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## **Key Issues in Global Electricity**

***Oxford Energy Seminar***

***10 September 2002***

***Dr John Bower***

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**National electricity market liberalisation**

**Cross-border trade and regional electricity markets**

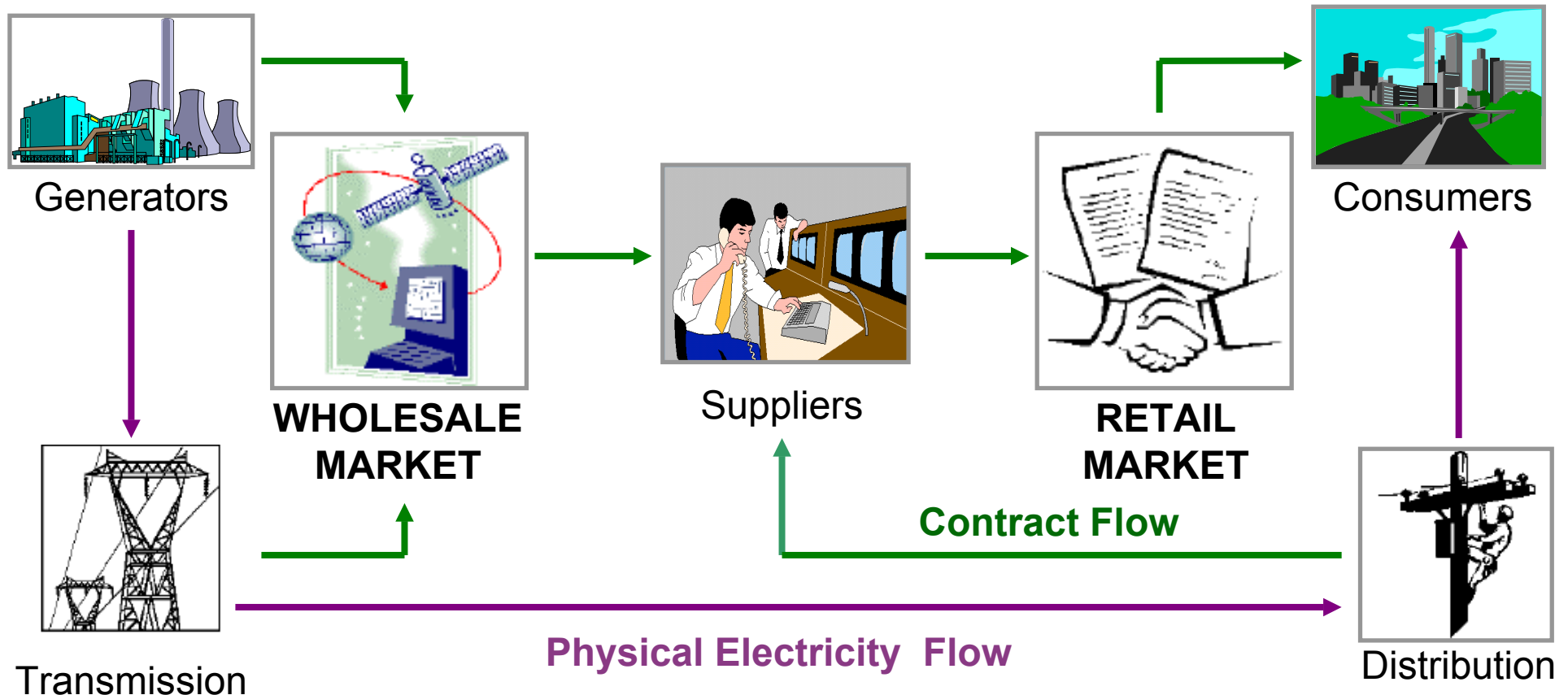
**Unresolved issues**

**A feasible solution**

# National electricity market liberalisation

Liberalisation means wholesale / retail markets replace government control and ....

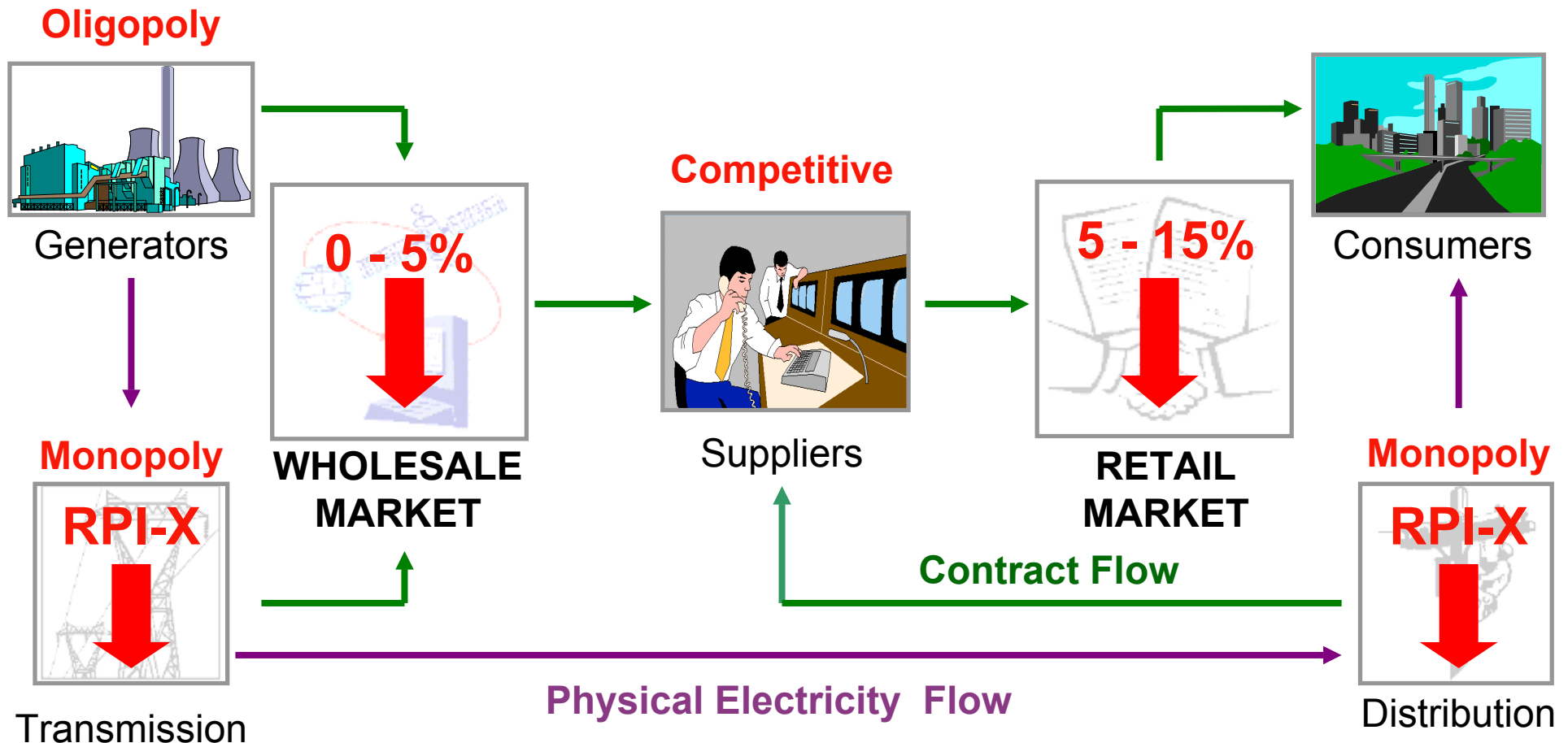
## STRUCTURE OF A LIBERALISED ELECTRICITY MARKET



# National electricity market liberalisation

.... in theory new entrants and increased efficiency should reduce consumer prices....

