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Electricity regulation in UK and Europe

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**SAFIR Core Training Programme for
Infrastructure Regulators**

Bangalore 27 April 2010

<http://www.electricitypolicy.org.uk>

Outline

- **Why** regulate?
 - Public vs private ownership and interstate trade
- Objectives and challenges of regulation
 - credibility and institutional requirements
- Unbundling electricity - **what** to regulate?
- **How** to regulate:
 - US rate-of-return vs UK price cap regulation
- the UK model: incentive regulation
- European regulation and cross-border challenges

Why regulate?

- Networks are natural monopolies
 - investors and consumers need protection under private ownership
- Why privatise?
 - Separate competitive services from network
 - competition reduces costs, transfers gains
 - Competition difficult under public ownership
- Cross-border trade: public and private utilities
 - regulation + restrictions on state aid to avoid distortions
- Regulation to protect against subsidy

The regulatory trap

- sunk investment risks regulatory opportunism
- hold down prices to benefit consumers

⇒ utility may underinvest

⇒ underinvestment precipitates nationalisation

***Inability to restrain regulatory opportunism
may make state ownership only solution***

Problems with public ownership

- State's tax powers can finance investment
 - State concerned to meet demands
 - State subject to strong interest groups
- ⇒ undermines ability to penalise poor performance, leads to financing problems

Hard to ensure adequate prices and finance efficient and prudent investment

Regulation: the challenge

- Regulator represents community
 - grants access rights, franchise
 - wants guaranteed supply at low prices
- Utility makes sunk investments
 - wants secure future profit
 - has huge potential market power
 - will not invest without assurance

Curbing opportunism

- both want investment \Rightarrow cooperate
- both want rents \Rightarrow conflict

How to restrain opportunism?

*Regulation/public ownership evolves to
finance investment and distribute rent*

Regulation

- Transfer efficiency gains to consumer

$$R = b\underline{R} + (1-b)C$$

- conflict between incentives and transfers
- *b is power of incentive*
- high power = strong efficiency incentive
- low power for rent transfer

Applies for public ownership and regulation

Rate of return regulation

- US Constitution entitles utility to ‘fair return upon the value of that which it employs for the public convenience’ (1898)
- rate of return will be adequate to attract new investment if it is ‘used and useful’ and not ‘imprudent’

low powered regulation

Contrast RPI-X regulation

- intended to mimic competitive market
- originally designed for BT to improve incentives (by Littlechild)
- high powered if \underline{R} independent of C in

$$R = b\underline{R} + (1-b)C$$

but is it credible?

Incentives vs credibility

- **Rate-of-return** or cost-of-service regulation
- either party can request a rate review
- limits excess profits and losses
- **Price-caps** set for 5 years
 - sometimes with appeal if costs rise $> 10\%$
- variability of profits larger \Rightarrow windfall taxes?

Better incentives at expense of reduced credibility

What makes regulation credible?

- Ideally self-enforcing: if cost of breaking regulatory compact high:
 - cost of losing confidence of utility high because
 - high need for future investment (rapid demand growth)
 - investment requires private management/finance
 - high cost of poor service (few alternatives)
- External enforcement: but needs institutions
 - regulatory independence, legal enforcement
- Regulatory compact threatened if
 - technical progress - alternatives cheaper (AT&T)
 - investment needs fall (US electricity)

Restraining opportunism

US system:

- Constitutional guarantees
- Separation of powers: DoJ, FCC, PUCs
- Administrative law to challenge regulatory discretion

UK problem: Parliament sovereign

- need to restrain Government
- => licences upheld by courts

Licenses and Legislation in UK

- Primary legislation contains framework
 - duties of regulator, requirement for licences
 - dispute resolution
 - Details contained in licences
 - like contracts, upheld by courts
 - Licence modification by consent or reference to Competition Commission
- ⇒ *Costly for either party to deviate*

Creating credibility in UK

- Regulator has a duty to ensure that investment can be financed
- Price controls reset every 5 years
 - but changed only if “in the public interest”
- Utility can appeal against new price control
 - appeal considered by Competition Commission
 - and subject to Judicial Review
 - disputes costly for both parties

The British model

- **Legislation** defines duties
- **Licences** to provide credibility
- **Regulator** to insulate from politics
- **RPI-X** for incentives and inflation
- **Periodic review** for rent transfer
- **Dispute resolution**: Competition Commission

Regulatory equilibrium

- regulation reflects balance of interest groups
- conflicts lead to inefficiencies
 - cross-subsidy, costly investment, costly coal
- normally remarkably stable, hard to reform
- technical change may alter balance
 - new entry (telecoms); loss of scale economies
 - ⇒ may precipitate new structure

privatisation changes balance of power
particularly if utility restructured



What to regulate

The case for unbundling

Structural remedies

- conduct remedies ineffective
- structural reforms disturb interest groups:
- regulation inefficient \Rightarrow reduce where possible

Competition where feasible,

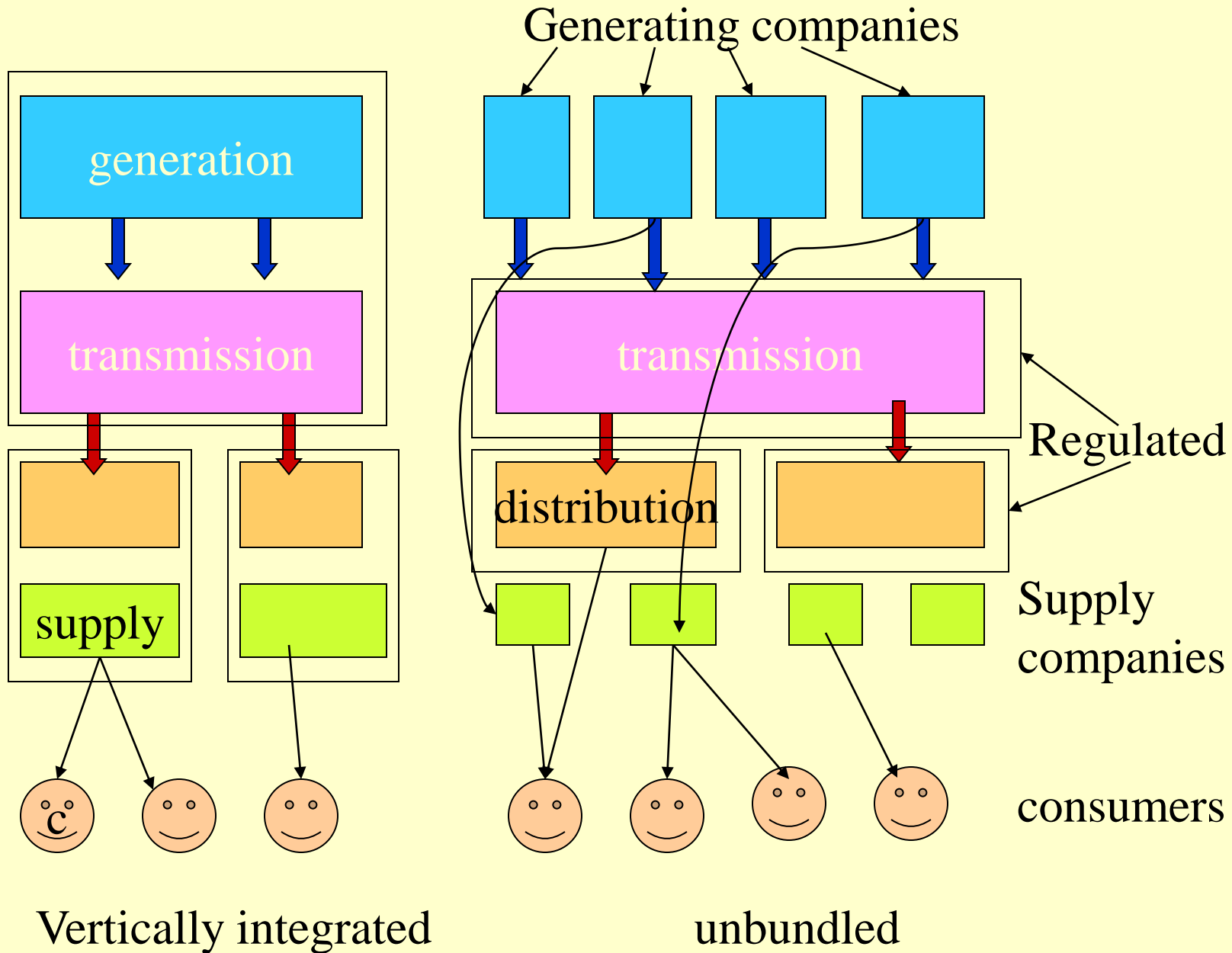
regulation to mimic competition where not

