What is still needed from science now?

Klaus Hasselmann

Max Planck Institute for Meteorology,
Hamburg, and
ECF

ECF Annual Conference,
26-27 March 2007, Berlin

We are seeing a major sea change in the public, business and political response to climate change, with numerous new initiatives from

- business councils
- NGOs
- public administrations on the regional level
- policymakers nationally and internationally

What can science contribute?

Is there an effective independent role that scientists can play?

ECF charter:

"The goal of ECF is to strengthen the cooperation between scientists and stakeholders in order to provide improved support for the development of climate policies"

1st Step: Exchange of information (annual conferences, workshops, discussions,…) ✓

2nd Step: Develop appropriate analysis tools ?

Question to Richard Benedick, former US chief negotiator in the Montreal protocol on the protection of the ozone layer:

"Are the integrated assessment (IA) models of the coupled climate-socioeconomic system developed by scientists helpful for climate policy negotiations?"

Benedick: "Frankly, no. They are still too far away from the real concerns of policymakers"

Climate policy concerns of policymakers:
Answers provided by current IA models:

- What will be the impact on the employment level? 0
- What will be the total costs in national GDP? (✓)
- What will be the impact on individual sectors of the economy? (✓)
- How will the public respond? 0
- What will be the impact on international competitiveness? (✓)
- What will be the impact on international security and coexistence? 0

Why is the batting average of IA models so poor?

Because they have evolved from the tradition of Computable General Equilibrium (CGE) models and cost-benefit analyses. These are good for studying market interactions.

But they are unable to capture the non-equilibrium dynamic processes governing the multi-national, multi-stakeholder response to the global climate change problem.

Result: Recent climate reports (Stern, Lehman Brothers, Kinsley, …) have emphasized the dangers and costs of climate change rather than providing detailed analyses of specific solutions.

The problem is very evident in the impact of IPCC.

The 1st Working Group of IPCC (“The Science of Climate Change”) has been highly effective in convincing the public and policymakers on the reality of climate change.

However, IPCC Working Groups II and III (“Impacts, adaptation, vulnerability and mitigation”), by their detachment from the political process, have had much less influence.

Thus the Stern Report, for example, relies heavily on IPCC WG I, but draws its own economic conclusions, largely independent of IPCC WGs II and III

How can science better support the development of effective climate policies?

Proposal: create a special

Climate Policy Panel (CPP) within IPCC

mandate: work closely with policymakers to analyze alternative pathways to a sustainable global economy within the constraints of "avoiding dangerous climate change" (less than 2^0C warming above pre-industrial level)

ECF could provide an important input to such work.

But to be effective, IA modelers must first work together with stakeholders and policymakers to develop a meaningful suite of models that addresses the concerns of stakeholders and policymakers.

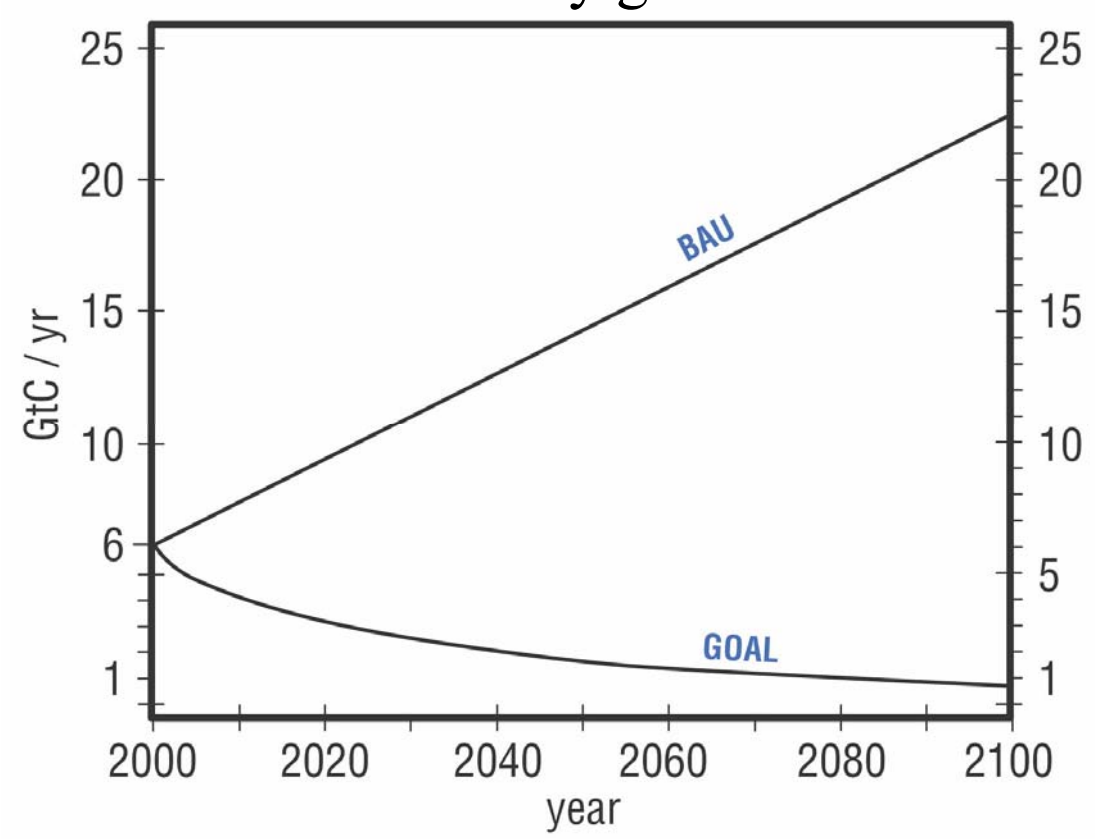
Model properties:

