DECOMMISSIONING NUCLEAR POWER PLANTS IN EUROPE LESSONS LEARNED: IMPROVING EFFICIENCY

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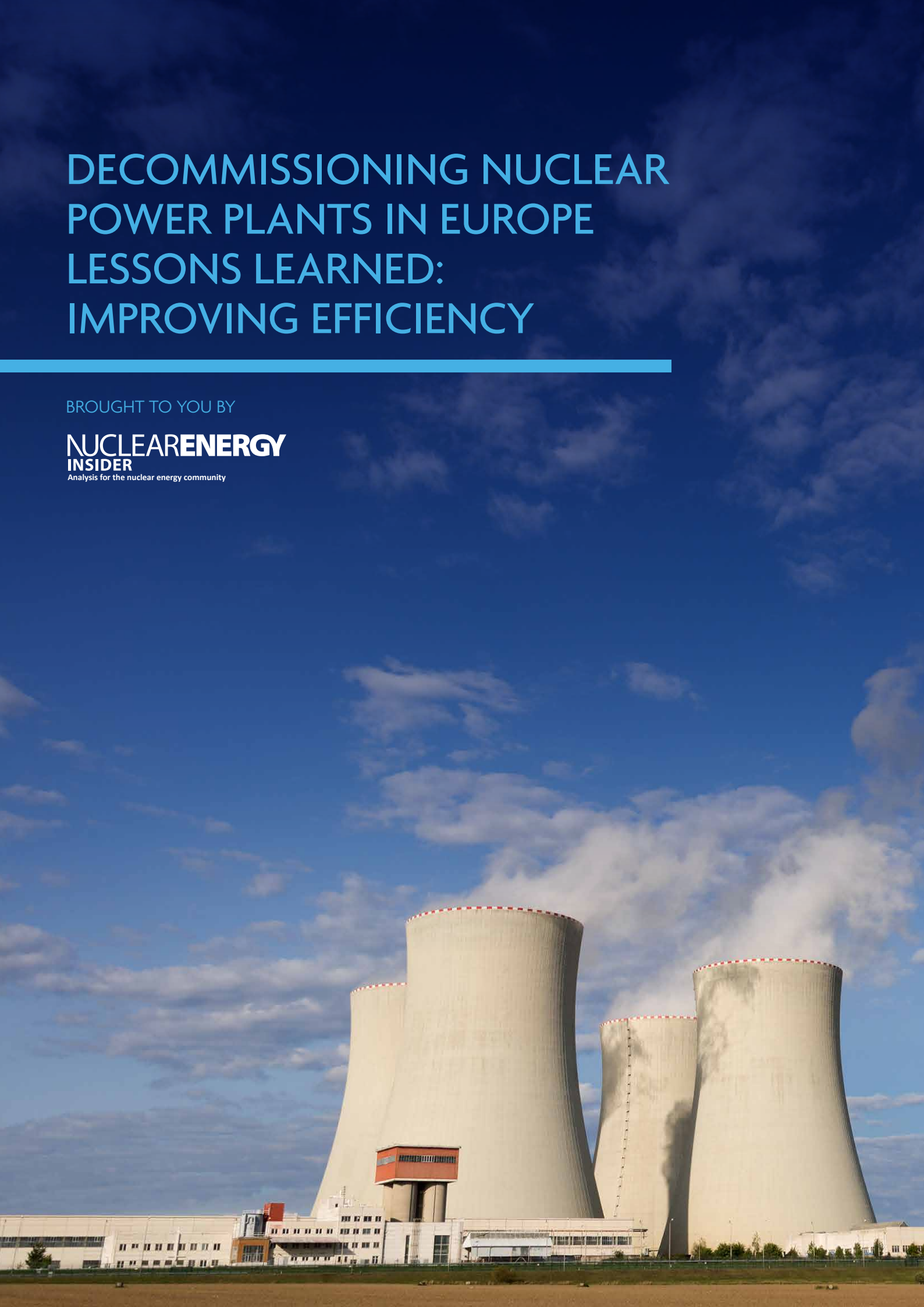
Analysis for the nuclear energy community



About Nuclear Energy Insider

Nuclear Energy Insider is a leading business intelligence provider that serves the global nuclear energy community. Focusing on the entire nuclear lifecycle, we help businesses address complex challenges and opportunities in plant construction, SMRs, O&M, plant digitalization, decommissioning and waste management. Our clients include utilities, operating companies, EPCs, OEMs, suppliers, government bodies, regulatory organizations and financial institutions.

