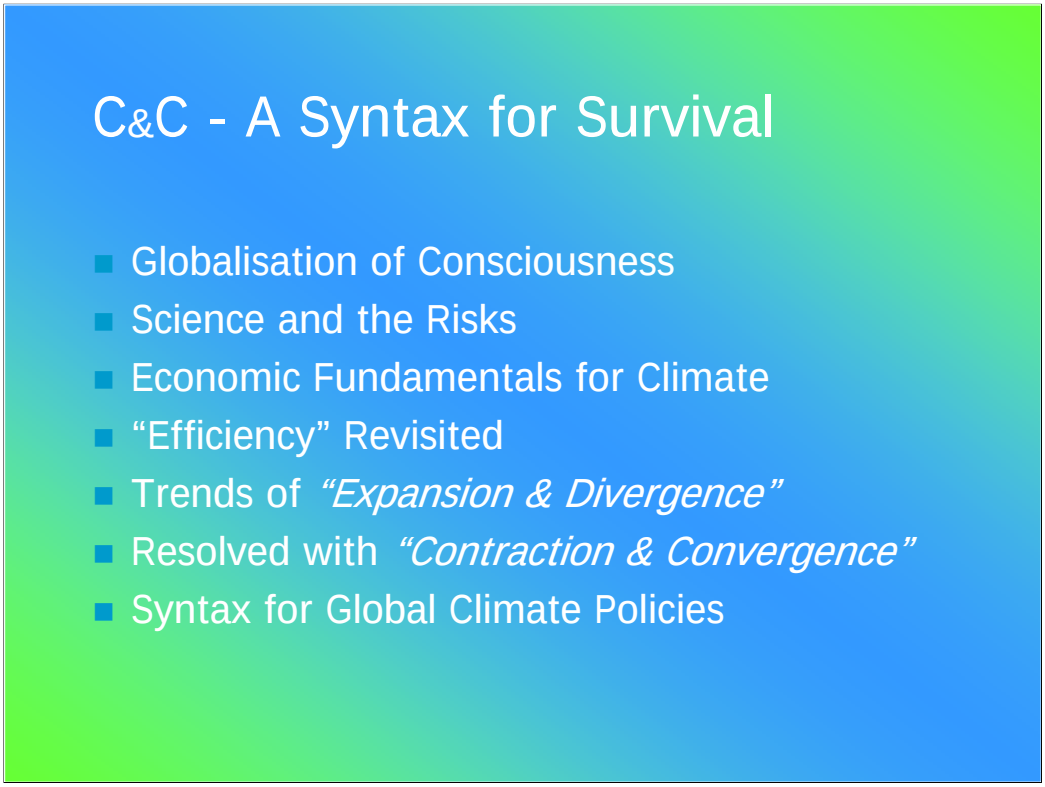
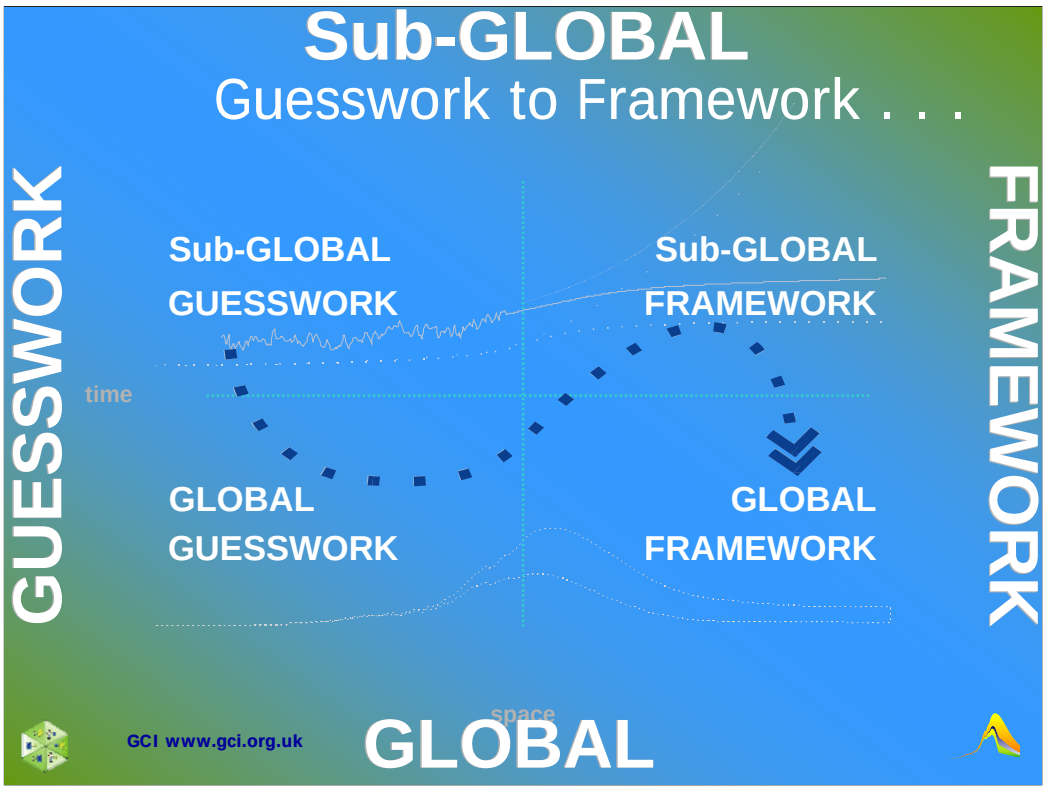


C&C – A Syntax for Survival

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.

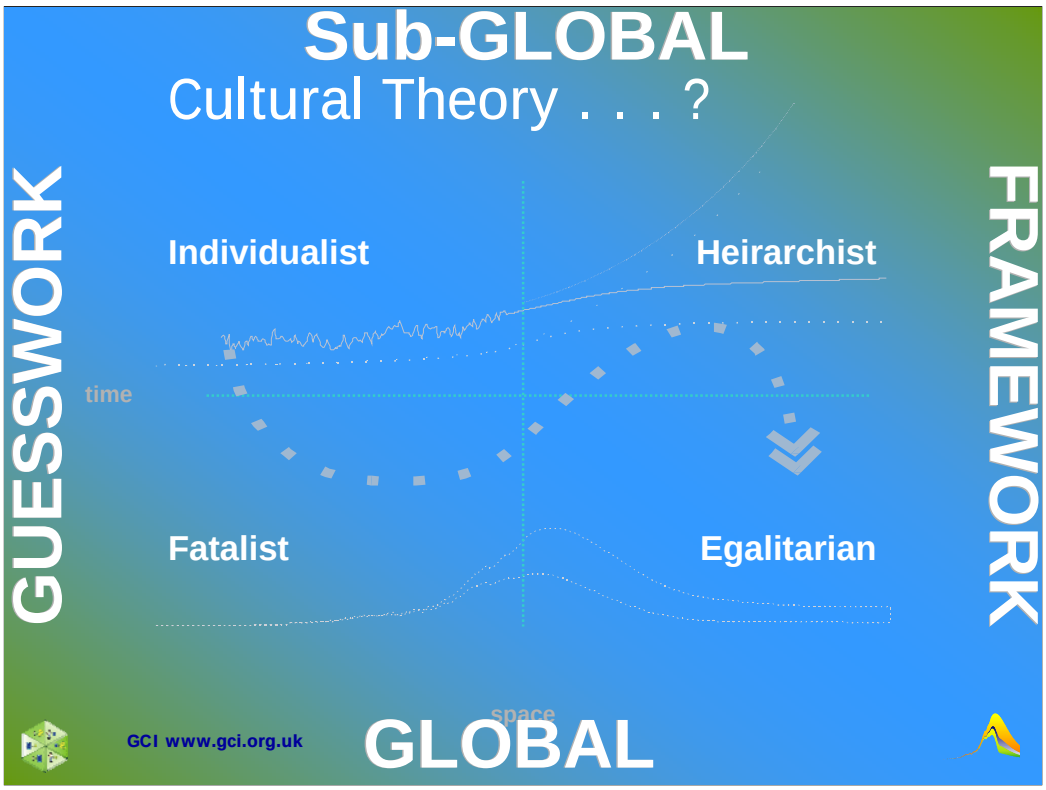
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

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: -

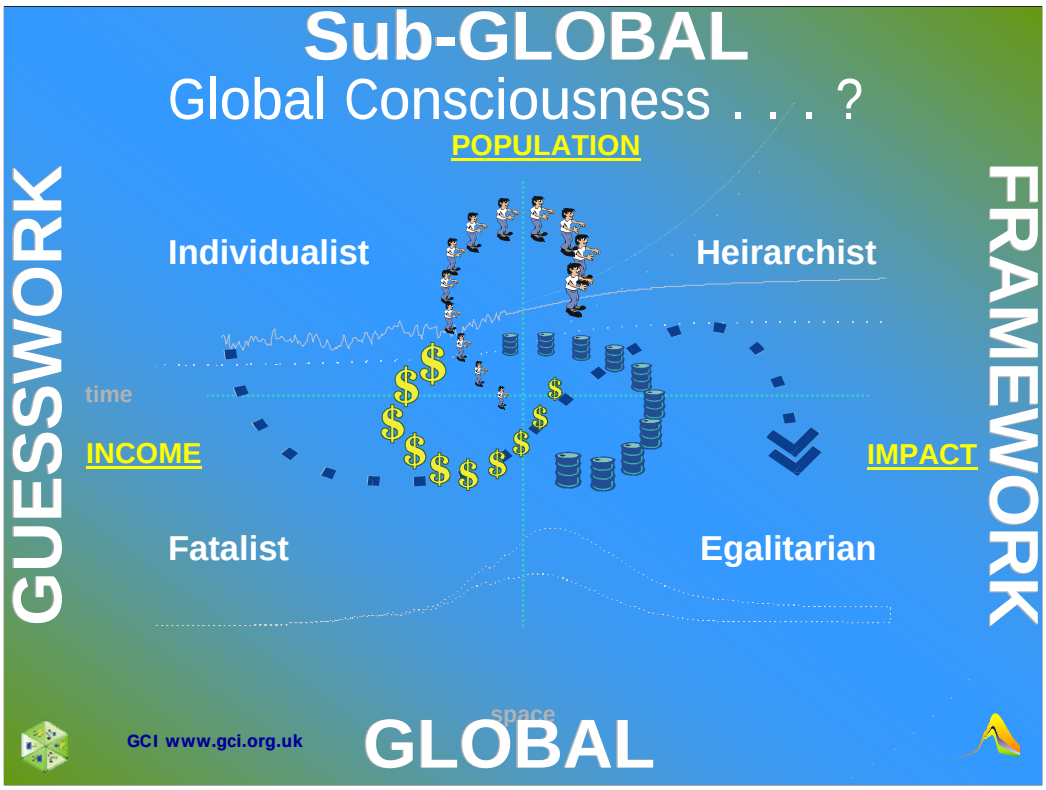
- Individualist: predator, in tactical conditions of 'local guesswork':
- Fatalist: prey, resigned in a state of global 'che sera sera':
- Heirarchist: mediates with 'sub-global policy frameworks':
- Egalitarian: sees 'conception-constitution', or 'global framework'.

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.

