Financial Aspects of Decommissioning

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ABSTRACT

European Commission adopted recently two proposals of Directives designed to pave the way for a Community approach to the safety of nuclear power plants and the processing of radioactive waste. Nuclear safety cannot be guaranteed without making available adequate financial resources. With regard, in particular, to the decommissioning of nuclear facilities, the Directive defines the Community rules for the establishment, management and use of decommissioning funds allocated to a body with legal personality separate from that of the nuclear operator.

In order to comply with the acquis communautaire, Romanian Government issued the Emergency Ordinance no. 11/2003 which set up the National Agency for Radioactive Waste (ANDRAD) and soon will be established the financial mechanism for raising the necessary funds. Societatea Nationala “Nuclearelectrica” S.A. operates, through one of its branches, Cernavoda NPP Unit 1 and has to prepare its decommissioning strategy and to analyze the options to assure the financing for covering the future costs.

The purpose of this paper is to clarify the financial systems’ mechanisms to the satisfaction of the nuclear operator obligations, according to the disbursement schedule foreseen by decommissioning projects.

The availability of cash to pay for all the decommissioning expenditure must be foreseen by setting up assets and establishing a suitable financing plan. The different practices of assets management shall be presented in this paper on the basis of the international experience. Some calculation samples shall be given as an illustration.

1. INTRODUCTION

The nature of the technical operations, the long term perspective and the amount of money involved for decommissioning have financial consequences in regards to cost estimating and financing for which there does not exist to date one single answer. In the current frame of the opening of the European electricity market and of the enlargement process of the European Union, the financial assessment of decommissioning operations has become an important decision driver. Thus there is a crucial need for reliable cost calculation methods and strategies for financial planning of dismantling operations. Most of the countries using nuclear power have regulated the decommissioning cost liabilities in acts or rules. In most of the countries the legal obligations include general principles:

— The owner’s responsibility: The generality should not diminish the owner’s responsibility. The owners have to foresee the necessary economic and financial measures to meet future decommissioning expenditures.

— Clear calculation of the costs: It is of great importance that the decommissioning costs are calculated properly and re-evaluated periodically. This allows the integration into the
operating costs, i.e. in the kWh price.
— **Minimizing costs transfer in the future:** The decommissioning costs have to be benefited from the operational benefit and the funds have to be collected during the operational time.

There are different possibilities of who bears the responsibility of the financing of the decommissioning and its realisation:
— The responsibility is transferred to a central external agency depending on the state. This system is called **“centralised control of funds / centralised responsibility of obligations”** (Italy, Spain);
— The responsibility remains at the producers, but the accumulated funds are retained in a separate account controlled by the state. This system is called **“centralised control of funds / decentralised responsibility of legal obligations”** (Finland);
— The responsibility remains at the producers, but they have to give guaranties in the subject. This system is called **“guaranties given by producers / decentralised responsibility of legal obligations”** (USA);
— The responsibility is at the level of the company that creates the burdens. This system is called **“provision passed by producers / decentralised responsibility of legal obligations”**. This is the system that prevails in many countries, i.e. in Germany, Belgium.

Concerning the financing of the decommissioning, the key questions raised by the nuclear facilities are:
1. How to face the decommissioning expenses when the time comes with an acceptable probability of funds availability?
2. Which investments should the owners of NPPs choose to meet their obligations?

**2.1. General Financial Considerations**

The availability of cash to pay for all the decommissioning expenditure must be foreseen by setting up assets and establishing a suitable financing plan. Decommissioning financing system has to maximize the probability of providing sufficient financial cover to meet the expenses incurred while, at the same time, observing certain constraints.

The type of cover has to meet the following conditions:
- To face, when the time comes, with an acceptable level of risk, expenses for which the financial cover system has been set up and managed;
- To avoid value destruction, caused by an anticipated return on an asset inferior to the cost of the assets itself.

**a) Availability of funds**

Available funds are linked on the one hand to the capital saved over a period of time as well as the wealth generated by the company itself. Necessary resources for financing the future dismantling commitments are therefore made of industrial assets and/or financial assets and will rely on appropriate asset/liability management. An adequate diversification of assets, within the regulatory constraints of each country, will allow an optimisation of the profitability/risk ratio. Assets should become more and more available as the disbursement time comes nearer and nearer. When a State accepts the entire liability and corresponding risks (in consideration of instalment of a cash sum balance from the operator, or state taxation of the client), it can rightfully decide the type of asset/liabilities management it prefers. But the companies concerned don’t have to make provisions in this case and the state option concerning asset/liabilities management can no longer influence the company competitiveness. For these companies only the financial conditions of asset transfers exert an influence. A reinvestment of part of the cash-flow into industrial assets therefore allows
optimisation of the profitability return/risks ratio while bearing in mind the time period involved.

