Co-Benefits of Climate Change Mitigation Policies

2nd International Workshop on Sector Approaches

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Outline

- Definition
- Categories of co-benefits
- Air pollutant pathways
- Economic analysis framework
- State of the literature
- Conclusions
  - Implication for policy

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1. Definition

- Co-benefits/co-costs refer to:
  - *combined effects of GHG abatement policies both on climate change and other environmental, energy security or social impacts.*
- In practice analysts tend to focus on non-climate impacts.

2. Categories
Many different types of co-benefits

- Human health
- Crop, pasture and forestry yields
- Water availability and quality
- Biodiversity conservation
- Adaptation
- Reduced damages to buildings
- Energy security
- Social and distributive benefits

Examples from the LULUCF sector

Examples from the LULUCF sector

- Reducing emissions from deforestation may greatly contribute to biodiversity conservation as most of the Earth's terrestrial biodiversity lives in tropical forest where most deforestation takes place.
- Preserving mangrove forest may provide protection for coastal communities in case of extreme events
- Reforestation can increase water availability and quality (reduced siltation) as well as protect from flooding.
- Increasing soil carbon in agricultural soils can increase resilience in case of drought or flooding.

Lower GHG, Energy Use & Reduced Air Pollution (1)

Existing literature:

- Human health benefits in the form of reduced mortality and morbidity from reduced local air pollution (PM)
- Reduced material damage to buildings (acid deposition)
- Lower regulatory costs (SO_x, NO_x)

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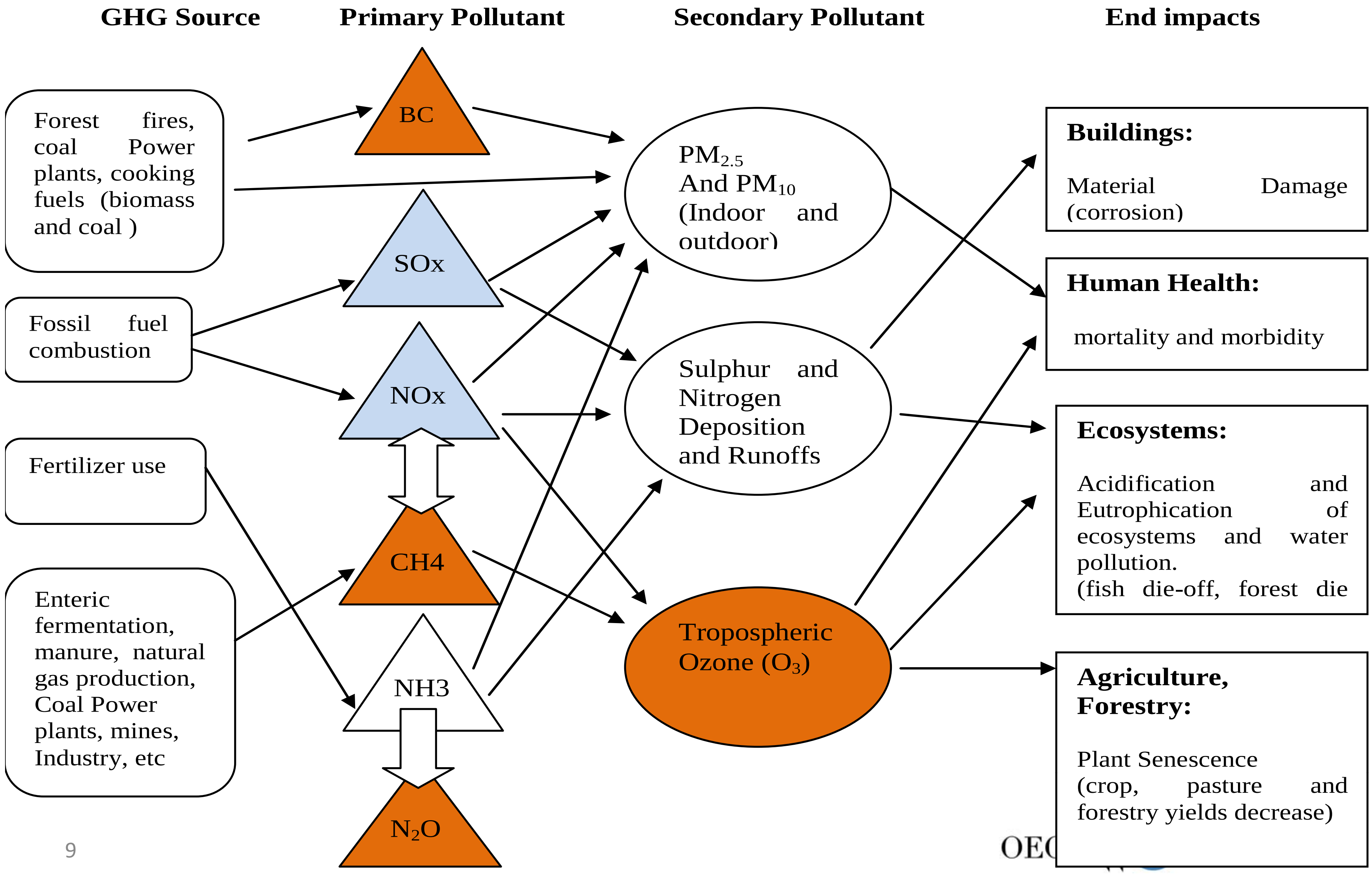
Lower GHG, Energy Use & Reduced Air Pollution (2)

