

# Impacts of the EU ETS on Electricity Prices

**Prof. P. Capros**

**E3Mlab - NTUA, [kapros@central.ntua.gr](mailto:kapros@central.ntua.gr)**

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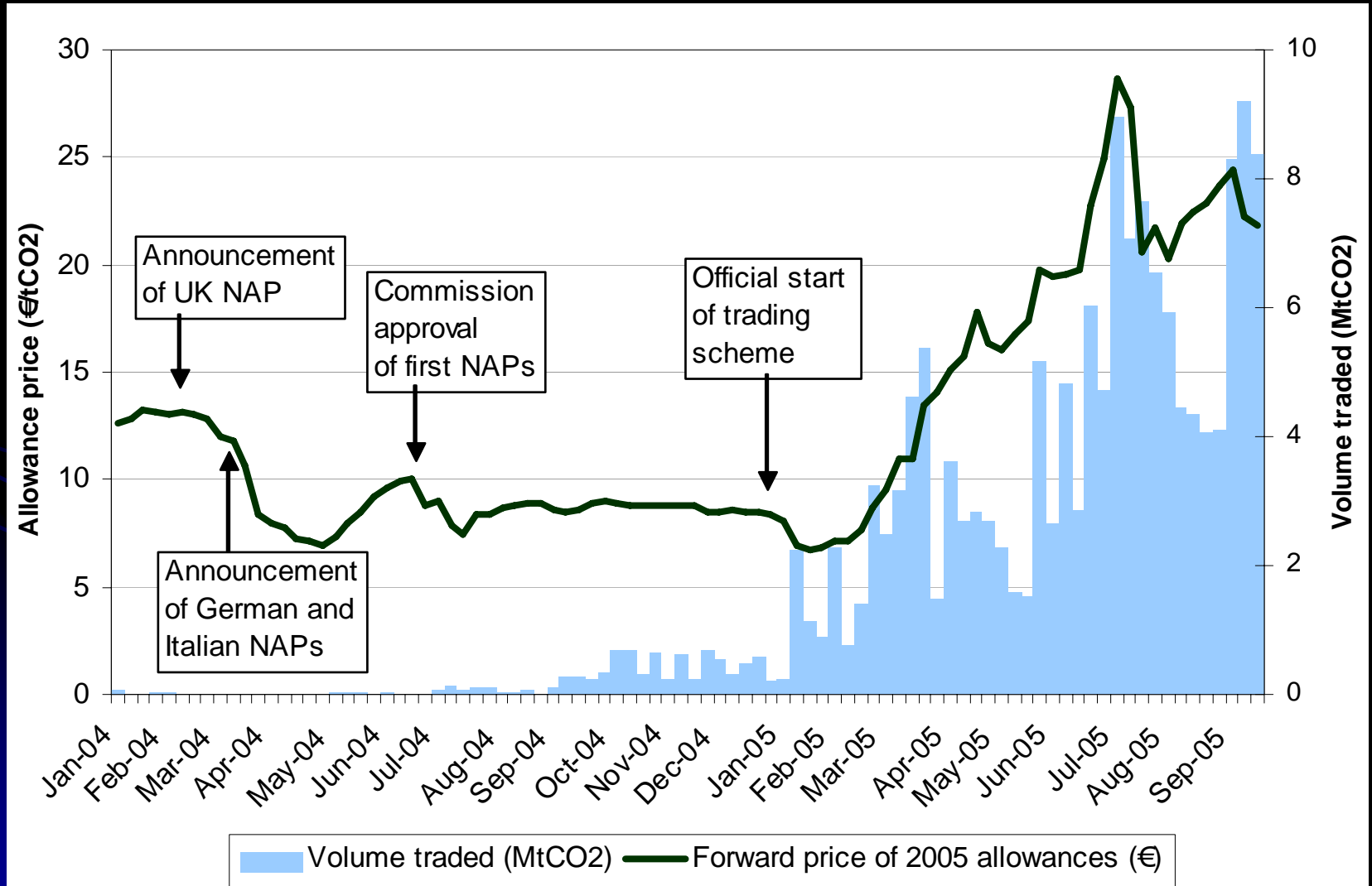
# The EU ETS - definition

- Cap and Trade system
  - Cap defined by a National Allocation Plan (NAP)
  - The cap set so as to reduce, from a reference, total carbon emissions in the ETS sector
- Spot EU-wide market of allowances sets a spot price: all transactions at that price
  - An electricity generator would buy allowances if bound by the cap and marginal abatement cost higher than allowance price; otherwise it would sell

# The EU ETS – impact on costs

- Paying for allowances increases variable cost of power generation, therefore electricity prices are affected
  - Directly whenever marginal plant's variable cost set the wholesale price
  - Indirectly depending on the extent to which firms have the market power to pass through costs to consumers
- Total costs are less affected than marginal costs because most of the allowances are granted for free

