URBAN AGE INDIA CONFERENCE
NOVEMBER 2007

Nicholas Stern
London School of Economics

Climate Change, Risk and Urbanisation

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Urban Age Conference
Mumbai
3rd November 2007

- **Analysis of Global Effects**
  - Impacts/ Risks
  - Costs/ Investments

- **Climate Change and Cities**
  - Adaptation
  - Mitigation

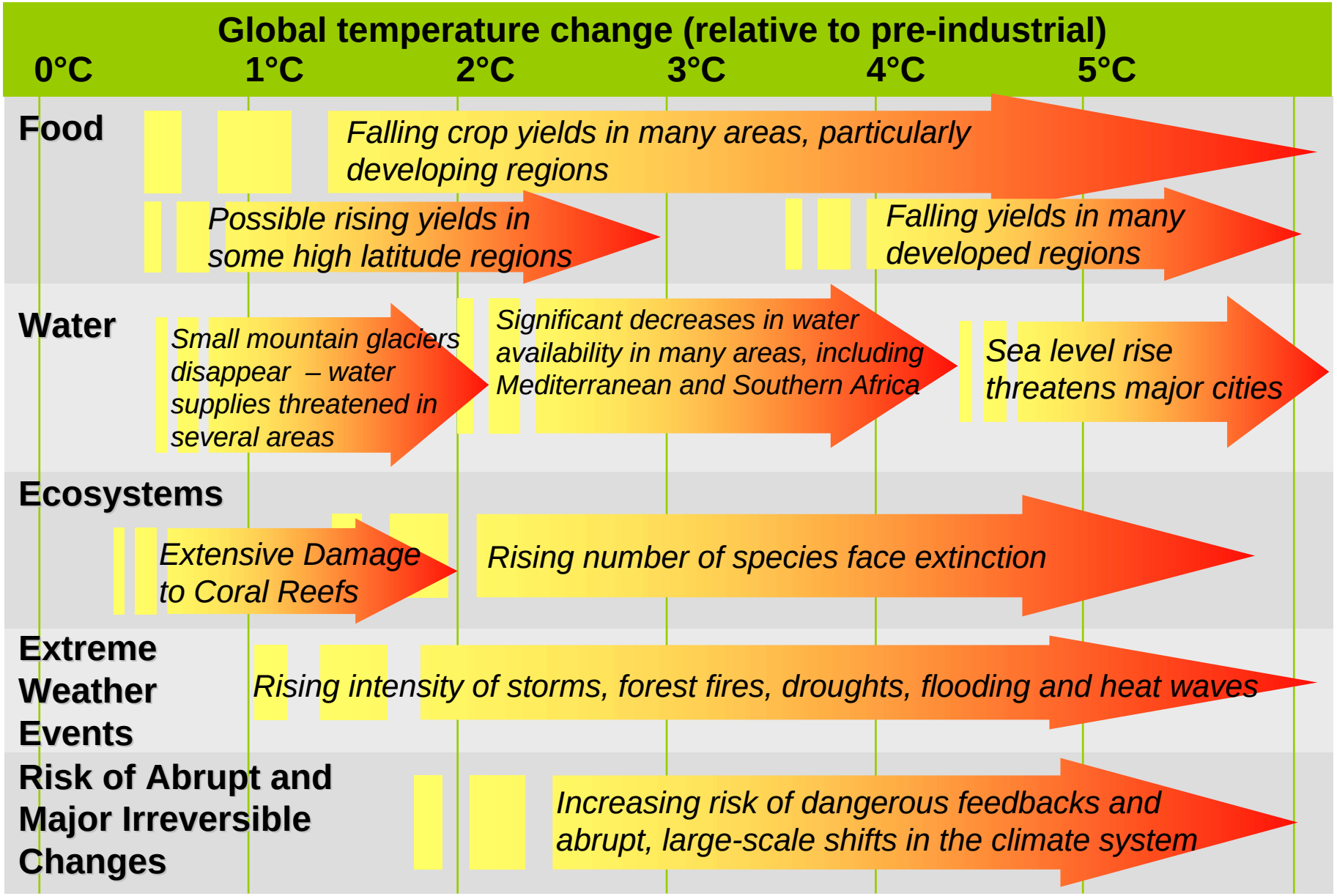
- **Global Deal**

Analysis of Global Effects

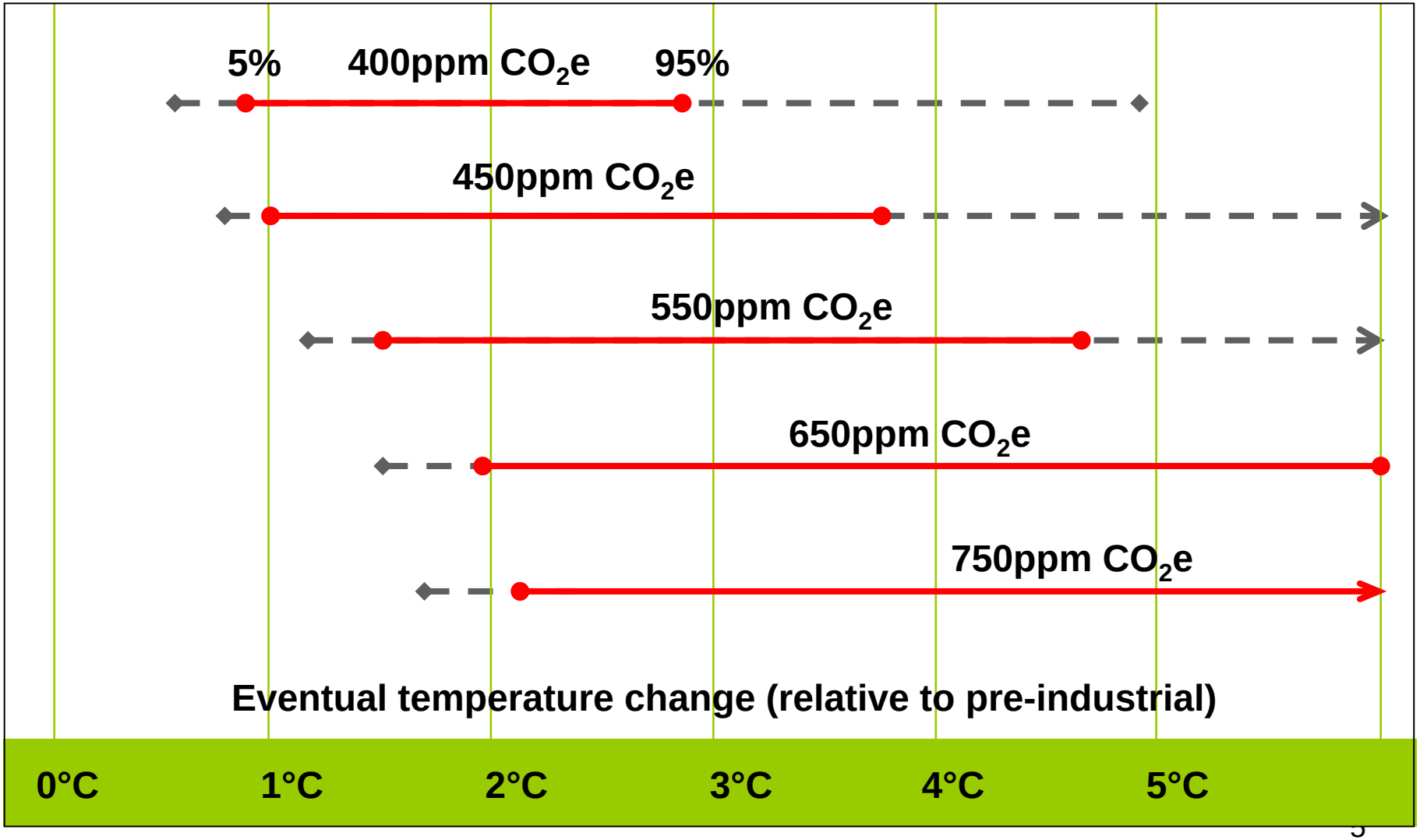
Impacts/Risks

Costs/Investments

