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The Hinkley Point decision: An analysis of the policy process

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HIGHLIGHTS

- Britain's nuclear power policy is failing due to high costs and problems of finance.
- This has implications for European countries who want to use the same financing model.
- The continued pursuit of a failing policy is due to poor advice from civil servants.
- Lack of expertise in the media and lack of public engagement have contributed.
- Parliamentary processes have not provided proper critical scrutiny.

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ABSTRACT

In 2006, the British government launched a policy to build nuclear power reactors based on a claim that the power produced would be competitive with fossil fuel and would require no public subsidy. A decade later, it is not clear how many, if any, orders will be placed and the claims on costs and subsidies have proved false. Despite this failure to deliver, the policy is still being pursued with undiminished determination. The finance model that is now proposed is seen as a model other European countries can follow so the success or otherwise of the British nuclear programme will have implications outside the UK. This paper contends that the checks and balances that should weed out misguided policies, have failed. It argues that the most serious failure is with the civil service and its inability to provide politicians with high quality advice – truth to power. It concludes that the failure is likely to be due to the unwillingness of politicians to listen to opinions that conflict with their beliefs. Other weaknesses include the lack of energy expertise in the media, the unwillingness of the public to engage in the policy process and the impotence of Parliamentary Committees.

1. Introduction

The UK plan to build two reactors at the Hinkley Point C site is of crucial importance for the nuclear industry. If the order is placed, this will be significant evidence that the Nuclear Renaissance the nuclear industry predicted more than 15 years ago has not failed.

In November 2005, Prime Minister Blair announced a review of energy policy with an objective to determine whether Britain 'would take enabling steps to facilitate the construction of a major programme of new nuclear power plants in Britain'.[1] The Green consultation paper, published in July 2006 concluded: 'new nuclear power stations would make a significant contribution to meeting our energy policy goals'.[2]

However, by 2016, most of the premises on which the policy was based, particularly a promise that there would be no public subsidies, had been abandoned. Yet the policy was still pursued by the government with undiminished enthusiasm. This paper examines the policy process and attempts to identify why a policy, which has proved impossible to implement in its original form, has not been at least subject to a comprehensive review. It looks in particular at the checks and balances' that would be expected to prevent failing or misconceived policies from being pursued. The institutions examined are: party politics; Parliamentary scrutiny; the civil service; the public and the media; and a pro-nuclear lobby.

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[1] http://webarchive.nationalarchives.gov.uk/20060715135117/http://number10.gov.uk/page8606 (Accessed July 27, 2015).

[2] Department of Trade & Industry, 2006. The Energy Challenge, Cm 6887, DTI, London. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/272376/6887.pdf.

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I look at:

- The context of the 2006 decision.
- The attempt to implement the policies over the following decade, identifying in particular where and why the policy was changed.
- The status of the project including remaining uncertainties in 2016 and the more general lessons for nuclear ordering.
- The roles of the parties identified above in the policy and why they appear to have had little impact on it.

I identify issues raised that might explain the history presented but which are beyond the scope of the analysis presented and appear worthy of further investigation. Conclusions are drawn on how the policy process could be strengthened to avoid costly pursuits of misconceived or unachievable goals.

1.1. The context to the 2005 decision and the position in 2016

The economic experience with nuclear power in the UK has been poor with high costs falling on the public. The key element that made the policy politically acceptable was a promise that no public subsidies would be offered. The Green Paper stated: 'Any new nuclear power station would be proposed, developed, constructed and operated by the private sector who would also meet decommissioning and their full share of long-term waste management costs'.[3] The implication was that new nuclear power plants would compete on equal terms in the market with other forms of generation.[4] In October 2013, the government and the state-controlled utility, Electricité de France (EDF), announced agreement in principle to the terms for purchase of power from the proposed Hinkley Point C nuclear power plant.[5] These terms were revised in October 2015 but either party could walk away with no penalty. By mid-2016, a final investment decision for Hinkley Point C had not been taken. There was opposition to the agreement even from those strongly in favour of nuclear power and increasing practical hurdles to be cleared before the project can proceed. Table 1 shows that to get this far has required the government to go back on many of the promises on which the policy was sold to the public, particularly the promise of no subsidies.

2. The 2006 decision

UK government reviews of energy policy are infrequent, typically taking place no more than once a decade (see Table 2 for a timeline of UK nuclear policy decision since 2000). So the announcement of a review in November 2005 two years after publication of the previous policy White Paper[6] was surprising. What made the announcement more remarkable was the focus on reviving nuclear ordering when only two years previously, the nuclear option had been rejected. The 2003 White Paper stated:

> 'Although nuclear power produces no carbon dioxide, its current economics make new nuclear build an unattractive option and there are important issues of nuclear waste to be resolved. Against this background, we conclude it is right to concentrate our efforts on energy efficiency and renewables'. 'However we do not rule out the possibility that at some point in the future new nuclear build might be necessary if we are to meet our carbon targets'.

One unusual feature of the review that led to the 2003 White Paper, was that it was not carried out by the energy ministry, the Department of Trade & Industry, but by a division of the Prime Minister's Cabinet Office, the Performance & Innovation Unit (PIU). The PIU was set up in 1998 and portrayed in the press as a tool to increase Blair's control over government departments.[7] However, the PIU brought in a wide range of independent experts to contribute to the review and might have been more independent as a result.

The proviso in the 2003 White Paper that the nuclear power option should remain open was reported as down to Tony Blair. In 2001, he had been reported as ordering the government to keep the nuclear option open.[8] However, the spectacular financial collapse in 2001 and 2002 of British Nuclear Fuels Limited (BNFL), the state-owned fuel cycle company, and British Energy, the privatised nuclear generation company, meant that any attempt to launch a nuclear power construction programme would have been politically difficult. By 2001, it was clear that BNFL could not meet the clean-up cost for the facilities it owned, then estimated at about £34bn.[9] The government chose to break-up and sell off its component parts placing all the liabilities in a new government organisation, the Nuclear Decommissioning Authority (NDA). British Energy had been privatised in 1996 and in 2002, it went effectively bankrupt.[10] The British government chose to rescue the company at a cost to taxpayers estimated by the government of in excess of £10bn.[11] Both rescues required European Union state-aid cases and it was not until 2005 that the rescue of British Energy was approved, and the NDA launched.[12]

In May 2006, two months before the results of the review were published in a Green Paper, Blair pre-empted the findings. In a speech to the Confederation of British Industry he said: 'These facts put the replacement of nuclear power stations, a big push on renewables and a step-change on energy efficiency, engaging both business and consumers, back on the agenda with a vengeance'.[13] This conclusion was particularly surprising given that the expected costs of nuclear power had gone up since 2003 and there was no evidence that the cost of energy efficiency and renewables had risen.

One explanation is that Tony Blair favoured a nuclear programme long before the 2005 announcement and had waited until the fall-out from the failure of BNFL and British Energy had cleared

[3] Department of Trade & Industry, 2006. The Energy Challenge, Cm 6887, DTI, London. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/272376/6887.pdf.

[4] Blair's Energy Minister, Malcolm Wicks, was more explicit when questioned by the Commons Energy Select Committee. In response to the question: 'Is that the Government's position? No direct subsidies and no indirect subsidies', he stated: 'No checks will be written, there will be no sweetheart deals'. http://www.publications.parliament.uk/pa/cm200506/cmselect/cmtrdind/1123/6101005.htm Q 483 and Q 488. (Accessed April 17, 2016).

[5] https://www.gov.uk/government/news/initial-agreement-reached-on-new-nuclear-power-station-at-hinkley (Accessed July 27, 2015).

[6] Department of Trade & Industry, 2003. Our energy future: creating a low carbon economy, Cm 5761, DTI, London. http://webarchive.nationalarchives.gov.uk/+/http:/www.berr.gov.uk/files/file10719.pdf (Accessed July 27, 2015).

[7] The Independent. Parliament & Politics: Blair sets up new Whitehall machine, July 29, 1998.