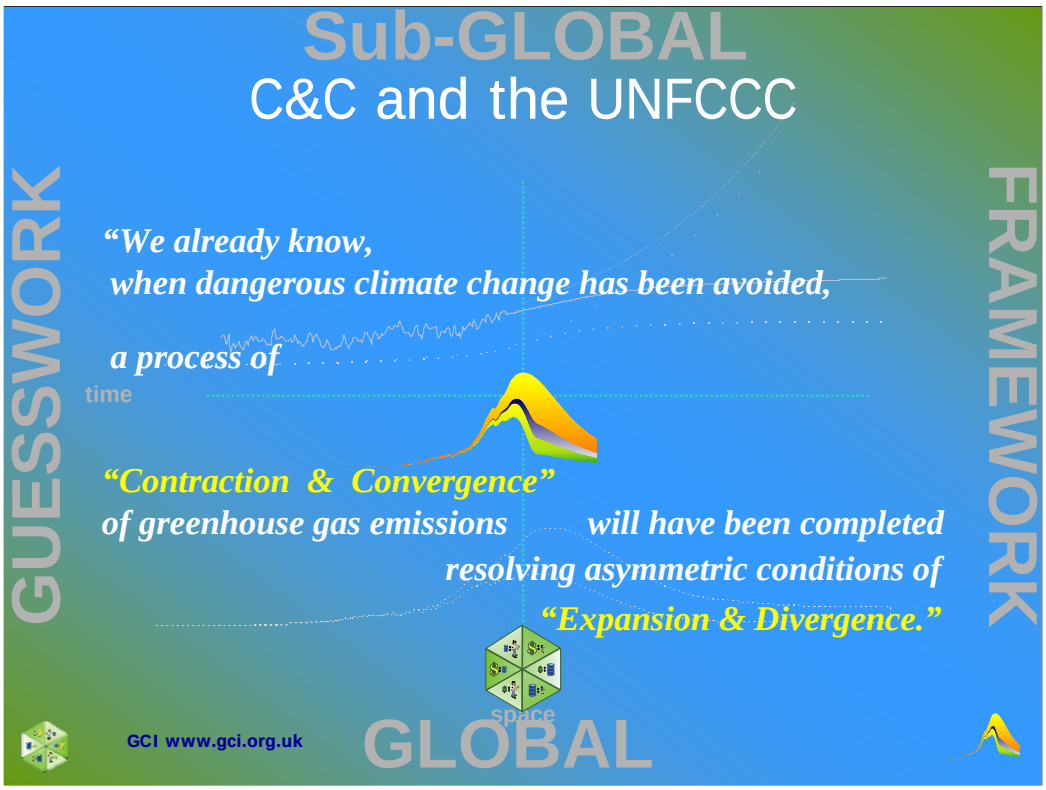
These traces persist throughout most of the presentation to facilitate comparisons between the rates of change in the economy and in the climate system.



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.

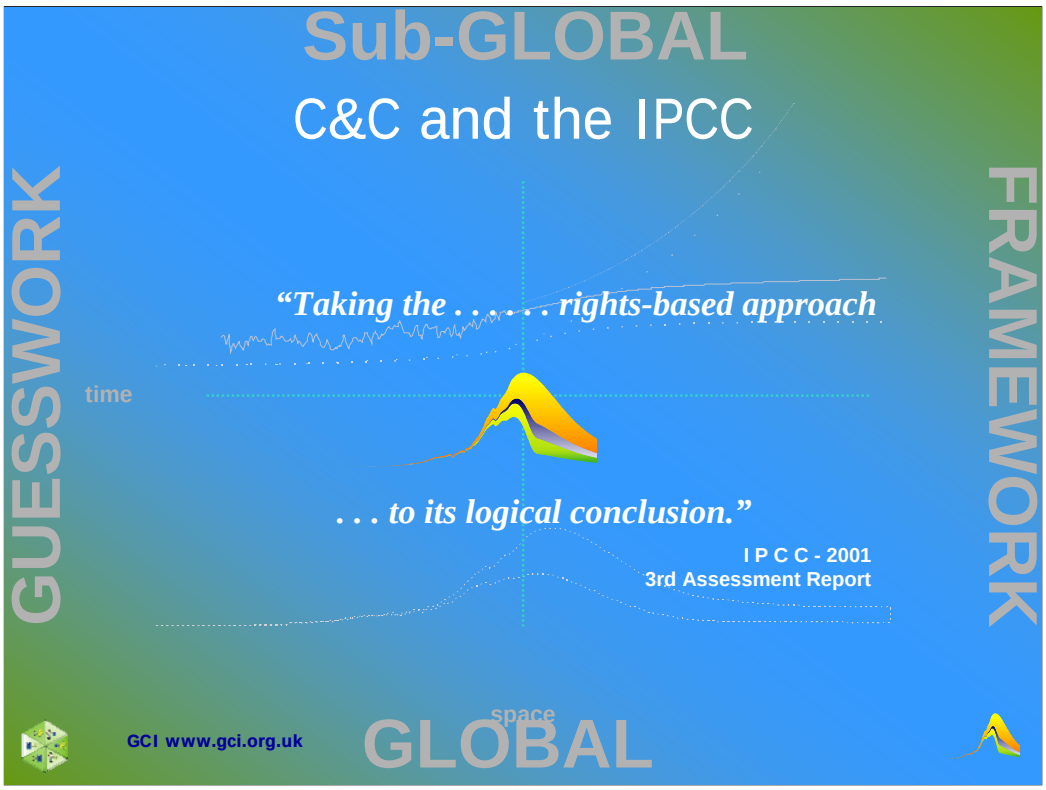
So sustaining income and opportunity depends on limiting the environmental impacts of greenhouse gas emitting sources of energy, such as fossil fuels coal, oil and gas.

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: -

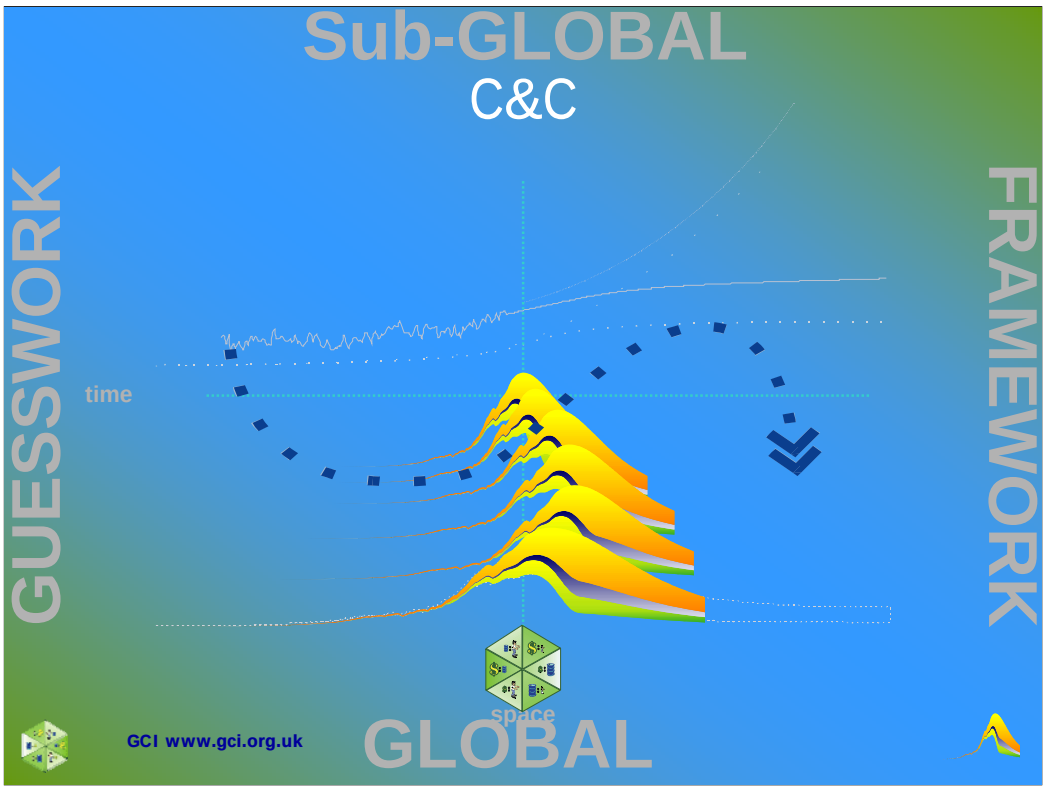
- A global contraction of greenhouse gas emissions in the order of 60 – 80% of current output in some time frame will have been completed, and . . .
- A formal international convergence of shares in this contraction will also have occurred by definition within the contraction planning framework of the 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."*

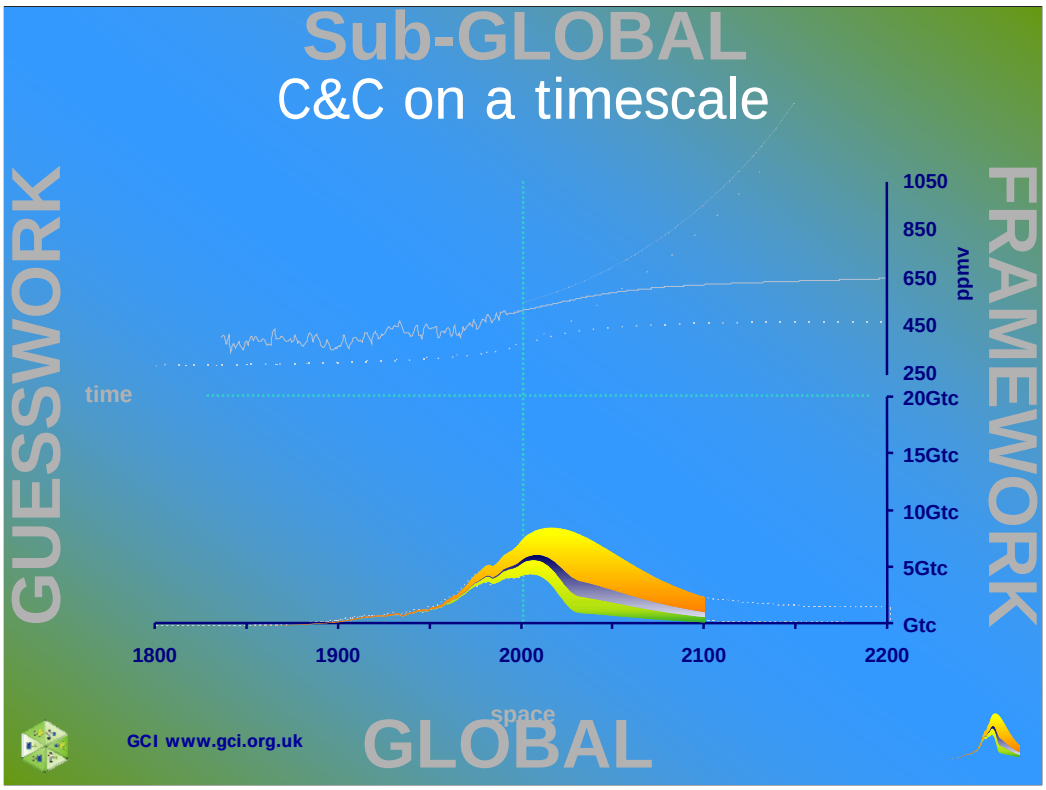


Transition Slide

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).

