Status Capacity and Capability of North Sea Decommissioning Facilities

Prepared by CRF Consultants, September 2016

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CRF Consultants would clarify that this report is based upon publically available information and any use of the ports should be verified with the relevant parties including port owners/operators and supply chain companies.
Potential use of ports for decommissioning is purely the opinion of CRF Consultants and not based on discussions with owners or other involved stakeholders. Details of this are beyond the scope of this report.

1 Glossary of Terms and Acronyms

BEIS	Department for Business, Energy and Industrial Strategy
CoP	Cessation of production
E&P	Exploration and production
HLV	Heavy lift vessel
Jacket	Support structure for an offshore installation, normally made from steel or concrete
LAT	Lowest astronomical tide
LSA	Low Specific Activity (scale)
Manifold	Safe support structure on seabed housing subsea valves
Mattress	Network of concrete slabs connected by ropes used to protect and support subsea structures
MLWS	Mean low water spring
NORM	Normally occurring Radioactive materials
OGA	Oil and Gas authority
P&A	Well Plug and Abandonment
RSA	Radioactive substance act (1993)
SEPA	Scottish Environmental Council
Shearleg	Two legged floating lifting device
SLV	Single Lift Vessel
SWL	Safe working load
Topsides	The drilling, operational and accommodation modules of an offshore installation
WEEE	Waste electric and electronic equipment

2 Introduction

Decommissioning activity is now beginning to flourish with a number of very large projects either underway or in the planning phase. The nature of competitive tendering, along with the capacity and capability of the UK supply chain is resulting in much of this work being won by non-UK companies.
GMB wish to ensure that they fully understand the status and capability of onshore reception facilities in Scotland in order that technical and investment requirements are understood so that Scotland can become competitive in the decommissioning market.

This report will outline the following

- Provide a high level view of the assets in the UKCS and the likely timing of decommissioning of these assets over next 40 years.
- Indicate current cost estimates for decommissioning, including specifically the cost for the onshore disposal element.
- Likely impact on tax payer- Treasury exposure.
- Examine evaluation criteria for disposal yards including detail of the essential requirements.
- Overview of onshore reception facilities in the UK. This will summarise yard facilities, waste and handling licenses and some decommissioning history. Provide context to compare and contrast capabilities of specific yards.
- High level overview of facilities in Norway and Eastern Europe in order to enable a full understanding of the competition.
- Summary of current UK position in the decommissioning market including estimate of revenue to date and likely position in the future.

3 Context: Decommissioning Overview

Decommissioning of oil and gas assets is typically thought to be, in its absolute sense, the dismantling, removal and disposal of these structures and associated infrastructure at the end of their operational life. However, decommissioning can be described more accurately in its relative sense, within the context of the full lifecycle of an oil and gas asset.

The full cycle can be described as a series of distinct phases:

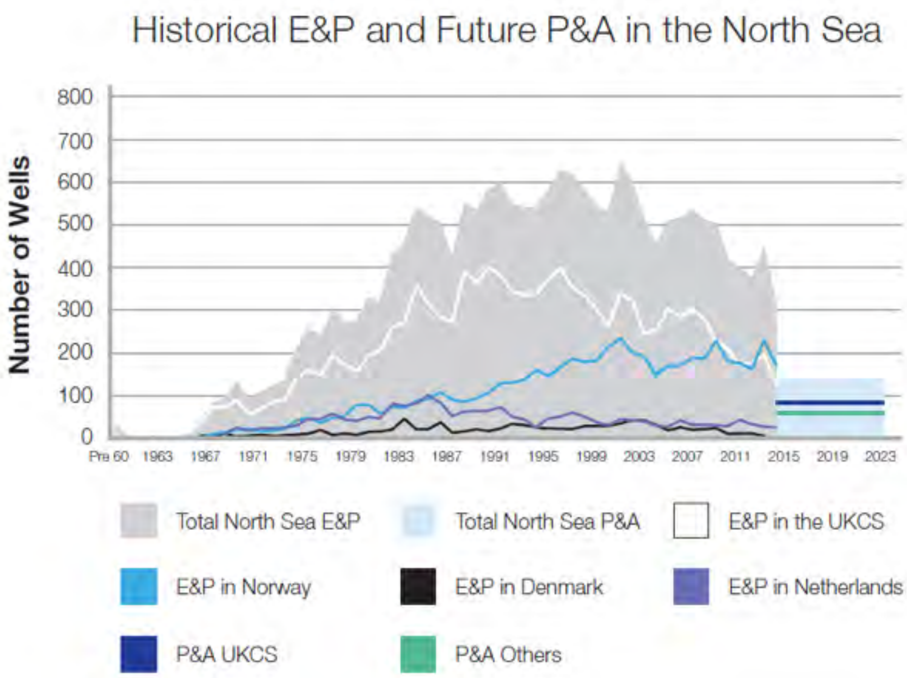
Acquire License
Explore & Appraise
Design and Develop
Operate
Enhance Production and Reduce Costs
Cease Production
Make Safe
Dismantle & Remove
Monitor

Decommissioning starts at the original design stage of the field and the Field Development Plan. Detailed planning for decommissioning typically starts around 5 years before the asset is expected to cease production. In the UK, an asset producing hydrocarbons can only formally cease production permanently when authorised by the Oil and Gas Authority (OGA). The asset owners will have to have demonstrated that all options for producing and processing equity and 3rd party hydrocarbons economically have been exhausted, and that alternative uses for the asset, for example CO_2 storage, have been explored.

3.1 Plug and Abandonment of Wells

Once the asset has ceased producing, it must be physically disconnected from any reservoirs. Plug and abandonment is essentially the permanent isolation of the reservoir from the environment, using cement plugs. This is a routine operation and is completed across the world on a regular basis.

1. Placement of reservoir barriers (setting plugs)
2. Displacement of hydrocarbons (flushing clean)
3. Well tubing, safety valves and casing removal where required
4. Installation of intermediate barrier (lower plug) and environmental (higher) plugs
5. Conductor recovery



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3.2 Cleaning

All equipment must be cleaned to a level where there is minimal hazard associated with the decommissioning of the equipment. For example, removal of hydrocarbon oil and gas, asbestos, chemicals and other hazardous waste which is carried out by specialist cleaning teams.

Topsides infrastructure must be cleaned of hydrocarbons to a level that meets the requirements of the removal method and contractor. For those methods that do not involve breaking of any containment of the original hydrocarbon envelope, a lower level of cleanliness may be acceptable. Dismantling using onsite demolition is likely to require a higher level of cleaning.

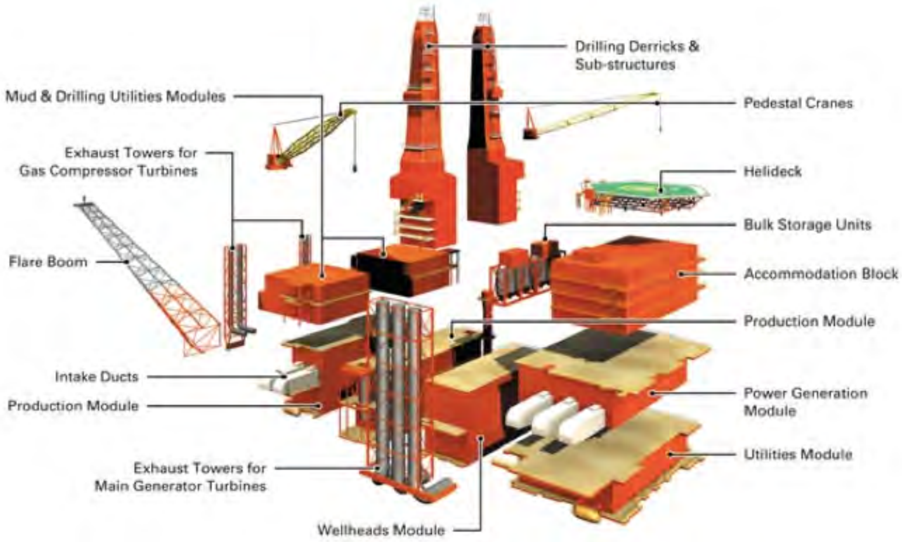
Equipment that is to remain in-situ, such as some pipelines, must be cleaned to an agreed specification which must demonstrate that any residual contamination would not cause concern to the eco system in which it remains.

3.3 Pipelines

All pipelines must be isolated from the installation equipment by 'air gapping', which is physical separation between the pipeline and installation equipment.

3.4 Removal

There are a variety of technically feasible methods to remove the jackets and topsides of an installation. These can be summarised in to 3 core techniques, although in reality any solution is typically a combination of two or more.



Key Components of the topsides of large installation

1. **Reverse of Installation:** Most installations were installed as modules which were lifted into place with an HLV (Heavy Lift Vessel). This process can be reversed, however significant preparatory works are required to separate the modules and to ensure structural integrity of each module remains.

