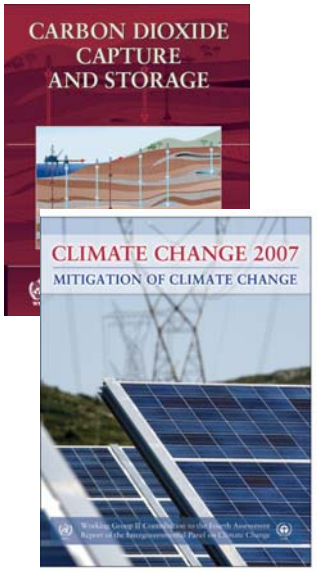
Mitigation of Climate Change and the role of CCS

IPCC Working Group III contribution to the Fourth Assessment Report



Bert Metz

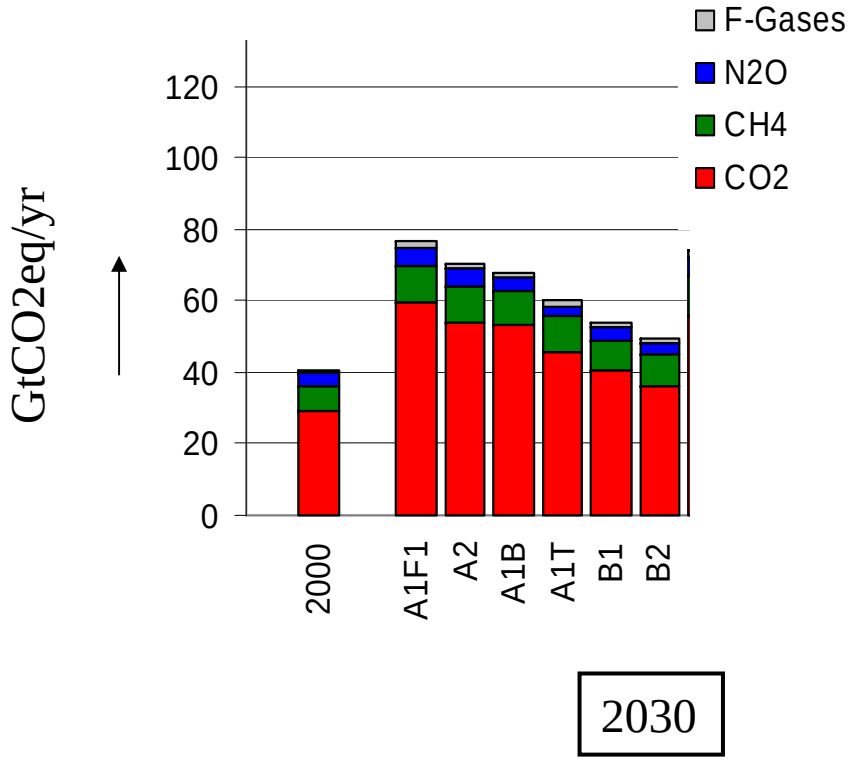
Netherlands Environmental Assessment Agency

Co-chair IPCC WG III

2nd International Symposium on Capture and Storage of CO2,
Paris, October 4-5, 2007

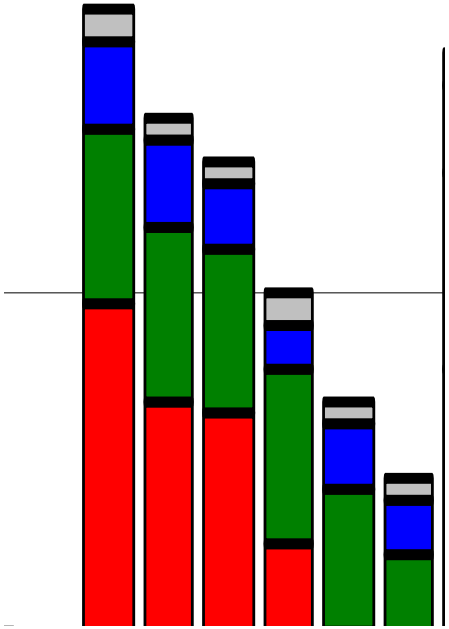
With current climate change mitigation policies *and related sustainable development practices*, global GHG emissions will continue to grow over the next few decades

- IPCC SRES scenarios: 25-90 % increase of GHG emissions in 2030 relative to 2000

