The Challenges of Climate Change Policy in the 21st Century

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October 2009

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The Nature of the Problem

- Climate change is very different from other challenges we have faced as a planet.
- The three key issues are:
  - Huge uncertainty about future impacts
  - The very long term nature of the impacts
  - The big divide between rich and poor countries with respect to responsibilities for climate change and the impacts of climate change.

The Role of Science

- In spite of the great effort that has been made in the last 20 years or so we still have many gaps in our knowledge.
  - Pure climate science: e.g. how big is the climate sensitivity factor?
  - Mitigation: what are the best options, and how can we ensure they are selected?
  - Adaptation: at the local level where are the most likely impacts and what is the best way to deal with them?
  - Negotiation: how can we achieve international agreement in reducing emissions and making the right adaptation actions?
- Most of these need interdisciplinary action.

Uncertainty in Science of Climate

Climate Sensitivity

- Climate sensitivity S is an amplifying or scaling multiplier for converting changes in emissions into temperature change by the linear approximation:

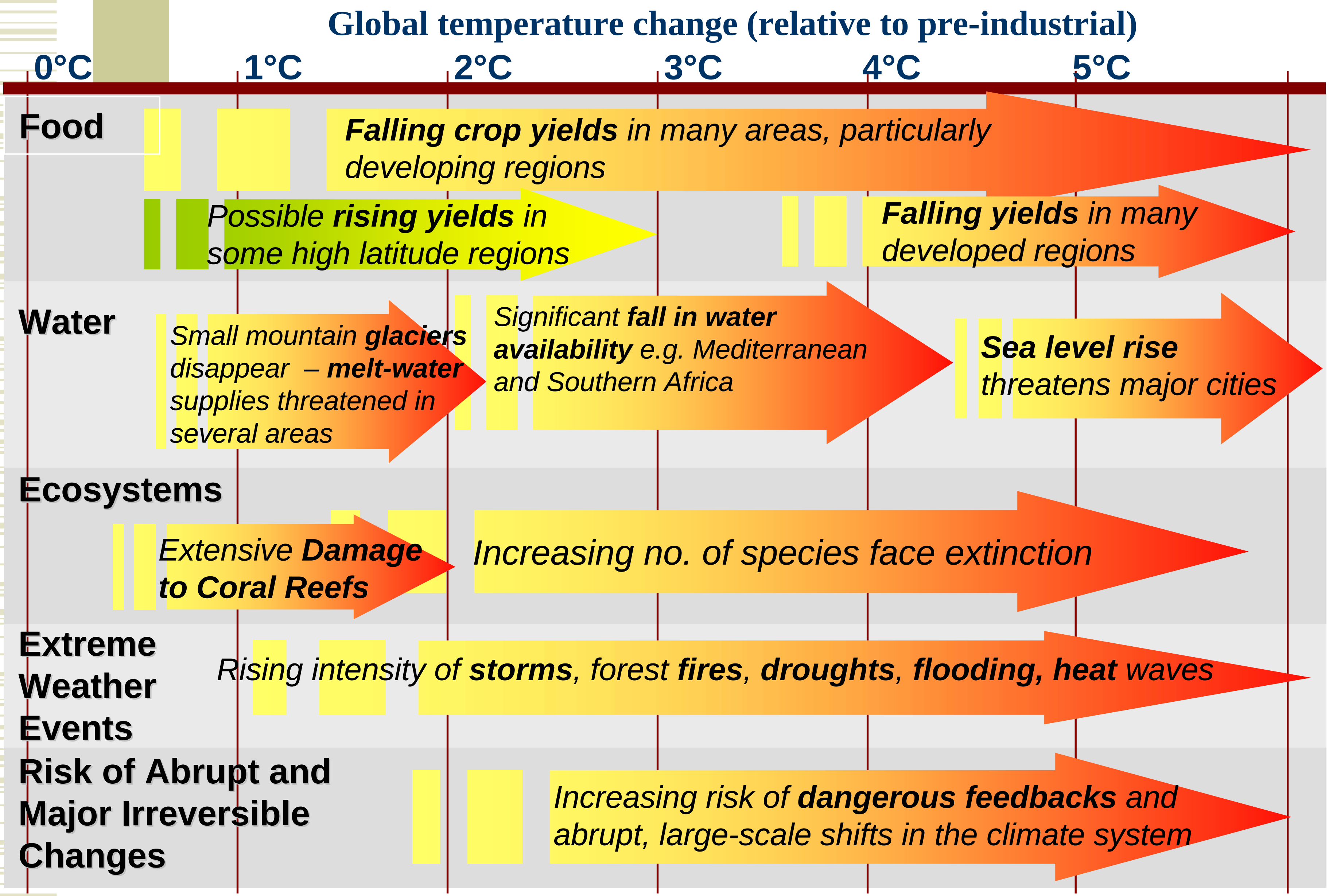
$$\Delta T \approx (S / \ln 2) \Delta LnCO_2$$

- S is the global warming following a doubling of CO_2 concentrations. $\Delta LnCO_2$ is change in log of sustained CO2 concentrations.

