

Blue Transmission London Array Ltd



Decommissioning Programme

Blue Transmission London Array Ltd

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Abbreviations

Abbreviation	Definition
DECC	Department of Environment and Climate Change
DTI	Department of Trade and Industry
EIA	Environmental Impact Assessment
ES	Environmental Statement
GIS	Gas Insulated Switchgear
HDD	Horizontal Directional Drilling
HSSE	Health, Safety, Security, and Environment
IMO	International Maritime Organisation
LAL	London Array Limited
MCA	Maritime and Coastguard Agency
O&M	Operations and Maintenance
OFTO	Offshore Transmission Owner
OSPAR	Administrator of the Oslo and Paris Conventions for the protection of the marine environment of the North-East Atlantic
PLA	Port of London Authority
RSPB	Royal Society for the Protection of Birds
THLS	Trinity House Lighthouse Service
UNCLOS	The United Nations Convention on the Law of the Sea

1. Introduction

This document presents the proposed OFTO decommissioning programme for the Blue Transmission London Array assets and is based upon the proposals by the Developer for the decommissioning of its Wind Farm.

In December 2006 London Array were granted planning permission for the offshore components of the London Array offshore wind farm. The wind farm is located more than 20km (12 miles) off the Kent and Essex coastlines, in the outer Thames Estuary. In order to connect the electricity generated by the wind farm to the national grid an onshore substation and associated cabling has been constructed at Cleve Hill in Graveney. Planning permission for these works was granted in August 2007.

Phase 1 of the wind farm comprises 175 turbines, 2 offshore substations, associated array cabling, 4 offshore transmission cables and 1 onshore electricity substation.

This document presents the decommissioning programme for the offshore elements of Phase I of Blue Transmission London Array assets and is being submitted for approval in accordance with the requirements under Section 105 of the Energy Act 2004.

This document is applicable to all the offshore transmission assets including the offshore substation and export cables. The programme is informed and supported by the EIA that was conducted by LAL to support the planning applications made by LAL in June 2005. The programme assumes that full decommissioning will commence after the design life of the wind turbines (20 years).

This Decommissioning Programme for the OFTO assets will be reviewed in the years preceding decommissioning to reflect the relevant proposal and the best practises established at that time.

A cost estimate for the decommissioning activity has been predicted. In addition Blue Transmission London Array is fully aware of its obligations to provide appropriate financial security to ensure that liabilities can be met.

2. Executive Summary

In accordance with Section 105 of The Energy Act 2004, Blue Transmission London Array is required to prepare a Decommissioning Programme for the Blue Transmission London Array assets. This document constitutes the preliminary Decommissioning Programme for the OFTO assets and is intended to form the basis of discussion with DECC. We will adopt the principles of the DECC programme process stages. However we believe that the process will differ because of the change in circumstances and will be:

- | | |
|---------|--|
| STAGE 1 | Blue Transmission London Array discusses draft decommissioning programme with DECC, LAL and other consultant parties |
| STAGE 2 | Blue Transmission London Array produces decommissioning programme |
| STAGE 3 | Review of decommissioning programme |
| STAGE 4 | Responsible person ensures decommissioning programme is carried out in accordance with the programme |

STAGE 5 Responsible person carries out post decommissioning monitoring, maintenance and management of site and as specified in the programme

The programme is informed and supported by the EIA carried out for the London Array Project. The resulting ES was submitted by LAL as part of the Project's application for consent in June 2005. The ES provides detailed analysis of the baseline physical, biological and human environment. The assessment of the impact of the project on stakeholders takes into account decommissioning provisions that are consistent with those presented in this document.

In considering appropriate decommissioning provisions, Blue Transmission London Array has sought to adhere to the following key principles:

- No harm to people
- Consideration of the rights and needs of legitimate users of the sea
- Minimise environmental impact Promote sustainable development
- Adhere to the Polluter Pays Principle
- Maximise the reuse of materials
- Commercial viability
- Practical integrity

3. Background Information

3.1 Project Description

The London Array project is an offshore wind farm located in the Outer Thames Estuary, in one of the three strategic areas the Government identified for the 2nd Round of offshore wind farm development. LAL has been awarded an option for a 50-year lease for the site and cable route to shore from The Crown Estate.

The London Array Phase 1 project is situated midway between the Kent and Essex coastlines, more than 20km (12 miles) from each shore. It consists of 175 wind turbines, installed on the Long Sand and Kentish Knock banks and in the Knock Deep channel that lies between. The OFTO assets consist of two offshore substation platforms which are each connected to an onshore substation by two export cables.

