"* are not obviously quantified even though they are identified. In particular cost estimates were given in 1992 by Hohmeyer and Gaertner for the increased incidence of malnutrition and of malaria which far exceeded the direct costs.

As reported in *New Scientist* (13th May 1995), recent research by scientists at the Tropical Vegetation Monitoring Unit of the European Commission's Joint Research Centre at Ispra, Italy strongly supports the view that malaria will spread far beyond its present range. Widespread debilitation and increased mortality would result across much of the densely inhabited northern temperate zones whose populations have no natural immunity.

Hohmeyer and Gaertner have suggested 10 million extra cases of malaria worldwide by the time of doubling, (which they expect in 2030). We translate this to be a rate of 500,000 extra cases per year. In the absence of evidence to hand, we split this between the OECD and the LDCs in proportion to their population. Hopefully better estimates will become available shortly. To estimate a suitable WTA-based cost, we asked a small sample of UK citizens unconnected with GCI or other environmental group what lump-sum compensation they would be willing to accept for the increased risk of malaria and received replies ranging from £5,000 to £1,000,000, with the most often chosen value being £50,000 and the median somewhat higher. To be conservative, we have used the figure of £50,000 (i.e. $75,000). At 5% of the value ascribed to a life this seems consistent. In addition, Hohmeyer and Gaertner suggest 0.5% mortality is likely (of the 10 million total cases, not of the 500,000 annual increase), that is another 50,000 deaths per year.

Another extra cost which we feel it is important to incorporate is an estimate of the cost of forced migration to the migrant. Tol does include such a cost in his work - at a rate of three times the migrant's average annual income - but Fankhauser does not, costing migration only insofar as it induces costs in the host nation. We use a rather smaller figure than for malaria, $50,000 or 3% of the value of a life. This is approximately consistent with Tol for OECD countries.

Finally we add in the largest cost identified by Hohmeyer and Gaertner - death through malnutrition, a factor not quantified by Fankhauser. Hohmeyer and Gaertner forecast at least 10 million deaths per year - a very high number but only a doubling, according to them, of the present level. Remaining conservative, we use half this figure as our best guess, so that the high end of our forecast range will be their figure of 10 million.

We do not claim that these extra damage categories are all -- there will be others which are even harder to quantify or have simply not been thought of: remember that no-one forecast polar ozone holes when the debate on CFCs and ozone depletion was starting. So this means that our estimate, like all others, is more of a lower bound than a forecast.

OUR QUANTITATIVE CONCLUSIONS

Our re-analysis of data on costs is set out in Table A. We show the effect of our differing assumptions on Fankhauser's costings in a series of stages, represented by the columns of the table. We also show the costs in PPP (1988) US dollars and as a proportion of Gross Regional Product (GRP)[k] and of Gross World Product (GWP).[l]

Column F of Table A gives our estimates of damage costs, which range up to over 130% of GWP, many times higher than the costs estimated by Fankhauser. The discrepancy results from the extra cost categories (based largely on Hohmeyer and Gaertner's work) which we have taken into account, in particular malnutrition-related deaths. Even if these deaths are not incorporated into the calculations, however, our damage costs range up to 37% of GWP (see Column E). For the LDC region, high-end costs go up to over 250% of GRP reflecting the high impact of deaths costed at OECD rates. At the low end of our overall uncertainty range, on the other hand, global costs could be as little as 1.3% of GWP without the allowance for malnutrition-related deaths or 12.5% with it.

TABLE A - Cost Estimates on different bases

			A	B	C	D	E	F
$(1988) Billions	OECD	low		$32	$55	$55	$55	$72
		medium	$181	$181	$325	$325	$325	$387
		high		$1,100	$1,741	$1,741	$1,741	$1,916
	LDCs	low		$16	$27	$58	$221	$2,365
		medium	$89	$89	$160	$514	$1,217	$10,830
		high		$546	$868	$3,724	$6,098	$25,614
	WORLD	low		$48	$82	$114	$276	$2,437
		medium	$270	$270	$485	$838	$1,542	$11,217
		high		$1,646	$2,609	$5,465	$7,839	$27,530
%s Regional (PPP) GNP	OECD	low		0.3	0.5	0.5	0.5	0.6
		medium	1.6	1.6	2.9	2.9	2.9	3
		high		10	15	15	15	17
	LDCs	low		0.2	0.3	0.6	2.3	24
		medium	0.9	0.9	1.6	5	12	111
		high		6	9	38	63	263
	WORLD	low		0.2	0.4	0.5	1.3	12
		medium	1.3	1.3	2.3	4.0	7	53
		high		8	12	26	37	131
%s Global (PPP) GNP	OECD	low		0.2	0.3	0.3	0.3	0.3
		medium	0.9	0.9	1.5	1.5	1.5	2
		high		5.2	8	8	8	9
	LDCs	low		0.1	0.1	0.3	1.0	11
		medium	0.4	0.4	0.8	2.4	6	51
		high		2.6	4	18	29	122
	WORLD	low		0.2	0.4	0.5	1.3	12
		medium	1.3	1.3	2.3	4	7	53
		high		8	12	26	37	131

