Oil & Gas Authority

UKCS Decommissioning

2018 Cost Estimate Report

June 2018

Contents

Cover page image - Brent Delta decommissioning – photograph courtesy of Shell UK Limited

1. Executive summary

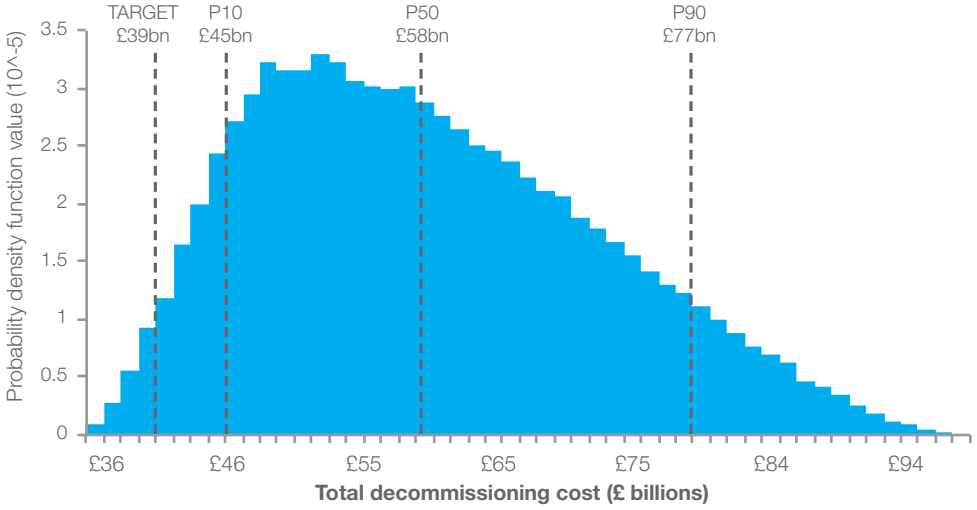
The cost of oil and gas decommissioning for the UK Continental Shelf (UKCS) has reduced from the 2017 baseline of £59.7bn*. The OGA estimates the total costs of remaining oil and gas decommissioning, including newly sanctioned projects, and changes to the portfolio of potential, as-yet unsanctioned, new developments to be:

	P10	P50	P90
2018 Estimate**	£45bn	**£58bn**	£77bn

*2016 prices

**2017 prices

Figure 1: Decommissioning cost distribution [Updated 2018 inventory]



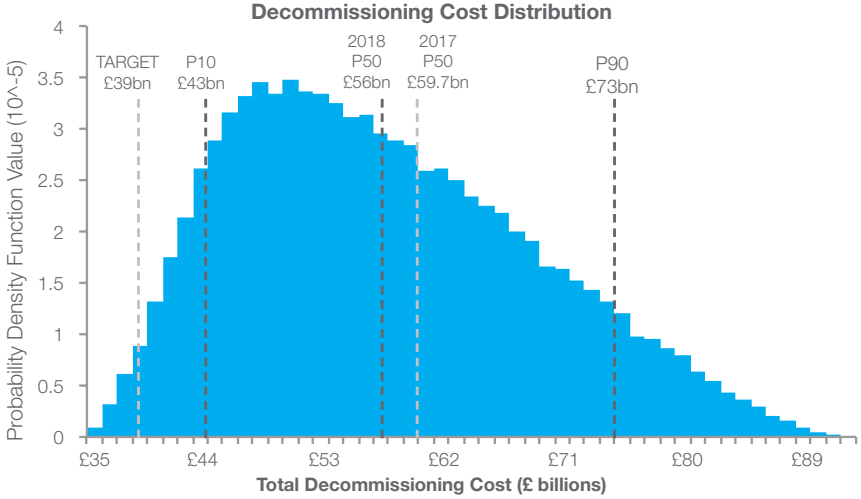
This positive change represents a strong reduction in underlying costs, partially offset by increases in the anticipated long-term decommissioning portfolio, with more infrastructure and wells included than in 2017, prompted largely by new project sanctions and increased operator confidence that as-yet unsanctioned projects will be implemented.

A strong underlying decommissioning cost reduction can be readily recognised from a like-for-like cost comparison with the same portfolio evaluated in 2017:

	P10	P50	P90
2018 Estimate*	£43bn	**£55.7bn**	£73bn
2017 Estimate*	£44bn	**£59.7bn**	£83bn
Change*	-£1bn	**-£4bn**	-£10bn
		-7%	

*2016 prices

Figure 2: Decommissioning cost distribution [Like-for-like comparison with 2017 estimate]



The 7% underlying reduction on a like-for-like basis is primarily driven by rapidly improving planning and execution practices, leading to large reductions in the cost of:

- Platform well plug & abandonment (P&A) in the Northern North Sea (NNS) and Central North Sea (CNS)
- Platform running costs in the NNS
- Topsides and substructure removals in the NNS
- Reduced contingency associated with improved estimating definition

The positive trends of improving cost performance and estimating confidence are complemented by opportunities for further substantial cost improvement in future. Nonetheless, there remain threats and uncertainties with the potential to increase costs. The extent to which UKCS decommissioning operators can quickly realise cost reduction opportunities in all UKCS regions, over all other major cost categories, and also manage/mitigate/eliminate the cost threats, will determine the success of achieving the >35% UKCS cost reduction (<£39bn$_{2016\text{-}Real}$) target referenced in the OGA Decommissioning Strategy[1].

1 https://www.ogauthority.co.uk/media/1020/oga_decomm_strategy.pdf

Flowline recovery via anchor handling vessel

Maersk Oil UK, now part of Total, used an AHV instead of a traditional construction vessel in order to successfully recover flexible flowlines directly on to the anchor handling winch drum, as opposed to the standard carousel or reel drive system. This significantly reduced mobilisation time and equipment and allowed for quicker recovery in field. This method of flowline recovery was estimated to be around 30% of the cost of the normal solution of a reel drive system.

2. Introduction

The Maximising Economic Recovery (MER) Strategy for the UK sets out a central obligation accompanied by a number of supporting obligations, including clarifying the actions and behaviours required for decommissioning.

Lower decommissioning costs will help maximise value extraction from the UKCS. For the supply chain, which holds the specialist skills, knowledge and equipment to execute the work, there is a clear and sizeable opportunity to develop an efficient, low cost and exportable industry capability.

