SEminaire de Recherche en ECOnomie
LARSEN – Fontenay aux Roses

Approches sectorielles et politiques de lutte contre le changement climatique: Industries lourdes et secteur électrique

Richard Baron
Division de la maîtrise de l'énergie et de l'environnement

Agence Internationale de l'Énergie - OCDE

10 Janvier 2008

Introduction: les projections énergétiques de l'AIE en 2030

Quels enjeux pour la politique climatique?

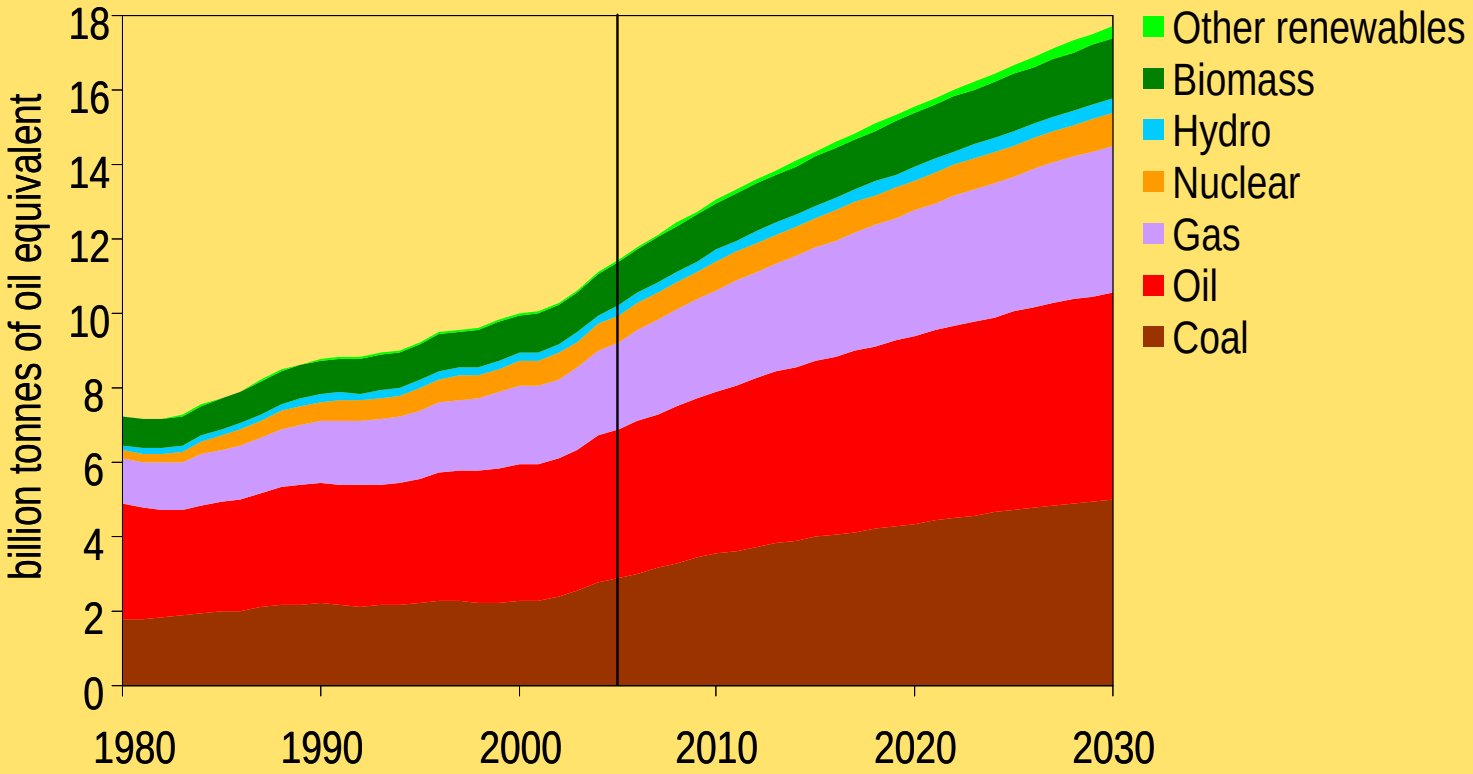
INTERNATIONAL ENERGY AGENCY

WORLD ENERGY OUTLOOK 2007

China and India Insights

Reference Scenario:

World Primary Energy Demand



Global demand grows by more than half over the next quarter of a century, with coal use rising most in absolute terms

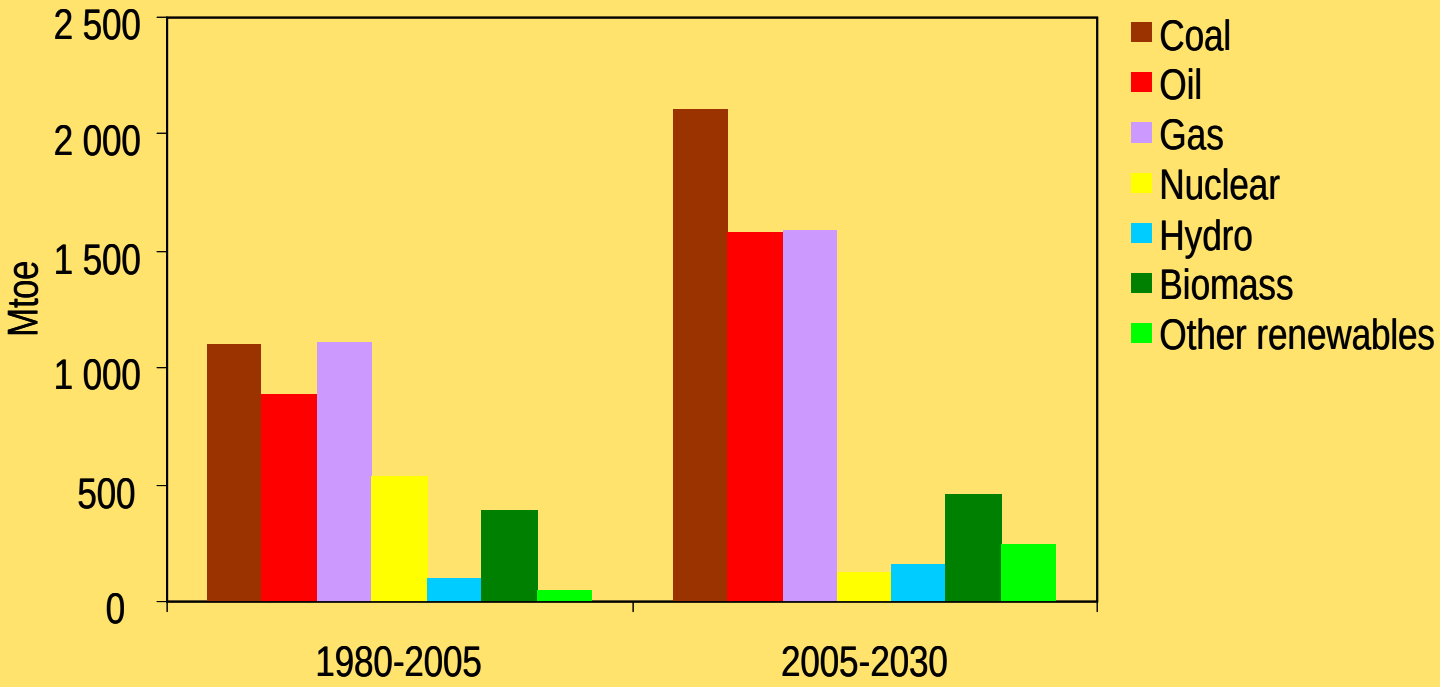
INTERNATIONAL ENERGY AGENCY

WORLD ENERGY OUTLOOK 2007

China and India Insights

Reference Scenario:

Increase in World Primary Energy Demand



Fossil fuels account for most of the increase in global demand between now & 2030, though non-hydro renewables grow fastest

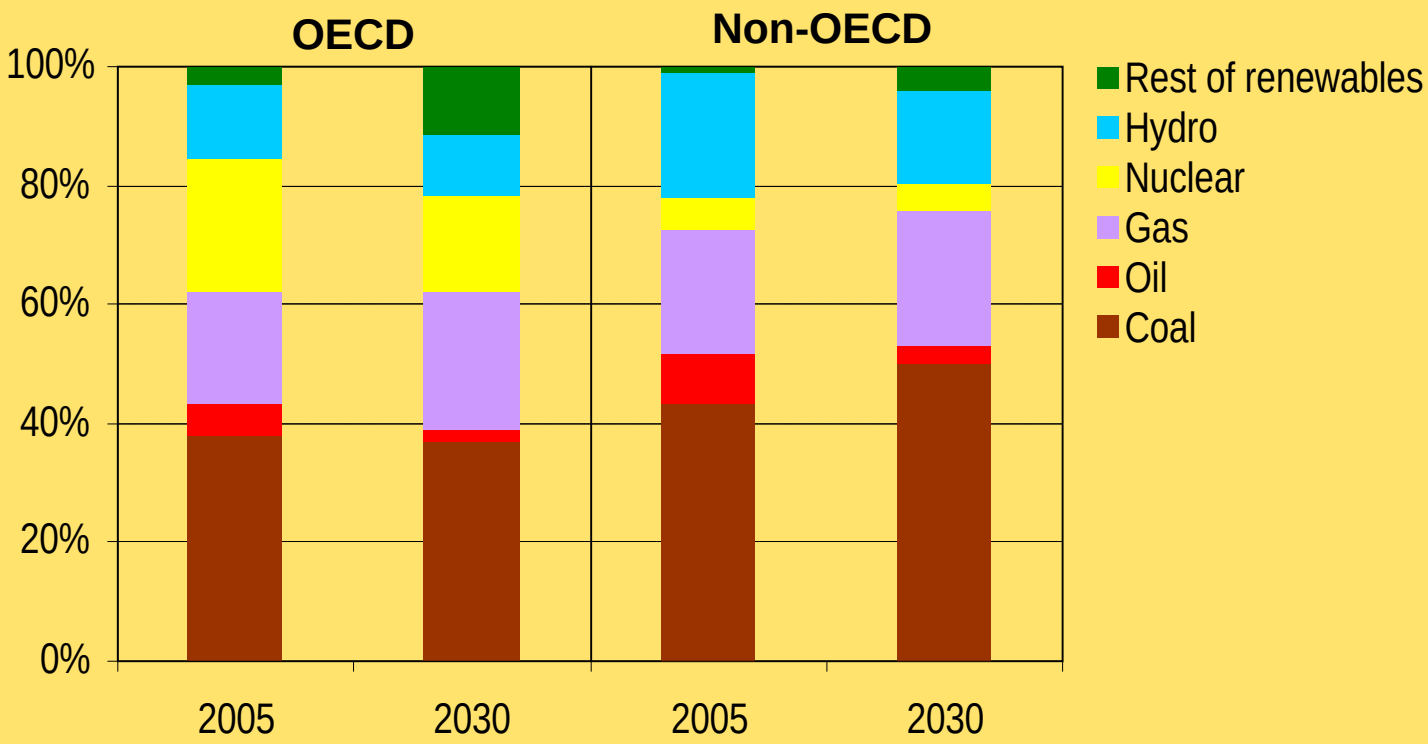
INTERNATIONAL ENERGY AGENCY

WORLD ENERGY OUTLOOK 2007

China and India Insights

Reference Scenario:

Fuel Mix in Power Generation



Dependence on coal for power rises strongly in emerging economies, while it stagnates in the OECD

