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UK Generation

Undergoing major change

Nigel Hawkins

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Executive summary

UK Generation – undergoing major change

- ▶ For many years, UK electricity demand, at ca.350TWh per year, has been declining, as energy savings initiatives and lower manufacturing use have been curbing consumption levels. In time, this scenario may well reverse if the electric vehicle (EV) market takes off as aggressively as its advocates believe – in which case, a major rise in the sector’s investment will be urgently required.
- ▶ Irrespective of plunging share prices in recent days, the UK’s electricity generation sector is currently undergoing profound change. While, throughout most of the 20th century, “King Coal” reigned, this is no longer the case. By 2025, every UK coal-fired plant is due to have been decommissioned. Instead, gas and nuclear – assuming further new nuclear build after Hinkley Point C takes place – will be key to meeting base-load demand.
- ▶ While Combined Cycle Gas Turbine (CCGT) plants are central in providing base-load power, no new plants, except SSE’s Keadby 2 project, are currently being built. Indeed, only the 910MW Carrington CCGT plant has been commissioned since 2013. To justify their investment on financial grounds, CCGT plants need to operate on a base-load – not a mid-merit – basis.
- ▶ After years of indecision, construction of the ca.£2.2bn Hinkley Point C nuclear plant is finally under way, but it is unlikely to generate much power before 2030. Its guaranteed price of £92.50p (2012 and inflation-proofed) per MWh is way above prevailing power prices. Whether further new nuclear build in the UK takes place is debatable.
- ▶ Heavy investment is expected in the rapidly growing renewable generation sector, which is currently producing around a third of the UK’s total output. The ending of subsidies for most new renewable plants from 2017 has curbed some onshore wind and solar investment, despite far lower operating costs. The government is expected to announce new initiatives to re-incentivise onshore wind and solar investment.
- ▶ Offshore wind is the new “go-to” investment sector. Successive North Sea auctions have seen rapidly falling bid prices; last year’s hard-fought auction produced a price of just £39.65 per MWh to develop part of the Dogger Field.
- ▶ Renewable Energy Infrastructure Funds were analysed in a recent Hardman and Co publication (5 February 2020), *UK Renewable Energy Infrastructure Funds – A 20/20 vision*.

Introduction

Generation cycles

The UK electricity generation sector has operated on a basis of cycles – and especially recently. Throughout much of the 20th century, coal was the dominant fuel, despite its pronounced environmental shortcomings and recurring industrial relations problems.

Oil generation sunk by 1970 price hikes

Following the commissioning of the UK's first nuclear plant at Calder Hall in 1956, nuclear power output became material in the 1960s. Subsequently, oil-fired plant emerged to become a favoured electricity generation resource. However, the quintupling of oil prices in the 1970s moved oil-fired plant to the margins, predominantly as peak-load, back-up plant.

The 1970s also saw prolonged – and very damaging – strikes in the coal mining industry, especially in 1972 and 1974.

Rich potential of offshore wind

In the 1980s, several new nuclear plants were commissioned, but the 1990s will be remembered as the era of the “dash for gas”, which quickly replaced coal as the base-load fuel. Over the last decade, renewables have emerged as a credible – and environmentally-friendly – generation option. Many onshore wind farms have been built, along with some solar capacity. However, developing the rich potential of the North Sea offshore wind sector is the industry's next big challenge.

Electricity supply and demand

Two-thirds of GDP benchmark

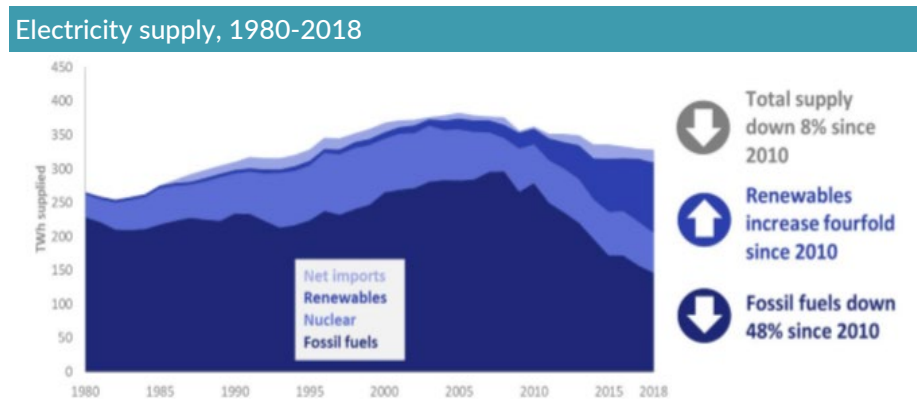
For many decades, annual electricity demand tended to rise at around two-thirds of the level of a year’s economic growth. However, this long-standing “rule of thumb” has proved to be inaccurate over the last 15 years, as lower manufacturing use and widespread energy savings initiatives have dampened electricity demand.