Projected impacts of climate change



Stabilization and eventual change in temperature



Aggregate estimates of impacts

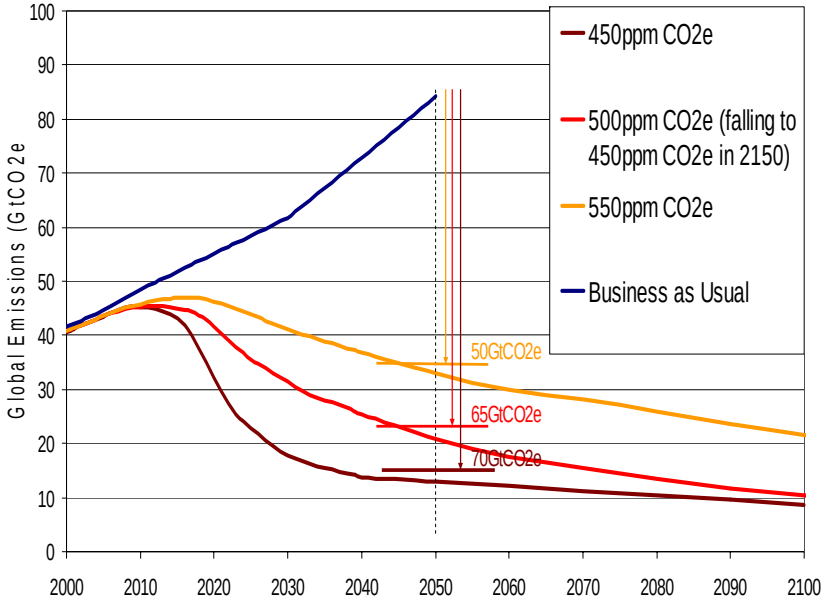
Sensitivity of total cost of climate change to damage function exponent and consumption elasticity of social marginal utility in baseline-climate scenario (mean BGE loss, 5-95% confidence interval).

Damage function exponent	*Consumption elasticity of social marginal utility (η)*		
	1	*1.5*	*2*
2	10.4 (2.2-22.8)	6.0 (1.7-14.1)	3.3 (0.9-7.8)
2.5	16.5 (3.2-37.8)	10.0 (2.3-24.5)	5.2 (1.1-13.2)
3	33.3 (4.5-73.0)	29.3 (3.0-57.2)	29.1 (1.7-35.1)

- Models should not be taken too literally
- Assumptions on discounting, risk aversion and equity affect the results
- Review central case was top left hand corner: high weight on future, conservative on risks. Plausible case for centring the argument further down the diagonal. Note: intra generational distribution, changing relative price of environmental goods, irreversibilities, all omitted and introduction would increase damage estimates