- A model *suite* (many separate issues)
- *Multi-actor* (many divergent interests)
- *Dynamic* (non-equilibrium response)
- Economic *and ethical* factors
- *Homogeneous* structure (for multi-criteria post-analysis of the set of all simulations)

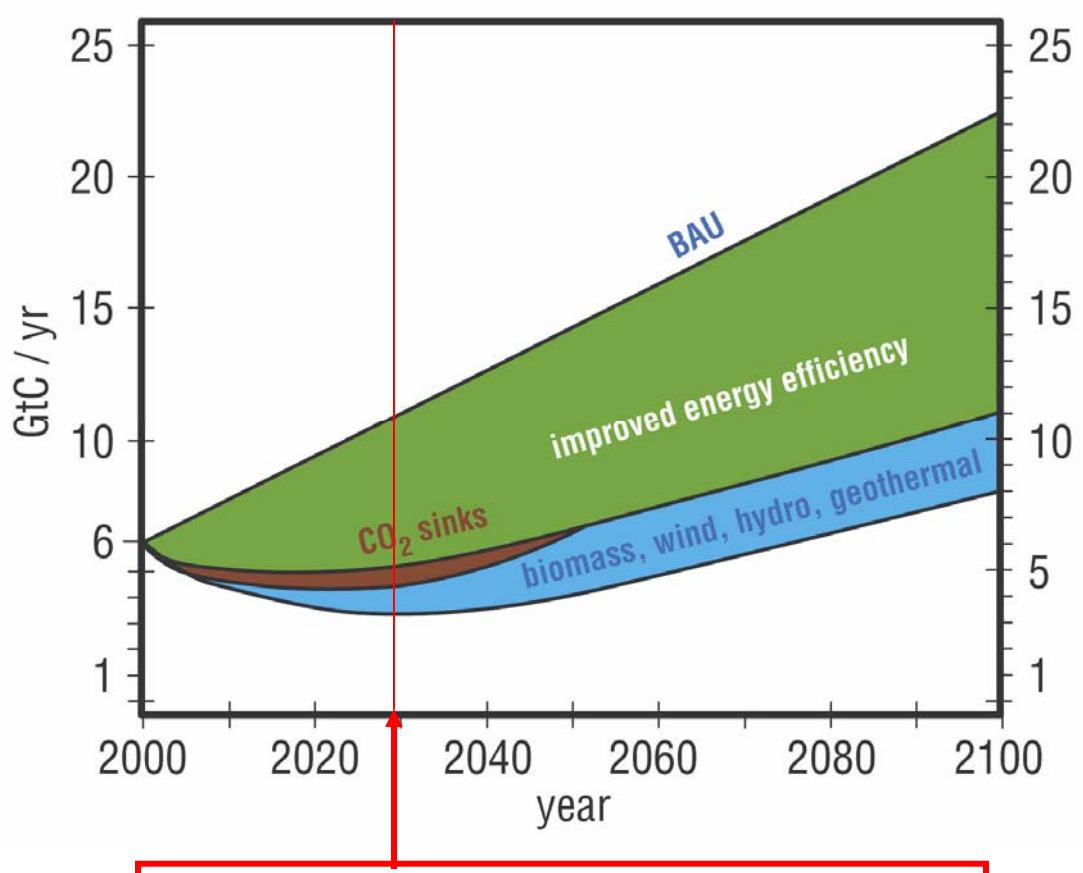
policy concerns	model suite				
	1	2	3	4	5
6		✓	✓			✓
• employment level	✓	✓	✓	✓	✓	✓
• total GDP costs	✓			✓		
• sectorial impacts			✓			✓
• public response				✓		
• competitiveness						✓
• security				✓		✓
• Internat. equity			✓			✓
• Intergener. equity						

