TIMELINE FOR THE DEPLOYMENT OF NUCLEAR POWER IN THE UK

This paper presents further details underlying the timeline for the deployment of nuclear power in the UK, presented as part of the Committee on Climate Change's first Progress Report.

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1. INTRODUCTION

The purpose of this paper is to present further details underlying the timeline for the deployment of nuclear power in the UK, presented as part of the Committee on Climate Change's first Progress Report[1]. The timeline is based on existing work carried out by the Office of Nuclear Development (OND) at DECC, which we consider to be a realistic view of what is achievable.

In the December 2008 Report, the Committee noted that there are debates about the long-term sustainability of nuclear waste storage and the implications of a global nuclear power industry for military nuclear proliferation. The Committee recognises that these issues go beyond cost economics alone. However, nuclear power is both cost-effective and an established technology compared to other forms of low-carbon generation (such as offshore wind and carbon capture and storage). Therefore, if in principle nuclear is acceptable, then cost economics will argue for nuclear to play a significant role in the generation mix in the 2020s and beyond.

In the Committee's first Progress Report (October 2009), we set out an indicative scenario for the power sector to 2022. This includes up to three new nuclear plants by 2022, with the first plant operational by 2018. This is in line with EDF's plans[2] and the trajectory developed by the OND within DECC.

To meet this timescale, the Government must put in place an enabling framework that covers all areas of regulation and planning. This includes:

a) Completion of the Generic Design Assessment (GDA), to develop a set of pre-approved reactor designs that can be easily deployed in the UK.

b) Identification of suitable sites for the deployment of nuclear power stations up to 2025 through the Strategic Siting Assessment (SSA).

c) The publication and approval of a National Policy Statement (NPS) that sets the framework for the Infrastructure Planning Commission (IPC) that will help reduce planning times.

d) Completion of the Regulatory Justification process to ensure the social, economic and other benefits of nuclear energy outweigh any health detriment arising from the use of ionising radiation.

e) A robust regulatory framework to deal with the costs of decommissioning and waste disposal.

[1] Readers should note that this document was developed alongside the October progress report – many of the steps referred to for the future will have happened shortly after publication (e.g. the National Policy Statements in autumn 2009)

[2] http://www.edfenergy.com/about-us/energy-generation/nuclear.shtml

These actions on behalf of Government are complementary to the stages that need to take place by the developer within project development and implementation. Operators need to provide a clear signal stating their commitment to nuclear new build to enable the supply chain to mobilise in time, and invest in new capacity. In addition, current actions to ensure a competent and skilled UK workforce need to continue. Construction will need to take place in a timely manner with due regard for health and safety.

This note is structured as follows:

- Section 1 sets out the CCC's indicative scenario for power sector decarbonisation.
- Section 2 lays out the key milestones that need to be achieved as part of a robust enabling framework to ensure the first nuclear plant is operational by 2018.
- Section 3 sets out a timeline to 2020.
- Section 4 analyses the constraints that may affect this timeline, potentially pushing the first plant into the 2020s.
- Section 5 provides a summary of the key conclusions.

2. SCENARIOS INCLUDING UP TO THREE NUCLEAR PLANTS

The CCC's First Progress Report: 'Meeting Carbon Budgets – the need for a step change' sets out an indicative scenario for power sector decarbonisation that includes high levels of wind generation, coal CCS (carbon capture and storage) demonstration plants and nuclear new build. Both wind and nuclear are desirable in the near term to ensure substantial power sector decarbonisation through the 2020s. As set out in the BERR (2006) cost-benefit analysis, nuclear new build is a cost-effective form of low-carbon generation, and likely to play an increasingly important role in the 2020s. This analysis included both the environmental and the security of supply impacts of investing in nuclear power.[3]

Our scenario for the decarbonisation of the power sector includes up to three new nuclear plants (1.6 GW each) by 2022, with the first nuclear plant being operational by 2018.

[3] http://www.berr.gov.uk/files/file39525.pdf

3. AN ENABLING FRAMEWORK WOULD NEED TO COVER ALL ASPECTS OF REGULATION INCLUDING PLANNING, AND WASTE DISPOSAL AND DECOMMISSIONING

The Nuclear White Paper published in January 2008 established the Government's position on nuclear development, laying out policy and regulatory milestones that need to be completed to ensure at least one plant is operational by 2018. Given the high capital costs and long lifetime of a nuclear plant, policy certainty is essential to enable the private sector to make decisions regarding long-term investments in nuclear power.