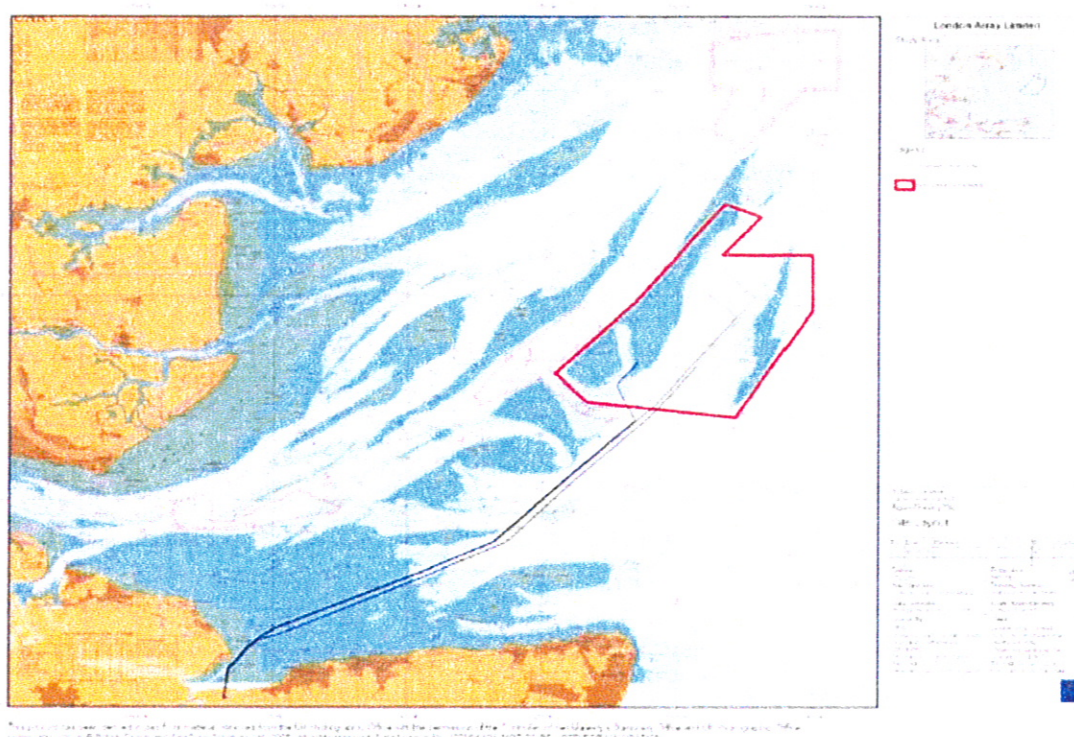


Figure 2: London Array Development

The detailed delivery programme associated with the project will be determined in discussions with the Developers of the wind farm (LAL).

[illegible]

3.3 Refined Design: Conditions and Mitigation Measures

The key permissions to enable delivery of the complete project (including OFTO assets) have now been received. These are:-

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- Section 5 Food and Environmental Protection Act 1985 (Deposits in the Sea in connection with Marine Construction Works)
- Section 37 Electricity Act 1989 (Onshore Overhead Electric Lines)
- Section 57 and 91 of the Town and Country Planning Act 1990 (Onshore Works and Offshore Works within the jurisdiction of the Planning Authority)
- Works Licensing under the Port of London Act 1968 and Medway Ports Act 1973 (Export Power Cables)

Since being awarded the relevant permission the design basis for the total project (including OFTO assets) has been refined in accordance with the licenses and with the technical design details provided by London Arrays contractors.

There are three principal elements to the process:

- Refinements to project design to mitigate against impacts
- Mitigation measures for project construction and operation
- Ongoing monitoring programmes to improve understanding of potential and experienced impacts, to achieve agreement on further mitigation measures and to enable decisions to be taken on Phase 2.

The London Array development area as permitted incorporates a buffer zone in the south west of the site achieved in consultation with the PLA and MCA by the removal of turbines adjacent to the Fisherman's Gat Precautionary Area. Provision has also been made for a buffer zone adjacent to the active aggregation extraction area adjacent to the northern boundary of the site. The London Array project will be developed in a phased manner with Phase 1 comprising 175 turbines. The northern boundary of the area for Phase 1 was determined through consideration of the potential impacts on wintering red-throated divers by agreement with Natural England and the RSPB. A satisfactory outcome to further monitoring of the divers on completion of Phase 1 will be a precursor to the development of Phase 2. A navigational marking and warning light specification has been agreed by LAL with THLS as shown in Figure 3 (repeated below).

