European Electricity Markets Structure and Trading
Phase I: Retail Competition and Crossborder Mergers

*Modelling and Managing Competitive Electricity Markets*

*30 September – 3 October 2003*

*John Bower*
Overview

European electricity market overview

The Directive and retail supply competition

Unresolved regulatory issues

BREAK

Transmission economics

Measuring market integration

Transmission pricing solutions

Case Study
European electricity market overview

Four coordinated AC transmission grids linked by DC lines define market boundary.…

TRANSMISSION SYSTEMS IN THE EUROPEAN ELECTRICITY MARKET

Source: UCTE
European electricity market overview

.... owned by 45 separate entities spread across 28 countries coordinated by ETSO

EUROPEAN TRANSMISSION SYSTEM OPERATORS (ETSO) MEMBERS

- TSOI, the association of TSOs in Ireland:
  - Irish Republic (ESB), Northern Ireland (NIE)

- UKTSOA, the United Kingdom TSO association:
  - England & Wales (NGC), Scottish Power (S. Scotland), N. Scotland (Scottish Hydro)

- NORDEL, the Nordic TSOs:
  - Norway (Statnett), Sweden (Svenska Kraftnat), Finland (Fingrid), W. Denmark (Eltra), E. Denmark (Elkraft)

- UCTE, the Union for the Co ordination of Transmission of Electricity, association of TSOs of the Continental countries of Western and Central Europe:
  - Belgium (Elia SA/NV), Germany (Bewag AG, Energie Baden Württemberg AG, E.On Netz GmbH, Hamburgische Elektrizitäts-Werke AG, RWE Net AG, Vereinigte Energiewerke AG),
  - Spain (Red Eléctrica de España S.A.), France (EdF Gestionnaire du Réseau de Transport d’Electricité),
  - Greece (Hellenic Transmission System Operator),
  - Italy (Gestore della Rete di Trasmissione Nazionale),
  - Slovenia (Elektro Slovenija),
  - Croatia (Hrvatska Elektroprivreda, FRJ, EP CG, Elektroprivreda Crne Gore, Elektroprivreda Srbije),
  - FYROM (Elektrostopastvo na Makedonija),
  - Bosnia –Herzegovina (Joint Power Coordination Center),
  - Luxembourg (Compagnie Grand Ducale d’Electricité du Luxembourg),
  - Netherlands, TenneT bv),
  - Austria (Tiroler Wasserkraftwerke AG, Verbund - Austrian Power Grid, Vorarlberger Kraftwerke AG),
  - Portugal (Rede Eléctrica Nacional, S.A.),
  - Switzerland (Aare-Tessin Ltd. for Electricity, BKW FMB Energie AG / BKW FMB Energie S.A.,
  - Elektrizitäts-Gesellschaft Laufenburg Grid AG/ Electricité de Laufenbourg Grid AG, S.A.,
  - Energie Ouest Suisse, Etrons Ltd., Nordostschweizerische Kraftwerke AG),
  - Czech Republic (CEPS),
  - Hungary (Magyar Villamos Művek Rt.),
  - Poland (Polskie Sieci Elektroenergetyczne SA),
  - Slovak Republic (Slovenské Elektrárne, a.s., Prenosova sústava)
European electricity market overview