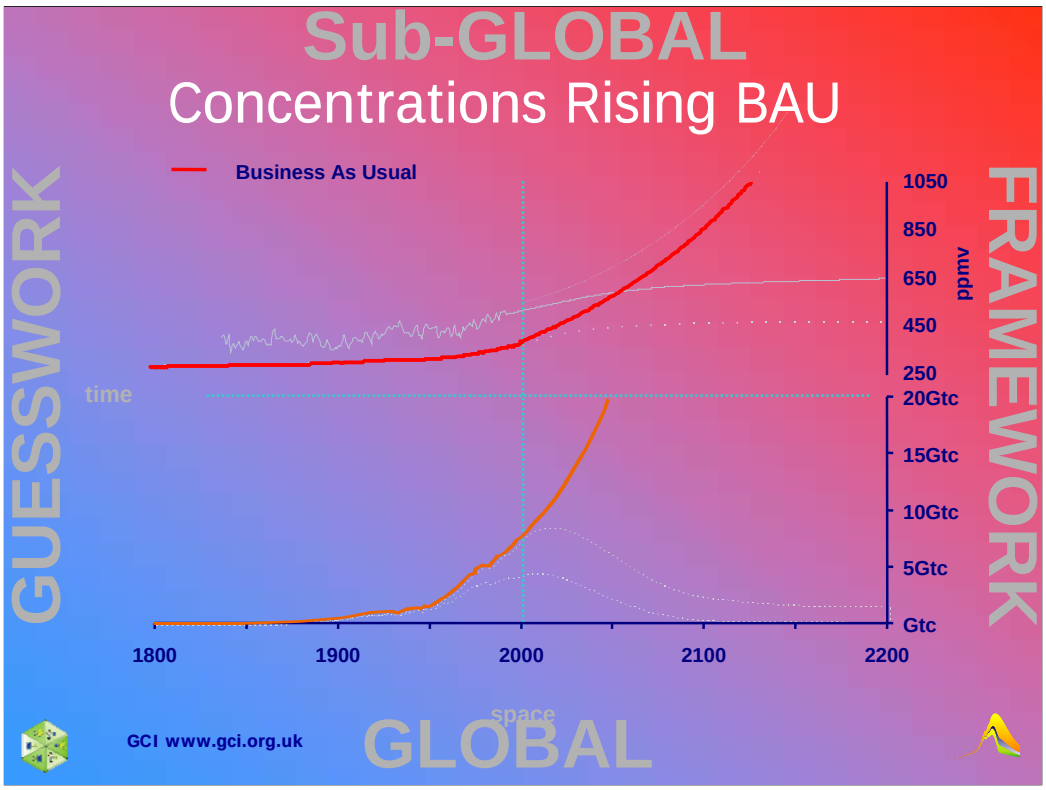


"Contraction & Convergence"

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.

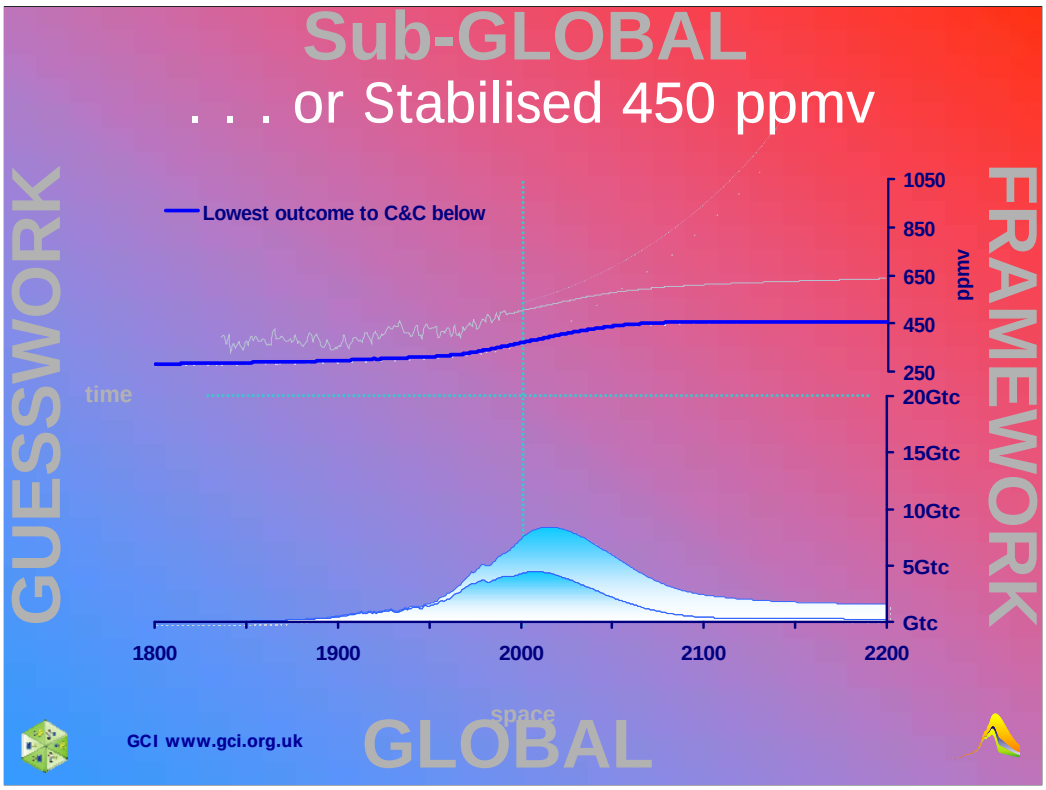
The means that continued BAU in the global economy drives the upper band of the relevant grayed-out traces in the opening slides for: -

- 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].

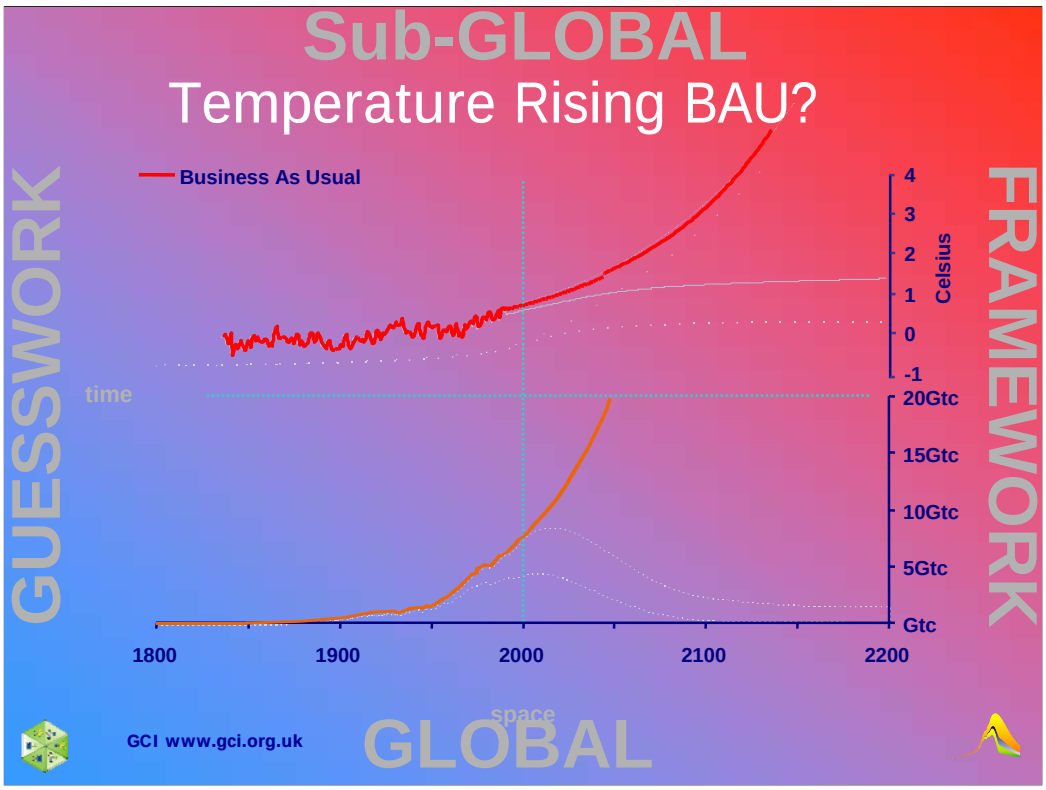


Atmospheric CO_2 CONCENTRATION Stabilised

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].



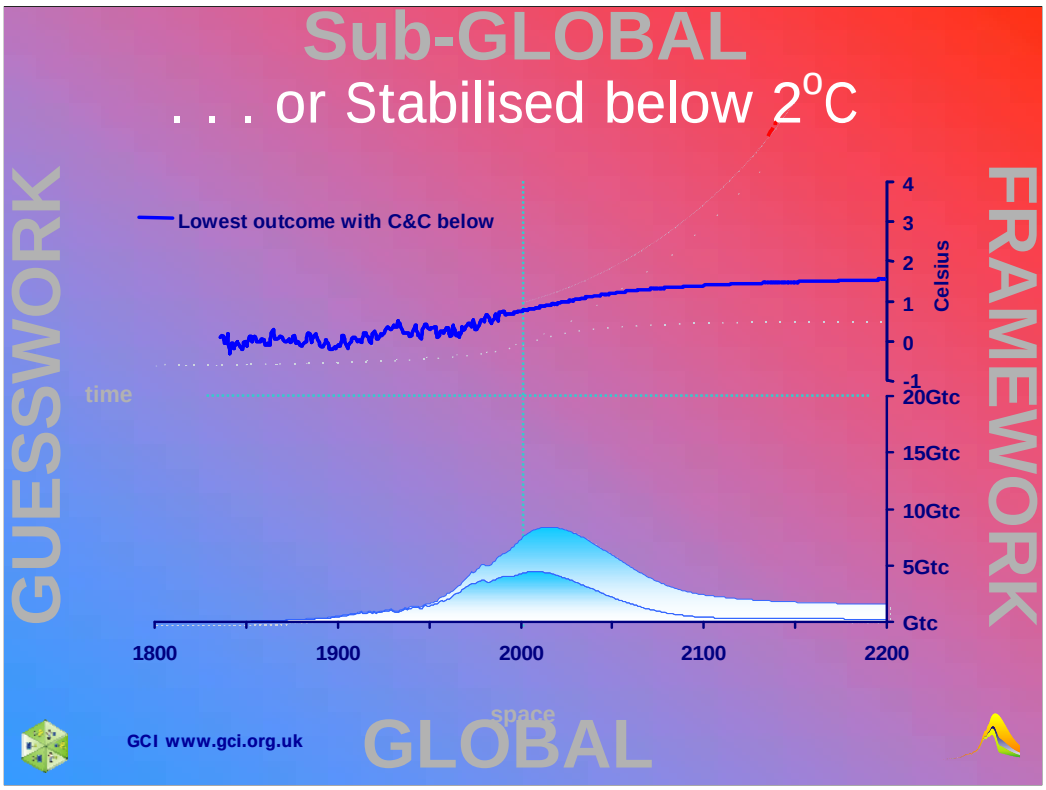
Global TEMPERATURE RISING BAU

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

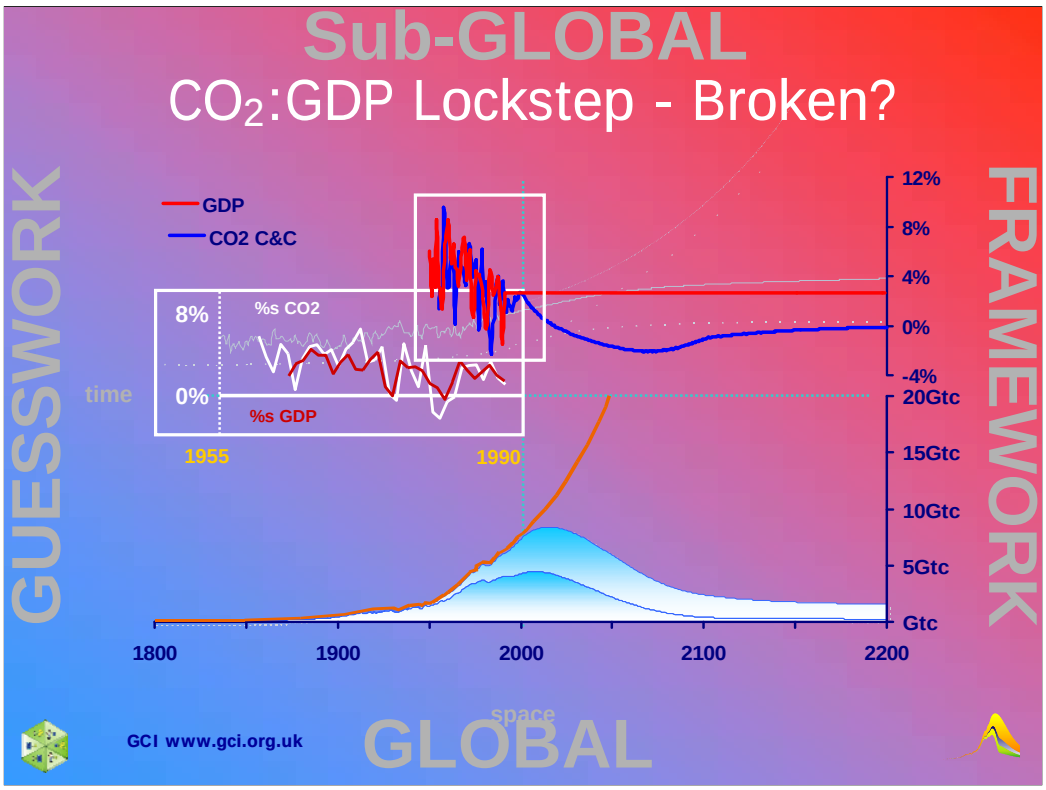
Global surface temperature from 1860 until 2000 shows an overall rise of 0.7°C.

