Electricity Policy Research Group

UNIVERSITY OF CAMBRIDGE

The rationale for a market monitoring process

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Southeast Europe Electricity Market Monitoring Workshop

Athens 4-5 October 2005

http://www.electricitypolicy.org.uk

Outline

- Liberalisation and the importance of effective competition
  - the need for market monitoring
- Tools for market monitoring
- Institutional and data issues

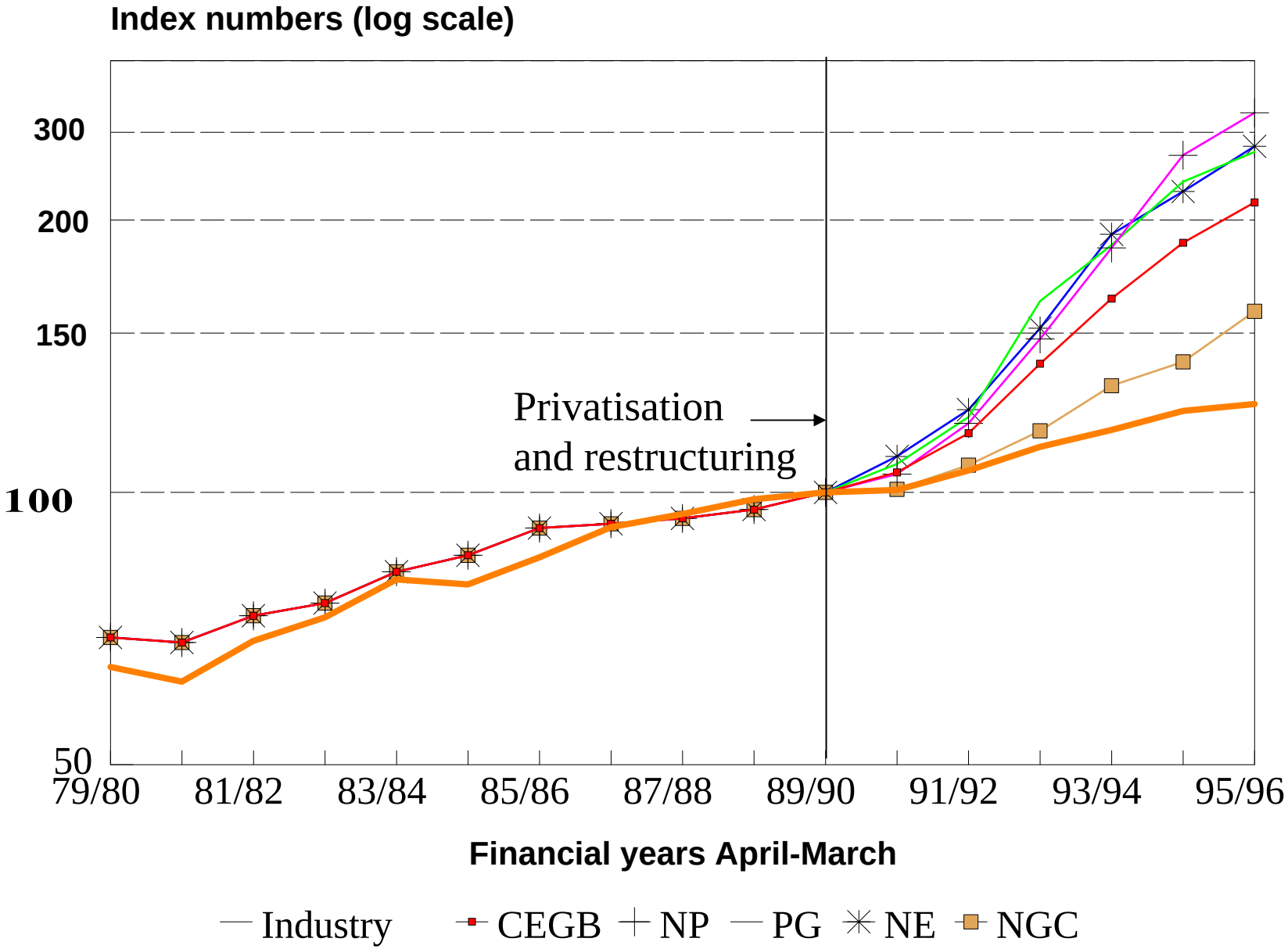
Liberalisation and the importance of effective competition

The need for market monitoring

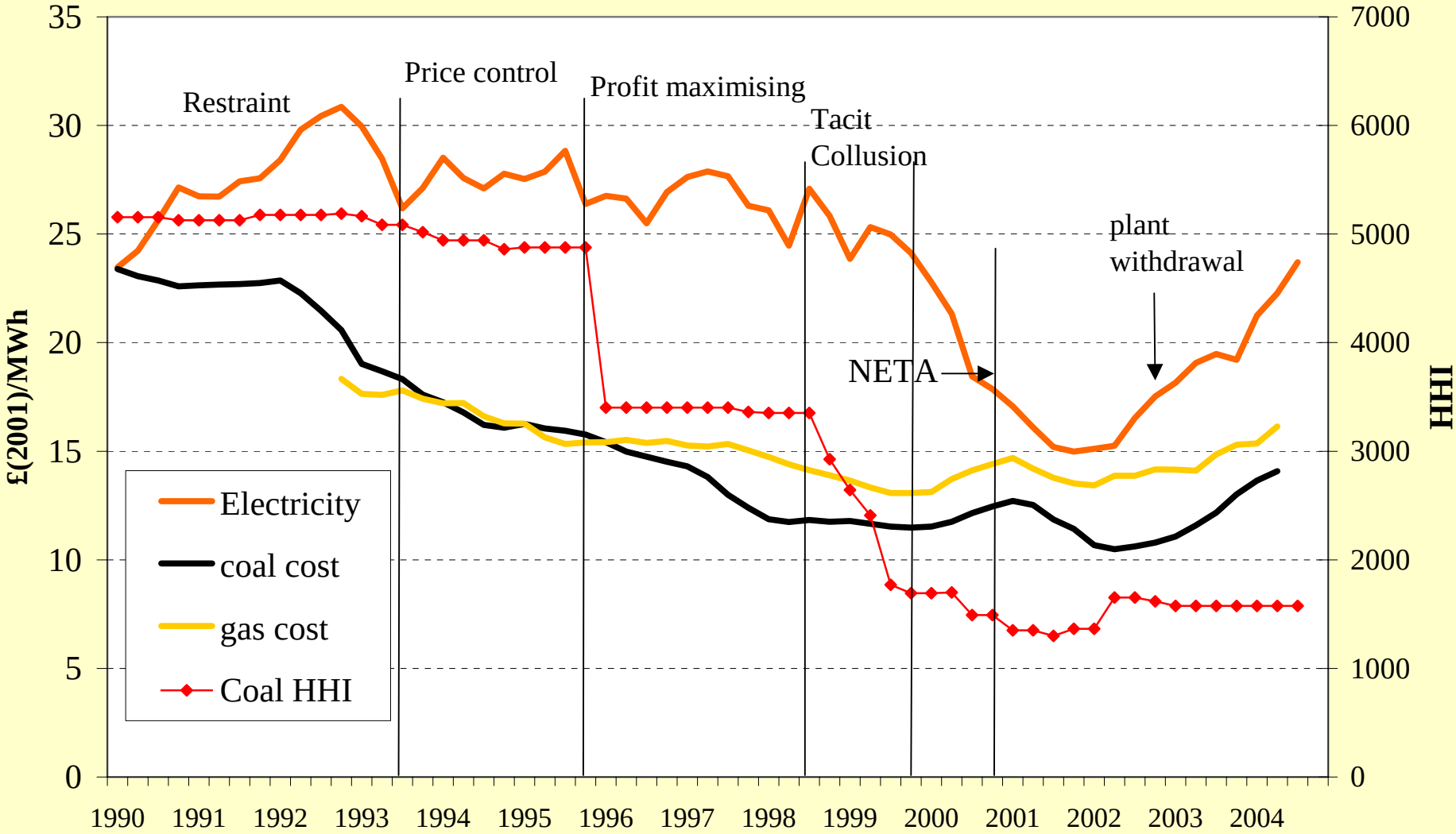
Energy Liberalisation

- Energy critical for economic success
- effective competition can
  - encourage cost reduction to increase profit
  - pass on cost reductions to consumers
- Productivity gains from well-designed restructuring and privatisation are impressive
  - often rapid doubling of productivity
- But consumers can lose if competition weak

Productivity of CEGB and successor companies relative to UK manufacturing industry



