When Politics Trumps Science -
A Critical View of the Paris Agreement

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(Based on work done in collaboration
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References

See papers by us available at

- Webpage of **Centre for Climate Change and Sustainability Studies** http://climate.tiss.edu

- Review of Agrarian Studies at http://www.ras.org.in (especially papers and notes in Vol. 5, No. 2, July - December, 2015, for this talk)

- Economic and Political Weekly at http://epw.in

Global warming is happening now

- A continuous phenomenon due to the effect of greenhouse gas emissions (mainly carbon dioxide) since the start of the Industrial Revolution.
- Currently global average temperature has risen almost

  0.85 – 1.0 deg Celsius since 1850-1870.
- Is leading to melting of polar ice-caps and glacier melting. Sea-level rise (measurable and increasing) (0.2 m during 1900 -2010)
- More heat waves and other extreme climate phenomena including hurricanes, height of storm surges, etc.
- Changes in precipitation – amount, pattern and variability in different parts of the world.

(Source – IPCC – Fifth Assessment Report)

Impact on Biosphere & Human society

- Has already affected flora and fauna – Movement to keep pace with rising tempertature
- Change in pest, disease vector behaviour and extension of their habitat.
- Depressor effect on agricultural yields (Not yet absolute reduction)
- Acidification of ocean – definite increase – Threat to marine life. Change in marine catch patterns
- India – Apple moving higher in Himachal Pradesh; Tank-bred carp in W. Bengal breeding season extended

The Future with Global Warming

- All these effects would increase in magnitude, intensify and be more frequently extreme.
- **Significant uncertainties in actual estimates!!**
- New effects may appear. (Many of these are known. Catastrophic effects are immediately unlikely)
- Beyond a “threshold” - sudden rise in negative impact and damages.
- Sea-level rise may seriously affect coastal zones, islands in various oceans.
- **What is the “safe” limit? Keep global average temperature increase as low as possible!! -- 1.5 or 2 deg C.**

How should the world reduce emissions?

UNFCCC – Two key principles.

UNFCCC - Article 2

`ultimate objective' of the Convention is the ``stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system''

UNFCCC- Article 3.1

`` Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities.''