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].



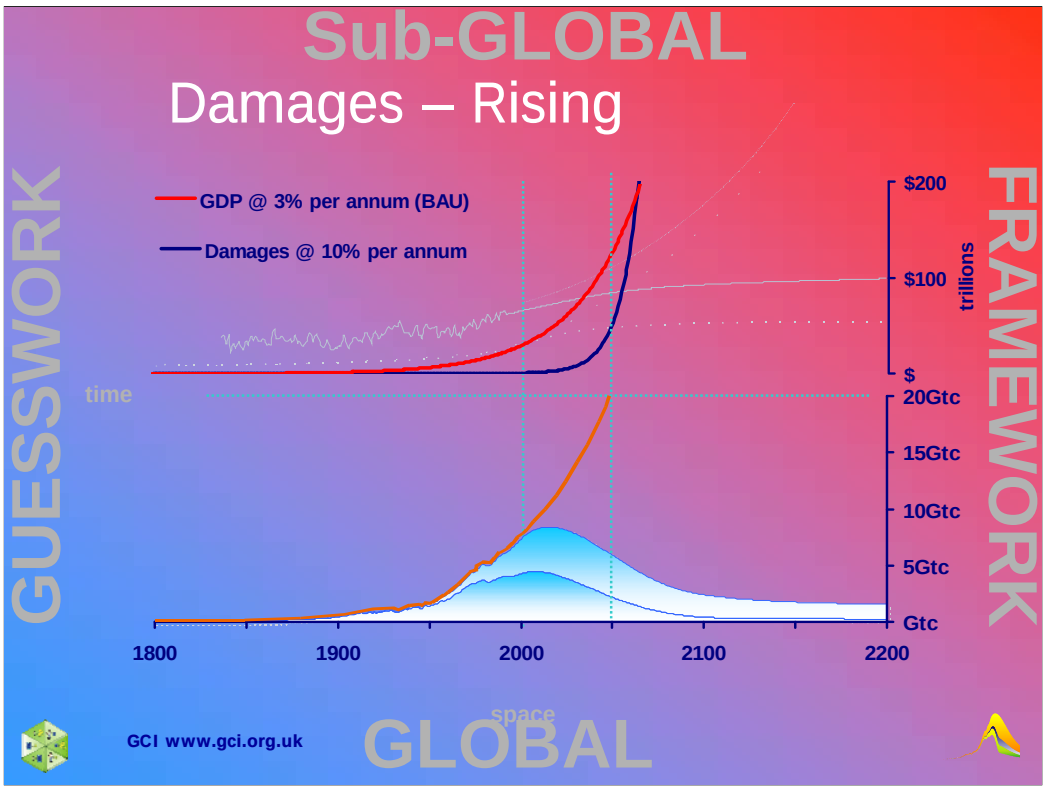
Breaking GDP:CO_2 "Lockstep"

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.

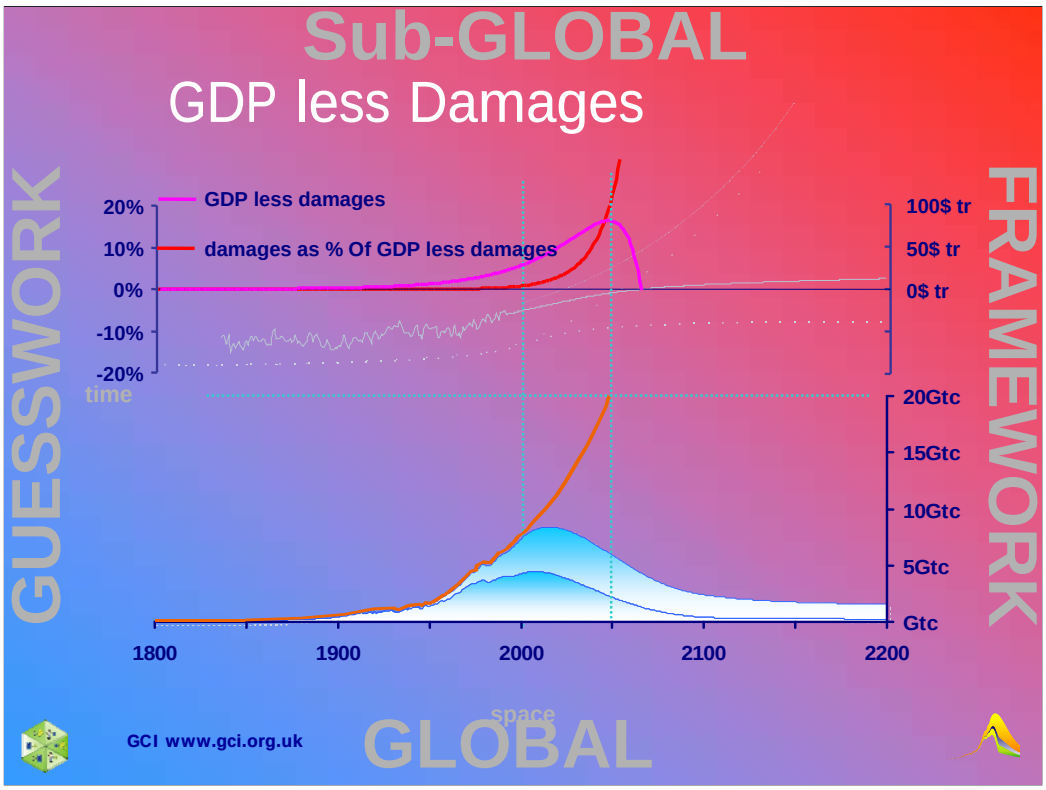
This means that – albeit from a low based figure - the growth in damages has been at over three times the rate of economic growth. If these global trends are projected on the back of emissions Business-as-Usual (BAU), damages appear to exceed GDP by 2065. This is clearly unsustainable. It suggests that, 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



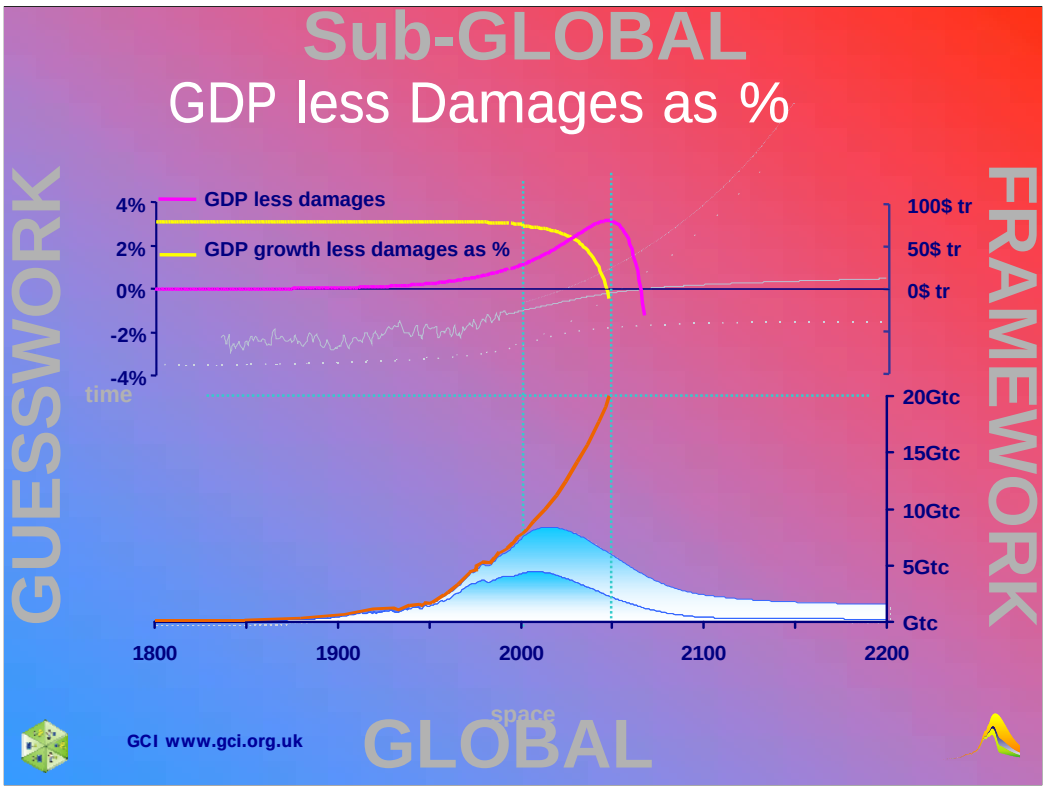
GDP Less Damages

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.



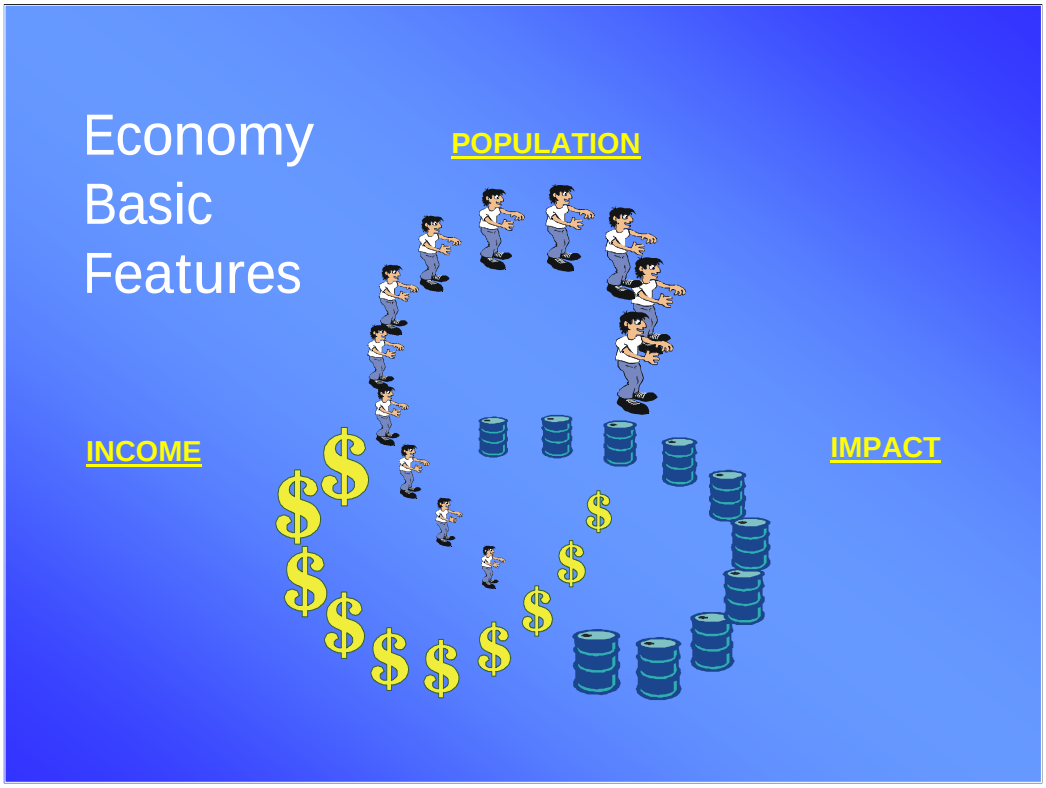
GDP less Damages as a %

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.