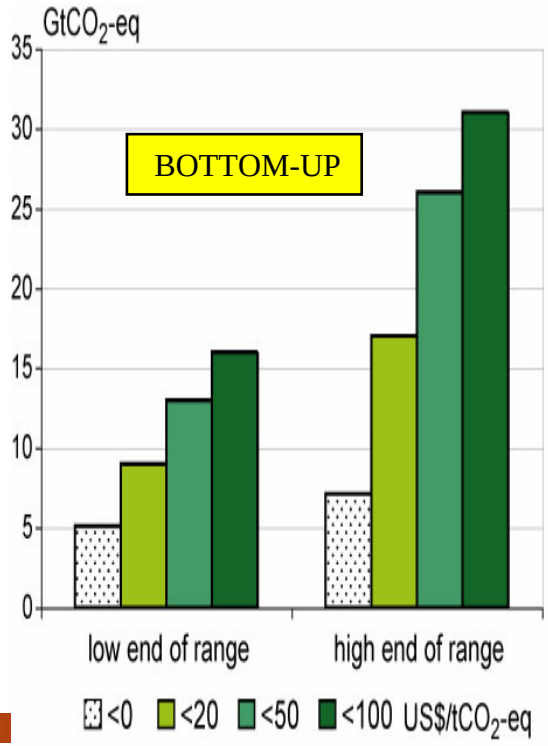


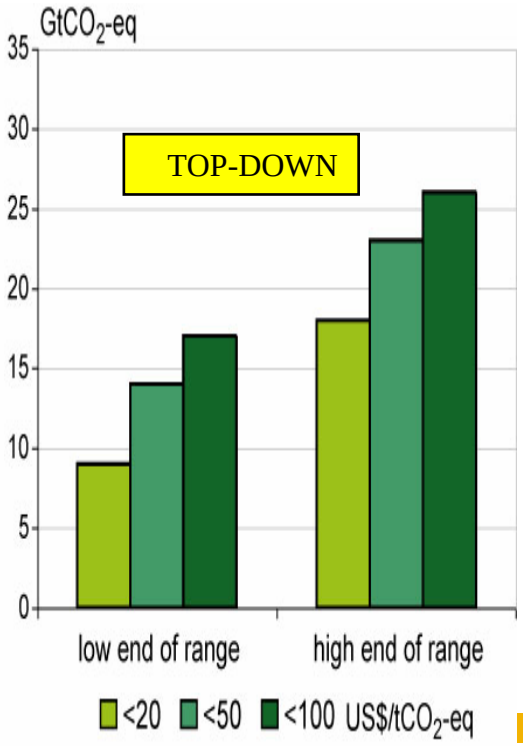
Economic mitigation potential could offset the projected growth of global emissions, or reduce emissions below current levels

Projected increase



Potential decrease





How can emissions be reduced?

Sector	Key mitigation technologies and practices currently commercially available. (Selected)	Key mitigation technologies and practices projected to be commercialized before 2030. (Selected)
Energy Supply	efficiency; fuel switching; nuclear power; renewable (hydropower, solar, wind, geothermal and bioenergy); combined heat and power; ***early applications of CO2 Capture and Storage (CCS)***	***CCS for gas, biomass and coal-fired electricity generating facilities;*** advanced nuclear power; advanced renewables (tidal and wave energy, concentrating solar, solar PV)

Potential share of global electricity supply in 2030 for US$50/tCO2eq:

- Renewable energy: 30-35% (now 18%)
- Nuclear: 18% (now 16%)
- ***CCS: 9% of coal powered capacity***

How can emissions be reduced?

Sector	**(Selected) Key mitigation technologies and practices currently commercially available.**	**Key mitigation technologies and practices projected to be commercialized before 2030. (Selected)**
Industry	More efficient electrical equipment; heat and power recovery; material recycling; control of non-CO_2 gas emissions	Advanced energy efficiency; ***CCS for cement, ammonia, and iron manufacture;*** inert electrodes for aluminium manufacture

Update of CCS Special Report

- *No significant change:*
  - Maturity of technology
  - Energy requirements
  - Cost
  - Health, safety and environment risks
- *Some new information:*
  - Capture ready power plants
  - Storage capacity
  - Share of CCS in mitigation portfolio
- *Not covered:*
  - Update on (pilot) projects
  - Progress on legal, public acceptance and emissions accounting

“Capture ready” power plants

- What can it mean?
  - Space reservation for capture unit
  - Siting to enable access to storage reservoir
  - Studying options for capture retrofit
  - Pre-investments in various parts of the plant
- Economically attractive?
  - Depends on specific circumstances
- New information: IEA GHG R&D Technical Study, May 2007

What are the macro-economic costs in 2030?

