An International Dimension of Climate Change Technology: the question of intent

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GTSP Steering Committee Meeting

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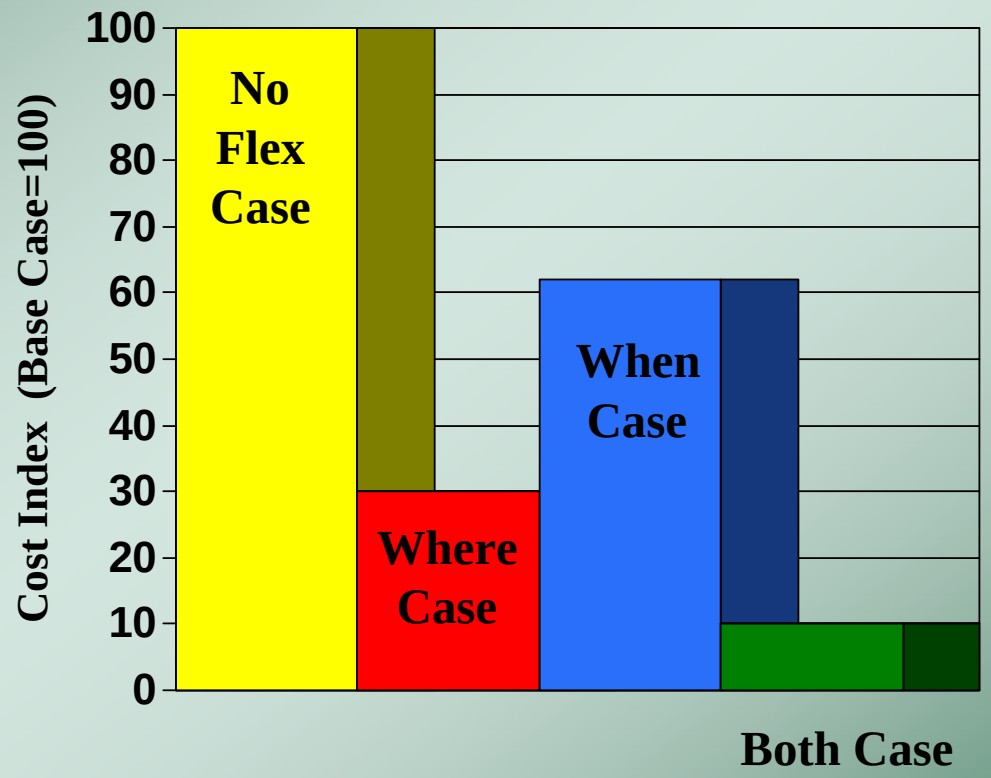
The international context for GTSP has deep roots ...

- 1992 - The UN Framework Convention on Climate Change
- 1992-1995: PNNL models go global with a network of international collaborators (India, Korea, China, Russia)
- 1996: The watershed - Wigley Richels and Edmonds (1996)

When and where flexibility makes international cooperation not only necessary but also cost-effective ...

1996



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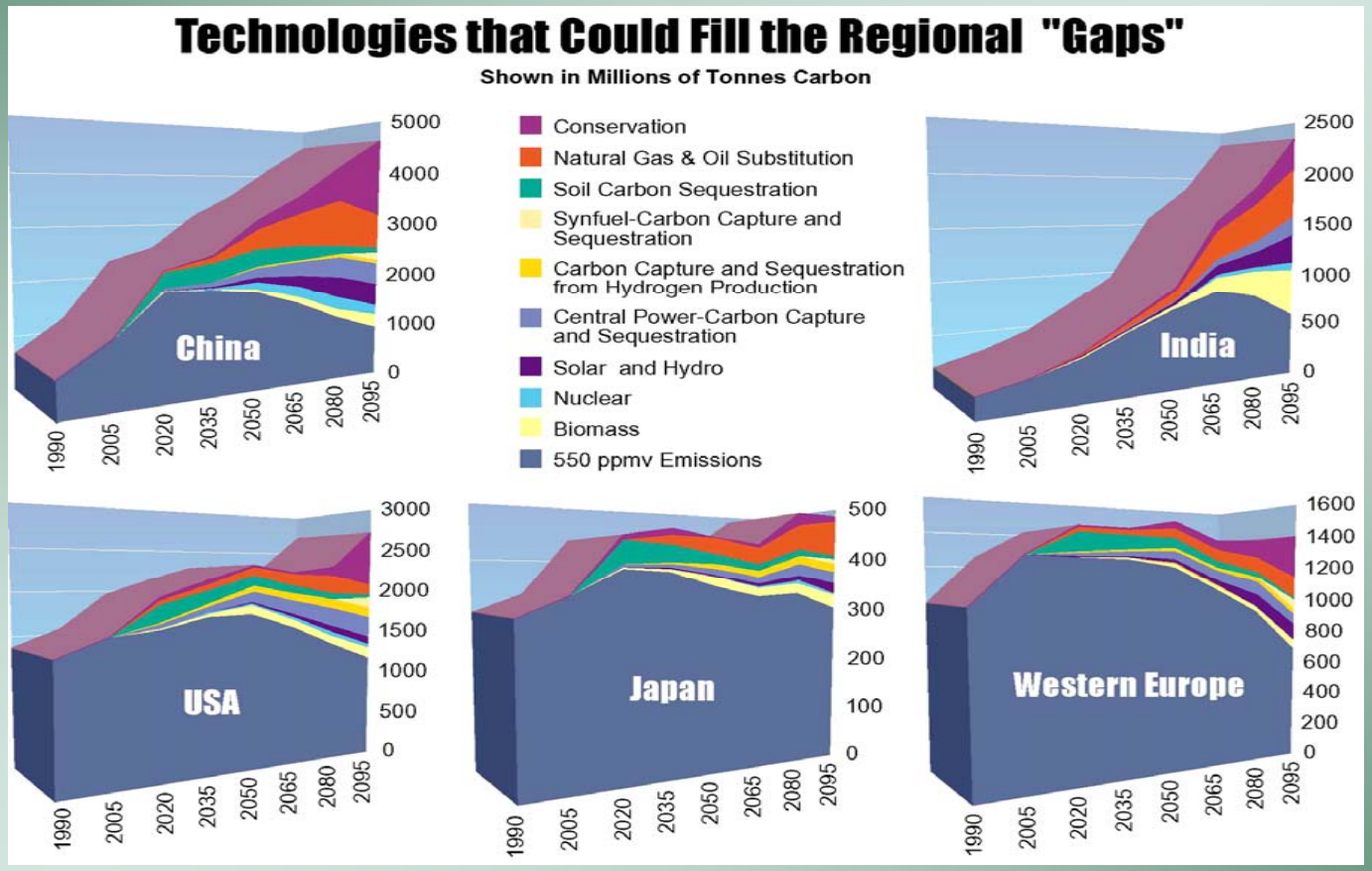
And early GTSP results showed how this flexibility might play out ...



