



Electricity liberalisation in the UK – the end is nigh

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Preamble: The Dynamics of Power

- Generation investment in liberalised power markets will be problematic for governments
- It will be lumpy, undiverse and driven by perceptions of risk
- Security has attracted most attention but is manageable; environmental protection and electrification are still problems.
- Unless governments develop market-friendly instruments, liberalisation is at risk



The unresolved contradiction

1. Liberalised markets don't guarantee specific outcomes but environmental policy prescribes outcomes.

In principle there are ways through the dilemma, but:

2. Electricity (investment) will have to be the main route to achieving climate change targets.
3. There is no policy mechanism for delivering in a liberalised power market.
4. Either liberalisation or the environmental objectives have to go (and the government has made it clear which it will be).



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Markets are like democracy

They are about

- process not outcomes
- discovery not deliverables
- individual preferences not politicians' goals

Yet “we have set the market free; now we expect it to deliver” (lower prices, environmental improvement, new investment etc)



No fundamental conflict: markets and environmental improvement

- Encourage resource efficiency and reduce waste
- Better at finding and exploiting new techniques
- More responsive to consumer needs

At first (1990s) liberalisation and environmental improvement (and price reduction, new investment etc) went hand in hand.



Markets can incorporate environmental externalities

But instruments used need to be:

- Market friendly – eg economic instruments (taxes or trading)
- Based on simple, transparent, groundrules
- Predictable, consistent and credible
- Minimally prescriptive on means (not picking winners)





Instead we have

- Multiple targets (EU, UK, ghgs, renewables, energy efficiency etc)
- Policy volatility (4 White Papers; U-turns on coal, gas, nuclear; changes in support schemes)
- Multiple instruments (ETS, CCAs, UKETS, CRC, IPPC, LCPD, RO, CHP, nuclear, SEA, SSA, S36, CC Act)
- Low credibility – most targets have been and will be missed.



Climate policy will continue to be prescriptive

- International framework based on targets. President Obama accepts principle.
- EU policies based on targets for renewables, energy efficiency etc.
- UK is reinforcing targetry via Climate Change Act.



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UK – the climate challenge

- CO₂ emissions up since late 1990s – though down since 1990 (or 1970). Turning point was Kyoto coming into effect.
- Favourable trends of past have run their course – dash to gas in homes and power; nuclear expansion; de-industrialisation; reduction in non CO₂ gases.
- Self-imposed constraints: to meet Climate Change Act targets, very aggressive measures will be needed



The Climate Change Act

- 80% reduction in ghg emissions by 2050
- 26% reductions in CO₂ by 2020 (to be reviewed)
- Aviation and shipping to be included (or Parliament must know why)
- Interim budgets – Committee on Climate Change to advise – will include aviation etc



Electricity is the most practical technical and political route to reductions

- Electricity can be made from any energy source (often only effective route eg for many renewables, nuclear)
- Electricity can substitute for any energy source (in the long run, even personal transport)
- Changes can be made upstream (c 30 sites account for 30% of UK emissions); behaviour changes not needed
- Limited trade – “competitiveness” lobbying less acute
- Low price elasticity – limits distortions and substitution



CO₂ Intensity of Power Generation (g CO₂/kWh) and consumption/head

(Source: IEA CO₂ Emissions from Fuel Combustion 2008).

- India: 943 g 503 kWh
- China: 794 g 2040 kWh
- US: 567 g 13515 kWh
- Europe: 326 g 7922 kWh
- Brazil: 84 g 2060 kWh
- Sweden: 48 g 15230 kWh
- Iceland: 1 g 31306 kWh



Electricity offers “low hanging fruit” - swift and substantial emissions reductions

- 1990 – 1999: UK – down c 50 MtCO₂ (10% of UK total)
- 1979 – 1987: France – down c 100 MtCO₂ (20% of French total)
- 1979 – 1983: Sweden – down c 20 Mt CO₂ (25% of Swedish total)

Only comparable reductions due to industrial collapse – eg FSU – or war (Source: IEA CO₂ Emissions from Fuel Combustion 2008).