Multi-criteria meta-analysis

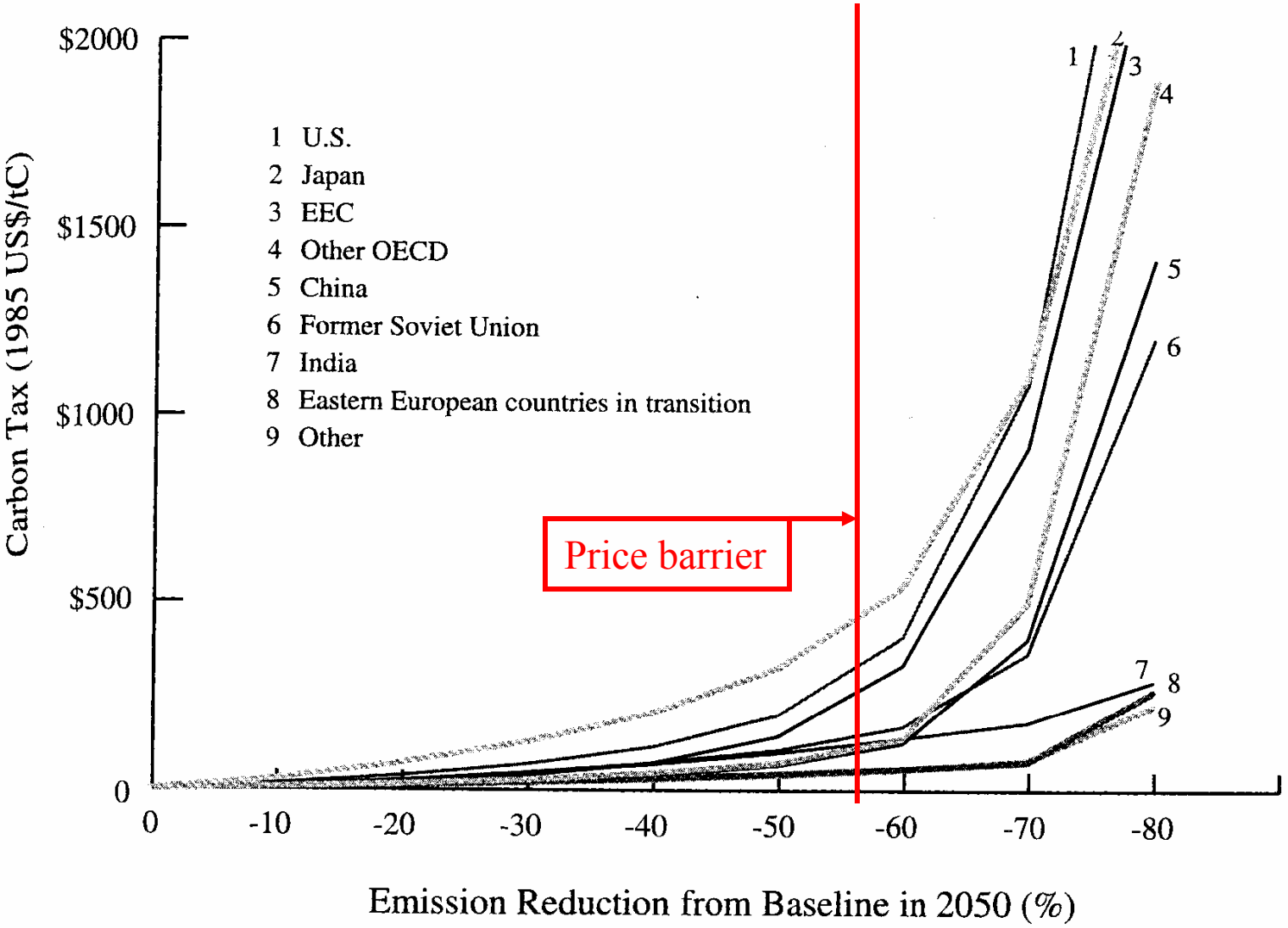
Business as Usual CO_2 emissions and sustainability goal