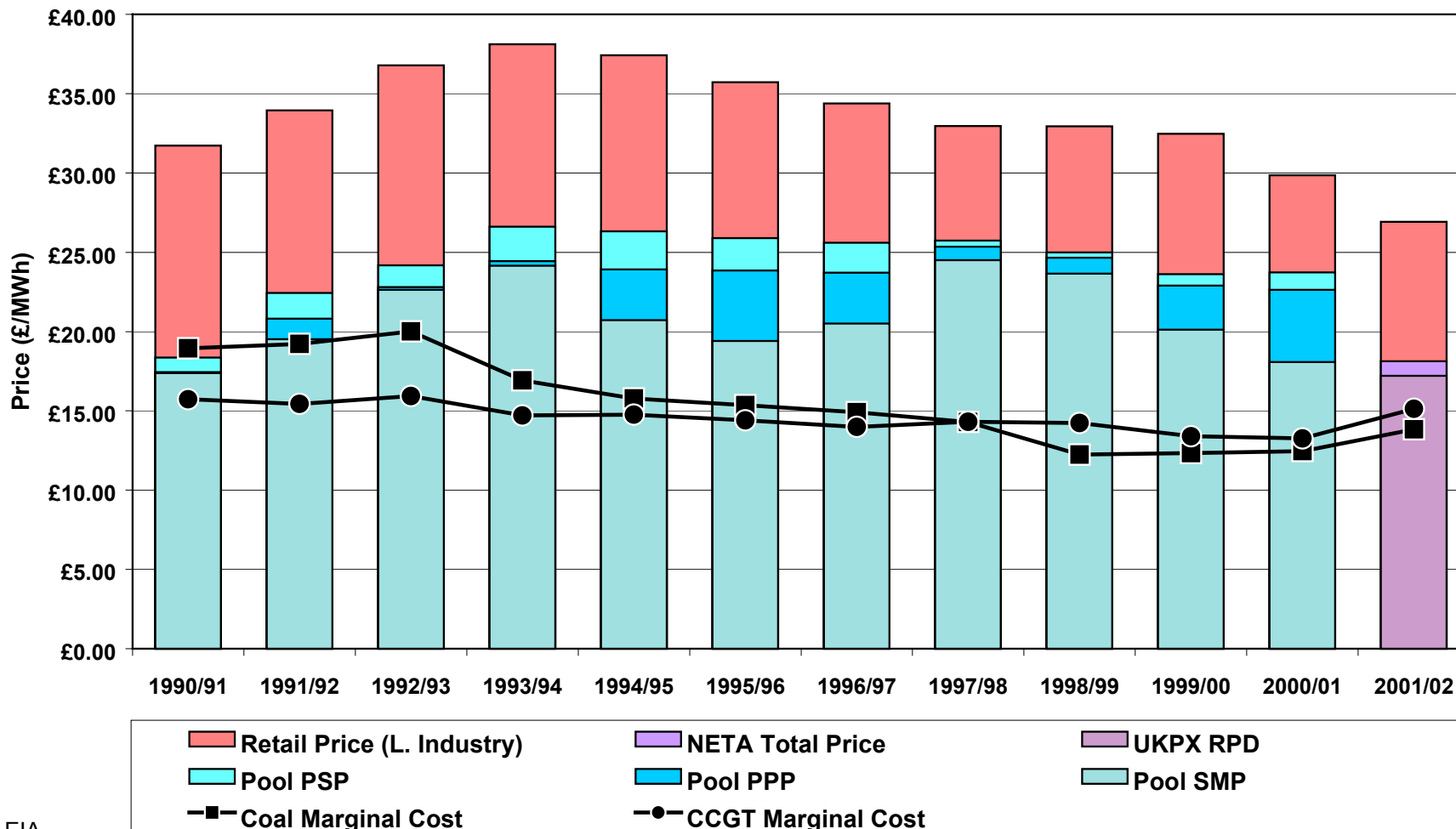
## IMPACT OF LIBERALISATION IN ENGLAND & WALES 1990 - 2002



# National electricity market liberalisation

.... but this outcome is not guaranteed and prices may rise instead.

## EUROPEAN ELECTRICITY MARKET GENERATION CAPACITY MIX

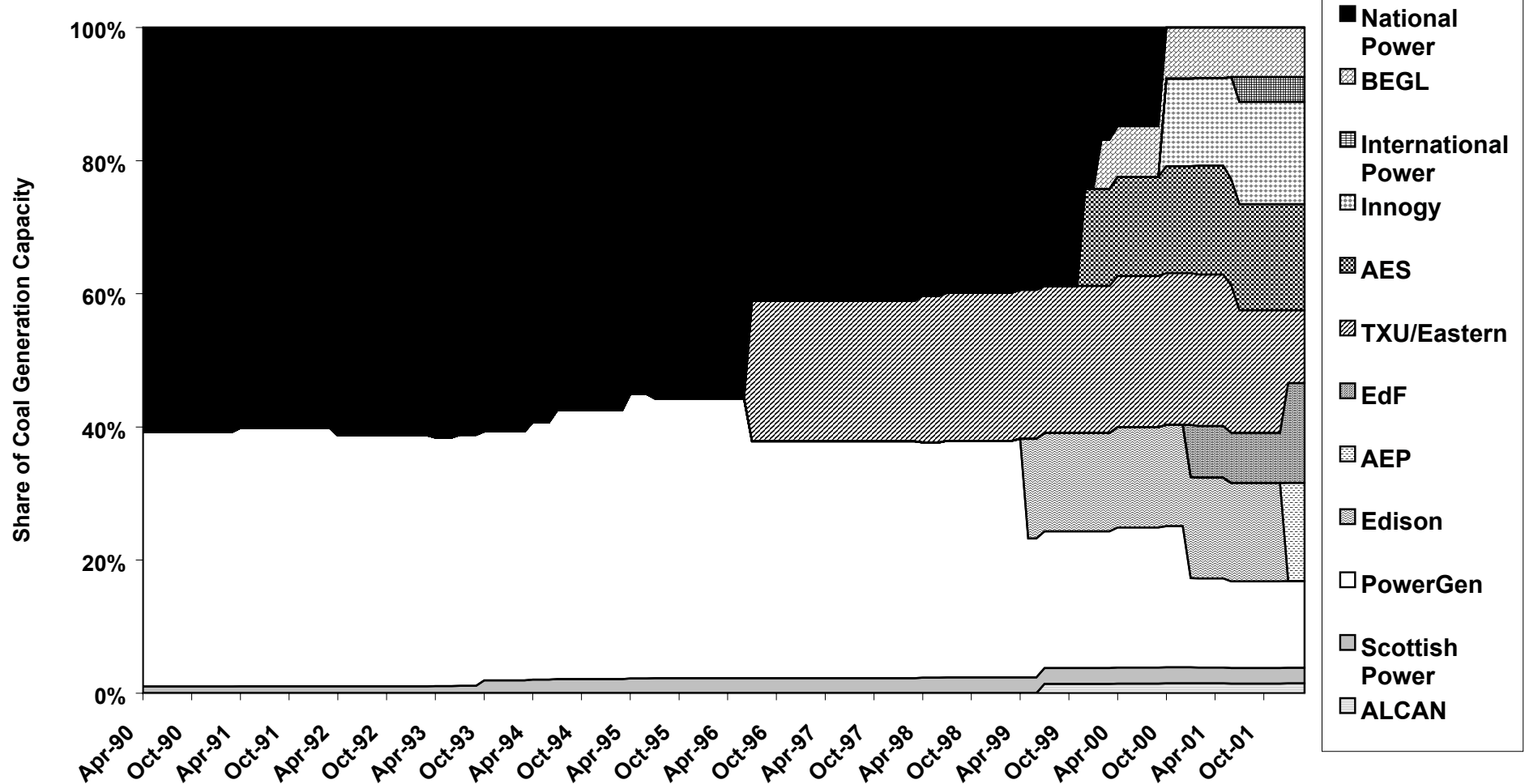


Source: EIA

# National electricity market liberalisation

In reality regulation is still required to create and maintain a competitive industry...

## SHARE OF COAL GENERATION CAPACITY IN ENGLAND & WALES



Source: EIA

.... and governments will always want to intervene to set national energy policy

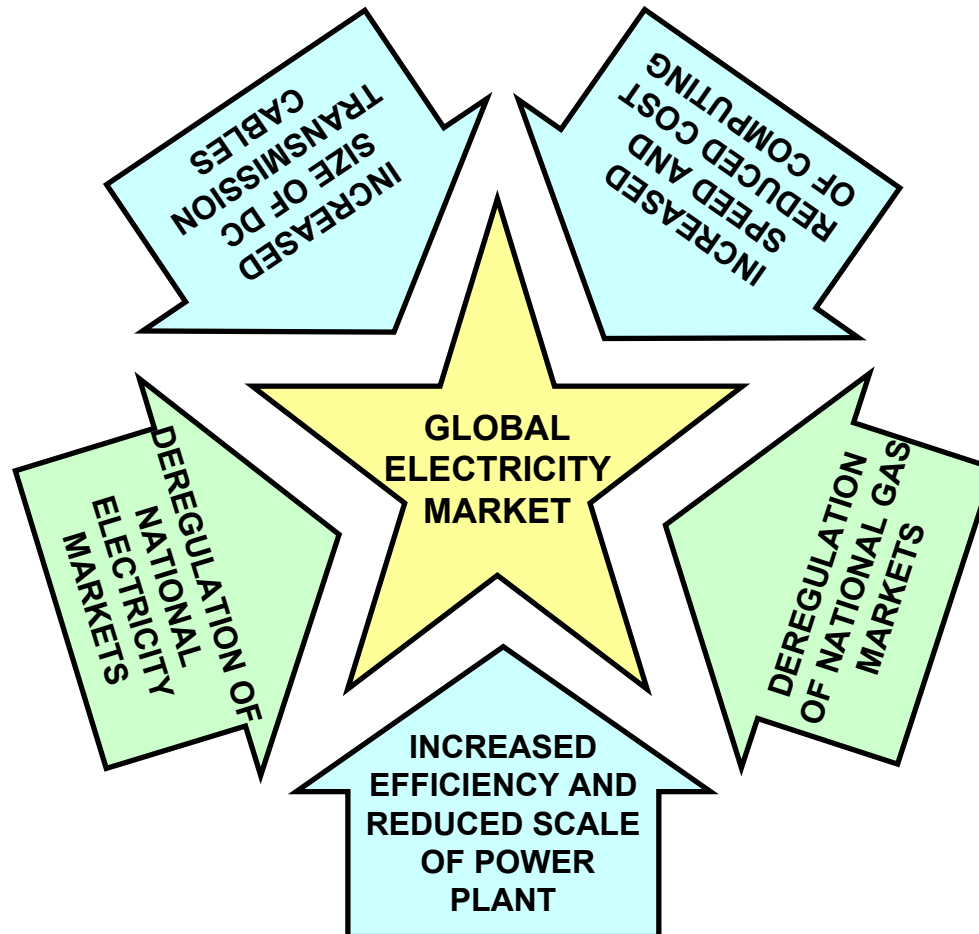
## RECENT BRITISH ENERGY HEADLINES

- 28 Aug 02**      **British Energy drained by low prices-minister**
- 1 Sep 02**      **British Energy ponders US sale**
- 6 Sep 02**      **Nuclear firm British Energy begs for bailout**
- 7 Sep 02**      **British Energy shares suspended as company warns of insolvency**
- 8 Sep 02**      **Ministers offer guarantees to British Energy**
- 9 Sep 02**      **British Energy falls almost 80 pct after LSE lifts trading curbs**

# Cross-border trade and regional electricity markets

New regional electricity markets are being created by economic / technical pressures....