Delaying mitigation is not only dangerous..but also costly

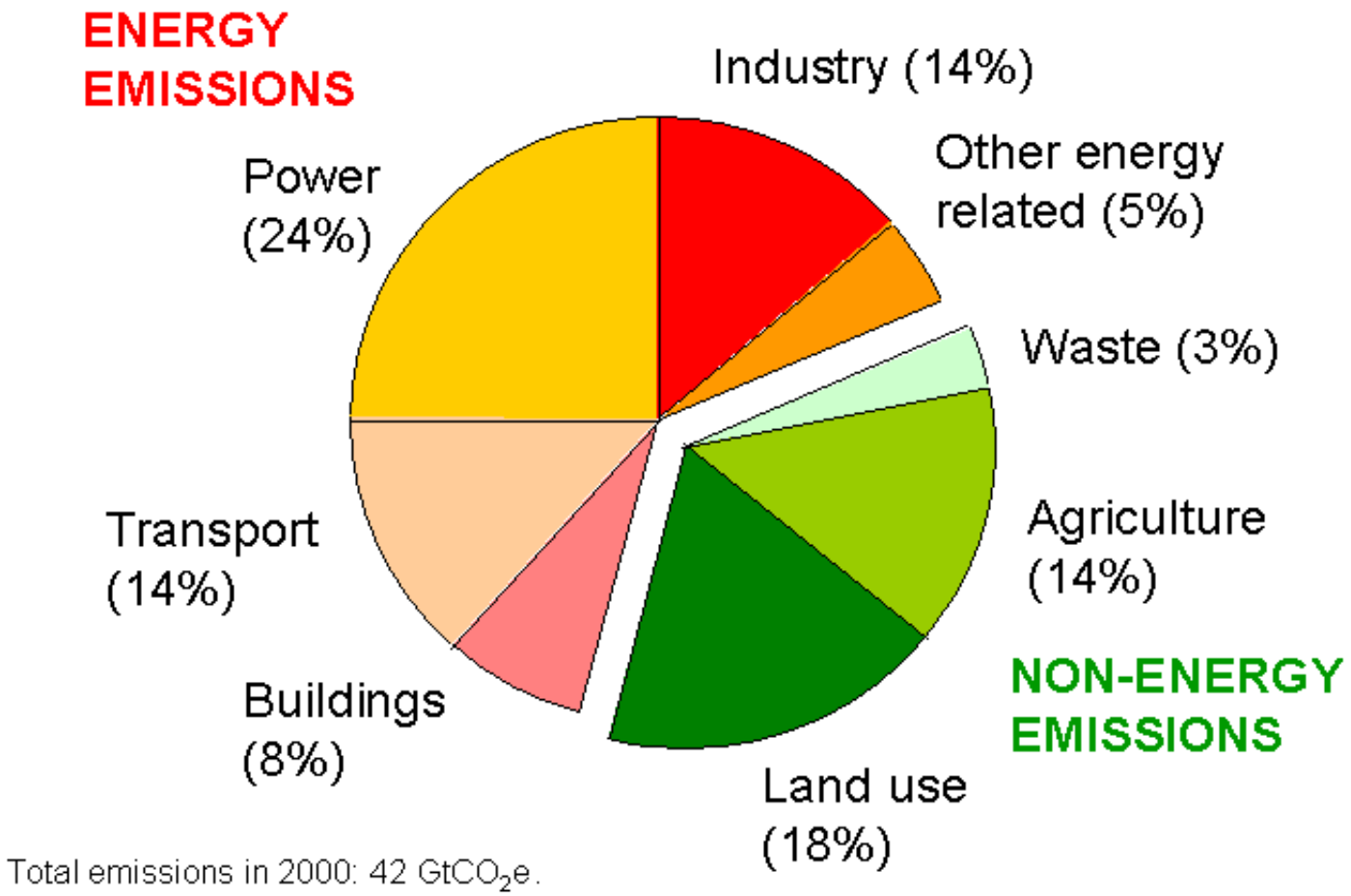
- Stabilising below 450ppm CO2e would require emissions to peak by 2010 with 6-10% p.a. decline thereafter.
- If emissions peak in 2020, we can stabilise below 550ppm.
- This can be done by achieving an annual decline of 1 – 2.5% in CO2e thereafter.
- A 10 year delay almost doubles the annual rate of decline required



Scope for mitigation: target flows

- Current 40-45 Gt CO2e p.a. Current stocks around 430ppm; pre-industrial stocks 280ppm
- Heiligendamm 2007 pledge to halve global emissions by 2050 – consistent with stabilisation of CO_2e below 500ppm
- The United States and the EU countries combined accounted for over half of cumulative global emissions from 1900 to 2005
- 50% reduction by 2050 requires per capita global GHG emissions of 2-3T/capita (20-25 Gt divided by 9 billion population)
- Currently US ~ 20+, Europe ~10+, China ~4, India ~1 T/capita

