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Transitions in the UK Gas System

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Originating the British Gas regime (1795-1812)

- ❑ Coal gas lighting industry developed from 1790s, as offshoot of existing technological tradition
 - Distillation: charcoal, tar, coke, gases obtained from heating wood/ coal in closed ovens with limited oxygen
- ❑ Gaslight inventors used knowledge, techniques, instruments borrowed from ‘pneumatic chemistry’ (Tomory 2012)
- ❑ UK gaslight take-off aided by British scientific knowledge & mechanical skills & fast-growing growing, coal-based economy
- ❑ 1790s experiments: Lebon; Murdoch for Boulton & Watt (B&W)
 - Paris, 1801: Lebon shows *Thermolamp*; B & W respond
 - 1805: B & W install industry-scale plant in Phillips & Lee’s textile mill, replacing 3,000 candles with cheaper gas light
 - B & W built many plants until 1812 (also Clegg & others)

The Market-Led 1st Transition (1812-1880): From distributed standalone model to urban piped network

- ❑ Gas Light & Coke Company (1812), led by German merchant Frederick Winsor (also visited Lebon, 1801)
 - World's 1st public gas supply company, focused on gas sales
 - Built path-breaking, integrated, tightly-coupled network in London, before railways
 - Drew on experience, legal forms & models of existing networks (canals & water supply)
 - Led to networked urban infrastructure by big company, making gas in a few big gasworks, distributed via a network of pipes ('mains')
- ❑ Rapid spread of gas supply networks in Britain
 - London: 1815 - 30 miles of pipes; 1820 - 120 miles
 - By 1819: coal gas networks in large towns & cities
 - 1826: networks in nearly all towns of >10,000 people
 - 1829: 200 companies

The Market-Led 1st Transition (ii)

- ❑ Although market-led transition, government & state enabled environment where inventors, manufacturers & entrepreneurs could flourish (Mokyr 2009)
- ❑ But growing problems/concerns
 - Low quality & reliability of service; disruption of streets & pavements; exercise of local monopoly power; balance of shareholder earnings & consumer prices
- ❑ => Regulation: Gasworks Clauses Acts
 - 1847: dividend control to limit company profits;
 - 1871: obligation to supply all consumers on demand
- ❑ Professionalisation: Gas Institute founded 1881
- ❑ By 1882, 490 private or municipally-owned firms
 - Seeking profits or net revenue

2nd Transition: 1880–1914: broaden services, expand customer base, cut costs & raise quality

- ❑ Creation of new markets & services; a market-led transition
- ❑ Pressures
 - low load factors; poor customer perceptions; monopoly power issues; from 1880, new incandescent electric light
- ❑ Responses
 - Extend & promote services to heating & cooking (exhibitions & demonstrators – ‘lady demons’)
 - Broaden customer base (hire purchase; pre-pay slot meters)
 - Cut costs/raised quality: eventual use of more efficient Welsbach incandescent mantles (4-6 x illumination)
- ❑ By 1914, wider services; growing body of working class users; customers tripled to 7 million

3rd Transition: 1915-1947 – growth, fragmentation & incoherence



- ❑ By late 1930s
 - largest gas industry in Europe (11 million customers) - but precariously competitive
- ❑ Industry fragmented
 - uncoordinated relative to electricity; many small-scale firms
- ❑ By World War II: 800 firms; >1000 gas works
 - 800 private & municipal firms supplying town gas manufactured from coal, from > 1000 gas works
- ❑ 1941: senior industry figure labelled it ‘incoherent’; must
 - Expand or be left with ‘limited & costly supply of gas’
 - With increasingly expensive feedstock (coal)
 - Struggling to compete with electricity in the home & coal, coke & oil in commerce & industry

4th Transition: 1948 -1977 (I) State-led reorganisation, new processes & then **natural gas**



- ❑ 1945: post World War II socialist Labour Party government
- ❑ 1948/9: nationalisation, rationalisation & reorganisation
 - State-owned company, led by **Gas Council**, rationalised & reorganised industry structure, with 8 **Area Boards** & vertical integration
- ❑ Accepted need to respond to growing competition & reduce costs, via development of new markets & processes
 - Promoted central & space heating services (1960s)
 - Experimented with niche technologies, especially
 1. Lurgi complete coal gasification (1960s) – 2 demo. plants
 2. Gas from reforming oil distillates (1960-1970) - expansion
 3. Imported LNG to meet peak urban loads (Louisiana/Algeria, 1957-60); then new British 'backbone' pipeline (1961), to deliver re-gasified LNG to Area Boards)