New issues, emerging literature:

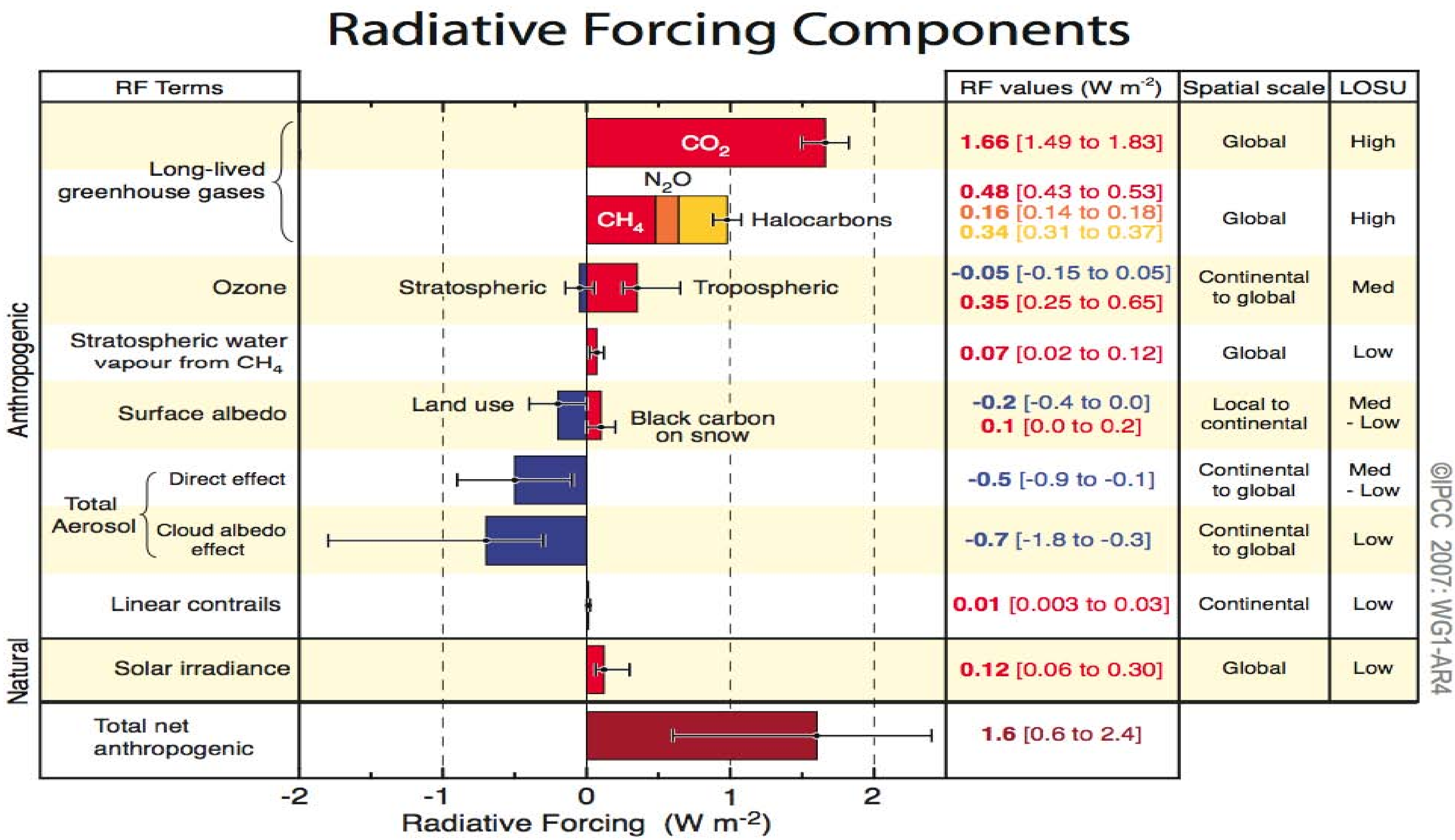
- Linkages between CH_4 reduction and tropospheric (surface) ozone events
  - Reduced crop, pasture and forestry yield losses from local air pollution
  - Human health benefits – urban areas
- Linkages between GHG policy and indoor air pollution (IAP)

