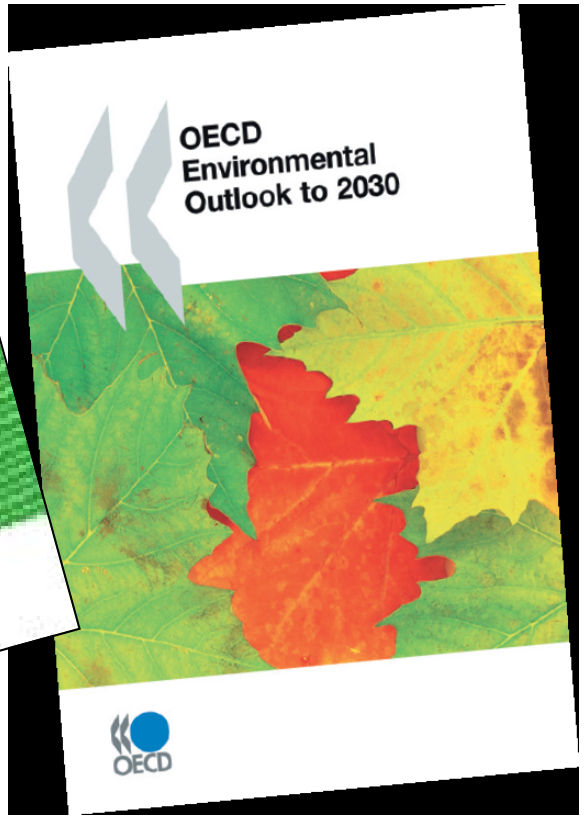
OECD: the Economics of Adaptation and Mitigation

Economic Aspects of Adaptation to Climate Change

OECD Environmental Outlook



Cities & Climate Change

Ranking the world's cities most exposure to coastal flooding

The OECD Environmental Outlook to 2030

What is the *OECD Environmental Outlook to 2030*? What does it cover?

Economic Projections

- economic growth, population, urbanisation, globalisation
- sectors: energy, agriculture, fisheries, transport
- selected industries (chemicals, steel, cement, pulp&paper, tourism)

Environmental Consequences

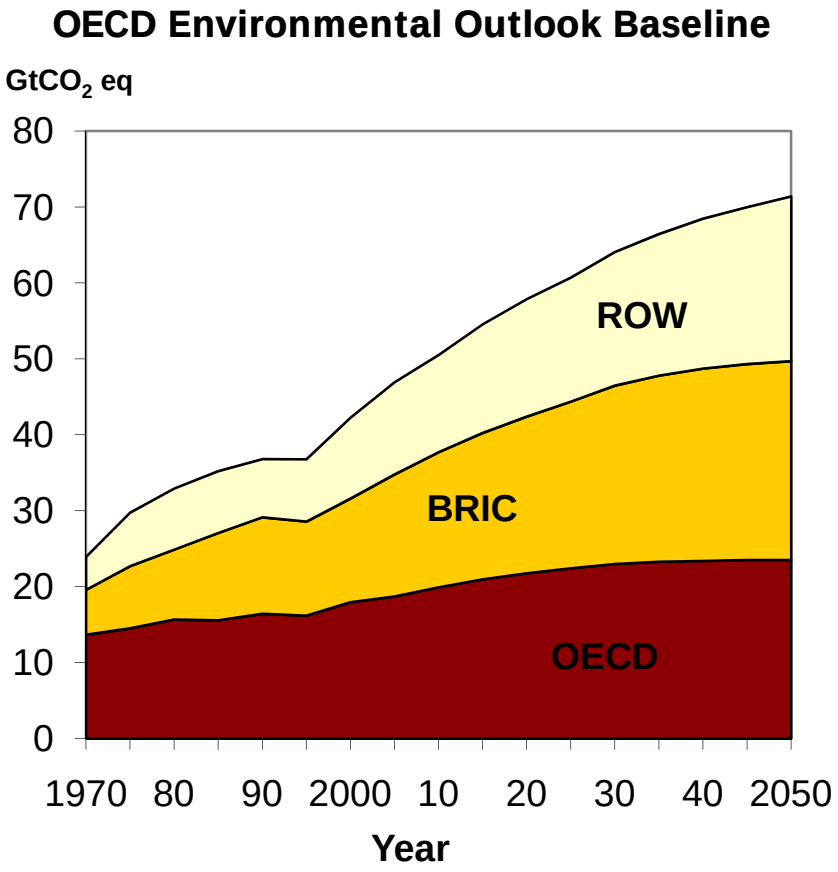
- climate change, air pollution, biodiversity, freshwater, waste, health & environment
- costs of inaction

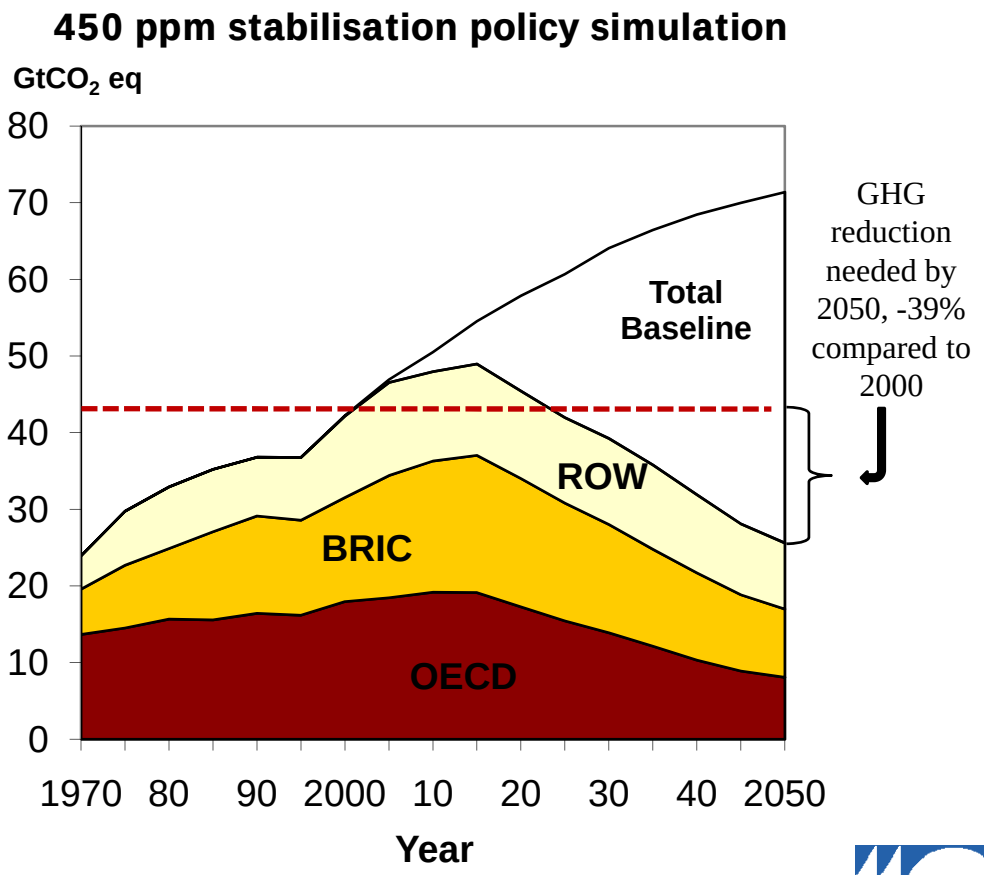
Policy Solutions

- the policies and policy packages needed to address the main environmental challenges and how they can be implemented
- global environmental co-operation-- how OECD and non-OECD countries can best work together

The OECD Environmental Outlook

Climate Change: Total greenhouse gas emissions (by region) 1970-2050; Baseline: by 2050 foresee more than a 50% increase in GHG from today without new policy