\( h) \) Annual expenditure

The withdrawal of necessary resources for the dismantling of the installations is linked to the following:

- the aggregate reference cost

Many dismantling experiences carried out across the world have been on prototype or preindustrial installations. Those have permitted us to define procedures and to master the techniques. Nevertheless the aggregate cost of the dismantling of a large power reactor has yet to be demonstrated practically.

- the elasticity of time schedule

The time schedule depends on that selected by the company: immediate dismantling after flushing and evacuation of fuels and fluids, or deferred dismantling, profiting from the natural radioactivity decrease. In the case of immediate dismantling, it is foreseeable that 100% expenditure is undertaken within the ten years following the closure of the plant. In the case of deferred dismantling, main expenditure is required only 50 years after the plant closure and spread over ten years. Currently there is no law defining the maximum amount of time within which dismantling has to be completed. A deferred dismantling allows decrease "direct" costs but leads to not inconsiderable site surveillance costs during the waiting period.

- the uncertainty of the plants lifespan

Some plants, whose anticipated operational life is 30 years will be able to extend it to 40 years or more. On the other hand, others can be decommissioned early for unforeseen technical, economic or political reasons. The possibility of spreading the dismantling expenditure and getting an effective flexibility on the time schedule of these expenditure could mitigate the risk of not meeting the cover and therefore limit the necessity of covering it.

c) Constraints

- the regulations

Regulatory constraints can induce a dramatic rise in costs. These risks refer to modifications in legislation (required dismantling level, "green field" for example) or waste storage costs, according to local or national tax systems (for example, in France, only the VAT applies whereas in the USA, the applicable federal waste tax is 200%).

- deregulation

Because of the growing uncertainty that deregulation facts will weigh on the value and profitability of their assets, companies could be increasingly constrained to create dedicated funds, thus limiting the free use of part of their cash flow. Due to the heightened dangers caused by the deregulation, it is normal that the community views invested assets more at risk in the electricity producer core business and that it demand a better diversification of the assets portfolio, in order to have on time the necessary available cash to meet expenditure when the time comes. Politicians are balanced by the wish to maintain the industry’s competitiveness and alternative energy costs. By anticipating the effect on tariffs and cash flow levels, the correct choice of decommissioning financing system can be made. The two following issues must be addressed: the suitability of the chosen system in the context of risk spreading within the regulatory structure and the evolution of the financial structure of the company and the utilization of its free cash flow, according to political and legal environment in which it operates or may operate in the future.

2.2. Accounting Standards

According to current accounting standards, two methods are used by companies to evaluate expenses which will occur in the future but for which a precise date cannot be attributed:
• The method of current value consists of evaluating future expenses by their present cost. The result is corrected every year for inflation and is revised periodically for technical and legal changes. In this way, the value of future expenses does not depend on when the expenditure is carried out. This is the method generally used in France and Germany for example.

• The method of net present value consists of calculating the current value by discounting future costs. This method is notably used in Belgium, the United Kingdom and Sweden. When choosing the method of calculation, the various companies are largely influenced by the legal requirements and accounting practices used in their respective countries, as well as by contractual considerations. The current value method accelerates the making of the necessary provisions. The net present value method is very sensitive to the precise calendar of the forecast expenditures and to the real yield (above inflation) expected in the long run of accumulated capital. Under the current value method provisions are made gradually during the operation of the installations, according to their estimated duration and rhythm of activity (economic and technical). The net present value method provides an annuity to cover future costs by comparing the difference with the previous year’s calculations.

2.3. The choice of a discount rate

The choice of a discount rate to select public or private investments has been a long source of debate between economists. Is it necessary to depreciate the future (therefore to discount incomes and expenditures that will appear tomorrow) or is it necessary on the contrary to add, without discounting them, sums available at different times?

Two types of argument are often advanced:
- not discounting (therefore to opt for a void discount rate), to the cause that the future generation interest would be "crushed" if we depreciate the future, is economically disputable because there exists a "pure preference for the present";
- discounting, (and to retain a strongly positive rate) risks leading to arbitration in favour of the present generation to the detriment of future generations. It is an ethically indefensible choice, because it is our duty to take into account the welfare of the future generations, especially when the choice made today will have long lasting consequences for tomorrow.

In the absence of explicit and direct procedure for the determination of the discount rate, it seems that the choice of this rate relates to the three considerations and aims described below:

• The discount rate equivalent to the internal rate of return

The definition of the discount rate takes into consideration on the one hand, the cost of the long-term debt, if the firm has to borrow to invest and, on the other hand, the remuneration rate of an alternative investment that it can make if it does not choose to invest while its self financing capacity would allow it.

