

# Regulating Electricity to ensure efficient competition

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*CEPR/ESRC I-O Workshop*

*The Political Economy of Regulation*

[www.econ.cam.ac.uk/dae/research/regulate.htm](http://www.econ.cam.ac.uk/dae/research/regulate.htm)

# Equilibrium structure pre-1990

- universal service obligation in exchange for franchise monopoly
- vertically integrated
- final prices controlled: ‘just and reasonable’

⇒ regulation or state ownership

- both under cost-of-service regulation

# Historical contrasts: US vs UK

- US: *evolved* cost-of-service regulation
- deregulation, not privatisation
- default is regulation
- UK: privatisation for many motives
- recognise need for price control
- *designed* to avoid US inefficiency
- default is reference to MMC/CC

# Example of US Electricity

- Federal Power Act 1935 requires prices that are ‘just and reasonable’
- Selling at market-related prices requires:
  - utility and affiliates do not have market power
  - competitive prices are just and reasonable
  - can withdraw right if there is market power
  - can re-impose cost-based prices caps

# Vertical integration under attack

- liberalisation creates tensions
  - unsustainable cross subsidies (AT&T)
  - access problems motivate unbundling
- easy at privatisation, harder if private
  - US gas, BG, painfully dismembered
  - CEGB unbundled at privatisation

# Evolution of UK policy

- Licenses define rights and powers
  - Needed for regulatory credibility
    - for sale, to ensure private investment
  - competition not privatisation for efficiency
  - RPI-X as transition from incumbency
- ⇒ incentive regulation of natural monopoly

# Impetus for ESI reform in EU

- UK (and Norway) considered successes
- Single market requires unbundling
- Electricity markets seen as unproblematic
- Reasons for institutional solutions ignored
- Little guidance given to member states
- Two years to enact Electricity Directive

# Politically acceptable liberalisation requires:

- A regulator who can credibly ensure :
  - sustainable competitive outcomes
  - absence of abusive market manipulation
  - efficient free entry and investment