Since 2010, Nuclear Energy Insider has created original content to help our community navigate potential threats and upcoming opportunities. Received by over 30,000 professionals globally, we do this through:

- Interviews with industry experts
- Project announcements & technology developments
- Analysis & commentary on nuclear energy activities around the world

This whitepaper covers:

The number of European nuclear reactors decommissioning is set to rise sharply in the next decade, especially as Germany's nuclear program is due to close by 2022. Operators face time, money, labor and regulatory pressures, which impact on a project's efficiency and time-to-completion.

This whitepaper examines the decommissioning challenges faced by the European nuclear industry and the potential application of lessons learned to improve efficiency of projects.

Introduction

The International Atomic Energy Agency (IAEA) reports that a total of 166 nuclear reactors have permanently shut down, most of which are in Europe, and up to 200 additional reactors are set to go offline in the next two decades. Factors include ageing fleets, changes to government energy policies, enhanced safety requirements and financial viability, the latter prompting a recent spate of premature closures.

The Callan Institute's 2017 Nuclear Decommissioning Funding Study evaluated 54 utilities, 27 investor- and 27 public-owned, and demonstrated a trend in rising costs of decommissioning in the U.S. since 2008. Cost estimates for plants totalled $55 billion in 2008 compared to $91 billion in 2016. The report highlights labor, energy, and waste material transportation and disposal as the primary components of decommissioning costs.

The Organization for Economic Cooperation and Development (OECD) Nuclear Energy Agency (NEA) 2016 report on the Costs of Decommissioning Nuclear Power Plants highlighted only 16 reactors have completed decommissioning and the majority of these were in the U.S. The report analyzed data collected from member countries with the aim of improving benchmarking of decommissioning cost estimations against actual cost data.

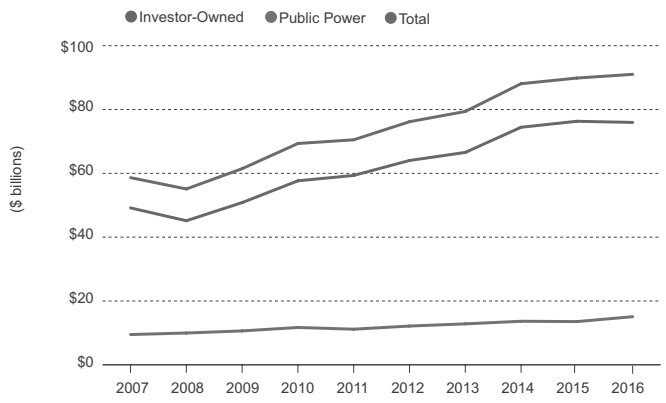
Globally, operators are proactively planning for decommissioning while their nuclear power plants (NPP) are still operational in an attempt to identify and enact efficiencies before shut down. There are now calls from the industry to replicate its collaboration on safety and cooperate more openly on information sharing and lessons learned to maximize efficiencies and accelerate the time to project completion and license termination.

Cost Estimates

Total decommissioning cost estimates have risen from a low of $55 billion in 2008, reaching $91 billion in 2016. The modest $1.1 billion (1.3%) increase from the $90 billion in 2015 is likely due to a combination of updated site-specific cost studies by several owners and NRC minimum amounts that fell from their 2014 estimates.

As with NDT fund balances, investor-owned costs have accounted for more than four-fifths of total costs over the past decade, with public power costs accounting for the rest.

Cost Estimates of Decommissioning in Current Dollars



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Investor-Owned ($bn)	49.2	45.1	50.8	57.7	59.3	64.0	66.6	74.4	76.3	76.0
Public Power ($bn)	9.5	10.0	10.6	11.7	11.2	12.1	12.8	13.6	13.5	15.1
Total ($bn)	**58.7**	**55.1**	**61.5**	**69.4**	**70.5**	**76.2**	**79.4**	**88.1**	**89.9**	**91.0**

Did You Know?

Of the U.S. operating nuclear power plants:

Largest: Palo Verde in Arizona

Smallest and Oldest: Oyster Creek in New Jersey

Newest: Watts Bar in Tennessee

Source: Nuclear Energy Institute

AECOM

AECOM Imagine it. Delivered.

