National Audit Office

Report
by the Comptroller
and Auditor General

The Department of Energy & Climate Change

Nuclear power in the UK

HC 511 SESSION 2016-17 13 JULY 2016

Overview

Context

1 The Department of Energy & Climate Change (the Department) is responsible for maintaining a secure supply of electricity to power the UK. The UK's policy and regulatory framework for electricity has created a system that has historically provided a secure and reliable supply. But the electricity generating sector is undergoing a major transition from old, polluting technologies, to cleaner low-carbon sources. Much of the UK's existing electricity generation plant is set to close over the next two decades. At the same time, the government expects electricity demand will increase due to take-up of electricity-based technologies, particularly for transport and heating homes and buildings.

2 According to the Department's strategic aims, as well as securing the supply of electricity the UK needs, new sources of electricity should support its ambitious greenhouse-gas emissions target and be affordable for bill payers. These three aims can be in tension; they are often described as the Department's 'trilemma'. For example, some low-carbon generation is intermittent and some is more expensive than traditional fossil-fuel power. Additionally, the cost of building new generating capacity is passed onto energy consumers, rather than being funded through general taxation. The UK also has an ambitious target to reduce greenhouse gas emissions by 80% from 1990 levels by 2050.

3 Since the UK's electricity market was privatised in the late 1980s, the private sector has been responsible for financing and building the infrastructure to generate and transport electricity. The Department does not seek to determine the precise future mix of generating technologies. It oversees policies aimed at helping developers overcome barriers to investment to encourage competition, leading to a supply mix that supports its decarbonisation objectives.

4 The Department wants nuclear power to form an important part of a "balanced mix" of generating technologies, so it provides reliable, low-carbon and cost-competitive electricity. New nuclear investment faces particular challenges, including high upfront costs, which can make financing projects difficult. In the last 10 years, UK governments have developed measures to reduce these challenges for investors.

5 The Department has provisionally agreed terms on a deal to support construction of Hinkley Point C (HPC), a new nuclear power station that could generate around 7% of the UK's electricity. The deal is with NNB Generation Company (NNBG), a subsidiary of French state-owned energy company EDF. China General Nuclear Power Corporation (CGN) will take 33.5% ownership of NNBG once the deal is finalised. The deal centres on a 'contract for difference' (CfD), whereby the Department has agreed that NNBG will receive an index-linked £92.50 per megawatt hour (MWh) (2012 prices) for the electricity HPC sells for 35 years.[1] HM Treasury has also offered to guarantee up to £2 billion of bonds that NNBG may issue to finance its construction of HPC. The Department expects EDF to take its final investment decision to build HPC in the near future, and wants this to be the first in a series of similar deals for new nuclear power stations.

Scope

6 This report sets out:

- some of the main electricity system challenges that the UK faces in the next two decades, and the aims and responsibilities of the Department in meeting those challenges (Part One);
- the Department's policies for encouraging investment in new generating capacity, including its specific measures for nuclear power stations (Part Two); and
- the value-for-money risks that the Department needs to manage (Part Three).

7 This report provides the background for any future National Audit Office reports on the government's deal to support construction of HPC. Our intention is to report on the deal once EDF has taken its final investment decision to build HPC. The report is also intended to support Parliamentary scrutiny of the Department's role.

Key points

Electricity system challenges

8 The Department's central projection is that 95 Gigawatts (GW) of new generating capacity will be constructed by 2035 – equivalent to 90% of the grid's current capacity (**Figure 1** overleaf). Future electricity generation scenarios are subject to uncertainty, so the Department produces a range of projections. Its central projection is based on:

- a 20% increase in demand for electricity over the next two decades because of demographic changes, economic growth and the electrification of heat and transport;
- ageing coal and nuclear power stations worth nearly 30 GW of capacity shutting as they reach the end of their technical lives;

1 £92.50 is the strike price in 2012 prices. This will reduce to £89.50 if EDF builds another nuclear power station at Sizewell.