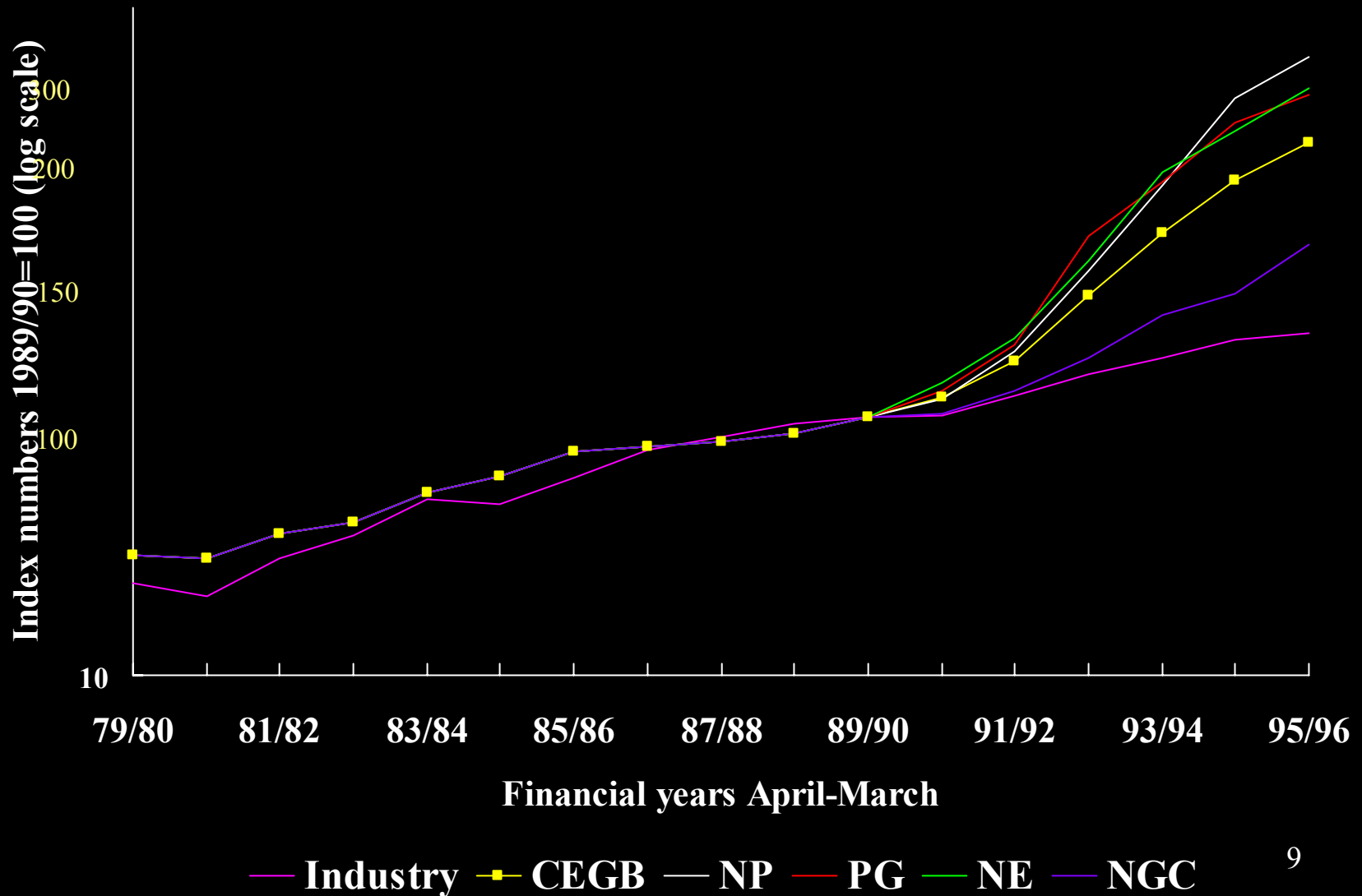
*These challenges remain unmet in EU*



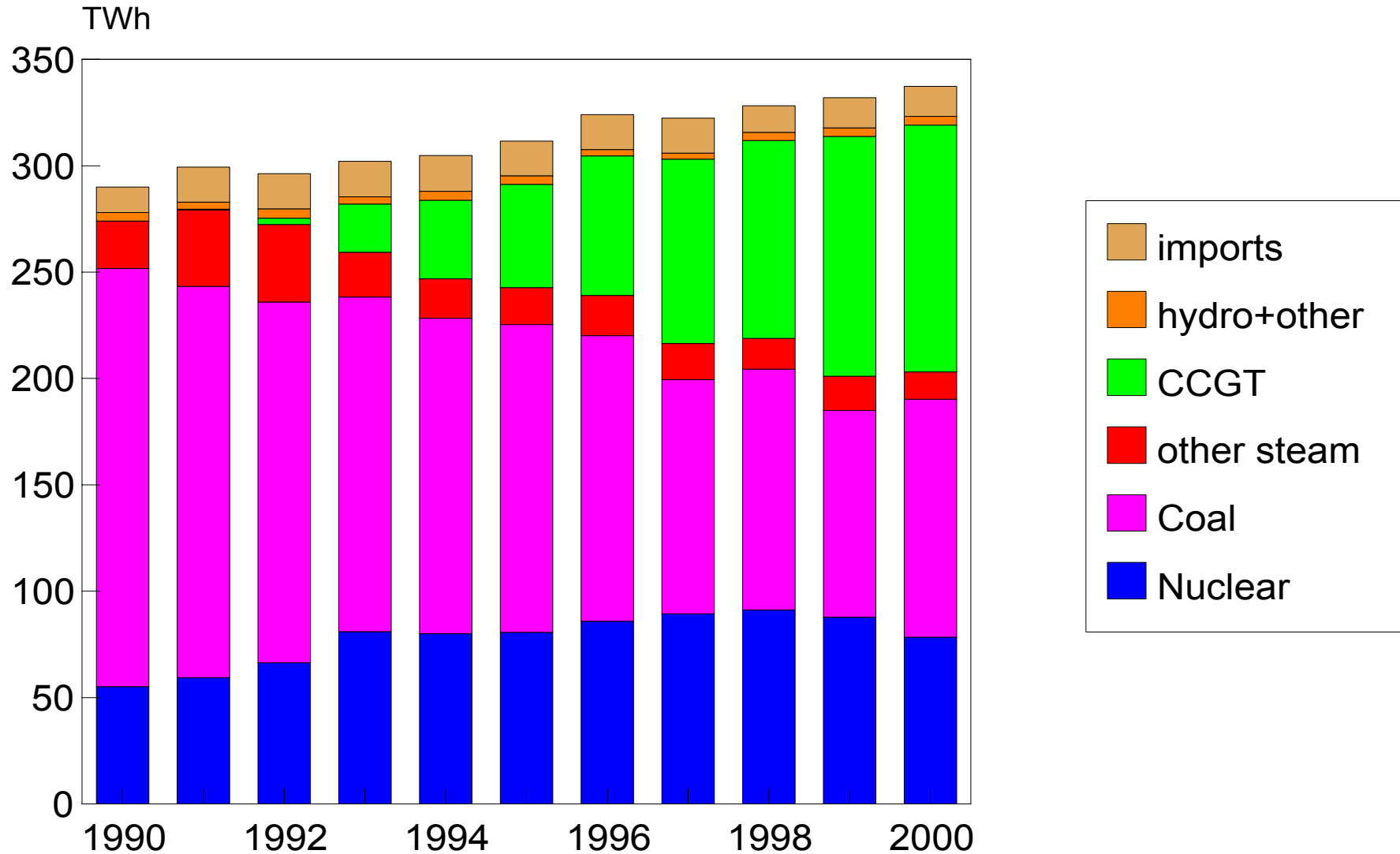
# Lessons from UK ESI

- England+Wales unbundled, Scotland not
  - social benefits: 6% p.a. E+W; 0 in Scotland
  - = 100% return on CEGB sales value
  - consumers lose, generators win
  - ⇒ regulatory pressure to increase competition
  - tough price controls to pass through cost fall
  - ⇒ E+W model for EU Electricity Directive

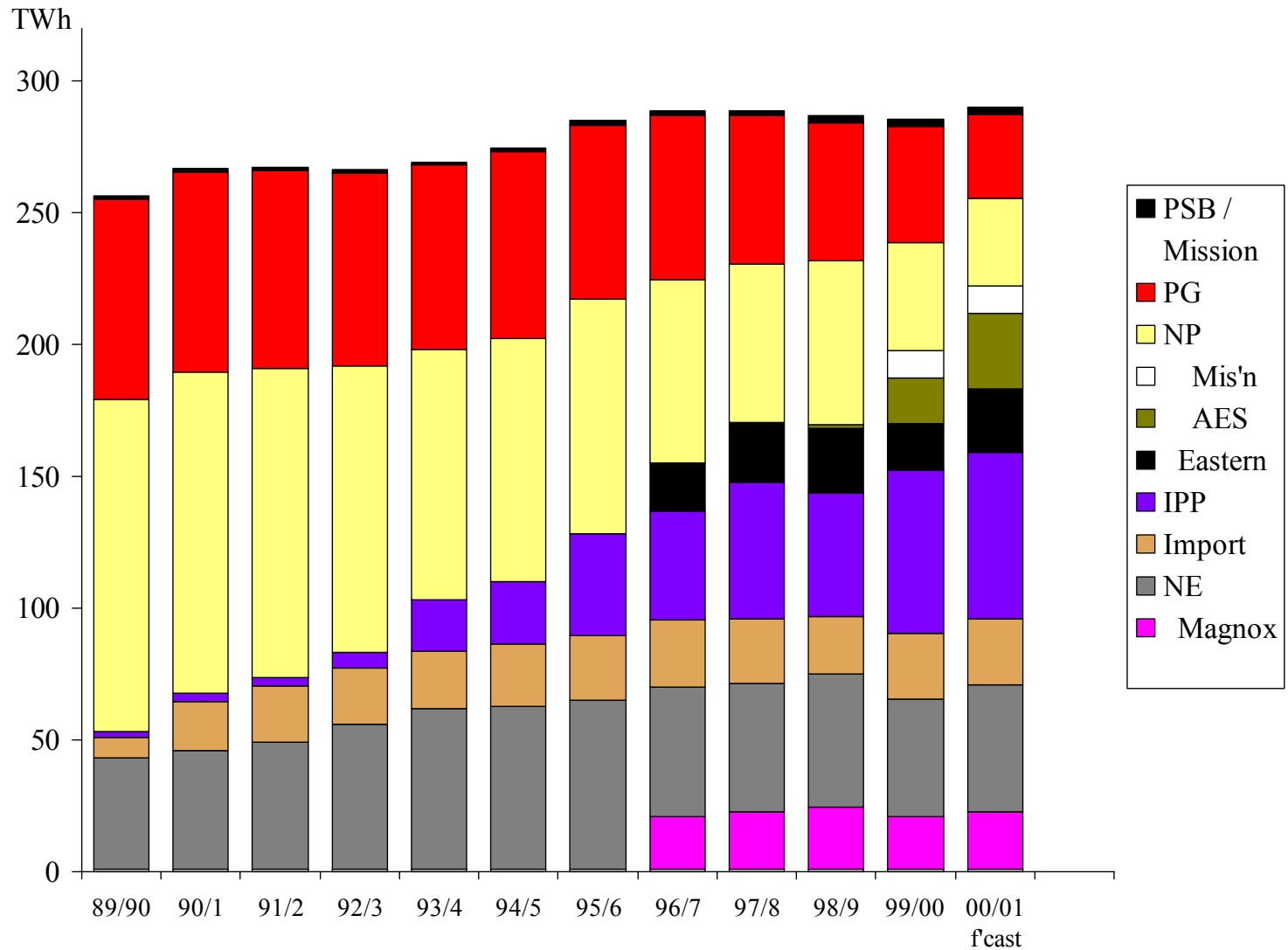
# Productivity of CEGB and successor companies compared to UK manufacturing industry



