FICHTNER
Consulting Engineers Limited

OFGEM

WEST OF DUDDON SANDS TRANSMISSION ASSETS

EX ANTE TECHNICAL INVESTIGATION

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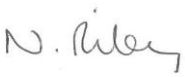
Prepared by:	Nicola Riley		Senior Consultant	28/06/13
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ABBREVIATIONS

A	Ampere
ABB	ABB Contracting
AC	Alternating Current
BS	British Standards
CCC	Current Carrying Capacity
DECC	Department of Energy and Climate Change
EPC	Engineering, Procurement, Construction
Fichtner	Fichtner Consulting Engineers Limited
FIDIC	International Federation of Consulting Engineers
GBP	Pound sterling
GIS	Gas Insulated Switchgear
HDD	Horizontal Directional Drilling
HV	High Voltage
HVAC	High Voltage Alternating Current
IEC	International Electrotechnical Commission
IM	Information Memorandum
ITT	Invitation to Tender
ITV	Initial Transfer Value
JV	Joint Venture
kV	kilo Volt
kVA	kilo Volt Ampere
LME	London Metal Exchange
MTBF	Mean Time Between Failure
MTTR	Mean Time To Repair
MVA	Mega Volt Ampere
MVAr	Mega Volt Ampere Reactive
MW	Mega watt
NGET	National Grid
NKT	NKT Cables NV
OFGEM	Office or Gas and Electricity Markets
OFTO	Offshore Transmission Owner
OSP	Offshore Substation Platform
OWF	Offshore Wind Farm
PIM	Preliminary Information Memorandum
PLGR	Pre-Lay Grapnel Run
QTT	Qualification to Tender
ROV	Remotely Operated Vehicle
SCADA	Supervisory Control And Data Acquisition
Scaldis	Scaldis SMC NV
SGT	Super Grid Transformers
SQSS	Security and Quality of Supply Standard
STDL	Siemens Transmission & Distribution Limited
SVC	Static VAR Compensator
UK	United Kingdom of Great Britain & Northern Ireland

UXO	Unexploded Ordinance
V	Volt
VO	Variation Order
VSMC	Visser & SMIT
WoDS	West of Duddon Sands
WTGs	Wind Turbine Generators
XLPE	Cross Linked Poly Ethylene

EXECUTIVE SUMMARY

Fichtner has been appointed by Ofgem, to carry out an ex ante technical investigation of the WDS Transmission Assets. The main objective of the ex ante technical investigation is to support Ofgem's own analysis and assessment on whether the costs associated with developing and constructing the WDS Transmission Assets that will transfer to the OFTO are economic and efficient.

The technical investigation is based on information provided to Fichtner on Contract Award and on subsequent discussions including information supplied by Ofgem and further information supplied by the WDS project team.

Fichtner has undertaken a review of all the information provided. Detailed conclusions and recommendations are provided in Section 2 of this report. A summary of the assets and key findings of the report are summarised below.

Design Philosophy and Offshore Transmission Asset Review

(1) The WDS Transmission Assets include an onshore substation, offshore substation platform, two export cables and an OFTO dedicated SCADA system.
(2) From our review, we can conclude that the overall design philosophy of the Transmission Assets appears to be sound and adequate from an engineering perspective.
(3) The WDS project team undertook a preliminary detailed design process for the Transmission Assets and this formed a reliable basis for contractors' tender prices.
(4) The Developers confirmed that there has been an iterative development of the detailed design post-contract award for the main electrical plant items and overall electrical design of the scheme. This is considered to be normal by Fichtner for a scheme such as WDS and fine tuning of a design based on information identified by system studies and more detailed information in general is not considered uncommon.
(5) Detailed design and calculations were undertaken for the subsea export cable by NKT post-contract award, which resulted in a re-design of the landfall section, replacing the long HDD section by an 'open cut trench' with only 2m instead of 8m depth. This is described in further detail in Section 2.1.1.
(6) The system is compliant with industry codes, international/ national design standards and meets the SQSS and Grid Code.

Procurement Process

(1) WDS has executed a multiple contract procurement strategy.
(2) The main equipment supply and/or installation contracts for the offshore substation, subsea cables, onshore cables and the onshore substation have been competitively tendered. The extension works to National Grid's Heysham Substation were contracted directly with NGET.
(3) Interfaces between the packages were managed and robust pre-qualification, tender and contracting processes were implemented.

Contract Strategy and Management of Risk

(1) Post contract award changes have been managed by WDS through structured and well documented variation orders.
(2) All the contracts are let under a FIDIC standard form of contract, which is considered appropriate for all the contract packages.
(3) The contracts are fixed price and include payment milestones, liquidated damages, limits of liability, advance payment bonds, performance bonds and parent company guarantees as set out in Appendix D. These provisions are considered appropriate for the management of technical and commercial risks associated with each contract package.
(4) The fixed price structure of each contract transfers the risk of cost overruns to the equipment supply and/or installation contractors. Each contract has been awarded as a fixed price lump sum contract to a limiting contract value. Mechanisms for revaluation of these contract prices are limited to expenditure of a small number of specified provisional sums, pricing options or contingencies. The values of these mechanisms are included in the contract value and are allocated to specified scope changes that were anticipated at contract award.

Export Cable Supply Cost Analysis

(1) In order to assess the costs for the export cable, Fichtner has undertaken a 'top-down' analysis of the price based on benchmark projects and a 'bottom-up' calculation undertaking a full-cost calculation of the asset.
(2) Using both these methodologies, Fichtner has concluded that the export cable supply costs are within the upper limit of the expected range of benchmarked costs and therefore the export cable supply cost is not considered to be an outlier. Detailed analysis of the export cable supply costs is provided in Section 6.1.
(3) The tender and procurement process for the WDS export cable coincided with a period of high copper market prices. As copper forms a significant proportion of the export cable cost basis, it can be concluded that the date of July 2011 for finalisation of the contract price metal adjustments, caused a significant impact on the cable price due to high copper prices.

Export Cable Installation Cost Analysis

(1) The export cable installation cost is driven by several factors including complicated seabed and soil conditions and additional risks such as third party service crossings and potential boulders, wrecks and slopes in the landfall sections.
(2) The tender process for the export cable installation commenced prior to all geotechnical and geophysical surveys being completed.
(3) VSMC made an assessment of the likely ground conditions based on available information and their experience on the Walney 1 and Walney 2 cable installations works and provided this assessment as a part of their tender proposal. This assessment is contained in the annexes to VSMC's contract. It assumes a worst case drag rate for cable laying and includes allowances for rock armour protection when cable depths cannot be achieved. There is not a mechanism in the contract for the revaluation of the contract price if different ground conditions are encountered.
(4) Taking account of the above risks, and comparing benchmark costs of reference offshore projects within the North Sea, the submitted contract price appears to be in the range expected and is not identified as a cost outlier.

Wider Cost Analysis

(1) A wider cost analysis of the initial transfer value, excluding the subsea cable supply and installation costs, has been undertaken by Fichtner.
(2) Based on our own benchmarking analysis and experience in the market, we can conclude that the initial transfer value costs, excluding subsea cable components, appear reasonable from an engineering perspective.
(3) No further items within the initial transfer value have been identified as cost outliers.
(4) A summary of the key cost items is included in the table below.