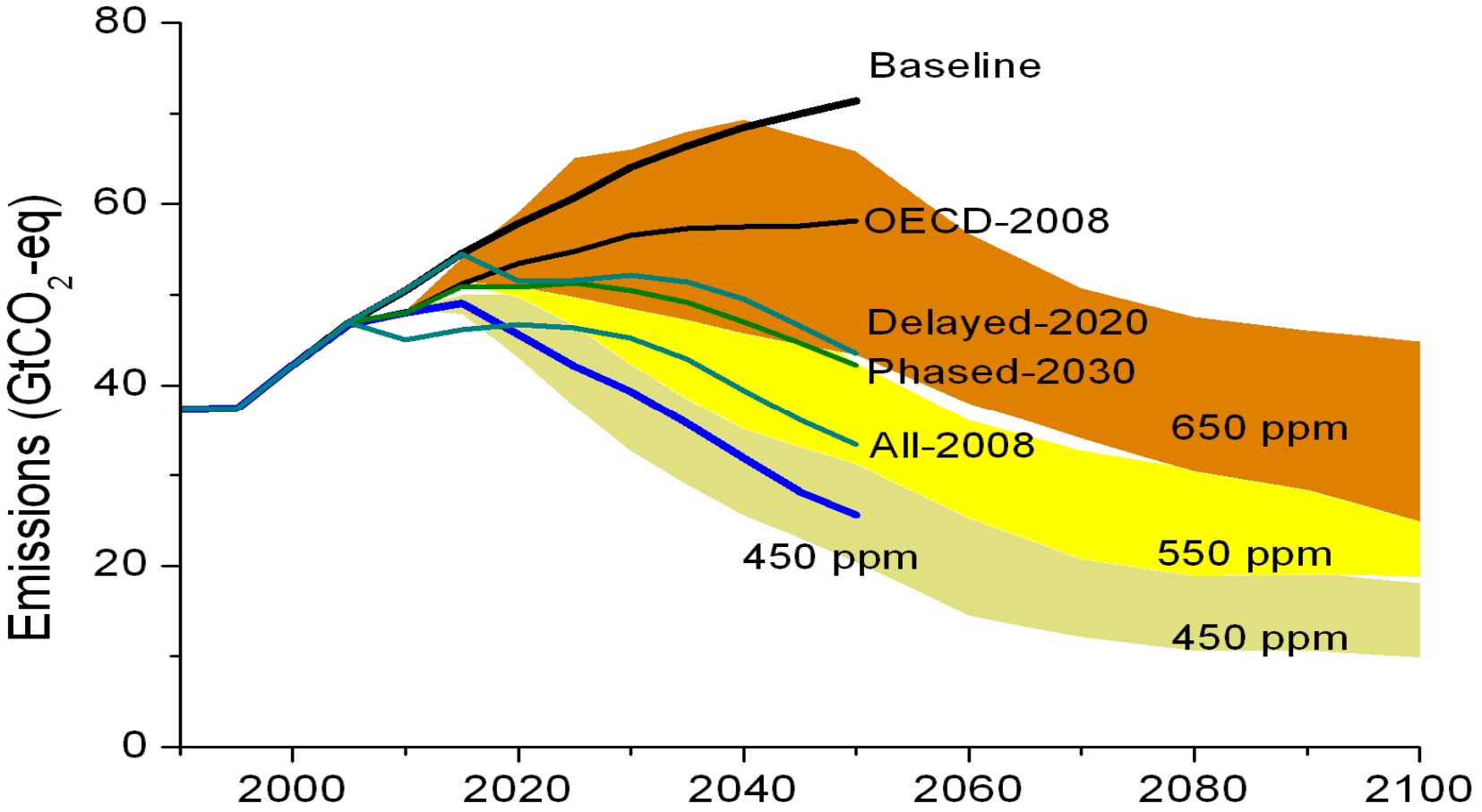




Source*: OECD (2008), *OECD Environmental Outlook to 2030
OECD Environmental Outlook modelling suite, final output from IMAGE cluster

The OECD Environmental Outlook

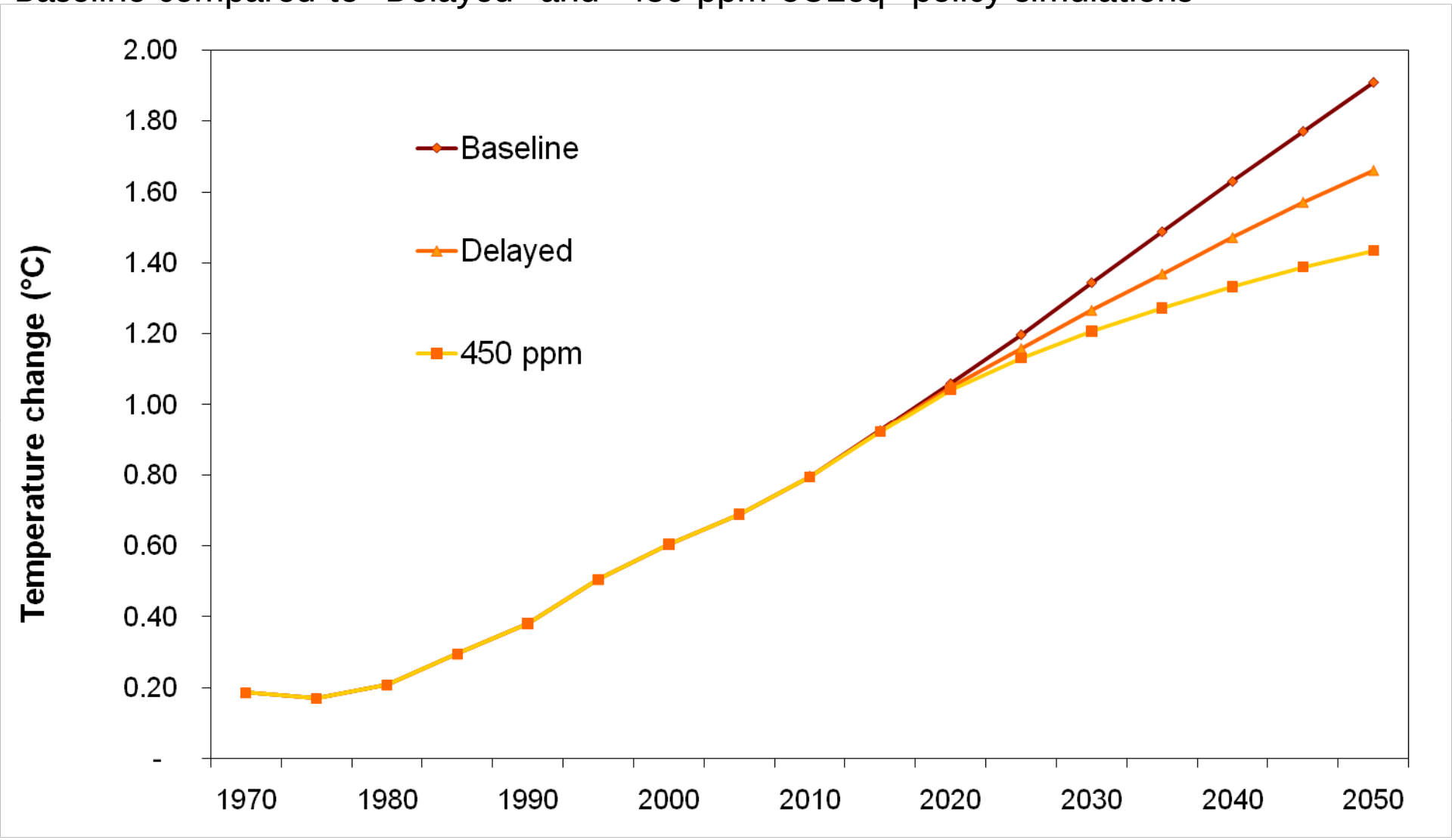
Climate Policy Simulations: GHG emissions under Baseline and mitigation cases to 2050, compared to 2100 stabilisation pathways



Source*: OECD (2008), *OECD Environmental Outlook to 2030;* including data from Van Vuuren (2007) *OECD Environmental Outlook modelling suite, final output from IMAGE cluster

Climate consequences and avoided temperature change:

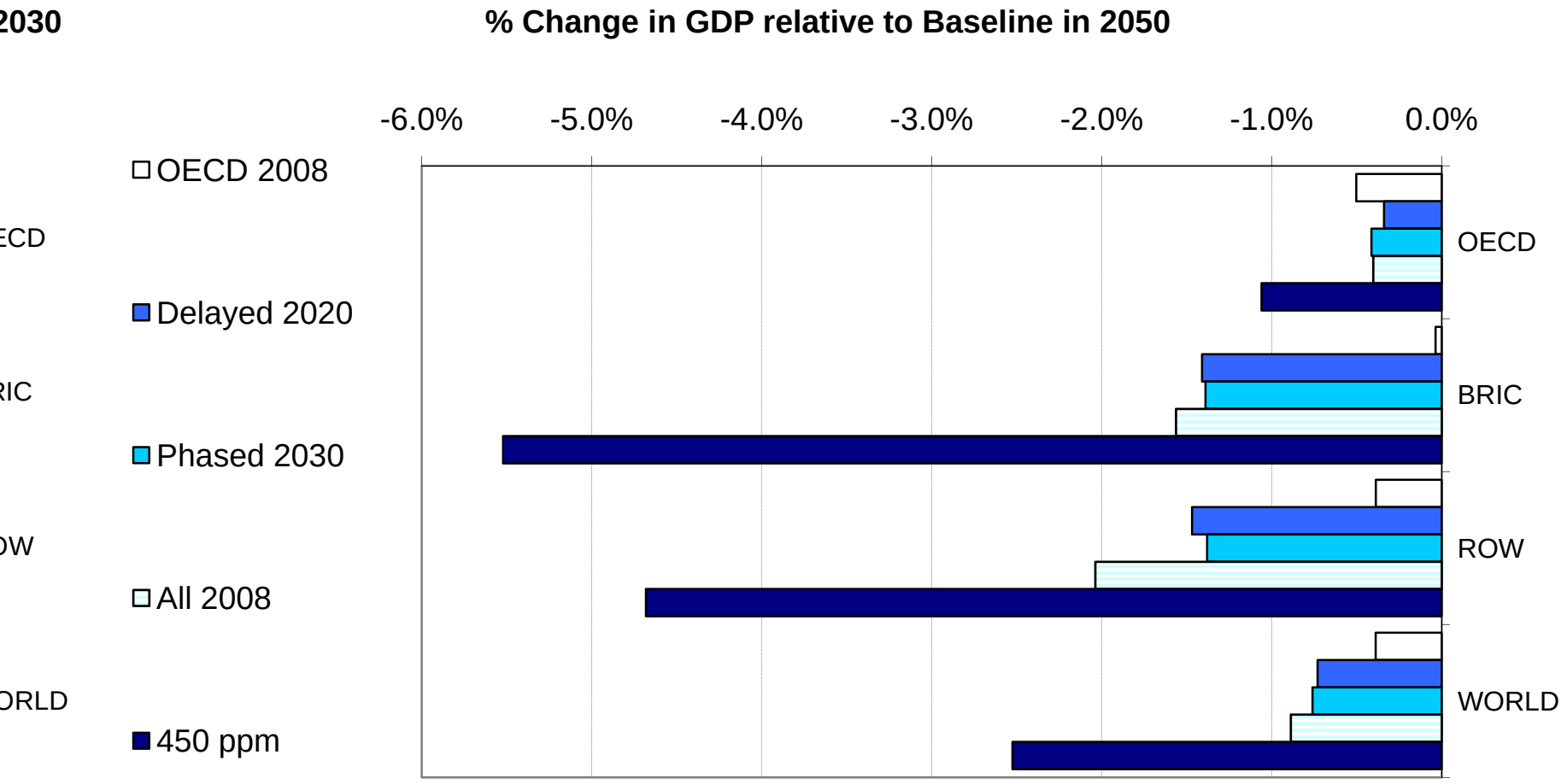
Global mean temperature change (2050 compared to preindustrial),
Baseline compared to “Delayed” and “450 ppm CO2eq“ policy simulations



Source*: OECD (2008), *OECD Environmental Outlook to 2030
OECD Environmental Outlook modelling suite, final output from IMAGE cluster

The OECD Environmental Outlook

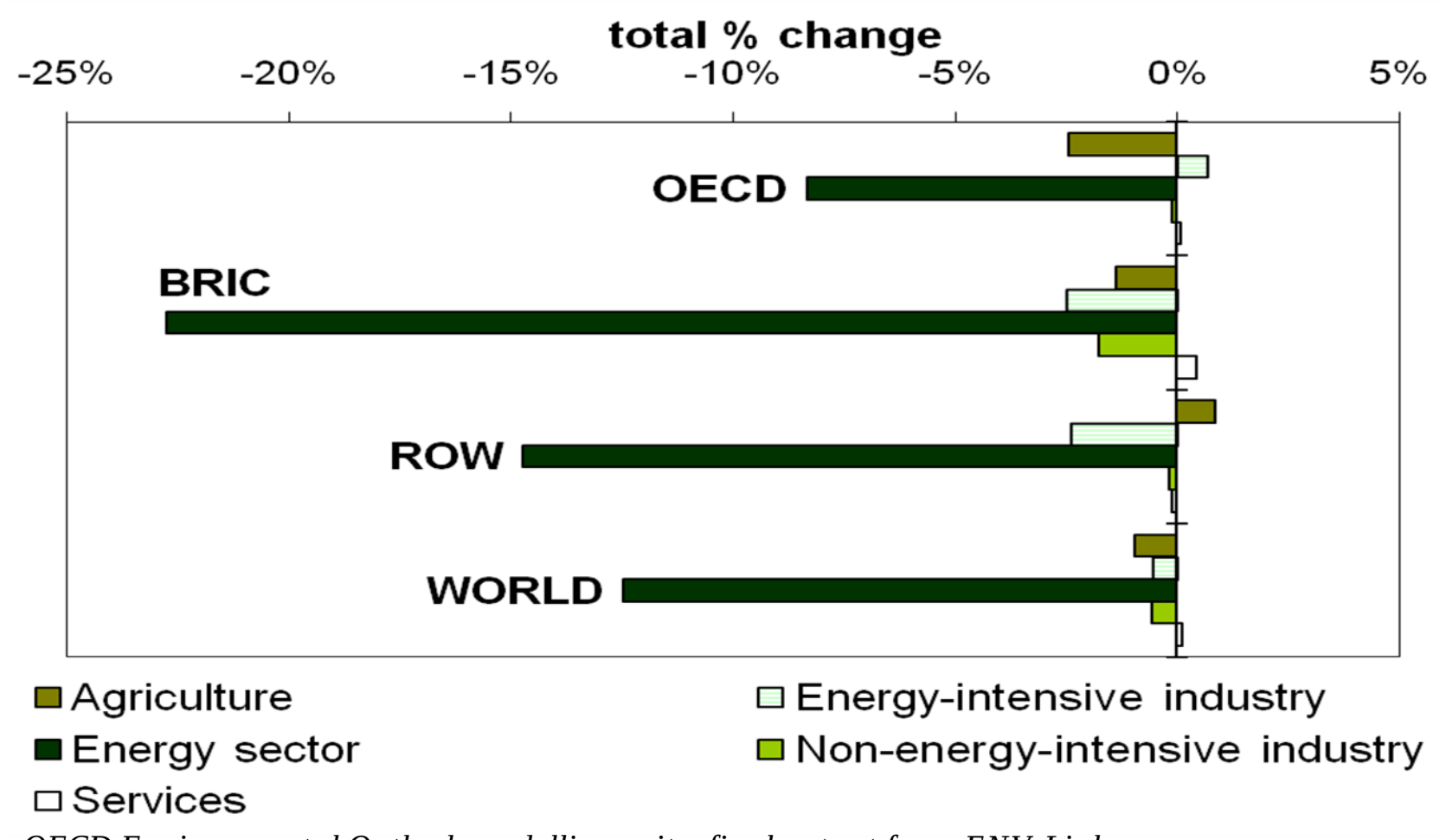
Economic cost of climate mitigation policy cases by country group



Source*: OECD (2008), *OECD Environmental Outlook to 2030
OECD Environmental Outlook modelling suite, final output from ENV-Linkages

The OECD Environmental Outlook

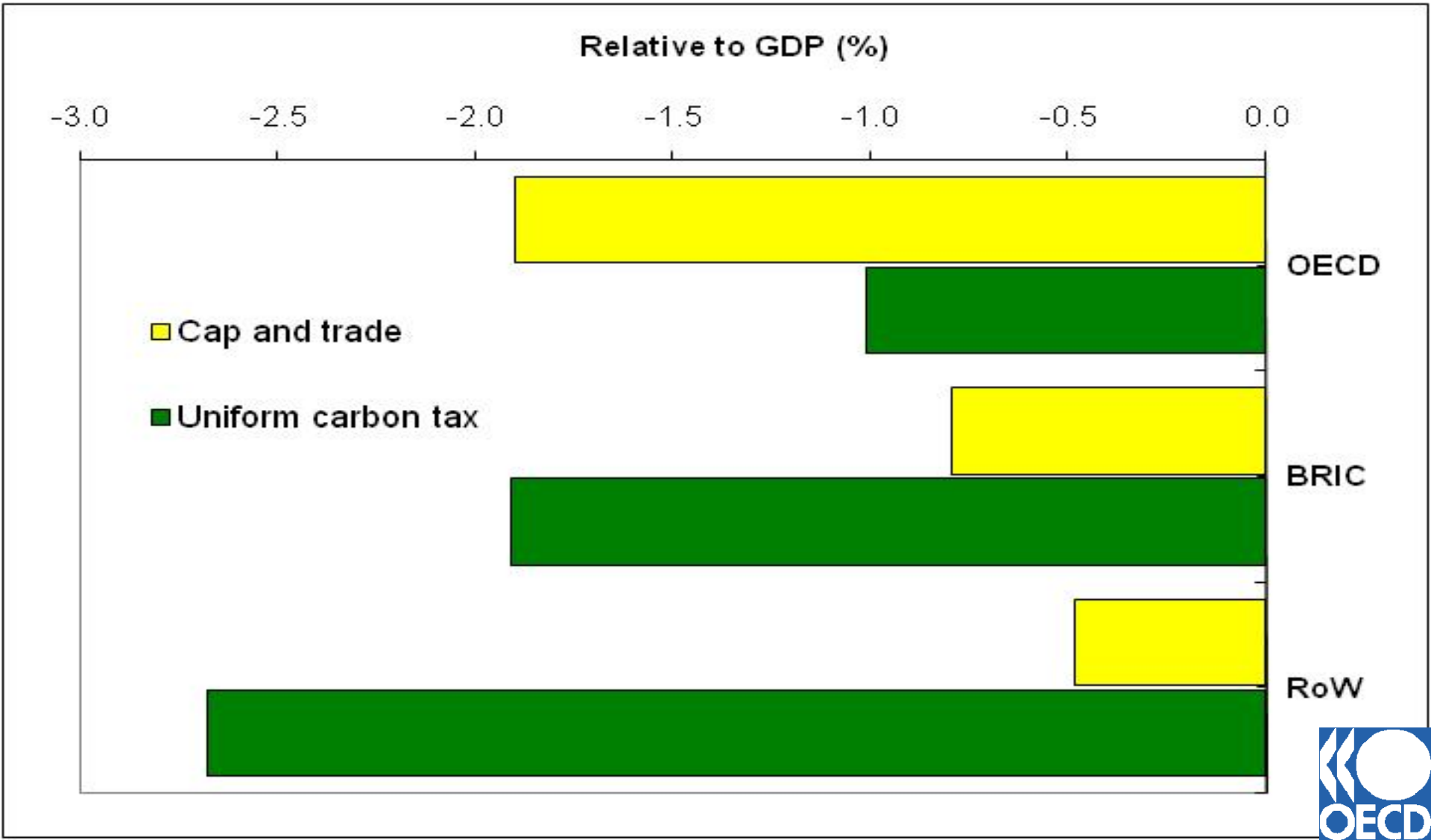
Change in value-added from Baseline for 450 ppm tax case, by sector and region



