

Time for action?

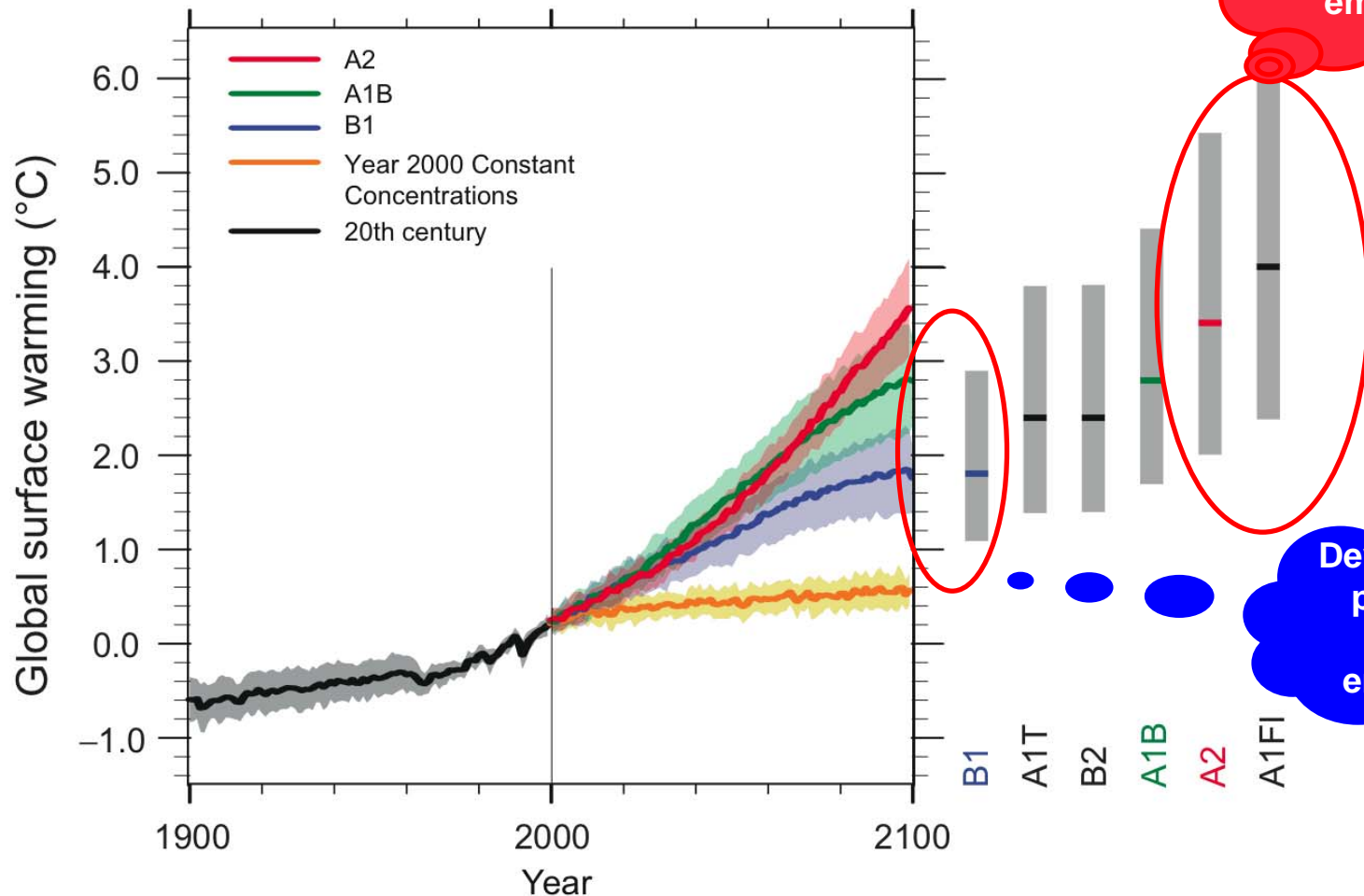
Options to address climate change

Bert Metz

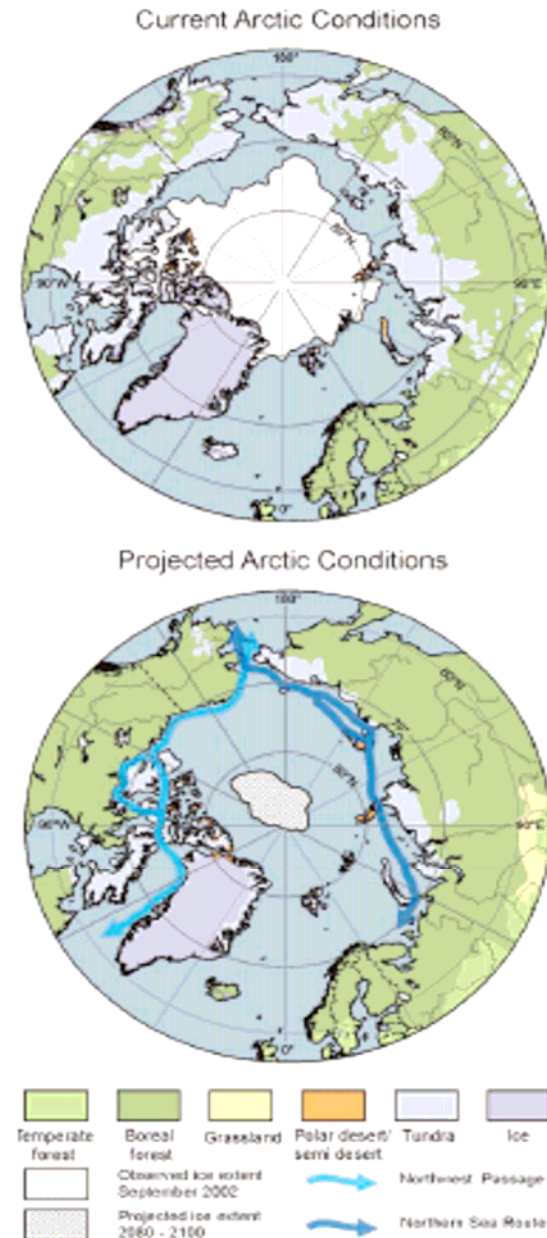
Netherlands Environmental Assessment Agency

Co-chairman IPCC Working Group III

Projected climate change



Projected changes in the Arctic by 2090-2100



Food production threatened



Grain productivity in tropics goes down at any warming;