Market serves 460 million people with peak load of 400 GW using 2784TWh per year

### EUROPEAN ELECTRICITY MARKET STATISTICS

<table>
<thead>
<tr>
<th>Country</th>
<th>Area (km²)</th>
<th>Population (Million)</th>
<th>Installed Generation Capacity (MW)</th>
<th>Maximum System Load (MW)</th>
<th>Total Net Generation (GWh)</th>
<th>Pump Storage Consumption (GWh)</th>
<th>Total Consumption (GWh)</th>
<th>Net Imports (GWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>83900</td>
<td>8.10</td>
<td>13517</td>
<td>7728</td>
<td>54068</td>
<td>1986</td>
<td>50718</td>
<td>-1364</td>
</tr>
<tr>
<td>Belgium</td>
<td>30500</td>
<td>10.20</td>
<td>14088</td>
<td>12291</td>
<td>80162</td>
<td>1639</td>
<td>82851</td>
<td>4326</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>78866</td>
<td>10.30</td>
<td>13746</td>
<td>8744</td>
<td>67741</td>
<td>749</td>
<td>56974</td>
<td>-10018</td>
</tr>
<tr>
<td>Denmark</td>
<td>43000</td>
<td>5.30</td>
<td>12544</td>
<td>6284</td>
<td>34230</td>
<td>2148</td>
<td>32748</td>
<td>666</td>
</tr>
<tr>
<td>Finland</td>
<td>338000</td>
<td>5.20</td>
<td>16143</td>
<td>12700</td>
<td>67113</td>
<td>2901</td>
<td>76093</td>
<td>11881</td>
</tr>
<tr>
<td>France</td>
<td>544000</td>
<td>58.60</td>
<td>108291</td>
<td>66863</td>
<td>503998</td>
<td>6604</td>
<td>427471</td>
<td>-69923</td>
</tr>
<tr>
<td>Germany</td>
<td>357000</td>
<td>82.00</td>
<td>107769</td>
<td>74300</td>
<td>496588</td>
<td>5789</td>
<td>493953</td>
<td>3154</td>
</tr>
<tr>
<td>Great Britain</td>
<td>243300</td>
<td>59.00</td>
<td>69866</td>
<td>51000</td>
<td>359637</td>
<td>3497</td>
<td>370312</td>
<td>14172</td>
</tr>
<tr>
<td>Hungary</td>
<td>93030</td>
<td>10.10</td>
<td>7847</td>
<td>5543</td>
<td>32420</td>
<td>0</td>
<td>35858</td>
<td>3438</td>
</tr>
<tr>
<td>Croatia</td>
<td>56538</td>
<td>4.70</td>
<td>3601</td>
<td>2430</td>
<td>9829</td>
<td>18</td>
<td>13763</td>
<td>3952</td>
</tr>
<tr>
<td>Greece</td>
<td>132000</td>
<td>10.50</td>
<td>9401</td>
<td>7699</td>
<td>45208</td>
<td>585</td>
<td>44617</td>
<td>-6</td>
</tr>
<tr>
<td>Ireland</td>
<td>70300</td>
<td>3.70</td>
<td>4165</td>
<td>21634</td>
<td>2449</td>
<td>449</td>
<td>21283</td>
<td>98</td>
</tr>
<tr>
<td>Italy</td>
<td>301300</td>
<td>57.60</td>
<td>65513</td>
<td>49019</td>
<td>262426</td>
<td>9177</td>
<td>297706</td>
<td>44457</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>2600</td>
<td>0.40</td>
<td>0</td>
<td>888</td>
<td>1145</td>
<td>1022</td>
<td>5834</td>
<td>5711</td>
</tr>
<tr>
<td>Netherlands</td>
<td>41500</td>
<td>15.60</td>
<td>14210</td>
<td>12255</td>
<td>52910</td>
<td>0</td>
<td>71824</td>
<td>18914</td>
</tr>
<tr>
<td>Norway</td>
<td>324000</td>
<td>4.50</td>
<td>27622</td>
<td>20420</td>
<td>137000</td>
<td>10256</td>
<td>107721</td>
<td>-19023</td>
</tr>
<tr>
<td>Poland</td>
<td>120728</td>
<td>38.60</td>
<td>30135</td>
<td>21836</td>
<td>144681</td>
<td>2790</td>
<td>135517</td>
<td>-6374</td>
</tr>
<tr>
<td>Portugal</td>
<td>92400</td>
<td>9.90</td>
<td>9784</td>
<td>6022</td>
<td>37573</td>
<td>560</td>
<td>37949</td>
<td>936</td>
</tr>
<tr>
<td>Slovakia</td>
<td>48845</td>
<td>5.40</td>
<td>7832</td>
<td>4149</td>
<td>28718</td>
<td>392</td>
<td>25653</td>
<td>-2673</td>
</tr>
<tr>
<td>Slovenia</td>
<td>20253</td>
<td>2.00</td>
<td>2400</td>
<td>1698</td>
<td>12529</td>
<td>0</td>
<td>11180</td>
<td>-1349</td>
</tr>
<tr>
<td>Spain</td>
<td>504800</td>
<td>39.70</td>
<td>44921</td>
<td>32430</td>
<td>195372</td>
<td>4908</td>
<td>194905</td>
<td>4441</td>
</tr>
<tr>
<td>Sweden</td>
<td>450000</td>
<td>8.90</td>
<td>32934</td>
<td>26000</td>
<td>139994</td>
<td>11707</td>
<td>132974</td>
<td>4687</td>
</tr>
<tr>
<td>Switzerland</td>
<td>50000</td>
<td>8.90</td>
<td>14606</td>
<td>9027</td>
<td>65392</td>
<td>1974</td>
<td>56401</td>
<td>-7017</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>4026860</td>
<td>459.2</td>
<td>630935</td>
<td>439326</td>
<td>2850368</td>
<td>69151</td>
<td>2784305</td>
<td>3088</td>
</tr>
</tbody>
</table>
The Directive and retail supply competition