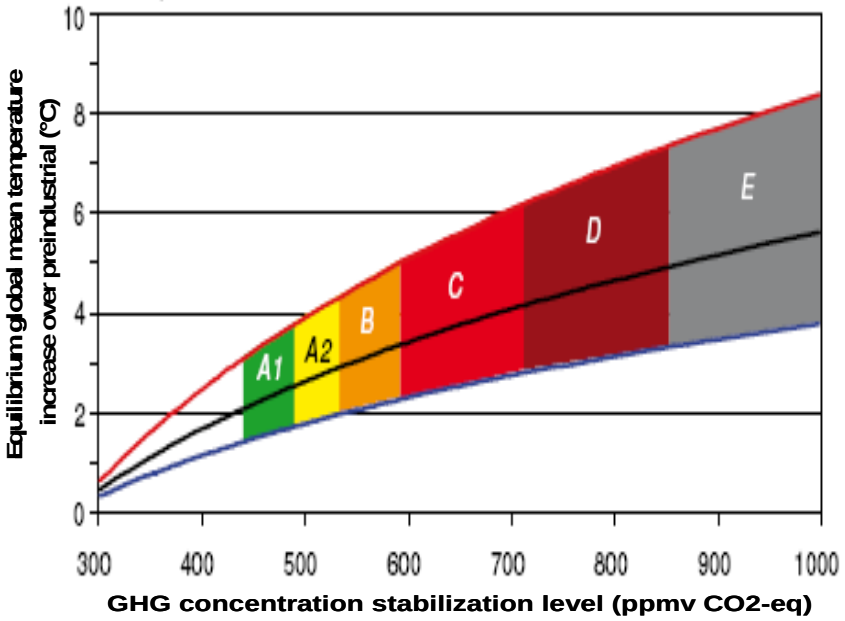
- Costs are global average for least cost appoaches from top-down models
- Costs do not include co-benefits and avoided climate change damages

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.

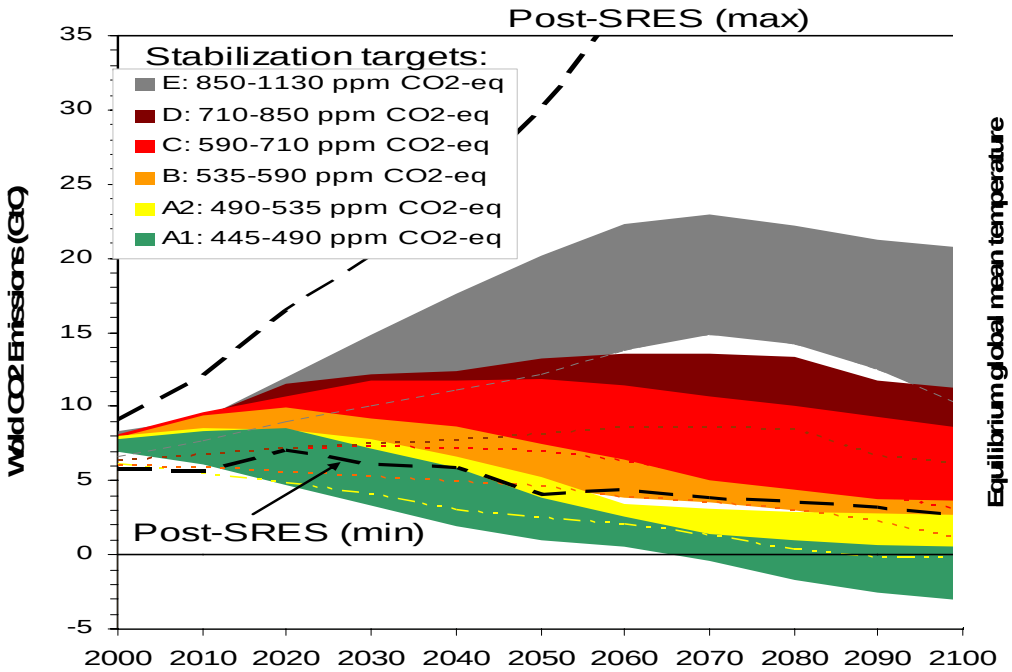
The key question: can “dangerous anthropogenic climate change” be avoided?

