

## Special Comment

# Moody's Global Project Finance

May 2008

## Decommissioning and Waste Costs for a New Generation of Nuclear Power Stations

### Summary

Following an extended debate and a recent public consultation exercise<sup>1</sup>, the United Kingdom Government has announced that private sector companies will be allowed to build a new generation of nuclear power stations.

Government's approach is based upon the premise that new nuclear generation is commercially viable and will not require any form of regulatory or commercial support or incentives; operators will be expected to bear risks typical for projects of this type including those associated with radioactive waste and decommissioning.

Operators will however be required to pre-fund expected nuclear waste and decommissioning liabilities and the proposed model provides a high degree of transparency and external supervision by independent trustees and the Government. This provides assurance that operators will have the resources to meet waste and decommissioning liabilities as they fall due and comfort that there will be independent scrutiny of the arrangements; this may be considered critical for newly established operators.

We note that Government has decided to offer operators a fixed price for the future disposal of radioactive waste. This is positive from a credit perspective. Moody's believes that the uncertainty would otherwise have been particularly high and equity providers and lenders would have required a significant risk premium.

In this report, we summarise the background to Government's decision to allow the development of new nuclear power stations and comment further on the decommissioning and waste proposals. We consider whether they achieve the desired objective in ensuring that operators will bear the full costs of their activities and the possible consequences for the companies involved. Finally, in an appendix, we provide a summary of the proposals.

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<sup>1</sup> "The Future of Nuclear Power – The Role of Nuclear Power in a Low Carbon UK Economy", DTI, May 2007



## Decommissioning and Waste Costs for a New Generation of Nuclear Power Stations

### Why Nuclear Power?

There are a number of important drivers behind Government's decision:

1. Significant need for new capacity - the UK has around 76GW of generating capacity<sup>2</sup> to meet annual consumption of about 350TWh and peak demand of 63GW but it is estimated that 23GW of this capacity will close by 2020<sup>3</sup> and that 30 to 35GW of new capacity will be required over the next two decades;
2. Declining domestic fuel supplies - oil and gas production peaked in 1999 and coal production is falling;
3. Government's commitment to meeting ambitious EU targets for reductions in greenhouse gases - nuclear power produces about the same level of greenhouse gas emissions as wind power and, unlike wind, is capable of providing baseload supply;
4. Cost considerations - the cost of nuclear energy is estimated to be comparable with the cost of electricity generated by modern CCGT power stations<sup>4</sup>; and
5. proposals have been developed for dealing with high and intermediate level waste<sup>5</sup>.

Security of supply is a key consideration in the development of nuclear power in the UK and elsewhere but new nuclear power stations will be as reliant on imported fuel as CCGT plants, the benefit will be simply in terms of diversification. We note also that there is some debate as to the quantum of economically recoverable uranium reserves and, given the expected growth in demand, how long supplies may last.

### The Timetable

Enabling legislation (the Energy Act 2008) was introduced into Parliament in January of this year. An assessment of potential sites is currently being carried out together with a generic design review process intended to pre-approve a number of commercially available reactor types. Government is also taking steps to streamline the planning process.

As shown below, Government believes that new nuclear power stations could be operational by 2019 although Moody's believes that the complexity should not be underestimated and that Government views on both timing and cost may prove to be optimistic. Construction of the Olkiluoto 3 nuclear power plant in Finland is reported to be two years behind schedule and Government's assumed construction cost of £1,250/kW is significantly below other estimates that go as high as £2,500 to £3,000/kW.