Electricity can lead to a genuine low emissions economy

(Source: IEA CO₂ Emissions from Fuel Combustion 2008)



| Country | tCO ₂ /head | tCO ₂ /head electricity | tCO ₂ /head transport | tCO ₂ /head residential |
|-------------|------------------------|------------------------------------|----------------------------------|------------------------------------|
| Denmark | 10.2 | 5.1 | 2.4 | 0.6 |
| France | 6.0 | 0.8 | 2.1 | 1.0 |
| Germany | 10.0 | 4.2 | 1.9 | 1.5 |
| Netherlands | 10.9 | 3.3 | 2.2 | 1.1 |
| Sweden | 5.3 | 1.0 | 2.5 | 0.1 |
| UK | 8.9 | 3.4 | 2.2 | 1.2 |
| US | 19.0 | 8.1 | 5.1 | 1.0 |



CO₂ in Electricity and Total UK CO₂ emissions 1990-2006 – Electricity is the key sector

(Source: DECC)



| Year | gCO ₂ /kWh electricity | CO ₂ emissions from electricity (Mt) | Total CO ₂ emissions from energy (Mt) |
|------|-----------------------------------|-------------------------------------------------|--------------------------------------------------|
| 1990 | 672 | 242 | 592 |
| 1999 | 441 | 189 | 540 |
| 2006 | 505 | 220 | 555 |



EP 68 Forecasts - 2000



Table 7.5 Emission Projections, CH, MtC

| | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2020 |
|-----------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Power Stations | 54.1 | 44.1 | 40.0 | 38.0 | 37.6 | 39.4 | 37.8 |
| Refineries | 5.1 | 5.9 | 5.1 | 6.0 | 6.3 | 6.5 | 6.5 |
| Residential | 21.5 | 21.7 | 22.0 | 21.9 | 22.0 | 22.6 | 23.1 |
| Services | 8.4 | 8.8 | 9.6 | 9.5 | 9.8 | 10.0 | 10.2 |
| Industry | 35.2 | 34.3 | 33.7 | 32.5 | 31.8 | 31.6 | 31.5 |
| Road Transport | 29.8 | 30.2 | 32.0 | 34.5 | 36.9 | 39.4 | 41.8 |
| Off-road | 1.6 | 1.5 | 1.3 | 1.2 | 1.2 | 1.2 | 1.2 |
| Other transport | 3.6 | 3.2 | 3.1 | 3.0 | 3.0 | 3.0 | 3.1 |
| Total | 159.3 | 149.6 | 146.7 | 146.6 | 148.7 | 153.6 | 155.2 |



Future Targets – Residential and Transport Expected to Contribute

(White Paper 2007 Projections)

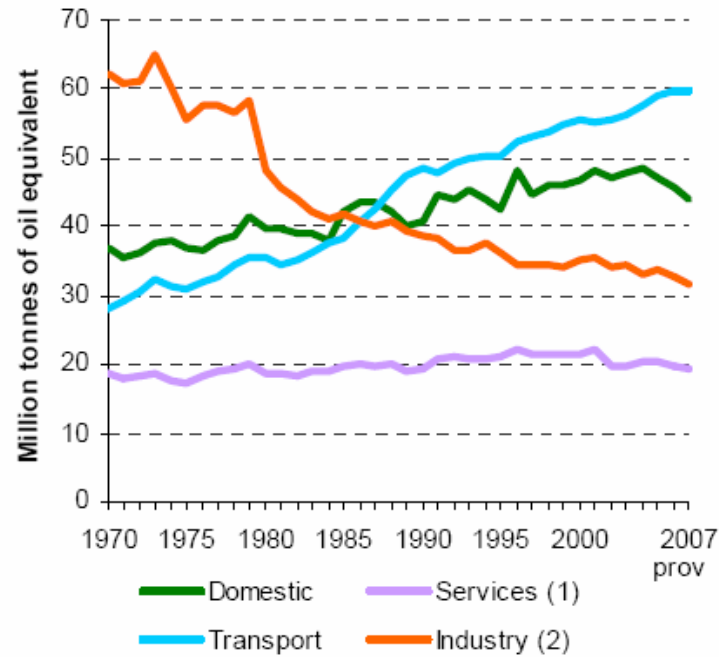
| Sector | 2005 (MtC) | Baseline (MtC) | | High Carbon Saving (EP 68) (MtC) | |
|--------------|------------|----------------|------|----------------------------------|---------|
| | | 2010 | 2020 | 2010 | 2020 |
| Electricity | 47 | 45 | 49 | 43 (38) | 33 (37) |
| Residential | 23 | 20 | 18 | 20 (22) | 14 (23) |
| Transport | 39 | 39 | 40 | 39 (41) | 34 (45) |
| Total | 151 | 146 | 151 | 144 | 123 |