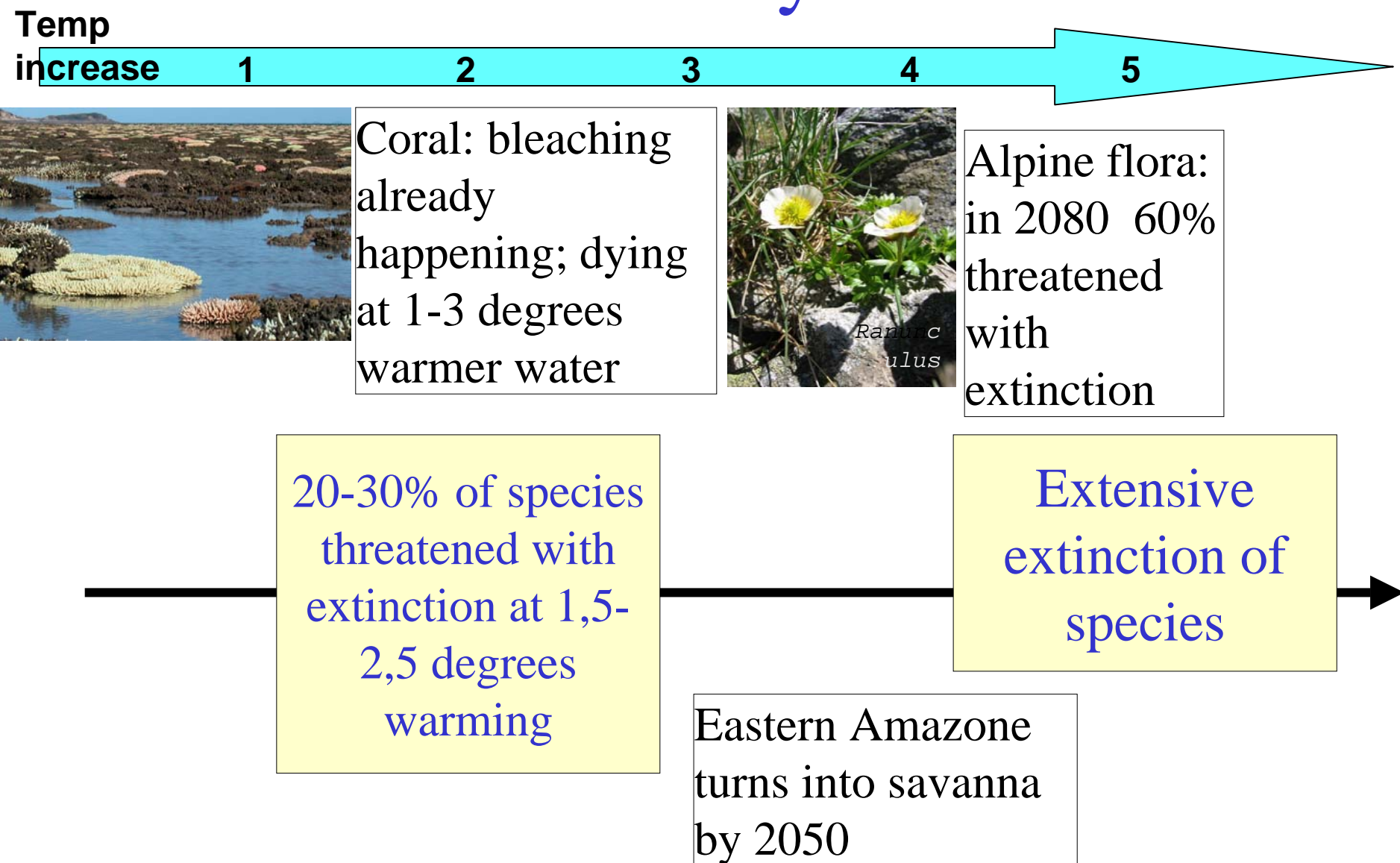
Rainfall patterns change and risk of drought increases (particularly in dry areas)

In temperate areas productivity of some crops increases with moderate warming;

With more than 3 degrees warming also there a decline



Nature seriously threatened



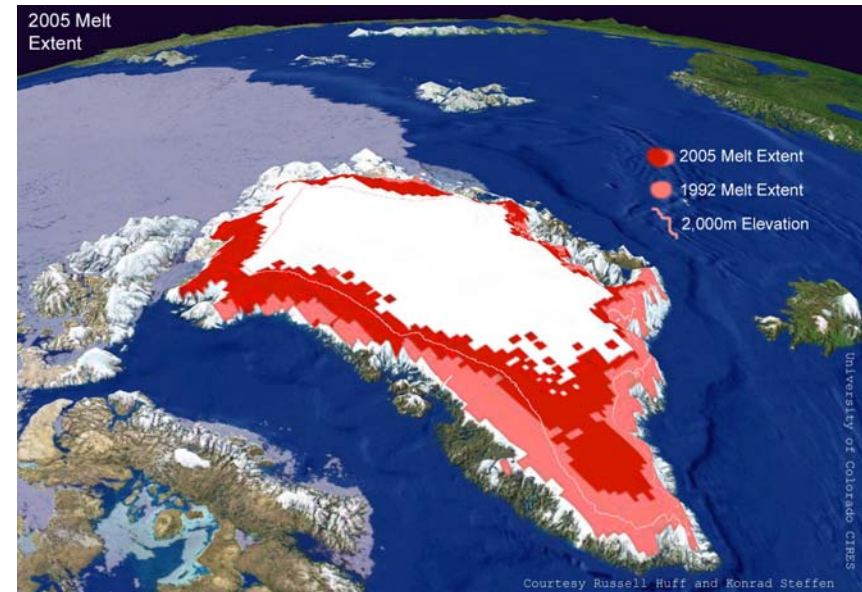
Threatened deltas



Relative vulnerability of coastal deltas as indicated by the indicative population potentially displaced by current sea-level trends to 2050 (Extreme ≥ 1 million; high 1 million to 50,000; medium 50,000 to 5,000)

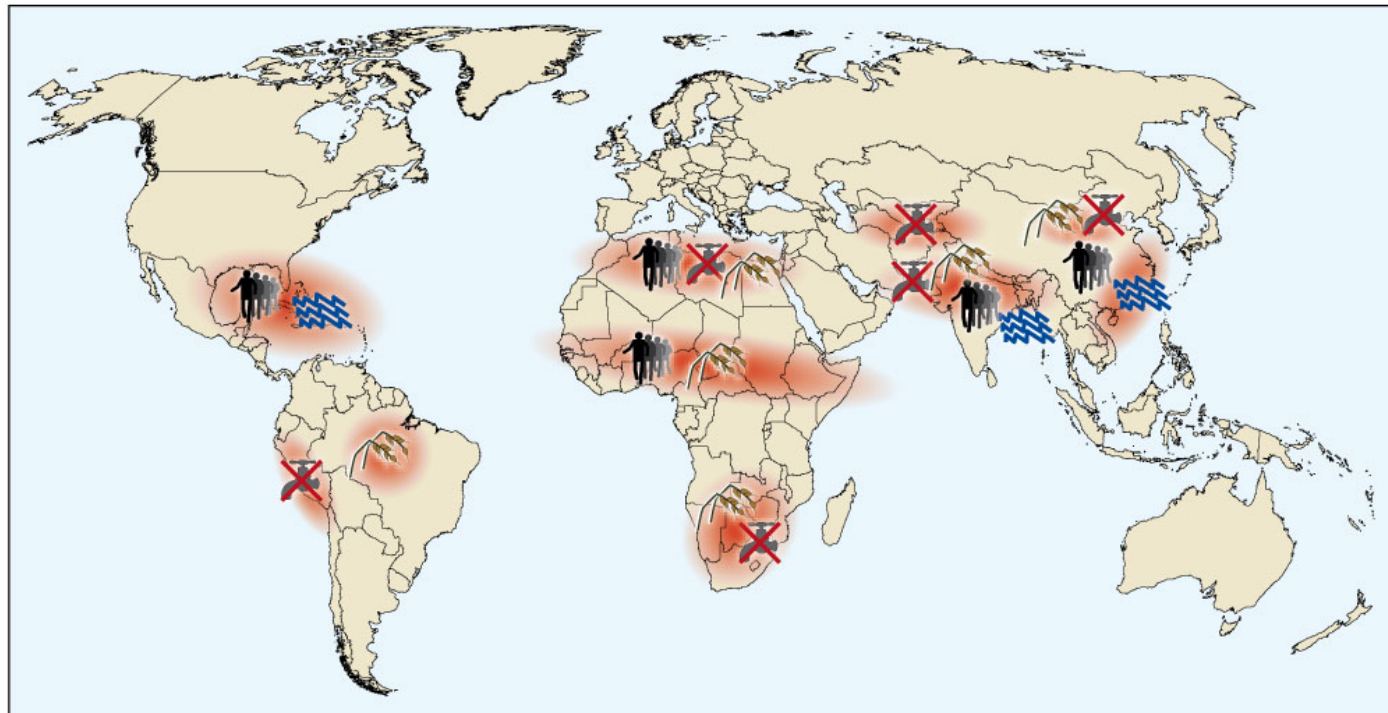
Sea level rise unstoppable

- 2100: 20 -60 cm
- Many centuries:
several meters
(WITHOUT melting
Greenland/ Antarctica
ice sheets)



- 1.5 to 4°C warmer for several centuries/
thousands of years: **up to 7m increase
from melting Greenland ice sheet**
(like 125,000 years ago)

