Overview of the Financing Arrangements for Nuclear Power Plant Decommissioning Financing in France

Louis DU PASQUIER
General Directorate for Energy and Climate Direction of Nuclear Industry

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Nuclear power plants in France

• EDF Nuclear Power Plant fleet is composed of 58 PWR, located on 19 sites.

• Composition:
  – 34 units of 900 MW
  – 20 units of 1300 MW
  – 4 units of 1450 MW

• Total nuclear power reaches 63.3 GW, average age of 31 years in 2015

• In 2015, nuclear fleet produced 416.8 TWh, representing 76% of total electricity production in France.

• EDF also has 9 reactors currently being decommissioned
Presentation of French financing mechanism and control
Presentation of French financing mechanism: application of the polluter-pays principle and its control

- **Full and infinite responsibility of operators:** the nuclear operators are in charge of estimating future costs, financing these costs and paying them when they occur, **under the control of an administrative authority (with sanctions powers).** They are infinitely responsible for all costs (decommissioning, spent fuel and waste management): no payment/fee to an external fund that would release the operator from its obligation. Financial risk on assets is also supported by the operator.

- **Segregated internal funds:** model based on European insurance supervision: the funds are in the operator’s accounts, but protected by law and separated from the rest of the operator’s balance sheet: they cannot be used for any other purposes than payment of nuclear charges, even in case of operator’s bankruptcy.

- **Parent company liability:** the administrative authority can impose the operator’s parent company to finance these costs, should the operator fail to do so.

- If funds are not sufficient (e.g. in case of increase in estimated or effective costs, or in case of losses in the assets portfolio), the operator has to add cash in the segregated fund.

- **Investment quality:** the regulation frames the type of investments that are accepted in the funds, and the companies must provide a margin to cover for financial risk.

- **NPP decommissioning financing is made jointly with any other nuclear costs financing (other facilities, spent fuel and radioactive waste).**
Main figures for EDF
Main figures for EDF

Repartition of 36,1 B€ reserves

- Decommissioning: 8,254
- Spent fuel management: 14,931
- Long term management of radioactive waste: 12,946

Repartition of 75,8 B€ costs

- Decommissioning: 20,593
- Spent fuel management: 26,073
- Long term management of radioactive waste: 28,891

Data as of 31/12/2015, M€
Focus on the actualisation mechanism

- Why is there no need to finance 100% of gross costs at the end of the NPP’s lifetime?

- Due to the actualisation mechanism, even after final shutdown, available assets will continue to produce income. For instance, EDF’s yearly assets income is around 1 B€ per year in average.

- The further the costs, the less assets needed at final shutdown: a NPP decommissioning lengths 20 years or more, Cigeo expected to operate from 2025 to 2156…

- The longer the cost horizon, the less money needed:

<table>
<thead>
<tr>
<th>Time</th>
<th>Amount needed today (€)</th>
<th>Assets needed at final shutdown (€)</th>
<th>Decommissioning cost (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>17 €</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2066</td>
<td>55 €</td>
<td></td>
<td>100 €</td>
</tr>
</tbody>
</table>

Diagram showing actualisation during 60 years at 3% and 20 years at 3%.
Main figures for EDF: focus on NPP decommissioning costs

- EDF has 58 PWR (second generation) in operation, which decommissioning cost has been estimated at 19,6 B€ cost at YE2015, corresponding to 11,9 B€ reserves.

- EDF also has 9 reactors definitively shutdown (6 Graphite gaz, 1 fast neutron, 1 PWR and 1 heavy water reactor), called first generation, that are being decommissioned. EDF estimates a 6,4 B€ decommissioning cost corresponding to approx 3 B€ reserves.

<table>
<thead>
<tr>
<th>EDF</th>
<th>31/12/2015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gross costs</td>
</tr>
<tr>
<td>First Generation reactors decommissioning costs</td>
<td>6 431</td>
</tr>
<tr>
<td>Second Generation reactors decommissioning costs</td>
<td>19 639</td>
</tr>
<tr>
<td>Other costs (spent fuel and radioactive waste)</td>
<td>49 484</td>
</tr>
<tr>
<td>TOTAL</td>
<td>75 554</td>
</tr>
</tbody>
</table>

- The 58 PWR decommissioning cost is estimated using a standard cost for a site with four 900 MW PWR, which is then extrapolated to the rest of the fleet.

- The reactors definitively shutdown decommissioning costs are estimated on a site by site basis.
Audit lead on EDF’s 58 PWR decommissioning costs
Audit lead in 2015 on decommissioning costs for EDF operating NPPs

Administrative authority has ordered an audit:

- Lead by external auditors, under the supervision of DGEC.
- A year and a half long (6 month call for tender, 1 year of work), report finalized during summer 2015.

Perimeter and objectives:

- Undiscounted costs computed by EDF for 58 operating NPPs, based on a detailed study for one site (Dampierre), extrapolated to the rest of the fleet: ~20 B€ costs.
- Get an external opinion on the hypothesis retained by EDF.

Report is public and available on Ministry’s website:

- The audit concludes that EDF’s figure is globally adequate, even though estimating decommissioning costs is a delicate exercice.
- It participates in the transparency of decommissioning costs estimations.
Audit lead in 2015 on decommissioning costs for EDF operating NPPs

Main points of attention:

- Risk analysis
- Detailed decommissioning planning for the fleet
- Productivity / scaling / mutualisation effects
- Importance of the extrapolation methodology of a standardized cost to the whole fleet
- Site’s initial state knowledge / final state aimed and soil treatment
- Availability of radioactive waste repository
- Regulatory framework and relations with nuclear safety authority
- Consolidation of national and international comparisons
Thank you for your attention