Jay Brister
Vice President, International Business Development, Power, Construction Services,
AECOM

AECOM is the managing partner for the U.S. San Onofre Nuclear Generating Station (SONGS) Decommissioning Solutions (SDS) Joint Venture Company formed with EnergySolutions (ES). SDS is responsible for decommissioning SONGS units 2 and 3, and for the disposal of the reactor vessel from SONGS 1. In addition to SONGS, AECOM manages more than US$5.2 billion in government nuclear decommissioning projects that involve transuranic material handling and spent nuclear fuel management responsibilities.

AECOM brings the full suite of decommissioning experience to performing complex nuclear power station and weapons complex decommissioning and dismantlement (D&D) projects. These start with site characterization and decommissioning planning, working through the transition phase and ultimately reaching site release and license termination. For more than 30 years, AECOM has played instrumental roles in most of the significant nuclear power and federal site closure efforts.

The main challenge facing collective decommissioning across Europe is the varying governing regulatory structures. Regulations not only differ between countries but, in some cases such as Germany, the requirements might also vary in-country between federal and state levels. Consequently, almost every project is bespoke rather than following a proven and integrated decommissioning strategy.

Similarly, the challenge of waste disposal is driven by varying requirements. Some NPP decommissioning projects have clear and straightforward waste streams with defined repositories. Other projects begin D&D without a final destination for the decommissioning waste, resulting in on-site storage that incur extra costs due to waste being handled twice rather than once. This challenge is exacerbated by the necessity for additional storage structures, which consume more money, time, labor and involve further regulations.

A third area in the challenge space is around the overall decommissioning planning approach taken by European operators. Operating personnel are often retained to deliver the decommissioning project without the decommissioning experience to plan and execute the work. There is the risk that an operational culture will roll into and prolong the decommissioning project, which requires a much more practical approach and has a much lower risk profile. Although external factors such as local labor laws might necessitate the retention of staff, it must be established that the site is no longer an operational NPP, rather it is waste in the wrong configuration that has to be demolished and disposed of safely.

In the U.S. these challenges are largely not encountered due to the uniformity of federal regulatory requirements that govern all nuclear decommissioning activities. Although there might be some nuances peculiar to each NPP site that require additional effort, they can be easily built into the detailed cost estimate and project execution plan at the beginning of the project. This uniformity in approach gives greater clarity over the requirements necessary to execute the work and lends cost certainty to the project.

Decommissioning SONGS with ES allows both companies to bring the depth and breadth of experience into a team that then has the capability to apply and integrate a vast legacy of lessons learned and intellectual capital to the project. AECOM brings a decommissioning model that addresses the above challenges. A plant is turned over to a team that controls the site as a project within a fixed budget and schedule and

decommissioning experts take on the execution risks associated with delivering the project to completion. The structure that AECOM builds into this process, as well as having a detailed bottom-up cost estimate, drives for performance necessary to deliver monetary value for the project's stakeholders. It should be noted that at the core of this approach is a decommissioning delivery model with elements that can be applied to European Union (EU) based decommissioning projects.

Going forward, the question remains of how European NPPs can take advantage of lessons learned elsewhere in the industry to optimize a decommissioning delivery model that is informed by varying regulations and local, site-specific requirements. Although there is an openness to learn from the U.S. on approaches to physical activities, waste management and license stewardship, the global industry needs to take a higher perspective. Once the bespoke nature of each project is understood, commonalities need to be identified to enable sharing of appropriate synergies and past experiences.

Historically, the global nuclear industry has always prioritized NPP safety before optimizing performance, forming associations and organizations to enable information sharing on these issues. An industry approach similar to the focus on safety and operational performance taken in the 1980s and 1990s with great results, should now be migrating toward a focus on safety and decommissioning as the industry matures and to allow it to collectively learn as an industry.

It is time for the industry to look at decommissioning as the next frontier and focus collective efforts on the final stages of the NPP lifecycle. Similarly, to operators drawing on an operating experience database, owners of NPPs approaching shut down would benefit from accessing a decommissioning experience database. This might also prove to have long-term benefits to the whole industry.

OECD Nuclear Energy Agency

Strål säkerhets myndigheten
Swedish Radiation Safety Authority

Simon Carroll
Chair OECD, Senior Analyst
Nuclear Energy Agency DCEG, SSM

In 2017, the OECD-NEA Decommissioning Cost Estimation Group (DCEG) started a project looking at benchmarking costs and exploring methods that compare actual with estimated costs. Although still in a relatively early phase of work, the aim is to complete work on a report by the end of 2018 for publication in early 2019.