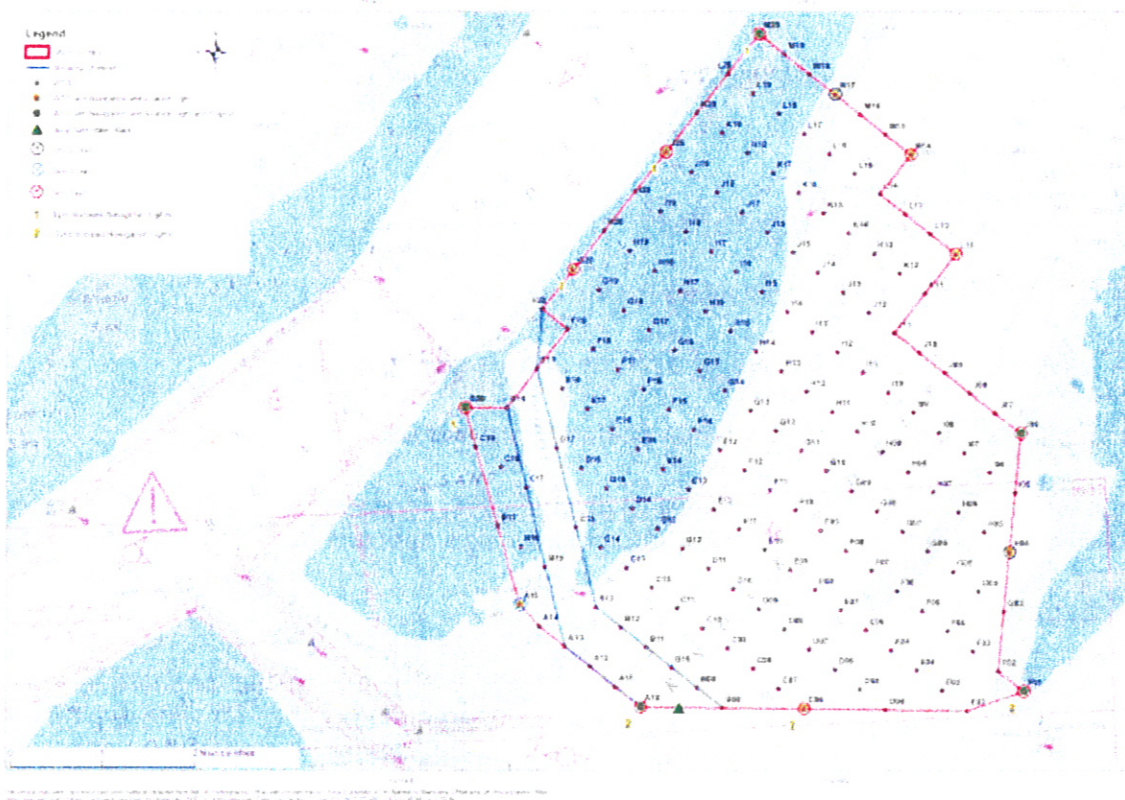


Figure 3: London Array Phase 1

The majority of mitigation measures and the mechanisms for establishing monitoring programmes have now been agreed in consultation with statutory bodies and have been incorporated as conditions into respective consents, licences and permits. The full list of detailed conditions is within each consent or permit.

3.4 Detailed Engineering and Build

The principal elements of the equipment supply and contracting are described in this section. Please note that this Decommissioning Plan is specific to the offshore elements of the Blue Transmission London Array OFTO assets.

3.4.1 Transformer platforms

The purpose of an offshore sub-station platform is to transform the voltage of the electricity generated at the wind turbine to a higher voltage suitable for transmission of power to shore.

The two offshore sub-stations are located within the turbine array. The substations have typical dimensions of 22m length x 24m width x 10m height. The total height of each sub-station including the foundation is up to 38m above LAT.

The components within the sub-station offshore platforms include:

- Medium voltage switchgear
- Medium to high voltage transformers

- High voltage GIS
- Back-up diesel generator and tank
- J-tubes
- Medium and high voltage cables
- Systems and Control containers for the substation
- Workshop and store including a refuge and life saving equipment.

The foundations supporting transformer platforms are in the form of monopiles.

The piles each weigh approximately 415 and 556 tonnes for substations 1 and 2 respectively. The topsides including all equipment weigh approximately 1500 tonnes.

3.4.2 Export Cables

Subsea power cables are required to connect the wind farm to the onshore electricity transmission system. These cables also comprise internal fibre optics for wind farm control purposes. The 3-core cables consist of copper conductors with integral insulation, core screening, and steel armour (for stiffness and impact resistance).

The export cables have been buried to a depth ranging between c.1.0m to 2.0m below seabed. It is considered that the burial depths for export cables are sufficient to ensure that the cables do not become exposed by the removal of overburden material. Phase 1 of the wind farm has 4 export cables to transmit power along the c.50km long route from the off-shore substations to the landfall in the Swale Estuary. At the beach end of the cable route, the export cables pass under the sea defence wall through sealed HDD conduits.

There are two cable crossings along the length of the export cables, each has been installed with scour protection.

3.4.3 Scour protection

Scour is the term used for the localised removal of sediment from the area around the base of support structures located in moving water. When a structure is placed in a current, the flow is accelerated around the structure. If the bed is erodable (and the shear stresses are of sufficient magnitude), a scour hole forms around the structure. This phenomenon is known as local or structure-induced sediment scour.

At the London Array site, some scouring of the upper softer clay and/or sand and gravel material may occur around the substation foundations and scour protection measures around the structures, such as rock dumping or fronded mattresses, is needed to protect the cable entry area. Scour protection has been installed for the cable crossings and offshore substations.

3.5 Offshore construction and installation

The foundations were prefabricated onshore, from where they were loaded onto transport barges or floated directly to the site. Installation was carried out from a jack-up (Figure 5).



Figure 5: Installation of monopiles

The presence of obstacles on the seabed may alter local flows around the structures that may lead to scouring of the seabed. Scour protection material may be placed around the base of the substation foundations and cable route to minimize the effects of scour.

The transmission export cables were installed using one of three methods; ploughing, trenching or jetting subject to local conditions.

As the first phase of the project is commissioned, civil construction of the onshore substation is complete and most of the electrical equipment has been installed, with the remaining equipment installation activity depending on the timing of subsequent project phases.

3.6 Health, Safety, Security and Environment (HSSE)

In its management of the London Array project, LAL has committed to uphold the highest standards as far as is reasonably practicable for HSSE. The Blue Transmission London Array is also committed to these standards and in particular committed to:

- pursue the goal of no harm to people,
- protect the environment by maintaining a high standard of environmental care, assessing the ongoing environmental impact of its activities as an integral part of decision making,
- play a leading role in promoting best practices in the wind power industry through continuous performance appraisal and targeting ongoing improvement,
- manage HSSE matters as any other critical business activity and promote a culture in which all persons working on the LAL construction project and ongoing O&M, including contractors and sub-contractors share this commitment.

