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Energy Policy: Which Way For The UK?

By Nigel Hawkins

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The ERC has previously published a number of Research Papers on energy, including "The Digest of Energy Statistics" (2008), "New Nuclear Build in the UK" (2008), "The New Economics of Energy Security" (2006) and "Electrifying Britain" (2005).

About The Author

Nigel Hawkins is an investment analyst who specialises primarily in the electricity, gas, water and telecoms sectors. He has worked in the City since 1988, notably for Hoare Govett (now RBS), Yamaichi and Williams de Broe (now Evolution).

He is a regular feature writer for Utility Week and Cleantech magazines and frequently contributes to the financial media. He has written two other research papers for the ERC; "New Nuclear Build in the UK" and "Aqua Brittania!"

Prior to joining the City, he worked for six years in politics, including three years as Political Correspondence Secretary to Lady Thatcher at 10 Downing Street. In 1987, he stood in the general election as Conservative Party candidate in Sedgefield against Tony Blair.

He was awarded a degree in law, economics and politics from the University of Buckingham and subsequently qualified as an Associate of the Institute of Chartered Secretaries and Administrators (ACIS), whilst working as Export Sales Manager at Marlow Ropes, Hailsham, East Sussex.

About This Paper

The lack of a serious energy policy in the UK is leading to the possibility that the country could be left short of a reliable electricity supply in the next five to ten years. This really is something that must be addressed, and quickly, or we will face potentially disastrous consequences that will have an impact on the whole economy.

We are very pleased that Nigel Hawkins, author of previous ERC Research Papers "New Nuclear Build in the UK" and "Aqua Britannia!", has revisited the question of the imminent dangers facing the UK energy supply in this latest paper.

Damon de Laszlo
ERC Chairman

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Summary

- Having wasted over a decade in addressing the UK's energy supply gap – much of which was predictable as North Sea gas reserves ran down – the Government is now faced with devising a strategy to prevent serious risks to electricity supplies from *c*2015 onwards.

- Despite the plethora of White Papers – including that published in July 2011 - and Consultation Documents in recent years, the fate of future UK electricity provision lies principally with the six integrated energy companies – EdF, E.On, RWE, Iberdrola, Centrica, and SSE (formerly Scottish and Southern Energy). Importantly, the four international companies have both high net debt as well as formidable investment programmes outside the UK.

- To reduce the security of supply risk substantially, the UK has just one priority – to build new base-load generation plant, whether gas-fired, coal-fired or nuclear. With very few exceptions, renewables generation - to which successive Governments have accorded an undeserved priority and massive funds - cannot generate base-load electricity.

- Over the last two decades, new gas-fired plant has eclipsed all other forms of electricity generation in the UK. Despite a low technology risk, CCGTs are very exposed to the gas supply risk, pipeline interruptions and to rising prices, especially if a gas equivalent to OPEC emerges: future EU gas supplies will be very dependent on Russia, Iran, the Middle East and North Africa.

- Investment in new coal-fired plant is being held back by the insistence that some form of Carbon Capture and Storage (CCS) should be incorporated, despite the fact that current technology is many years from developing a commercially-sized plant. E.On's exit from its planned Kingsnorth project underlines the uncertainty.

- Despite the Fukushima disaster in Japan, the UK's need for new nuclear-build is imperative – and not just as a hedge against higher gas prices and scarcer gas resources. The Government should act positively by introducing a range of financial incentives, particularly a low carbon obligation, to persuade the most likely investors, EdF and the German Horizon consortium (with or without RWE), to build new nuclear plant: EdF's preferred sites are Hinkley Point and Sizewell.

- There is a need to get real with renewables. The reality is that only wind-power – an intermittent power source – has made a significant contribution to UK electricity output over the last decade. It is self-delusion to expect that renewables generation, which is very challenging to finance and beholden to public subsidies, can fill the ever-widening UK base generation gap.

Background

Historically, the UK has relied upon coal-fired plant to meet its electricity demands: its pre-dominance lasted until the early 1990s. However, prior to that date, it had faced challenges from other fuel sources, notably from oil in the 1960s onwards until oil prices soared in the mid-1970s.