Building on that work, the key milestones within the regulatory and planning framework fall under the following five areas:

1. Generic Design Assessment
2. Strategic Siting Assessment
3. Planning Reform (National Policy Statement and Infrastructure Planning Commission)
4. Regulatory Justification
5. Regulations for a Funded Decommissioning Programme

1. **Generic Design Assessment (GDA) to have a set of pre-approved reactor designs in place by mid-2011.**

The purpose of the GDA is to improve the overall efficiency of the regulatory process by clearly separating design issues from site-specific issues. By addressing the technical aspects of reactor designs upfront, the GDA aims to leave only certain site-specific issues to be addressed during the licensing stage. This will enable regulators to involve designers at an early stage, where they can have the most influence and apply the lessons learnt from one design to others that are being looked at.

One of the reasons for the planning delay for Sizewell B was that various design adjustments had to take place at various stages of the timeline.[4] This delayed the project and increased costs. Similarly, the well-publicised delays for the Olkiluoto 3 plant in Finland are due, in part, to certain parts of the regulatory framework being addressed after the project was underway. This meant that required design adjustments and changes have been made at various stages of the project. The GDA process aims to address these problems and reduce the costs of deployment.

[4] A nuclear site application was made in 1981 for Sizewell B, but was not granted permission until 1987, with total planning time of 6 years and at the cost of £30 million. The project came into operation in 1995, i.e. 14 years after the initial application was made.

The GDA process is jointly being carried out by the Health and Safety Executive (HSE) and the Environment Agency. They are currently evaluating two designs – the UK EPR developed by AREVA and EDF being deployed in France and Finland, and AP1000 developed by Westinghouse Electric Company being deployed in China and USA. Unlike previous designs that were 'one-off' designs, the current designs are being deployed internationally, increasing the scope for the UK to learn lessons from other countries, and tap into existing supply chain capability.

Once the regulators accept a particular design, it will go through the site-specific licensing stage that will test designs against a wider set of criteria. The site-specific licensing would require an operator to present any assumptions of the type and reliability of a grid connection, the density and distribution of local population, including factors that might affect individuals from radiological risk, and external factors such as earthquakes, flooding etc. An unsound proposal may lead to a rejection of the project going ahead, even if the reactor design has successfully passed the GDA process.

If, for some reason, certain areas of licensing are not completed, it would be included as part of the site-specific licensing. This would create uncertainty and almost inevitably delay the timeline set out here. The quality of the GDA should be up to a level that ensures site-specific licensing takes one year or less, which we have assumed in our timeline.

2. Strategic Siting Assessment (SSA) finalised by April 2010.

The purpose of the SSA is to identify suitable sites for the deployment of nuclear power stations up to 2025. It will bring forward the site selection process, ensuring the viability of sites with the intention of addressing any environmental and local concerns upfront.

Sites have been nominated both by energy companies wishing to invest in nuclear energy and the NDA (Nuclear Development Association). The initial list of 11 sites (9 of which are in existing locations) was also put out for public consultation, encouraging individuals and firms to provide their views on the viability of the sites and allow them to voice any concerns. This is in addition to a formal consultation that will take place towards the end 2009. If new build takes place in existing locations, as the initial list strongly suggests, it may not only reduce the risk of local opposition (as locals have possibly directly or indirectly benefited from nuclear power through job creation), it also allows nuclear operators to upgrade existing transmission lines rather than build new ones, reducing the overall cost burden.

These sites will be evaluated against a set of national criteria that have been consulted on, and will take into account the impact of nuclear energy on the surrounding environment. This includes the risk of flooding, proximity to civilian aircraft movements, demographics, proximity to military activities etc. Going forward, it should enable operators to focus on site-specific licensing rather than debate the viability of alternative sites. This will ensure a simpler planning process and reduce the burden on operators.

While the IPC will take this list of sites into consideration while making its decisions (see point 3), it does not necessarily guarantee that a project would go ahead at one of these sites. When an operator applies for a site-license, the IPC and other regulators, such as the Nuclear Installations Inspectorate would still need to consider local issues, such as seismic

risk, proximity to mining, drilling and other underground activities. Therefore, while the SSA will simplify the site selection process by accepting sites at a national level, a particular site could still be rejected by the IPC and regulators once local criteria have been taken into consideration.[5]

3. **Nuclear National Policy Statement to be published and approved; and the Infrastructure Planning Commission established by Spring 2010.**

The Planning Act 2008 aims to create a coherent planning policy for major infrastructure projects, by establishing the Infrastructure Planning Commission (IPC) and publishing a suite of National Policy Statements (NPS). The NPS for nuclear will establish the national case for new nuclear power (see Box 1). The IPC will take over the decisions on major infrastructure projects (such as a new nuclear plant) and the aim is to determine applications within a set time period (around nine months).