Heavy Lift Vessel removing modules from a large installation

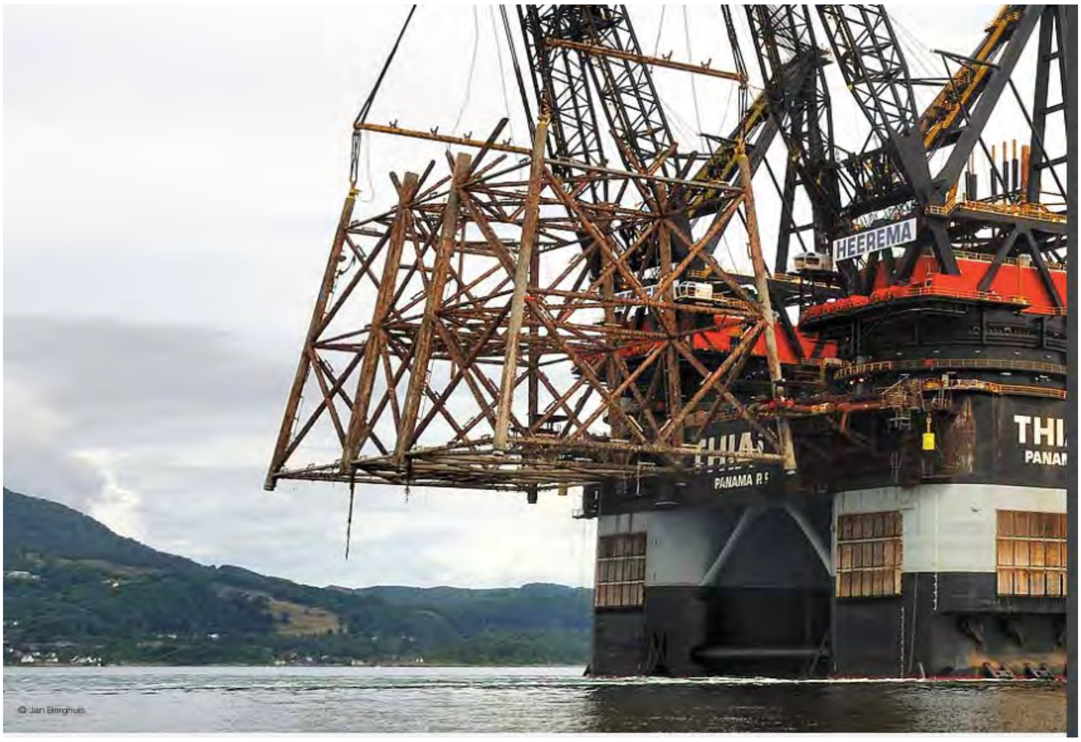
2. **Single Lift:** Smaller assets are candidates for removal in a single lift with an HLV, but specialist SLV (Single Lift Vessels) are emerging on the market to remove the much larger, multi module assets in one lift. As with reverse of installation, significant preparatory works, including strengthening of the structure, are required to facilitate this method.

Single lift vessel 'Pioneering Spirit' lifting the topsides of the Yme platform in August 2016

3. **Demolition in-situ:** A team of specialists with industrial demolition machines and hydraulic shears reside on the platform and dismantle the asset over an extended time period. There is limited preparatory work required for this option, but may require more people offshore for longer compared to the other options.

Piece small demolition

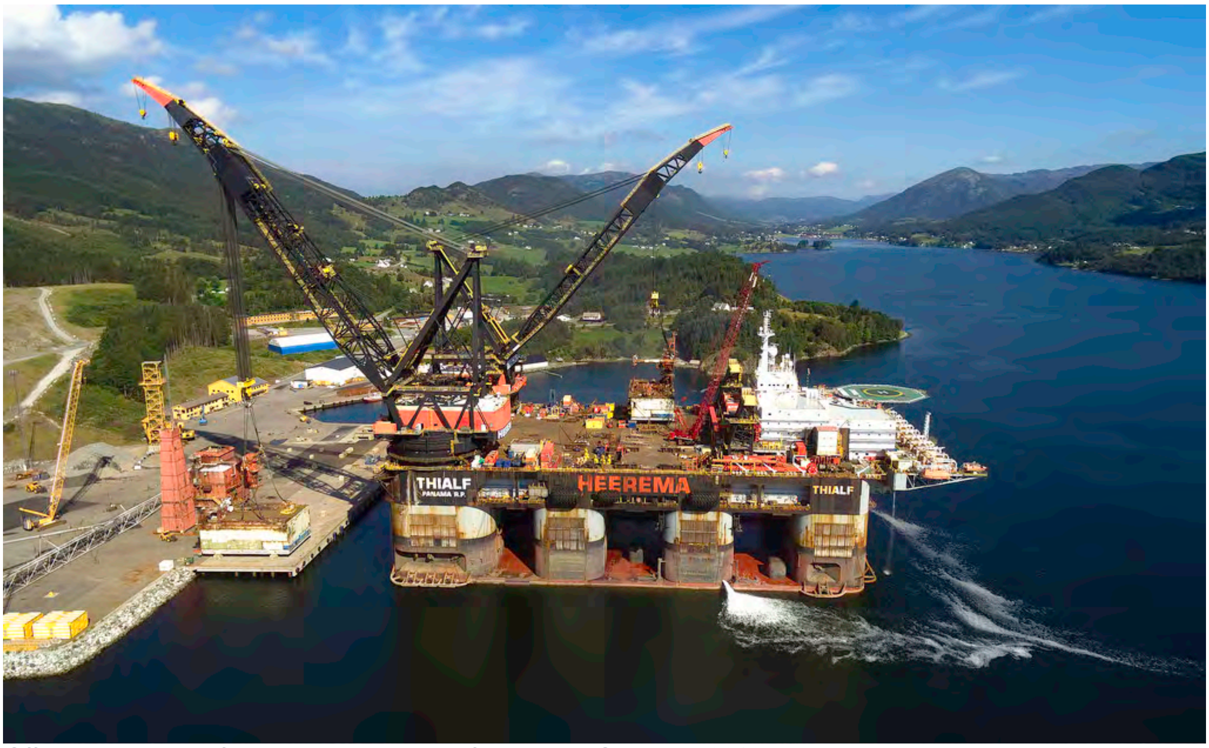
Jacket removal can make use of the same techniques as topsides removal, although demolition in-situ would require divers and ROV (Remotely Operated Vehicle) systems to cut the jacket into manageable pieces which would then be lifted to the surface. There is an opportunity to dismantle the jacket in varying sized elements depending on the size and design of the original jacket. This technique is commonly known as cut and lift. There are some innovative solutions for jacket recovery, including using buoyancy tanks to float the structure, allowing it to be towed ashore for inshore dismantling.



Heavy Lift vessel with a section on jacket on the hooks

For pipelines and subsea equipment, more options are available but all centre on a common theme which is the use of marine vessels with suitable lifting capacity, deck space and facilities to support diving and ROVs.

3.5 Disposal



Offloading modules from the Murchison platform at VATS, August 2016

The first phase of disposal is transportation and offload to a disposal yard

All recovered equipment must be managed to ensure protection of the environment and achievement of compliance with environmental and waste legislation, industry standards and the concept of the Circular Economy.

The concept of the Circular Economy aims to promote reuse and repair/remanufacturing over recycling because reuse and repair/remanufacturing are less costly and therefore constitute more economically sound means of waste management.

3.6 Monitor

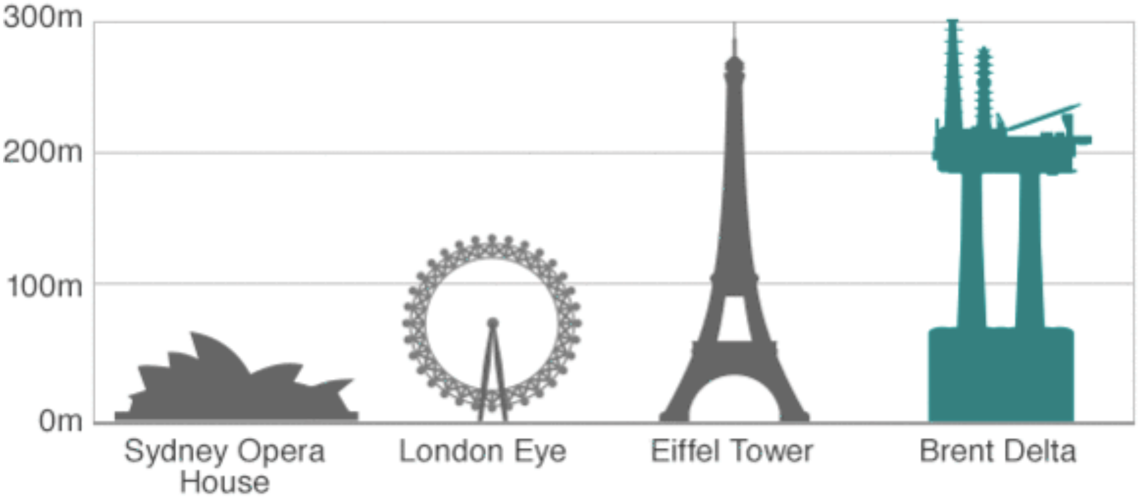
Once all decommissioning activities have been completed, there is a requirement within current UK legislation to continue to monitor the site in perpetuity. The frequency and extent of the monitoring is determined by the operator in agreement with the regulator, but there is an expectation that it will be sufficient to mitigate any issues should they arise in a reasonable time frame.

3.7 Planning for Decommissioning

Unlike capital investment projects, there is no “prize” at the end of a decommissioning project. In investment projects, Oil and Gas companies will have provided expectations of incremental value to their stakeholders resulting from that project (often expressed as recoverable barrels) and set dates for project first gas/first oil, which would imply that schedule is the primary project driver. In contrast, the key goals of a decommissioning project are different; safety of people, protection of the environment, upholding company values and reputation are the key success factors all done at the lowest cost. There is debate over whether schedule is critical for a decommissioning project; on one hand each project day adds another day of costs, whilst on the other hand flexibility of schedule can be an enabler, allowing for example campaigning (a programme of projects, done in sequence) and availability of supply chain, therefore taking advantage of a competitive market or avoidance of an overheated one.

So why do we have to decommission at all and not just “walk” away? Firstly, there is clearly a social responsibility for asset owners to restore the area to its original state rather than just abandon assets in-situ, and then of course they also have to comply with local regulations on decommissioning. Regulations across the globe vary but have a common thread but are underpinned by the international regulation UNCLOS 1957 United Nations Conference on the Law of the Sea) ; isolate from the reservoir, disconnect pipelines from all hydrocarbon sources, then clean-up process equipment that has been contaminated by hydrocarbons and other hazardous materials. The requirement to remove and dispose of assets (which includes topsides, jackets, pipelines and subsea structures & debris) is dependent on local laws.

