Global Power/Europe
Special Report

Assessing the Risk of Nuclear Liabilities

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■ Overview

The emphasis on reducing CO_2 emissions within the EU and the current high price of traditional fuels (coal, gas and oil) have thrown nuclear power again into the limelight as a possible economically viable energy source. Nuclear power is currently used to produce about 13% of the EU's electricity; offering low CO_2 power generation at baseload capacity, which many other low CO_2 technologies such as wind cannot. Nevertheless, due mainly to environmental concerns, some European countries have chosen to accelerate the retirement of nuclear plants.

A recent European Commission report estimated that 50 to 60 of the 155 nuclear reactors currently operating in the European Union will need to be decommissioned by 2025. As plant shutdowns draw nearer, the liabilities are looming larger on nuclear operators' agendas. In addition, the recent financial restructuring of British Energy plc ("BE") has highlighted the risk of creditors becoming subordinated to nuclear decommissioning payments. These two factors illustrate the importance of considering nuclear liabilities when assessing the creditworthiness of energy companies.

Analysing cash flows for a nuclear installation is very different to that of a thermal (coal, gas or oil fired) power plant. For any power producer, the cost of generation comprises not only the operating expenses (fuel, maintenance, etc), but also building and decommissioning the power plants. Where most of the cash flows for thermal installations are incurred as the plant operates, a nuclear installation requires a larger original investment, lower operating costs, but then much higher closure costs in the form of interim and long-term nuclear waste storage as well as plant dismantling.

Within the EU there are marked differences between member states' estimated nuclear liabilities and the manner in which these obligations are funded and managed. Therefore, amongst the power companies rated by Fitch Ratings, nuclear exposure varies enormously.

Traditional tools of financial analysis tend to focus on cash flow generation (be it Funds from Operations or EBITDA), which does not take into account future costs – therefore distorting the profitability comparison to the benefit of the nuclear operators due to their lower generation costs. The challenge for the analyst is to find the tools to take these future costs into account while recognizing that those estimates vary significantly from country to country and company to company. This report focuses on the different approaches to decommissioning that prevail across Europe. In a follow-up report, the agency will outline analytical tools it uses when assessing this exposure and the effect that this has on rated entities.

25 April 2005

A Heterogeneous Situation

What are Nuclear Liabilities?

The future costs involved in decommissioning nuclear power plants as well as the long-term management, storage and final disposal of radioactive waste materials and spent fuel are collectively known as nuclear liabilities. What do these costs refer to?

Decommissioning

All power plants have a lifespan beyond which it is neither technically nor economically feasible for them to remain operational. At this point, they need to be dismantled and the sites made available for other purposes. The costs included cover all aspects, from shutdown and removal of fissile material to environmental restoration of a site. Decommissioning, independent of the strategy chosen (see *Choice of Decommissioning Strategy* and *Asset Life* below) begins immediately following permanent closure and continues, ideally, until the site where the facility had once stood is totally decontaminated. It should be noted however that most countries and operators have different definitions of decommissioning liabilities, when they start and what they entail.

Spent Fuel and Radioactive Waste Management

A separate cost included within a company's nuclear liabilities is for 'spent' nuclear fuel or radioactive waste management. Throughout its life, a nuclear power plant generates radioactive waste ranging from contaminated building materials to items of clothing worn by employees. In addition, a large by-product of the nuclear reaction is 'spent fuel'. Consisting of un-reacted uranium, plutonium and waste products, this material is highly radioactive and, along with the low-level waste previously mentioned, has to be removed from a plant throughout its life as well as when it is eventually shut down. These by-products of operating a nuclear power plant are then stored, reprocessed or disposed of.

Storage (Or Interim Storage)

This is where spent nuclear fuel and other radioactive waste is placed in cooling tanks until it can be safely reprocessed or disposed of.

Reprocessing

Spent fuel contains components that can be reused, the recovery of which is called reprocessing. The used fuel undergoes a chemical process to separate out the uranium and plutonium and other waste products. The uranium and plutonium are then reused and the high level waste remaining disposed of or stored.

Disposal

This is the placement of waste in a suitable facility indefinitely. This is also often called long-term storage, though the latter suggests that there is intent to retrieve the waste at some point in the future. Suitable sites are yet to be chosen for disposal in most countries. However, the majority have decided on underground facilities, such as Yucca Mountain in the US.

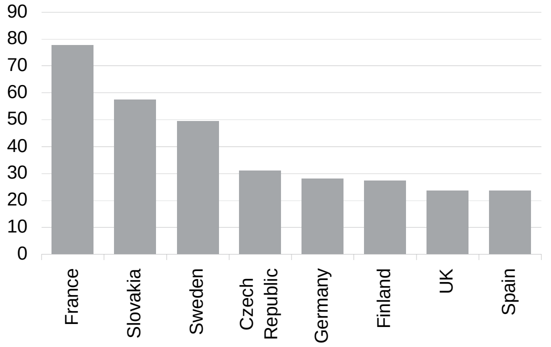
The choice of what to do with radioactive waste and spent nuclear fuel is determined by both the company and the government or regulatory body, based on economic, environmental and public safety issues.

The Political Agenda

Unlike conventional thermal power, nuclear production, because of its possible long-term environmental impact and potential military use, remains under heavy regulatory control in all countries. In most cases, the government sets the national strategy in terms of nuclear investment, decommissioning and treatment of radioactive waste.