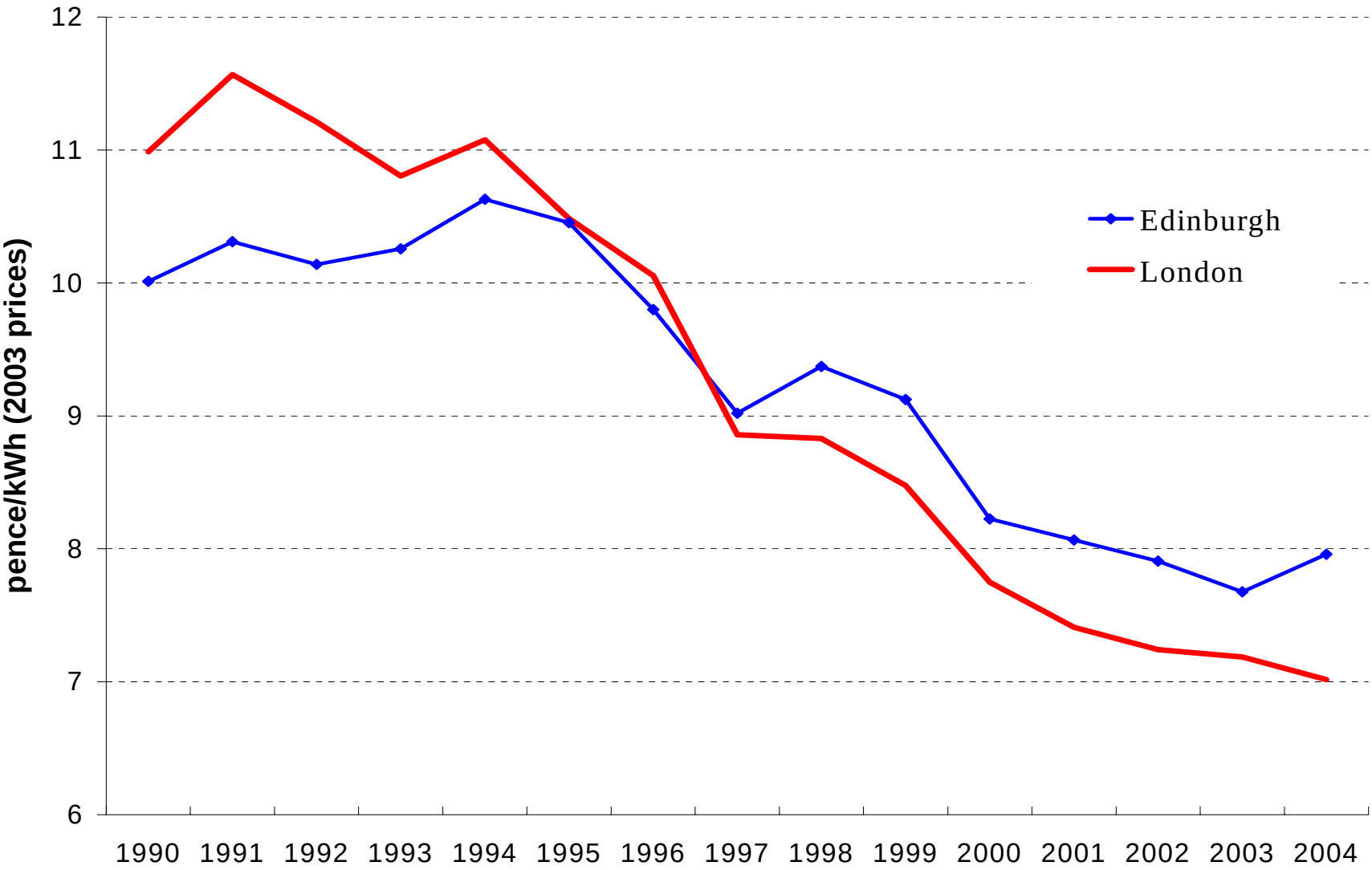
Real GB electricity prices and costs



Unbundling transmission

- Unbundling T & G critical for competition
  - England unbundled and improved productivity
  - Scotland remained integrated -
    - no productivity gain, little benefit from privatisation
  - German utilities remain integrated
    - profits generated in network, deters and denies entry
- Vertical integration makes access regulation critical and very difficult

Domestic electricity prices England and Scotland excl taxes



Politically acceptable liberalisation requires:

- confidence in supply security
- sustainable competitive outcomes
- absence of market abuse
- ability to mitigate market power
- credible regulation for efficient free entry and investment

These challenges remain in EU and elsewhere

Competition policy for utilities

Principle: separate out natural monopolies:

– "Competition where possible, regulate where not"

=> Leave network services that are assured to be workably competitive to competition law (?)

=> Regulation essential for networks

But regulators should retain power to ensure that services are and remain workably competitive

Dimensions of market power

- Short-term markets vs long-term contracts
  - elasticity of supply rises with more time
- Pools vs PX vs OTC markets
  - transparency may allow collusion
- Futures and forward markets
  - thin markets associated with market power
  - selling forward reduces spot market power
- Interconnectors and coupling
  - sequential markets offer more gaming chances

Why is monitoring important?

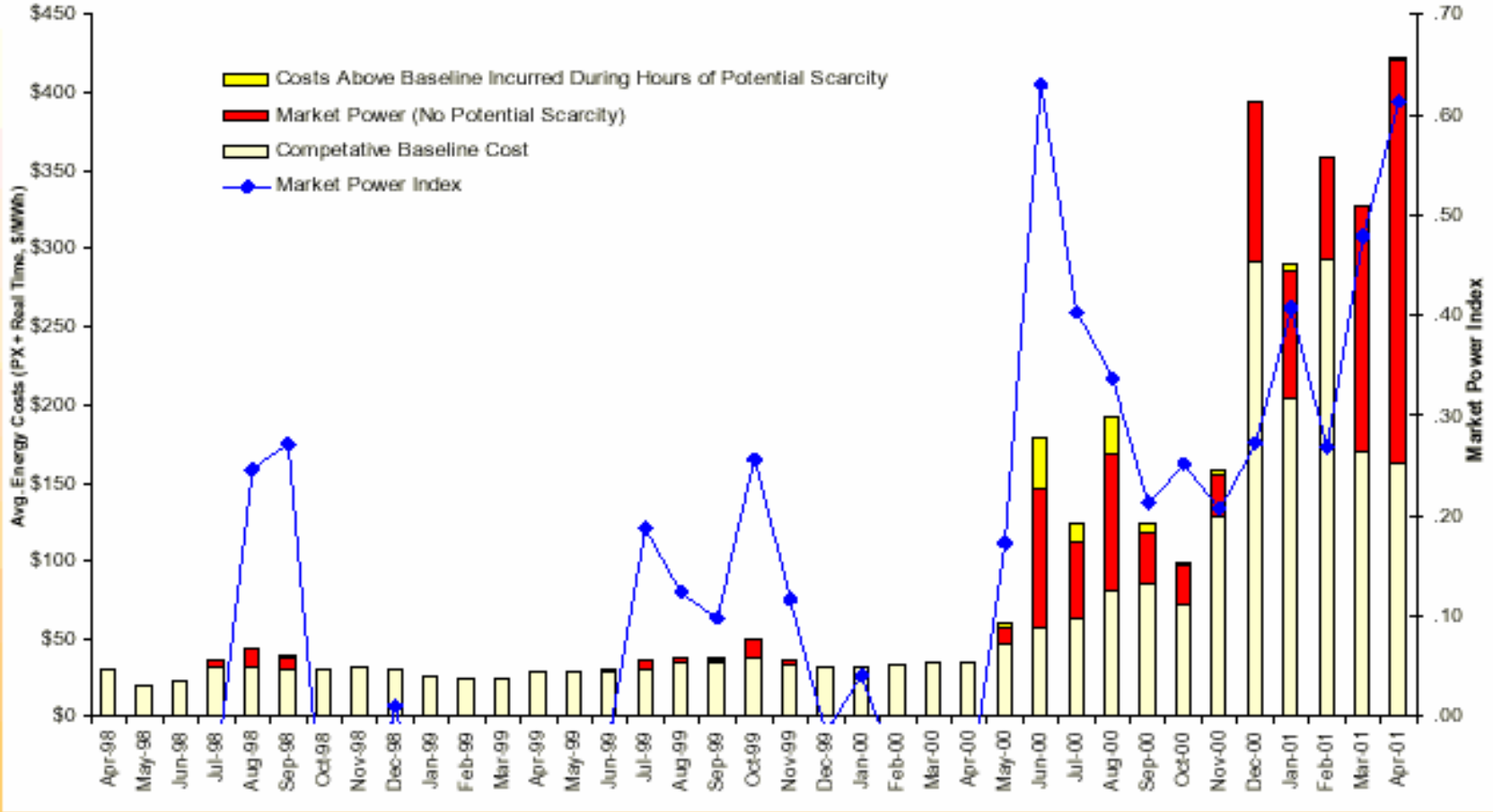
- Electricity has special characteristics
  - supply and demand must be instantly balanced
  - cannot store in thermal systems
  - failures can cascade into blackouts
  - short-run demand elasticity very low
  - short-run supply may be inelastic at peak
  - cannot easily ration by price

=> system operation is a monopoly

Generators may have significant market power

What Explains the High Prices?

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



Why is monitoring important? 2

- Potential competitors need assurance that they will not be disadvantaged
- Power exchanges and OTC markets need liquidity for successful competition
  - like financial markets need careful monitoring to detect and prevent fraud and manipulation
- Market designs and grid codes, etc need adjustment in light of experience
  - Monitor needs good information and analysis

Contrasts between US and EU

United States

- **Acquiring** monopoly position may be illegal
  - **holding** a monopoly is not,
  - fiduciary duty to maximise profits
  - contrast EU Art 82: **abuse of dominance illegal**
- ESI governed by Federal Power Act 1935
  - regulators must ensure prices are “just and reasonable”

EU

- Directives limited to structure and networks
  - treatment of G and S left to member states

Implications for monitoring

United States and PUCs

- duty to monitor prices (“just and reasonable”)
- duty to mitigate market power
- strong tradition of publicly available data

EU

- market monitoring needed to bring cases of abuse
- monitoring to inform regulators of market behaviour
  - critical in event of e.g. merger, change in market design
- need to be explicit about information powers
  - some regulators lack legal powers to demand information

Importance of interconnectors

- Imports can compete with domestic G
  - can greatly reduce market power - Scandinavia

=> Maximise and efficiently allocate ATC

- Loop flows require TSO cooperation
- Cross-border ownership creates problems
- Building interconnectors attactive
  - both need NRA cooperation