Item	ITV Cost	FCE Range	Report Section
Export Cable Supply	[redacted]	£700-800/m	6.1
Export Cable Installation	[redacted]	£32.8 m-38.95m	6.4
Offshore Substation Supply	[redacted]	€38-48m	6.5.1
Offshore Substation Installation	[redacted]	€12-18m	6.5.1
Offshore Substation Electrical Supply	[redacted]	€5.5-6.2m	6.5.2
Land Cable Supply	[redacted]	£3.4-£3.5m	6.6
Onshore Substation Civils Works	[redacted]	£ 7.4m	6.7.1
Onshore Substation Electrical Package	[redacted]	€18.6-20.4m	6.7.2

***Derived value based on Fichtner calculation.**

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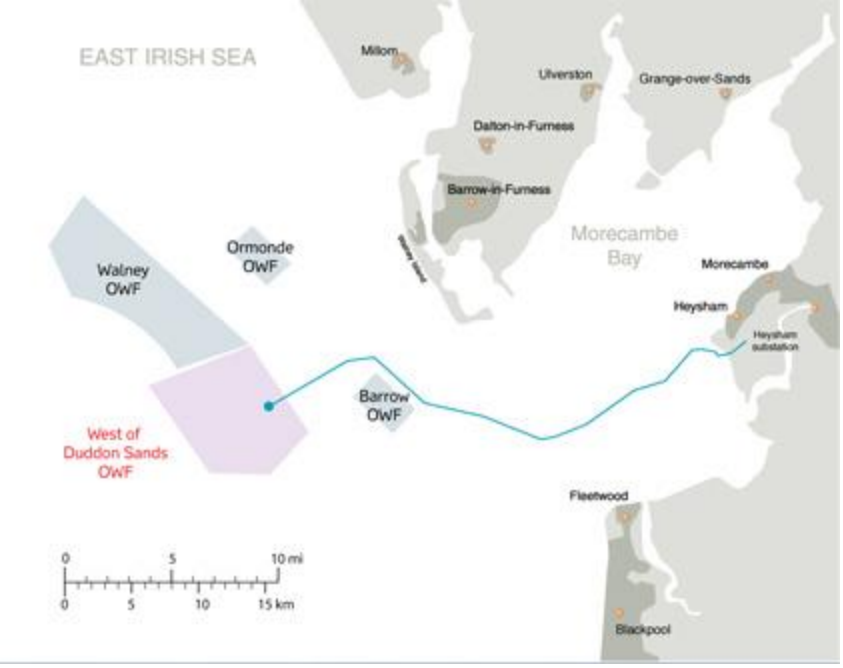
1 INTRODUCTION

1.1 Background

Fichtner has been appointed by Ofgem, to carry out an ex ante technical investigation of the WDS Transmission Assets. The WDS Wind Farm will consist of 108 Siemens 3.6MW WTGs and will be located in the East Irish Sea, approximately 14km from the nearest coast on Walney Island, Cumbria. It is situated in the vicinity of nearby operational wind farms: Barrow, Ormonde, Walney 1 and Walney 2. WDS will be entirely located within UK territorial waters.



The WDS transmission assets are currently owned by ScottishPower Renewables (WDS) Ltd (50%) and DONG Energy West of Duddon Sands (UK) Ltd (50%), (the Developers), via an Unincorporated JV. The transmission assets include an onshore substation, offshore substation platform, two export cables and an OFTO dedicated supervisory control and data acquisition (SCADA) system.

Under the Ofgem/ DECC Transitional Tender Process the WDS transmission assets will transfer to an OFTO. The Tender Process for the transmission assets is currently at the QTT stage and bidders have been asked to assume the value of the assets to be £311 million (the ITV). The ITV has been estimated on the basis of costs provided by the Developers to Ofgem.

The next stage of the cost assessment will be to determine the 'Indicative Transfer Value'. This is an estimate of the economic and efficient costs incurred in connection with developing and constructing the transmission assets. This will be released to bidders at the Invitation to Tender (ITT) stage of the tender process in August 2013. Ofgem is currently in the process of determining this value and the ex ante technical investigation will form part of this analysis.

1.2 Objective

The main objective of the ex ante technical investigation is to support Ofgem's own analysis and assessment on whether the costs associated with developing and constructing the WDS Wind Farm transmission assets, which will transfer to the OFTO, are economic and efficient. The technical investigation of these costs is based on the Developer's current estimate of total costs for the delivery of the WDS transmission assets, which was provided by the Developers to Ofgem in November 2012. We anticipate that these costs will be revisited once the construction and commissioning phase is complete for the transmission assets, in order to determine the Final Transfer Value.

Information to support the technical investigation was provided to Fichtner at the Contract Award, based on the following key documents:

- Cost template used to derive the Initial Transfer Value submitted to Ofgem in November 2012;
- WDS Preliminary Information Memorandum (PIM) December 2012, prepared by Ofgem and RBC Capital Markets (and Information Memorandum (IM));
- Relevant information contained in the Ofgem developer data room; and
- Ofgem's internal benchmarking analysis for the WDS project.

Further relevant information has been provided to Fichtner by the Developers through teleconference discussions and an ongoing question and answer process. A full list of the additional documents made available to Fichtner during the review period can be found in Appendix A. A completed question and answer list is provided in Appendix B.

The following key activities were specified by Ofgem to be undertaken as part of the ex ante technical investigation:

(1) Review of the WDS export cable supply and installation costs

- Provide information on the export cable design and rating, continuous and cyclic composite design ratings for the circuits, and documentation to back up the design parameters;
- Investigate the factors that influenced the project's cable supply and installation costs and whether the submitted costs are economic and efficient; and
- Outline whether there is any supporting information regarding the cable route, including consideration of environmental factors – this should take account of cable embedding or additional rock dumping due to local conditions.

(2) Cost Analysis

- Where cost outliers are identified, carry out a bottom up cost review, in particular identifying where there are any bespoke non-standard main components outside of the normal benchmarking levels, and if the cost proposed for this equipment is reasonable; and
- Consultant will be expected to use its own benchmarking methodology and have a supporting cost database to justify its figures from a build up of costs to take a view on the ITV based on the contract type (i.e. EPC, PM etc) with associated appropriate contingency levels.

(3) Review of WDS procurement process

- Identify the main contracts and the timeline and chronological overview of the procurement process;
- Outline the WDS criteria for assessing tenders, and the criteria that influenced choosing contractors e.g. cost, quality etc – the consultant should outline whether this appears reasonable or not;

- Tender assessment for the transmission assets;
- Identify if post contract award, there were any substantial design changes; and
- Outline overall views on the WDS procurement process was undertaken efficiently.

(4) Contract strategy and management of risk

- Identify whether the contract strategy adopted supports the level of Project Management and contingency allowance, and provide indicative percentages for similar projects as a benchmark;
- Outline whether the level of premium on the main contract strategy looks reasonable and what the cap is on liabilities;
- Identify whether there has been a risk assessment undertaken on the main cable supply and installation process (to take account of weather windows slipping, and delays in export supply etc) and if there is a system to monitor and control risks. You should also indentify how this has been covered in the contingency arrangements; and
- Outline whether adequate seabed survey work has been undertaken to allow route conditions to be adequately assessed by the installation contractors and is the contract value for the installation commensurate with the levels of risk they are taking on under the arrangements.

(5) Design Philosophy

- Outline the offshore transmission network layout and design engineering; including options that were considered for the design, preferred option and rationale, audit trail for decision making and influences i.e. onshore connection points, marine cable landing points, external factors such as planning constraints etc – the consultant should provide a view on whether the design is the most economic and efficient for the system as a whole; and
- Outline the electrical infrastructure design and equipment rating; supporting information e.g. harmonic studies, redundancy in design and reactive power studies.

(6) Offshore Transmission Asset Review

- Provide a description of the assets including the onshore substation, offshore substations and export cables, and whether a unique and novel solution was required i.e. driven by external factors; and
- State whether the system is compliant with industry codes (Grid Code, SQSS etc), and international /national design standards (type test, FAT plant and equipment specifications etc).

Fichtner has presented the detailed review of the scope items in the body of the report. Conclusions and Recommendations are outlined in Section 2.

2 CONCLUSIONS AND RECOMMENDATIONS

2.1 Design Philosophy and Offshore Transmission Asset Review

(1) The WDS Transmission Assets include an onshore substation, offshore substation platform, two export cables and an OFTO dedicated SCADA system.