For example, the high proportion of nuclear generation in France can be attributed to the French government's desire, after the first oil shock, to be more independent of the hydrocarbon producers. Other fuel-poor economies, such as Spain and Italy, have not embraced nuclear quite so actively. The following chart illustrates the differing levels of nuclear generation in various EU states.

Electricity from Nuclear Generation as % of Total Supplied, 2003



Source: International Atomic Energy Agency

Even today, each government's attitude towards nuclear power continues to be dictated by a mixture of economic and political considerations. As such, many have chosen to phase out their nuclear generation capabilities, but questions remaining over the availability of viable, low CO_2 alternatives have so far hindered the closures.

- Sweden decided to postpone closure of its second reactor in 2003.
- The Netherlands, in 2003, chose to postpone closure of its only nuclear plant until 2013.
- Belgium, despite deciding in January 2003 to close all of its nuclear plants, is now facing mounting pressure from industry to reverse this decision.
- Germany's government reached agreement with the plant operators in 2000 to limit the lives of plants to 2,623 billion kWh of production, or about 32 years, whilst not allowing any new plant construction.
- Spain's commitment to nuclear power is unknown. Prior to the elections in March 2004, the new socialist government included phasing-out nuclear energy in its manifesto. However, since coming to power, and without a defined policy as yet (a white paper is expected later in 2005), the tone has changed towards one that could perhaps see additional nuclear capacity, provided technological innovation can further limit risks.
- In Italy, on the other hand, despite choosing to eliminate nuclear power in 1987 after a referendum, current Prime Minister, Silvio Berlusconi, recently indicated a possible move away from this anti-nuclear stance. This is due to the government's objectives of reducing reliance on power imports and controlling CO_2 emissions in line with new regulations. 14% of Italy's power is imported, primarily from France.

While some governments are either rejecting nuclear energy altogether or sitting on the fence, others are embracing it wholeheartedly. As outlined above, this is the case in France, where a prototype pressurised water reactor is to be built in Normandy. Likewise, Finland is planning to bring a new 1600MW reactor online by 2009.

Setting the agenda in terms of decommissioning has significant consequences in terms of the timing and the size of the liabilities of each power producer. Critically, each country has its own approach as to how these liabilities should be funded (see *Provisions and Cash Funding*).

Timing

Apart from government-imposed timing for closure, the expected expenditure schedule for each player is also influenced by the choice of decommissioning strategy, as well as the assumed "technical" life of their power plant portfolio.

Choice of Decommissioning Strategy

Once the date of plant closure is agreed, the profile of expenditure can vary depending on the decommissioning strategy adopted. In Europe, strategies generally fall within two broad categories.

Immediate Dismantling

This involves decommissioning a plant as soon as it is shut down but requires substantial funds to have been accumulated by the date of closure. Countries that have chosen this option include Finland, Germany, Italy, Lithuania, Slovenia and Spain. It should be noted, however, that economic prudence can impose itself upon government policy where this threatens the financial viability of nuclear operators.

Deferred (Safestore)

This option delays the dismantling process for some time, usually between 40-60 years. In the interim, the facility is placed in a safe storage configuration and monitored while the level of radioactivity decreases. This results in cheaper dismantling costs due to the reduced level of radioactivity, though this cost benefit needs to be weighed up against the interim costs incurred whilst monitoring the plant.

A number of EU member states have yet to decide on a decommissioning strategy, namely Belgium, France and Sweden. In these countries, a strategy is often chosen on an ad hoc basis, mostly left up to the operator.

However, there is a lack of transparency in why certain strategies are chosen and what assumptions are made in making those choices. In addition, there are often inconsistencies in operators' definitions of dormancy periods, which can result in an immediate decommissioning strategy taking just as long as a deferred.

It can be beneficial from a corporate standpoint to choose deferred decommissioning as liabilities may be reduced due to discounting future costs over a longer time period. Depending on the discount rate used (see *Cost Estimation and Accounting*), the choice of decommissioning strategy as well as the asset life of the power plant can have a material impact on the recorded balance sheet liabilities.

Asset Life

Decommissioning starts as soon as the plant is shut down, the timing of which, for funding and accounting purposes, is extremely important. The lifetime of a nuclear plant is influenced by a number of factors:

- The design lifetime (generally from 30 to 60 years, depending on the type of reactor), though this can sometimes be extended with sufficient refurbishment, replacement or upgrades.
- Economic factors, such as high oil prices, can make it favourable to extend operating lives.
- Political factors, as highlighted above.

The following table illustrates estimated nuclear power plant lives by operator as well as the number of reactors and the average remaining time, weighted by plant capacity, until plant shutdown. Further information on individual plants is available in Appendix 1.

Nuclear Power Plant Asset Lives

	No. of Power Reactors	Estimated Useful Life	Avg Years Until Shutdown Weighted by Plant Size
EDF	59	40	20.4
E.ON	9	32	9.3
RWE	4	32	8.1
EnBW	5	32	9.6
CEZ	6	40	29.6
Slovenske elektrarne	6	40	19
British Energy	15	30-43	12.5

N.B. E.ON's plant life does not include its share in Sydkraft
Source: Company reports, Energy Information Association, Fitch estimates

A longer life allows for lower annual depreciation charges and provisions. For instance, in 2003, EDF increased the expected life of its plants from 30 to 40 years, which reduced the nuclear liability by EUR2.8 billion. An extended useful life also delays the point at which cash funds need to be in place.