# Generation in England and Wales by fuel type



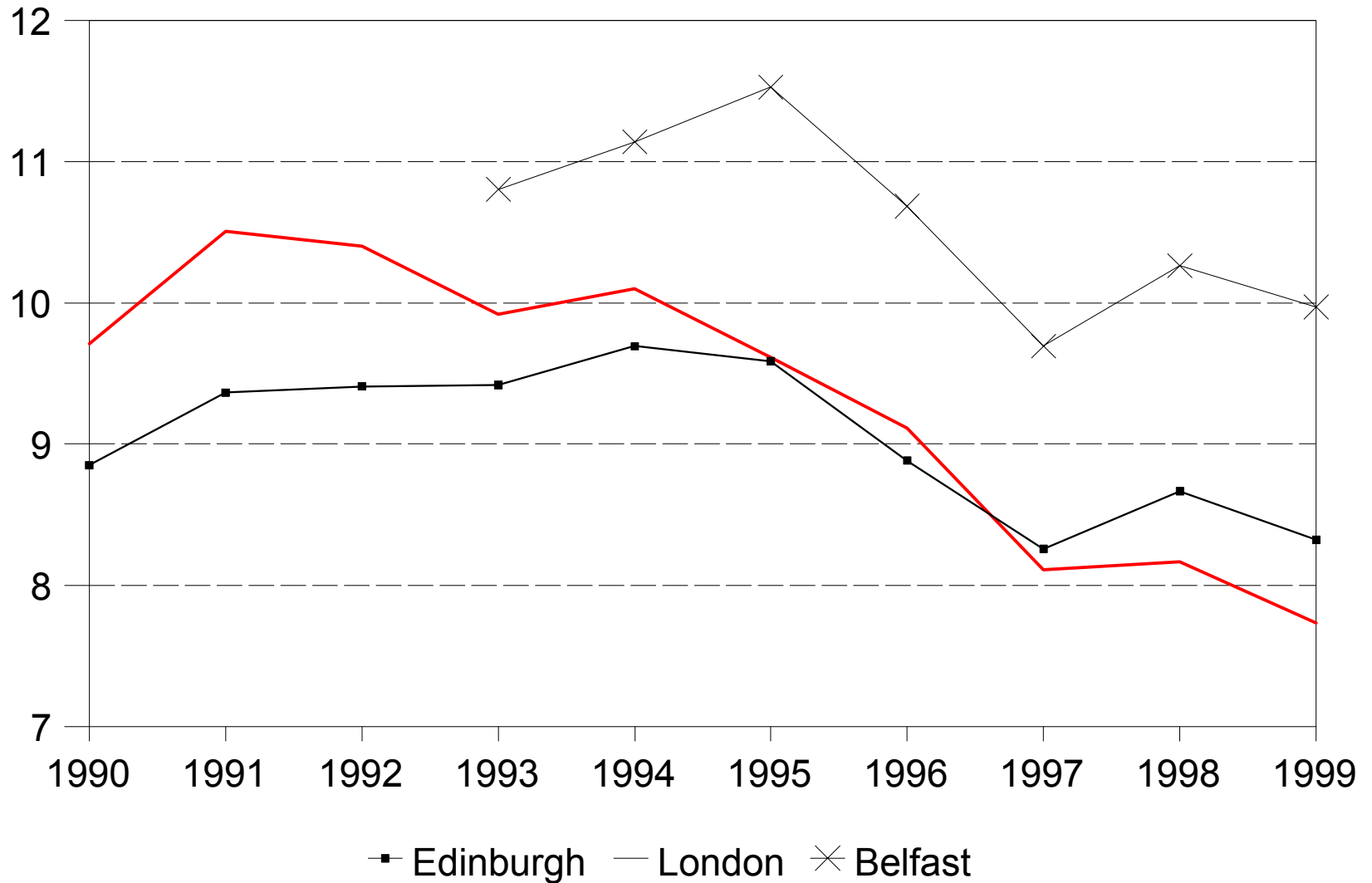
# Generation in England and Wales



# Performance of other ESIs

- Scotland: vertical integration
  - small gains offset by costs
  - little competition, lower price fall
- N Ireland: Single buyer model
  - large efficiency gains: 3 times CEGB
  - hard to transfer to consumers because of PPAs
  - UK Govt. subsidises electricity prices

# Electricity prices by town 3,300 kWh at 2000 prices excl VAT





# A Single European Electricity Market?

*Lars Bergman, Geert Brunekreeft,  
Chris Doyle, David Newbery,  
Michael Pollitt, Pierre Regibeau,  
Nils von der Fehr*

# Lessons from EU Study

- authorisation preferable to tendering
- **access** is key to creating single market
  - press for rTPA
  - require transparency
  - charge depend only on connection point
- require ownership separation of G & T/D
- strong sector-specific regulation needed

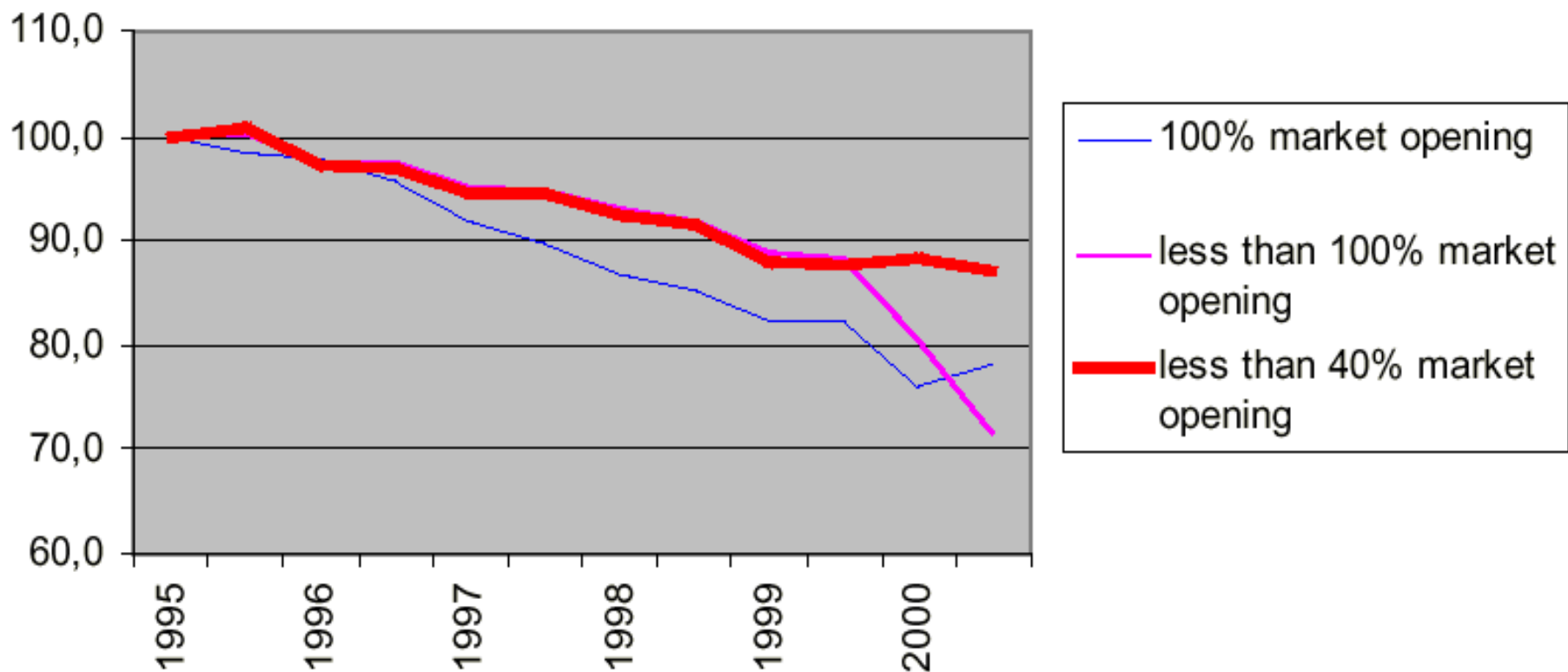


# EU response

- Lisbon 2000 European Council asks CEC to work to complete single ESI market
- CEC reaches same conclusion as CEPR
- Stockholm 2001 CEC presents
  - analysis: working papers
  - Press Release: ‘California not a problem’
  - proposed amendments to Gas+Elec Directives