3. Air Pollutant Pathways



Added layers of complexity --

Both cooling and warming effects of aerosols



Source: IPCC 2007

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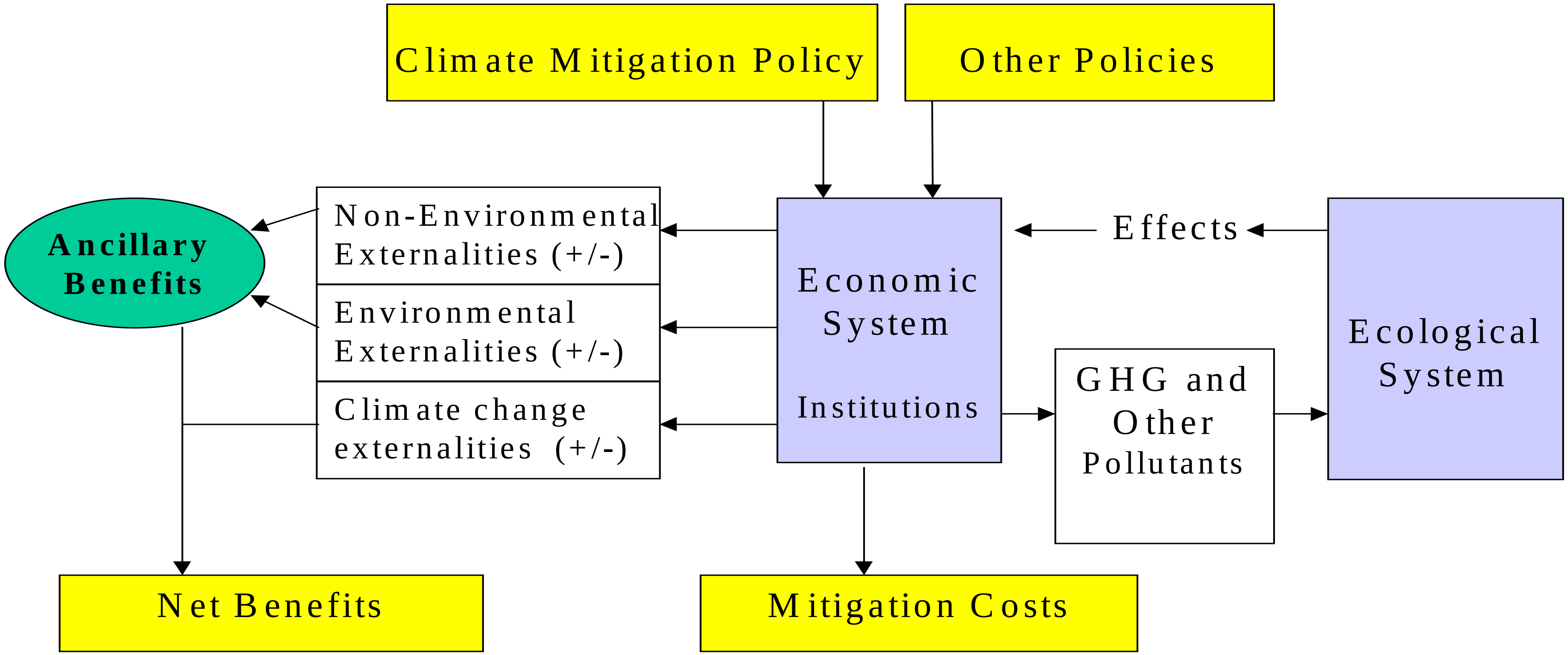
4. Economic Analysis Framework