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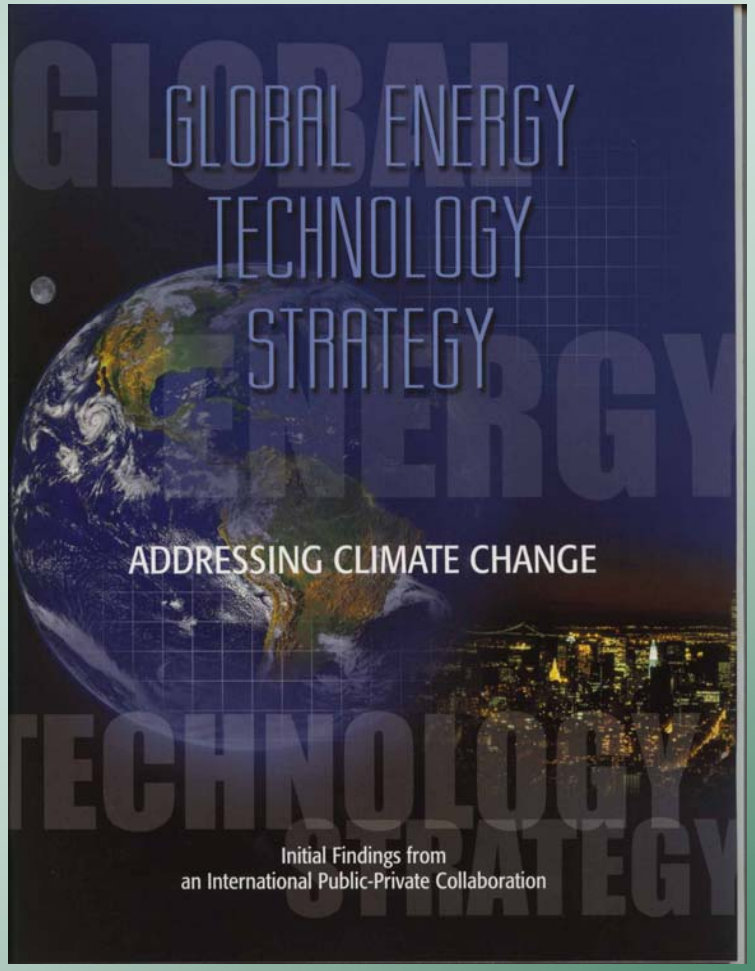
Our first summary report painted a broad technology picture ...

- Global Technology Strategy Project - released at COP6 in the Hague challenged the view that we had ‘enough’ technology to stabilize concentrations
- ... And pointed out the declining investment in R&D.
- ... And was not as well-received as we had hoped



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But since COP 6 the IPCC has acknowledged technology's role.

CCT	Lead WG	Anchors	Country
1. Risk and Uncertainty	WG1	Manning Petit	USA France
2. Regional Integration.	WG1	Giorgi Carter (Anchor 3)	Italy Finland
3. Water	WG2	Kundzewicz Mata	Poland Venezuela
4. Key Vulnerabilities (including UNFCCC Art. 2 Issues)	WG2	Schneider Semenov Patwardhan	USA Russia India
5. Adaptation & Mitigation	WG3	Grubb Huq	UK Bangladesh
6. Sustainable development	WG3	Srivastava Heller	India USA
7. Technology	WG3	Edmonds Mirera	USA Brazil

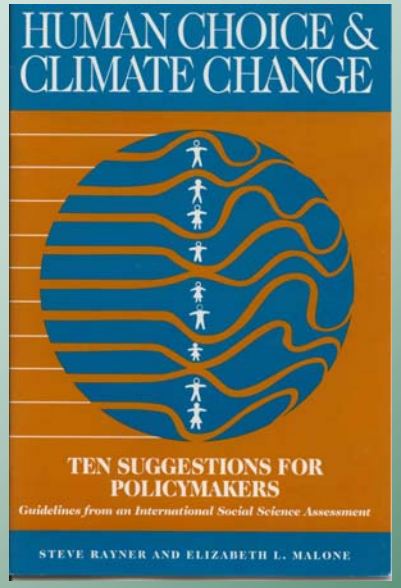
And the IPCC also acknowledges the social character of technology ...

- For the purposes of the technology cross cut theme (CCT), we will refer to technology as the broad set of processes covering know-how, experience and equipment, used by humans to produce services and transform resources.

- **<u>Not just devices</u>**

Foreshadowed in Human Choice and Climate Change ...

- **View the issue of climate change holistically, not just as the problem of emissions reductions**.
- Recognize that, for climate policymaking, institutional limits to global sustainability are at least as important as environmental limits.
- Prepare for the likelihood that **social, economic, and technological change will be more rapid and have greater direct impacts on human populations than climate change**.
- Recognize the limits of rational planning.
- Employ the full range of analytic perspectives and decision aids from the natural and social sciences and the humanities in climate change policymaking.
- **Design policy instruments for real world conditions rather than try to make the world conform to a particular policy model.**
- Incorporate climate concerns into other more immediate issues, such as employment, defense, economic development, and public health.
- Take a regional and local approach to climate policymaking and implementation.
- Direct resources into identifying vulnerability and promoting resilience, especially where the impacts will be the greatest.
- Use a pluralistic approach to decision making.