Many visualise a decommissioning project as the removal of huge oil platforms, the likes of which are typically required for deep water environments like the central and northern North Sea in the United Kingdom Continental Shelf (UKCS). However, the scale and variety of assets to be decommissioned varies significantly across the basin and the world.

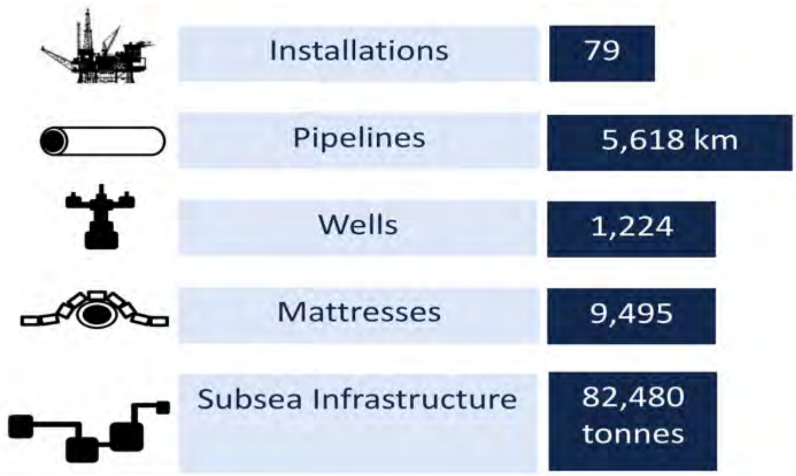


Relative size of Shell Brent Delta Platform

Large Northern North Sea platform

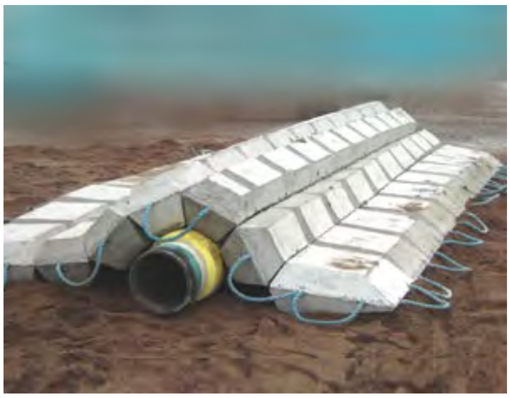
Smaller Southern North Sea Platform

In addition, there is a significant mass of structures on the sea bed; pipelines, manifolds, sub-sea valve assemblies, wellheads and mattresses.



Structures to be decommissioned in the UKCS

Typical Subsea manifold

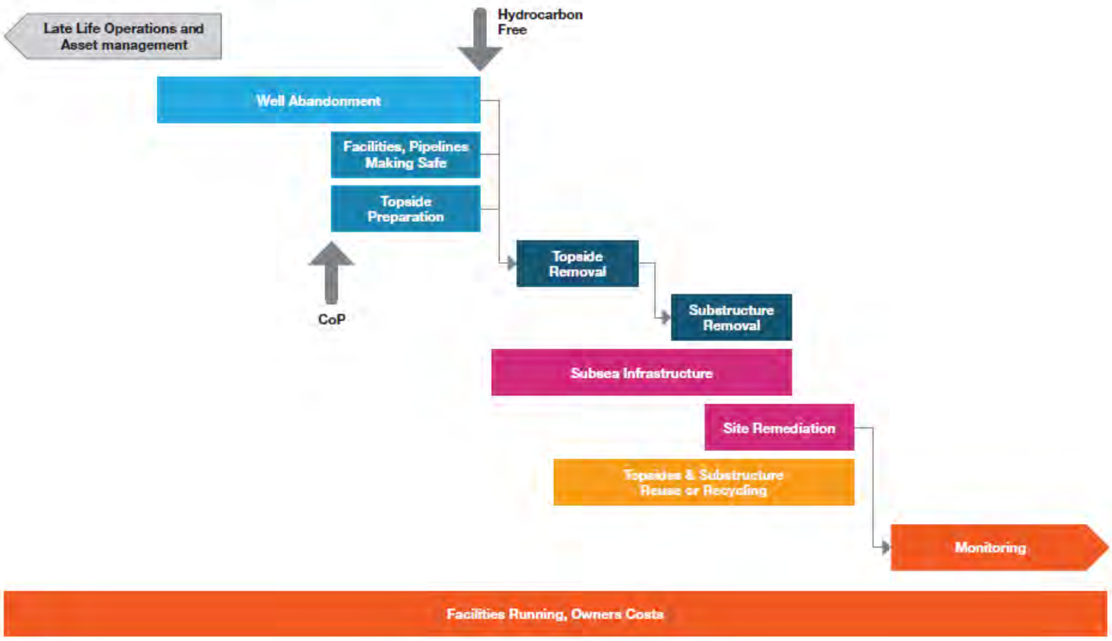


Pipeline protected by mattress

The decommissioning programme commences with the management of the asset during late life through to monitoring of the seabed after the asset has been decommissioned.

The programme duration depends on the technical complexity of the project as well as a range of commercial considerations. A typical project is often carried out in parts with several periods of inactivity, rather than a series of continuous activities. The OGA believes however that there will be efficiencies and cost savings if projects are continuous and that if several projects could be put together in a campaign this would drive a more commoditised market.

3.8 Regulation



Typical decommissioning programme

Regulation holds people and companies to account to deliver safe, environmentally sound and socially responsible activities. But all regulation should develop; technology changes, data are gathered and consequently knowledge and experience both improve over time.

The decommissioning of offshore oil and gas infrastructures is governed by multiple regulations and regulators across the world. Within the North Sea basin, countries who have signed up to the OSPAR (combines OSLO and Paris Commissions) convention are expected to return the seabed to its “clean” status. The OSPAR decision 98/3 focuses specifically on the full removal of any jacket structures. Provision is acknowledged with the decision 98/3 for old, highly complex and large structures where, subject to extensive assessment, derogation from this expectation allows the lowest part, or footings, of steel structures to be left in-situ, or the entire concrete structure for gravity based jackets.

4 The Market

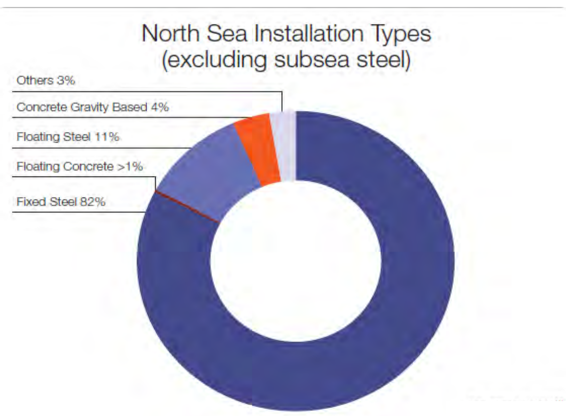
4.1 Market Size

There are more than 1500 registered installations in the North Sea including small fixed steel installations of less than 100 tonnes, large gravity based, fixed steel, floating steel, concrete and subsea steel. Excluding subsea structures, there are over 700 installations in the North Sea with most (83%) being fixed steel and located in the UKCS (53%).

Only around 12% of North Sea installations have been decommissioned to date which is a reflection of the nascent nature of the market.
Of the installations that have been commissioned, only around 9 have been granted derogation to allow some of the infrastructure to remain in place, these being concrete and steel substructures from NW Hutton, Frigg, Ekofisk, Brent and Murchison fields.

The UKCS contains a mix of platform sizes with lighter installations predominately in the southern area and heavier in the North.

Despite having a similar number of installations to the Norwegian sector, the majority of Dutch and Danish sector installations are relatively small



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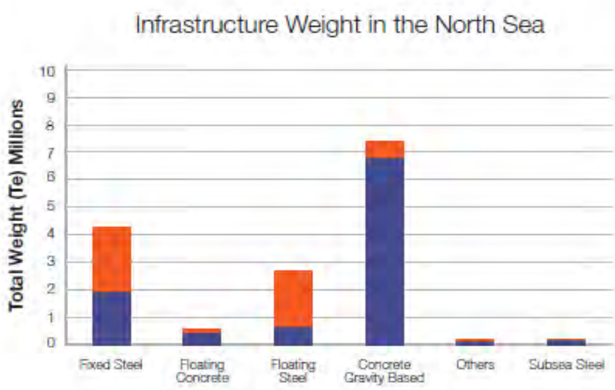