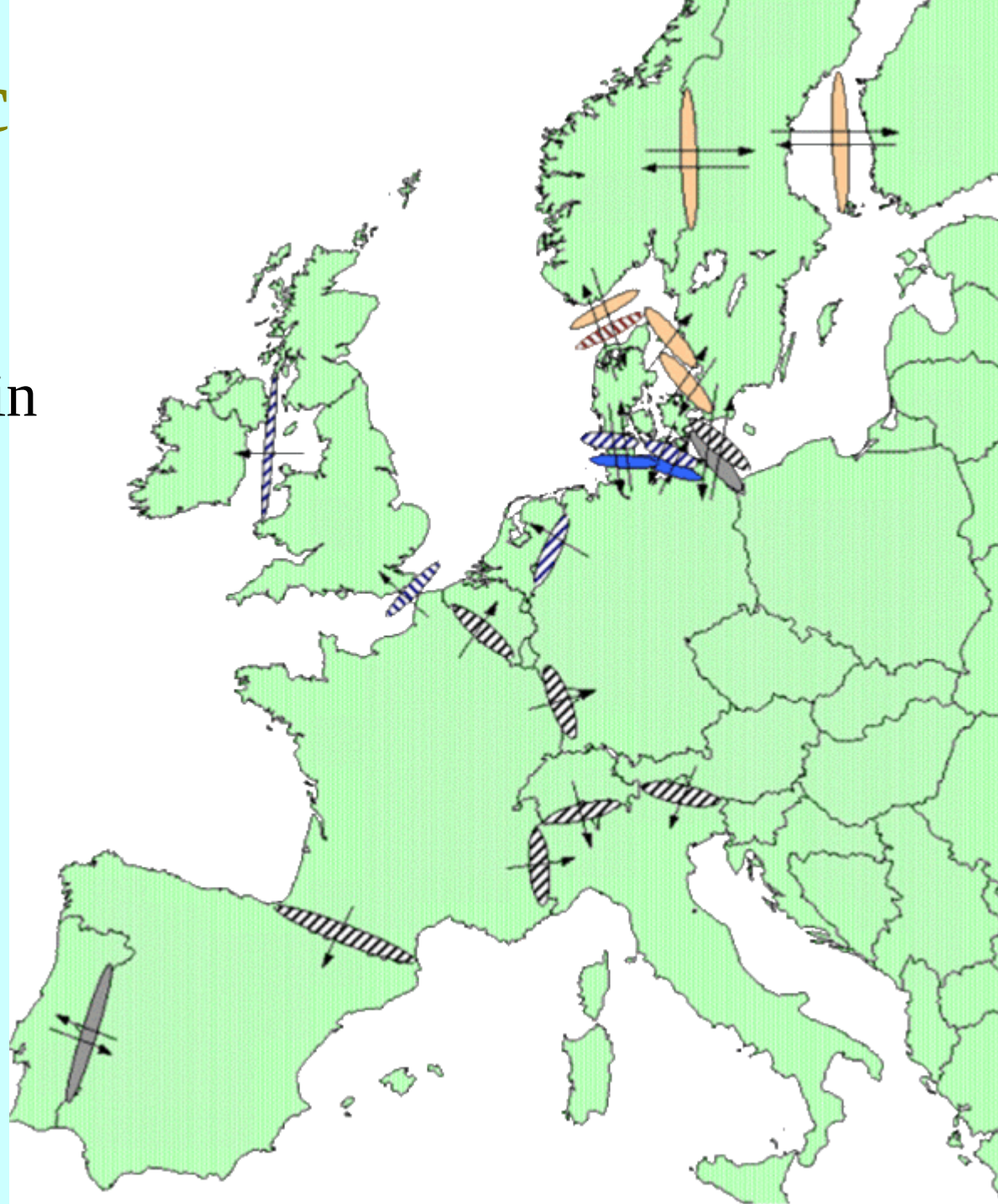
Congested interc

←

Mainly congested in direction of arrow

⇄

Congested both directions



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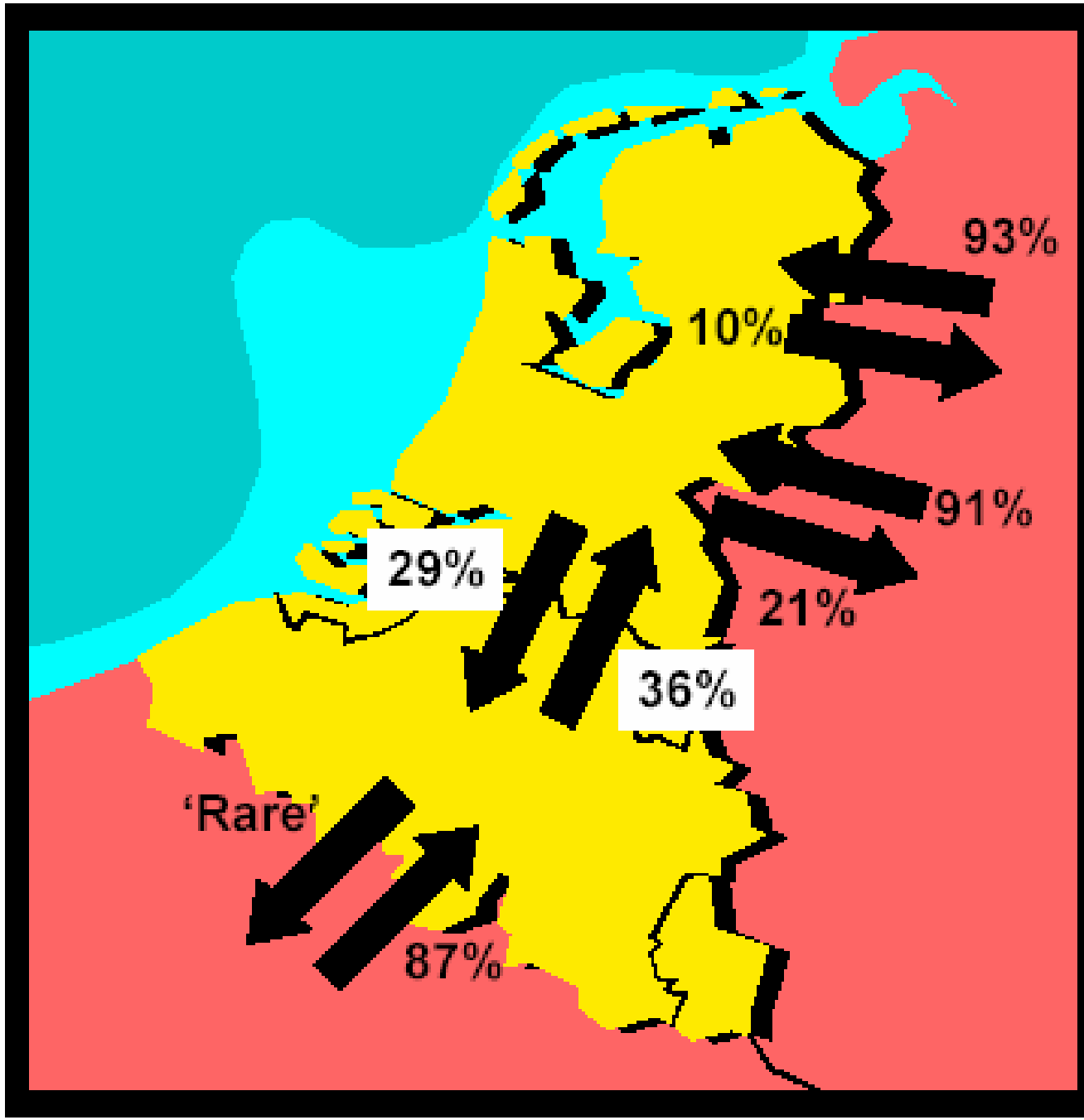
Percent of time contractual constraints exist in Benelux (Brattle, 2003)