Security risks associated with climate change



Conflict constellations in selected hotspots



Climate-induced degradation of freshwater resources



Climate-induced decline in food production



Hotspot



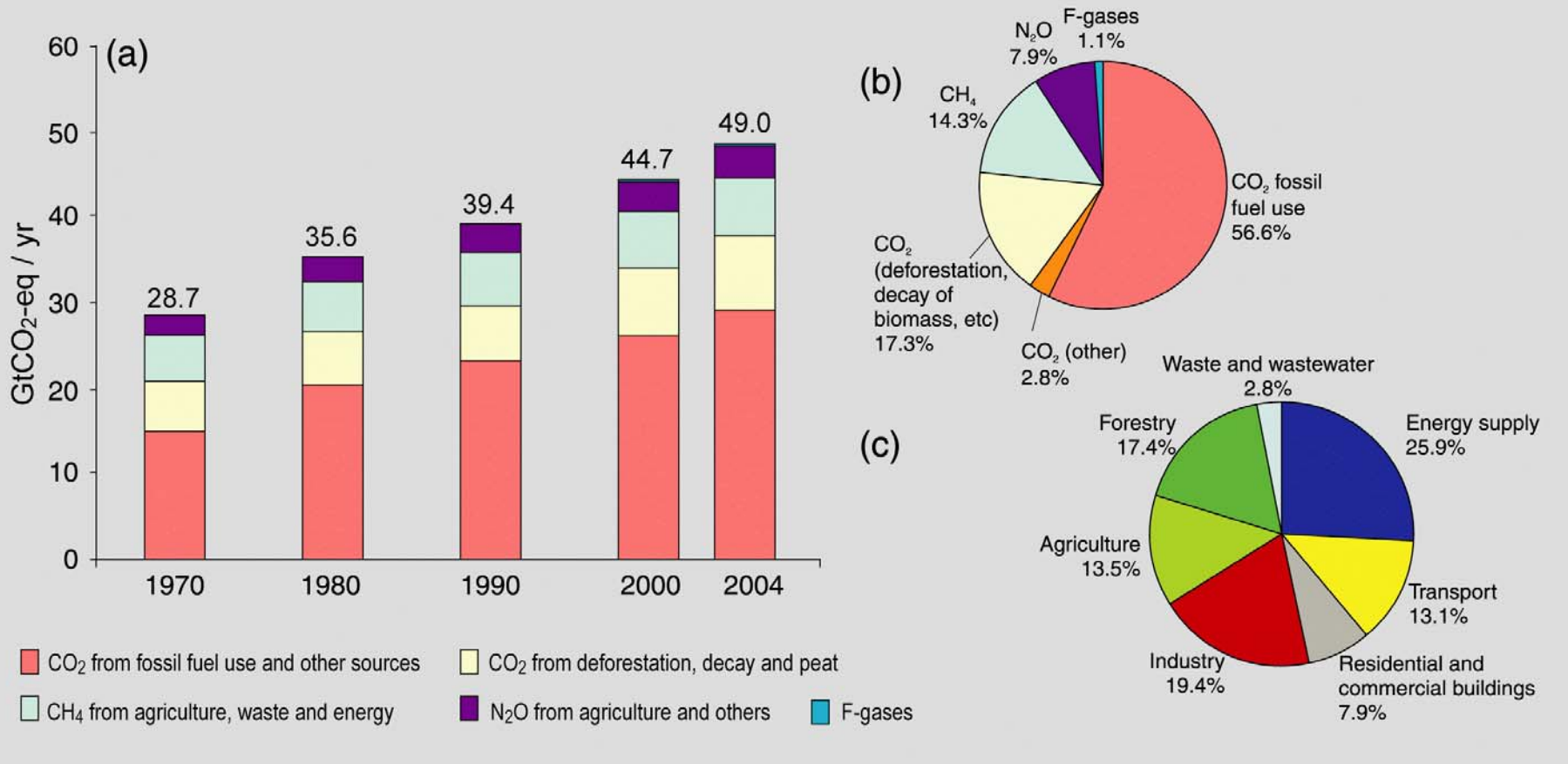
Climate-induced increase in storm and flood disasters