Decommissioning large-scale nuclear power facilities is still in a phase of learning and development, not only in Europe but also internationally. Significant uncertainties concerning NPP decommissioning costs remain, including identifying the major drivers of these costs in practice. This has resulted in ongoing issues around assuring the adequacy of decommissioning funds, as well as limited insight into which opportunities should be prioritized in the delivery of a project to maximize cost efficiencies.

Attempting to learn from project experience gained from decommissioning older 'legacy' facilities, research reactors, or complex multi-facility sites like Sellafield in the UK presents further challenges, as these approaches are unlikely to yield directly applicable project-level insights. Although the development of

equipment and application of techniques will yield valuable NPP decommissioning learning experiences, the differences in context at project level may result in the decommissioning of NPP projects developing along very different learning curves.

A tight pool of decommissioning expertise across a number of disciplines is set to remain a challenge for project planning in Europe, as bottlenecks associated with demand peaks for qualified personnel are forecast for the late 2020s. Strategies to overcome this challenge differ between companies and countries, with some opting to retain and retrain operational staff and others choosing to downsize and hire external decommissioning specialists, while it is possible to combine both approaches. Companies also appear to be considering accelerating or postponing certain decommissioning activities within their overall program schedule in order to reduce the risks of delays caused by lack of availability of qualified and experienced personnel.

Concerns still surround decommissioning cost estimates and whether they give a realistic picture of actual costs, as well as providing sufficiently good insights into costs to enable estimates to be incorporated into project controls to actively manage costs during decommissioning. Validating the estimates will require scrutiny of actual project costs and how these compared with the estimates. Until such validation occurs, including an understanding of nature of the real cost drivers, significant uncertainties in the costs will remain.

To improve the quality of the cost estimates and to facilitate comparability, the OECD NEA has been addressing the need to promote greater insight into decommissioning costs and has published guidance documents on important aspects of cost estimation for projects. These include the 2012 International Structure for Decommissioning Costing (ISDC) jointly published with the IAEA and European Commission (EC). These guidance documents have established a sound basis for producing comprehensive and high-quality project cost estimates, improving transparency of the underpinning data and calculations to enhance confidence in the estimates. They also provide more explicit representation of the uncertainties that may impact on project costs.

Benchmarking is a key to untapped value that could address some of the remaining challenges. Although internal benchmarking is a valuable discipline undertaken by individual companies, understanding what is happening inside one company only shows part of the picture. There also needs to be a reliable understanding of what is happening outside and external benchmarking allows a company to determine how it is performing in comparison to the market leaders.

It requires access to sufficient comparable data and insights to be developed to ensure relevant points of reference are identified. These could then be used to effectively compare activity, process and performance metrics for projects, which would lend more confidence in estimates and facilitate targeting areas for improvement. The new DCEG project is focusing on identifying relevant methods and approaches for benchmarking that could be specifically relevant for NPP decommissioning. It will also be exploring ways to facilitate the sharing of necessary data.

Lessons learned from other nuclear or large-scale industrial decommissioning markets that could be adapted to the European NPP decommissioning market are limited. Although more NPPs have been decommissioned in the U.S. than Europe, only a relatively small number have been fully completed. In addition, these have tended to be one-off projects rather than applying a systematic development of industrial-scale approaches. One U.S. trend that could make future cost data more relevant to the European market is the shift in the U.S. from postponing decommissioning using the SAFSTOR approach to immediate decommissioning amid expectations that the latter will lower overall costs and diminish uncertainties. This is the preferred option for most European NPP decommissioning, which also creates possibilities for greater sharing of experience and alignment of considerations.

The offshore oil & gas industry has limited practical experience to-date in decommissioning large-scale offshore projects and is looking to build its own competence in this area as a large number of decommissioning projects will begin over the coming decades. The parallels with NPP decommissioning are striking, as both face a significant increase in the number of projects over a relatively short period. They both have limited experience upon which to base planning and cost estimates, and both need to ensure adequate financing and effective project delivery.

One key difference is that the oil and gas industry has a more established practice of access to and analysis of detailed industry cost data. There is a mutual interest in developing benchmarks to improve industry performance through promoting a culture that would improve the accuracy of cost estimates and enhance confidence in benchmarking for European decommissioning projects.

