Electricity Policy Research Group

UNIVERSITY OF CAMBRIDGE

Avoiding collusion and market power

David Newbery

Auctioning carbon allowances in the ETS

DG Environment Brussels

22 February 2008

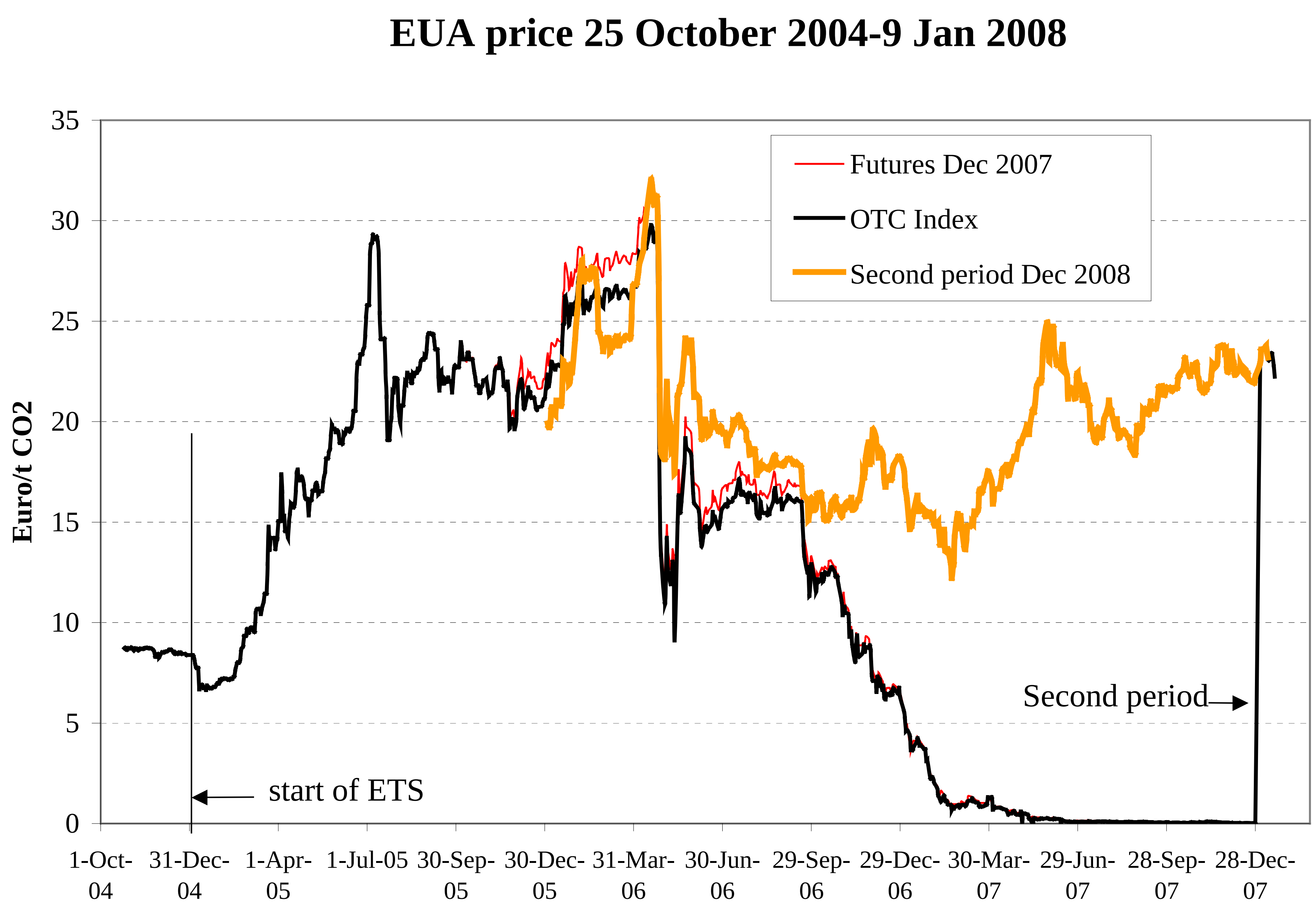
http://www.electricitypolicy.org.uk

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

The argument

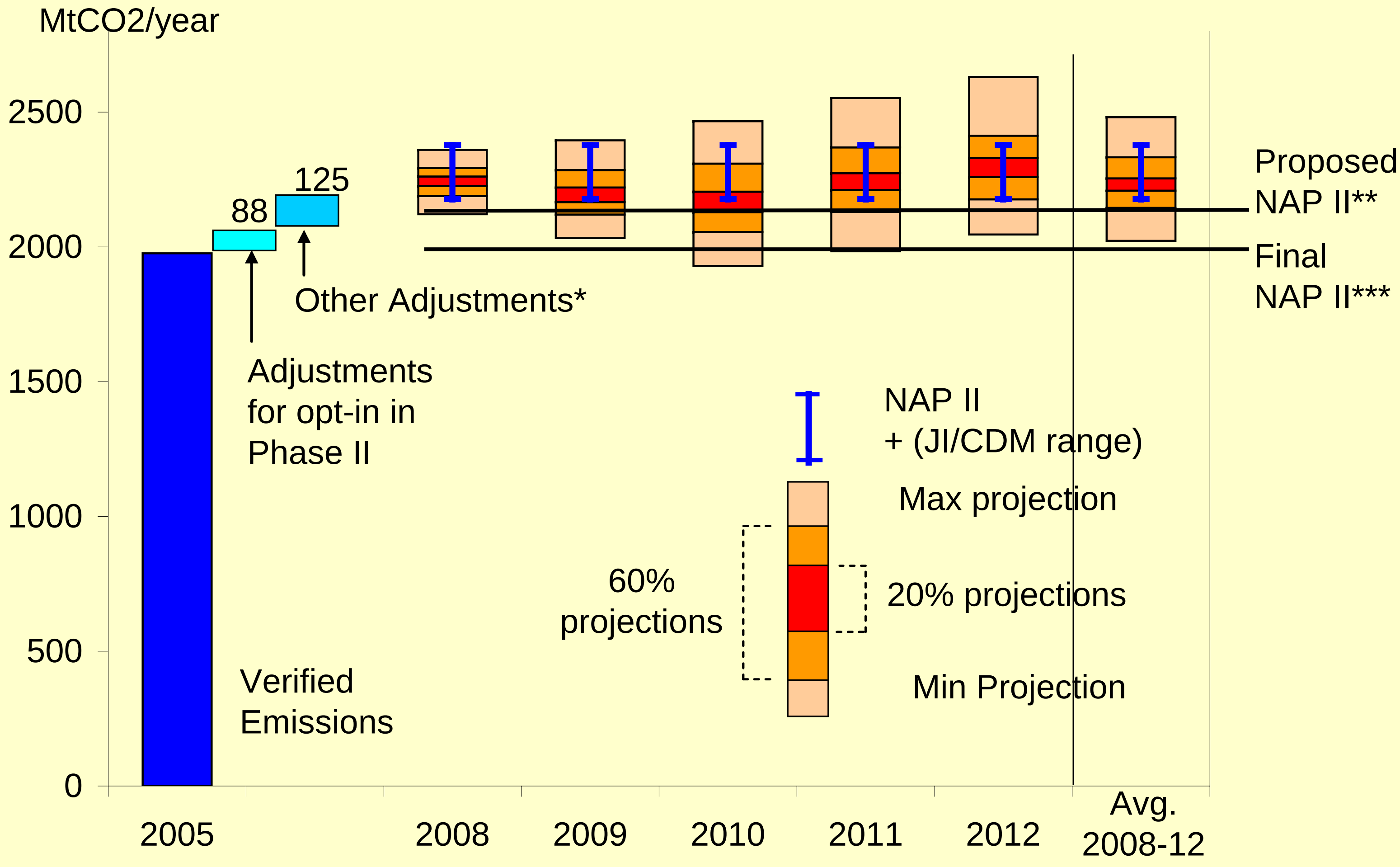
- Markets to examine for market power
  - EUA market
  - electricity markets
  - gas markets
- EUA price affects electricity & gas prices
  - who has incentive to influence EUA price?
  - Who has ability to do so?
- Effect of quantity limit on gas market power