Sharing the Burden in Emissions Reduction

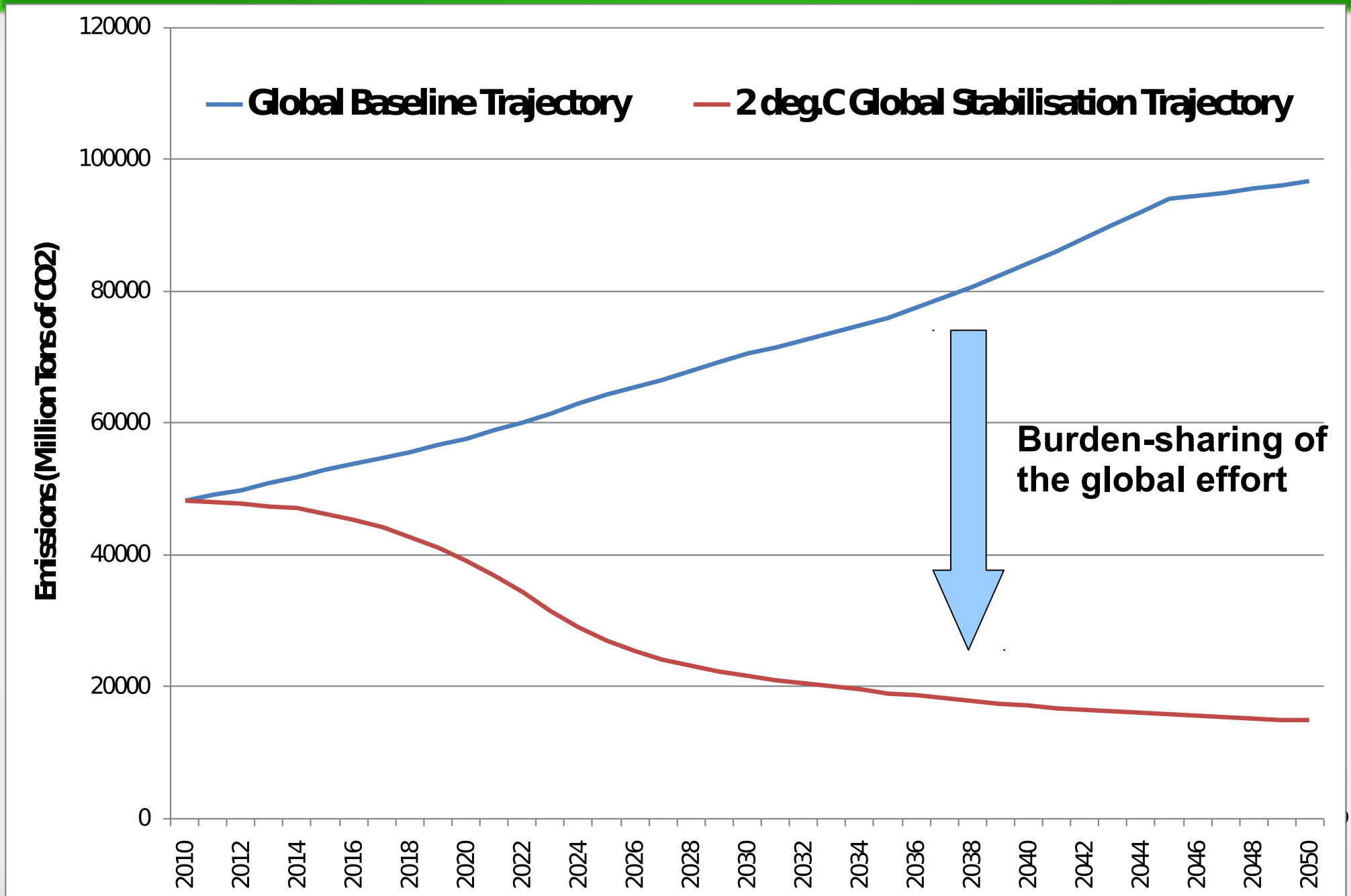
- Global Warming in an **Unequal** world.
- Developing Countries – Large energy needs; Industrialization incomplete; Large populations with serious energy deficits. Technological and economic uncertainties in strategising for future energy infrastructure.
- Developed Countries - Reluctance to take the lead (USA!!). Lack of political will. Huge investment in existing infrastructure. Insistence that all countries must declare long-term emissions reduction plans.
- How will the burden of emissions reduction be shared? Key dispute between developed and developing nations.

Limiting Emissions – Traditional View

- Focus on reducing the flow of emissions – Emissions must peak and then reduce to a (very) low level.
- For 2 deg C, must have already peaked and started reducing from 2010!!
- Rate of reduction – fixed partly by considerations of climate science and partly by economics.

Note – 2 deg C rise is temperature increase after equilibrium is reached.