Figure 1 - Ancillary Effects of Climate Mitigation: A Conceptual Framework



Source: Krupnick et al in OECD 2000

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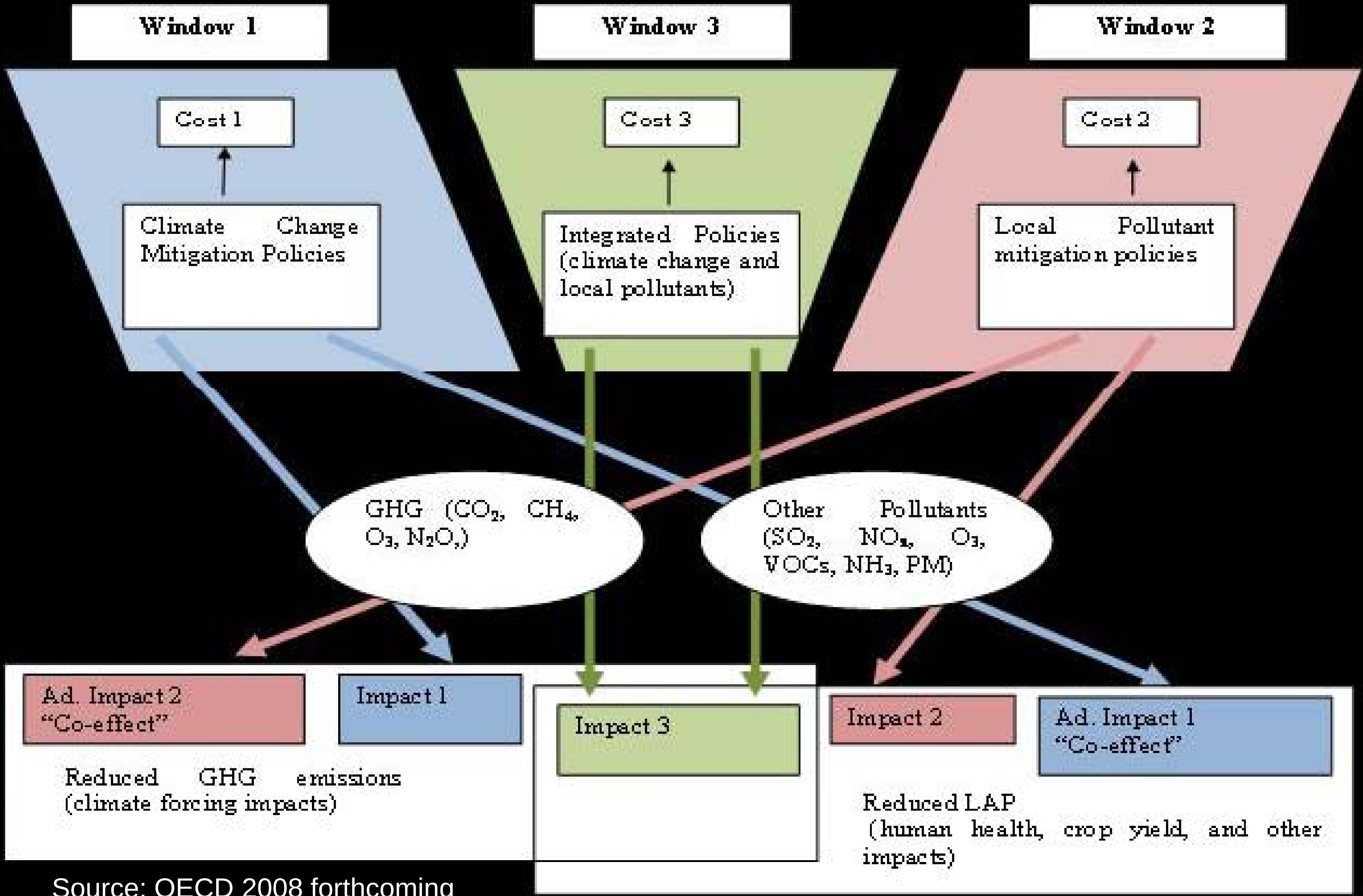
Three “Windows” of Analysis