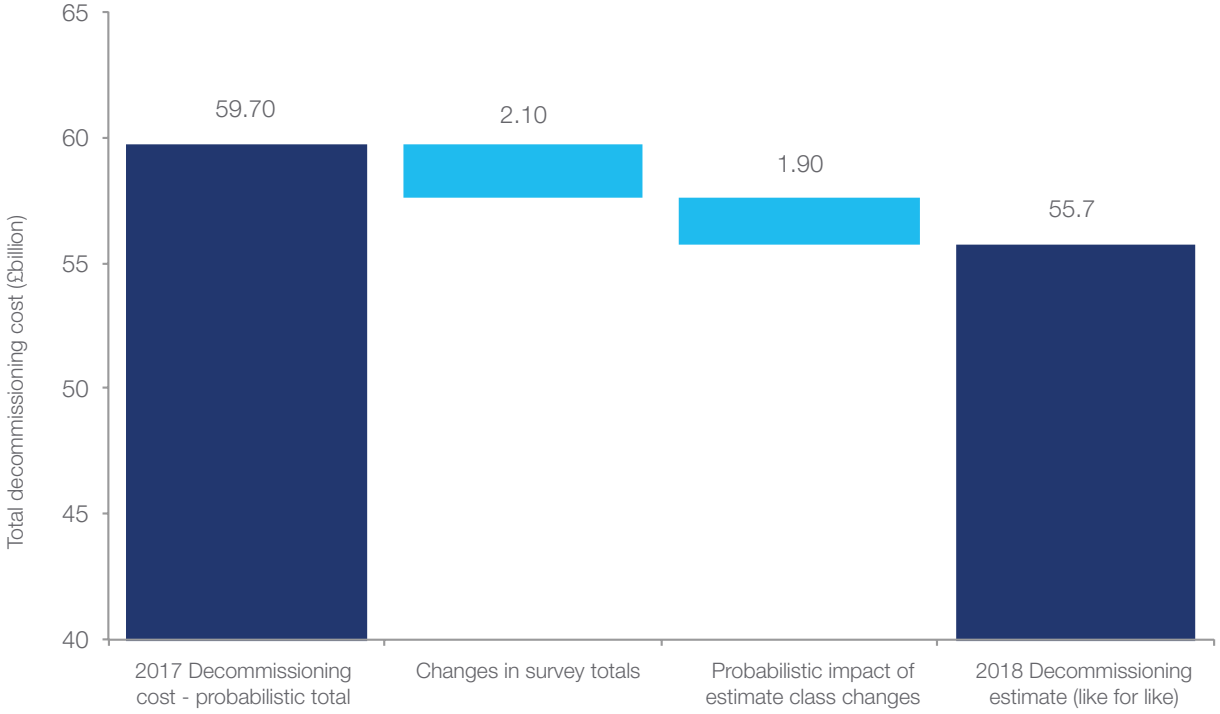
The OGA takes a probabilistic approach to estimating total UKCS decommissioning costs, taking into account the often wide range of uncertainties inherent in cost estimates. Cost estimates for all fields are provided to the OGA by operators each year via the UKCS Stewardship Survey. These serve as the basis for the evaluation. The method applied in this report is unchanged from that used in 2017[1] (see UKCS Decommissioning 2017 Cost Estimate for a description of the approach/method, and further background)

The OGA has derived an updated full cost distribution range of:

	P10	P50	P90
2018 Estimate 2017prices (Updated Inventory 2018)	£45bn	**£58.3bn**	£77bn
2018 Estimate 2016 prices (Like-for-like with 2017)	£43bn	**£55.7bn**	£73bn
2017 Estimate 2016 prices	£44bn	**£59.7bn**	£83bn

1. https://www.ogauthority.co.uk/media/4742/ukcs-decommissioning-cost-report-v2.pdf

Figure 3: Probabilistic cost changes relative to 2017 estimate



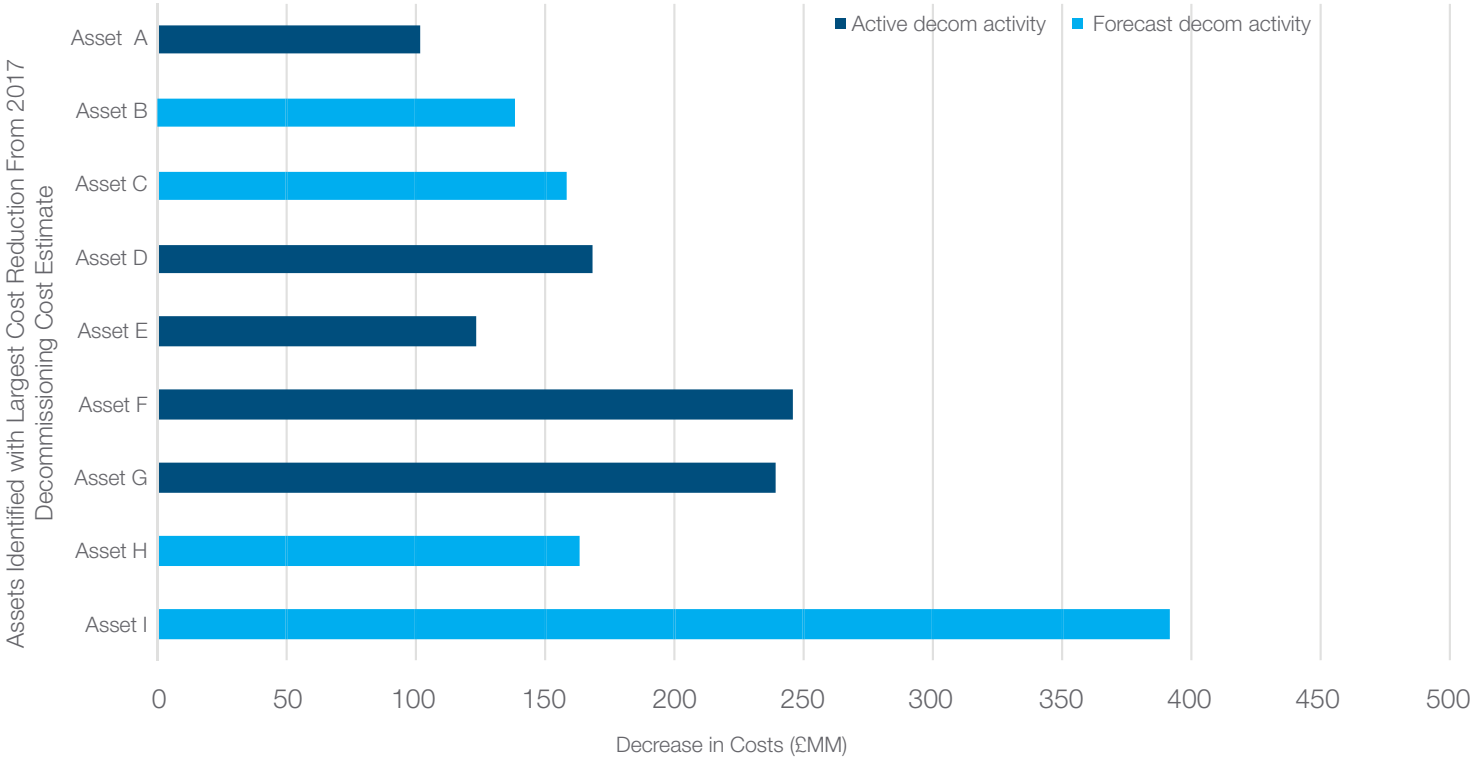
Ultimately increased competence and cost effectiveness of operators and their contractors will deliver the targeted >35% savings relative to the 2017 baseline. The OGA supports and facilitates this through:

- Use of benchmarks derived from actuals to proactively assess estimates during stewardship reviews with individual operators, as well as during Decommissioning Programme (DP) discussions.
- Creating metrics from the UKCS Stewardship Survey and publishing these regularly, with particular focus on high cost elements
- Working with operators and the wider industry to ensure effective sharing of learning
- Improvements to the decommissioning component of the UKCS Stewardship Survey to maximise consistency and value of data collected
- Promoting the development of innovative, collaborative contracting solutions
- Promoting enhanced supply chain capability
- Working with industry and the Oil and Gas Technology Centre (OGTC) to promote the development and application of cost effective technologies

Several operators are already achieving step changes in cost outcomes (see Figure 4), through adopting different approaches, learning-from/sharing-with others, and challenging previous norms. The supply chain is also bringing innovative solutions to the market in terms of technology, business models and pricing structures.

Several decommissioning estimate reductions in excess of £100 million (deterministic) contribute to the overall reduction, with a high proportion of these being driven by cost experience on active decommissioning programmes.

Figure 4: Major decommissioning cost reductions relative to 2017 estimate



3. 2018 Update: analysis

The geographic distribution of decommissioning costs is summarised below. Decommissioning costs in the CNS comprise a disproportionately large element of the total, due to the many expensive-to-decommission subsea wells in the sector, and a substantial number of large production platforms.