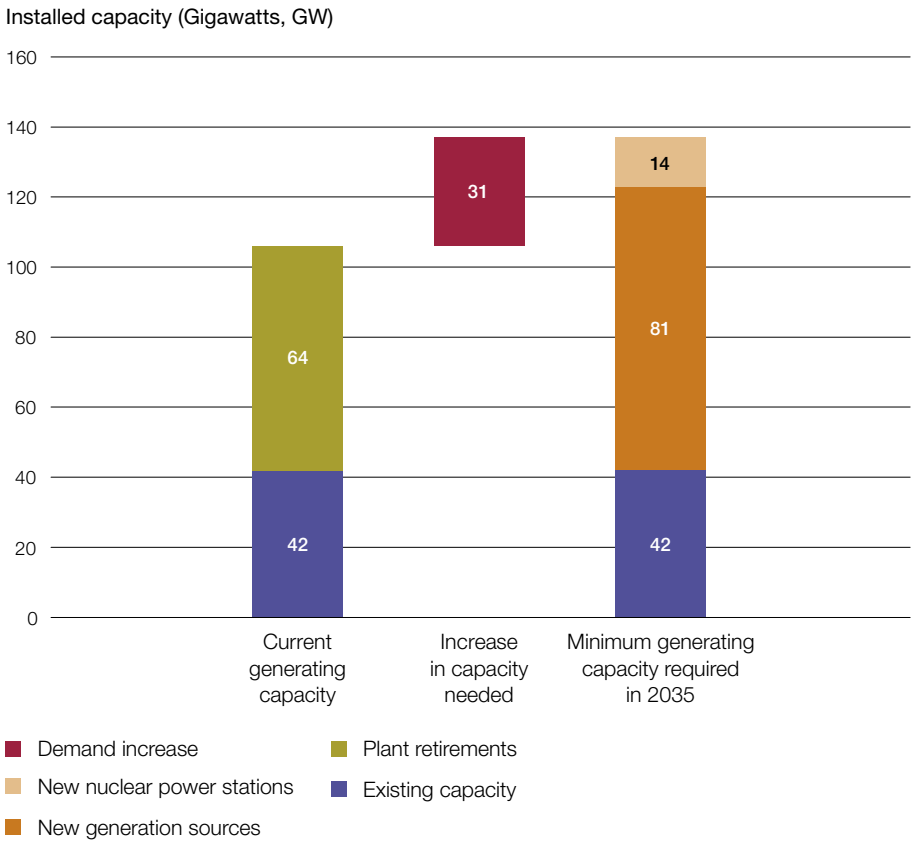
- new capacity replacing existing generating sources which, while not at the end of their technical life, are less efficient than new sources meaning they are priced out of the market; and
- an increasing proportion of generation coming from intermittent sources such as wind and solar power, meaning the total generating capacity needs to be higher to ensure there is sufficient capacity to meet demand.

There is, however, significant uncertainty over these factors, particularly future electricity demand (paragraphs 1.2 to 1.6; and Figures 1 to 4).

Figure 1

The UK's energy challenge up to 2035

The Department projects that electricity demand may increase at the same time that a large proportion of existing generating capacity retires



Notes

1 The Department projects a range of scenarios for the future of electricity generation. This figure uses the scenario based on its central estimate of economic growth and fossil-fuel prices and shows the generating capacity required to meet the Department's security of electricity supply and decarbonisation objectives.

2 The figure shows total installed capacity – the maximum electrical output that power generators can produce unadjusted for plant availability and outages.

3 New generation sources includes 17 GW from European electricity interconnectors.

Source: National Audit Office analysis of Department of Energy & Climate Change energy and emissions projections data

9 At the same time, the UK is committed to ambitious reductions of its greenhouse-gas emissions. The Climate Change Act 2008 requires the UK to reduce greenhouse-gas emissions by 80% from 1990 levels by 2050. Existing power stations emit around 25% of the UK's greenhouse gases. The Department wants new generating capacity to come mainly from lower-carbon sources, such as wind, solar, nuclear and gas, to help meet its decarbonisation goal (paragraphs 1.13 to 1.15; and Figures 7 and 8).

10 The costs of new generating capacity will largely be passed on to consumers through their electricity bills. The government predicts that investment in new generating capacity may cost around £140 billion to 2030. A further £40 billion of investment could be needed in electricity transmission and distribution. The impact of this and other energy policies on bills is uncertain. The Department estimates that by 2030 the total cost of its policies could add £230 to the average annual electricity bill. However the Department predicts that its policies for increasing energy efficiency, creating a more flexible energy system and other price effects of its policies could offset these increases. Taking these policies into account, the Department expects a net impact on annual bills of between a decrease of £26 and an increase of £117 by 2030 (paragraphs 1.11 and 1.12; and Figure 6).