Importantly, too, the first generation Magnox plants made an impact initially in the 1960s; furthermore, the building of second generation Advanced Gas-Cooled Reactor (AGR) plants brought about a rapid expansion of nuclear power in the UK.

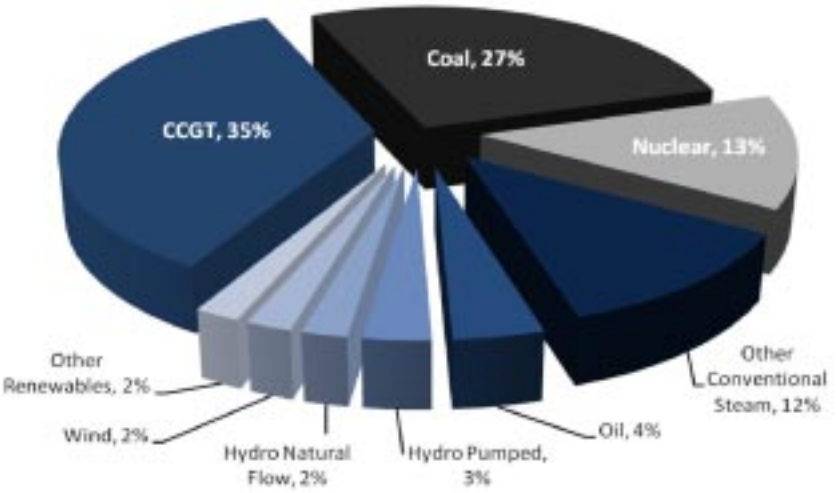
However, in the wake of the privatisation of the electricity supply industry in the early 1990s, most major investment in new generation plant was gas-fired: it was epitomised by the 'dash for gas' trend in the 1990s.

As a result, there has been a pronounced switch in fuel sources as illustrated by the following table.

UK Generation Sources (%)						
Source	*1970*	*1980*	*1990*	*2000*	*2006*	*2009*
Conventional Thermal	86	86	78	41	38	28
Nuclear	10	12	20	22	19	18
CCGT (Gas)	0	0	0	35	36	44
Others	4	2	2	2	7	10
Source: Annex to White Paper 2007 (as amended)						

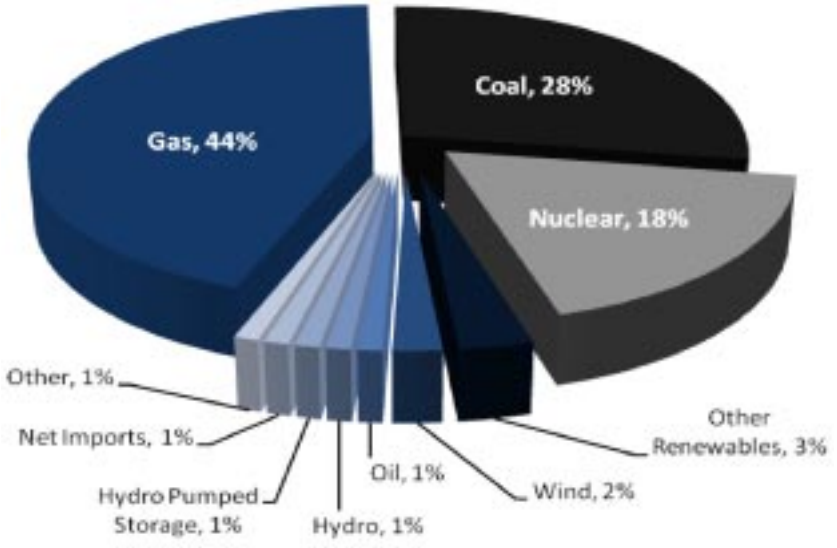
The two pie charts below show the UK's generation capacity by fuel source as at 2009 and how the 379 TWh of output in that year was generated by each source.

Electricity Generating Capacity in the UK by Fuel Source



Source: DECC, Digest of UK Energy Statistics 2010

UK Electricity Supply in 2009 (Total 379 TWh)



Source: Digest of Economic Statistics 2010

As the electricity supply pie chart above demonstrates, 90% of the 379 TWh output in 2009 was accounted for by gas, coal and nuclear sources – the key base-load generation fuels: furthermore, almost half this 90% figure was gas-fuelled output. By contrast, the wind contribution - at just 2% - was marginal.