It is important to note that assumptions made to compute provisions may differ, sometimes significantly, from actual experience. Provisions are set according to certain accounting principles (including prudence), but in reality, the expenditure profile may vary depending on the affordability for each operator, regulatory constraints and technical improvements. However, it is not the role of Fitch as a rating agency to second-guess the operator's estimate for asset life, and it will thus base its analysis on the assumptions published by each operator regarding the life of their plants.

Provisions and Cash Funding

Once the strategy has been chosen and the future costs for both, nuclear waste management and decommissioning estimated (see *Cost Estimation and Accounting* below), a process to ensure adequate funds are going to be available needs to be in place. This is of great concern to both governments and the EU, to ensure future generations are not burdened with a prohibitively expensive nuclear legacy. This is also of primary concern to Fitch when analysing the financial profile of companies active in nuclear generation, and the liabilities embedded in their nuclear generation fleet.

One must distinguish between provisions and funding. Each company responsible for funding future decommissioning must build reserves against these future costs in its accounts. While these provisions are a useful indicator of the present value of estimated future costs, they do not substitute for a funding strategy.

Nuclear provisions or liabilities may be long term but their sheer size (in excess of EUR10 billion for large European players) requires that an adequate funding strategy is in place well ahead of time. A prudent way to provide for future cash outflows is by putting a portion of cash profits generated into a fund throughout the life of the plant. With prudent investment of this fund, compounded returns should increase its value sufficiently to enable suitable coverage of the future liabilities.

Fitch has noted two alternative approaches to nuclear decommissioning funding.

Separate Funding

Some countries have adopted an external strategy where the management of funds earmarked for nuclear liabilities is separate from the accounts of the nuclear operator. This approach provides transparency and ensures the funds will be available for their intended use even if the operator goes bankrupt. If specific funds are held by the state, Fitch assumes that they will not be used for anything other than their stated purpose.

This approach is also generally adopted in countries where responsibility for these costs has been transferred, either in full or in part, to the government (e.g. full in Spain and partial in the Czech Republic).

Spanish nuclear liabilities are currently the responsibility of state-owned Empresa Nacional de Residuos Radioactivos (Enresa). It finances its activities through a levy on the end-user electricity tariff. However, this may soon change as Spain's Director General for Energy recently stated that the operators themselves will have to pay for their liabilities in accordance with "the polluter pays" principle. He stated that: "The cost of nuclear waste disposal will add EUR0.002/kilowatt-hour (EUR2/megawatt-hour) to the cost of generating power from nuclear plants." Requiring generators to pay for the nuclear clean-up costs will bring Spain more in line with the rest of Europe.

Internal Funding

In other countries, such as France and Germany, the funding strategy has been left to the operator and cash resources are managed internally. This way each company has more flexibility over the use of the funds and both the technical and financial responsibility lie with the companies themselves. However, this approach does not allow the same level of transparency as external management, nor does it guarantee that the funds will be used for their intended purposes. To the extent that a company has "earmarked" funds to meet future decommissioning liabilities, Fitch will review whether these funds are truly ring-fenced, or commingled with other company resources. To the extent that ring-fenced cash funding is available, Fitch will not consider this cash as available to the company for general purposes (i.e. it will not be deducted in the net debt calculation). On the other hand, segregated cash reserves for nuclear expenses will be netted off the agency's estimates of nuclear liabilities. The analysis will also focus on the way each company intends to increase such cash reserves in the future.

Certain states, such as Belgium, have allowed for the funds to be managed internally but with state control over their use.

Nuclear Energy Funding Policies in Europe

	Funding Policy	Operators Affected	Operator Ownership
France	Internal	EDF	Government
Germany	Internal	E.ON, RWE	Private
Czech Republic	External/ Internal	CEZ	Government
Slovakia	External	Slovenske elektrarne AS	Government
Spain	External	Iberdrola, Union Fenosa, Endesa, Hidrocantabrico	Private/ Government
UK	External	British Energy	Private

Source: Company reports, Nuclear Energy Agency

Political imperatives on decommissioning dates also influence funding strategies. According to a Nuclear Energy Agency ("NEA") report 'Decommissioning Nuclear Power Plants: Policies, Strategies and Costs' published in 2003, Germany and Sweden have stated that the full decommissioning cost must be accumulated within 25-30 years of the plant commencing operation, i.e. before plant closure.

The European Commission is currently reviewing nuclear liability funding with the intention of recommending external funds, to guarantee suitable transparency and management to enable the provision of cash in 30 to 70 years' time.

By and large though, funds are currently insufficient to cover future nuclear liabilities. While most operators still have many years to build adequate reserves, the underfunding situation may be exacerbated if governments require early closure of plants. A deficit can also become more evident when state-owned nuclear generators are privatised and it was previously assumed that the state would cover their liabilities. For example, Slovenske elektrarne ("SE") says its fund, controlled externally and overseen by the Ministry of the Economy of the Slovak Republic, was in deficit by SKK10,288m (YE03). However, this has been addressed with a new levy introduced in January 2005 on electricity bills, which will fund the deficit over the next 10 years.