## FORCES FOR CHANGE IN CROSS-BORDER ELECTRICITY TRADE

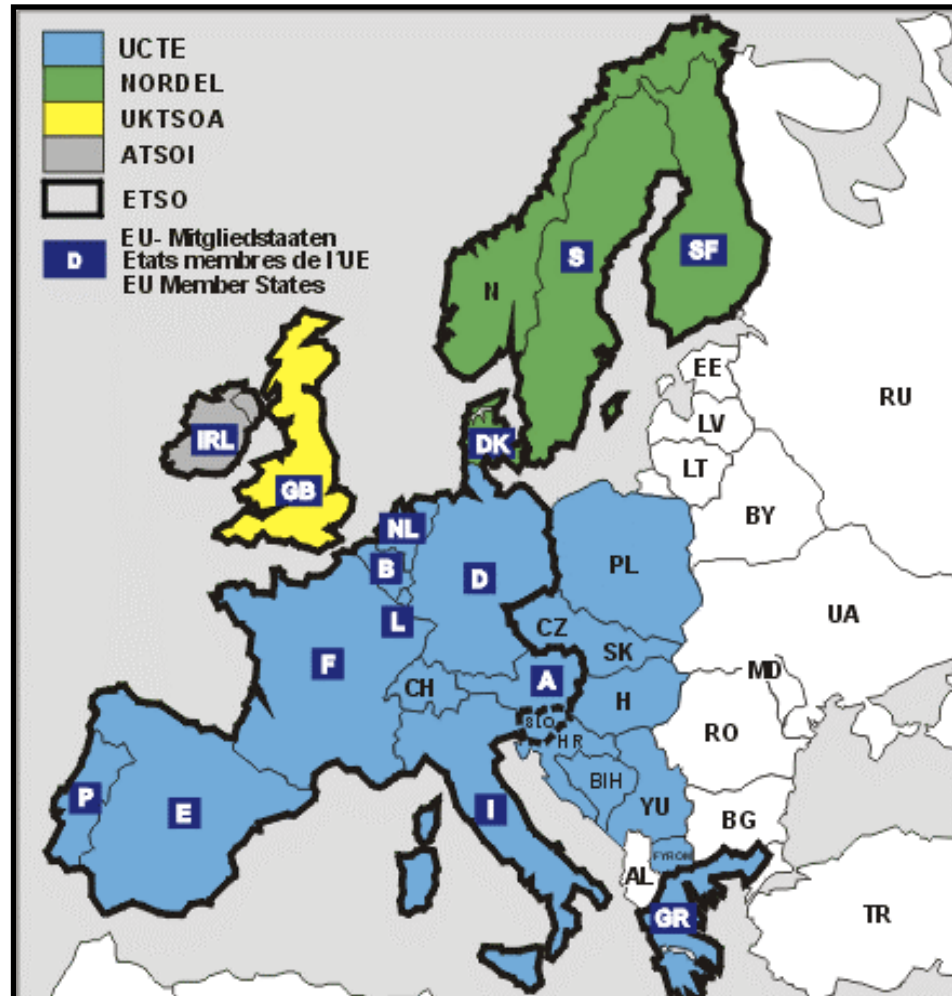




# Cross-border trade and regional electricity markets

Interconnections have always existed between national electricity systems...

## TRANSMISSION SYSTEMS IN THE EUROPEAN ELECTRICITY MARKET

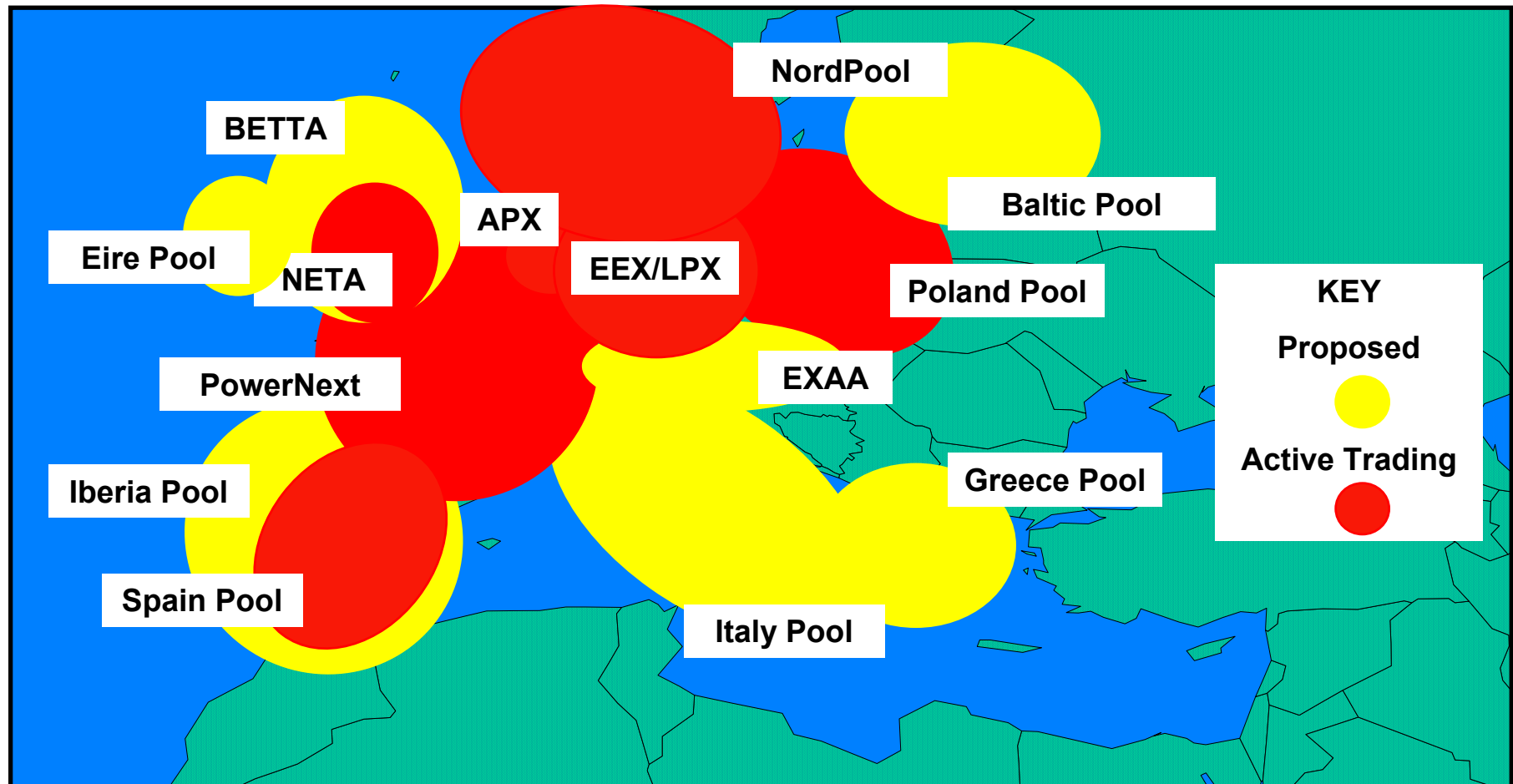


Source: UCTE

# Cross-border trade and regional electricity markets

.... but as wholesale spot / forward markets emerge so should cross-border trade

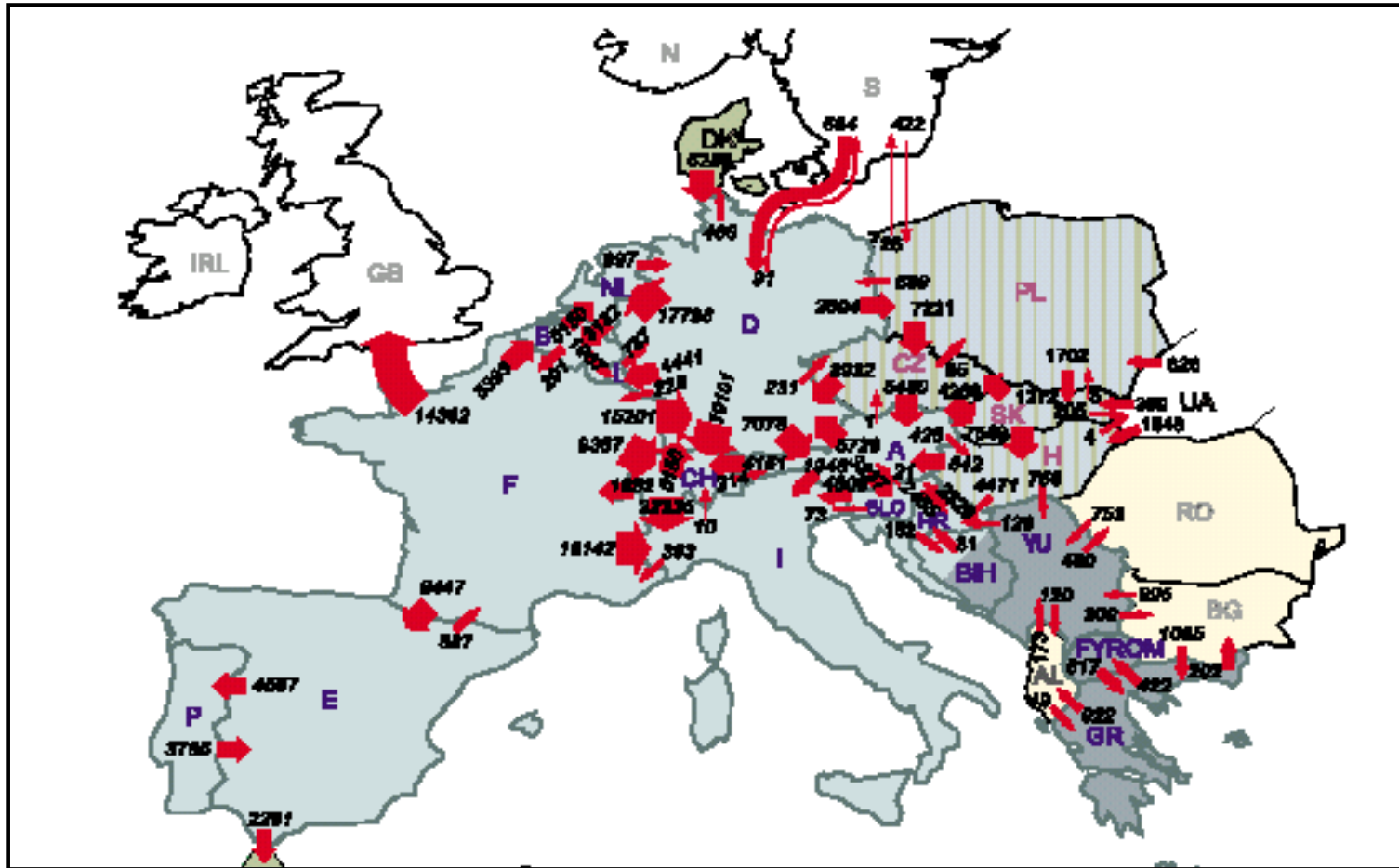
## GEOGRAPHIC COVERAGE OF EUROPEAN ELECTRICITY EXCHANGES



# Cross-border trade and regional electricity markets

.... and increase market efficiency by increasing competition between national generators