\Rightarrow regulate natural monopoly of network

\Rightarrow competition for services over network

Competition

- prices set by competitors
- increased profits requires cost cuts
- competition transfers gains to consumers
- innovation rewarded, not impeded
- incompatible with central state ownership



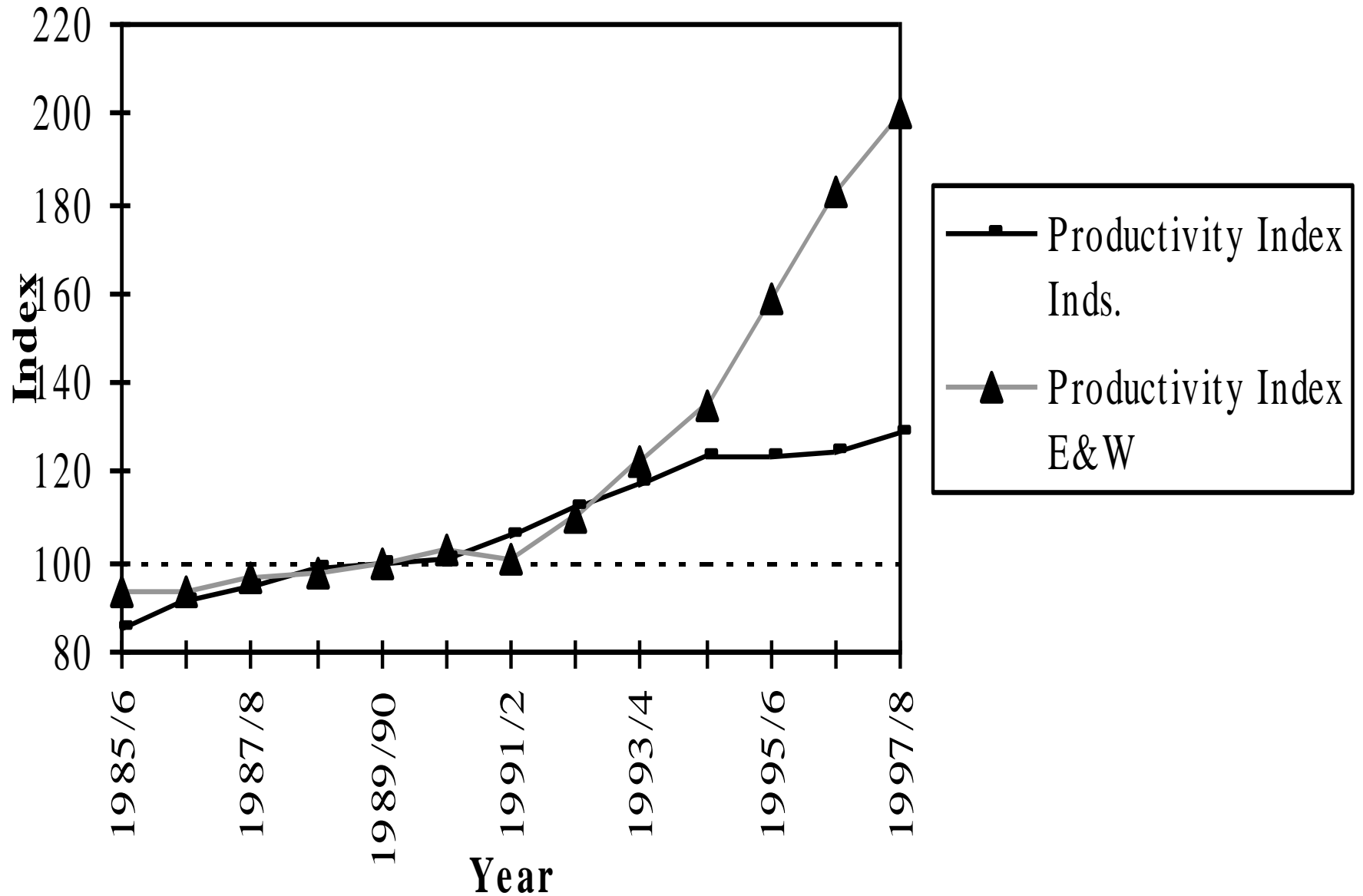
British electricity privatisation

- 1989 CEGB unbundled
- 1990 CEGB privatised (England and Wales)
 - 2 fossil gencos, 10 regional elec cos (RECs) + national grid sold, nuclear remains public
- 1990 Scottish industry privatised as 2 vertically integrated companies
- 1995 Nuclear electric sold, grid separated
- 1999 electricity franchise ends

Privatising and regulating the RECs

- One-third of turnover of ESI
- 12 RECs privatised Mar 31 1990
- Price control 1 Apr 1990 to Mar 31 1995
- regional monopoly on distribution
- prices periodically reset: benchmarking used

Productivity Index



Performance of RECs

- Little productivity gain first period
- Charges fall 25% 1995-1999
- take-overs allowed 1995 => big efficiency gains
- Efficiency gains to 2000: £5.4 bn @ 6%
- Restructuring costs £1.1 bn



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How to regulate

Various models

Accounting for the utility's cost

- Full cost C is operating expenditure, O , plus return *on* and *of* capital

- Regulatory Asset Base (RAB) = B_t

$B_{t+1} = B_t + I_t - D_t$ where D_t is depreciation
(for each asset j $\sum_t d_{jt} = k_j$, its initial cost)

$C_t = O_t + rB_t + D_t$, r is cost of capital

Rate-of-return regulation

- PUC sets **all** prices to cover costs,
- PUC determines fair rate of return, $f > r$
 - RAB normally written down book value
- Utility meets demands q_i at these prices p_i
 $\Rightarrow \sum p_i q_i = R = O_t + fB_t + D_t$, fixed by PUC
- Utility decides *how* to produce output

Incentive to over-invest and gold-plate

Price-cap regulation

- Designed by Littlechild for BT
 - mimics effect of competition
- Regulator collects data from utility
 - forecast efficient operating costs O_t^*
 - asset value, investment plans $\Rightarrow B_t$
 - demand forecasts
 - calculates wted av. cost of capital $WACC = r$
- Determines revenue required:

$$R_t = O_t^* + rB_t + D_t$$

Correcting for inflation

- UK model: RPI-X
 - RPI corrects for inflation,
 - X for predicted/required efficiency gain
 - => prices can increase by inflation *less* X
- measure assets at constant prices
- WACC, r , *real*
- Interpret prices as real prices: deflated by RPI

Price caps and baskets

Utility chooses p_i s.t. Laspeyre's index does not increase

$$\sum_{i=1}^n p_i q_i^{t-1} \leq \sum_{i=1}^n p_i^{t-1} q_i^{t-1}$$

$$\sum_{i=1}^n p_i q_i^{t-1} \leq (1 - X) \sum_{i=1}^n p_i^{t-1} q_i^{t-1}$$

Effects of different baskets

- Laspeyre's price reductions are welfare improving
- Far-sighted utility maximising PDV of profits converges on Ramsey pricing
- Revenue cap can lead to *inverse* Ramsey pricing