A	Fankhauser
B	plus allowance for IPCC climate sensitivity
C	plus allowance for feedbacks and sulphur emission reductions
D	plus allowance for VOSLs @OECD value
E	plus allowance for parity-unit-damage-valuation at OECD values
F	plus allowance for GCI estimates for malaria and migration costs

CBA AND CLIMATE CHANGE

The critique we have made in this paper raises wider questions about he validity of using CBA and related techniques as tools for policy making. When WG3 was restructured in 1992, its terms of reference were broad, stressing the need for the assessment to be set in the context of "Sustainable Development" and even to take account of the "cross-cutting economic and other issues".

[k] Corrected for Purchasing Power Parity (PPP).

[l] Corrected for Purchasing Power Parity (PPP).

The bulk of the work of WG3 since then has however, been carried out by economists with relatively little input from other disciplines. Thus little attention is paid to the 'other issues'.

As events unfolded, the original proposal broad discussion in WG3 "Assessing the Benefits of Responses to Climate Change" was transformed into an overwhelmingly market-valuation based assessment of global GDP losses, following the earlier work of Nordhaus, Cline, Pearce, Titus, Tol and Fankhauser.

Indeed, much of WG3's effort has been in practice an attempt to apply the technique of Cost-Benefit Analysis (CBA). CBA works very well in microeconomic decision-making, and comes naturally to economists and businessmen, but is generally very unsuitable in national and international affairs. It has not featured, for example, in the fairly successful negotiations, starting at Montreal, on ozone depletion and CFCs. CBA methods are inevitably biased towards the rich, and there is a well-documented history of conflict aggravation (rather than resolution) between winners and losers assessed with it. An excellent summary of this is given by Adams.[20] Here we summarise some of the major problems with CBA, particularly with regard to the climate debate.

1. The whole exercise of "global costing" assumes that varying - and often contradictory - values can be commensurated along a single monetary yardstick. In reality, there are still many social groups in the world (living in both monetarised and non-monetarised societies) who would reject, and in practice at present do their best to reject, attempts to value the environment and ways of living in monetary terms. Using WTP in such cases is meaningless. Likewise, to use WTAC properly involves asking them to assimilate and properly comprehend a completely different culture. Why should they have to? Indeed, "Global Cost Benefit Analysis" is attempting an impossible task. Even WTP cannot be reliably estimated in practice. In actual interview situations it is normal for 30% or more of people to refuse to reply to WTP questions or to register 'protest' answers. And of those who do reply, the values will differ hugely. WTAC values for potential climate change damage can only be assigned by (normally OECD-based) "experts" rather than the people who are supposed to be willing to accept compensation.

2. CBA neatly side-steps questions of liability for past activity, an area of potential conflict in climate change negotiations which cannot be ducked. In the WG3 negotiations LDC representatives from India and elsewhere have continually stressed the fundamental importance of understanding the effect of disparate global consumption patterns on the causation of and response to climate change, and of integrating these into the assessments being undertaken.

3. CBA focuses attention solely on what is measurably marketable, rather than what is most important to people in their daily lives, and side-steps the key issue of who decides what is valuable and how it should be valued. It thus attempts to de-politicise what is a deeply political debate.

4. CBA leads generally to unrealistically confident, unsafe and dangerous conclusions. In the case of the IPCC process, it has led WG3 to the contested conclusion that by the time CO2 concentrations have doubled in 2050 or whenever, we will experience between 1.5% -2.0% GDP-losses per annum globally.