## UCTE PHYSICAL ELECTRICITY FLOWS (MWh) IN 2000

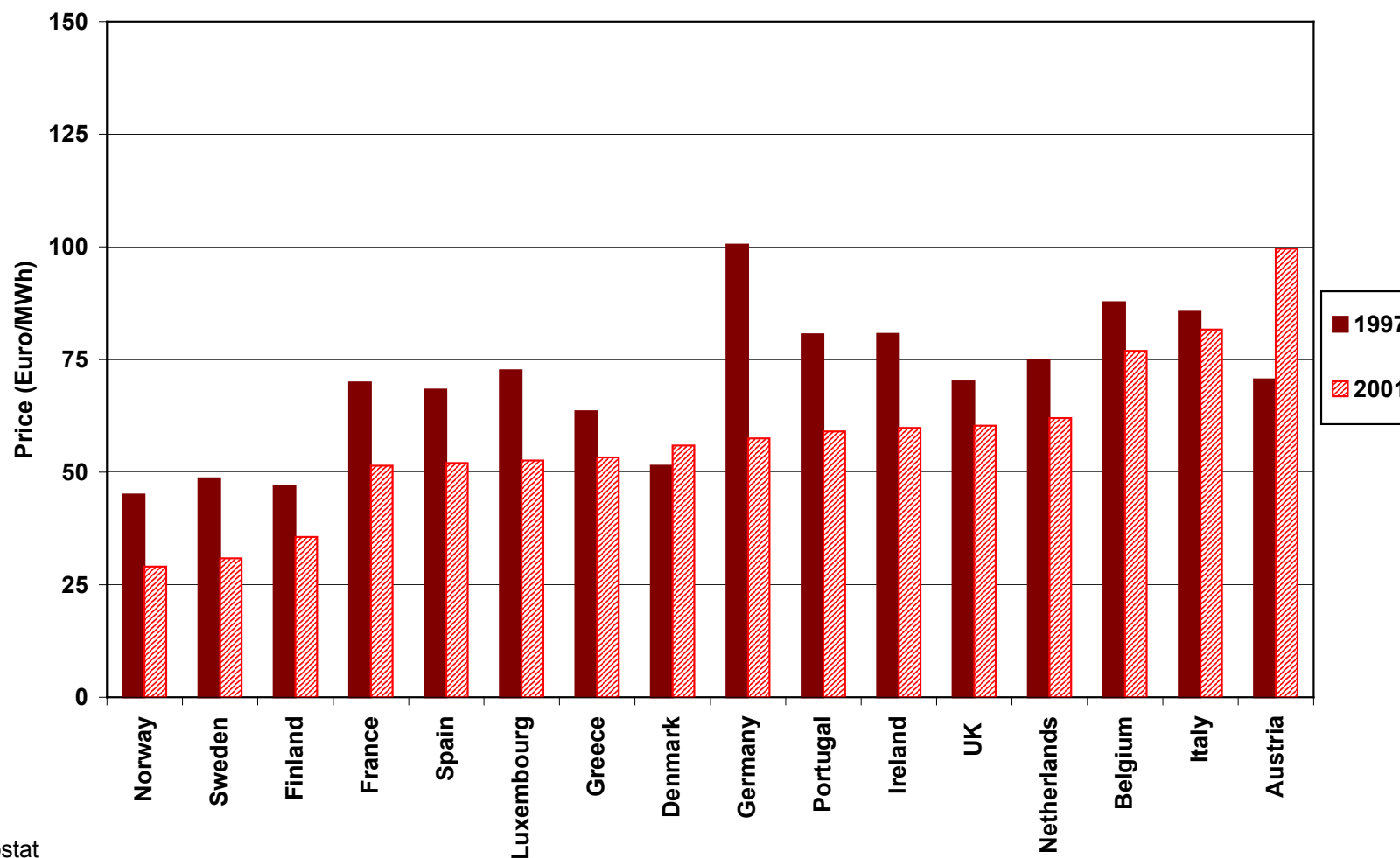


Source: UCTE

# Cross-border trade and regional electricity markets

As a result EU industrial price fell 24.4% 1997 – 2001 but 180% range persists....

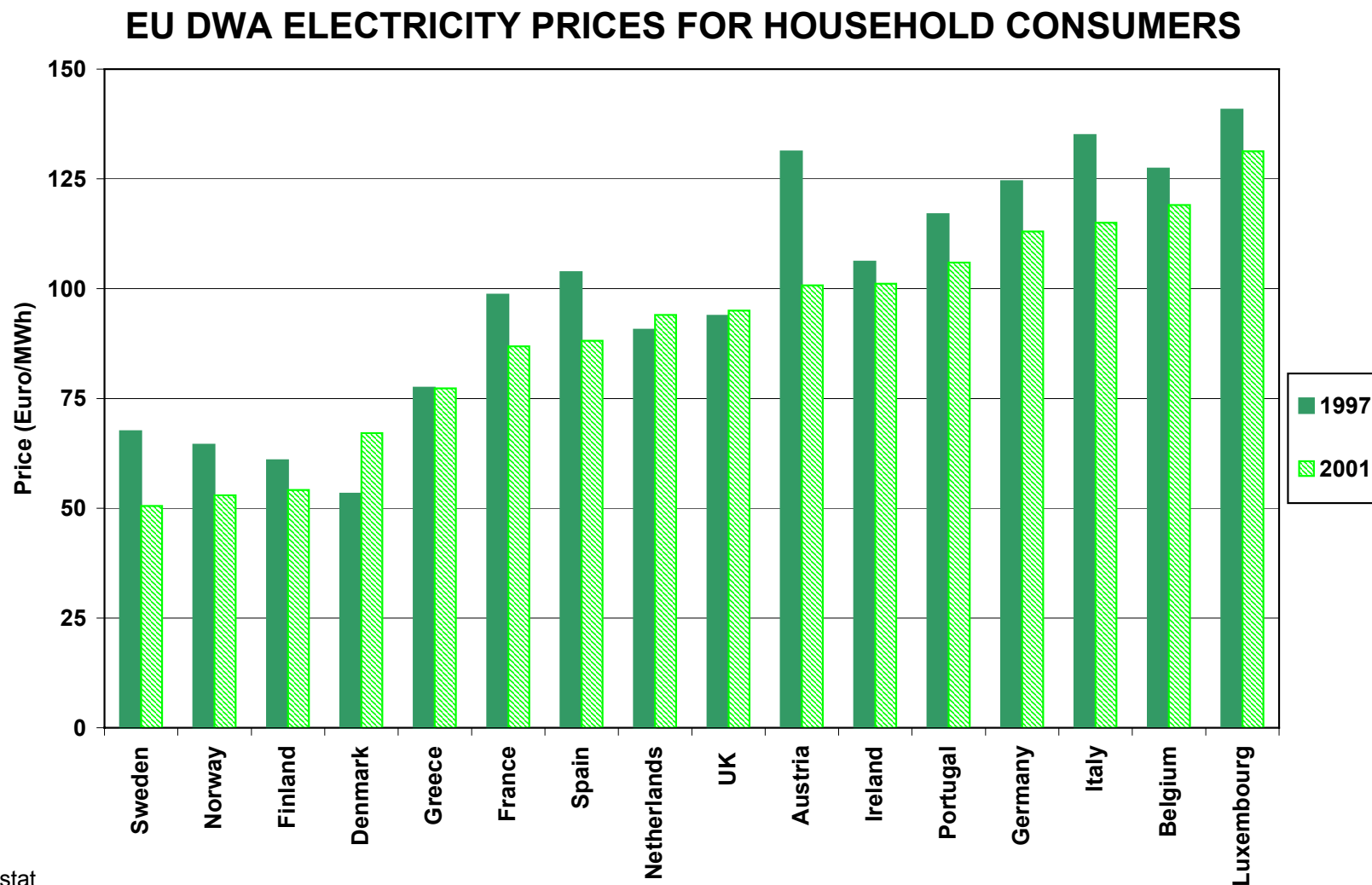
## EU DWA ELECTRICITY PRICES FOR INDUSTRIAL CONSUMERS



Source: Eurostat

# Cross-border trade and regional electricity markets

.... but household price only fell 10.1% 1997 - 2001 but still 160% range persists



Source: Eurostat

State and Federal policy objectives are interdependent and often in conflict

## LIBERALISATION CONFLICTS

### Competition

- Profit motive of capital market versus public service obligations
- Open access rights to transmission / distribution versus monopoly ownership
- Competitive industry structure versus creation of national champions