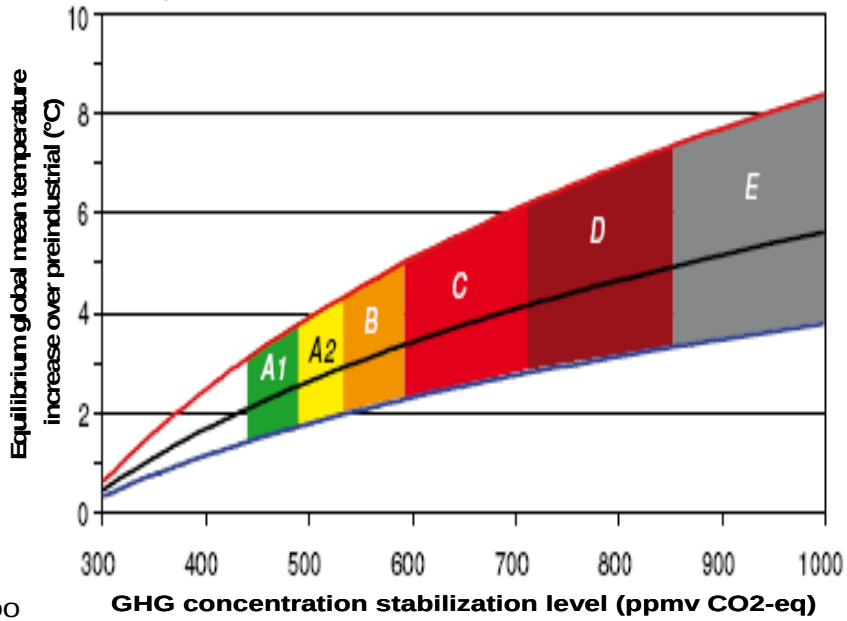
EU,
Norway



At 2 degrees global mean warming serious adaptation is required!

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 CO_2-eq)	**Global Mean temperature increase at equilibrium (°C)**	**Year global CO_2 needs to peak**	**Year global CO_2 emissions back at 2000 level**	**Reduction in 2050 global CO_2 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