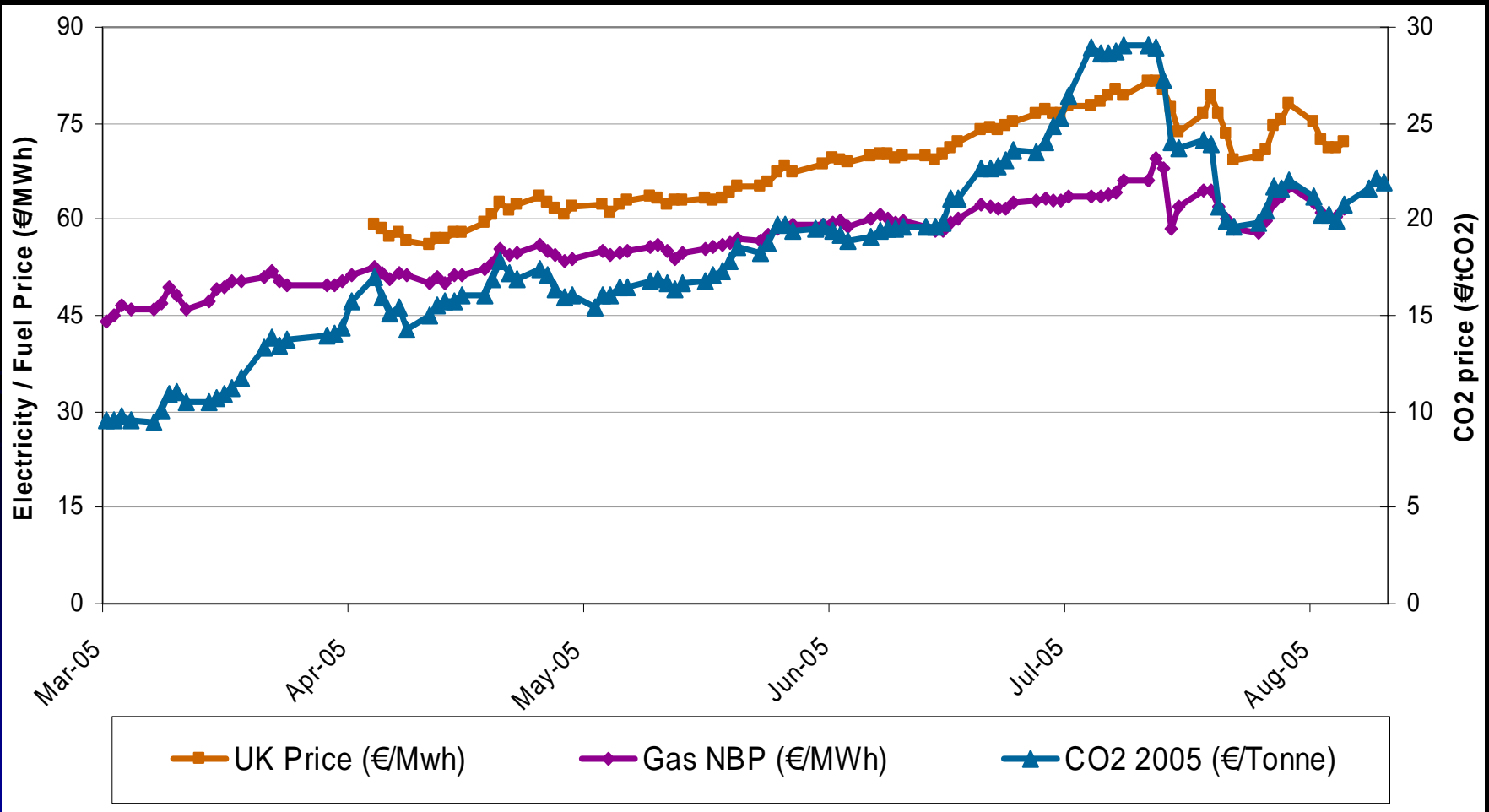
# The Spot Market for Carbon experiences high prices