In assessing the rating of a corporation with nuclear liabilities, Fitch's primary concern will be that the funds, whether internal or external, should meet expected future costs as they arise. Unless the relevant government has legally guaranteed payment of these future costs, the agency will start with the assumptions that each generator is responsible for meeting these obligations from its own corporate resources.

Cost Estimation and Accounting

Estimating the size of the nuclear liabilities is a complex process. Companies, under the auspices of national and international regulatory bodies, estimate how much decommissioning will cost in the future. The number of nuclear reactors that have been decommissioned to date is relatively low, although increasing, and estimates of decommissioning costs vary. The plant dismantling component can be estimated based on expert opinion and prior experience. Interim radioactive waste management costs can normally be evaluated based on existing contracts with storage facilities and reprocessing installations. However, long-term spent fuel storage is harder to estimate due to lack of experience, available storage capacity and definitive government policy. The NEA study mentioned above, which was based on questionnaires sent to operators in 26 different countries, highlighted the significant disparity in costs for different reactor types. As an example, it put the decommissioning costs for PWR reactors generally between USD200 and USD500 per kWe (2001 value), bar a few exceptions. This study provided a useful benchmark for decommissioning costs, but Fitch cautions use of the average cost by kWe shown in that study to predict the future cost for each operator, given the very broad range it was drawn from.

Generally, published accounts do not provide adequate detail on how these estimated costs are calculated. For instance, to what degree do they make allowances for future efficiency improvements due to technological innovation?

The accounting for spent fuel provisions differs to that for plant decommissioning in that the full cost of the latter is estimated at the commissioning date. Spent fuel liabilities are accrued and readjusted as the fuel is used, i.e. today's spent fuel liability does not incorporate the expected cost of the fuel an operator will use in the next fuel cycle. Therefore, to make a useful comparison between operators' spent fuel provisions, further detailed information is needed, which is not always included in published company reports.

Having estimated the future cost of its nuclear liabilities, the operator records the value on its balance sheet in accordance with IFRS or US GAAP.

US GAAP

Decommissioning costs are subject to SFAS 143 on 'asset retirement obligations'.

The liability for decommissioning is established as soon as it is incurred (i.e. at the commissioning of the plant) and can be reasonably estimated. The estimated future cost is discounted by the most appropriate rate to the balance sheet date and recorded as a liability. An associated amount is capitalised and added to the carrying value of the asset. The total construction cost of the plant and the capitalised cost of the initial retirement obligation are depreciated over the life of the asset.

In subsequent years, the liability is accrued via a non-cash interest expense.

Revision of the estimate for future liabilities (resulting from changes in cost estimates or their timing) are dealt with by adjusting the carrying value of the liability, using the discount rate applicable at the time the original liability was recorded. The capitalised asset due to this revision is adjusted and depreciated on a prospective basis, with no prior year adjustment of assets or depreciation and with no 'income statement' effect.

Changes due to a new applicable discount rate do not affect US GAAP financial statements.

IFRS

IFRS, in the interests of convergence, try to duplicate the treatment of decommissioning liabilities to match US GAAP. Differences, however, arise due to changes in the market-based discount rate used for accruals and discounting. Unlike US GAAP, IAS 37 requires provisions be made at the current best estimate and should therefore reflect current discount rates. The discount rate should reflect prevailing market estimates of the time value of money and the risks specific to the liability. Therefore, any change in discount value involves a restatement of the liability and associated asset.

Future liabilities are reassessed as appropriate and requisite adjustments made to reflect any change in regulation or a company's assumptions.

Recent Developments

A 2002 European Commission communication on "Nuclear Safety in the European Union" suggested that there should be specific regulations applied to the creation, calculation and management of financial resources for decommissioning. Currently, both the individual companies and member states can influence the size of the nuclear liabilities, making it hard for analysts to assess and compare nuclear operators across Europe. .

The recent move towards IFRS accounting should allow for closer comparison as previously the operators were reporting under different accounting standards. In addition to this, the European Commission recently asked member states to provide details of how decommissioning is actually being financed in the EU. Over time, these initiatives may lead to greater disclosure of each operator's assumptions, and greater consistency in the funding strategy adopted. Fitch, however, expects that the choice of decommissioning strategy and assumptions adopted will largely remain in the hands of the operators. In addition, harmonisation of the definition and content of nuclear liabilities across the EU is unlikely to occur in the immediate future.

■ Nuclear Liabilities of Selected European Players

Sector Overview

As the above discussion has shown, there are a large number of estimates, variables and differing policies involved in creating the accounting liabilities recorded by each operator. Combined with the lack of transparency in decommissioning fund management, it is clear that it is hard to find a meaningful method of comparison between nuclear operators.

The table overleaf summarises the current level of nuclear liabilities amongst the large European players as of year-end 2003, and compares it to their installed nuclear capacity. Further detail on the breakdown of the provisions and the adjustments made by Fitch is shown in appendix 2. We have added for comparison purposes the provisions reported by British Energy at YE March 2003, the last year prior to financial restructuring.