Reducing emissions requires action across many sectors

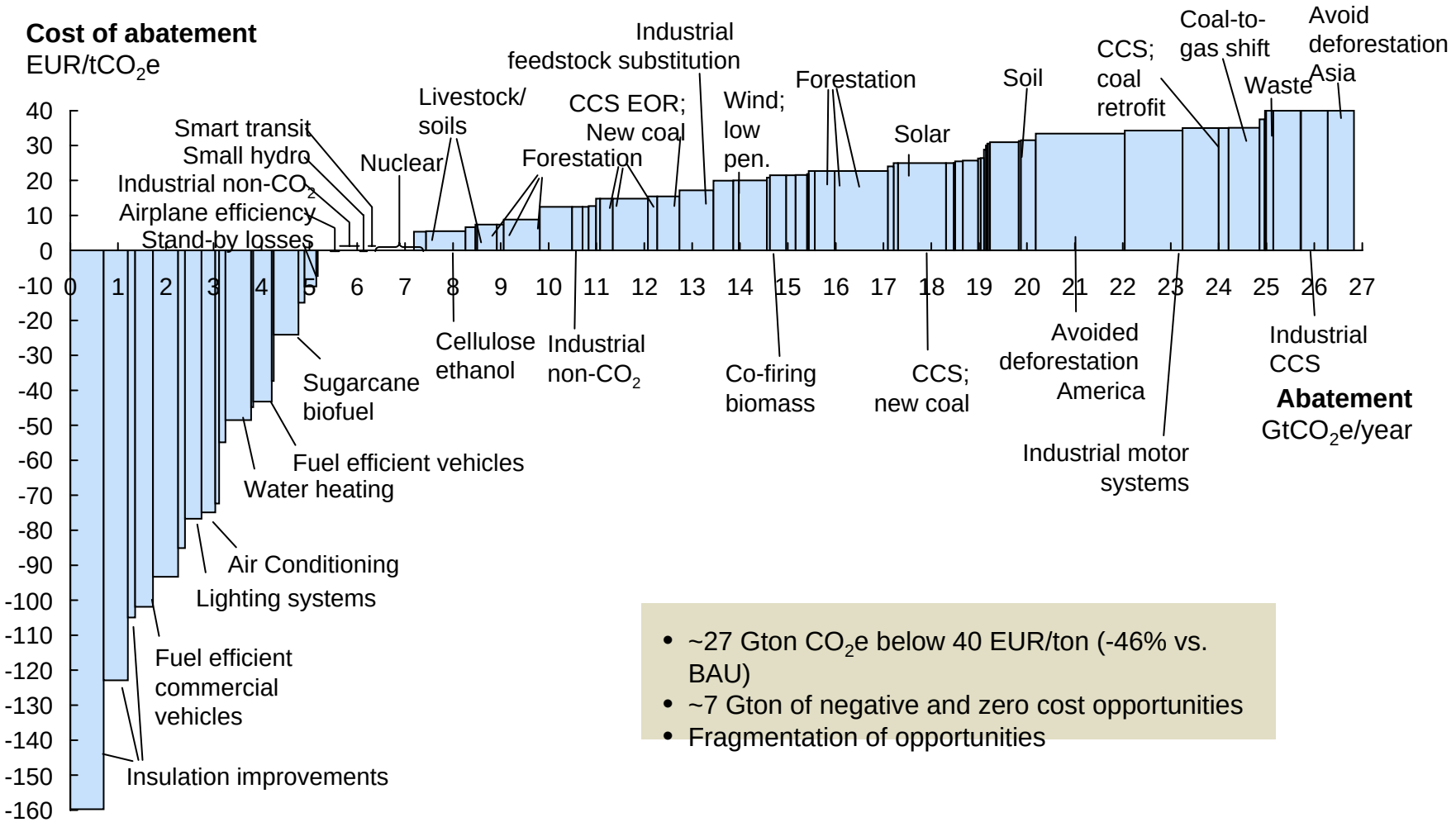


Mitigation Cost Estimates

- *Review* examined results from bottom-up & top-down studies. It concluded that world could stabilise below 550ppm CO_2e for around 1% of global GDP
- Subsequent analyses by Edenhofer/IPCC top down have indicated lower figures
- So too have bottom-up measures adopted by IEA and McKinsey & Company

McKinsey bottom-up approach

2030



- ~27 Gton CO_2e below 40 EUR/ton (-46% vs. BAU)
- ~7 Gton of negative and zero cost opportunities
- Fragmentation of opportunities

Mitigation policy instruments

- Pricing the externality- carbon pricing via tax or trading, or implicitly through regulation
- Bringing forward lower carbon technology- research, development and deployment
- Overcoming information barriers and transaction costs– regulation, standards, co-ordinated procurement by big cities
- Promoting a shared understanding of responsible behaviour across all societies – beyond sticks and carrots
- Combating deforestation

Climate Change and Cities

Vulnerabilities

- Surge in the number of extreme events
- Rising temperature and cities as heat islands
- Volatility of precipitation
- Tidal, river and storm water flooding; droughts and subsidence
- Many cities close to the sea and vulnerable to sea level rise.