## Electricity Price Development for Industry 1995 - 2000

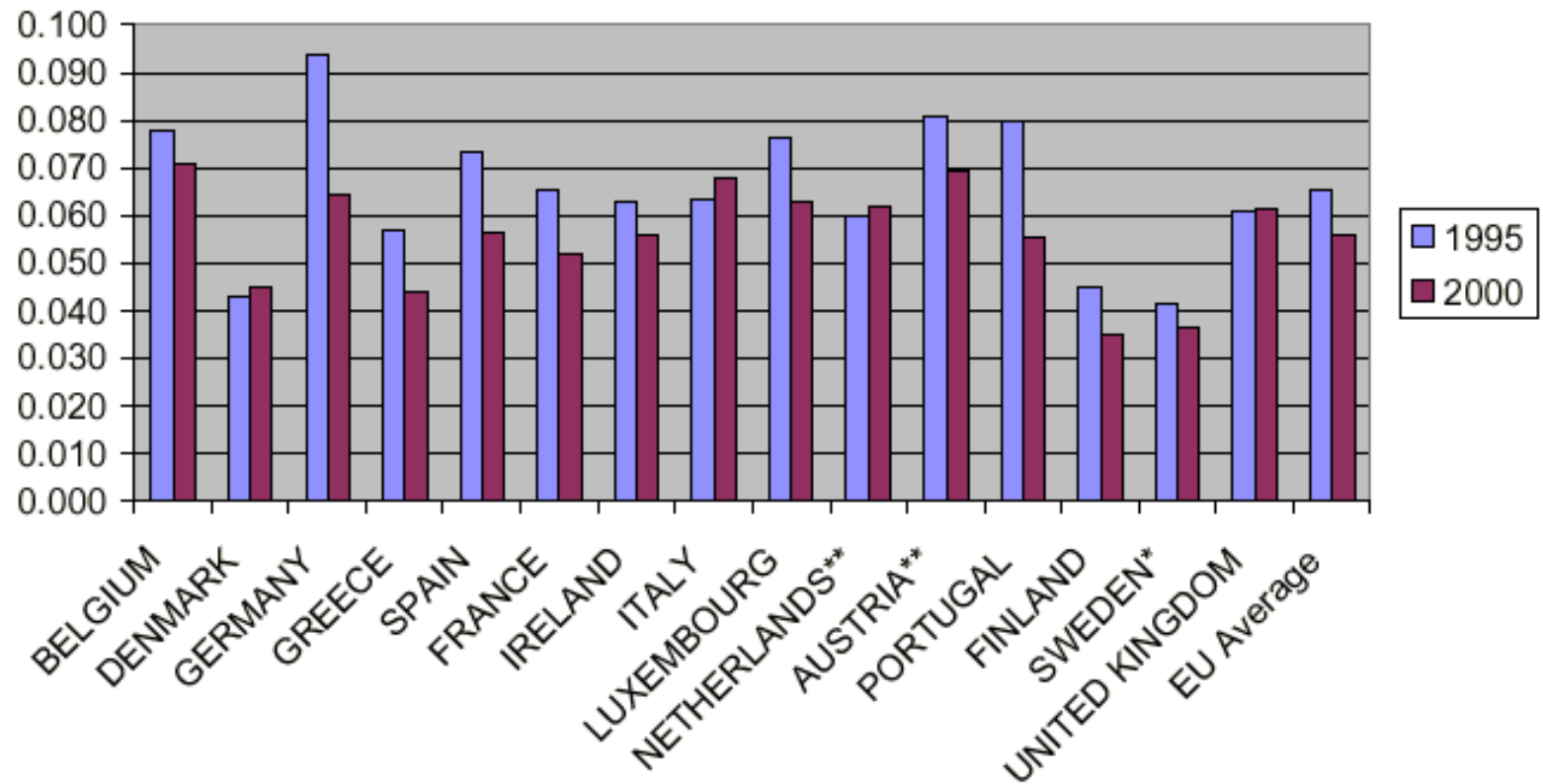
1995 = 100



Source: Eurostat.

Note: Prices exclude energy taxes and VAT and prices have been deflated. "Industry" is defined as an annual electricity consumption of 2 GWh.

### Average electricity prices in € cents per kWh for industrial consumers (VAT and energy taxes excluded)



Source: Eurostat. In Member States where there is more than one observation, an arithmetic average has been calculated.

Note: Industry is here defined as an annual electricity consumption of 2 GWh

# Proposed New Directive

- for electricity *and* gas
- only rTPA, tariffs published *ex ante*
- sector-specific regulator
- legal (but not ownership) unbundling G&T
- no SBM, no tendering (except reserve)
- 1.1.2005 all gas + elec markets fully open

# Stockholm, March 2001

- CEC claims reforms will avoid California problems caused by “inadequate legal framework and .. capacity”
- France opposes new Directive: not convinced of liberalisation
- Germany opposes need for regulator
  - also has nTPA and vertical integration

# What happened in California?

1996: cost of new power < regulated price

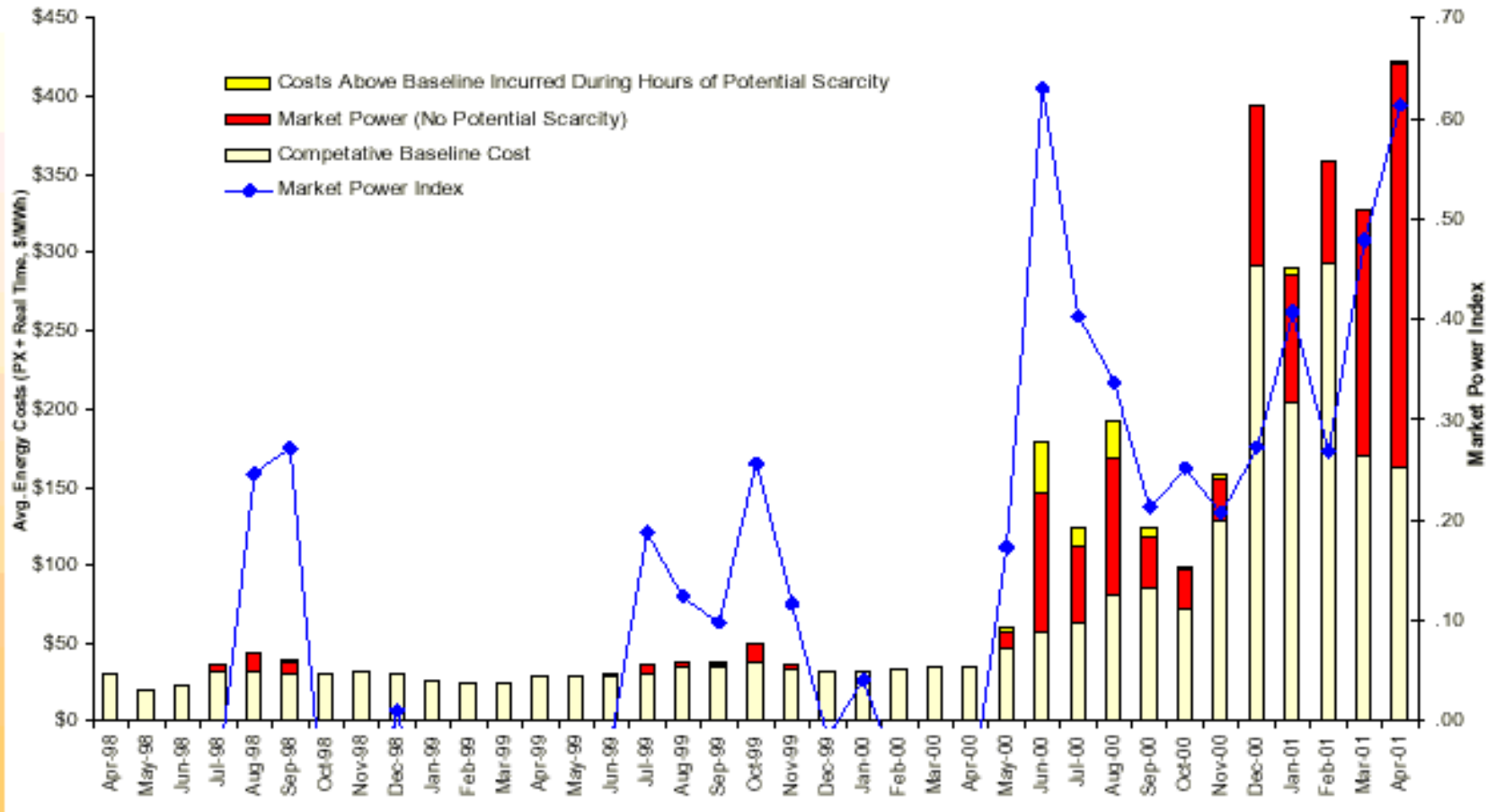
– buy out stranded generation assets

- Price cap until then, expect price fall, *but*
- *average* 2000 wholesale price 3 x 1999
- Jan-Apr 2001 prices 10 x 1999
- distribution companies bankrupted
- State steps in at huge cost



