

# **The Economics of Climate Change**

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**Second IG Patel lecture**

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# **The economics of climate change**

- Impacts, Risks, Costs: Global
- Possible Impacts on India
- Planning for Adaptation
- Mitigation Policy
- Global Deal

# **Impacts, Risks, Costs: Global**

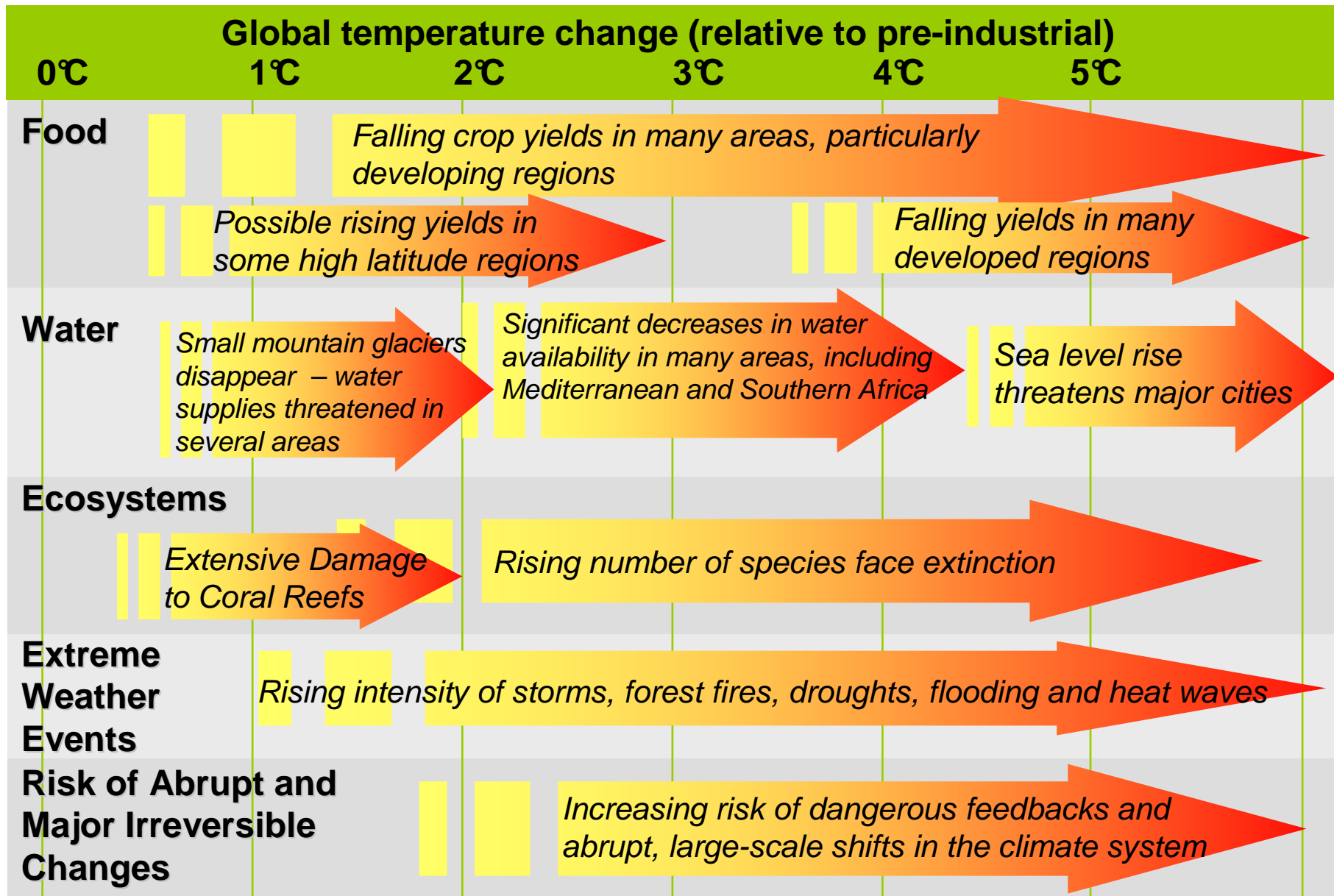
# **Why science implies this externality is different**