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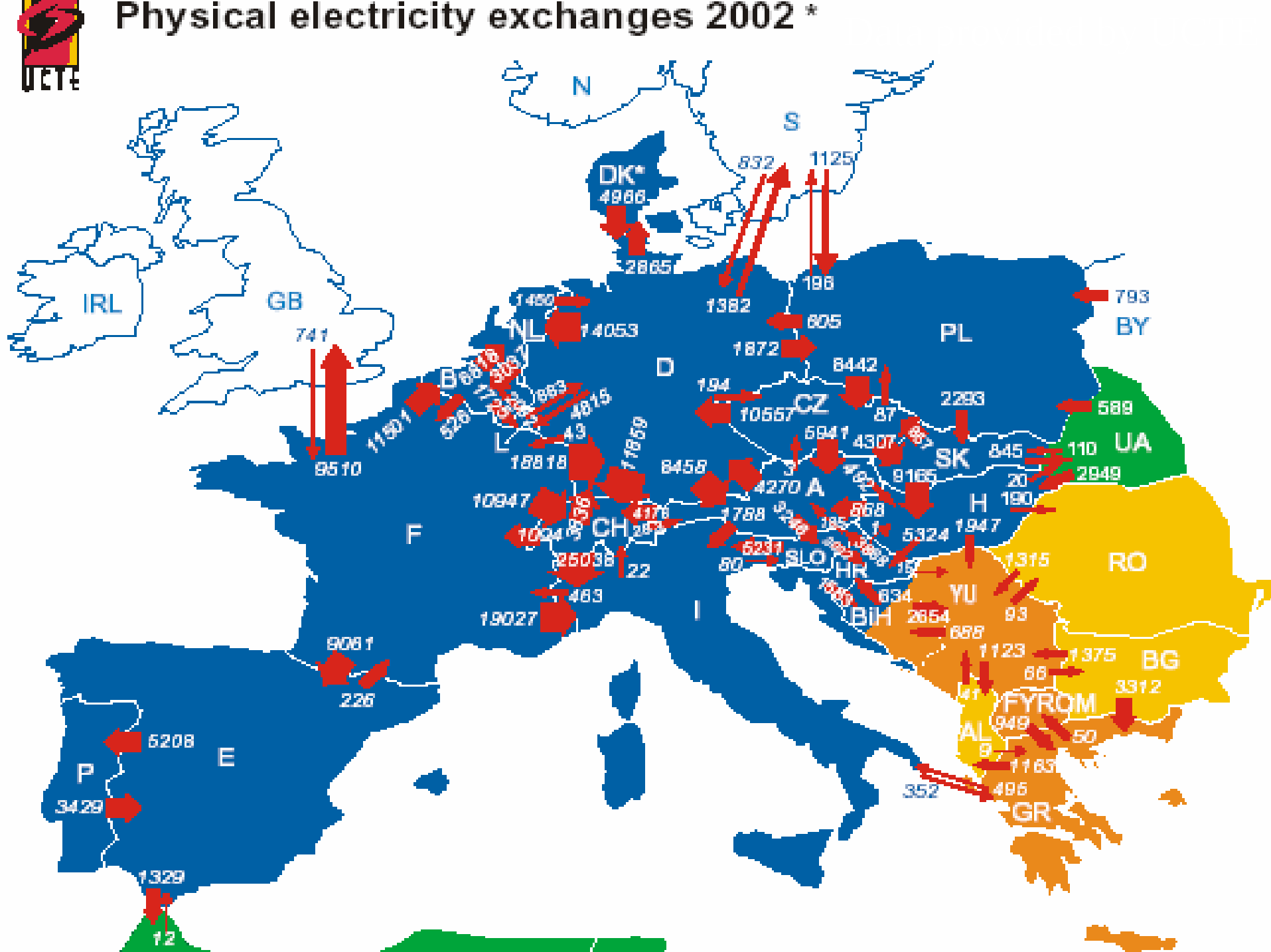
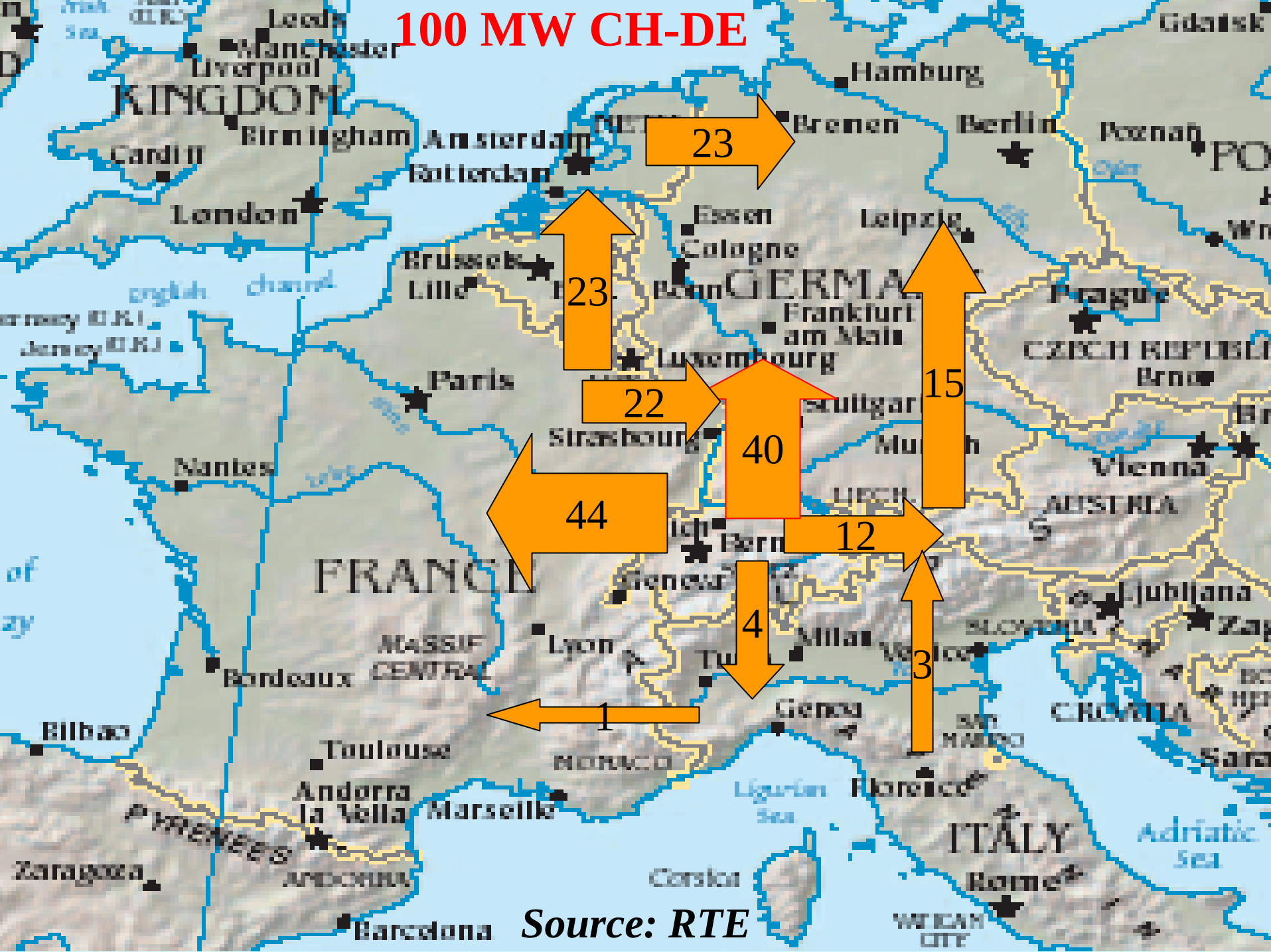
Physical electricity exchanges 2002 *




100 MW CH-DE
23
23
22
40
15
44
12
4
3
1
Source: RTE

The Cambridge-MIT Institute

SUPERGEN

A Review of the Monitoring of Market Power

Paul Twomey, Richard Green, Karsten Neuhoff and David Newbery

download CMI EP 71from

http://www.electricitypolicy.org.uk/pubs/wp.html

Part of the research was funded by the Association of European Transmission Operators ETSO.

Market Power Detection Tools

Choose tools suitable for different tasks:

- Ex-ante versus ex-post analysis
- Long-term vs. short-term/real time analysis
- System-level market power vs. local market power vs firm-level market power
- Horizontal market power vs vertical market power

Applications of Market Power Detection Tools

	Ex-Ante	Ex-Post
Long-Term	- Merger rulings - Assessing applications for market-based rates - Determining potential must-run generators - requiring contracts	- Litigation cases (e.g. California refund case) - Changing market design - requiring contracts and VPPs
Short-Term	- Spot market bid mitigation - Must-run activation & other system operator contracting	- Short term price re-calculations - Penalties for withholding

Inspired by a similar table in Helman (2004)

Market Power Detection Tools – List

- **Behavioral Indices and Analysis**
  - Bid-Cost Margins (e.g. Lerner Index)
  - Net Revenue Benchmark Analysis
- **Structural Indices and Analysis**
  - Concentration ratios and HHI
  - Residual Supply Index
  - Residual Demand Analysis
- **Simulation Models**
  - Competitive Benchmark Analysis
  - Oligopoly Models

Bid-Cost Margins

- Lerner Index:

$$LI = \frac{\text{Price} - \text{Marginal Cost}}{\text{Price}}$$

- In a competitive market *LI* is zero
  - if MC correctly interpreted as scarcity price
- Cournot oligopoly *LI* = market share/elasticity
- Do not require geographic market definitions
- Is a standard measure of exercise of market power
- but which MC? Short-run or long-run?

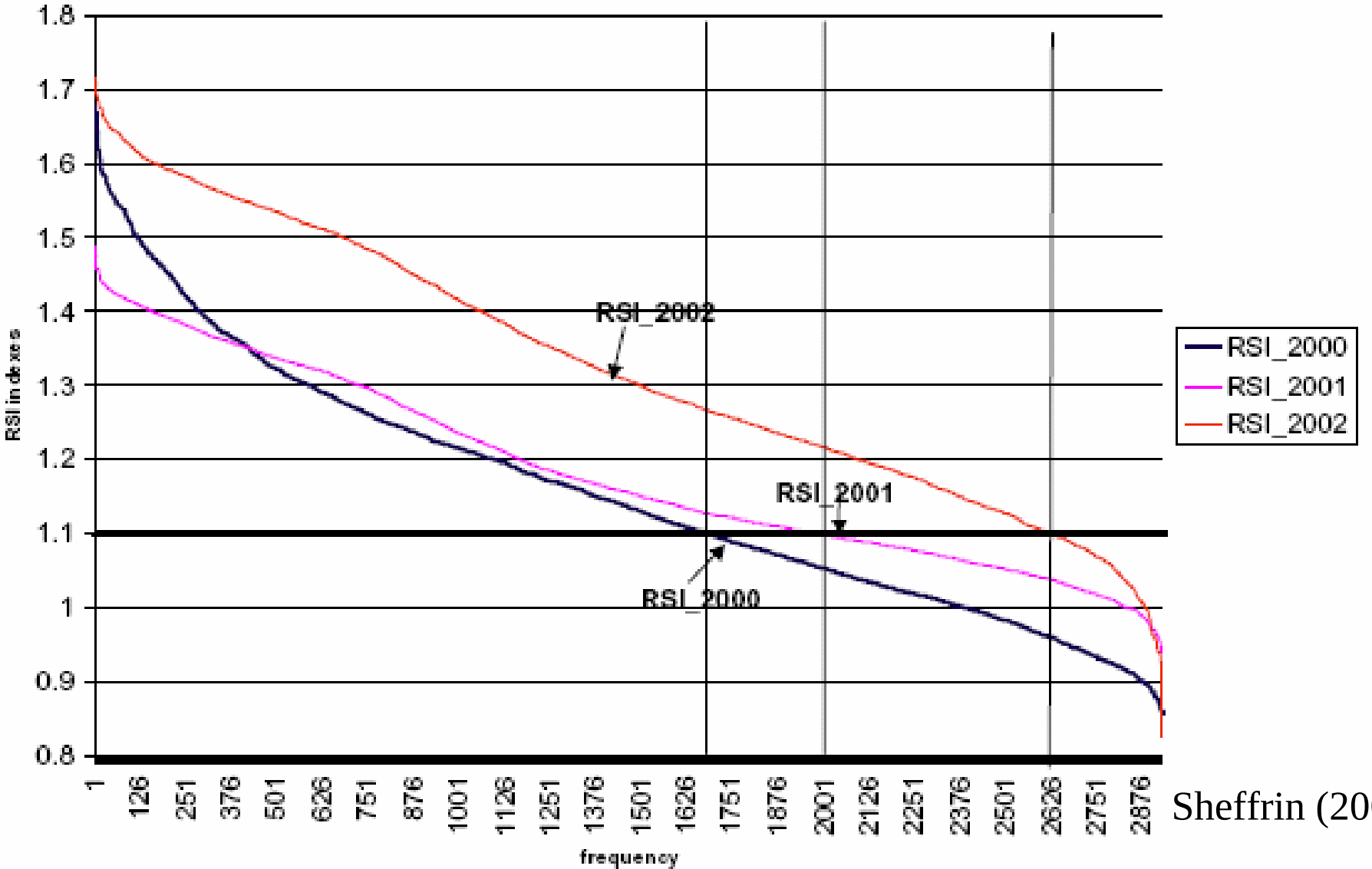
Residual Supply Index

- Measures the extent to which a generator's capacity is necessary to supply demand after taking into account other generators' capacity
- Residual Supply Index – continuous variable

$$RSI = \frac{\text{Total Capacity} - \text{Company i's Relevent Capacity}}{\text{Total Demand}}$$