(2) The voltage between the wind turbines and the OSP is 34 kV. The voltage between the OSP and land fall is 155 kV and it is likely that these voltages were selected by the Developers as they are the approximate optimum voltages for the amount of electricity flowing through the circuits.

(3) The Developers undertook the concept design for the transmission assets and these formed the basis for tender prices.

2.1.1 Export Cable Design

(1) The design of the export circuits is based on the installation of two export cables operating at 155 kV and Fichtner conclude that there is a sound engineering basis for the selection of this voltage level. The basis for this is explained in further detail in Section 3.2.

(2) From our review, the concept engineering basis for the export cable appears to be sound and adequate.

(3) In relation to the detailed design engineering for the export cable, an issue with the detailed export cable design and agreed cable price was initially identified in the technical review that required further investigation and discussion with the Developers:

a) NKT was awarded the export cable supply contract on the basis of a smaller conductor cross-section (1000mm^2) compared to the two other bidders. NKT proposed a non-magnetic 'low-loss' armour solution on parts of the cable route (particularly in relation to the landfall section);

b) A third party cable design verification was performed by the University of Duisburg of the smaller conductor cross-section that concluded that the design was not adequate for the HDD section at landfall;

c) Detailed design and calculations were undertaken by NKT post-contract award that resulted in a re-design of the landfall section, replacing the long HDD section by an 'open cut trench' with only 2m instead of 8m depth;

d) The 'low-loss' armour was no longer required with this solution and resulted in a reduction of [redacted] million in the contract price; and

e) Fichtner has not reviewed any detailed information on this re-design as this was not made available; however, based on our own engineering experience, we can confirm the adequacy of this solution from a technical point of view.

2.1.2 Offshore Substation Design (Ex Electrical) and Installation

(1) The documents made available for review in the Developers' data room on the offshore substation structure, demonstrate a standard design of a piled jacket construction and topside, including the necessary electrical components.

(2) The grouting is of critical importance for the overall stiffness and life cycle of the substation. It is recommended that a full installation handbook, including all material properties, installation methods and foreseen measurement systems is provided by the Developers to the successful OFTO.

(3) The Fabricom contract for the offshore substation fabrication includes a range of liquidated damages to militate against late delivery.

(4) For the installation of the substation, the heavy lift vessel Rambiz was employed, which is suited for installation purposes of heavy structures.

(5) The chosen contractor for the offshore substation installation, Scaldis SMC NV, and the EPC contractor, JV Fabricom/Lemants, are both highly experienced in performing these tasks and they already have a proven track record within the offshore wind industry.

2.1.3 Offshore Cable Installation

(1) The export cable route from the WDS Offshore Substation to the onshore transition joint bay near Heysham is divided into three work sections with two cable circuits.

(2) The target burial depth along the cable route is 2.0m.

(3) The soil conditions along the installation route are not homogeneous, ranging from mud, sand and stiff glacial till with gravel and boulders. The sand varies from very loose to very dense in density, the glacial till ranges from stiff to, very stiff to hard conditions. These soil conditions pose the highest demands on installation technologies, vessel solutions and experience of the site engineers and other related staff.

(4) Due to the highly cohesive soil conditions at WDS, a vessel with a special pulled plough is required for the installation of the subsea export cable.

(5) In the contract documents, VSMC propose a vessel such as the Stemat Spirit. This vessel has extensive experience in the region from the Walney export cables and the Ormonde export cable installation and is considered suitable for the installation of the WDS export cable.

(6) It is possible that the target burial depth of 2.0m will not be achieved for some lengths of the cable route. VSMC made an allowance in their contract price for rock armour protection where cable depths cannot be achieved. There is not a mechanism in the contract for the revaluation of the contract price if different ground conditions are encountered. Rock dumping is common practice in the industry. However, during the operational phase it is prudent to inspect the cable route from time to time (every 2-5 years), particularly in areas where there are strong currents and potential for shifts in seabed conditions. Negligence to perform suitable asset management could result in a reduction in asset availability.

2.1.4 System Design

(1) The overall system design is considered to be adequate because over their lifetime the assets are predicted to have availability better than the OFTO requirement of 98%.

2.1.5 Electrical Infrastructure and Equipment Rating

(1) The design of the onshore and offshore substations (electrical) has been one of continuous development and no substantial design changes have been identified.

(2) This process of continuous development is quite normal for a scheme like this and fine tuning of a design based on information identified by system studies and more detailed information in general, is not uncommon.

(3) The onshore and offshore substations have been designed to IEC and BS standards, where necessary, and the operating conditions are within the equipment ratings.

2.2 Procurement Process

(1) WDS has executed a multiple contract procurement strategy awarding a total of 19 supply and/or installation contracts for the main equipment.

(2) Fichtner's review has focused on those main contracts of a value greater than £1.5 million. Contract information was provided on all contracts above this threshold.

(3) The main equipment supply and/or installation contracts for the offshore substations, subsea cables, onshore cables and the onshore substation have been competitively tendered.

(4) The extension works to National Grid's Heysham Substation were contracted directly with National Grid Electricity Transmission plc.

(5) Interfaces between the packages were managed and robust pre-qualification, tender and contracting processes were implemented.

(6) Invitations to tenderers were issued to an appropriate number of tenderers.

(7) The tenders received have then been reviewed in a structured and methodical manner.

(8) WDS were asked to provide their documented procurement strategy for the project. This has not been provided for review. However, Fichtner were provided with a copy of DONG Energy's procurement policy dated March 2012 that requires the implementation of best practice for transparent and competitive supplier tendering. We can confirm that WDS has followed a process of transparent and competitive supplier tendering.

(9) An overall master time schedule for the procurement process has not been provided to Fichtner, however the WDS Offshore Wind Farm OFTO Related Programme (Rev 2) has been reviewed and in general, contracts have been awarded in accordance with this Rev 2 Programme.

(10) Post contract award changes have been managed by WDS through structured and well documented variation orders.

2.3 Contract Strategy and Management of Risk

(1) All the contracts are let under a FIDIC standard form of contract.

(2) The contracts are fixed price and include payment milestones, liquidated damages, limits of liability, advance payment bonds, performance bonds and parent company guarantees as set out in Appendix D. These provisions are considered appropriate for the management of the technical and commercial risks associated with each contract package.

(3) The fixed price structure of each contract transfers the risk of cost overruns to the equipment supply and/or installation contractors. Each contract has been awarded as a fixed price lump sum contract to a limiting contract value. Mechanisms for revaluation of these contract prices are limited to expenditure of a small number of specified provisional sums, pricing options or contingencies. The values of these mechanisms are included in the contract value and allocated to specified scopes changes that were anticipated at contract award.

(4) Mechanisms are included for alternatives or provisional items that could not be defined or quantified at contract award, for example metal price adjustment for the cable supply contract, provisional sums for alternative jacket foundation installation hammer type pending post contract award selection by WDS and daily cable storage charges.

(5) Fichtner has reviewed the provisions within the contracts with regards to risks to programme and cost overrun and conclude that they contain adequate provisions to manage these risks.

(6) The values of liquidated damages provide variable levels of compensation to WDS for the contractors' failure to meet key milestone dates. The variations in liquidated damages values take cognisance of the severity of impact of the delay on the overall project delivery. This is demonstrated, for example, by the high value of liquidated damages for the late completion of the offshore substation fabrication.

2.4 Export Cable Supply Costs

(1) According to Ofgem's estimate, the cost for supply and installation of the export cable of [redacted] million represents [redacted] of the overall estimated capital expenditure and development costs for the WDS Transmission Assets.

(2) Ofgem noted that the export cable supply and installation unit costs appeared to be relatively high when compared with other transitional tender round projects used in the benchmarking analysis and this was communicated to the WDS Developers in a letter dated 13 December 2012.

(3) In order to assess the costs for the export cable, we have undertaken a 'top-down' analysis of the price based on benchmark projects and a 'bottom-up' calculation undertaking a full-cost calculation of the asset.