Future Generation

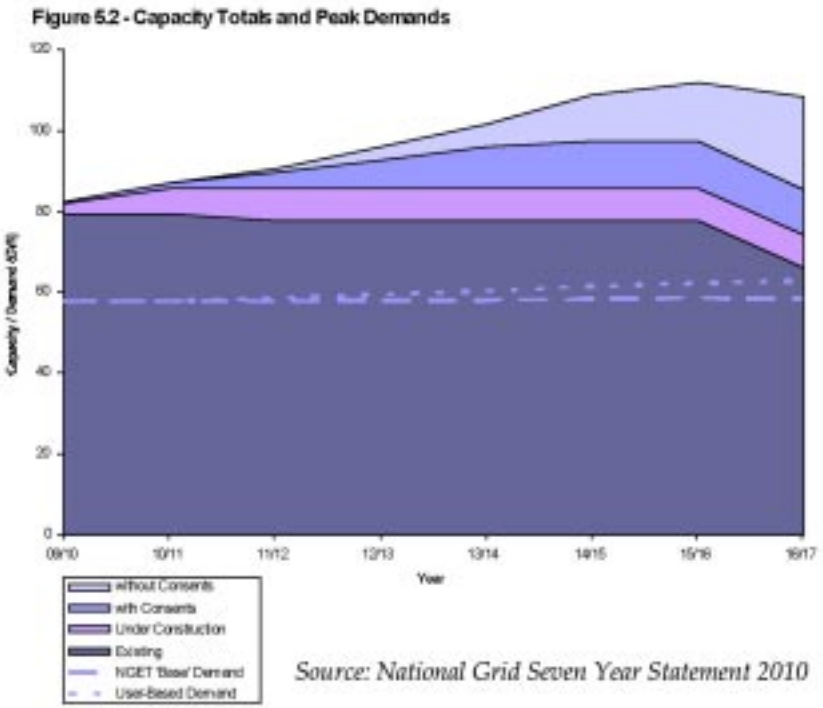
Looking forward, a mixed energy policy is the optimum solution – a scenario with which virtually every energy expert would agree, even if there are polarised views as to whether it should include new nuclear-build.

National Grid's central case projection is for peak electricity demand to remain relatively stable at *c*60 GW, or perhaps rising slightly. Currently, the UK's generation capacity stands at *c*85 GW.

From this latter figure, deductions are needed to reflect the planned closure, under the Large Combustion Plant Directive (LPCD), of *c*12 GW of coal and oil-fired capacity by 2016. Furthermore, *c*7 GW of nuclear capacity is expected to be shut down by 2020.

Offsetting these expected closures are 7 GW of capacity that is currently being built and a further 10 GW of capacity that has secured planning approval but is still to be built – over 8 GW of this latter figure is gas-fired.

This plant scenario is illustrated by the graph below taken from National Grid's recent Seven Year Statement.



Hence, these figures roughly balance out with peak demand remaining broadly unchanged. However, a differing level of usage requiring a higher plant safety margin, some premature plant closures and delays in building new capacity would mean that National Grid might well face serious problems in meeting peak demand, especially if it exceeded current forecasts.

In the future, there should be increased scope for imports, especially through the French Interconnector which consists of four pairs of cables between Sellindge in Kent and Calais. Nonetheless, its capacity is limited and high UK electricity demand – during a prolonged period of cold weather for example – may well coincide with increased demand in France

and elsewhere in Western Europe. Importantly, Germany and France account for around two-thirds of Western Europe's generated output.

With regard to the ongoing debate about the cheapness of individual power sources, it is argued that the key criterion for any country is to have a diversified energy base, unless there are compelling reasons – such as very cheap indigenous fuel supplies - for not doing so.

