

DECOMMISSIONING OF NUCLEAR POWER PLANTS

NUCLEAR



IS A LOW-CARBON
ENERGY SOURCE



ENSURES SECURITY
OF SUPPLY



IS ENVIRONMENTALLY,
ECONOMICALLY AND
SOCIALLY SUSTAINABLE

EU NUCLEAR INDUSTRY IN NUMBERS



ACCOUNTS FOR
25%
OF ELECTRICITY



ALMOST
50%
OF LOW-CARBON
ELECTRICITY



SUPPORTS AROUND
1Mn
JOBS



TURNOVER OF
100bn
PER YEAR

Introduction

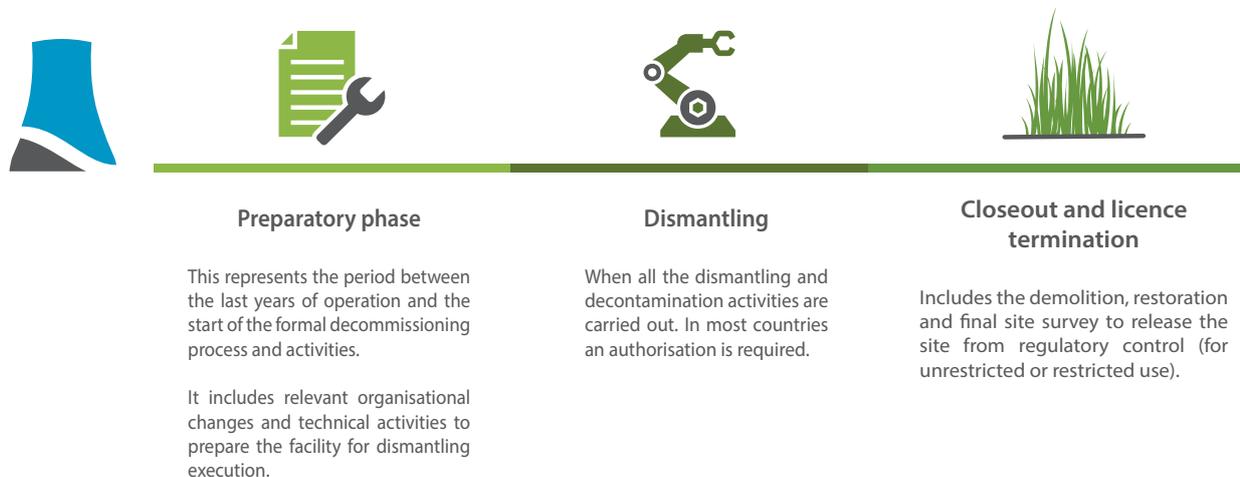
All power plants (coal, gas and nuclear) have a designed lifetime beyond which it is often not economically or technically feasible to operate them. Generally, older nuclear plants have a designed lifetime of about 40 years, although with refurbishment some have operated for much longer periods (up to 50 or 60 years). Newer plants have a designed lifetime of 60 years, with refurbishments potentially enabling them to operate for a further 40 years. Once a nuclear power plant is permanently shut down, facilities need to be decommissioned so that the site can be used for other purposes.

1. What is decommissioning?

According to the Organisation for Economic Cooperation and Development's Nuclear Energy Agency (OECD NEA)¹, decommissioning refers to the "administrative and technical actions taken to allow the removal of some or all of the regulatory controls from a nuclear facility after its shutdown and the return of its site to an acceptable end-state. These actions involve decontamination, dismantling and removal of radioactive materials, waste, components and structures. They are carried out to achieve a progressive and systematic reduction in radiological hazards and are undertaken on the basis of pre-planning and assessment, in order to ensure public and occupational safety during and after decommissioning operations, and protection of the environment."

2. What are the phases of decommissioning?

The decommissioning of nuclear power plants takes place in three phases:



3. What are the different decommissioning strategies?

According to the International Atomic Energy Agency (IAEA)² there are two main decommissioning strategies:

- **Immediate Dismantling:** This is considered when decommissioning actions begin shortly after permanent shutdown. Equipment and structures, systems and components of a facility containing radioactive material are removed and/or decontaminated to a level that permits the facility to be either released from regulatory control for unrestricted use or released with restrictions on its future use.