The views expressed in this article are personal and should not be assumed to be those of the OECD Nuclear Energy Agency or the Swedish Radiation Safety Authority

Enkom Consulting

Martyn Jenkins
Managing Director,
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Cost management specialists for the nuclear market, with a focus on benchmarking to improve data accuracy and increase industry confidence to plan and budget based on robust decommissioning cost estimates. The company is involved in the decommissioning of Sellafield in the UK, provides commercial advice for Magnox and participated on the IAEA mission advising the Italian government on decommissioning planning. Currently, Enkom is represented on the Germany-Sweden-UK tripartite working group on decommissioning.

European NPP operators and owners continue to face challenges around defining the scope of a decommissioning project, as well establishing realistic timescales and well-defined budgets. Risks are also being increasingly recognized as a significant challenge and there is growing understanding that some risks are too large to pass onto the supply chain, as well as recognizing a diminishing appetite in the supply chain to take on a lot of risk associated with unforeseen escalation in project costs.

From a business perspective, there is greater sensitivity to uncertainty and the industry has moved away from entering into an arrangement amid expectations that it will manage any risks as they arise. Now, it is paramount there is a greater understanding of risk transfer and clearer definitions between organizations with regard to which entity will carry certain risks and how risks have been defined and will be managed.

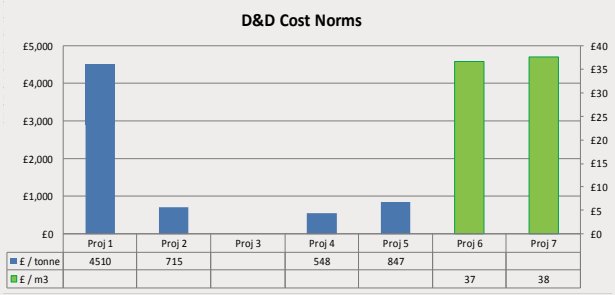
A recurring challenge for the nuclear decommissioning market is retention and recruitment of expertise and knowledge accumulated while delivering decommissioning projects. Strategies to address losing experience through natural wastage include using established knowledge management tools to retain or capture and store information. More recently companies are turning to capturing knowledge in a digital format that is transferred onto models.

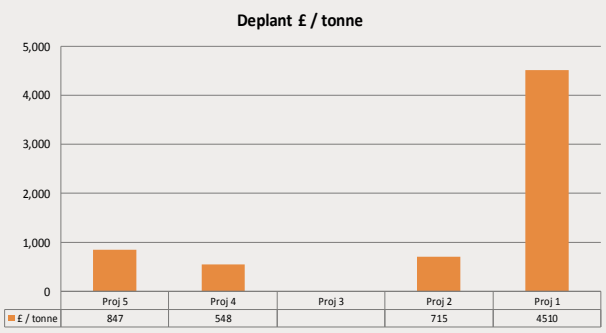
Waste disposal also remains a challenge, particularly in terms of identifying and agreeing final repository sites. Although nuclear waste categories and their appropriate disposal are well-defined at an international level, there are still issues around how and where intermediate level radioactive waste (ILW) will be deposited. This adds to the uncertainties of project costs related to storage, removal and transport of contaminated waste materials and spent fuel.

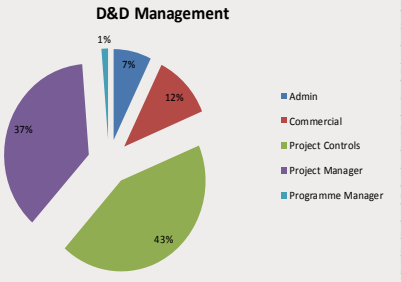
Organizations including the OECD have identified benchmarking as a key driver to addressing these challenges. Countries and companies are encouraged to discuss data that could be shared without compromising confidentiality and a standardized format is being developed to capture data. Barriers to uptake revolve around confidentiality issues, as well as the relevance of some of the cost-basis comparisons. For example, it is not useful to analyze and compare labor costs country-by-country if a profession is perceived as high-value in one country but not in another. Expectations of what benchmarking can deliver for projects must also be managed.