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Means and ends: the climate conundrum

Does GHG mitigation have to be the intent if you are to get credit?

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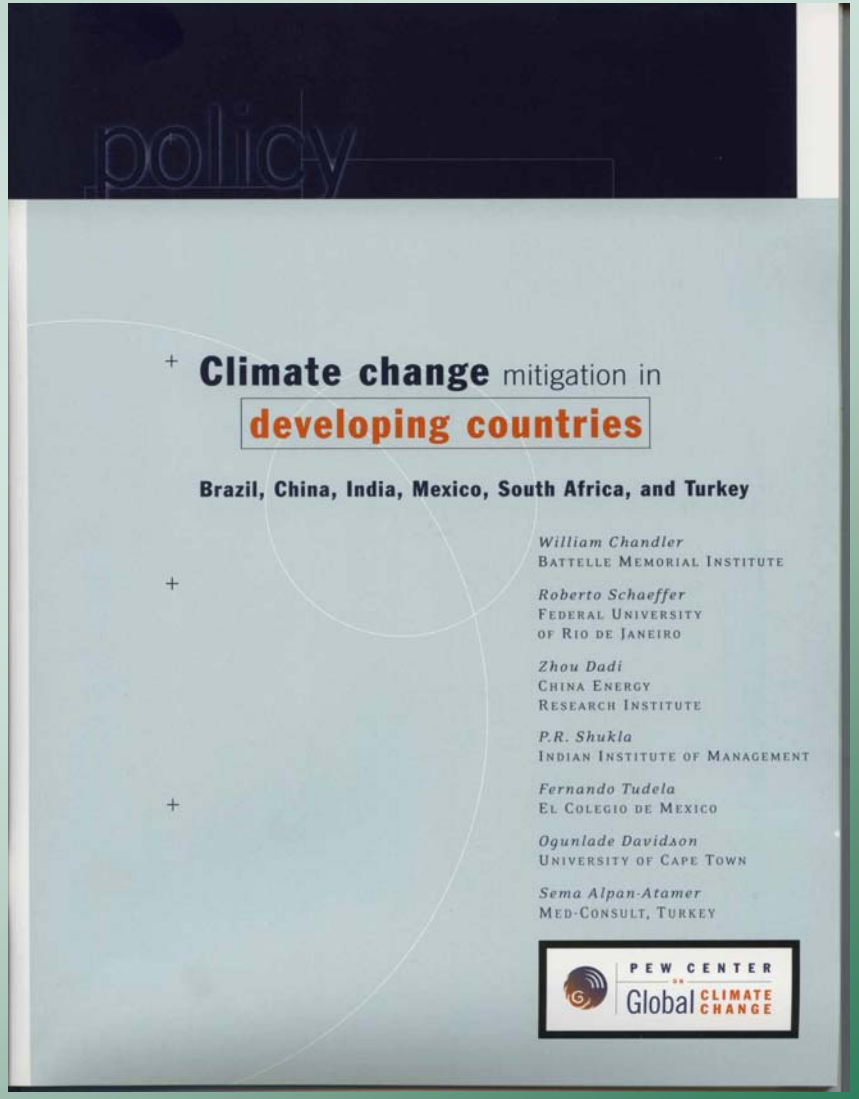
Carbon emissions reductions came in many forms ...

- Transitional economies were/are the poster child for efficiency as a path to economic well-being.
- Advertised as achieving “co-benefits”
  - Local environmental protection
  - Economic development
  - International security
- Maybe climate was the co-beneficiary of good (and appropriate) economic policy ...

Non-climate related actions create significant climate outcomes ...

- In developing countries actions taken for other purposes, such as local pollution and energy security, have led to significant annual reductions in carbon emissions relative to prior projections.



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While Kyoto seemingly dominates the current implementation conversation ...

We need to be mindful of the end game - global deployment

We don’t need existence proofs, but gigaton technologies ...

