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PLATFORM DECOMMISSIONING COSTS

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Introduction

There are over 6500 platforms world-wide contributing to the offshore oil and gas production industry. In the North Sea, from where the offshore industry contributes over a third of Europe's total oil and gas requirements, there are around 500 platforms in place. Although the pace of development in the North Sea slowed at the end of the eighties, there is continuing development in all sectors and this is anticipated to continue for many years to come. The UKOOA Towards 20/20 survey envisages about 10 to 15 new field developments per year over the next 20 years on the UKCS.

As we enter the next century, therefore, we will see continuing investment in offshore oil and gas production but we will also see increasing expenditure on the decommissioning of platforms as they come to the end of their useful lives. There was a major drive in development in the North Sea in the seventies. and, although the useful life of a field is typically expected to be in the range of 15 to 25 years, we have seen very few installations decommissioned to date. This is, primarily because evolving technology and approaches to operating efficiency are tending to increase the amount of recovery and the economic life of the fields. However we can anticipate a growing spend on decommissioning in the next ten years and, eventually the costs for decommissioning will tend to be a major proportion of annual costs.

There are many factors to be considered in planning for platform decommissioning and the evaluation of options for removal and disposal. The environmental impact, technical feasibility, safety and cost factors all have to be considered. This paper considers what information is available about the overall decommissioning costs for the North Sea and the costs of different removal and disposal options for individual platforms.

Regulatory Background

The fundamental aspects of sustainable development are to conserve the environment, conserve natural resources and also to generate wealth for economic growth so that societies can continue to develop. The concept of including economics and costs in environmental conventions and practices dealing with protection of the seas is well accepted. The London Convention, which is the global convention for prevention of marine pollution from disposal encompasses economic aspects in its evaluation. The assessment framework takes a precautionary approach and current thinking is that a permit for disposal shall be refused if other appropriate opportunities exist that do not involve undue risks to human health or the environment or disproportionate costs.

In the North Sea, the regional convention for protection of the seas is the Oslo and Paris Convention (OSPAR) which is due to be ratified shortly and here also the concept of Best Available Techniques and Best Environmental Practice which govern the decisions on disposal take account of economic feasibility and implications.

Similarly, the national regulations, embrace and implement the international law and conventions and take costs into account as a factor. In the UK, for example, where they use the Best Practicable Environmental Option evaluation technique the practice is to identify the best environmental option and then test the practicability of that option against other criteria of technical feasibility, safety and costs.

The regulatory framework, requires us to find the right balance for decommissioning decisions between environmental impact, technical feasibility, health and safety and economic factors. It became clear during the Brent Spar incident that the public acceptability of achieving the right balance is also important both to industry and the regulators and for solutions to be implemented.

Reliable information about the various factors is required by all interested parties in a format that can be readily understood. The industry is committed to an open and transparent approach to decommissioning and making information available so that any decisions on achieving the right balance can be understood. Detailed information on all the individual platforms is however not available and any cost model must reflect the current uncertainty of the data

Data Uncertainty

DISCLAIMER

There have been many estimates of the costs and economic importance of platform decommissioning and the information is not reported consistently. It is not always clear, for example, how many platforms are being considered, what disposal options are assumed, whether the estimates are in money of the day or whether the costs are based on a particular year. This makes it difficult to understand if we are comparing like with like.

It is not surprising that the information is so uncertain when we look at what assumptions are made in arriving at the costs. The number of platforms in the estimate may include only those actually producing today or it could include those we know will go into production over the next few years or a projection as to the ultimate number of installations. The definition of the area being considered can also be confusing. We tend to talk of North Sea platforms but this can sometimes mean the North East Atlantic (i.e. the OSPAR region) or sometimes only the two main producing areas of UK and Norway. These difficulties can be resolved by clear definition of what is included.

When we look at the profile of when money will be spent it is also very uncertain. Early expectations were that fields would start coming to the end of their lives in the mid-nineties. UKOOA estimated in 1994 that some 50 platforms would be decommissioned on the UKCS (about 20%) in the ten years from 1995 to 2005. In practice, there have been very few platforms removed to date and there is not expected to be a significant number before the end of the century. It is almost impossible to predict the cessation of production date for platforms with any accuracy. Recent events like the use of extended reach drilling to access peripheral areas of the reservoir and changes to the culture of operating mature assets has led to announcements of extended lives for fields formerly thought to be due for decommissioning in the next couple of years. It is reasonable to anticipate a steady increase in decommissioning operations in the period 2000 to 2010 and then continuing but declining operations towards 2020 and beyond.