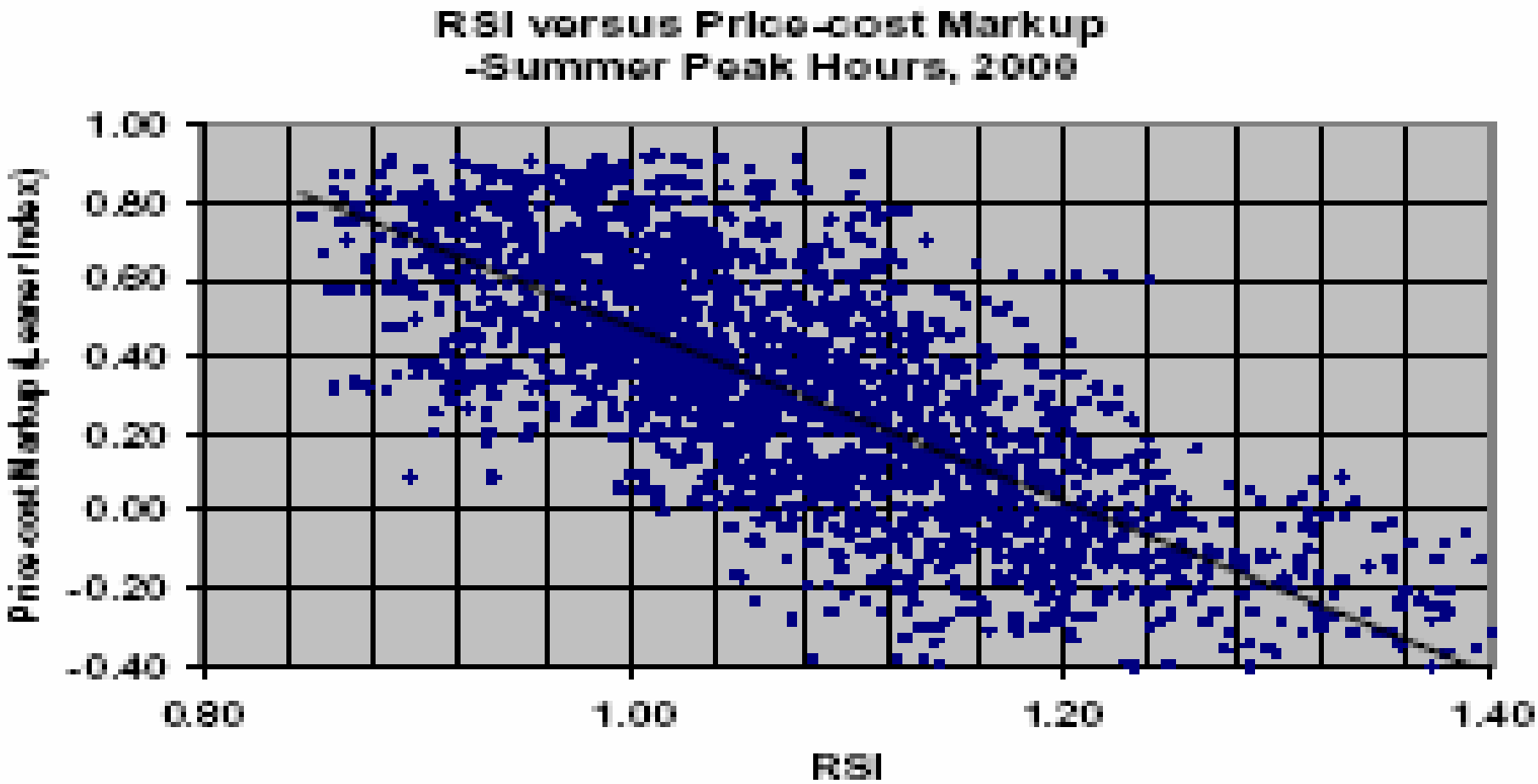
Sheffrin's screen test: RSI must not be less than 110% for more than 5% of hours per year

California RSI duration curve
June-Sep 2000-2002 all hours



Sheffrin (2002)

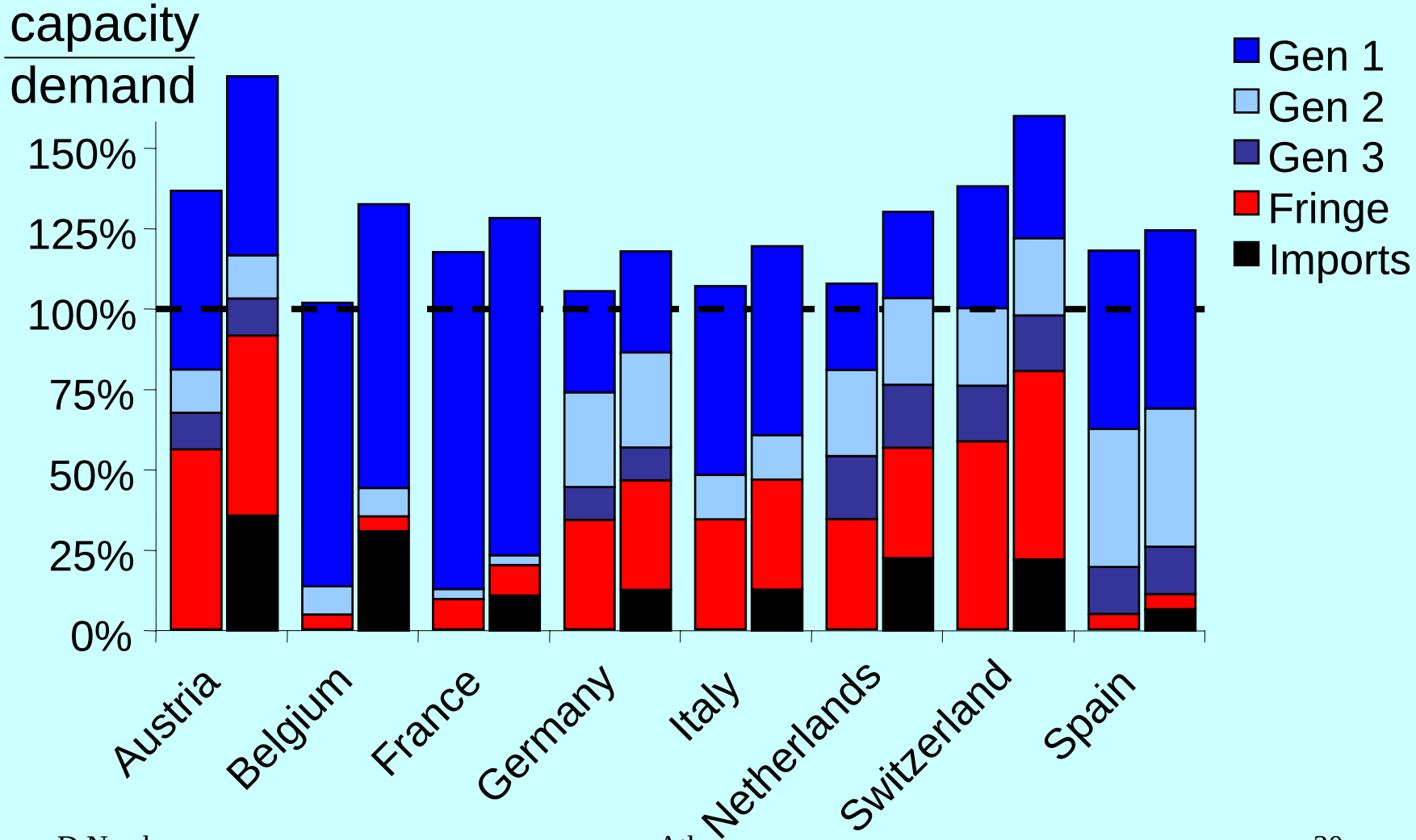
Significant Correlation between RSI and Price-Cost Markup



Sheffrin (2002)

Generation companies have MP within countries

... and retain market power due to transmission constraints



Source: Remaining capacity and availability factor from UCTE Power Balance Forecasts 2002-2004, NTC from ETSO (Winter 2001/2002), National Generation Shares from ICF consulting, Annual reports and presentations