Can other sectors provide the savings? - sectoral history

(Source: DECC)

Chart E11.2:
Final energy consumption by sector, 1970 to 2007



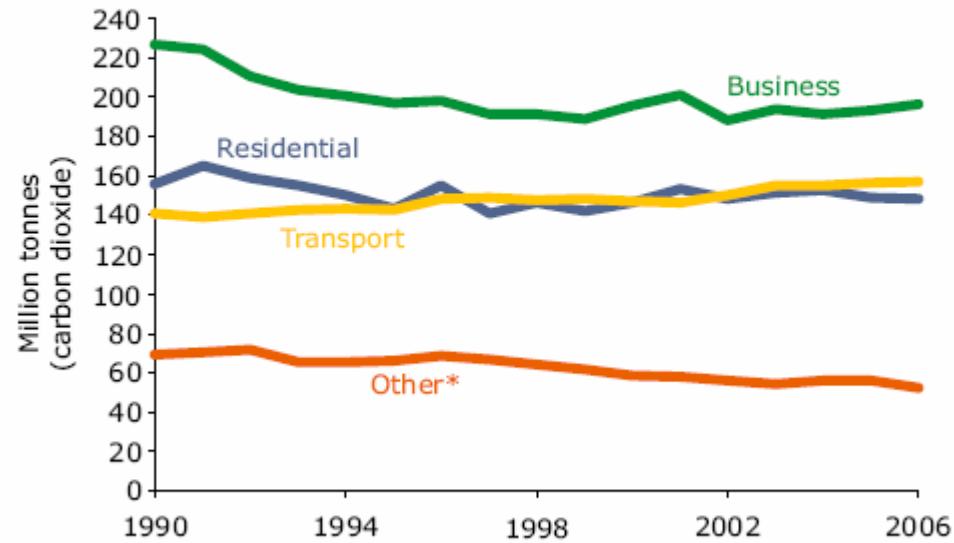


Sectoral emissions trends

(DECC)

Carbon dioxide emissions by end user, 1990 to 2006

United Kingdom



*Mostly of public, industrial and agricultural sectors

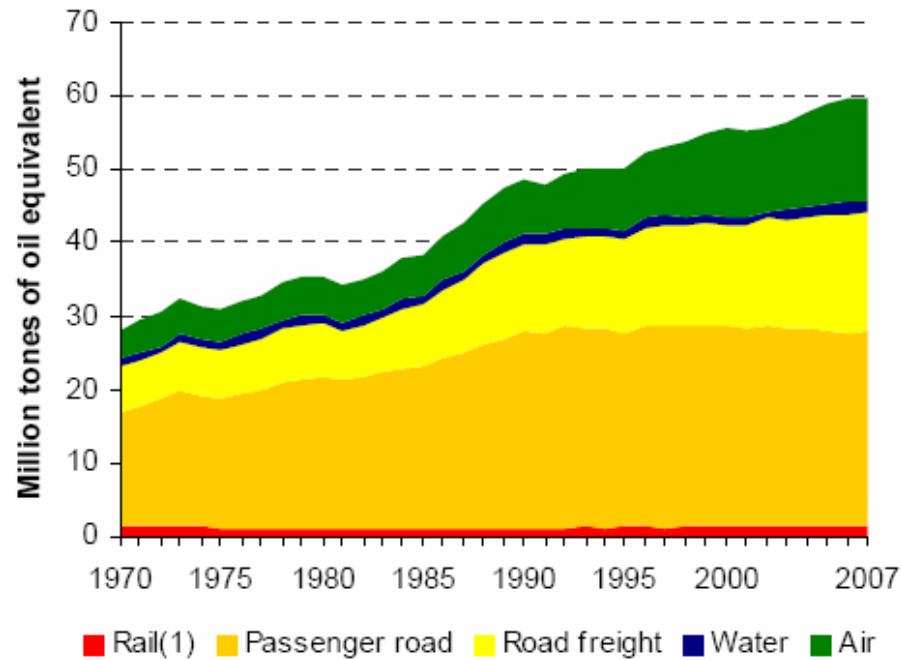
Source: AEA Energy and Environment



Transport trends

(DECC)