The Planning Act aims to address the shortfalls of the previous planning regime, where national policy was not clearly stated in all cases. This meant that national policy had to be clarified at the enquiry stage for each individual application resulting in uncertainty and increased delays at the public enquiry stage.[6]

The key point for the new planning regime is that it provides a more streamlined and coherent consent process, without compromising public and local engagement.

Box 1: National Policy Statements (NPS) and the Infrastructure Planning Commission (IPC)

The National Policy Statements (NPS) will set out the policy framework for the IPC to take decisions and lay out any special considerations the IPC would need to account for.

The aim of the nuclear NPS is to reduce the risk of any enquiries on individual applications in the future, regarding issues such as whether or not there is a case for new infrastructure. In contrast to the previous planning regime, it increases the need for vigorous consultation and debate on the Government's proposals and ensures that project developers consult with the public regarding the impacts of their projects.

The new system will provide greater opportunity for public consultation at each of the three key stages –

1. The draft NPSs will be out for public consultation and undergo Parliamentary Scrutiny (the draft NPS is expected to be published in Autumn 2009).

2. Project developers and promoters are required to consult with the public regarding their particular proposals.

3. Communities and individuals are allowed to participate and voice their objections to

[5] For a full list of criteria setting out suitability of sites, see http://www.nuclearpowersiting.decc.gov.uk/criteria/

[6] For example, in the case of Sizewell B, see footnote 2, above.

specific projects that might have an adverse negative impact on them.

There is scope for an organisation or individual to legally challenge both the NPS and the final decision of the IPC on grounds of illegality, procedural impropriety, or irrationality, and any such challenge would need to be launched within 6 months of the publication.

4. **Consultation on the Regulatory Justification process will take place in Autumn of 2009 with a decision being taken by ministers in early 2010.**

The purpose of the Regulatory Justification process is to ensure that the potential benefits of nuclear outweigh any health detriments or other costs before the Government grants permission for the deployment of nuclear power in the UK. This will be undertaken by the Secretary of State for DECC and is based around specific reactor designs, in this case the two reactor designs being covered by the GDA.

EU regulations require countries to undertake a high-level cost benefit analysis to ensure that the economic, social or other benefits outweigh the health costs arising from any activity that involves ionising radiation. This principle is based on the recommendations of the International Commission on Radiological Protection, which sets the basic safety standards for protecting the health of workers and the general public.

This a crucial step by early 2010 to ensure the first plant is operational by 2018, as any delay would prevent other parts of the timeline proceeding. In addition, a judicial review into the Government's decision (on the basis that the Justification was incomplete or incorrect in its determination) would lead to further delays, possibly pushing the first plant into the 2020s or even resulting in a project being abandoned (see section 5, below). The Justification should therefore be as comprehensive and robust as possible.

5. **The current ambition is to have the regulations for a Funded Decommissioning Programme (FDP) in place by 2010, and the first FDP approved by the Secretary of State by 2011 in order to facilitate a new plant by 2018.**

The regulations being put in place by Government will ensure a robust mechanism for operators to develop individual Funded Decommissioning Programmes to tackle 'back-end' decommissioning and waste disposal costs.

The FDP is a plan for decommissioning to be prepared by the operator and must include[7]:

- Necessary steps to decommission the nuclear plant at the end of its life and manage the disposal of hazardous waste.
- Estimated costs of undertaking these steps.
- Details of any security to be provided in relation to these costs.

[7] http://www.berr.gov.uk/files/file48571.pdf

All decommissioning and waste disposal costs will be borne completely by nuclear operators and their FDP should outline a clear strategy to meet these costs.

While the plans will be developed by nuclear operators, the Government set up an independent body – the Nuclear Liabilities Financing Assurance Board (NLFAB) – to ensure the robustness of waste funding plans, with the authority to ask operators to top up the fund if there is a shortfall. Operators would be required to carry out both annual and five-yearly reviews of the FDP to ensure their cost estimates are accurate.

Box 2: Funded Decommissioning Programme (FDP) and the fixed unit price

The Nuclear White Paper stated that all waste and decommissioning costs should be completely paid for by nuclear operators. This will include the fixed costs of setting up a geological disposal facility and variable costs associated with each unit of waste produced. To ensure these costs are covered, generators will be required to set aside funds to pay for end-of-life costs.