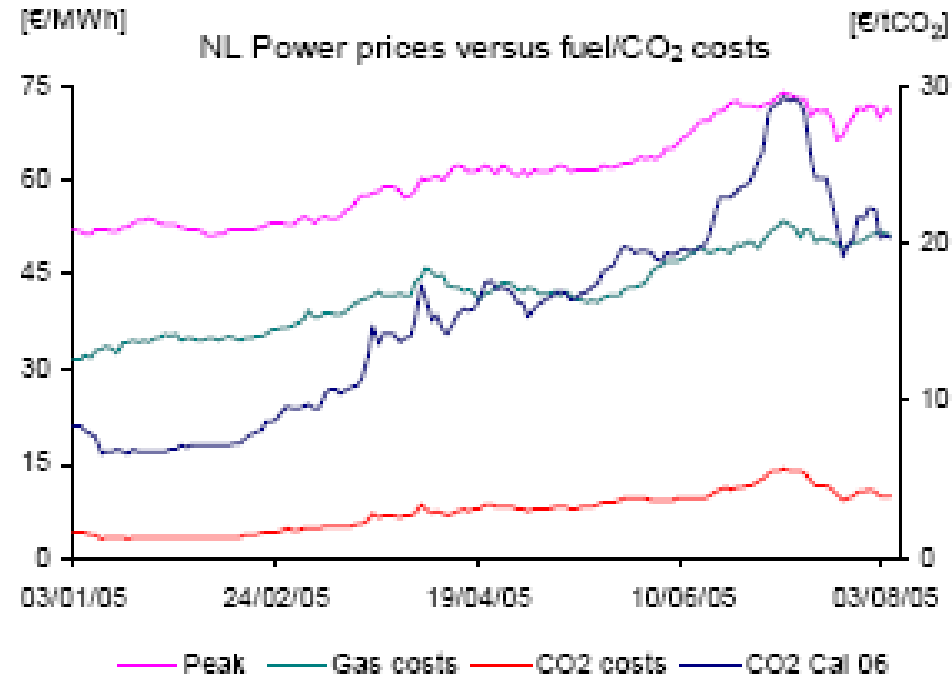
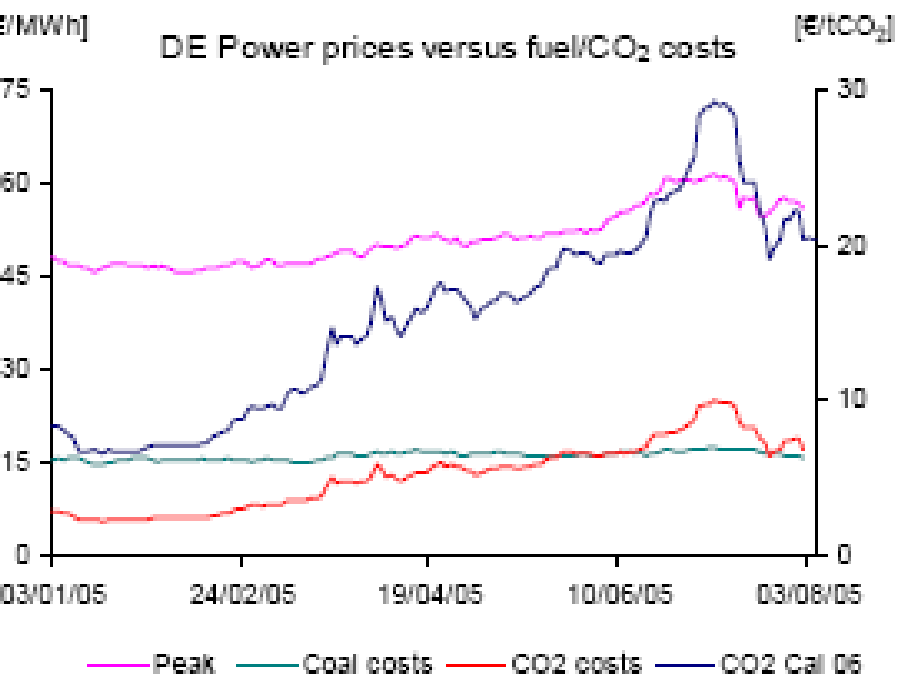