- Global
- Long-term; irreversibilities
- Uncertainty
- Scale

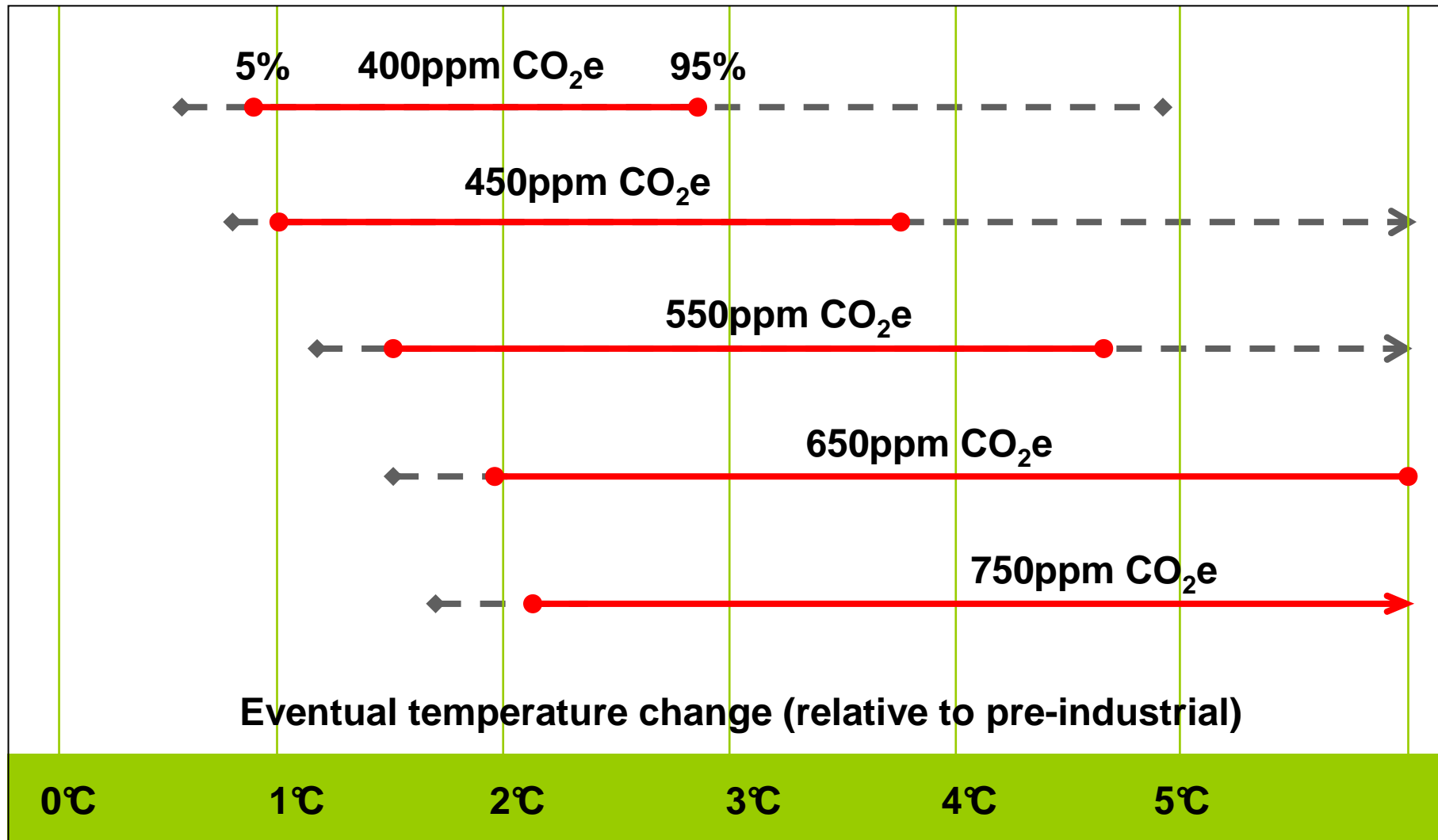
# Key messages

- The costs of strong and urgent action to avoid serious impacts from climate change are substantially less than the the damages thereby avoided
- Even with strong action to reduce greenhouse gas emissions adaptation must be a crucial part of development strategy
- Policy requires urgent and international action, pricing for damages from greenhouse gases, supporting technology development and combating deforestation

# Projected impacts of climate change



# Stabilisation and eventual change in temperature



# Aggregate estimates of impacts

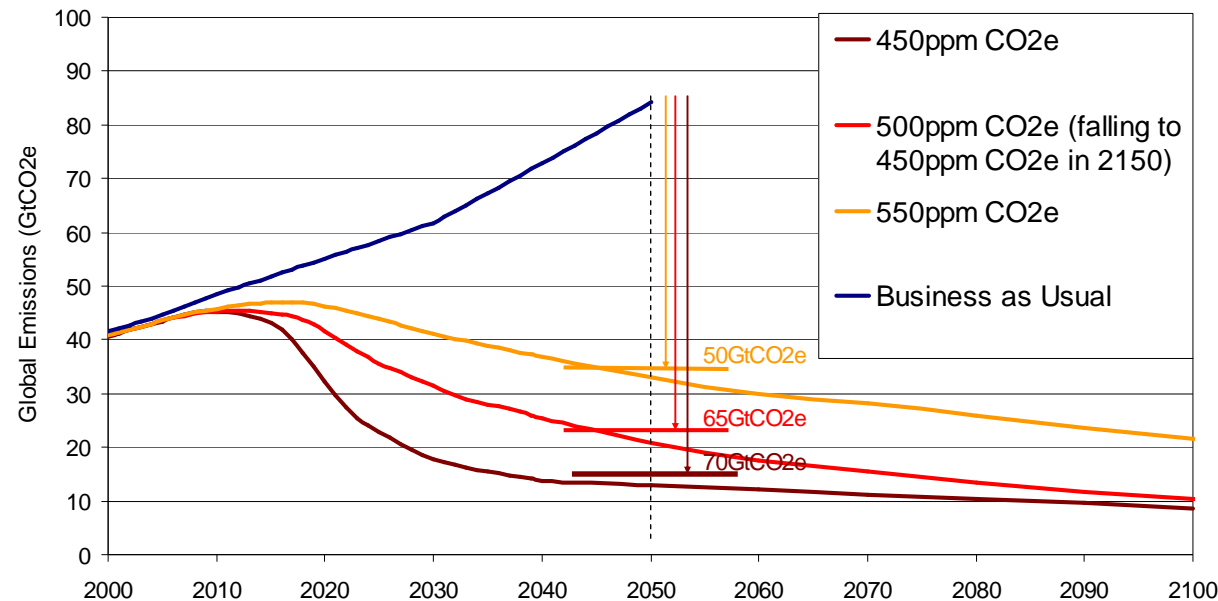
Sensitivity of total cost of climate change to damage function exponent and consumption elasticity of social marginal utility in baseline-climate scenario (mean BGE loss, 5-95% confidence interval).