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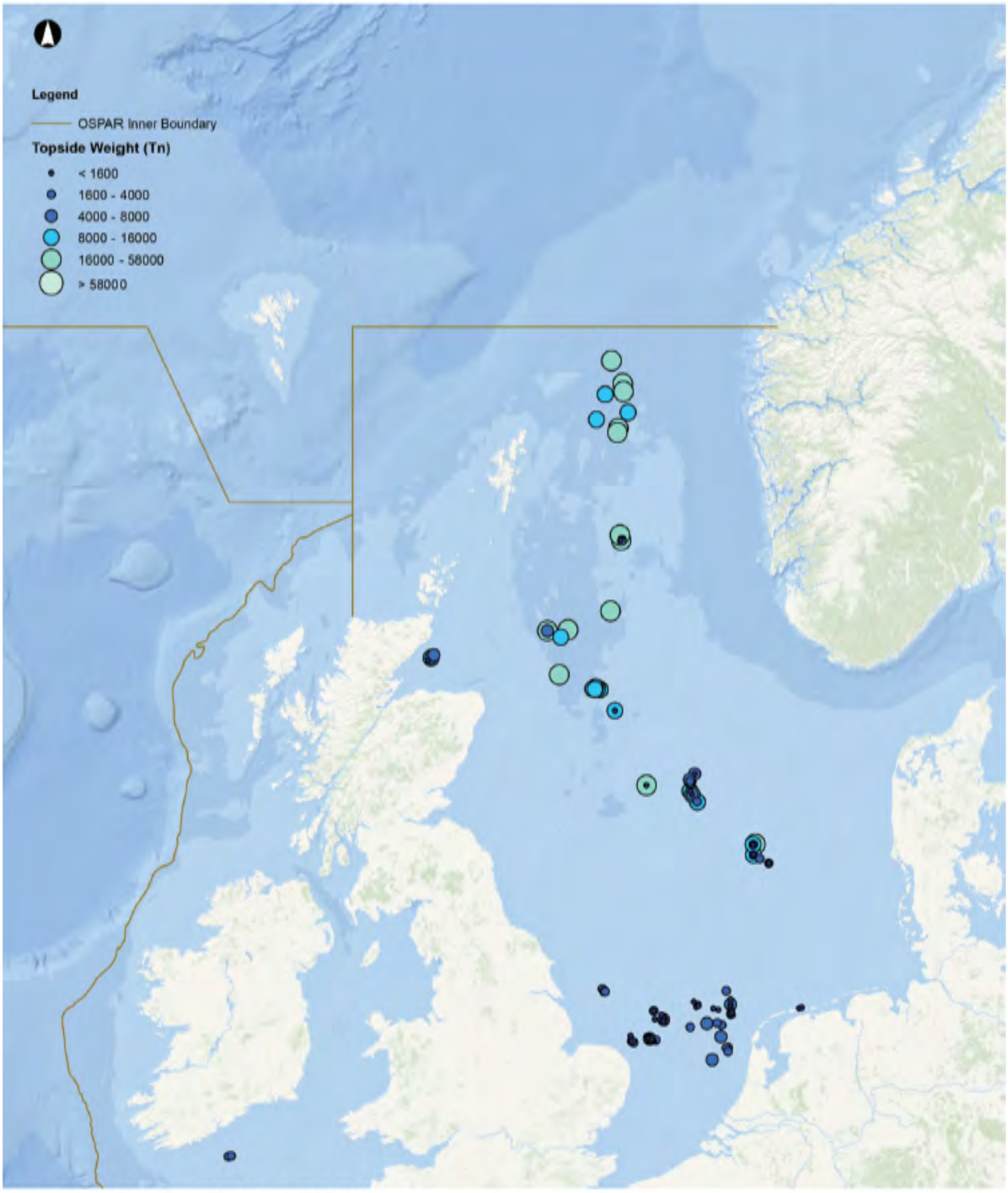
Topsides Substructure

The main classification of structures includes

- Steel installations
- Floating installations
- Concrete gravity based structures

The majority of substructures will require total removal with the option to apply for derogation (leaving the footings of steel jackets, or the entire legs of a gravity based structure and drill cuttings, if applicable).

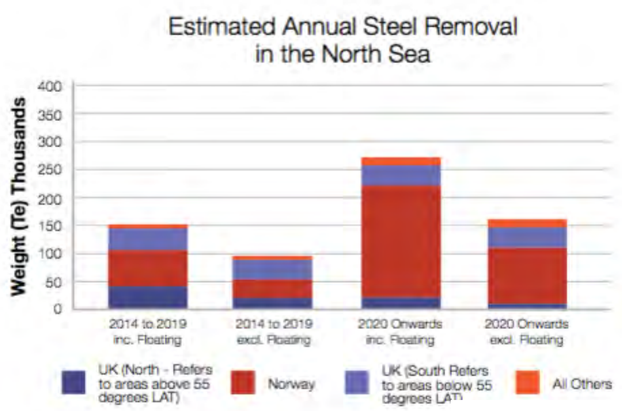


Topsides weight distribution. OSPAR [2]

4.2 Market Activity

There is limited available information in the public domain on future activity. It is important to understand the terminology; often the term 'cessation of production' (CoP) is reported as the economic limit of the asset, when costs exceed revenues. However, in order to cease production, an asset must have the authorisation of the Oil and Gas Authority (OGA), who will give a 'no earlier than' date. Once this has been approved, the operator can elect to cease production at any time after this date, and indeed may elect to run the asset on a cash negative basis. Once the asset has ceased production, the operator may just 'suspend' activity rather that move immediately into the decommissioning phase. Interpretation and anticipation of activity is therefore much more complicated that even the available data would suggest.

In the UKCS, it is estimated that around 440,000 tonnes of steel will be removed between now and 2022. This is around 9% of the existing steel infrastructure in the UKCS. Activity in Norway is much less certain, with estimates of 50,000 tonnes to 80,000 tonnes removed to 2020.



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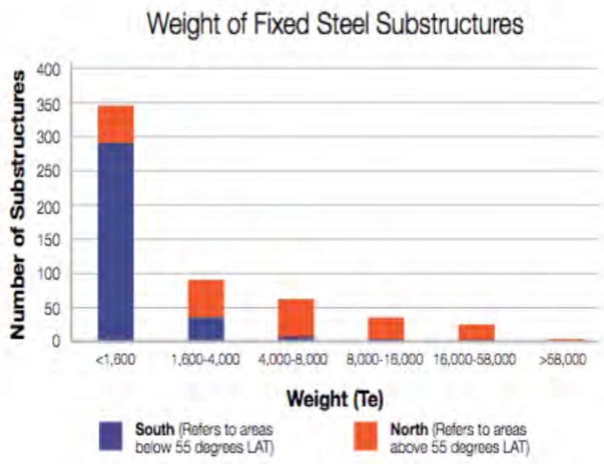

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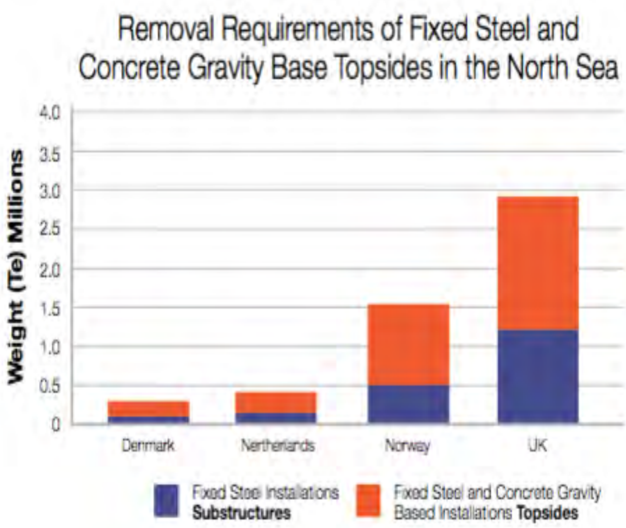

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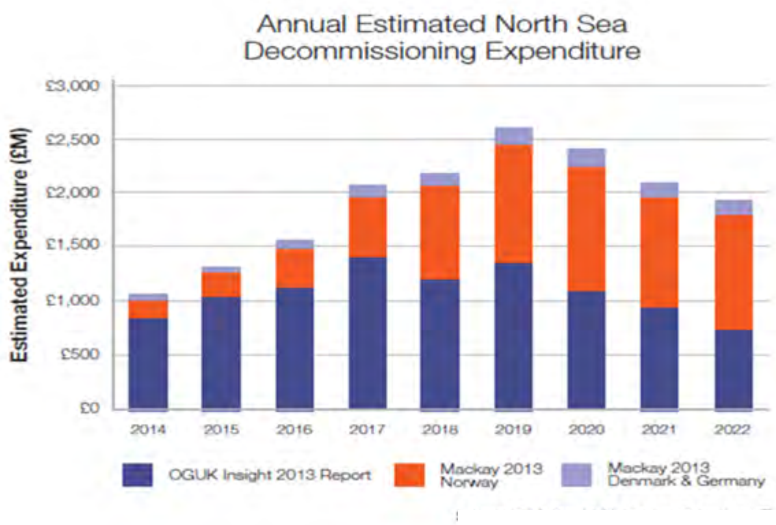
Forecast Activity 2015-2024			
	Central and Northern North Sea/West of Shetland	Southern North See & Irish Sea	Total UKCS
No of wells to be abandoned	950	274	1224
Topsides modules to be removed/t	255	66	321
Topsides weight to be removed/t	288,000	78,790	366,890
Number of platforms	22	57	79
Substructure weight to be removed/t	105,140	46,200	151,340
Number of mattresses to be removed	6,145	3,350	9,495
Subsea infrastructure to be removed/t	80,230	2,250	82,480

Number of pipelines to be decommissioned	598	179	777
Length of pipelines to be removed/km	2,189	3,429	5,618
Total tonnage coming onshore/t	492,250	127,330	619,580

Decommissioning forecast activity, OGUK [1]

4.3 Costs



Until recently, the estimated cost for decommissioning was £35-40bn then recently at a Well Abandonment Seminar in Aberdeen, based on work by the Department of Energy and Climate Change (DECC, now BEIS) delegates were informed that the costs were likely to be £40-70bn.