[8] The Independent. Blair wants UK to keep nuclear power, December 16, 2001. http://www.independent.co.uk/environment/blair-wants-uk-to-keep-nuclear-power-9198699.html (Accessed July 27, 2015).

[9] The Telegraph. BNFL on the brink of bankruptcy, October 21, 2001.

[10] On September 5, 2002, British Energy shares were suspended after the company warned the government it could face insolvency if it did not receive immediate financial assistance. Financial Times 'British Energy issues insolvency alert' September 6, 2002.

[11] http://eur-lex.europa.eu/legal-content/EN/ALL/? uri=OJ: L:2005:142: TOC (Accessed July 27, 2015).

[12] http://eur-lex.europa.eu/legal-content/EN/ALL/? uri=OJ: L:2006:268: TOC (Accessed July 27, 2015).

[13] http://webarchive.nationalarchives.gov.uk/20040105034004/http://number10.gov.uk/page9470 (Accessed July 27, 2015).

Table 1
The British nuclear power programme: promises and reality.

What was promised	What was agreed
No subsidies: would compete in the market on equal terms with all other sources.	Contract for 35 years. Government loan guarantees perhaps covering all the borrowing, about £17bn, of the expected (including finance) cost.
No 'sweetheart deal'	No competitive procurement process
Competitive with other forms of generation generating at £31–44/MW h.	Most expensive power on system,£92.5/MWh: more than double 2013 wholesale electricity cost.
Construction cost excl. finance £2bn per reactor.	Construction cost, excl. finance £8bn per reactor.
First power 2017.	First power 2026.
Consortium 80% EDF, 20% Centrica	Consortium 66.5% EDF, 33.5% Chinese companies
Programme of 12 reactors by 2030	No more than a handful of reactors built by 2030
Competition between developers & technologies.	Bilateral negotiations with NNB GenCo+ EPR

Table 2
Key policy points in British nuclear power policy post-2000. Sources: See footnotes.

Date	Decision
June 2001	Tony Blair announces a review of strategic issues surrounding energy policy to be carried out by the Performance and Innovation Department of the Cabinet Office[a]
Feb 2003	White Paper (policy) published giving a negative verdict on the economics of nuclear power[b]
Nov 2005	Tony Blair announces a new review of energy policy[c]
July 2006	Green Paper (consultation) published giving a favourable verdict to new nuclear power plants[d]
Feb 2007	High Court rules consultation on new nuclear build flawed and orders it be re-done[e]
May 2007	White paper on energy policy published and new consultation on nuclear power launched[f]
Jan 2008	White paper on nuclear power proposing measures to promote new orders published[g]
Dec 2010	Electricity Market Reform programme launched expected to lead to big changes to the market[h]
Oct 2013	Provisional agreement on terms for Hinkley Point C between government and EDF[i]
Dec 2013	Energy Act 2013 passed giving legal basis for Hinkley deal including Contracts for Difference[j]

[a] http://www.publications.parliament.uk/pa/cm200102/cmhansrd/vo010625/text/10625w01.htm#10625w01.html_spmin0 (Accessed August 19, 2015).
[b] Department of Trade & Industry, 2003. Our energy future: creating a low carbon economy. Cm 5761, DTI, London. http://webarchive.nationalarchives.gov.uk/+/http:/www.berr.gov.uk/files/file10719.pdf (Accessed July 27, 2015).
[c] http://webarchive.nationalarchives.gov.uk/20060715135117/http://number10.gov.uk/page8606 (Accessed July 27, 2015).
[d] http://webarchive.nationalarchives.gov.uk/+/http:/www.dti.gov.uk/files/file31890.pdf (Accessed August 18, 2015).
[e] http://www.greenpeace.org.uk/media/press-releases/governments-nuclear-plans-declared-unlawful-by-high-court (Accessed July 27, 2015).
[f] Department of Trade & Industry, 2007. Meeting the Energy Challenge, Cm 7124, TSO, London http://webarchive.nationalarchives.gov.uk/20100512172052/http:/www.decc.gov.uk/en/content/cms/publications/white_paper_07/white_paper_07.aspx (Accessed July 27, 2015) & Department of Trade & Industry, 2007. The future of nuclear power, DTI, London. http://webarchive.nationalarchives.gov.uk/+/http:/www.berr.gov.uk/files/file39199.pdf (Accessed August 18, 2005).
[g] Department for Business Enterprise & Regulatory Reform, 2008. Meeting the Energy Challenge: A White Paper on nuclear power, Cm 7296, BERR, London http://webarchive.nationalarchives.gov.uk/20100512172052/http:/www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/nuclear/white_paper_08/white_paper_08.aspx (Accessed July 27, 2015).
[h] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/42636/1041-electricity-market-reform-condoc.pdf (Accessed August 18, 2015).
[i] https://www.gov.uk/government/news/initial-agreement-reached-on-new-nuclear-power-station-at-hinkley (Accessed July 27, 2015).
[j] https://www.gov.uk/government/collections/energy-act (Accessed August 18, 2015).

sufficiently to make a policy to re-launch nuclear power politically plausible.

The Green Paper[14] was challenged by Greenpeace in the High Court, which found the consultation process was 'seriously flawed and that the process was manifestly inadequate and unfair' and the consultation had to be redone.[15] The White Paper, 'Meeting the Energy Challenge',[16] that followed on from the Green Paper was published in May 2007 and coincided with the launch of the consultation paper, 'The Future of Nuclear Power'[17] on nuclear power. The preliminary conclusion on the economics of nuclear power was that.

> 'Based on this conservative analysis of the economics of nuclear power, the Government believes that nuclear power stations would yield economic benefits to the UK in terms of reduced carbon emissions and security of supply benefits under likely scenarios for gas and carbon prices. As an illustration, under central gas and nuclear cases, and with a future carbon price of €36/tCO2, the net present value over 40 years of adding 10 GW of nuclear capacity would be of the order of £15 billion'.

In January 2008, the government published 'Meeting the Energy Challenge: A White Paper on nuclear power'[18] which concluded.

> 'The Government believes it is in the public interest that new nuclear power stations should have a role to play in this country's future energy mix alongside other low-carbon sources; that it would be in the public interest to allow energy companies the option of investing in new nuclear power stations; and that the Government should take active steps to open up the way to the construction of new nuclear power

[14] Department of Trade & Industry, 2006. The energy challenge, Cm 6887, DTI, London. http://webarchive.nationalarchives.gov.uk/+/http:/www.dti.gov.uk/files/file31890.pdf (Accessed August 12, 2015).
[15] http://www.greenpeace.org.uk/media/press-releases/governments-nuclear-plans-declared-unlawful-by-high-court (Accessed July 27, 2015).
[16] Department of Trade & Industry, 2007. Meeting the Energy Challenge, Cm 7124, TSO, London. http://webarchive.nationalarchives.gov.uk/20100512172052/http:/www.decc.gov.uk/en/content/cms/publications/white_paper_07/white_paper_07.aspx (Accessed July 27, 2015).
[17] Department of Trade & Industry, 2007 'The future of nuclear power' DTI, London. http://webarchive.nationalarchives.gov.uk/+/http:/www.berr.gov.uk/files/file39199.pdf (Accessed August 18, 2015).
[18] Department for Business Enterprise & Regulatory Reform, 2008. Meeting the Energy Challenge: A White Paper on nuclear power, Cm 7296, BERR, London. http://webarchive.nationalarchives.gov.uk/20100512172052/http:/www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/nuclear/white_paper_08/white_paper_08.aspx (Accessed July 27, 2015).

stations. It will be for energy companies to fund, develop and build new nuclear power stations in the UK, including meeting the full costs of decommissioning and their full share of waste management costs'.