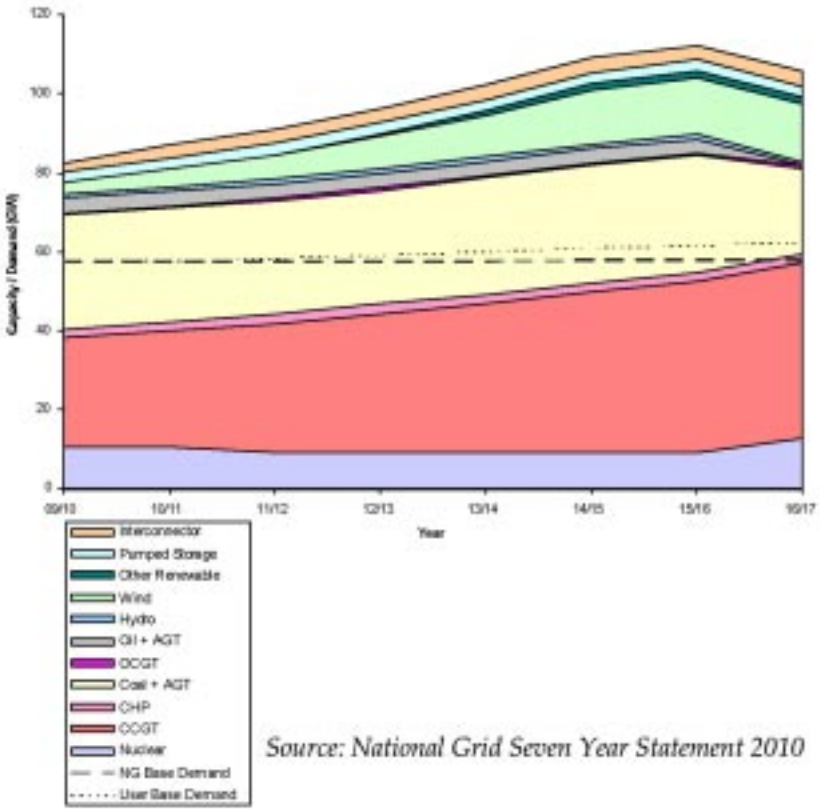
In any event, assessing the true cost of electricity generation from a particular fuel is highly dependent upon individual assumptions. In terms of new nuclear-build, for example, a 60-year life assumption and a weighted average cost of capital (WACC) of 5% would produce a very low cost per MWh. By contrast, a 40-year life assumption and a WACC of 10% would give rise to a very high cost per MWh.

Crucially, if few decisions are made and insufficient investment is forthcoming, it seems very probable that the UK will be over-dependent upon gas for base-load generation, with *c*70% of the UK's electricity demand being met by gas-fired plant.

Such a scenario entails very substantial risk for the UK. Dwindling North Sea gas resources and the uncertainty attached to sharply higher imported levels of gas have greatly raised the energy risk level – a feature that this Paper addresses.

This future over-dependence on gas is demonstrated by the graph below which was published in National Grid's 2010 Seven Year Statement. CCGT capacity is shown in red, whilst the nuclear and coal capacities are represented in lilac and cream respectively.

Figure 3.2 - Installed Capacity and Peak Demand



Source: National Grid Seven Year Statement 2010

It also needs to be recognised that the UK electricity industry is almost totally owned by the private sector or – in EdF's case – by the French Government: RWE, too, has large municipal shareholders. It follows, therefore, that it is predominantly privately-owned companies that hold the key to the UK's future energy supplies.

The Six Integrated Energy Companies

In recent years, most investment in large generating plants in the UK has been undertaken by the six integrated energy companies, which – along with their current market capitalisations – are listed below. Significantly, the share prices of the major EU utilities have been very weak in recent months, with RWE being particularly seriously impacted by the German Government's announcement that it will close down all its nuclear plants by 2022.

- ***EdF***, the world's leading electricity generator due to its ownership of 58 French nuclear power stations. **Market capitalisation:** *£28.8bn*.

- ***E.On***, Germany's top energy company, which has expanded aggressively in Northern Europe. **Market capitalisation:** *£28.3bn*.

- ***Iberdrola***, the Spanish-based energy utility which specialises in renewable generation and owns ScottishPower. **Market capitalisation:** *£23.0bn*.