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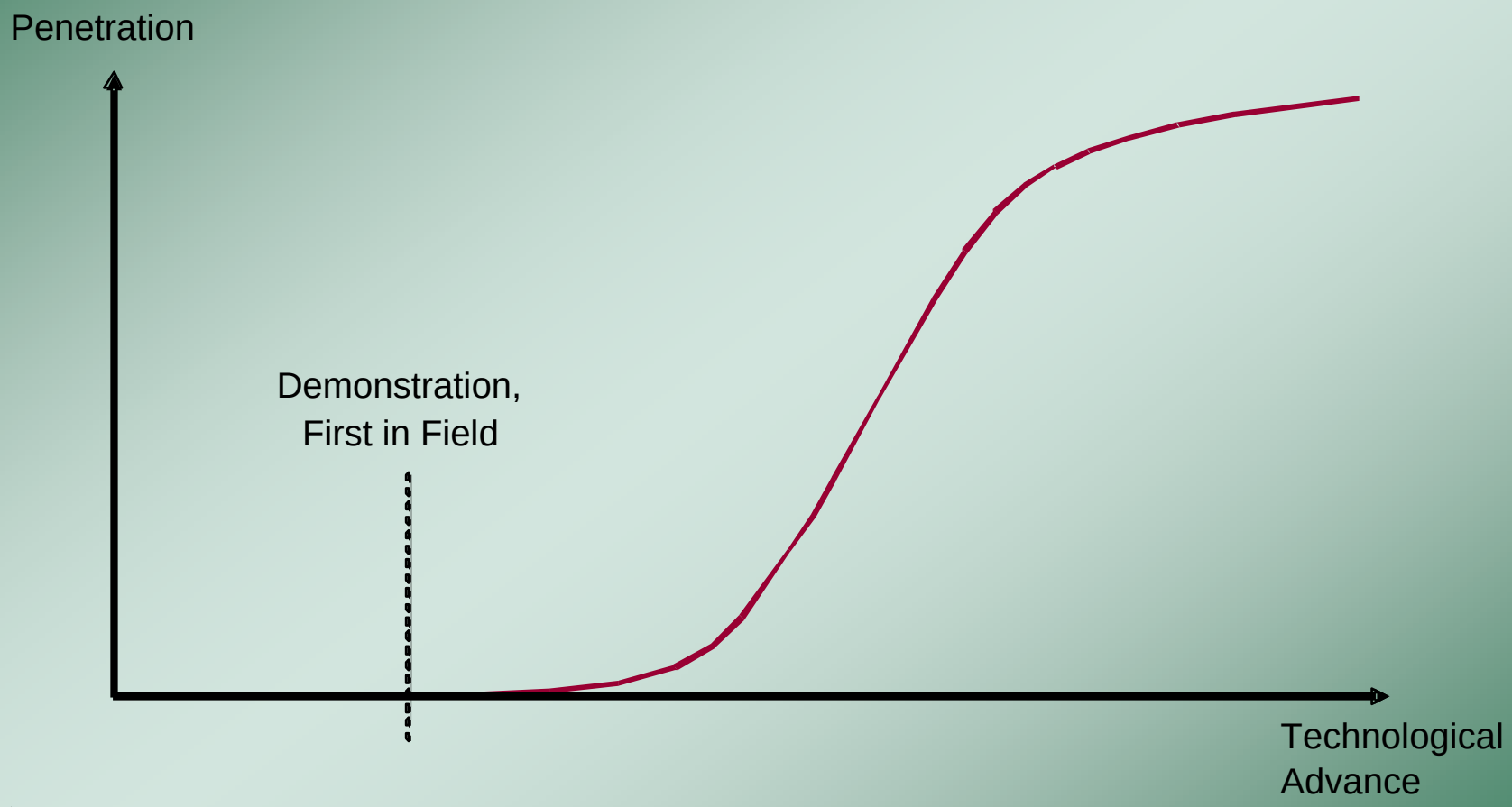
R&D does not ‘solve’ the problem …

- Energy R&D refers to a series of linked processes by which technologies for energy supply, end use, or carbon management move from theoretical conceptualization to feasibility testing and, ultimately, to small-scale deployment.

Demonstration of technological feasibility is a long way from widespread deployment



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The technology must also compete in the marketplace …

- Commercial feasibility implies:
  - The technology can be successfully operated with a reasonable return on investment.
  - This means operation at reasonably predictable cost
  - Adequate personnel to manage the facility on the day-to-day basis,
  - Minimal likelihood of operational or regulatory surprises
  - Widespread public acceptance of the technology.
- It affects both initial penetration and eventual extent of penetration
- And every country is different ...

Even those homogeneous Scandinavian places ...

TWh (2002) Electricity	Conventional thermal	Hydro	Nuclear	Wind
Norway	0.8	129.7		
Sweden	11.2	66	65.6	0.8
Finland	39.8	10.6	21.4	
Denmark	32.3			4.9

Noting: Norway is a major oil and gas exporter; and, only recently did wind pass biomass in as an energy source in Denmark.

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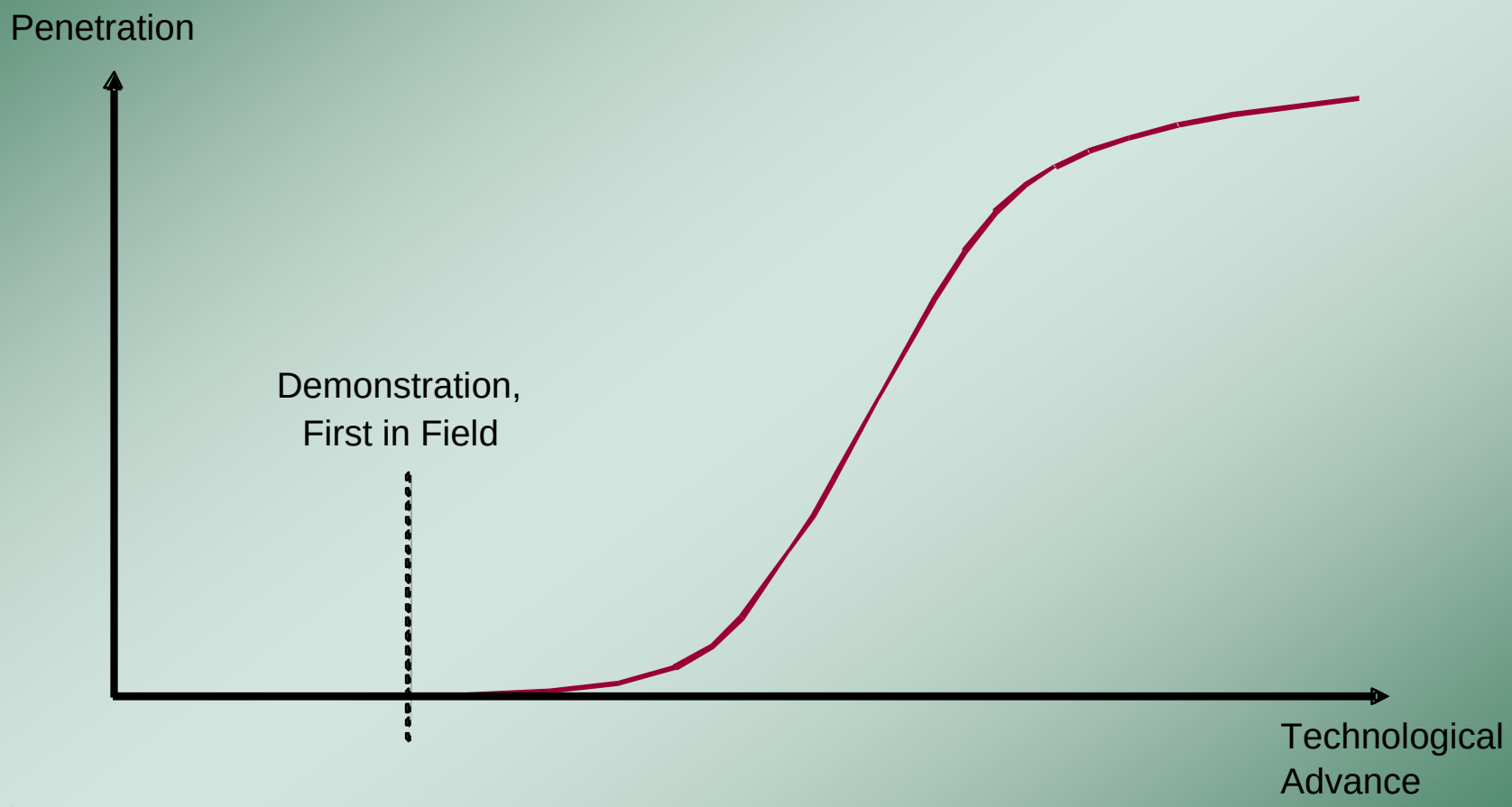
Between technical feasibility and commercial viability is …