The White Paper claimed nuclear power would benefit from the fact that nuclear power plants do not emit carbon dioxide and its owners would not need an emissions permit.[19] With a Carbon emissions permit price (in the European Union's Emissions Trading Scheme (EUETS)) of €36/tCO_2, it forecast nuclear power would be competitive under all its scenarios and that 'in the central case and high cases for gas prices and a central case for nuclear costs, nuclear power provides economic benefit regardless of the carbon price'. The White Paper stated that the government would not be making any investment but that it would allow 'energy companies the option of investing in new nuclear power stations'.[20] To allow companies to make such decisions enabling measures were needed so that companies did not face unnecessary barriers to ordering nuclear power plants.

3. The enabling measures and their implementation

The main enabling measures were:

- Streamlining the planning system to prevent delays implementing decisions.
- Identification of sites for nuclear plants approved by the government.
- Introduction of a Generic Design Assessment (GDA).
- Efforts to make the EUETS a more effective instrument.

In addition to these, two further enabling measures, Contracts for Differences (CfDs) and loan guarantees were later introduced to try to overcome problems of financing nuclear investment.

3.1. The planning system

Reforms to the planning system were announced in July 2011 and were aimed at 'removing uncertainty to give industry the confidence to invest in much needed new energy infrastructure in this country' by use of Energy 'National Policy Statements'.[21]

3.2. Identification of sites and the potential investors[22]

A Strategic Site Assessment (SSA) process was launched in 2008[23] and eleven potential sites were identified with three green-field sites and eight sites of existing nuclear facilities. Only the existing sites were identified as suitable for nuclear power plants (see Blowers (2010) for a discussion of why sites of existing facilities were chosen).[24] Four were wholly owned by the Nuclear Decommissioning Authority (NDA), two were wholly owned by British Energy and both organisations owned parts of the other two. In 2009, before the final selection had been made, land at the four sites solely owned by NDA was auctioned and bought by the three consortia set up to build nuclear plants.[25]

These three consortia remain the established candidates to build nuclear plants in Britain, and were formed of electric utilities already with significant businesses in the UK: NNB GenCo (EDF 80%, Centrica 20%), Horizon (EON 50%, RWE 50%) and NuGen (GDF Suez 37.5%), Iberdrola 37.5%, S&SE 25%.

EDF took over the British nuclear generation company, British Energy, in 2009 giving it sole or part ownership of four of the eight sites. EDF also bought land in the auction at NDA's Bradwell site. Horizon bought land at NDA's Wylfa and Oldbury sites while NuGen bought land adjacent to NDA's Sellafield location at a site known as Moorside.

In 2012, Horizon was sold to the reactor vendor Hitachi-GE for about £700 m[26] and in 2013, Centrica withdrew from NNB GenCo.[27] S&SE sold its stake in NuGen in 2011 for £5.75 m leaving GDF Suez and Iberdrola each with 50% of the company.[28] In January 2014, the reactor vendor, Toshiba paid £102 m to take over Iberdrola's stake and some of GDF Suez's[29] stake giving it 60% of the equity.[30]

3.3. Generic design assessment

Four designs were submitted to the Office of Nuclear Regulation (ONR)[31] GDA process in 2007, the Areva European Pressurised Reactor (EPR), the Toshiba/Westinghouse AP1000, the AECL ACR-1000 and the GE-Hitachi ESBWR. The latter two designs were withdrawn within a year of the process starting. EDF chose the EPR design while Horizon and NuGen had not chosen their technologies by the time they were taken over by Hitachi-GE and Toshiba respectively. The GDA for the EPR was due to be completed in June 2011 but was delayed, amongst other reasons by the Fukushima disaster. In December 2011, the UK regulator gave Interim Design Acceptance Confirmations to the EPR and AP1000 subject to resolution of 29 and 51 design issues respectively.[32] This was completed for the EPR in 2012[33] but Toshiba did not attempt to resolve the AP1000 issues because it then had no prospective UK customer.[34] The Design Acceptance Confirmation is valid for 10 years.

Hitachi-GE chose the Advanced Boiling Water Reactor (ABWR)

[19] Some argue that the use of fossil fuels particularly in the mining and processing of uranium is high enough, especially as the ore quality being exploited goes down, that nuclear power should not be seen as 'low-carbon'.

[20] Department for Business Enterprise & Regulatory Reform, 2008. Meeting the Energy Challenge: A White Paper on nuclear power, Cm 7296, BERR, London, p. 19. http://webarchive.nationalarchives.gov.uk/20100512172052/http:/www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/nuclear/white_paper_08/white_paper_08.aspx (Accessed July 27, 2015).

[21] https://www.gov.uk/government/news/energy-planning-reforms-approved-by-parliament (Accessed July 28, 2015).

[22] The devolved Scottish government had made a decision not to build new nuclear plants and so two existing sites in Scotland were not considered.

[23] Department for Business Enterprise & Regulatory Reform, 2008. Consultation on the proposed process for the Strategic Siting Assessment, BERR, London. http://webarchive.nationalarchives.gov.uk/+/http:/www.berr.gov.uk/files/file47136.pdf (Accessed September 14, 2015).

[24] Department of Energy & Climate Change, 2011. National Policy Statement for Nuclear Power Generation, TSO, London. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47859/2009-nps-for-nuclear-volumeI.pdf (Accessed July 28, 2015).

[25] http://www.nda.gov.uk/2009/04/winning-bidders-in-nda-land-auction-announced/ (Accessed August 12, 2015).

[26] Sunday Times. Hitachi bets £700 m on nuclear Britain; Japanese reactor maker's bid for Horizon consortium is boost for UK energy strategy, October 28, 2012.

[27] Nucleonics Week. EDF Energy considers new Hinkley partners, February 7, 2013.

[28] Platts European Power Daily. SSE closes NuGen stake sale to GDF, Iberdrola, February 17, 2012.

[29] GDF Suez was subsequently renamed ENGIE.

[30] Nucleonics Week. Toshiba to buy 60% of UK's NuGen, plan AP1000s at Moorside, January 16, 2014.

[31] The Nuclear Installations Inspectorate was renamed the Office of Nuclear Regulation in 2011.

[32] http://www.world-nuclear-news.org/RS_Last_stage_of_UK_reactor_licensing_1412111.html (Accessed August 12, 2015).

[33] http://www.onr.org.uk/new-reactors/reports/step-four/close-out/epr70475n.pdf (Accessed July 28, 2015).

[34] http://www.onr.org.uk/new-reactors/reports/ap1000-onr-gda-idac-11–002-issue-1–131211.pdf (Accessed July 28, 2015).

for Horizon and in January 2014, the ONR began the main phase of the assessment with an expectation the process would be completed in 2018.[35] Toshiba asked to reactivate the GDA process for the AP1000 to resolve the remaining issues and in January 2015, work began in earnest. Toshiba aimed to complete the process in early 2017.[36]

3.4. Contracts for differences

Utilities were expected to be unlikely to choose nuclear because of the risks inherent in a competitive electricity market. Financiers were concerned about two major risks: technology risk, the risk that the costs would be higher than forecast; and market risk, the risk that the electricity wholesale price would fall below the cost of generation of the nuclear plant. These risks had not been important to utilities while they were monopolies because they had generally been able to pass on to consumers whatever costs were incurred.

Market risk was clearly illustrated in 2002 when the operating cost alone of Britain's nuclear power plants, was higher than the electricity market price and British Energy was effectively bankrupted. CfDs were introduced as part of the 2010 UK Electricity Market Reform (EMR). In February 2010 the Energy Minister, Ed Miliband, and the economic regulator for the energy sector, the Office of Gas & Electricity Markets (OFGEM) announced that market-driven electricity system would not meet objectives in terms of reliability and greenhouse gas emissions. The Chief Executive of OFGEM stated (OFGEM 2010):

> 'The unprecedented combination of the global financial crisis, tough environmental targets, increasing gas import dependency and the closure of ageing power stations has combined to cast reasonable doubt over whether the current energy arrangements will deliver secure and sustainable energy supplies'.

The Energy Minister in the Labour government agreed.[37].

> 'The Neta system [the British wholesale market], in which electricity is traded via contracts between buyers and sellers or power exchanges, does not give sufficient guarantees to developers of wind turbines and nuclear plants'.