If not CBA, then what? The techniques of multicriteria analysis (MCA) and decision analysis, mentioned in the text of the SAR but ignored in the conclusions, might help. MCA however in practice usually, and as described in the SAR, ends up by combining the different criteria into a single weighted value, and so seems essentially equivalent to CBA. Tol uses Decision Analysis,[21] but his use of advanced statistical techniques but the conclusions of this part of his work do not appear to be reflected in the SAR. Funtowicz and Ravetz[22] call for ethics-based methods that do not rely on monetary valuations. Adams says, and we agree, that *'We are stuck with the messy and protracted process of argument, discussion, negotiation and compromise. The skills in shortest supply are not economic, but scientific and diplomatic'*. In effect, CBA needs to be abandoned. Instead we need to revert to old-fashioned, if difficult, political negotiations based on a proper use of the precautionary principle and on a realistic assessment of a range of possible futures .

APPENDIX A - STATISTICAL ANALYSIS

We bring together here the quantitative derivation of the numerical results presented in the main text. The principal matter is the addressing of uncertainty.

Firstly we address the various factors influencing the mean global temperature expected in 2050. Our starting point is a business-as-usual future broadly in line with IPCC's IS92a scenario, but with 50% reduction in anthropogenic sulphur emissions from power stations.

We assume the climate sensitivity range of 1.5°C to 4.5°C can be treated as a 95% confidence interval. We focus first on a number of different kinds of feedback that have been identified by the IPCC and others, but not taken account of in climate models, such as the co-feedback with stratospheric ozone and Antarctic plankton depletion. The feedback mechanisms are listed in Appendix B below. Being feedbacks, these effects are inherently nonlinear. We have taken a simple approach of assuming that the combined effect of the feedbacks induces an increase in the temperature, above that taken from the GCMs, which is proportional to a power function of the temperature rise since pre-industrial. i.e. we assume that:

$$\Delta\Delta T = k(\Delta T)^r.$$

where $\Delta\Delta T$ is the extra temperature increase due to the feedbacks and k and r are parameters. We choose r=1.3 to give a modest acceleration of the feedback effect as the temperature rises and we choose k so that a 10% extra temperature rise at ΔT=2.5°C is triggered. This approach amounts to a perturbation of the GCMs and only makes sense for small values of $\Delta\Delta T/\Delta T$, and it assumes that meaningful results can be obtained by small perturbations to a GCM. It results in a temperature range for 2050 of 1.5º to 5.0º, with a central estimate of 2.75º. Note that this amounts to saying that CO_2 doubling is likely to occur rather earlier than 2050 given the influence of these feedbacks.

At this stage we add in the aerosol effect. The WG1 view is that sulphate/biomass aerosols now contribute a cooling effect that is substantial though highly uncertain in magnitude. The Hadley Centre's latest forecast[23] suggests that a 0.7°C extra cooling, globally averaged, can be expected by 2050 given the extra amount of sulphur emissions expected under the IS92a scenario. WG1 also stress that the aerosol cooling cannot simply be considered as a partial countereffect to greenhouse-gas warming, as the aerosols are concentrated over industrial zones. We are unable to take account of this uneven global distribution, but since the magnitude of the effect is so uncertain, this need not affect our somewhat crude calculations.

We have suggested that it is prudent build policy on the basis that, principally due to measures to address acid rain damage, but also to a lesser extent due to general pollution avoidance measures, aerosol emissions will decline drastically, rather than increase. IPCC94 figures suggest that this is capable of producing a warming pulse of up to 0.5°C; and the effect would be immediate as aerosols, unlike most greenhouse gases, have a very short residence time in the atmosphere (measured in days rather than years). We take as our best estimate of the temperature increase due to the atmospheric aerosol decline by 2050 to be half of the maximum possible, i.e. 0.25°C, and estimate the uncertainty by assuming that we are 97.5% certain that this figure is positive, and that it is independent of the GCM/feedback range of 1.5ºC to 5.0Cº. The overall effect is to produce a best-estimate temperature rise of 3.0°C at 2050, with an uncertainty range from 1.8°C to 5.3°C.

If sulphate emissions, rather than being reduced, are in fact increased as assumed in IS92a, then the expected rise is much lower. But the extra rise of 1ºC or more is then latent, and will happen relatively quickly if or when sulphate emissions are eventually reduced.

Temperature/damage relationship

At this stage we need an estimate for this relationship. It appears to be generally agreed that the relationship is not linear, and in practice of course it would be extremely complex, with a different structure for each different kind of damage. Tol [3] has produced such an estimate. What we seek to do here is to give a crude, simple, apparently new but hopefully transparent approach, by looking at how damages would hypothetically grow for temperature increase ranging from the few °C expected in 2050 up to several tens of degrees. Using such a method avoids having to input arbitrarily the very significant exponent in a power-law relationship.