11 Developers of many new generating sources face investment barriers given current and expected wholesale electricity prices as well as other long-term risks. Wholesale electricity prices, which determine revenues, are uncertain and have reduced dramatically in recent years. 'Levelised cost of electricity' (LCOE) estimates lifetime costs on a comparable basis across technologies. LCOE forecasts for new generation sources in the 2020s are in the region of £60 to £100 per megawatt hour (MWh). While this cost is falling, it is still higher than the current wholesale electricity prices of around £45 per MWh. For large-scale projects, such as nuclear and offshore wind, the risks can be even greater due to construction risks and the potential for changes in government policy to affect their commercial viability. In these conditions, developers require financial support for their investment to be profitable (paragraph 1.7; and Figures 12 and 19).

The Department's strategy and recent progress

12 The Department aims to overcome market failures so that there is a competitive market of private investment in new and existing generating capacity. The Department has agreed 35 CfDs for new low-carbon power sources. Through CfDs, the generator is paid the difference for electricity sold between a contractual 'strike price' and the 'reference price' – a measure of the average market price for electricity in the UK. If the strike price is higher than the reference price then the developer will receive a top-up. At times when the reference price exceeds the strike price, the generator is required to pay back the difference. Through the Capacity Market, the Department auctions capacity agreements whereby it commits to providing future revenue certainty to new or existing power generators. This is in return for guarantees that capacity will be available at a certain time in the future, even if it not actually called on to provide power. The Department expects this will ensure there is enough capacity to maintain security of supply while the wholesale market may not be sufficient to keep some plant in operation. The Department aims for these policies to encourage competition to drive down generators' costs, which are passed onto consumers through their electricity bills (paragraphs 2.2 to 2.9; Figures 9 to 11; and Figures 13 and 14).

13 The government introduced the Levy Control Framework to manage spending on its consumer-funded support for low-carbon generation. The Levy Control Framework places a cap on the amount the Department can raise through levies on energy bills in each year. The cap in 2020-21 is £7.6 billion, equivalent to around £92 (7%) of the forecast average bill in 2020. However, the most recent forecasts suggest that the cap will be breached by around £1.1 billion a year (paragraphs 3.13 and 3.14).

New nuclear

14 The Department wants nuclear power to form an important part of a 'balanced mix' of generating technologies over the long term, as it could provide reliable, low-carbon and cost-competitive electricity. The Department projects that between now and 2035, around 14 GW of new nuclear generating capacity may be built. The government wants to support a renaissance of the UK nuclear industry – the last new nuclear power station in the UK was completed in 1995 (paragraph 2.10; and Figures 4 and 8).

15 There are specific barriers to investment in nuclear power. Nuclear power plants have high upfront costs and take a long time to build. EDF expects HPC to cost £18 billion to build over 10 years, excluding financing costs. There are also costs to deal with spent nuclear fuel, and decommissioning the facility once it has stopped generating power. The costs of new nuclear power plants are expected to be higher in the UK than other countries, in part because the UK has not built any nuclear plants since the 1990s. Nuclear power plants also have long payback periods, which increases investor exposure to changes in government policy that would reduce operating revenues. The risks associated with nuclear projects (including policy, technology and construction risks) make finance difficult to raise (paragraphs 2.11 and 2.12).

16 The government has introduced measures aimed at removing barriers to investment in new nuclear power stations. These include planning guidance, site licensing and a standard regulatory approvals process for new reactor designs. The HPC CfD will last 35 years, while most existing CfDs for other low-carbon technologies last 15 years. The government negotiated the contract bilaterally with EDF, rather than its preferred practice of relying on competition to minimise the strike price and so reduce the cost to consumers. It aims to mitigate this risk by negotiating 'gainshare' mechanisms as part of the CfD. These mean consumers benefit if construction costs are lower or returns on the project are higher than anticipated. The Department hopes that concluding the deal will generate wider investor confidence to pave the way for subsequent new nuclear projects (paragraph 2.13; and Figures 15 and 16).