<i>Damage function exponent</i>	<i>Consumption elasticity of social marginal utility (<math>\eta</math>)</i>		
	<i>1</i>	<i>1.5</i>	<i>2</i>
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



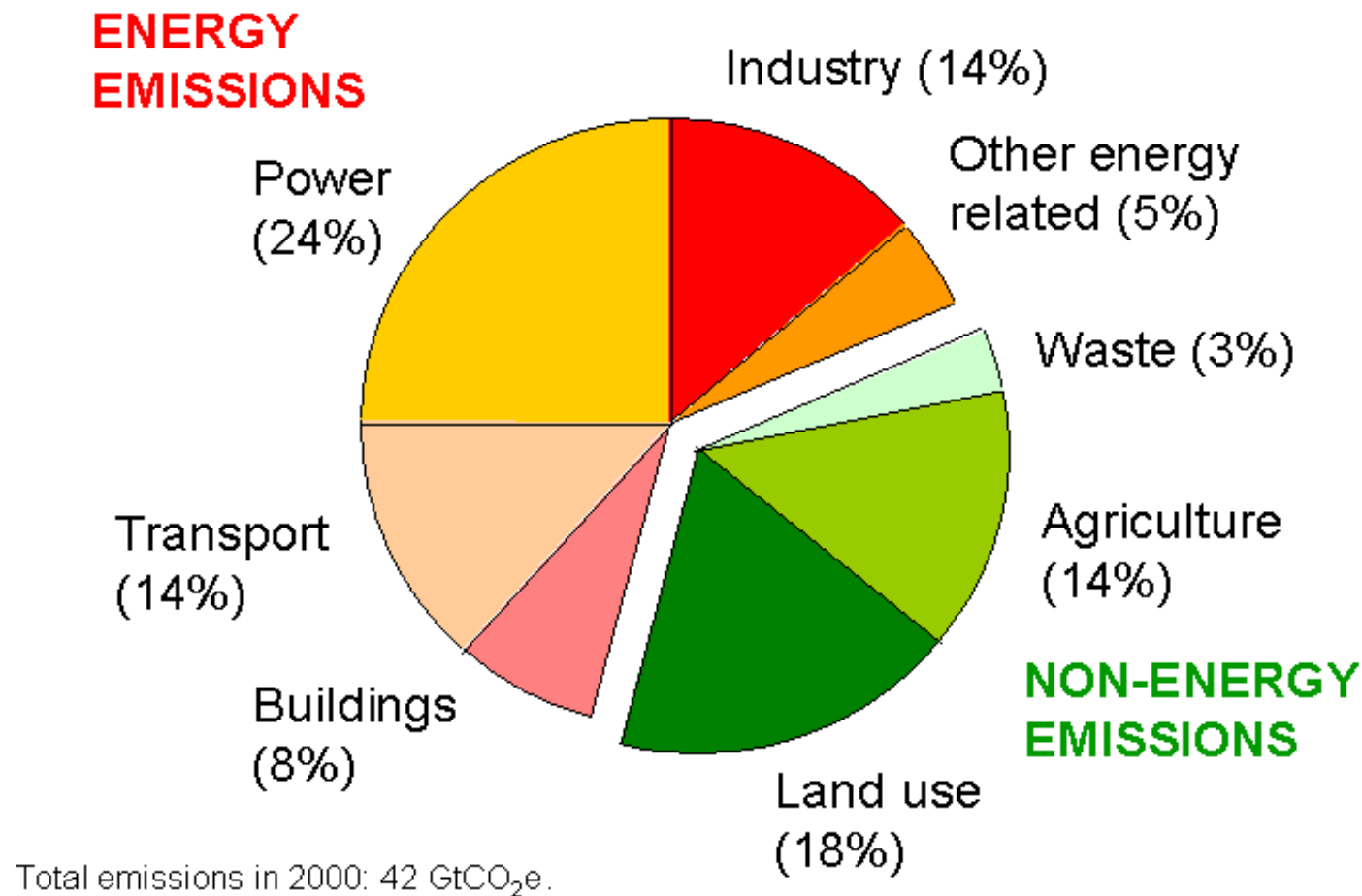
# Delaying mitigation is dangerous and costly