Fitch-Adjusted Provisions and Ratios

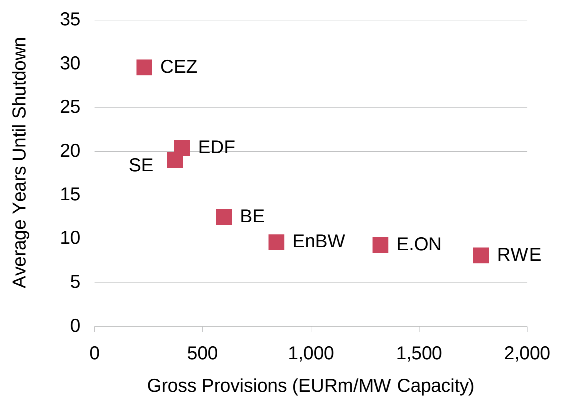
Year-end 2003	EDF	E.ON	RWE	EnBW	CEZ	Slovenske Elektrarne	British Energy (31 Mar 03)
Capacity (GW)	66.00	11.06	5.67	5.14	3.76	2.64	9.60
Average Years until Shutdown [1]	20.4	9.3	8.1	9.6	29.6	19.0	12.5
Nominal Rate Assumed by Company %	5.0	5.5	5.5	5.5	7.0	5.0	3.0
Fitch Adjusted Gross Liability (EURm)	26,759	14,609	10,123	4,326	869	982	5,744
Fitch Adjusted NET Liability (EURm)	24,459	13,758	9,472	3,920	686	624	5,257
Gross Liability (EURm)/Capacity (GW)	**405**	**1,321**	**1,787**	**842**	**231**	**372**	**598**
NET Liability (EURm)/Net Debt (EURm)	**102%**	**150%**	**47%**	**55%**	**64%**	**53%**	**655%**

[1] Weighted by plant capacity
Exchange rates used as of balance sheet dates (YE 03)
Source: Company reports, Fitch

In the table below, a simple analysis reveals marked disparities between the ratios across the rated universe. However, the table also illustrates how important nuclear liabilities are for these operators, as nuclear liabilities represent between 50% and 150% (excluding BE), of these companies' net debt.

The difference in terms of nuclear provisions per MW of installed capacity is also significant but, as already mentioned, may be largely explained by the spent fuel element being provisioned on an accruals basis, diverse assumptions, and critically, the different remaining life of each portfolio. The graph below illustrates the impact of portfolio life by plotting the ratio of total provisions per GW of capacity against the time until plant shutdown.

Nuclear Power Plant Asset Lives



Source: Fitch

EDF

EDF is Europe's largest nuclear operator, with 59 nuclear reactors in France, and generated 421 TWh of electricity in 2003.

EDF's fleet is relatively young and the government continues to support a strong nuclear policy. Fitch estimates that EDF's portfolio has a residual average life of 20 years.

All aspects of future liabilities are the financial responsibility of EDF, including long-term storage.

EDF publishes separate provisions for "decommissioning and last core" consisting of dismantling costs and those for future losses on unused fuel following the final reactor shutdown and "end of nuclear fuel cycle" charges that include the reprocessing expenses, as well as storage and the disposal of radioactive waste. The table in Appendix 2 splits this up into the decommissioning aspect, the disposal and storage of nuclear waste, and the rest is combined under interim and long-term storage.

EDF tops its nuclear decommissioning funds up each year, and at end-2003 had allocated assets worth EUR2.3bn. These are not ring-fenced funds, but these marketable assets are recorded as financial investments on the balance sheet. This amount has been deducted from Fitch adjusted liabilities.

EDF has a current policy in line with the French government of increasing its nuclear stake, and has announced the development of a new third generation EPR (European Pressurised Water Reactor) plant in Normandy.

E.ON

E.ON is the second largest European nuclear operator with nine reactors in Germany as well as capacity in Sweden (through its 55% stake in Sydkraft).

It has split its provisions into the management of spent fuel, asset retirement obligations (decommissioning) and waste disposal. It has subtracted from this advance payments to third parties or government funds for these purposes.

Cash funds are paid to Sweden's national fund for nuclear waste management and, in Germany, advanced payments are made for long-term storage. These prepayments are netted off against the recorded future liability in the published accounts, therefore, in the table shown in appendix 2 Fitch has adjusted the gross provision for this amount and shown an associated receivable.

Both the Swedish and German governments are currently phasing out nuclear power, with Germany restricting asset life to approximately 32 years. Fitch estimates that the average remaining life of E.ON's plants is just over nine years.

RWE

RWE's five nuclear reactors are all in Germany. It maintains provisions for nuclear waste management on its balance sheet totalling EUR9,472m, including all costs relating to final storage and disposal, interim storage and reprocessing as well as decommissioning. The amounts are not split into separate liabilities, but prepayments totalling EUR651m, made to third parties, have been netted off from the provisions. Therefore, Fitch has adjusted the gross provisions for this amount and shown a corresponding receivable.

RWE's portfolio is subject to the same limitation on asset life and the same constraint on funding as the German portfolio of E.ON. Fitch estimates the average remaining life of RWE's plants to be just over eight years.

EnBW

Disposal for EnBW primarily involves the costs associated with reprocessing and the disposal of related waste and eventual final storage.

Decommissioning costs assume a strategy of immediate dismantlement on shutdown. This appears to be a conservative policy.

EnBW has a provision relating to nuclear power of EUR3,920m. This is net of payments on account of EUR405.6m, assumed to be for interim and long-term storage. In the above table, the gross provision has been increased by this amount.