• The discount rate for the choice of investments of public interest

The choice of the rate is then complicated by the fact that very often, the whole of the externalities generated by alternative projects are difficult to appraise and the temptation exists to internalise these externalities by the choice of a specific level of the discount rate. In this case, as in the case of private investments, but to a lesser extent, the level of long-term interest rate has to be taken into account.

• The discount rate in case of long-term investments

The choice of a discount rate depends on decision-maker status. The state one has an essential reference; the rate of return of the long-term bonds, when the private investor will choose the average capital cost. The decision-maker can see that positive effects on nuclear electricity production are very important, notably because they make a contribution to solve macro economical imbalances.
It is not satisfactory to keep the choice of a sole discount rate to study scenarios in such a long time scale. It is necessary to define a discounting technique that better takes into account the rationality of the economical agent including those of the public decision-maker. One choose there to build a discounting technique that, while preserving a certain economical efficiency to investments has the double aim to take into account:

1. first, the three following realities that condition the choice of the discount rate level: the decision-maker has a "pure" preference for the present, the fact that it generates wealth effects and it creates technological progress that could be profitable for future generations.
2. secondly to consider greatly the future generations welfare, so as not to underestimate the negative consequences that they would be susceptible to sustain.

Due the length of time scales, the discount rate would not have to be uniform.

Three discount rate scenarios are therefore proposed. Each of the first two has a double discount rate. The first rate covers a period of 30 to 40 years and the second rate covers the following period. These scenarios are summarised below in the Table 1: Discount Rate Scenarios:

<table>
<thead>
<tr>
<th>Year</th>
<th>Discount rate 1</th>
<th>Discount rate 2</th>
<th>Discount rate 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6%</td>
<td>5%</td>
<td>3.5%</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td>0.5%</td>
<td></td>
</tr>
</tbody>
</table>

As an example, we could compare a present sum of 100 Euro to a future sum at different periods, considering the three different discounting scenarios, as in Table 2 below.

<table>
<thead>
<tr>
<th>Year</th>
<th>Discount rates 1</th>
<th>Discount rates 2</th>
<th>Discount rates 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>2010</td>
<td>55.8</td>
<td>61.4</td>
<td>70.9</td>
</tr>
<tr>
<td>2020</td>
<td>31.2</td>
<td>37.7</td>
<td>50.3</td>
</tr>
<tr>
<td>2030</td>
<td>18.5</td>
<td>24.3</td>
<td>35.6</td>
</tr>
<tr>
<td>2040</td>
<td>13.3</td>
<td>14.9</td>
<td>25.3</td>
</tr>
<tr>
<td>2050</td>
<td>9.9</td>
<td>13.6</td>
<td>17.9</td>
</tr>
<tr>
<td>2100</td>
<td>2.2</td>
<td>10.5</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Assuming a decommissioning cost of 100 Euro/kW, the discounted value is shown in the Figure 1, according to the three discount rate scenarios.

![Figure 1 – Discounted Decommissioning Costs](attachment:image1.png)
2.4. European Commission initiatives

2.4.1. The “Nuclear Package”
At the end of April 2002 the EU’s Vice-President Loyola de Palacio announced in the European Parliament that the time had come for "common [nuclear] standards and control mechanisms which will guarantee the application of the same criteria and methods in the whole of enlarged Europe".
On 6th November the Commission’s college finally discussed and adopted what became known as the ‘nuclear package’ which encompassed legislation on safety standards, uranium imports and radioactive waste management strategies. At the time of the publication the Commission stated that ‘to avoid any difference of treatment between the current Member States and the new Member States, the legal regime will need to be operational on the date of the enlargement of the Union, i.e. 1st January 2004’. However, this is not realistic or necessary and by placing such an arbitrary and unachievable timetable the Commission will totally undermine the legislation.

A memo ‘Towards A Community Approach to Nuclear Safety’ which seeks to explain to the public the necessity and requirements of the directives accompanied the launch of the package. In particular it should be noted that:

‘This directive will introduce common safety standards’: This is not true as the directive will only require the establishment of common safety principals.
‘Decommissioning funds set up by operators must be managed separately from their other financial resources’: This is not true as operators may, under justified circumstances, manage their funds.