### Security

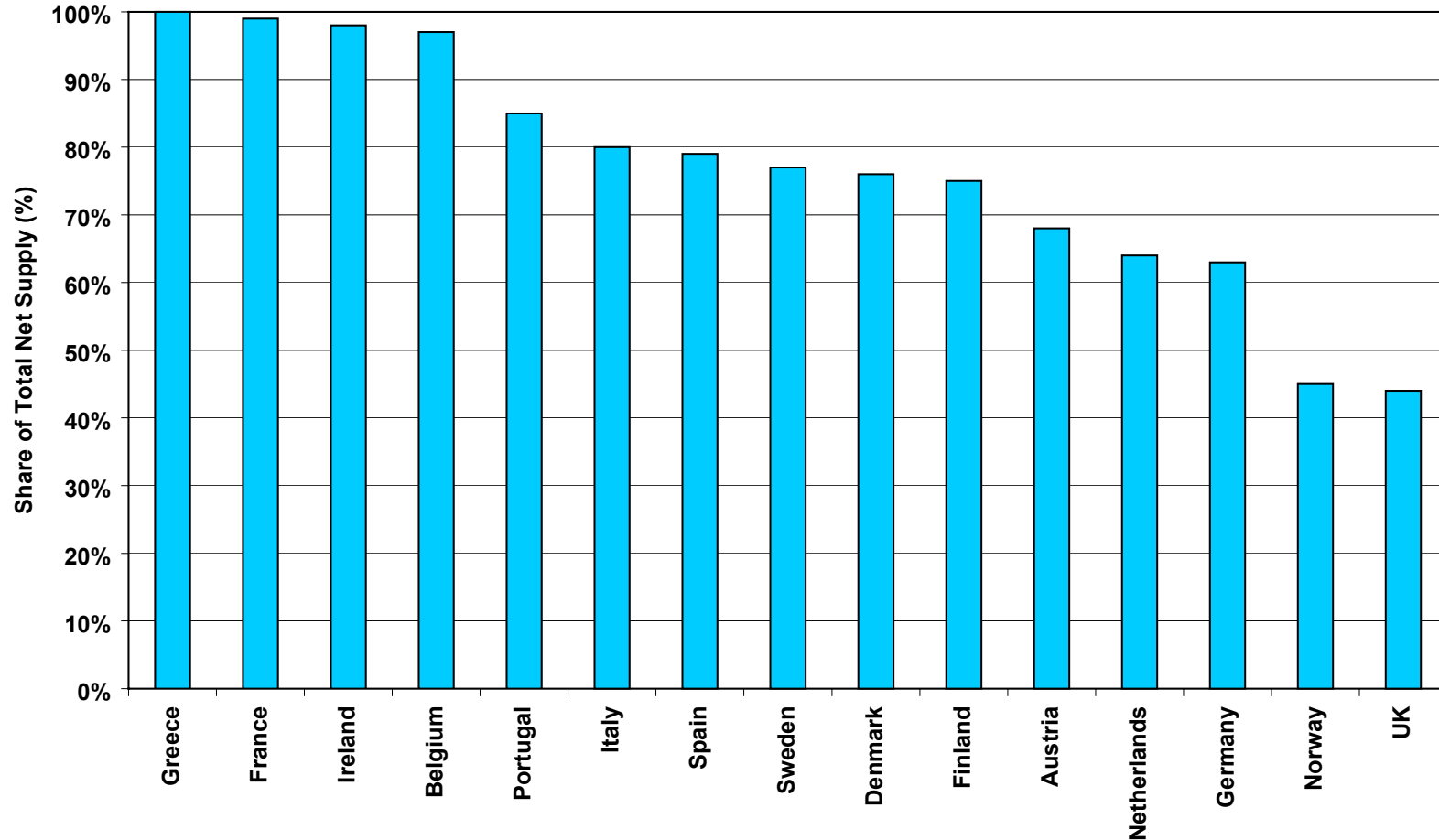
- Indigenous generation versus low cost imports
- Generation fuel self sufficiency versus low cost imports
- Managed bilateral trade versus reliance on transit routes through third countries

### Environment

- Lower prices versus higher environmental taxes
- Lowest cost technology (CCGT) versus renewables and nuclear
- Regional benefit of cross-border transmission lines versus impact on local area

Persistent differences in national prices are due to generator market power...

## EU GENERATION CAPACITY CONCENTRATION RATIO (3 FIRM) 2001

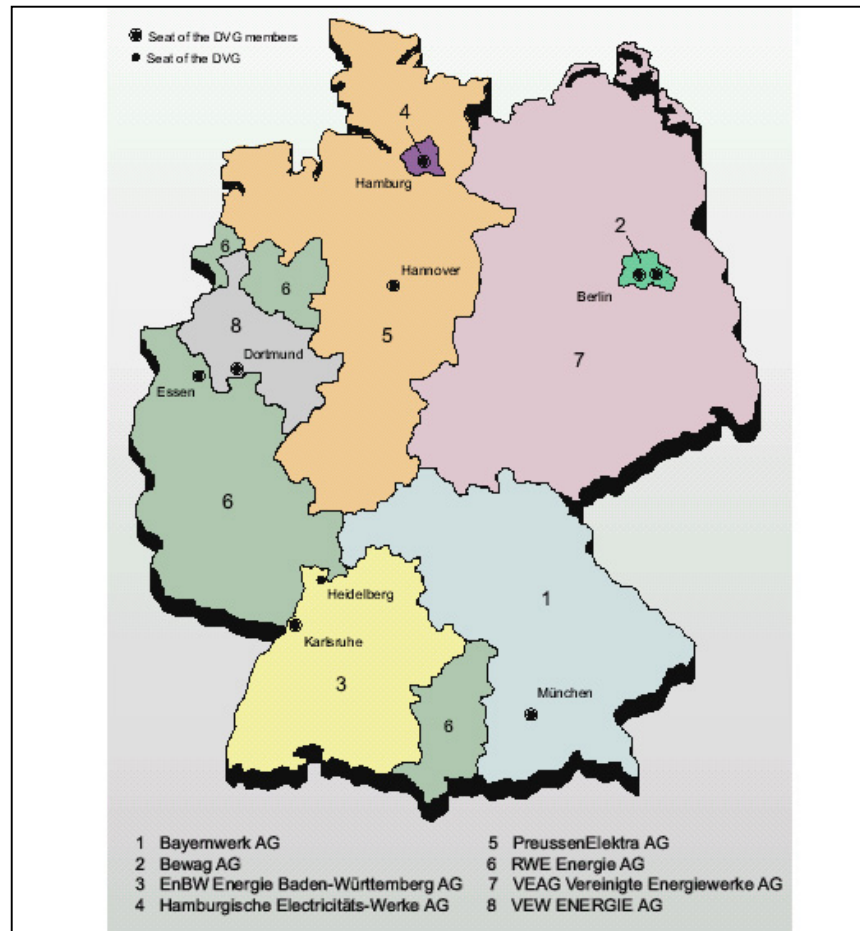


SOURCE: European Commission, Company Accounts, OIES estimates

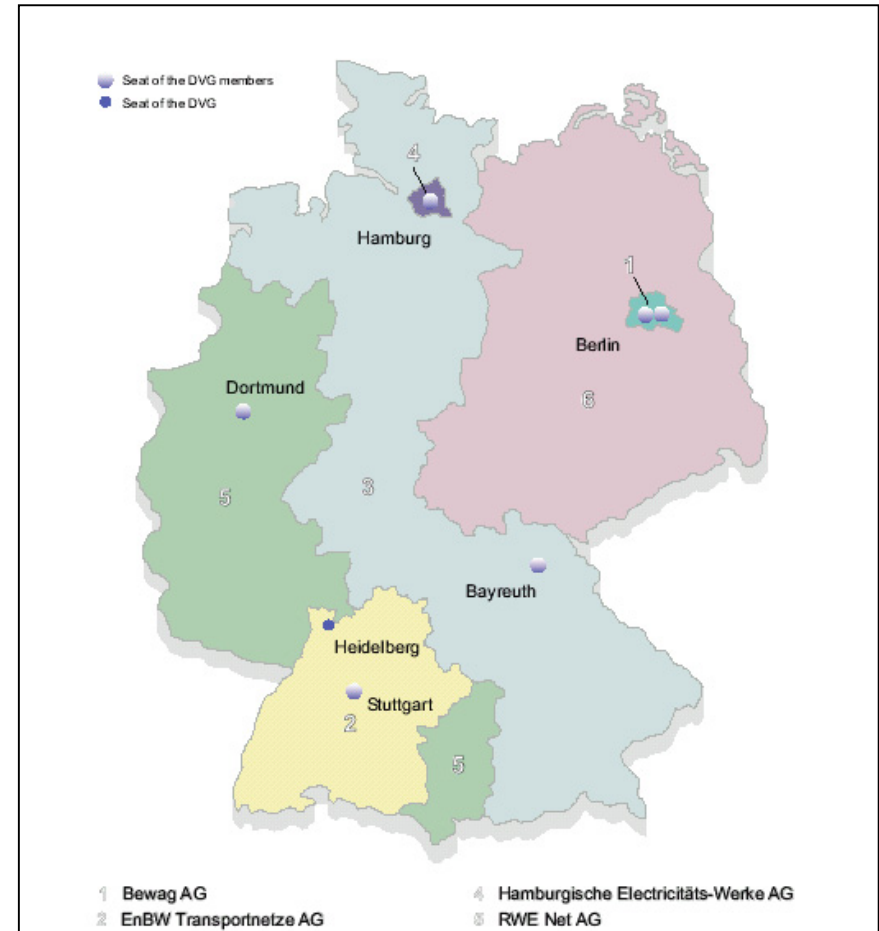
# Unresolved issues

.... vertical integration between concentrated generation sector and monopoly 'wires' ....