Global Emissions Trajectory



Problems with the flow approach

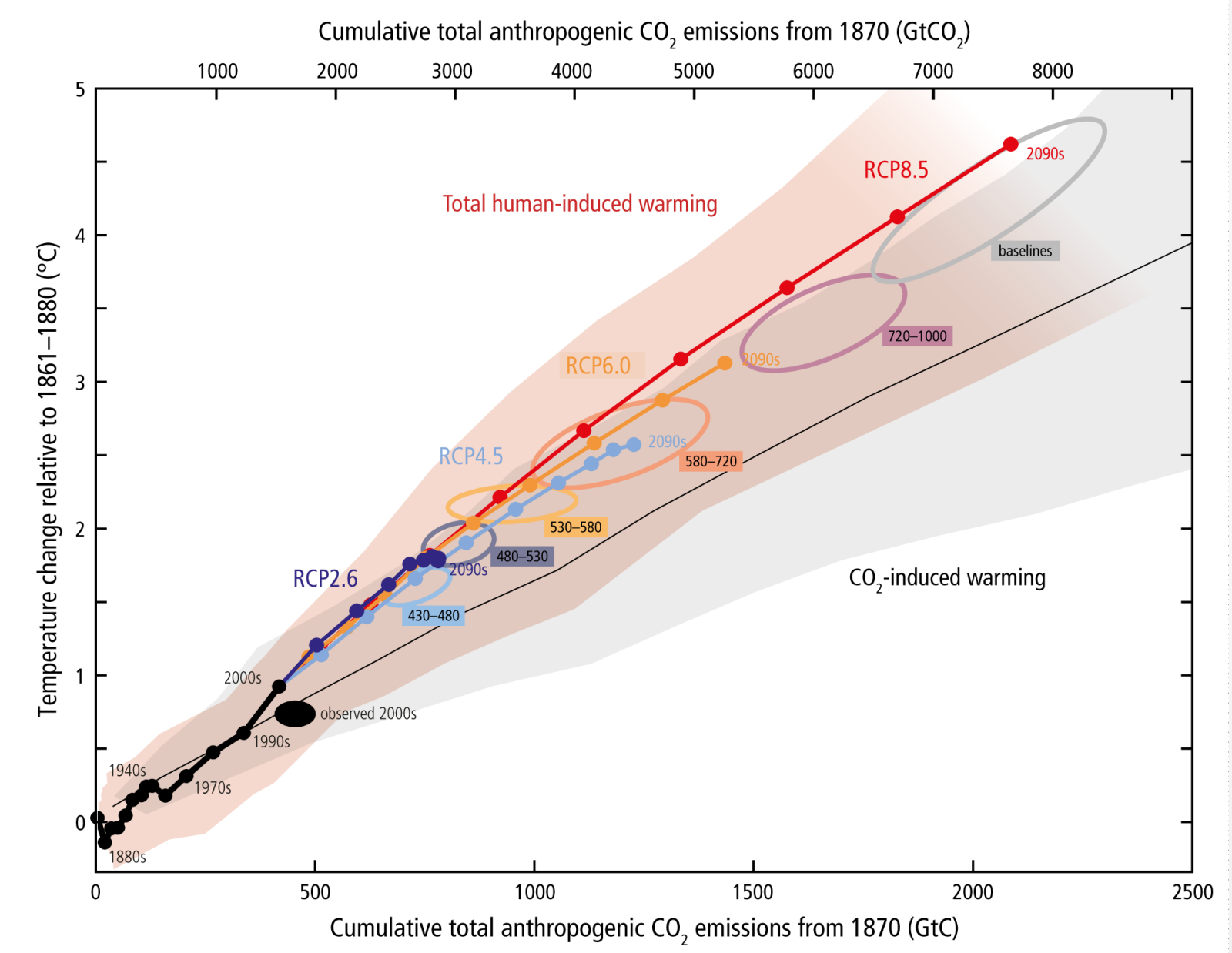
- Rests on counterfactual considerations.
- Need to estimate future emissions growth of ALL countries. Then determine the reduction each country must achieve from this trajectory to match the global requirement.
- Reduction to be determined country-wise by some formula.
- Major uncertainties in determining future requirements.
- Reaching a developmental target is a cumulative effect.
- Puts unnecessary restrictions on developing countries – Future developmental trajectories are seen merely as extrapolation of current trends.

Limiting Emissions – Global Carbon Budget

- Major scientific advance – Reported (consensus?) in latest IPCC Fifth Assessment Report (2013).
- If **maximum** temperature rise has to be limited to a particular value - then the world's cumulative emissions (from 1850 onwards) has to be limited to some definite amount.
- World has to live on a GLOBAL CARBON BUDGET.

Lessons from Climate Science

- Global temperature increase approximately proportional to cumulative emissions of greenhouse gases