We have built a number of simple models to assess possible damage effects of different temperature rises under the different damage cost evaluation cases that we address. These are of the form:-

$\text{Damage}=(\text{Limiting value})(1-\exp(-a\Delta T))^b$ -- where a and b are positive constants, b>1.

This class of equations has the property of yielding 0 damages for ΔT (temperature rise above pre-industrial)=0, zero rate of change of damages at $\Delta T=0$, of being S-shaped, and having the damages rise towards a limiting value representing near-total destruction of society as the temperature increases to very high levels.

For the range of cases we consider, the results are similar to a simple power-law relationship for the temperature damage function with an exponent varying between 1.5 and 3.5. This is a steeper increase than that considered by Cline or Tol, though within the range discussed by Fankhauser and Pearce [18].

We have done this exercise separately for the OECD and the LDCs, for the several models of costing described above. For the limiting value we have used the sum of gross regional product, (PPP version) and an estimate of the annual increment in human capital. This latter we have computed as the value of a life ($1.5 million in most cases) multiplied by the regional 1988 population and divided by seventy (average lifespan estimate) to convert from a 'stock' value to an annual rate.

We have six models in total to compute the results shown in Table A. The parameters for each are calculated by setting the damage costs at a 30°C rise to be 90% of the limiting value, and the damage costs at 2.5° to be the values the values discussed in the main text. There are two cases for the OECD--with and without our additional damage category estimates, and four for the LDCs--Fankhauser's figures unmodified, and with the VOSL, PUDV and extra damage additions applied successively.

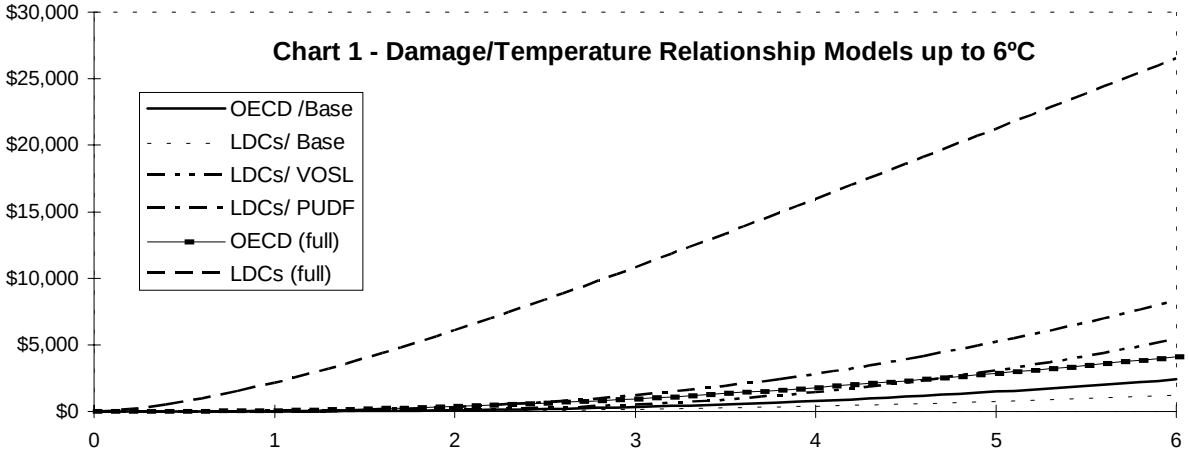
As a sanity check we report on the damages expected at a 0.5° rise--i.e. at around now. They look plausible--as there is no consensus as to what if any current costs on society are attributable to greenhouse warming, it is impossible to say whether they are 'correct' or not.