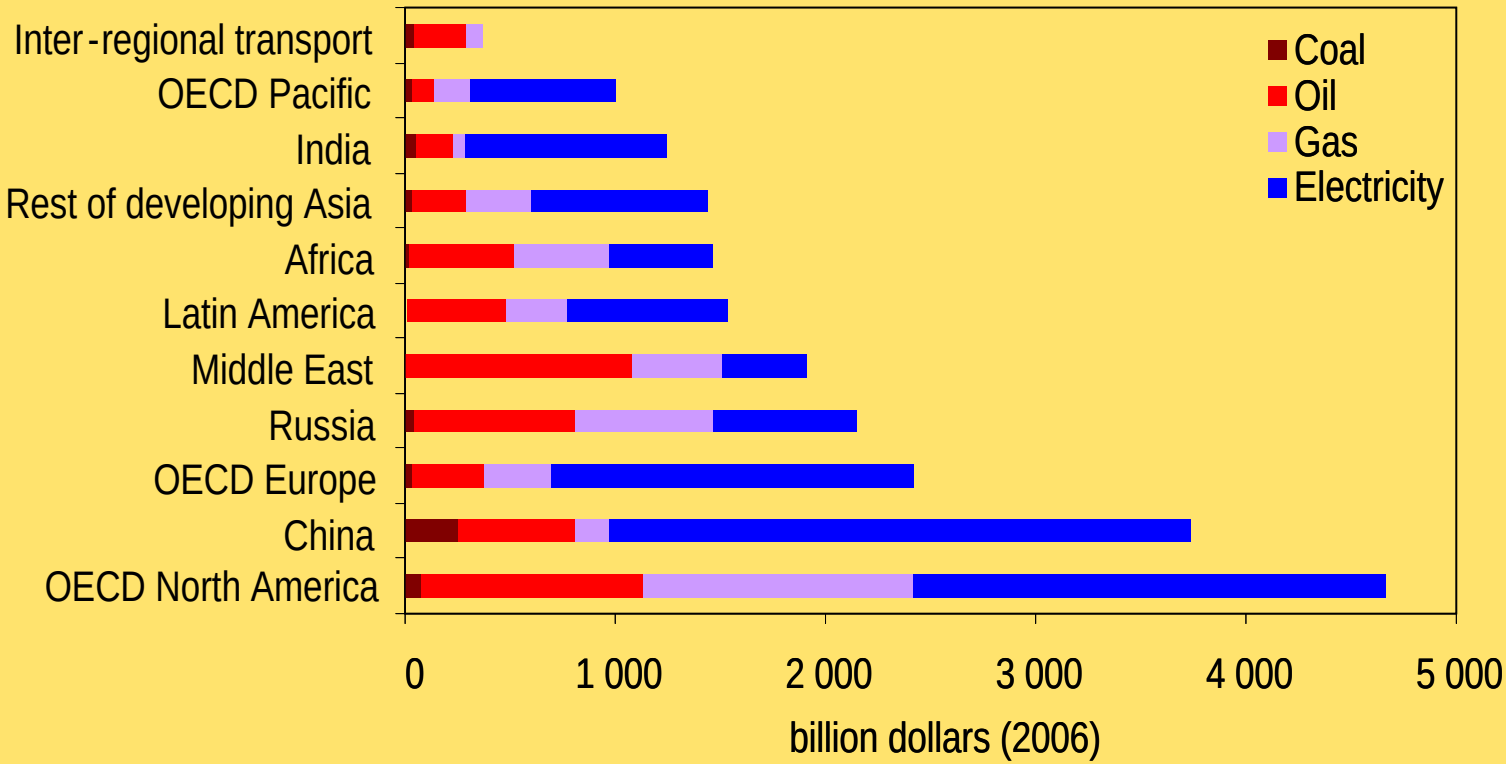
INTERNATIONAL ENERGY AGENCY

WORLD ENERGY OUTLOOK 2007

China and India Insights

Reference Scenario:

Cumulative Investment in Energy-Supply Infrastructure, 2006-2030



Just over half of all investment needs to 2030 of $22 trillion are in developing countries, 17% in China & another 6% in India alone

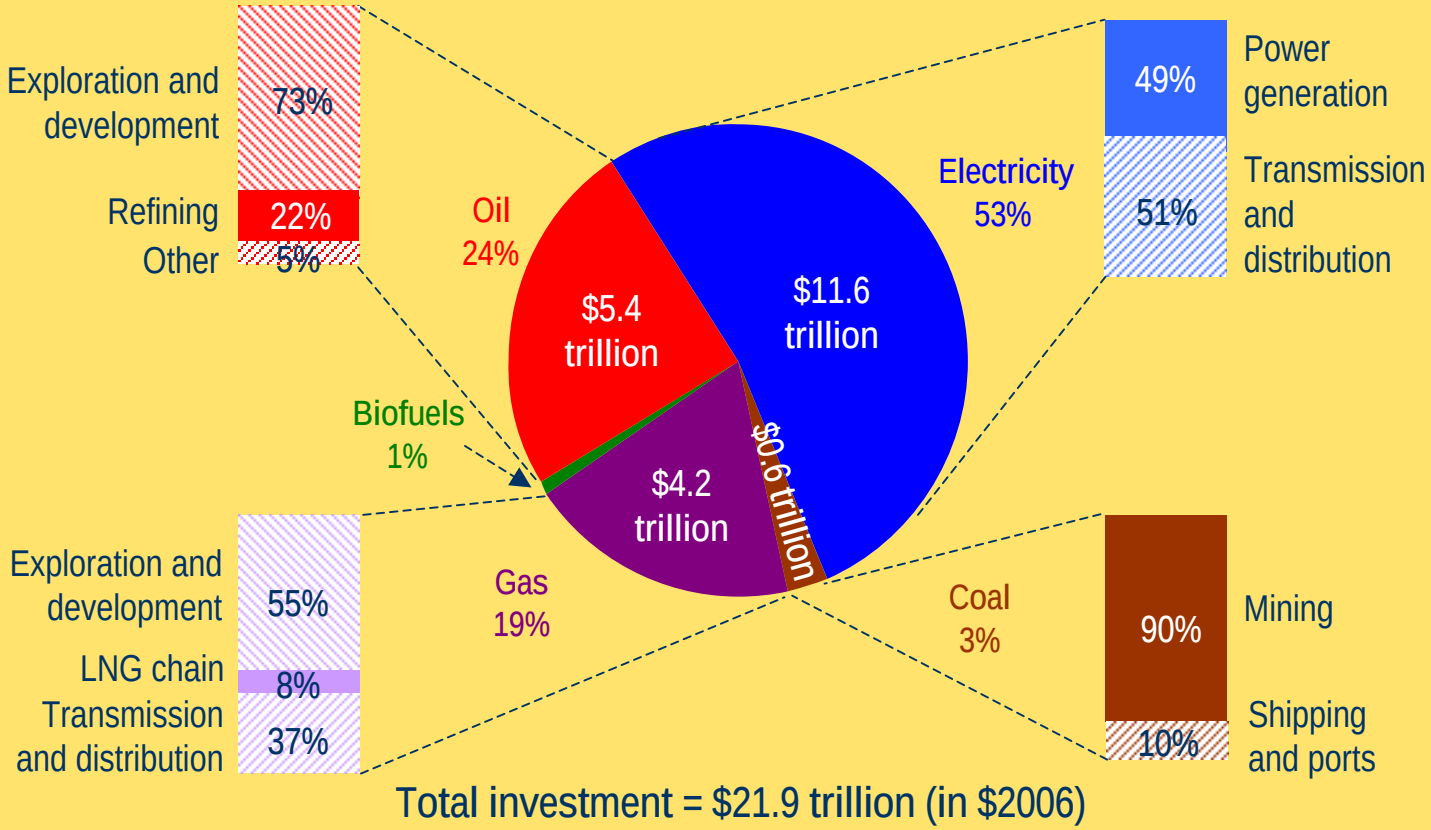
INTERNATIONAL ENERGY AGENCY

WORLD ENERGY OUTLOOK 2007

China and India Insights

Reference Scenario:

Cumulative Investment in Energy-Supply Infrastructure, 2006-2030



Just over half of all investment needs to 2030 of $22 trillion are in developing countries, 17% in China & another 6% in India alone

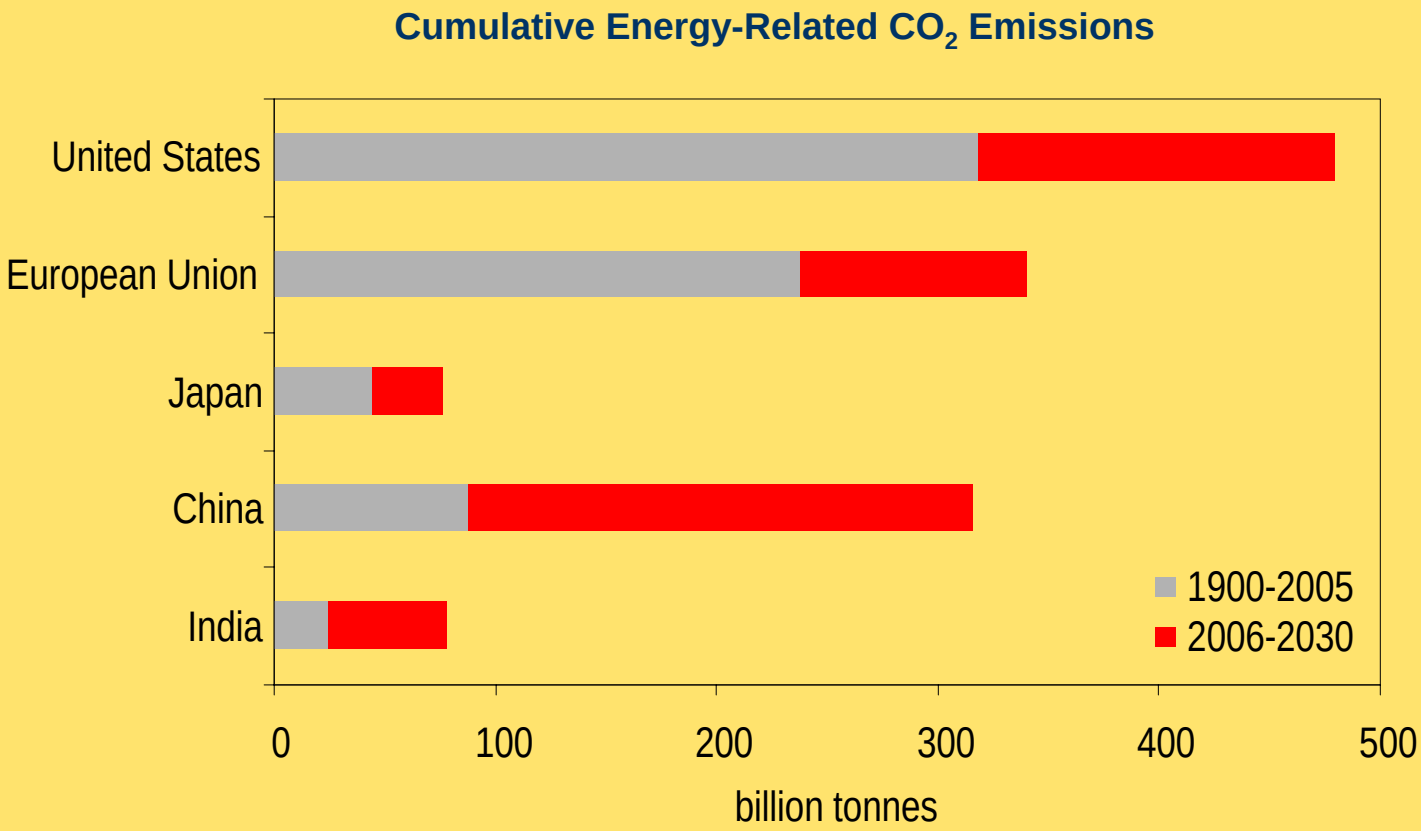
INTERNATIONAL ENERGY AGENCY

WORLD ENERGY OUTLOOK 2007

China and India Insights

Reference Scenario:

China & India in Global CO_2 Emissions



Around 60% of the global increase in emissions in 2005-2030 comes from China & India