- ***Centrica***, the UK's leading domestic gas supplier which is also expanding in the UK electricity sector. **Market capitalisation:** *£14.8bn*.

- ***RWE***, the major electricity competitor to E.On in Germany, but also with a strong focus on the European gas sector. **Market capitalisation:** *£12.6bn*.

- ***SSE*** *(formerly Scottish and Southern Energy)*, privatised in 1991, owns a wide range of generation capacity, especially renewables plant. **Market capitalisation:** *£11.7bn*.

It may be that the Government's recent announcement of a National Infrastructure Plan, which is designed to attract large inflows of money from pension funds, may also play a material role in funding investment in new electricity generation projects.

Whilst it is not significantly involved in electricity generation, National Grid's role as the UK's monopoly transmission business is crucial in transporting electricity from new generation plant. Currently, it invests over £3 billion per year, some of which is in the US; this figure is planned to rise sharply in coming years, especially as more renewable generation plants are built. Nonetheless, with net debt of £20 billion, National Grid does have financial constraints in expanding its business.

In total, Ofgem has calculated an energy investment requirement of *c*£200 billion over the next decade as the UK seeks to meet its carbon reduction commitments as well as replacing obsolete plants. If some of the 'green' initiatives in Ofgem's projections were scaled back, the investment bill would be markedly lower.

Risks

For many years, the key decisions on UK energy policy have been ducked – especially the issue of new nuclear-build. Time is now catching up as the generation safety margin remains historically low. As more renewable generation – at very considerable expense - comes on-stream, this margin will need to rise significantly given the former's pronounced intermittency.

Whilst the latest White Paper included several clear-cut proposals, many uncertainties remain. If they persist, the energy supply risks to which the UK is exposed, especially regular and lengthy power cuts, will become increasingly serious. The main risks to the UK's energy model are set out below.

- *Gas imports are interrupted, thereby preventing CCGTs from operating;*
- *Gas purchasing prices soar;*
- *Coal purchasing prices rise sharply;*
- *Technical problems arise at existing nuclear plants, causing extended outages;*
- *New nuclear-build efforts fail given the immensely difficult challenges, especially in terms of raising the requisite funds, notwithstanding planning and construction issues;*
- *Renewables expansion fails to take off;*
- *Raising sufficient investor funds for renewable generation projects proves to be impossible;*

- *Technical shortcomings preventing off-shore wind power becoming commercially viable.*

If these risks materialise to any substantial degree, the likelihood is that the UK will face:

- *Far higher electricity prices, for both the wholesale and retail sectors;*

- *Regular and widespread power cuts.*

Power Cuts

In terms of power cuts, it should be remembered that the 2011 scenario is very different from the early 1970s when they were a regular feature, notably in 1973/74 when a three-day week was imposed by the Government as it sought to reduce the use of electricity.

And, despite the year-long miners' strike of 1983/84, no widespread power cuts took place during 12 months of bitter attrition between British Coal and the National Union of Mineworkers (NUM).

Given the sharp rise in electricity consumption in recent decades, it is clear that the impact of any sustained period of power cuts would have a more devastating impact on the UK economy compared with the early 1970s, despite the subsequent decline of manufacturing industry.

Whilst back-up generation equipment can mitigate short-term power cuts – at a considerable cost – the reality is that extensive power cuts would cause serious dislocation, especially with regard to:

- *Commercial IT systems, on which the UK is now highly dependent;*
- *Home computer services;*
- *Transport networks, especially aviation and railways;*
- *Manufacturing industry;*

- *Domestic 'white goods' use – UK households now have far more appliances than in the early 1970s;*

- *Hospital operations;*

- *Credit card and other banking services;*

- *TV broadcasting and telephone systems.*

Recent experiences in other countries underline the necessity of ensuring that there is sufficient generation capacity in place. India, in particular, is notorious for being affected by both power cuts and very regular 'brown-outs' where voltage levels are reduced – its strong economic growth over the last decade has worsened the problem.

The South African situation is particularly relevant in that many mines have faced short-time working over the last three years because of power shortages, due mainly to inadequate investment in new power capacity.