OECD Environmental Outlook modelling suite, final output from ENV-Linkages

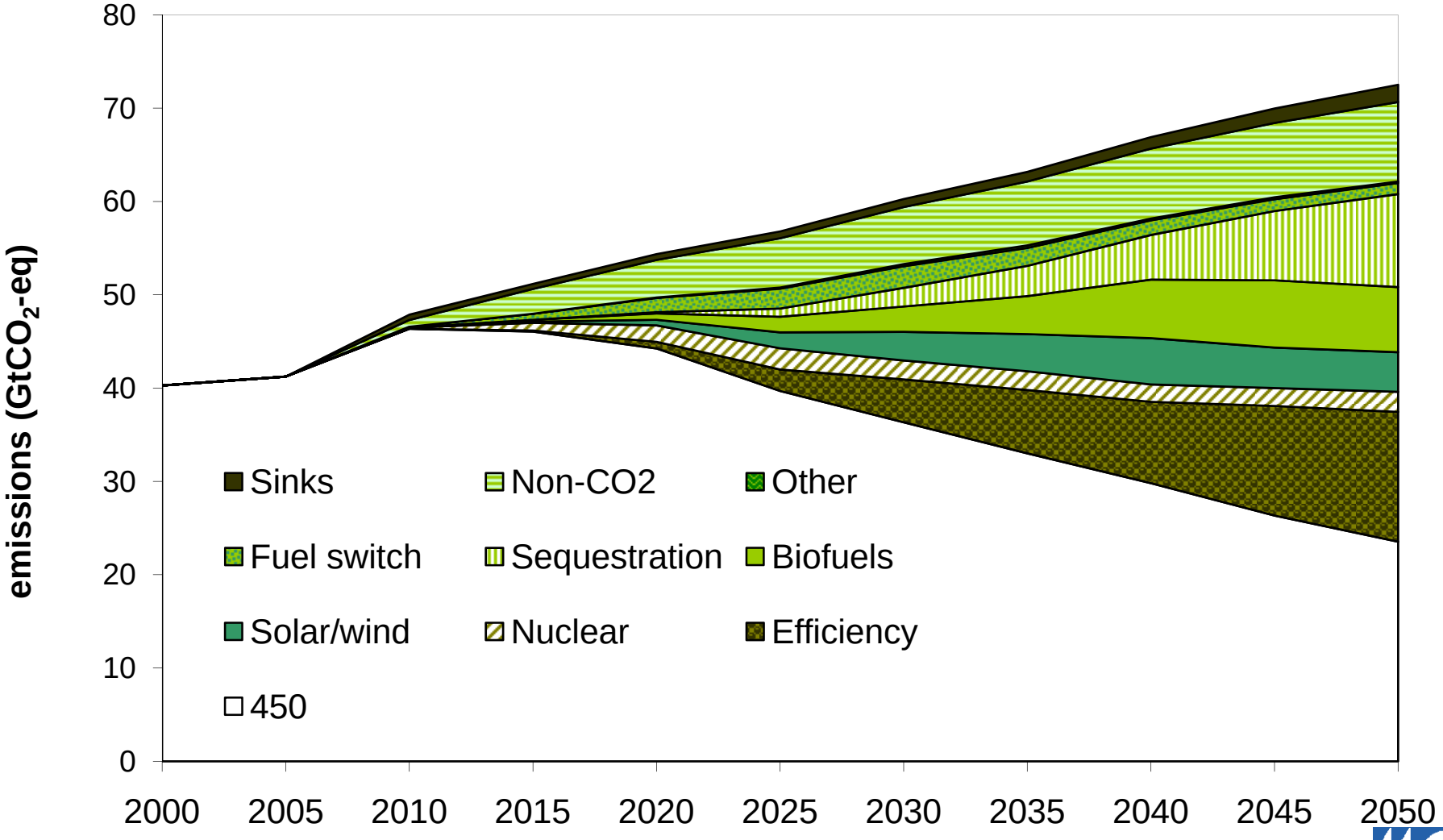
Redistributing the costs of action will be key:

cap & trade vs global tax scheme (450 ppm case)
regional direct cost of GHG abatement, 2050



What technologies are needed?

Technology "wedges“ of emission reduction, 2000-2050 -- 450 ppm CO_2eq

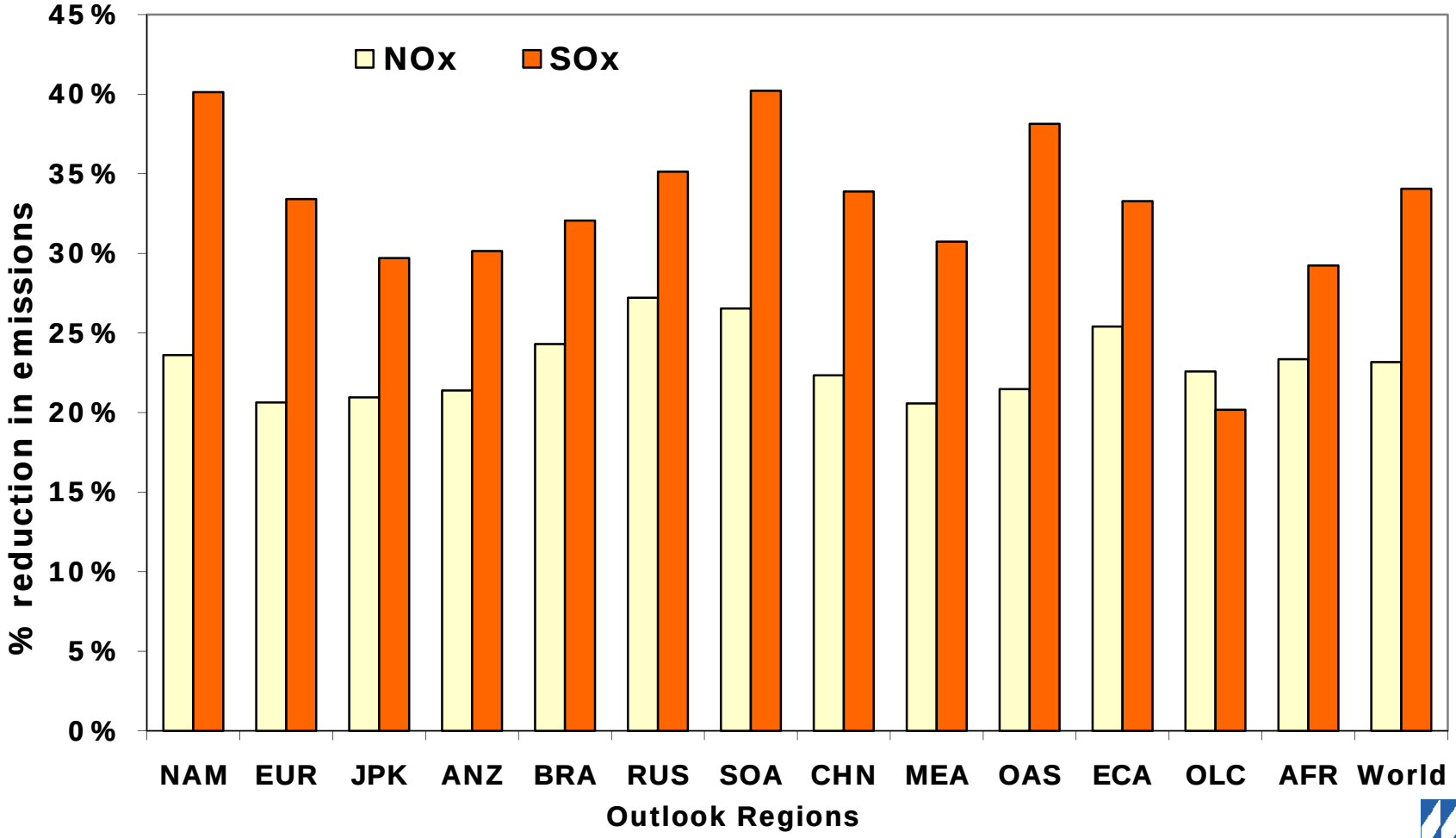


Source*: OECD (2008), *OECD Environmental Outlook to 2030
OECD Environmental Outlook modelling suite, final output from IMAGE cluster