¹ OECD NEA (2006). *Selecting Strategies for the Decommissioning of Nuclear Facilities*

² IAEA (2014). *Decommissioning of Facilities, General Safety Requirements Part 6*

- **Deferred dismantling:** In this case, after removal of the nuclear fuel from nuclear installations, all or part of a facility containing radioactive material is either processed or placed in such a condition that it can be put in safe storage and the facility maintained until it is subsequently decontaminated and/or dismantled. Deferred dismantling may involve early dismantling of some parts of the facility and early processing of some radioactive material and its removal from the facility, in order to prepare for the safe storage of the remaining parts of the facility.

A combination of these two strategies may be considered practicable on the basis of safety requirements or environmental requirements, technical considerations and local conditions, such as the intended future use of the site, or financial considerations.

- **Entombment**, in which all or part of the facility is encased in a structurally long structural life material (such as concrete), is not considered a decommissioning strategy and is not an option in the case of planned permanent shutdown. It is only considered as a solution under exceptional circumstances (e.g. following a severe accident).

4. Is there a cost and funding scheme?

Generally, the operators/licensees are responsible for the decommissioning costs. There is considerable variability in format, content and practice of decommissioning cost estimates, therefore a direct comparison cannot be made between different plants and countries. In 1999, the European Commission, IAEA and OECD NEA launched a joint initiative to standardise the cost structure, defining specific cost items. This cost structure known as International Structure for Decommissioning Costing (ISDC) and can allow one to understand the discrepancies in the different projects.

4.1 Decommissioning costs

Decommissioning costs depend on several drivers, some of which are country specific (e.g. national legislation, regulatory framework, availability of disposal facilities and disposal costs) whilst others depend on the facility itself (e.g. decommissioning strategy, size, initial radiological status, end state, contractor strategy, etc.).

According to the ISDC structure³, the following items could be included within the scope of decommissioning costs:

- Pre-decommissioning actions and facility shutdown activities
- Additional activities for safe enclosure (only in the case of deferred decommissioning)
- Dismantling activities within a controlled area
- Waste processing, storage, transportation and disposal
- Site infrastructure and operation
- Conventional dismantling, demolition and site restoration
- Project Management, engineering and support
- Research and development
- Fuel and nuclear material
- Miscellaneous expenditures

³ OECD NEA (2012). *International Structure for Decommissioning Costing (ISDC) of Nuclear Installations*.

4.2 Decommissioning fund

Financing methods vary from country to country. As described in the Nuclear Illustrative Programme (PIN) 2016, the most common funds are:

- **The segregated internal fund** kept by the operator of the installation but as a separate budget which can only be used for decommissioning and waste management purposes, and which remains under the control of the national body. Funds of this type exist for example in France and Belgium.
- **The segregated external fund**, meaning external to the operator of the installation. Such a fund exists in Finland and Sweden (and is outside of the Member State budget) as well as in Hungary, Romania, Slovakia and Bulgaria (although in this case the funds fall somehow within the Member State budget).
- **Non-segregated internal funds** exist in Germany, where the Commercial Law requires the companies operating NPPs to build up reserves in their balance sheets to cover future decommissioning and waste management costs.

In most Member States, funding schemes cover both waste management and decommissioning activities, whereas a few have set up separate funds. According to the Nuclear Illustrative Programme 2016, the estimated total cost of decommissioning in the EU amounts to **€123 billion**.

5. Future decommissioning challenges

In the next few decades, the nuclear industry will face a significant challenge in terms of decommissioning its NPPs in line with high standards of safety, ensuring efficiency, being cost effective and meeting stakeholders' expectations.

The search and use of best practices in the different stages of the decommissioning process have to be the main objective of the Member States. Actions should focus on the following aspects:

- Use of a gradual approach that allows the regulatory situation to evolve towards a reduction in radiological risk levels as progress is made throughout the process.
- Improving the waste management strategies to minimise the volume of waste to be disposed of.
- Using advanced project management tools to minimise the delay and risks of extra-costs.
- Digitalization, virtual reality, 3D modelling, and making best use of automation and robotics.
- Standardize and improve current decommissioning techniques (projects are no longer "first of a kind") and move towards industrial schemes.

Sources:

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About us

nucleareurope is the Brussels-based trade association for the nuclear energy industry in Europe. The membership of nucleareurope is made up of 15 national nuclear associations and through these associations, nucleareurope represents nearly 3,000 European companies working in the industry and supporting around 1.1 million jobs.



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