  => Stabilising EUA price desirable



EUA price 25 October 2004-9 Jan 2008
Euro/t CO2
35
30
25
20
15
10
5
0
1-Oct-04
31-Dec-04
1-Apr-05
1-Jul-05
30-Sep-05
30-Dec-05
31-Mar-06
30-Jun-06
29-Sep-06
29-Dec-06
30-Mar-07
29-Jun-07
28-Sep-07
28-Dec-07
Futures Dec 2007
OTC Index
Second period Dec 2008
start of ETS
Second period

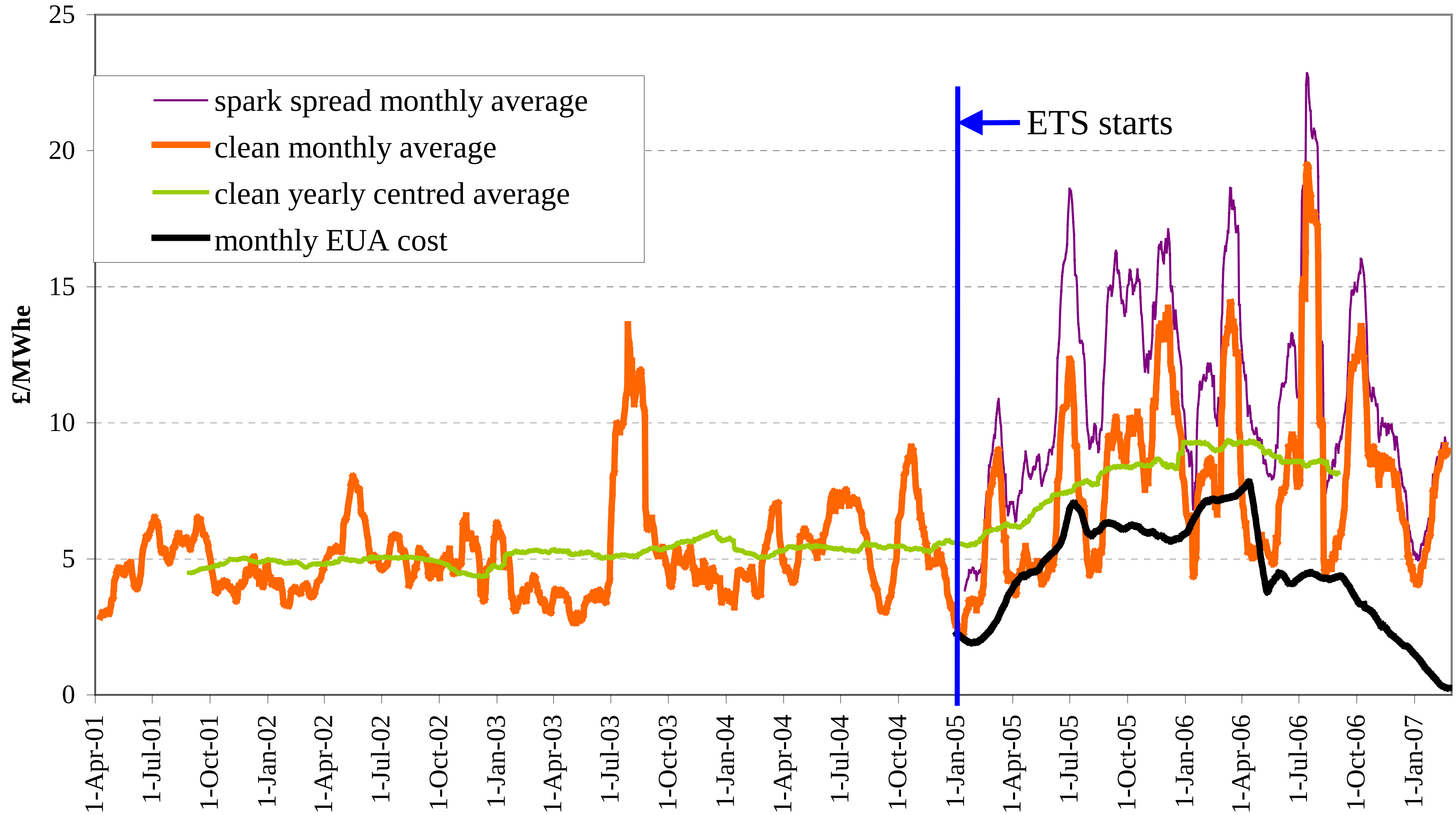
Emission projections – large utilities is there a risk of price collapse?