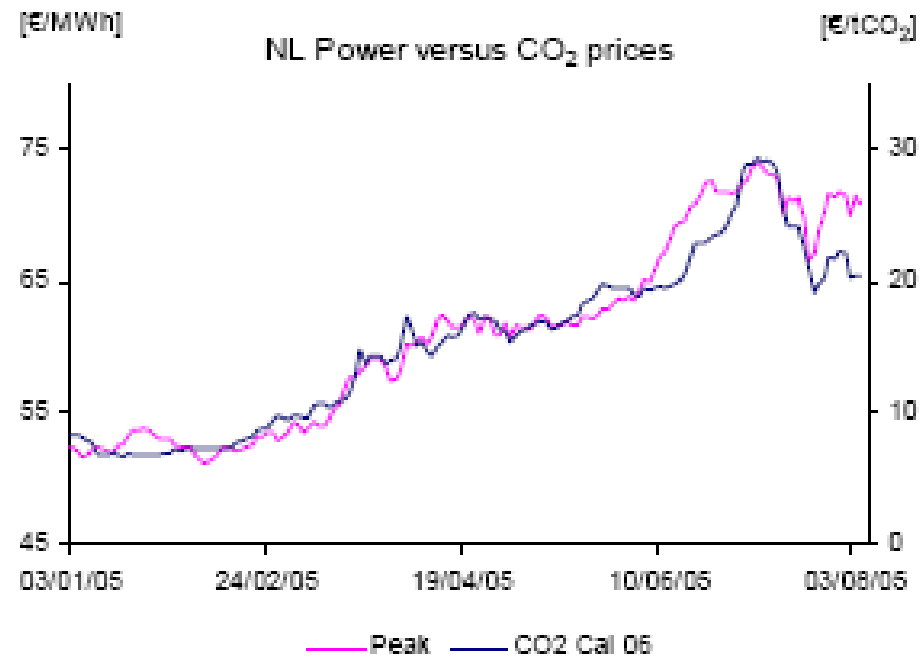
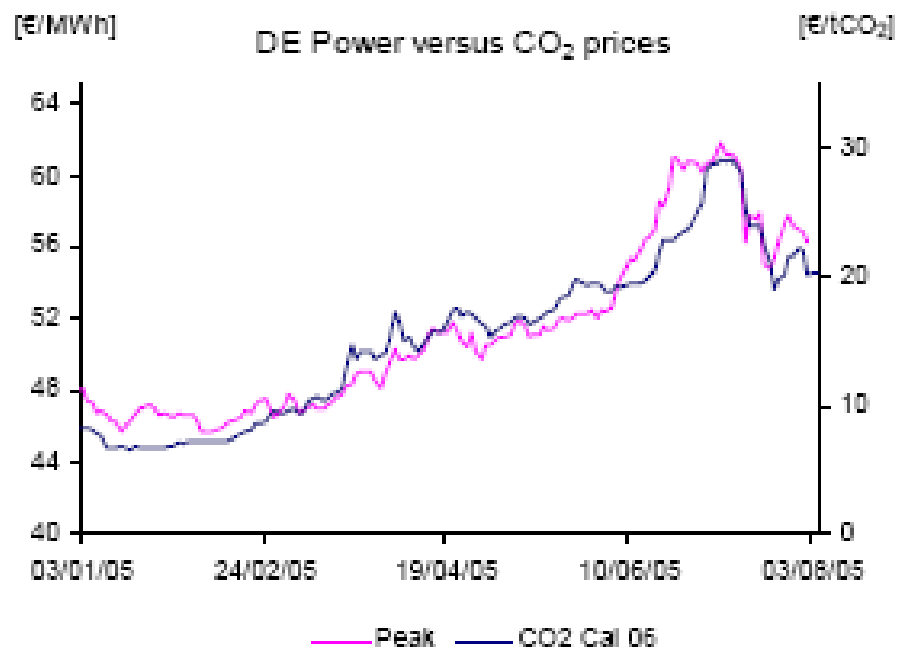