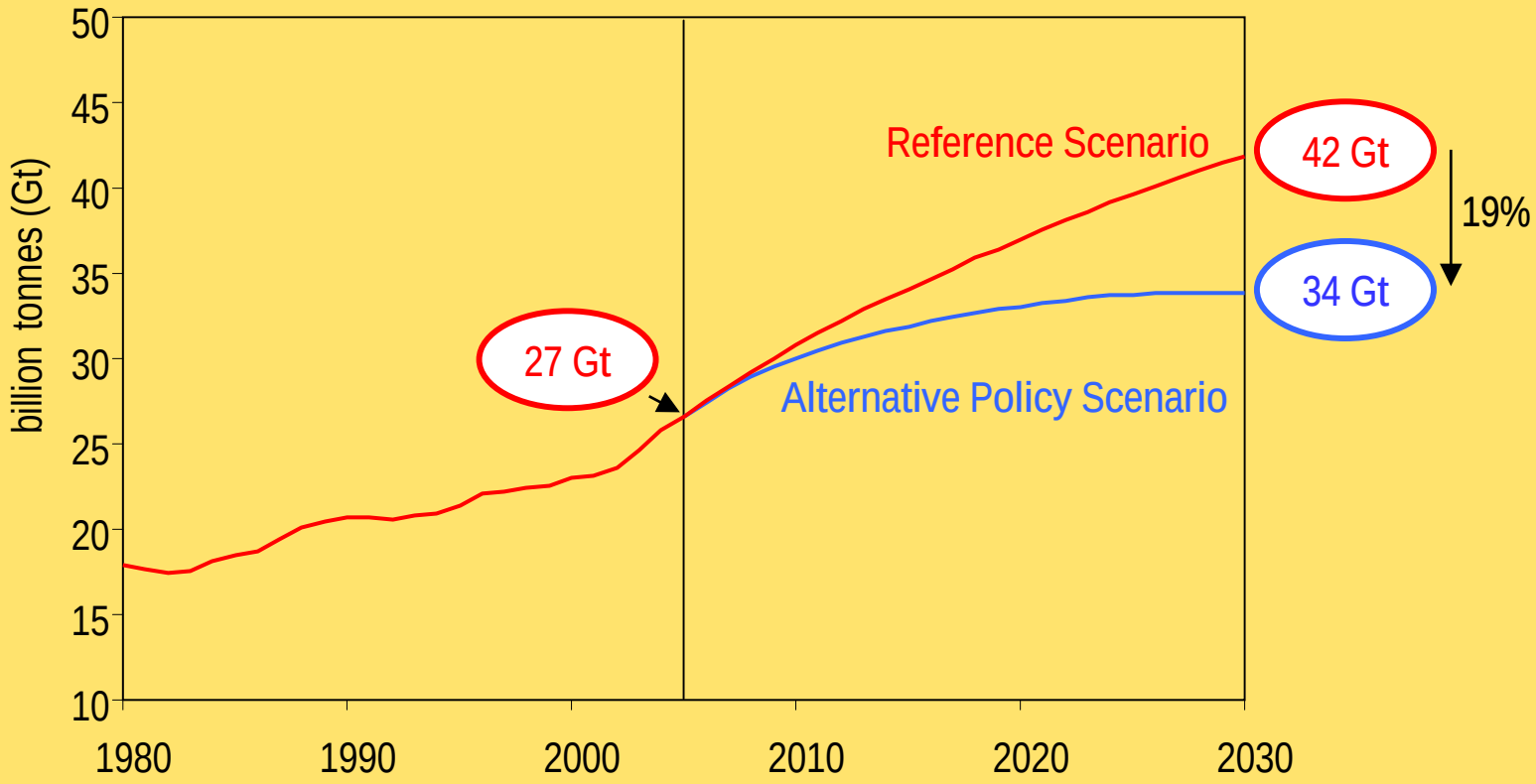
INTERNATIONAL ENERGY AGENCY

WORLD ENERGY OUTLOOK 2007

China and India Insights

Alternative Policy Scenario:

Global Energy-Related CO_2 Emissions



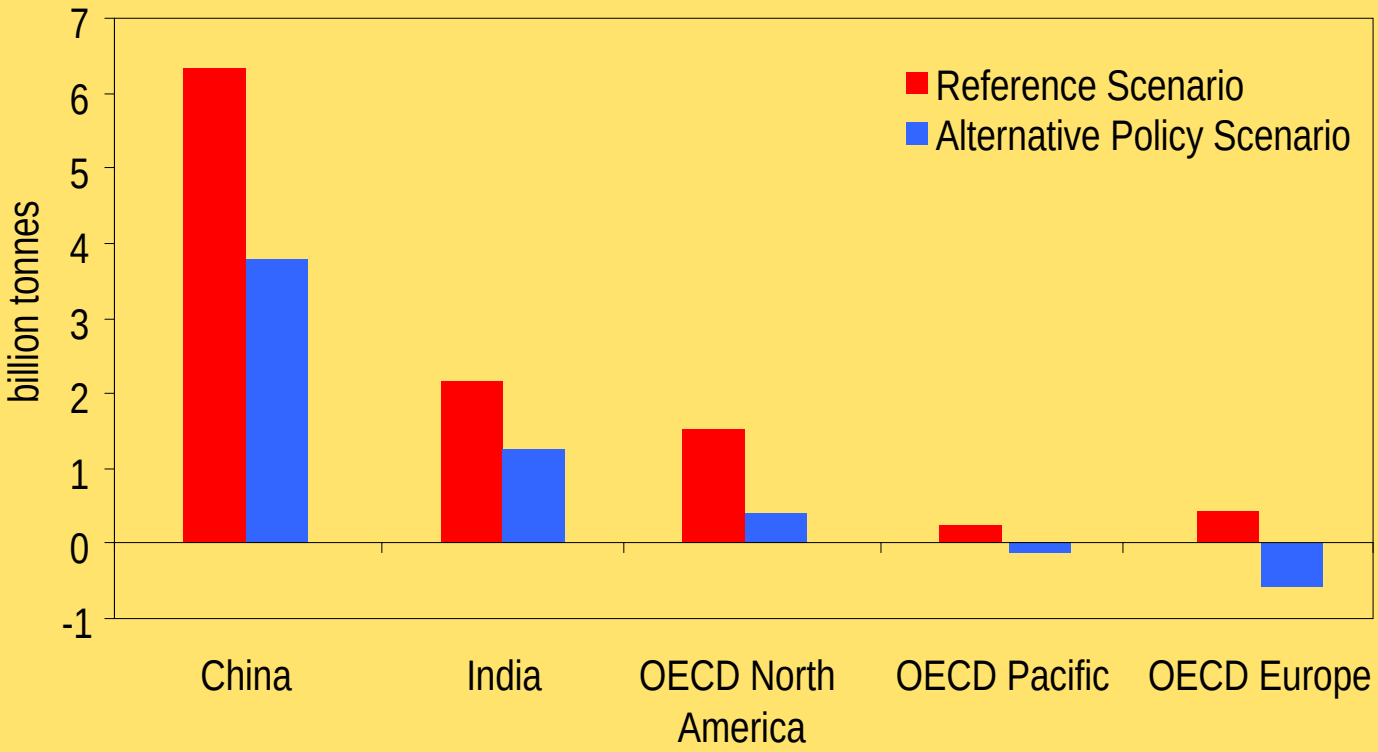
Global emissions grow less than half as fast as in the Reference Scenario, stabilising in the 2020s

INTERNATIONAL ENERGY AGENCY

WORLD ENERGY OUTLOOK 2007

China and India Insights

Incremental Energy-Related CO_2 Emissions, 2005-2030



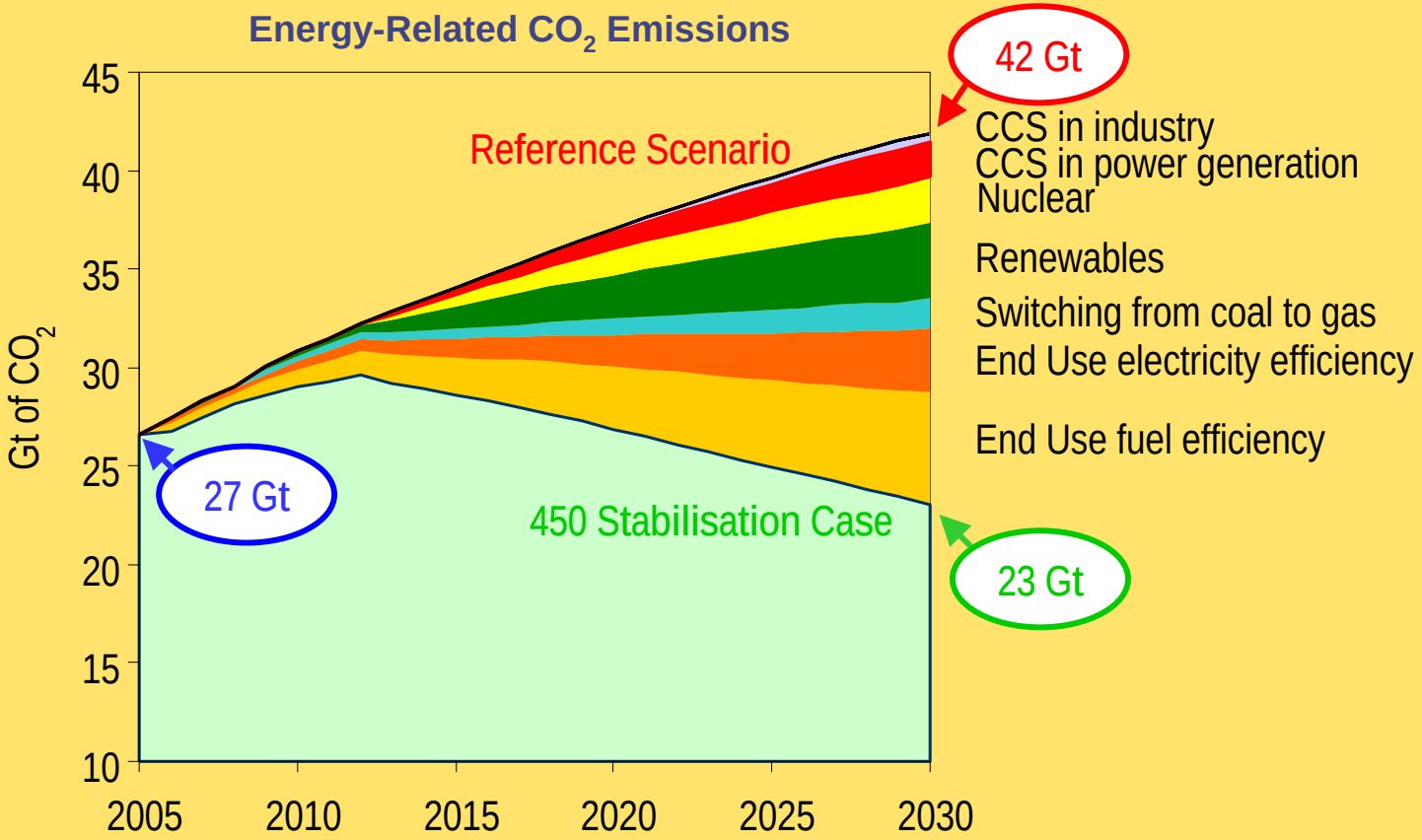
Most of the increase in emissions are projected to come from China & India in all scenarios