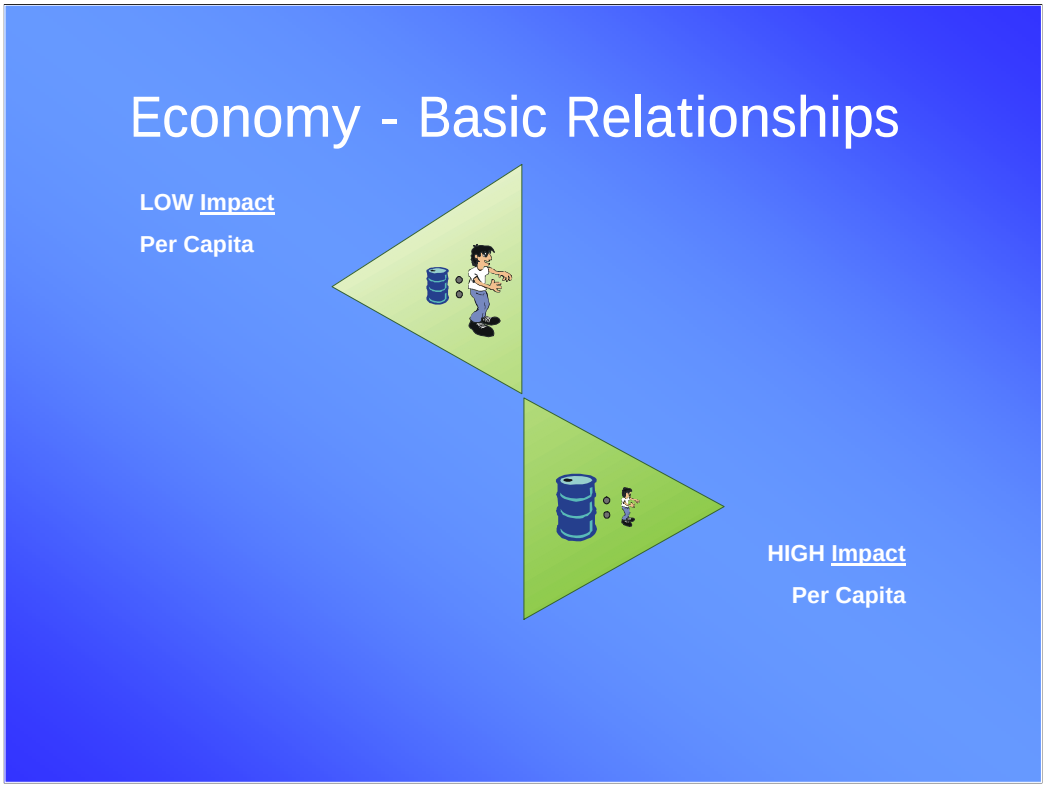
- PEOPLE – population
- INCOME – production measured as $s Gross World Product (GWP)
- IMPACT – pollution [tonnes of carbon (and equivalent) from CO_2 emissions from fossil fuel burning.



Climate Economy – Basic Flow

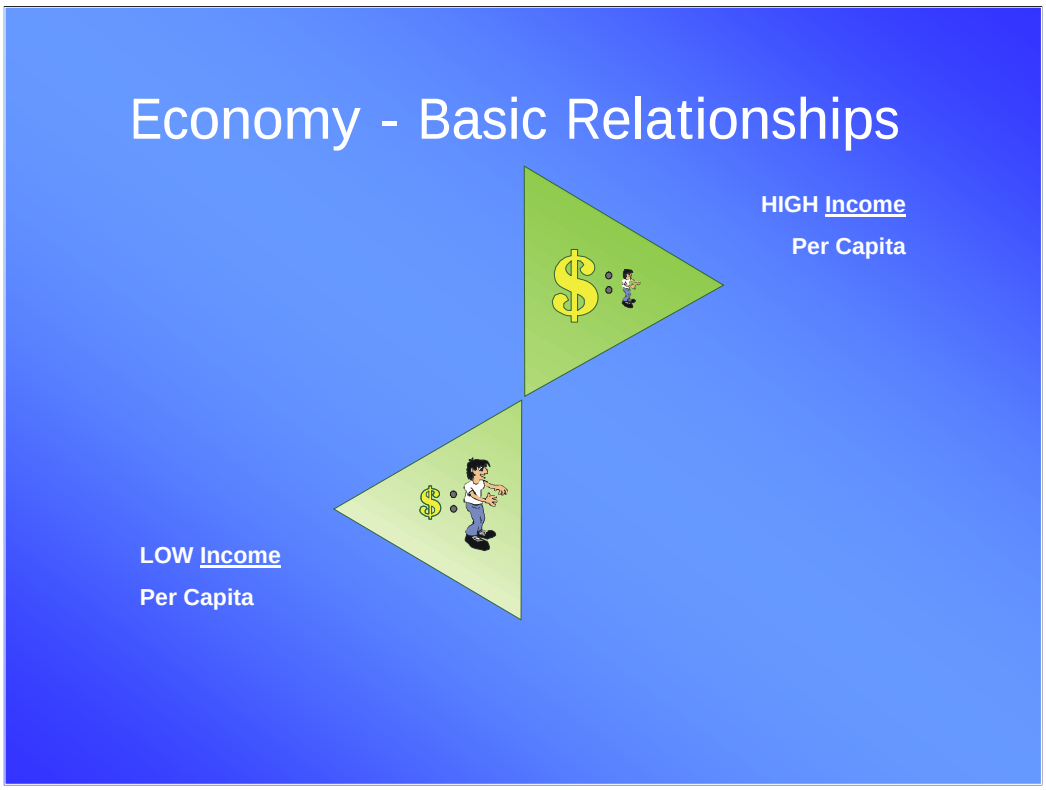
The three basic features of the climate economy are growing. They are also now feeding back to the system as a whole as *"Expansion & Divergence"* (See charts 25 – 27).