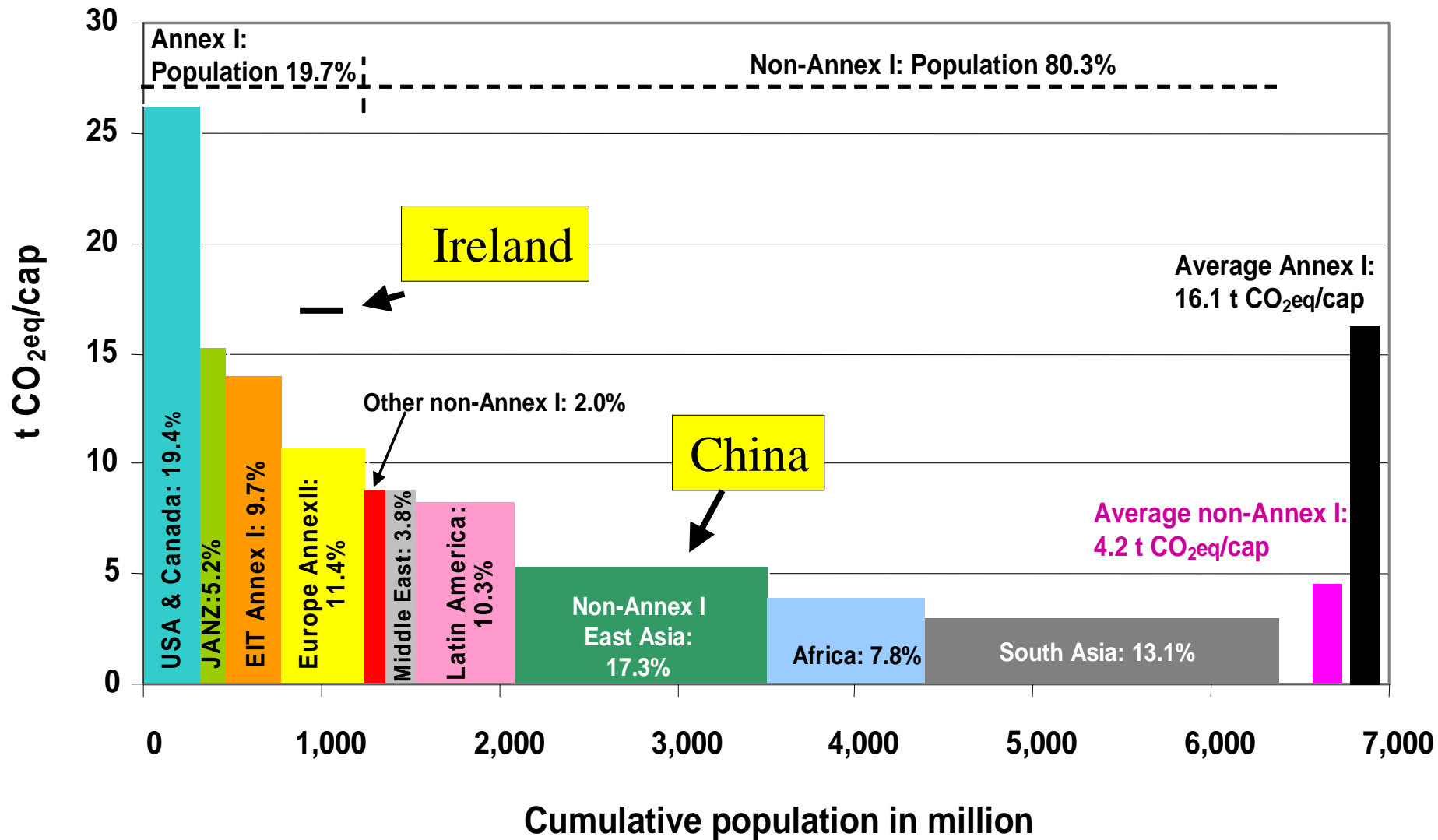
Environmentally-induced migration

Source: German Advisory Council on Global Change, 2007

Emissions of Greenhouse Gases increased by 70% between 1970 and 2004

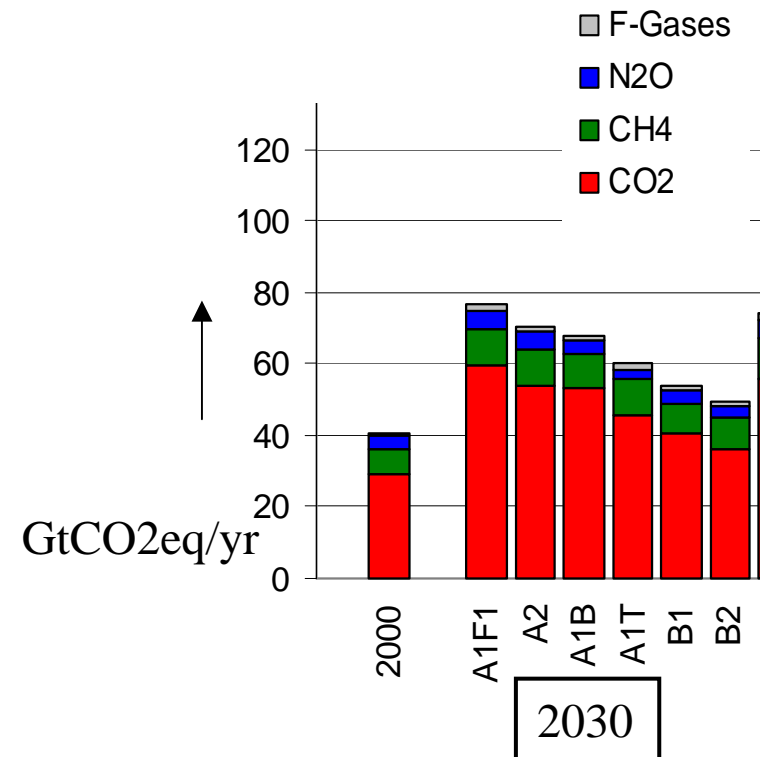


Differences in per capita emissions



With current climate change mitigation policies *and related sustainable development practices*, global GHG emissions will continue to grow over the next few decades

- IPCC SRES scenarios: 25-90 % increase of GHG emissions in 2030 relative to that of 2000
- Two thirds to three quarters of the increase of CO₂ emissions are projected to come from developing countries
- Average per capita CO₂ emissions in developing country regions will remain substantially lower (2.8– 5.1 tCO₂/cap) than in developed country regions (9.6-15.1 tCO₂/cap).

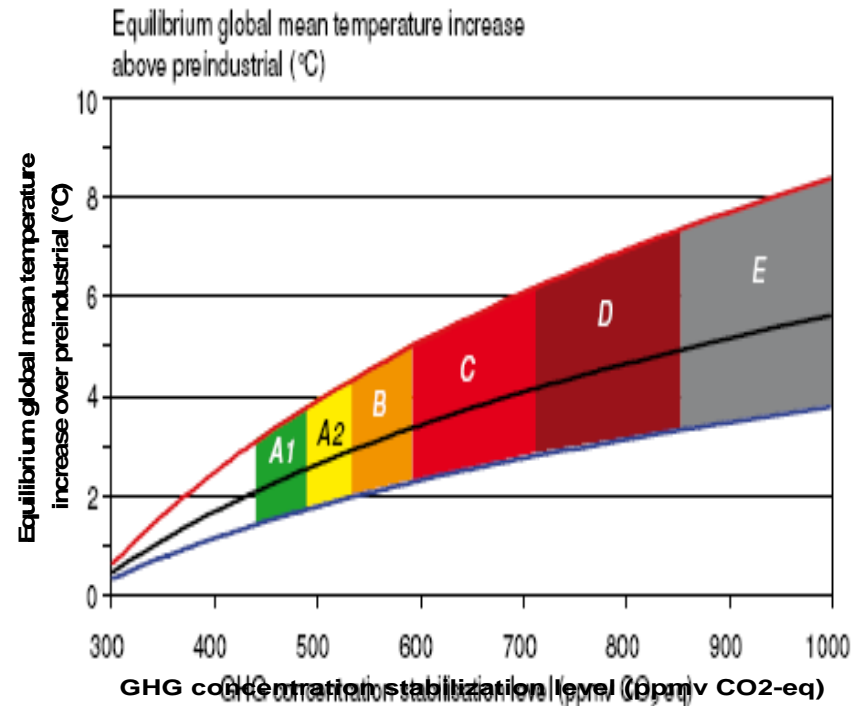


The key question: can “dangerous anthropogenic climate change” be avoided?

EU,
Norway

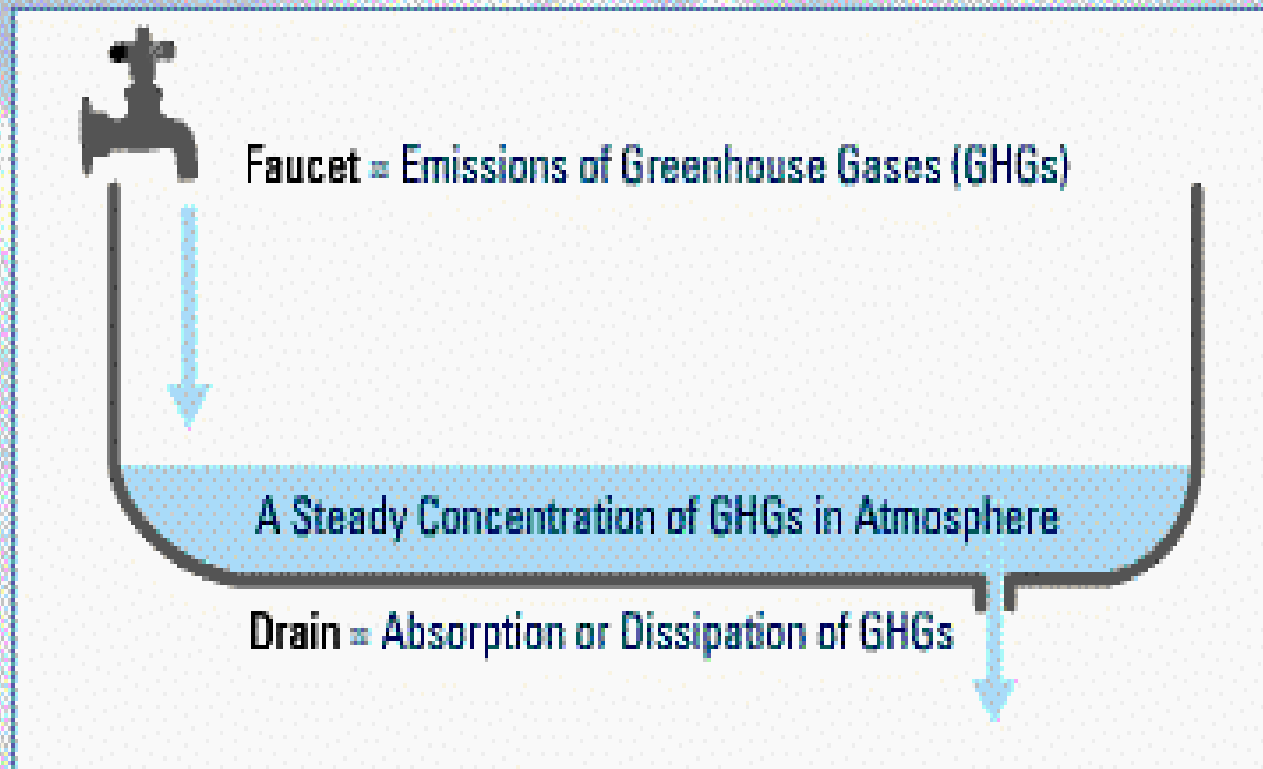


At 2 degrees global mean warming serious adaptation is required!