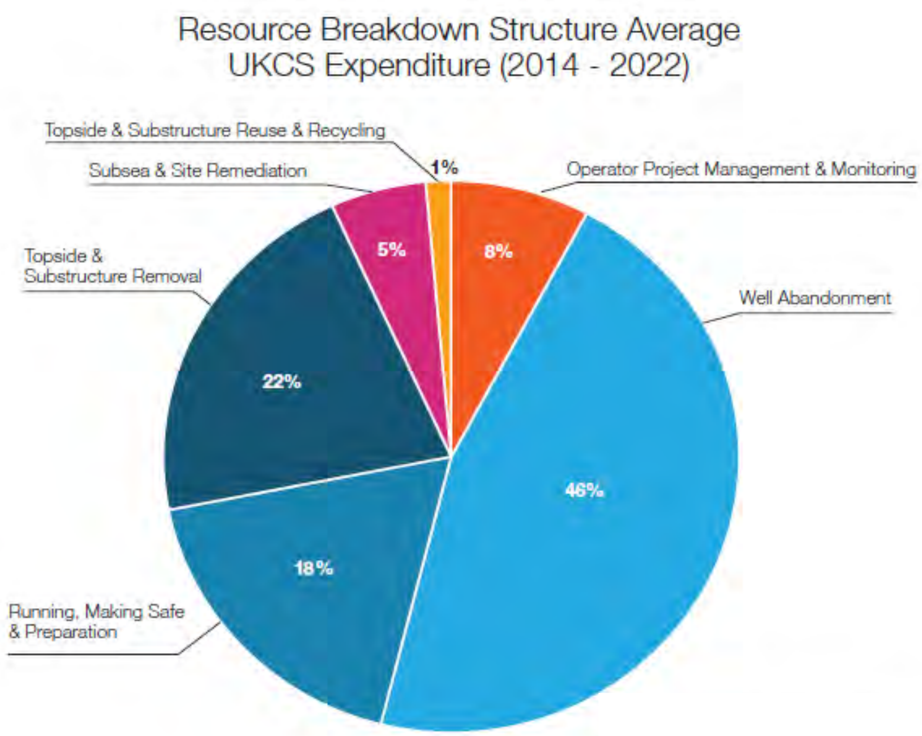
As many of these cost estimates are AACE (Association for the Advancement of Cost Engineering) class 4 (High, +20% to +50%) or class 5 (High, +30% to +100%) it is not unreasonable to suggest that these figures could double, with Treasury being liable for 50-

75% of these cost in tax refunds (level of refund depends on applicable taxation to field. 50% is corporation tax refund which rises to 75% if the field paid PRT (petroleum revenue tax)).

While ‘high-level’ costs have previously been reported, now that decommissioning activity is underway then actual costs are now available, and are higher than expected.
According to Oil & Gas UK figures, average cost estimates are rising by 14% per year but cost over-runs are reported at around 60% of the estimated decommissioning costs.
The final cost of decommissioning is likely to be > £100bn.

Current data forecasts that overall decommissioning expenditure in the North Sea could be between £1.1bn and £2.6bn per annum and is estimated to reach over £17bn between now and 2022, and £47bn to 2040.

Total expenditure per work breakdown structure element in dominated by well plug and abandonment (46%) while preparation and removal of topsides accounts for a further 40%. In the context of this report, only 1% of the costs are associated with topsides and structure recycling, around £0.5bn.



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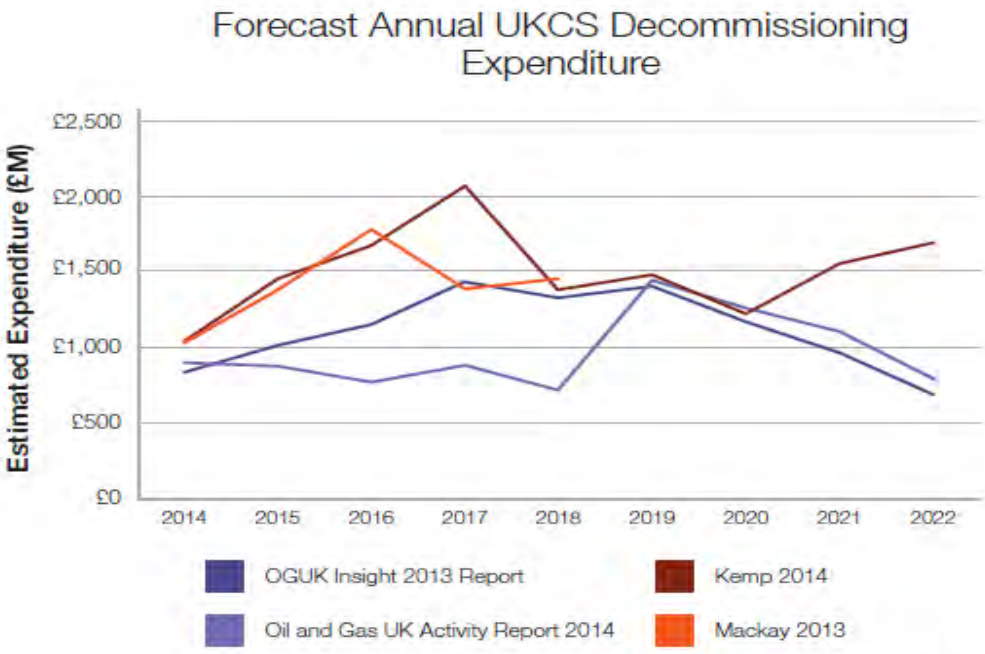

Forecast Annual UKCS Decommissioning Expenditure
Estimated Expenditure (£M)
£2,500
£2,000
£1,500
£1,000
£500
£0
2014
2015
2016
2017
2018
2019
2020
2021
2022
OGUK Insight 2013 Report
Kemp 2014
Oil and Gas UK Activity Report 2014
Mackay 2013

OGUK [1]

5 Overview of Main UK reception Facilities in the UK

5.1 ABLE UK

Privately owned and established in 1966 when engaged in site reclamation, property development and decommissioning and recycling of marine structures including oil and gas platforms and ships. It is located at Seaton Port.

The ABLE yard is currently being upgraded to receive the topsides of the four Brent platform topsides which will each arrive at the yard in a single piece via the vessel “Pioneering Spirit’.

Summary Of Facilities
Located near river Tees in Seaton Channel, 1 nautical mile from River Tees turning circle and 4.5 nautical miles from Tees Fairway Buoy
No width or air draft restrictions in the approach channel
Dredged channel depth of -4.6m LAT, high tide of 5.5m above LAT
11 Quays, quay 10 and 11 dredged to 14.5m below chart datum
75m mT/m^3 heavy load out pad at Quay 10 and 11
Total 1720m quay with 20 mT/m3. Minimum water depth 7.5m below chart datum
Designated laydown area of 1,850,000m^2
Located within 0.2km for Seaton Meadows Hazardous Waste Landfill Facility and 0.7km of liquid waste treatment facility
Road and rail access

Waste Handling & Licenses
Environmental Agency Waste Management License for a total of 363,650 tonnes decommissioning waste per year including 365 tonnes of hazardous waste and 230,00 tonnes of ships and marine structures
ISPS (International Ship and Port Facility Security) compliant
Valid Asbestos License
Bonded area for LSA materials
Treatment of trade effluent through fabric liner filter arrangements, in-line interceptor treatment plants, filtration plants.
Located within 0.2km for Seaton Meadows Hazardous Waste Landfill Facility and 0.7km of Shanks Waste Solutions liquid waste treatment facility
Road and rail access

Past Projects
Albuskjell, Philips petroleum, 1985
Bravo platform topsides, Shell Expro, 1994
Dunlin topsides, Shell Expro, 1994
Cormorant A Topsides, Shell Expro, 1995
Charlie topsides, Shell Expro, 1996
Esmond, BHP Hamilton, 1996
Leman Bk topsides, Shell UK, 1996
Delta topsides, Shell Expro, 1997
Leman Jacket, Shell UK, 1997
K11-FA-1, NAM BV, 1999
Frig/Froy templates, TotalFinaElf, Petroleum Norge AS, 2002
K14 Topsides, NAM BV, 2003
Camelot CB Platform, Mobil North Sea, 2002/05
North West Hutton, BP, 2008/09

5.2 Greenhead Base, Shetland

Operated by Lerwick Ports Authority

Summary Of Facilities
120m wide approach channel dredged to 9m below Chart Datum
Less than 100 nautical miles from many facilities in the northern North Sea
Concrete pad of 20,000m^2, warehouse storage of 3800m^2. Future development potential of 55000m^2 reclamation area
Double bunded storage areas, quarantine areas and emergency areas
90m long South Quay with minimum water depth of 8.2m LAT with deep water berth of 150m dredged to 9.2m LAT
18 X 50 Te capacity bollards, with intermediate 30t bollards. 2 large 150t bollards for load-in operations
Onsite availability of mobile cranes with capacities up to 250t

Waste Handling & Licenses
Permits to receive and handle wastes from offshore structures
RSA authorisation for receipt, handling, processing and temporary storage of LSA wastes

Liquid run-off contained within the pad, with drains to interceptor

Past Projects
MCP-01
TCP2 Module Support Frame
Schiehallion

5.3 Harland & Wolff, Belfast

Legendary shipbuilder, with Titanic clearly the most famous. The decline of shipbuilding has diversified their offering into heavy engineering, fabrication and rig repair.

Summary Of Facilities
16 miles inside Belfast Lough and 6 miles to end of Victoria channel.
Minimum access water depth 8.5m, maximum depth 12.6m
Chanel width of 152m and no air draft restrictions
556 x 93m dry dock serviced by tow gantry cranes with total capacity of 1600t
432 of outfit quay with 8.4m water depth
170m concrete quay with 8.6m water depth
150m steel quay with 8.6m water depth
Fabrication shop, paint shop etc.
Road and rail access

Waste Handling & Licenses
Have partnerships with environmental market leader Golder Associates (UK) Ltd, offer a fully licensed marine vessel and offshore structure recovery and recycling service.
Licensed to accept 300,000t permitted wastes per annum, including 4500t of hazardous waste, 45,000t metals and 200t marine growth

Past Projects
None known

5.4 Peterhead Decommissioning

Peterhead is a supply base for North Sea oil and Gas industry, with close proximity to the central and northern North Sea sectors. It is a consortium of seven companies and with current facilities is capable of receiving small/medium piece packages, umbilical's and flexibles.