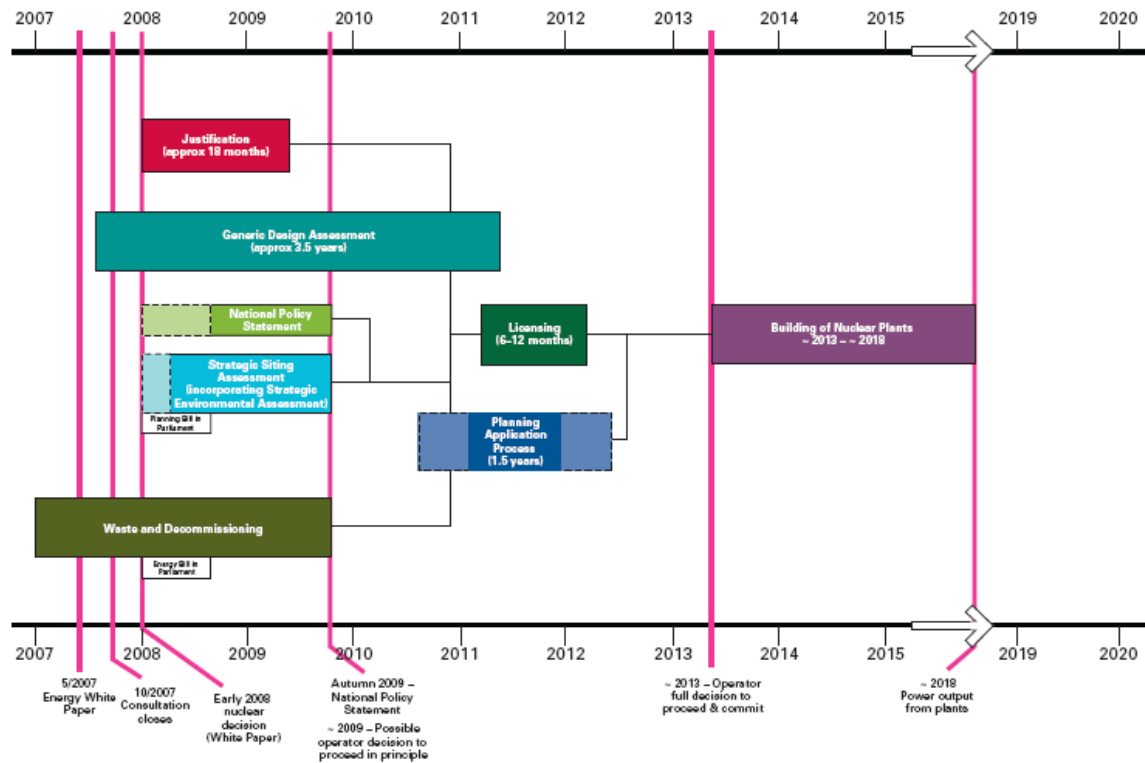
<sup>2</sup> The watt is the SI unit of power. One kilowatt (symbol kW) is equal to one thousand watts, one megawatt (MW) is equal to one million watts, one gigawatt (GW) is equal to one thousand million watts and one terawatt (TW) is equal to one million million watts. A new nuclear power station might generate 13,000 gigawatt hours (GWh) of electricity in a year and the average annual electricity consumption for a household in London is around 4,300 kilowatt hours (kWh) (source: Digest of United Kingdom Energy Statistics 2007). A nuclear power station might therefore supply more than three million homes.

<sup>3</sup> The UK currently has nuclear generating capacity of approximately 11GW but this is expected to fall below 4GW by 2015 and 1GW by 2025 as stations reach the end of their operating lives. In addition, the EU Large Combustion Plant Directive imposes a number of constraints on coal and oil fired power stations requiring around 11GW of capacity to close by 2015 and restricting the operation of a further 20GW of capacity post 2016

<sup>4</sup> "The Future of Nuclear Power – The Role of Nuclear Power in a Low Carbon UK Economy", DTI, May 2007

<sup>5</sup> "Managing Radioactive Waste Safely – A framework for implementing geological disposal", Defra et al, June 2007

## Decommissioning and Waste Costs for a New Generation of Nuclear Power Stations

*Proposed Programme for Nuclear Development*

Source: BERR<sup>6</sup>

## Decommissioning and Waste Proposals

Government's proposals are set out in a White Paper<sup>4</sup> (a consultation document) and related guidance<sup>7</sup> and described in some detail in Appendix A to this report but, in summary, the operator of a new nuclear power station will be required to submit a plan (the "Funded Decommissioning Plan", or "FDP") to the Secretary of State describing in detail the steps that they will take to manage and dispose of radioactive waste and in decommissioning the facility at the end of its life. The operator will further be required to set aside funds to cover these costs over the life of the power station and, it is anticipated, these funds will be held in one or more segregated funds managed by independent trustees. The operator will determine the investment policy for the fund(s) but the trustees will set the contribution schedule so that there will be adequate resources to meet the expected costs as they fall due.