(4) Based on the value of [redacted] million given in the Initial Transfer Value for the project's cable supply and installation costs, and on the signed contract value for the NKT cable supply contract of [redacted] million, Fichtner has derived an overall cable price for the WDS 155kV 3-phase export cable of [redacted] /metre(m) ([redacted]/m). This includes all accessories but excludes the comparably short land cable portion.

(5) The benchmark data allows a determination of a price range between £700 - £800 /m; using this benchmark data the derived cable price for WDS is at the upper limit of the expected range and is therefore not considered to be a cost outlier.

(6) The 'bottom-up calculation', which takes account of copper prices, production and manufacturing costs and some margin/ contingency, estimates a cable price of £780/m. This price is within the expected export cable benchmark price range. Therefore, using this full cost analysis method, the export cable price is not seen as an outlier.

(7) The tender and procurement process for the WDS export cable coincided with a period of high copper market prices. As copper forms a significant proportion of the export cable cost basis, it can be concluded that the date of July 2011 for finalisation of the contract price metal adjustments, caused a significant impact on the cable price due to high copper prices.

(8) The Developers confirmed that a more competitive supplier environment would have been desirable, but was not achievable, a trend that is currently apparent in the cable supply market. However, the tender process was compliant with the overall DONG procurement policy.

2.5 Export Cable Installation Costs

(1) The export cable installation contract price is driven by several factors.

(2) The tender process for the export cable installation commenced prior to all geotechnical and geophysical surveys being completed. VSMC made an assessment of the likely ground conditions based on available information and their experience on the Walney 1 and Walney 2 cable installations works and provided this assessment as a part of their tender proposal. This assessment of ground conditions is contained in the annexes to VSMC's contract, it assumes a worst case drag rate for cable laying and includes allowances for rock armour protection when cable depths cannot be achieved. There is not a mechanism in the contract for the revaluation of the contract price if different ground conditions are encountered.

(3) The final cable route was not defined at the contract execution date and the contract price does not include a mechanism for revaluation based on the final route selection.

(4) Complicated seabed and soil conditions at the WDS project site have necessitated the use of special ploughing techniques and installation vessels, the cost of which is included in the contract price.

(5) There is a potential high risk of boulders, wrecks and slope instabilities in the landfall section, which is included in the contract price.

(6) Route Clearance and PLGR operation is anticipated along 7.8km of the proposed installation route. This has been included in the contract price as an item for revaluation based on actual works completed ([redacted]).

(7) Additional risks are indentified due to third party service crossings of the Barrow OWF export cable, 2 pipelines and the Walney 2 OWF export cable, combined with a lack of clarity on contractual interfaces. The contract price specifies a total of 5 crossings but includes for the cost of all crossings, should further crossings be required.

(8) Jointing operations are required, which will require the burial of the cable with an extra mass flow excavating tool. This is included in the contract price. The contract price also includes the cost of a guard vessel for 133 days during jointing operations as an item for revaluation based on actual works completed ([redacted]).

(9) With the exception of items (6) and (8) above, the remaining risks have been included in the fixed lump sum price of VSMC's contract and therefore the cost risk being taken by VSMC. Items (6) and (8) are included in the contract price as items for revaluation and therefore the risk of cost overrun is taken by WDS.

(10) Considering these risks against reference offshore projects within the UK and North Sea, the contract price is lower than the range expected and is not identified as a cost outlier.

2.6 Wider Cost Analysis

(1) A wider cost analysis of the initial transfer value, excluding the subsea cable supply and installation costs, has been undertaken by Fichtner.

(2) Based on our own benchmarking analysis and experience in the market, we can conclude that the initial transfer value costs, excluding subsea cable components, appear reasonable from an engineering perspective.

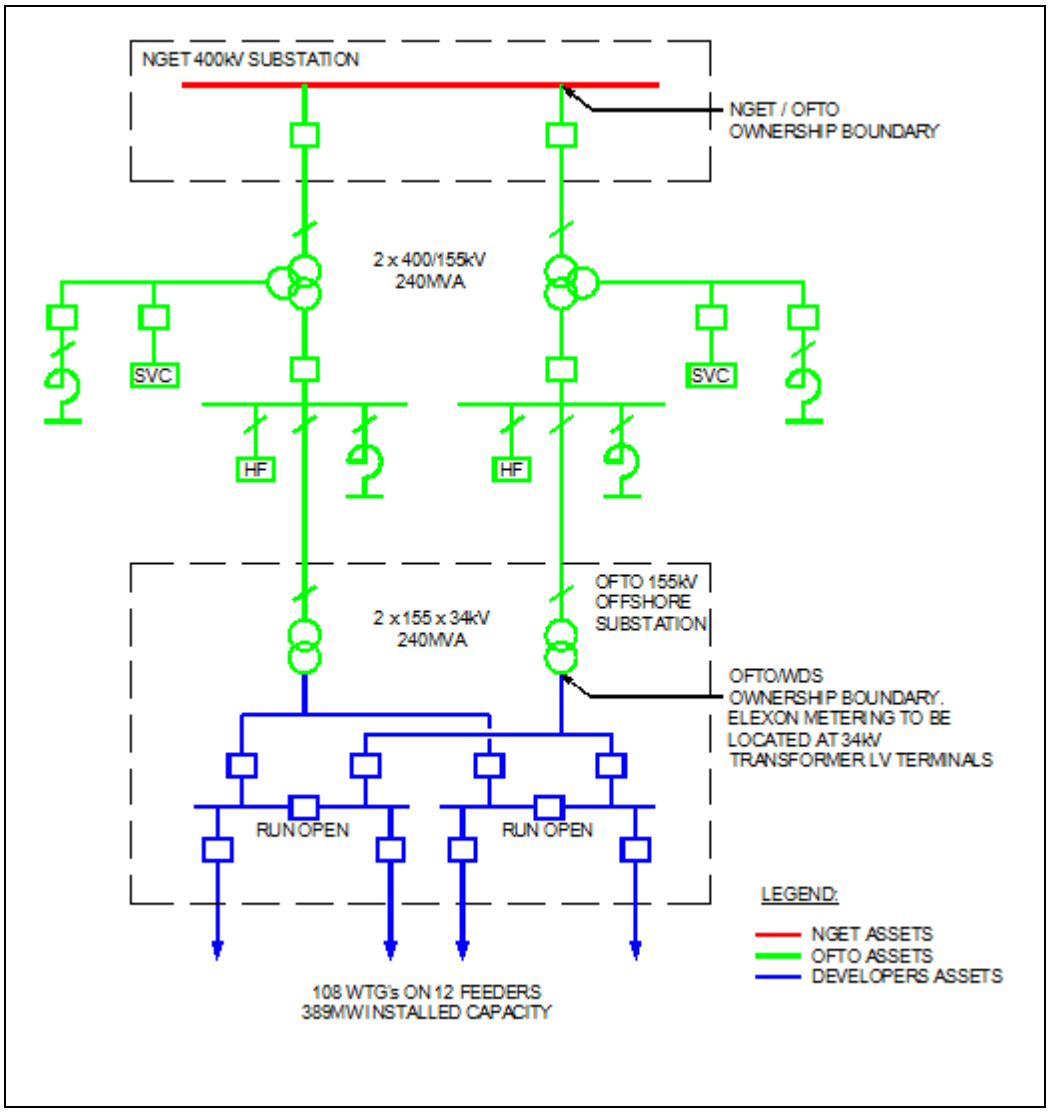
(3) No further items within the initial transfer value have been identified as cost outliers.

(4) In order to evaluate if the apportionment of project management costs appears to be reasonable between contracts, further detailed breakdown is required under each of the headings in the table above. The Developers have stated that more detailed project management cost breakdown has previously been supplied to the financial advisors undertaking the ex ante forensic accounting investigation. This detailed breakdown was not provided to Fichtner. Therefore, we have not included more detailed analysis of the breakdown.