Summary Of Facilities
South base is capable of receiving piece small packages up to 400t and has working area of 850m^2
Smith embankment can receive topside modules up to 2500mt and site has 16,000m^2 working area
Quayside water depth of 10m and approach water depth of 9m at CD. Entrance is 200m wide.

Waste Handling & Licenses
Member company Enviroco is a waste management company
Member company SITA is responsible for disposal and recycle of metals and have landfill site for asbestos
Liquid run-off contained within the pad, with drains to interceptor

Past Projects
None known

5.5 Swan Hunter, Tyneside, Newcastle

Owned by North Tyneside Council and One North East. The yard now offers its facilities for construction, storage and decommissioning.

Summary Of Facilities
Located on river Tyne 7nM from the harbor entrance, approach water is 9.1m
85,000m2 of storage area
330m quay with 50Te bollards and capstans and storm anchor points
6m quay height above LAT, and 6m water depth below LAT. Tidal range of 2.4m
Two load-in points with 10t/M^2 capacity
Facilities to use several crawler cranes with capacities 40 – 250t.
Access by road

Waste Handling & Licenses
Licensed to receive all wastes expected from oil and gas platforms.
Located in heavy industry area
Licensed to process 120,000t ships and marine structures
Local disposal facilities including an energy recovery incinerator, landfill site, mud cuttings treatment facility.

Past Projects
Viking A
Shell Inde

6 Facilities in Scotland

6.1 Ardesier, Moray Firth

The yard once employed 4,500 people

Closed since 2001, several firms have expressed an interest in the 700-acre site. Ardesier employed 4500 people at its peak having operated as McDermott Yard since the early 1970's.

Located on the east coast of Scotland with deep water access the yard is strategically located for servicing the oil and gas industry for decommissioning projects.

Ardesier was previously used as a fabrication/construction yard for oil and platforms.

6.2 Ardyn Point, Loch Striven

Located on Loch Striven on the west coast of Scotland, Ardyne point build three of the heaviest Gravity Based Structures for the North Sea. The yard was closed down in 1978 and there has since been several proposals for its use.

6.3 Burntisland Fabrications Limited, Fife

Burntisland Fabrications Ltd., Bifab, is a major construction facility and recently built the accommodation module and wellhead jacket and piles for the Cygnus project on behalf of GDF Suez E&P UK. Bifab operates the Burntisland and Methil facilities.

Summary Of Facilities - Burntisland
Design services
2 undercover assembly halls - 5470m2
3 fab shops
1 exotic pipe workshop – 1200m2
Paint shop
Environmentally controlled storage
Open storage – 60,000m2
Load out quay 5000t capacity
No-tidal dock with access for 300 x 90ft barges
Cranes – 3 – 100t

Summary Of Facilities - Methil
Design services
undercover assembly hall - 64000m2
fab shops - 7900m2
paint shop
Environmentally controlled storage- 6800m2
2 Load - out quays 200,000t capacity each
Maximum water depth at quayside 9m

6.4 Dales Voe, Shetland

Operated by Lerwick Port Authority

Summary Of Facilities
Sheltered location and anchorage
Existing facility has 12.5m water depth
Quayside extension under construction to 130m
60t/m2 load bearing quayside under construction
Heavy lift berth immediately adjacent to proposed development site
Laydown expansion to 40,000m under construction

6.5 Hunterston, Clyde Ports

Owned by Clydeport Ltd and is primarily a bulk terminal.
Has 26 m water depth

6.6 Montrose

Summary Of Facilities
Berthing at N Quay to 558m
5.5m water depth at quayside
Mobile cranes with lifting capacity 15-750 t

6.7 Nigg Energy Park, Tain

Owned by Global Energy Nigg Ltd

Extensive experience in oil and gas fabrication, plus repairs and maintenance.

Summary Of Facilities
Site boundary 700,000 m2
Fab shop 30,000 m2
Quayside – 900m heavy load bearing, water depth 12M LAT
Cranes – to 120 t

6.8 Port of Dundee

The most northerly port owned by Forth Ports Authority and is one of the largest economic generators in the city of Dundee. Strategically located on the east coast of Scotland and lies on the sheltered northern side of the Firth of Tay. The port has the capability to handle a wide range of bulk, agricultural and forest products.
A £10M investment has been announced by Forth Ports Authority to create a new quayside with "industry -leading heavy-lift capability. The plans also include the creation of a large onshore operational base with according to Forth Ports Authority "will position the Port of Dundee at the forefront of the North Sea oil and gas decommissioning and offshore wind sectors."
It is reported that the new assets, coupled with a deep water berth and 60 acres of land, will enable the port to handle the largest cargoes used in the emerging North Sea industry sectors.
The new quayside will effectively add both berthing and land capacity at the Port of Dundee and once complete, will represent significant increase in port capacity in the north east region. The construction of the new facility is expected to take 18 months to complete.

Summary Of Facilities
Storage areas
Warehouses
Deepwater berths
Heavy lift quaysides
Development land

1600m quayside

6.9 Kishorn

Owned by Kishorn Port Limited, which is a 50/50 JV between Ferguson Transport (Spean Bridge) Ltd and Leiths (Scotland) Ltd.
Ross, Skye and Lochaber MP Ian Blackford is urging ministers to help the Kishorn Port, which employed 3,000 workers making oil platforms in the 1970's, so secure work worth "billions of pounds to scrap rigs". "There is no better facility to engage in decommissioning than the Kishorn Port" he added, "which is still in operation today and has a unique large dry dock facility that is ideally suited to oil and gas decommissioning.
The Kishorn dry dock was used to build the 600,000t Ninian Central platform, then the largest movable object ever created by man, but it was closed due to bankruptcy in 1987 and then used again to help construct the Skye bridge. Ferguson Transport now use the quay as a port for fish farming supplies, forestry and other products.

Summary Of Facilities
80 m deep channel in Loch Kishorn
100m + deep sheltered berths in Raasay Sound
160m diameter dry dock with up to 13m water at high tide
3 hard edged quays with 10m water at high tide
Industrial footprint of 450,000m2

6.10 Leith

The port of Leith is the largest deepwater port in Scotland and has the capacity to handle ships up to 50,000t.

The port provides full cargo handling services for a range of vessels and cargoes and is equipped with cranes and storage facilities.
Leith has earned a strong reputation for its support serves for offshore developments. In 2012 a memorandum of understanding was signed between the port, Scottish Enterprise and the City of Edinburgh wit the aim of developing a new master plan to create a 21st century gateway for the port to support key industries in Scotland.

Summary Of Facilities
Three 25t bulk storage cranes
One harbour mobile crane
Two gantry cranes
Two dry docks
Industrial footprint of 450,000m2

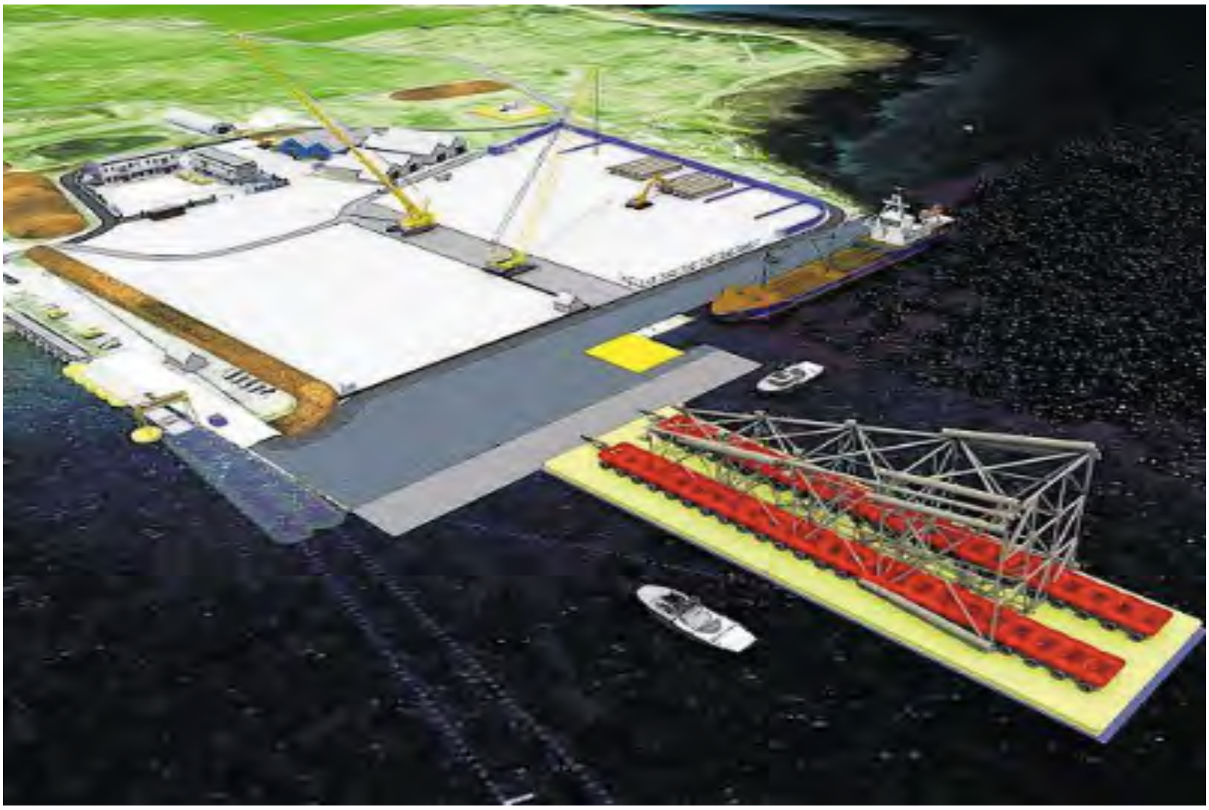
6.11 Wick

Owned by Wick Harbour authority.