Available technologies for filling out the wedge

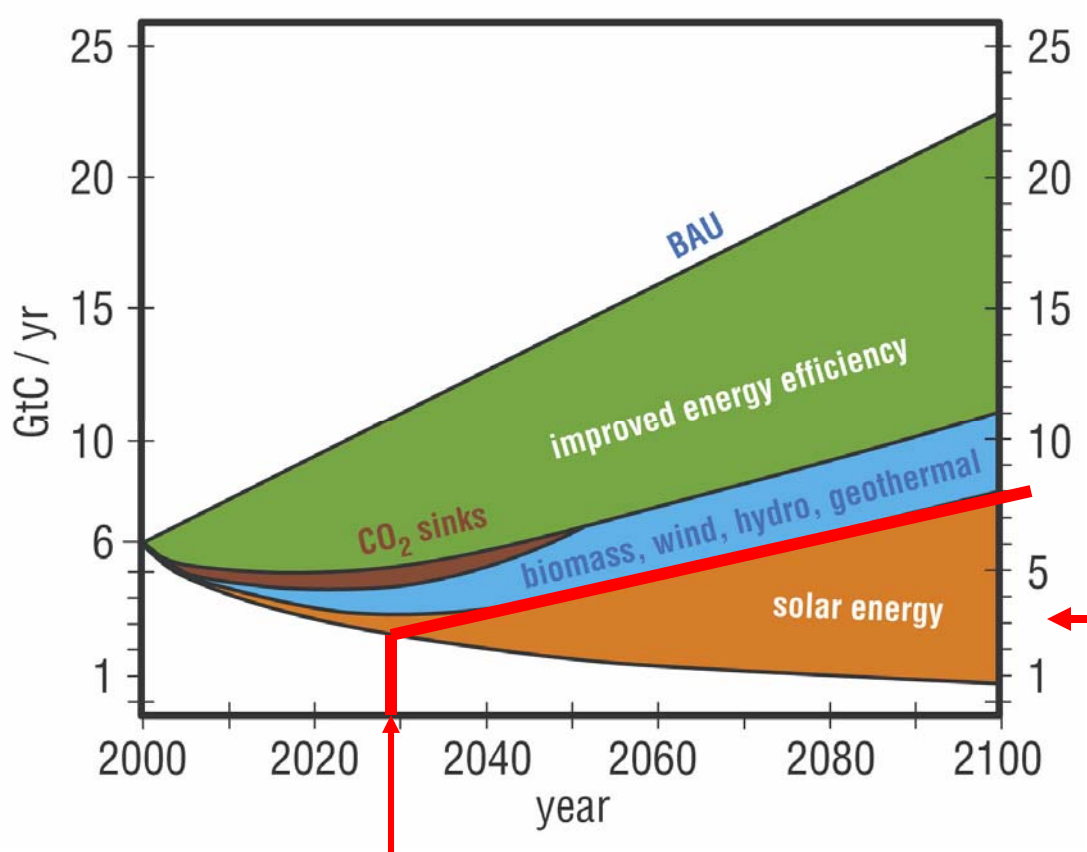


Minimal reduction level achievable with relatively low-cost technologies



Source: Van der Mensbrugghe (1995).

Figure 9.26: Regional carbon tax required for equiproportional CO_2 emission reductions from baseline.



Price barrier

Higher-cost, unproven or controversial options:

photovoltaic
solar thermal
CO_2 sequestration
nuclear fission
nuclear fusion

Reduction of price barrier feasible through

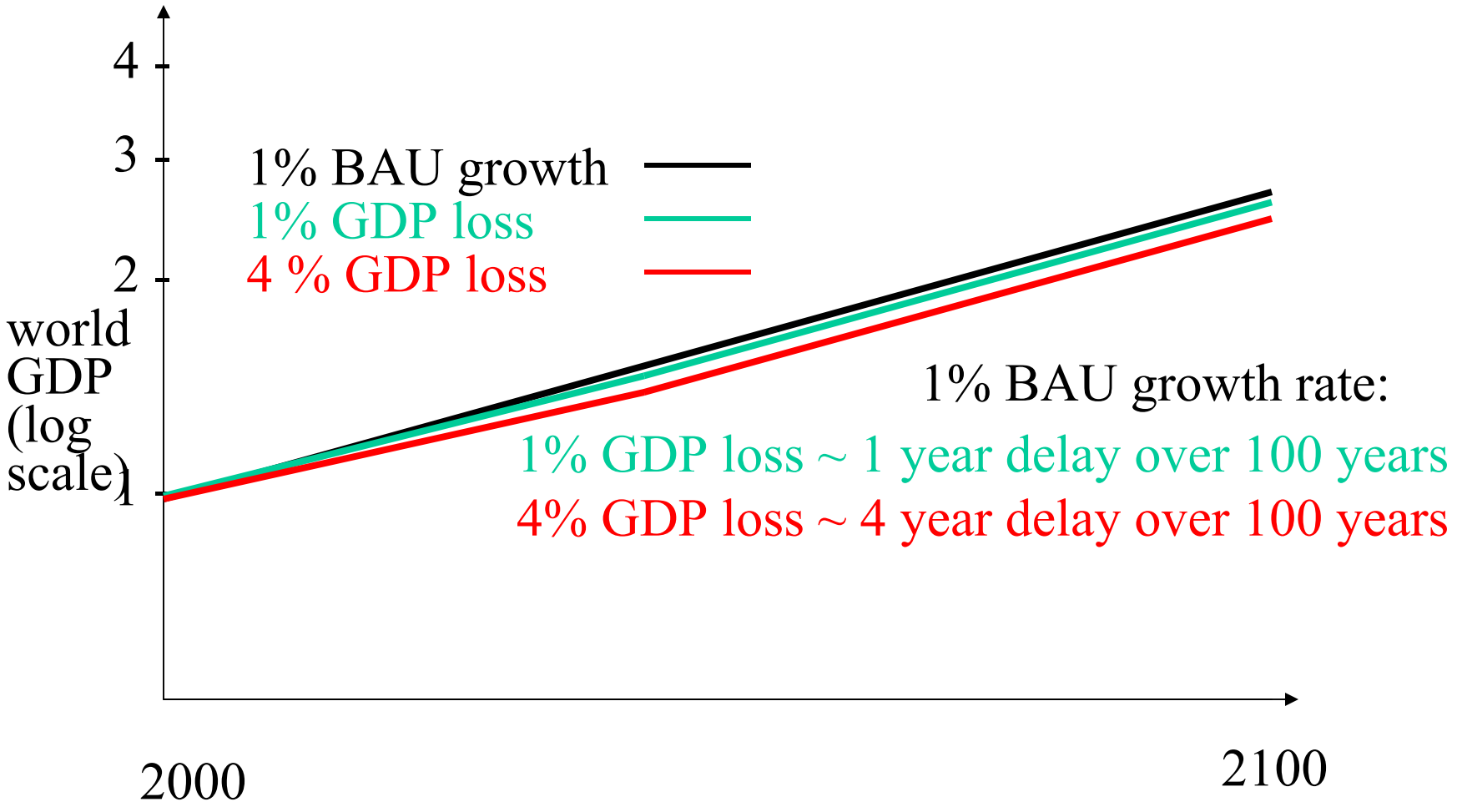
1) Experience (learning by doing)
2) R&D (learning by researching)

Stern report adopts (perhaps optimistic) recent estimates of Edenhofer et al:

Long term mitigation costs:

1% of world GDP

Is climate change mitigation affordable?



Conclusions:

1. Mitigation is definitely affordable
2. The problem is primarily an

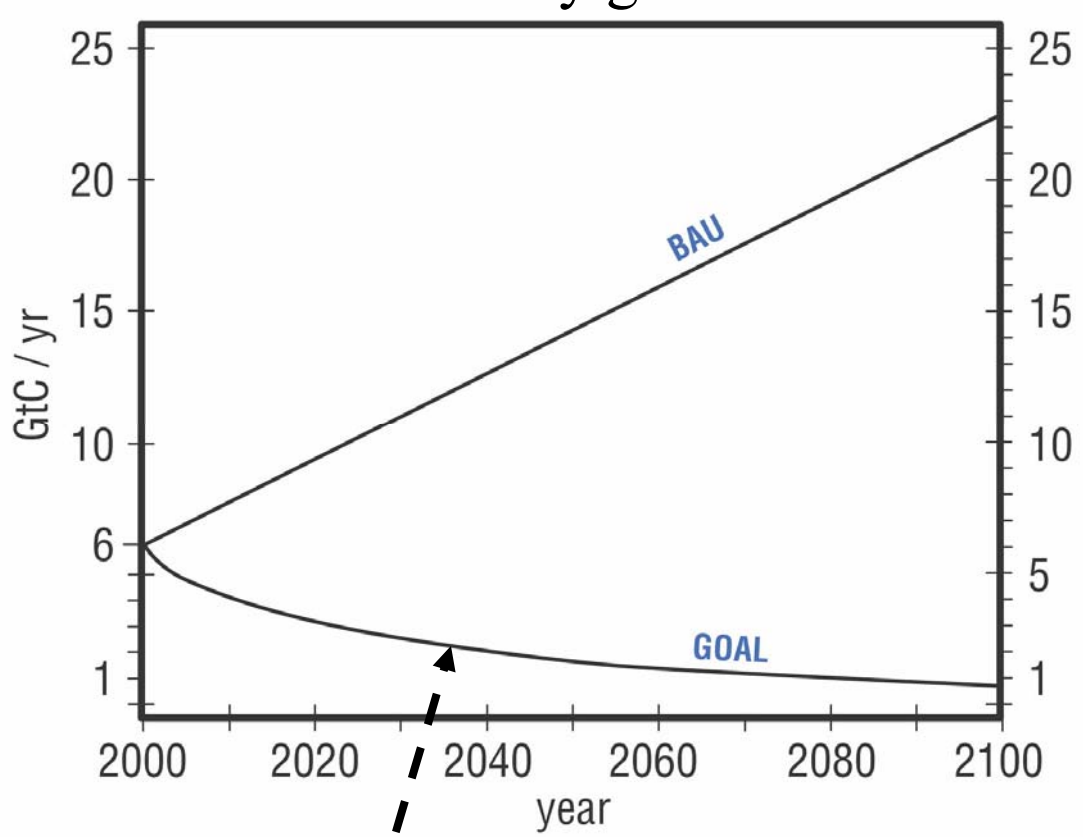
- ethical problem:
  the distribution of costs over
  different generations and
  different countries, and a
- political-technical problem: the choice of the right instruments to achieve the desired distribution and promote the (already available) technological solutions.

(Once the *long-term policies* are in place, business is able to respond)

Available instruments:

- Taxes: known carbon price, unknown emissions;
  difficult to harmonize internationally
- Cap and Trade: unknown carbon price, known emissions;
  automatic harmonization in global market;
  can achieve interregional equity
- Regulations: similar to cap without trade,
  useful where market forces inadequate
- Subsidies: carrot and whip both needed to optimize climate strategy

Business as Usual CO_2 emissions and sustainability goal



defines caps

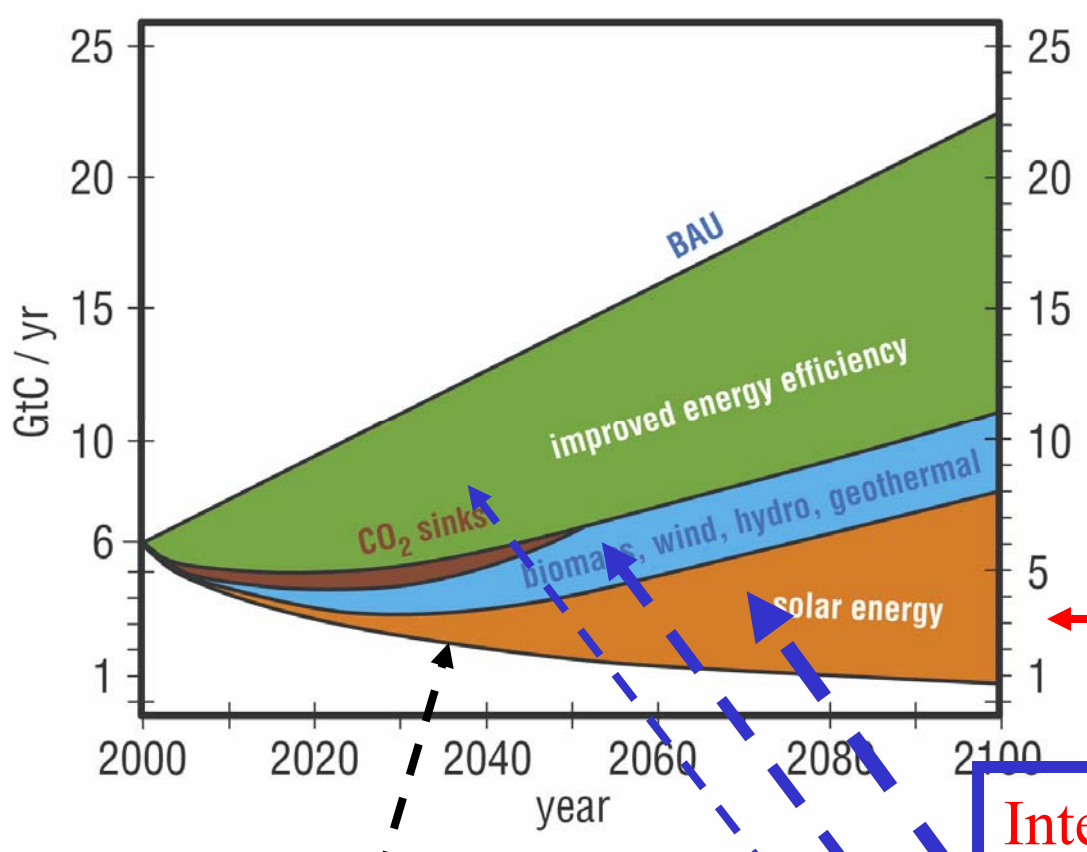
If the caps are defined, will not market forces automatically realize the optimal technical solutions that provide least-cost energy under these constraints?