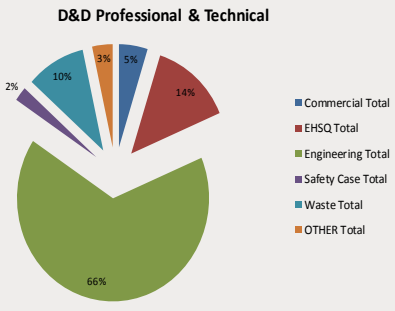
Examples of Benchmarking within a Decommissioning Project

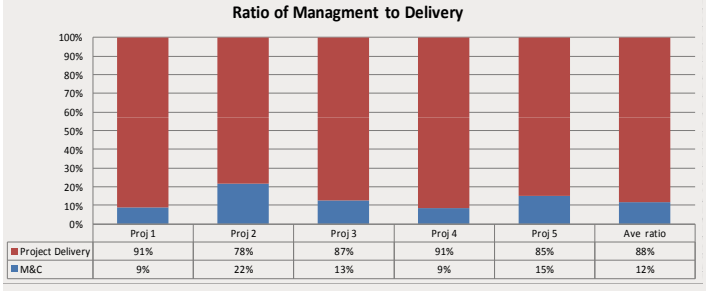
Data analysis is conducted at various levels to derive cost norms including unit costs, trends and ratios, while the project scope and outputs are recorded in Project Cases Studies. In addition, Management Dashboard and project data sheets are created, enabling data visualization as demonstrated below:

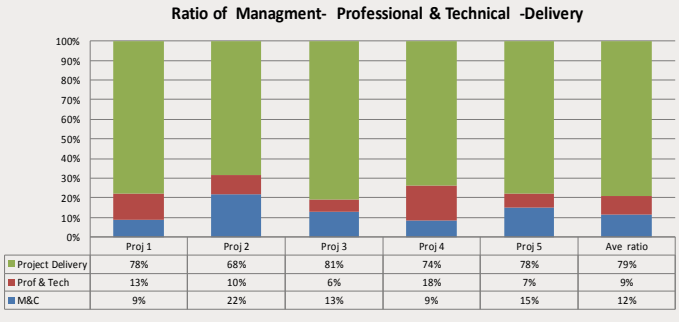












Enkom is adapting benchmarking to data capture in a practical setting, so clients are not burdened with high volumes of detailed data to analyze. Benchmarking standards need to be less formulaic and data driven, enabling the application of experience and knowledge to a project rather than just the application of numbers. To demonstrate the benefits of benchmarking, Enkom works with clients to develop data structures such as Cost Breakdown Structures, generate comparisons using 'should cost' estimates, business plans and early-stage budget approvals. These data provide a level of information and insight appropriate for clients to make informed decisions on the work and progress of decommissioning projects.

Current forecasts indicate that decommissioning of NPPs is set to increase significantly over the next ten years. In consideration of this trend, the UK Department for International Trade (DIT) has established a working group involving Swedish, German and British organizations to work collaboratively, share knowledge of their respective markets and seek opportunities for future decommissioning projects across Europe and further afield.

This tripartite group is leveraging the extensive practical experience gained from the work carried out in Germany and the UK on state-funded projects, together with an understanding of the European utilities that operate many of the plants in Western Europe and with the supply chain that has specialist knowledge of nuclear decommissioning. Along with Enkom's benchmarking expertise, the group is providing unique insight into how cost reductions can be achieved.

Mott MacDonald

Mark Liddiard
Global Practice Leader – Nuclear,
Mott MacDonald

Mott MacDonald brings together more than 40 years of experience to nuclear plant decommissioning and is a key supplier of asset management advisory services to the UK's National Decommissioning Authority (NDA). Clients include Sellafield Ltd and Magnox Ltd, the latter responsible for the decommissioning of 12 nuclear sites across the UK. Mott MacDonald opened a new office in Bulgaria in 2015 to facilitate the application of expertise gained from decommissioning projects in the UK to projects in Eastern Europe.

Taking a broad and uniform approach to the European decommissioning market is currently unfeasible, as each country faces different challenges and often with significant variations. For example, for political reasons Germany's nuclear power program is due to close by 2022 and NPPs will shut down ahead of the planned expiration of their operating licenses. This will result in a shortfall of expected revenue for the private sector owners and, unless additional funding is forthcoming from government, it could also lead to the scope of decommissioning projects being restricted due to tight budgets.

A further significant decommissioning challenge is the lack of final repositories. Scotland has a policy of indefinitely storing nuclear waste above ground, as the UK does not have a final disposal route. This results in the approach taken to demolition and decommissioning of NPPs undermining the project's efficiency, as storage infrastructure must be built to regulations in order to demolish the existing buildings before transferring the generated waste to the new and approved storage sites.