The OECD Environmental Outlook

Air pollution co-benefits of GHG mitigation

reduction in NO_x and SO_x emissions; 450ppm case and Baseline, 2030



Source: OECD (2008), *OECD Environmental Outlook to 2030*
OECD Environmental Outlook modelling suite, final output from IMAGE cluster

The OECD Environmental Outlook Climate Change - Conclusions

Policy solutions are:

Available, achievable and affordable

- World GDP projected to grow by nearly 100% to 2030, and to more than triple in size to 2050.
- Ambitious action (the 450ppm case) is estimated to cost 0.5% of that growth in 2030, and 2.5% of the growth in 2050.
- Need to work with all major emitters, across all emission sources and gases to implement least cost policies that put a price on emissions

The OECD Environmental Outlook

Key Message: Timing is critical

- Huge investment opportunities in the coming decades in rapidly growing economies
- Important to avoid "lock-in" of dirty fuel choices and buildings with poor energy efficiency.
- Avoid irreversible damage to ecosystems and loss of biodiversity.

…there is a "window of opportunity"

Multilevel governance: global-local climate policy

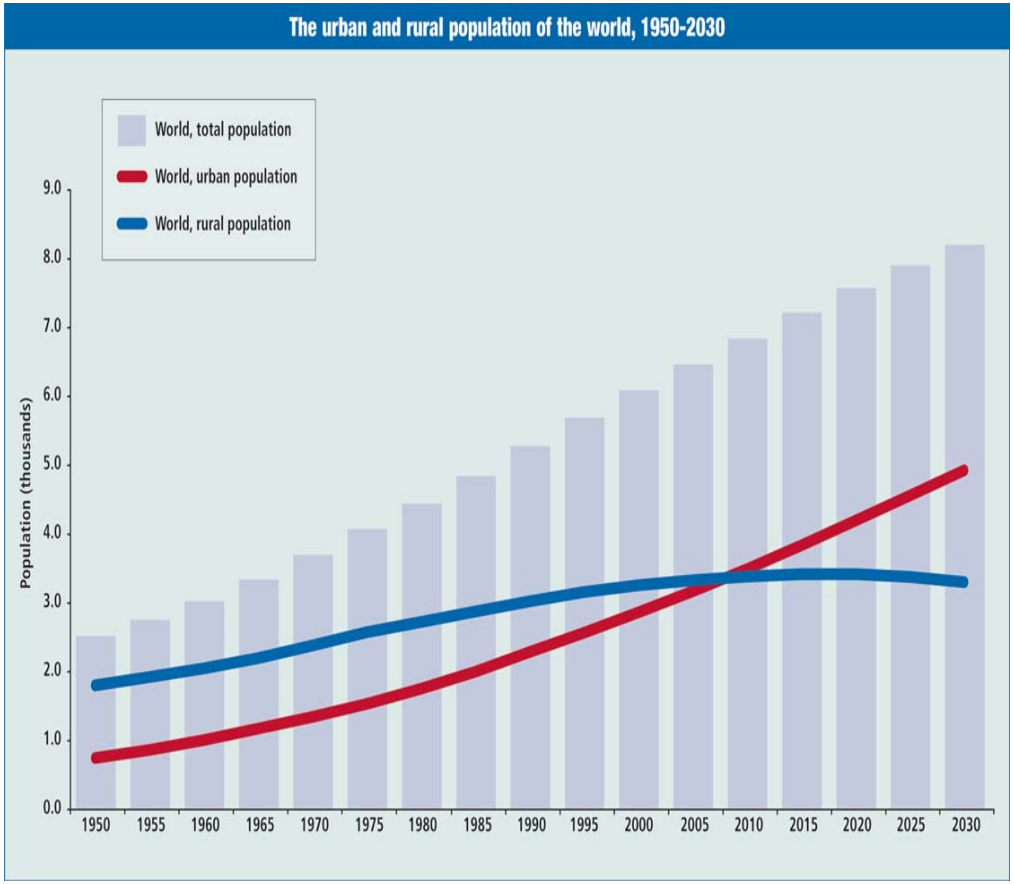
Cities & Climate Change

- **Global port city assessment: sea-level rise & extremes**
- **Copenhagen & Mumbai case studies (forthcoming)**
- **Multilevel governance and the policy challenge (forthcoming)**

Importance of Local Action

A majority of the world's people and human activities associated with GHG are concentrated in urban areas.

- Over half of the world's population now lives in cities.
- Urban activities estimated generate close to 80 percent of all CO2 emissions as well as significant amounts of other GHG.
- How cities develop will determine the vulnerability of over half the world's people to climate extremes and mean change



City Studies: A Review

Source: Alistair Hunt and Paul Watkiss (2007). OECD. ENV/EPOC/GSP(2007)10

Coverage of City Studies

	Market	Non -Market	Socially contingent
Projection **e.g. mean temperature or SLR**	**SLR** - Singapore (V) - Mumbai (V) - Alexandria (V) **Energy** - Athens (Q) - Boston (Q) - California (Q)	**SLR non-market** - Singapore (V) **Health** - Lisbon (Q) - Melbourne, Sydney (Q) - Boston (Q) - Toronto (Q) - Los Angeles (Q)	**SLR Migration** - Nile delta (qualit.)
Bounded **e.g. precipitation and extremes**	**SLR and storm** - New York (V) - Boston (V) - London (Q) **Riverine flooding** - Boston (V) **Transport / infrastructure** - Boston (Q) - Wellington	**Water** - Los Angeles (semi-Q)) - London (semi-Q)	None
Major change **e.g. major tipping points**	**Major SLR** - London 4 to 5 m SLR	None	None

Key: (Q) Quantified, i.e. expressed in physical terms; (V) Valued i.e. expressed in monetary terms.

Source: Alistair Hunt and Paul Watkiss (2007). OECD. ENV/EPOC/GSP(2007)10

Ranking the world's cities most exposed to coastal flooding today and in the future *(an OECD study)*

AUTHORS

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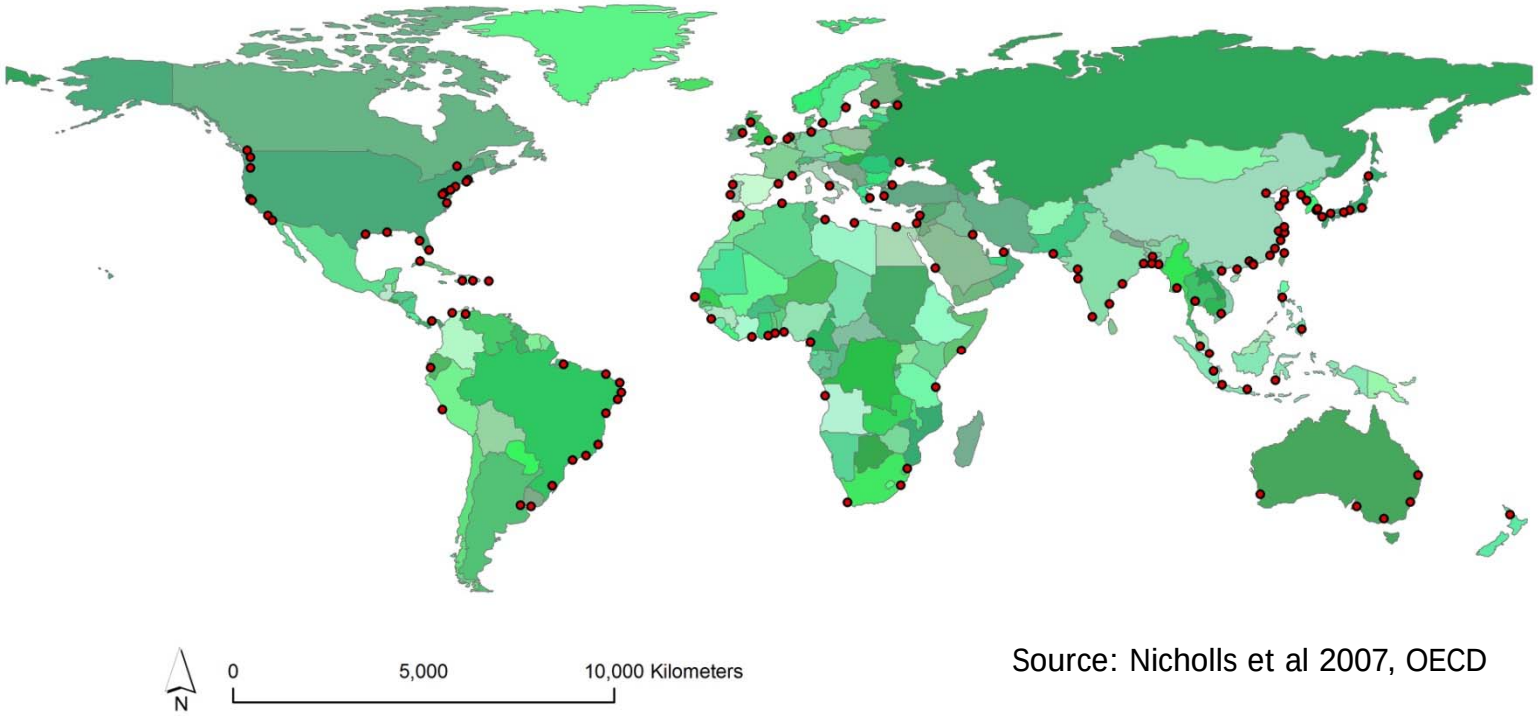
OECD RMS™ University of Southamp C.I.R.E.D. Tyndall Centre METEO FRANCE Toujours un temps d'avance