INTERNATIONAL ENERGY AGENCY

WORLD ENERGY OUTLOOK 2007

China and India Insights

CO_2 Emissions - 450 Stabilisation Case



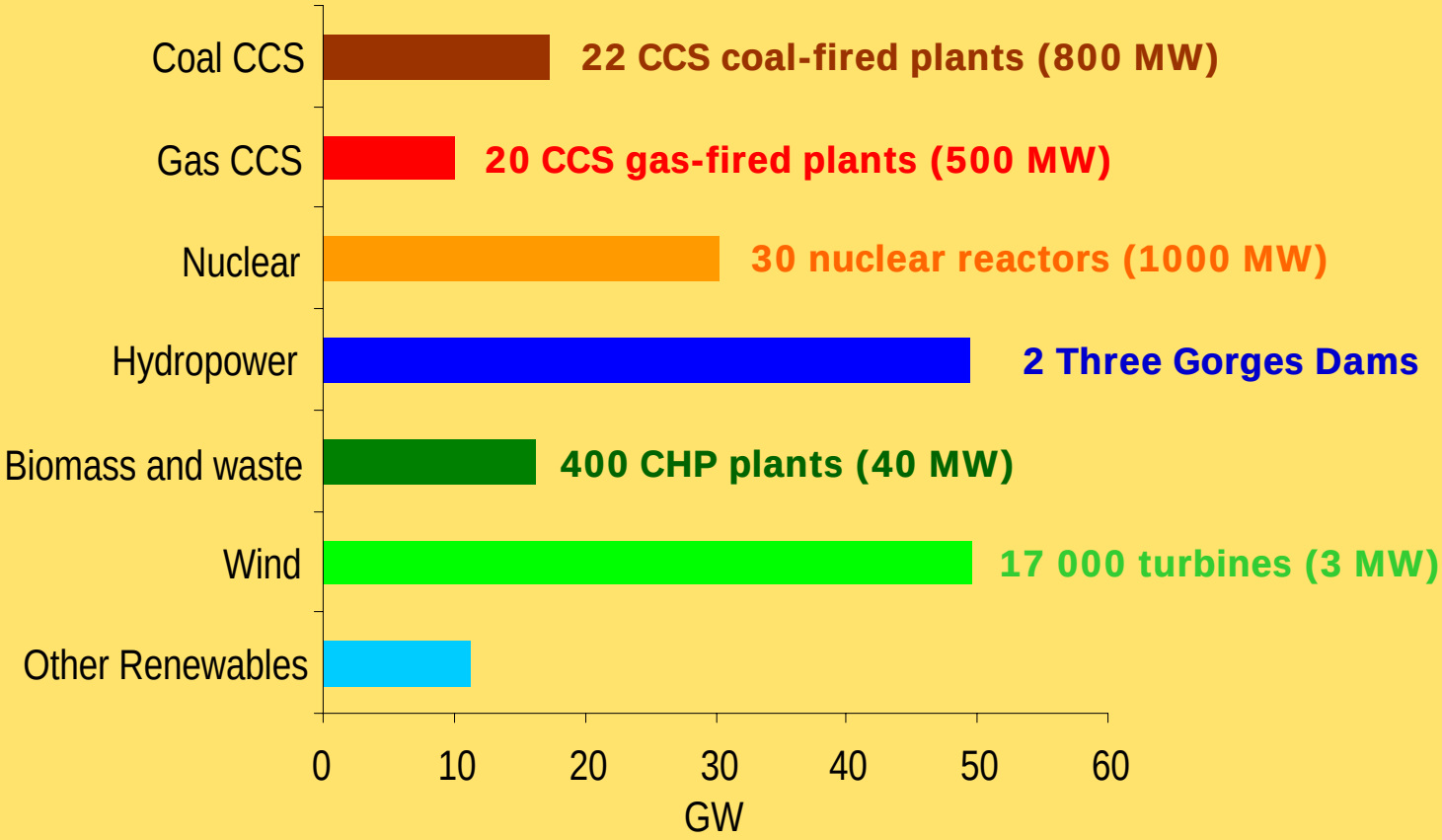
By 2030, emissions are reduced to some 23 Gt, a reduction of 19 Gt compared with the Reference Scenario

INTERNATIONAL ENERGY AGENCY

WORLD ENERGY OUTLOOK 2007

China and India Insights

Average Annual Power Generation Capacity Additions in the 450 Stabilisation Case, 2013-2030



A large amount of capacity would need to be retired early, at some economic cost

Approches sectorielles et politiques de lutte contre les émissions de CO_2

Plan d'action de Bali - COP/MOP3

"…a long-term global goal for emission reductions…"

"…quantified emission limitation and reduction objectives by all developed* [countries]…"

"Nationally appropriate mitigation actions by developing* country Parties supported and enabled by technology, financing and capacity-building, in a measurable, reportable and verifiable manner"

"*Cooperative sectoral approaches and sector-specific actions*"

"Various approaches, including opportunities for using markets, to enhance cost-effectiveness of […] mitigation actions … "

** Noter l'abandon des termes "Annex I" and "non-Annex I"*

Sectoral approaches: why?

- **UNFCCC Parties are searching for means to broaden greenhouse gas reduction activities**
  - Some (most) countries will not take country-wide targets yet
  - A focus on sectors could reveal win-win opportunities for CO_2 reductions
  - Rapid growth in GHG-intensive industrial activities outside Annex I regions
  - ➔ Sector-based commitments, for some countries, as part of a post-2012 climate regime?

- **Need to address competitiveness concerns for trade-exposed energy-intensive industries**
  - Climate policy costs hamper competition of some industries in some countries only
  - Competitiveness concerns are a constraint on governments' willingness to set more ambitious goals

On climate policy and competitiveness

Günter Verheugen, Vice President, European Commission, EU Commissioner for Enterprise and Industry, **November 27, 2007**

"Europe will be a first mover in realising a low carbon and resource efficient economy. Energy will be at the centre of the changes needed as it is crucial to the cost base and competitiveness of industry, particularly energy intensive industries. ***Those industries often compete internationally and many cannot pass on increases in energy costs occurring uniquely in the EU*** to their customers without risking significant reductions in their market share.

Enabling these industries to remain competitive through providing the right conditions so that they can adapt to the future low carbon economy will be paramount to achieving a sustainable future and minimising the risk of carbon leakage. ***Therefore a policy framework is needed that enables European businesses to remain competitive in this context***."

"*Towards a low carbon economy*"
High-Level Group on Competitiveness, Energy and Environment

Compétitivité industrielle et politique climat

EU Emissions Trading Scheme
Evaluating impacts on Competitiveness

- Direct costs: estimated from an assumed shortage of allowances
- Indirect costs: effect of CO_2 prices on wholesale electricity prices
- Allowances available at EUR 20/tCO_2
- Three scenarios. Installations face:
  - a 2% shortage of allowances,
  - a 10% shortage of allowances
  - the full CO_2 cost (marginal cost)
- Compare CO_2 cost with production costs for
  - Iron and steel, cement, paper, aluminium

Source: Reinaud, J. (2005): '*Industrial competitiveness under the EU ETS*', *IEA*.

Estimated Cost of CO_2 Constraint for Large Energy Users in the EU (allowance price = € 20/tCO_2)

% final product cost increase	Integrated steel 1.9 tCO_2/t	Electric arc furnace steel 0.15 tCO_2/t	Cement 0.9tCO_2/t	News-print 0.4tCO_2/t
allowance purchase = 2% of ex-ante emissions	1.2 %	1.7 %	4 %	2 %
Allowance purchase = 10% of ex-ante emissions	2.4 %	1.85 %	7 %	3 %

Reinaud, J. (2005): '*Industrial competitiveness under the EU ETS*' IEA Information Paper

Solving (transitory?) competitiveness problems

- Sectoral approaches: envision international, sector-based agreements
  - Sector-based commitments for developing countries (electricity, forestry, cement or steel?)
    - Face a (mild?) constraint on sector-level GHG emissions
    - Incentives? Credits sold on the international carbon market (an extension of CDM, from project to sectors)
  - Unilateral, industry-led initiatives
    - Establish a sector's sustainability to preempt more aggressive government policies
  - Not clear how these approaches could dispel competitiveness concerns

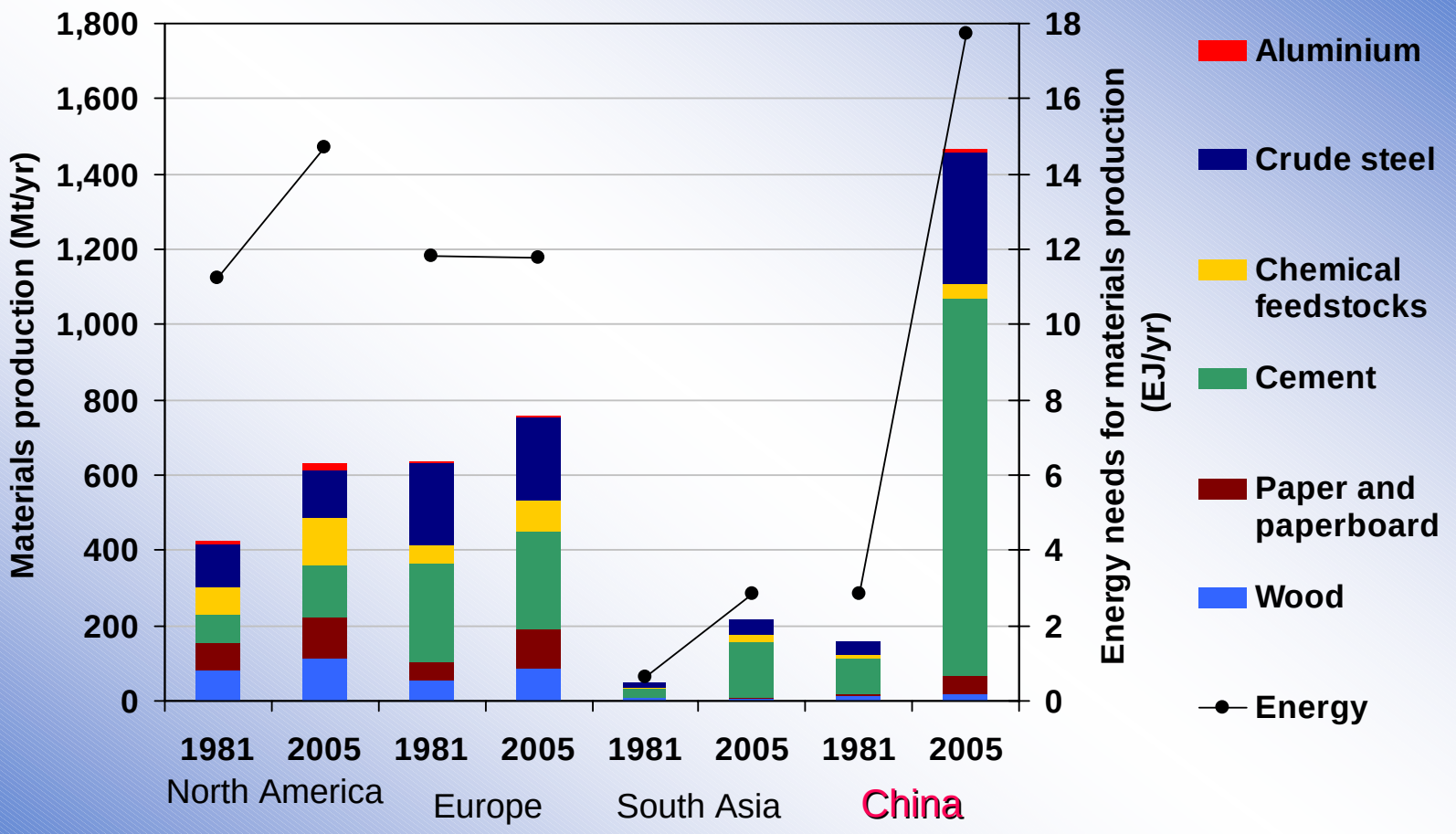
What could a sectoral approach consist of?