**Control Areas of the German Transmission System Operators as at 1 Jan 2000**



**Control Areas of the German Transmission System Operators as at 1 Jan 2001**

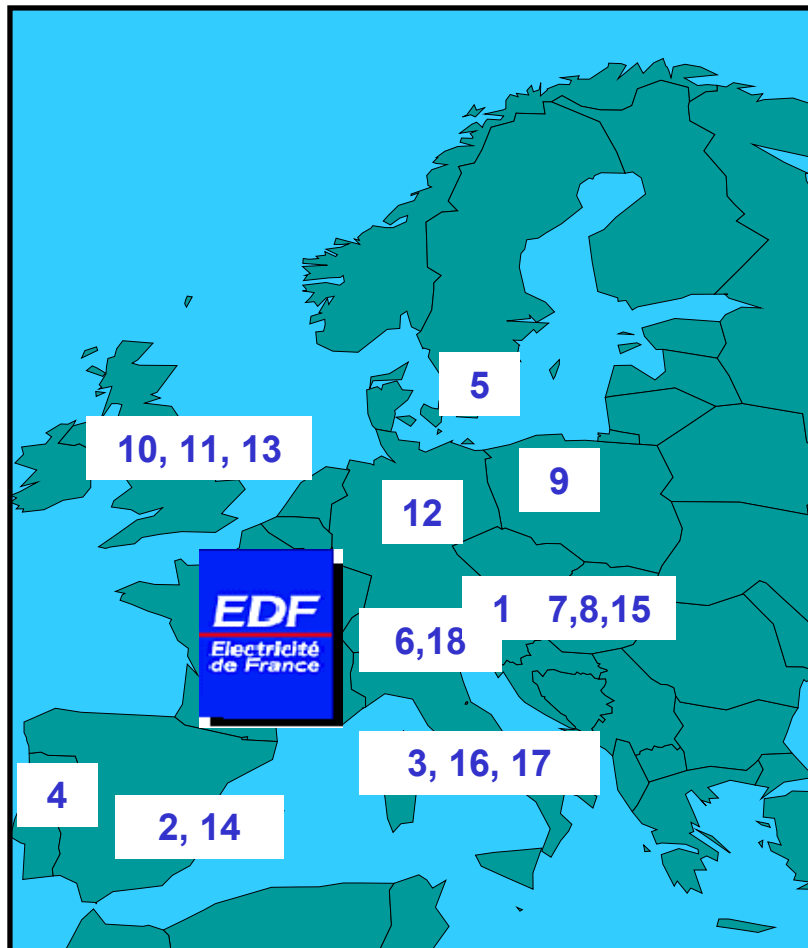


Source: Source: DVG (Deutsche Verbundgesellschaft) [http://www.dvg-heidelberg.de/extern/DVG/res.nsf/files/Regelzonen2001-GB.pdf/\\$file/Regelzonen2001-GB.pdf](http://www.dvg-heidelberg.de/extern/DVG/res.nsf/files/Regelzonen2001-GB.pdf/$file/Regelzonen2001-GB.pdf)



.... plus cross-border mergers may be preventing access to transmission / distribution

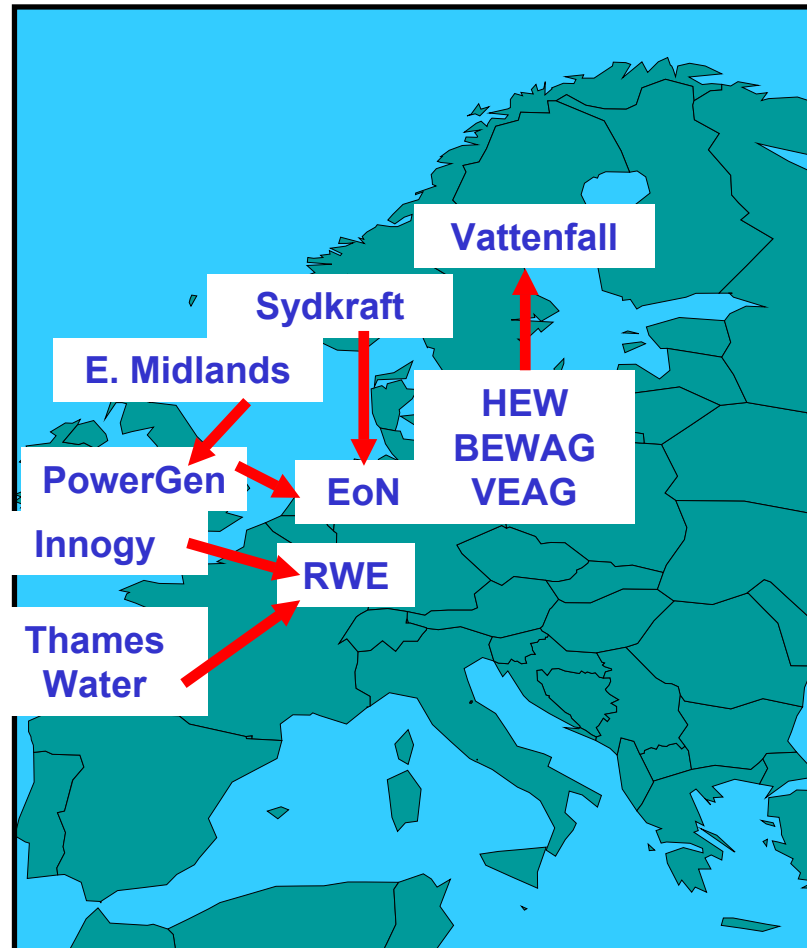
## EUROPEAN INVESTMENTS OF EDF (APR 2002)



- |                         |                     |
|-------------------------|---------------------|
| 1. Estag 25%            | 15. Bert 89%        |
| 2. Elcogas 29.1%        | 16. Itالenergia 18% |
| 3. ISE 30%              | 17. Montedison 97%  |
| 4. Pego 10%             | 18. ATEL 13%        |
| 5. Graningue 36%        |                     |
| 6. Motor Columbus 20%   |                     |
| 7. Edasz 29%            |                     |
| 8. Demasz 50.0%         |                     |
| 9. Ech 58%              |                     |
| 10. London Elec. 100%   |                     |
| 11. SWEB 100%           |                     |
| 12. EnBW 34%            |                     |
| 13. Seaboard 100%       |                     |
| 14. Hidrocantabrico 59% |                     |

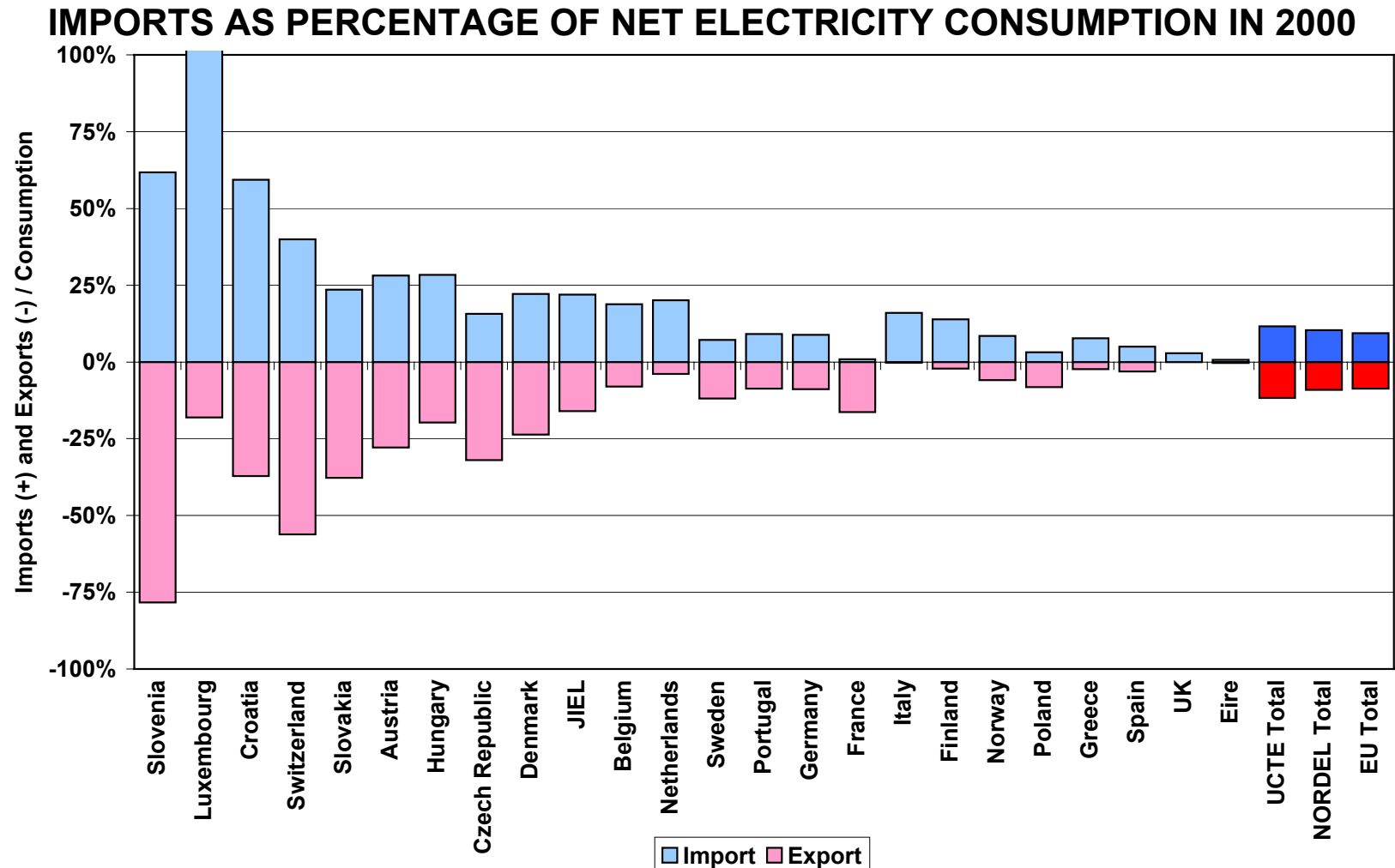
Interlocking relationships make regulation of network effects very complex

## CORPORATE LINKS BETWEEN SWEDISH, GERMAN, UK MARKETS (APR 2002)



# Unresolved issues

Commission believes import / export flows restricted by lack of transmission capacity....

