What future(s) for liberalized electricity markets?

David Newbery

Energy Industry at a Crossroads

Toulouse 5th June 2014

http://www.eprg.group.cam.ac.uk
Outline

• Why did we liberalize electricity?
  – Contrast reasons and starting points
  – Was it worth it? When does it work well?

• What are the problems with this model?
  – High discount rates => short-termism
  – Collapse of R&D
  – Hard to invest in viable low-carbon generation

Do energy politics undermine this model?

What other models are on offer?
Traditional ESI structure

- Vertically integrated regional monopoly G+T
  - Default state-owned, US: investor-owned & regulated
- Developed countries: state can sustain high investment
  - Weak capital discipline, low (nominal) cost of borrowing
    => low electricity prices relative to LRMC
  - Fuel mix set by energy policy => from oil to coal or nuclear
    => Do we trust the government to invest wisely and efficiently?
  - Perhaps in France – doubtful in UK
- Developing countries: mixed, IFAs provide funds
  => under-price, unable to finance own investment => black-outs
State finance supports massive investment

Capital Investment England & Wales ESI 1948-1989

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Pressures for reform

• UK: poor management control; failed White Papers, concerns over nexus of coal and miners’ union strength

• State planning suspect: “Roll back frontiers of the state”
  – Privatize oil, telecoms, gas – why not electricity?

• Lessons of earlier privatizations learned:
  – Restructure then sell, Act creates regulator, licences to ensure competition where possible, incentive regulation where not

• ESI restructuring hard, aided by spare capacity

Different structures deliver different outcomes
Forecasts and outturns CEGB 1950-88

ACS Demand (GW) (log scale)

Spare capacity - No need to invest

- Out-turn (at ACS)
- Planning Forecast
- Available capacity*

*assuming 10% planning margin
Electricity Council
• **Contrast restructuring:**
  – CEGB (England and Wales) with Scotland
• 1 regulator, 2 models, 3 grids
• **Electricity Act 1989:**
  – restructured and **unbundled** CEGB in 3 Gencos, National Grid, Distribution companies (domestic franchise to 1988)
  – set up Electricity Pool for GB
  – Scotland: retained 2 incumbent **vertical integrated** utilities
• set up Offer to regulate under RPI-X
• 25yr Licences for all companies as contracts
  – \( P_0, X \) can be reset for wires companies at periodic review
**Benefits of privatizing in GB**

<table>
<thead>
<tr>
<th>Cost savings:</th>
<th>PDV at 6%</th>
<th>£ (95) billion</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>CEBG</td>
<td>Scotland</td>
</tr>
<tr>
<td>Consumers</td>
<td>-1.3</td>
<td>-1.5</td>
</tr>
<tr>
<td>Govt. excl sales</td>
<td>-8.5</td>
<td>-5.2</td>
</tr>
<tr>
<td>After-tax profits</td>
<td>19.4</td>
<td>6.7</td>
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<tr>
<td>Net benefits</td>
<td>9.6</td>
<td>-0.1</td>
</tr>
<tr>
<td>Govt. sales proceeds</td>
<td>9.7</td>
<td>3.6</td>
</tr>
<tr>
<td>Net govt. position</td>
<td>1.2</td>
<td>-1.6</td>
</tr>
</tbody>
</table>

**levelised reduction per kWh**

|         | 5.7%  | 0%    |

Lessons: Gains modest – easily lost (Scotland)

- **competition** improves performance
- **unbundling** needed for effective competition
- **Privatization** precipitates further reforms?
  - NETA, BETTA, EMR, TransmiT, ….

Energy Policy Research Group

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Problems with the UK model

• Supported by “dash for gas” and cheap CCGT
  – And pro-market energy policy under Conservatives
• Labour energy policy: secure, sustainable & affordable
• But ability to deliver sustainability doubtful
  – EU Climate Change policies not credible unaided
  – R&D collapsed
• hard to finance costly nuclear and renewables
• But regulated networks successfully invested

UK Solution (?) - Electricity Market (?) Reform
CCC’09 UK 2020 target is 27,000 MW

Installed wind capacity in MW

UK’s lags behind
Despite good wind
Premium FiT risky

Support to Wind under the ROC Scheme (real prices)
Little recovery after backloading and tightening post 2020