The Government is expected to set a fixed price per unit of waste to cover the expected costs of both intermediate level waste and spent fuel. Generators will be required to set aside funds based on this unit price and the amount of waste they produce.

Government intends to set the fixed unit price above the expected waste disposal costs and will include a significant risk premium to reflect the uncertainty regarding waste disposal costs. This is intended to ensure that operators bear the full costs of risk and uncertainty and protect the taxpayer if actual costs exceed projected costs.[8]

In addition to the enabling framework being put in place by Government, there are certain steps that need to be carried out by operators to ensure timely project progress (and thereby contain costs):

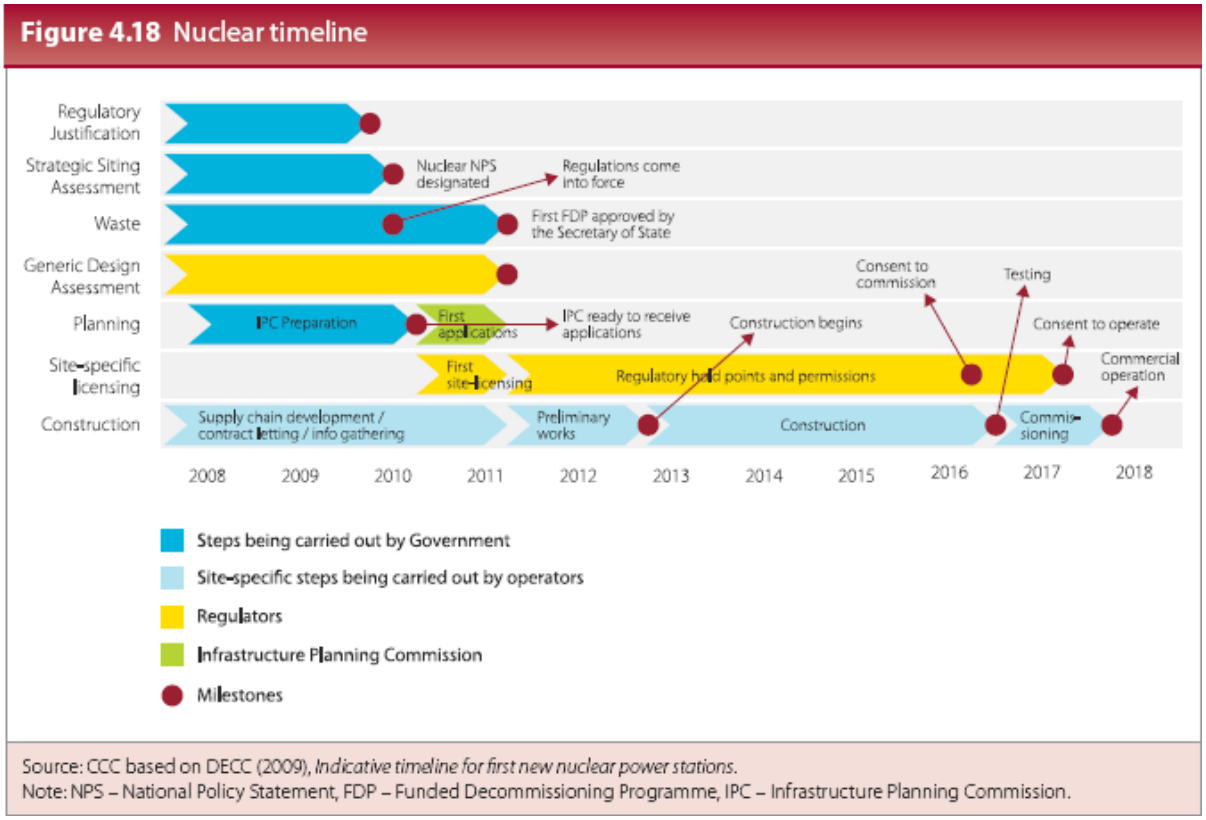
- It is the responsibility of operators to construct and operate nuclear plants, ensure that they meet safety standards and have adequate mechanisms in place to tackle potential problems that may arise.
- Planning applications need to be robust, and ensure that they meet the criteria set out by the IPC to mitigate delays at the planning stage.
- Operators need to ensure that the supply chain delivers to high standards, and engage with companies working in the supply chain to expand capacity if required.
- It is crucial that workers in the nuclear industry have the right qualifications and accreditations, meet the high safety standards of the nuclear industry. Operators need to ensure that workers have sufficient opportunities to develop and upgrade their skills.