Fitch estimates that the average remaining life of EnBW's nuclear assets is just under 10 years.

CEZ

CEZ operates two nuclear power stations in the Czech Republic. Its nuclear provisions are split between decommissioning costs and interim and long-term storage, as per the above table.

The final disposal of spent fuel and nuclear waste is the responsibility of the Czech Republic, for which CEZ must make an annual payment of CZK50/MWh generated (EUR1.54/MWh). These payments go into a Nuclear Account administered by the State Repository Authority. CEZ still provisions for these costs under long-term storage as the company will still be liable for these costs if the Nuclear Account is insufficient. At mid year 2004, the balance of this fund stood at approximately CZK4,700m (EUR145m).

CEZ is also required to place funds in an escrow account to fund its decommissioning costs, which held CZK1,245m (EUR38m) at YE03.

There is no fund for interim storage; these costs are paid as an ongoing operating expense and mainly comprise the purchase of storage casks, with the physical storage taking place at its own plants.

Due to CEZ's young nuclear fleet, Fitch estimates the average remaining life to be just under 30 years.

Slovenske elektrarne

At year-end 2003, SE had nuclear liabilities totalling SKK22,175m (EUR539m), including all decommissioning and interim storage costs for its three nuclear power plants (only two are operational).

Long-term storage and disposal, after 50 years of interim storage, have not yet been provisioned for as these future costs cannot be reliably estimated at this point given the diverse options available and the timeframe. Nevertheless, preliminary estimates put the discounted figure at SKK18,288m (EUR443m).

Against these liabilities SE records as an asset the cash funds held externally by the Slovak Republic in the State Decommissioning Fund. These currently amount to SKK10,916m (EUR265m). In addition to this, there is a receivable from the European Bank for Reconstruction and Development comprising grants for costs incurred for the early closure of two blocks of one of its plants, of SKK3,819m (EUR93m).

SE contributes SKK350,000/MW (approx. EUR1.25/MWh) of installed nuclear capacity and 6.8% of the sales price of electricity generated to the State Fund. These funds can be used for decommissioning and storage purposes only, including long-term storage.

The SE plants are relatively young, and Fitch estimates the average residual life of the portfolio to be 19 years.

British Energy

BE, which recently completed its restructuring, is included in the table for comparison purposes. The FY03 profile has been used as this represents the last audited year prior to the commencement of the restructuring in Q403 when the business retained full responsibility for all of its decommissioning and back-end nuclear costs.

Based on the FY03 financial statements, compared with similar operating frameworks, the business looked adequately provisioned. However, BE's ultimate insolvency resulted not from inadequate provisioning but from the tight liquidity and poor financial outlook as electricity prices fell to historical lows. This resulted in management seeking immediate financial assistance from the UK government. Assistance was provided on an arms' length basis and resulted in subordinating existing creditors. As part of the restructuring, BE undertook to pay GBP20m annually for future liabilities as well as GBP150,000/tonne of fuel loaded into its reactors (both indexed to inflation). These amounts are paid into a government administered account (NLF). In addition to this, BE will give the government (NLF) 65% of free cash flow.

In return, all uncontracted nuclear liabilities (including decommissioning) are now the financial responsibility of the UK government. However, the decommissioning cost of GBP20m p.a. will be met ahead of debt service obligations – demonstrating the impact decommissioning liabilities can potentially have on recovery prospects for unsecured creditors.

Conclusion

The restructuring of BE has further confirmed the need for analysts to take into account the potential liabilities faced by nuclear operators on closure of their plants. However, as highlighted above, there are marked discrepancies between the calculation, treatment and funding of nuclear liabilities for European operators, reflecting both corporate and national policy.

While decommissioning experience is building up, the real cost of decommissioning, and in particular the "long-term storage" cost, remains uncertain. Companies and governments use different policies and calculations that are specific to their unique conditions and requirements. As such, any comparison between estimates should be undertaken with caution. A 1999 NEA study noted this and recommended a standard cost structure for decommissioning. Even with this harmonisation, however, estimating costs will remain subject to judgement and contingencies.

On the balance sheet, nuclear provisions reflect each company's different cost assumptions, which are themselves influenced by government policies, funding strategy, as well as the chosen discount rate. Critically, the level of provisions is also commensurate with the remaining asset life of each portfolio. Provisions, while imperfect, give an instant snapshot of the future liabilities faced by the nuclear operators, and are considered by Fitch as part of each company's analysis.

This report has outlined the very different degree of exposure among companies rated by Fitch. In all cases, however, nuclear exposure for the players under review is significant.

It is possible that some of the responsibility for funding these costs will be transferred to governments in the future, as has been the case in Spain until now, and has become the case in the UK. Such transfers could be made against, potentially, a fixed contribution by the operators, or indeed electricity consumers. However, until such a plan is in place, Fitch's analysis has to assume that these costs are actual liabilities of the operators. In addition, while long-term in nature, they can crystallise quickly if the financial situation deteriorates.

Fitch is currently analysing each operator's liabilities based on both qualitative and quantitative factors. The agency is refining its methodology to incorporate nuclear liability costs into its ratio analysis and will consult with industry leaders in the next six months to refine its approach.

Whatever the outcome of these discussions, the adjusted ratios will continue to reflect qualitative factors, such as asset life, and will be taken in the overall context of each company's strengths and weaknesses rather than forming the sole guideline for future ratings.

