Energy Review – Nuclear Proposals

Proposal

The Energy Review should make a positive statement about the role a new generation of nuclear power stations could have in achieving the Government's climate change and security of supply goals. The Review should say that under likely scenarios for gas and carbon prices nuclear power would yield economic benefits in terms of carbon reduction and security of supply.

It will be for the private sector to initiate, fund, construct and operate any new nuclear power station and to cover the costs of decommissioning and their full share of long-term waste management. But the Review should commit the Government to:

- taking "facilitative" measures to reduce regulatory risk in the planning and licensing processes

- establishing a clear strategy and timetable for dealing with decommissioning and waste

- undertaking further assessment to assist developers in identifying the most suitable sites for new build (Industry has indicated that the most viable sites for new build are likely to be adjacent to existing nuclear generating plant).

In particular, on planning, we will set out a clear framework for the consideration of the relevant issues for nuclear new build and the context in which any planning inquiries should be held. This framework will be set out in a White Paper to be published around the turn of the year. To support preparation of this White Paper, Government is consulting on the proposed framework.

We also propose that Departments will consider the case for economic incentives for nuclear power with a view to HMT considering their analysis on the Climate Change Levy (CCL) treatment of nuclear as part of the PBR/Budget cycle. Treasury Ministers will take decisions as part of the normal PBR/ Budget timetable.

Carbon is an important consideration for nuclear. The Review proposals on carbon are covered in detail in a separate paper. The main elements are summarised in the following two paragraphs.

A strong and credible EU ETS will help to generate a carbon price that is sufficiently high and reliable to build investor confidence that investments in low carbon technologies, including nuclear generation, will earn acceptable long-term returns. That is why we are recommending that Government reaffirms its commitment to the EU ETS, including setting out how it would like to see the scheme evolve, in order to create clear, long-term incentives for investment in low carbon technologies and to ensure its future effectiveness as a long-term mechanism for securing emissions reductions across the EU. .

However, uncertainties for investors are inherent within the EU ETS, and hence we are also recommending that the Government announces its commitment to ensure a value will continue to be attributed to carbon in the UK, with a strong preference for the EU ETS to deliver this, but announcing that it will keep open the option of taking further measures, if necessary, to reinforce the operation of the EU ETS in the UK (see paper on carbon market mechanisms policy proposals).

Background

The 2003 "Our Energy Future" White Paper noted that nuclear power is currently an important source of carbon free electricity in the UK, but said that the "current economics of nuclear power make it an unattractive option for new generating capacity" and noted there are "important issues for nuclear waste to be resolved." Since the publication of the White Paper the economics of building nuclear power stations compared to other energy sources have changed. We now expect gas prices to be significantly higher, and the development of the EU Emissions Trading Scheme is beginning to attach a carbon price to emissions from gas and coal power generation that reflects their environmental impacts. Together these developments are making new nuclear investment potentially commercially viable.

Work is underway to tackle the legacy of nuclear waste. The Nuclear Decommissioning Authority (NDA) is setting a UK-wide strategy for more effective decommissioning and clean up of its sites. The Committee on Radioactive Waste Management (CoRWM) was established in the second half of 2003 to make recommendations on the best options for the long-term management of the UK's higher activity radioactive waste. CoRWM produced interim recommendations in April. In these, CoRWM concluded that deep geological disposal in a repository is the best available approach for the long-term management of waste, and that a programme of interim storage (already planned by the NDA as part of its strategy) is required. While CoRWM has no position on the desirability or otherwise of nuclear new build, CoRWM has confirmed that waste from any new build programme could be accommodated technically within

the options that they are evaluating.[1] CoRWM's final report will be published in July, and Government's response to the report will set out how work to develop a long term waste solution will be taken forward.

Nuclear's current contribution to the UK and global energy mix

Worldwide, there are over 440 nuclear reactors in more than 25 different countries. These power stations generate 16% of the world's electricity generation capacity[2].

There are currently 12 nuclear power stations operating in the UK, providing 19% of the UK's electricity generation capacity. The UK share is likely to decrease to 7% by 2020, although plant refurbishment projects and the scope for potential lifetime extensions could serve to extend the period over which closures of nuclear plants take place.

However, there remains some uncertainty over how long the current nuclear power stations will remain in operation. British Energy (BE), as the operator of those stations most likely to be technically capable of extended operation, must seek approval from the Nuclear Decommissioning Authority and Government to operate beyond the stated accounting lives. BE would make a decision on whether to submit an application for approval based on their estimates that extensions would be economically viable. There are also some technical limitations on the extended operation of plant.

A central estimate of the potential for life extensions for plant that have not yet had life extensions is that they continue to operate for an additional five years over and above their current accounting lives. This is the assumption that the City is making, and British Energy have not corrected this. Any life extensions would help mitigate the decline in low-carbon generation in the period towards the end of the next decade. Based on this assumption, emissions would be about 4MtC lower in 2015/16 than otherwise.