Any overall cost estimate for decommissioning will depend on a summation of the anticipated costs for each installation or some kind of cost model for different types of installation. In practice, although companies will have carried out a preliminary assessment of decommissioning costs for the purposes of provisioning, the fact that very few platforms are due to be closed down in the near future means that detailed technical, environmental and cost studies have only been carried out on a few platforms to date. When looking at cost models we need to be cognisant that there is no typical platform in the North Sea. the plots of substructure weight (i.e. excluding topsides) for steel and concrete platforms (figures 1 and 2) show the wide divergence of structural weights for facilities in similar water depths. Although there is some clustering of data points for the shallow waters, it is clearly difficult to generalise about the larger platforms in the central and northern North Sea.

In developing a cost model there are also limitations in seeking comparisons from other areas of the world. There have been very few decommissioning operations anywhere in the world other than the Gulf of Mexico - where the offshore industry started in 1947. There have been around 1400 platforms removed to date in the Gulf but 97% of them are in shallow water of less than 75 metres and indeed over 70% of them are in water depths of less than 30 metres. They have generally been very light structures and typical removal costs have been in the order of $0.5 to $1.5 million dollars -an order of magnitude different to the cost estimates for the smaller North Sea platforms. The difference relates to the weight and complexity of the platforms, the maritime operating environment, the types of equipment used and differences in the contracting market. There are undoubtedly lessons to be learned from the Gulf of Mexico but the cost data base is not directly applicable to the North Sea environment.

Costs For Complete Removal and Onshore Disposal

A number of published estimates for the total cost of removal and onshore disposal of platforms from the North sea is included in Table 1. The main sources are the presentations to the UK House of Lords Committee in 1996, the report by John Brown NV for the European Commission in 1996 and some other articles. There is a wide range in the estimates but they all show a large investment of several billions of dollars with the North Sea costs being a major proportion of the overall world-wide cost. This is understandable since in the North Sea there are a large number of deep water structures designed for a hostile environment and they often support high throughput processing facilities. It is important to note that these costs relate primarily to fixed steel platforms and there is virtually no information on the cost of removing large concrete substructures. This is partly due to questions on the feasibility of removing many of the platforms and the John Brown NV report concludes that it is not possible to give reliable estimates at this stage.

Some of the variations in estimates relate to the numbers of platforms considered and the dates when the estimates were made . The variations also depend on the assumptions made about the complexity of the removal and disposal operation

Basis For A Cost Model

In order to look more closely at the basis for a cost model, it is useful to group the structures in the North sea into categories. The data collected by OSPAR indicates the following number of platforms in the N.E.Atlantic at the end of 1996 - predominantly in the North Sea. The fixed steel platforms are grouped into two categories in line with the IMO guidelines which draw distinctions on the removal requirements for these two types of structure.

- 26 floating installations
- 119 subsea installations
- 372 fixed steel platforms in less than 75m of water with substructures weighing less than 4000 tonnes.
- 112 other fixed steel structures
- 28 concrete gravity based structures.

The cost estimates for the largest category - the "small" steel platforms - are likely to be more reliable since there is some experience of removing these platforms and, although there may be some exceptions, the removal operation is well within the industry's capability. It can generally be expected that, once removed, these installations will be brought ashore for partial reuse or recycling. The platforms are generally in the 30 - 50m water depth range in a zone stretching from the UK southern North Sea through Netherlands to Denmark. The topsides weight can vary from as little as a hundred tonnes to 6000 tonnes or more with an average weight of around 1,700 tonnes. Removal of the topsides will tend to be the main cost determinant . There is also a wide range of jacket weights with the average being around 700 tonnes. The typical costs of full removal and onshore disposal of an average sized platform in this category is likely to be around $5 to 10 million.

There are a wide variety of types of floating installation but because of the limited number in use, the overall economics are not particularly sensitive to the individual cost estimate. The ease of removal of the floating section means the estimate will be primarily dependent on the arrangements necessary for disposal. The benefits and technical feasibility of removing the seabed anchor structures associated with these installations is however unclear and this is an area of uncertainty in the costs.