Appendix 1

Nuclear Reactors

Operator	Power Plant	Capacity (MW)*	Connection Date	Decommissioning Date	Years Remaining	
EDF	Belleville 1	1,310	Oct 87	2027	22	
EDF	Belleville 2	1,310	Jul 88	2028	23	
EDF	Blayais 1	910	Jun 81	2021	16	
EDF	Blayais 2	910	Jul 82	2022	17	
EDF	Blayais 3	910	Aug 83	2023	18	
EDF	Blayais 4	910	May 83	2023	18	
EDF	Bugey 2	920	May 78	2018	13	
EDF	Bugey 3	920	Sep 78	2018	13	
EDF	Bugey 4	900	Mar 79	2019	14	
EDF	Bugey 5	900	Jul 79	2019	14	
EDF	Cattenom 1	1,300	Nov 86	2026	21	
EDF	Cattenom 2	1,300	Sep 87	2027	22	
EDF	Cattenom 3	1,300	Jul 90	2030	25	
EDF	Cattenom 4	1,300	May 91	2031	26	
EDF	Chinon B1	905	Nov 82	2022	17	
EDF	Chinon B2	870	Nov 83	2023	18	
EDF	Chinon B3	905	Oct 86	2026	21	
EDF	Chinon B4	905	Nov 87	2027	22	
EDF	Chooz B-1	1,500	Aug 96	2036	31	
EDF	Chooz B-2	1,500	Apr 97	2037	32	
EDF	Civaux 1	1,495	Dec 97	2037	32	
EDF	Civaux 2	1,495	Dec 99	2039	34	
EDF	Cruas 1	915	Apr 83	2023	18	
EDF	Cruas 2	915	Sep 84	2024	19	
EDF	Cruas 3	915	May 84	2024	19	
EDF	Cruas 4	915	Oct 84	2024	19	
EDF	Dampierre 1	890	Mar 80	2020	15	
EDF	Dampierre 2	890	Dec 80	2020	15	
EDF	Dampierre 3	890	Jan 81	2021	16	
EDF	Dampierre 4	890	Aug 81	2021	16	
EDF	Fessenheim 1	880	Apr 77	2017	12	
EDF	Fessenheim 2	880	Oct 77	2017	12	
EDF	Flamanville 1	1,330	Dec 85	2025	20	
EDF	Flamanville 2	1,330	Jul 86	2026	21	
EDF	Golfech 1	1,310	Jun 90	2030	25	
EDF	Golfech 2	1,310	Jun 93	2033	28	
EDF	Gravelines 1	910	Mar 80	2020	15	
EDF	Gravelines 2	910	Aug 80	2020	15	
EDF	Gravelines 3	910	Dec 80	2020	15	
EDF	Gravelines 4	910	Jun 81	2021	16	
EDF	Gravelines 5	910	Aug 84	2024	19	
EDF	Gravelines 6	910	Aug 85	2025	20	
EDF	Nogent 1	1,310	Oct 87	2027	22	
EDF	Nogent 2	1,310	Dec 88	2028	23	
EDF	Paluel 1	1,330	Jun 84	2024	19	
EDF	Paluel 2	1,330	Sep 84	2024	19	
EDF	Paluel 3	1,330	Sep 85	2025	20	
EDF	Paluel 4	1,330	Apr 86	2026	21	
EDF	Penly 1	1,330	May 90	2030	25	
EDF	Penly 2	1,330	Feb 92	2032	27	
EDF	Phenix	233	Dec 73	2013	8	
EDF	St. Alban 1	1,335	Aug 85	2025	20	
EDF	St. Alban 2	1,335	Jul 86	2026	21	
EDF	St. Laurent B 1	915	Jan 81	2021	16	
EDF	St. Laurent B 2	915	Jun 81	2021	16	
EDF	Tricastin 1	915	May 80	2020	15	
EDF	Tricastin 2	915	Aug 80	2020	15	
EDF	Tricastin 3	915	Feb 81	2021	16	
EDF	Tricastin 4	915	Jun 81	2021	16	
EDF Total		**63,388**	**Avg. # of Years Until Plant Shutdown Weighted by Reactor Capacity**			**20.38**

Nuclear Reactors (Cont/d)