The liabilities and the amount(s) set aside in the fund(s) will be subject to periodic reviews by the operator and fund trustees. Trustees will be able to require the company to increase its contributions if investment returns are lower than expected or it otherwise appears likely that there will not be enough funding to meet the expected liabilities. In addition, the Secretary of State will be able to make changes to a previously agreed Funded Decommissioning Plan to require, for example, the operator to make additional contributions if this is necessary following a change in decommissioning practices.

Government's planning in this matter is related to the fact that, where no other party takes responsibility and under international treaties<sup>8</sup>, Government is responsible for the costs of dealing with radioactive waste. This subject will no doubt be fresh in the Government's mind as it recently agreed to underwrite costs estimated at £5.3 billion as part of the restructuring of British Energy<sup>9</sup>.

<sup>6</sup> "Meeting the Energy Challenge, A White Paper on Nuclear Power", January 2008, BERR

<sup>7</sup> "Consultation on Funded Decommissioning Programme Guidance for New Nuclear Power Stations", February 2008, BERR

<sup>8</sup> 1957 Euratom Treaty, 1996 Convention on Nuclear Safety and other agreements

<sup>9</sup> "The Restructuring of British Energy", House of Commons Committee of Public Accounts, July 2007

## Decommissioning and Waste Costs for a New Generation of Nuclear Power Stations

### Moody's Comments on the Proposals

#### *Requiring operators to set aside funds to meet future nuclear liabilities is sensible*

Funds to cover decommissioning costs are currently being set aside in most countries with nuclear power programmes<sup>10</sup> although there are a number of different models including funding from government, internal segregated or non-segregated funds and (as proposed for the UK) external segregated funds. The envisaged reporting requirements would provide transparency that is not available under other systems<sup>11</sup> and, together with independent trustees, comfort that an operator was making proper provision for future liabilities.

#### *But it does not fully protect against the collapse of an operator*

Requiring operators to build up funds clearly reduces the risk that Government will be required to step in to cover costs in the future.

Accepting the above, the proposed arrangements do not eliminate the risk of a British Energy style collapse and the difficult choices that Government faced at that time (see box below). An operator may still fail, the reserves that have built up in the fund may then be insufficient to meet the costs of disposing of the waste and decommissioning the facility and, in any event, supply or other considerations may dictate that the plant must remain operational. Government may again be left with little choice but to support another bail-out.

The White Paper suggests that Government could only be called upon to step in during extreme circumstances, it is not clear from what has been proposed that this will be the case.

#### **British Energy**

British Energy Group plc ("BE" rated Ba2/stable outlook) is the largest electricity generator in the United Kingdom. Its eight nuclear power stations generate approximately 20 per cent of the electricity used in England and Wales and half of that used in Scotland. The formerly state owned company was privatised in 1996 raising a total of £2.1 billion for the Government.

The company's performance following privatization was good, it made a number of acquisitions in the UK and overseas and its share price increased significantly. However, it subsequently got into difficulties following changes in the UK electricity market leading to declining prices and after a series of prolonged and unplanned outages at a number of its plants. BE was forced to approach the Government for help in September 2002.

Government does not usually bail out failing private sector companies but allowing BE to collapse was not really a serious option. Whilst there was (and is) spare generating capacity, the loss of such a large volume would have left the system vulnerable during periods of peak demand. There were also concerns about nuclear safety if the company was to enter administration and, if the company failed, then Government would have had to assume liability for the waste and decommissioning costs.