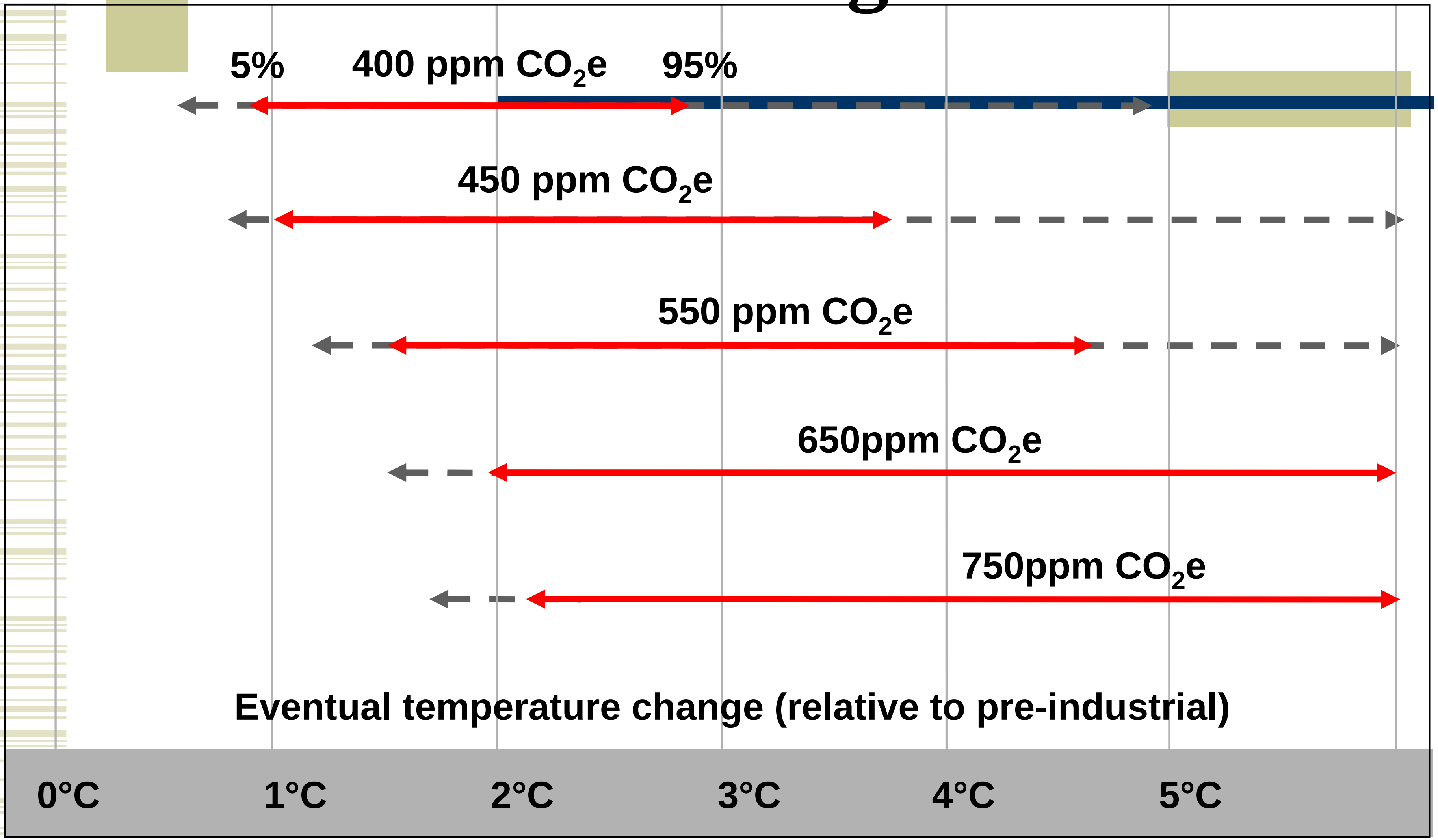
Climate Sensitivity

- S is likely to be in the range 2 to 4.5^{0} C with a best estimate of 3^{0} C, and is very unlikely to be less than 1.5^{0} C. Values substantially higher than 4.5^{0} C cannot be excluded.
- IPCC gives a probability of 17% that S is substantially higher than 4.5^{0}
- Based on the tail of the distribution there is a probability of 2% that S > 8%.
- Such an increase has not been experienced for tens of millions of years and would imply disaster for the planet.