Stabilising below 450ppm CO<sub>2</sub>e would require emissions to peak by 2010 with 6-10% p.a. decline thereafter

If emissions peak in 2020, we can stabilise below 550ppm CO<sub>2</sub>e if we achieve annual declines of 1 – 2.5% afterwards. A 10 year delay almost doubles the annual rate of decline required

# Reducing emissions requires action across many sectors

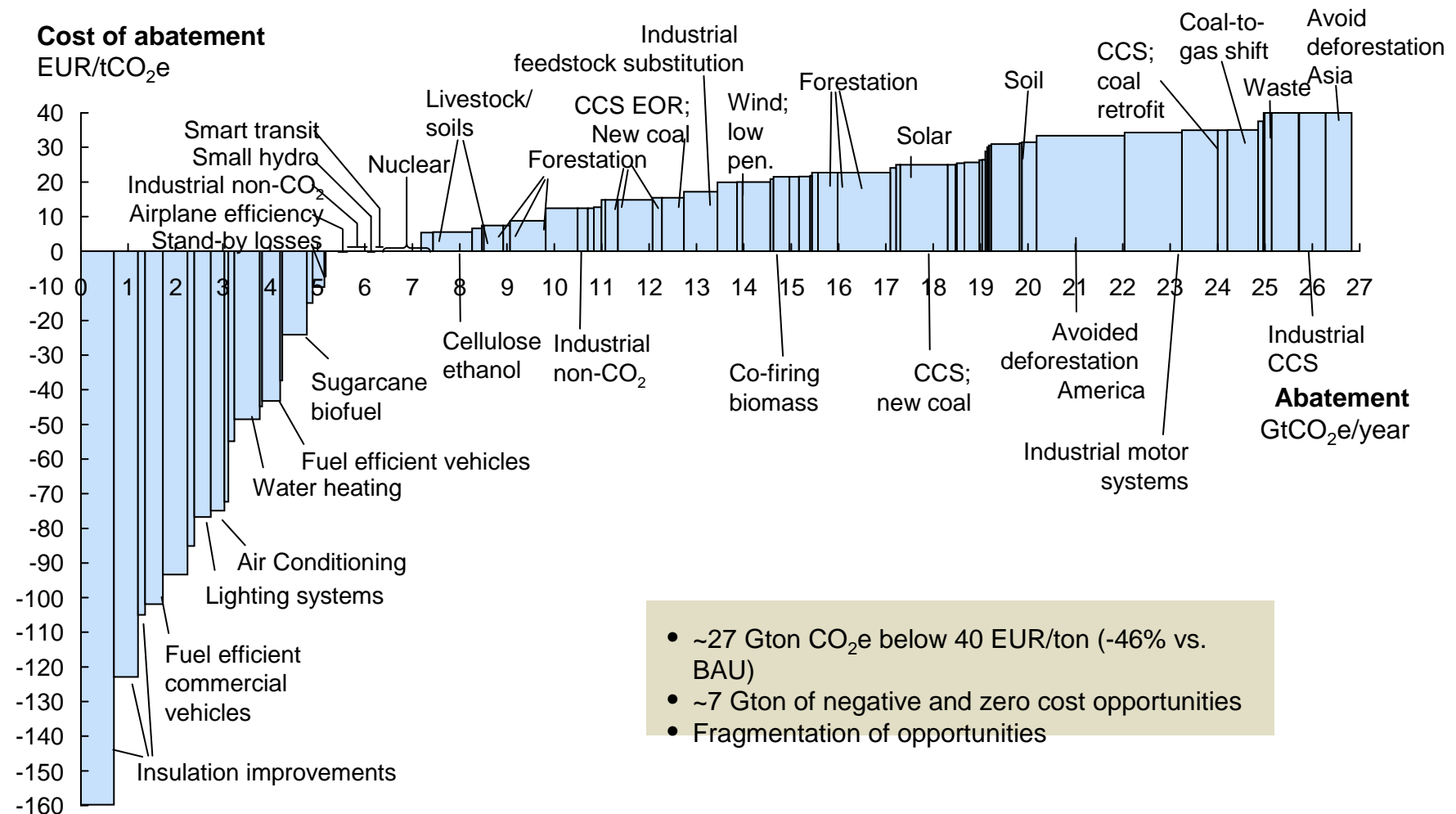


# Cost estimates

- Review examined results from bottom-up & top-down studies: concluded that world could stabilise below 550ppm CO<sub>2</sub>e for around 1% of global GDP
- Subsequent analyses Edenhofer/IPCC top down have indicated lower figures
- So too have bottom-up IEA and McKinsey
- Options for mitigation: McKinsey analysis examines approach of chapter 10 of Review in more detail

# McKinsey bottom-up approach

2030



# **Possible impacts on India**

# **Intense monsoons, glaciers' recession, flooding and water scarcity**

- Number of extreme rainfall events likely to increase
- Rapid retreat of Himalayan glaciers and snow
- Severity of droughts and floods likely to increase; torrents in rainy season, dry rivers in dry season
- Water scarcity in the long run caused by reduced inflows in river system