The Blue Transmission London Array will implement an HSSE policy that:

- has a systematic approach to HSSE management designed to ensure compliance with the law and to achieve continuous performance improvement
- sets targets for improvement; measures, appraises and reports performance
- requires its Contractors, vendors and suppliers to manage HSSE in line with this policy
- ensures that HSSE is the responsibility of all managers and individuals
- requires everyone to stop any work, or prevent work from starting, where adequate controls of HSSE risks are found not to be in place including HSSE performance in the appraisal of all persons working on the project

Blue Transmission London Array intends to have a HSSE performance it can be proud of, to earn the confidence of customers, business partners and society at large, to be a good neighbour and to contribute to sustainable development.

To implement these policies, a Business Management System (BMS) is currently being put in place to ensure that health, safety, security and environmental matters are properly addressed by the project in a way that complies with legislative requirements and is consistent with the HSSE policies, procedures and targets operated by the Blue Transmission London Array.

4. Detail of Proposed Decommissioning Measures

4.1 Guiding Principles

In considering the proposed decommissioning programme for the London Array, LAL has sought solutions for each offshore element of the wind farm that adhere to the following principles:

Guiding principle	Comments
No harm to people	Blue Transmission London Array is committed to adhering to the highest standards for health and safety throughout the lifecycle of the Blue Transmission London Array assets. LAL seeks to promote safe practices and minimise risk in the development and implementation of decommissioning solutions.
Consideration of the rights and needs of legitimate users of the sea	Blue Transmission London Array respects the rights and needs of other users of the seabed. Decommissioning activities will seek to minimise the impact on stakeholders and emphasis will be placed on clear, open communication.
Minimise environmental impact	The Best Practicable Environmental Option (BPEO), at the time of considering the precise decommissioning procedure, will be chosen in order to minimise impact on the environment at an acceptable cost.
Promote sustainable development	In decommissioning the Blue Transmission London Array assets, Blue Transmission London Array will seek to ensure that, as far as is reasonably practicable, future generations do not suffer from a diminished environment or from a compromised ability to make use of marine resources.
Adhere to the Polluter Pays Principle	Blue Transmission London Array's decommissioning and waste management provisions acknowledge our responsibility to incur the costs associated with our impact on the environment.
Maximise the reuse of materials	Blue Transmission London Array is committed to maximising the reuse of waste materials and pays full regard to the 'waste hierarchy'.
Commercial Viability	In order that commercial viability is maintained, the Best Available Technique not Entailing Excessive Cost (BAT-NEEC) decommissioning solutions will be sought.
Practical Integrity	Solutions that are necessary to achieve one or more of the above objectives must be practicable.

4.2 Proposed Decommissioning

The overriding aim for LAL during the construction of the Wind Farm has been to develop a project that is safe, durable and cost-efficient throughout its lifetime. Taking a lifecycle approach to the design and development work ensures that decommissioning considerations are incorporated into decision-making and, where possible, means that the principles identified above were incorporated into early decision-making.

Taking into account the UK's commitments under UNCLOS; IMO standards and the work of the OSPAR Commission, Blue Transmission London Array's starting assumption in establishing the decommissioning requirements has been complete removal of all offshore components to shore for reuse, recycling or incineration with energy recovery or disposal at a licensed site. This assumption has been assessed for all components against the key principles presented above. In some instances this option has not been considered to be appropriate and alternative options have been considered. These alternatives have also been assessed according to the above principles and the optimum solution selected.

A further prerequisite for not fully removing a component is consistency with at least one of the circumstances set out on page 20 of DTI (now DECC) guidance ("Decommissioning Off-shore Renewable Energy Installations Under the Energy Act 2004, Guidance Notes for Industry, January 2011) as situations where such a solution may be considered. The circumstances set out in the guidance are listed below.

- *"the installation or structure will serve a new use, whether for renewable energy generation or for another purpose, such as enhancement of a living resource (provided it would not be detrimental to other aims, such as conservation). In these situations, we would normally expect the decommissioning programme to set out the eventual decommissioning measures envisaged should the installation or structure finally become 'disused' and a point reached when extending its life or finding a beneficial reuse is no longer possible;*
- *entire removal would involve extreme cost. It is considered that design decisions should, as far as possible, result in installations which are affordable to remove, but it is recognised that some elements, such as deep foundations, may nonetheless be costly to remove;*
- *entire removal would involve an unacceptable risk to personnel;*
- *entire removal would involve an unacceptable risk to the marine environment;*
- *the installation or structure weighs more than 4000 tonnes in air (excluding any deck and superstructure) or is standing in more than 100 m of water and could be left wholly or partially in place without causing unjustifiable interference with other uses of the sea."*

The methods of decommissioning will be affected by site specific factors, by final design choices, and by the equipment and vessels available at the time. The measures described in this section are based on current technology and information, but it should be recognised that the methods are likely to evolve over time.