[8] Government has consulted on their proposals, with full details available from: http://www.berr.gov.uk/files/file47629.pdf

4. TIMELINE TO 2022

We have drawn together the key milestones in the following diagram. In that diagram we assume there are no delays in the regulatory and planning framework described above. It shows that the first plant must begin construction no later than 2013 in order to be on line by 2018, subject to the milestones within planning, regulation and waste funding described above. In the next section we assess the likelihood of any delays to the trajectory, and illustrate what such delays might imply for the deployment of new nuclear plants over the next 10-15 years.

Figure 1: Nuclear Timeline



Source: CCC based on DECC (2009), *Indicative timeline for first new nuclear power stations.*
Note: NPS – National Policy Statement, FDP – Funded Decommissioning Programme, IPC – Infrastructure Planning Commission.

There are areas that are not captured in the diagram, but will form an important part of the Committee's wider monitoring of indicators:

- **Supply chain:** Independent research suggests that in 2007/08 the civil nuclear manufacturing supply chain in the UK had a turnover of around £3.6 billion and recruited 33,000 people.[9] With this expertise to build on, and with the right signals from the nuclear industry and a clear commitment to invest, the supply chain should mobilise in time to support deployment on the scale we envisage.

  BERR's Low Carbon Industrial Strategy has designed ways to help the UK manufacturing supply chain, to ensure it plays a key role within the global nuclear

[9] BIS and DECC (2009), *The UK Low Carbon Industrial Strategy*, based on research by Innovas

supply chain, with some money being set aside for this as part of the 2009 Budget.[10] Actions include:

- £15 million to establish a Nuclear Advanced Manufacturing Research Centre, bringing together manufacturers and universities to help workers achieve civilian nuclear standards and accreditations.
- Strengthening the Manufacturing Advisory Centre, to provide support to British based suppliers working for the nuclear industry.
- Along with industry and trade bodies, a programme of nuclear supply chain promotional work. For example, the Nuclear Industry Association (NIA) is promoting supply chain opportunities and requirements through a series of regional and sub-sectoral supply chain conferences and seminars.

UK companies are well placed to provide all services related to 'pre-build' and project management services. Furthermore, there are several UK based companies with manufacturing experience to supply components.[11] Rolls Royce has set up a civil engineering division and are working closely with EDF on its existing nuclear fleet, and on the GDA process in the UK.

Certain areas within the supply chain have been identified as potential bottlenecks. For instance, Japan Steel Works is the only manufacturer of ultra large forgings[12], and a global increase in demand will place pressure on the firm to deliver orders on time. Other potential pinch points include pressure vessels, valves and pipes.

- **Skills shortages**: Given the long lead times of nuclear, this is unlikely to pose a problem provided the Government and industry continue to invest in and retain skills. As a result of the power sector's recruitment drive in the 1980s and the country's existing nuclear fleet, the UK has a strong and competent workforce capable of handling all areas of decommissioning.

  Encouraging more students to study science and engineering would increase the base of relevant skills. The Skill Academies have increased efforts on apprenticeship programmes, developing nuclear skills 'passports' to help staff move easily between different projects. Nuclear postgraduate courses are also being offered at universities including the University of Manchester and Imperial College London.

  A clear signal from the nuclear industry showing their commitment to build new nuclear plants in the UK and emerging job opportunities in the sector, should encourage more students to take up relevant training. Given the global supply of skilled engineers, labour mobility would help address short-term shortfalls. To this

[10] The 2009 Budget set aside £405 million to support low-carbon industries and advanced green manufacturing http://www.hm-treasury.gov.uk/d/Budget2009/bud09_chapter7_193.pdf

[11] NAMTEC (2008), *A supply chain for a new nuclear build programme.*

[12] Forging is a special fireplace, hearth or furnace in which metal is heated before shaping. Anecdotal evidence suggests that UK based firms are looking to enter the market.

end, the Nuclear Skills Passport being developed by the National Skills Academy (in partnership with industry) will ensure that skills are easily transferrable across the nuclear industry, and that new employees meet the required safety standards.

5. CONSTRAINTS ON THE 'IDEAL' TRAJECTORY AND IMPACT OF THESE CONSTRAINTS

There are certain constraints that may prevent the first plant being operational by 2018:

- **Judicial review**. If there is the belief that there are flaws in the framework established by the Government, for example, in the remit of the IPC and its subsequent decisions, it could face a legal challenge in the form of a judicial review. Based on past evidence,[13] this could lead to a delay of anywhere between 9-18 months. A successful judicial review may also lead to subsequent changes to the Government's regulatory framework that would further delay the timeline. If the risk of a judicial review is perceived to be lower in other countries then there is a possibility that investment could be diverted.