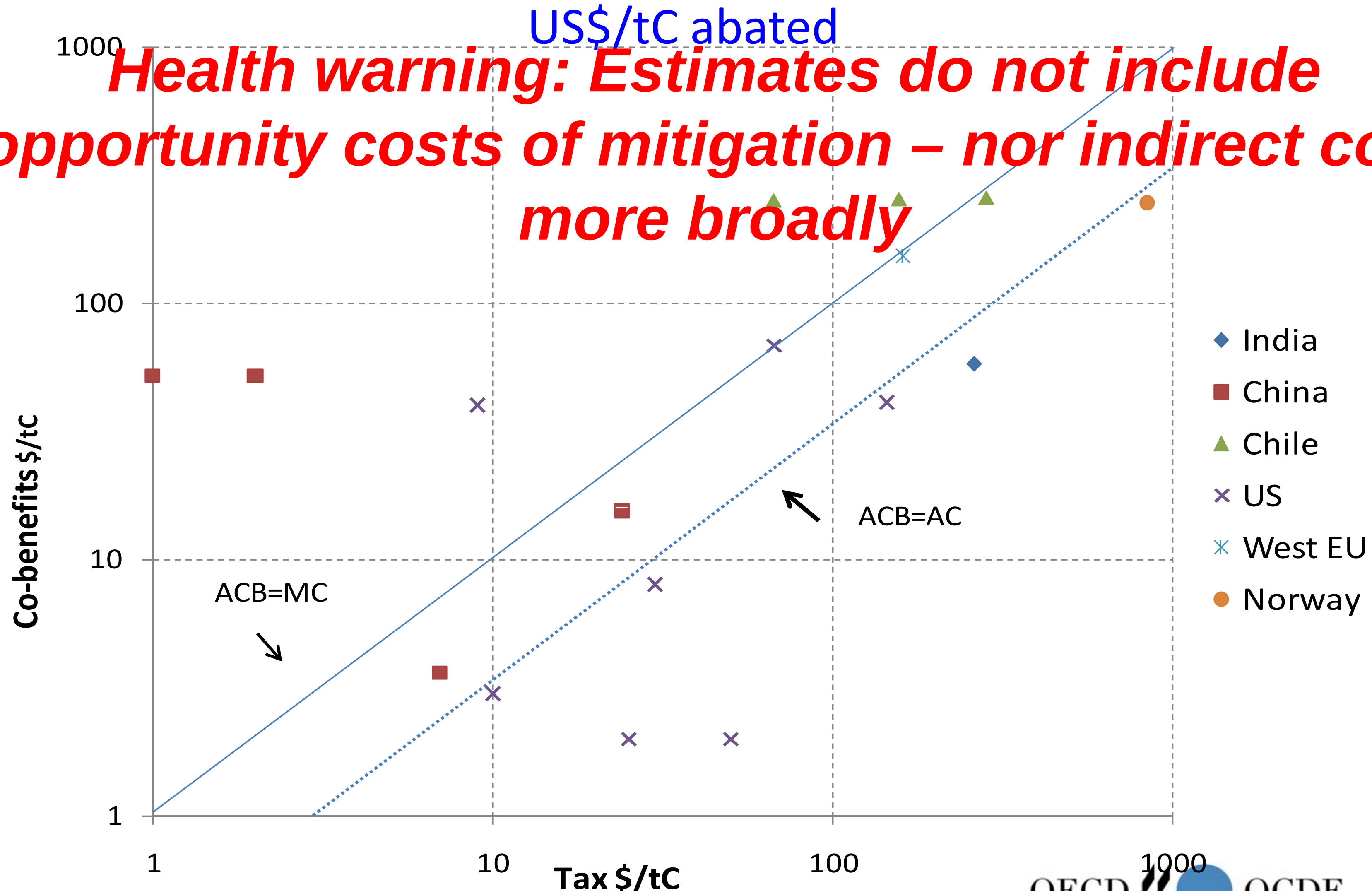


Source: OECD 2008 forthcoming

5. State of the literature

Window 1: large co-benefits

Health warning: Estimates do not include opportunity costs of mitigation – nor indirect cost more broadly



Source: Updated from Davis et al in OECD 2000

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Window 3: Optimal policy for human health