Summary Of Facilities
Three basins
River harbour quay suitable for larger vessels
Total quayside 1366 m
Water depth at quayside 1.7m
River basin depth 4.2 m
Max vessel length 85m

7 Potential Yards in Scotland

7.1 Lyness, Orkney



Birmingham based DSM Demolition is investigating the potential to create this new facility at Lyness on the East coast of Orkney pending agreement with the Orkney Islands Council who won the site. Planning application will be submitted this year with a view to opening the site in late 2018. The site has been identified because of its existing harbour and deep water anchorage.
DSM have extensive experience in demolishing steel structure across the UK, and previously lost out to Global Energy Group to but the Nigg Yard in Easter Ross.

7.2 Aberdeen Nigg

Aberdeen Harbour Board has carried out a consultation regarding the Nigg Bay expansion plan.
The proposed facility will have –

- 1400m quayside
- 9m water depth
- Laydown area 125,000 m2
- Heavy lift capability
- Fully serviced berths

The economic case for the expansion, commissioning by Scottish Enterprise, has estimated that under the full development scenario the site will contribute £2BB annually to the Scottish Government and support 15,00 jobs to 2020.

8 Main Yards in Norway

The world class yards at VATS and STORD will be the main competition to winning business in the UK and Scotland. In addition, a further yard is being built at Lutelandet collaboration with Veolia to decommissioning the Yme platform being removed by the single lift vessel 'Pioneering Spirit'.

8.1 VATS, Ruadness Norway

VATS is owned by AF Decom, a subsidiary of AF Gruppen.
VATS is currently processing 25,000t of modules from the Murchison platform topsides and will receive the Murchison jacket when it is removed in 2017.

Summary Of Facilities
Set down area of 68,000m2 and 60,000 m2 storage area
800m navigational channel with a minimum water depth of 80m
182m main quay with water depth of 23m plus additional 125m barge/cargo quay
300m barge quay with 10m water depth
Ground bearing capacity of 10mt/m2, point loading up to 533mt/m2
Waste handling up to 50,000t including steel, WEEE and hazardous waste
Containment system for run down liquids

8.2 STORD, Norway

Owned by AKER Solutions and share the site with Scanmet in a cooperation arrangement.

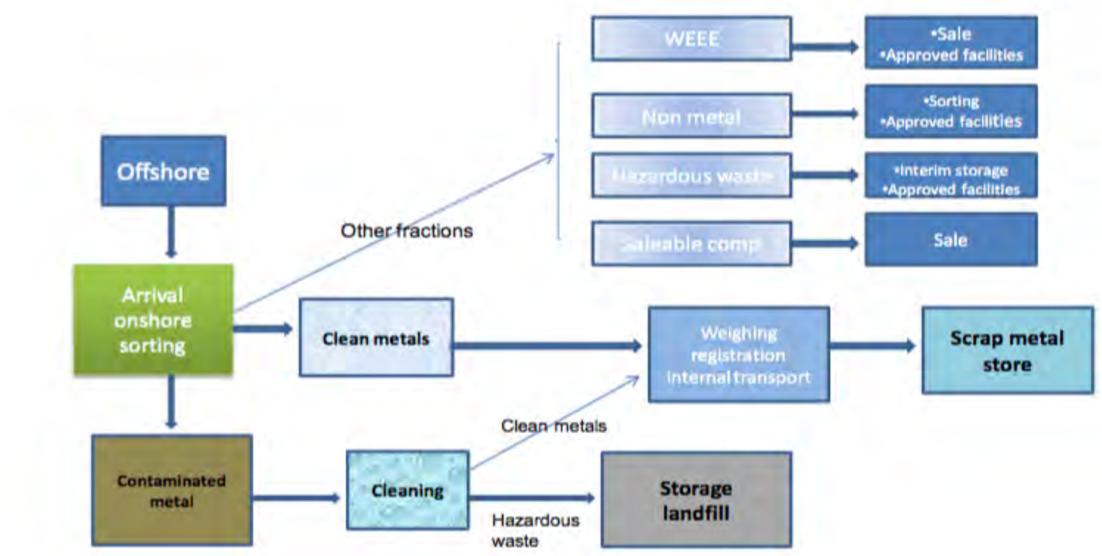
Pioneered the use of Buoyancy Tanks for the removal of the Frigg jacket.

Summary Of Facilities
63,000 yard area
Ground bearing capacity of 15mt/m2 at quayside
149 m quay with a minimum water depth of 15m and 32m quay with 8m water depth
Crane capacity 240t
Waste handling permits

Figure 2Yard Locations

9 Onshore Disposal

There is now significant socio-economic pressure to re-use and recycle as much waste as possible, but there are limited number of facilities with the necessary equipment and available skills.



Onshore processing flow diagram

The main activities at an onshore disposal yard are

- Inventory mapping of hazardous waste
- Offloading
- Decontamination of hazardous waste
- Deconstruction/demolition
- Waste management

9.1 Yard Preparedness

For a yard to be considered fully prepared for receiving and managing decommissioned materials it must fulfill the following criteria –

- quayside of sufficient length to berth a barge, HLV or SLV
- sufficient water depth to allow berthing of of these vessels
- cranes to offload materials to the quayside
- quayside has sufficient strength to support the materials, and support offloading modular transporters if they are required
- cranes to move the materials into space to dismantle
- space to dismantle
- dismantling site must be constructed with concrete to contain hazardous spill-off
- hazardous spill-off must be routed for clean up
- access to demolition contractor to dismantle

- proximate to licenced contractor to cut and sort metal into ferrous and non-ferrous, and waste into hazardous and non-hazardous. Waste contractors must have access to transport waste metals to European smelters, and landfill for other waste.
- Keep audit trail of all materials from receipt to final destination

Waste disposal routes must ne identified prior to generation of waste to ensure that wastes can be safely, efficiently and legally disposed of. This ensures that unexpected ‘orphan’ wastes do not unexpectedly arise and create a disposal issue.

9.2 Offloading

Transfer of decommissioned equipment from transportation vessel to quayside involves the use of the following equipment:

- Self propelled modular transporters
- Purpose built or standard hydraulic skid shoes
- Quayside crawler cranes
- Floating cranes

The use of skidded offloading techniques allows transfer of very heavy structures between barge and quayside.

9.3 Inventory and Mapping of Hazardous Waste

Inventory and mapping of hazardous waste will be completed offshore prior to removing or demolishing the platform modules. Both identification and quantity of materials is required, such as:

- Carbon steel
- Alloy and stainless steel
- Aluminium
- Cement
- Copper
- Glass reinforced plastic
- Iron
- PVC
- Non-ferrous metals
- Plastics and rubber

Typical residual waste:

- Hydrocarbon sludge
- Chemicals
- LSA Scale
- Diesel
- Heating and cooling medium
- Hydraulic oil
- Seal oil
- Asbestos
- Mercury

9.4 Decontamination and Demolition

Waste streams are identified, segregated and removed for safe disposal by specialist contactors licensed for this purpose. These activities include –

- Draining all fluids from the structure
- Removal of asbestos
- Removal of LSA scale
- Removal of waste electrical and electronic equipment (WEEE)
- Demolition, segregation, transportation and storage

Common methods of removing scale that could contain pollutants (trace metals, LSA scale for example) are high-pressure water jetting and mechanical scrubbing. In some cases chemical cleaning methods will have to be used. The materials used in the construction of the modules will be dependent on its age – many older modules (>30 years) may have asbestos which of course is now prohibited. Gas processing pipework and other equipment from some gas field can occasionally have compounds of mercury entrained in the steelwork which is very difficult and hazardous to remove.

10 Evaluation Criteria

A qualitative assessment of decommissioning readiness is presented based on evaluation criteria; location, facilities, accessibility by sea, proximity to waste disposal and containment of hazardous waste.

10.1 Location

Some of the yards in this report are well established in decommissioning activity while others are planned to be established or upgraded.

Factors to be considered are a) established facilities with history of decommissioning projects, b) readiness of the facility to receive platform materials without significant investment c) licensing in place for handling waste

A scale of 1-5 defines the ranking for location

1	Facility is in planning phase, not yet started. Has potential to be developed.
2	Construction in progress, will be ready >5 years
3	Existing facility, currently engaged in the marine/offshore industry. May require permits for waste handling for decommissioning activity
4	Existing facility, currently engaged in the marine/offshore industry. Has permits for waste handling for decommissioning activity
5	Existing facility, currently engaged in the marine/offshore industry. Has permits for waste handling for decommissioning activity Capable of handling large modules and jackets

10.2 Yard facilities

Qualitative assessment of facilities, based on a) berth and offload form a standard barge using trailers or sheer leg vessels b) sufficient area for set-down and demolition of modules and jackets c) containment systems for run-down liquids d) dismantling equipment in place such as cranes etc.