Residual Supply Index

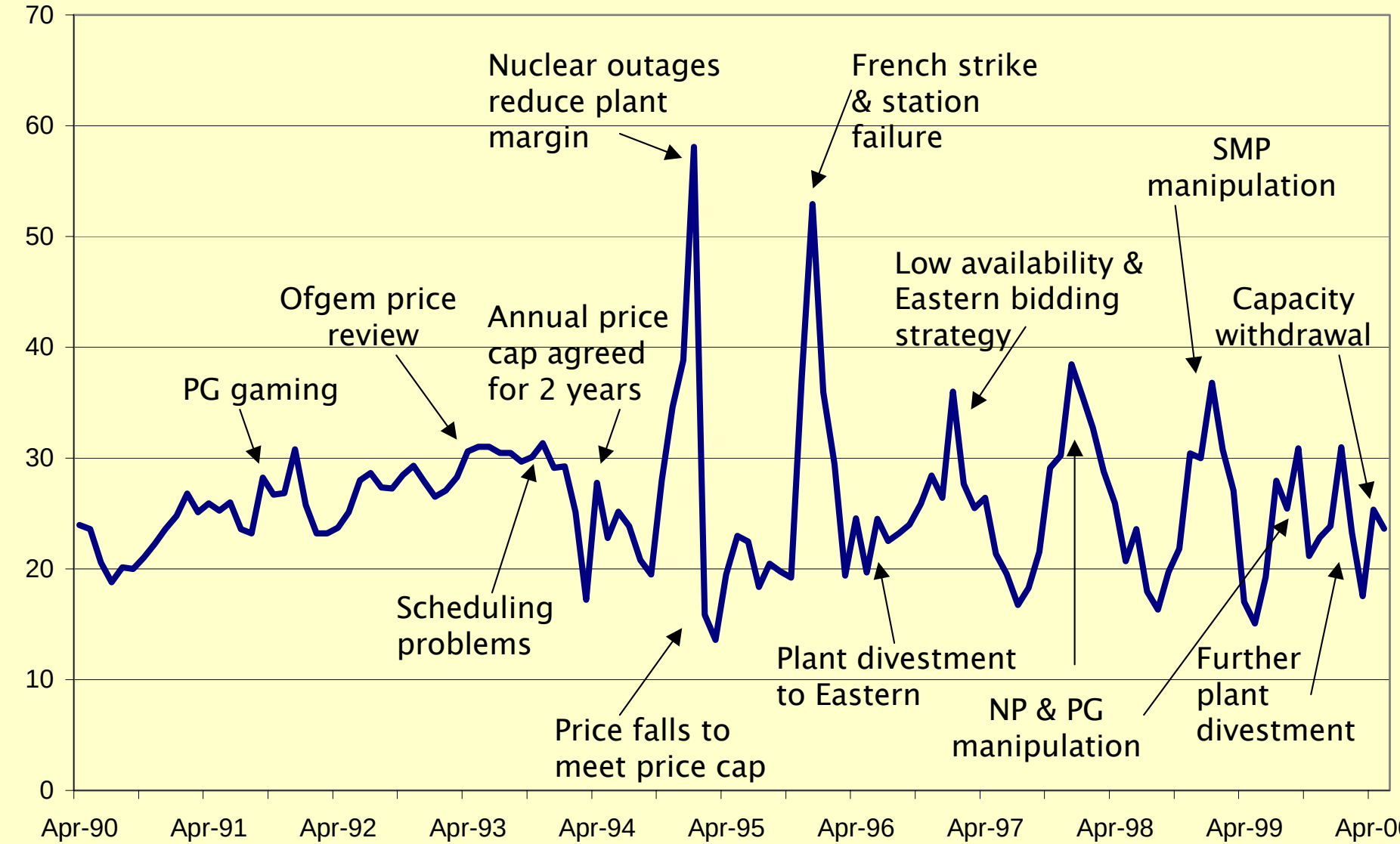
- Takes account of capacity scarcity
- Suited to dynamic analysis on an hour-by-hour basis and local market power analysis
- Empirical support of predicting market power
- Needs access to availability data (from TSO?)

Arguably the best tool

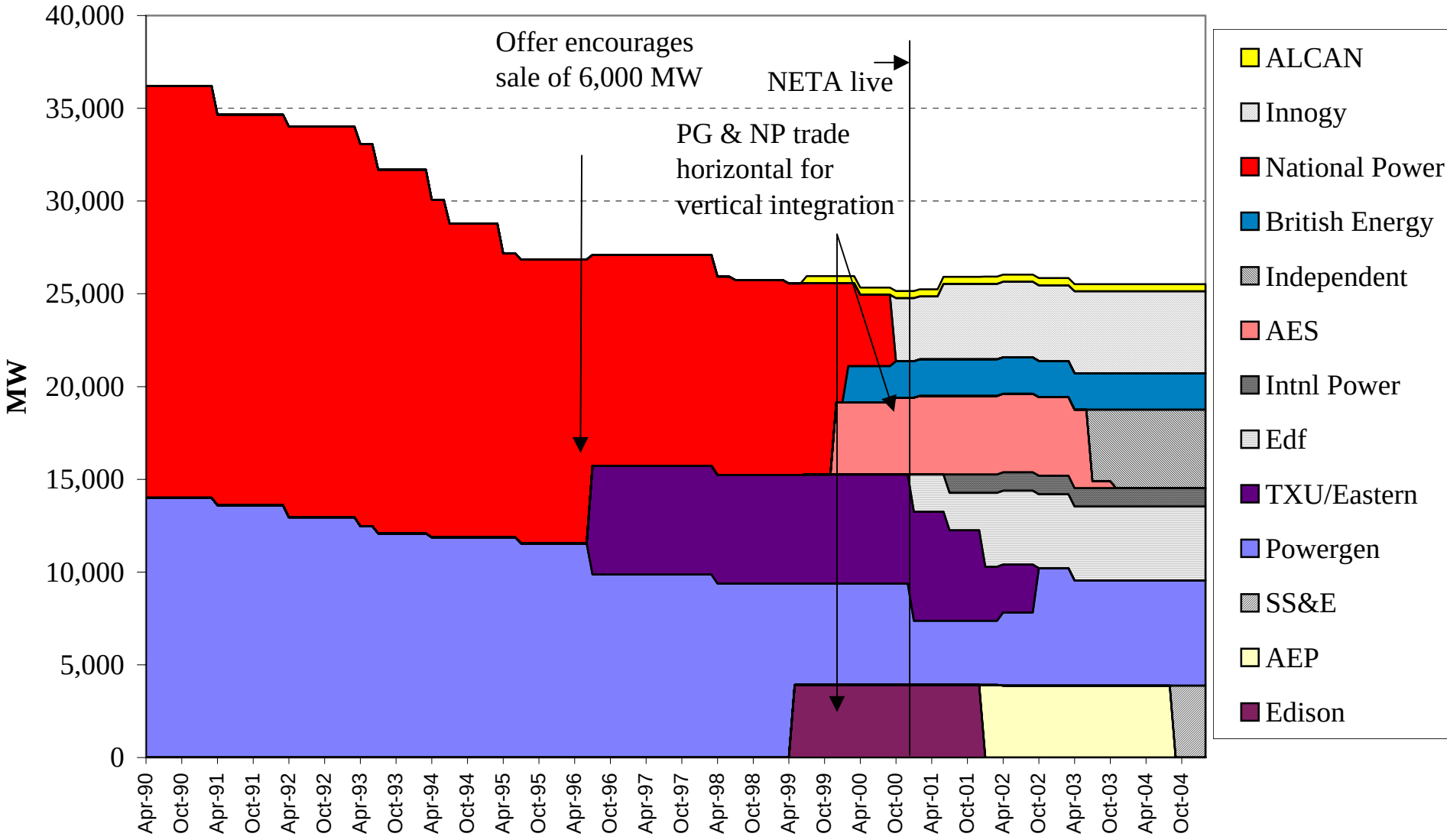
Collective dominance if:

- Market characteristics conducive to tacit coordination, ***and***
- Tacit coordination sustainable:
  - firms lack ability and incentive to deviate, given incentives for retaliation, and
  - Buyers, fringe firms, entrants cannot challenge tacit coordination

Pool prices since vesting



Capacity Ownership of Coal Generation 1990-2004



Source: NGC *Seven Year Statements*, various years, and data from J Bower and C Humphries, slide from D Newbery

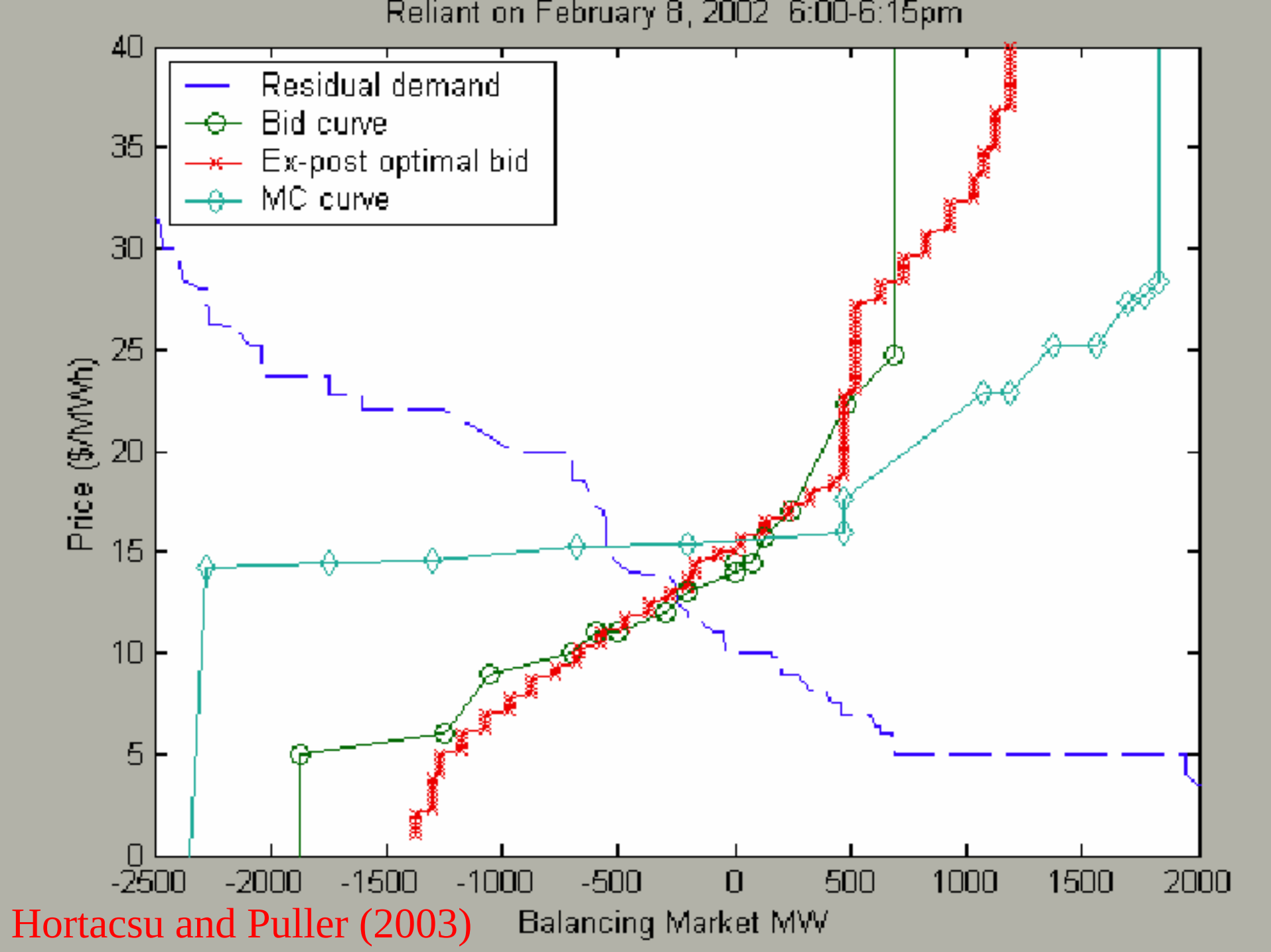
Collective dominance: the GB Electricity Pool