As part of a restructuring involving a debt for equity swap, the Government agreed to underwrite nuclear liabilities valued at £5.3 billion<sup>12</sup>.

#### *Powers to require operators to increase payments into the fund may be of limited value*

As described above, the White Paper envisages a dynamic rather than a static regime whereby the Secretary of State and the trustees monitor the financial health of the operator, any credit support that may have been provided, the expected liabilities and costs and the performance of the fund(s) relative to the liabilities. It is envisaged that Government and the trustees will have the ability to step in to try and prevent a potential problem as it develops and this is sensible. However trying to increase payments into the decommissioning and waste funds by a troubled operator may create further financial distress and in these circumstances would it necessarily be in the interest of the Government or the trustees to do so?

<sup>10</sup> "Decommissioning Funding: Ethics, Implementation, Uncertainties", Nuclear Energy Agency

<sup>11</sup> See "Moody's Analytical Adjustments for Nuclear Energy Liabilities in EMEA" for a general discussion on nuclear waste policy and disclosure

<sup>12</sup> "The Restructuring of British Energy", House of Commons Committee of Public Accounts, July 2007

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By way of illustration, one of the most significant risks that a nuclear operator faces is that of an extended outage and whilst these are typically resolved within 30 days it has been known for them to stretch beyond two years and, in such circumstances, it may be better to allow an operator who has missed scheduled contributions or cannot make increased contributions into the fund to continue than to push it into administration.

Accepting the above, it is of course better for Government and trustees to have the power to act if circumstances change even if they subsequently choose not to use those powers.

### *Could Government be better protected?*

Government could require operators to pre-fund the full amount of the expected waste and decommissioning costs before any fuel is loaded into the reactor of a new nuclear power station. Alternatively, operators could be required to cover their obligations in full with letters of credit issued by highly rated financial institutions. In both cases there could be near certainty that costs would be covered in all circumstances and it would be correct to say that Government would only be called upon in extreme circumstances (although the estimated costs may clearly change over time).

Whilst the above approach would provide welcome certainty, it would also increase the costs and reduce the expected returns for operators. We discussed the drivers behind Government's decision to "allow" the private sector to build new nuclear power stations above but the reality seems to be that Government needs new nuclear power stations. The pragmatic rather than bullet-proof approach that has been adopted may simply reflect this need and a desire to encourage the private sector to take the lead.

We note that Government proposes to consider developer's proposals on a case by case basis and this is very sensible; what might be considered appropriate for a new nuclear power station being built by a large and diversified utility is likely to be very different to what might be considered reasonable for a facility being developed on a stand-alone basis by a special purpose vehicle owned perhaps by a broad consortium. In Moody's view, the credit standing of the operator and any guarantors should be an important consideration as significantly greater reliance can be placed on the ability of a lower risk or well rated operator or guarantor to contribute additional funds towards decommissioning and waste costs in future years. The Consultation Paper considers credit ratings in the context of guarantors but does not focus on the credit standing of the operators, a critical factor in Moody's analysis.

### *What do the proposals mean for operators?*

The proposed arrangements would make building and operating a new nuclear power station more expensive and more complicated but nuclear power is not for the faint hearted!

Building a new nuclear power station on a limited recourse, project finance, basis appears likely to be challenging. It is not clear that suppliers will be willing to offer the sort of fixed price, date certain construction contract typically seen in project finance transactions, or that (absent a strong industry sponsor) the project company would be able to enter into the long-term offtake arrangements that lenders are likely to seek to mitigate the high operational gearing and other risks. Proposals to fix the costs associated with radioactive waste are helpful in a project finance context but the proposed ability for Government to change an agreed decommissioning plan, potentially imposing additional costs on operators, is not.

Finally, Government has proposed making "associated" companies liable for any shortfall in decommissioning and waste funds and this would serve to limit the value of a project finance approach (we note however that there are a number of ways in which transactions might be structured to obfuscate the economic interest of the parties).