Objectives of study

- **Rank the world's port cities in terms of their exposure to coastal flooding today and in the 2070s**

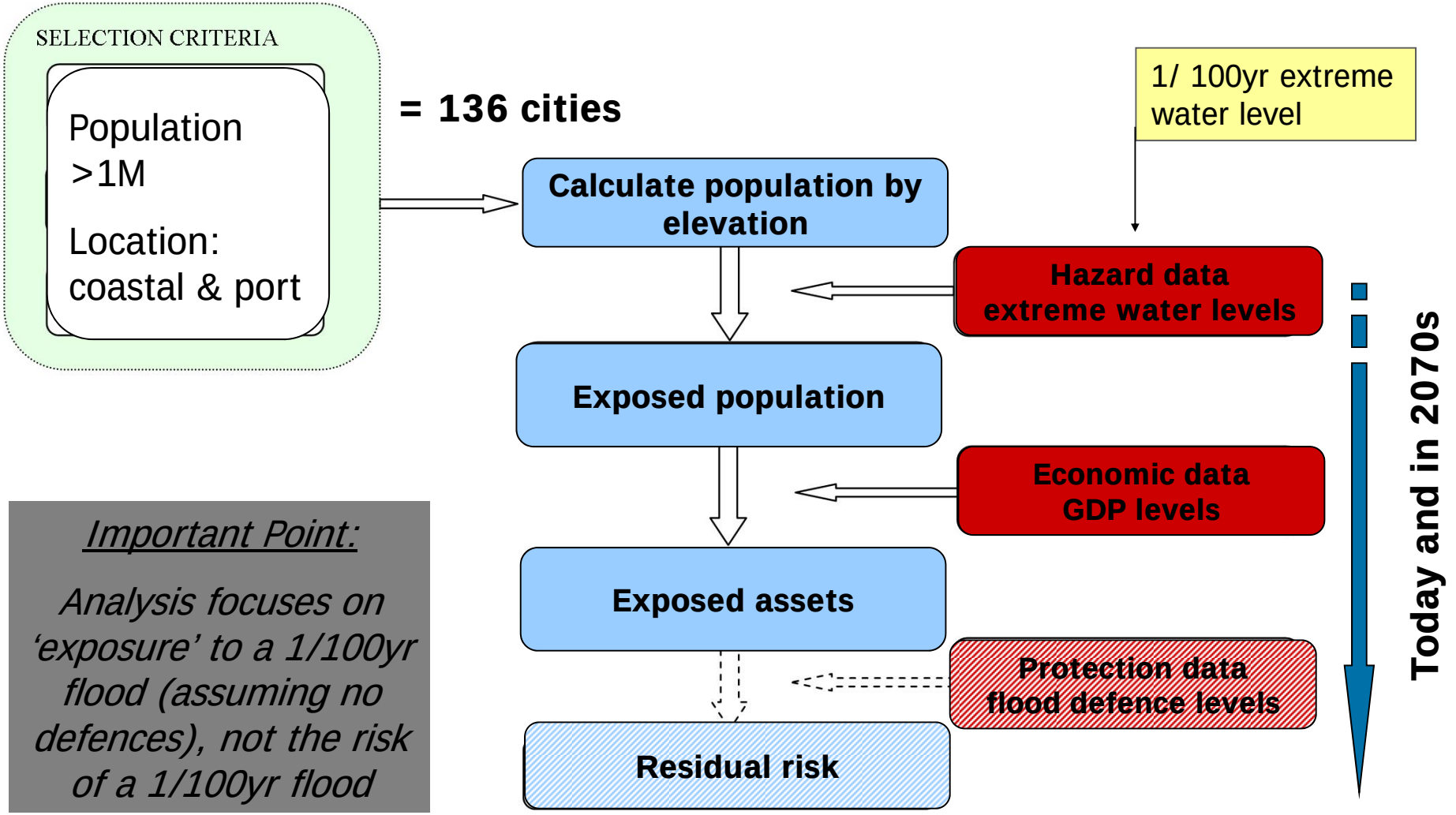


Source: Nicholls et al 2007, OECD

- **Rankings provide a first-cut indication of:**
  - **where investment in adequate flood defences is most critical**
  - **and, where to focus adaptation efforts in the coming decades**

Methodology for cities ranking: a snapshot

Source: Nicholls et al 2007, OECD: Paris



Important Point:

Analysis focuses on 'exposure' to a 1/100yr flood (assuming no defences), not the risk of a 1/100yr flood

What is considered for the 2070s projections?

- A range of climate and other change factors:
  - Global sea-level rise
    (0.5m by 2070s – Rahmstorf [2007] mid-range)
  - More intense storms and higher storm surges
    (illustrative scenario of storm enhancement where windstorm risk currently exists based on IPCC AR4 findings)
  - Natural subsidence/uplift
    (GIA [c.f. Peltier 2000] adjusted by natural subsidence in deltaic areas)
  - Potential human-induced subsidence
    (based on geology/morphology of area)
  - Population and economic growth
    (based on baseline projections from OECD ENV-Linkages model)

Why we chose the *'exposed to a 1/100yr surge'* ranking metric

- Flood protection does not eliminate risk – defences can fail...
- *Exposure* tells us the population/assets *reliant on adequate and well maintained flood defences,* in this case to the minimum 1/100yr standard
- Different cities currently have different protection levels – wealth does not always translate into better defences
- At a global scale, 1/100yr events occur frequently: *each year there is a 75% chance of a 1/100yr event happening in at least one of the 136 cities*

City	Approximate Protection Standard
London	1:1000
Shanghai	1:1000
Osaka	1:300
New York	1:100
Tokyo	1:1000
Amsterdam	1:10000
Rotterdam	1:10000
New Orleans	1:200[1]

Source: Nicholls et al 2007, OECD

Results

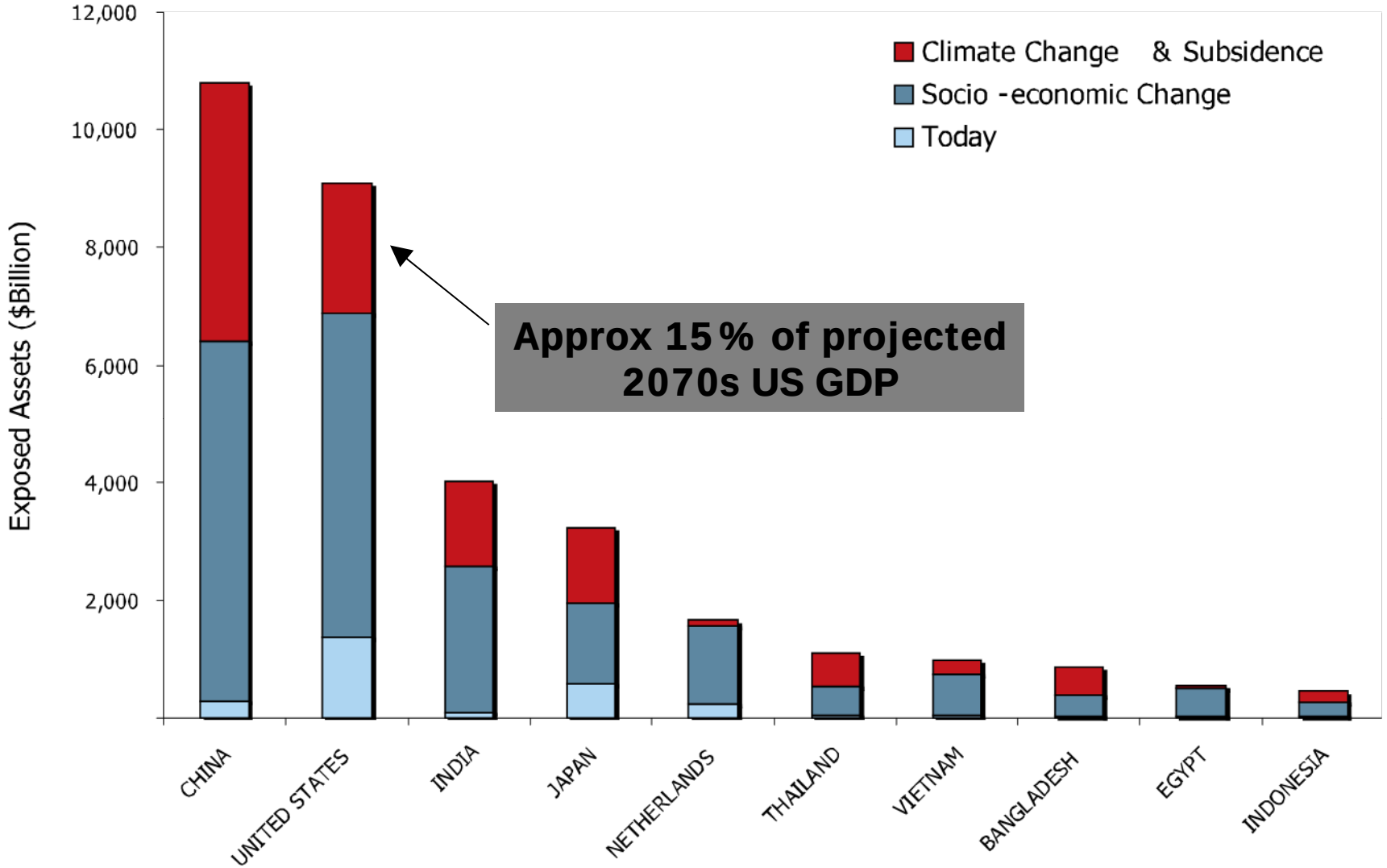
Key Stats: growth in global flood exposure