Source: Bollen et al. 2007

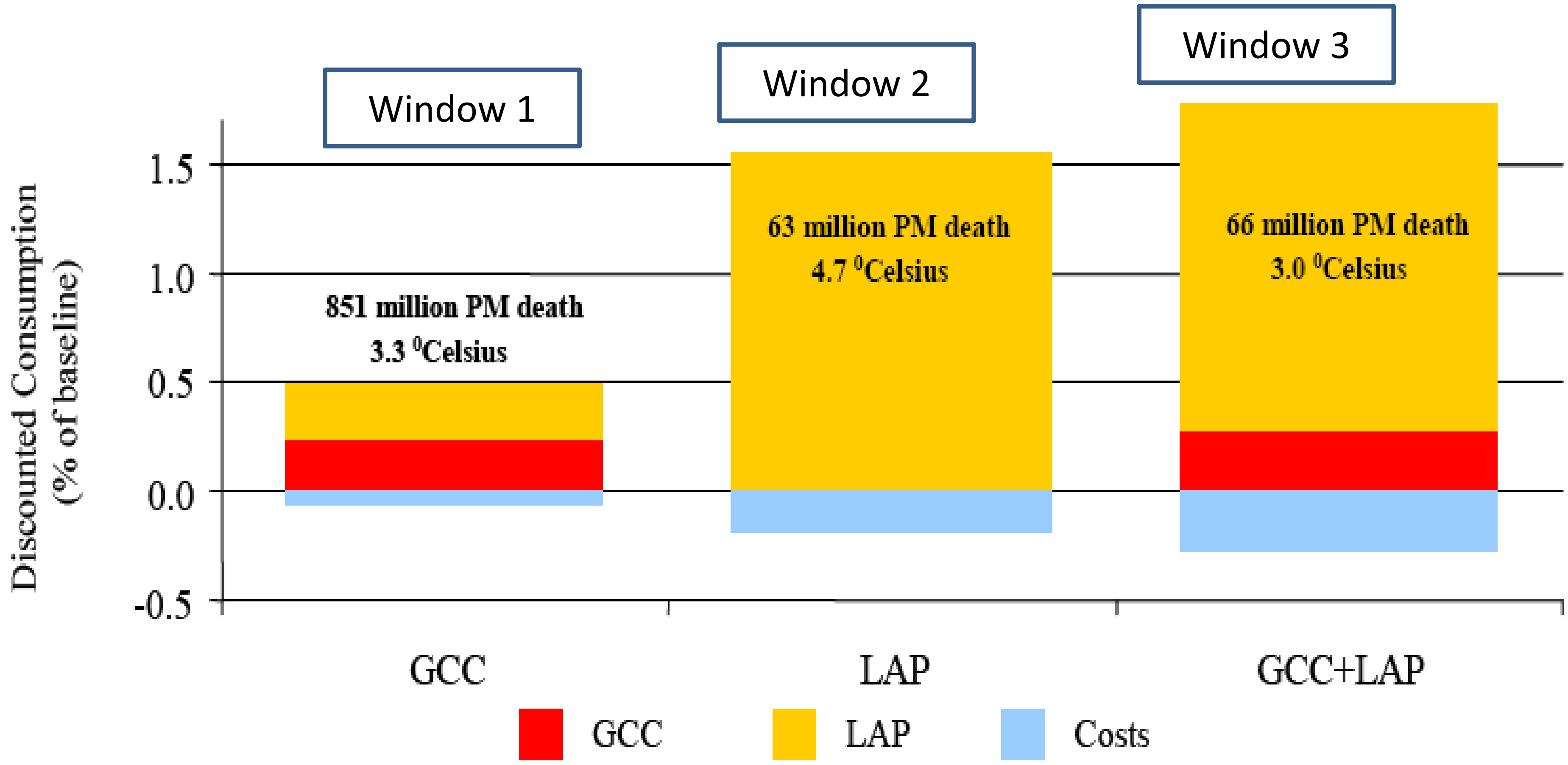
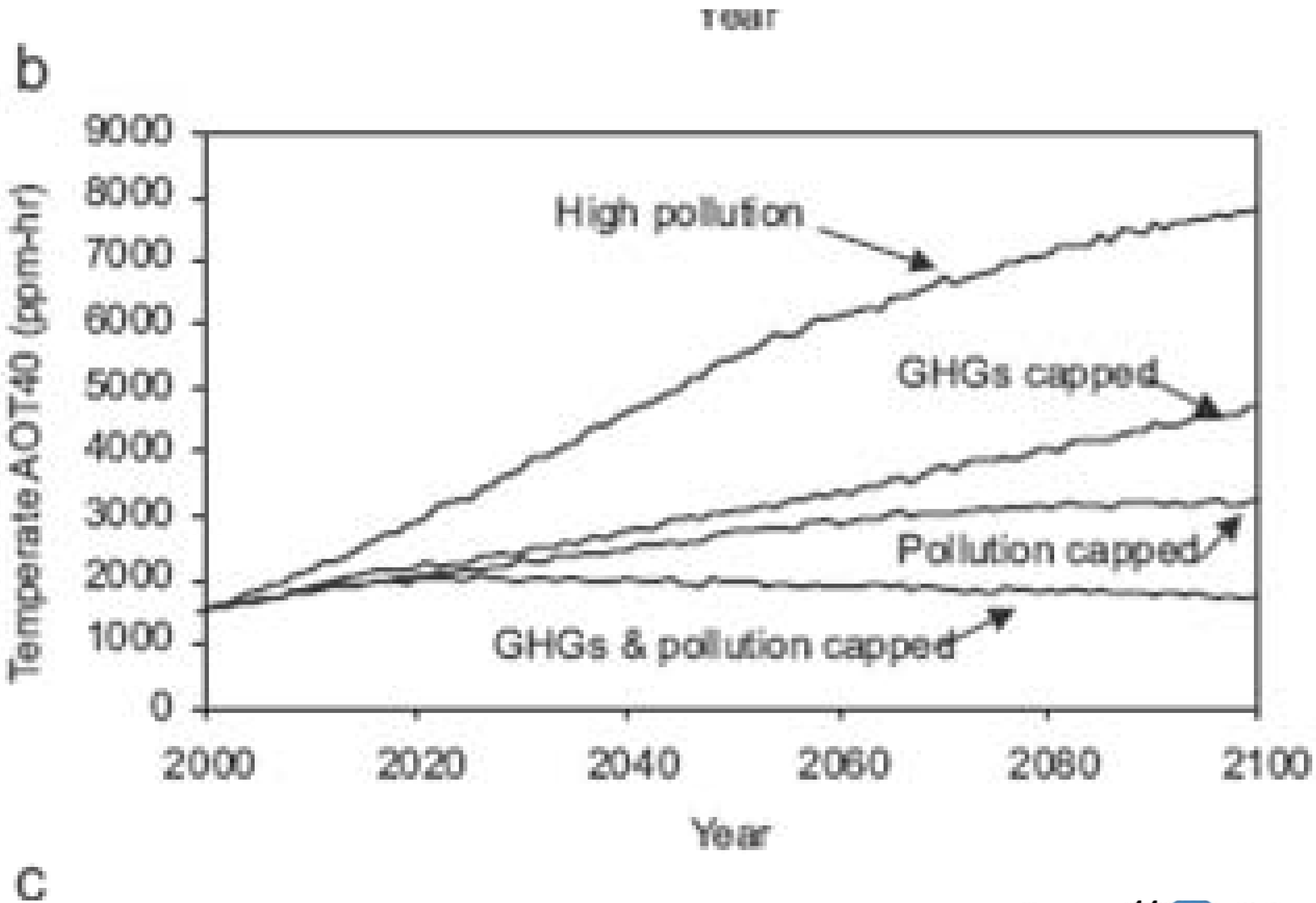


Figure 4. Changes in costs, benefits, and global welfare for three scenarios (GCC, LAP, and GCC + LAP), expressed as percentage consumption change in comparison to the baseline.