Figure 5: Decommissioning cost distribution by category

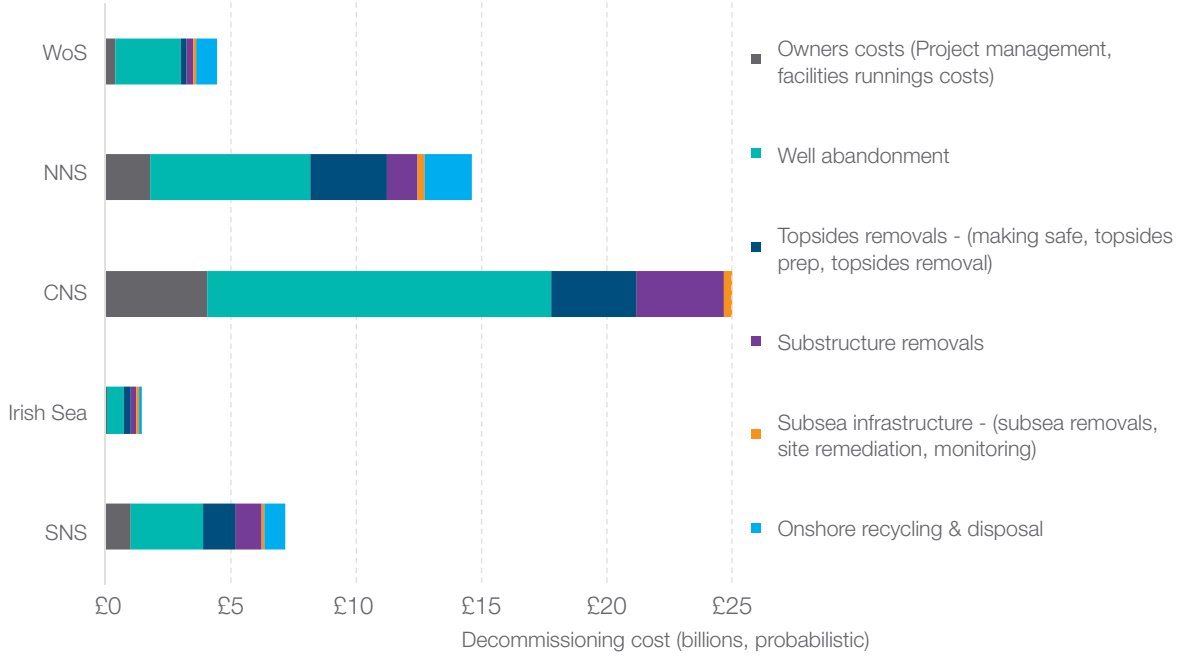


Figure 6: Well P&A cost distribution by geography

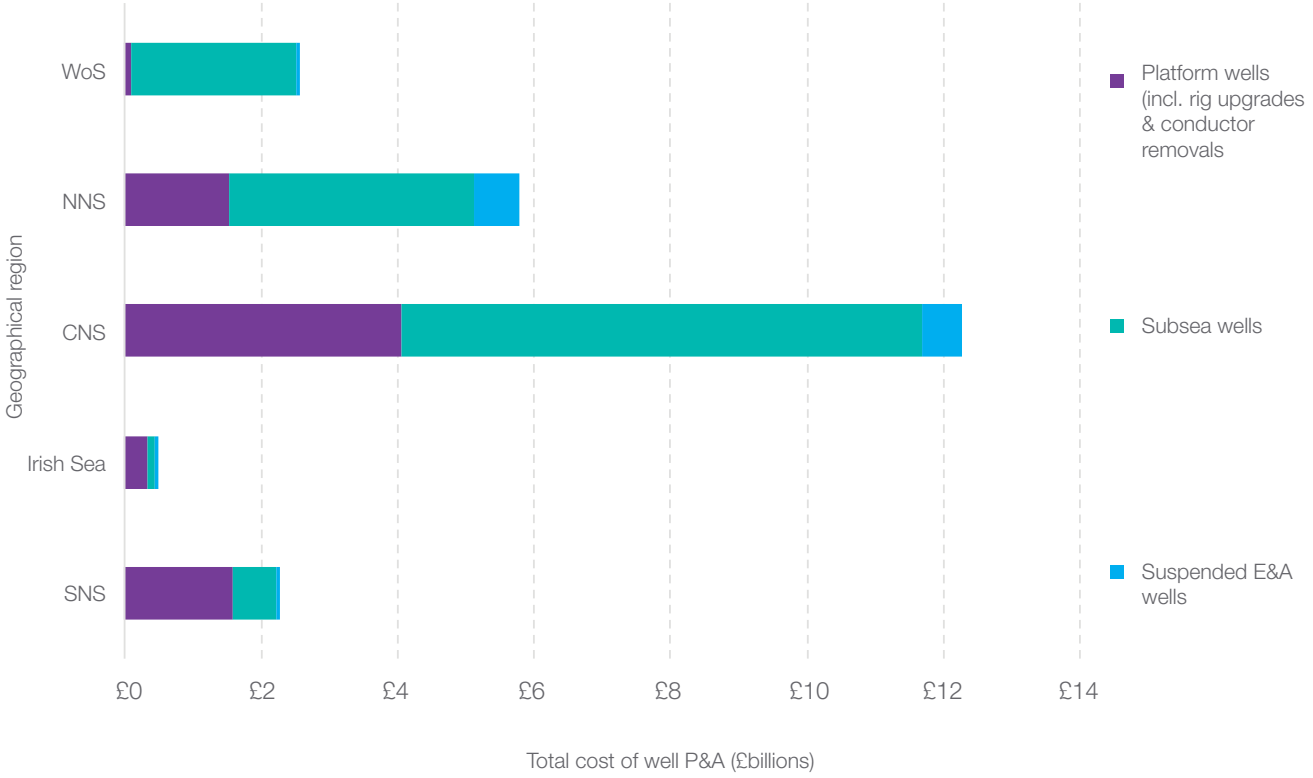
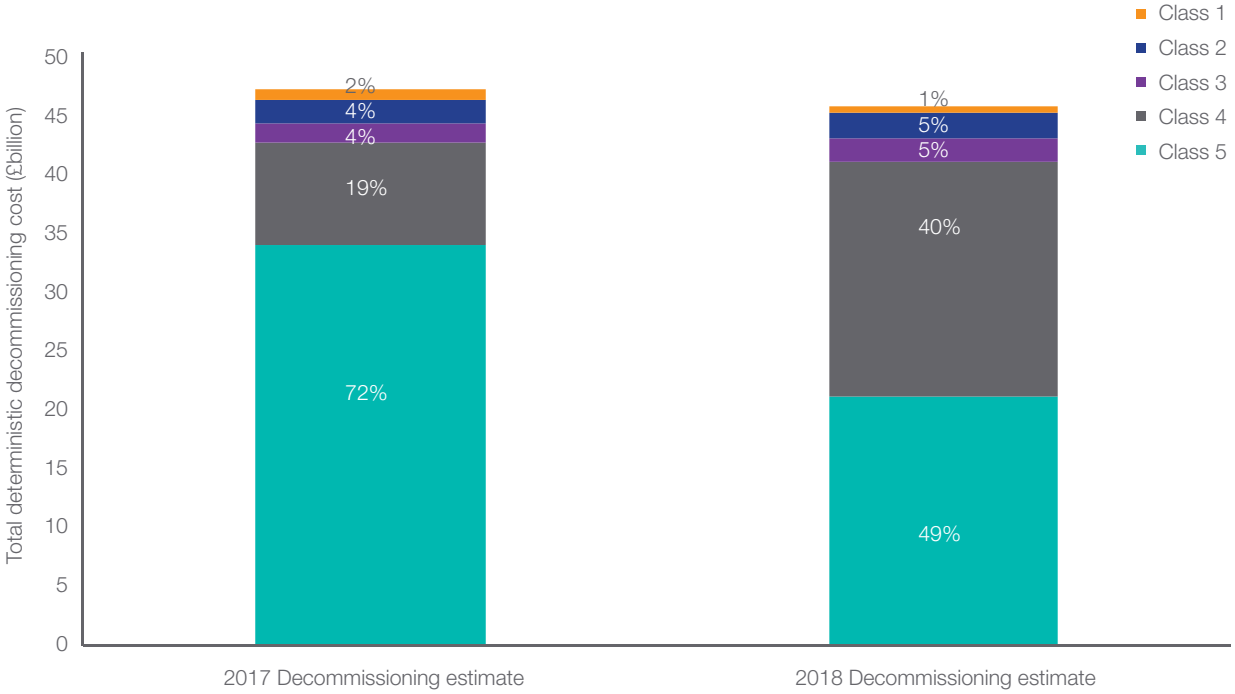


Figure 7: Decommissioning cost distribution by geography

The quality of the decommissioning estimates provided by operators has improved since the previous survey. Nonetheless the fraction of decommissioning cost estimates in Association of the Advancement of Cost Engineering (ACCE) Classes 4 and 5 remains high, even for assets being decommissioned in the coming five to six years.

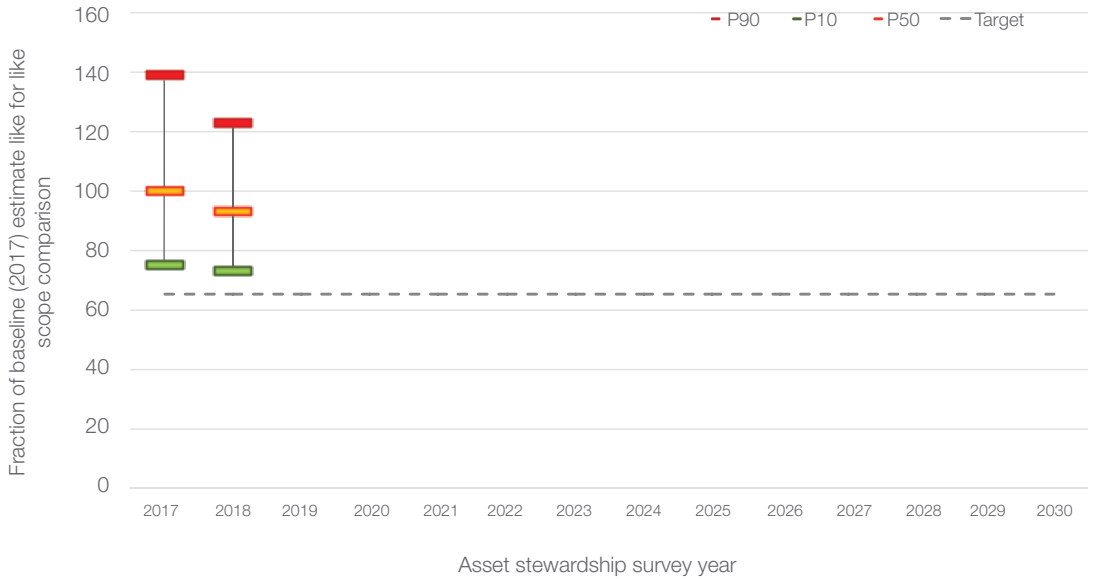
Figure 8: Decommissioning cost distribution by estimate quality