Operator	Power Plant	Capacity (MW)*	Connection Date	Decommissioning Date	Years Remaining	
E.ON	Brokdorf	1,370	Oct 86	2018	13	
E.ON	Brunsbuettel	771	Jul 76	2008	3	
E.ON	Grafenrheinfeld	1,275	Dec 81	2013	8	
E.ON	Grohnde	1,360	Sep 84	2016	11	
25% E.ON	Gundremmingen-B	321	Mar 84	2016	11	
25% E.ON	Gundremmingen-C	322	Nov 84	2016	11	
E.ON	Isar-1	878	Dec 77	2009	4	
E.ON	Isar-2	1,400	Jan 88	2020	15	
E.ON	Kruemmel	1,260	Sep 83	2015	10	
E.ON	Unterweser	1,345	Sep 78	2010	5	
E.ON Total		**10,302**	**Avg. # of Years Until Plant Shutdown Weighted by Reactor Capacity**			**9.34**
RWE	Biblis-A	1,167	Aug 74	2006	1	
RWE	Biblis-B	1,240	Apr 76	2008	3	
RWE	Emsland	1,329	Apr 88	2020	15	
75% RWE	Gundremmingen-B	963	Mar 84	2016	11	
75% RWE	Gundremmingen-C	966	Nov 84	2016	11	
RWE Total		**5,665**	**Avg. # of Years Until Plant Shutdown Weighted by Reactor Capacity**			**8.13**
EnBW	Neckarwestheim-1	785	Jun 76	2009	4	
EnBW	Neckarwestheim-2	1,269	Jan 89	2021	16	
EnBW	Obrigheim	340	Oct 68	2005	0	
EnBW	Philippsburg-1	890	May 79	2012	7	
EnBW	Philippsburg-2	1,392	Dec 84	2016	11	
EnBW Total		**4,676**	**Avg. # of Years Until Plant Shutdown Weighted by Reactor Capacity**			**9.62**
Slovenske Elektrarne	Bohunice 1	408	Dec 78	2006	1	
Slovenske Elektrarne	Bohunice 2	408	Mar 80	2008	3	
Slovenske Elektrarne	Bohunice 3	408	Aug 84	2025	20	
Slovenske Elektrarne	Bohunice 4	408	Aug 85	2025	20	
Slovenske Elektrarne	Mochovce 1	405	Jul 98	2040	35	
Slovenske Elektrarne	Mochovce 2	405	Dec 99	2040	35	
SE Total		**2,442**	**Avg. # of Years Until Plant Shutdown Weighted by Reactor Capacity**			**18.96**
CEZ	Dukovany 1	412	Feb 85	2025	20	
CEZ	Dukovany 2	412	Jan 86	2026	21	
CEZ	Dukovany 3	412	Nov 86	2026	21	
CEZ	Dukovany 4	412	Jun 87	2027	22	
CEZ	Temelin 1	950	Dec 00	2040	35	
CEZ	Temelin 2	950	Dec 04	2044	39	
CEZ Total		**3,548**	**Avg. # of Years Until Plant Shutdown Weighted by Reactor Capacity**			**29.57**
British Energy	Dungeness B1	555	Dec 65	2008	3	
British Energy	Dungeness B2	555	Apr 83	2008	3	
British Energy	Hartlepool A1	605	Aug 83	2014	9	
British Energy	Hartlepool A2	605	Oct 84	2014	9	
British Energy	Heysham 1 Unit A	575	Jul 83	2014	9	
British Energy	Heysham 1 Unit B	575	Oct 84	2014	9	
British Energy	Heysham 2 Unit A	625	Jul 88	2023	18	
British Energy	Heysham 2 Unit B	625	Nov 88	2023	18	
British Energy	Hinkley Point-B Unit A	610	Oct 76	2011	6	
British Energy	Hinkley Point-B Unit B	610	Feb 76	2011	6	
British Energy	Hunterston B1	595	Feb 76	2011	6	
British Energy	Hunterston B2	595	Mar 77	2011	6	
British Energy	Sizewell-B Unit B	1,188	Feb 95	2035	30	
British Energy	Torness Unit A	625	May 88	2023	18	
British Energy	Torness Unit B	625	Feb 87	2023	18	
BE Total		**9,568**	**Avg. # of Years Until Plant Shutdown Weighted by Reactor Capacity**			**12.51**

* N.B. Capacity figures may be different from those reported on company reports
Source: Energy Information Association and Fitch

■ Appendix 2

Nuclear Liabilities of Selected European Corporates

	Company Data						Fitch Adjusted Data				
Year-end 2003	Receivables Relating to Nuclear Liabilities	Decomm- issioning Provision	Interim Spent Fuel and Radioactive Waste Storage	Long-Term Storage and Disposal	Total Recorded Liability	Receivable or Prepayments	Decomm- issioning	Interim Spent Fuel & Radioactive Waste Storage	Long-Term Storage and Disposal	Fitch Adjusted Gross Liability	Fitch Adjusted NET Liability
EDF[4]	0	10,477	12,523	3,759	26,759	2,300	10,477	12,573	3,759	26,759	24,459
E.ON	0	8,491	← 5,267 →		13,758	851	8,491	← 6,118 →		14,609	13,758
RWE[1]	0	4,180	← 5,292 →		9,472	651	4,180	← 5,943 →		10,123	9,472
EnBW	0		← 3,920 →		3,920	406		← 4,326 →		4,326	3,920
CEZ	38	252	97	520	869	183[3]	252	97	520	869	686
Slovenske Elektrarne	358	← 539 →		0	539	358	← 539 →		443[2]	982	624
British Energy 31 Mar 03)	487	1,453	← 4,291 →		5,744	487	1,453	← 4,291 →		5,744	5,257

[1] The split for RWE's decommissioning and spent fuel provisions was taken from a DrKW Debt Research paper.
[2] EUR443m corresponds to the estimated cost of disposal, which has not been reported on the balance sheet. Fitch has included it for our comparison as there is expected to be a future cost to the company.
[3] EUR183m includes the approximate value of the state run 'Nuclear Account' (CZK4,700m)
Exchange rates used as of balance sheet dates (YE 03)
[4] Interim spent fuel for EDF comprises reprocessing of nuclear fuel and provisions for last core
Source: Company reports, DrKW Debt Research, Fitch