# Electricity prices have increased

## Is this due to ETS or to fuel prices or both?

UK electricity and gas prices (forward Q4 2005), CO<sub>2</sub> prices

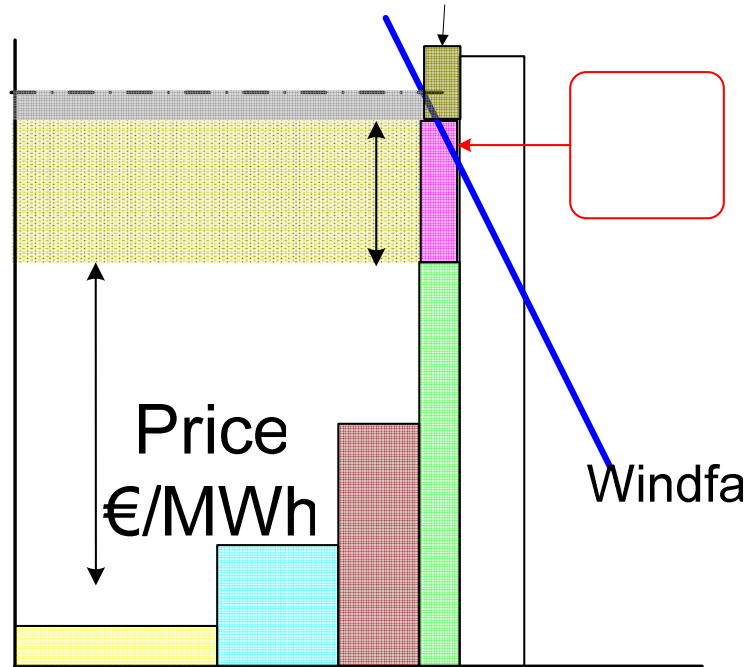




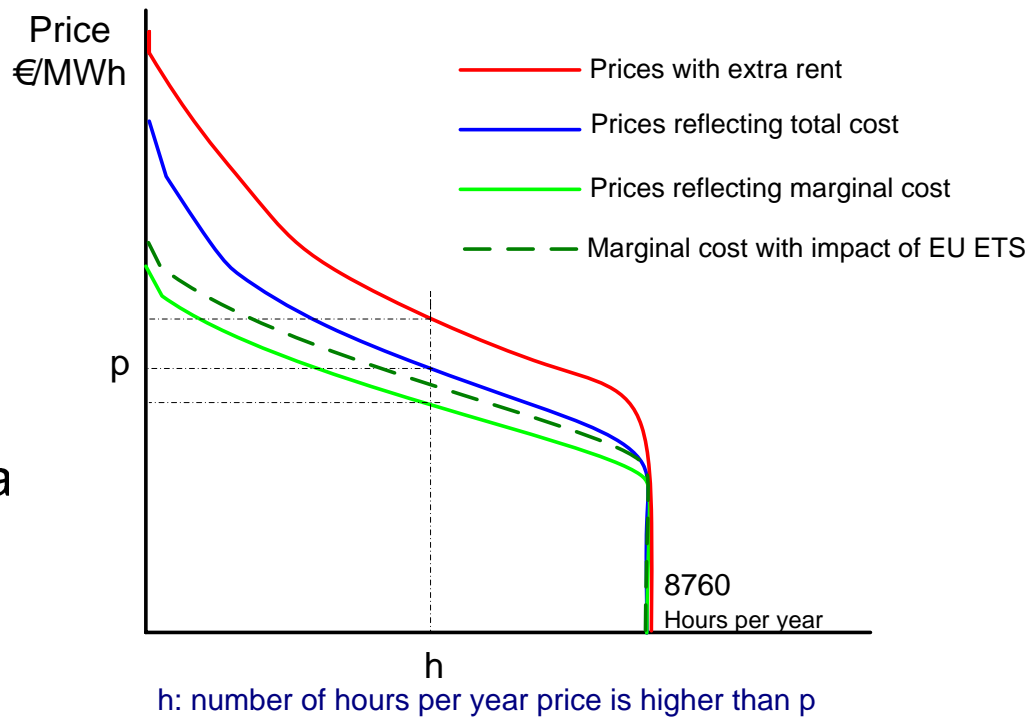
# Cost, Revenues and Prices

- Total cost of power generation splits into
  - Variable costs, mainly fuel purchase costs
  - Fixed cost of operation and maintenance
  - Capital costs; per year it is in annuity terms
- Revenues of power generation
  - If through a wholesale market, producer surplus on top of variable costs cover fixed and capital costs
  - If through direct customer payments, tariffs are set to recover all cost items
- The possibility for extra rent or windfall profit depends on market power under competition and the consumer's willingness to pay
  - Mark-up: ratio of consumer price over total average cost
  - Mark-up higher than one possible only if market power exists.