4. Opportunities and risks

The current positive progress on decommissioning costs is largely based on operators' experience in 2016/2017 of being able to achieve significant cost reduction in platform running costs, platform well P&A costs and removal costs, all in the NNS and CNS.

Figure 9: Decommissioning cost reduction towards 35% reduction target (like-for-like)



Opportunities

- The NNS and CNS together comprise 77% of the currently estimated cost of decommissioning, so the wider application of the 2016/2017 learnings, even to those sectors alone offers considerable promise. Many learnings will also be applicable in other sectors such as the Southern North Sea (SNS)

- To-date there has been relatively limited experience with the P&A of subsea wells. Compared to platform wells, these are disproportionately costly to abandon, so there is a strong incentive to reduce those costs

- Further improved asset stewardship to optimise value and costs through late-life and decommissioning

    - The OGA-operator stewardship engagement process (see Appendix. 2) is proving an effective, and increasing, contributor to understanding and managing decommissioning performance

- New entrants to the market initiate different, lower-cost approaches, contracting solutions, and pricing bases for decommissioning projects

- Innovative cost reducing technologies or techniques are implemented for well P&A activities

- Volume-based efficiencies from campaign-based approaches e.g. multi-operator well P&A campaigns

- Regulations are complied with appropriately and consistently to ensure safe and environmentally acceptable outcomes, at minimum cost

- Continued and extended close working between the OGA and industry facilitates shared learning and knowledge, and increased collaboration

- Focussed technology development and maturation towards major cost drivers offers potential for significant cost reduction

    - The OGA closely collaborates with operators, suppliers and the OGTC to this end

- Strengthened international standardisation of benchmarks and decommissioning performance measurement, to facilitate global comparisons and learning

Risks

- The currently depressed supply chain market and strong competitive forces have contributed to the cost reductions, supplementing and contributing-to execution improvements. Decommissioning will continue for decades, over multiple economic cycles, with corresponding risks of less attractive price offerings

- Should it prove problematic to substantially reduce subsea well P&A costs, it will be difficult to compensate by reducing other decommissioning cost types

- Operators may commence planning for decommissioning too late, thereby eliminating cost saving alternatives

- Traditional development project and contracting approaches are adopted for the planning, managing and executing decommissioning projects, unnecessarily over-engineering the solutions and increasing the cost

- A lack of investment in new technologies and transfer of existing technologies from other sectors may fail to capture cost reduction opportunities
- Some operators may be optimistic in developing provisioning estimates and this could result in unrepresentative values, knowingly or otherwise

Ninian North decommissioning

CNRI's successfully completed a 24 well P&A three months ahead of schedule. Working closely with the supply chain, they took an innovative approach to Xmas tree removal. The average cost per well was <P10 compared with the current NNS OGA P50 benchmark of £3.6 million. Ninian North P&A campaign achieved a 40% schedule improvement per well compared to their Murchison campaign. The Ninian North decommissioning programme achieved >35% cost reduction per well or per facilities tonne, compared with Murchison.

5. Benchmarks

Substantial improvements in decommissioning performance were achieved in 2017. The charts in this section summarise cost performance for key cost drivers, based on actual cost experience (i.e. not including cost estimates/forecasts).

- Where sufficient data is available (e.g. for new platform well abandonments), Probability of Exceedance curves are created for both new and older/aggregated datasets.

- Where insufficient new data is available, new data are added to the previous datasets, to create updated aggregated datasets.

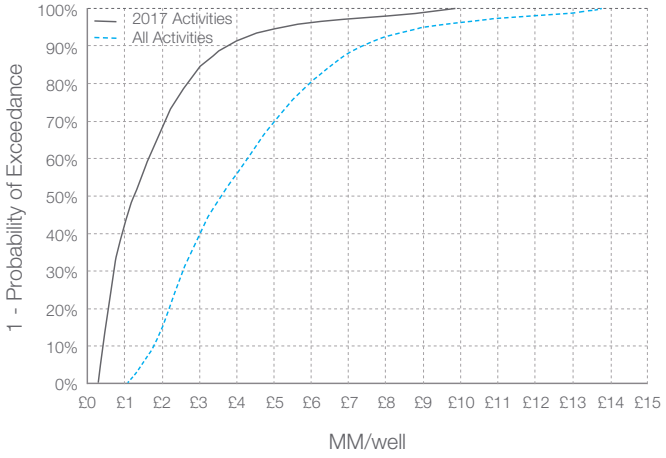
- All ‘s-curves’ use abbreviated 5-point datasets, whereby the P0, P10, P50, P90, P100 points are extracted from the full datasets and used to create the graphs. This allows easier comparison of datasets of different sizes.

- A check is always made to ensure that the abbreviated 5-point dataset fairly reflects the full underlying dataset.

Well abandonment costs

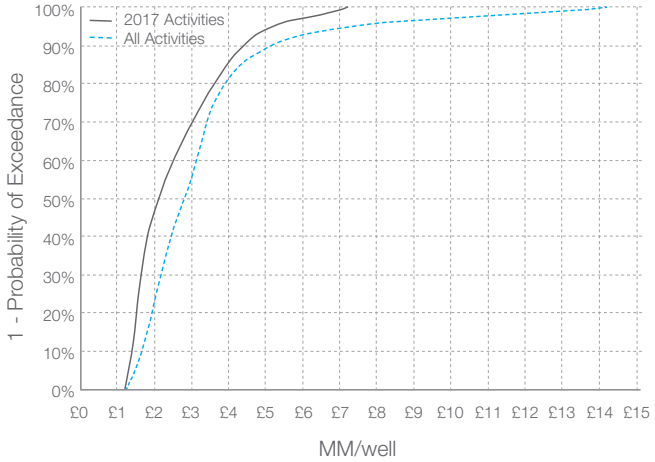
Decommissioning operators in the Northern North Sea have improved platform well P&A costs very significantly, through a combination of leveraging batch P&A methods, de-risking through wellbore surveys when setting mechanical reservoir plugs, improved casing milling performance and using risk-based methods when defining scope. There are wide variations in operator performance, with certain operators having large fractions of their outcomes in the third and fourth quartiles, and other Operators' predominantly in the first and second quartiles.