# Rate of Glacier Retreat in the Himalaya

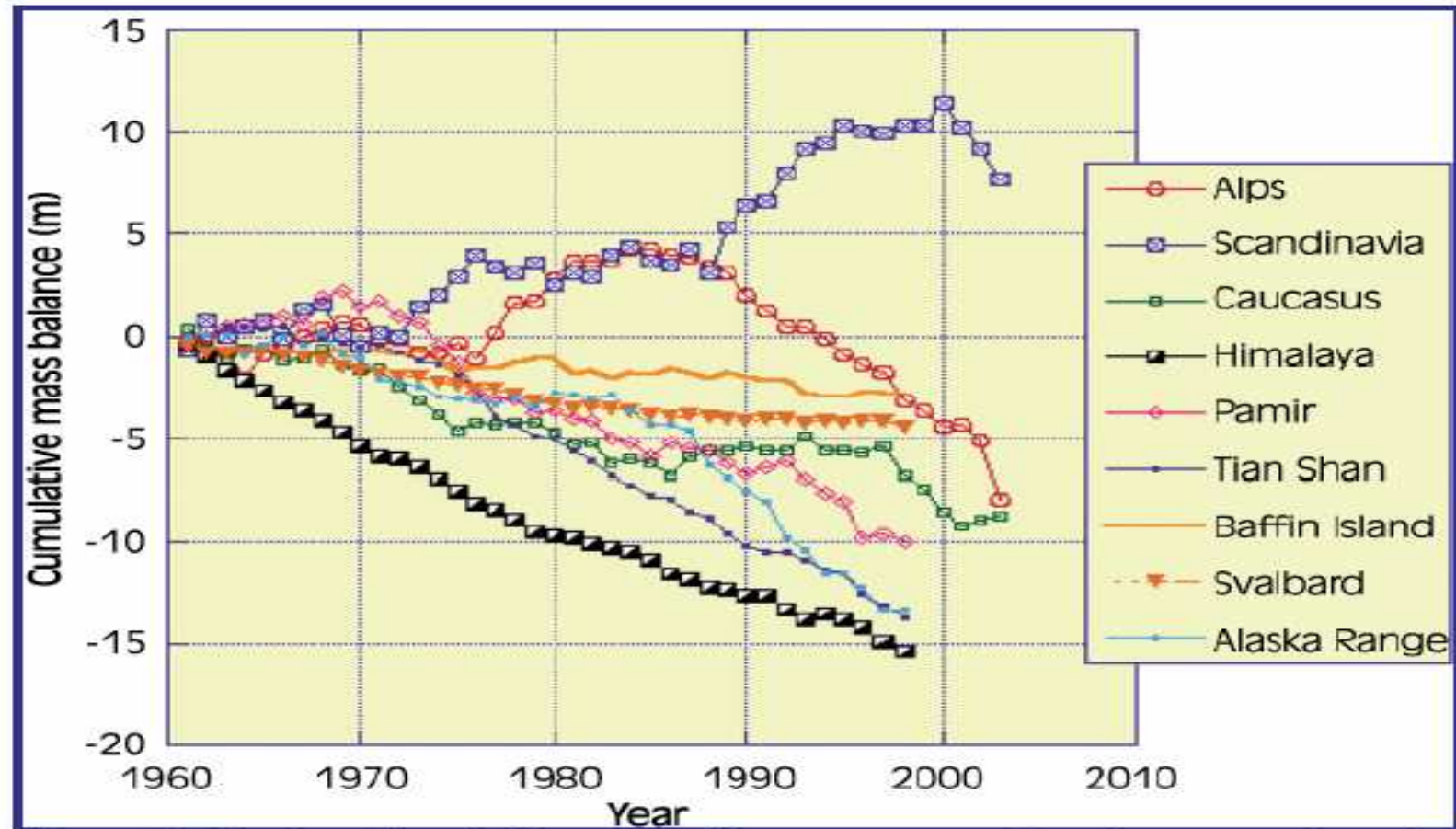