Projected impacts of climate change



Stabilisation and Commitment to Warming



A Current "Consensus"

- We should aim to stabilize GHG concentrations at 550 ppmv to avoid serious risks.
- This will require global emissions to peak in 2020 and to decline steadily thereafter.
- By 2050 emissions globally should be 50% of 2000 levels
- For developed countries they need to fall by around 80% by 2050.

Can We Achieve This Target?

- Yes, but at what cost?
- And who is going to make the required reductions in emissions?
- These are the most difficult questions to answer in the context of the climate change negotiations.
- In the following slides I present some options based on the POLES model.

The POLES Model

- Global energy model, which takes macroeconomic projections for different countries as given and looks at measures needed to meet different emissions reductions targets.
- Model is detailed for the energy sector and especially for the electricity sector. It is a combination of a top-down and bottom-up model (Hybrid model).

The POLES Model

- It includes all sources of supply of fossil energy and allows markets to determine the prices of oil, gas and coal.
- The model runs to 2050.
- I report the results of two versions:
  - A Baseline case, where no further action is taken to reduce GHGs (Copenhagen fails)
  - A Success Case, where we make the target reduction of 50% of GHGs with respect to 2000 by 2050. This is achieved through a price of carbon and international trading of permits (or global carbon tax).

The ‘Results’ for 2030-2050: GDP Per Capita

GDP Per Capita €05	2010	2030	2050
ESP	21,445	28,870	36,950
EU15	23,690	30,980	39,250
China	7,960	19,950	35,270

Small convergence between ESP and EU15 but big convergence between EU15 and China

Holds for both no success and success at Copenhagen

Results for 2030-2050: GHG Emissions and Prices of Oil, CO2

BASELINE

Item	Unit	2010	2020	2030
CO2 World	MT	29940	35434	40550
Price Oil	***€05/bl***	65.7	77.2	95.2
Price Carbon	***€05/bl***	0	0	0

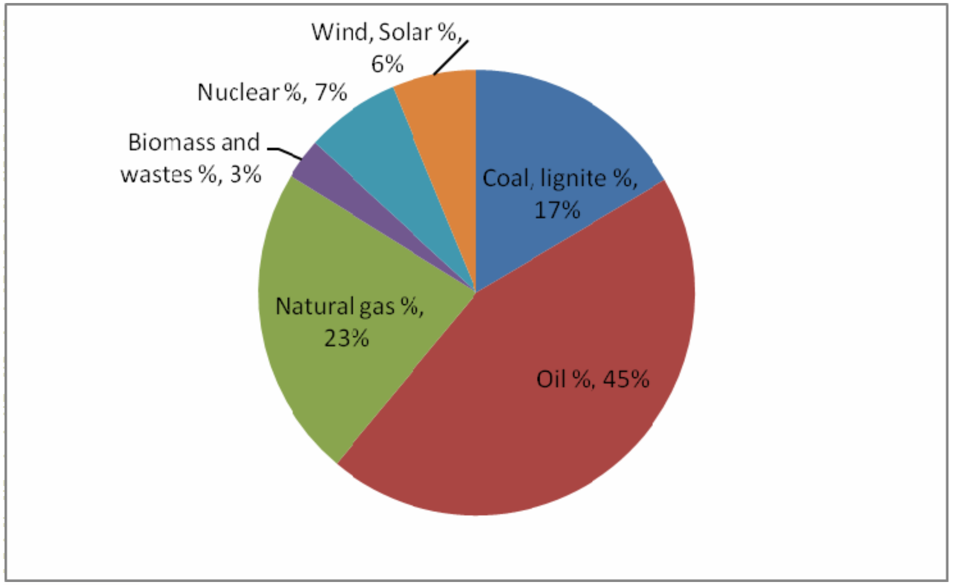
TARGET 50% GLOBAL REDUCTION BY 2050 2000