2.4.2. Decommissioning Funds
For a number of years the Commission has been considering legislation to regulate the use of decommissioning funds. In a 1998 Commission publication it was stated: “Different situations exist among the Member States for the financing of decommissioning, e.g. simple provision in the accounts allowing reinvestment of the collected funds for other than decommissioning purposes, segregation of collected funds outside the sphere of the company, or a complete State organisation and management of decommissioning by separate specialised, mostly publicly owned companies. Moreover, the amount of yearly funding required, the requirements as to when and how decommissioning has to be accomplished, and the applied calculation methods and discount rates differ substantially between Member States. This situation could lead to distortion and discrimination between now competing nuclear electricity producers from different Member States. Decommissioning costs are clearly seen as part of the electricity production costs.” (see reference [5]).
The key issue is accessibility to these funds. In some Member States such as France and Germany, the nuclear operators retain control of the funds they must set aside for decommissioning and waste management. While in others, such as Spain, Finland and Sweden, the funds are managed by a separate legal entity. Therefore in some countries decommissioning funds may be used by the utility for investments, either in their existing facilities or for market acquisitions. It is already clear that the same companies which could have access to their decommissioning funds are also those that are most active in purchasing other electricity or energy companies. Therefore the European Parliament, in its first reading of the Electricity Market Directive in March 2002, proposed an amendment which sought to address the market distortion. The amendment, was passed in the Plenary and stated: “In order to ensure the availability of funds for future decommissioning and to avoid obstacles to fair competition in the energy market, Member States must adopt separate accounting for the...
financing of future decommissioning or waste management activities. These funds must be reviewed and audited annually by an independent body, such as the regulator or regulatory bodies, to verify that the revenues and the associated interest raised for these future activities shall only be used for these purposes, that is for decommissioning or waste management activities and not used directly or indirectly to fund activities in the market.”

The Commission rejected the Parliament’s amendment claiming that they agreed on the importance of the issue, but rejected the intention of its inclusion within the electricity market directive. Rather they stated that a directive specifically addressing this issue would be prepared. Instead of this, the issue has finally been addressed in an annex of the directive on nuclear safety guidelines. In this it states: “The assets of the funds are to be used only to cover the costs set out in paragraph 2 [decommissioning and spent fuel management costs] above in line with the decommissioning strategy and may not be used for other purposes. To this end the decommissioning funds shall be duly established with their own legal personality, separate from the operator of the installation. If exceptional and duly justified reasons make such legal separation impossible, the fund could continue to be managed by the operator.”

While the first part of the paragraph goes some way to meet the requirements of the Parliament's amendment, the second sentence completely undermines the whole intent. Such a loophole totally undermines the whole purpose of restriction on the use of decommissioning funds.

2.5. Nuclear Safety Issues in Romania

The electricity delivered into the national grid by Unit 1 of Cernavoda was 5.106 million MWH in 2002, the installed power being used at 89.37%, which represents the highest values in the 6 years of commercial exploitation. The nuclear fuel necessary for the functioning of Unit 1 of Cernavoda is provided by Nuclearelectrica, through the Pitesti nuclear fuel plant. The investment works at Unit 2 of Cernavoda are 50% completed.

SN Nuclearelectrica SA has set up with its own funds the first module of the burnt fuel intermediary store in Romania. The value of the investment is of USD 15 million, the store being set into function in April this year. The final capacity of this store ensures the storage of the burnt nuclear fuel resulted from the functioning of the two units for a period of 30 years. In order to comply with the acquis communautaire, Romanian Government issued the Emergency Ordinance no. 11/2003 regarding the management of spent nuclear fuel and radioactive waste, including the final storage. According to this legal act, the process of safe management of spent nuclear fuel and radioactive waste produced in the course of different nuclear activities will be co-ordinated by the National Agency for Radioactive Waste (ANDRAD). By the end of this year the secondary legislation will be adopted for establishing the financial mechanism for raising the necessary funds as well as the responsibilities and the manner this fund shall be managed.

Societatea Nationala “Nuclearelectrica” S.A. has to prepare its decommissioning strategy and to analyze the options to assure the financing for covering the future costs. Societatea Nationala “Nuclearelectrica” S.A.’s option is for deferred dismantling. The breakdown of production cost for the MWh delivered by Cernavoda NPP Unit 1 shall include a component which shall, once the invoices amounts are collected, feed the fund dedicated for decommissioning. This cost component shall be included in the overall cost of electricity produced after the repayment of loans contracted by our company for Unit 1 completion, which is scheduled to end in 2006.

According to the present estimates, decommissioning costs represents about 15% of the investment costs. One can say that must be accumulated funds of about 280 millions USD,
which means that the cost of MWh delivered to the grid, applied for a period of 20 years, shall be of about 2.9 USD.

2.6. Conclusions

With over 30% of the EU’s electricity coming from nuclear power, distortions within this sector can have significant impacts on the wider electricity industry.

1) The European Commission is attempting to significantly increase the powers of the EU to regulate nuclear facilities. While everyone would like to see measures introduced that would lead to a significant increase in safety standards across the EU, it is important to assess what the changes the proposals will actually require and what impact they will have.

2) The accessibility of funds for decommissioning and waste management is a key factor in both the attractiveness of a utility to outside investors and the opportunity of a nuclear utility to expand. As there is no definition of what ‘exceptional’ circumstances are and no indication who shall judge the justification for the exception which allows the operator to manage the funds, this issue must be clarified.

REFERENCES