For large and diversified utility companies, Moody's recognises that nuclear power can represent an important element of their overall power generation capacity/suite although as with any significant new build project there will be an increase in business and operating risk attributable to the size and complexity of the project, the long-term nature of the construction cycle, the uncertainties associated with all-in costs. Overall, for the larger companies, Moody's considers such risks should be manageable, with the cost of any one new station likely to be absorbable in the context of their ongoing investment programmes.



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### Appendix A - Government Funded Decommissioning Proposals

To ensure that the operators of new nuclear plants make adequate provision for the costs of dealing with waste and decommissioning, the White Paper and related guidance envisages that they will be required to provide the Secretary of State with:

1. a Decommissioning and Waste Management Plan; and
2. a Funding Arrangement Plan.

The Decommissioning and Waste Management Plan and the Funding Arrangement Plan together will constitute the operator's Funded Decommissioning Programme. This programme must be approved by the Secretary of State and the White Paper notes that approval may be given subject to modifications or conditions. Recognising the need for specialist advice, Government intends to establish the Nuclear Liabilities Financing Assurance Board ("NLFAB") which will comprise a small group of experts that will provide independent scrutiny of the proposals submitted by operators.

It will be a criminal offence to construct or operate a nuclear power station without an approved programme, to fail to adhere to an approved programme, to fail to provide the Secretary of State with relevant information or to provide false information.

#### *The Decommissioning and Waste Management Plan*

The Decommissioning and Waste Management Plan ("DWMP") will set out the steps that operators expect to take in managing and disposing of waste and spent fuel and in decommissioning the station at the end of its life and meeting the associated costs.

The White Paper provides operators with guidance for developing a DWMP in the form of a generic plan or "Base Case" which sets out the key points that Government would expect to be addressed. Plans are expected to cover each stage on the station's life, from permitting through to decommissioning and site clearance and to describe how waste will be dealt with at each stage. Proposals are required to be sufficiently detailed to allow each element of the work to be costed.

Operators will be required to submit a DWMP to the Secretary of State for approval before construction of any new facility begins. There will additionally be a requirement for ongoing monitoring and reporting to ensure that the plan remains up to date and operators will be required to seek re-approval of their plan if they propose to change the way in which they will handle waste or decommission the site. Operators will also be required to seek re-approval following any change of ownership or control.

#### *The Funding Arrangement Plan*

The Funding Arrangement Plan ("FAP") will set out the operators' proposals for meeting the decommissioning and waste costs identified in the DWMP and it is expected that this will be through one or more funds to be built up during the life of the facility. Operators are required to set out in their FAP the precise details of how these fund(s) will be structured and operated and the White Paper describes Government's expectations as summarised below.

#### *Fund Structure*

The funds are to be independent of both the operator and the Government. It is proposed that there will be independent trustees (or equivalent) who will be expected to act with due skill and care in the best interests of the fund(s). Monies that accumulate will only be available to meet decommissioning, waste management and waste disposal costs (until all such costs have been met) and it is expected that the funds will be ring-fenced so that *inter alia* they are insulated from credit events at the operator level.

There may be a single fund or a number of funds covering a single facility or a fleet of nuclear power stations but the Consultation Paper anticipates that there will be segregation between funding for individual stations

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and funding for, firstly, decommissioning and waste management costs and, secondly, for the waste disposal costs that will be payable to Government.

### *Investment Policy*

According to the White Paper, it will be for operators to determine the investment policy for the funds and this will be set out in a Statement of Investment Policy ("SIP"), within the FAP. That being said, the White Paper also says that it is expected that the SIP will ensure that the investment strategy will be appropriately diversified to reduce investment risk, define restricted circumstances in which the funds may be invested in the operator and provide for a general reduction in investment risk as the end of the station generating life approaches.

### *Contributions*

It is clearly intended that fund(s) should accumulate sufficient monies to meet the decommissioning and waste management and disposal costs as they fall due and within the confines of the SIP it will be for the trustees of the fund to determine the contribution schedule. It is expected that the first payment into the fund(s) will be made shortly after the plant enters the operating phase and that contributions by the operator will be operating expenses to be met ahead of debt service. It is intended that the payments by the operator will be contractual commitments, legally enforceable by the fund trustees.