Figure 10: Change in platform P&A cost distribution: NNS & CNS



While platform well P&A costs have also improved in the SNS, these are much more incremental in nature.

Figure 11: Change in platform P&A cost distribution: SNS



Relatively few UKCS subsea wells were decommissioned in 2016-2017, and it is therefore relatively difficult to determine performance improvements. The benchmark information therefore includes wells for both 2017 and prior years. There is no indication that subsea well P&A costs are reducing, though there were no examples of the worst-performance/fourth-quartile outcomes in 2017. As with platform wells there are wide variations in operator performance, with certain operators having large fractions of their outcomes in the third and fourth quartiles, and other operators predominantly in the first and second quartiles.

Figure 12: Subsea well P&A cost distribution: NNS & CNS

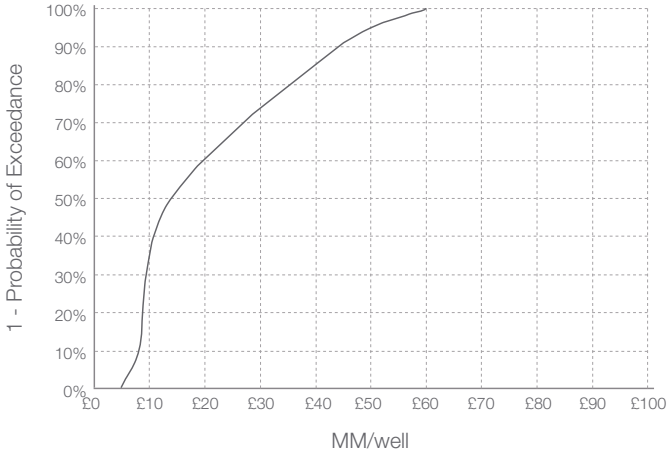
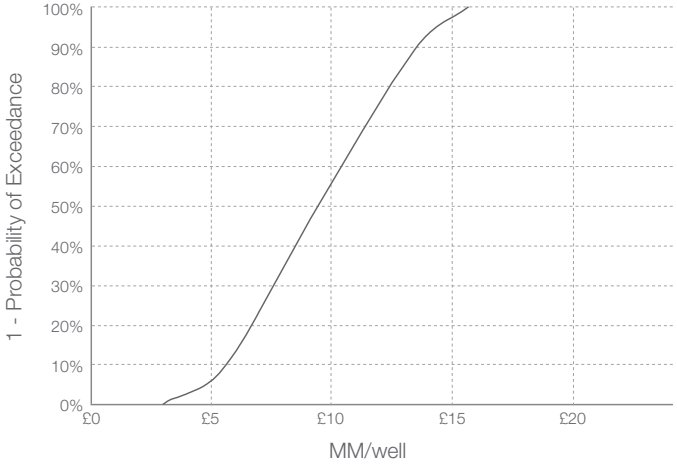
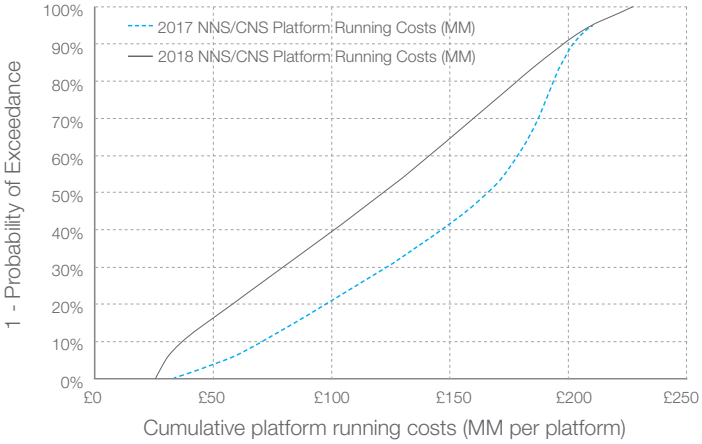


Figure 13: Subsea well P&A cost distribution: SNS



Platform running costs in the NNS have been reducing substantially, largely due to better optimisation of the late-life and warm/cold phases of decommissioning, with rapid reduction in running costs after cessation of production (CoP). Scheduling well P&A and make safe activities so as to minimise the inspection/maintenance-intensive warm phase, and then de-manning, has typically proven very cost effective.

Figure 14: Change in platform running cost distribution: NNS & CNS



Due to the infrequent and longer term nature of this benchmark, Figure 14 includes estimates for platforms still being decommissioned, where the relevant operator has a well defined plan and recent decommissioning experience with similar infrastructure. Even in these relatively advanced stage cases, cost decreases are being realised, albeit with the benefits diluted by the sunk costs.

Collaborating on wells P&A

ConocoPhillips and Spirit Energy collaborated on a joint wells P&A campaign in the SNS, minimising costs through sharing of knowledge and expertise. Using one jack-up rig to P&A wells on the manifold meant significant savings were realised on the rig move, interface and Dive Support Vessel (DSV) costs. Efficiencies were also realised through batch operations across the wells, enabling full P&A to be completed 40% ahead of AFE duration estimates.

Appendix 1: Methodology

The 2017 UKCS Stewardship Survey was used as the data source, with decommissioning cost inputs provided by all operators for all current and proposed offshore facilities, pipelines, development wells, suspended open water exploration and appraisal wells and onshore terminals. Data were collected using the Oil & Gas UK Work Breakdown Structure (WBS) as with previous estimates compiled by Oil & Gas UK.

The OGA's approach, unchanged from last year, has been to develop a probabilistic cost estimate which takes into account the wide range of uncertainties in estimates submitted by operators. Estimate classes in the survey were requested with reference to the Association for the Advancement of Cost Engineering (AACE Recommended Practice No. 18R-97, see Figure 15) and AACE guidance followed for selecting the values from these ranges.

The estimate is comprised of various elements, not all having the same estimate classification. The estimate raw data classification was requested from the operators responding to the UKCS Stewardship Survey and no adjustments were made to these operator self-assessments.