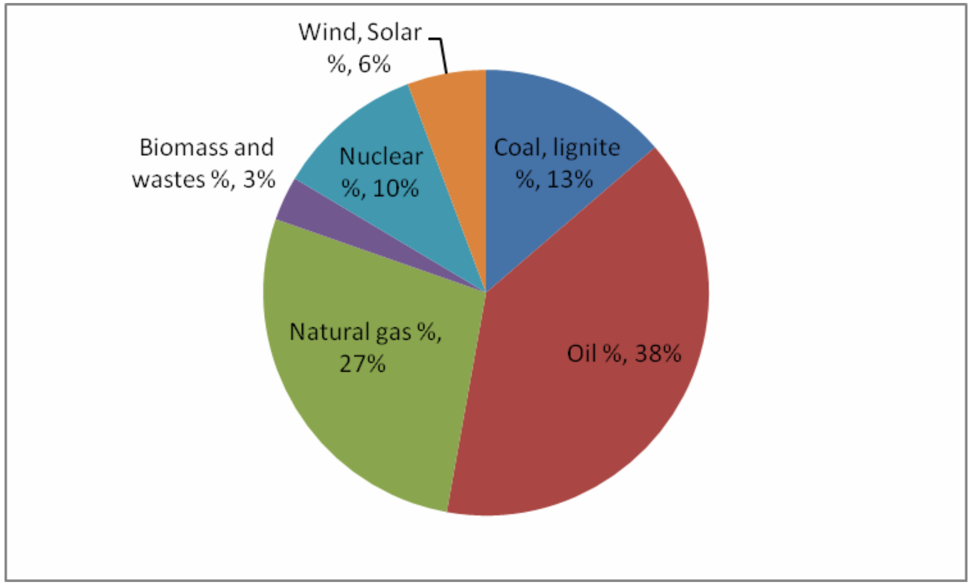
Item	Unit	2010	2020	2030
CO2 World	MT	29574	29392	23309
Price Oil	***€05/bl***	65.8	73.4	77.8
Price Carbon	***€05/bl***	8.87	41.41	118.30

Results for 2030: Energy Use in Spain

BASELINE CASE

Target 50% Global Reduction by 2050





No Sequestered Carbon

Sequestered Carbon Via CCS= Biomass + Wind/Solar

What Will it Cost?

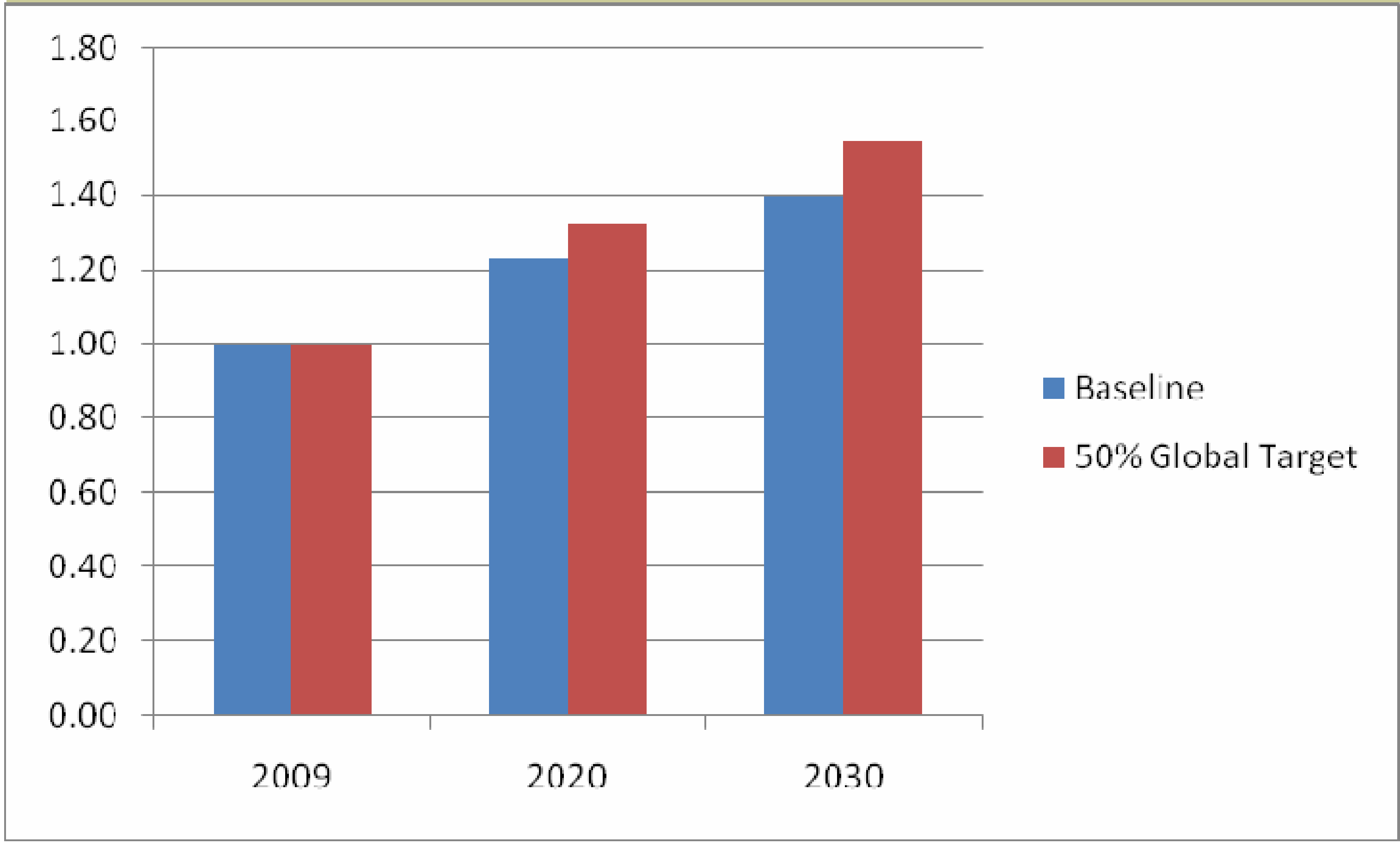
- Energy will cost more, but increases will not be large.
- Increases in R&D will have to be funded by cutting other budgets.
- How much we have to pay to buy emissions rights will depend on how they are allocated. That could cost more…