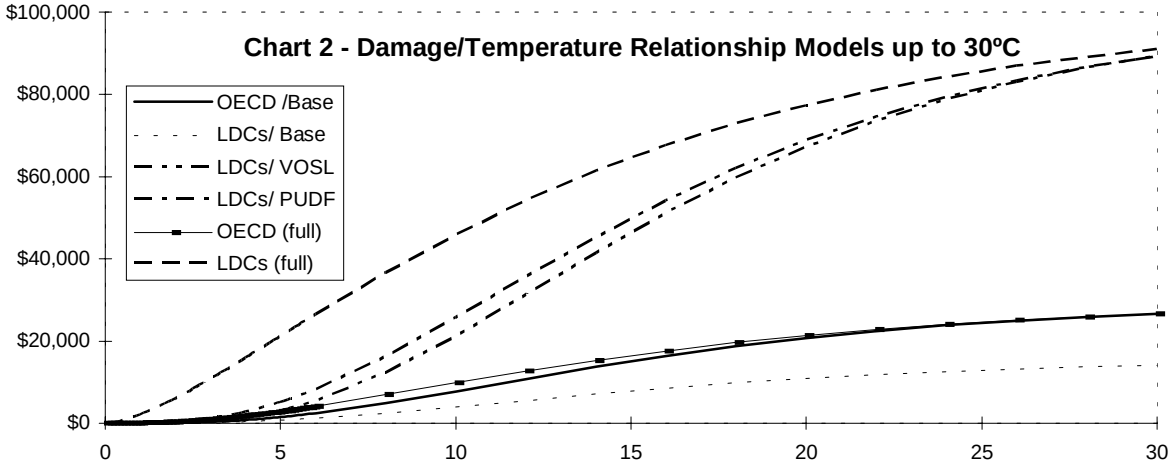
Table B shows the models we have derived and the damage values in $Billions they yield for the temperature rises of most interest. Charts 1 and 2 show the six S-curves for temperature ranges from 0°-6°C and from 0°-30°C respectively.

Adding in Damage Uncertainties

The last stage in the process is to add in the uncertainty due to the assorted different kinds of impact for a given temperature. The damage costs quoted for wetland destruction, water shortages, deaths and the rest can be no more than educated guesses. We assume that the different effects are all independent--for a given temperature or sea-level rise--and associate with each a standard deviation of half the estimate value, signifying that we are 97.5% confident that there is at least some effect of the kind estimated. We then add variances to deduce a combined uncertainty. Note that if the assumption of independence is invalid, the effect would be to increase our uncertainty estimates. The final step of deducing a 95% confidence interval assumes an overall normal distribution of damages. Given that these are a sum of assumedly independent variates, this is not as strong an assumption as it sounds; but it does of course ignore the positive skewness, which has been identified by many authors, and which is almost certainly significant. But again the effect of such skewness would only be to increase our uncertainty estimates.

TABLE B - Model Damage Costs in $ Billions							
		OECD /Base	LDCs/ Base	LDCs/ VOSL	LDCs/ PUDF	OECD (full)	LDCs (full)
Expected damages at 2.5deg rise		$181	$89	$258	$697	$222	$8,391
Asymptotic damages at very large rise		$29,405	$15,760	$99,960	$99,960	$29,405	$99,960
Target damages at 30deg rise		$26,465	$14,184	$89,964	$89,964	$26,465	$89,964
Temp. range for climate sensitivity only	1.5	$32	$16	$34	$135	$43	$3,990
	2.5	$181	$89	$258	$697	$222	$8,391
	4.5	$1,100	$546	$2,168	$3,918	$1236	$18,600
Temp range for c-s +feedbacks+aerosols	1.8	$58	$28	$67	$234	$75	$5,114
	3.0	$325	$160	$514	$1,217	$398	$10,830
	5.3	$1,738	$867	$3,715	$6,084	$1913	$22,866
Approximate present-day 'forecast'	0.5	$1	$0	$0	$3	$1.0	$742
Model parameters	a	0.1	0.1	0.1	0.1	0.1	0.1
	b	3.8	3.8	4.5	3.6	2.7	1.6





APPENDIX B: - TEMPERATURE/GREENHOUSE GAS FEEDBACK MECHANISMS

The following sources of positive feedback are identified by the IPCC 94 WG1 report and not apparently addressed by GCMs:-

1. Temperature causes drying of soils causes outgassing of CO_2.
2. Methane emissions from northern wetlands, permafrost areas and continental shelf clathrates are expected to be stimulated by increased temperatures. Recent evidence suggests this effect may be greater than has been assumed before (New Scientist, July 8th, 1995).
3. Climate change causes dieback of vegetation, especially forests, releasing CO_2.
4. A recent study by Greenpeace[24] documents the way in which this last process is being augmented by large, globally significant, fires in boreal forests.

The main negative feedback the IPCC identify is the stimulation of photosynthesis through increased CO_2 concentrations.