Figure 15: AACE classification of estimates

Cost Estimate Classification	Level of Definition (% of Complete Definition)	Cost Estimating Description (Techniques)	Expected Accuracy Range
Class 1, Definitive	65% - 100%	Detailed unit cost with detailed take-off	L: -3% to -10% H: +3% to +15%
Class 2, Intermediate	30% - 75%	Detailed unit cost with forced detailed take-off	L: -5% to -15% H: +5% to +20%
Class 3, Preliminary	10% - 40%	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%
Class 4, Budget	1% - 15%	Equipment factored or parametric models	L: -15% to -30% H: +20% to +50%
Class 5, Order of Magnitude	0% - 2%	Capacity factored, parametric models, judgement, or analogy	L: -20% to -50% H: +30% to +100%

The values within the expected accuracy ranges and used in the probabilistic distributions were selected at the higher end of the low (L) and high (H) accuracy ranges shown above. For example, class 5 estimates were given an expected accuracy range of -20% / +100%. This was to address the possibility of estimating optimism from operators for decommissioning scope. This potential was assessed as being high for the following reasons:

- Estimates may be influenced by issues such as estimating bias and emphasis on future cash flows

- Immaturity of decommissioning expertise within many UKCS operators
- The lack of industry experience generally with decommissioning

The project scope includes the decommissioning of all UKCS infrastructure including:

- Facilities and development wells still in place and yet to be decommissioned
- All facilities and development wells currently undergoing decommissioning, excluding work performed prior to and including 2016
- All sanctioned facilities and wells not yet in place
- Proposed project developments, not yet sanctioned or built, weighted by probability
- All intra-field pipelines and export lines
- Suspended open water exploration and appraisal wells
- Onshore terminals

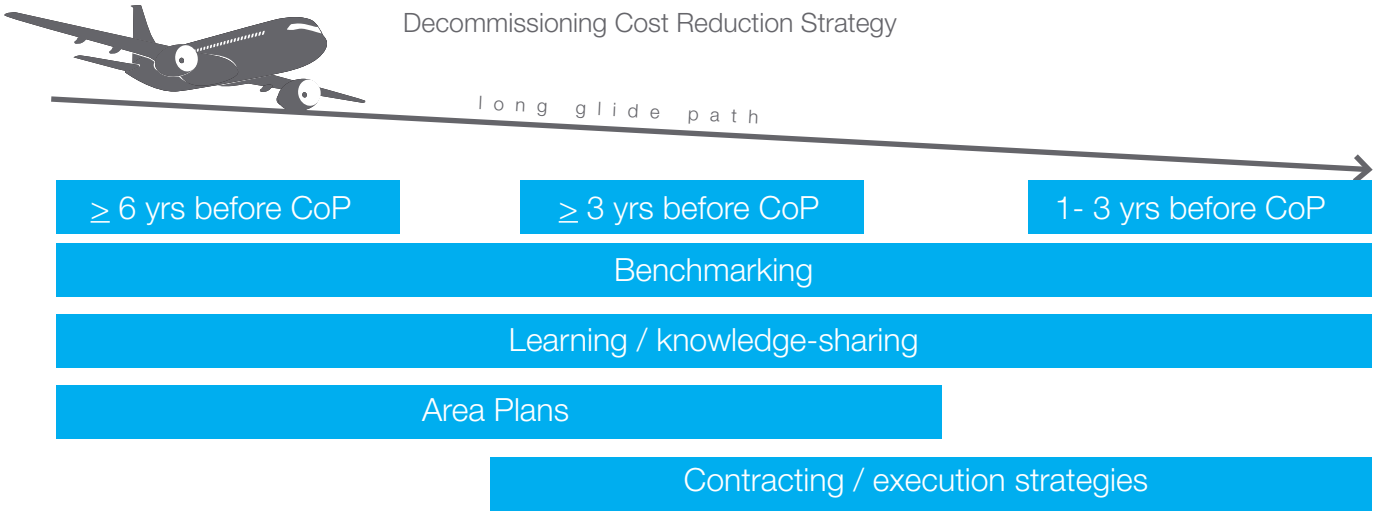
The estimate raw data have been collected using the Oil & Gas UK decommissioning Work Breakdown Structure (WBS):

- Operator Project Management
- Facility Running/Owner Costs (Post-CoP Running Costs)
- Well Abandonments
- Facilities/Pipelines Making Safe
- Topsides Preparation
- Topsides Removal
- Substructure Removal
- Onshore Recycling
- Subsea Infrastructure (incl. subsea structures, pipelines, mattresses, etc)
- Site Remediation
- Monitoring

Appendix 2: Stewardship review process

The OGA interacts with decommissioning operators based on a ‘long glidepath’ strategy, by which early, structured engagements support operators to embed good practices in sufficient time to deliver cost effective decommissioning. The framework and requirements are set out in the OGA Stewardship Expectations SE-10 Planning for Decommissioning Implementation Guide

Figure 16: 'Long glidepath' cost reduction strategy



Six or twelve-monthly 'Tier 2' strategic engagements are scheduled with all operators, ranked primarily on the timing and materiality of their decommissioning costs. The engagements are structured on a standard agenda, to ensure a comprehensive discussion and efficient follow-up of plans to mature cost reduction opportunities.

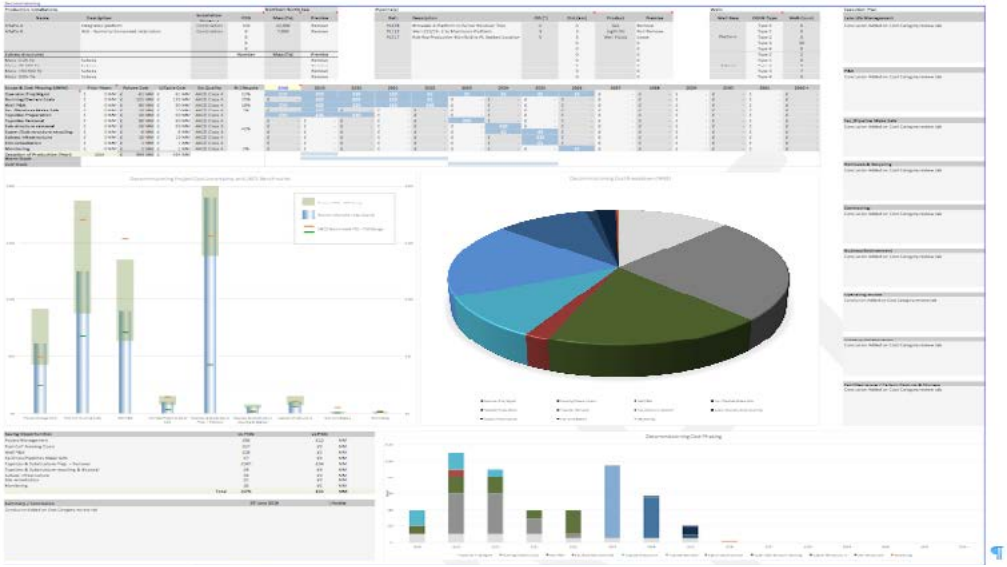
Figure 17: Standard OGA-operator stewardship agenda