Total UK electricity demand in 2018 was 352TWh, around one-third higher than was the case in 1980, but 8% lower than the 2010 figure. Indeed, the previous year, 2017, saw the lowest level of UK electricity demand since 1996.

Around 95% of the 2018 demand figure was met by UK generation sources, with net imports accounting for just over 5%.

A 38-year time line

The graphic below shows the pronounced changes over the last 38 years, in terms of both fluctuating electricity supply and demand, along with very marked changes in fuel sources.



Source: UK Energy Statistics (DUKES)

Generation sources

The table below provides an illustration of the fundamental changes faced by the UK generation sector, especially from the late 1980s, when coal-fired capacity began increasingly to be supplanted by gas-fired plant. More recently, renewable generation has assumed a far greater role; previously, it was barely on the periphery of UK generation.

The table below provides a historical analysis of fuel source contributions; “others” includes renewable generation and imports.

UK generation sources (%)						
Source	1970	1980	1990	2000	2010	2020E
Conventional thermal	86	86	78	41	48	4
Nuclear	10	12	20	22	15	18
Gas	0	0	0	35	32	39
Others	4	2	2	2	5	39

Source: White paper 2007, Nigel Hawkins Associates

Coal

The 1,000 pits/1m miners' era

The decline of the coal industry is part of the UK's national history. Shortly after World War 1, there were over 1 million miners, working in over 1,000 pits (although not in the same year).

Coal's role for most of the 20th century had been pivotal, as the infamous national coal strikes of 1972, 1974 and 1984 demonstrated. From the early 1990s, though, coal-fired plant was superseded by more efficient gas-fired plant.

2025: all coal plants to close

By 2025, the government expects all UK coal-fired plants to have closed. Unlike in Germany, there are no new UK coal plants, with the appropriate pollution abatement equipment, to enable production in the longer term. Also, deep coal mining now belongs to a past era: the last deep coal mine at Kellingley was closed in 2015.

The decline of the coal industry, and of many of the associated coal-fired plants – most now import their remaining coal needs, although some are still supplied by open-cast mines – has, indeed, been dramatic. It illustrates the sea-change, predominantly environmentally inspired, that has overtaken the UK generation sector.

Gas

The "dash for gas" in the 1990s

Prior to the privatisation of the electricity supply industry in the early 1990s, gas-fired plant capacity was minimal. However, on the back of the technical efficiencies of new CCGT plants, cheap and accessible gas supplies, and a declining and troubled coal industry, the "dash for gas" became a reality.

Many CCGTs were built – neither coal nor nuclear investment of any significance took place between 1995 and 2019 – with the result that gas-fired capacity rapidly became the UK's most important base-load generator.

CCGTs need base-load place in the merit order

However, for the finances of a CCGT plant to earn a decent return, the plants do need to operate on a base-load – and not on a mid-merit – basis. In recent years, as renewable generation has become more available and gas prices less competitive, CCGTs have been relegated in the merit order.

While several new CCGT plants were commissioned between 2010 and 2013, the only major CCGT plant currently under construction is the 840MW plant at Keadby 2, a project led by Scotland's SSE.

Nuclear

Nuclear plants edging towards decommissioning

UK nuclear capacity is gradually declining, as the older Advanced Gas-cooled Reactors (AGRs) are nearing the end of their working lives; all are due to close in the mid-2020s, although, in some cases, further life extensions may be granted. Most were built either in the 1970s or in the 1980s. Only Sizewell B, the UK's first and only Pressurised Water Reactor (PWR), can expect a prolonged life – it was commissioned in 1995.

UK Generation: Undergoing major change

Details of the current UK AGR and PWR nuclear plant portfolio are set out below.

UK AGR and PWR nuclear plants			
Site	Commissioning date	Capacity (MW)	
Hinkley Point B	1976	1,220	
Hunterston B	1976	1,190	
Dungeness	1985	1,110	
Torness	1988	1,250	
Heysham 1	1989	1,150	
Heysham 2	1989	1,250	
Hartlepool	1989	1,210	
Sizewell B	1995	1,188	

Source: Hardman & Co Research

Construction has finally started on a new generation of nuclear plants

After years of debate, construction has finally started on a new generation of nuclear plants – the combined 3,200MW pair of reactors being built at Hinkley Point C, which is being led by France's EdF. These reactors are unlikely to generate power in meaningful quantities until the end of this decade. Other related nuclear projects have been put forward, but there must be real doubt as to whether any further new nuclear build will actually materialise in the UK.