Europe's shining lights, particularly for waste management, are the decommissioning projects in Finland and Sweden, where there are funded decommissioning programs and definitive plans for final waste repositories.

Identifying waste routes remarkably improves efficiency, as packaging requirements and transports routes are known. This reduces uncertainty in the project, as well as the need for temporary storage facilities.

Progress in decommissioning more efficiently is achievable if there is a fleet approach in European countries rather than each site undertaking isolated and bespoke strategies. Although the UK's DIT set up tripartite working group from the UK, Germany and Sweden, information-sharing between countries and projects needs to be more proactive in order to realise opportunities and learn lessons learned from these respective decommissioning experiences.

The UK's decommissioning successes are centred around the fleet approach, which was adopted by Magnox Ltd to decommission its 12 sites and has driven efficiencies by transferring successful activities between projects. For example, Mott MacDonald designed the weather cladding for buildings at Bradwell to ensure the site remains passively safe for the next 60 to 80 years until decommissioning can be completed. This design process is now being transferred and replicated at Hunterston, for which Mott MacDonald is also designing weather cladding for the site's buildings.

Further success has been achieved through the simplification of contract structures and implementation. Introduced by the NDA, this has facilitated contracting with small- and medium-sized enterprises (SMEs), expanding their involvement in decommissioning which has driven innovation and remarkably improved the use of cost estimates, baseline plans and change control.

NPPs with limited decommissioning funding could adopt the UK approach, as it allows sufficient decommissioning to safely store nuclear waste before decommissioning using conventional techniques can be resumed. This is a sensible way of managing a project, although it does require stakeholder agreement that the waste storage building is on-site for decades longer than would be necessary if an advanced and rapid decommissioning program was undertaken.

However, the main challenge of characterizing waste and identifying disposal routes early on in national decommissioning planning remains a long-term barrier to optimizing cost, time, labor and regulatory efficiencies. Taking an approach based on 'waste-informed decommissioning' would allow the project's strategy, implementation and work to be driven by waste management. Characterizing the levels of radiation across a site's buildings before demolition would optimize the safe and efficient segregation and minimization of contaminated waste, reducing uncertainty and potentially costly delays to the project's completion.

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Invernizzi is researching a PhD thesis entitled Benchmarking Analysis Nuclear Decommissioning, investigating How Benchmarking Can Support the Selection, Planning and Delivery of Nuclear Decommissioning Projects. Dr Locatelli's expertise includes nuclear power, megaprojects, project management, energy economics, energy storage, small modular reactors (SMRs).

Nuclear Decommissioning Projects and Programmes (NDPs) carry several risks including lengthy schedules and cost estimates that extend into hundreds of billions (GBP). Cost and time estimates for some NDPs continue to increase, while the body of knowledge from managing decommissioning NDPs is limited, mostly due to the negligible NPPs that have been decommissioned compared to the number of facilities that have been built.

The limited knowledge in managing NDPs is due to several factors [1], including:

(i) the first NPPs were designed for a lifecycle of approximately 30 years, but an early tendency in preferring the deferred dismantling strategy (e.g. in France), inaccurate and incomplete knowledge management, and limited planning for the post shutdown stage, has resulted in postponing decommissioning;

(ii) (ii) newer NPPs are designed for a 40-60 year lifecycle and the majority of these have not yet reached the decommissioning stage, with some also extending their operating license.

NDPs do not benefit from the positive cash in-flow and revenue-generating assets are not created, jobs are lost and not replaced, and there is no new infrastructure because the site's use is restricted for several years after decommissioning ends. Therefore, the motivation to complete a project on time and within the budget is virtually absent, posing significant socio-economic challenges [1] [2].

Although research into the factors that impact on the NDP performance is at an early stage, lessons have been learned from using a top-down benchmarking analysis. For example, the cross-comparison between the 'similar but different' NDPs at the U.S. military nuclear weapons facility Rocky Flats and the nuclear site at Sellafield in UK is available [3].

Owned by the U.S. Department of Energy (DoE), Rocky Flats produced plutonium and enriched uranium from 1953 and its waste was shipped to other U.S. states. Rocky Flats was shut down in 1989 and the DoE estimated decommissioning would take 70 years and US$36 billion. The project was, however, completed by a joint venture in less than ten years at a cost of US$3.5 billion [4][5]. Conversely, Sellafield still handles radioactive material shipped from other UK nuclear sites and overseas, and its decommissioning will take an estimated 120 years and a cost up to US$167 billion (GBP120 billion) [6].