Window 3: Optimal Policy for Ozone

Change in peak ozone concentrations by scenario



Source: Reilly et al 2007

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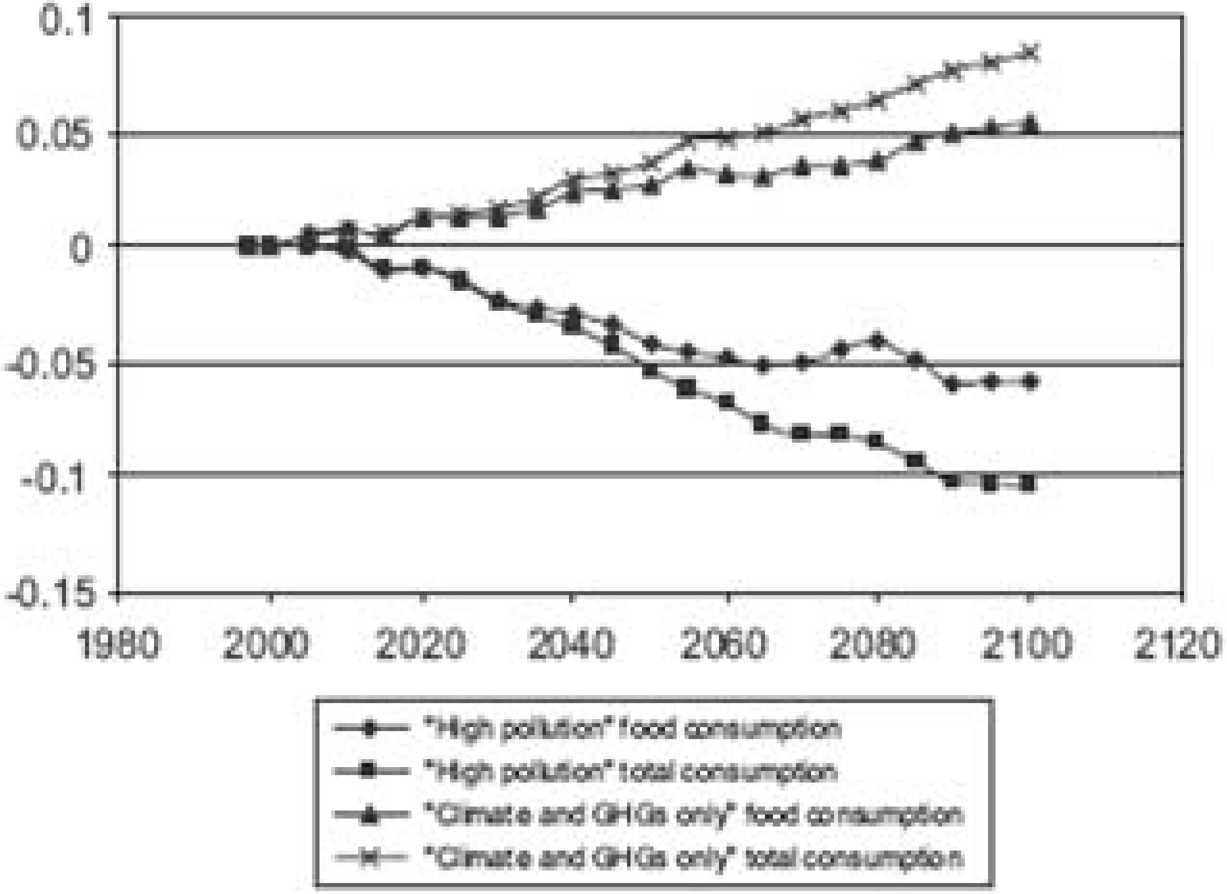
Climate change, ground-level ozone & agriculture

Macro-economic consumption effects



A change in sign:

- Positive - GHG only
- Negative if both O_3 & GHG

Total macro-economic effects of policies depend on trade & resource allocation decisions

General-equilibrium effects matter in the assessment of co-benefits

Source: Reilly et al 2007
Reference scenarios - change in food & total consumption relative to agricultural production