- The ‘Valley of Death’
  - Solution: an heroic model of breaking down barriers to market penetration
- Or - the ‘Muddle in the Middle’
  - The interaction between government and the private sector is very complex in this domain - incentives, standards and the impact of seemingly unrelated policies (e.g. agricultural policy, land-use and bio-fuels)

What factors might inhibit large scale deployment?



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What happens at scale ...

- In terms of resources - the technology moves from being a “price taker” to a “price maker”
  - For energy systems, in particular, their scale will greatly increase demand - e.g. land for bio-fuels
- The expertise for managing the technology must be a product of the standard education system and cannot count on the over-qualified developers that demonstrate the technology
- Seemingly low probability safety occurrences become increasingly likely as deployment increases, and small collateral effects, like emissions, become increasingly important in aggregate.
- And this happens every where ...

And where exactly is everywhere?

Lots of debates about first steps

... But the end game means addressing the whole problem ...

... In the age of Asia ...

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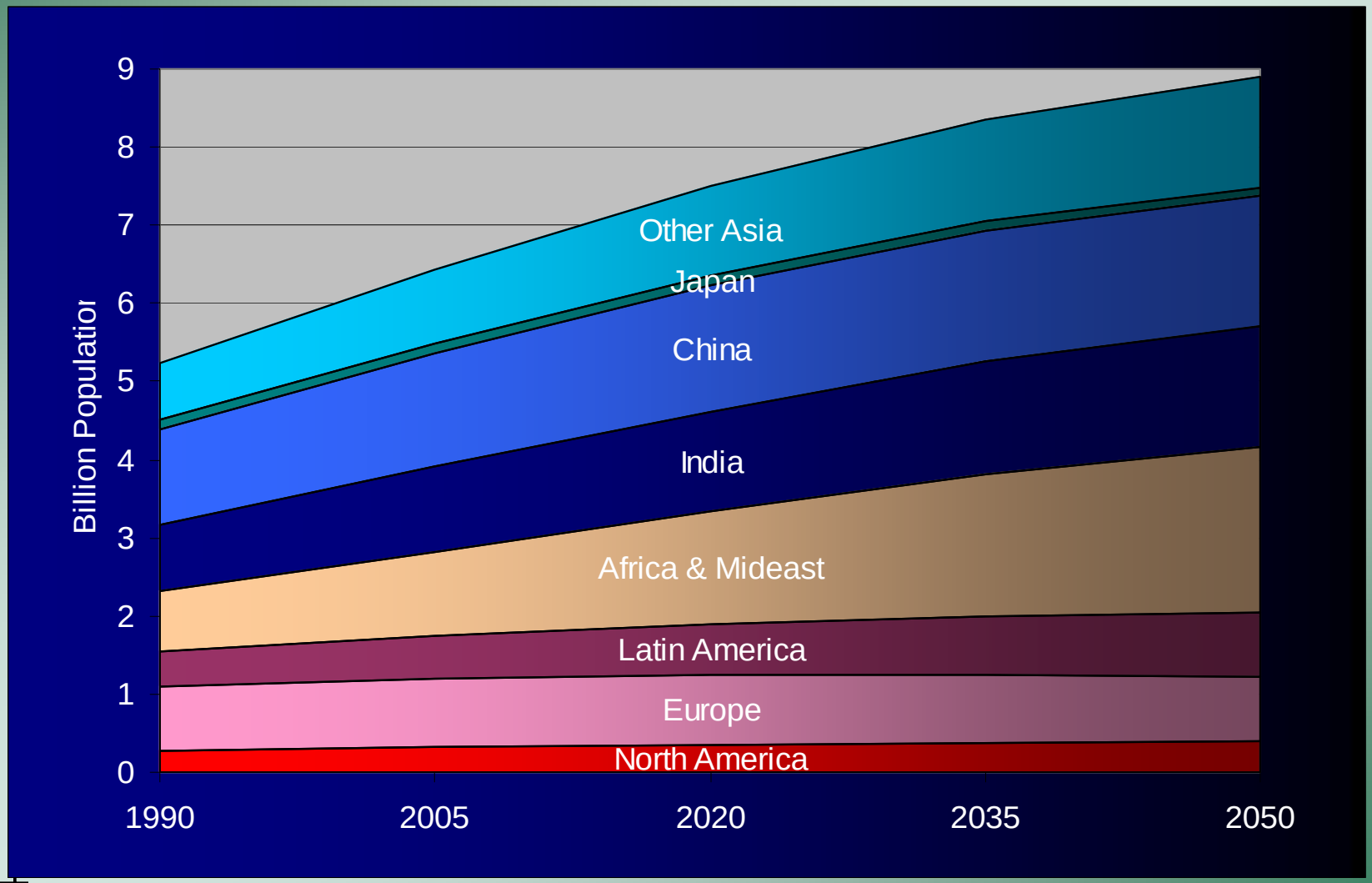
Kaya term #1: Population