Of most relevance to the nuclear programme was the introduction of Contracts for Difference. These were said 'to provide stable financial incentives to invest in all forms of low-carbon electricity generation'.[38] In practice, these were simply fixed price contracts with part of the payment coming from the market at market price with the 'difference' between the market price and the contract price paid by a consumer subsidy.[39]

The energy minister claimed in a statement to Parliament in October 2010 that the government was not offering subsidies to nuclear power. However, the statement appears contradictory: 'I should like to take the opportunity to reconfirm the Government's policy that there will be no public subsidy for new nuclear power. To be clear, this means that there will be no levy, direct payment or market support for electricity supplied or capacity provided by a private sector new nuclear operator, unless similar support is also made available more widely to other types of generation'.[40] It was not until October 2015 that the government acknowledged that 'the no subsidies policy no longer applies'.[41]

3.5. Loan guarantees

Technology risk has always been a feature of nuclear projects because reactors have often not been built to time and cost, operating reliability has not met expectations and operating costs have been higher than expected. Despite the accumulation of experience, there is little sign technology risk is diminishing.

The government announced a programme of infrastructure loan guarantees worth up to £40bn in July 2012[42] and in June 2013, it offered guarantees under this programme to Hinkley.[43] The Hinkley project is pre-qualified to receive these guarantees.[44] Under this scheme the banks financing a nuclear project will effectively be lending money to the government. If the plant owner fails, taxpayers repay the loans.[45]

The risk to utilities was limited by the utilities creating consortia that would own and operate the plants. If the plant was uneconomic, the parent companies might simply allow the consortia to go bankrupt and there would be no recourse to them beyond their stake in the company. The loan guarantees would reduce any incentives on lenders to demand performance guarantees from the members of the consortium in their role as contractors.

3.6. The EUETS

The government's initial case for nuclear power was dependent on a well-functioning Carbon market if gas prices were low. However, by 2010, there was no sign that the EUETS would produce prices that reflected the additional cost of using low-carbon sources. The government announced in 2011 it would introduce a Carbon Floor Price (CFP) to apply from 2013 onwards to give greater predictability to carbon prices. However, the offer of CfDs meant the carbon price had no impact on the economics of nuclear.

4. The state of negotiations in 2016

In September 2010, EDF claimed it would make a Final

[35] http://news.onr.org.uk/2014/01/regulators-begin-second-phase-of-assessment-of-new-nuclear-reactor-for-uk/ (Accessed July 28, 2015).

[36] http://news.onr.org.uk/2015/03/revised-resolution-plans-for-westinghouse-ap1000-design-published/ (Accessed July 28, 2015).

[37] The Times. Labour prepares to tear up 12 years of energy policy, February 1, 2010.

[38] http://webarchive.nationalarchives.gov.uk/20121025080026/http:/www.decc.gov.uk/en/content/cms/legislation/white_papers/emr_wp_2011/emr_wp_2011.aspx (Accessed July 31, 2015).

[39] In the event the market price was higher than the contract price, the generator would repay the difference.

[40] https://www.gov.uk/government/news/written-ministerial-statement-on-energy-policy-the-rt-hon-chris-huhne-mp-18-october-2010 (Accessed August 6, 2015).

[41] It stated: 'The Government confirms that it is not continuing the 'no public subsidy policy' of the previous administration'. https://www.gov.uk/government/news/hinkley-point-c-to-power-six-million-uk-homes (Accessed June 3, 2016).

[42] https://www.gov.uk/government/news/government-uses-fiscal-credibility-to-unveil-new-infrastructure-investment-and-exports-plan (Accessed August 12, 2015).

[43] The Guardian. Investment in renewables may get hit despite rise in wind farm subsidies, June 27, 2013.

[44] https://www.gov.uk/government/publications/uk-guarantees-scheme-prequalified-projects/uk-guarantees-scheme-table-of-prequalified-projects (Accessed August 12, 2015).

[45] The documentation states: 'HMT will provide an unconditional and irrevocable financial guarantee in favour of a Beneficiary and on behalf of the Company, capable of demand in the event of non-payment of scheduled principal and interest owing from time to time under the underlying document (be that a loan, a bond, or other financial instrument). To this end, HMT will unconditionally and irrevocably agree to pay to the Beneficiary any such amounts which have become due for payment but are unpaid by reason of non-payment'. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/209806/UK_Guarantee_-_A_brief_overview_-_Allen___Overy.pdf (Accessed September 14, 2015).

Investment Decision (FID) in 2011, start construction in 2013 with first power in 2017.[46] However, it was not till October 2013 that initial agreement between the government and EDF on the terms for a power purchase agreement was reached. EDF then claimed an FID was imminent and first power would be in 2023. In October 2015, revised terms were announced. The costs remained the same but the completion date had been put back to 2025, the expected composition of the NNBG consortium had been changed and there was more clarity on the loan guarantees (see below). By June 2016, the contracts for Hinkley had still not been signed despite repeated announcements by EDF that an FID was about to be taken and EDF acknowledged that the 2025 target probably could not be met.[47] In this section we examine what the factors behind these delays have been.

4.1. The October 2013 deal

The terms of the power purchase agreement for the reactors planned for Hinkley Point C announced in October 2013.[48] The power purchase contract would cover 35 years, at a pre-determined price, the 'strike price', of £92.5/MWh (2012 prices) index-linked to inflation, outside the market and at levels more than double the wholesale market price for electricity that prevailed in 2013. This agreement was based on an assumption that each reactor would cost £8bn (in 2012 prices) four times the cost forecast by the government in 2008. Financing charges were expected to add about £4bn per reactor, and sovereign loan guarantees covering all the borrowing, expected to be about £17bn, were expected to be offered. A second pair of EPR reactors at the Sizewell site would also be built by the consortium but no timings were given.

4.2. State-aid inquiries

The October 2013 agreement was far from a final deal. The immediate hurdle was that it had to be examined by the European Commission competition authorities to determine whether the contract represented state aid that would distort the electricity market between member states. If it did, this be illegal under EU law. With a number of member states looking to follow the UK's example with their own nuclear programmes if the contracts are acceptable under EU law, this decision would have far-reaching consequences.[49]

Despite an initial evaluation that was highly critical of the deal,[50] on October 2014, the Commission published its verdict that the deal did not break European Union law.[51] However, far from clearing the way for the project to go forward more hurdles have appeared since then. The Austrian and Luxembourg governments[52] and some renewable companies[53] announced their intention to challenge the Commission's verdict but by June 2016, these challenges had not been heard. A separate inquiry into the terms being offered by the government to deal with waste management plans was also required and in October 2015, this was approved.[54] By June 2016, no announcement had been made as to whether the rescue of Areva and the further aid EDF will receive from the French government discussed below will trigger state-aid inquiries.

4.3. The October 2015 announcement

In October 2015, revised terms were announced by EDF and the British government.[55] It was asserted that the construction cost and the strike price were unchanged but the completion date had gone back to 2025 and there had been significant changes to the composition of the consortium. The 'Funded Decommissioning Programme', the arrangements under which decommissioning would be paid for, was approved by the UK government although few details of this have been published. It was also announced that EDF would release its Bradwell site to a Chinese company, China General Nuclear (CGN) which is expected to be a minority stakeholder in Hinkley. Chinese technology, the Hualong One nuclear reactor design would be built there. CGN announced it would submit this design to ONR in 2016.[56] By June 2016, this had not happened, the number of reactors to be built had not been announced and no timings given.

4.4. The consortium

By mid-2016, the consortium had not been established. The October 2013 agreement stated it was expected to comprise EDF with 40–50%, the two Chinese companies, CGN and China National Nuclear Corporation (CNNC) with 30–40%, Areva, with 10% and investors with whom discussions had already taken place taking 15%. The October 2015 agreement inevitably saw Areva, which by then had financially collapsed, drop out, the 15% to be taken by other investors had not materialised leaving EDF with 66.5% and CGN with 33.5%. CNNC was not mentioned in the deal although subsequently it claimed it would still be an investor.[57] For Sizewell, the consortium would be 80% EDF with Chinese investors taking the rest, while for Bradwell, it would be 66.5% CGN and the rest EDF.