New EU Directives give all electric (gas) consumers right to choose supplier by 1 July 07

MAIN EU LEGISLATION ON SINGLE MARKET FOR ENERGY


SINGLE EUROPEAN ACT

Transparency Directive

Transit Directive

Electricity Directive

Gas Directive

Gas Directive II

Electricity Directive II

Gas Consumption 20% 28% 100%

Electricity Consumption 30% 33% 100%
The Directive and retail supply competition

…. with energy market liberalisation also being driven by economic / technical pressures

FORCES FOR CHANGE IN CROSS-BORDER ELECTRICITY TRADE
The Directive and retail supply competition

The Directive guarantees competition in supply with transmission / distribution access.

KEY PROVISIONS OF THE ELECTRICITY DIRECTIVE

• **Unbundling of accounts**
  – Prevents subsidisation and distortion of competition in vertically integrated firms

• **Competition in construction and operation of new plant**
  – Authorisation procedure allows market to determine investment criteria
  – Tendering procedure allows central planner to determine when/where to build capacity

• **Open access to transmission (and distribution) networks**
  – Independent Transmission System Operator (TSO) must be appointed
  – Tariffs for connection and carriage must be transparent and non-discriminatory
  – Reciprocity clause and system reliability issues allows countries to bar access

• **Right of consumers to choose their supplier**
  – Increasing number of consumers should be authorised to choose their suppliers
The Directive and retail supply competition

About 70% of electricity retail market volume is now eligible for supply competition and...

PERCENTAGE OF ELECTRICITY CONSUMPTION ELIGIBLE TO CHOOSE SUPPLIER

Source: European Commission DG Energy and Transport
The Directive and retail supply competition

.... about 80% of gas retail market volume.

PERCENTAGE OF GAS CONSUMPTION ELIGIBLE TO CHOOSE SUPPLIER

Source: European Commission DG Energy & Transport
Unresolved regulatory issues

In reality State and Federal policy objectives are interdependent and often in conflict

LIBERALISATION CONFLICTS

• Security
  – Concern about dependence on other countries for generation capacity
  – Concern about dependence on other countries for generation fuels
  – Concern about dependence on other countries for gas / electricity transmission routes

• Competition
  – Conflict between capital market and public service obligations
  – Access rights to transmission/ distribution and pricing of transmission
  – Increasing industry concentration through mergers and acquisitions

• Environment
  – EUETS (CO2) and LCPD (NOx, SOX, particulate) costs versus lower prices
  – Renewables versus Combined Cycle Gas Turbines (CCGT)
  – NIMBY delays on approval of transmission routes / generation site licences
Unresolved regulatory issues

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

STRUCTURE OF A LIBERALISED ELECTRICITY MARKET

Generators  
Transmission  
WHOLESALE MARKET  
Suppliers  
RETAIL MARKET  
Consumers  
Physical Electricity Flow  
Contract Flow
Unresolved regulatory issues

.... with new entrants and increased efficiency reducing prices....

IMPACT OF LIBERALISATION IN ENGLAND & WALES 1990 - 2003
Unresolved regulatory issues

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

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

SHARE OF COAL GENERATION CAPACITY IN ENGLAND & WALES

Source: EIA
Unresolved regulatory issues

.... but many countries still pursue the ‘national champion’ objective....