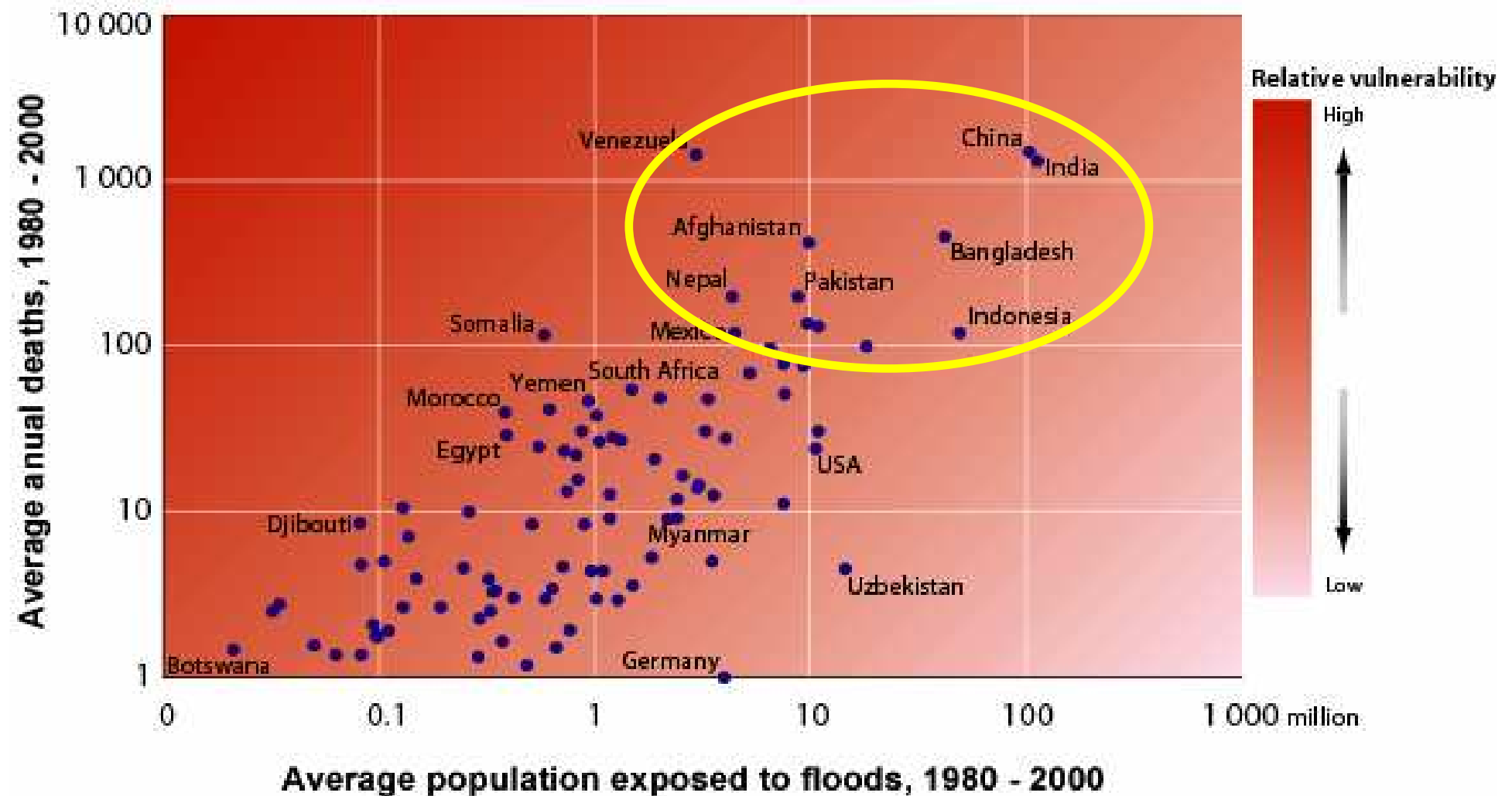