4.5. The loan guarantees

In June 2013, Ed Davey, the Secretary of State for DECC announced that loan guarantees worth up to £10bn would be available to Hinkley.[58] The DECC press release for the October 2013 announcement stated: 'HM Treasury announced on 27 June 2013 that Hinkley Point C had been pre-qualified for consideration for a UK Guarantee'. The press release for the Commission state-aid decision[59] stated: 'With respect to the State guarantee, the Commission found that the initial guarantee fee which the operator

[46] Nucleonics Week. Despite slippages, EDF on target for 2013 construction at Hinkley, September 9, 2010.

[47] http://www.world-nuclear-news.org/NN-EDF-Energy-chief-refuses-to-prejudge-outcome-of-HPC-talks-24051601.html (Accessed June 3, 2016).

[48] https://www.gov.uk/government/news/initial-agreement-reached-on-new-nuclear-power-station-at-hinkley (Accessed July 27, 2015).

[49] For more detailed analysis see: Thomas, S., Fouquet, D., 2013. The new UK nuclear power programme: A FIT for nuclear and a blueprint for state aid, Greens/EFA Group – European Parliament, Brussels. http://www.nuclearconsult.com/docs/Turmes_report.pdf (Accessed September 14, 2015).

[50] http://ec.europa.eu/competition/state_aid/cases/251157/251157_1507977_35_2.pdf (Accessed August 5, 2015).

[51] http://eur-lex.europa.eu/legal-content/EN/ALL/? uri=OJ: L:2015:109: TOC (Accessed August 5, 2015).

[52] Platts European Power Daily. Austria files lawsuit against EC nuclear ruling, July 8, 2015.

[53] Platts European Power Daily. Ten companies to file lawsuit over Hinkley, July 2, 2015.

[54] http://ec.europa.eu/competition/elojade/isef/case_details.cfm? proc_code=3_SA_34962 (Accessed June 3, 2016).

[55] https://www.gov.uk/government/news/hinkley-point-c-to-power-six-million-uk-homes and https://www.edfenergy.com/energy/nuclear-new-build-projects/hinkley-point-c/news-views/agreements-in-place (Accessed June 6, 2016).

[56] https://www.edfenergy.com/energy/nuclear-new-build-projects/hinkley-point-c/news-views/agreements-in-place (Accessed June 6, 2016).

[57] The Telegraph 'Second Chinese company poised to invest in Hinkley Point' May 7, 2016. http://www.telegraph.co.uk/business/2016/05/07/second-chinese-company-poised-to-invest-in-hinkley-point/ (Accessed June 6, 2016).

[58] http://www.theguardian.com/politics/2013/jul/05/davey-minister-nuclear-power-hinkley-point.

[59] http://europa.eu/rapid/press-release_IP-14–1093_en.htm.

would have paid to the UK Treasury was too low for a project with this risk profile. The guarantee fee was therefore significantly raised'. And 'The new Hinkley Point C nuclear power station will require debt financing of GBP 17 billion'. The common assumption then was that loan guarantees to cover all the debt were fully agreed. However, closer examination of the Commission verdict revealed there were conditions, particularly a 'Base Case Condition' which was that until Flamanville 3 was in commercial service, there would be a cap on the guaranteed loans effectively meaning funding would be primarily through equity.[60] The Base Case Condition had to be met by the end of 2020 or the loan guarantees would be withdrawn. There are increasing doubts that Flamanville 3 can meet this deadline (see below). During a state visit by the Chinese President, the UK Treasury announced an initial £2bn in loan guarantees which would 'pave the way for a final investment decision by energy company EDF, supported by China General Nuclear Corporation and China National Nuclear Corporation, later this year, and with further amounts potentially available in the longer-term'.[61] The Treasury stated…further amounts [would be] available should EDF meet certain conditions and subject to fuller government approvals'.[62] The implication that loan guarantees were not as committed as had been commonly assumed was reinforced by EDF implying it would fund construction of Hinkley from equity (its own funds) rather than borrowing. It seems improbable that EDF would choose to do this if borrowing with loan guarantees was an option given its low profitability and the relatively high cost of equity compared to debt. It was also reported EDF was looking to sell up to €10bn in assets to fund construction.[63] In January 2016, the Telegraph reported[64]: 'EDF had originally been expected to use project financing for Hinkley, backed up by up to £16bn in UK Government guarantees via Infrastructure UK. But Mr Lévy [EDF CEO] announced in October a "radical change" to what he said was a "more efficient" option of delivering its £12bn share of the project from EDF's own balance sheet. It has since emerged the UK had attached a sub-investment grade BB+ credit rating to the project'. In March 2016, Reuters reported[65]: 'Levy said in a letter to staff the utility will not go ahead with its plan to build two nuclear reactors in Britain unless it gets more financial support from the French state'. In May 2016, it was reported the French government was looking to sell some of its stakes in companies such as Peugeot to support a capital injection to EDF through bond sales of €4bn.[66] Doubts as to the availability of loan guarantees increased after a reply by the UK Treasury on May 10, 2016 to a Parliamentary Question stated[67]: 'This initial guarantee (the £2bn announced in September 2015) will be repaid (sic) in December 2020. There is no further obligation to issue guarantees after that date'. There had been no hint that this initial guarantee had been so short-term and the stress that there were no obligations to issue further guarantees increased suspicions that the terms and conditions required by the UK government for further guarantees were unpalatable to EDF. There was clear dissent within EDF with the resignation of the Chief Financial Officer, Thomas Piquemal, in March 2016 in protest at the deal while the union representatives on the Board were threatening to vote against the deal.[68] EDF's credit rating is in decline and Moody's downrated EDF in May 2016 partly because 'EDF had not accounted for the incremental risks associated with Hinkley Point C'.[69]

4.6. The collapse of Areva

In March 2015, Areva's annual results revealed losses of €4.8bn.[70] The French government brokered a rescue and a provisional deal was announced in July 2015. This involved EDF taking a majority stake (at least 51%) costing about €2bn in the reactor sales and servicing division of Areva, Areva NP[71] with Areva taking no more than 25%. Other potential investors included CNNC and CGN, and the Japanese company, Mitsubishi. Standard & Poors stated the takeover deal might not be completed in 2016.[72] It seems implausible that a state-aid inquiry will not be required given the reported need for the French government to provide a €4–5bn capital injection as well as having to indemnify buyers from any liabilities resulting from the Olkiluoto order and the problems with reactor vessels (see below).[73]

4.7. Reactor vessel issues

In April 2015, Areva informed the French safety authorities, Autorité de Sureté Nucléaire (ASN), of 'an anomaly in the composition of the steel in certain zones of the reactor vessel head and reactor vessel bottom head of the Flamanville EPR'.[74] The same manufacturing fault applied to the parts supplied to the two EPRs in China (Taishan) plus parts destined for the two Hinkley reactors and a reactor subsequently not ordered for the Calvert Cliffs site in the USA. For Taishan and Flamanville, the components had already been installed and if the anomalies are too serious, it may be uneconomic to replace or repair these parts. Some of the parts destined for Hinkley and/or Calvert Cliffs are being destructively tested to determine whether they meet requirements. A decision by ASN on the adequacy of the material was not expected before late 2015 or 2016.[75] Even if construction at Taishan and Flamanville is allowed to proceed, this problem has seriously damaged the credibility of Areva as a supplier of equipment. As a result of these issues, ASN asked Areva to carry out a quality review on the manufacturing work carried out in its Creusot Forge plant. This revealed: 'irregularities in the manufacturing checks on about 400 parts produced since 1965, about fifty of which would appear to be in service in the French NPPs. These irregularities comprise inconsistencies, modifications or omissions in the production files, concerning manufacturing parameters or test results'.[76] By June

[60] The size of the cap was redacted in the published verdict as being commercially confidential.