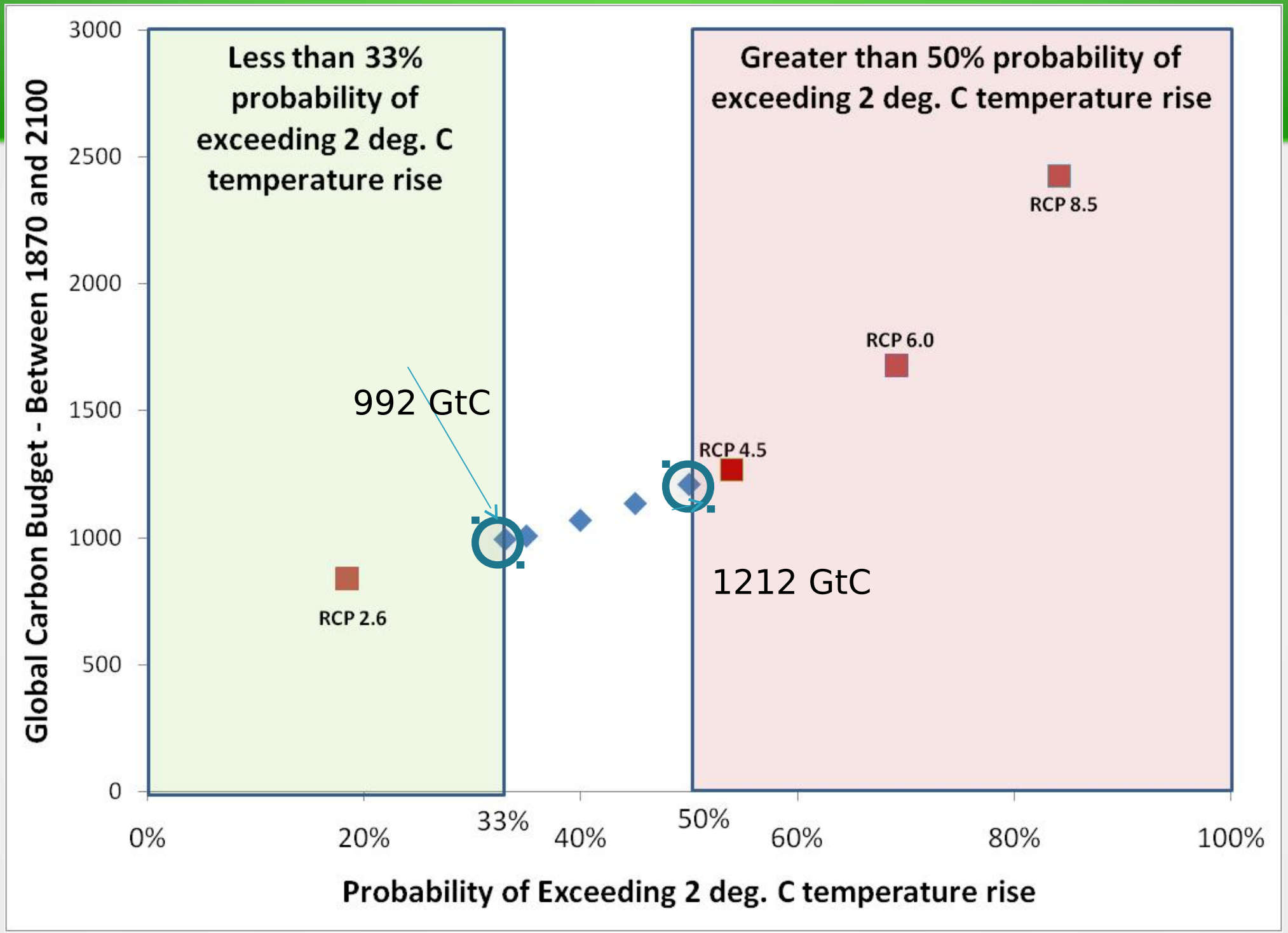
Probability of exceeding 2 deg C and the carbon budget

- For a greater probability of exceeding 2 deg. C – a greater **'Global Carbon Budget'** is available.

(Probability distributions derived from model simulations, across a range of models).

- Physical limit on emissions that is not determined by energy costs, carbon price or feasible low carbon pathways – Least economic and policy uncertainty

- What is the quantum of the budget?


Less than 33% probability of exceeding 2 deg. C temperature rise
Greater than 50% probability of exceeding 2 deg. C temperature rise
RCP 8.5
RCP 6.0
RCP 4.5
RCP 2.6
992 GtC
1212 GtC
Global Carbon Budget - Between 1870 and 2100
3000
2500
2000
1500
1000
500
0
0%
20%
33%
40%
50%
60%
80%
100%
Probability of Exceeding 2 deg. C temperature rise

Range for the Carbon Budget

- 67% (high) to 50% (low) probability of limiting temperature rise to 2 deg. C
- 992 to 1212 GtC between 1870 and 2100
- 325 to 545 GtC between 2012 and 2100
  - 667 GtC already emitted (including estimated 152 GtC of non - CO2 emissions)
- How is this to be divided among all parties?