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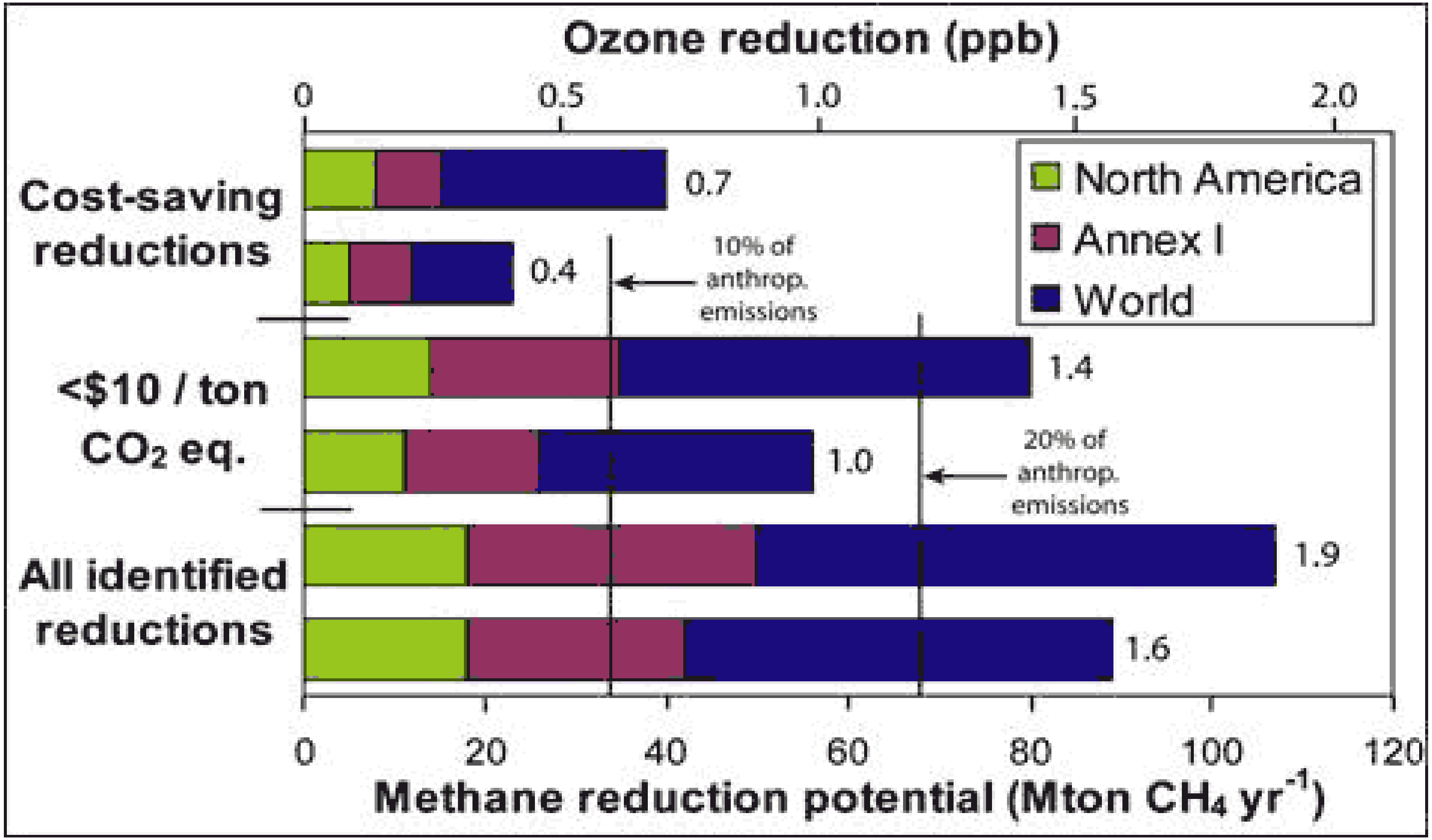
Indoor air pollution - a key health issue in developing countries

- Health effects more significant than outdoor air pollution in many developing countries (WHO 2004)
- 2.5 million people depend on traditional biomass (Stern 2006)
- Question: ***how will GHG policies interact with indoor air pollution?***
  - Exempting biomass fuels from GHG regulatory regime could have perverse effects on health
  - Some evidence of asymmetries – limited kwh access
  - No comprehensive modelling of this interaction

Example: mitigating CH_4 – at what cost?



Source: West & Fiore 2005

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Example: connecting climate & LAP actions -- CH_4 , indoor air pollution & human health

Biodigester Technology

A basic anaerobic digester for hog manure in China can reduce CH_4 emissions (and background surface ozone) while substituting dirty cooking fuels with bio-gas. This reduces indoor air pollution (PMs) and helps boost water quality through lower nitrogen and phosphorus runoff (Srinivasan 2006).

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Main synergies and trade-offs depend on policy design and end-points

- Synergies:
  - Energy efficiency: win-win-win
  - Transport: the key pathway to reduce PM
  - CH_4 mitigation (waste, coal & gas supply): interactions with tropospheric ozone (agriculture & health effects
  - Indoor air pollution?
- Trade-Offs:
  - Transport: biofuels can increase PM and Nox
  - Indoor air pollution?

6. Implications for Policy & Further Analysis: Sector Approaches

- Policy design is key to optimise synergies and minimise trade-offs
  - Carbon tax or other GHG market instruments will not internalise all externalities
- The complexity of interactions between GHG/LAP may be best addressed at the, sector project or technology specific level
  - Methane, PM (indoor & outdoor)
  - Transport, household cooking
- How mitigation occurs determines to co-benefits: pathway dependent
- Integrated LAP & climate policy a way forward
- How can sector approaches be designed to harvest high co-benefits?