- Population exposed to coastal flooding in the 136 cities is projected to increase **3X** (from 50M to 150M) by the 2070s due to climate change, subsidence and urban development

- Assets exposed globally is projected to increase > **10X**, from $3Tr Today (5% of current global GDP) to $35Tr in the 2070s (9% of projected global GDP)

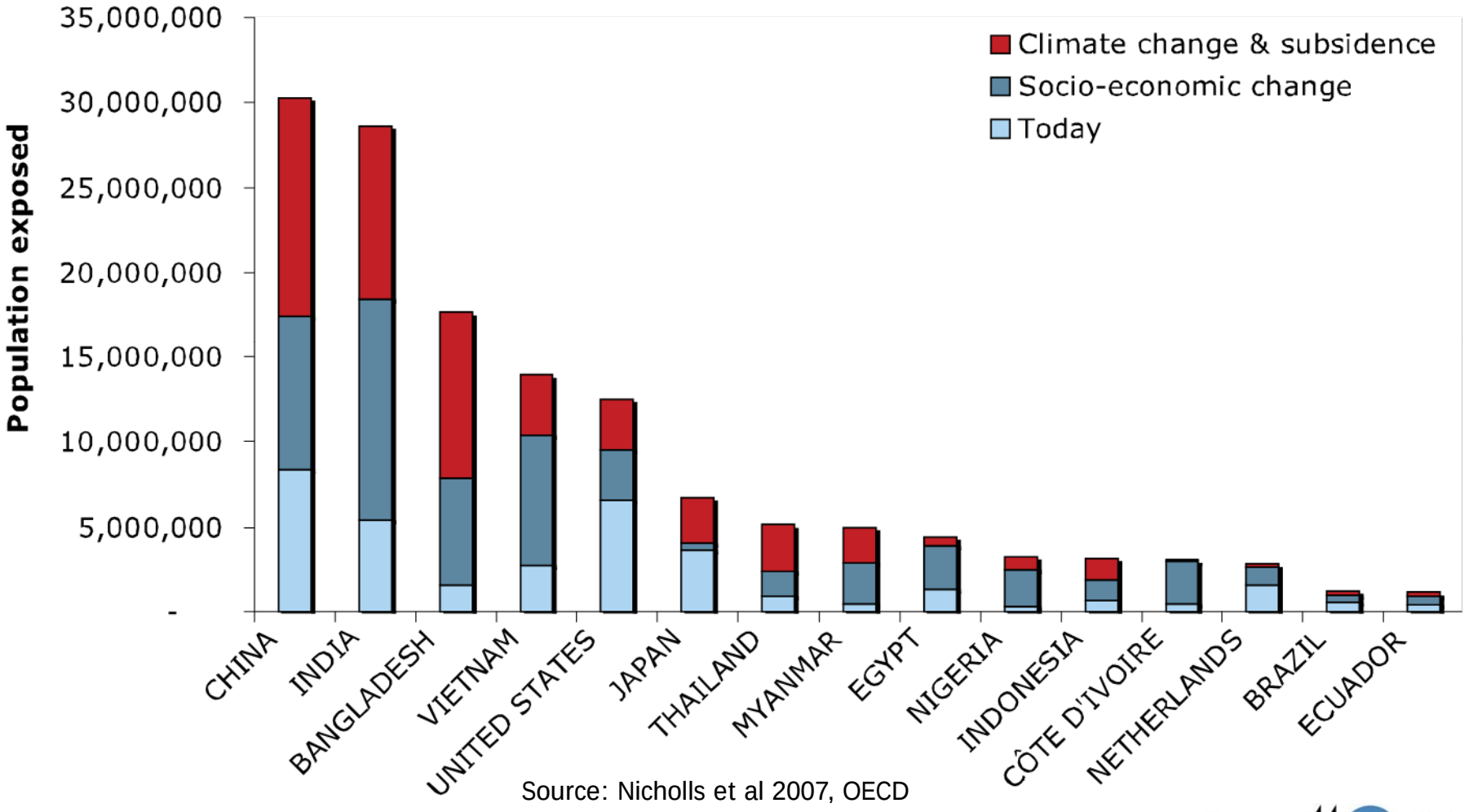
- Collectively, climate change and subsidence contribute approx. **1/3rd** of the increase in exposure, with socio-economic growth (population growth, economic growth & urbanization) accounting for **2/3rds**