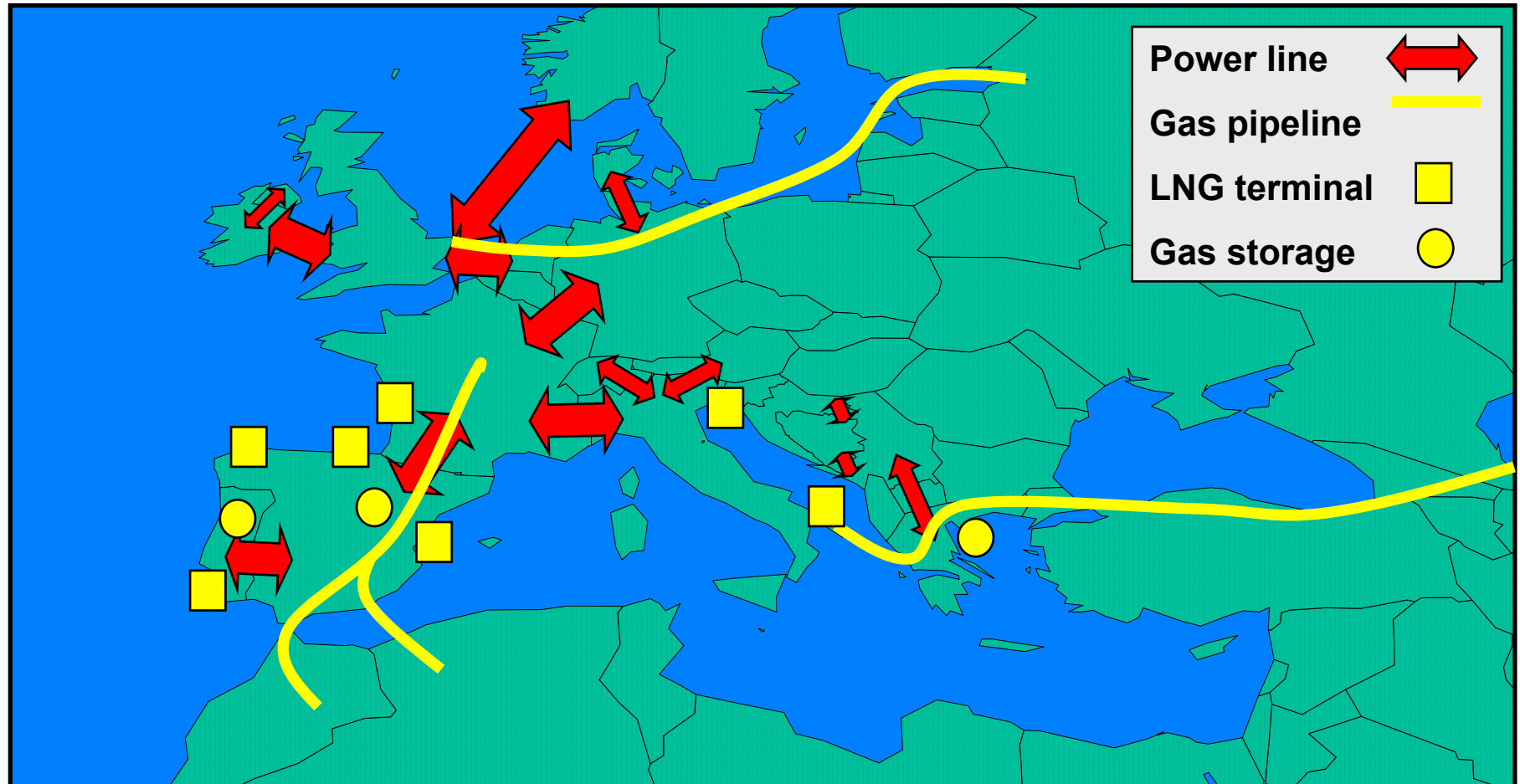


Source: All data for 2001 except Eire which is for 2000 and from UCTE Memo 2001 ([www.ucte.org](http://www.ucte.org)) or Eurostat Energy Monthly Statistics 05:2002

# Unresolved issues

... and proposes 20% funding 7 electricity (5 gas) cross-border transmission axes ....

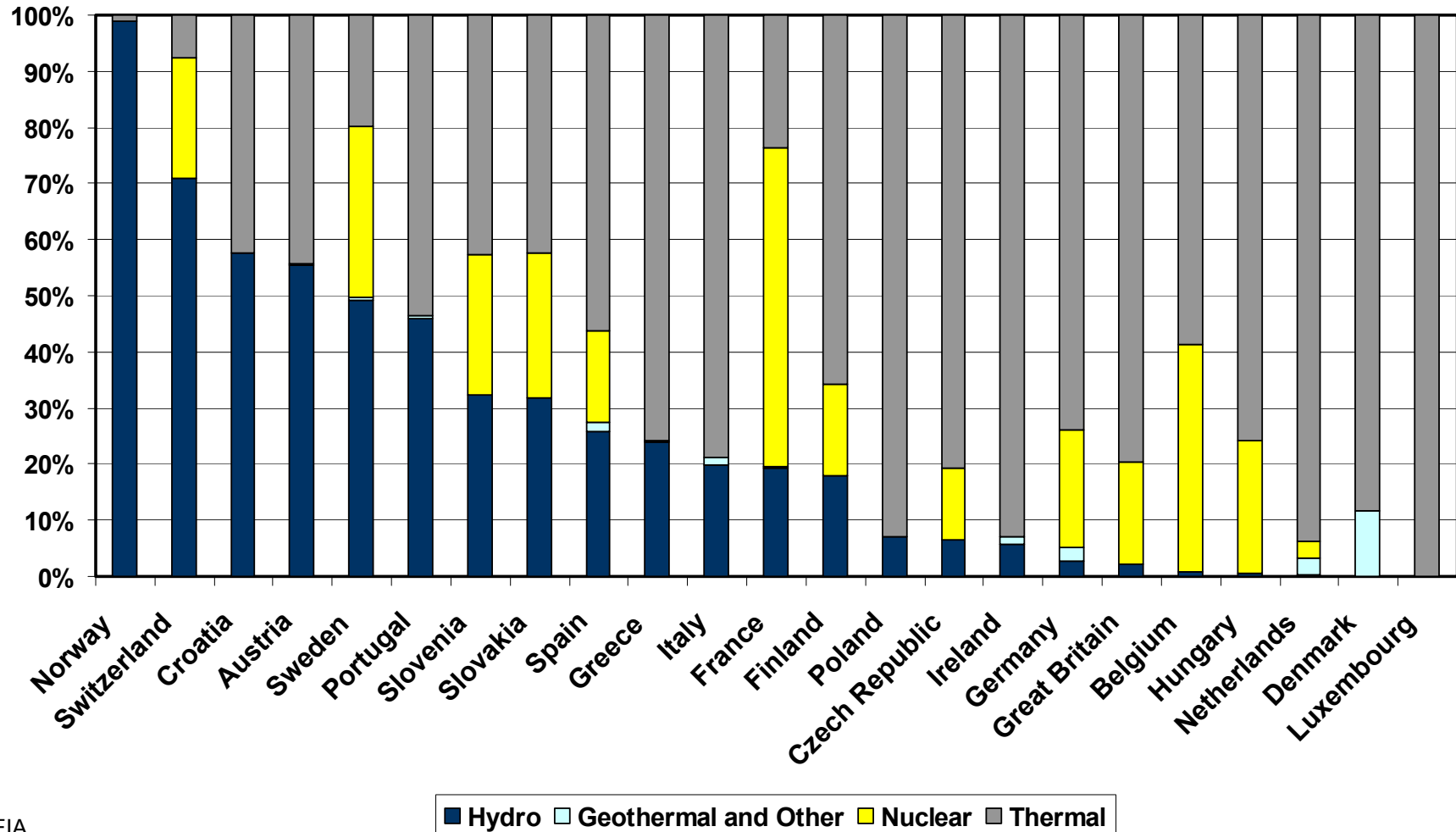
## TENS INTERCONNECTOR PROJECTS OF COMMON INTEREST



# Unresolved issues

...and a 10% target for renewables by 2010 to cut emissions and increase security....

## EUROPEAN ELECTRICITY MARKET GENERATION CAPACITY MIX 2000

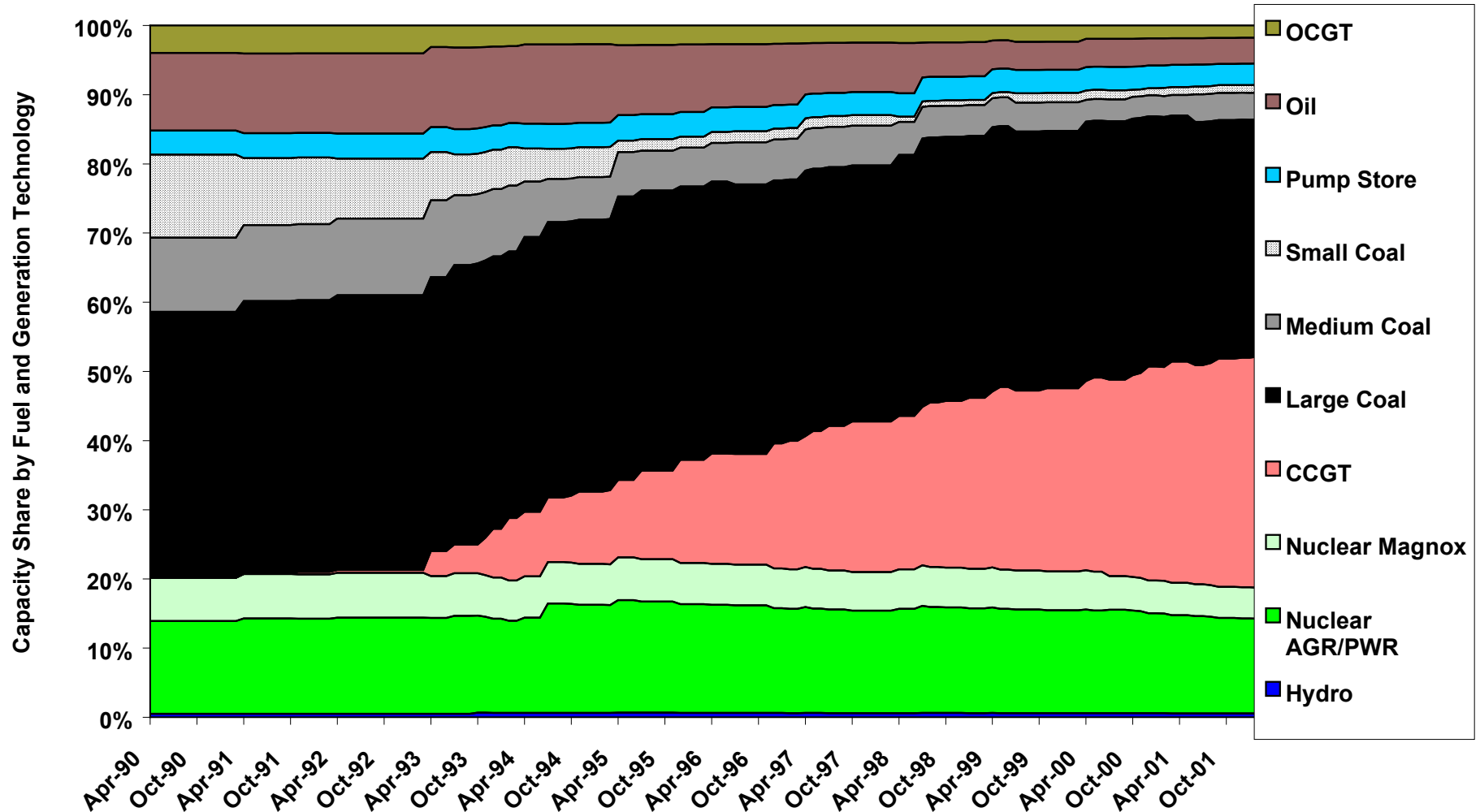


Source: EIA

# Unresolved issues

... but competitive markets prefer low cost fuels increasingly from non-EU countries