1	Inadequate facility to berth and offload from barges No containment system for run down liquids Insufficient area for demolition of modules and jackets
2	Facility to berth small barge No containment system for run down liquids, but containment facilities available Insufficient area for large scale demolition of modules and jackets
3	Can berth and offload barges but not heavy lift vessels, sheer legs or mono hull vessels Bunded area for run down liquids Sufficient area for demolition for demolition but only piece small - cannot handle large modules
4	Can berth and offload barges, sheer legs or mono hull vessels Bunded area and receptor facilities for run down liquids Sufficient area for large scale demolition of modules and jackets
5	Can berth and offload barges, sheer legs, mono hull vessels and heavy lift/single lift vessels

	Bunded area and receptor facilities for run down liquids Sufficient area for large scale demolition of modules and jackets

10.3 Sea Accessibility

Qualitative assessment of the facility with respect to distance involved form the field to the reception facilities – a) sailing distance to the field b) access for heavy lift vessels and barges c) draft and air draft restrictions d) all year weather accessibility

1	Restricted/limited access for a transportation barge More than 5 days sailing distance
2	Restricted/limited access for a cargo barge 3 - 5 days sailing distance
3	Restricted/limited access for a heavy lift vessel 3-5 days sailing distance
4	Adequate access for a heavy lift vessel 3- 5 days sailing distance
5	Adequate access for heavy lift or single lift vessel 1-3 days sailing distance

10.4 Proximity to waste disposal

High (H). Waste disposal contractor is on site facilities
Medium (M). Waste disposal contractor is within 50 miles of yard
Low (L). Waste disposal contractor is > 50 miles from yard

10.5 Liquid Containment

Area for size reduction and waste handing is made of concrete and is capable of managing waste run-off on a pollution prevention basis.

Yes (Y) No (N)

Summary of Preparedness of North Sea Yards

Yard	Location	Facilities	Sea Accessibility	Proximity to waste disposal	Waste licences	Liquid containment
ABLE UK	5	4	3	H	Y	Y
Greenhead Base	5	3	4	H	Y	Y
Harland & Wolf	3	3	3	H	Y	Y
Peterhead	3	3	3	M	Y	Y
Swan Hunter	3	3	3	M	Y	Y
Ardesier	3	3	3	L	N	N
Ardyn Point	2	2	3	L	N	N
Burntisland	3	3	3	H	N	N
Methil	3	3	1	H	N	N
Dales Voe	3	3	1	H	N	N
Hunterston	2	2	2	L	N	N
Montrose	4	3	2	H	N	Y
Nigg Energy	4	4	4	H	N	Y
Port of Dundee	3	4	3	H	N	N
Kishorn	3	3	4	L	N	N
Leith	3	3	3	M	N	N
Wick	3	2	3	L	N	N
VATS	5	5	5	H	Y	Y
STORD	5	5	5	H	Y	Y

11 Commentary and Conclusions

11.1 Demand versus capacity and capability

From a UK capability perspective, it is likely that this is adequate in the short to medium term. Certainly the ability to demolish and recycle material is in place while the potential to offload very large structures in limited. All of the yards currently in the decommissioning business are capable of managing piece small decommissioning to some extent, however only a few are capable of hosting very large heavy lift vessels and most will reply on the transfer barges; the cost of this ‘double transfer’ is probably under-estimated.
Looking at UK capacity, there is unlikely to be constraints in the short to medium term. With 690,000t of decommissioned materials forecast for the period to 2024 (~69,000t/yr.) the market has sufficient capacity.

Other factors will also prevail; most of the facilities are not dedicated to decommissioning activity and there is potential for the offshore wind industry to compete with oil and gas both for fabrication and decommissioning space.

The core port offering from Scotland is currently in Shetland, where existing and developing facilities are well placed to receive piece -small material or single modules.
Many other of the potential yards in Scotland are capable of receiving piece- small material, with some investment.
Only the very large yards at ABEL, VATS and STORD are capable of handling a multi-module decommissioning project like the recent Murchison platform. Shetland is capable from a sea access perspective but needs much more space. The yards at Dundee and Nigg are well placed from a waste disposal perspective with Robertson Metals at Dundee and John Lawrie at Eventon. Nigg has much deeper water, a bigger quayside and much more space then Dundee.

Speculation in the press is mis-guided; some caution is required in estimating the number of jobs that will be created in this market, and certainly not the “thousands” that some commentators are quoting.
In terms of actual numbers, an example is the 500t offshore module which was decommissioned by John Lawrie at Port of Dundee; the module was first “downsized”, then the metals further processed and shipped to a smelter. The operation took only six men just seven days to complete. Furthermore, the Murchison topsides have recently been delivered to VATS in Norway, around 25,000t of modules; only 45 people will be required to downsize and process all of this material at the yard, which will be clear to receive the Murchison jacket next year.

11.2 Future Investment

The decommissioning ‘removal’ segment is dominated by non-UK companies:

- Single Lift Vessel - Pioneering Spirit (Allseas, Switzerland)
- Heavy Lift vessels, Thialf, (Heerema, Netherlands). S7000 (Saipem, Italy)
- Sheer leg and jack-up vessels, Boskalis (Netherlands, Mammoet (Netherlands), Seaway Heavy Lifting (Netherlands), Seafox (Netherlands)
- Piece small, AF Decom (AF Gruppen), Norway

Floating shear-leg crane

Jack-up vessel

There is concern amongst UK Government and Unions that much of the decommissioning business is not being won by UK companies (e.g. CNRI - Murchison, Maersk -Janice). With a significant percentage (50-75%) of decommissioning costs being borne by the UK tax payer via tax refunds, it is likely that there will be political pressure exerted to keep these rebates within the UK economy.
There is a strong case for collaboration between the dominant removal contractors and Scottish ports to attract some of this business into the Scottish economy.
The recycling/waste management segment of the total cost of decommissioning is around 1% (~£0.5 to £1.0bn) and this will undoubtedly restrict both the returns and the appetite for future investment given the number of existing operational yards and the competition from facilities outside of the UK.

11.3 Moving Forward

In order to move forward and avoid significant value leakage to the UK and Scotland, the following should be addressed

11.3.1 Field life extension

Many of the incumbent oil companies with a high cost base are finding it increasingly difficult to sustain economic production from their assets in todays economic climate, and in many instances will be willing sellers. The buyer community is restricted by the current decommissioning tax treatment, where oil companies enjoy corporation tax relief against decommissioning costs. However, this relief is ring fenced against corporation tax paid by the asset, and so potential buyers with tax capacity in UK business elsewhere will not attract this benefit. This is severely restricting the potential for new entrants with a more agility and loser cost base to extend the life of many UKCS fields.
This would in turn delay decommissioning and give time for the UK to approach decommissioning in a more collaborative and cost effective way.

11.3.2 Job retention

Oil companies are continuing to lower costs through restriction of discretionary spending and this is having an effect on jobs in two ways 1) oil company job losses 2) less services required resulting in a supply chain oversupply, with consequential job losses in the supply chain.
The UK government must take ownership of this situation, and where possible take action to retain jobs or a prepare transition process into decommissioning where different skills/training may be required.
While there will be onshore opportunities through transition of employment and skills and through job creation in the supply chain, the majority of jobs will be required for offshore

purposes, including plug and abandon activities, preparation (isolating, cleaning and removal), decommissioning vessel crews and project management.

11.3.3 Decommissioning Execution

In an ideal decommissioning project plan, the buyer will have cost certainty and the contractors will have execution certainty. This rarely happens as risks are not allocated appropriately, cost models are uncertain and scope is unclear. This is primarily due to the oil companies tendering for a solution (which has a high degree of uncertainty) through normal Invitation to Tender (ITT) procurement methods, rather than tender a problem, where the supply chain has more appropriate skills.

On the one hand this is creating significant project cost overruns (much of these borne by the UK tax payer) and on the other it is stifling innovation and collaboration within the supply chain.

11.3.4 Port of Dundee

This port has the potential to become an important hub and generate more jobs in this part of Scotland, and it has most of the components required to be 'decommissioning ready'. However, some issues have to be addressed –

- The Forth Ports Authority need to understand that they may not best placed to advise on required facilities, and also require to be very collaborative and identify enabling stakeholders; the port needs a recognisable identity.
    - Dundee should benchmark itself against the world class facility at VATS
- The road and rail infrastructure needs upgraded and modified, which could stimulate businesses proximate to the port.
- Collaboration with the neighbouring Burntisland and Methil yards could be key, in providing ancillary and overspill services

12 Appendixes

12.1 Summary of Established North Sea facilities

	Yard	Total area, m2	Laydown area, m2	Approach width, m	Approach depth, m	Depth at quayside, m	Ground bearing capacity mT/m2	Mooring facilities, barges	Mooring facilities, HLV
1	ABLE UK	510,000	185,000	120	6.5	9.5	75	Y	Y
2	VATS, Norway		128,000	800	80	23	10	Y	Y
3	STORD, Norway		83,0000	1000	220	15.3	15	Y	Y
4	Lyngdal, Norway		600,000			9, 18		N	N
6	Harland & Wolf		25,000	152	8.5	8.6		Y	Y
7	Peterhead Decommissioning		3,500	200	9	6.2	5	Y	N
8	Swan Hunter		85,000		9.1	9	10	Y	Y

12.2 Summary of Existing UK Facilities (where data exists)

Yard	Total area, m2	Laydown area, m2	Approach width, m	Approach depth, m	Depth at quayside, m	Ground bearing capacity mT/m2	Mooring facilities, barges	Mooring facilities, HLV
ABLE UK	510,000	185,000	120	6.5	9.5	75	Y	Y
Greenhead base, Shetland		75,000	120	9	9.2	10	Y	Y
Harland & Wolf		25,000	152	8.5	8.6		Y	Y
Peterhead Decommissioning		3,500	200	9	6.2	5	Y	N
Swan Hunter		85,000		9.1	9	10	Y	Y
Ardesier	-	-	-	-	-	-	-	-
Ardyn Point	-	-	-	-	-	-	-	-
Burntisland	-	60,000	-	-	-	5000 total	-	-
Methil	-	277,000	-	-	9	-	-	-
Dales Voe	-	40,000	-	-	12.5	60	-	-
Hunterston	-	-	-	26	-	-	-	-
Nigg Energy Park		700,000	-	-	12	900 total	-	-
Port of Dundee	-	-	-	-	-	-	-	-
Kishorn	-		-	-	-	-	-	-
Leith	-	-	-	-	-	-	-	-
Wick	-	-	-	-	1.7	-	-	-

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