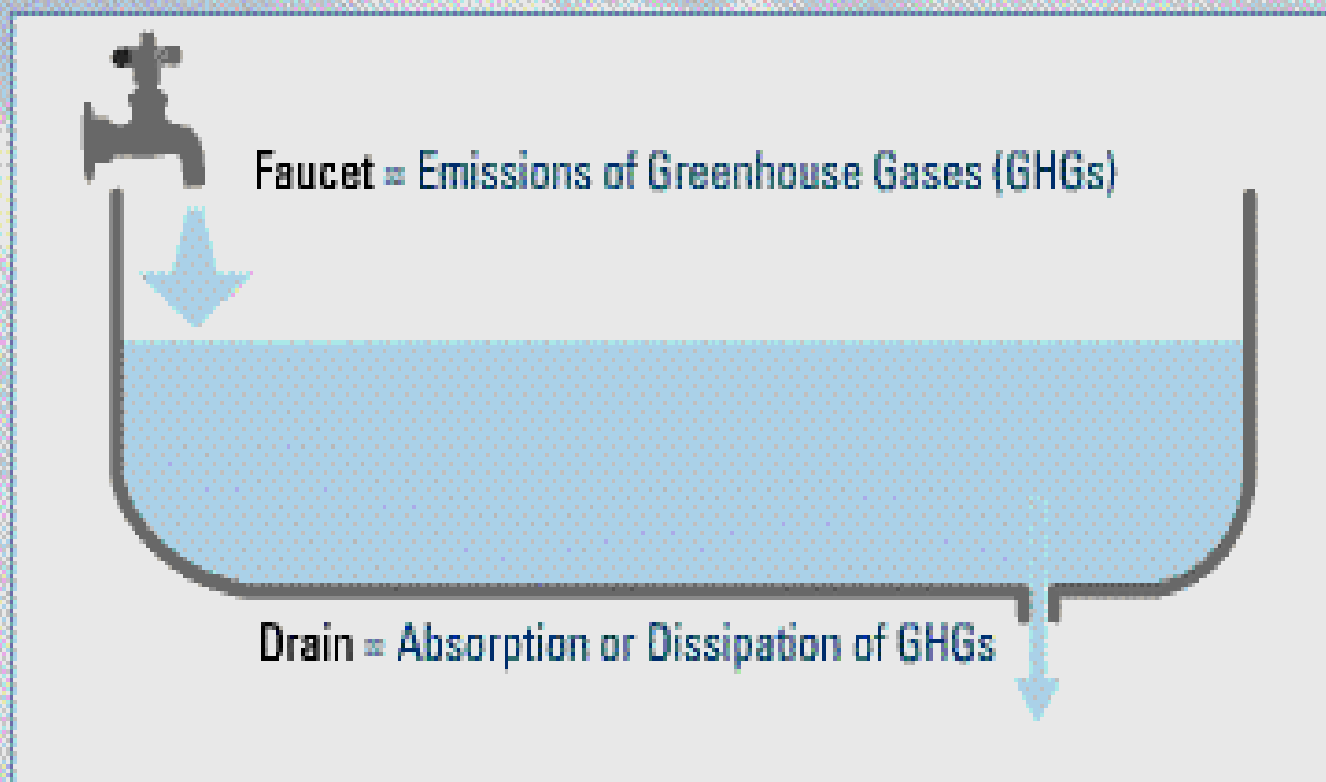
The Greenhouse Effect

Think of the atmosphere as a bathtub...

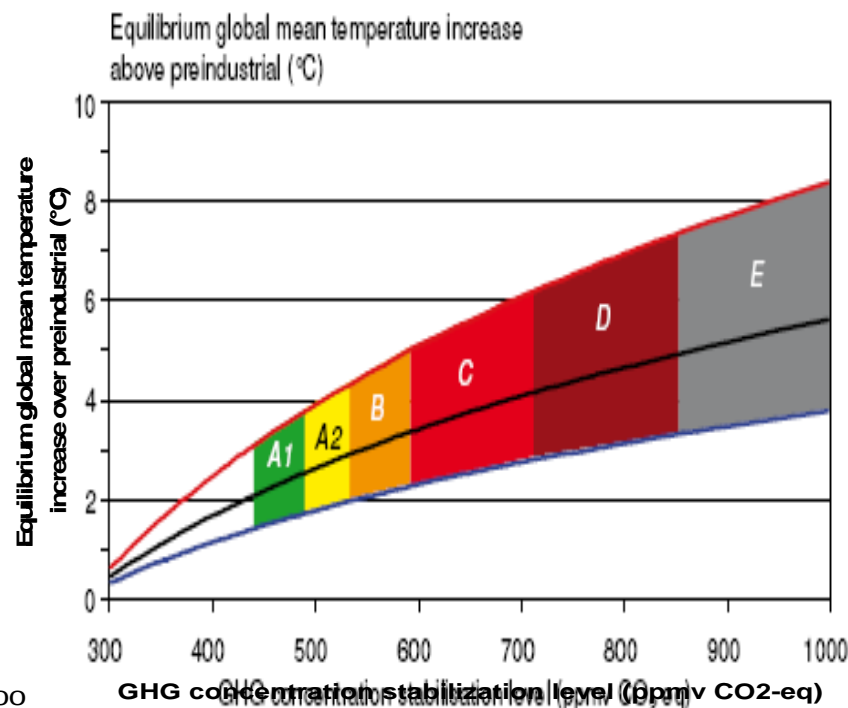
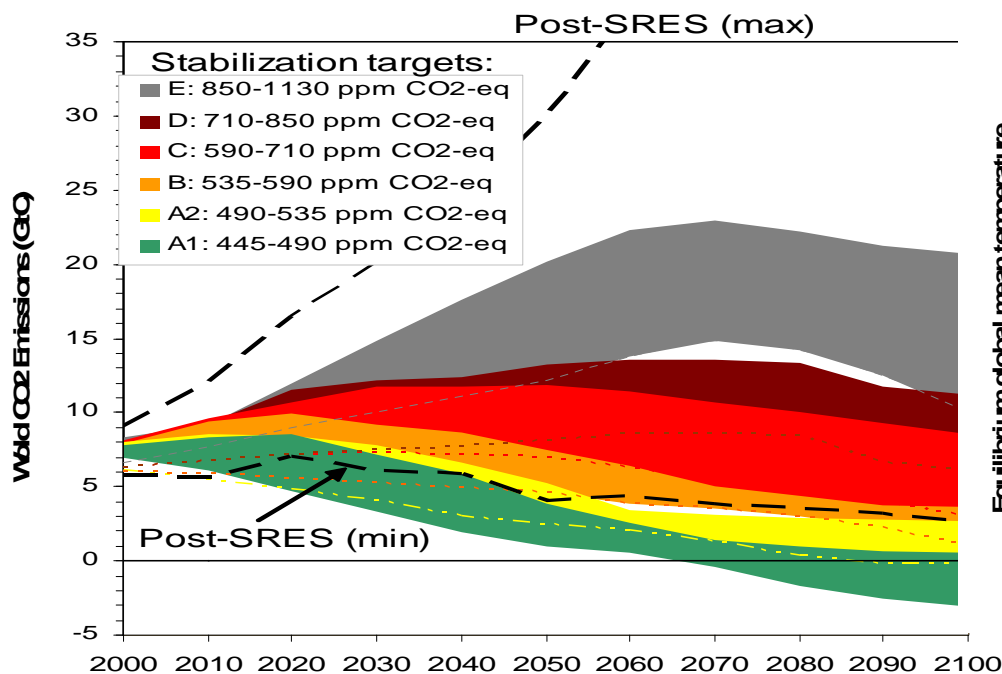


The Greenhouse Effect

If the 'faucet' is opened wider while the 'drain' stays the same, the bathtub may overflow.