(Sharing the global commons)

Carbon budgets vs Carbon Flows

- Carbon budget treats the atmosphere as a global commons (vs the pollution approach implicit in flows)
- Each nation can be allocated a share of the global carbon budget (based on Art. 3.1). Equity considerations are easy and transparent.
- The specific peaking year is not an issue since the rate of rise and decline of flows can vary, provided total cumulative emissions are within the budget.

Entitlements – Benchmark for Equity

1870-2100 (%)	Simple Per Capita Entitlements	Per Capita Entitlements - weighted by GDP	Per Capita Entitlements - weighted by HDI
Developed Countries (Annex-I)	19%	17%	14%
Emerging Economies	52%	53%	54%
Least Developed Coauntries	29%	30%	32%

Based on population figures for 2011

Entitlements in GtC

1870 -2100 (GtC)	Simple Per Capita Entitlements	Per Capita Entitlements - weighted by GDP	Per Capita Entitlements - weighted by HDI
Developed Countries (Annex-I)	184 - 225	173 - 211	139 - 170
Emerging Economies	518 - 633	521 - 637	533 - 651
Least Developed Countries	290 - 355	298 - 364	320 - 391

Annex-I Over-occupation

- Annex-I countries currently over-occupy carbon space

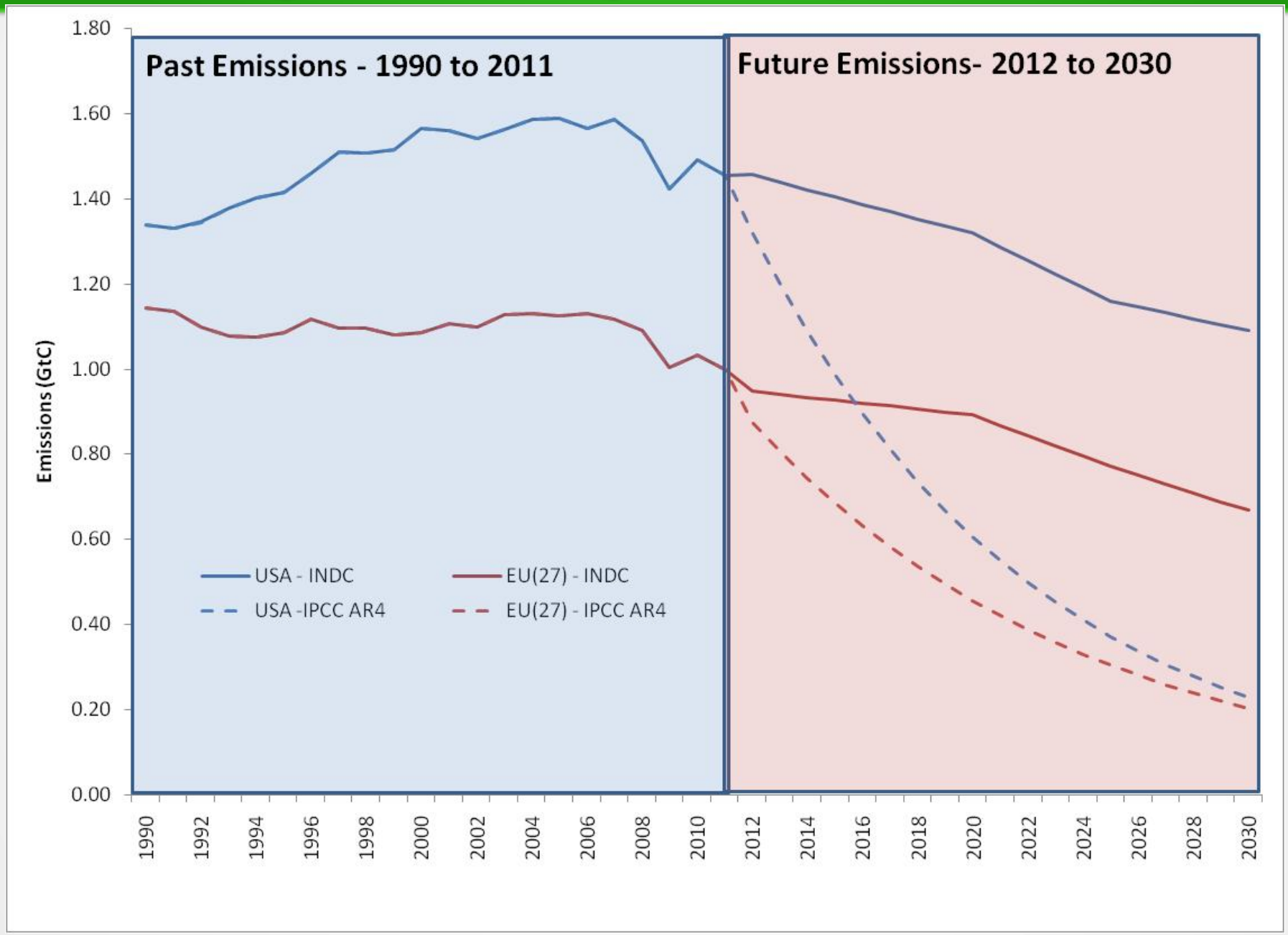
GtC	Simple Per Capita Entitlements	Per Capita Entitlements - weighted by GDP	Per Capita Entitlements - weighted by HDI
Entitlements	184 - 225	173 - 211	139 - 170
Actual Past Emissions		492	
Extent of Overdrawal of Carbon Space	267 - 308	281 - 319	322 - 353