Unfortunately, not:

Business responds to the short-term stakeholder goal of a high return on capital, not the societal long-term goal of protecting the climate.

Thus business operates with high discount rates, governments with low societal discount rates.

To internalize the discount differences and achieve intergenerational equity, government subsidies are needed.



Higher-cost, uproven or controversial options:

photovoltaic
solar thermal
CO_2 sequestration
nuclear fission
nuclear fusion

defines caps

Intergenerational equity:

requires subsidies to realize low social discount rates in place of high business discount rates

Cap and trade:

Free allocation (grandfathering) or auctioning?

Carbon trade sets the carbon price = cost of replacement of an equivalent unit of fossil-generated energy by a unit of renewable energy.

Grandfathering: no government revenue for subsidizing renewables from permits; minor increase in mean energy costs for consumer.

Auctioning: high government income; high fossil-energy costs for the consumer equal to the marginal cost of renewables.

Optimal solution: ratio of freely allocated to auctioned permits gradually decreasing to zero.

However, the optimal time dependent ratio of grandfathered to auctioned permits has not yet been analyzed quantitatively from the viewpoints of the various actors and stakeholders involved.

Goal: gradual merging of the existing patchwork of various regional cap-and-trade systems to an equitable global emissions trading system.

A central task for Integrated Assessment Modellers

An example:

Interaction between

- economics ✓
- intergenerational equity ✓
- interregional equity, and ←
- co-existence and security

in the post-Kyoto negotiations (involving the EU, US, China, India, developing countries,….)

Interregional equity:

How should the caps be distributed between countries?

Basic human rights principle:

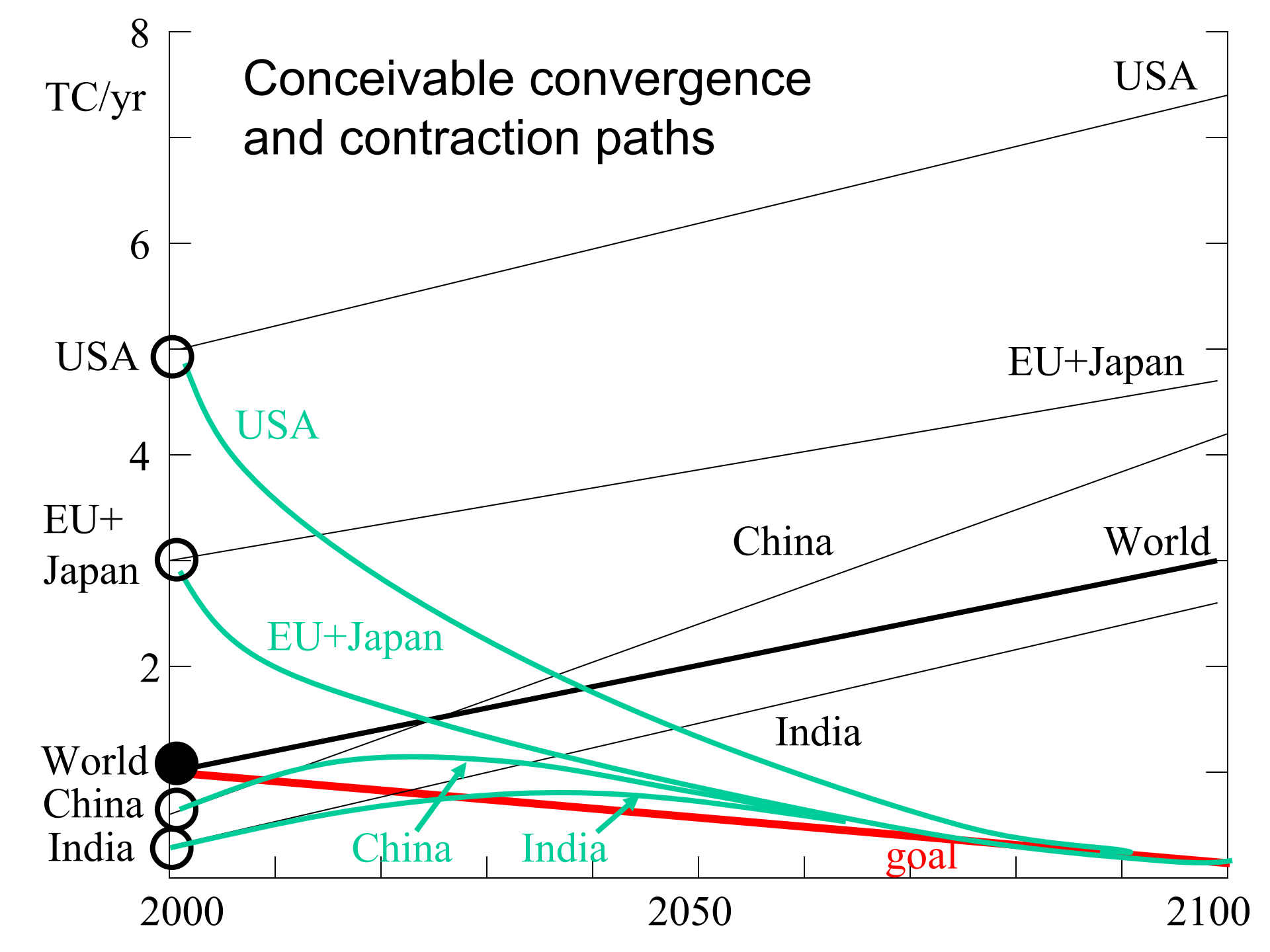
Every person in the world has the right to the same personal level of CO_2 emissions.