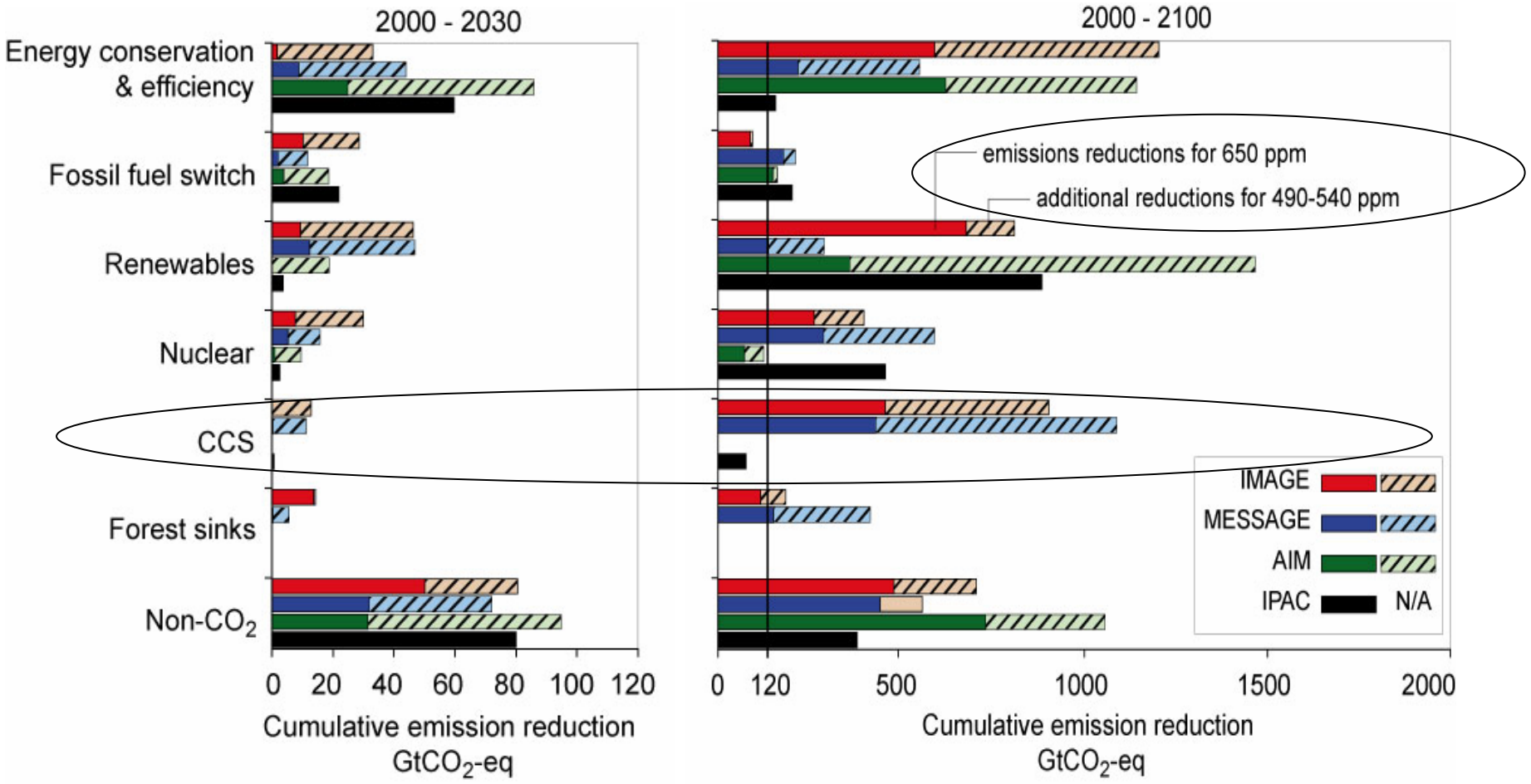
Scenario category	Region	2020	2050
A-450 ppm CO_2 –eq[2)]	Annex I	-25% to -40%	-80% to -95%
	Non-Annex I	Substantial deviation from baseline in Latin America, Middle East, East Asia	Substantial deviation from baseline in all regions
B-550 ppm CO_2 -eq	Annex I	-10% to -30%	-40% to -90%
	Non-Annex I	Deviation 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