# What Explains the High Prices?

Prices above competitive levels were due to both higher production cost and higher mark-up from market power



# Causes of the Californian debacle

- Under-investment + cheap hydro from NW
- high demand growth in WSCC
- Huge swing in hydro supply (=12 nukes)
- Gas price rise, NO<sub>x</sub> permits double cost,
- Regulatory disapproval of contracts
- Price caps imposed with perverse effects
- High Western prices ⇒ bankruptcy



# Lessons from California

- Inelastic demand + tight market  $\Rightarrow$  large market power
- Unbundling  $\Rightarrow$  price risks - need hedging
- discouraging contracts  $\Rightarrow$  market power
- Capacity- public good in federal system
- Local intervention in interconnected system problematic

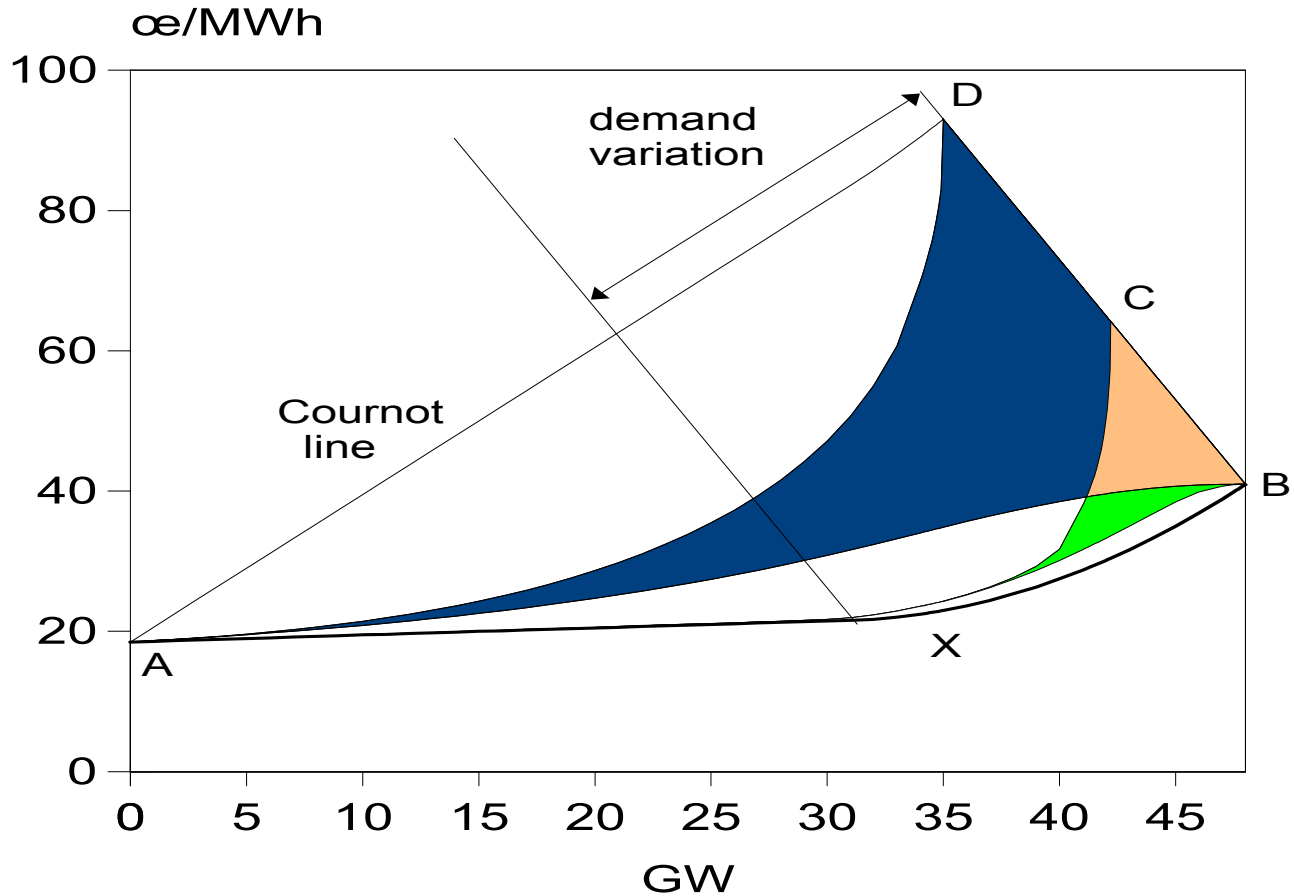
# Theory of electricity pricing

- Supply Function Equilibria
  - Green and Newbery (1992) *JPE*
- Cournot (by hour of day)
- Auctions: pay-bid vs Pool
- Commercial software
  - captures non-convexities