- What would it seek to "control"?
  - Direct emissions (boundary: plant)
  - Plus indirect GHG emissions (including waste reduction, power generation emissions)?
- How would goals be formulated?
  - CO_2 per unit of output
  - Energy efficiency goals
  - Diffusion rate of a specific, low-CO_2 technology
  - Absolute emission targets
  - National, international?
- Mechanisms of international coordination / collaboration?
  - A common price of carbon and flexibility on compliance
  - Pooling R&D resources
  - Technology assistance
  - Information sharing
  - Harmonised domestic policies
    - Policy-development assistance
  - Border-tax adjustments
- Different tools for different players?

Typology of sectoral approaches (SA)

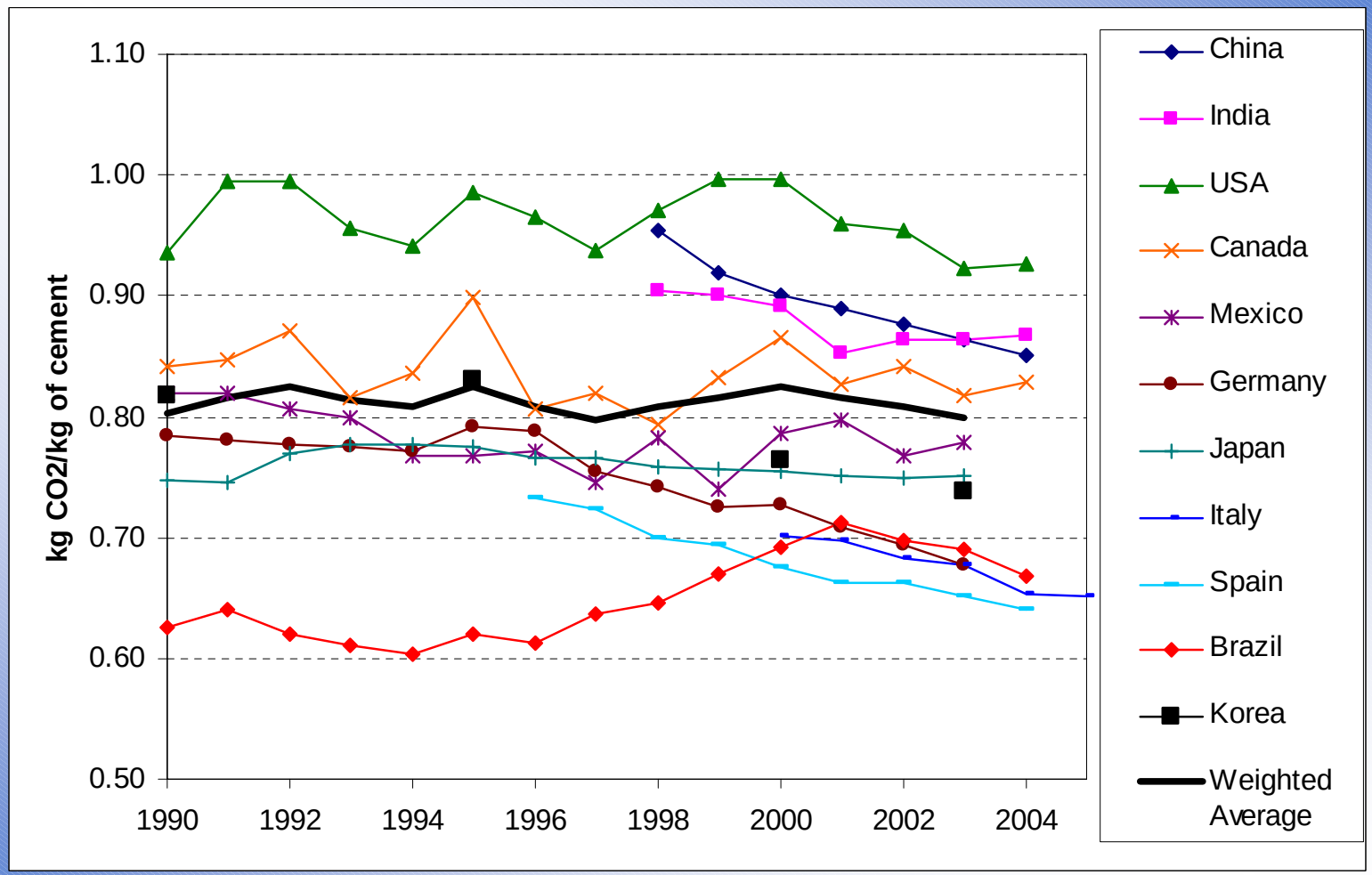
- ***Existing initiatives*: transnational sectoral approaches**
  - **E.g. International Aluminium Institute sustainability goals (incl. PFC reductions); WBCSD Cement Sustainability Initiative; International Iron and Steel Institute**
    - **Data gathering ➔seeking best practice ➔ offer policy options**
    - **In some cases, R&D towards innovative technologies (IISI)**
    - **Governments not involved so far**
  - **Public-private: Task Forces under the Asia-Pacific Partnership on Clean Development and Climate (APP)**
- ***Considered*: sector-level action under the UNFCCC**
  - **Country-specific sectoral objective with GHG crediting**
    - **"No lose" sectoral target (CCAP) / non-binding sectoral target**
  - **Sustainable Development Policies and Measures**

Industry growth: introducing China



Source: IEA, 2007 (forthcoming), *Energy use in the new millennium*.

CO_2 emissions per tonne of cement

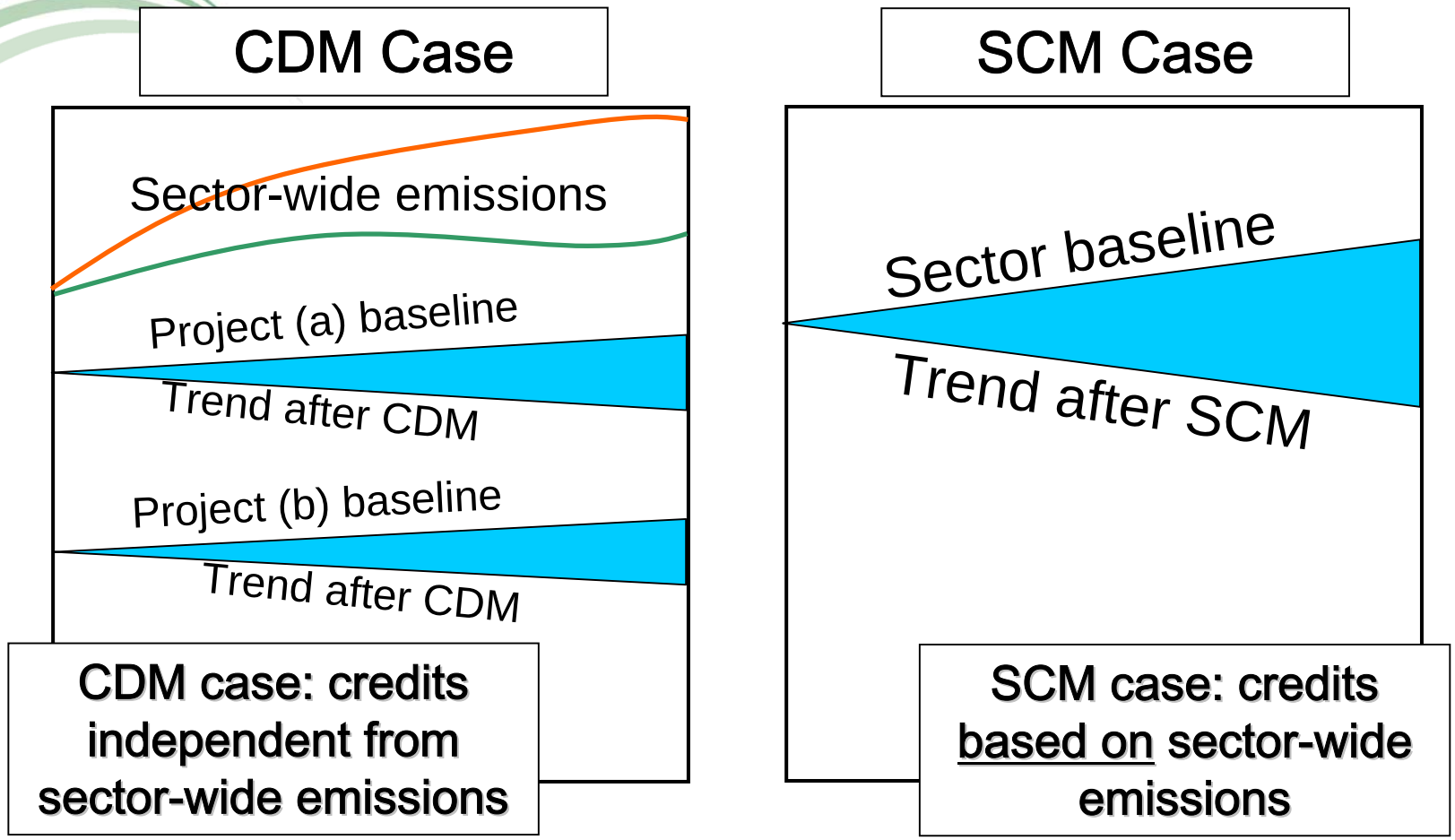


Note: Country averages, include process and energy-related CO_2 emissions.
Source: IEA, 2007, *Tracking Industrial Energy Efficiency and CO_2 Emissions.*

Instrumenting sectoral approaches

- **Sharing best practice**
  - **Industry benchmarks (e.g. x tCO_2 per tonne of y)**
    - **Sector-wide goal at international level or**
    - **Country-specific goals based on common methodology**
  - **Government policies (see IEA G8 mandate)**
- **Incentives**
  - **Improve economic and energy performance (win-win energy efficiency potentials)**
  - **Potential credits under the *Clean Development Mechanism* (Kyoto Protocol)**
  - **Extending GHG crediting to a sector basis**

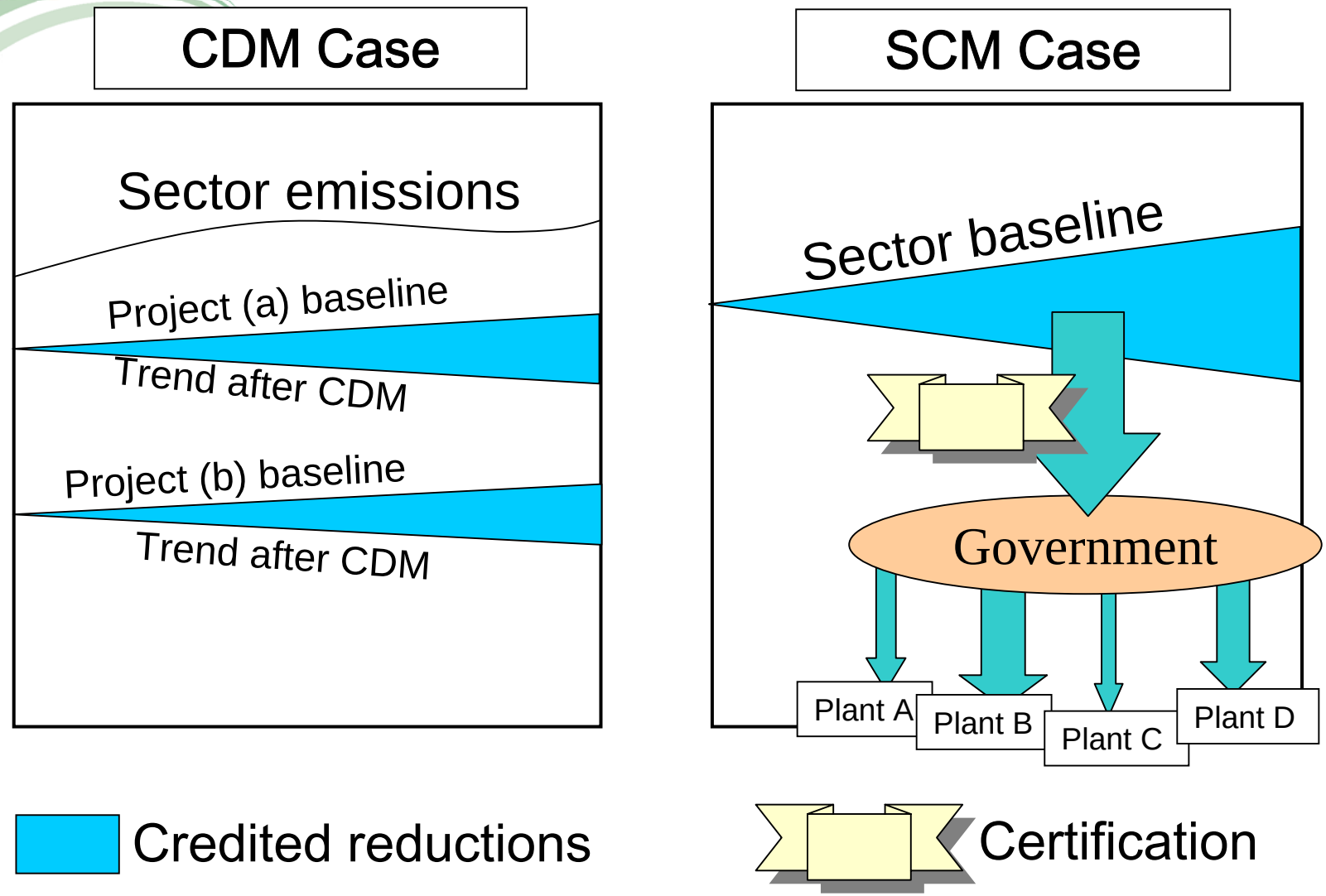
CDM projects versus SCM



Credited reductions

Can SCM work?