- Markets concentrated, transparent, mature ✓
- Low elasticity of demand ✓
- homogenous product, similar costs, shares ✓
- little excess capacity, barriers to entry **?**
- excess pricing, profit ✓
  - little response to cost fall, ✓
  - barriers to switching **??**

Need to be able to test for tacit collusion

Residual Demand Analysis

- Best response to generator's residual demand
- Theoretical justification – Supply Function Equilibria (locally profit maximising)
- Requires individual bid data to construct residual demand curves
- Can detect collusion as well as market power
- e.g. Wolak, Sweeting, Hortacsu/Puller



Hortacsu and Puller (2003)

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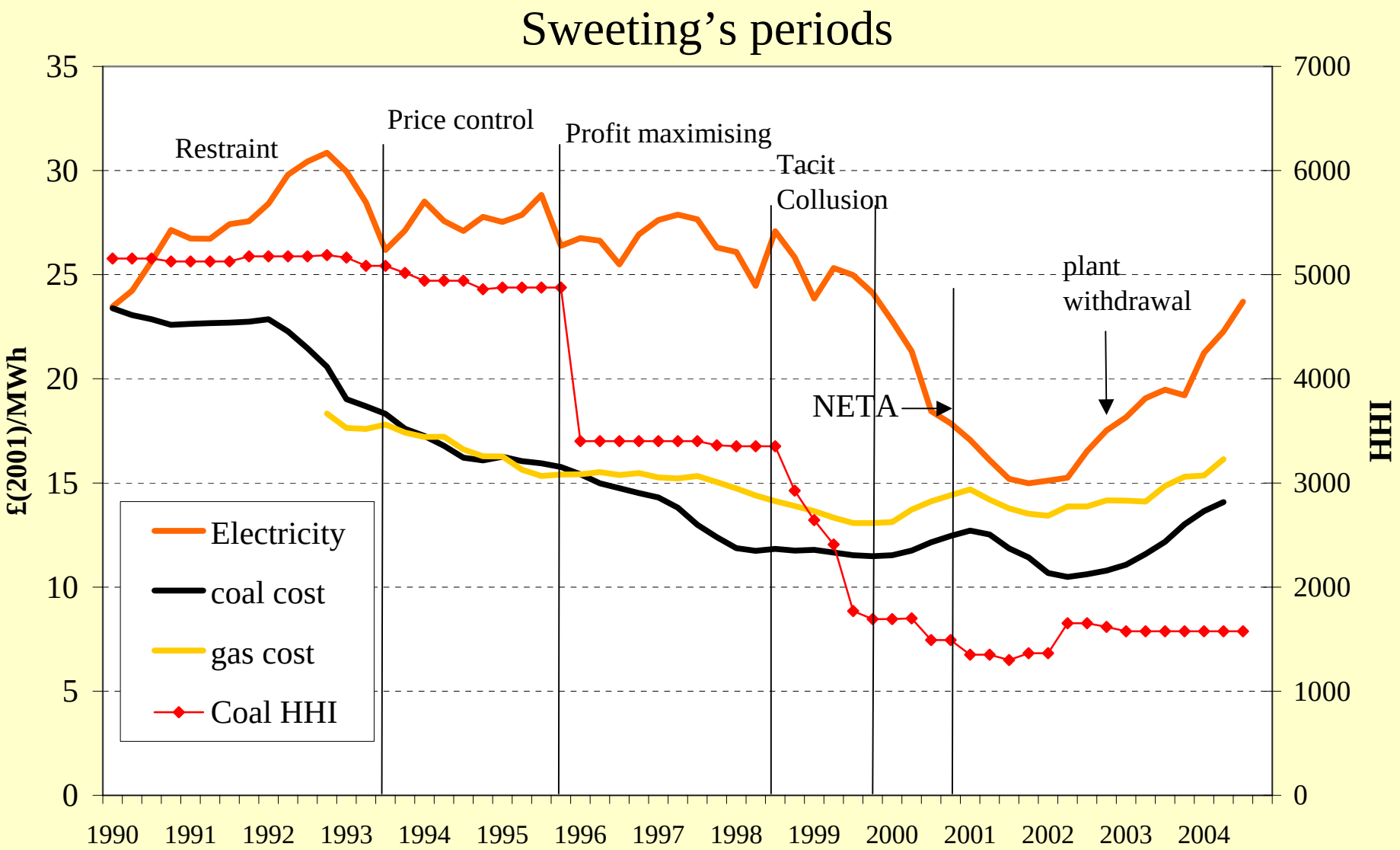
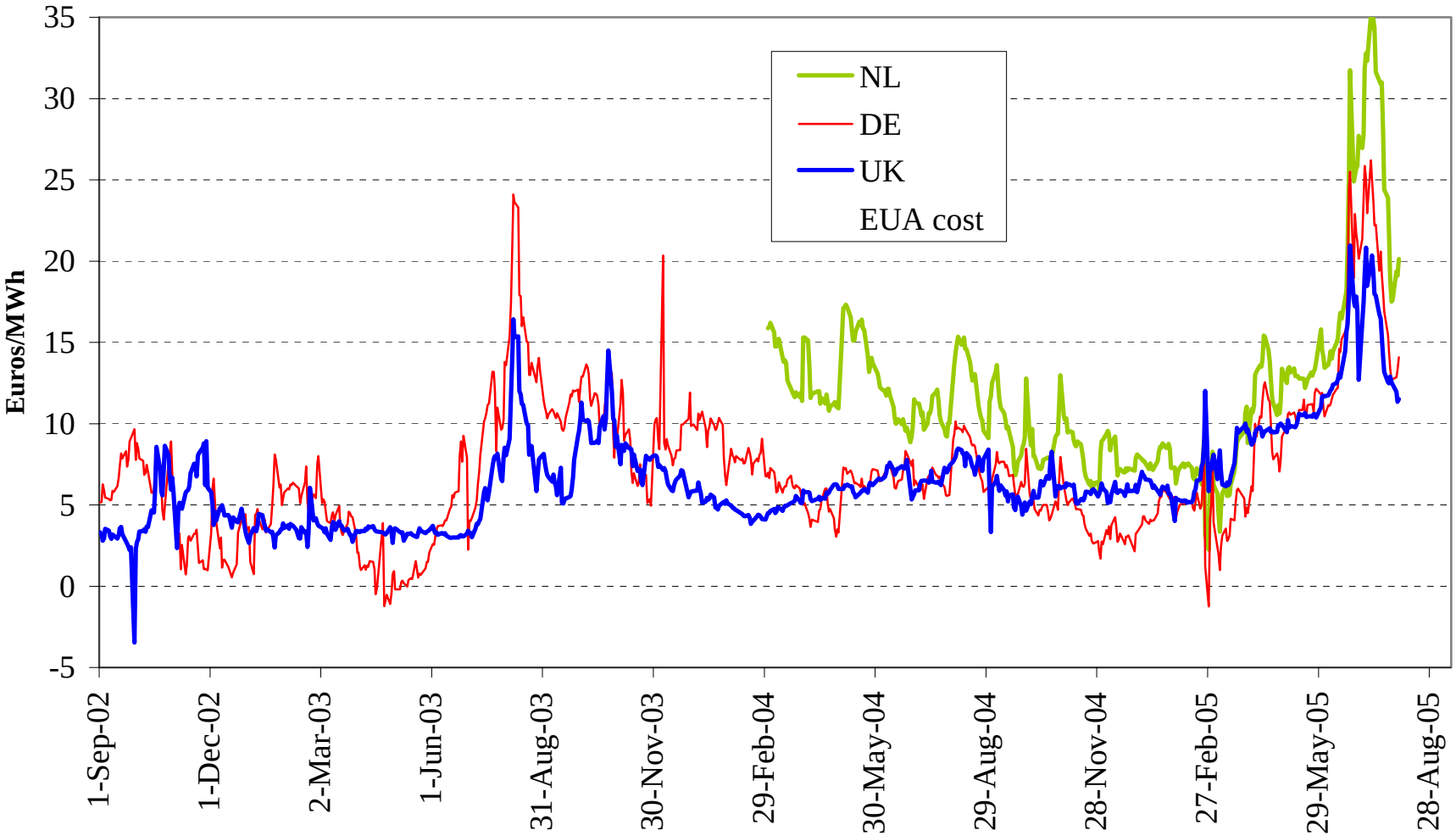


Net Revenue Benchmark Analysis

- Compares estimated revenues with total costs
- Assess financial viability and barriers to entry
  - important in presence of price caps
- Spark and dark spreads useful proxy
  - need to allow for EUA opportunity cost
- Persistent excess profit suggestive of market power and barriers to entry
- Persistent failure to cover total costs suggestive of predatory behaviour?