*Agree on general form of equilibrium*

# Feasible Supply Functions

## Duopoly and Quintopoly



- Marginal Cost
- 2-firm range
- 5-firm range
- Maximum Demand

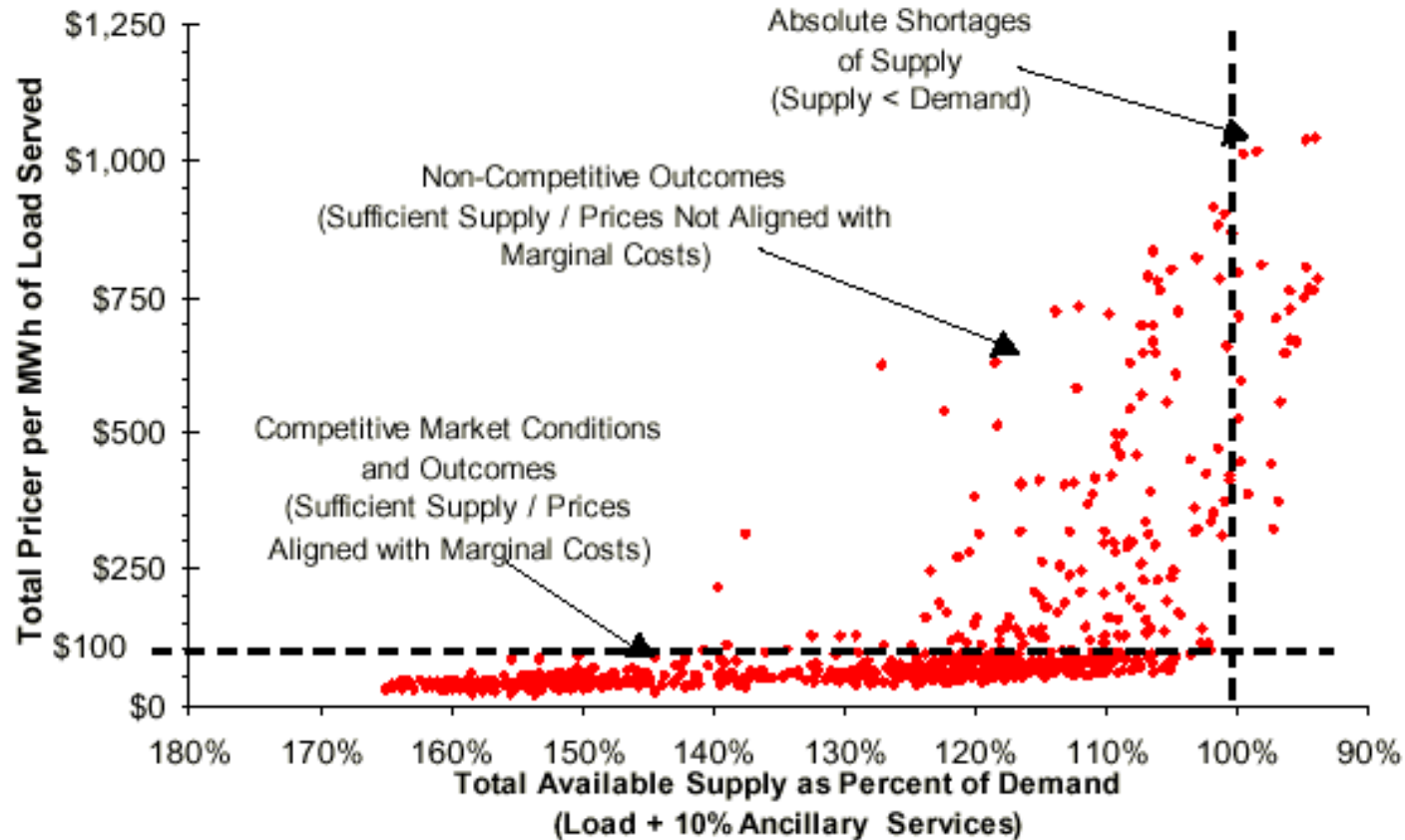
Calibrated for England 1990

# Supply function equilibria

- Spare capacity  $\Rightarrow$  Bertrand competition
- Tight capacity  $\Rightarrow$  Cournot competition
- Spot competition for uncontracted output
- Entry determines average price
- Peak price depends on capacity
- Capacity depends on  $p-c$  for least-run plant



# Scarcity or Market Power?



\* Source: Report on California Energy Market Issues and Performance: May-June, 2000, Prepared by the Department of Market Analysis, August 10, 2000

# Wholesale prices depend on:

- Number of competitive generators
- Short-run elasticity of demand
- Capacity
- Contract coverage
- Entry conditions
- Demand uncertainty

# Market power in networks

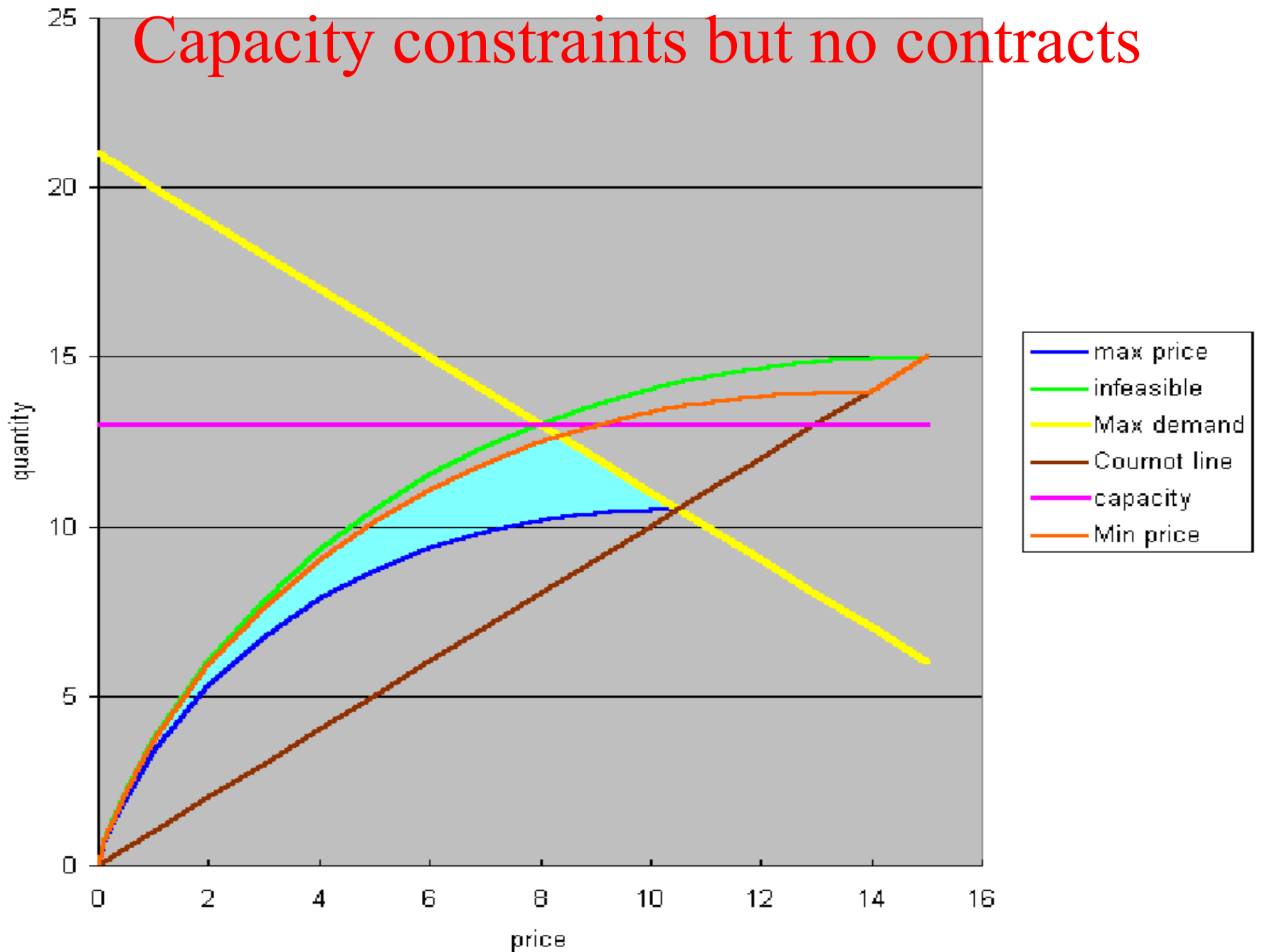
- peak price increases as  $1/\{(n+1)\epsilon\}$
- peak price decreases with contract cover
- demand elasticity  $\epsilon$  very low
- transmission constraints fragment market
  - reduce effective number of generators,  $n$
- generators can exploit constraints

# Dealing with market power

- desirable to reduce concentration
  - trend is in other direction
- encourage contracting
- desirable to increase spare generation
  - hard to sustain in liberalised market
- desirable to maximise extent of market
  - regulate for “excess” transmission - but how?
- Should TO's take account of market power?