Other studies have identified a positive feedback loop with stratospheric ozone depletion. 'Global' i.e. surface/tropospheric warming is associated with stratospheric cooling. Colder conditions in the stratosphere increase the catalytic decomposition of ozone by chlorine compounds. The resulting increased UV flux has been observed to decrease planktonic biomass; i.e. to reduce planktonic fixing of CO_2. (Not referred to by the IPCC)

Other sources of feedback are referred to in the IPCC reports and in accounts of GCMs in ways which makes it unclear whether they are held to be adequately addressed by the GCMs or not:-

1. Climate change will have a big influence on the nature and extent of cloud cover, but even the sign of the effect is unclear, so this feedback could be positive or negative.
2. Climate change warms sea surfaces and may modify ocean circulation and up/down-welling patterns which may affect the net uptake/release of CO_2 by the oceans.

Finally we note that it is entirely possible that there are unidentified sources of positive feedback, and indeed of negative feedback. The evidence of sudden climate changes in the epoch prior to the present post-ice-age era suggests that positive feedback processes were significant in the climate some tens and hundreds of thousands of years ago. Applying the precautionary principle, in this case recognising that we probably do not know all relevant processes, should lead one to allow for extra possible effects--just as in budgeting it is common practice to add in provision for unforeseen contingencies.

Appendix C - Basic Damage Categories Used

Category	Brief Description of Costs
Sea Level Rise	Annuitised costs of preventing capital loss by buildind defences.
Dryland (Lost Benefits/yr)	Loss of area of land with commercial or other value
Wetlands (Lost Benefits/yr)	Loss of area of land with commercial or other value.
Value of Lost Ecosystems	Estimated by what people are willing to pay to preserve them
Costs to Agriculture	Lost production
Damage to the Forestry Sector	Production loss due to reduced area
Reduction in Fish Harvests	Covered by wetland valuation
Cost of Increased Energy Demand	Mainly for extra cooling of buildings.
Commercial & domestic water supply	Value loss due to reduced runoff
Mortality	Deaths from heat stress
Increased Air Pollution	Costs due to increased NOx and SOx.
Migration Costs	Costs of absorption into host economy.
Increased Tropical Storms	Extra deaths and damage to property

Derived from: Fankhauser.[25] Note the above table is a very cursory summary to indicate the general nature of the damage cost categories. For a proper understanding of what is covered and what is not, and why, please refer to Fankhauser's book.

APPENDIX D: A RECALCULATION OF THE SOCIAL COST OF CLIMATE CHANGE; A COMMENT BY SAMUEL FANKHAUSER AND RICHARD TOL

Meyer and Cooper have written an interesting article, which points out many important issues in the economic assessment of the impact of climate change. On several fronts we agree with the authors, and the criticised IPCC chapter often makes the same points as Meyer and Cooper (e.g. on the importance of uncertainty and extreme events, and the limitations of the $2xCO_2$ benchmark). In some other aspects, however, we fundamentally disagree. We would like to thank the editors of The Ecologist for giving us the opportunity to react, make clarifications on the IPCC Social Cost chapter, and point the reader to a number of misconceptions in the paper by Meyer and Cooper.

IPCC

The IPCC was established by the World Meteorological Organisation and the United Nations Environment Programme to provide sound scientific analysis that can assist policy makers in deciding on the appropriate course in climate policy. The IPCC is a scientific panel, which critically assesses the relevant literature. The IPCC does not carry out its own research, take position, or give advice. The IPCC merely reflects the literature, and presents it in a comprehensive and accessible way. IPCC reports are written by teams of internationally leading experts, carefully balanced between the geopolitical regions. The reports go through an extensive peer and government review. Non-governmental organisations are also admitted to the review procedure, and many have taken up this opportunity. Meyer and Cooper mainly comment on Chapter 6 of the Second Assessment Report of Working Group III: 'The Social Costs of Climate Change'. The chapter was written in 1994 by a team of seven researchers, headed by Prof. David Pearce of University College London. The team members are from Europe, India and the United States, and have backgrounds in economics, biology, statistics, civil engineering and anthropology. The chapter went through the IPCC review process in 1995 and was revised in the light of many helpful comments. The revision included a literature update, so that the chapter reflects the state of the art in early 1995. No later publications are taken into account. The chapter is now finalised and awaits official adoption by the governments of the United Nations.

Comparison of Estimates

Meyer and Cooper list a series of issues - willingness to pay versus willingness to accept, regional differentiation, aggregation, cost benefit analysis, timing, market exchange rates versus purchasing power parity, uncertainty and omitted damage categories - and we address the major ones. Lumping everything together, Meyer and Cooper derive damage estimates of 12-130% of Gross World Product (GWP) for $2xCO_2$, compared to the 1.5-2% best guess of IPCC Chapter 6.