Technology

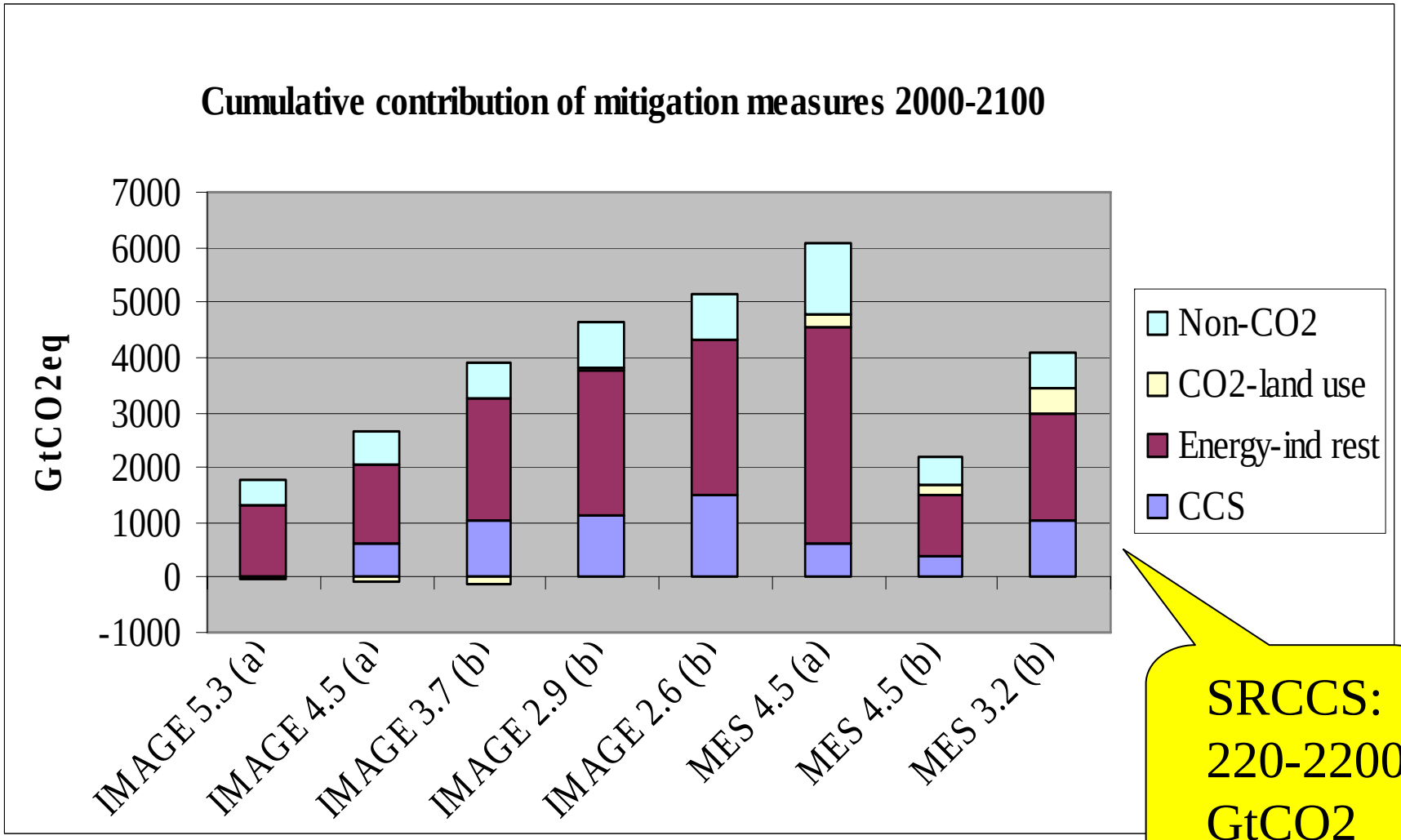
- The range of stabilization levels can be achieved by
  - deployment of a portfolio of technologies that are currently available and
  - those that are expected to be commercialised in coming decades

- This assumes that appropriate and effective incentives are in place for development, acquisition, deployment and diffusion of technologies and for addressing related barriers

The role of mitigation technologies



The share of CCS in the mitigation portfolio



Geological storage potential (GtCO2)

Need for common methodology stressed

	SRCCS	**AR4**
Oil/gasfields	675-900	560- 1170
Unmineable coal seams	3-200	N/A
Deep saline formations	1000- 10000	4000+
Total	*Likely* at least 2000	Higher than 2000

The policy challenge

- Many barriers for implementing low-cost mitigation measures
- An effective carbon-price signal could realise significant mitigation potential in all sectors
- Policies are essential to create a carbon price (direct or indirect)
- Meaningful climate policy should lead to carbon prices of $50-100/tCO2eq by 2030

IPCC SRCCS:
significant penetration
of CCS at carbon prices
of $25-30/tCO2eq

Investments

- Energy infrastructure investment decisions, (20 trillion US$ till 2030) 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%

UNFCCC: CCS investment around $40 billion till 2030

- It is often more cost-effective to invest in end-use energy efficiency improvement than in increasing energy supply

The importance of technology policies

- The lower the stabilization levels (550 ppm CO2-eq or lower) the greater the need for more efficient *RD&D efforts* and *investment* in new technologies during the next few decades
- Government support is important for effective technology development, innovation and deployment through
    - financial contributions,
    - tax credits,
    - standard setting
    - market creation.
- BUT, government funding for most energy research programmes has been declining for nearly two decades: now about half of 1980 level.

Other considerations

- Energy security considerations can lead to higher CCS use (domestic coal, oil production from tar sands,coal-to-liquid)
- Air quality/ health concerns can lead to higher use of IGCC
- Mandated use of CCS can go beyond least-cost share
- Bank lending policies are important

The Summary for Policy Makers , the Technical Summary and the full Report (subject to editing) can be downloaded from

www.mnp.nl/ipcc

Further information:

IPCC Working Group III Technical Support Unit
at the Netherlands Environmental Assessment Agency:
ipcc3tsu@mnp.nl