Nevertheless, and even acknowledging these differences, these two NDPs are comparable in size and budget and share similar histories, and the investigation into the factors responsible for Rocky Flats NDP having successful performance highlighted several important characteristics, e.g. [1][3]:

- Funding arrangements and contracting schemes, especially if tailored to individual employees. Rocky Flats adopted the 'abundance approach' aimed at filling the gap between 'forecast' (successful) performance and 'spectacular' performance [5]. This, together with incentives singularly allocated to employees to promote feasible ideas, supported better NDP performance.
- The free space available to manage radioactive waste within the site's perimeter. Although Rocky Flats is comparable in size to Sellafield, it also had sufficient space to manage the radioactive material [5]. In contrast, Sellafield is a built-up site, and the limited space available hinders construction of new facilities used to treat and store radioactive material.
- Early and timely engagement of stakeholders that will be impacted by decommissioning. Effective communication and involvement in collaborative action support the smooth delivery of a project, avoiding controversy that could delay or halt a NDP [2].

Therefore, the criteria for evaluating the success of an NDP should also include socio-economic criteria. These issues have been recognized and are currently being addressed. Moreover, not only do the traditional methods used to measure project success in terms of cost overruns need to be transparent [7], they also need to be complemented by other indicators such as the scheduling to complete the project that is often the main cost-driver.

LIST OF ACRONYMS

DCEG (OECD) Decommissioning Cost Estimation Group

D&D decontaminate and dismantle

DoE (U.S.) Department of Energy

DIT (UK) Department for International Trade

ES EnergySolutions

EC European Commission

EU European Union

IAEA International Atomic Energy Agency

ILW intermediate level (radioactive) waste

ISDC International Structure for Decommissioning Costing

OECD Organization for Economic Cooperation and Development

NDA (UK) National Decommissioning Authority

NDP Nuclear Decommissioning Projects and Programmes

NEA Nuclear Energy Agency

NPP nuclear power plant

SAFSTOR safe storage

SONGS San Onofre Nuclear Generating Station

SDS Songs Decommissioning Solutions

SMR small modular reactors

SME small- and medium-sized enterprises

SSM Swedish Radiation Safety Authority

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TOP SPEAKERS INCLUDE:

Vladimir Michal, Acting Sector Head – Decommissioning and Environmental Remediation, **IAEA**	Joerg Viermann, Head of Sales Department Waste Management, **GNS**	Joseph Boucau, Director, Decommissioning and Dismantling Business Development, **Westinghouse**	Mika Pohjonen, Managing Director, **Posiva Solutions Oy**	William Roberts, Director, **Decommology**

- **Discover how to implement efficient strategy development and cost planning within changing regulatory frameworks** and how improved relationships with regulators will facilitate your operations
- **Hear case studies on successful decommissioning projects** and the latest developments in waste management solutions across the globe to share in the industry's lessons learnt
- **See how innovation is driving change** in the industry and where this can help reduce risk, cost and delays while enhancing total project control
- **Gain an insight into the latest developments in spent fuel and waste management,** and how these will impact your choice of waste solution
- **Learn from international bodies how best to establish yourself in an international market** and which factors will be key to building a presence abroad

NEW ADDITIONS FOR 2018

€ **NEW Closed-Door utility workshop on decommissioning financing:** Designed exclusively for utilities and owner/operators, this closed door workshop will cover fund management, controlling overheads and benchmarking. Discuss your challenges with your peers and international economic experts and policy advisors in this new, private workshop

NEW Innovation session: Discover the latest features in research and development for the Nuclear Decommissioning and Waste Management industry such as 3D visualisation, automation and robotics; and find out how these will drive the change leading to risk reduction, lower costs and better processes

NEW Contracting and legal session: Learn how industry peers and non-nuclear companies have optimised their supply chain performance with fair and secure contracts, all while improving communication and supplier relationships

COMPANIES THAT HAVE PREVIOUSLY ATTENDED NDC:

EDF, Magnox, Sellafield Ltd, IAEA International Atomic Energy Agency, Fortum, EnBW, VATTENFALL

GROUP DISCOUNTS AVAILABLE FOR 2+ ATTENDEES

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