EUA price October 2004-January 2014

Source: EEX
UK Electricity R&D intensity

Too little R&D, too much deployment?
Electricity Market Reform

• **Energy Act** 18 December 2013 to address:
  – Security of supply and carbon/RES targets
  – problems with EU ETS
  – Market/policy failures

• To deliver **secure low-C in UK affordably**
  => capacity payments
  => Carbon Price Floor
  – **de-risk investment** => **Contracts** to lower cost of capital
UK’s Carbon Price Floor - in Budget of 3/11

EUA price second period and CPF £(2012)/tonne

Corrective tax

Budget 2014

Forward prices

Source: EEX and DECC Consultation
CfD in *Energy Act 2013*

- 2013: Government announces strike prices and annual subsidy limit (Levy Control Framework)
  - uniform by technology (except Island wind), set 2014-17
  - runs *in parallel* with ROCs to 2017
  => has to be made as attractive as ROCs
  => comparable rate of return (rather high for on-shore wind)
  => undermines logic of lowering cost by lowering risk
  => relies on locational grid signals (still under review)

- May 2014: replace with auctions for mature RES

*Finally - sense breaks through*
Criticisms of EMR

• “Contracts mark return to Single Buyer Model”
  – but all IPPs in 1990s were long-term PPAs

• “Bureaucrats, not markets choose investment”
  – but current RES support Govt designed after intense lobbying by incumbents
  => tenders, auctions to create competition
  => contracts should incentivise efficient operation

• “Wholesale price will be distorted by contracts”
  – fossil at margin until 2020+, problem is low variable cost plant => capacity payments?

• Without govt underwriting contracts no cheaper
  – need guarantees that are defensible under state aid rules
EU role: to address *public goods*

- **ETS**: need adequate **credible** future C price
  - Best: backed by CfDs on EU C-price *or*
  - long-term contracts supported by carbon price floor (UK EMR approach) *and/or*
  - emissions standard for new plant: tonnes/MWyr plus sector-wide emissions target set 20 years ahead

- **Integrate deployment, demo and R&D support**
  - Financial targets for MSs, competitive tendering and benchmarking for efficiency
What electricity models?

• Decarbonising: high capital cost, low variable cost
  – Need to de-risk, lower cost of capital
  ⇒ hard in liberalised market without credible C-price
  ⇒ contracts, capacity payments, price caps – where is market?
• Renewables are intermittent, paid high price per MWh
  – RES support distorts prices, location, trade ⇒ Reform!
• Options
  – Adapt US Standard Market Design
  – Single Buyer model based in ISO
  – State: owns nuclear; procures & auctions RES sites

Aims: cheap capital, socialize risks, efficiency
Several possible solutions

- Real public sector interest rates now near zero
  - Govt finance attractive when backed by productive assets
  - Aggregate risks low, markets amplify company risks
  => finance low-C generation from state development banks

- But need contestability to deliver efficiency
  => tender auctions for PPA contracts?
    - Or regulated revenues if flexibility needed? (but generating is simple!)
  => single buyer (ISO) for efficient dispatch? Or Pool?
  - Or complex audited bids & central dispatch (SMD) e.g. SEM

Design market to fit technology

Commodity markets not good models
Objectives

- First fix public good problems
  - C-pricing (or C-intensity cap), RDD&D support
- Then address market/policy failures
  - Retain contestability via auctions and spot markets
  - Reduce cost of capital via state funding/counterparty
=> market friendly long-term contracts
  - With incentives for performance and efficient trade

Solution may depend on market power & size
EU Standard Market Design?