The lower the stabilisation level the earlier global emissions have to go down



Multigas and CO₂ only studies combined

Mitigation efforts over the next two to three decades will have a large impact on opportunities to achieve lower stabilization levels

Stabilization level (ppm CO₂-eq)	Global Mean temperature increase at equilibrium (°C)	Year global CO₂ needs to peak	Year global CO₂ emissions back at 2000 level	Reduction in 2050 global CO₂ emissions compared to 2000
445 – 490	2.0 – 2.4	2000 - 2015	2000- 2030	-85 to -50
490 – 535	2.4 – 2.8	2000 - 2020	2000- 2040	-60 to -30
535 – 590	2.8 – 3.2	2010 - 2030	2020- 2060	-30 to +5
590 – 710	3.2 – 4.0	2020 - 2060	2050- 2100	+10 to +60
710 – 855	4.0 – 4.9	2050 - 2080		+25 to +85
855 – 1130	4.9 – 6.1	2060 - 2090		+90 to +140

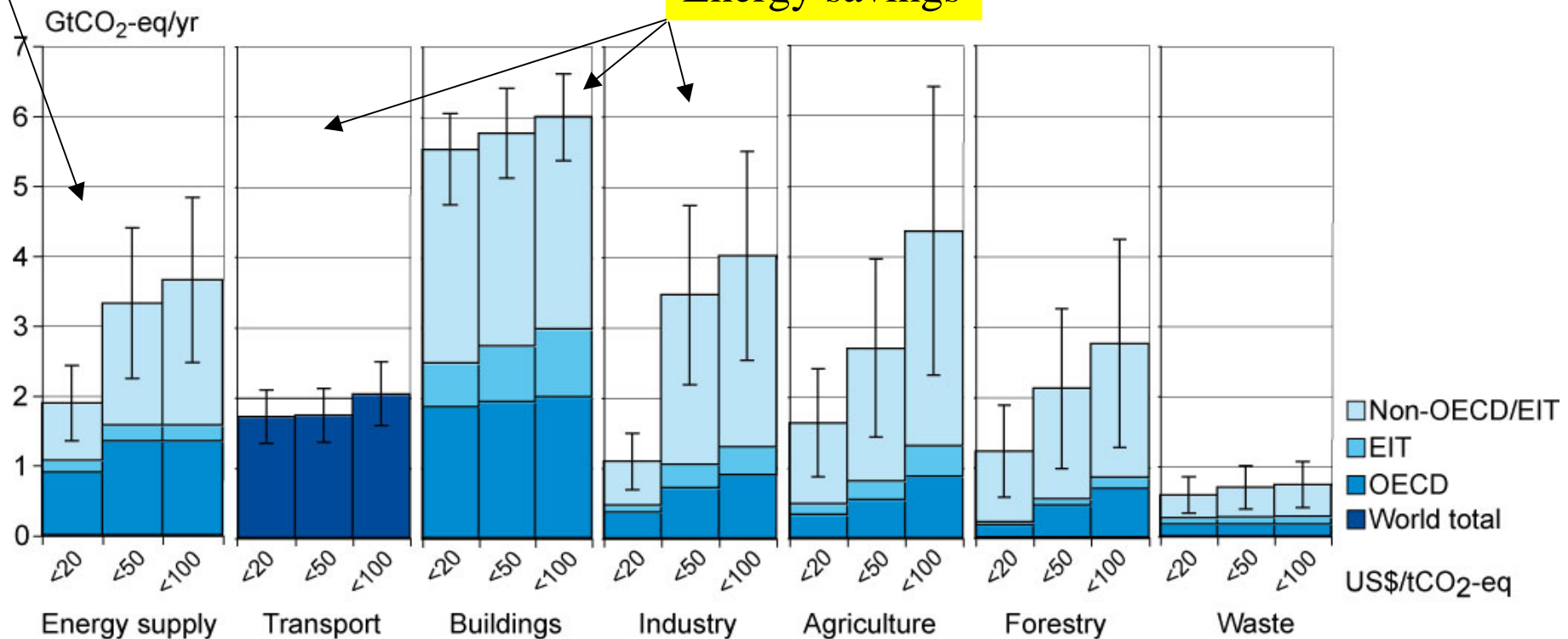
Implications for international agreements

Scenario category	Region	2020	2050
A-450 ppm CO ₂ -eq ²⁾	Annex I	-25% to -40%	-80% to -95%
	Non-Annex I	Substantial deviation from baseline in Latin America, Middle East, East Asia	Substantial deviation from baseline in all regions
B-550 ppm CO ₂ -eq	Annex I	-10% to -30%	-40% to -90%
	Non-Annex I	Deviation from baseline in Latin America and Middle East, East Asia	Deviation from baseline in most regions, especially in Latin America and Middle East
C-650 ppm CO ₂ -eq	Annex I	0% to -25%	-30% to -80%
	Non-Annex I	Baseline	Deviation from baseline in Latin America and Middle East, East Asia

Economic mitigation potential in 2030 could offset the projected growth of global emissions, or reduce emissions below current levels

Changing energy source

Energy savings



Note: estimates are for 2030 and do not include non-technical options, such as lifestyle changes.

What does US\$ 50/ tCO₂eq mean?

- Crude oil: ~US\$ 25/ barrel
- Gasoline: ~9 euro ct/ litre (50 ct/gallon)
- Electricity:
 - from coal fired plant: ~4 euro ct/kWh
 - from gas fired plant: ~1 euro ct/kWh

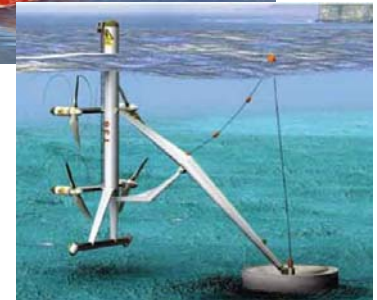
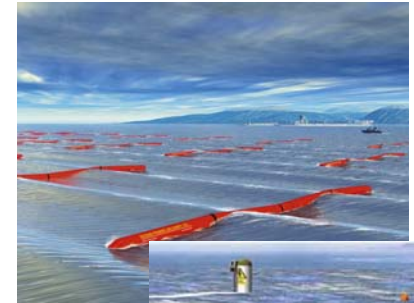
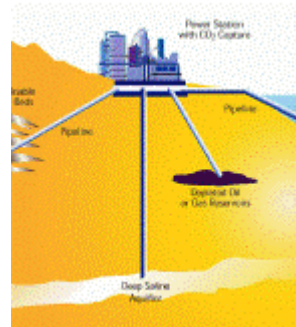
Commercial energy supply mitigation technologies

NOW

2030



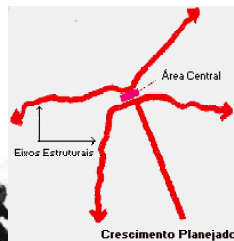
Courtesy of The National Renewable Energy Laboratory (NREL)



Commercial transport mitigation technologies

NOW

2030



How much does biofuel really reduce CO₂?