Standard Decom Meeting Agenda

1. Decommissioning portfolio	
• High-level decommissioning strategy	Operator
• Assets (incl. Open-water E&A wells)	Operator
• Schedule / schedule-changes	Operator
• Anticipated project outcome/end-state	Operator
• Estimated cost / cost-changes by cost-category	Operator
• Learning, & impact	Operator / OGA
2. Cost reduction opportunities	
• Expected magnitude of savings (by cost-category/activity e.g. P&A, technology)	Operator / OGA
3. Plan/schedule to mature cost reduction opportunities ('Glidepath')	
• Risks, Uncertainties, Decisions	Operator
• Supply Chain opportunities (incl. Supply Chain Action Plans) / Area Plans	Operator
4. Future engagement schedule	All

A ‘Decommissioning Dashboard’, using the operators’ own data as submitted during the UKCS Stewardship Survey, is used as the basis for performance/cost analysis. The Oil & Gas UK Decommissioning Work Breakdown Structure (WBS) is used as the basis for cost classification.

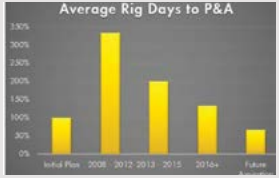
Figure 18: Example Decommissioning Benchmarking Dashboard



In certain cases, the OGA may request operators to facilitate separate OGA reviews of certain decommissioning activities with key contractors involved. The purpose of this is to allow, with the benefit of hindsight, identification of unrealised savings or performance improvements which might not be apparent to the client/operator. Non-proprietary, non-confidential elements of this may then be shared with industry through:

- Encouraging the parties to increase awareness through presentations at relevant conferences, or through industry knowledge-sharing portals (e.g. L2P2.net)
- the OGA making other operators aware directly through the operator engagement process, and perhaps including follow-up in the agreed cost-reduction plan.
- the OGA informing industry directly through decommissioning knowledge-sharing frameworks on its website.

Brent field wells P&A



Shell successfully completed a 37 well P&A campaign on Brent Bravo 12 months ahead of schedule and anticipates completing the Brent Alpha P&A 24 months ahead of original schedule. This achievement is based on: competitive scoping, including full transparency of costs and value; affordable technology; optimal barrier selection through in-depth subsurface analysis; efficient planning and execution; collaboration with other operators via a P&A forum; and collaboration with the supply chain, including integrated 2 contracts model (drilling contractor and integrated service provider).

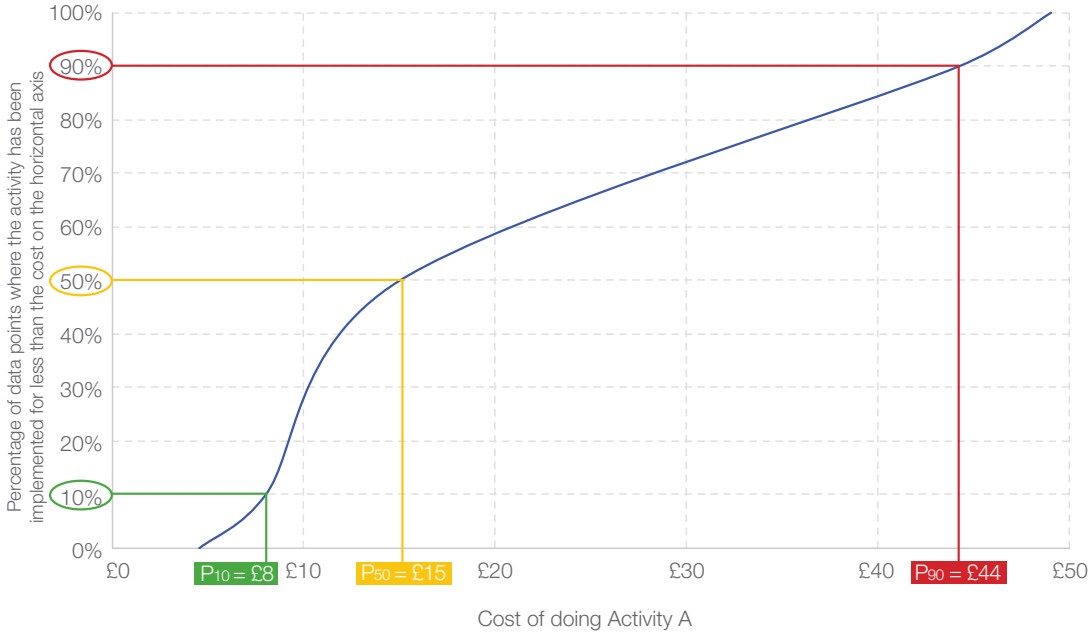
Appendix 3: Representation of Cost Uncertainty

The terms P10, P50 and P90 are used extensively throughout this document, and 's-curve' graphs are used in the benchmarking section to illustrate cost performance of different cost elements.

Cost information is collected from all UK decommissioning operators. Comparable data is grouped (e.g. platform wells in the Southern North Sea), sorted from large to small, and then graphed. Reading from the vertical and horizontal axes then characterises the cost variances experienced for that parameter.

In the generic example below, 10% of Activity A, as executed by all those contributing to the sample, was executed for £8 or less, 50% for £15 or less, and 90% for £44 or less. The terms P10, P50 and P90 refer to these values i.e. the cost values below which 10%, 50% and 90% of these activities are executed.

Figure 19: Example of 's-curve' used to characterise uncertainty



The P90 value, therefore represents the value at which 90% of cases, where this work was executed, were cheaper than this i.e. figures at or above the P90 comprise the most expensive 10%. Conversely, figures below the P10 represent the cheapest 10%, and the P50 the value at which there are an equal fraction (i.e. 50%) of examples above and below.

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