Periodic review of the Decommissioning Programme and the measures proposed within it will take place throughout the lifetime of the wind farm to accommodate new information. For example, new offshore technologies are continually being evaluated, tested and developed. Blue Transmission London Array expects considerable advances over the lifetime of the

project with new techniques evolving as experience and knowledge in the sector grows. In particular, it is acknowledged that lessons may be learned through the construction and operation of the project and through industry experience in decommissioning renewable energy and other offshore installations. Sufficient time must be given to researching the different available technologies for each phase of the decommissioning operation.

It may also be necessary to amend these measures in order to comply with revised best practice guidelines and future legislation.

Section 8 sets out a formal timetable for reviewing the decommissioning provisions for the Blue Transmission London Array Assets in order to ensure that the best technology is selected and efficient and safe procedures are followed.

4.3 Offshore Substation Platform Foundations & Transition Pieces

Design considerations have been made to ensure that the installations are affordable to remove. However, design codes and standards limit the ability to reduce steel thicknesses and to lighten the structures to ease future removal. The result is that the monopoles and the jacket piles are of a size that means they will not be able to be removed from the seabed once piled to the design penetration depth of approximately 35m – 45m below seabed. Consequently it is proposed that the foundations are cut at or below seabed. In the first instance a general target of cutting one metre below seabed is proposed, though it may be necessary to vary the target depth for each offshore substation platform foundation subject to site specific factors such as the specific ground conditions at each platform location. In contrast, for complete removal it should be noted that in order to overcome vast frictional forces, considerable excavation will be needed – in some instances up to 20m depth must be foreseen. In order to be able to undertake the cutting procedure, the diameter of the excavation hole will increase by at least two metres for every additional metre in depth below seabed. As such, it may be considered too intrusive and damaging to consider cutting below one metre depth.

It is proposed that, following the cutting operation, the foundations and transition pieces be removed as a single structure.

The following table compares and contrasts the options of complete removal of foundations with the alternative of cutting below seabed as described above. The same considerations apply to the foundations used for transformer platforms and met masts.

Criterion	Complete removal	Cutting below seabed
No harm to people	High risk to personnel associated with lifting extreme weights. Risk compounded by significant length of time needed to undertake works offshore. Diver operations would be required.	Fewer activities to be undertaken over a shorter time period offshore, minimising risk to personnel. Post decommissioning site monitoring will identify any unlikely exposure with the result that safety risk is insignificant.
Consideration of the rights and needs of legitimate users of the sea	Disadvantages to other users of the marine environment include disruption over a longer time period whilst the works are undertaken and remaining scour holes	No risk presented providing cutting is to sufficient depth, site is monitored post decommissioning; any unlikely exposure identified.

	associated with excavation.	
Minimise environmental impact	Excavation pits over a wide area causing significant impact to marine environment. Associated dumping of excessive volume of waste material also required. Disturbance would take place over long time period. Some artificial reef habitat may be lost, but long term risk of decay and pollution will be eliminated.	Considerably reduced works footprint relative to complete removal. Works would take place over reduced time period and involve less equipment. Seabed recovery time shorter than complete removal scenario. Some artificial reef habitat may be lost, but long term risk of decay and pollution will be eliminated.
Promote sustainable development	In the long term complete removal affords maximum flexibility over use of seabed, though considerable destruction over the whole site in short-medium term	Some activities may be limited at turbine locations: e.g. extraction (given incidence of London clay on site demand for extraction unlikely). Providing remaining structures do not become exposed most future activities will not be affected. Seabed recovery is highly likely.
Adhere to the Polluter Pays Principle	Consistent in principle, assuming a suitable disposal solution can be found for the excavated waste material and that the seabed can be restored.	Consistent as far as is reasonably practicable – all remains to be suitably buried.
Maximise the reuse of materials.	Maximum material potentially available for reuse.	Less material available for reuse relative to complete removal.
Commercial Viability	Not commercially viable – excavation and extreme lifting involves major equipment requirements over longer periods of time	Less expensive alternative to complete removal, involving minimal excavation.
Practical Integrity	Not a practical solution: Extreme risk associated with heavy lift, considerable excavation needed with associated storage or disposal of large volume of waste.	Standard procedures and equipment.

This analysis shows that cutting below seabed is preferable to complete removal on the grounds of safety, practical integrity and commercial viability.

Blue Transmission London Array considers that there is consistency between this proposal and the relevant circumstances set out in DTI/DECC guidance:

- Entire removal would involve extreme cost.
- Entire removal would involve an unacceptable risk to personnel.

It is also noted that this approach is standard practice within the oil and gas industry for similar structures.

Although Blue Transmission London Array is committed to cutting foundations below seabed, contingency plans will be put in place to ensure appropriate actions are carried out in the case that remaining structure(s) become exposed. Please see Section 10 for details.

On current knowledge, abrasive diamond wire cutting is likely to be the preferred method for cutting all the foundation structures at or below seabed.

The use of divers for any of the removal works will be minimised and if possible eliminated completely.