EdF and Centrica are nuclear sellers

Currently, the UK's seven AGRs and the PWR at Sizewell are owned on an 80%/20% basis by EdF and Centrica. Both companies are planning to reduce their stakes, while Centrica is seeking a full exit from the nuclear sector.

Renewables' rising role

Political momentum – and taxpayers' subsidies – have been key factors in driving ahead renewable generation, which, in 2019, met over 26% of the UK's overall electricity demand – biomass output is excluded from this figure. From very modest beginnings outside hydro power, renewable generation has really taken off in the UK over the last five years.

Greencoat UK Wind and TRIG are capitalised at over £2bn each

Indeed, both Greencoat UK Wind and The Renewable Infrastructure Group (TRIG), the two leading quoted renewable energy infrastructure funds, are now worth over £2bn each. In time, the UK's offshore wind capacity is widely expected to soar, given the very aggressive bidding, in both 2017 and 2019, for electricity supply contracts in the North Sea.

While there are various renewable technologies, three are especially important in the UK:

- ▶ First, hydro power has been a key source for SSE – and its predecessors – over many decades in Scotland, although its deployment is minimal south of the border.
- ▶ Secondly, onshore wind has expanded strongly in recent years, at least until 2017, when the subsidy regime for new onshore wind plants was ended.
- ▶ Thirdly, solar power is now beginning to make inroads, especially in the southern half of England, with several infrastructure funds investing in solar farms. Nevertheless, the removal of subsidies in 2017 for new solar plants has, as expected, curbed investment levels.

Drax's vast US wood imports

Other renewable technologies have been less successful, although the Drax Group imports a vast volume of wood from the US for use in its eponymous plant, four of whose six units have been converted to run on biomass products. Marine-based generation initiatives have proved short-lived, despite considerable R&D efforts.

Leading UK quoted generators

While much of the UK electricity generation capacity still lies in foreign ownership, such as Iberdrola’s ScottishPower subsidiary, there are various quoted UK-owned generators, with a market value of at least £700m. Along with their main generation sources, they are listed below.

Leading UK quoted generators		
Company	Main sources	Market cap. (£m)
Centrica	Nuclear	2.5
Drax Group	Coal, biomass	0.7
Greencoat UK Wind	Onshore wind	2.0
SSE	Renewables, gas	13.5
TRIG	Onshore wind, solar	2.0

Source: Hardman & Co Research

Conclusion

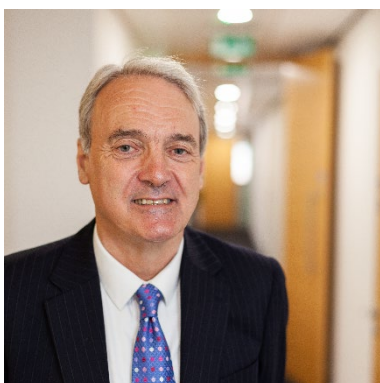
Renewables are sector disruptor

Over the years, and especially recently, UK generation has undergone massive change. Back in the 1960s, the advent of nuclear power and the potential of oil-fired plant, fuelled by cheap imports from the Middle East, were widely seen as the future, but coal's dominance endured until the advance of CCGTs in the 1990s.

The latest sector disruptor is renewable generation, which – on the back of years of R&D and of generous subsidies – is now making real inroads.

The electricity generation future for the UK looks likely to be shared between gas and nuclear for base-load output – assuming that other Hinkley Point C plants are built – with a surge from renewables, predominantly from the rapid development of offshore wind farms in the North Sea.

About the author



Nigel Hawkins is the Utilities sector analyst at Hardman & Co.

Nigel is responsible for analysing the UK Utility companies, including those privatised in the 1980s and 1990s, as well as newer arrivals in the sector. He has been involved in the Utilities sector since the late 1980s, as a feature writer at Utility Week magazine and as an analyst at Libertas Capital. Prior to that, he was the Telecoms analyst at Williams de Broë. Between 1989 and 1995, he worked at Hoare Govett as the Water and Electricity analyst.

Between 1984 and 1987, Nigel was the Political Correspondence Secretary to Lady Thatcher at 10 Downing Street.

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