Mumbai, 2005

Bihar, 2007

Rate of Glacier Retreat in the Himalaya

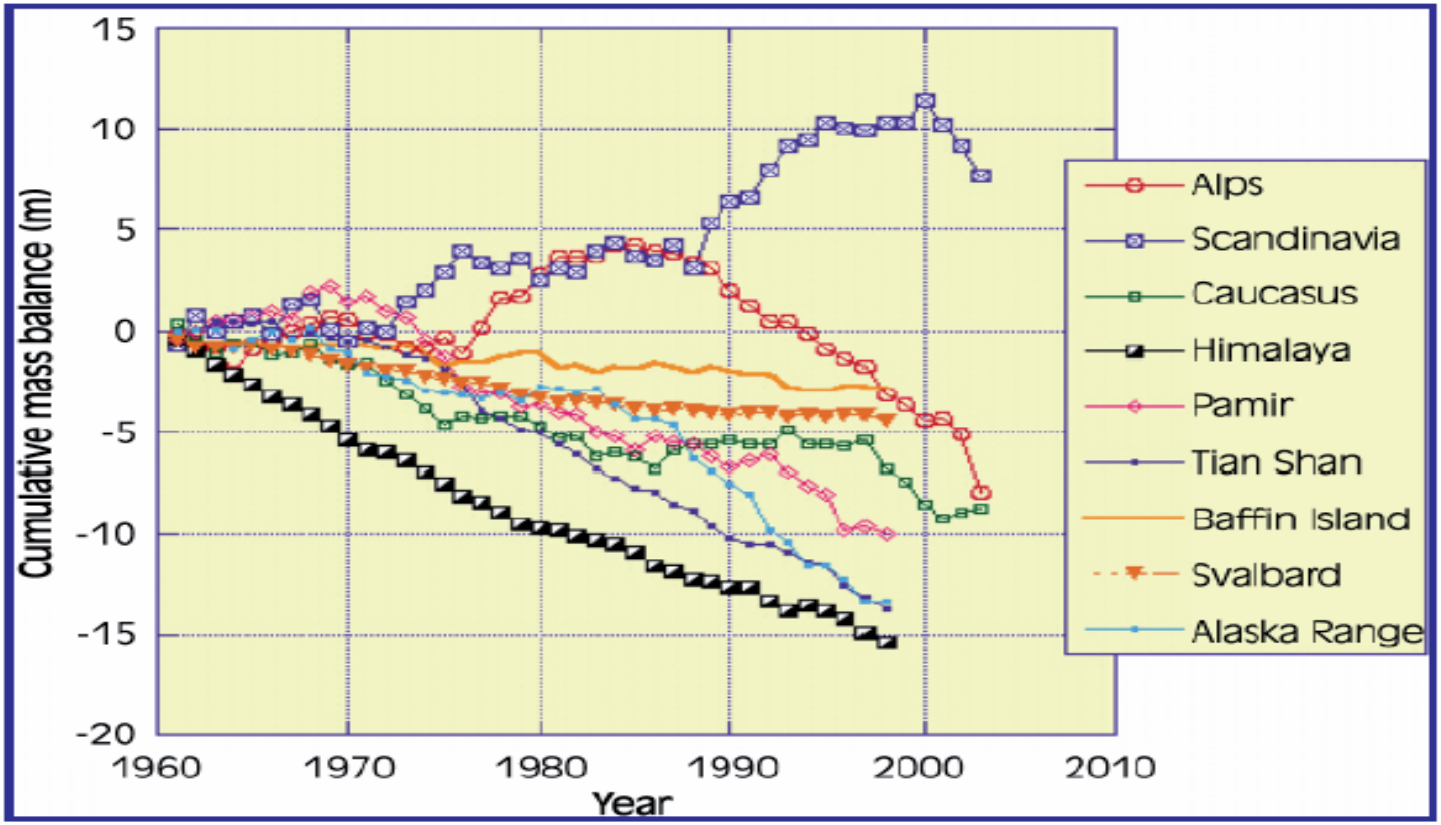


Figure 2: Rapid retreat of greater Himalayan glaciers in comparison to the global average (Dyurgerov and Meier 2005)