Asset exposure rankings by country: today and in the 2070s



Source: Nicholls et al 2007, OECD

Population exposure rankings by country: today and in the 2070s



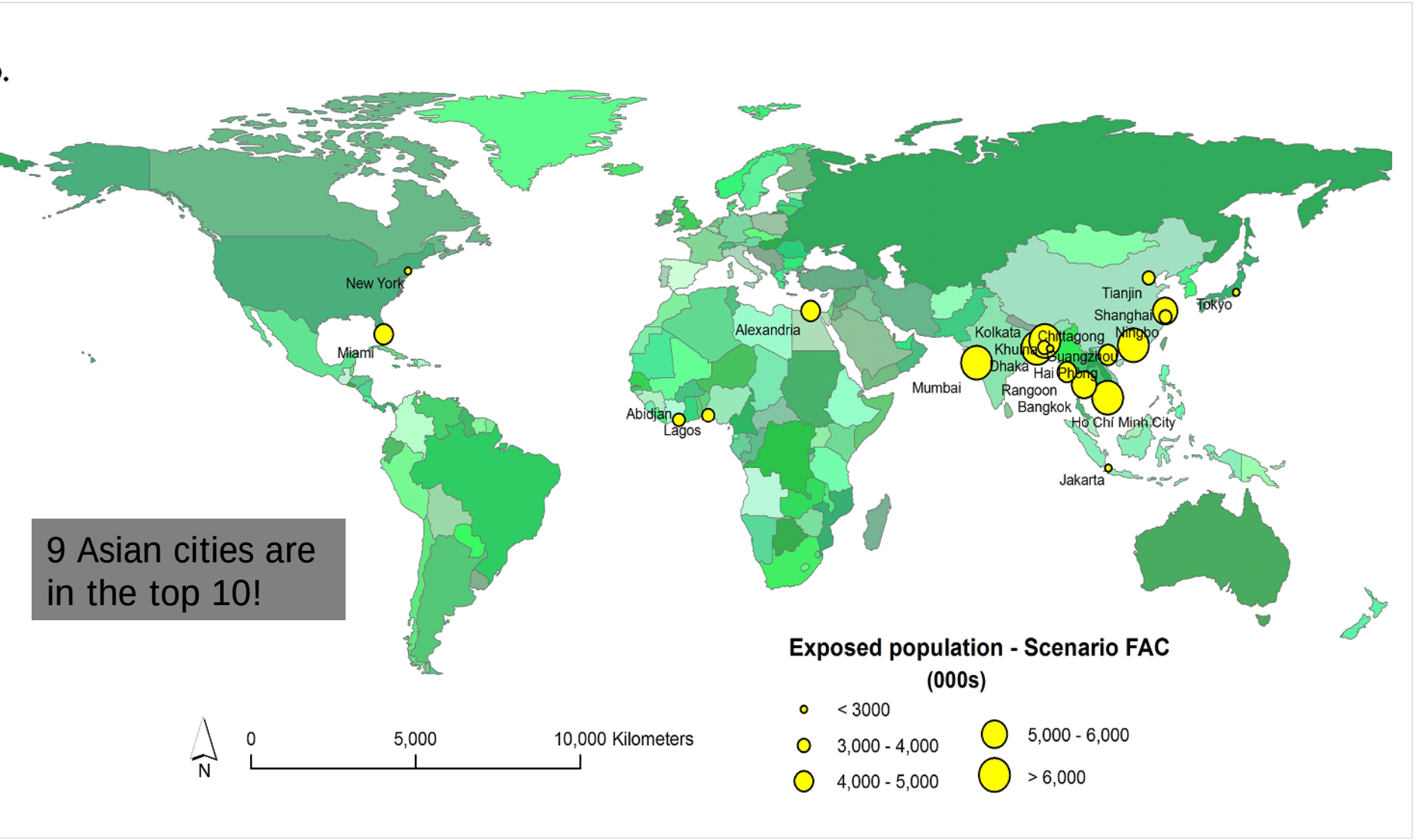
Source: Nicholls et al 2007, OECD

Top 20 cities for ‘exposed population’ in 2070s

Source: Nicholls et al 2007, OECD

Rank	Country	Urban Agglomeration	Exposed Population Current	Exposed Population Future
1	INDIA	Kolkata (Calcutta)	1,929,000	14,014,000
2				11,418,000
3				11,135,000
4				10,333,000
5				9,216,000
6				5,451,000
7				5,138,000
8				4,965,000
9				4,795,000
10				4,711,000
11				4,375,000
12				3,790,000
13				3,641,000
14				3,305,000
15				3,229,000
16				3,110,000
17				2,931,000
18				2,866,000
19				2,521,000
20				2,248,000

Top 20 cities for ‘exposed population’ by 2070s



9 Asian cities are in the top 10!

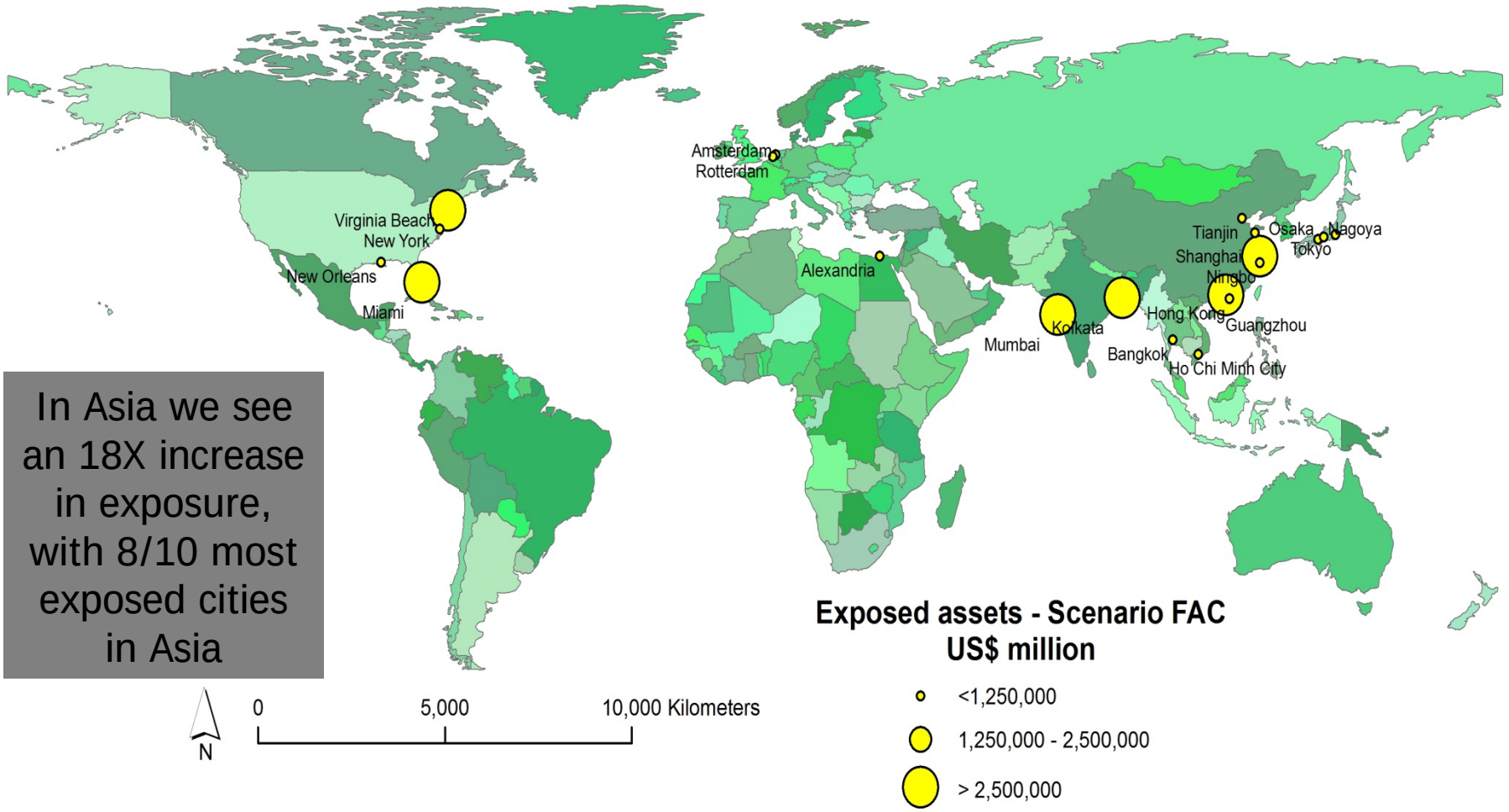
Top 20 cities for ‘exposed assets’ by 2070s

Source: Nicholls et al 2007, OECD

Rank	Country	Urban Agglomeration	Exposed Assets, Current ($Billion)	Exposed Assets, Future ($Billion)
1	USA	Miami	416.29	3,513.04
2				3,357.72
3				2,147.35
4				1,961.44
5				1,771.17
6				1,598.05
7				1,231.48
8				1,207.07
9				1,163.89
10				1,117.54
11				1,073.93
12				1,013.45
13				968.96
14				843.70
15				825.68
16				652.82
17				623.42
18				601.59
19				581.69
20				563.28

Top 20 cities for ‘exposed assets’ by 2070s

Source: Nicholls et al 2007, OECD



In Asia we see an 18X increase in exposure, with 8/10 most exposed cities in Asia

Port Cities: Policy Messages

- The large amount of future port city exposure to coastal flooding ($35Tr) argues for investment in proactive and risk-informed adaptation
- The concentration of this exposure in a small number of cities (top 20) underscores the urgent need for attention to, and leadership in, these areas
- GHG mitigation will slow the effects, and at the very least ‘buy precious time’ for cities to implement adaptation
- Adaptation timescales are often several decades or more -- efforts must begin today to protect cities from the impacts expected by the middle of this century

Cont...

Port Cities: Policy Messages (cont...)

- For fast growing developing world cities, there is an opportunity to significantly reduce future risks through managing development into lower risk areas, managing subsidence and limiting other aggravating practices
- City-scale risk analysis is needed; it can identify where adaptation is most needed
- Of immediate concern: there are 11M people in port cities today that live in 'low-income' countries, many of whom have limited protection, with large human exposure

Need for multilevel climate change governance: mitigation & adaptation

- Many policy areas where cities & other sub-national governments (states or provinces) play a significant role, but authority often intertwined with federal policy
  - Energy supply and management
  - Transport
  - Land-use planning
  - Building regulations
  - Waste management
  - Water provision
  - Flood defences
  - Disaster management
- Cities are able to inform and contextualize national policies in local terms
  - Importance of local knowledge
  - Develop emission inventories, understand sources of emissions & opportunities to mitigate
  - Identification of vulnerabilities to establish adaptation priorities

Global-Local Policy Challenges

- Long-established policies governing different sectors (water, agriculture) have not yet been adjusted to account for climate change and may lead to the wrong outcomes:
  - More emissions
  - Mal-adaptations
- Interplay between policies can create synergies or inhibit adaptation or mitigation
- New policies need to be examined, or ‘climate proofed’ and their interaction better understood

Getting hold of the reports

- *The OECD Outlook - see:*
  - www.oecd.org/environment/outlookto2030
- *Cities & Climate Change*
- *Alistair Hunt and Paul Watkiss. Literature Review on Climate Change Impacts on Urban Centres. OECD. ENV/EPOC/GSP(2007)10*
  - see also www.oecd.org/env/cc .
- Port Cities - report & supplementary available online:
- *Nicholls, R. et al. "Ranking Port Cities with High Exposure and Vulnerability to Climate Extremes: Exposure Estimates"*
- The full report is published online as an OECD Environment Working Paper (2007):
  - http://www.oecd.org/env/workingpapers