The general methodology for decommissioning of the offshore substation platform monopiles is likely to be as follows:

- Operate cutting procedure at or below seabed
- Remove transition piece and upper part of monopile as a single object using suitable lifting vessel
- Transport to onshore location for offloading/disposal
- Remove internal equipment, disassemble onshore

4.4 Offshore Substation Platform Topsides

It is proposed that the oil/resin filled transformers are sealed and removed separately and taken to shore complete, reducing the potential for offshore spillage risk and facilitating safe dismantling. Next the topside is cut from the monopile and removed in one piece. Finally the monopile is cut 1m below seabed and removed. The complete lift weight will be in the region of 800 tonnes. The justification for described removal of the topsides is outlined below:

Criterion	Complete removal
No harm to people	Safest option, involving standard procedures and minimal work offshore.
Consideration of the rights and needs of legitimate users of the sea	Complete removal of structure best long-term solution. Appropriate notification and consultation would precede temporary works/disturbance.
Minimise environmental impact	Risk of spillage slight as all pollutants are fully contained and removed in a few controlled lifts. The majority of dismantling takes place onshore
Promote sustainable development	Materials completely removed from site, ensures future generations do not suffer from a diminished environment or from a compromised ability to make use of marine resources.

Adhere to the Polluter Pays Principle	Entirely consistent: owner pays full cost of removal and disposal.
Maximise the reuse of materials.	Maximum potential for reuse of materials.
Commercial Viability	Most commercially viable solution: minimal works offshore, maximum resale/reuse value from materials, minimum residual risk.
Practical Integrity	Main risk is heavy lift and this can be mitigated by use of correct procedures and capable vessels and equipment. Most practical method.

The justification for cutting foundations below seabed provided in section 4.3 above also applies to this proposal.

The complete 'topside' structure will be removed in a single lift, taken by suitable vessel to an onshore facility where the equipment and structure will be dismantled and the constituent parts processed for reuse, recycling and or disposal.

4.5 Cables

Blue Transmission London Array intends to follow the current industry standard by leaving both inter-array and export cables in situ. As such, life-cycle costs and environmental impact will be considered in the design of the export cables.

It is proposed that export cables adjacent to the transformer platform are cut at a point below the surface of the seabed to allow the cable to remain buried. The cut sections would be removed with minimal disruption of the seabed. It is proposed to leave the remaining cable in situ as the disruption caused by jetting and or excavating the seabed to remove the cable is regarded as being detrimental.

Whilst it is considered that cables are buried at a safe depth, contingency plans will be put in place to ensure appropriate actions are carried out if the cables do become exposed. Please see Section 10 for details.

An exception is made for the inter-tidal zone where Blue Transmission London Array considers that the best practise would be to cut and pull through the HDD conduits. However, due to requirements of local easements, it is likely that the cutting point would be at the mouth of the Swale.

Criterion	Complete removal	Leaving in situ
No harm to people	Risk to personnel not excessive	Burial within stable clay seabed does not pose safety risks to marine users
Consideration of the rights and needs legitimate users of the sea	Removal affords maximum flexibility over use of seabed	No risk presented from leaving buried cables in situ. Potential for extraction activities limited (though unlikely in London Clay)
Minimise environmental impact	Given the considerable length of cable and the need for jetting techniques, removal would cause considerable damage and	Benign - no environmental impact associated with long term disintegration of buried cables.

	disruption to the seabed and established communities. These impacts could be considered large relative to the environmental gains from removal.	
Promote sustainable development	Though considerable 'troughs' would remain on the seabed in the short-medium term, complete removal affords maximum flexibility over use of seabed in the long term.	Some future activities may be limited, eg extraction (unlikely on London clay).
Adhere to the Polluter Pays Principle	Consistent, assuming suitable disposal option is found for surplus cable components	Benign, no pollution risk
Maximise the reuse of materials.	Maximum material, e.g. copper, potentially available for reuse	No reuse possible if left in situ
Commercial Viability	Expensive operation, off-set to an extent by copper resale value	Limited cost involved with re-burial of cable 'ends'
Practical Integrity	Possible to undertake. Likely to cause damage to marine environment.	N/A

In light of the proposal to leave cables buried under the seabed, the cable will be cut at a suitable point as close to the foundation as possible, with the ends buried to a proposed depth of 1 metre below seabed level. This will minimise the further disruption to the seabed and any established marine life in the area.

In the event of economic justification in the future, complete removal of the cables from the seabed would be considered subject to an environmental assessment.

4.6 Scour Protection

It is proposed that scour material is left in situ following decommissioning.

Complete removal	Leave in situ	No harm to people
No harm to people	Removal is a labour intensive activity, involving divers and posing an unacceptable risk to personnel	Reduced risk for contractors. Marginal, increase in risk to marine users: some additional rock over small areas at specific locations
Consideration of the rights and needs legitimate users of the sea	Removal affords maximum flexibility over use of seabed	May limit uses of seabed. May generate positive habitat benefits.
Minimise environmental impact	Removal will cause considerable damage and disruption to the seabed and established communities. Associated equipment and	Habitat for established communities retained, no short or long term detrimental effects on marine

	vessels will generate disturbance and additional noise over wide area. These impacts could be considered large relative to the environmental gains from removal. Materials gathered would need to be dumped elsewhere.	environment anticipated.
Promote sustainable development	Consistent in principle, assuming suitable disposal solution found	Prevents some future activities on the seabed. Total area of sterilisation is small
Adhere to the Polluter Pays Principle	Consistent in principle	Inferior option to complete removal in this regard
Maximise the reuse of materials.	Opportunities for reuse of materials gathered are limited. Materials would need to be disposed of elsewhere.	N/A
Commercial Viability	Expensive, labour intensive, high volume operation	Costs limited to ongoing monitoring
Practical Integrity	High reliance on manual work, labour intensive. Possible but not practical	N/A

In relation to the circumstances set out in the DECC guidance where non-removal may be considered acceptable, it is considered that in this instance "the installation or structure will serve a new use ... through the enhancement of a living resource". It is also considered that entire removal would involve an unacceptable risk to personnel.