Design of basket has important welfare effects

Yardstick regulation

- Need: set of comparable companies
 - e.g. 12 RECs
- estimate average unit costs of *other* firms c_{-j}
- price cap for firm j is $p_j = (1-b) c_j + b c_{-j}$
- power of yardstick is b

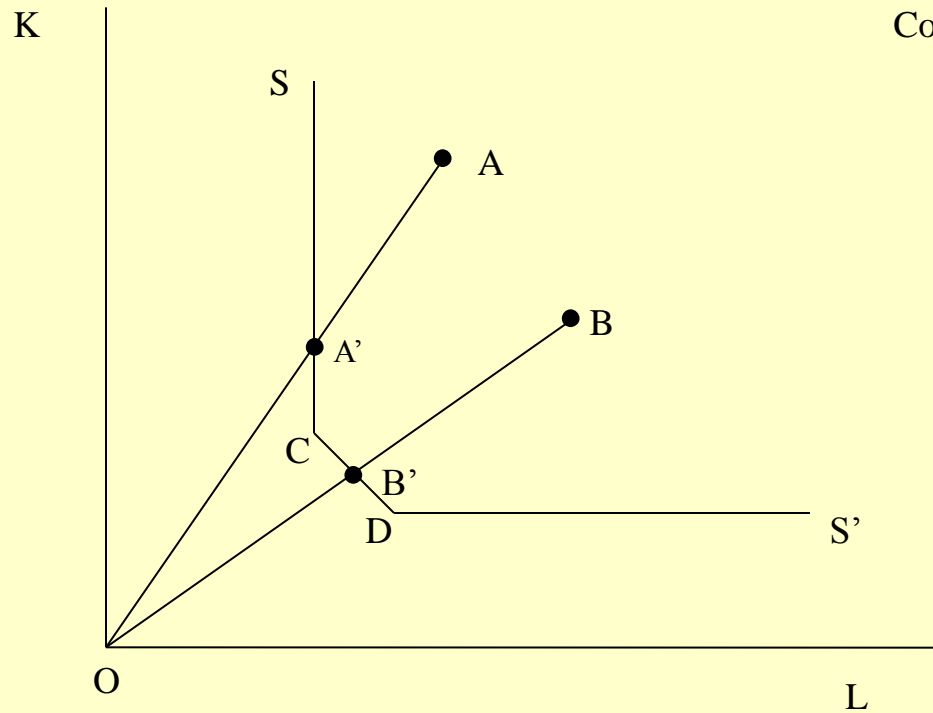
What if other companies face different costs?

Benchmarking

- objective: to set \underline{R} = efficient costs
- Need: set of comparable companies, and enough data to identify important cost drivers
- Identify efficiency frontier
- determine distance of company from frontier
- X_i set to catch up frontier
- predict rate of movement of frontier

Illustration of Methods

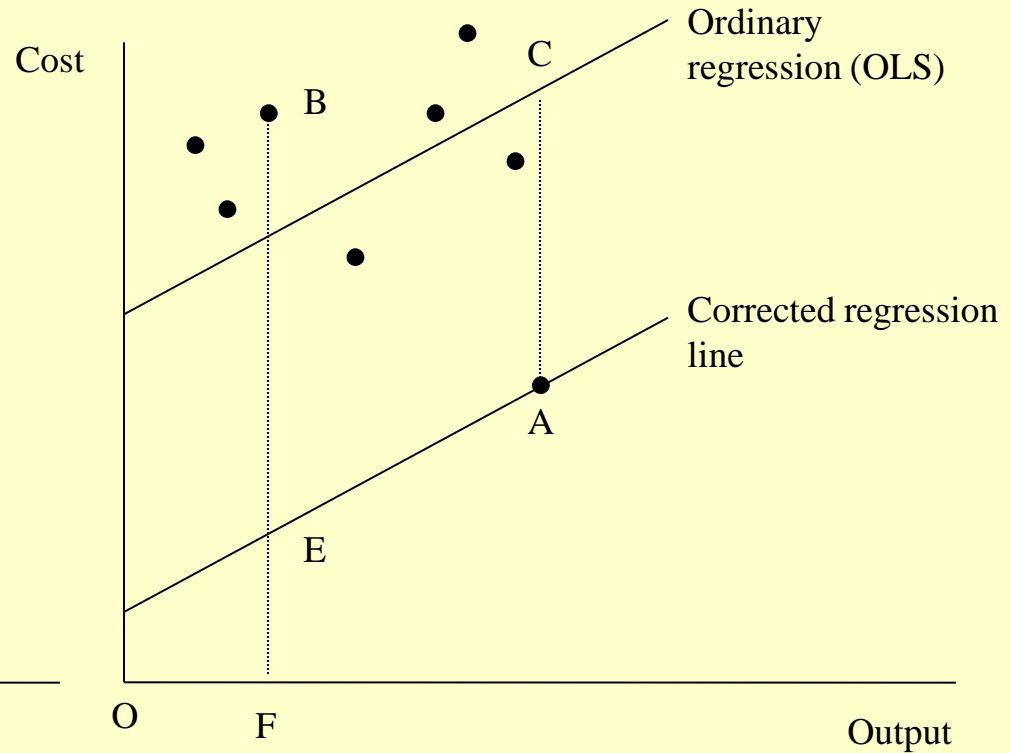
DEA



DEA efficiency scores:

- Point A: OA'/OA
- Point B: OB'/OB

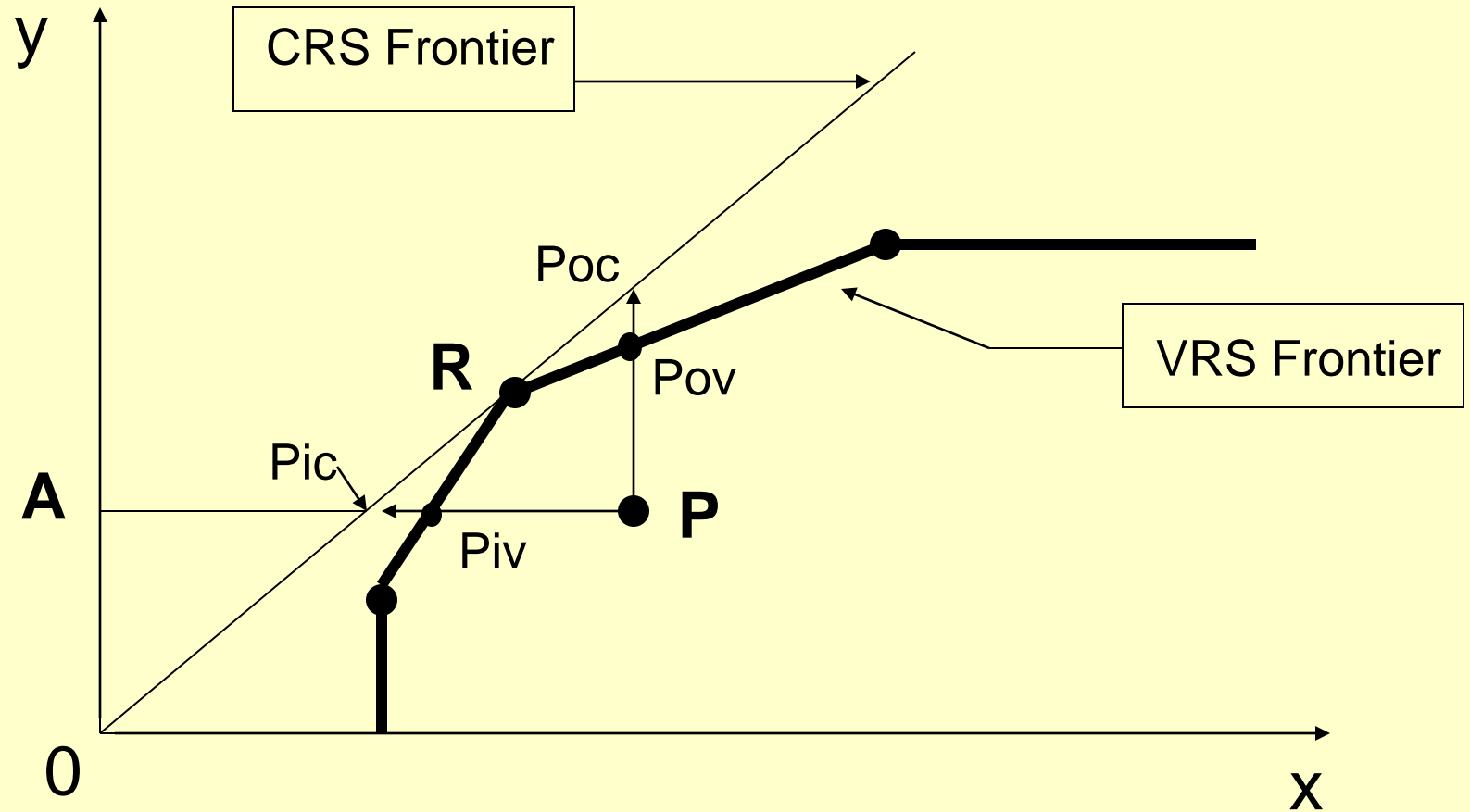
COLS



COLS Efficiency scores:

- Point A: 100%
- Point B: EF/BF

CRS vs. VRS DEA

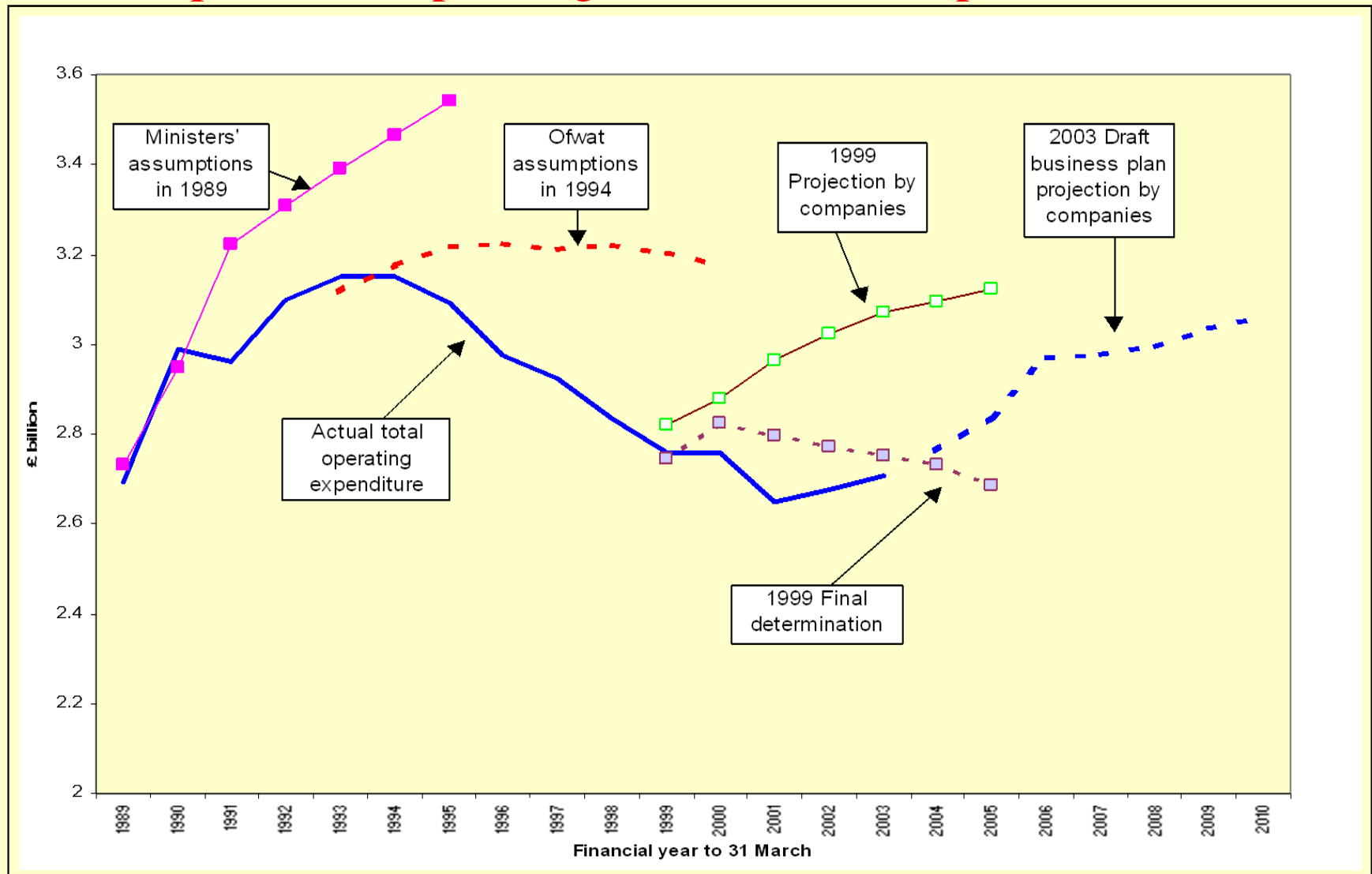


Eff. scores - UK vs. Japanese DISCOs

1997-8	DEA-CRS	DEA-VRS	OFGEM-COLS
Eastern	81.1%	100.0%	103%
East Midlands	58.3%	58.8%	77%
London	67.4%	78.8%	82%
Manweb	65.6%	84.3%	80%
Midlands	63.9%	67.7%	64%
Northern	51.5%	65.9%	71%
NORWEB	56.3%	62.0%	64%
SEEBOARD	84.5%	98.3%	87%
Southern	100.0%	100.0%	103%
SWALEC	49.5%	82.4%	82%
South Western	93.5%	100.0%	73%
Yorkshire	74.5%	82.6%	72%
JP1	41.6%	49.2%	-
JP2	28.5%	99.7%	-
JP3	34.1%	100.0%	-
JP4	40.3%	99.9%	-
JP5	40.9%	45.9%	-
JP6	43.8%	100.0%	-
JP7	31.6%	54.0%	-
JP8	34.4%	37.4%	-
JP9	32.7%	100.0%	-
Avg. UK	70.5%	81.7%	77.17%
Avg. Japan	54.5%	76.2%	-