- This over-occupation cannot be undone in ‘physical’ carbon terms.

Differentiation and Carbon Space Occupation

- Annex – I and Non – Annex I differentiation clearly reflected in the over-occupation of carbon space, well beyond fair share.
- Non-Annex I parties have not occupied beyond fair share – Few exceptions amounting to less than 20 GtC!!
- Also reflects the variations in national situation within this binary division.

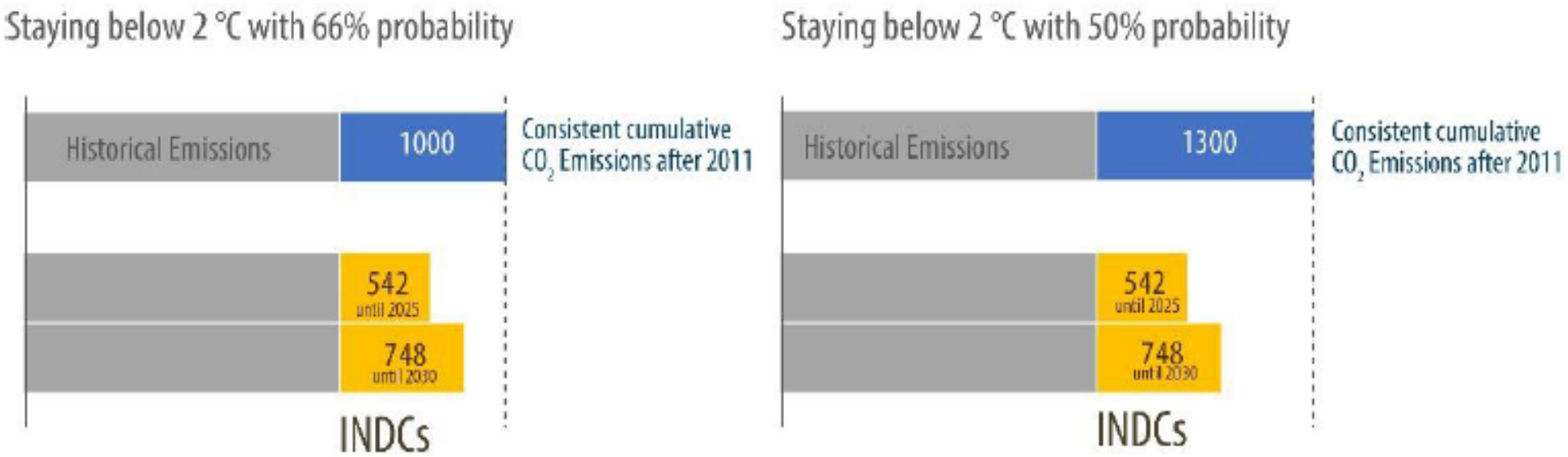
Existing INDCs grossly inadequate



UNFCCC Synthesis Report on the aggregate effect of the INDCs

Figure 13

Cumulative CO_2 emissions



Abbreviation: INDC = intended nationally determined contribution.