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?"*



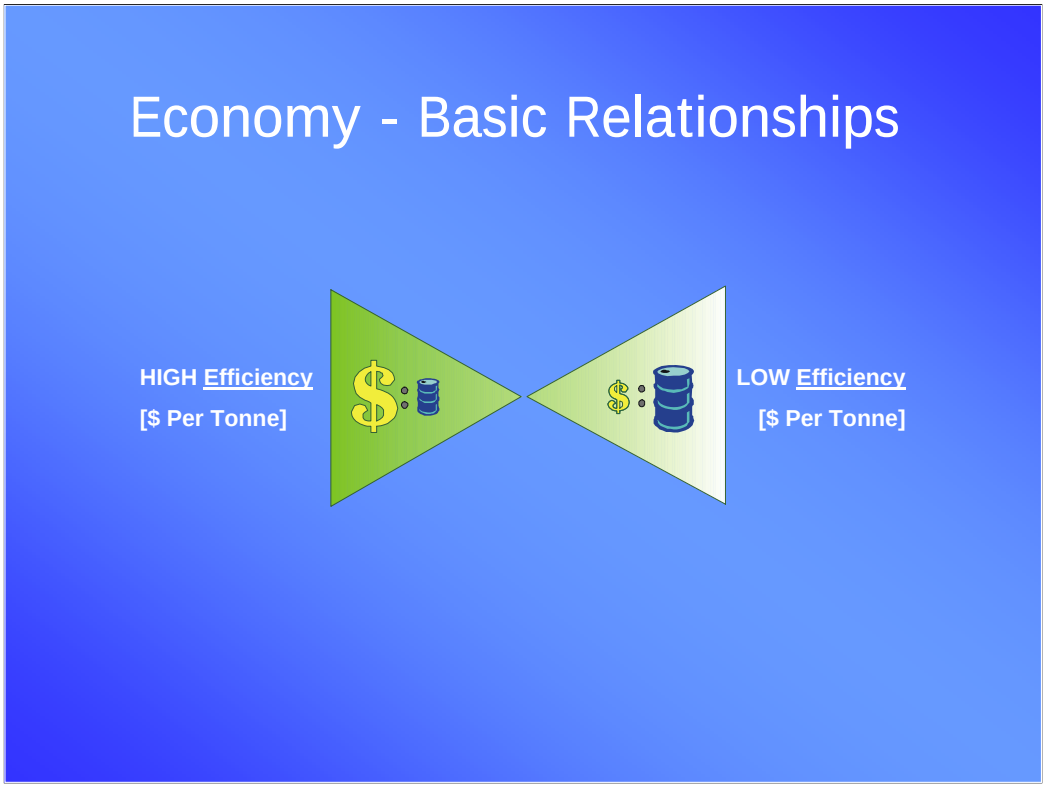
Climate Economy – Basic Relationships

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



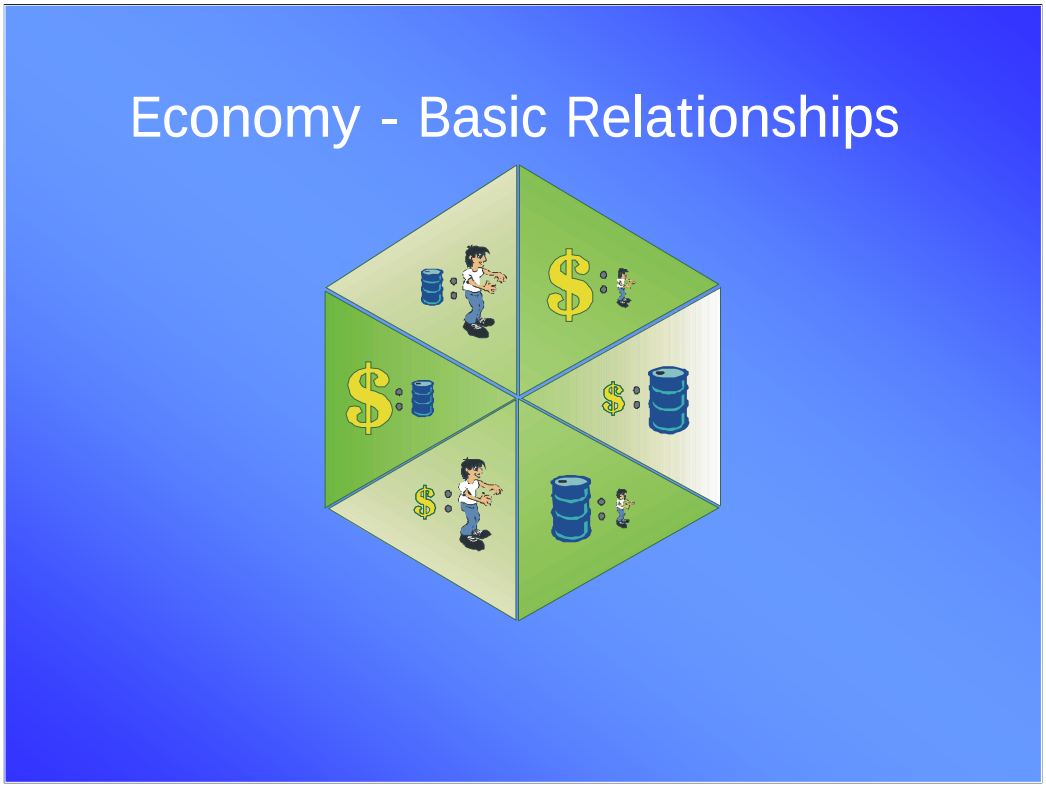
Climate Economy – Basic Relationships

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

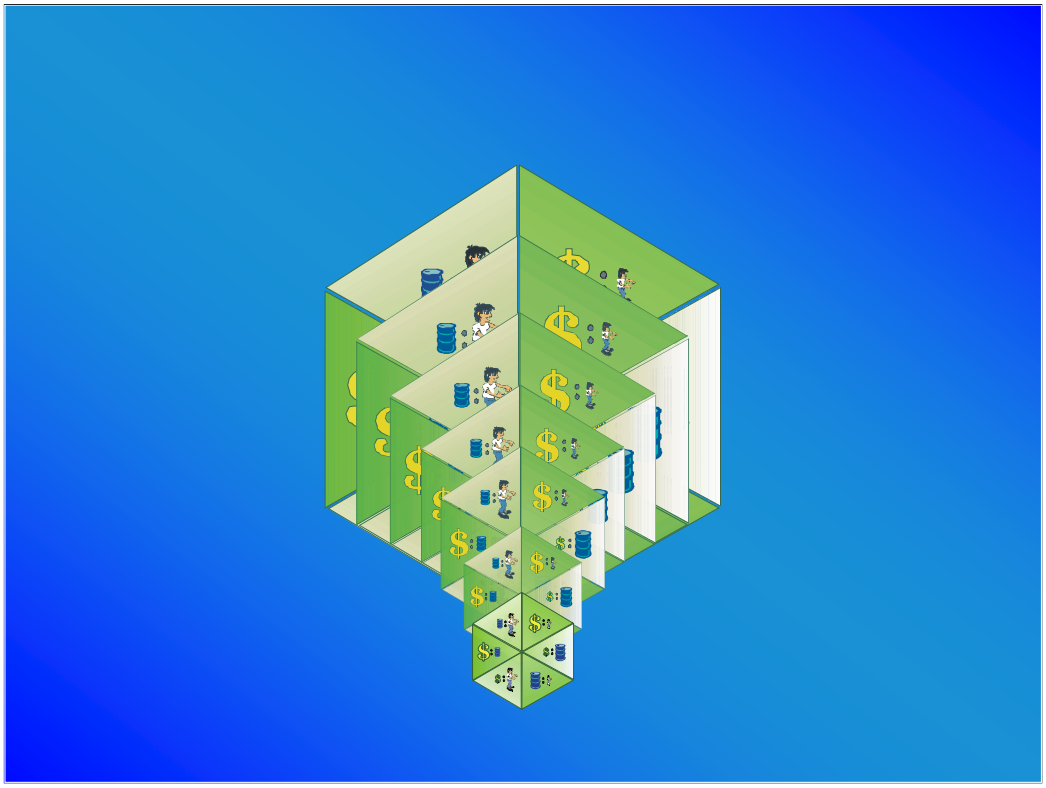
Here are the three basic features of the climate economy integrated in the same model: -

- 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.

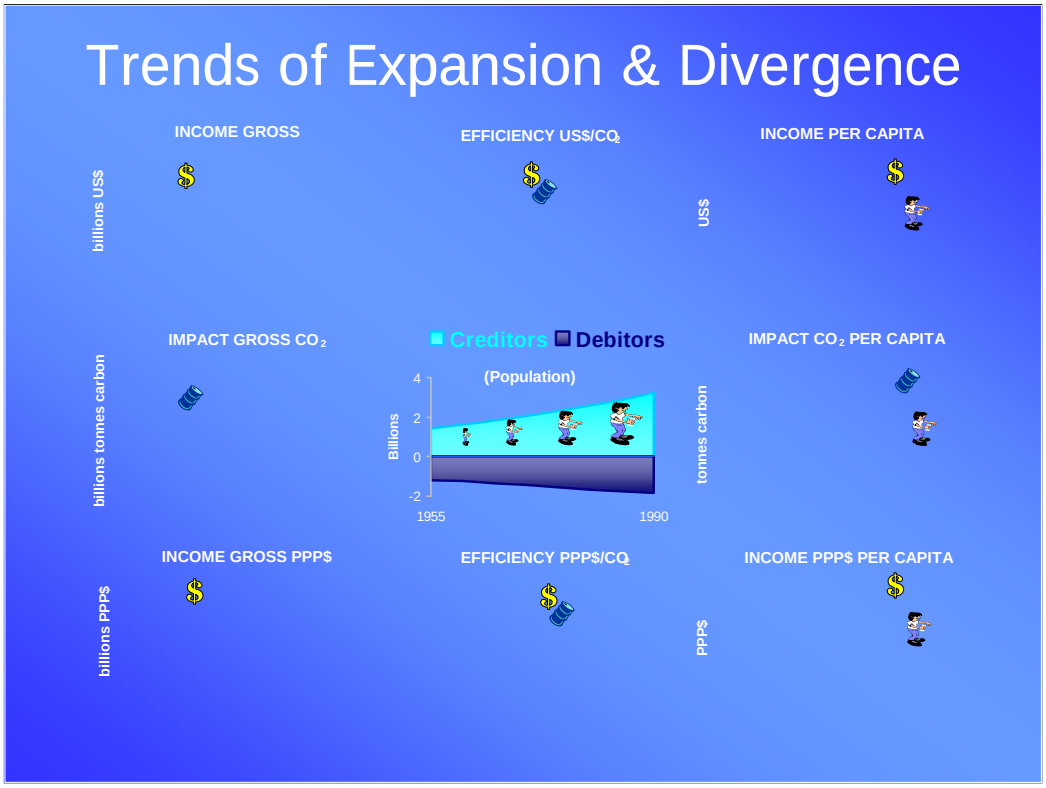
On present values and at present rates of change, the USA will be as efficient as Nepal only in some hundreds of years.

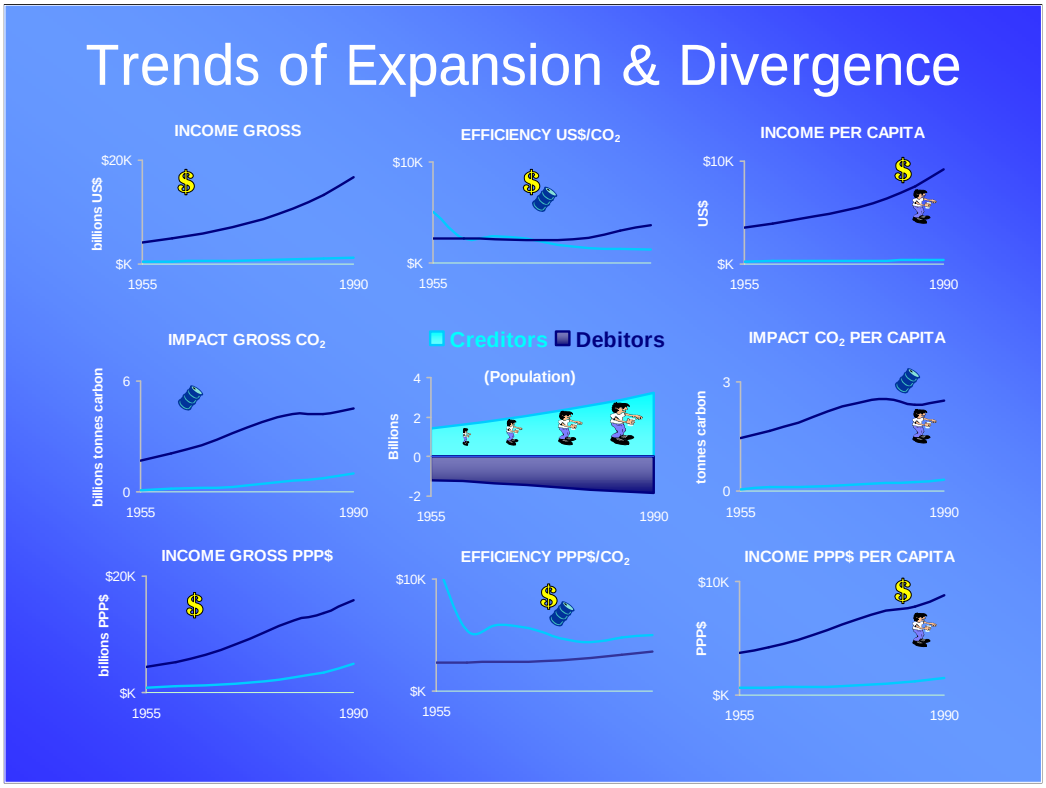
The currency values have been corrected for exchange rate distortions.

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%.

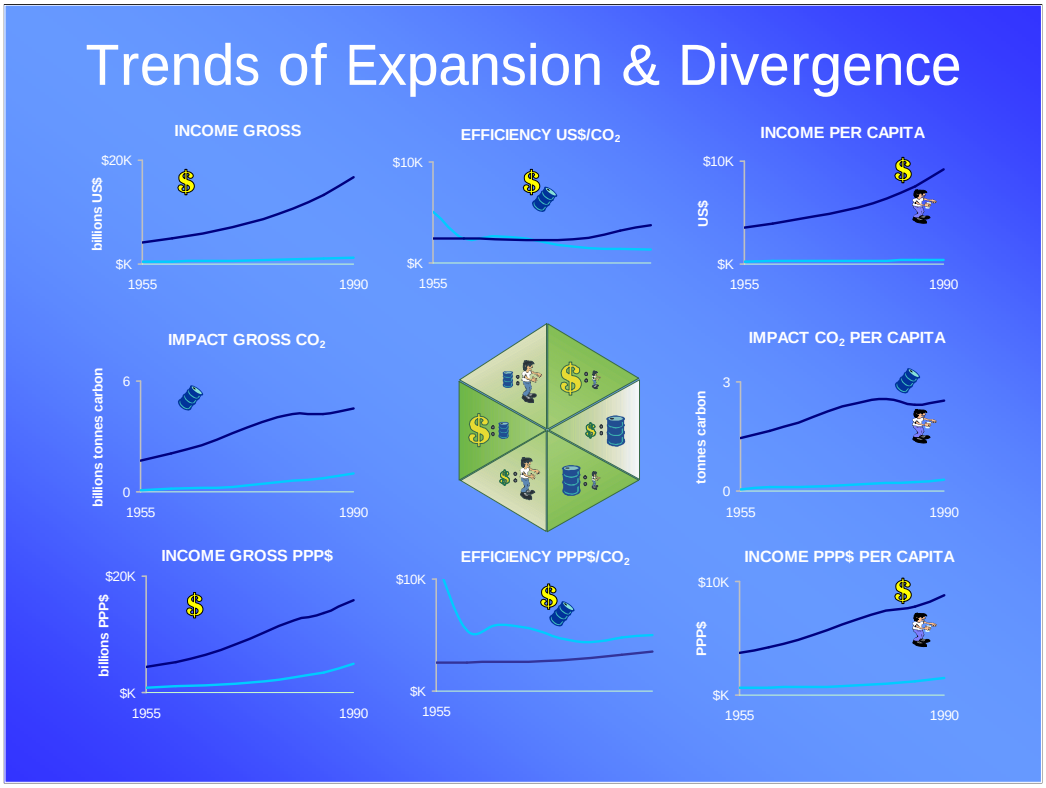
While this global SDI was $1,200 per person per annum, national SDI totals were obtained by multiplying that figure by each countries population for that year. These allocations were then compared with each nation's actual dollar and Purchasing Power Parity (PPP) dollar equivalent income (GDP) to give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