Water and Sewerage in England & Wales

Comparison of operating costs in constant prices 1989 - 2003

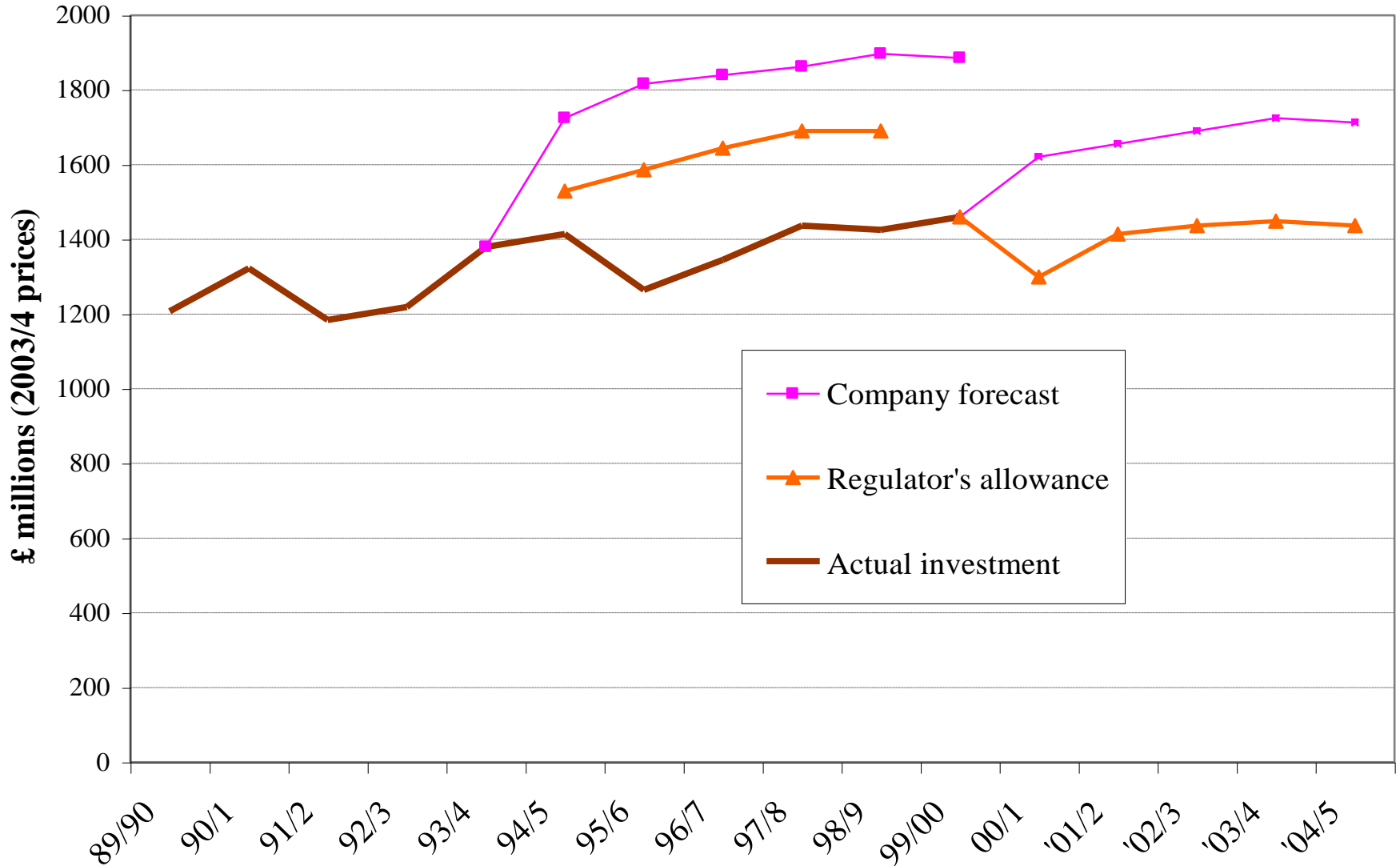


Incentives for investment

- benchmarking used for opex, hard for capital
 - Investment plans \Rightarrow RAB_{*t+i*} \Rightarrow price path
 - e.g. use of *K* factors for water
- \Rightarrow Utility overstates investment plans
- delay investment until end of price control period
 - if RAB updated \Rightarrow rate-of-return regulation?
 - If RAB based on benchmarks \Rightarrow under-invest?

Need to monitor quality with price caps

British Electricity Distribution Investment

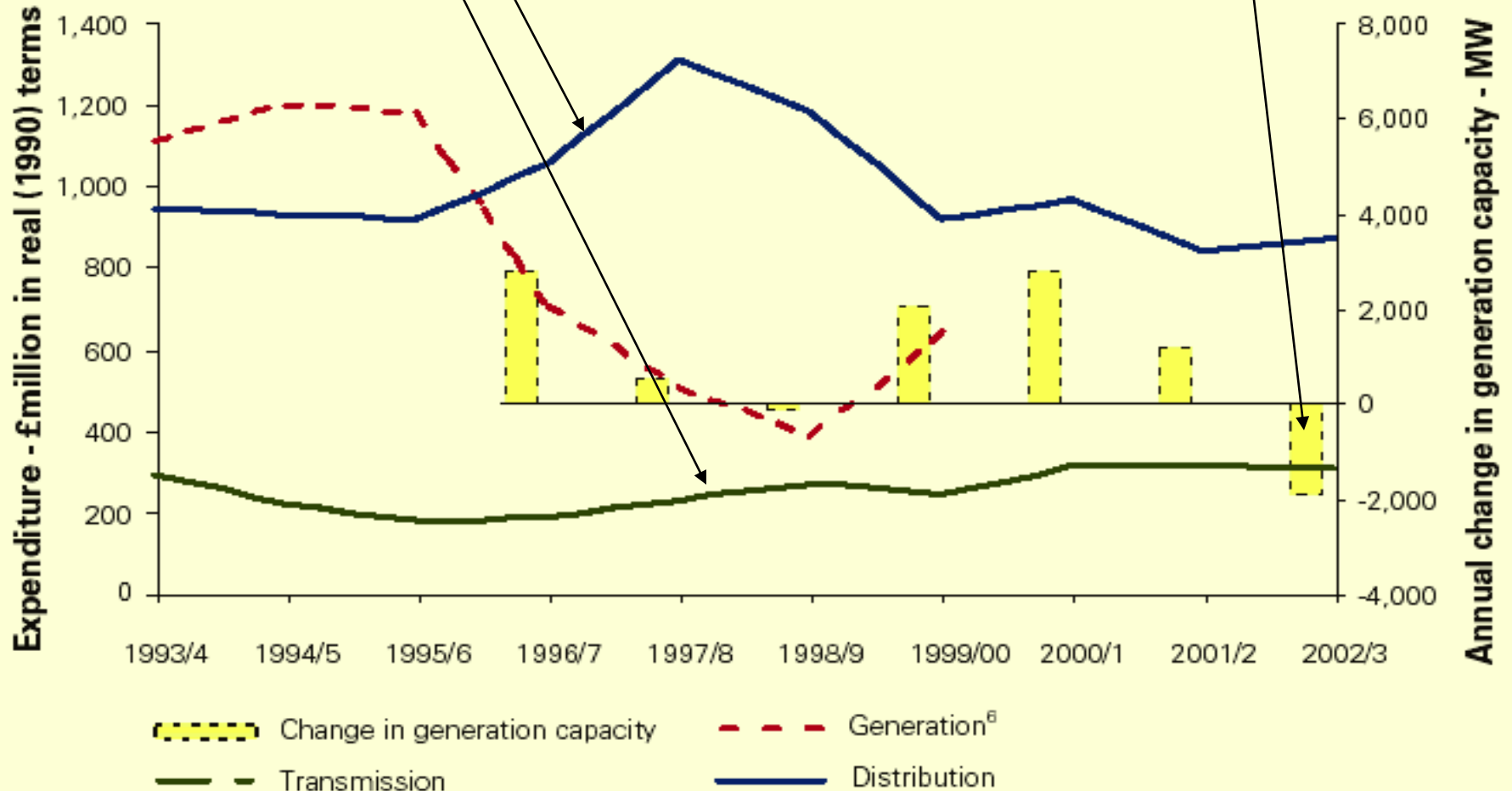


Transmission adequacy

- National Grid has incentives for reliability and investment
 - To reduce the cost of ancillary services
 - To reduce interruptions and increase availability
 - has invested £3.5 billion since 1990
 - distribution+transmission investment = £16 billion