Adaptation to climate change, developing countries

- Development key to adaptation is that it enhances resilience and increases capacity
- Adaptation to current climate variability reduces costs of natural disasters
- Adaptation requires economy-wide planning and regional co-operation.
- Key role for Heads of Government, Finance and Economic Ministries
- How well is India prepared for the change in climate? Example: floods in Bihar, Maharashtra, Gujarat, etc

Adaptation rich country cities – various adaptations

- **New York**: Managing flood risk and water resource problems through- Staten Island Blue Belt Program and Climate Change Task Force
- **Tokyo:** Flood management in Tsurumi River Basin & managing urban heat island through planning policy and public communication emphasis
- **Basel:** High temperatures: green roofs
- **Seattle:** Management of storm water to combat floods
- **London:** increase capacity sewers; air-condition Underground; strengthen Thames barrier

Cities – where energy is consumed

- **50%** of world population live in cities
- Over **75%** of energy consumption is directly related to cities
- Fast rise in energy consumption in cities
- Rapid urbanisation
- Note: deforestation and agriculture (~ 35% of GHG emissions) are in rural areas, but indirectly linked to cities

Masdar – a visionary approach

- World's first zero-carbon, zero-waste city in Abu Dhabi
- Aim is to offer a sustainable urban blueprint for the future
- Primary energy sources: photo voltaic, wind, bio-fuel
- Car free
- Broad, integrated approach includes
  - conversion of organic waste material into gas which then runs an engine which generates electricity
  - construction features that resist high temperatures, including extra shading and slab cooling
  - grey water used for irrigation, toilet flushing
  - railway stations within 200 metres everywhere

Source: Foster

Dongtan, China – Carbon neutral sustainable city

- Expects to use one third energy of a comparable city
- Social sustainability plan includes integrating current population into city design rather than displacing them
- Components: city design, transportation, buildings, waste and energy & flood protection

Woking, UK

- Reduce Woking's CO_2 emissions by 50% of its 1990 levels by 2050
- Purchase 20% of Council's electrical energy from sustainable energy resources by 2010/11
- Council achieved its 5 year target to reduce energy consumption by 20% in 4 years (from 1990)
- Woking has reduced Council Tax substantially

Cities: scale, innovation & replication

- Concentration of resources: networks and other increasing returns (ex. public transport, CHP and local grids)
- Proximity facilitates replication and learning by watching
- Skill agglomerations (technical, organisational, financial)
- Standards and economies of scale, including joint procurement by big cities

Global Deal

Key elements of a global deal: I

Targets and Trade

•Rich countries to take on ***strong individual targets,*** creating demand side for reductions

•Rich country reductions and trading schemes designed to be ***open to trade with other countries***, including developing countries

•***Supply side from developing countries*** simplified to allow much bigger markets for emissions reductions, ***through sectoral or technological benchmarking***

Key elements of a global deal: II

Funding Issues

- Strong initiatives, with public funding, on **deforestation** to prepare for inclusion in trading
- Demonstration and sharing of **technologies**
- Rich countries to deliver on Monterrey and Gleneagles commitments on **ODA** in context of extra costs of development arising from climate change

Note:

Combination of the above can, with appropriate market institutions, help overcome the inequities of climate change and provide **incentives for developing countries to play strong role** in global deal, eventually **taking on their own targets.**

India: starting point for policy

- India is very vulnerable to climate change
- India will be central to discussion of a global deal
- India's contribution to past emissions is low & India has very small current emissions per capita
- India has strong and important objectives in growth and poverty reduction
- Note Stern Review has no policy recommendations for India

India: possible policy

- Support global target: Heiligendamm : 50% by 2050
- Insist on strong responsibilities for rich countries: at least 75% reductions by 2050
- Promote GHG trading to generate financial flow
- Encourage rapid technological advance with sharing of technologies at reasonable cost
- Work towards targets which take into account history of flows, standard of living and development aspirations, as flows and technologies are established
- Pursue urgently intensive study of challenges of adaptation