How to manage domestic incentives?



SA and competitiveness

- Industry-led efforts. Possible aims:
  - Establish the sustainability of an activity vis-à-vis GHG emissions (good corporate citizenship)
  - Possibly substitute lighter/smarter constraints/costs to existing policies
- Asia-Pacific Partnership on Clean Development and Climate
  - Prompt industry to share know-how with China and India
- Allocation under the EU ETS based on industry-wide benchmark
  - Seeks to homogenize impacts across installations within Europe
- Sector-wide GHG crediting in developing countries
  - Encourages GHG reductions in developing countries …
  - … but subsidizes them to do so, while Northern competitors face a carbon cost

  ➔ Encourages relocation? ➔ Adjust stringency of the credit baseline

  Note: Industry stakeholders generally in favour of facilitating CDM projects in their respective activity. Contradicts Cness argument?

  ➔ Sector-wide commitments for more "domestic" sectors?

Sectoral Approaches
Different views

- EU industry: a substitute, or complement, to the EU CO_2 emissions trading system
  - Hard to go back on the EU ETS
  - But sectoral insights can help make the ETS more effective
- Japanese industry: a vehicle to enhance efficiency in China, India, etc.
  - Potential in Japan limited at present
- A method to build GHG commitments for Kyoto Parties, based on sectoral potentials (see G8)?
  - Critical question: at what cost?
- UNFCCC: a stepping stone for developing country commitments

Criteria to assess future sectoral approaches

- Environmental effectiveness
  - Leads to a meaningful environmental outcome?
- Fairness
  - Set a more level international playing-field in relevant industries – where CO_2 policy drives a wedge in cost-competitiveness
- Cost-effectiveness
  - Does not create large differences in cost of CO_2 reductions – avoid 'carving out' sectors
  - Paves the way for an economic signal on CO_2 emissions

Summarising expectations on sectoral approaches

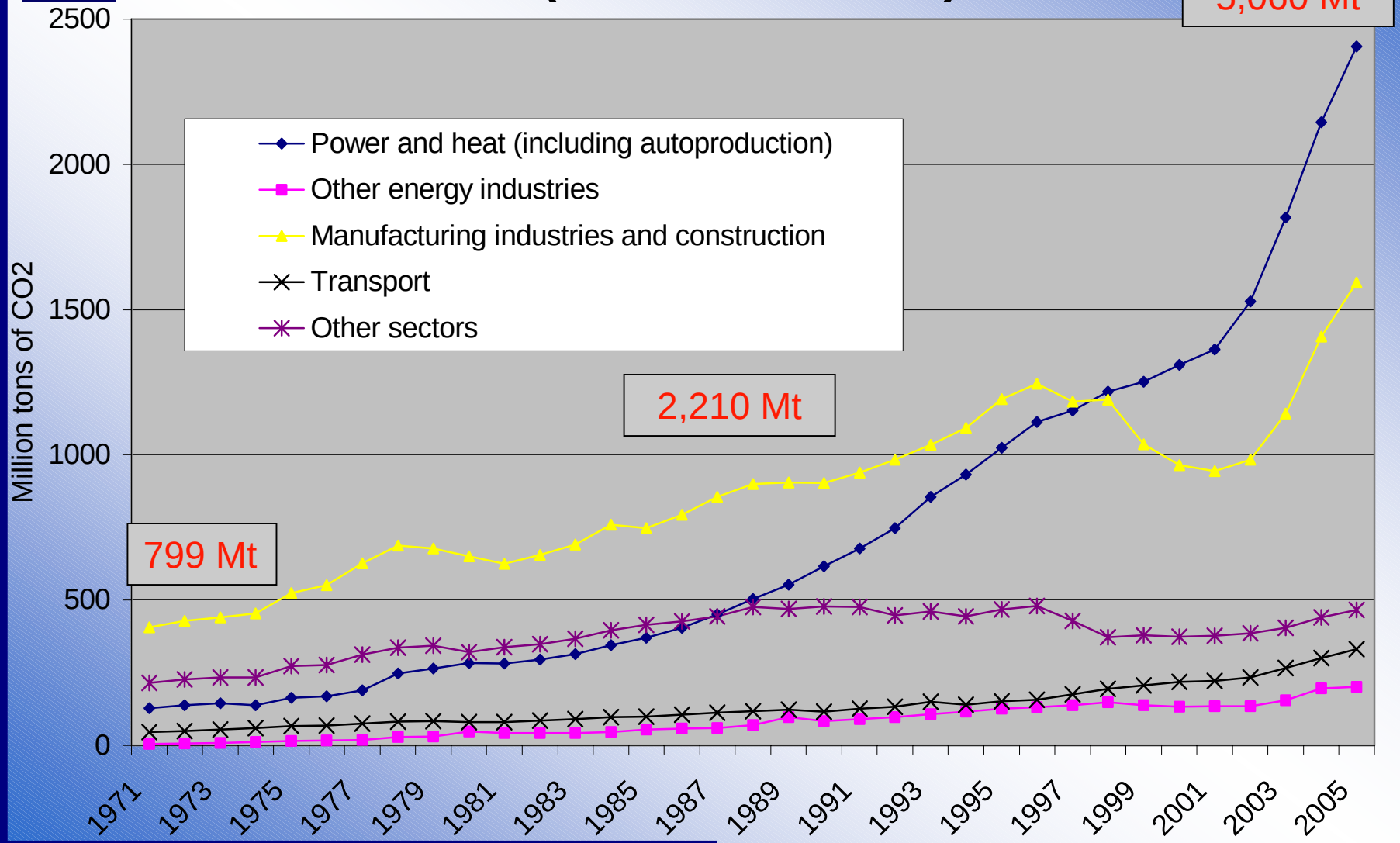
- Sectoral expertise needed to envision ambitious GHG goals
  - But refrain from "planning" each sector's contribution - a proper CO_2 price should do that
  - SA should be compatible with some form of CO_2 pricing
- Options for SA to date offer no straightforward solutions to competitiveness concerns
  - Starting points (in Annex I and outside) differ widely
  - Can international industry groups offer a convincing, ready-made approach to governments? To be continued (CSI, IISI)
- Sector-based commitments for developing countries?
  - Must consider implications of broadening GHG crediting
  - Technically, power generation offers interesting prospects

Approches sectorielles et secteur électrique

Approches sectorielles et production d'électricité

- Périmètre? les pays émergents
- Type? Objectif non-contraignant ("non-binding")
  - Le premier secteur émetteur, à croissance très rapide dans les pays émergents
  - Des enjeux compétitifs moindres que ceux des grands secteurs industriels
  - Des potentiels d'amélioration bien identifiés
  - "Crédits CO_2": des méthodologies établies dans le CDM (MDP)
    - Crédits désormais possibles pour les centrales à charbon efficaces
  - Formulation des objectifs sectoriels: tCO_2/MWh
    - Spécifique aux combustibles?
    - Spécifique à chaque pays, au vu des ressources locales?

CO_2 emissions in China
(1971, 1990, 2005)



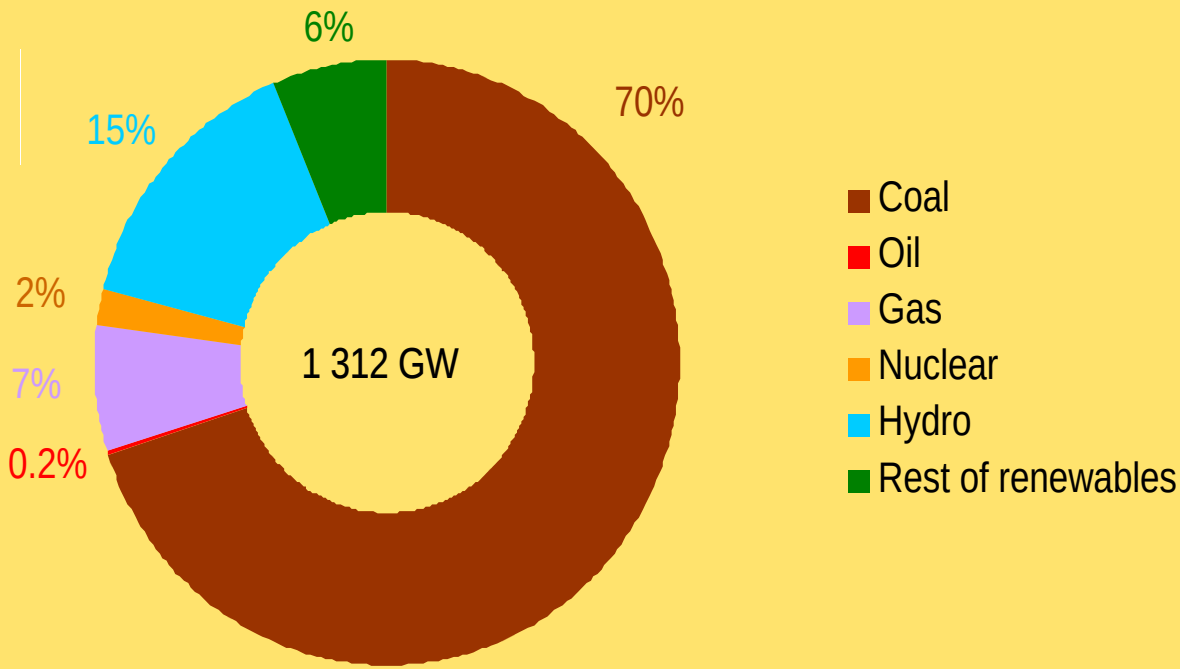
INTERNATIONAL ENERGY AGENCY

WORLD ENERGY OUTLOOK 2007

China and India Insights

Reference Scenario:

Power Generation Capacity Additions in China, 2006-2030



Most of the increase in coal demand comes from power generation

Questions à résoudre

- **Articulation des politiques offre / demande**
  - **Crédits CO_2 bénéfiques du côté de la génération**
  - **Quelles politiques pour contenir la croissance de la demande – et limiter les coûts futurs de dé-carbonisation?**
- **Questions politiques**
  - **Partage du coût? CDM: coût financé à 100% par le "marché carbone" – quid si l'on passe à l'échelle sectorielle?**
  - **Et, toujours: comment assurer l'équilibre offre demande sur le marché du carbone dès lors qu'on crédite du CO_2 à l'échelle de secteurs, et non plus de projets?**

Avenir des approches sectorielles?