Network investment looks fine but generation falls with price

11 Electricity capital expenditure – GB



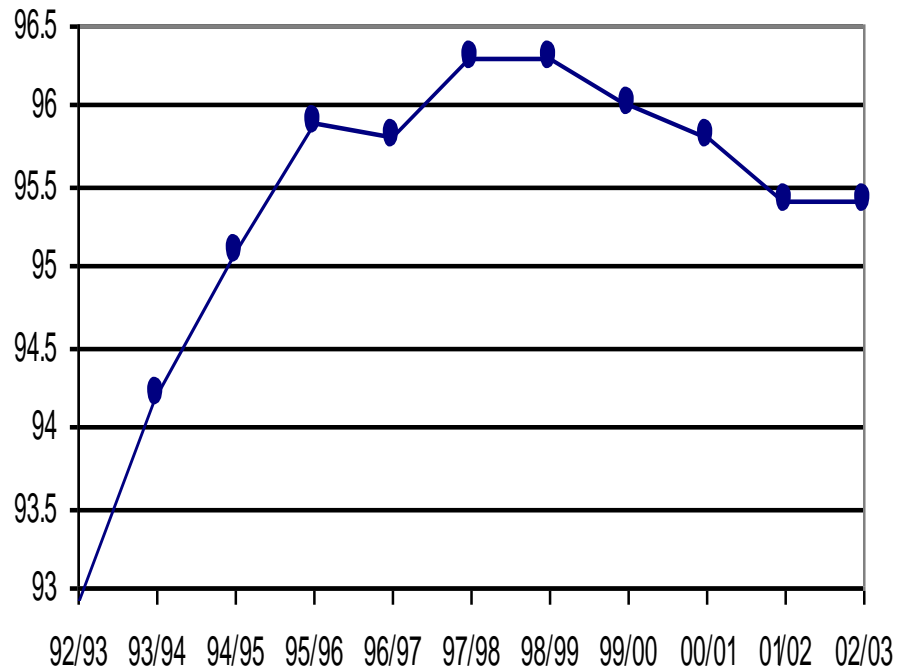
⁶ Generation information discontinued by the CRI after 1999/2000.

- Source: JESS Report Nov 2003

Transmission & Distribution Reliability

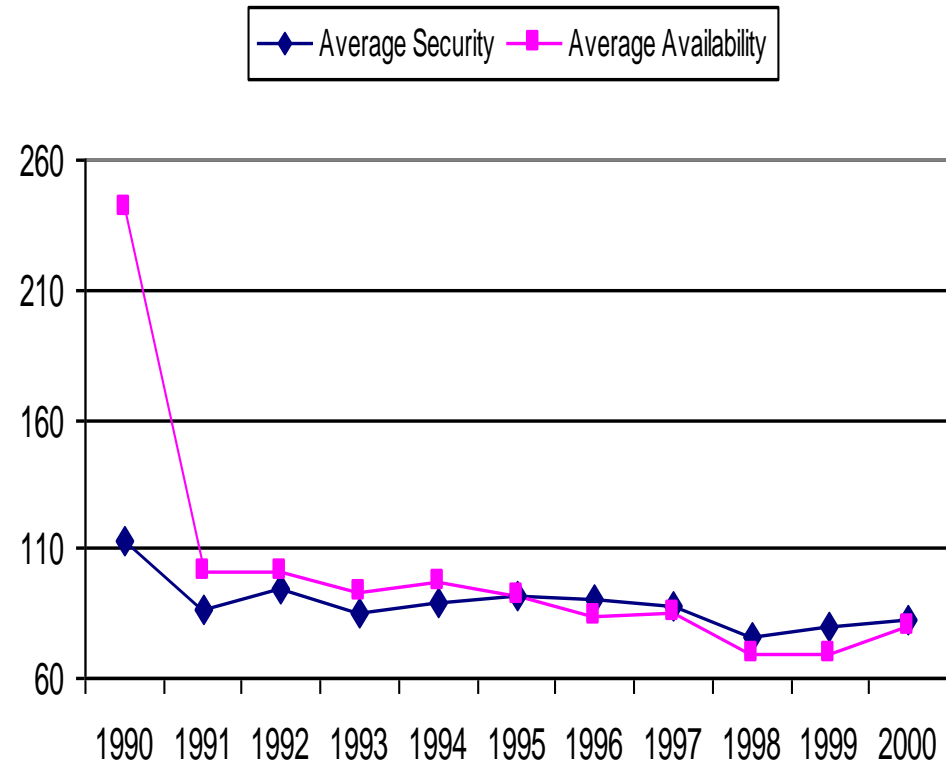
Average Transmssion System Availability (%)

Source: National Grid



DNOs supply interruptions (min/year)

Source: OFGEM



Summary of UK experience

- trade-off between rent capture and incentives:

$$R = b\underline{R} + (1-b)C$$

- Rate-of-return regulation \Rightarrow over-investment
- Price-caps \Rightarrow risk of under-investment
- good price-cap baskets \Rightarrow allocative efficiency
- Regulating natural monopolies requires good information about efficient costs \underline{R}
 - benchmarking useful



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European experience

Driven by the European Commission

EU Energy Directives

- Electricity 96/92/EC due Feb 1999
 - Gas 98/30/EC due Aug 2000
 - justified by experience in UK, Norway, Chile
- ⇒ increased role of Commission
- ⇒ de-politicise national energy policy
- ⇒ energy policy to be market friendly
- aim: create competitive single energy market***

Security of supply

- SoS critical as cannot store electricity
 - spare capacity aids liberalisation
 - encourages competition \Rightarrow low prices
 - early liberalisers had spare capacity
- \Rightarrow gives time to learn how to regulate
- Britain developed regulation, licences
 - Continent unprepared for Energy Directives?