The White Paper

Yet another Energy White Paper was published last July, as the Government's increasing nervousness about the prospects for new nuclear-build becomes more apparent. This latest White Paper addressed the issue of incentives for investment in generation and especially for new nuclear plants. The three key financial mechanisms proposed are:

- *'Rigging' the Carbon Price;*
- *Granting Capacity Payments;*
- *Paying Feed-in-Tariffs.*

In terms of the carbon price - currently at very low levels - it is difficult to devise a scheme which could endure for decades. After all, the EU-backed carbon trading market is very volatile. However, the Government has proposed a system which encourages potential investors in low carbon generation by effectively offering to guarantee the carbon price - the mechanism will be very complex.

Capacity payments - whereby plants receive a fixed payment whether they generate or not - have their attractions. However, this mechanism is most suitable for peak-load plants that are seldom called up to generate – and only do so when there is excess demand or outages elsewhere. The White Paper has proposed new contractual arrangements in respect of peak-load plants.

The White Paper also endorsed the introduction of Feed-in-Tariffs (FITs), which would provide a guaranteed per MWh base for future revenues, thereby substantially reducing the top-line financial risk. Such a scheme could work alongside the existing Renewables Obligation, until the latter was replaced in 2017.

In fact, FITs have been widely used in Europe, notably in Spain and Germany, where they have driven investment in renewable generation. But the cost has been heavy; so heavy in fact that the Spanish Government has sharply cut back such subsidies.

The Government is planning to introduce primary legislation to enact its energy market reforms, with a view to Royal Assent being given in the first half of 2013.

Gas-Fired Generation

Investment in gas-fired generation capacity took off when the electricity supply industry was privatised in the early 1990s. With older coal-fired and Magnox plants being closed down, the UK's gas-fired generation capacity is crucial – and likely to be even more so over the next decade. However, gas-fired plant is exposed to both interruptions to the gas feedstock, most of which is now imported, and to any major upward movement in prices.

Facts:

- *With the exception of the Sizewell B Pressurised Water Reactor (PWR) nuclear plant commissioned in 1995 (but designed in the 1980s), every major UK power station built since 1990 has been gas-fired.*

- *Gas-fired plants are ideal for base-load use and the Combined Cycle Gas Turbine (CCGT) model is technologically proven.*

- *Up to 70% of the operating costs of a CCGT are accounted for by fuel.*

- *If no large coal-fired or nuclear plants are commissioned within the next decade, virtually all of the UK's major generation plants will be gas-fired – with all the attendant risks of rising gas input prices and supply interruptions to imported gas.*

Coal-Fired Generation

Historically, the UK was dependent upon coal-fired plant using locally-mined coal. However, the UK underground mining industry is now a shadow of its importance in the 1920s when there were over 1,000 pits. Nowadays, there are only a handful of underground mines in operation with most coal-fired plant using imported coal – a trend that seems set to continue. However, much tighter environmental constraints mean that coal-fired plants, such as Drax, are set to be less competitive.

Facts:

- *The last sizeable coal-fired investments in the UK were the third and fourth units at Drax which were commissioned in the 1980s.*

- *Despite heavy Research and Development expenditure over many years, commercially viable clean coal-fired plants using Carbon Capture and Storage (CCS) technology are still many years away.*

- *Within the EU, the most advanced CCS plant in operation is the 30 MW Schwarze Pumpe demonstration unit in Germany, which was opened in 2008.*

New Nuclear-Build

The UK nuclear industry began with the opening of the Calder Hall plant in 1956. Subsequently, the first generation nuclear reactors were replaced by the Advanced Gas-cooled Reactor (AGR) which was UK-designed. Furthermore, in 1987, work began on building the UK's first Pressurised Water Reactor (PWR) at Sizewell.

Although the latter was commissioned in 1995, no further nuclear plants have been built in the UK, partly due to the Chernobyl disaster in 1986 but also due to the privatisation of the electricity supply industry, which provided minimal financial incentive for long-term nuclear power investment.