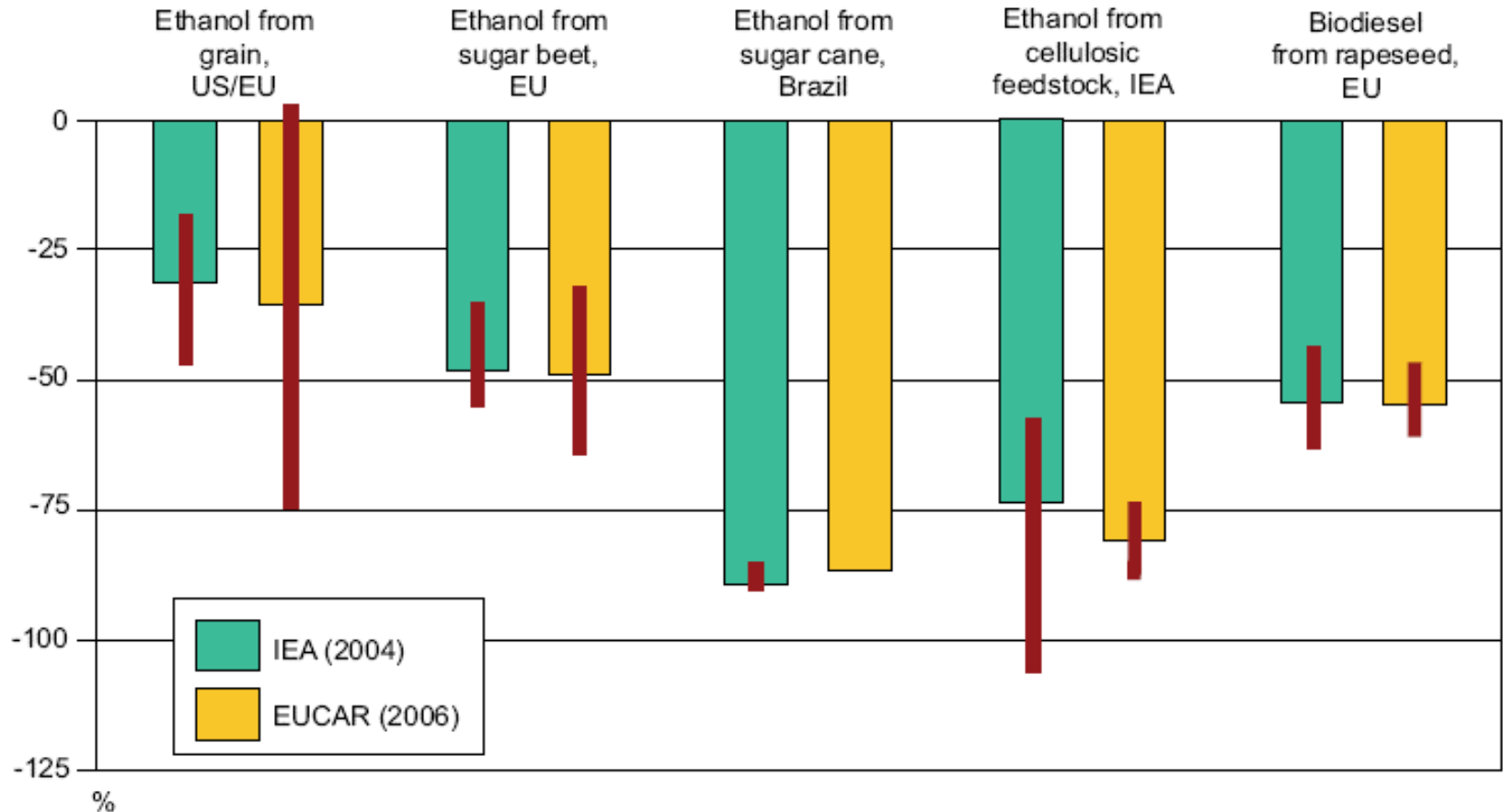


Figure 5.10: Reduction of well-to-wheels GHG emissions compared to conventionally fuelled vehicles

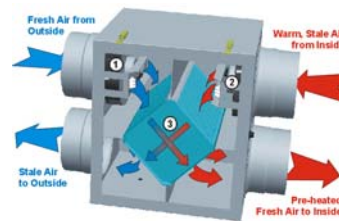
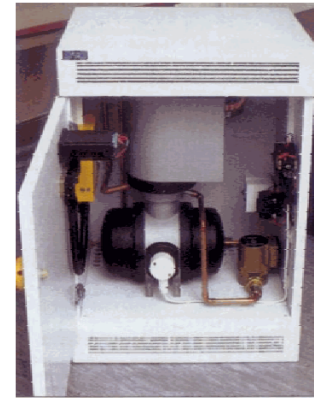
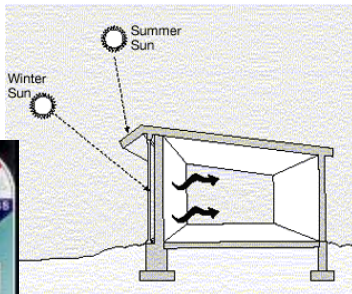
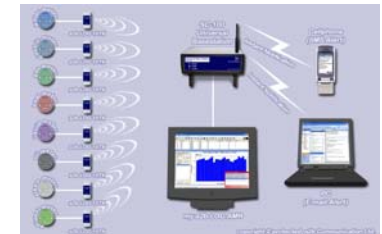
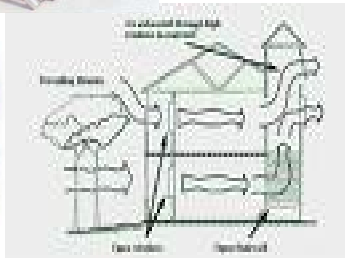
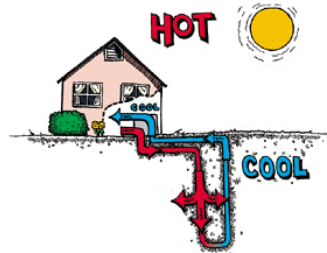
Note: bars indicate range of estimates.

Source: IEA, 2004c; EUCAR/CONCAWE/JRC, 2006.

Commercial mitigation technologies in the building sector

NOW

2030



Changes in lifestyle and behaviour patterns can contribute to climate change mitigation

- Changes in occupant behaviour, cultural patterns and consumer choice in buildings.
- Behaviour of staff in industrial organizations in light of reward systems
- Reduction of car usage and efficient driving style, in relation to urban planning and availability of public transport

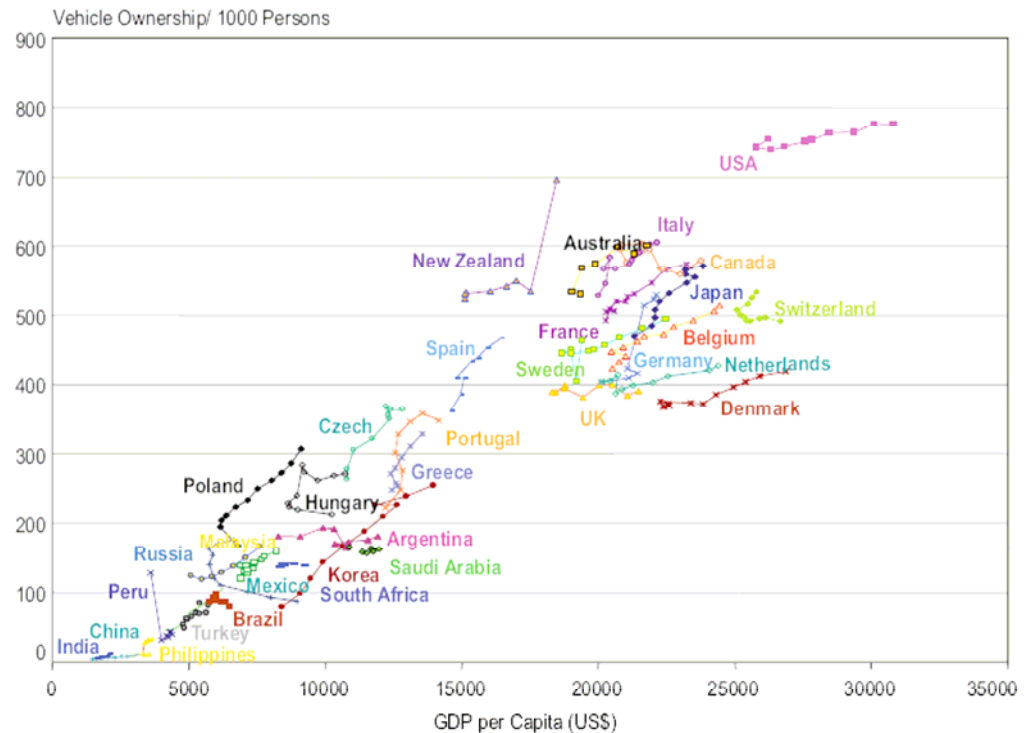


Figure TS.14: Vehicle ownership and income per capita as a time line per country [Figure 5.2].

Note: data are for 1900–2002, but the years plotted vary by country, depending on data availability.

What are the macro-economic costs in 2030?