3 Design Philosophy and Offshore Transmission Asset Review

3.1 Overview of the Offshore Transmission Assets

The WDS transmission assets include an onshore substation, offshore substation platform, two export cables and an OFTO dedicated SCADA system. An indicative single line diagram of the transmission assets configuration is shown below.



Source: Information Memorandum West of Duddon Sands, Offshore Transmission Assets

The turbines are connected in strings of approximately eight WTGs per string operating at 34kV; the strings are connected to an offshore substation at which the voltage is transformed from 34 kV to 155 kV. The offshore ownership boundary to the OFTO is located at the 34 kV terminals of the 34/155 kV transformers; the total installed capacity at the interface point is 388.8MW[1].

[1] 382MW is the capacity at the point of connection to the OFTO.

The voltage between the wind turbines and the Offshore Substation Platform (OSP) is 34 kV. The voltage between the OSP and land fall is 155 kV. It is likely that these two voltages were chosen by the WDS project team because they are the approximate optimum voltages for the amount of electricity flowing through the circuits. Higher voltages mean the cables' cross sectional areas are smaller than they would be at lower voltages and therefore more cost effective.

There are two 155 kV 3 core subsea steel wire armoured export cables which have 1000mm^2 copper conductors. The subsea cables are jointed at onshore transition joint bays to two circuits of 3 single core onshore export cables, rated at 170 kV, which have 1600mm^2 aluminium conductors.

The onshore export cables run to the WDS onshore substation along a route which is approximately 3km in length. The voltage is transformed from 155 kV to 400 kV at the WDS substation via two 155/400 kV SGTs. From the SGTs, two circuits of 3 single core 1000mm^2 aluminium conductor cables rated at 420 kV are connected to GIS at Heysham substation. The onshore interface point between the OFTO and NGET is the busbar clamps on the GIS.

The grid connection point is at the Heysham 400 kV substation, which is owned and operated by NGET. Heysham substation is a double busbar arrangement and two 400 kV circuits from WDS are connected to each of the busbars. The WDS generation (wind farm) assets and the WDS transmission assets will both be operated and controlled by a SCADA system with main and back-up data links between each asset group to exchange signals. Each SCADA system comprises offshore and onshore controllers networked via fibre optic communication links accommodated within the cable circuits. The transmission assets SCADA system includes an interface with NGET to deliver the signals required for Grid Code Compliance. The offshore and onshore substations have separate OFTO SCADA and Wind Farm SCADA equipment rooms.

3.2 Export Cable Design

The design of the export circuits is based on the installation of two export cables operating at 155 kV. Alternatively, energy could have been transmitted to shore via export cables operating at 132 kV, however the number of cables would have increased to three. Whilst the three 132 kV cables would have had a slightly lower cross sectional area, the supply and installation costs would have increased and space through the cable corridors and inside the substation would have been reduced.

A connection could also have been made based on one export cable operating at 220 kV or higher, which would have a larger cross sectional area. However, there is a lack of general market experience with 220 kV three phase submarine cables, which is likely to have increased costs and reduced competition. Security of supply would also have been reduced due to a lack of redundancy in a single transmission circuit. Therefore, there is a sound engineering basis for the selection of two export cables operating at 155 kV. The subsea export cables will run to the landfall at Middleton Sands, where an open cut installation will be made through the sea defense to the transition joint bays. The onshore cables will run from the transition joint bays through local land and roads via jointing bays to the onshore substation site boundary.

Each export cable circuit is designed to carry 780A continuous load (206.4 MVA) at 155 kV, therefore if the supply through one cable is lost the export capacity of the wind farm will be reduced to approximately 50 % of its total capacity. This could have been avoided in the design process; however it would have meant installing four subsea cables rather than two, which would have proved uneconomic in the overall cost of the asset.

The Developers confirmed in a teleconference on 8 May 2013 that the basic design for the export cable was developed by the internal WDS project team. From our review, the concept engineering basis for the export cables, which specified basic parameters such as currents, voltages and export cable lengths (onshore and subsea), appears to be sound and adequate.

In relation to the detailed design engineering for the export cable, Fichtner initially identified an issue with the cable design and agreed cable price that required further investigation and discussion with the Developers.

The Employer's Technical Requirements stated that the offered conductor size must comply with IEC standard (i.e. IEC 60228). While [redacted] and [redacted] both offered cables with 1200mm^2 (though both without a valid type test) in their tender returns for the export cable supply contract, NKT offered the next smaller cross-section (1000mm^2). NKT won the tender in mid 2011 by pricing based on the smaller cross-section conductor when compared to the cables offered by the other two competitors. NKT confirmed the adequacy of their design during the following clarification round.

The reason for this reduction of conductor cross-section is detailed in the cable design, specifically in the material used for the armour wires. Using non-magnetic low loss steel wires instead of standard steel wires reduces the magnetization losses in Alternating Current (AC) cables. Low-loss armour was proposed over the nearshore and landfall sections of the cable route.

The Developers commissioned the University of Duisburg (Germany) to verify the results of the current rating calculations presented by NKT. The report provided calculation results for the current carrying capacity (CCC) of the submarine cable with the conductor cross-section of 1000mm^2 as specified by NKT. The report concluded that for the seabed section and the J-tube section of the cable route, the smaller cross-section conductor was sufficient. However, at the landfall section of the cable route, it was anticipated that a higher CCC would be required due to the need for Horizontal Directional Drilling (HDD) to 8m depth. HDD is commonplace for cable landfall sections where trenching or excavating is not practical. The University of Duisburg report concluded that the minimum requirement of 840A for full load could not be met at this section as the cross-section of 1000mm^2 was not sufficient.

A variation order to the NKT cable contract was agreed on 16 April 2012 by the Developers to replace the non-magnetic 'low loss' armour wires by 'normal' steel wires[2i] along the nearshore section. However, the reasons for removing the 'low loss' armouring, which enabled the use of the smaller cable size were not clear and therefore, Fichtner requested further information from the Developers in order to explain this design process.

The Developers provided further clarification on 28 May 2013 that, post contract award with NKT, a redesign of the landfall was undertaken, which replaced the HDD section by an "open cut trench" at a depth of only 2m instead of 8m associated with the HDD. This solution was more favourable in terms of thermal distribution, therefore the trenching option confirmed that a solution utilising the 'normal' steel wires was viable, reducing the cost of the subsea cable by [redacted] million. As a consequence of this design change there was a concurrent small increase in costs for the trenching work. Although we have not received detailed cable capacity calculations in this review, we can confirm the adequacy of this solution from a technical point of view.

3.3 Offshore Substation Design (ex Electrical) and Installation

Fichtner is aware, through publicly available information, that the foundation jacket and topside modules have now been installed on the project, however we have not been provided with progress or completion reports from the Developers. Therefore, for the purpose of this review we will comment on the overall design and anticipated installation methodology.

[2] In subsea cable design steel armour wires are applied to counteract the substantial longitudinal forces during cable laying. However, these steel wire armours cause additional magnetisation losses and thus reduce the current carrying capacity. Using non-magnetic stainless steel wires instead of "normal" galvanized steel wires can mitigate these additional magnetization losses to varying degrees depending on the specification of the steel armouring.

The documents made available for review in the Developer's data room on the offshore substation structure, demonstrate a standard design of a piled jacket construction and topside including the necessary electrical components. The substation installation is proposed to be undertaken in a three step procedure during the construction period.

First, the piles will be installed with a piling frame (pre piling) or through the lowered jacket substructure (post-piling). Secondly, the load transfer of the substructure and the piles for lateral and horizontal loads will be completed with a grout connection. The third step involves the installation of the topside after a sufficient setting period for the grout material. This will then be grouted a second time with the substructure.