[61] https://www.edfenergy.com/energy/nuclear-new-build-projects/hinkley-point-c/news-views/treasury-announcement (Accessed June 7, 2016).

[62] https://www.gov.uk/government/news/2-billion-support-for-hinkley-point-c (Accessed June 7, 2016).

[63] Utility Week 'EDF looking at (EURO)10bn assets sale' October 23, 2015.

[64] http://www.telegraph.co.uk/finance/newsbysector/energy/12123674/Hinkley-Point-go-ahead-delayed-amid-EDF-funding-doubts.html.

[65] http://af.reuters.com/article/energyOilNews/idAFL5N16J4TT.

[66] The Times 'French sell-off to help pay for Hinkley Point' May 2, 2016.

[67] http://www.parliament.uk/business/publications/written-questions-answers-statements/written-questions-answers/?page=1&max=20&questiontype=AllQuestions&house=commons%2clords&use-dates=True&answered-from=2016-03-01&answered-to=2016-05-01&member=3930&keywords=Hinkley%2cPoint (Accessed June 7, 2016).

[68] http://www.bbc.co.uk/news/business-36394601 (Accessed June 7, 2016).

[69] http://www.world-nuclear-news.org/C-EDF-ratings-downgraded-UK-arm-clarifies-Hinkley-cost-13041601.html.

[70] Areva, 2014. Areva 2014 Reference Document, Areva, Paris. http://www.areva.com/finance/liblocal/docs/doc-ref-2014/DDR_EN_310315.pdf (Accessed August 5, 2015).

[71] Areva is split into three main divisions, Areva NP supplies reactors and reactor services, Areva NC for nuclear fuel and Areva TA for nuclear propulsion and research facilities.

[72] Nuclear Fuel 'S&P expects clarity on Areva recapitalization by December' October 26, 2015.

[73] Financial Times. Lossmaking Areva needs €7bn capital injection, July 30, 2015.

[74] http://www.french-nuclear-safety.fr/Information/News-releases/Flamanville-EPR-reactor-vessel-manufacturing-anomalies (Accessed August 5, 2015).

[75] Inside NRC. Flamanville-3 RPV issue technical, not regulatory: ASN official, June 1, 2015.

[76] http://www.french-nuclear-safety.fr/Information/News-releases/Irregula

2016, the implications of this revelation were not clear but if they add further potential liabilities to Areva, a rescue of Areva as a going concern might be impossible.

4.8. Prospects for the order going ahead

The concessions that the British government had to give to get the provisional deal were predictable. In 2008, Thomas wrote[77]:

> 'Subsidies and guarantees required to allow them to build a nuclear plant would probably include: a guarantee from either the vendor or the government that the cost they pay will be the contract price, so that if the costs do overrun, they do not pay; loan guarantees so that if the companies go bankrupt, the banks that lend the money are still repaid (in order to ensure affordable interest rates on the loans); and some guarantee on the price paid for the power produced so that if the electricity wholesale price collapses, as it did in 2002, the company is protected'. And 'On any realistic schedule, the first nuclear order is still five years away and companies like EDF cannot be held to promises made now that they can build plants without subsidy. The fear must be that if companies insist they will not proceed unless subsidies are offered, even after five years of the government pursuing what Hutton calls "a strong nuclear agenda", the government will be prompted to drop its refusal to give subsidies before abandoning its nuclear ambitions'.

By mid-2016, it was unclear whether the Hinkley deal would go ahead with new barriers, such as the financial collapse of Areva, the quality control issues, the internal dissent within EDF and the barriers to loan guarantees appearing more rapidly than existing ones are overcome.

4.9. Orders beyond Hinkley

Given the extreme difficulty EDF is having financing 66.5% of Hinkley Point C, it is implausible that Sizewell C with an 80% EDF stake can go ahead much before 2030.

If the Hinkley deal collapses it may be that Horizon and NuGen will also not proceed. The Horizon consortium plans to build two ABWRs at each of its sites. The GDA for the ABWR is scheduled to finish in 2017 and if Hinkley is a guide, agreement with the government on the terms will take a year and it will be 2–3 years before construction can start. Horizon is forecasting first power from Wylfa before 2025 but this seems unlikely and Oldbury will be significantly later.

NuGen plans to build three AP1000 reactors at its Moorside site with the first expected on-line by 2024. This will be an expensive site to develop because unlike the other sites, it does not have a connection to the national grid. The GDA for AP1000 will not be complete before 2017. So, like Horizon, first power is more likely to be closer to 2030 for the first reactor. The Bradwell project is much less advanced and is unlikely to be on line before 2030.

4.10. Barriers to nuclear ordering

The history of this project has revealed more clearly the extent of the barriers, especially in terms of finance, to nuclear ordering. What gave Blair's 2006 announcement resonance was the claim that new nuclear plants could be built without subsidy. This claim has proved false partly because nuclear costs have continued to rise making it uncompetitive with some renewables. However, the main factor is the technology risk resulting from the poor record of reactors being built to time and cost. The new generation of nuclear designs which the nuclear industry claimed would address the issues of high cost and high technology risk have failed to deal with these issues (Thomas, 2015).

The Generic Design Assessment process has the apparent attraction of ensuring there will be no construction delays due to regulatory issues once construction has started. However, the process is lengthy taking five years for the one reactor that has completed the process in the UK. A comparable procedure is in place in the USA but here, the duration of reviews is even longer, more than nine years. The process remains unproven in practice in the UK and the USA, with the four reactors under construction in 2016 in the USA using this method three years into construction. All of these are at least three years behind schedule.

5. The policy process

5.1. Party politics

Nuclear power has generally not been a party political issue with the two main parties never anti-nuclear as a matter of principle. There have been concerns about costs and an awareness of the continuing failure of government policies towards nuclear power and the parties have always contained dissenting minorities. What is remarkable is how many of the key policymakers appear to have either reversed their position on nuclear power or have at least shifted dramatically. These include Prime Ministers Tony Blair and David Cameron and the Energy Ministers in the 2010–15 coalition government, Chris Huhne and Ed Davey.

Some see the nuclear programme as part of Tony Blair's legacy. At the time of the Blair announcement in 2006 there were reports that anti-nuclear elements in the Cabinet had been sacked.[78] Blair had already appointed Malcolm Wicks, a strong supporter of nuclear power, as Minister for Energy in May 2005. Wicks was moved from this post in November 2006 to be replaced by Alistair Darling. However, under Gordon Brown, Tony Blair's successor, Wicks was moved back to his former position in Gordon Brown's first reshuffle in June 2007 and held that position until October 2008, when he became Gordon Brown's special representative on international energy issues. He was replaced by Ed Miliband who held that position until the May 2010 general election.[79] In June 2007, John Hutton became a Minister at the ministry (Business & Enterprise and Regulatory Reform, BERR) that then contained the energy portfolio, a position he held until he announced in June 2009 that he would not be standing for re-election. In June 2010, he became a member of the board of a US nuclear power company, Hyperion Power Generation. In June 2011, he became Chair of the Nuclear Industry Association, the Trade Association for the UK nuclear power industry.

The Liberal Democrats had, up to the 2010 election, been anti-nuclear and their 2010 Election Manifesto said Liberal Democrats would:

> 'Reject a new generation of nuclear power stations; based on the evidence nuclear is a far more expensive way of reducing carbon emissions than promoting energy conservation and

(*footnote continued*)
rities-concerning-components-manufactured-in-its-Creusot-Forge-plant (Accessed June 7, 2016).

[77] Guardian. This nuclear agenda is losing power, Comment is Free, June 12, 2008. http://www.theguardian.com/commentisfree/2008/jun/12/nuclearpower.nuclear (Accessed September 14, 2015).

[78] Sunday Herald. Tony Blair says he's seen a 'first cut' of a DTI energy review when a summary does not even exist. Anti-nuclear Cabinet have been reshuffled, May 21, 2006.