# EU ETS on Hourly Wholesale



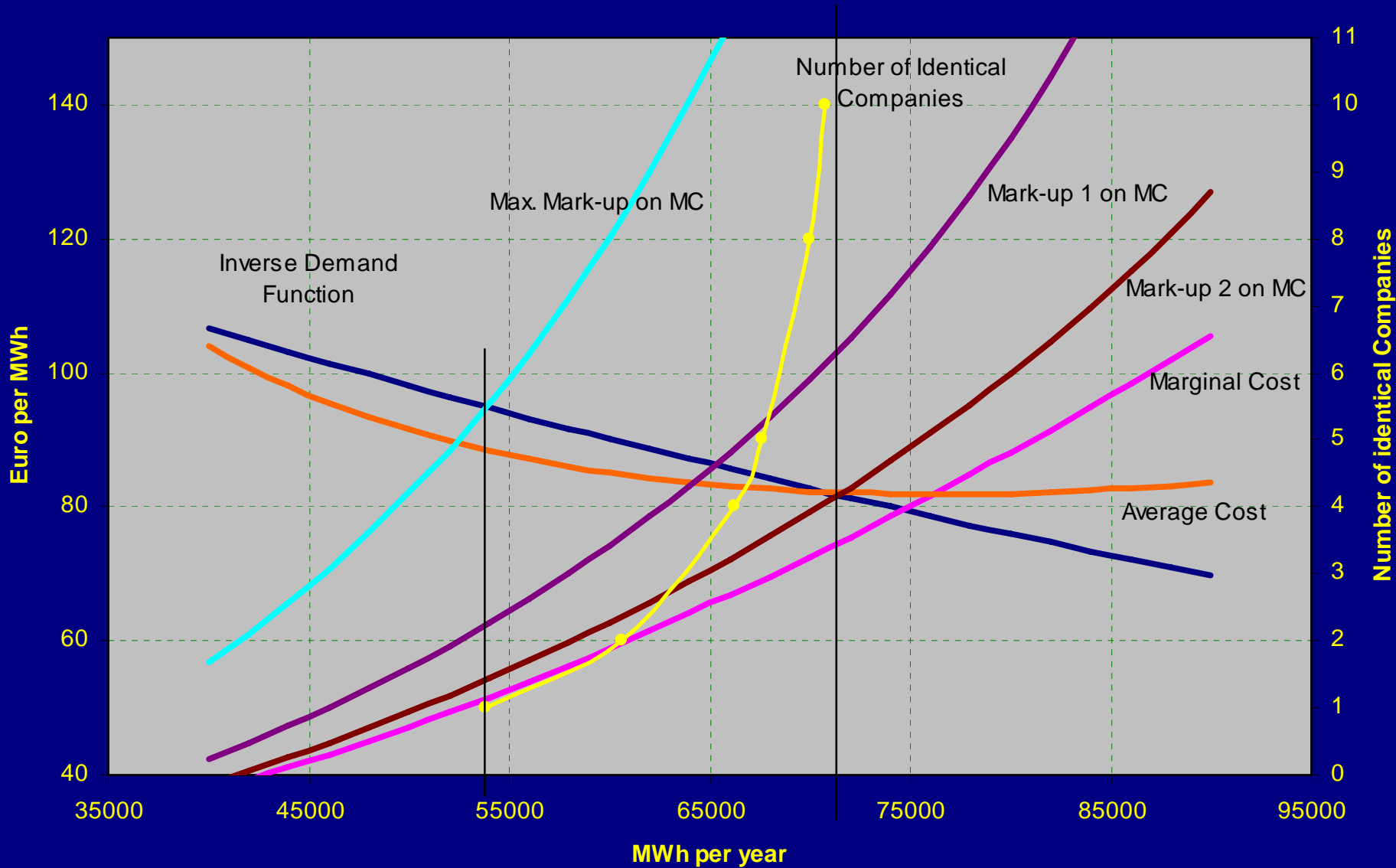
*Price duration curve*



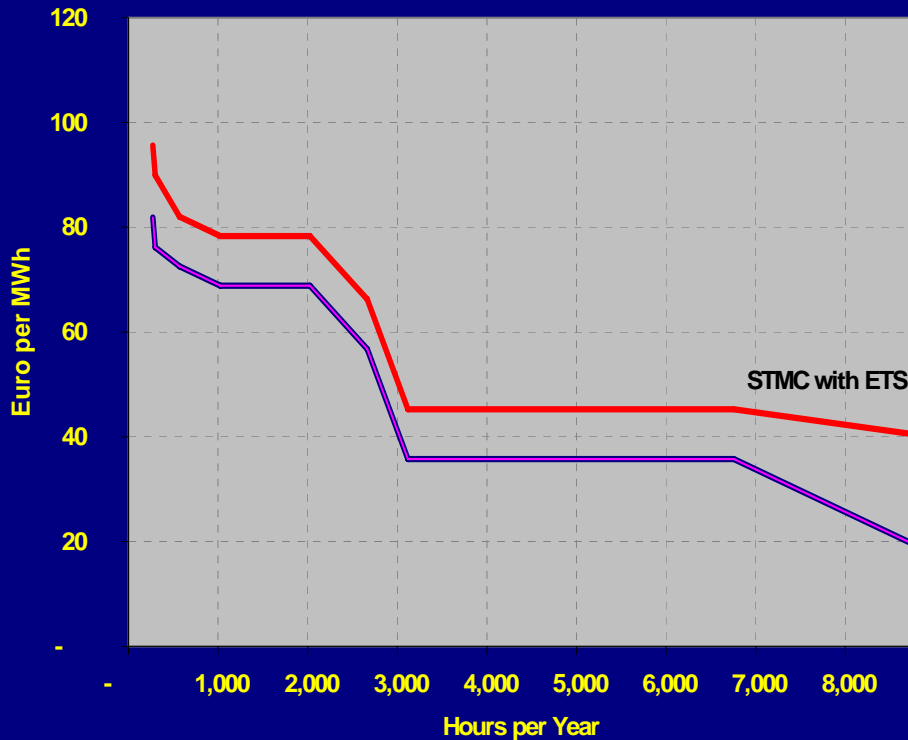
- Over the year, the wholesale prices reflect marginal costs but also are set so as to recover all other costs, as for example fixed and capital costs
- Pricing to consumers depends on a price duration curve and at least reflects total average costs, including the net total cost of purchasing of allowances
- Whether or not the electricity firm can apply tariffs higher than average costs, depend on prevailing market regimes and her market power (the mark-up)
- In the long term, only Ramsey-Boiteux pricing (i.e. reflecting long term total average costs) is sustainable, either because of competition or regulation.



# Illustration of relation between cost and prices of electricity



## Short Run Marginal Cost Duration Curve (Germany 2010, PRIMES simulation)



- This example from PRIMES model simulation, shows how impact on end-use prices must be small, although the effects on short run marginal cost are considerable

but ..