Nevertheless, despite the European and UK hiatus in developing nuclear power, substantial research has been undertaken in the nuclear industry. It is generally recognised that the two leading third-generation models are the European Pressurised Reactor (EPR) developed by Areva, and the Westinghouse AP-1000: the latter company is now Japanese-owned and is currently building four AP-1000 reactors in China. In the long term, thorium-fuelled nuclear reactors may become technically feasible.

However, the disaster at Japan's Fukushima nuclear plant, following a massive *tsunami,* has re-ignited the debate about the safety of nuclear power. Radioactivity levels from the Fukushima plant are estimated to be equivalent to *c*20% of those released by the Chernobyl disaster in 1986.

There is little doubt, too, that this accident has been a key factor for Germany's abrupt U-turn to close down all its nuclear plants by 2022, which is bound to have major repercussions for the EU nuclear industry. Indeed, the future of nuclear power is likely to feature prominently in next year's French Presidential Election.

More specifically in France, EdF has reported that its Flamanville new-build project – a first-of-a-kind (FOAK) plant – will not be completed until 2016, compared with the original 2012 date: furthermore, the cost has risen from almost £3 billion to over £5 billion.

Importantly, the cost of new nuclear-build continues to increase partly due to higher specialised steel prices but also due to the proliferation of additional safety and regulatory requirements. This trend has seen projected unit generation costs from new nuclear plants rise sharply.

Facts:

- *With the exception of Sizewell B, every UK nuclear plant is due to be closed – subject to no further plant extensions being granted – by 2023.*

- *New nuclear-build offers additional base-load capacity, which will be desperately needed by the UK within the next decade.*

- *To invest in new nuclear-build, major international companies require a range of financial incentives in order to justify their investment to shareholders. Without them, there is no obvious reason to proceed, especially since any financial returns will not materialise for a decade or so.*

- *Although recent cost over-runs at the Olkiluoto plant in Finland and at Flamanville in France are clearly excessive, time and financial over-runs are to be expected when FOAK nuclear power plants are built.*

- *The most likely investors in UK new nuclear-build - France's EdF and the German E.On/RWE Horizon consortium – all have high net debt and are cutting their investment programmes; moreover, RWE's long-term commitment to the UK electricity industry is far from being assured. Significantly, each has a lengthy list of potential generation projects, many of which will be discarded.*

Renewables

Despite the building of large-scale hydro plants, especially in Scotland in the first half of the 20th century, UK renewables generation only really began to take off in the 1990s. There are seven widely recognised technologies – wind (on-shore and off-shore), marine (wave and tidal), biomass, small-scale hydro, geothermal, solar and fuel cells.

Facts:

- *Total UK renewable energy subsidies, whose costs are passed through to consumers, currently exceed £7 billion per year.*

- *Virtually no renewable power source can offer base-load electricity. Given the various fossil-fuel plant and nuclear plant closures within the next few years, new base-load capacity is the UK's paramount electricity requirement.*

- *Despite all the publicity surrounding renewable generation sources – of which there are the seven quoted above – the reality is that, excepting the aged hydro-plants in Scotland, only on-shore wind generation plants have made a meaningful contribution to supplying the UK's electricity requirements.*

- *On-shore wind plants, especially in England, have performed quite poorly; many operate at less than 30% of nameplate capacity.*

- *Irrespective of all the efforts to promote renewable energy through the offering of substantial subsidies to investors, most of the renewables investment in the UK is undertaken by the six integrated energy companies shown above – despite the recent National Infrastructure Plan initiative, this scenario is unlikely to change.*

Conclusion

To address the widening generation gap, the Government needs to take firm decisions which are sufficiently attractive to persuade the six integrated energy companies to invest in new UK plant. Given their high debts and, in some cases, their heavy financial commitments elsewhere in Europe, there is no guarantee that this much-needed investment, which is expected to cost *c*£200 billion over the next decade, will be forthcoming.

Without this crucial investment, the UK will be running very major risks of regular - and prolonged - power cuts. Whilst the experience of power cuts in the early 1970s gave rise to massive inconvenience and reduced industrial output, especially during the three-day week, the impact of widespread extended power shortages these days would be immeasureably more serious.

After years of energy talk, action is now the priority.

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Economic Research Council
55 Tufton Street, London, SW1P 3QL
0207 340 6016

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