17 Progress in encouraging investment in new nuclear power stations has been slower than for other low-carbon technologies. The deal to build HPC is the most advanced nuclear project as it is the only one with development consent, a site licence and regulatory approval. However, EDF's final investment decision has been subject to ongoing delays and it is still uncertain when EDF will begin constructing the facility (paragraphs 2.14 to 2.18; and Figure 17).

Value-for-money risks

18 The Department's strategy is subject to value-for-money risks for consumers. In particular:

- **Demand uncertainty:** It is difficult to predict how much demand for electricity will increase, as it is subject to economic trends, technological developments and changes in consumer behaviour. If the Department overestimates demand, it could provide support and incentives for more projects than necessary, resulting in poor value for money. Equally, if the Department underestimates demand, it may need to take short-term remedial action in the future, which could be more expensive to consumers, or more polluting (paragraphs 3.3 to 3.9).

- **Market conditions:** The government relies on the private sector to build new capacity, which means it is exposed to market conditions that influence investor confidence. If investor confidence falls there could be less competitive pressure to minimise costs, resulting in consumers paying more. Political and regulatory risks can particularly impact on investor confidence. Some stakeholders have said that recent changes in the emphasis of government policy has had a negative effect on investors committing to building new generating capacity. The two Capacity Market auctions to date, although competitive for existing generators, resulted in relatively little investment in new generation sources. The Department expects this to change in future auctions when there are fewer existing sources able to bid for capacity agreements. There has been little competition for nuclear support. The Department negotiated the HPC contract for difference bilaterally with EDF as it considered this preferable to waiting for alternative nuclear options. The uncertainty following the EU Referendum could also impact investment decisions (paragraphs 3.10, 3.11 and 3.25; and Figure 18).

- **Wholesale electricity prices:** CfDs fix the cost to consumers of the electricity from new generating sources, regardless of the market price. Since 2012, the Department has revised downwards its projections of future wholesale electricity prices, mainly because of a global reduction in the prices of fossil-fuels. While CfDs reduce the risk to consumers of market price volatility, they also mean consumers benefit less from wholesale price falls, which are offset by increased top-up payments. The present value of future top-up payments through existing CfDs has increased by £5.6 billion in the 2015-16 financial year because of lower projected wholesale electricity prices. We estimate that future top-up payments through the HPC CfD have increased from £6.1 billion to £29.7 billion since the Department and EDF agreed the strike price in 2013 (paragraphs 3.15 to 3.17; and Figures 19 and 20).

- **Total delivery costs:** UK infrastructure costs have historically been higher than those overseas, including for energy infrastructure. Private finance is more expensive than if the government funded new generating sources, but can be value for money provided the benefits from risk transfer (such as construction risk) and commercial disciplines outweigh the costs (paragraphs 3.21 to 3.24; and Figure 21).

19 There are particular value-for-money considerations for nuclear power compared to other generating technologies. The government is offering longer-term CfDs for new nuclear investment than other low-carbon technologies, reflecting the longer payback periods for nuclear power stations. This adds to price certainty for consumers but increases the risk that they do not benefit as much from any long-term changes, such as technological advances that reduce the cost of other low-carbon sources. The greater complexity and risk of nuclear power projects also could lead investors to require a higher return than for other low-carbon technologies. This means careful consideration is needed of the allocation of risks between the government and investor, such as including gainshare mechanisms (paragraphs 3.18; and 3.23 to 3.25).

20 The government's new nuclear strategy means there are also particular value-for-money risks to taxpayers (as distinct from consumers) compared with other technologies. With CfDs, taxpayers are not exposed to project risks such as cost overruns during construction. However, as part of the government's deal for HPC, HM Treasury has provisionally agreed to guarantee up to £2 billion of bonds that NNBG will issue to finance HPC's construction repayable by NNBG's shareholders in 2020. If the shareholders fail to repay and the government's guarantee is ever called, or if the developer manages to negotiate further guarantees that are called, the funds required would be drawn from government budgets. Additionally, the HPC deal includes a Funded Decommissioning Programme, whereby the Department stipulates an amount that NNBG must set aside to cover decommissioning costs. The government will be liable for any decommissioning costs above the amount NNBG sets aside. The Department calculates the risk of this happening is very low (paragraphs 3.19 and 3.20).