US Declaration of Independence, 1776:

"…We hold these truths be self-evident, that all men are created equal…."

French Declaration of Human Rights, 1789

"Liberté, Egalité, Fraternité"


Conceivable convergence
and contraction paths
TC/yr
8
6
4
2
USA
EU+
Japan
World
China
India
USA
EU+Japan
China
India
World
USA
EU+Japan
China
India
goal
2000
2050
2100

Political implications:

1) The emerging economies (and LDCs) will not be willing to contribute to the convergence and contraction scenario as long as their per capita emissions are significantly lower than the industrial countries;

2) The realization of the convergence and contraction scenario will require a very large transfer of know-how and investments from the industrial countries to the rest of the world.

How can this be achieved?

Simple economic and ethical long-term solution:

A global cap and trade system in which the number of emission permits which each country is allowed to auction or allocate is proportional to the population of the country.

Consequence:

- an internationally agreed global cap is realized
- every person worldwide has the same right to emissions
- countries that have other more urgent problems can obtain the necessary investments by selling emission rights or through CDM-type projects (without compromising the global caps goal)

An example:

Interaction between

- economics ✓
- intergenerational equity ✓
- interregional equity, and ✓
- co-existence and security ←

in the post-Kyoto negotiations (involving the EU, US, China, India, developing countries,….)

US Declaration of Independence, 1776:

"…We hold these truths be self-evident, that all men are created equal….with certain inalienable Rights, among these are: Life, Liberty and the *pursuit of Happiness*."

French Declaration of Human Rights, 1789

"Liberté, Egalité, *Fraternité* "

Climate Change: global "Tragedy of the Commons":

Individual "*pursuit of Happiness"* successful only within context of global "*Fraternité* "

Alternative: The ultimate "global chicken game": Try to make others reduce emissions first.

These elementary relations between economics and equity will be apparent to all nations committed to mitigating global climate change.

Nations that try to ignore them (for example, by requiring that China reduces emissions at a rate comparable to the developed nations without significant transfer payments via a global cap-and-trade system) will loose the moral high ground, with obvious implications for peaceful coexistence and national security.

The growing international recognition of the urgency of the climate change problem will generate growing opposition to countries that deny the implications of equity and economic reasoning.

What does this mean for science?

The task of policymakers is to implement policies that transform the present non-sustainable and inequitable distribution of per capita CO_2 emissions to a sustainable, equitable distribution.

The task of science should be to analyze the implications of the alternative policies proposed from the diverse viewpoints of different countries and stakeholders.

This will require a new generation of multi-actor, dynamic Inegrated Assesment models, and the coordination of the modeling efforts in a new IPCC Climate Policy Panel with the specific mandate of advising policymakers.