Figure 2: Rapid retreat of greater Himalayan glaciers in comparison to the global average (Dyurgerov and Meier 2005)

# Relative Vulnerability for Floods

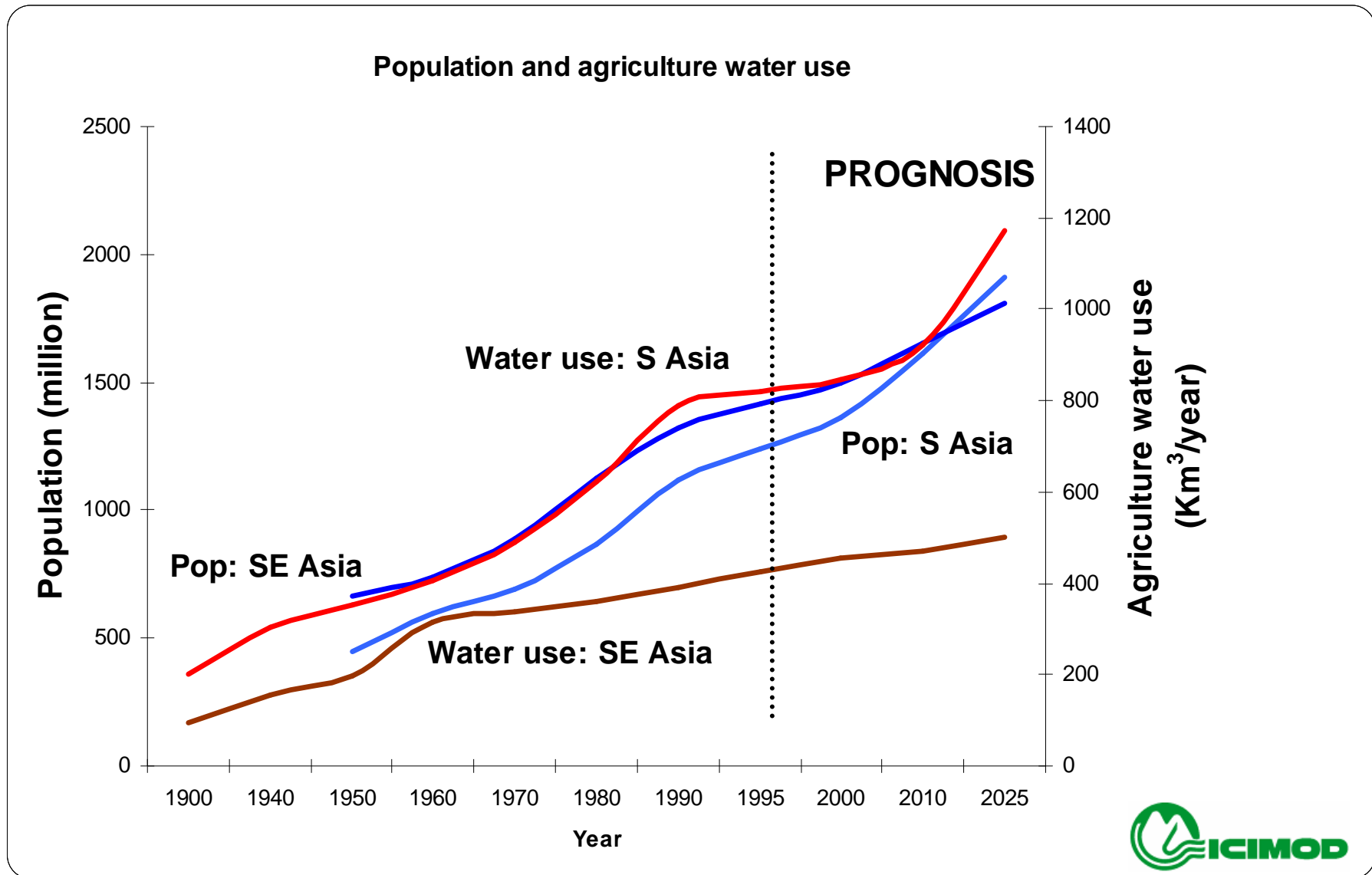


Source: Reducing Disaster Risk, A Challenge for Development, 2004, UNDP





# Increase in Population and Agricultural Water Use in Asia



# **Planning for Adaptation**

# Adaptation and development

- Development key to adaptation: enhances resilience and increases capacity
- Adaptation to current climate variability reduces costs of natural disasters
- Adaptation requires economy-wide planning and regional co-operation
  - Leadership and co-ordination is essential: key role for Heads of Government, Finance and Economic Ministries
- How well is India prepared for the change in climate? For example record floods this year

# Responsibilities for adaptation

- Central role for individuals, firms, and civil society in responding to climate change
- Measures for strengthening adaptation include
  - Ensuring access to high-quality information
  - Increasing the resilience of livelihoods and infrastructure
  - Improving governance
  - Integrating climate change impacts in issues in all national, sub-national and sectoral planning processes and macro-economic projections.
  - Encouraging a core ministry with a broad mandate, such as finance, economics or planning, to be fully involved in mainstreaming adaptation
- Local study of impacts and possible responses is crucial

# International support for adaptation

- Development in context of climate change will be much more costly: likely to be scores of billions of dollars p.a.
- Rich countries are main source of climate problem: responsibility to help finance consensus
- Essential to meet commitments made to double aid flows by 2010
- UNFCCC process and funds essential to support capacity-building and prioritisation
- Given necessary scale additional ODA flows will be a bigger source of funding for adaptation and development

# Global opportunities for adaptation

International action also has a key role in supporting global public goods for adaptation:

- Forecasting climate and weather
- Disaster response
- More resilient crop varieties
- Technologies for water conservation and irrigation
- New methods to combat land degradation
- Prevention and treatment of malaria and other water- and vector- borne diseases