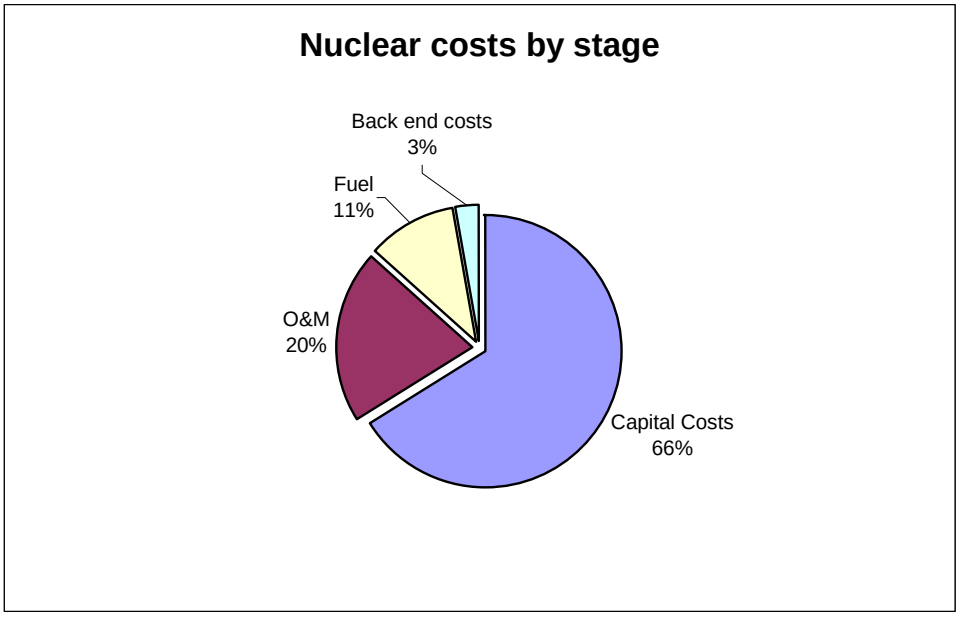
REDACTED MATERIAL

The Economics of Nuclear Power

The cost profile of nuclear power is different from that of most other generating technologies. The graph below shows the levelised cost of nuclear power, i.e. average cost per megawatt hour over the life of the plant. The majority of nuclear costs are capital, reflecting the complexity of the construction of the plant. By

[1] CoRWM draft recommendations www.corwm.org.uk
[2] World Nuclear Organisation; www.world-nuclear.org

contrast, the fuel cost is low. This is in stark contrast to the profile for gas. For example, the largest component of the levelised cost for a gas plant is fuel at 71% whereas the capital cost is only 20% of the overall cost. The fact that the capital costs are so high as a proportion of the overall nuclear costs is what makes it so important to remove regulatory uncertainties for any future nuclear project. Delays once capital has been committed can dramatically affect the economics. In contrast, the economics of gas plants are much more susceptible to changes in fuel costs because of the relatively low proportion of capital costs. Furthermore nuclear power has the additional costs of spent fuel and decommissioning. Our current analysis suggests that this may only represent around 3% of the overall project life costs, but additional work is required to understand these costs further.



Source: DTI analysis 2006

Cost Benefit Analysis for Nuclear Generation

The economics of new nuclear build depend on expectations about future gas and carbon prices, as well as expected costs of building, operating, decommissioning and dealing with the waste of a new nuclear plant. The Energy Review has modelled a number of scenarios.

The central gas price scenario (36p/therm) models a world where the current market situation prevails, and the gas price remains linked to the oil price. Whereas the gas price has been around 20 pence / therm on average over the last decade, the average price in 2005 was 42 pence / therm. Going forward the central gas price is expected to remain high by historical standards, in line with expectations on the oil

price. The high gas price scenario models a world where there is a significant increase in the oil price. The low gas price scenario models a world where there is increased competition in the gas market, resulting in decoupling of the gas price from the oil price, and a falling of the gas price towards marginal cost.

Regarding carbon prices, the range covered in the analysis models worlds where:

- there is no commitment to carbon reduction (then the carbon price is €0 / tonne);
- there is some commitment, but carbon reduction targets are such that abatement costs remain low (€15 / tonne);
- there is ongoing commitment to carbon reduction, resulting in a carbon price in line with the EU ETS market price (€25 / tonne);
- there is ongoing commitment to carbon reduction, with tightening targets resulting in increased abatement costs (€36 / tonne).