Chart E11.8:
Transport energy consumption by type of transport, 1970 to 2007





Sectoral issues - transport

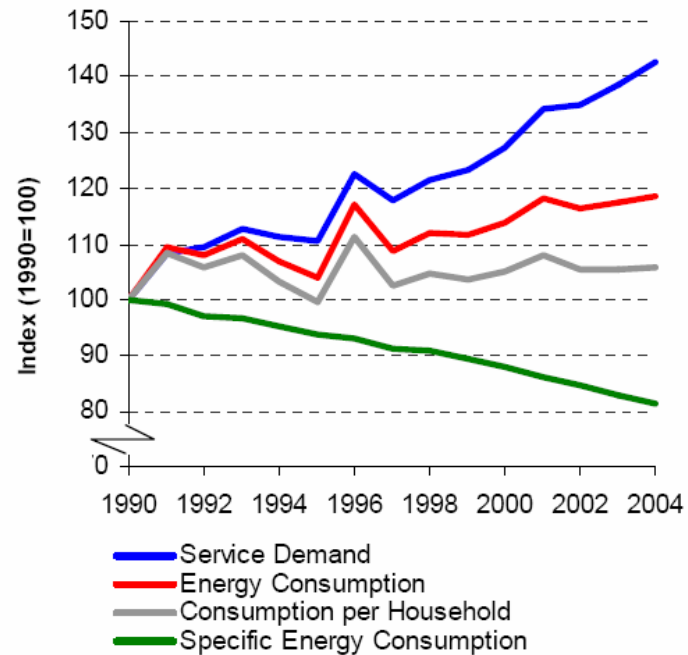
- Main tools are vehicle efficiency and road pricing
- But transport consumption and emissions have steadily increased despite higher vehicle efficiencies
- Road pricing and petrol taxes are politically sensitive
- Major price increases or significant intervention would be needed to change trend until new technology available.
- No sign of political will or technology breakthrough.



Household trends

(DECC)

Chart E11.18:
Specific energy consumption for households



Source: Department of Energy and Climate Change



Households

- Main tool is energy efficiency
- But thermal efficiency of housing has increased steadily and SEC (an overall efficiency measure) has improved by 20% since 1990
- Meanwhile, service demand, energy consumption and consumption per household have all gone up.
- Household formation still expected to increase.
- Projected savings are unprecedented and unlikely



Climate Change Strategy

“Any feasible path to a 80% reduction by 2050 will require the almost total decarbonisation of electricity generation by 2030”

(Climate Change Committee *Building a Low Carbon Economy* 2008)



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The nature of electricity

- System, not aggregate
- Non-storability
- Network effects
- Monopoly elements
- Administered markets etc



Some aspects of liberal market dynamics

- Other things are **not** equal following an intervention
- Risk shift to producers changes behaviour
- Uncertainty (particularly over environmental regulation) - waiting has an option value
- Government and companies appraise investment in a different way



The impact of liberalisation

In a liberalised market, investment appraisal changes from

- levelised cost; to
- risk-weighted NPV; to
- game theory benefit

Investment is about risk - the risk of investing vs the risk of not investing (leads to herd behaviour and cyclicity)



To encourage new investment

Government needs to:

- Reduce risk
- Increase predictability
- Ensure policy consistency
- Affirm commitment to market mechanisms



Interventions vs market dynamics

- Renewables: expensive, implausible and distorting – adds to risk
- Nuclear: in public interest – but up to market to deliver
- Taxes/trading: volatility and uncertainty discourage clean investment
- Targets: create uncertainty over acceptability (eg coal)