EU GENERATION CAPACITY CONCENTRATION RATIO (3 FIRM) 2001

SOURCE: European Commission, Company Accounts, OIES estimates
Unresolved regulatory issues

... and 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

Unresolved regulatory issues

Cross-border mergers may now be preventing access to transmission / distribution . . . .

EUROPEAN INVESTMENTS OF EDF (APR 2002)

1. Estag 25% 15. Bert 89%
2. Elcogas 29.1% 16. Italenergia 18%
3. ISE 30% 17. Montedison 97%
4. Pego 10% 18. ATEL 13%
5. Graningue 36%
6. Motor Colombus 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%
Unresolved regulatory issues

.... creating interlocking relationships make regulation of network effects very complex

CORPORATE LINKS BETWEEN SWEDISH, GERMAN, UK MARKETS (APR 2002)
Unresolved regulatory issues

All national governments want to intervene to set national energy policy….

RECENT BRITISH ENERGY HEADLINES

28 Aug 02  British Energy drained by low prices-minister
01 Sep 02  British Energy ponders US sale
06 Sep 02  Nuclear firm British Energy begs for bailout
07 Sep 02  British Energy shares suspended as company warns of insolvency
08 Sep 02  Ministers offers £410 million loan to British Energy
09 Sep 02  British Energy falls almost 80 pct after LSE lifts trading curbs
26 Sep 02  Ministers extend loan to British Energy and increase it to £500
18 Sep 03  Government sets deadline on British Energy restructuring
22 Sep 03  Nuclear plants may get new lease of life
02 Oct 03  ???????
Unresolved regulatory issues

... usually under the guise of energy security...

GENERATION TECHNOLOGY CAPACITY SHARE IN ENGLAND & WALES (Apr 1990 – Mar 2004)
Unresolved regulatory issues

…but is in conflict with the environmental objectives of EUETS and LCPD…

EU EMISSIONS TRADING SCHEME AND LARGE COMBUSTION PLANT DIRECTIVES

**EU Emissions Trading Scheme**
- **Precursor**
  - 2003 – 2004
  - National Plan Formulation
- **Phase I**
  - 2005 – 2007
  - CO2 only
  - Allocation only
- **Phase II**
  - 2008 – 2012
  - CO2 + other gases
  - Allocation + Auctions

**EU Large Combustion Plant Directive**
- **Precursor**
  - 2002 - 2003
  - National Plan Formulation
- **Phase I**
  - 2004 – 2007
  - SOx, NOx, dust
  - ELV or NP
- **Derogation Phase**
  - 2008 – 2015
  - SOx, NOx, dust
  - ELV or 20k hr derogation

Source: EIA
Unresolved regulatory issues

...even the EU Renewables Directive 10% target by 2010 is really about energy security

**EUROPEAN ELECTRICITY GENERATION OUTPUT 2000**

Source: EIA
Unresolved regulatory issues

Some EU industrial price fell initially but beginning to rise now and a wide range persists….

**EU ELECTRICITY PRICES FOR INDUSTRIAL CONSUMERS (Ex Tax) AT 1 JANUARY**

Source: Eurostat
Unresolved regulatory issues

…. while household prices only fell a little overall and went up a lot in Scandinavia

![EU Electricity Prices Chart](chart.png)

Source: Eurostat
Speaker

John Bower is a Senior Research Fellow at the Oxford Institute for Energy Studies which is an independent research charity affiliated to Oxford University and dedicated to advanced research in the social science aspects of energy. John joined OIES in November 2001 and his research interest is in the emergence and evolution of integrated cross-border electricity and gas markets. Specifically; the development of efficient pricing and investment mechanisms for energy, transmission capacity, and emissions.

Before joining the OIES, John completed his PhD at London Business School and his previous career was in the commodity industry. 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. Immediately prior to his PhD he was Global Controller Metals/Commodities at Deutsche Morgan Grenfell.

Oxford Institute for Energy Studies
57 Woodstock Road
Oxford OX2 6FA
United Kingdom

Telephone: +44 (0)1865 889 125
Facsimile: +44 (0)1865 310 527
Email: john.bower@oxfordenergy.org
URL: http://www.oxfordenergy.org