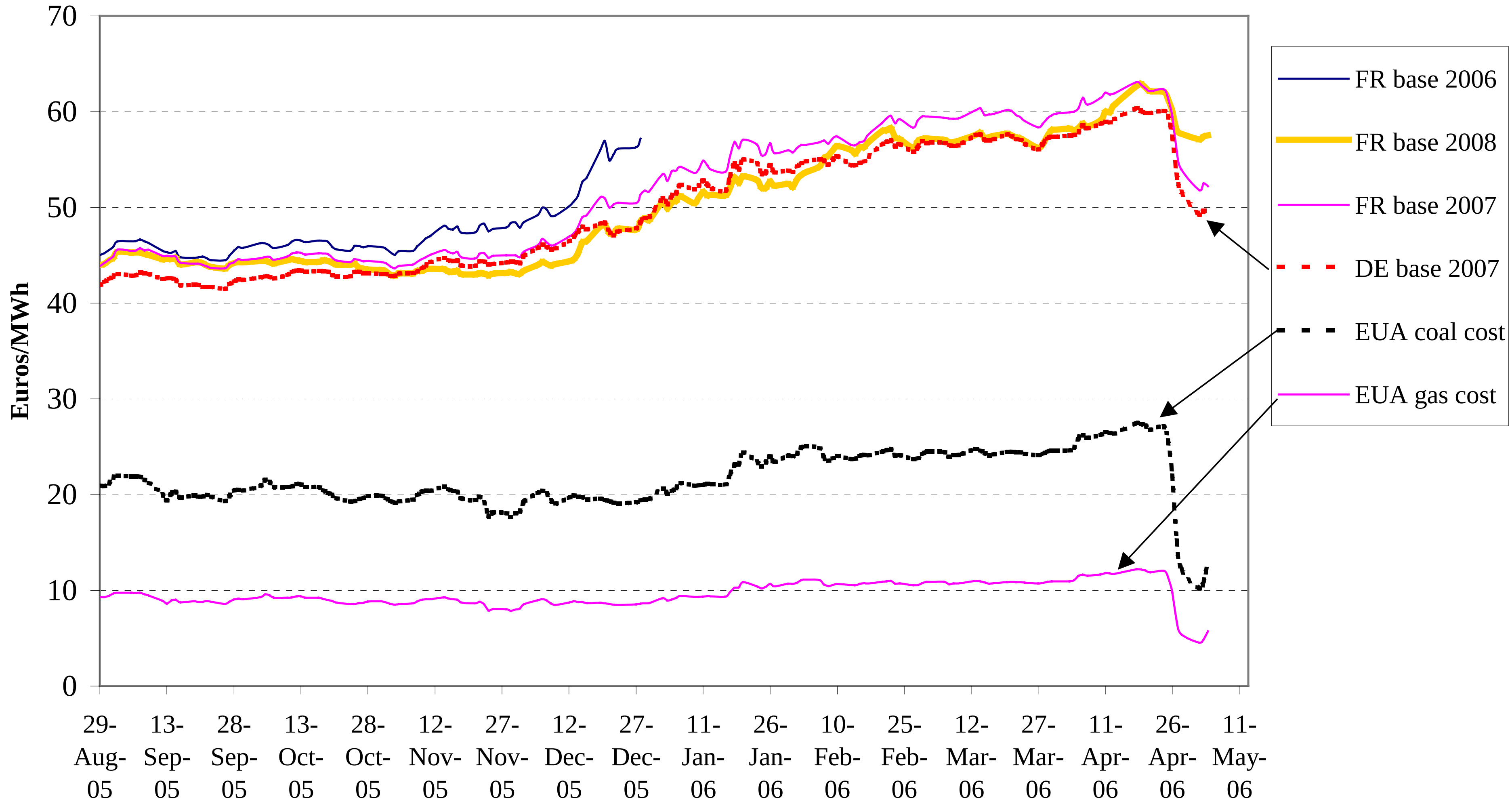
Source: Emissions Projections 2008-2012 versus NAP2 (2006) by Karsten Neuhoff, Federico Ferrario and Michael Grubb. Published in Climate Policy 6(5), pp 395-410.

Electricity price rise higher than gas cost increase

Clean spark spread UK (50% efficient) monthly averages (profitable hours only)