To ensure a safe installation of the piles, a piling procedure driveability study is required in order to assess the driving fatigue of the piles, hammer performance and other related issues. The axial bearing capacity of the piles should be verified by dynamic load testing. The structure design is mainly governed by axial loads due to the high load of the topside. In addition it is usual to clarify if cyclic degradation of the soil under cyclic loads should be considered for the life cycle of the structure.

The grouting is of critical importance for the overall stiffness and life cycle of the substation structure. With regard to the installation of the grout itself, we recommend that a full installation handbook, including all material properties, installation methods and foreseen measurement systems, is provided by the Developers to the successful OFTO.

For the installation of the topside, only small weather windows are applicable for the installation of such structures. In addition the availability of sufficient installation vessels is very limited, therefore an availability guarantee must be provided by the contractor. Mitigation measures should be in place in respect to delays and shift occurring during fabrication or shipment. For this project, the heavy lift vessel Rambiz will be employed, which is suited for installation purposes of heavy structures. Nevertheless, weather criteria and installation limits have to be taken into consideration.

The chosen contractor for the offshore substation installation, Scaldis SMC NV, and the EPC contractor, JV Fabricom/Lemants, are highly experienced in performing these tasks and they already have a proven track record within the offshore wind industry.

3.4 Offshore Cable Installation

The export cable route from the WDS Offshore Substation to the onshore transition joint bay near Heysham is divided into three work sections with two cable circuits. The first section of work is the marine installation works for the export cable, which involves the burial of two 155 kV submarine cables from the shore end to the offshore jointing location situated approximately 9 km offshore. The second and third section of work involves laying and burial of two 155 kV submarine cables from the offshore jointing location to the Offshore Substation, which will have a length of 32 km. The connection to the transition joint will be carried out by pulling the 155 kV cable systems into the shore crossing to the transition joint. The cable routes are approximately 41 km in length for each line. The route of the export cable will cross the Barrow Offshore Wind Farm (OWF) export cable, two pipelines and the Walney 2 OWF export cable during the installation procedure.

The following information has been made available to Fichtner and analysed:

(1) Geophysical survey;

(2) Bathymetric data;

(3) In situ testing data; and

(4) Interpretations and evaluations concerning UXO.

In addition the export cable installation method statement for the contracted cable installer, Visser & SMIT (VSMC), was analysed with respect to the different potential installation vessels and the experience gained from the nearby offshore wind farm projects (Walney and Ormonde).

The target burial depth along the cable route is 2.0m. The soil conditions along the installation route are not homogeneous, ranging from mud, sand and stiff glacial till with gravel and boulders. The sand varies from very loose to very dense in density, the glacial till ranges from stiff to, very stiff to hard conditions. These soil conditions pose the highest demands on installation technologies, vessel solutions and experience of the site engineers and other related staff.

Further details on the impact of the seabed conditions on the offshore cable installation contract and costs, are reviewed in Section 6.4.

Under non-cohesive soil conditions the cable installation is performed in a two step procedure. In the first step, the cable will lowered to the seabed. The second step is to inject the cable to the target depth with a Remotely Operated Vehicle (ROV) or special vehicle. This installation method is not possible in high cohesive soils, as is the case in the WDS project area. For the installation of this project's export cable, a vessel with a special pulled plough is recommended for the nearshore and the further offshore installation. One vessel that is suggested by VSMC is the Stemat Spirit. This vessel has extensive experience in the region from the Walney export cables and the Ormonde export cable installation. The vessel has a shallow draft design and can be settled safely to ground when the local seabed has suitable stiffness.

On the basis of the complicated soil conditions and necessary plough technology, VSMC expects that target burial depth might not be achievable for sections of the route. In terms of project experience in the nearfield area it is anticipated that the target depth of 2.0m for a distance of 14 km will be achieved. Furthermore it is anticipated that at a distance of 15.5 km there will be significant hard soils and even a burial depth of 1.3m may not be achieved.

During the geophysical investigation of the site several boulders and wrecks were indentified along the route. The highest density of boulders occurs on Morecombe Flats and where glacial till is reported close to the surface.

The archaeological investigation revealed several large targets in the installation routing of the export cable. Large targets, such as wrecks, overlay smaller targets due to their magnetic sensitivity. It is possible therefore, that UXO and other targets are in the routing of the export cable.

The hydrological conditions along the cable route show difficult conditions with high currents and large tidal range. Besides areas with sand waves (megaripples), areas were identified in the geotechnical report which indicates movement of the seabed level.

3.5 System Design

An overall available capacity of 98.05 % was calculated for the full system using Mean Time Between Failure (MTBF) and Mean Time To Repair (MTTR) figures for the WDS transmission assets. The overall availability over the lifetime of the assets is therefore predicted to be better than the OFTO requirement of 98%; however, the dominant factor which determines the overall availability of the transmission assets is the availability of the subsea cables. A cable fault that causes a 50% outage in a calendar year will reduce the availability measured over that year to 94.5%, assuming a MTTR of 40 days. Any year where 50% outage durations are greater than 14.6 days will result in the annual availability being less than 98%. The design is considered adequate because over their lifetime the assets are predicted to have availability better than the license requirement of 98%.

3.6 Electrical Infrastructure Design & Equipment Rating

Specifications were included in each contract as an element of client requirements and the resulting designs are subject to design reviews throughout project execution. A general design principle for construction of the assets has been to do as much as possible onshore and to minimise offshore installation activity where possible.

System studies have been undertaken by the Developers and the results provide the more detailed parameters required to design the harmonic filter and reactive compensation equipment to ensure compliance with the Bilateral Connection Agreement, SQSS and the Grid Code.

The design of the onshore and offshore substations has been one of continuous development and no substantial design changes have been identified. WDS confirmed there have been a number of minor alterations but these were associated with equipment ratings, identified as a result of system studies. This process of continuous development is quite normal for a scheme like this and fine tuning of a design based on information identified by system studies and more detailed information in general, is not uncommon.

Alstom Grid will deliver the 25 MVAr, 155 kV harmonic filter that will be designed to limit the harmonic levels at the 400 kV interface point to the planning limits given in Energy Networks Association, Engineering Recommendation G5/4.

Siemens will supply the 50 MVAr Static VAR Compensator (SVC) and other reactive compensation equipment, which will be designed to ensure reactive power control meets the requirements specified in the Grid Code.

The onshore and offshore substations have been designed to IEC and BS standards, where necessary, and the operating conditions are within the equipment ratings. Other design criteria has also been taken into account such as surface finishing applied to withstand the effects of salt fog and other environmental impacts that can cause corrosion due to coastal locations.

The relevant equipment ratings and operating parameters can be found in Table 1 below.

Location	Rating	Operating
Equipment on offshore platform		
Transformer 2off	240MVA 36/170kV	240MVA 34/155kV
Gas Insulated Switchgear (GIS) 2 x 1 bay	170kV	155kV
Auxiliary and earthing transformers 2 off	400kVA 36/0.42kV	400kVA 34/0.4kV
Standby diesel generators 2 off	275kVA & 220kVA 420V	275kVA & 220kVA 400V
Subsea cables		
2 x 3 core 41km	170kV	155kV
Onshore cables		
2 x 3 single core, 3km	170kV	155kV
2 x 3 single core 0.25km	420kV	400kV
Onshore substation		
Transformers 2 off	240/240/80MVA 170/420/17.5kV	240/240/80MVA 155/400/13.9kV
Gas Insulated Switchgear 2 x 4 bays	170kV	155kV
Reactors 2 off	60MVAr 170kV	60MVAr 155kV
Harmonic filters 2 off	25MVAr 170kV	25MVAr 155kV
Auxiliary transformers 2 off	300kVA 17.5/0.42kV	300kVA 13.9/0.4kV
Circuit breakers 4 off	TBC	13.9kV
Disconnector with two integrated earth switches 4 off	TBC	13.9kV
Earth switches 4 off	TBC	13.9kV
Static Var Compensators (SVC) 2 off	±50MVAr 13.9kV	±50MVAr 13.9kV
Reactors 2 off	30MVAr	30MVAr 13.9kV
Heysham substation		
Gas Insulated Switchgear 2 x bays	420kV	400kV

4 PROCUREMENT PROCESS

4.1 Overview of WDS Procurement Process

WDS has executed a multiple contract procurement strategy awarding a total of 19 supply and/or installation contracts for the main equipment. In addition WDS have awarded numerous smaller supply and installation, professional services, testing, investigation and survey contracts to support these main contracts. This review has focused on those main contracts of higher value for which contract information was provided.