The cost of new nuclear power generation is assumed to be around £38 / MWh, as a central case. However, we have also considered high case of (£44 / MWh) and a low case of (£30 / MWh). The main cost drivers are construction and financing costs, giving an assumed capital cost of £23 / MWh in the central case[3]. Other categories of cost are small in comparison: fuel costs are around £4 / MWh, and Operation and Maintenance costs are roughly £8 / MWh. Back end costs (decommissioning and waste recycling), whilst potentially of a large order of magnitude far into the future, would need only a relatively small annual contribution over time to ensure that the required amount is available. No decisions have been taken on the specific mechanism required. We describe how we plan to ensure adequate provision is made by the private sector for decommissioning and waste in a later section.

Gas fired generation has a narrow cost advantage over new nuclear generation in the central gas price scenario, and this advantage becomes greater as the gas price falls and / or the nuclear cost increases. Nuclear generation has a cost advantage in a high gas price scenario and in a low nuclear cost scenario. Nuclear also offers benefits in terms of reduced carbon emissions and reliance on gas.

The Review team have undertaken a cost-benefit analysis, taking account of the rise in fossil fuel prices (and projected prices) and the assessment of a carbon price. Under some scenarios (e.g. low gas prices and low or zero carbon price), the analysis for nuclear is unfavourable. However, their overall judgement is that we should place more weight on those scenarios where long term prices have settled around a central case or higher and where carbon prices reflect the kind of levels we would expect to see in a world where the international community

[3] To note, this assumption is higher than the capital cost for the project currently under implementation to add a new nuclear plant in Finland.

demonstrates sustained commitment to tackling climate change. Based on this, the economics of nuclear now look more positive.

For the central scenario (gas prices of 36p/therm and carbon price of €36/tCO2) the economics of nuclear remain robust for generating costs up to £43/MWh. This is well above the forecast cost of power generated from the Finnish nuclear project currently under construction, by a margin that far exceeds any historical cost overruns associated with nuclear projects, e.g. Sizewell. The benefits of nuclear, in terms of carbon emissions and security of supply, will accrue further where either the carbon or the gas price increases. Table 1, below, shows the scenarios where nuclear is economic:

Table 1: nuclear generation welfare balance under alternative gas price, carbon price and nuclear cost scenarios, £ / GW

	Low gas price	Central gas, high nuclear	Central gas price	Central gas, low nuclear	High gas price
Carbon price = €0/tCO2	-2100	-1400	-400	**900**	**1400**
Carbon price = €15/tCO2	-1500	-900	**200**	**1400**	**2000**
Carbon price = €25/tCO2	-1100	-500	**600**	**1800**	**2400**
Carbon price = €36/tCO2	-700	0	**1000**	**2300**	**2800**

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Nuclear waste

The UK has a historic legacy of nuclear waste that it is estimated will total 475,000m³ (high and intermediate level). Similar to France, the UK's legacy nuclear wastes include a complex mix of waste forms from both the civil and military programmes which increases the technical challenges in conditioning them for ultimate disposal. Through the NDA, and the nature of the ownership of the current civil nuclear industry, the public sector is ultimately responsible for delivering and paying for a long term waste management solution. The private

sector would pay its full share of the costs of long term waste management arising from any new nuclear build.

Modern nuclear plants produce significantly less waste than earlier generations of nuclear reactors. CoRWM's inventory study suggests that if the current level of nuclear capacity were replaced with new build, existing waste stocks would increase by about 10% by volume. Storage and geological disposal of both legacy and any new wastes would have to meet regulatory requirements to ensure short and long term safety and environmental protection.

U**ranium**

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As highlighted above, increases in the price of fuel will have a relatively minor effect on the economics of nuclear, because fuel costs represent only approximately 10% of the levelised cost[4]. A doubling of uranium prices would have a minor impact on final fuel costs and overall generation costs[5].

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Where might new nuclear stations be built?

Industry has indicated that the most viable sites for new build are likely to be adjacent to existing nuclear generating plant. The Review's preliminary assessment is that there is there is sufficient space on these sites to support a new build programme capable of replacing the current nuclear generating capacity. We will undertake further assessment which will help developers in identifying the most suitable sites, but it will be up the potential participants of new build to discuss with the owners appropriate access to suitable sites. Government will monitor whether an appropriate market in suitable sites is developing.

At existing sites in England we expect that it would be possible to install an additional 12.8GW (our current capacity is 12GW) without major controversial grid upgrades on land adjacent to the existing stations.[6] There is further capacity for 4.8GW in Wales and Scotland, although devolution issues require

[4] DTI analysis 2006
[5] As above
[6] In some cases this would require existing plant to close before new plant could open. However, based on expected lifetimes of existing plant, and plausible timescales for new build, this would not impact on the delivery of new stations.

consideration. In Scotland, the powers under the Electricity Act to grant consent for all power stations >50MW are exercised by Scottish Ministers who would therefore have to approve any proposals for new build. In Wales, the Secretary of State for Trade Industry exercises the Electricity Act powers, but planning inquiries would be held against a background of anti-nuclear statements by the Welsh Assembly Government.