Forward base year contracts - France and Germany Aug 2005-May 2006

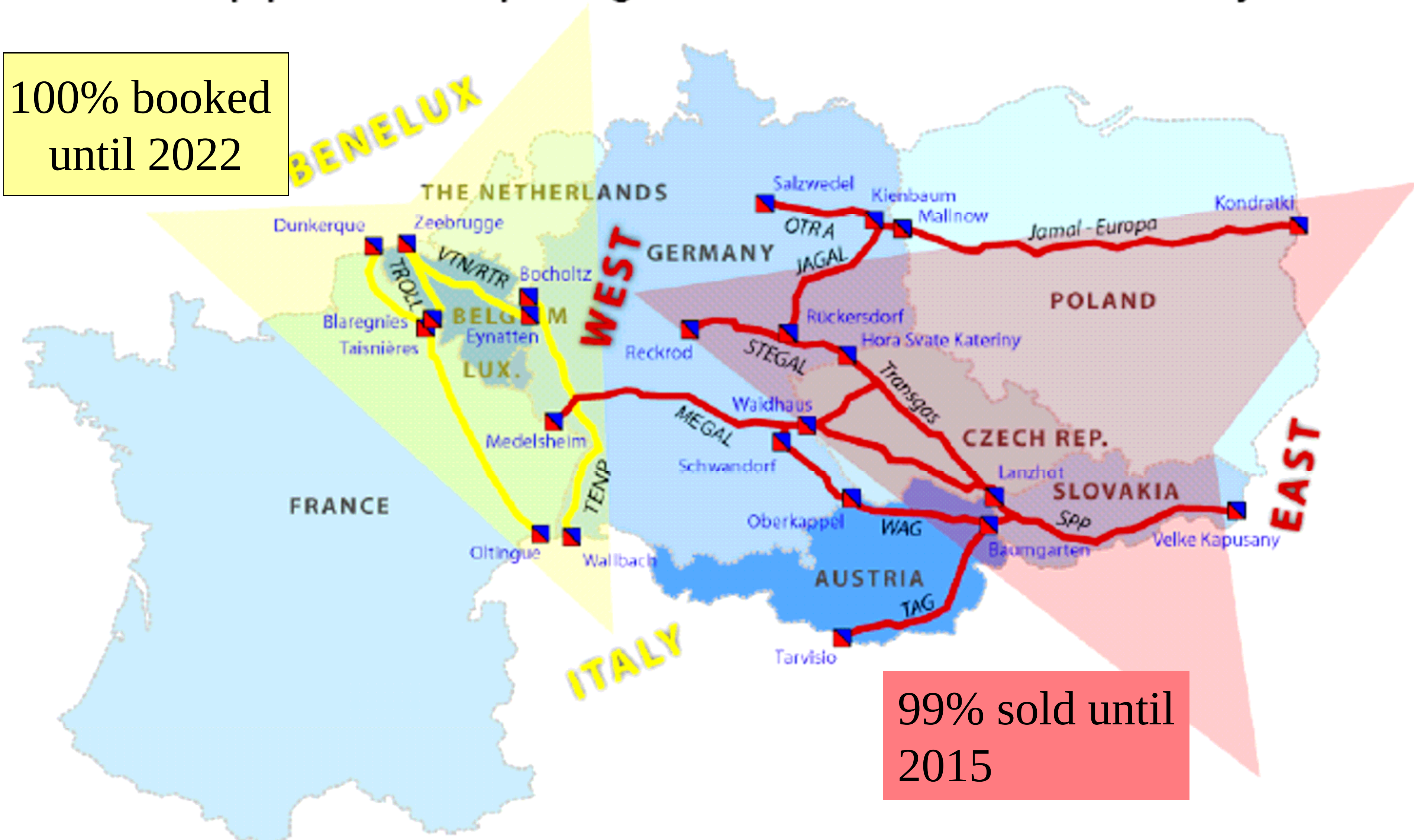


Relevant markets and actors

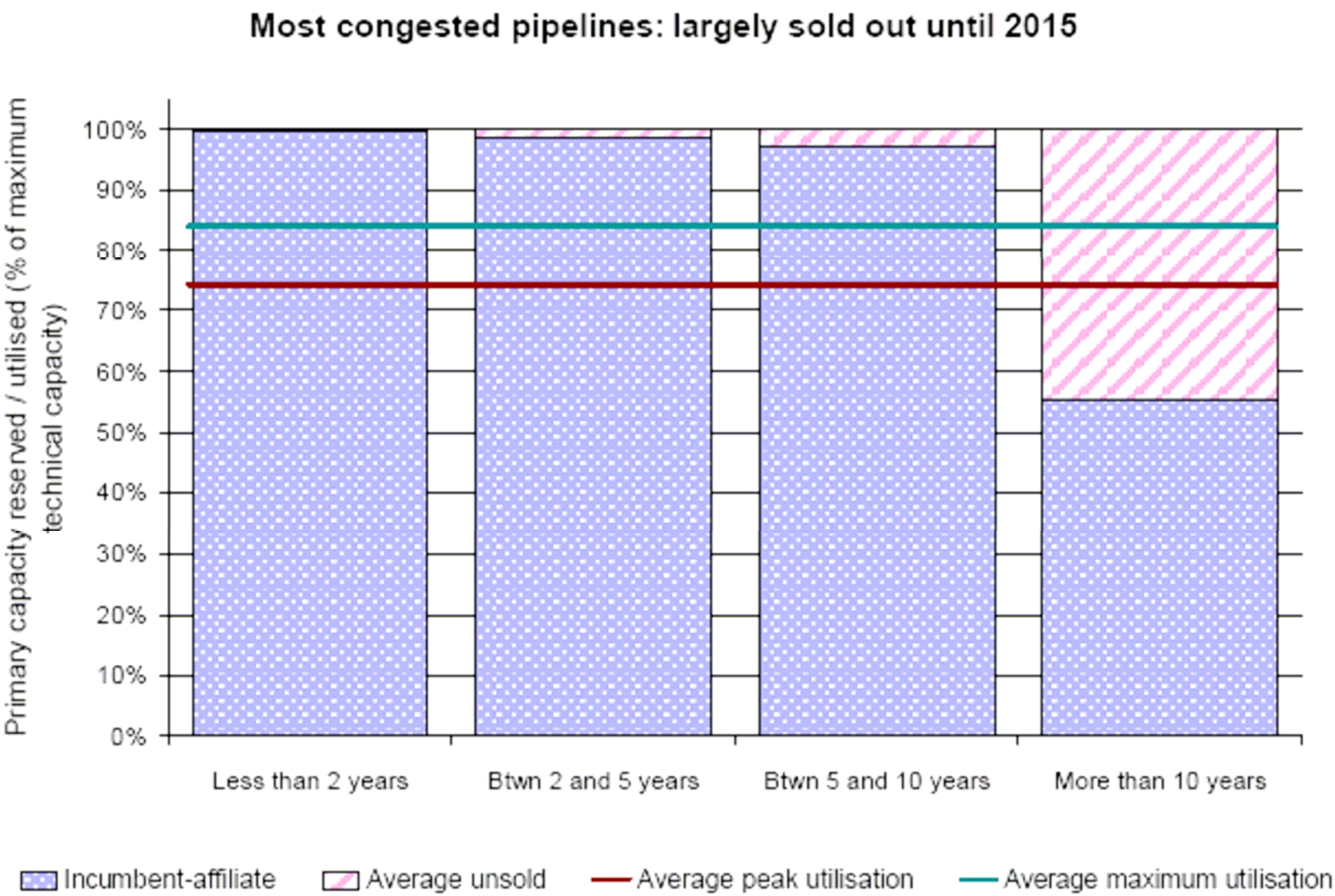
- EUA: traders, speculators - too small
- Electricity wholesale market: generators
- Gas wholesale market: those controlling access to markets, gas suppliers, integrated gas+electricity companies