[79] Malcolm Wicks died in September 2012.

renewable energy'.[80]

The Coalition agreement that made Liberal Democrats junior partners in the coalition stated:

> 'We will implement a process allowing the Liberal Democrats to maintain their opposition to nuclear power while permitting the Government to bring forward the National Planning Statement for ratification by Parliament so that new nuclear construction becomes possible'.[81]

Under the Cameron coalition, the Secretary of State for Energy & Climate Change, was from the Liberal Democrat party, Chris Huhne and Ed Davey from February 2012 onwards. Despite their Manifesto and Coalition Agreement commitments, Huhne and Davey have been no less enthusiastic than their predecessors in promoting the nuclear policy.

It might have been expected, given the poor record of public expenditure on nuclear power, the huge liabilities that had fallen on the public purse following the collapse of British Energy and BNFL and the major commitment of public money that a 35 year CfD and the loan guarantees represented that the Treasury would have concerns about a nuclear programme. However, there had been no sign of opposition from the three long-serving Chancellors of the Exchequer (the Chancellor is the minister in charge of the Treasury) since 1997 until the conditions on the loan guarantees appeared to tighten from 2014 onwards.

In the May 2015 general election, nuclear power barely featured in any of the three parties' manifestos with no more than bland acceptances of the need for nuclear power.

There seems no clear evidence that the nuclear programme was a product of a particular politician. Blair appeared to have a strong commitment to nuclear power, but given that the succeeding Brown and Cameron governments have pursued the nuclear policy with equal zeal, this does not seem to have been a decisive factor. Similarly, the ministers and advisors in the Blair and Brown governments were well disposed to nuclear power but again, their successors, even ones who had previously been anti-nuclear, have not been any less enthusiastic in their pursuit of nuclear power. The lack of opposition politics may have been important in the failure to challenge the suspect cost data that the programme was based on.

5.2. Parliamentary scrutiny

Various Parliamentary committees should have provided critical analysis of the programme. The most regular scrutiny should have come from the Committee that monitors the energy ministry. Various reports were published. For example, in March 2013, the Energy & Climate Change Committee published a report.[82] However, the report was equivocal and addressed mostly delays in the process rather than reviewing the underlying policy. The Chair of this Committee, Tim Yeo, was known to be a strong supporter of nuclear power while members of the Committee have been strong critics, so the lack of a clear voice is not surprising. The Committee formed after the 2015 General Election asking for submission 'on which Government policies require scrutiny over the coming years'. This mentioned affordability, energy security, and sustainability but there was no reference to nuclear power.[83]

The Environmental Audit Committee is not yet a powerful voice. The main inquiry relevant to nuclear power examined energy subsidies. In relation to the government's continued claim that nuclear was not being subsidised, it concluded in 2013 that.[84]

> 'It makes no sense to claim that a subsidy applicable to more than one technology therefore does not constitute a subsidy. It is already clear that new nuclear is being subsidised. The contractor for Hinkley Point will be able to use the guaranteed strike price for the electricity generated to raise capital at lower cost'.

The Public Accounts Committee (PAC) and the investigatory body that reports to it, the National Audit Office (NAO), are generally seen as powerful. However, their function is to review 'value for money' for public expenditure that has been committed. So they inevitably become involved late in the process too late to influence the basic policy. The NAO announced in October 2013 when the provisional terms of the Hinkley deal were announced that it was examining the deal but by August 2015, the NAO website still stated: 'We will publish this report at an appropriate time after the conclusion of the deal'.[85] Overall, the contribution of the Parliamentary Committees has been weak and has had no impact on government policy.

5.3. The civil service

The record of decisions on nuclear power made by the civil service department responsible for energy is poor. Dating back to the mid-1960s and the decision to adopt Advanced Gas-cooled Reactor technology, none of their decisions have proved well-founded in the Department's analysis. Whether this record is worse than that of other departments is hard to say, and government decisions are always ultimately taken by politicians but their apparent complicity in ill-conceived policies over a period of 50 years suggests an institutional failure.

Unlike its predecessor which was based on analysis by the part of the Cabinet Office, the Energy White Paper of 2006[86] was based on analysis carried out by the line ministry, DTI/BERR and was much more favourable to nuclear power. A public consultation was opened, as required by the 2003 White Paper as a condition to relaunch nuclear ordering. Greenpeace won a High Court decision that found that the consultation was flawed and the consultation had to repeated, albeit with similar results but the Nuclear White Paper was not published until January 2008.[87]

The White Paper foresaw construction costs of £2bn per reactor and generation costs of as little as about £30/MW h, figures less than a third of those likely to be included in any contract to build Hinkley Point C. The government seemed to accept uncritically the assurances of the three consortia formed to build in the UK that they would go ahead without subsidies. In July 2008, soon after the publication of the White Paper, the government formed the

[80] Liberal Democrats. 2010, 'Liberal Democrat Manifesto 2010' http://network.libdems.org.uk/manifesto2010/libdem_manifesto_2010.pdf (Accessed September 27, 2013).

[81] HM Government, 2010. The Coalition: Our programme for government. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/78977/coalition_programme_for_government.pdf (Accessed September 27, 2013).

[82] Energy & Climate Change Committee 'Building new nuclear: The challenges ahead' http://www.publications.parliament.uk/pa/cm201213/cmselect/cmenergy/117/11703.htm (Accessed September 14, 2015).

[83] http://www.parliament.uk/business/committees/committees-a-z/commons-select/energy-and-climate-change-committee/news-parliament-2015/ecc-priorities-tor/ (Accessed 7 August 2015).

[84] Environmental Audit Committee, 2013. 'Environmental Audit Committee – Ninth Report: Energy subsidies'. http://www.publications.parliament.uk/pa/cm201314/cmselect/cmenvaud/61/6102.htm (Accessed August 6, 2015).

[85] https://www.nao.org.uk/work-in-progress/ (Accessed August 6, 2015).

[86] Department of Business, Enterprise & Regulatory Reform, 2007. Energy White Paper: Meeting the energy challenge, HMSO. http://www.berr.gov.uk/files/file39387.pdf (Accessed August 15, 2015).

[87] Department of Business, Enterprise & Regulatory Reform, 2008. Meeting the energy challenge: A White Paper on nuclear power, HMSO, London. http://webarchive.nationalarchives.gov.uk/+/http://www.berr.gov.uk/files/file43006.pdf (Accessed September 14, 2015).

Office for Nuclear Development (OND) within DECC and since then it appears to have operated as a promoter of nuclear power, apparently at arm's length from the rest of DECC rather than the normal role of civil servants giving impartial advice to ministers.

The Treasury is often seen as the most powerful ministry and its public expenditure teams would be expected to have a policy view on the main policy issues which the Departments they shadow have to deal with and it can generally veto projects it considers to be an imprudent use of public money. However, it appears to have only got substantively involved late in the process when contract negotiations began, by which time it was too late to have an influence to question the fundamentals of the policy. It may have been that the Treasury was critical but with strong support from Gordon Brown who had been the Chancellor throughout the period of office of the Blair government and George Osborne, the Chancellor in the Cameron governments, it is likely that even if there were concerns within the Treasury, they were overridden.

5.4. The media and the public

While energy remains a major public policy issue, media expertise in this area has declined. In the past, major newspapers had correspondents whose brief was to cover energy. Now, energy is covered by a range of general correspondents including industrial, environmental and political correspondents who do not have the expertise to cover the issue in the depth needed. Media expertise in energy is increasingly concentrated in specialist newsletters that do not have the reach to influence public opinion.

One of the more puzzling aspects for those outside the UK is the apparent lack of interest by the British public in nuclear power decisions. There are determined local opposition groups, for example, Stop Hinkley,[88] but at a national level, the environmental NGOs such as Greenpeace and Friends of the Earth gave up any capability in nuclear power policy long ago and have not campaigned strongly. There are a number of possible explanations for this apparent lack of interest. It may be that:

- This is symptomatic of a more general lack of interest by the British public, as compared for example with Germany, in long-term strategic issues.
- The public believes that it has no ability to influence government decisions.
- After 50 years of failed attempts to launch major nuclear programmes in the UK, the public expects the policy to fail without the need for intervention.