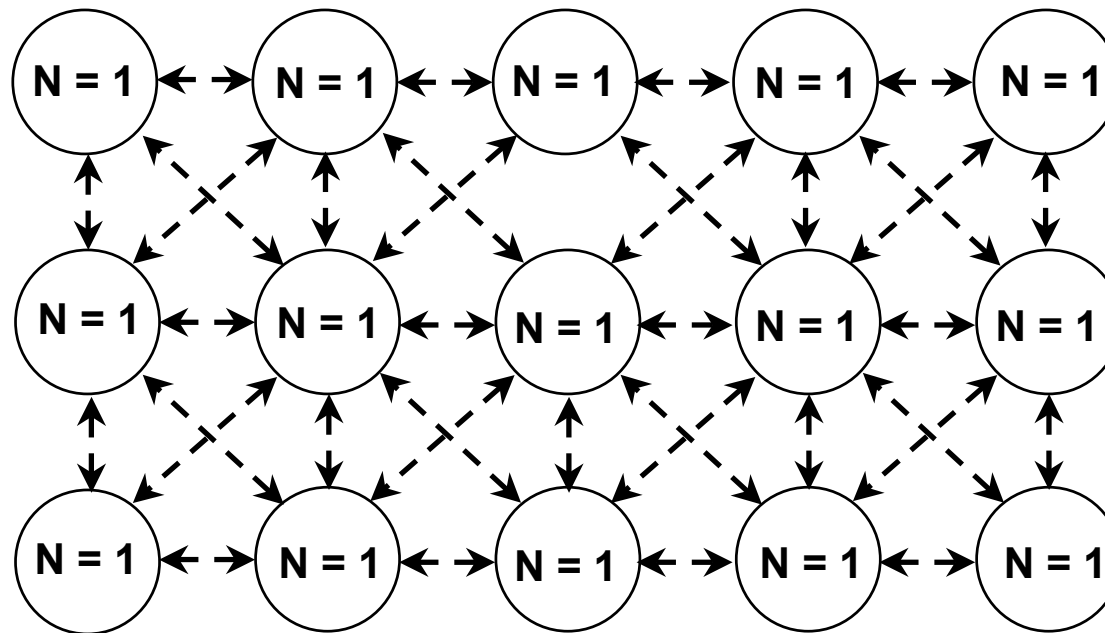
## GENERATION TECHNOLOGY CAPACITY SHARE IN ENGLAND & WALES



# A feasible solution

Pre-liberalisation most countries had monopoly ESI and competitive imports were banned

## REGULATED MONOPOLIES



$P = \text{Price}$     $k = \text{Marginal Cost} = 20$     $A = \text{Constant} = 50000$     $E = \text{Elasticity} = 50$

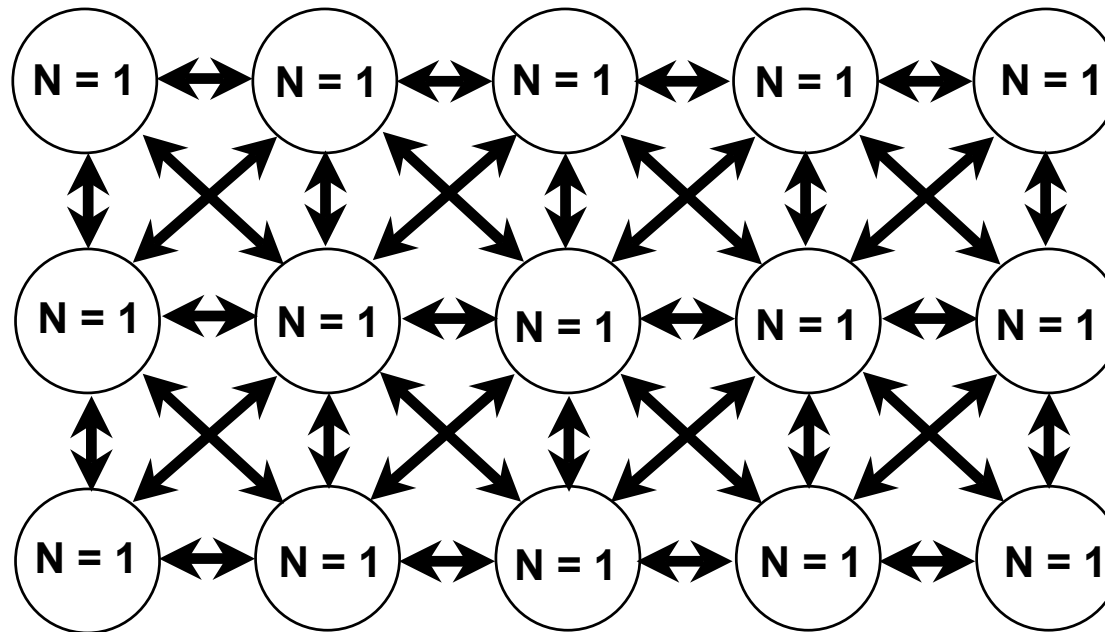
$\text{Import Capacity Between Countries} = 1000$     $\text{Net Flow Between Countries} = 0$

$$P_{\text{monopoly}} = A/2E + k/2 = 50000/(2*50) + (20/2) = 510 \qquad P_{\text{regulated}} = 50$$

# A feasible solution

Public funding of cross-border transmission capacity build may increase competition....

## COMPETING MONOPOLIES



$P = \text{Price}$     $k = \text{Marginal Cost} = 20$     $A = \text{Constant} = 50000$     $E = \text{Elasticity} = 50$

$\text{Import Capacity Between Countries} = 50000$     $\text{Net Flow Between Countries} = 0$

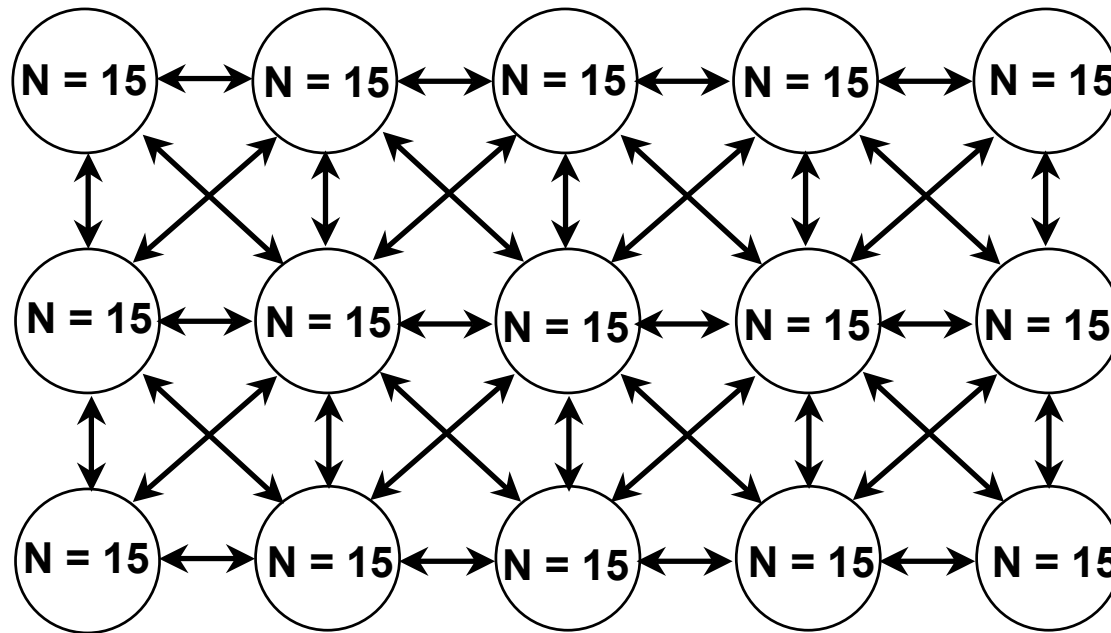
$$P_{\text{competitive}} = 20$$



# A feasible solution

.... but this would not be necessary if dominant firms were broken up first

## COMPETITIVE MARKET



$P = \text{Price}$     $k = \text{Marginal Cost} = 20$     $A = \text{Constant} = 50000$     $E = \text{Elasticity} = 50$

*Import Capacity Between Countries* = **1000**   *Net Flow Between Countries* = **0**

$$P_{\text{competitive}} = 20$$

**John Bower** is Senior Research Fellow at the Oxford Institute for Energy Studies. His research interest is in the emergence and evolution of cross-border electricity and gas markets. Specifically; the development of efficient pricing and investment mechanisms for transmission capacity, integration of energy markets, and energy price / credit risk management.

John's previous career was in the commodity industry and his experience ranges from energy trading, at Marc Rich & Co, to risk management consultancy, with Coopers & Lybrand, advising commodity traders, producers and processors in base metal, precious metal, 'softs' and energy markets. Before joining the PhD programme he was Global Controller Metals/Commodities at Deutsche Morgan Grenfell.

John completed his PhD at London Business School in 2000. He also has an MBA from London Business School and an MA in Biochemistry from Oxford University.



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