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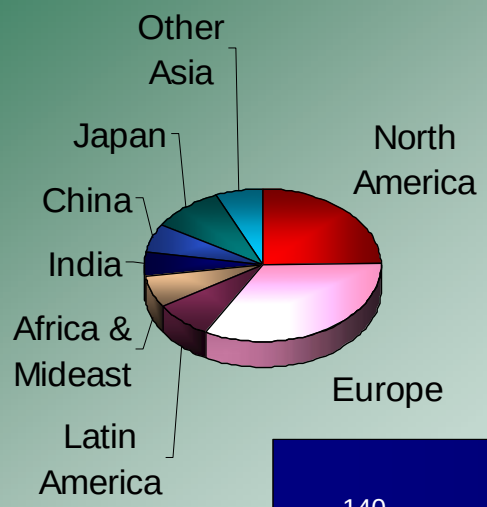
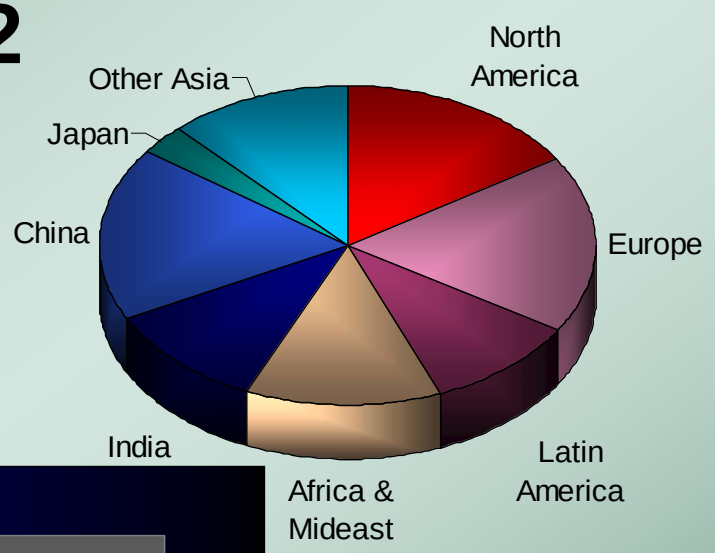
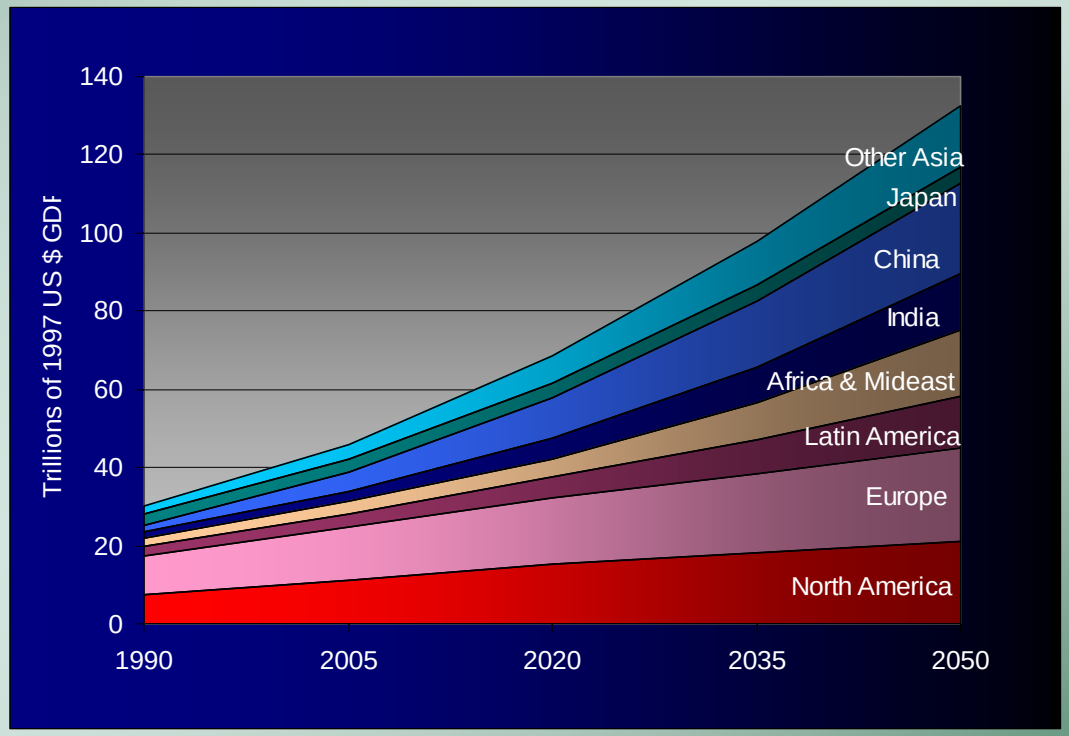
Kaya term #2
GDP