- Soutien politique fort à Bali
  - Mais des intérêts multiples, divergeants?
- Volonté politique des pays émergents en vue d'objectifs sectoriels?
- Capacité institutionnelle de mener ces engagement sectoriels à bien?
- Interactions avec le futur marché du carbone?
- Quid des problèmes de compétitivité?

References on sectoral approaches

Baron R. et alii (2007) Sectoral approaches to greenhouse gas mitigation – Exploring issues for heavy industry. www.iea.org

Asia Pacific Partnership on Clean Development and Climate (2006): Charter for the Asia-Pacific Partnership on Clean Development and Climate, 12 January 2006.

Baron R. (2006): Sectoral approaches to greenhouse gas mitigation – Scenarios for integration. OECD/IEA, Paris

Baron R. and J. Ellis (2006): Sectoral crediting mechanisms for greenhouse gas mitigation: institutional and operational issues. OECD/IEA, Paris

Baumert K., Herzog T., Pershing J. (2005): Navigating the Numbers – Greenhouse Gas Data and International Climate Policy. World Resources Institute, Washington DC.

Ellis J. and R. Baron (2005): Sectoral crediting mechanisms: an initial assessment for electricity and aluminium. OECD/IEA, Paris

METI, Tanaka K., Sasaki K., Tagami T., Kudo H. (2005): *Analysis of a Sectoral Approach for Diffusing Existing Mitigation Technologies*. Minister of Economy, Trade and Industry, October 4, 2005, Japan. November 2, 2005.

Philibert C., Pershing J., (2001). “Considering the options: climate targets for all countries”, Climate Policy, 1: 211-227.

Reinaud J. (2004) Industrial competitiveness and the EU emissions trading scheme. IEA Information Paper.

Schmidt J., Helme N. (2005): Operational Issues for a Sector-Based Approach: Questions and Answers. Center for Clean Air Policy. October 2005.

Si le temps le permet…

Améliorer l'efficacité du système de quotas européen?

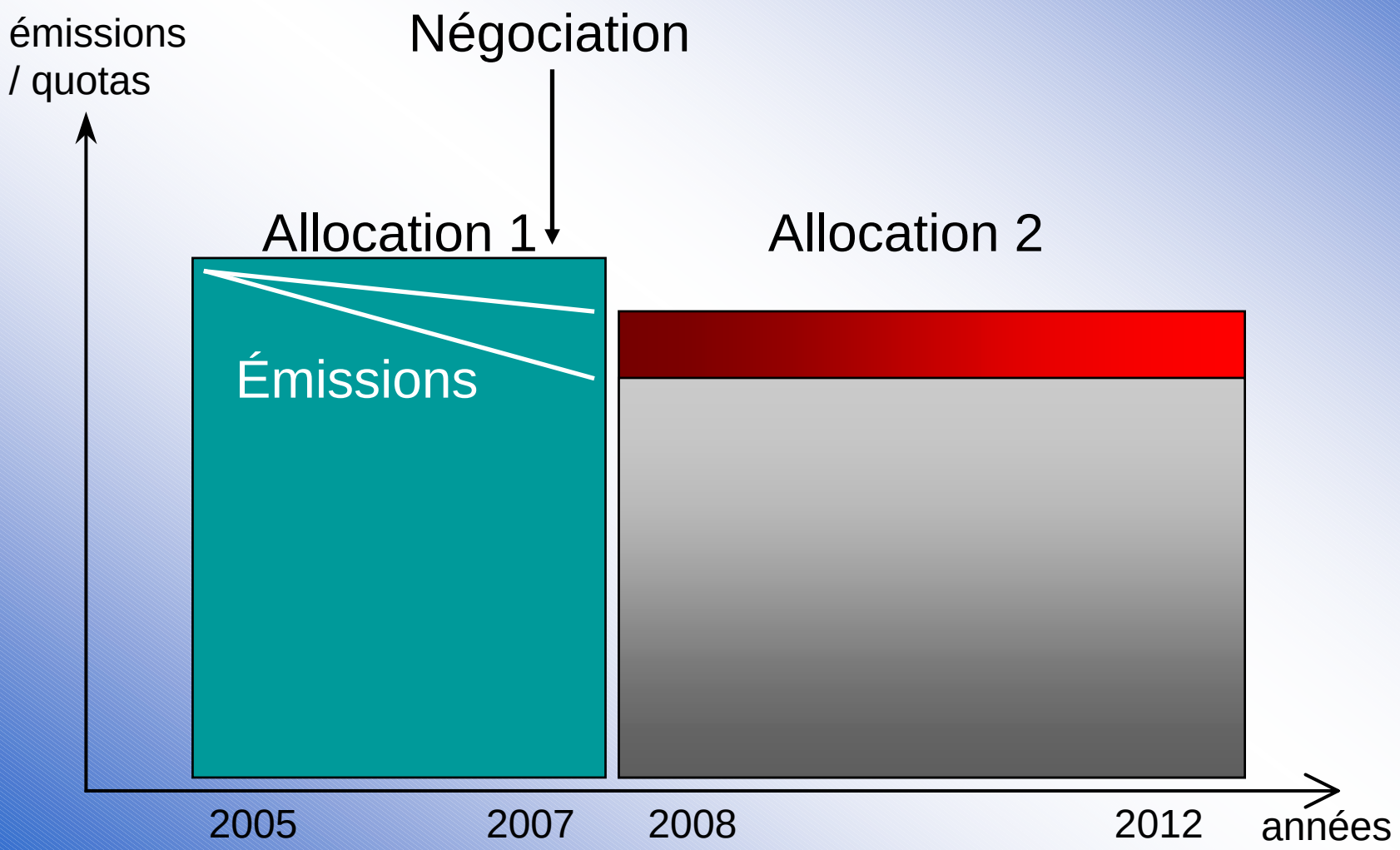
Quelles incitations ?

- Le prix du carbone couplé à l'existence de quotas doit inciter à des investissements (ou des mises au rebut de capital productif) jusqu'au point où le coût marginal des émissions évitées atteint le prix du carbone sur le marché
- Illustration :
  - Fermer une centrale au charbon et investir dans une centrale efficace au gaz naturel si le prix dépasse durablement € 20 / tCO_2
    - Les quotas excédentaires dégagés peuvent être vendus
- Dans la Directive : pas d'allocation à long terme (cf. SO_2)
  - Les Plans d'allocation prévoient de récupérer les quotas libérés par la fermeture de l'installation (= une perte d'actifs)
  - Les objectifs de la période suivante seront forcément inflencés par les émissions de la période actuelle
  - Double incitation à ne pas engager des changements radicaux de production si ceux-ci réduisent trop les émissions

Quelles incitations ?

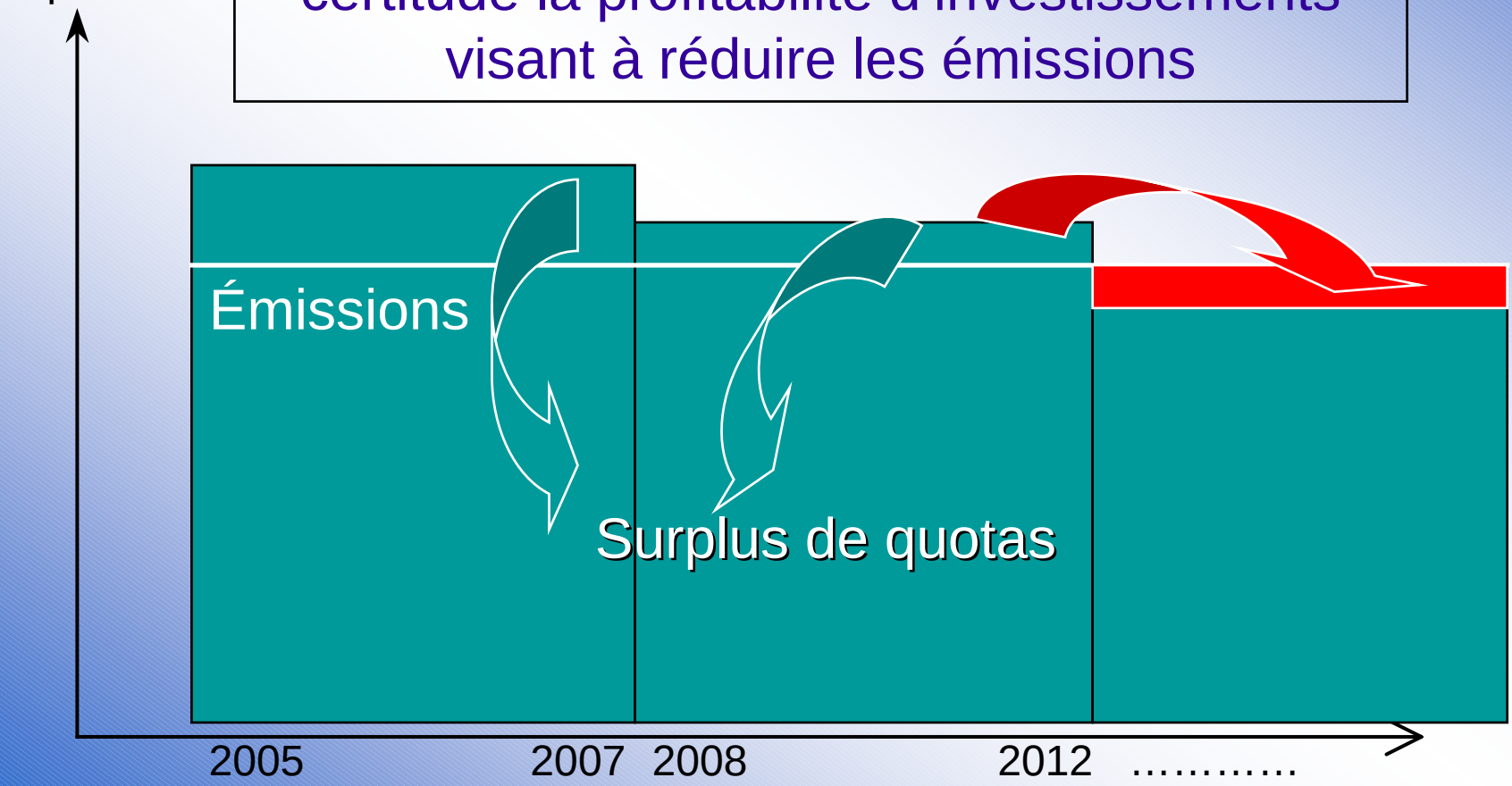
- Le prix du carbone couplé à l'existence de quotas doit inciter à des investissements (ou des mises au rebut de capital productif) jusqu'au point où le coût marginal des émissions évitées atteint le prix du carbone sur le marché
- Illustration :
  - Fermer une centrale au charbon et investir dans une centrale efficace au gaz naturel si le prix dépasse durablement € 20 / tCO_2
    - Les quotas excédentaires dégagés peuvent être vendus
- Dans la Directive : pas d'allocation à long terme (cf. SO_2)
  - Les Plans d'allocation prévoient de récupérer les quotas libérés par la fermeture de l'installation (= une perte d'actifs)
  - Les objectifs de la période suivante seront forcément inflencés par les émissions de la période actuelle
  - Double incitation à ne pas engager des changements radicaux de production si ceux-ci réduisent trop les émissions