4th Transition: 1948 -1977 (ii): Natural Gas

- ❑ North Sea Exploration & search for natural gas (mid 1960s & 1970s) & oil
- ❑ Gas Council involved in exploration (mid-1960s); monopsony buyer in UK natural gas regime, 1966
- ❑ Bold move to North Sea natural gas – 1967-77
 - Reorganised industry & actors; developed LNG terminals & built national gas grid from the LNG ‘backbone’ pipeline
 - Gas Act 1972: Reinforced centralisation of the regime & the state-led transition
 - 10-year challenging appliance conversion (higher calorific value of natural gas)
 - » Conversion designed as single operation without intermediate phase or period but with pilot
 - » By 1977: modified appliances of 14 million consumers

4th Transition: branching points in the state-led transition to natural gas, 1948–1977

<i>Choices made at Branching Point</i>	<i>Outcome for the Transition Pathway</i>
Branching Point 1: Perceived need to reduce cost in response to pressures from higher coal costs & competition from electricity, coal & oil	
Promotion of central & space heating (1960s)	Reinforcement of incumbent regime, creation of new markets; increase pressures on production side, esp. for Metropolitan Boards
Introduction of Lurgi process (1960s)	Niche technology for local problems. Internal adaptation, renewal & reconfiguration
Introduction of oil gasification processes (1960-1970)	Re-alignment of the regime/dominant technology in the late 1960s
Early experimental LNG transportation (1957-1960)	Experimental phase important for enrolment of key actors to wider scale use of LNG
LNG pipeline (1961)	Niche technology for local problem & critical infrastructure. Pathway reconfiguration through hybridisation
North Sea Exploration and search for natural gas (mid 1960s and 1970s)	Landscape pressure on the incumbent regime. Technological substitution
Branching Point 2: Perceived opportunity to respond to the discovery of North Sea gas	
Gas Council monopsony in UK nat. gas regime (mid 1960s)	Reinforced the centralisation of the regime & the state-led transition
Conversion designed as single operation without intermediate phase or period (1966)	Conversion to natural gas (1967-1977). Facilitated & provided a fast pace to the 'technological substitution'
Pilot Schemes for local conversion (1967-1977)	Facilitated 'technological substitution': developing expertise & en-rolling new actors; persuading general public to support new regime.
'Guaranteed Warmth' campaign (1969)	Important for the enrolment to the new regime
Commissioning of the Morton Report (1970)	Important for the enrolment of new actors (the general public)
Gas Act 1972	Reinforced centralisation of the regime & the state-led transition

Source: Arapostathis et al. 2013, Foxon et al. 2013, Transition Pathways Project

4th Transition:1948–1977 - state-led response & transition to natural gas – key features

- ❑ At key earlier points, the industry
 - Recognised both challenges & opportunities
 - Resourced & undertook extensive R &D
 - Worked effectively with government
 - Undertook niche experimentation
 - Took & managed risks of natural gas conversion
 - Stranded hundreds of town gas production assets
- ❑ State-led nature of this transition to natural gas enabled
 - Close co-ordination of actors, including government
 - To reorganise industry & achieve transition that govt. & all industry actors agreed to be socially beneficial
 - Successfully imposed change on reluctant consumers, e.g. householders