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Facilitative Measures

Despite the positive indications from the cost benefit analysis, and signals from potential developers that there is appetite for new build, it is clear that developers will not come forward with new build proposals without greater certainty over the planning and regulatory processes, including on the issues of waste and decommissioning. The Government needs to take steps to reduce this uncertainty and remove regulatory barriers if developers are to consider nuclear as a viable option alongside other generating technologies. We propose the following measures.

Carbon

A strong carbon price signal is an essential element of the economics of low carbon forms of generation, including nuclear. Given the UK currently faces a substantive energy investment challenge, with approximately 30% of current electricity generation capacity to retire over the next two decades, it is essential that the right policy framework is in place to incentivise investment that is both timely and of a low carbon nature.

A strong and credible EU ETS will help to generate a carbon price that is sufficiently high and reliable to build investor confidence that investments in low carbon technologies, including nuclear generation, will earn acceptable long-term returns. That is why we are recommending that Government reaffirms its commitment to the EU ETS, including setting out how it would like to see the scheme evolve, in order to create clear, long-term incentives for investment in low carbon technologies and to ensure its future effectiveness as a long-term mechanism for securing emissions reductions across the EU. .

However, uncertainties for investors are inherent within the EU ETS, and hence we are also recommending that the Government announces its commitment to ensure a value will continue to be attributed to carbon in the UK, with a strong preference for the EU ETS to deliver this, but announcing that it will keep open the option of

taking further measures, if necessary, to reinforce the operation of the EU ETS in the UK (see paper on carbon market mechanisms policy proposals).

We also propose that Departments will consider the case for economic incentives for nuclear power with a view to HMT considering their analysis on the CCL treatment of nuclear as part of the PBR/Budget cycle. Treasury Ministers will take decisions as part of the normal PBR/ Budget timetable.

Pre-Licensing

As recommended by the IAEA International Regulatory Review Service, the NII has proposed introducing a new multi-stage design authorisation process to give developers certainty early in the process that a reactor design is licensable in the UK without significant modifications when the final site licence application is made. This process is expected to take three years per design, with incremental burdens on HSE resourcing during this period, but it would be possible for the HSE to consider multiple designs concurrently. It is expected that the costs for design authorisation assessments would be recovered from the applicant; HSE estimate a design assessment to cost between £5 and £10 million. However, Government should be ready to provide additional funding during initial phases so the HSE can gather the necessary expertise to begin considering power station designs. These costs could be passed through in licence fees. An expert report from the HSE/NII on pre-licensing was published on 28 June 2006; the executive summary is attached at Annex 3.

We would propose as part of the Energy Review outcome to ask HSE/NII to take forward the work necessary to implement this new design authorisation process.

For developers, this would create more certainty that by the time they incur the significant costs of securing planning permission (in the quantum of hundreds of millions), the safety regulator would not seek to impose expensive design modifications. The site licence process would focus on the organisation's capability to operate a nuclear plant and any necessary site-specific modifications.

Planning

The recommendations on streamlining the planning process for all new energy infrastructure is outlined in detail in the Review recommendations on planning. As part of this, there is a "no-regrets" option that would further help reduce risk and uncertainty in the context of nuclear. This option could be pursued without prejudicing any further action in the context of the Barker and Eddington Reviews (see below).

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Waste and Decommissioning

Satisfactory arrangements will need to be established for dealing with the costs of decommissioning and waste from nuclear new build. Government will need to be satisfied that participants in nuclear new build have put in place an appropriate structure to deal with these costs. It is important that proposals are sufficiently robust, particularly given that in order to comply with its international obligations for nuclear safety Government must bear the responsibility for the management (or disposal) of radioactive waste and spent fuel in the event that no other party is able to discharge those obligations.

We propose that Government should engage with industry and other experts to develop arrangements for managing these costs based on the principles set out below. The first step will be for Government (with the support of the NDA) and industry to have a common understanding of the likely costs of decommissioning and waste management. Industry participants will need to meet the financial requirements established by the Government's decommissioning and waste frameworks even in challenging downside scenarios.

Depending on the detail of any arrangements on decommissioning, primary legislation may be necessary to ensure that arrangements are robust, and taxpayers' interests are protected. State Aid approval may also be necessary.

In the case of waste disposal costs it is recognised there will need to be a mechanism that shares the burden between the existing legacy wastes and the cost arising from nuclear new build.

The cost uncertainties are greater on waste. Absolute clarity on costs will not be possible until it has been decided, in response to the CoRWM report, whether to build a deep underground repository, a site has been selected and extensive geological assessments have been completed. As with decommissioning, legislation and State Aid approval may be necessary.

Our suggested approach will be that the Government publishes its response to CORWM separately, rather than as part of the Energy Review. This response will need to set out how the Government intends to implement the decision on developing a final solution for waste disposal.

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