A documented procurement strategy for WDS was not provided for review. We have, therefore, determined the procurement strategy through a review of the tender assessment reports for each contract award recommendation, the signed contract documents and the approved variation orders issued to date for each contract package.

The main equipment supply and/or installation contracts have been competitively tendered, with the exception of the contract with National Grid for Heysham Substation. Interfaces between the packages were managed and robust pre-qualification, tender and contracting processes were implemented. Invitations to tenderers were issued to an appropriate number of tenderers. The tenders received have then been reviewed in a structured and methodical manner. Contractor proposals including price, technical compliance, programme and commercial conditions were assessed and developed with the contractors to produce packages from which the highest ranking contractors were appointed. Section 4.3 provides a summary of the tender assessment criteria used by WDS.

The main equipment supply and/or installation contracts have been awarded as fixed price contracts under either the Fédération Internationale Des Ingénieurs-Conseils (FIDIC) Conditions of Contract for Plant Design and Build or the FIDIC Short Form Contract. Both standard contract forms have been amended with Particular Conditions based on the DONG Energy Standards.

FIDIC is also referred to as The International Federation of Consulting Engineers. The FIDIC contracts are standard forms of contract which are commonly used for the procurement of mechanical and electrical engineering projects under fixed price lump sum mechanisms. They are, therefore, appropriate for the procurement structure followed in the WDS project and the contracts awarded. Section 5.1 provides a summary of the contracts and price structure awarded for each of the main contracts.

The contracts include a mechanism for variations and Section 4.4 provides a summary of the value of variations awarded to date. 5.2 discusses the approach to risk and contingency planning and management followed by WDS and how this relates to the variations to contract price to date and the remaining contingency available for future risks.

A generic DONG procurement policy, dated March 2012, was provided as an additional document by the Developers. This details best practice for procurement, including competitive tendering and a transparent process for supplier selection. The above tender process demonstrates compliance with the overall DONG procurement policy for each of the major contracts.

4.2 Procurement Programme

WDS offshore wind farm OFTO Related Programme (rev 2) was provided to Fichtner on 29 May 2013. This programme details planned contract award dates. The following table compares these against the actual contract award dates. In general contracts have been awarded in accordance with the Rev 2 programme. We are unable to comment on how the contract award dates compare to Rev 1 of the programme as we have not had sight of this document.

Main Contract Package	Contractor	Planned Award Date	Actual Award Date	Estimated Contract Completion Date
Offshore substation				
Jacket foundation and topside module (supply)	Fabricom and Lemants NV JV	[redacted]	[redacted]	[redacted]
Jacket foundation and topside module (installation)	Scaldis	[redacted]	[redacted]	[redacted]
Transformers	CG Power	[redacted]	[redacted]	[redacted]
GIS switchgear	Alstom	[redacted]	[redacted]	[redacted]
Auxiliary and earthing transformers	Siemens A/S	[redacted]	[redacted]	[redacted]
Subsea and onshore cables				
Supply	NKT Cables A/S	[redacted]	[redacted]	[redacted]
Installation (subsea cables)	Visser and Smit	[redacted]	[redacted]	[redacted]
Onshore substation				
Civil works and installation of onshore cables	[redacted]	[redacted]	[redacted]	[redacted]
400/155kV transformers, 155kV reactors, auxiliary transformers	SMIT Transformatoren BV	[redacted]	[redacted]	[redacted]
SVCs, 13.9kV reactors	Siemens STDL	[redacted]	[redacted]	[redacted]
GIS switchgear, harmonic filters	Alstom	[redacted]	[redacted]	[redacted]
SCADA	Schneider Electric	[redacted]	[redacted]	[redacted]
Heysham Substation	NGET	[redacted]	[redacted]	[redacted]

*Approximate date. Defined in contract version

4.3 Tender Assessment Criteria

As agreed with WDS and Ofgem, the Contract Award Recommendation Reports were requested for those main contracts with an award value greater than £1 million. The majority of these were provided as shown in the following table. These reports describe the tender assessment process followed by WDS and the justification of the contracts awarded. The award recommendations were based on the tender assessment criteria shown in the following table. The assessment weightings that were used differ for the various contracts, however the Contract Award Recommendation Reports do not provide explanations for how the various weighting percentages were determined.

Main Contract Package	Contractor	Tender Assessment Criteria (% weighting)							
		Price structure	*Health & Safety*	*Quality system and processes*	*Experience and track record*	*Technical evaluation*	*Commercial conditions*	*Programme*	*Approach to risk*
Offshore substation									
Jacket foundation and topside module (supply)	Fabricom and Lemants NV JV	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Jacket foundation and topside module (installation)	Scaldis	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Transformers	CG Power	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
GIS switchgear	Alstom	[redacted]							
Auxiliary and earthing transformers	Siemens A/S	[redacted]							
Subsea and onshore cables									
Supply	NKT Cables A/S	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Installation (subsea cables)	Visser and Smit	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Onshore substation									
Civil works and installation of onshore cables	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
400/155kV transformers, 155kV reactors, auxiliary transformers	SMIT Transformatoren BV	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
SVCs, 13.9kV reactors	Siemens STDL	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
GIS switchgear	Alstom	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Harmonic filters	Alstom	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
SCADA	Schneider Electric	Contract Award Recommendation Report requested but not provided.							
Heysham Substation	NGET	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

The number of tenders received the range of tender prices and the range of tender assessment scores are presented in the following table along with the recommended contract award value and the tender assessment score for the contract awarded, based on the weightings presented in the previous table. This shows that in all cases the contract was awarded to the tenderer with the highest tender assessment score and in the majority of cases this correlates with the lowest or mid range contract value. The high weighting given to the price in the tender assessment would support this relationship.

However, it is worth noting that price was only given a [redacted] weighting for the Cable Supply Contract and [redacted] to the cable installation contract.

Main Contract Package	Number of tenders invited	Number of tenders received	Range of tender prices	Awarded contract value	Range of tender assessment scores	Awarded tender assessment score
Offshore substation						
Jacket foundation and topside module (supply)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Jacket foundation and topside module (installation)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Transformers	[redacted]	[redacted]	not provided		[redacted]	[redacted]
GIS switchgear	Contract Award Recommendation Report not provided					
Auxiliary and earthing transformers	Contract Award Recommendation Report not provided					
Subsea and onshore cables						
Supply	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Installation (subsea cables)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Onshore substation						
Civil works – Supply	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
400/155kV transformers, 155kV reactors, auxiliary transformers	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
SVCs, 13.9kV reactors	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Harmonic filters	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
SCADA	Contract Award Recommendation Report not provided					
Heysham Substation	n/a	n/a	n/a	n/a	n/a	n/a

Notes:

#1 [redacted]

#2 [redacted]

#3 [redacted]

#4 [redacted]

#5 [redacted]

4.4 Post Contract Award Changes

Post contract award changes have been managed by WDS through structured and well documented variation orders. A summary of the number and total value of variation orders provided for review is presented in the following table. With the exception of the following contracts the value of variations ranges between [redacted] and [redacted]:

(1) SVCs and 13.9kV Reactors Contract with Siemens STDL which has a variation of [redacted]; and

(2) SCADA Contract with Schneider Electric which has a variation of [redacted].

The actual value of these variations, however, is low compared to the overall cost of the assets and the contracts are not cost outliers and therefore have not been interrogated further.