But the two sets of estimates are based on different assumptions, and are therefore not comparable. The studies underlying Chapter 6 estimate the impact of a climate change induced by $2xCO_2$ on the present economy. In line with IPCC Working Group 1 we assumed 2.5°C warming. Since the analysis is static, issues such as the timing of $2xCO_2$, feedback effects, and aerosols, which Meyer and Cooper cover in some depth, are irrelevant for $2xCO_2$ damage estimation. Currently, research is being undertaken on the impact of other-than-$2xCO_2$-climate-change on other-than-the-present-economy. The results are too premature to be taken up in the IPCC, given the explicit requirements laid down by IPCC to authors.

Meyer and Cooper analyse different scenarios with warming mostly greater than 2.5°C. Calculating different scenarios is useful. However, for a reasonable comparison we have to compare like with like. Their estimate closest to the 2.5°C warming scenario of IPCC would probably be in the order of 30% of GWP (given that the move from their scenario B to C increases medium damage by 175%). The discrepancy is thus much smaller, although theirs is still a much larger figure. The difference is mainly due to two reasons. The first is the inclusion of malnutrition and malaria damages. This is a useful extension, although the Hohmeyer and Gaertner estimates adopted by Meyer and Cooper appear to be huge overestimates in the light of the much more sophisticated work by Rosenzweig and Parry (on malnutrition) and Martens et al. (on malaria). The second reason is the uniform valuation approach taken by Meyer and Cooper. This is the issue where we most fundamentally disagree with the authors.

Uniform Unit Values

Meyer and Cooper frame the issue of uniform valuation in the context of the debate on willingness to pay (WTP) and willingness to accept compensation (WTAC). This is wrong. The choice between WTP and WTAC has no relationship with the question of regionally diversified value estimates, contrary to the suggestion of Meyer and Cooper. WTAC, like WTP, depends on income (even though bids are not constrained by income).A rich person will require a higher monetary compensation than a poor person, because his marginal utility of income is lower (a compensation of, say, $1,000 compensation is less interesting to a rich person than to a poor person). WTAC estimates might lead to higher damages, but they would still differ between regions. WTAC can therefore not be used to justify uniform values at the OECD level. But the concept of uniform values at OECD levels for all (market and non-market) damages is itself flawed. Meyer and Cooper fail to give a good reason for using it other than quoting other authors who have themselves failed to give a good reason. The whole purpose of regional damage analysis is to capture the regional diversity and assess differences in vulnerability. Regions differ in many respects, not the least in price and income levels. Using uniform unit damages defies this. It makes very little sense to estimate the costs of building a sea wall in India at US prices. Even if the US would fund the project, it would still be built in India using local workers and material paid at local rates. The same argument holds for intangible goods and services. Environmental commodities may serve different functions in different regions. To assess local vulnerability, it is the regional value that counts.

The Value of Statistical Lives

The concept of uniform values was conceived in the context of the value of a statistical life (VOSL). In this context, it is sometimes argued that for equity reasons all statistical lives should be valued equally. This may be appealing at first sight, but the case is far less obvious once the difference between VOSL and the 'value of life' as such is understood. Besides, it would point in the direction of using an average uniform value, not the OECD value. We have no problems with using a global average value to assess world damages. In fact, estimates of local environmental damages are commonly based on regionally averaged unit values. This is both convenient and in line with the approach usually taken by national governments. However, as we have pointed out there, using average values does not change the global results of IPCC Chapter 6.

Aggregation

Equity considerations are important in climate change policy, and to the extent WTP/WTAC estimates reflect the unfairness in the income distribution, this has to be corrected for. However, the way to do this is not by tinkering with the value system, but by giving different weights to different regions in the aggregation process. Comparison and aggregation are difficult, and cannot be done in an unambiguous manner. Ethical choices are required. Chapter 6 shows how these can be depicted.

PPP-Correction

The matter of market versus purchasing power parity exchange rates was not corrected because this issue is rather more complicated, although less far-reaching than Meyer and Cooper suggest. To us, there is no 'right' answer to the question of how absolute figures should best be expressed. Damages include both market and non-market impacts, while GDP (corrected or not) is restricted to market transactions. No division by a GDP-related figure therefore produces the 'clean' percentage ratio Meyer and Cooper aspire to. Nevertheless, PPP corrected figures are in preparation to illustrate the significance of this point, and will be published shortly.