- Impact on certain consumers, like on Heavy Industry Electricity Prices can be high : 12 to 15%

16,186	Total fixed cost (Meuro)
16,700	Total variable costs Meuro)
33,061	Total Costs (Meuro)
12,786	Total fuel cost (Meuro)
41.75	Average price of wholesale
24,875	Revenues from STMC Meuro)
8,186	Costs to be recovered (Meuro)
14.65	Mark up Euro per MWh
	35% rate of mark up
56.40	Total wholesale price €/MWh

## Example of EU ETS at 25 €/t

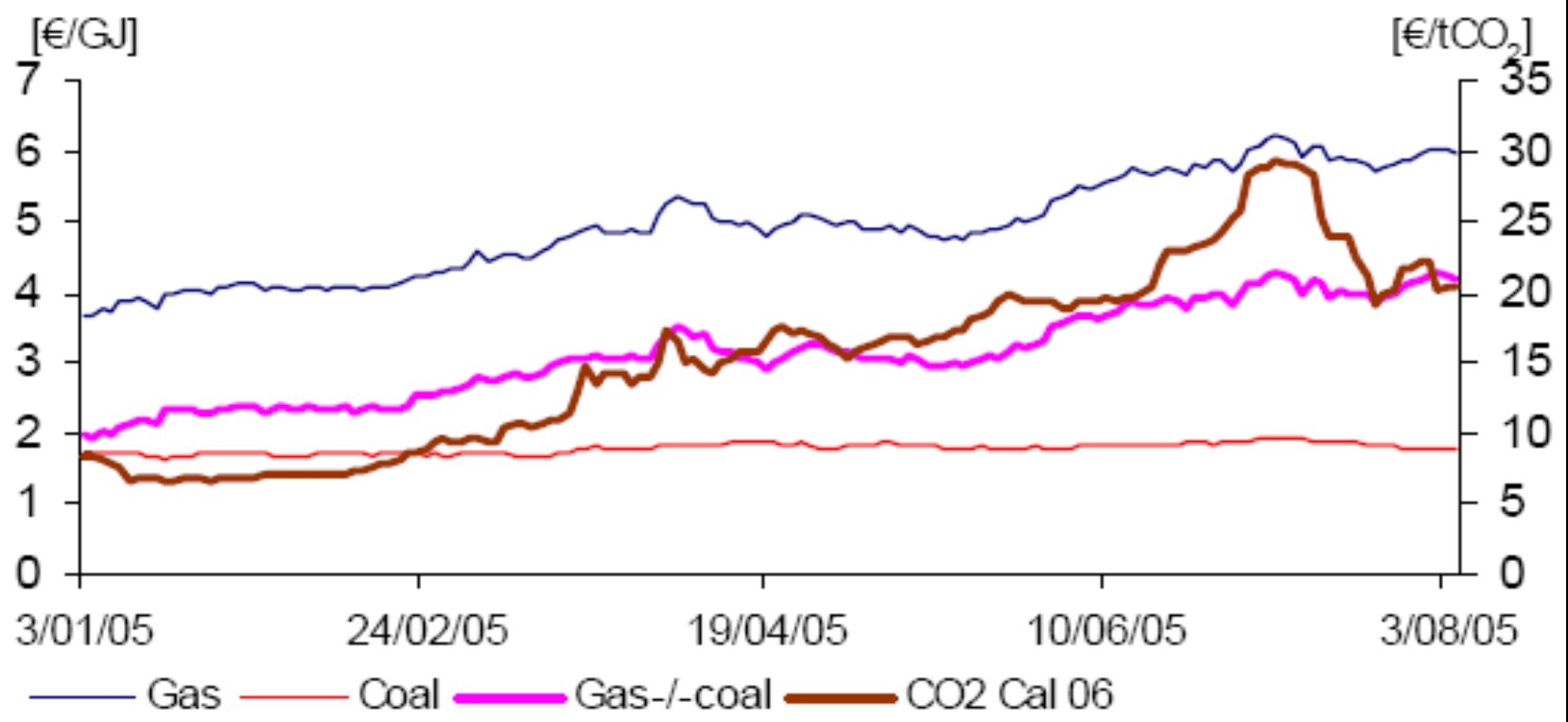
6,860	Windfall profits (Meuro)
394	Net Cost of Emission Cap M€ (e.g.)
33,455	Total Costs (Meuro)
54.02	Average price of wholesale
	29% Rate of increase due to ETS
30,197	Revenues from STMC Meuro)
3,258	Costs to be recovered (Meuro)
5.83	Mark up Euro per MWh
	11% rate of mark up
59.85	Total wholesale price €/MWh
	6% Rate of increase due to ETS
	4% Rate of increase of avg end-user price

# Impact on EU-ETS under long term Average cost pricing of electricity

- Additional cost elements
  - Incremental fuel and variable cost of possible change of merit order
  - Investment costs on top of baseline program
  - Stranded investment and fixed costs
  - Cost of purchasing emission allowances (or revenues from selling allowances)
- Average wholesale price readjusted
  - to recover all additional costs, optionally augmented by a mark-up to reflect market or regulation failure
  - taking into account possible reduction of demand due to higher prices
- Prices per sector-consumer calculated taking into account relative marginal costs, price-elasticity and possibly regulation allowing cross-subsidy at some degree.