Only relevant if actors have ability to influence relevant price

Transit pipelines comprising the East-West and Benelux-Italy axes

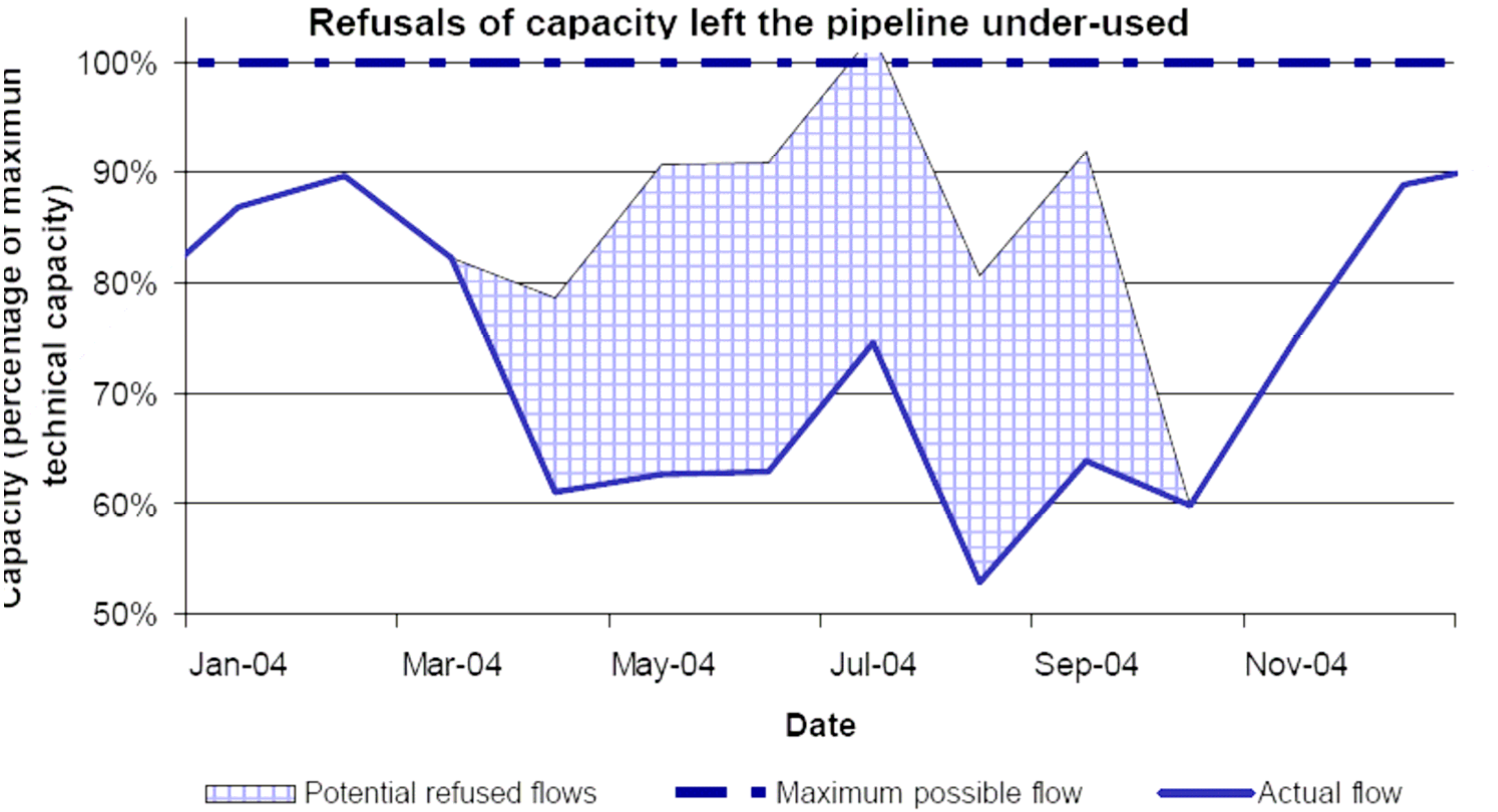


Source: Energy Sector Inquiry 2005/2006



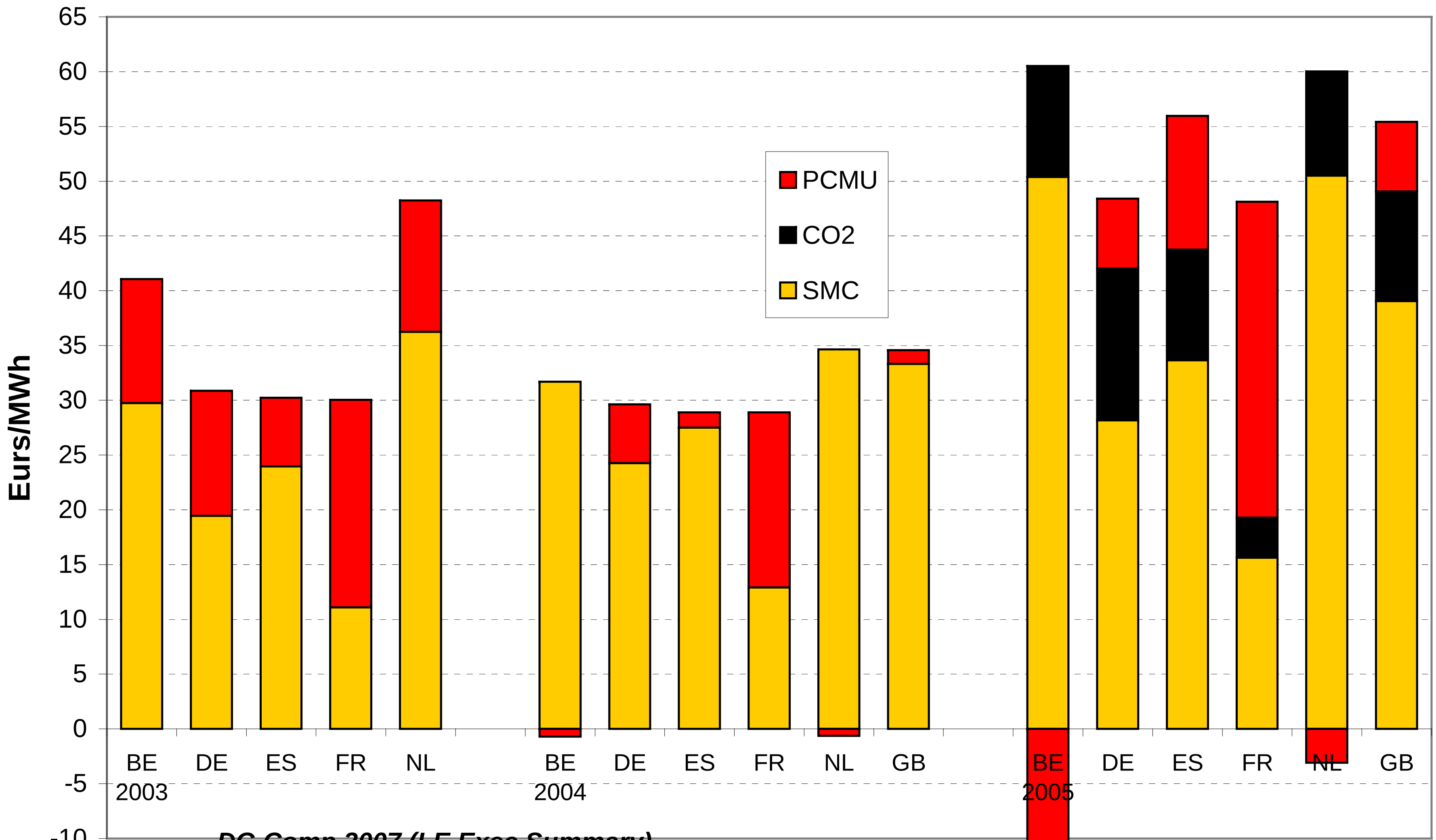
Source: Energy Sector Inquiry 2005/2006

Transit pipelines deny access



Source: Energy Sector Inquiry 2005/2006 fig 27

Price formation in 6 EU countries 2003-5



DG Comp 2007 (LE Exec Summary)

Incentives in electricity market

- Allocation of amount (large) E:
  - generators benefit from raising EUA price p_C :
  - $p_C \Uparrow$ price of elec $p_e \Uparrow$ => $E\, p_C \Uparrow$
  - Buy EUAs, burn coal, raise price of gas
- No allocation to ESI, full auctioning:
  - $p_C \Uparrow$ benefits gencos with more infra-marginal fuel
    - Hydro, nuclear, gas if coal at margin, coal if gas at margin
  - $p_C \Downarrow$ benefits gencos with less infra-marginal fuel

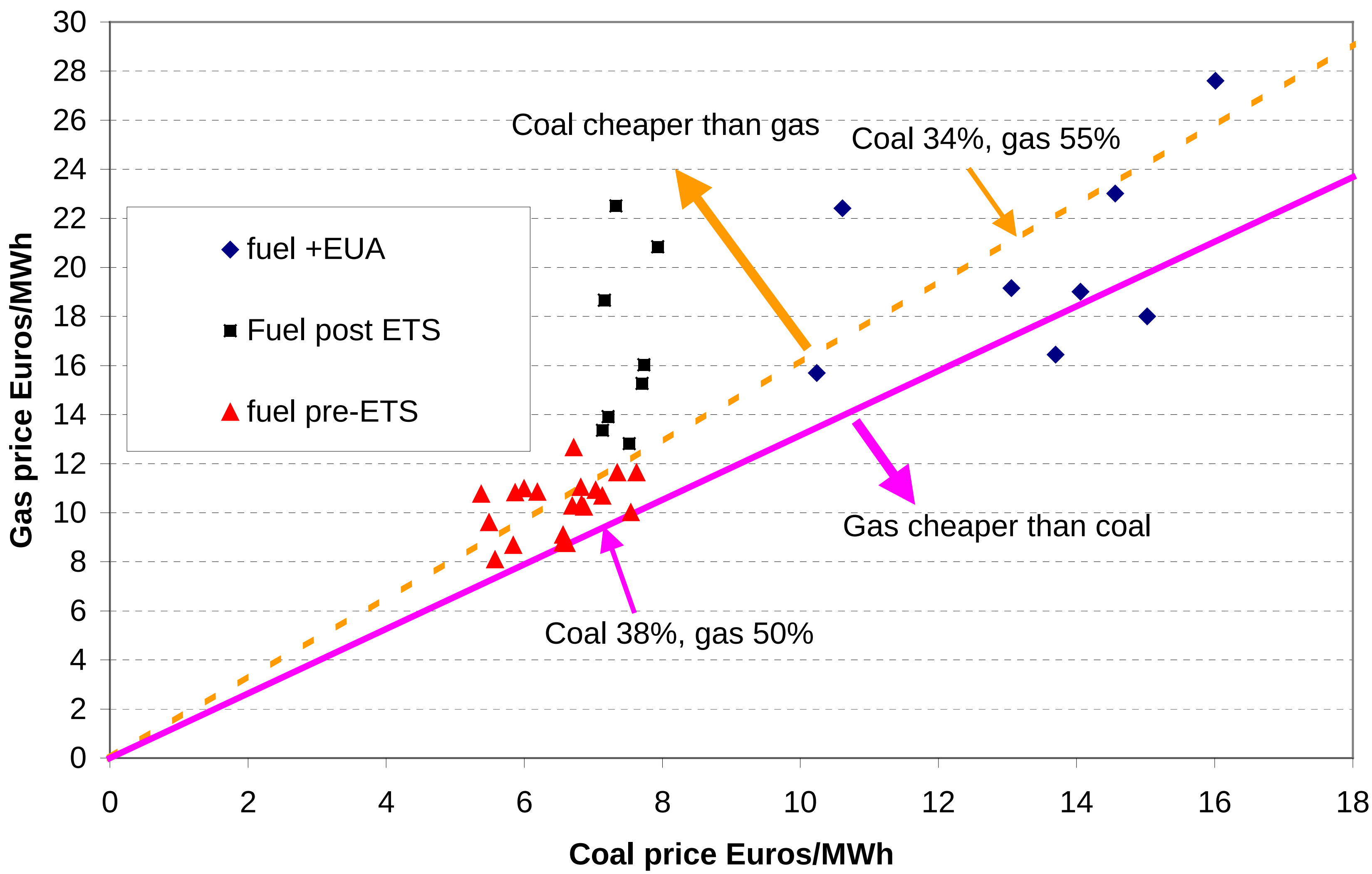
Evidence of more market power one way or other?