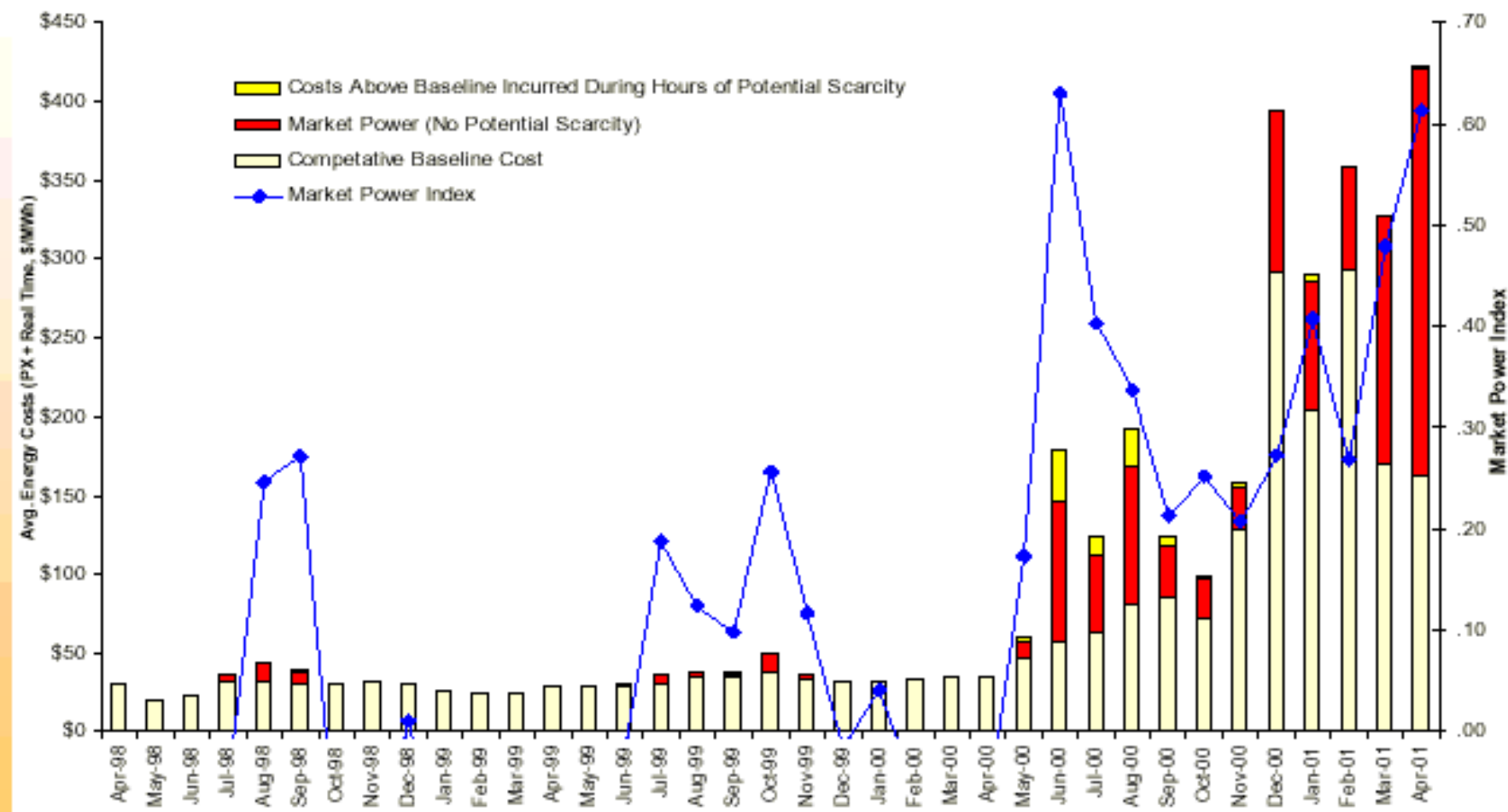
Proposed New Directive 2000

- for electricity *and* gas
- regulated not negotiated access,
 - tariffs **published** *ex ante*
- sector-specific regulator
- legal (but not ownership) unbundling G&T
- no single buyer model
- 2005 all gas + elec markets fully open
then California goes into melt-down



What Explains the High Prices?

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



Stockholm, March 2001

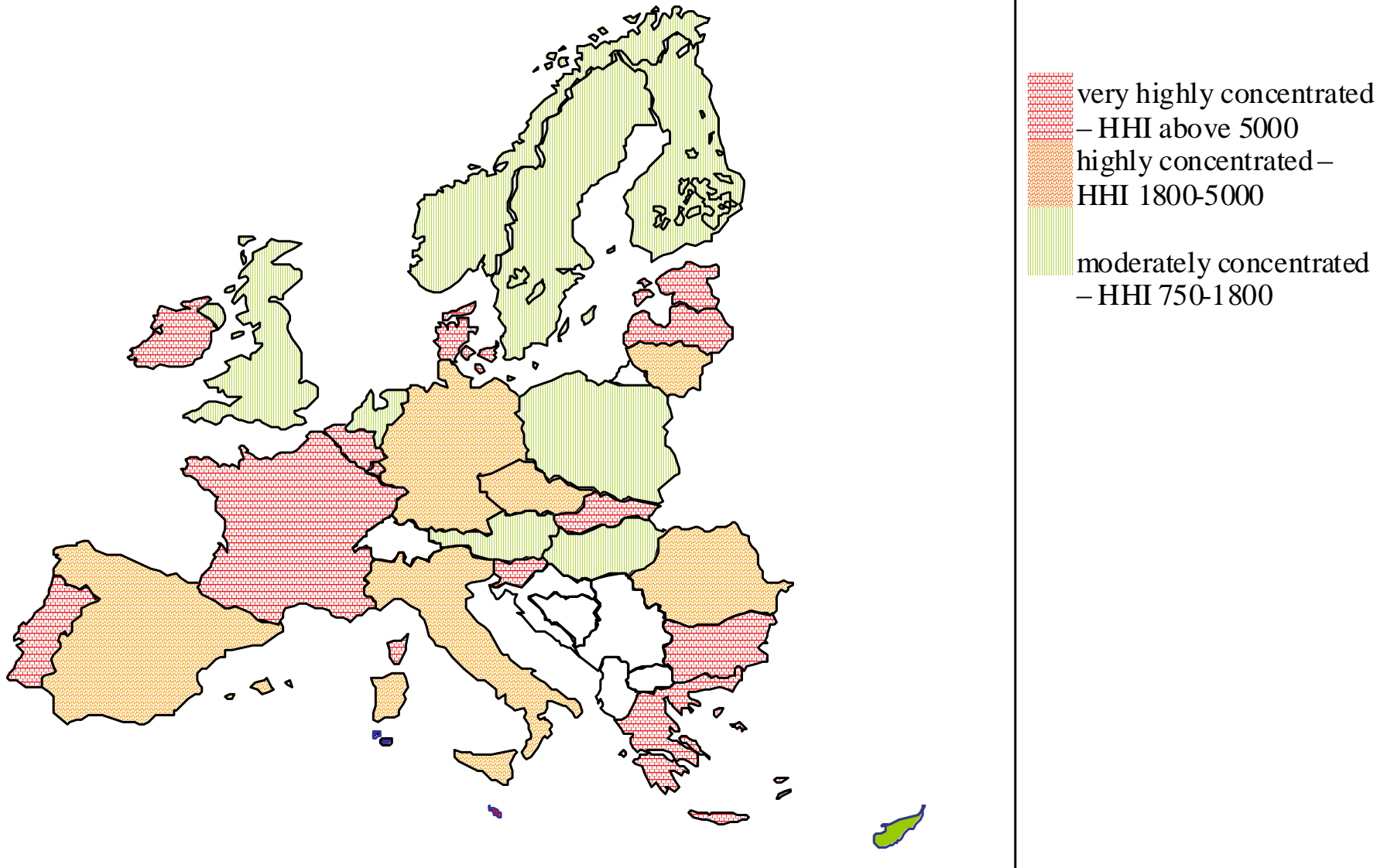
- CEC claims reforms will avoid California problems caused by “inadequate legal framework and .. capacity”
- France opposes new Directive: not convinced of liberalisation
- Germany opposes need for regulator
 - also has negotiated access and vertical integration

Agreement on New Directive in 11/02

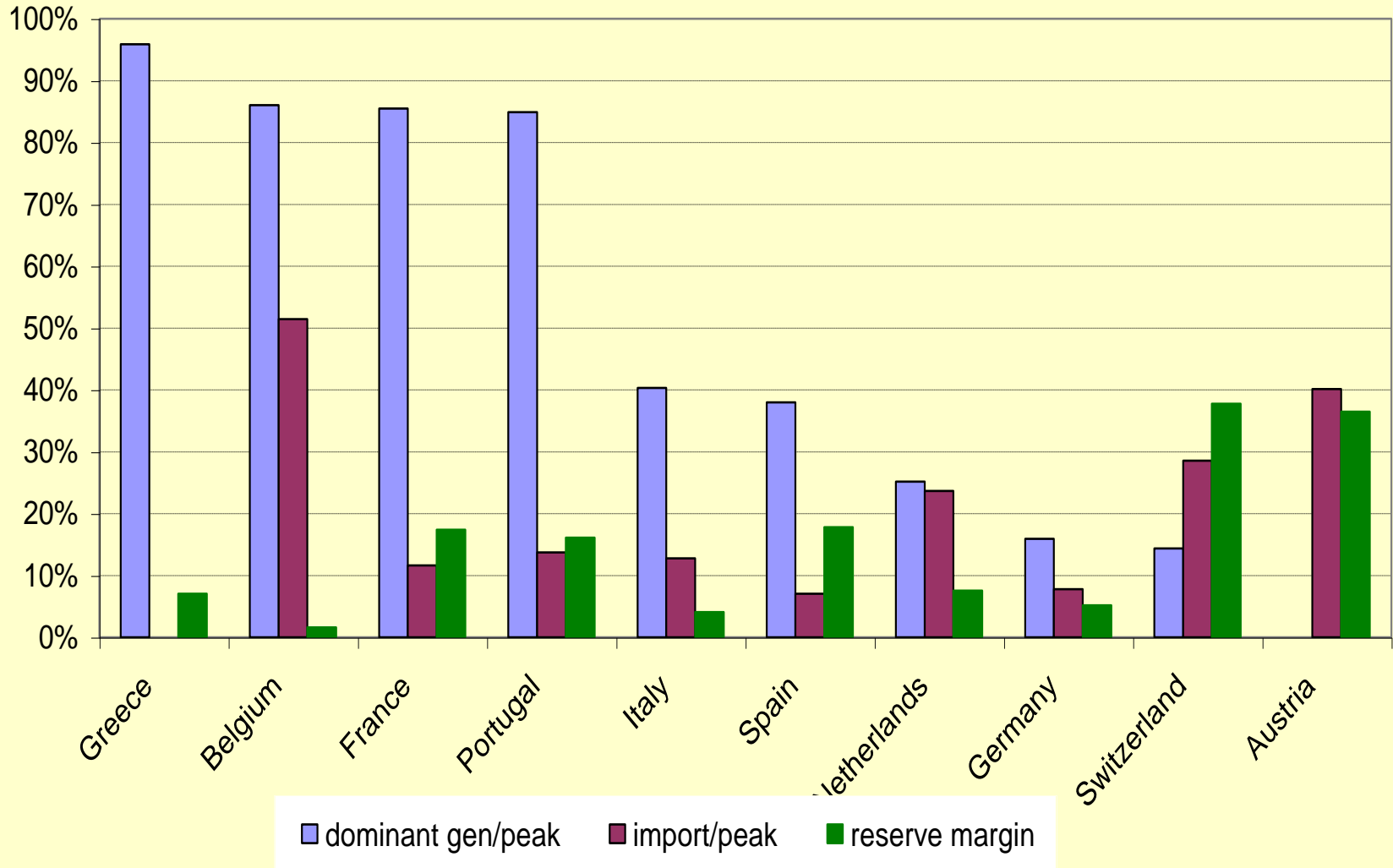
- for electricity *and* gas
- tariff ***or methodology*** to be published
- requires regulatory authority
- legal (but not ownership) unbundling G&T
- no single buyer model
- 2006: review experience before decision to open all gas + elec markets by 1.1.2007