1990 GDP (1997 US $)
Global Total $30x10^{12}



2050 GDP (1997 US $)
Global Total $133x1012





1990 Asia produces 27%

2050 Asia produces 44%

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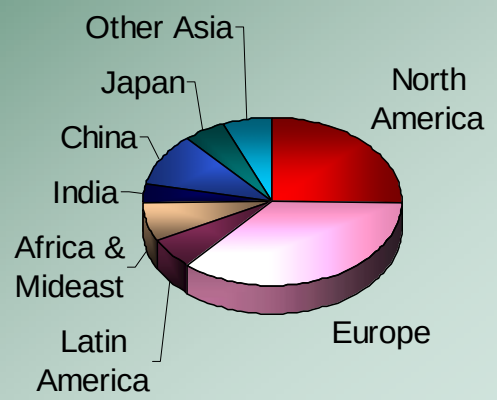
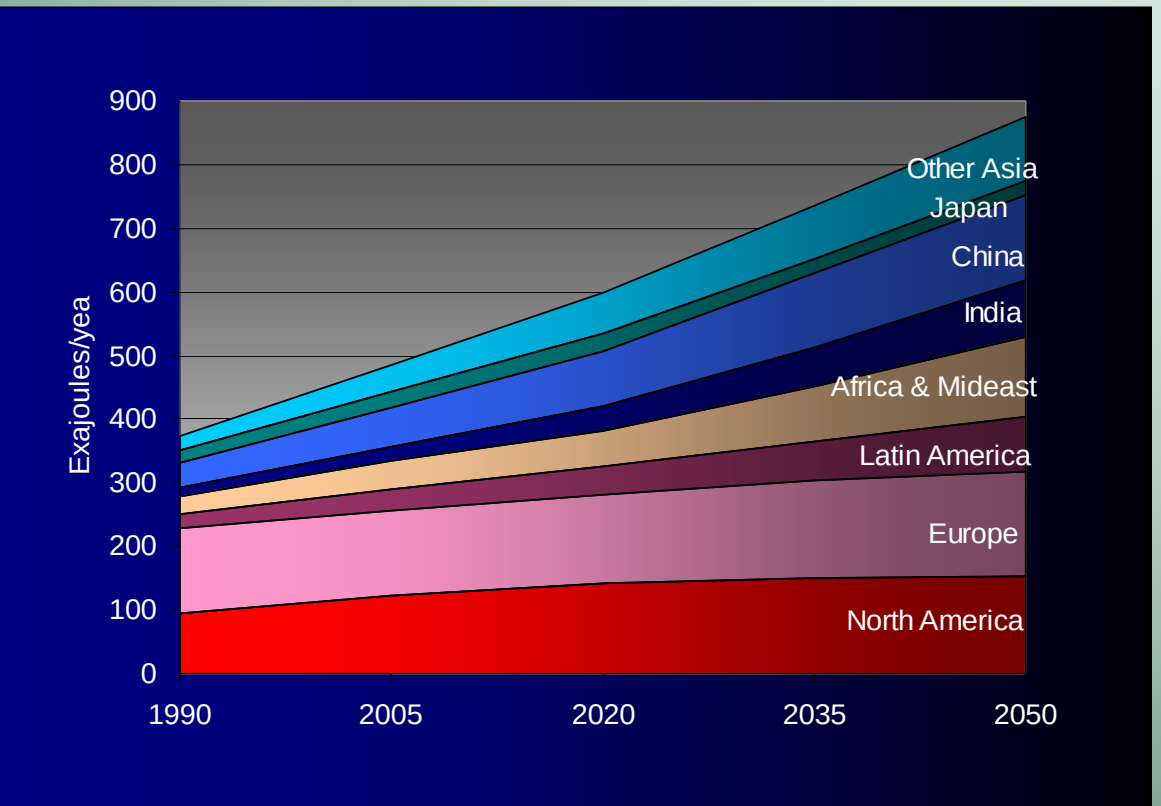
Kaya term #3: Energy

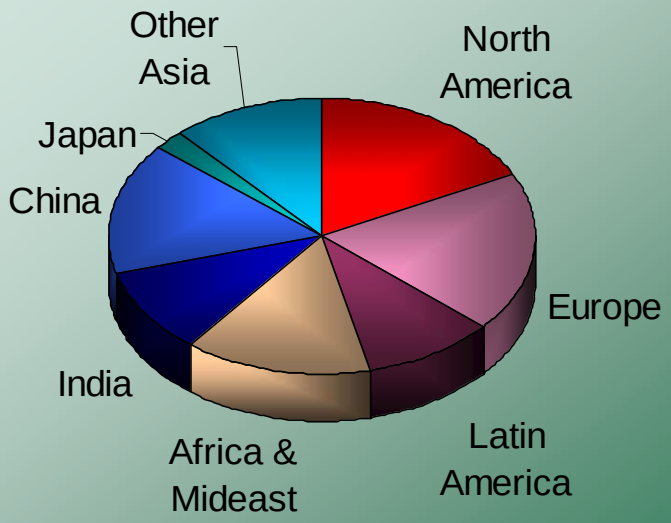
1990 Asia consumed 25%
2050 Asia consumes 40%