What about 1.5 deg C?

50% probability of staying below 1.5 C

– 550 GtCO2

33% probability of staying below 1.5 C

- 850 GtCO2

(until 2100)

Compare with cumulative emissions with current INDCs

542 GtCO2 by 2025

748 GtCO2 by 2030

Keeping global temperature below 1.5 deg C out of reach!!

(Kevin Anderson – 1.5 deg C is in the rear-view mirror!)

- What is available for the future (in physical terms)
  - 325 to 545 GtC
- Current INDCs – 204 GtC exhausted by 2030
  - UNFCCC Synthesis Report
- Very little left for the future beyond 2030
- Late developers will have no carbon space left!!

Claims on Carbon Budgets – 2012-2030

	Cumulative Emissions (GtC) 2012- 2030 Implied by INDCs	Remarks
USA	19	Cumulative Emissions till 2025 as implied by INDC as it extends only till 2025
EU (28)	16	
Russian Federation	7	
India	18	@ 7% GDP growth per annum
China	64	@ 8% GDP growth per annum

Claims on Carbon Budget vs. Remaining Fair Share

	Cumulative Emissions 2012 and 2030 Implied by INDCs	Remaining Fair Share 2030-2100 (Total Budget 992 GtC - 67% pro)
USA	19	-165
EU (28)	16	-119
Russian Federation	7	-41
India	18	138
China	64	59

	Cumulative Emissions between 2012 and 2030 Implied by INDCs	Remaining Fair Share 2012-2100 (Total Budget of 992 GtC - 67% Prob)	What remains of share if only future emissions (2012-2100) are Divided on Per Capita Basis (Minus what is implied by INDCs) - 2030-2100
USA	19	-165	-4
EU (28)	16	-119	7
Russian Federation	7	-41	0
India	18	138	39
China	64	59	-1

India's Fair Share – Illustrative

- Take the lower budget limit → 67% probability of limiting temperature rise to 2 deg. C →
- → 992 GtC from 1870 -2100
- → 325 GtC from 2012-2100
- India's fair share → Total entitlement (1870-2100) – past emissions (1870-2011)
- → 157 GtC
- India's share if only available space is divided equally → 57 GtC

India's Fair Share – for a range of budgets

Probability of temperature not exceeding 2 deg. C	Total Carbon Budget (1870-2100)	Carbon Space Available for the Future (2012-2100)	India's Fair Share (2012-2100) - Per Capita Entitlement (minus past emissions)	India's Share if Future Carbon Space is divided on a per capita basis (2012-2100)
82% - RCP2.6	839	172	130	30
67%	**992**	**325**	**157**	**57**
50%	**1212**	**545**	**170**	**96**
46% - RCP 4.5	1266	599	182	105

Conclusions

- Global carbon budget and acess to an equitable share of the global carbon budget is a rigorous, science-based approach to equity
- It demonstrates that the differentiation of the Annexes is empirically and scientifically valid
- Annex-I countries have grossly overoccupied carbon space
- Available future carbon space not sufficient to satisfy equity concerns in physical terms.
- Fair share of future carbon space must be accompanied by finance and technology transfer based on unaccessible carbon space.

1870 and 1970 Basis Comparative Table

For a Total Budget of 992 GtC - 67% Probability of Limiting temperature rise to 2 deg. C	Per Capita Entitlements (%) Based on 2010 Population	Past Emissions (%) of total past emissions		Future Share of Entitlement Remaining - 2012-2100 (GtC)		Future Share of Entitlement Remaining after accounting for INDCs - 2031-2100 (GtC)	
		1870-2011	1970-2011	1870 Basis	1970 Basis	1870 Basis	1970 Basis
USA	5%	29%	24%	-147	-60	-165	-78
EU (28)	7%	26%	21%	-103	-28	-119	-44
Russian Federation	2%	8%	9%	-34	-20	-41	-26
India	18%	3%	3%	156	112	138	94
China	20%	11%	13%	123	87	59	23