It is clear that the only impact opposition has had is when the public consultation process was deemed to be flawed in 2007 and had to be redone. However, this caused minimal delay.

5.5. The nuclear lobby

There is a common perception that there is a strong nuclear lobby in Britain orchestrating the process. It is hard to see how the nuclear policy of 2006 could have survived to 2016 without such a lobby. However, it is not readily apparent who that lobby might contain. 30 years ago a convincing UK lobby group based on self-interest of its members could have been constructed comprising: the state-owned generating company, the Central Electricity Generating Board; state-owned nuclear R&D and fuel cycle companies, the United Kingdom Atomic Energy Authority and British Nuclear Fuels Limited; and the national champion engineering company, GEC. However, by 2006, none of these existed. There are companies that will profit by supplying some of the components or bulk commodities such as steel and concrete but hardly likely to be able to mount the effort required to have a major influence on government policy.

Nevertheless, influential organisations have consistently supported nuclear power, including: the Confederation of British Industry (CBI)[89]; most of the major Trades Unions; the broadsheet press. It can also be argued that the Ministry of Defence has a vested interest in retaining a nuclear power programme so that some of the skills and facilities needed for a nuclear weapons and the submarine programme are retained.[90] The government's chief scientific advisor from October 2000-31 December 2007, Sir David King, is often seen as influential in convincing Blair to pursue nuclear power. When the energy policy review in December 2005 was opened, he said: 'Thus it is my scientific, not political, opinion that nuclear energy should be part of a wide portfolio of approaches'. Although he added: 'I emphatically do not believe in direct government subsidies for nuclear energy'.[91] By 2014, his position had changed and he was reported as saying: 'Britain "might well" be able to do without atomic power altogether'.[92] Gordon Brown's younger brother, Andrew Brown, became an employee of EDF in 2004 as its head of media relations and later Director of Communications and was still with EDF in 2016. He is sometimes seen as having influenced his brother to support nuclear power. So whilst the identity of the members of a lobby, if it exists, is difficult to identify, many of the opinion formers remain well disposed towards nuclear power.

6. Broader issues

The analysis above, particularly the apparently very poor advice given by civil servants to their political masters leads to a number of questions that are beyond the scope of this paper but deserve further investigation:

- Has the policy-making process got worse for this latest policy on nuclear power or is it merely a continuation of previous failures?
- Is the record of poor advice on nuclear power given by the British civil service significantly worse than that of civil services in other countries?
- Has the policy-making process on nuclear power been any worse than that on other energy issues; and
- Is the record of the Energy Ministry any worse than that of other ministries or is this failure symptomatic of a more general failure of the policy process.

This is far from an isolated failure of policy towards nuclear

[88] http://stophinkley.org/ (Accessed August 12, 2015).

[89] For example, in response to the Fukushima disaster, the CBI stated: 'The Government should press ahead with plans for new nuclear if we are to ensure investment in a secure, low-carbon energy supply'. http://www.cbi.org.uk/media-centre/press-releases/2011/05/cbi-comments-on-chief-nuclear-inspectors-report/ (Accessed September 27, 2013).

[90] On the submarine case, see http://www.theguardian.com/science/political-science/2015/aug/07/shining-a-light-on-britains-nuclear-state (Accessed August 6, 2015) and for nuclear weapons see http://www.theecologist.org/blogs_and_comments/commentators/2530828/bombs_ahoy_why_the_uk_is_desperate_for_nuclear_power.html (Accessed August 6, 2015).

[91] The Guardian. The nuclear option is not political expediency but scientific necessity, December 16, 2005. http://www.theguardian.com/politics/2005/dec/16/greenpolitics.environment (Accessed August 6, 2005).

[92] The Telegraph. Nuclear power may not be needed, says top atomic advocate, November 21, 2014. http://www.telegraph.co.uk/news/earth/energy/nuclearpower/11244499/Nuclear-power-may-not-be-needed-says-top-atomic-advocate.html (Accessed August 6, 2015).

power and over the past 50 years, it is hard to identify any government policy towards nuclear power that can be regarded as having been anything other than seriously misconceived. Further, there is strong evidence that British governments have made spectacularly bad decisions on large projects in general all too frequently. In 1976, Henderson gave a public lecture on two costly British-government sponsored errors, the AGR programme and the Concorde supersonic airliner.[93] In 2013, King and Crewe (2013) wrote of the large number of costly failures mistakes made by government, while Flyvbjerg (2014) argues that mega-projects end up costing more with smaller benefits than forecast and almost always end up with costs exceeding the benefits. Any policy initiative to address the failings in civil service advice need to address these questions to understand whether the issues raised are specific or whether they are symptomatic of a general malaise in the UK policy process.

7. Conclusion and policy implications

The attempt to re-launch nuclear power ordering in the UK appears to represent a failure of the policy process. A policy that has failed to deliver on nearly all the promises on which it was based has been allowed to proceed with no effective means to require that it be re-considered.

By 2016, the risk that the Hinkley Point project would not go ahead appeared to be significant despite the apparent unflinching determination of the British government to force the deal through. It may well be that, as with the previous two attempts no more than one or two reactors will be built before the programme collapses under the weight of high costs and, perhaps, poor performance in controlling costs and construction time.

If this happens, the real damage will not so much be the wasteful expenditure of public money on a failed policy: this is regrettable but in the context of overall public expenditure and expenditure on the electricity industry, the costs are not calamitous. The real problem is the opportunity cost and the fact that, as for the past half a century, British governments have operated in the belief that nuclear power can solve our major energy policy issues whether they are security of supply, affordability or environmental performance. The result is that options that might have been deployed more cost-effectively and more reliably, like energy efficiency and renewables have been neglected.

The general issue of how we can prevent misconceived policies from being pursued long after it is clear they should be abandoned is difficult to solve. It would be unrealistic to believe it would be possible to prevent national leaders pursuing 'pet' projects, putting ministers in place who are sympathetic to these projects and being heavily influenced by persuasive advisors.

Where policies have cross-party support, the normal process of opposition politics testing policies does not work. Parliamentary committees can identify where policies are being poorly implemented but are less comfortable questioning the basis of the policy. Politicians are also vulnerable to powerful industry lobbies especially where they can convince them that their proposals will bring employment and national prosperity.

The lack of critical scrutiny by the media and the public has also contributed but the key role to ensure policies are well-conceived appears to be that of civil servants. It is their duty to provide politicians with impartial high quality analysis, identifying where policies are misconceived and providing a counterweight to industry lobbies. This is an area where the energy part of the UK civil service has consistently failed over the past 50 years. One simple explanation might be that support for nuclear power dates back to the early days of nuclear power when there was little challenge to the view that nuclear power was the future for energy. This 'conventional wisdom' has been passed on uncritically to new incumbents who do not have the courage to question such a fundamental act of faith. With civil servants often moved onto different ministries on a regular basis, expecting them to potentially blight their careers by questioning the perceived wisdom is perhaps not realistic.

Giving civil servants the power and confidence to provide this advice is not something that civil servants can easily instigate. It is something that must come from politicians and runs against current trends under which politicians make their own appointments to key positions in the civil service. In 2012, Prime Minister Cameron launched a plan to reform the Civil Service.[94] However, the emphasis seemed to be on making the Civil Service 'sharper and quicker', giving civil servants scope and freedom to provide advice that ministers would not want to hear was absent. The Public Administration Select Committee carried out a year-long investigation into these plans and it described its report as 'brutal'.[95] It concluded the government's policy was bound to fail and that 'the present atmosphere promotes the filtering of honest and complete assessments to ministers and has in some parts of government become the antithesis of "truth to power"'. Despite this damning verdict, the likelihood that government will change its reform policy is low.

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[94] HM Government, 2012. The Civil Service reform plan. http://www.civilservice.gov.uk/wp-content/uploads/2012/06/Civil-Service-Reform-Plan-acc-final.pdf (Accessed September 10, 2013).

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