markets opened in 2007

Many markets still concentrated



Share of dominant generator in peak demand

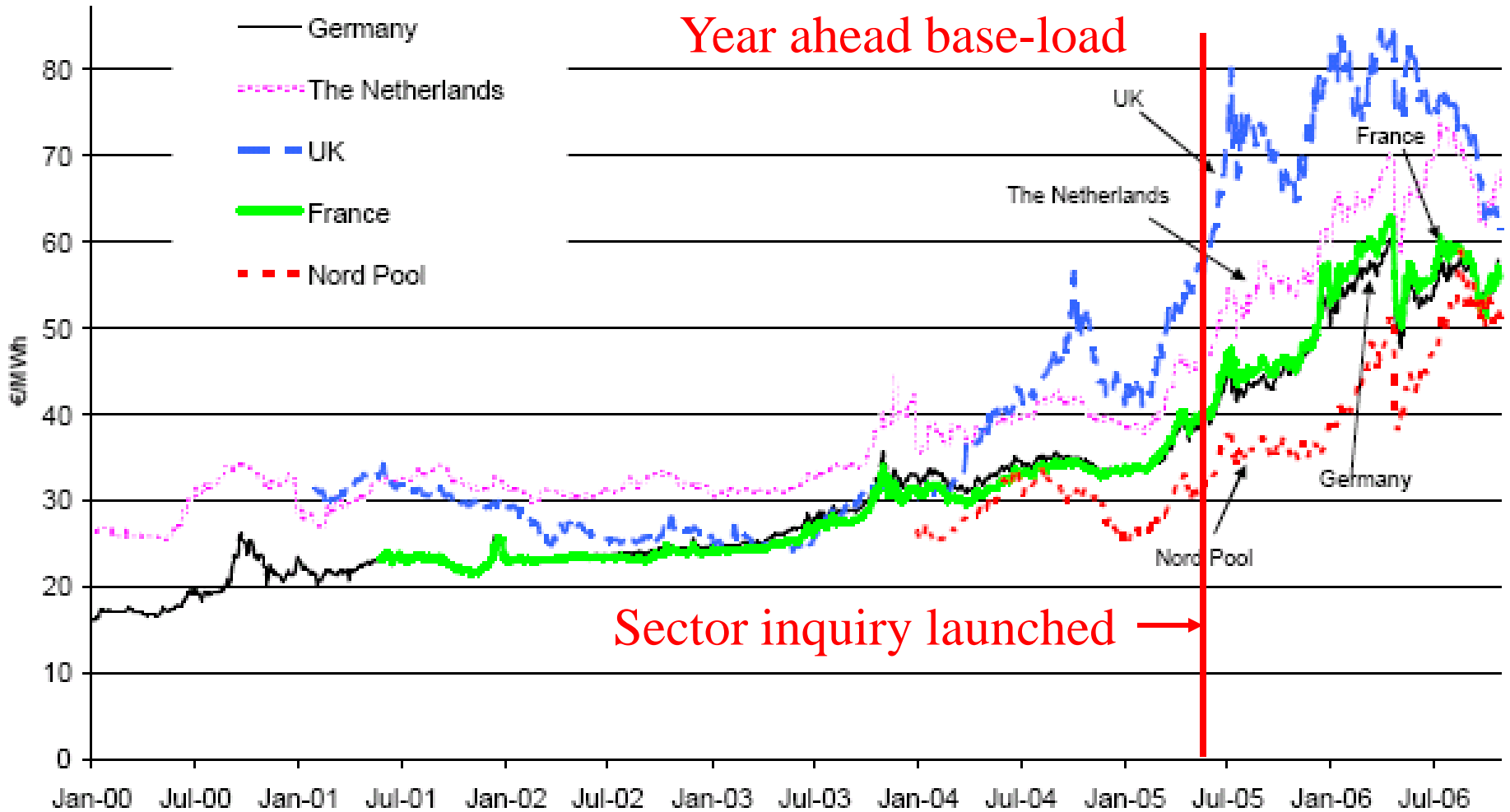


Preconditions for ESI liberalisation

- 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 ✗

Prices rise, Energy Sector Inquiry launched

Rising prices prompt *Inquiry*



Source: information received within the scope of the Sector Inquiry from Argus Media, Platts¹⁸⁴, and Nord Pool.

Sector Inquiry calls for action

Key areas calling for action:

- 1) effective unbundling
- 2) deal with cross-border regulatory gaps
- 3) address market concentration, barriers to entry
- 4) increase transparency

All easier with unbundled utilities

European developments

- *Energy Sector Inquiry* completed
 - concern over market power
- ⇒ some companies unbundle G & T
- gradual move to cooperation between NRAs
- aim to improve power to get information
 - slow progress on market surveillance

but inadequate attention to mergers

Contrasts between UK and EU

UK: carefully designed regulation

- but flawed execution on market structure
 - after 10 years now fairly competitive

EU: Electricity Directive forces change

- but inadequate attention to framework
- resistance to unbundling and competition

gradual progress towards the single market

Conclusions on competition

- Challenge: create effective competition
 - increasing cross-border trade helps
 - but needs adequate capacity and access
 - Market structure changes hard to reverse
- ⇒ Be cautious of mergers
- Need pro-competitive regulators
 - with adequate powers (information, enforcement)

Conclusions on regulation

- Regulation of private utilities must protect consumer *and* investor
 - Is the regulatory compact credible?
 - Need to combine credibility and ability to change rules
- ⇒ need good dispute resolution process
- its decisions must also be credible



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Acronyms-1

CC: Competition Commission

CEC: Commission of European Communities

CEGB: Central Electricity Generating Board

COLS: Corrected ordinary least squares

CRS: Constant returns to scale

DEA: data envelopment analysis

Disco: Distribution company

DOJ: US Dept of Justice

ESI: Electricity supply industry

G: generation

Acronyms-2

HHI: Hirschman-Herfindahl Index= sum of squared market shares

PDV: present discounted value

PUC: Public Utility Commission

RAB: regulatory asset base

REC: Regional Electricity (Distribution) Company

RPI: Retail Price Index

rTPA: regulated Third Party Access

T: Transmission

WACC: weighted average cost of capital