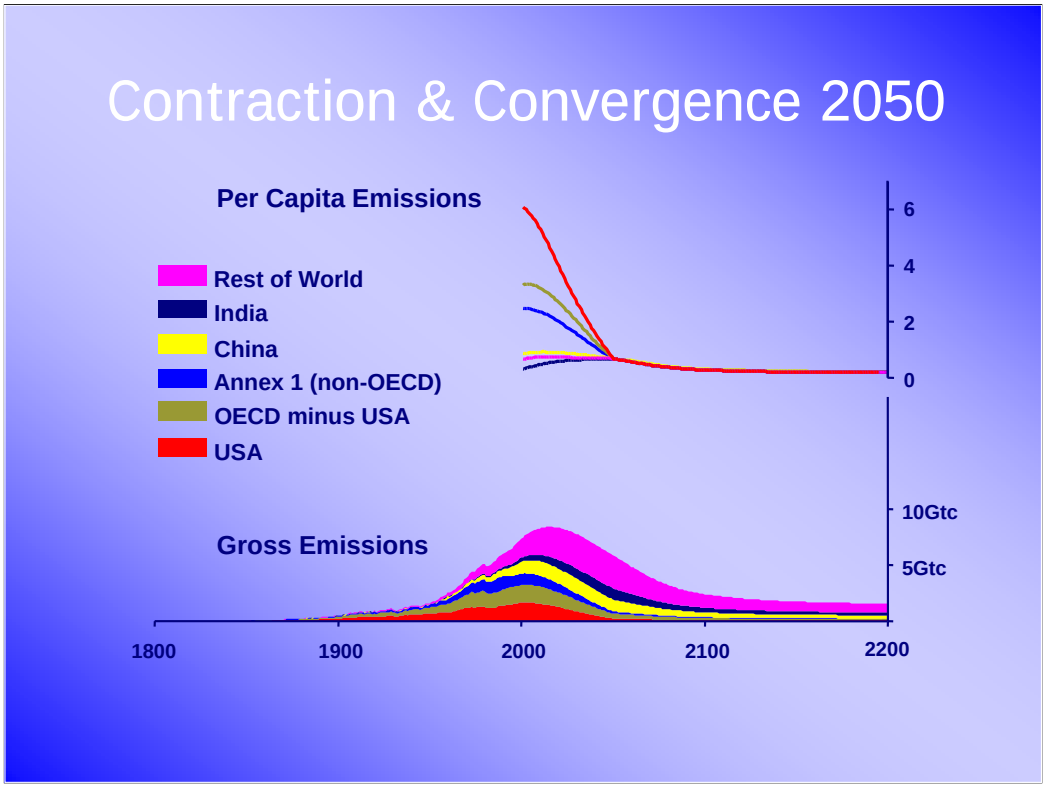
Debit here means in any year the amount by which a nation exceeded its SDI total. *Credit* means in any year the amount by which a nation fell short of its SDI total. *"Debitor"* means in any year the total number of people in the nations that took more than their equitable share of SDI globally. *"Creditor"*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

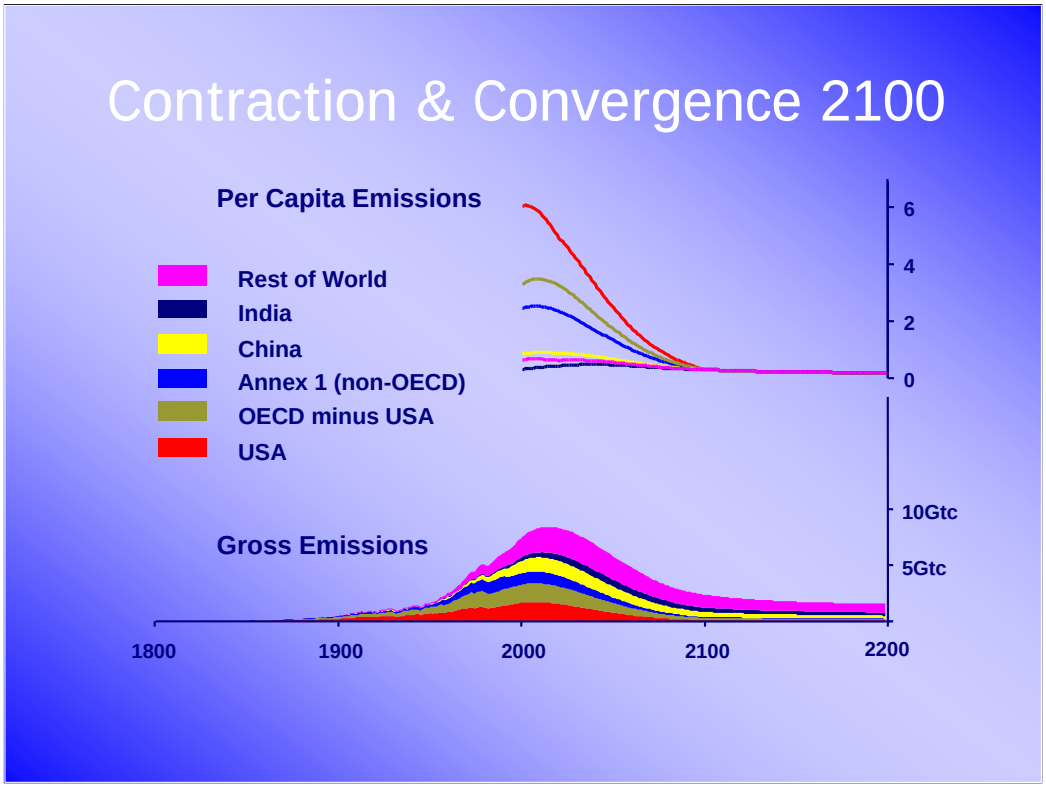

Trends of Expansion & Divergence
INCOME GROSS
billions US$
$20K
$K
1955
1990
EFFICIENCY US$/CO2
$10K
$K
1955
INCOME PER CAPITA
US$
$10K
$K
1955
1990
IMPACT GROSS CO2
billions tonnes carbon
6
0
1955
1990
IMPACT CO2 PER CAPITA
tonnes carbon
3
0
1955
1990
INCOME GROSS PPP$
billions PPP$
$20K
$K
1955
1990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



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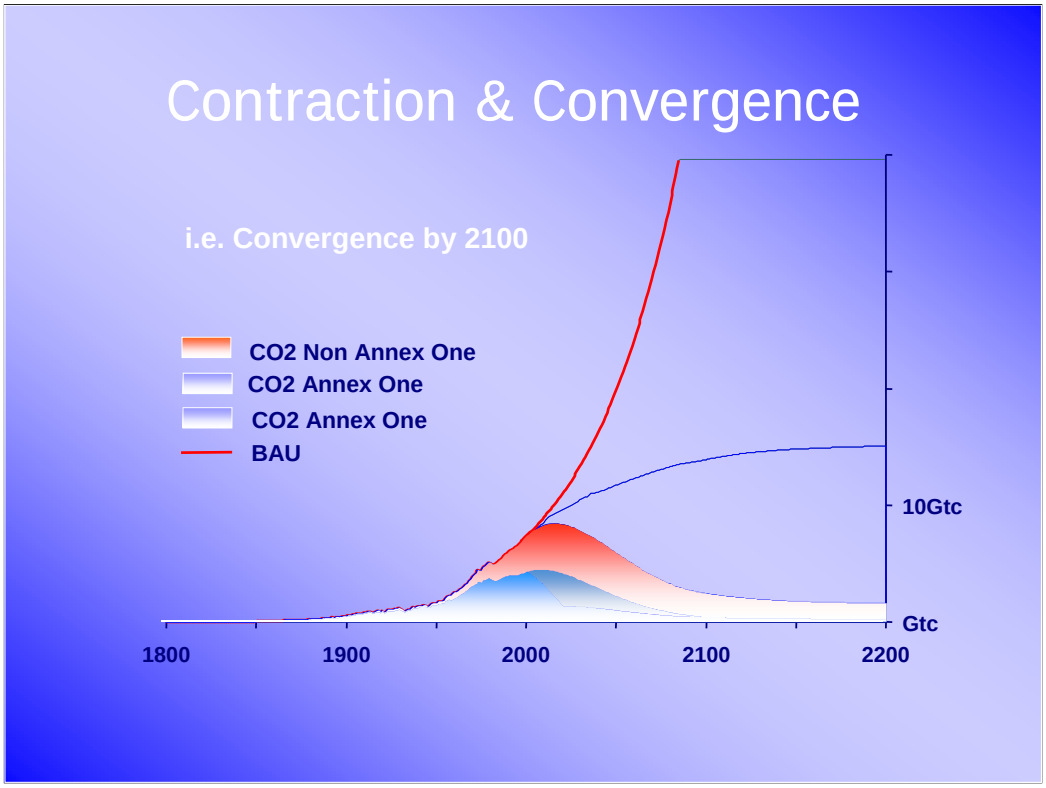
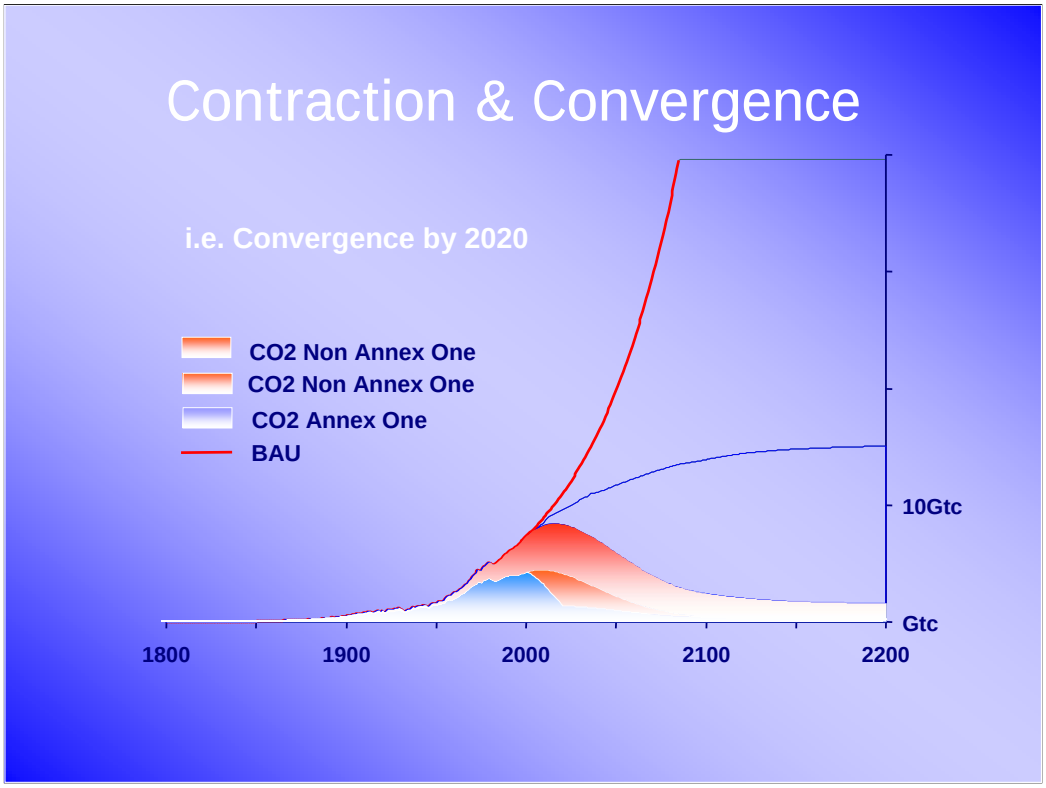


Contraction by 2100 with Convergence by 2100

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

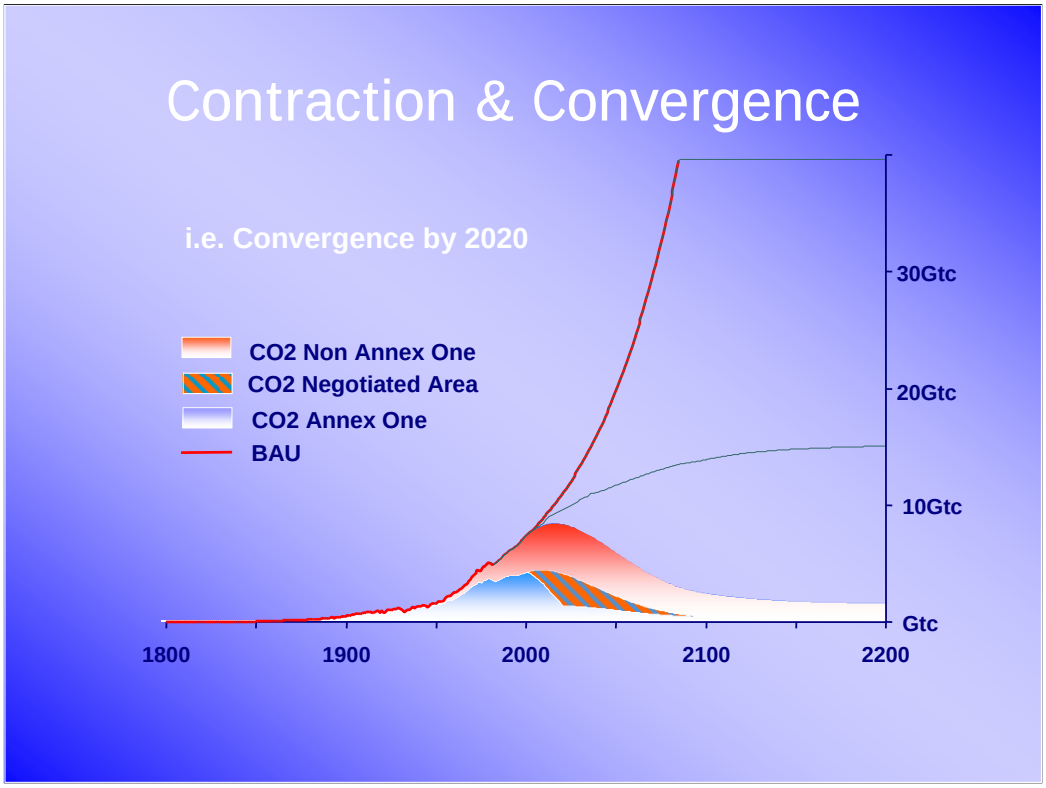
Under Contraction by 2100 for 450 ppmv, entitlements converge to equal per capita by 2100.