The impact of the renewables target: generation investment (£bn) (\$KM)

| Plant type | BAU | Renewables scenario |
|-----------------|-------------|---------------------|
| Coal | 3.9 | 3.9 |
| CCGT | 7.5 | 4.5 |
| Nuclear | 3.5 | 3.9 |
| Subtotal | 14.9 | 12.3 |
| | | |
| Onshore wind | 0.4 | 8.5 |
| Offshore wind | 0.9 | 45.8 |
| Biomass | 0.0 | 4.9 |
| Other | 1.0 | 1.0 |
| Subtotal | 2.3 | 60.2 |
| | | |
| TOTAL | 17.2 | 72.5 |



Total system costs

(SKM)

| Cost category | BAU | Renewables scenario |
|-------------------------------------|-------------|---------------------|
| Generation investment (£bn) | 17.2 | 72.5 |
| Network reinforcement (£bn) | 0.9 | 12.6 |
| | | |
| Marginal cost of generation (£/MWh) | 35.9 | 22.6 |
| Total cost of generation | 46.8 | 52.6 |
| Grid and balancing | 1.8 | 11.3 |
| | | |
| TOTAL (£/Mwh) | 48.6 | 63.9 |
| | | |

| Plant type | 2008 GW | 2008 % generation | 2020 GW | 2020 % generation |
|-------------------|-------------|----------------------|--------------|----------------------|
| | | | | |
| Coal | 29.4 | 34 | 21.9 | 16.8 |
| Gas | 29.4 | 42 | 27.8 | 23.2 |
| Nuclear | 10.6 | 15 | 6.0 | 11.4 |
| Inter-connector | 2.0 | 2 | 3.3 | 6.4 |
| Other | 9.6 | 2 | 6.8 | 1.5 |
| Subtotal | 80.9 | 95 | 65.8 | 59 |
| | | | | |
| Onshore wind | 3.5 | 2.5 | 12.9 | 8.4 |
| Offshore wind | 0.2 | 0.05 | 25.7 | 24.2 |
| Biomass | 0.2 | 0.08 | 2.9 | 7.0 |
| Other | 2.2 | 2.4 | 2.3 | 0.9 |
| Renewables | 6.1 | 5 | 43.8 | 41 |
| | | | | |
| TOTAL | 87.1 | | 109.6 | |



Nuclear risks

- Political (support reluctant and equivocal, Scotland, new government, etc)
- Environmental (carbon price, legal challenge, siting etc)
- Market
- Specific – decommissioning and waste
- Construction/operation
- Timescales



Nuclear prospects

“It is very unlikely that current electricity market arrangements would result in planned investment both in renewables at the levels envisaged.... and in new nuclear before 2020....If it becomes apparent that renewables investment ... is not feasiblethe result would be more investment in gas-fired plant.”

(Climate Change Committee)



Economic instruments and investment

- ETS price signals too volatile, too political, too short-lived to drive investment.
- No way of making a long term cap or price guarantee credible – but generation investment is long term by nature.
- European climate package adds further uncertainties and non-market elements.
- ETS in tension with other targets – eg renewables, energy efficiency.



Can prices drive investment?



“Coal could go ahead....renewables penetration would not be achieved ...nuclear will not go ahead” if it is left to price signals (Climate Change Committee)

CCS needs €90 plus ETS prices will not reach this level except in spikes ... nuclear needs c €40 (Deutsche Bank)

CC Committee estimates c €40 in 2020

Effective renewables support c €130

Price last week: <€12



Why the end of an era?

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Current interventions are not market friendly

- Renewables obligations distort and limit market but do not significantly affect need for other investment
- Nuclear and coal depend on government say so
- CCS will only happen with support
- Energy efficiency, CHP – add to risk without reducing emissions via ETS
- Effect of interventions is to discourage investment, increase uncertainty, decrease security, increase prices, have little environmental impact.





Commitment to liberalisation


Ed Miliband: “Sustainability, security and affordability are all challenges which the market alone cannot be guaranteed to solve”

Harriet Harman: “The energy companies must pass on the price cuts to consumersAnd, if they don't we will change the law to force them to do it.”

Climate Change Act targets probably enforceable; duty on SoS to introduce policies to meet them



Death by a thousand regulations

- 
- Government legally constrained by climate change targets
 - Its main instrument will have to be changes in electricity generation
 - Government is throwing a battery of measures at a complex system without much idea of the result. But it needs one.
 - Liberalisation will end – not with a bang but a whimper, as new measures are added.