Négociation répétée des quotas : une moindre incitation à réduire



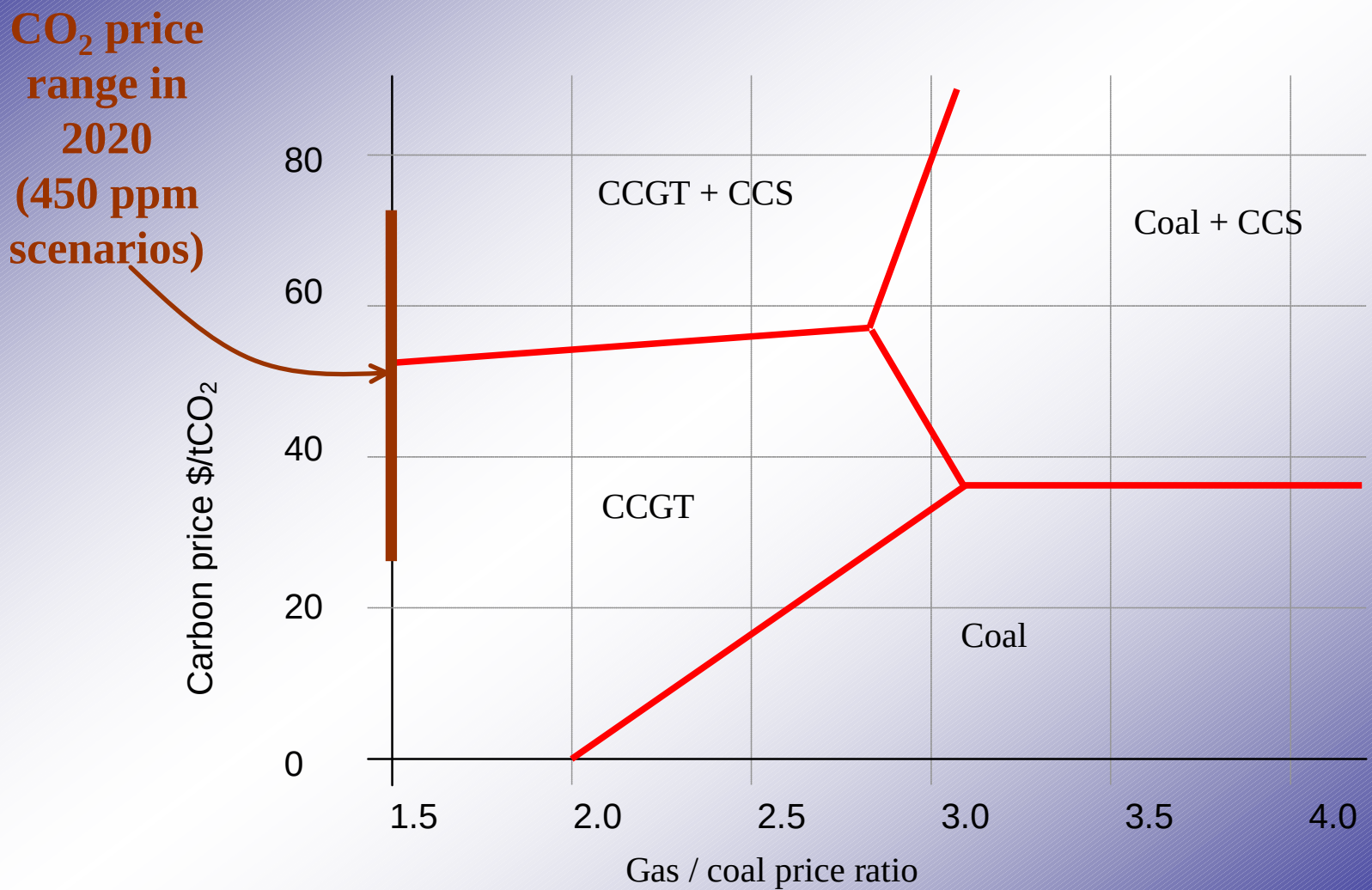
Une alternative ?

Une allocation claire à moyen / long terme permettrait d'envisager avec plus de certitude la profitabilité d'investissements visant à réduire les émissions



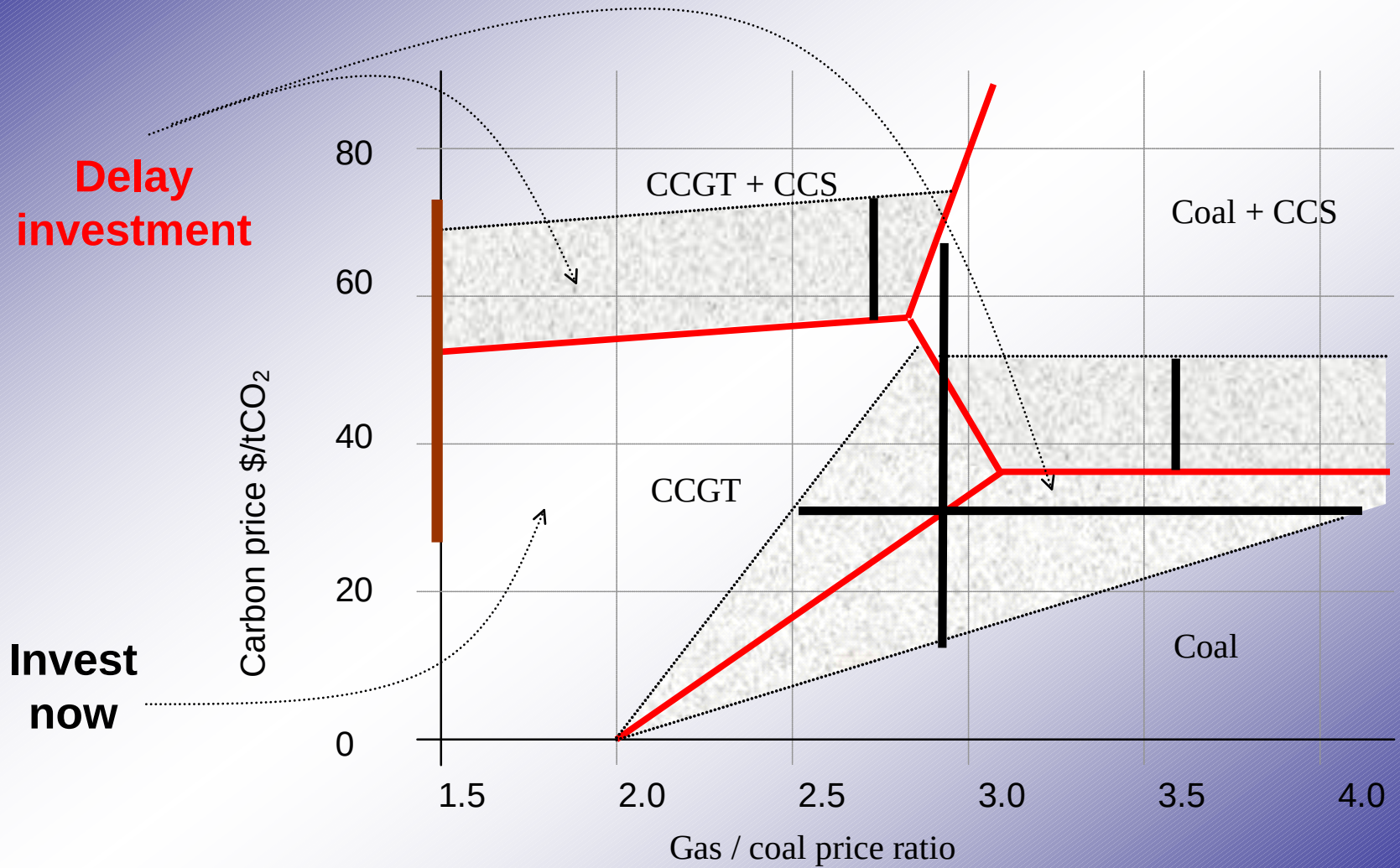
Une intuition confirmée … par une simulation théorique des décisions d'investissement dans l'incertain

Where should the next investment go? Look at relative prices…

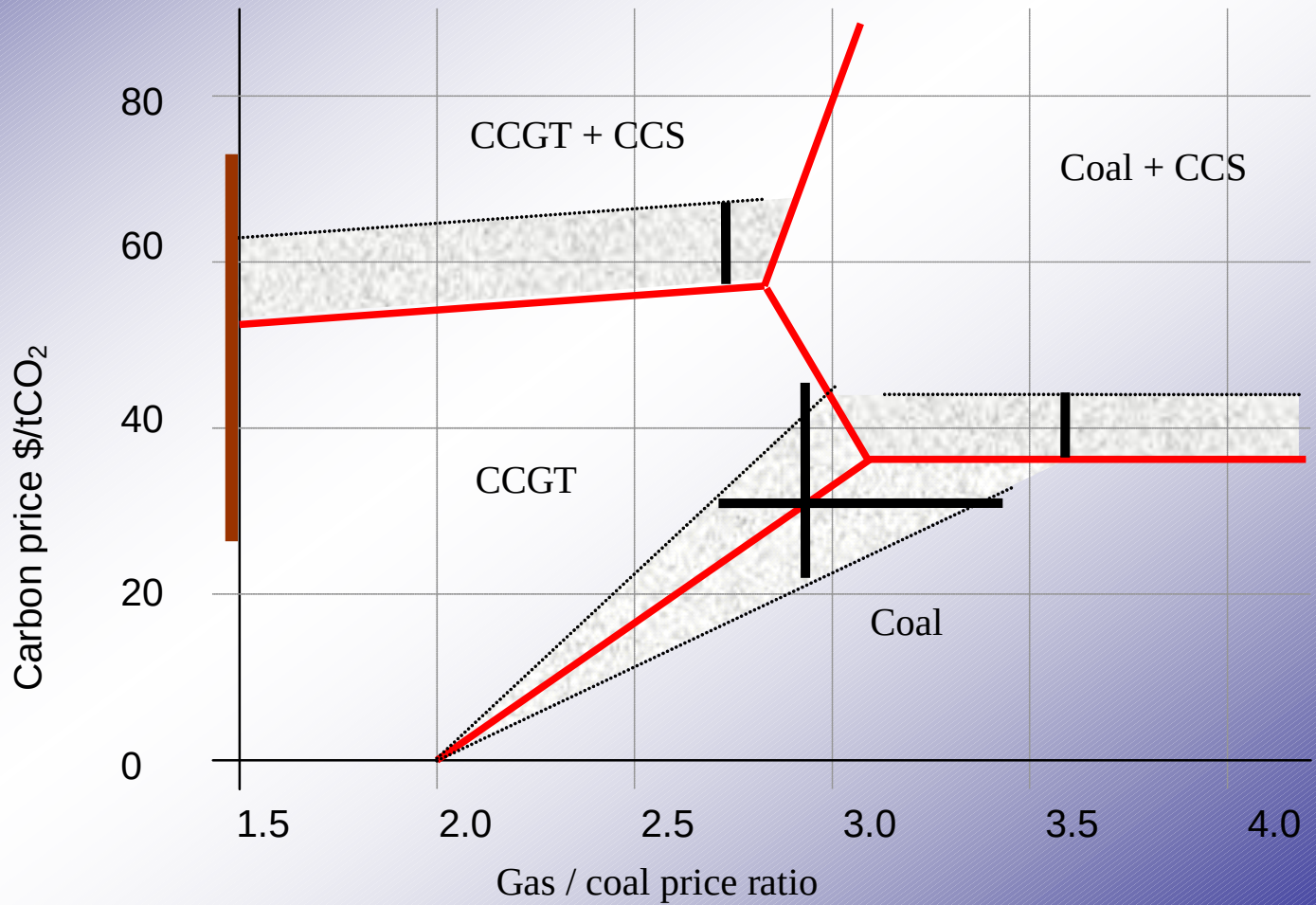


CCGT: combined cycle gas turbine – **CCS**: carbon capture and storage

If you expect a CO_2 price shock in 5 years: consider waiting



With a 10-year CO_2 allocation, investment choices are clearer



Sources: **IEA, 2007, Climate Policy Uncertainty and Investment Risk.**