Contraction by 2100 with Convergence by 2020

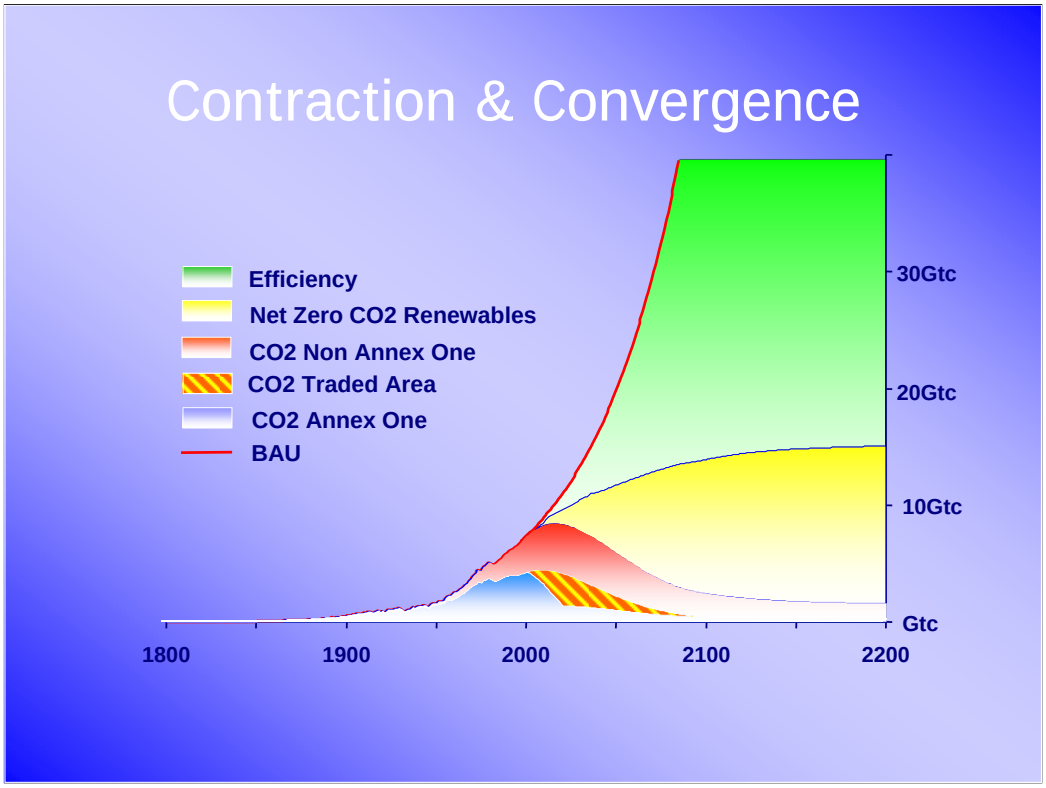
Here are greenhouse gas emissions for the world divided in two regions, the Developed and Developing Countries.

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.

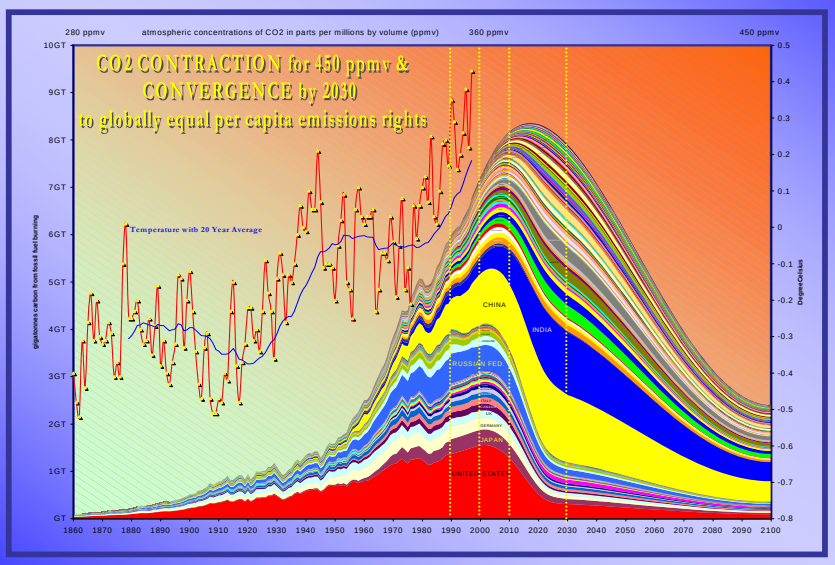
Whatever rate is negotiated the shares created thereby should be internationally tradable, and ideally redeemed for net zero emissions energy technology.

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.

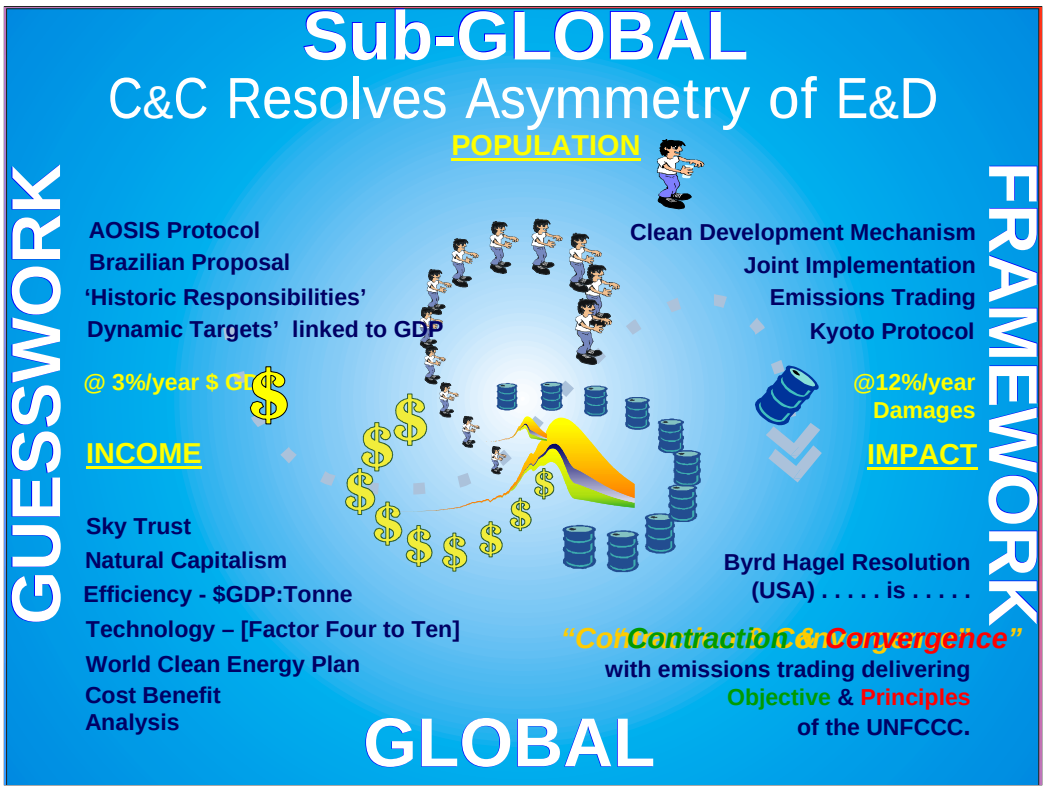
" C & C " – The Classic Image



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

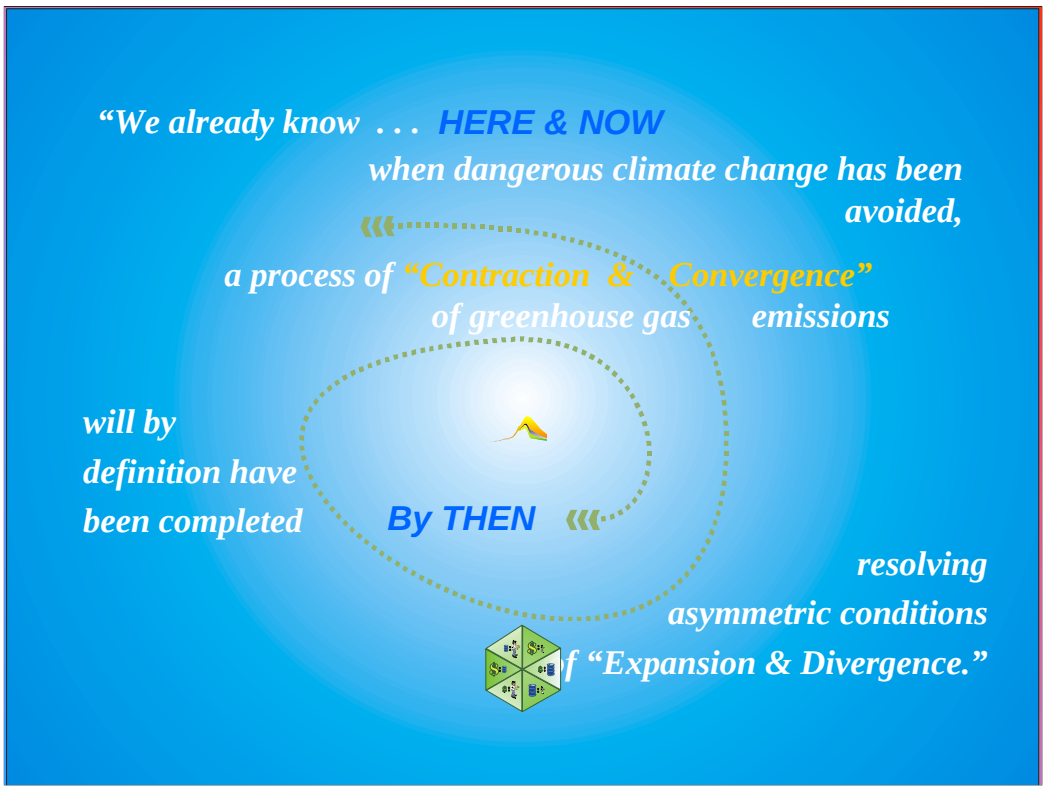
- will this happen by accident or will it happen by agreement and design?
- if the latter, what will the design be?
- how quickly will it be agreed and implemented?

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."