  Areas at risk of legal challenge include waste funding, the National Policy Statement, site selection and the Justification process. If Government policy is robust and based on sound analysis, the risk of a judicial review can be mitigated.

- **Planning and regulation.** There is a risk that certain regulatory milestones may slip, or alternatively may not be completed in their envisaged form. The GDA needs to be completed to a certain quality such that the site-licensing takes one year or less. There is a risk that the IPC may not function as envisioned, or it may take longer than expected to approve applications. The NPS needs to clearly define the role of the IPC and provide it with enough resources to handle a large number of applications. The IPC would be considering applications from across the energy sector (for example new wind farms). Thus, it would need significant resources to ensure it remains effective and is able to make timely decisions. Insufficient resources to handle applications could delay the timeline by between 1.5 to 2 years, alone pushing a new plant into the 2020s. This could also potentially drive away investment if nuclear operators lose confidence in the UK planning system.

  In terms of the Strategic Siting Assessment (SSA), we note that a risk of a site-specific challenge still exists. To mitigate this risk, local issues must be addressed both through the Government consultation on proposed sites, and by operators engaging with local communities.

- **Transmission.** As discussed in Chapter 4 of our First Progress Report, large amounts of grid infrastructure will be required over the next decade to support growing levels of generation.[14] In areas where there will be new nuclear alongside strong growth in wind, transmission companies will need to ensure that appropriate reinforcements are made to accommodate both types of generation.

[13] Greenpeace challenged the Government's consultation on the role of new nuclear in the Energy Review in 2006/7.

[14] http://www.ensg.gov.uk/index.php?article=126

6. CONCLUSIONS

There are number of actions that the Government is taking to establish a robust enabling framework to help deliver investment in new nuclear capacity in the UK. These must be delivered robustly to avoid unnecessary delays. Elements of the framework include:

1. Generic Design Assessment
2. Strategic Siting Assessment
3. Planning Reform (National Policy Statement and Infrastructure Planning Commission)
4. Regulatory Justification
5. Regulations for a Funded Decommissioning Programme

In conjunction with the enabling framework being put in place by Government, operators will need to deliver on a number of fronts to ensure the timely deployment of nuclear by 2018. Operators need to ensure planning applications are fully consulted on and robust to minimise delays, and need to continuously engage with the supply chain to ensure contracts are in place and companies meet the high safety standards required in the nuclear industry. Operators also need to invest in the training and development of their workforces and provide sufficient opportunities for them to develop their skills base.

There are certain risks that may delay the rollout of new nuclear including:

1. Judicial review could lead to a delay of anywhere between 9-18 months, and possibly result in projects being abandoned.
2. Existing regulatory milestones may slip, or alternatively may not be completed in their envisaged form. Besides delaying the timeline, this would also add to investment uncertainty.
3. Timely investments in transmission capacity are required to support growing levels of generation.

With the right signals from the nuclear industry and a clear commitment to invest, given the long lead times for nuclear and labour mobility, the supply chain should mobilise in time to support deployment so that a shortage of skilled workers is unlikely to pose a problem. We will actively monitor risks around the enabling framework and project implementation, and will cover both of these aspects as part of our wider monitoring exercise, as set out in Table 1 below.

Table 1: Nuclear indicators

	Budget 1	Budget 2	Budget 3
Nuclear			
Regulatory Justification process	2010		
Generic Design Assessment	2011		
National Policy Statement for nuclear (including Strategic Siting	2010		
Regulations for a Funded Decommissioning Programme in place	2010		
Entering planning	first planning application in 2010	subsequent applications at 18 month intervals	
Planning approval; site development and preliminary works begin	first approval and site development and preliminary works begin in 2011	subsequent application approvals, site development and preliminary works at 18 month intervals	
Construction begins		first plant in 2013, subsequent plants at 18 month intervals	
Plant begins operation			first plant in 2018, with subsequent plants at 18 month intervals*
Other drivers			
Nuclear outages			
Nuclear supply chain, availability of skilled staff			
Planning approval rates and frequency of public inquiries to decisions of Infrastructure Planning Commission			
* Up to 3 new nuclear plants by 2022.			

Key

Headline Indicators | Implementation indicators | Forward indicators | Milestones | Other drivers

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