Impact on fuel choice

- CO_2 content of coal twice CCGT
- coal generation costs rise more than CCGT

Does it matter?

Fuel choices in UK electricity generation



Impact of ETS on gas pricing

- Suppose gas price increases
  - initially: demand falls (fuel switch gas => coal)

  => demand for EUAs rises => EUA price ⇑

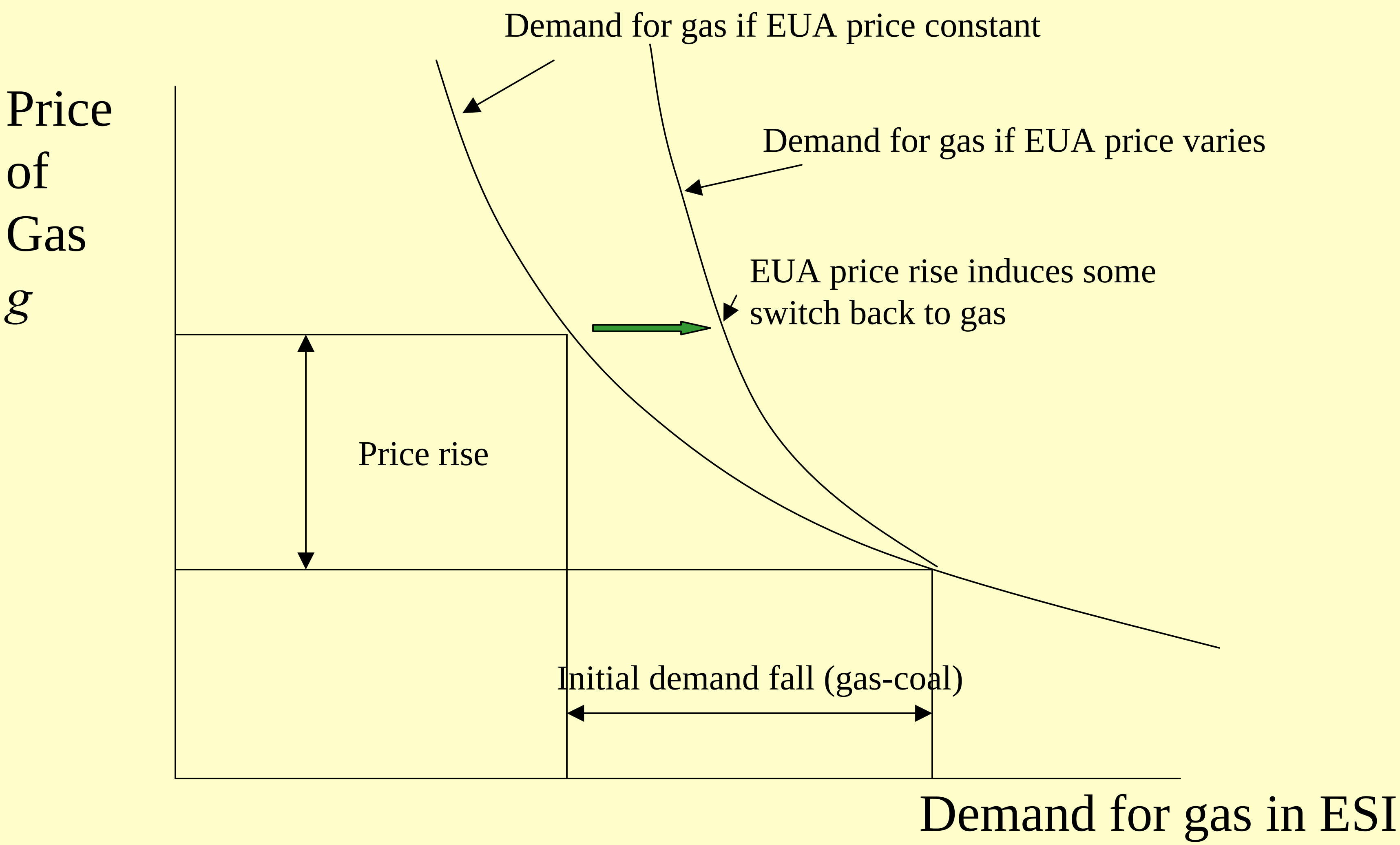
  => partially offsets advantage of coal

  => offsets some demand reduction for gas

  => reduces elasticity of demand for gas

  => increases market power of gas suppliers
    - EU Sector Inquiry finds gas market power

Demand for gas



Impact of ETS on gas elasticity

- reduces absolute value of price elasticity of demand for gas

=> increases market power

- Lerner Index $(p\text{-}c)/p = \alpha_i/\varepsilon$ where α_i is market share of firm, ε is market demand elasticity (or $(p\text{-}c)/p = 1/\varepsilon_{\mathrm{rd}}$ where $\varepsilon_{\mathrm{rd}}$ is elasticity of residual demand)

Policy implications

Fixing EUA quantity amplifies gas market power

=> delink EUA and gas prices

Stabilise CO_2 price

Can this be done by managing auctions?

Any other reasons for stabilising price?

Fixing prices or quantities?