### *Reviews and Reporting*

Operators will be required to review their DWMP and FAP on an annual and quinquennial basis to ensure that the plans remain up to date, reflecting any changes to the plant or in the operating and decommissioning/waste management and disposal plans and that the funding arrangements are still adequate.

The operator will further be required to report on these reviews for the benefit of the Secretary of State and the trustees and there is an expectation that at least some information will be made public.

Fund trustees will be expected to take appropriate expert advice to determine whether operators' plans are appropriate whilst NLFAB will provide the Secretary of State with ongoing advice.

The draft Energy Bill gives the Secretary of State wide ranging powers to monitor compliance with the Funded Decommissioning Programme including the right to obtain additional information from the operator, the fund trustees and others (including associated companies) as necessary.

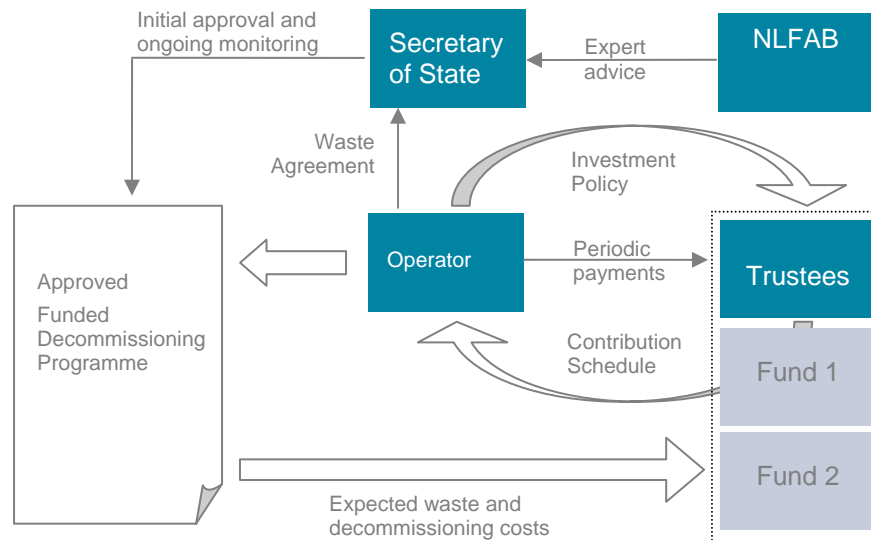
### *Protections Against an Insufficient Fund*

Whilst it is intended that the FAP arrangements will provide sufficient funding to meet the decommissioning and waste costs, operators will retain responsibility for all of the liabilities and any shortfall that may arise if the accumulated funds are inadequate.

Operators are required to describe in their FAP how they will manage and mitigate the risk that there will be insufficient funds and the White Paper suggests that an initial endowment to the fund followed by front-loaded contributions during the first few years of operation might be a partial mitigant. Other forms of security including insurance or financial instruments are also discussed in the White Paper as are parent company guarantees.

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### Summary of Proposed Arrangements



Source: Moody's

If trustees believe at any time that the level of contributions being made by the operator are not enough to meet the expected costs then they will have the ability to increase future contributions.

The Secretary of State will have powers to modify an agreed Decommissioning Programme to ensure that prudent provision is made for the decommissioning and waste costs and the White Paper provides some examples of the circumstances in which the Secretary of State may require modification, where the operator may be in breach of their obligations or following a change of control, or where there has been a change in the credit rating of a parent company guarantor.

If despite all the above, there is a funding shortfall then the Energy Bill provides that the Secretary of State may impose obligations which arise out of the Funded Decommissioning Programme on persons associated with the operator (meaning companies holding 20% or more of the shares of the operator).