An approximation of the costs for removal of subsea facilities installed to date can be made and again the overall estimate of North Sea decommissioning costs will not be particularly sensitive to variations in the costs for this grouping .The cost model for this category may change for new developments depending on the water depth, the operating environment and the type of installation involved.

It is in the categories of other fixed steel platforms and concrete GBS structures that there is the greatest uncertainty on costs and also the greatest impact on overall economics. The scale of the work involved is much greater and the estimate must fully account for the limitations on lift weights and the operational restraints of loading segments onto the crane barge or attendant barges. These become critical considerations for the topsides and the jackets for larger platforms. There are only a few large crane barges active in the North Sea and the estimate will be sensitive to the availability and market rate of key equipment.

A rough guide to the costs for full removal and onshore disposal of the fixed steel platforms is likely to be in the order of $4000 per tonne of installed weight but this will have a wide uncertainty band and there will be a variation in cost for different parts of the structures depending on the complexity. Clearly, the operation of removing the lower section of a jacket where it is connected by piles to the seabed will be more complex than removing the upper section of the jacket.

Breaking the offshore installations into groups in this way offers a better understanding of the overall cost model and the reasons for the uncertainty. Based on the above assumptions the estimate for complete removal and onshore disposal of the installations currently within the OSPAR region at the end of 1996 can be expected to be within a range of about $10 to $17 billion excluding the concrete installations for which there are no reliable estimates at this time.

Costs For Other Decommissioning Options

The IMO guidelines require complete removal in water depths of less than 75m except in exceptional circumstances or where the jacket weighs more than 4000 tonnes. In deeper water, options for partial removal can be considered provided there is a minimum of 55 metres of clear water for navigation above any remains. Any remains would need to be cleaned to comply with the regulations for prevention of pollution from hazardous substances and the remains would need to be stable so that there position can be well documented. In practice, no cleaning of the substructure would be required unless it had been used for storage.

The costs will vary for different partial removal options with the lower cost option being toppling of the structure at locations where the platform configuration and water depth are compatible to meet the navigation requirements. Alternatively, the top part of the platform can be removed down to the -55m level and emplaced alongside the installation. A further option would be removal of the platform to -55m and disposal of this part of the installation in deep water or onshore. Typically, for a deep water steel platform in say 140 metres of water, the topsides may account for half the total weight of the platform with a quarter of the jacket weight being above the 55m water mark and three quarters of the jacket weight being below this level.

There have been a number of preliminary studies into partial removal options but to date only three large platforms have been studied in detail in terms of the various options for partial removal. In the case of Odin, which is a relatively light structure in 100 metres of water The ratio of partial removal to full removal and onshore disposal was in the order of 1: 1.4 but for the other two platforms which are significantly heavier and in deeper water, the ratio is in the range 1:2 or 1:3 depending on which partial removal option is considered

These results are at variance with some generic studies by contractors that suggest the ratio is more likely to be in the range of 1:1.1 to 1:1.2. This highlights the limitations of using generic models

for the wide range of structures involved in the central and northern North Sea. In view of the lack of operational experience with removal operations, reliable comparisons of the cost estimates for different removal and disposal options will need to be based on case by case studies.

When considering the cost model, a difference in costs of 1:2 for each platforms in the "other steel" category could translate to an overall impact in the range of $3.5 to $6.5 billion if a partial removal option was selected in every case. Although this is unlikely, the analysis offers a bounding of the issue for the overall economic implications to be considered. Again, there is insufficient information on decommissioning costs of concrete installations to give comparisons of different removal and disposal options

Conclusions

There are a large number of offshore installations in the North East Atlantic that will need to be decommissioned in the next 20 years and more. The great majority of the installations will be fully removed and will generally be brought ashore for reuse, recycling or disposal.

The cost estimates for this decommissioning activity are uncertain at this stage because of the wide range of installations and the lack of experience with removal operations, particularly with the larger installations. Nevertheless a broad cost model can be established for the purposes of understanding the economic implications. It is very important that the assumptions made in such a model are clearly reported so that any comparisons of estimates are not confused.