- Aim is to mitigate climate change

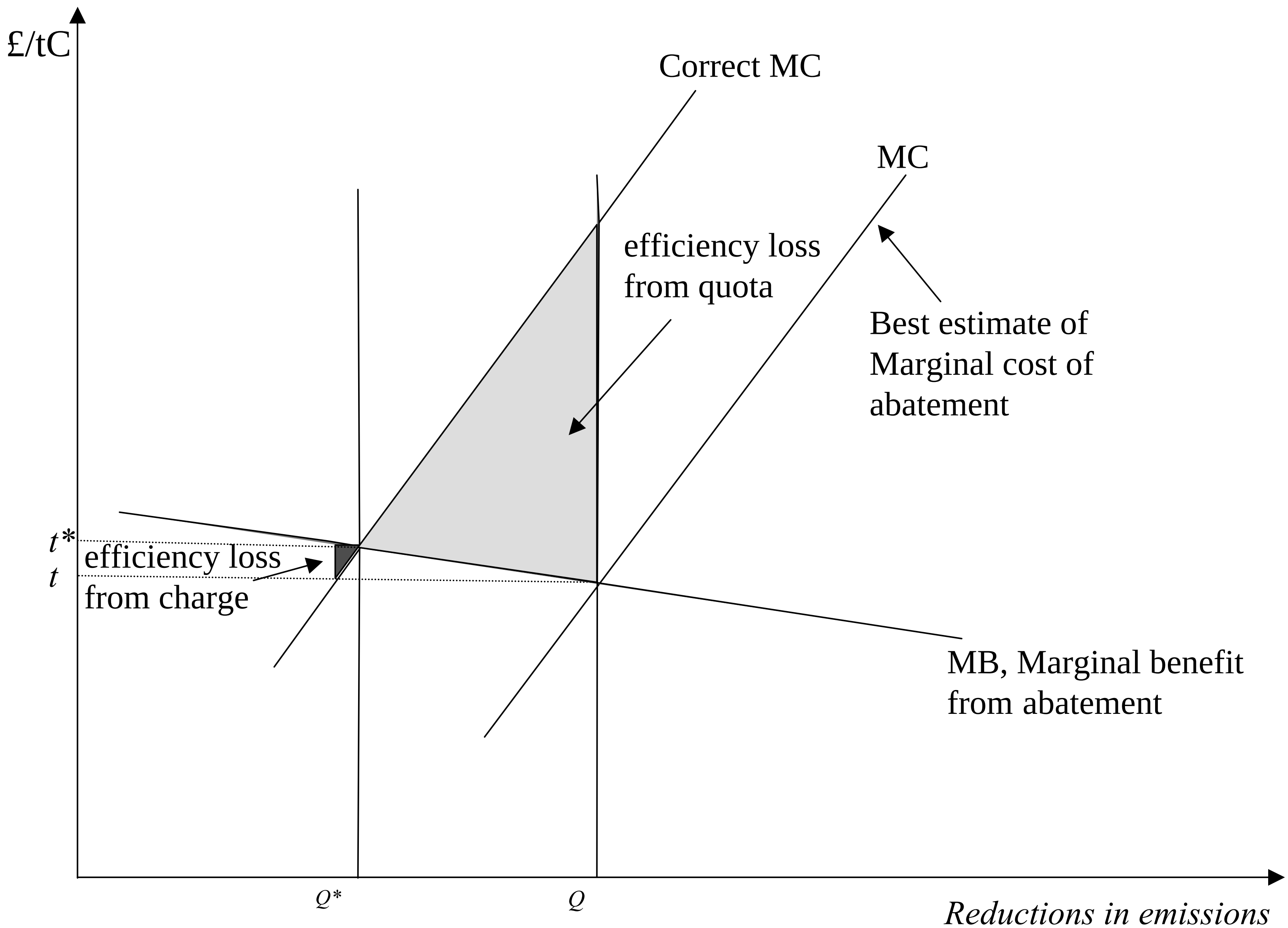
=>improve efficiency & investment in low-C

- helped by stable CO_2 prices
- fixing quantities destabilises price

=> cost of errors higher if marginal cost of abatement steeper than marginal benefit

Stabilise CO_2 price

Costs of errors setting prices or quantities



The case for price stabilisation

- CO_2 is a stock pollutant
  - CO_2 damage today effectively same as tomorrow
    => marginal benefit of abatement essentially flat
  - marginal cost of abatement rises rapidly
  - CCS, other renewables expensive now
  - support RD&D first, commercial deployment later

Auctions to stabilise price

- Decide on EUA price ceiling and floor
  - depends on cost of reducing CO_2
  - €15-20/t CO_2 for nuclear, wind?
- Set number EUAs to auction to achieve this
  - combined with banking and trading
  - allows ceilings and floors to be adjusted

Requires single centralised auction

Summary of interactions with gas

- present ETS imposes a quantity constraint
  - Destabilises CO_2 price
  - Makes gas demand less price sensitive

  => enhances market power of gas producers
- stabilising price better than fixing quantity
  - stock pollutant - damage insensitive to date

=> auction EUAs to stay within ceiling & floor

  - Stable predictable price good for investment
  - Delinks gas and CO_2 prices, reduces market power

Conclusion

- EUA market large, liquid, durable
  - Traders and speculators unlikely to be problem
- Some elec and gas co.s have market power
  - EUA price affects electricity price and gas WTP
- Some co.s may have incentive & ability to influence EUA price
  - Reduced by auctions for electricity
  - Reduced if EUA price delinked from gas price or gas market made more competitive

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Interactions between markets for electricity and CO_2

Let β_i = CO_2/MWh of firm *i*,

β = that of marginal price-setting firm

β_a = CO_2/MWh of ESI

s = EUA price, *p* be electricity price

q_i = output of firm *i*, *Q* = total elec output

$\alpha_i = q_i/Q$; ε = elasticity of electricity demand

$S(s)$ = supply of EUAs to electricity from other sectors = $\beta_a Q$,

$\varepsilon_s = (s/S)dS/ds$, elasticity of supply of EUAs to ESI

Interactions between markets for electricity and CO_2

Extreme case: Cournot assumptions

Max $\Pi_j = p(Q,s)q_j - C_j(q_j) - \beta_j q_j s,$

$$\partial \Pi_j / \partial q_j = 0 = p - MC_j - \beta_j s + q_j \, \partial p / \partial Q +$$

$$q_j (\partial p / \partial s) ds/dQ - \beta_j q_j \, ds/dQ$$

$$p(1 - \alpha_j / \varepsilon) = \{\mathrm{M}C_j + \beta_j s\} - \alpha_j Q(\beta - \beta_j) ds/dQ$$

$$\mathrm{MR} = \mathrm{MC} - \alpha_j s(\beta - \beta_j)/(Q\varepsilon_s)$$

$$p = \mathrm{MC}/(1 - \alpha_j / \varepsilon) + \alpha_j s(\beta_j - \beta)/\{Q\varepsilon_s(1 - \alpha_j / \varepsilon)\}$$

Interactions between markets for electricity and CO_2

$$\text{Max } \Pi_j = p(Q,s)q_j - C_j(q_j) - \beta_j q_j s,$$

$$\partial \Pi_j / \partial s = q_j(\partial p / \partial s) - \beta_j q_j$$

$$= q_j(\beta - \beta_j)$$