# Capacity constraints but no contracts



# Without entry threats Gencos may

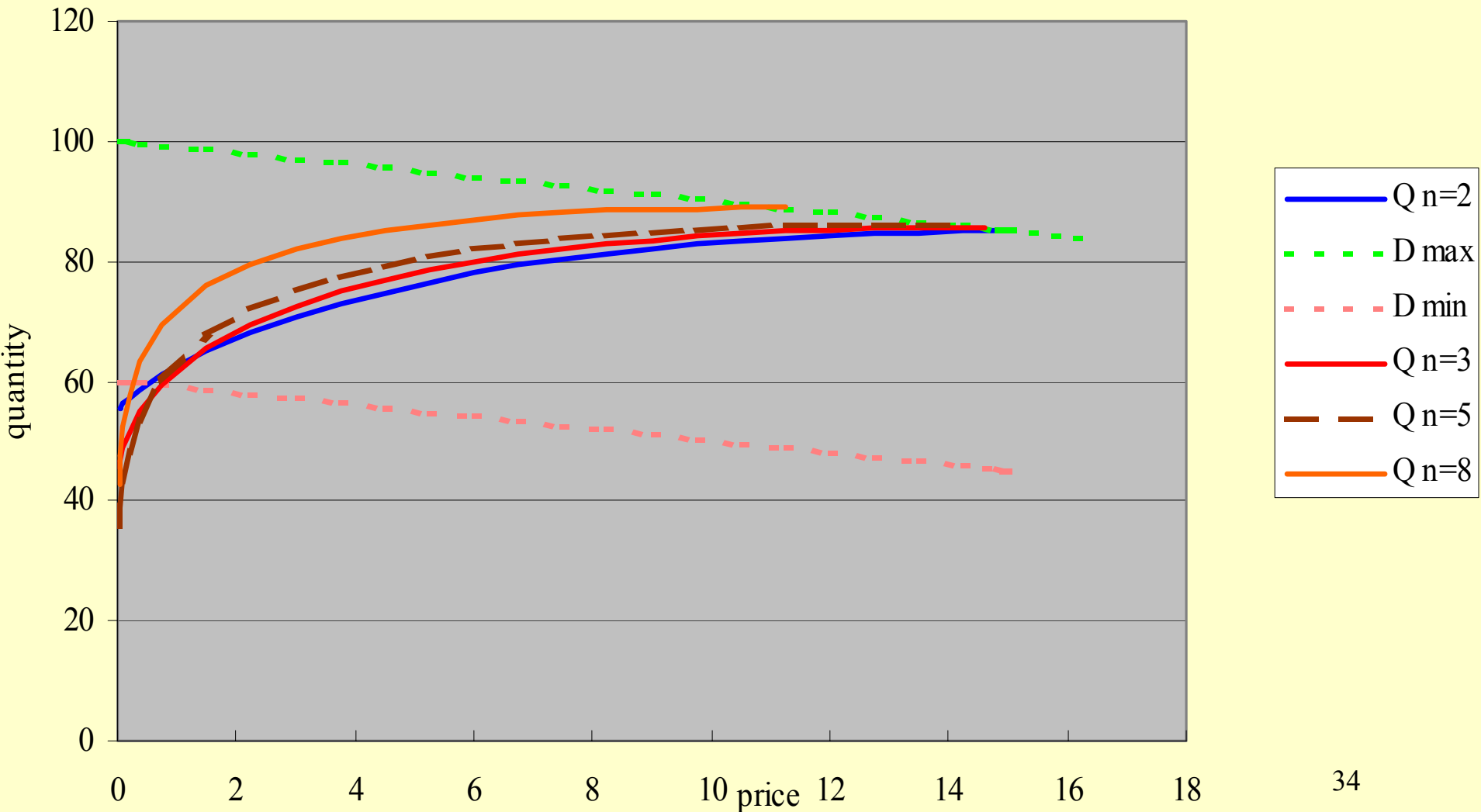
- Merge (c.f. Germany)
- Reduce spare capacity (Germany)

Contract cover demand driven  $\Rightarrow$  expensive  
 $\Rightarrow$  reduces cover  $\Rightarrow$  market power

$\Rightarrow$  Critical to minimise barriers to entry  
– ownership unbundling of G & T

# With contracts to deter contestable entry

Supply function equilibrium  
varying number of generators



# Entry and predictable demand

- Contracts reduce av. price to deter entry
- More competitors  $\Rightarrow$  less volatility

$\Rightarrow$  Expect actions to impede entry, e.g.

- pay-bid, opaque markets, vertical integration (NETA?)

# Preconditions for liberalisation

- rTPA + ownership unbundling: CEC ✓
- adequate and secure supply: CEC ✓
  - network adequate and reliable
  - production capacity adequate
  - security of supply of primary fuel
- power to regulate competition: CEC ✗

# Competition policy for utilities

“competition where possible, regulate where not”

- Leave markets to competition legislation?

- *Ex post*, penalties  $\Rightarrow$  legalistic, slow

- dominance  $\sim$  40+% of market

- information collected only for case

$\Rightarrow$  need *ex ante* regulatory powers

# British regulatory experience

- 2000: Market Abuse Licence Condition
  - refers to bidding in Pool
  - not accepted by AES, British Energy
  - ⇒ referred to Competition Commission
  - ⇒ not “against public interest” if unmodified
- Pool to be replaced by NETA 2001

# Lessons from Britain

- generator licence restrains market behaviour
  - can be modified after reference to CC
  - market power possible with  $HHI < 1800$ 
    - electricity cannot be stored
    - transmission constraints fragment market
    - supply must be matched to demand by second
    - demand inelastic in short run
- ⇒ volatile prices: £11-1100/MWh over 24 hrs



# Contrast EU with US

- US has long history of price regulation
- markets *may* achieve better outcome
  - if not, fall back on regulation
- EU assumes market *will* be better
  - no fall-back option

# Californian debate

- Dec 15, 2000 FERC
  - deems prices ‘unjust and unreasonable’
  - imposes soft price-caps on spot prices
- ⇒ perverse effects, ‘MW laundering’
- June 2001 FERC order extended to WSCC
  - must offer to spot market
- contrast with CA MSC mitigation plan

# MSC's mitigation plan

- IOUs sell at cost
- consumers can buy 85% at 2000 price
- right to market pricing only if
  - sell 75% capacity as 2-year contracts at 'competitive price' (\$54/MWh)
  - file annual outage plan, must bid otherwise
  - no cap on spot, AS markets
  - otherwise face cost-based price regulation

# Contrast approaches

- both attack capacity withdrawal
- FERC caps spot prices of whole region
  - ⇒ to avoid market power contagion
- CA MSC operates on contract price
  - ⇒ leaves spot price to signal scarcity
  - ⇒ rights to regulated contracts prices
  - ⇒ avoids costly long-term lock-in

# Attractions of contracts

- market power falls as contract cover rises
- confine price regulation to contracts
  - leaves spot price to signal scarcity
  - ‘dual pricing’ prevents large rent transfers
  - sustained by legacy contracts in short-run
  - long run requires franchise?