# **Mitigation Policy**

# Carbon dioxide emission projections

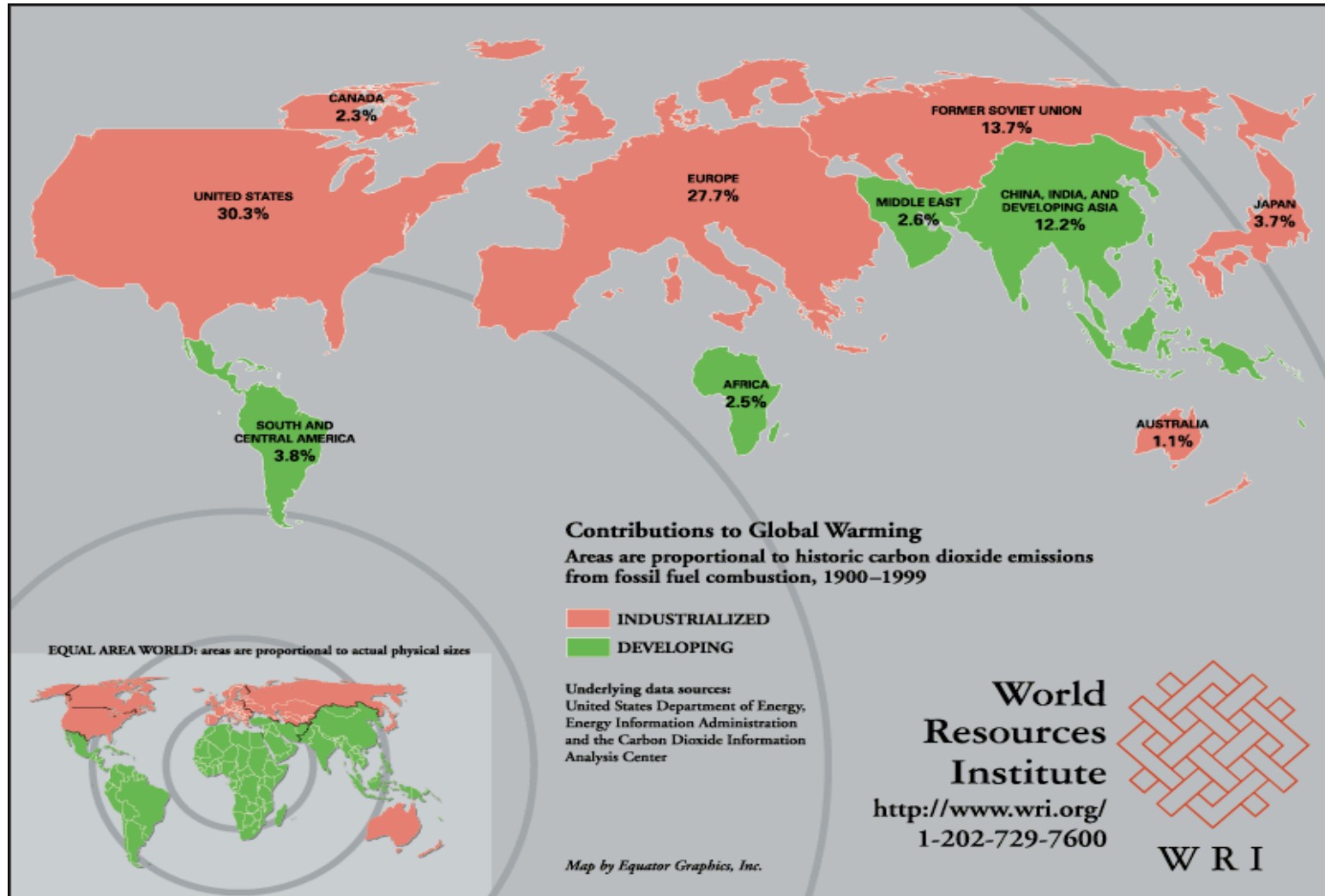
EIA Reference Case, MtCO <sub>2</sub> (from energy): 2002-2025				
Country	2002	2025	Avg. Annual Growth	Total Growth
<b>World</b>	<b>24,410</b>	<b>38,791</b>	<b>2.00%</b>	<b>58.90%</b>
Annex I	14,169	18,258	1.10%	28.90%
non-Annex I	10,241	20,533	3.10%	100.50%
<b>United States of America</b>	<b>5,752</b>	<b>7,980</b>	<b>1.40%</b>	<b>38.70%</b>
<b>Western Europe</b>	<b>3,550</b>	<b>3,953</b>	<b>0.50%</b>	<b>11.40%</b>
China	3,323	8,134	4.00%	144.80%
<b>India</b>	<b>1,026</b>	<b>1,993</b>	<b>2.90%</b>	<b>94.30%</b>
Brazil	341	678	3.00%	98.90%

Source: Climate Analysis Indicators Tool (CAIT) Version 4.0.

(Washington, DC: World Resources Institute, 2007).



# The CO2 emissions map



Note: Map reflects the relative emissions from fossil fuel consumption in 20th century.

# Target flows

- Current 40-45 GtCO<sub>2</sub>e p.a. Current stocks around 430ppm; pre-industrial stocks 280ppm
- Heiligendamm 2007 pledge to halve global emissions by 2050 – consistent with stabilisation of CO<sub>2</sub>e 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

# The GHG 'reservoir'

- Long-term stabilisation at 550ppm CO<sub>2</sub>e implies that only a further 120ppm CO<sub>2</sub>e can be 'allocated' for emission, given that we start at 430ppm
- Developing country can largely claim this 120ppm given their low emissions in the past. Note that rich countries largely responsible for increase from 280ppm to 430ppm
- Equity requires a discussion of the appropriate use of this reservoir given past history
- Thus convergence of flows does not fully capture the equity story, from emissions perspective
- Equity issues arise also in adaptation, given responsibilities for past increases

# 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
- Promoting a shared understanding of responsible behaviour across all societies – beyond sticks and carrots

# Growth, change and opportunity

- Strong mitigation costs around 1% p.a. worldwide
- Strong mitigation is fully consistent with the aspirations for growth and development in poor and rich countries. Business as usual is not.
- Costs will not be evenly distributed:
  - Competitiveness impacts can be reduced by acting together.
  - New markets will be created. Investment in low-carbon electricity sources could be over \$500bn a year by 2050.
- Mitigation policy can also be designed to support other objectives:
  - energy - air quality, energy security and energy access
  - forestry - watershed protection, biodiversity, rural livelihoods

# **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

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