- **Central dispatch** in voluntary pool
  - SO manages balancing, dispatch, wind forecasting
  - LMP + capacity payment = LoLP*(VoLL-LMP)
  - Hedged with reliability option (RO)

=> reference prices for CfDs, FTRs, balancing, trading

- **Auction/tender LT contracts for low-C generation**
  - Financed from state investment bank
    - Credible counterparty to LT contract, low interest rate
  - CfDs when controllable, FiTs when not, or
  - Capacity availability payment plus energy payment
    - Counterparty receives LMP, pays contract

- **Free entry of fossil generation, can bid for LT RO**
  - To address policy/market failures
Conclusions

- Liberalized *competitive* markets deliver efficiency
  - So does incentive regulation of natural monopolies
  - But *gains modest*, depend on spare capacity
    - And cheap investment options like CCGT
- Investment needed is capital-intensive
  - Balance shifts to reducing risk and cost of capital
    => Contracts, capacity payments, state finance/ownership
- Best choice depends on institutional endowment
  - And some options ruled out by State Aids
  ⇒ EU needs to think carefully how best to decarbonise

*Challenge is to reform markets, finance and support*
<table>
<thead>
<tr>
<th>Acronyms</th>
<th>Full Form</th>
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<tr>
<td>BETTA</td>
<td>British Electricity Trading &amp; Transmission Arrangements</td>
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<tr>
<td>CCGT</td>
<td>Combined cycle gas turbine</td>
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<td>CEGB</td>
<td>Central Electricity Generating Board</td>
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<tr>
<td>CfD</td>
<td>Contract for difference</td>
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<tr>
<td>CP</td>
<td>Capacity Payment</td>
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<tr>
<td>EMR</td>
<td>(UK) Electricity Market Reform</td>
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<tr>
<td>ESI</td>
<td>Electricity Supply Industry</td>
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<tr>
<td>ETS</td>
<td>Emissions Trading System</td>
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<td>EUA</td>
<td>EU Allowance for 1 tonne CO₂</td>
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<td>FiT</td>
<td>Feed-in tariff</td>
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<tr>
<td>FTR</td>
<td>Financial Transmission Right</td>
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<td>G+T</td>
<td>Generation and Transmission</td>
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<td>IPP</td>
<td>Independent Power Producer</td>
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<tr>
<td>ISO</td>
<td>Independent System Operator</td>
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<tr>
<td>LMP</td>
<td>Locational marginal price or nodal price</td>
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<td>LoLP</td>
<td>Loss of Load probability</td>
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<td>LRMC</td>
<td>Long-run marginal cost</td>
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<tr>
<td>LT</td>
<td>Long-term</td>
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<tr>
<td>NETA</td>
<td>New Electricity Trading Arrangements</td>
</tr>
<tr>
<td>PPA</td>
<td>Power purchase agreement</td>
</tr>
<tr>
<td>RDD&amp;D</td>
<td>Research, development, demonstration and deployment</td>
</tr>
<tr>
<td>RES</td>
<td>Renewable energy supply</td>
</tr>
<tr>
<td>RO(C)</td>
<td>Renewable Obligation (Certificate) or Reliability Option</td>
</tr>
<tr>
<td>SMD</td>
<td>Standard Market Design (the US model)</td>
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<tr>
<td>SEM</td>
<td>Single Electricity Market (of the island of Ireland)</td>
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<tr>
<td>VOLL</td>
<td>Value of Lost Load</td>
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Background to EMR

- **Security of supply**: reserve margin falling fast
  - 12 GW coal decommissioned by 2015 because of LCPD (20% of peak demand)
  - 6.3 GW nuclear decommissioned by 2016
  - extra flexible generation needed to handle wind
- **Climate change** challenge: reach \(<100\text{gm/kWh}\) 2030
  - Renewables falling short of targets
  - Nuclear not attractive at current CO\(_2\) price
  - Carbon not properly priced in EU ETS
- **Cost rising**: 2020 *energy* targets might cost £200 bn
  - £760 per household/yr, current energy bills = £1,100/yr
  - electricity alone £120 bn; £80+ bn on generation
Conclusions on EMR

- **Low-C** generation needs long-term contracts needed as no credible futures markets for corrective carbon tax
- FiTs make sense for unreliable RES (wind etc)
  - need to avoid exposure to balancing etc.
- EMR hampered by existing RO scheme
  - will be more expensive than intended
- Should move to auctions asap

*Subsidies should come from general taxation*
Capacity payments

- GB will have capacity payments from 2018
  - in return for capping wholesale price at £6,000/MWh
  - VoLL taken as £17,000/MWh, LoLE = 3 hours

- Efficient trade over interconnectors requires efficient scarcity pricing
  \[ \text{LoLP} \times (\text{VoLL} - \text{SMP}) \]

But EU auction platform has price cap of €3,000