# Gas prices and CO2 prices seem to be well correlated – why?

Fuel versus CO<sub>2</sub> prices Cal 06

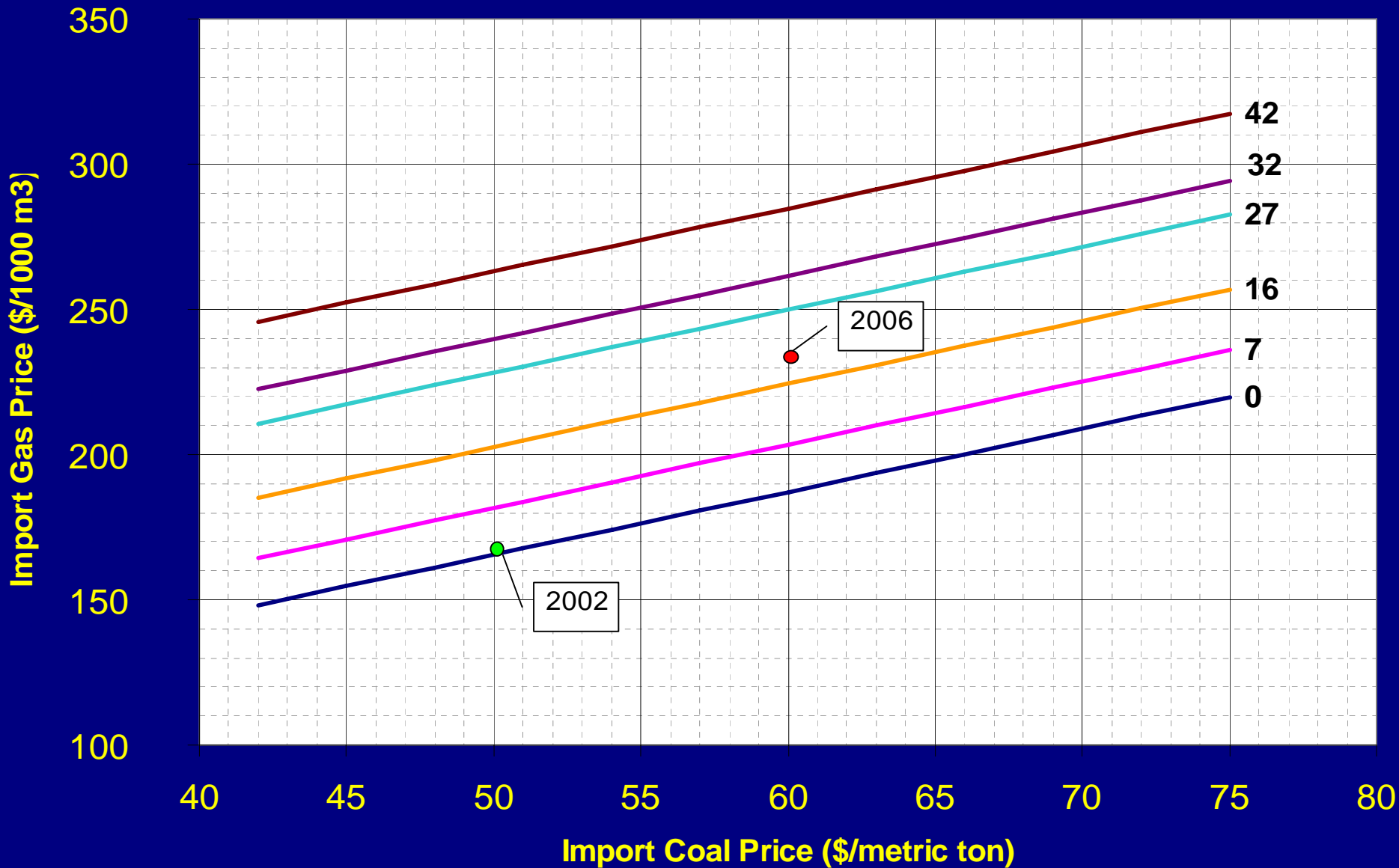


# Gas-Coal price Indifference Curves for various ETS prices

ETS in Euro per ton of CO<sub>2</sub>

Indifference in terms of Total Cost of Power generation in baseload

Area below an Indifference Curve denotes Gas preference



# Concluding Remarks

1. Impact of the EU ETS on marginal costs and some wholesale prices are considerable, but the consumer prices must be affected only to the extent allowed by competition and regulation.
2. In terms of total long term average cost pricing, impact of EU ETS on electricity tariffs must be small.
3. Passing through opportunity costs depends on market power in electricity supply. It has nothing to do with the ETS system but depend on the ability of competition and regulation to limit potential rents.
4. ETS started in a moment of high price and supply uncertainty of gas
  - This factor, together with oligopolistic upstream supply of gas, explain the high electricity prices
  - The regime in upstream supply of natural gas has led to such relative gas/coal prices that incorporate the differential benefit of gas versus coal in terms of CO<sub>2</sub> allowance prices