When evaluating the options for an individual platform there is potential for a wide variation in costs with the larger steel platforms in the central and northern North Sea. Reliable estimates can only be established by a detailed case by case analysis. In cases where a detailed evaluation has been carried out for a large deep water platform the results are that the cost of full removal is 2 to 3 times the cost of partial removal options. There is therefore a major additional investment involved in fully removing these steel platforms and the value of this operation is unlikely to be justified when viewed in the context of the limited environmental or other benefits of this option compared to partial removal options.

There are no reliable cost estimates for the removal and disposal of concrete GBS structures and the technical feasibility of fully removing many of the existing concrete installations has yet to be demonstrated.

ESTIMATES FOR TOTAL REMOVAL COSTS ($Billion)

	UK	Norway	North Sea	Worldwide
House of Lords Evidence				
- UKOOA (1989, 140#)	6.6			
- UKOOA (1994, 50#)	(1.5)			
- Greenpeace (?, ?)	4.5 - 6.8			
- Brindley (1995, 220#)	6.8 - 8.4			
- Brindley (1995, ?)			11.2 - 14.0	
- Professor Al Hassani (?,?)				Up to 40
Wood Mackenzie, (1996, c223#)	13.0			
*John Brown NV (1996, 220#)	11.2 - 13.7			
*John Brown NV (1996, ?)		5.0 - 6.9	18.0 - 23.2	
Industry 'Blue Book'		7.5		> 20
Range	6.8 to 13.7	5.0 to 7.5	11 to 23	20 to 40

TABLE 1

* Report for European Commission
(Date of estimate, number of platforms)
Based on 1.5 $ to £

ODCP

COMPARISON of WEIGHTS and DEPTHS

North Atlantic Steel Jackets

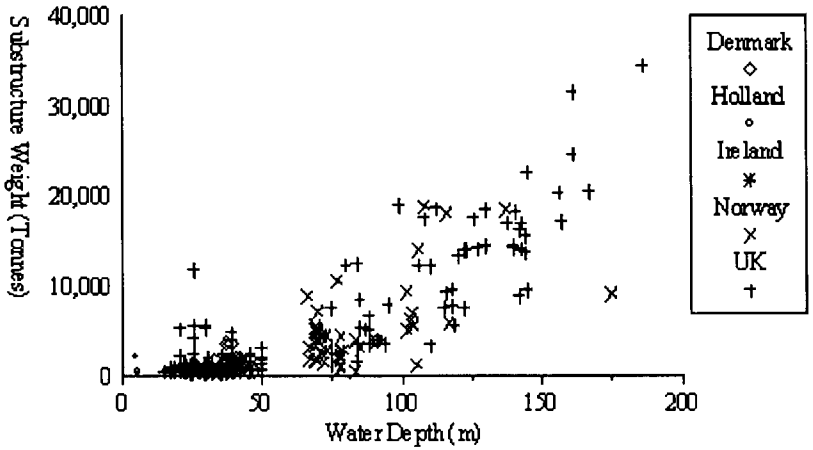

FIGURE 1

ODCP

COMPARISON of WEIGHTS and DEPTHS

North Atlantic Concrete Substructures

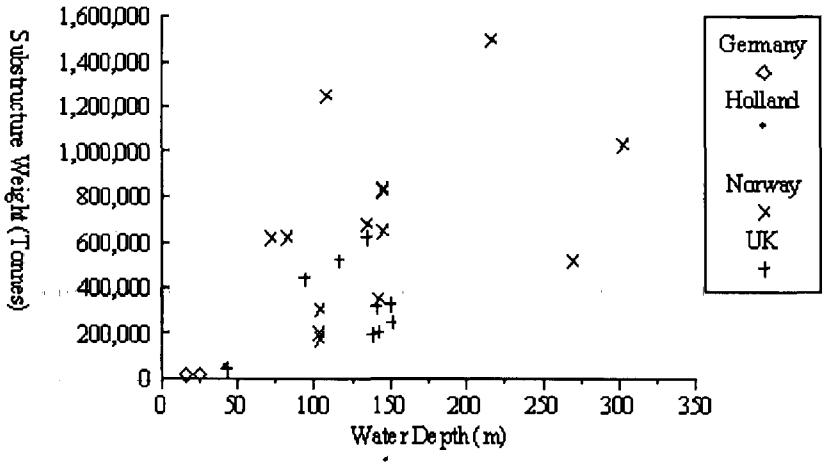

FIGURE 2

ODCP