Results for 2030: Impacts on Price of Gasoline

- Depends of course on taxation
- Assume current taxation €.45/lt. excise tax plus 16% VAT
- Exchange rate now $1.46=1€. This goes to $1.3=1€
- Margins for refining, distributing as per US data.

Price of Gasoline in 2030 €/lt.

Impact of CO2 Tax is less than normal variations due to oil price!



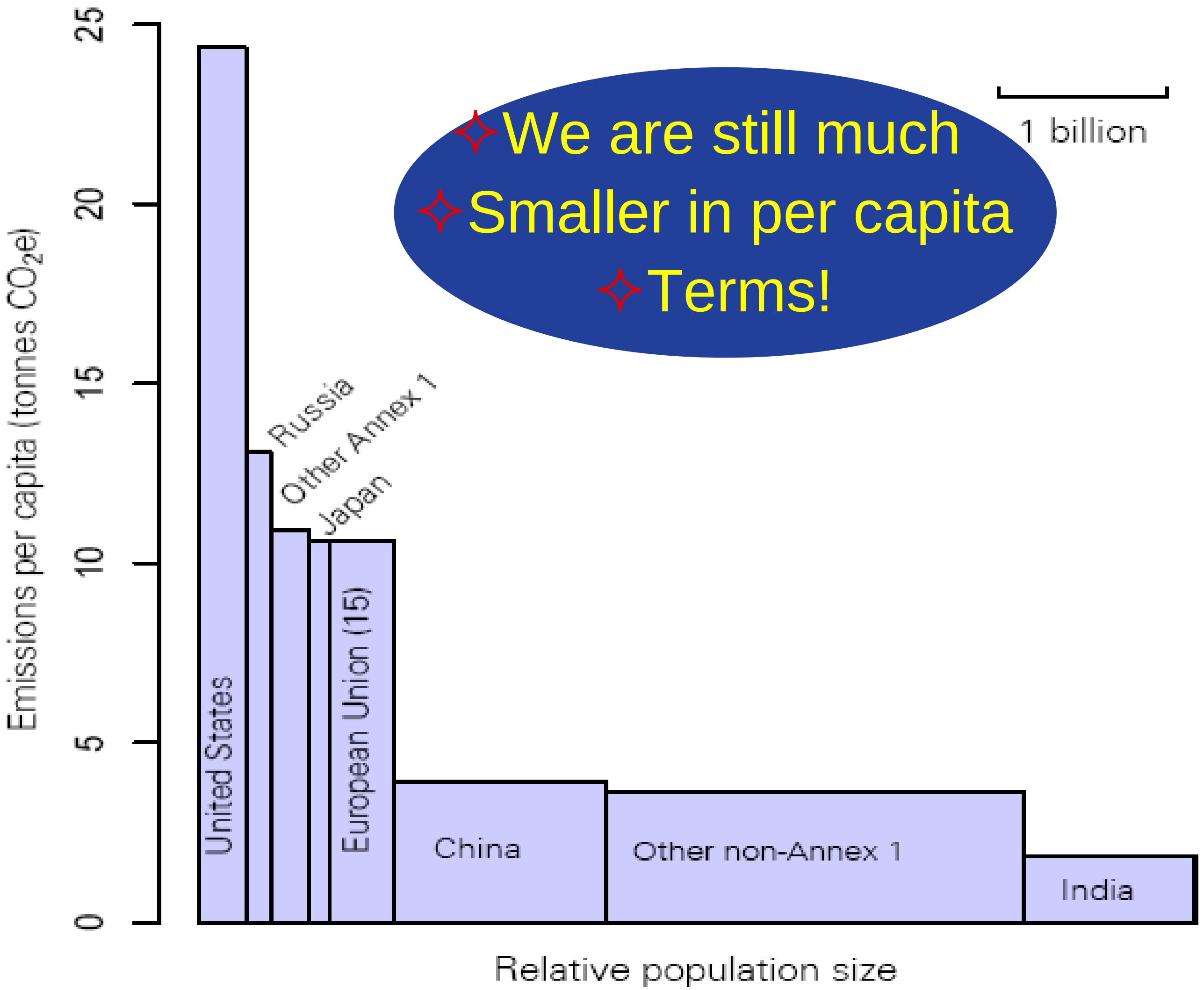
Rich and Poor Countries

A Challenge to Climate Policy and
How Science Can Help

Another Conflicting Interest: Rich and Poor

- Rich will have to make a bigger sacrifice to meet climate objectives.
- By and large the poor are more negatively affected by any future climate change.
- Poor countries will have to make some sacrifices as well if we are to meet targets.
- Rich carry a debt of responsibility for the GHG concentrations.

The Point that Developing Countries Make



How to Allocate Emissions Rights

- We can allocate them based on population applied to current emission.
- Then developed countries will have to buy a large number from developing countries
- Or we can allocate based on population but applied to historic emissions (go back to 1850?)
- Then developed countries will have to buy even more from developing countries!

Allocation Based on Population

		2020	2030
Emissions in China	MTCO2	6821	4862
Allowed Emissions	MTCO2	5319	3891
Net Purchase	€Bn.	62	115
Emissions in India	MTCO2	1885	1738
Allowed Emissions	MTCO2	5191	4081
Net Purchase	€Bn.	-137	-277
Emissions in EU27	MTCO2	3628	2867
Allowed Emissions	MTCO2	1882	1352
Net Purchase	€Bn.	72	179
Price of Carbon		41.4	118.3

Allocation Based on Population