It has been proposed that any scour protection will be left in situ.

4.7 Waste Management

Blue Transmission London Array is committed to maximising the reuse of waste materials and pays full regard to the 'waste hierarchy' which suggests that reuse should be considered first, followed by recycling, incineration with energy recovery and, lastly, disposal. In any event, waste management will be carried out in accordance with all relevant legislation and it would be intended that any disposal took place on land.

In following the waste hierarchy and subject to evolution of technology, change in regulations and demand for materials over the lifetime of the project, the waste management of the main project components might involve:

Waste Type	Pre-Treatment	Disposal/Reuse/Recycle
Substation foundations	Establish available design life at end of 25 years.	Reuse by repowering with new/superior wind turbines or other renewable generation technology.
Steel from substation foundations, removed to	Break down into transportable size	Recycle

shore		
Copper from power cables and transformers	Strip cable from power cables and transformers	Recycle
Used oil from transformers	Filter	Recycle
Non-recyclable materials and fluids		Landfill

As a part of the review process, all appropriate regulations and guidelines will be reviewed.

A waste management plan will be drawn up well in advance of the commencement of decommissioning to ensure that adequate time remains for the proper provisions to be made.

4.8 Lighting and Marking

In accordance with the London Array consent under Section 36 of the Electricity Act 1989, Blue Transmission London Array is committed to exhibiting the appropriate marks and lights during the decommissioning of the OFTO assets.

In relation to aviation safety, the shape, colour and character of the lighting will be compliant with the Air Navigation Order 2005 (or as otherwise directed by the Civil Aviation Authority).

In relation to navigational safety, lights and markings will be agreed with THLS, in consultation with the Maritime and Coastguard Agency. In particular, THLS will be consulted prior to decommissioning to specify any obstruction marking that may be required during the removal operations. In the event that any obstruction is left on site that may be considered to present a hazard to navigation London Array will provide the necessary marking specified.

5. Environmental Impact Assessment

Consistent with the commitment to undertake reviews of the decommissioning provisions contained within this document, it is proposed that the existing EIA is updated with the relevant information associated with the required monitoring works and reviewed throughout the lifetime of the project. A final review will be undertaken towards the end of the life of the installation when the final details of the decommissioning measures are known. At this point a decision will be made as to whether a more detailed assessment is required. Key criteria that will inform this decision include:

- Identification and assessment of potential impacts on the environment, including exposure of biota to contaminants associated with the installation, other biological impacts arising from physical effects, conflicts with the conservation of species, with the protection of their habitats, or with mariculture have been identified

Surveys in and around the wind farm that could inform this process could include:

- Benthic: side scan sonar, imaging
- Ornithological: a single year programme to identify key species and assess whether there are particularly sensitive times of year
- Marine Mammals: should decommissioning activity give rise to high noise levels, it may be appropriate to survey marine mammal activity and apply for necessary licences that may be in place at that time.

- Review of Nature Designations
- Identification and assessment of potential impacts relating to interference with other legitimate uses of the sea. It is possible that the nature and/or intensity of human activities taking place on/around the London Array site such as commercial fishing may have changed over the lifetime of the project. A review will be undertaken to identify those activities with potential to be affected by decommissioning.
- Identification and assessment of potential impacts on amenities, the activities of communities and on future uses of the environment
- Identification and assessment of potential impacts on historic environment interests
- If required, the final EIA will fill any 'gaps' in relation to the above. It will also describe the measures envisaged to avoid, reduce and, if possible, remedy any significant adverse effects indicated.

The use of explosives is not proposed, however should explosives be necessary during the course of decommissioning, the potential impact of these on marine life, particularly marine mammals, would be assessed. The use of explosives would require rigorous justification and a mitigation strategy would be proposed. All appropriate guidelines and regulations such as those currently available from JNCC would be followed.

6. Consultations with Interested Parties

LAL have demonstrated their effective and open communication and consultation as essential elements to the successful development of the London Array project. These principles were adopted during the development of the total windfarm project and will be applied by Blue Transmission London Array during the life of the OFTO assets including the decommissioning phase of the project.

LAL has sought the advice and opinions of the following parties, in drafting and reviewing the decommissioning programme for the project, in accordance with Section 105 of the Energy Act 2004:

- National Federation of Fishermen's Organisations
- Kent and Essex Fisheries Committee
- British Chamber of Shipping
- Royal Yachting Association
- Environment Agency English Heritage (London Region)
- Maritime and Coastguard Agency
- THLS
- PLA
- British Marine Aggregates Producers Association

- Natural England

Blue Transmission London Array will continue this consultation process during the lifetime and decommissioning of the OFTO assets.

In order that the impact on legitimate marine users and stakeholders is minimised, early and comprehensive consultation prior to decommissioning is required. This strategy will be finalised and undertaken as part of the final review process undertaken prior to decommissioning.