Spark spread month ahead 50% efficiency



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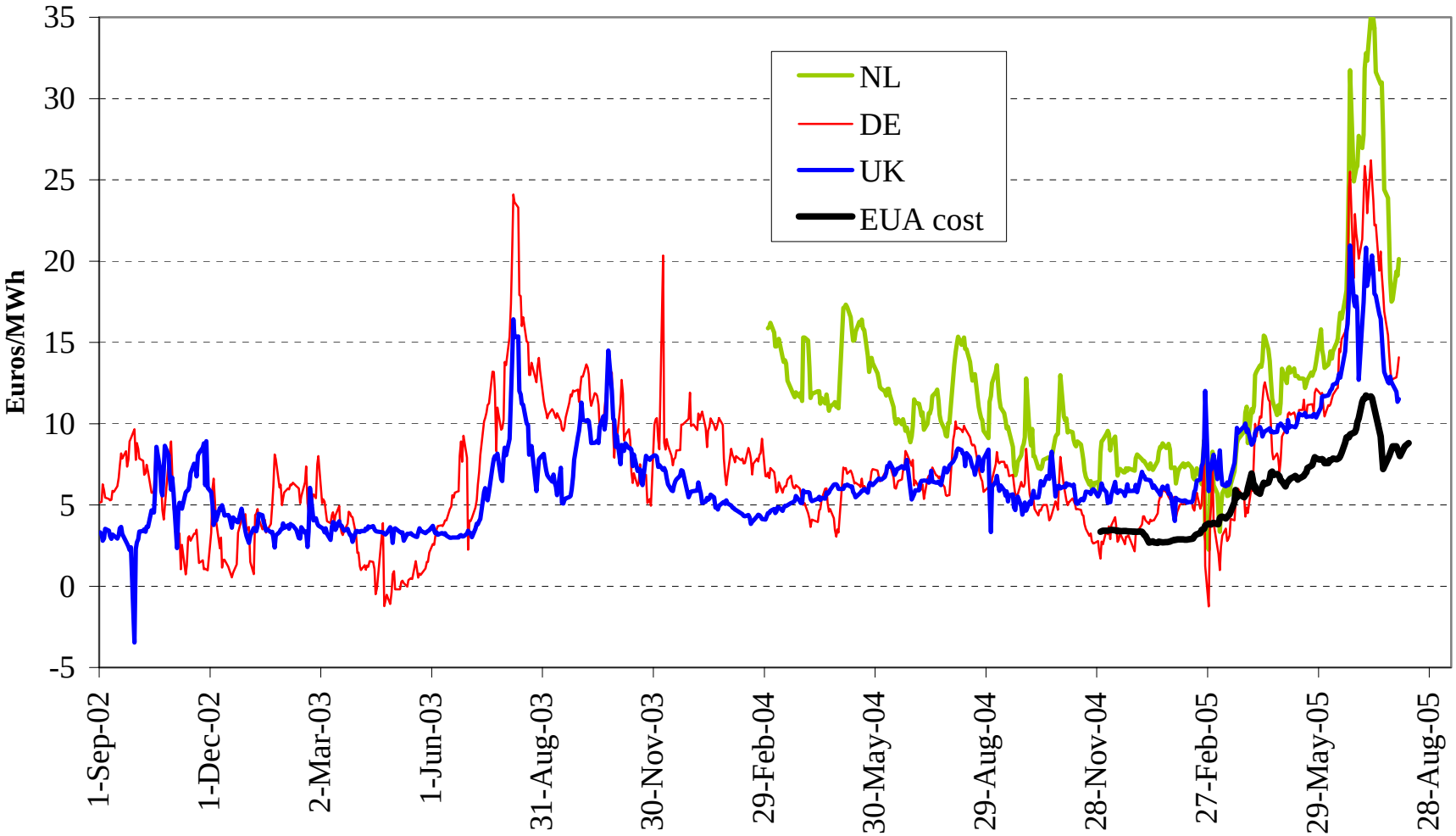
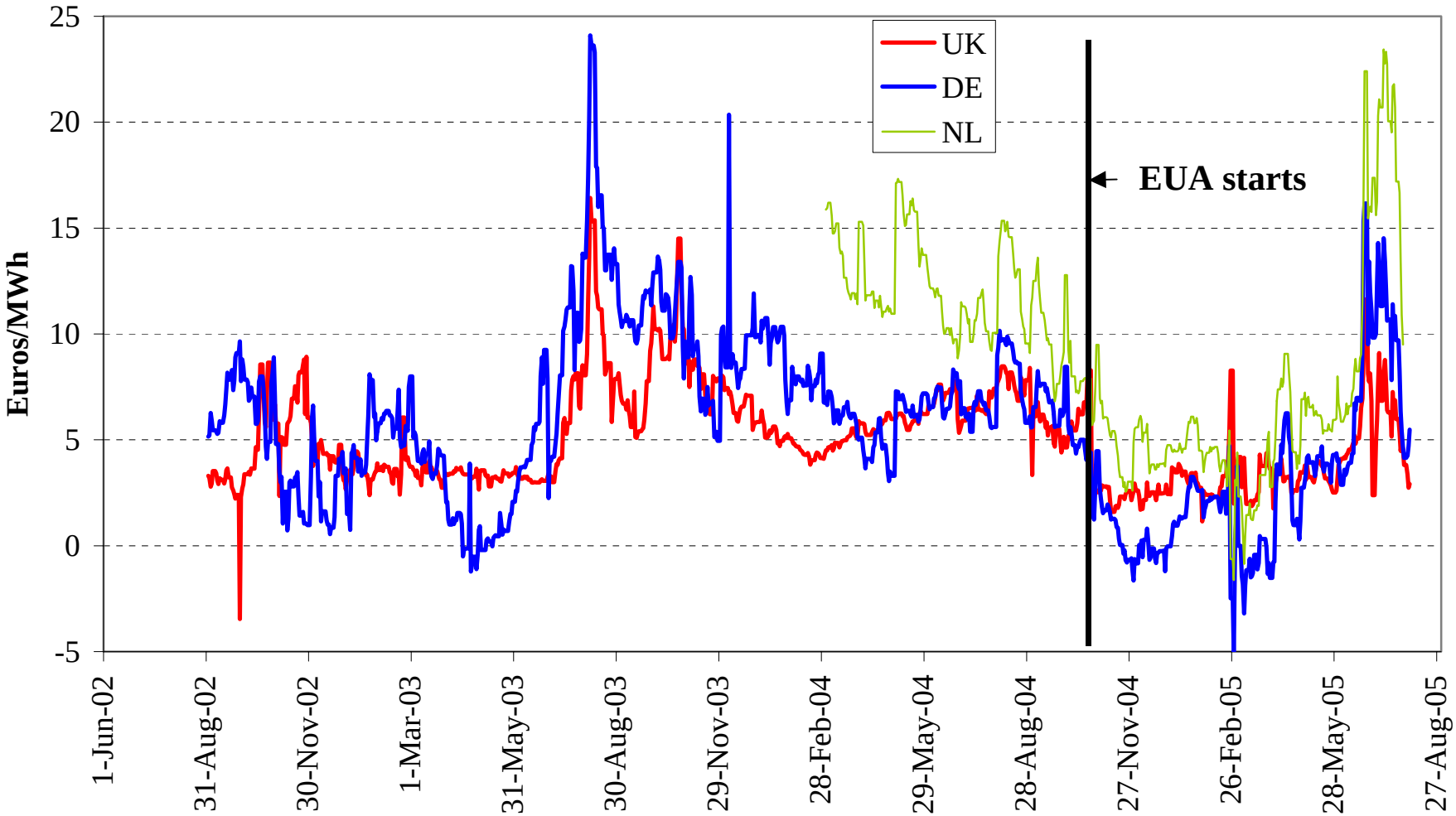


Spark spread net of EUA



Institutional and data issues

download CMI EP 71from

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Powers of Market Monitoring Units

- Generally monitor reports to regulator rather than taking action itself
- Primary task is to produce reports and conduct investigations
  - ideally these should be published on the NRA website

Challenges of market monitoring

- Requires rapid access to relevant data
  - needs legal right and systems in place
  - some countries fail to provide this to regulators
- demands skilled analysis and data manipulation
  - challenging for new NRAs concerned with network regulation and price controls
- may be outsourced
  - to academics (as in Netherlands initially)
  - to specialised consultancy

but need to have in-house expertise to interpret

Where is the data?

- **TSO/ISO**
  - Physical flow patterns
  - Bids in balancing markets
  - Bids in pool (if run by TSO/ISO)
- **Transmission Rights Auction** (if independent of TSO/ISO)
  - Bids, market clearing prices and allocation of transmission rights
- **Power Exchanges**
  - Bids, market clearing price and allocation for spot market and forward contracts of transactions through the power exchange.
- **Brokers, market makers**
  - Information on bilateral contracts brokered
- **Market participants**
  - Information on directly negotiated bilateral contract
- **Generators**
  - Information on costs, deratings, outages and capacities.

Role of different players

- Regulator has prime responsibility for MM
  - issues guidelines, reports
  - working in close cooperation with TSO, PX and explaining findings to stakeholders
- PX, MO need own monitoring
  - to assure traders, improve service
- Academics/media/consumers use published data for impartial comment
- Competition authorities need MOU with NRA
  - guidelines on how disputes investigated, resolved

Data Issues

- TSO/ISO requires physical data - well placed for complete, central record
  - Hold data for > 2+ years to allow ex-post investigations
- Homogenous format for data reduces cost of analysis and increase the integrity of data
- Regulatory authorities should have access to data automatically or on request without legal proceedings
- Maximise public availability of data
  - no case for confidentiality for monopoly functions
  - otherwise aggregate/anonymize data
  - dangerous to restrict to electricity companies

From Detection to Mitigation

- Standard Solutions:
  - Structural

    e.g. divestiture, removing entry barriers, transmission expansion, demand responsiveness
  - Regulatory

    e.g. vesting contracts, virtual power plant auctions, sunshine regulation
  - Market Rules

    e.g. unit-specific bid caps (e.g. AMPS)

Concerns and problems

- Companies will resist providing data
  - particular problem if TSO is vertically integrated
- Companies will dispute findings
  - expect delays if process goes to court
- Courts are poorly placed for economic analysis

  => avoid courts, appeals to competition authorities
- Expect companies to hire consultants to dispute
  - ensure that MM analysis well-found
  - hire/retain good academics to help

Conclusions

- Market power detection measures trade-off: simplicity vs insight
  - better methods like RSI demand better data
- Powers to collect information critical
  - maximise publication for transparency and market reassurance
- Monitoring is demanding - outsource?
- Cross-border cooperation between NRAs important to facilitate efficient trade

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Acronyms - 1

AMPs: Automatic Mitigation Procedure (very US)

ATC: Available Transmission Capacity

CEC: Commission of European Communities

CEGB: Central Electricity Generation Board

ESI: Electricity supply industry

EUA: EU allowance (permit to trade 1 tonne CO_2)

FERC: Federal Energy Regulatory Commission

GW: Gigawatt = 1000 Megawatt = 1m kW

G: Generation

HHI: Herfindahl Hirschman Index

ISO: Independent System Operator

MC: marginal cost

MO: market operator

Acronyms - 2

MOU: memorandum of undestanding

MM: Market monitoring

MP: Market power

NETA: New Electricity trading Arrangements

NRA: National Regulatory Authority

OTC; Over the counter (markets)

PUC: Public Utility Commission

PX: Power exchange

S: Supply

SSNIP: ‘small but significant non-transitory increase in price’

RSI: Residual Supply Index

T: Transmission

TSO: Transmission System Operator