- Costs are global average for least cost approaches from top-down models
- Costs do NOT include co-benefits and avoided climate change damages

Trajectories towards stabilization levels (ppm CO ₂ -eq)	Median GDP reduction ^[1] (%)	Range of GDP reduction ^[2] (%)	Reduction of average annual GDP growth rates ^[3] (percentage points)
590-710	0.2	-0.6 – 1.2	< 0.06
535-590	0.6	0.2 – 2.5	<0.1
445-535 ^[4]	Not available	< 3	< 0.12

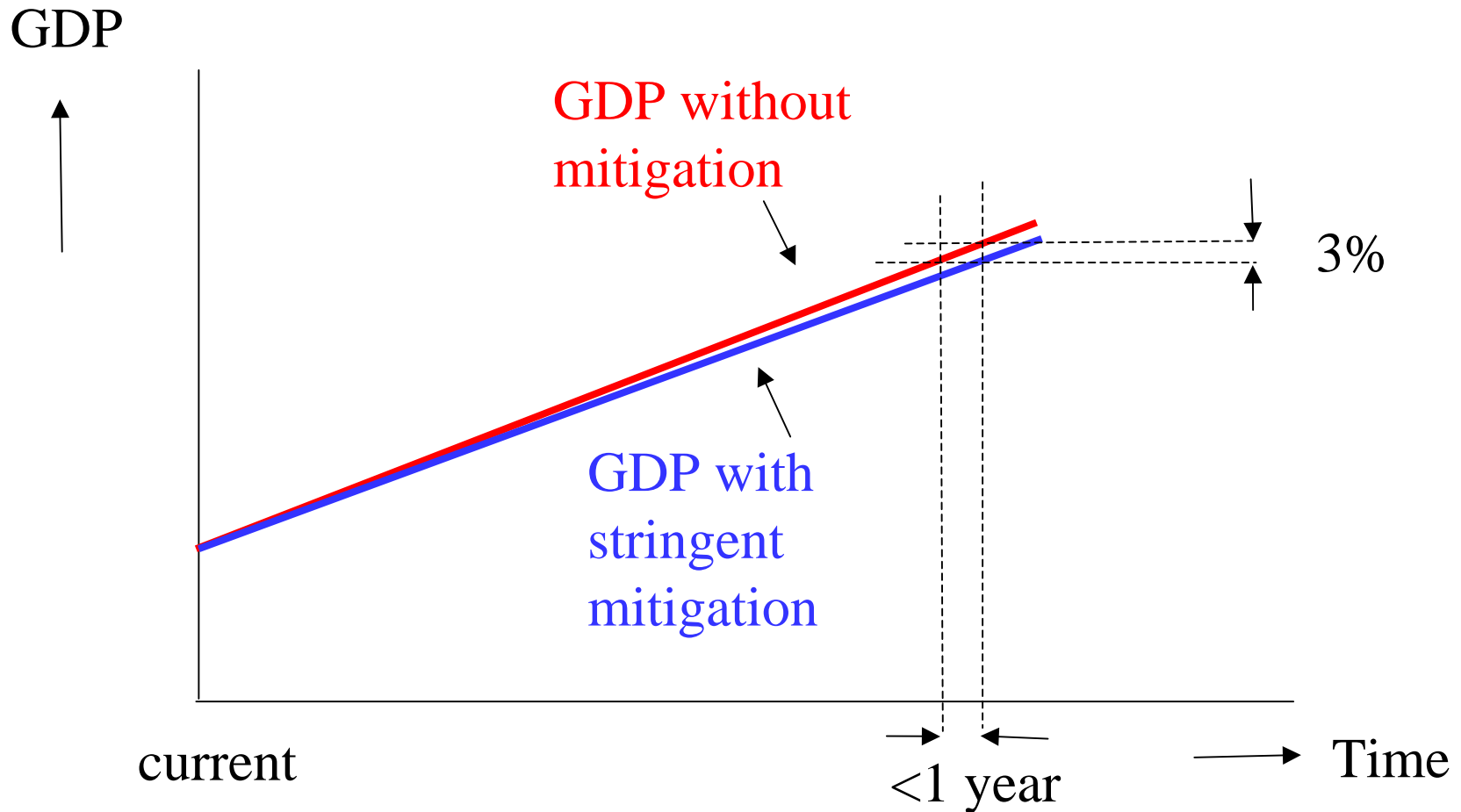
^[1] This is global GDP based market exchange rates.

^[2] The median and the 10th and 90th percentile range of the analyzed data are given.

^[3] The calculation of the reduction of the annual growth rate is based on the average reduction during the period till 2030 that would result in the indicated GDP decrease in 2030.

^[4] The number of studies that report GDP results is relatively small and they generally use low baselines.

Illustration of cost numbers



Technology in the long term

- The range of stabilization levels can be achieved by
 - deployment of a portfolio of technologies that are currently available and
 - those that are expected to be commercialised in coming decades.
- This assumes that appropriate and effective incentives are in place for development, acquisition, deployment and diffusion of technologies and for addressing related barriers

Adaptation

- Needed even with very stringent mitigation
- Limits to adaptation:
 - Certain risks can not be reduced
 - More serious impacts go beyond adaptive capacity
- Main areas:
 - Water
 - Agriculture
 - Infrastructure
 - Health
 - Tourism
 - Energy
- Adaptation and mitigation are complementary
- Costs hardly known

Co-benefits of mitigation and relation with adaptation

- Near-term *health benefits* from reduced air pollution may offset a substantial fraction of mitigation costs
- Mitigation can also be positive for: *energy security, balance of trade improvement, provision of modern energy services to rural areas, sustainable agriculture and employment*
- Land-use measures positive for improving resilience to climate change and for storing carbon

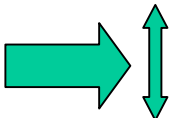
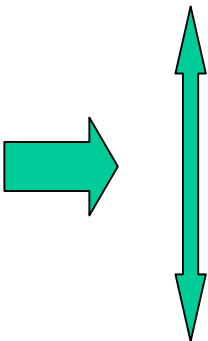
Climate change policies

- Many barriers for implementing low-cost mitigation measures
- Effectiveness of policies depends on national circumstances, their design, interaction, stringency and implementation
- Types of policies:
 - Regulations and standards
 - Taxes and charges
 - Tradable permits
 - Financial incentives
 - Voluntary agreements
 - Information instruments
 - Research and development

Giving CO₂ a price is the most important

- Policies that provide a real or implicit price of carbon could create incentives for producers and consumers to significantly invest in low-GHG products, technologies and processes.
- Such policies could include economic instruments, government funding and regulation
- For meeting EU 2 degrees target: about 100 US\$/tCO₂eq carbon price needed by 2030 (**current EU-ETS price ~\$ 25**)
- But... do not forget the co-benefits

Selected sectoral policies, measures and instruments that have shown to be environmentally effective

Sector	Policies ^[1] , measures and instruments shown to be environmentally effective	Key constraints or opportunities
Energy supply  	Reduction of fossil fuel subsidies	Resistance by vested interests may make them difficult to implement
	Taxes or carbon charges on fossil fuels	
	Feed-in tariffs for renewable energy technologies	May be appropriate to create markets for low emissions technologies
	Renewable energy obligations	
	Producer subsidies	

^[1] Public RD&D investment in low emission technologies have proven to be effective in all sectors.

Investments

- Energy infrastructure investment decisions, (20 trillion US\$ till 2030; 50% in developing countries) will have long term impacts on GHG emissions.
- The widespread diffusion of low-carbon technologies may take many decades, even if early investments in these technologies are made attractive.
- Returning global energy-related CO₂ emissions to 2005 levels by 2030 would require *a large shift* in the pattern of investment, although the *net additional investment required ranges from negligible to 5-10%*
- It is often more cost-effective to invest in end-use energy efficiency improvement than in increasing energy supply

Climate policy alone will not solve the climate change problem

- *Macro-economic policy*: taxes, subsidies, other fiscal policies, structural adjustment
- *Trade policy*: “embodied carbon”, removing barriers for low-carbon products, domestic energy sources
- *Energy security policy* : efficient energy use, domestic energy sources (low-high carbon)
- *Access to modern energy*: bioenergy, poverty tariffs
- *Air quality policy*: clean fuel
- *Bank lending policies*: lending for efficiency/ renewables, avoid lock-in into old technologies in developing countries
- *Insurance policy*: Differentiated premiums, liability insurance exclusion, improved conditions for green products

International agreements

- ***Climate Change Convention (UNFCCC) and Kyoto Protocol :***
 - Limited reduction of emissions industrialised countries
 - Array of national policies
 - International market for CO₂ credits
 - US, Australia not participating; Canada not implementing
- ***New agreement for after 2012:***
 - Much steeper reduction needed
 - All countries to contribute, according to capability
 - Will include adaptation
 - Bali (December): start of negotiations?

The full Report can be downloaded from

www.ipcc.ch

or

www.mnp.nl/ipcc

Further information:

IPCC Working Group III Technical Support Unit
at the Netherlands Environmental Assessment Agency:

ipcc3tsu@mnp.nl