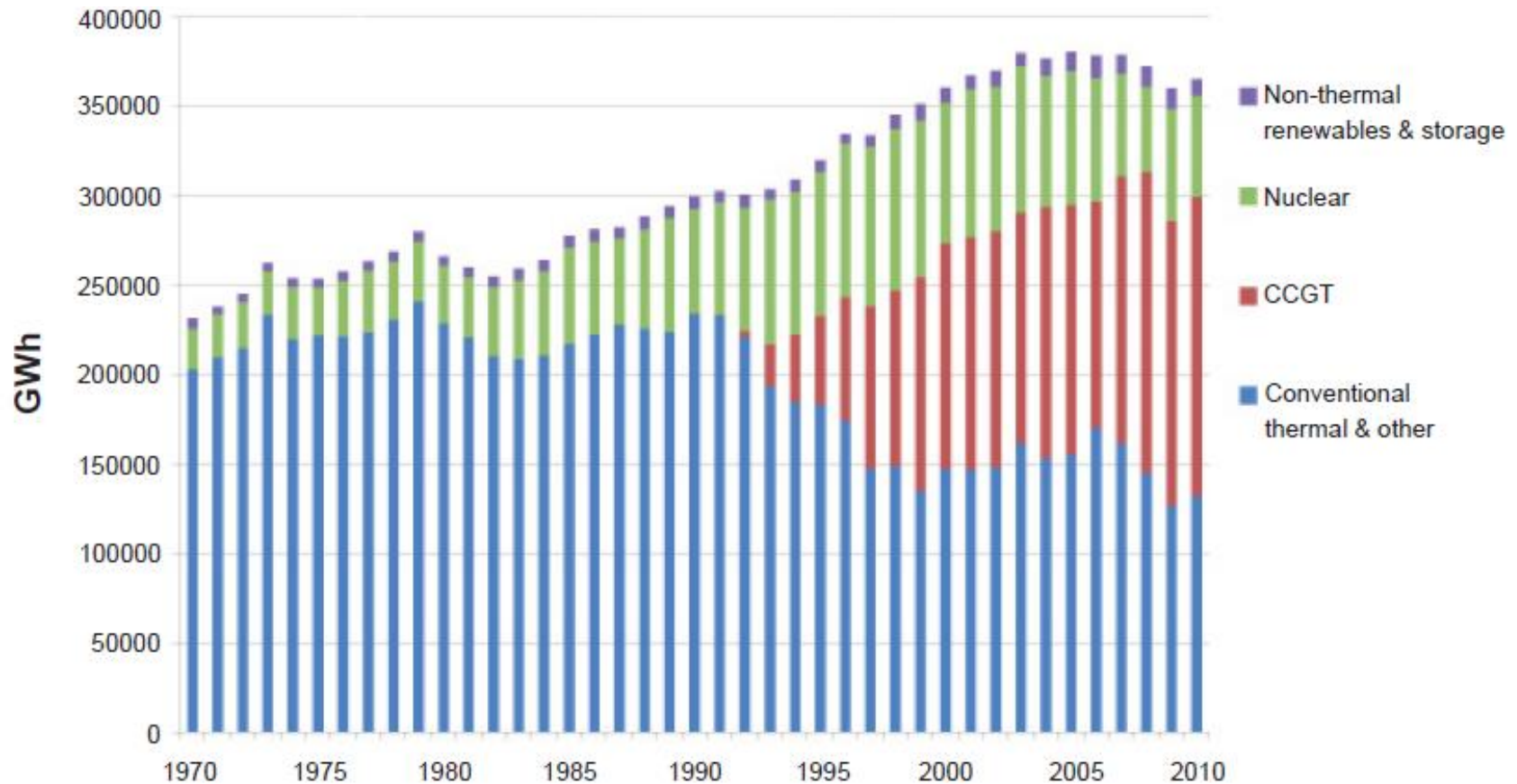
5th transition: 1978 – 2008 – return to the market

- ❑ Landscape pressures: 1970s oil price shocks; liberalisation & free market economics
- ❑ 1979: Thatcher Conservative Party government – privatisation/ liberalisation agenda
- ❑ 1987: Gas - UK's 1st major energy privatisation
 - British Gas sold as vertically integrated *monopoly* in transmission, distribution & supply of gas
 - New regulator appointed; gradual unbundling & competition: British Gas 'demerged' 1997 (Centrica/ Transco)
- ❑ From 1998: interconnectors to Belgium, Netherlands & Norwegian gas fields

UK Electricity Privatisation & Transition 1990 – the ‘Dash for Gas’

- ❑ 1990 : state-owned Central Electricity Generating Board (CEGB) split into duopoly: PowerGen & National Power
- ❑ Regional Electricity Companies (RECs) & others bought into Combined Cycle Gas Turbines (CCGTs)
 - Operated by them & IPPs;
 - & facilitated by regulator seeking more competition
- ❑ By 1995, 15 CCGTs expected to come on stream
 - Displacing 20-25 m tonnes of coal, as RECs & large incumbents made a ‘dash for gas’
 - By 2010 major inroads into coal generation (Figure)
- ❑ Major impacts on UK CO₂, SO₂ & NO_x emissions, trajectories & ability to meet international obligations
- ❑ And on UK international environmental policy stance

UK Electricity Generated & Supplied, 1970-2010



Data source: Digest of United Kingdom Energy Statistics Table 5.1.3: Electricity generated and supplied, 1970 to 2010.
http://www.decc.gov.uk/assets/decc/statistics/source/electricity/dukes5_1_3.xls (Published 28/07/11)

Source Pearson & Watson (2012), Fig. 5

6th Transition: 2008-2050 – gas & low carbon?

- ❑ Landscape pressure: climate change mitigation
- ❑ UK pathways to meet 80% GHG targets suggest need to go from gas as heating fuel to
 - Electric heat pumps, biomass boilers, etc.,
 - Or gas decarbonisation (e.g. biogas injection; injection or conversion to hydrogen).
 - Low-pressure gas mains networks might need decommissioning before 2050
- ❑ But pressure from UK & international shale & other gas interests to enhance gas presence
- ❑ Much depends on moves to renewable heat & success of CCS; and on future government commitment.
- ❑ What future(s) for the UK natural gas industry & network?

Acknowledgement & Some Sources

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