- In our model China and EU27 have to buy significant number of rights
- EU27 pays €72 Bn (€150 per person). In 2020 and €179 Bn. In 2030. Total ODA in 2007 was only €80 Bn.
- Problem at Copenhagen will be critically on how to allocate these rights. It is not likely that EU and other rich countries will agree to these kinds of transfers

So What is the Way Forward?

- Each country makes its own commitment to GHG reduction. (Not sure we can get to 550ppmv)
- Developing countries accept bigger reduction targets than their ‘rights’ would justify, but under major increases in ODA, technology transfer and funding for adaptation. (What would be enough and not all developing countries are in the same situation).

Adaptation and Development

- Development increases resilience
- Adaptation will put strong pressure on developing country budgets and ODA. Budget estimated at around €90 Bn. Per annum.
- International action also has a key role in supporting global public goods for adaptation
  - Disaster response
  - Crop varieties and technology
  - Forecasting climate and weather

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What Advice Can We Give?

- An increase in knowledge is very important (we need your support for research in this area)
- But the need for more knowledge is not an excuse for lack of action. We must aim to meet 550 ppmv.
- Action can and should be flexible.
- International agreements with cuts by all parties are essential
- Efficiency and equity objectives can be decoupled – use of market based instrument with ‘fair’ allocations of rights can play a role.
- Action on adaptation is essential

Thank You