	Entittlements	Past Emissions (1870-2011)	Past Emissions (1970-2100)	Remaining Share of Entitlements for period 2012-2100 after accounting for past Emissions (GtC) - 1870 Basis	Remaining Share of Entitlements for period 2012-2100 after accounting for past Emissions (GtC) - 1970 Basis
USA	5%	29%	24%	-147	-60
EU(28)	7%	26%	21%	-103	-28
Russian Federation	2%	8%	9%	-34	-20
Japan	2%	4%	5%	-9	-6
Australia	0%	1%	1%	-5	-3
Canada	0%	2%	2%	-10	-5
Other Annex-I	2%	4%	3%	-2	4
China	20%	11%	13%	123	87
India	18%	3%	3%	156	112
Brazil	3%	1%	1%	22	16
South Africa	1%	1%	1%	-1	0
Indonesia	3%	1%	1%	29	21
Mexico	2%	1%	1%	9	6
South Korea	1%	1%	1%	0	0
Other Emerging Economies	6%	4%	6%	31	19

From Copenhagen to Durban

- Copenhagen (COP 15) – Failure of old strategy of developed countries. Not impossible to impose top-down agreement on all (Not willing to accept such limitations on themselves).
- New strategy – Voluntary commitments by all – Not what is necessary BUT only what is doable.
- But global temperature target fixed – 2 deg C.
- Some commitment on finance - $100 billion annually by 2020.
- Cancun (COP 16) – made Copenhagen pledges part of formal UNFCCC outcomes

Durban Platform (COP 17)

- Agreement to have an agreement
- Should be legally binding on **ALL** countries
- No mention of equity or Common But Differentiated Responsibilities (CBDR). Attempt to wipe out differentiation
- India and China – relative isolation (especially India)
- India – NO proactive stance on equity

(Using equity only in defensive mode – No proactive proposal – Impossible ideal of Kyoto Protocol as the ideal arrangement)

- Agreement by 2015 – to be implemented by 2020.

Runup to Paris

- Several attempts to thrust an agreement on developing countries (Serious attempt at Bonn negotiations in late 2015)
- Development of idea of Intended Nationally Determined Contribution (INDC)
- Takeover by US of the thrust of negotiations in early 2015.

Major issues
I. Mitigation

- The global mitigation goal
- Temperature limit – but not going beyond
- 1.5 deg C is NOT feasible
- Global carbon budget is ignored!!

More Mitigation

- Ignoring individual country commitments
- On any country, let alone clearly differentiating
- Vague differentiation
- No idea of how the individual commitments will add up to the global carbon budget
- Currently – how do the INDCs add up?
- Answer: THEY DONT!!

II. Increasing Mitigation Efforts

- INDCs will become NDCs
- Unlikely to be more stringent (Well – there are some caveats here!!)
- Review of 2018, before these go into operation
- Urging to improve “ambition”, but nothing concrete.
- Global stocktake in 2023, and five years thereafter, but what will happen then?
- At the same time, they note in the decision accompanying the agreement that INDCs are

NOT ADEQUATE!!

- The review of 2018 will consider this issue of adequacy

(More intense negotiation three years away!!)

III. Monitoring and Review

- Every five years from 2023, (but also 2018)
- Modalities, procedures, guidelines yet to be fixed.
- Long, tiresome negotiations ahead!!
- Much noise on transparency - diversionary

IV. Finance

- Not much beyond the promised $100 billion per year from 2020.
- Developing countries are to provide requests for support but a technical expert review will be undertaken.

ECS and TCR

Equilibrium climate sensitivity (ECS) and transient climate response (TCR) are useful metrics summarising the global

climate system's temperature response to an externally imposed RF. ECS is defined as the equilibrium change in

annual mean global mean surface temperature (GMST) following a doubling of the atmospheric carbon dioxide

(CO2) concentration, while TCR is defined as the annual mean GMST change at the time of CO2 doubling following a

linear increase in CO2 forcing over a period of 70 years (see Glossary). Both metrics have a broader application than

these definitions imply: ECS determines the eventual warming in response to stabilisation of atmospheric composi-

tion on multi-century time scales, while TCR determines the warming expected at a given time following any steady

increase in forcing over a 50- to 100-year time scale. {Box 12.2; 12.5 .3}