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### Appendix B - Nuclear Waste

#### *Types of Nuclear Waste*

Radioactive waste is generally classified as follows:

1. Low level waste ("LLW") typically comprises lightly contaminated waste that arises from operations and monitoring including paper, plastics and metals. In addition, the decommissioning process for stations that have reached the end of their lives typically produces significant quantities of building materials as low level waste. Although LLW will eventually make up more than 90 per cent of the UK's waste legacy by volume, it will contain less than 0.0003 per cent of the total radioactivity.
2. Intermediate level waste ("ILW") is waste that exceeds the radioactivity limits set for LLW but which does not generate the heat associated with high level waste. Historically, ILW in the UK has arisen from the reprocessing of spent fuel and general operations and maintenance of radioactive plant. The major components of ILW are metals and organic materials with smaller quantities of cement, graphite, glass and ceramics.
3. High level waste ("HLW") is radioactive waste that also generates heat that must be taken into account in the design of handling and storage facilities. The UK has accumulated HLW since the 1950s, largely from the reprocessing of spent fuel at Sellafield and this is currently kept in vitrified form in metal canisters stored within large ponds.

Spent fuel is not presently classified as waste because it is sent for reprocessing although this is not expected to be the case for new reactors and spent fuel will effectively become HLW.

#### *Disposal of Waste*

The UK, in common with many other countries lacks a disposal facility for intermediate and high level waste.

The Committee on Radioactive Waste Management ("CoRWM"), which was established in 2002 as part of the Government's Managing Radioactive Waste Safely ("MRWS") programme to consider different storage alternatives, has recommended and Government has accepted that higher level waste should be managed through "geological disposal" being placed in an underground facility designed to minimize the escape of radioactivity<sup>13</sup>.

A number of other countries including Finland, France, Germany and the USA are pursuing a similar approach and construction work has already begun on some storage facilities although we note that the Yucca Mountain Repository in the USA was to begin accepting waste in 1998 but has yet to do so because of a series of delays and challenges.

What a UK geological disposal facility will look like and how, when and where it will be constructed are all uncertain. The Government has suggested that communities may wish to volunteer to host the facility in return for a benefits package that would ensure that the project "contributes to their further development and well being". Whilst it may sound far fetched, this approach follows that adopted elsewhere (in Belgium and Sweden) but the subject of radioactive waste is an emotive one and it is likely to be some time before any construction work starts – a facility may not be available before the middle of this century.

#### *Disposal Costs*

Government has published its assumptions for the costs of developing and operating a new 1,600 MW nuclear power stations<sup>14</sup>. It is assumed that it will cost £276 million (in today's money) to dispose of the intermediate and high level waste at the end of the station's 40 year life and a further £636 million to decommission the facility. This is equivalent to £1.10/MWh or less than 3% of estimated revenue meaning that the cost is material but not large.

<sup>13</sup> "Managing Radioactive Waste Safely, a framework for implementing geological disposal", June 2007, Defra, DTI et al

<sup>14</sup> "The Future of Nuclear Power, The Role of Nuclear Power in a Low Carbon Economy", May 2007, DTI

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### *Government's Proposals for ILW and HLW*

With no facility for the disposal of intermediate and high level waste, potential operators of new nuclear power stations face significant uncertainty – how will they be able to dispose of intermediate and high level waste and what will it cost?

Recognizing the potential constraint on the development of new nuclear power stations, Government proposes to offer operators fixed prices for disposing of ILW and HLW. This price will be a unit price for a fixed quantity of waste at a fixed future date, expected to be the scheduled closure date of the station, when title to and responsibility for the waste will pass from the operator to the Government. Operators will not be at risk if the ultimate disposal cost is above the price quoted by Government although, recognizing the risk that it will be assuming, Government expects that the prices that it quotes will include a significant risk premium.

If, as may be the case, the proposed geological storage facility has not been built when the new nuclear power stations reach the end of their lives then Government anticipates that waste will continue to be stored on the site where it originated; the operator will nevertheless be able to continue the work to decommission the site and return it to the agreed state and Government will assume responsibility for the waste.

If the operator decides at some point in the future to extend the station's life, or the volume of expected waste changes for other reasons then, they will have to approach the Government to agree a new price for the additional waste.

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Report Number: 109086

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