At the time of decommissioning, and in accordance with Clause 5 of the London Array consent under Section 36 of the Electricity Act 1989, Blue Transmission London Array will issue timely and efficient Notices to Mariners and other navigational warnings of the position and nature of the decommissioning activities that will be taking place. Efforts will be made to ensure that this information reaches mariners in the shipping and fishing industry as well as recreational mariners. The UK Hydrographic Office will be notified as appropriate on the progress and completion of the works.

7. Costs

Costs are confidential.

8. Financial Security

The financial security is confidential.

9. Schedule and the Review Process

It is proposed that decommissioning will not commence for at least 20 years following the commencement of operation of the first turbines to be installed, coinciding with the end of the design life of the turbines.

It is proposed that full decommissioning of the OFTO assets will be undertaken in conjunction with the Wind Farm in accordance with the provisions described above. Decommissioning of Wind Farm and OFTO assets will take approximately 12 months to undertake. Offshore decommissioning and onshore dismantling and disposal will run in parallel. A detailed programme of the works will be provided towards the end of the life of the project.

Blue Transmission London Array acknowledges that the most important steps in the decommissioning process are the planning ahead and the selection of the best decommissioning options. As has been indicated throughout this document, it is intended that the current decommissioning provisions are rigorously reviewed and assessed over the lifetime of the project.

Blue Transmission London Array intends to undertake internal reviews of the Decommissioning Programme throughout the life of the project and proposes that a formal review exercise is undertaken with DECC

2, 10 and 15 years following commencement of transmission of power.

It is proposed that a final review is undertaken in year 18. This will be the opportunity to finalise the detail of the decommissioning provisions, schedule and costs. This is also the opportunity to ensure that the impact of the works has been appropriately assessed and to determine in consultation with DECC and key stakeholders, whether a revised EIA or Appropriate Assessment is necessary. This will also be the final opportunity to consult with the stakeholders identified in Section 6 above about the details of the decommissioning provisions and the schedule of works.

10. Seabed Clearance

In accordance with the Polluter Pays Principle, Blue Transmission London Array proposes to clear the seabed in accordance with the provisions made in this Decommissioning Programme and to collect and provide evidence to reflect this.

Following decommissioning, surveys will be carried out to show that the site has been cleared. These surveys will enable identification and subsequent recovery of any debris located on the seabed which may have arisen from activities related to the London Array farm and which may pose a risk to navigation, other users of the sea or the marine environment. It is currently intended that side scan sonar will be used to identify debris, with an ROV deployed to investigate and recover any potential hazards identified.

The area to be covered will be determined prior to decommissioning but Blue Transmission London Array is aware of the guidance for oil and gas installations which specifies a 500m radius around any installation.

Reference will also be made to the "Archaeological No Build Areas" in order that these are not inadvertently cleared in the process of removing any debris. Analysis of the survey data will also ensure that items for removal and disposal relate only to the wind farm. The appropriate competent authority will be approached regarding the identification of other anomalies that may be of archaeological interest.

It is important that this process of collecting and presenting evidence that the site is cleared is independent. Blue Transmission London Array propose that an independent survey company complete the surveys and that they report in parallel to both Blue Transmission London Array and DECC.

11. Restoration of the Site

Blue Transmission London Array is committed to restoring the Blue Transmission London Array site, as far as is reasonably practicable, to the condition that it was in prior to construction.

Consistent with the decommissioning provisions detailed above, the key restoration work will relate to:

- Ensuring that foundations cut below seabed (platforms) are made safe and adequately covered
- Ensuring that cable ends are adequately buried

Active restoration relying on intervention with equipment is not proposed as it is considered that such works present unnecessary and unacceptable risk to personnel. Rather, it is

considered that allowing the seabed to 'self-settle' is sufficient and in proportion to the limited environmental impact of the proposed decommissioning.

12. Post-Decommissioning Monitoring, Maintenance and Management

Given that Blue Transmission London Array is not proposing to fully remove all installations, some post decommissioning activities are proposed in order to identify and mitigate any unexpected risks to navigation or other users of the sea which may be posed by the remaining materials (for example, where cables or foundations may have become exposed due to natural sediment dynamics).

The proposed post decommissioning activities are appropriate to:

- the scale and nature of the remaining infrastructure
- the degree of risk that any remains become exposed
- the degree of risk to marine users

It is considered that the risk of exposure is extremely low, primarily due to the depth at which foundations will be cut and cables buried.

In comparison to the oil and gas industry where the likelihood of debris falling overboard over the life of the installation is relatively high, such risks are low for the London Array project where offshore work associated with O&M is low.

On the basis of this low degree of risk, it is proposed that the following monitoring surveys are undertaken for elements left in situ beneath the seabed:

- Once at the time of completion of decommissioning
- Annually for the following two years
- Once after 5 years
- Optional survey after 10 years (depending upon any risks highlighted by 5 year survey)

At each proposed time, Blue Transmission London Array will perform a geophysical survey including a magnetometer survey on the site where equipment was installed. As indicated in section 8 above, Blue Transmission London Array proposes to use an independent survey company to complete the surveys. The company will be requested to report in parallel to both LAL and Government.

In the event of protrusion or in the event that scour protection materials are left on site following decommissioning, Blue Transmission London Array will ensure that notification is given to the Hydrographic Office so that suitable notation of a potential anchoring hazard can be marked on relevant charts and mariners informed accordingly.