1990 Primary Energy (exajoules)
Global Total 372



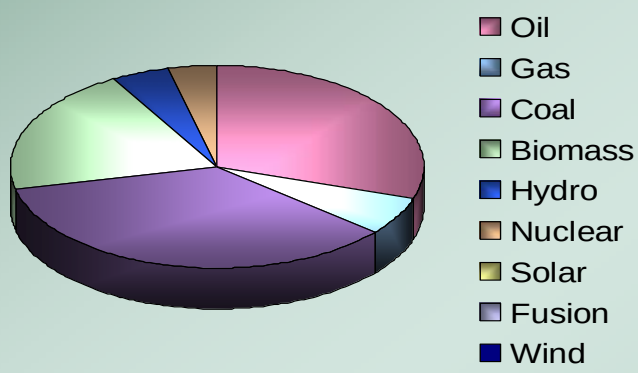


2050 Primary Energy (exajoules)
Global Total 875

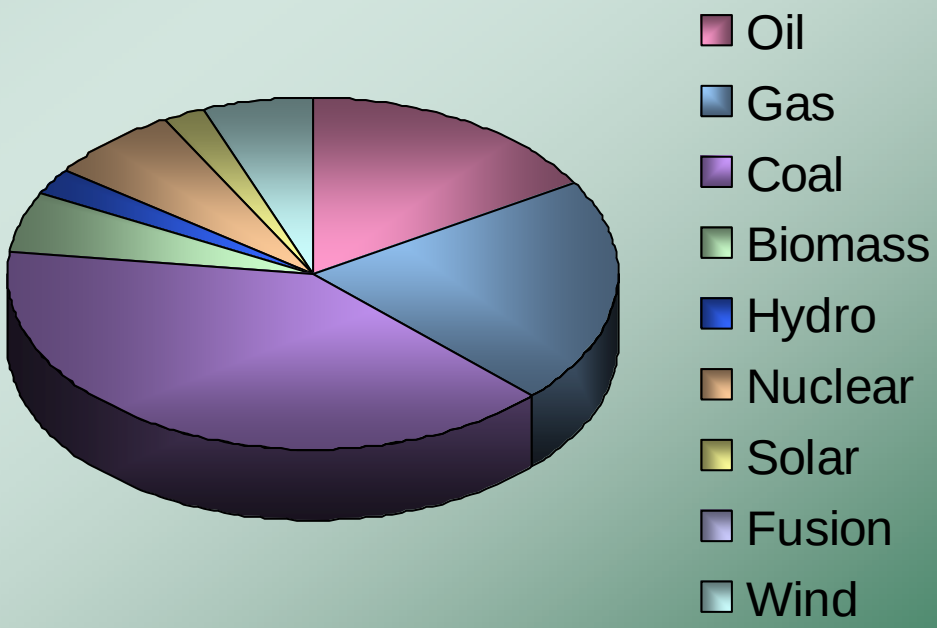


Energy Composition in Asia 1990 and 2050

Asian Energy 1990
94 exajoules/year



Asian Energy 2050
345 exajoules/year



Kaya term #4 - carbon intensity

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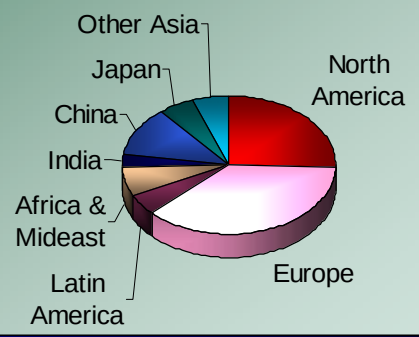
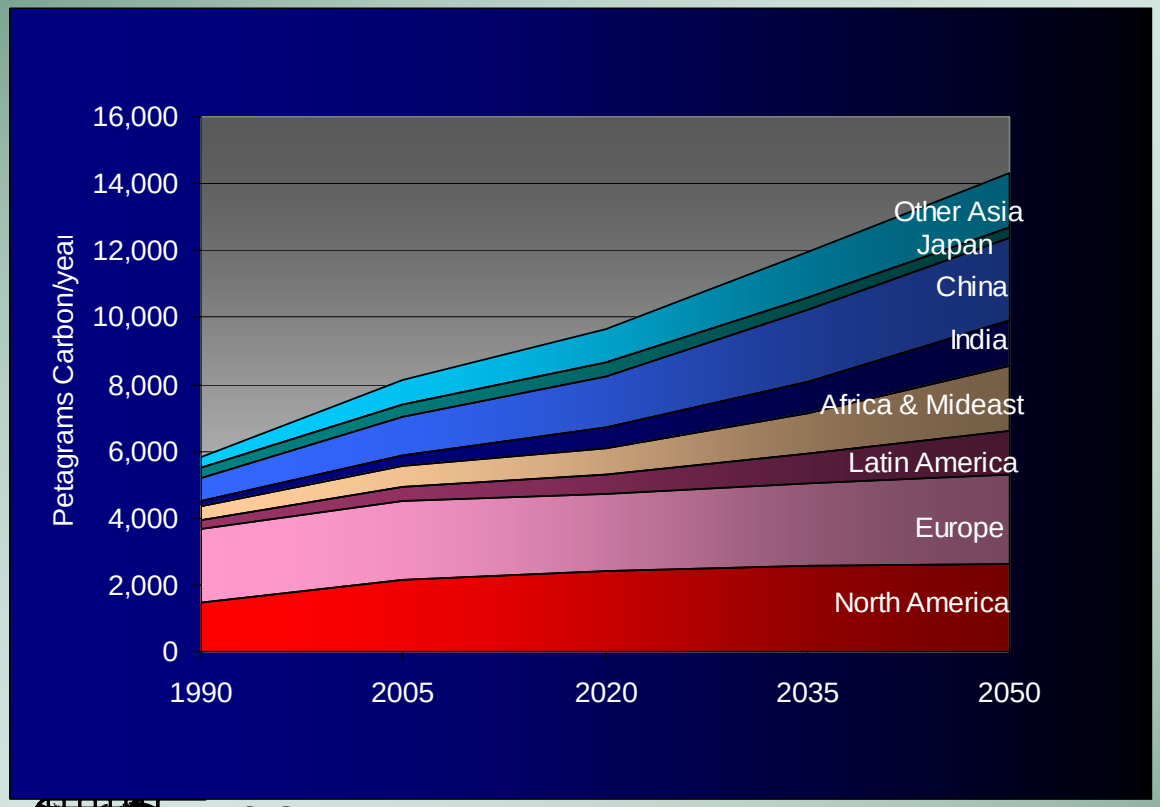
CO_2 Emissions

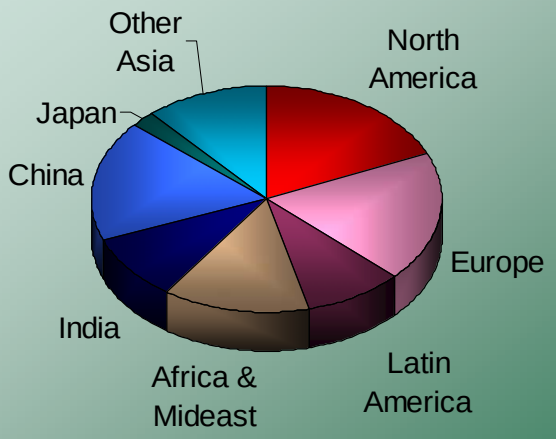
1990 Asia produces 25%
2050 Asia produces 40%

1990 Fossil Fuel CO2 (petagrams C/y)
Global Total 5816





2050 Fossil Fuel CO2 (petagrams C/y)
Global Total 1435



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Gigaton emissions can be best avoided where gigatons may be emitted ...

Carbon is fungible ...

A gigaton avoided is a gigaton avoided, regardless of intent ...

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Discussion