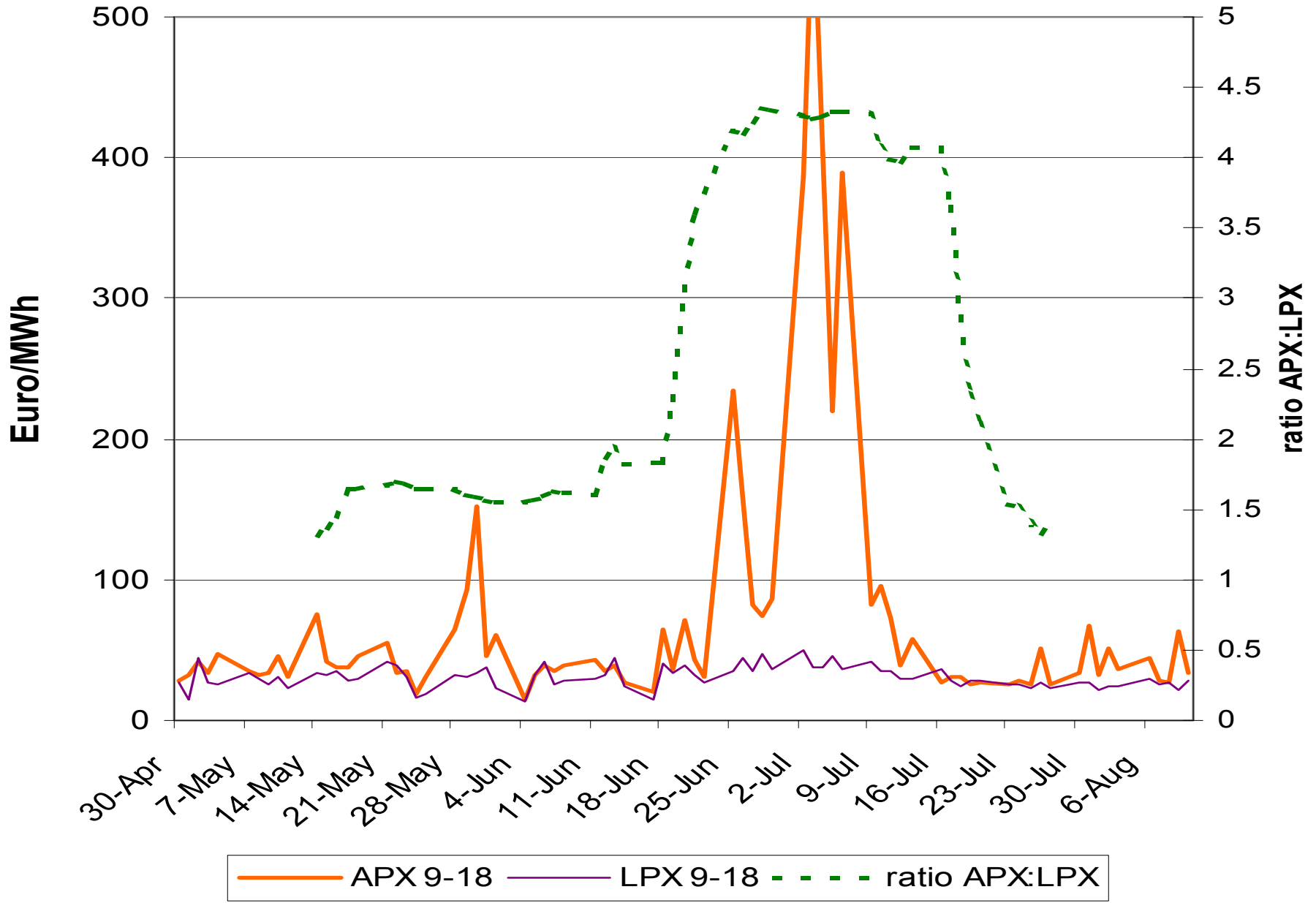
# Contrast with Europe

- no prior legislated cost-based regulation
  - no concept of ‘just and reasonable’ prices
  - little power to control wholesale prices
  - often limited power to get information
- ⇒ weak market surveillance
- competitive tests derive from other markets

# Competition problems in EU ESI

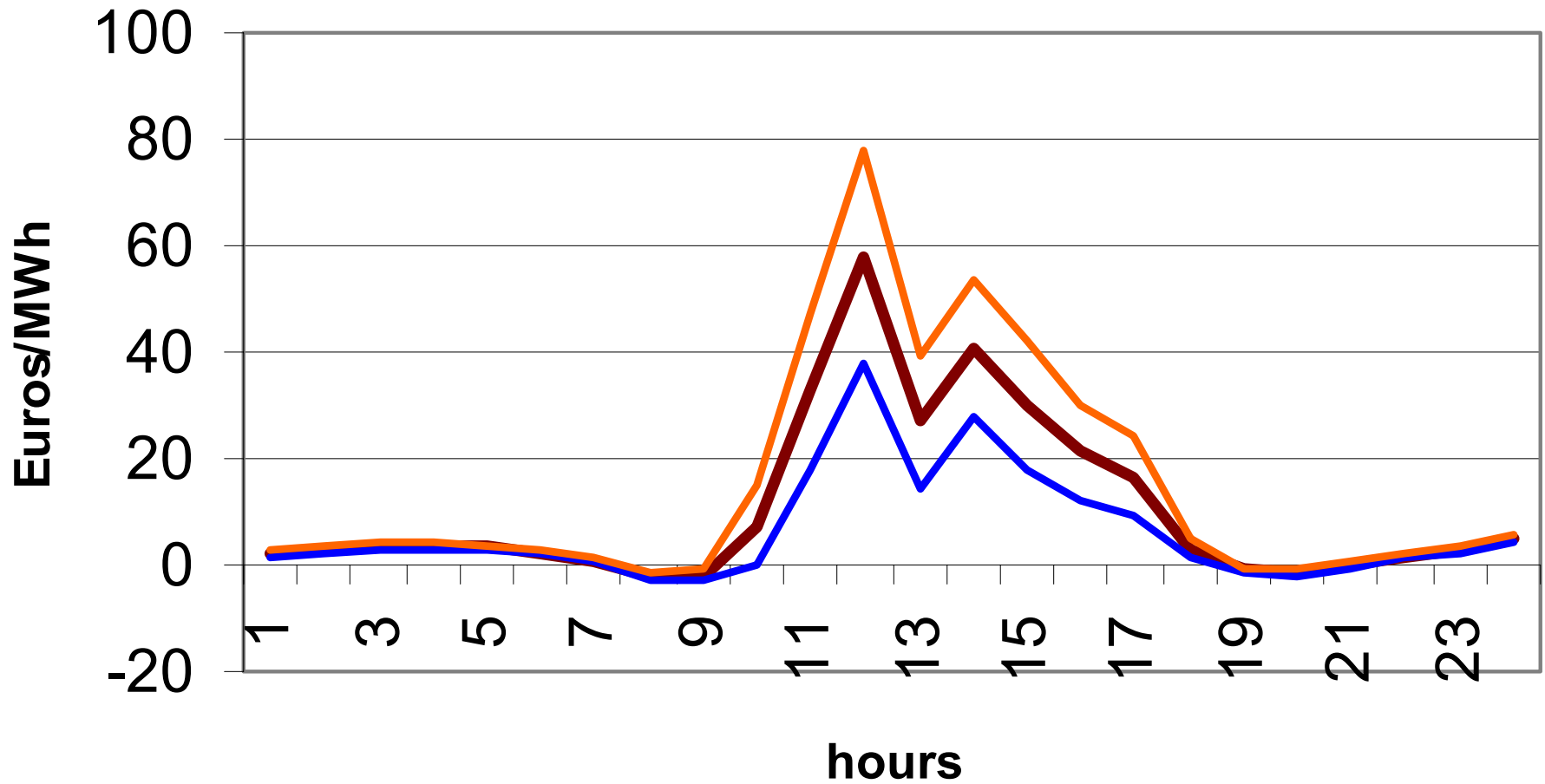
- dominant incumbents (Fr, Be, It)
- merger wave (EdF, E-on, RWE)
- inadequate interconnect transmission
- illiquid or absent wholesale markets
- under-staffed or no regulator
- access to information patchy
- lack of regulatory enforcement power

# APX and LPX Weekday prices May-July 2001





# Arbitrage profit weekdays May - July 2001



— Average — Av - 1 SE — Av + 1 SE

# Competition concerns

- vertical integration  $\Rightarrow$  recover fixed costs via access charges to grid?

$\Rightarrow$  low spot prices, entry deterrence, merger  
e.g Germany (Brunekreeft)

- Electrabel: 95% of Be, 30% of NL
  - vertically integrated in Be, no spot market
  - low cost but interconnector zero price

# Possible scenarios - 1

- lack of markets + domestic franchise  $\Rightarrow$  contracts necessary
  - reduces short-run market power, hedges spikes
  - yardstick regulation of PPAs countervails
- opaque markets & asym info deter entry
  - $\Rightarrow$  horizontal, vertical integration  $\Rightarrow$  old German-style equilibrium: safe but costly?

# Possible scenarios - 2

- new Directive ends franchise  
⇒ generators integrate into supply
- remove counterparties to entry contracts  
⇒ reduce spare capacity
- limited interconnector ⇒ market power in national markets
- ESI now 400 bn euros, high prices costly

# Solutions

- increase interconnect capacity rapidly
  - ‘excess’ T is public good
  - dilutes market power in short run
  - ⇒ reduces need for regulation
- ⇒ long run EU-wide shortages?
- Maximise contracts, also for capacity
  - G capacity is public good
- ⇒ keep franchise as counterparty?