Cost-Benefit Analysis

Being a scientific panel, Working Group 3 of the IPCC does not advocate cost benefit analysis as the appropriate tool for decision making, either at the global or the regional level. It does discuss its advantages and disadvantages compared to other tools, such as the precautionary principle. Monetary estimates of the impacts of climate change do facilitate, but do not imply cost-benefit analysis, and are equally useful in other approaches to decision making. It is certainly true that CBA will not replace 'argument, discussion, negotiation and compromise', as Meyer and Cooper say (nor does Chapter 6 or any part of Working Group III suggest any such view). But it is equally true that argument, discussion or negotiation uninformed by data on the costs and benefits involved is unlikely to produce a good compromise.

REFERENCES

[1] S Fankhauser.
"Valuing Climate Change". Earthscan 1995.

[2] RSJ Tol 1994.
"The Damage Costs of Climate Change: Towards More Comprehensive Calculations".

[3] WR Cline.
"The Economics of Global Warming". The Institute for International Economics, Washington DC. 1992.

[4] Pearce DW.
"The Social Costs of Greenhouse Gas Emissions"(with Sam Fankhauser) OECD 1993 (GD(93)74) and
"Blueprint 2 & Blueprint 4". Earthscan 1991 & 1995

[5] WD Nordhaus 1991.
"To Slow or not to Slow: The Economics of the Greenhouse Effect", in: Economic Journal 101no.6 pp920-937

[6] JG Titus 1992.
"The Cost of Climate Change to the United States, in: "Global Climate Change: Implications Challenges and Mitigation Measures", Majumdar, Kalkstein, Yarnal, Miller and Rosenfeld (eds.), Pennsylvania Academy of Science.

[7] Hohmeyer and Gaertner.
"The Costs of Climate Change - A Rough Estimate of Orders of Magnitude".
Report to the Commission of the European Communities, Directorate General XII. 1992.

[8] Arrow K, Solow R., Portney P, Leamer E, Radner R, Schuman H (1993)
"Report of the NOAA Panel on Contingent Valuation, Resources for the Future", Washington DC.

[9] AB Fleishman.
"Risk Criteria and the Role of Cost Benefit Analysis".
In Proceedings of Conference on Risk Analysis in the Offshore Industry. 1990. IBC Technical Services Ltd.

[10] D Burtraw and RJ Kopp.
"Cost Benefit Analysis and International Environmental Policy Decision Making. Problems of Income Disparity."
Discussion paper 94-15. Resources for the Future.

[11] Ekins P.
"Rethinking the Costs Related to Global Warming. A Survey of the Issues".
Environmental and Resource Economics 5 1-47 1995.

[12] Ekins. ibid

[13] Nordhaus WD. Op cit 5.

[14] Greenpeace (Michael Lazarus et al).
"Towards a Fossil-Free Energy Future". Stockholm Environment Institute - Boston Center. 1993.

[15] Cline W. Op cit 3.

[16] JT Houghton, BA Callander and SK Varney (Eds) Climate Change 1992*;*
"The Supplementary Report to the IPCC Scientific Assessment". CUP

[17] JFB Mitchell, TC Johns, JM Gregory & SFB Tett, Hadley Centre for Climate Prediction and Research.
"Climate Response to increasing levels of greenhouse gases and sulphate aerosols". Nature Vol376

[18] JT Houghton, LG Meira Filho, J Bruce, Hoesung Lee, BA Callander, E Haites, N Harris and K Maskell.
"Climate Change 1994. Radiative Forcing of Climate Change and An Evaluation of the IPCC IS92 Emission Scenarios". Cambridge University Press 1995.

[19] LR Kalkstein.
" The Potential Effects of Global Climate Change on the U.S. Appendix G Health. The Impact of CO2 and Trace-gas Induced Climate Changes Upon Human Mortality". Report to the US Congress 1989.

[20] Adams J.
"Cost-Benefit Analysis: Part of the Problem, Not the Solution".
Green College Centre for Environmental Policy and Understanding. march 1995.

[21] RSJ Tol. Op. cit. 2

[22] Funtowicz SO and Ravetz JR.
"The Worth of a Songbird". Ecological Economics 10 (1994) 197-207.

[23] Op. Cit 16.

[24] Greenpeace International.
"The Carbon Bomb". Stichting Greenpeace Council, Amsterdam, 1994

[25] S Fankhauser. Op. Cit. 1.