Main Contract Package	Contractor	Contract value at award	Number of variation orders	Total value of variation orders	Revised contract price	Percentage variation
Offshore substation						
Jacket foundation and topside module (supply)	Fabricom and Lemants NV JV	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Jacket foundation and topside module (installation)	Scaldis	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Transformers	CG Power	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
GIS switchgear	Alstom	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Auxiliary and earthing transformers	Siemens A/S	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Subsea and onshore cables						
Supply	NKT Cables A/S	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Installation (subsea cables)	Visser and Smit	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Onshore substation						
Civil works and installation of onshore cables	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
400/155kV transformers, 155kV reactors, auxiliary transformers	SMIT Transformator en BV	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
SVCs, 13.9kV reactors	Siemens STDL	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
GIS switchgear	Alstom	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Harmonic filters	Alstom	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
SCADA	Schneider Electric	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Heysham Substation	NGET	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

5 CONTRACT STRATEGY AND MANAGEMENT OF RISK

5.1 Outline of the WDS Contract Structure

The main equipment supply and/or installation contracts awarded by WDS are listed in the following table. All the contracts are fixed priced and under a FIDIC standard form of contract.

All the contracts comprise the following features:

(1) [redacted]

(2) [redacted];

(3) [redacted];

(4) [redacted];

(5) [redacted];

(6) [redacted]; and

(7) [redacted].

(8) [redacted].

(9) [redacted].

(10) [redacted]:

- [redacted];
- [redacted]; and
- [redacted].

A detailed summary of the main supply and installation costs is included in Appendix D.

Main Contract Package	Contractor	Scope	Form of contract	Price structure
Offshore substation				
Jacket foundation and topside module	Fabricom and Lemants NV JV	Supply	[redacted]	[redacted]
	Scaldis	Installation	[redacted]	[redacted]
Transformers	CG Power	Supply & installation	[redacted]	[redacted]
GIS switchgear	Alstom	Supply & installation	[redacted]	[redacted]
Auxiliary and earthing transformers	Siemens A/S	Supply & installation	[redacted]	[redacted]
Subsea cables				
2 x 39.4km 170kV 3 core cables	NKT Cables A/S	Supply	[redacted]	[redacted]
	Visser and Smit	Installation	[redacted]	[redacted]
Onshore cables				
2 x 2.7km 170kV 3 x 1c cables and 2 x 225m 420kV 3 x 1c cables	NKT Cables A/S	Supply	[redacted]	[redacted]
	[redacted]	Installation	[redacted]	[redacted]
Onshore substation				
Civil works	[redacted]	Supply & Installation	[redacted]	[redacted]
400/155kV transformers, 155kV reactors, auxiliary transformers	SMIT Transformatoren BV	Supply & Installation (3 contracts)	[redacted]	[redacted]
SVCs, 13.9kV reactors	Siemens STDL	Supply & Installation (2 contracts)	[redacted]	[redacted]
GIS switchgear, harmonic filters	Alstom	Supply & Installation (2 contracts)	[redacted]	[redacted]
SCADA	Schneider Electric	Supply & Installation	[redacted]	[redacted]
Heysham Substation	NGET	Supply & Installation	[redacted]	[redacted]

5.2 Risk Assessment

(1) WDS have provided their Transmission Assets Risk Register (rev 3) which assesses the risks associated with the construction activities for the transmission assets. This does not, however, identify and assess the risks inherent with each of the equipment supply and/or installation contracts to identify the provisions required in each of the contracts to mitigate or manage such risks.

(2) Therefore, Fichtner has reviewed the provisions within the contracts with regards to risks to programme and cost overrun and conclude that they contain adequate provisions to manage these risks, for example:

(3) The VSMC contract for the cable installation work provides for the following risks:

a) The fixed priced is based on a worst case installation rate of [redacted] which is the lower bound of their declared "very slow installation rate" of [redacted] to [redacted]. This should mitigate any risk to programme delay and cost overrun due to unsuitable ground conditions,

b) A remeasurable allowance has been included for where additional protection is required to cables to be buried in sections of the trench that did not achieved the 2.0m target depth,

c) A mechanism has been included for additional payment for delays due to inclement weather based on specified criteria for what constitutes an inclement weather delay, and

d) A total of [redacted] jointing operations are specified, however, VSMC have included in their fixed price for all jointing operations that may be required;

(4) The VSMC contract for the cable installation work includes a range of liquidated damages values for key milestones, including:

a) Vessel ready to load cables (batches 1, 2 and 3) [redacted];

b) Installation of System 1 completed [redacted]; and

c) Installation of System 2 completed [redacted].

(5) The Fabricom contract for the offshore substation fabrication includes a range of liquidated damages values for key milestones, including:

d) Jacket and topside ready for load out [redacted]; and

e) Jacket and topside ready for sail away [redacted].

(6) The values of liquidated damages provide variable levels of compensation to WDS for the contractors' failure to meet key milestone date. The variations in liquidated damages values take cognisance of the severity of impact of the delay on the overall project delivery. This is demonstrated, for example, by the high value of liquidated damages for the late completion of the offshore substation fabrication.

6 EXPORT CABLE SUPPLY, INSTALLATION COSTS AND WIDER COST ANALYSIS

As part of Ofgem's own analysis of the transmission assets, an initial cost assessment and benchmarking exercise has been undertaken. This was based on costs submitted to Ofgem by the Developers in November 2012. The benchmarking exercise included a cost comparison with other transitional tender round projects.

Fichtner has undertaken a benchmarking exercise based on available reference data for European and UK reference projects. Where this was not appropriate cost estimates have been based on standard materials and labour costs. The overall results are shown in the table below. This identifies that there are no significant cost outliers in the WDS transmission assets.

Item	ITV Cost	FCE Range	Report Section
Export Cable Supply	[redacted]	£700-800/metre	6.1
Export Cable Installation	[redacted]	£32.8 m-38.95m	6.4
Offshore Substation Supply	[redacted]	€38-48m	6.5.1
Offshore Substation Installation	[redacted]	€12-18m	6.5.1
Offshore Substation Electrical Supply	[redacted]	€5.5-6.2m	6.5.2
Land Cable Supply	[redacted]	£3.4-£3.5m	6.6
Onshore Substation Civils Works	[redacted]	£ 7.4m	6.7.1
Onshore Substation Electrical Package	[redacted]	€18.6-20.4m	6.7.2

*Derived cost/ metre

This identifies that there are no significant cost outliers in the WDS transmission assets. A detailed assessment of these costs is included in the following sections.

6.1 Assessment of WDS Export Supply Costs

According to Ofgem's estimate, the cost for supply and installation of the export cable of [redacted] million represents [redacted] of the overall estimated capital expenditure and development costs for the WDS Transmission Assets, [redacted]. Ofgem noted that the export cable supply and installation unit costs appeared to be relatively high when compared with other transitional tender round projects used in the benchmarking analysis and this was communicated to the WDS Developers in a letter dated 13 December 2012.

6.1.1 Approach

In order to assess the costs for the offshore export cable, i.e. the value of the submarine cable supply contract, we have selected two different approaches:

(1) A 'top-down' analysis based on cable prices from benchmark projects; and

(2) A 'bottom-up' calculation, undertaking a full-cost calculation of the asset. This requires detailed knowledge on actual production and material costs, which can generate inaccuracies due to differences in supply chain, production location and labour cost.

In spite of any potential inaccuracies, the bottom-up method allows the difference between cost and market price to be analysed and thus will reveal a potential excessive or unexplainable margin in the export cable supply contract.

6.1.2 Benchmarking projects

In order to identify a suitable range of prices per metre for the submarine export cables, a table of benchmark projects with similar characteristics to the WDS offshore windfarm has been created (see Appendix C). This list of projects comprises UK projects in the Irish Sea and North Sea. The voltage level of the benchmarked export cables ranges from 132 kV to 155 kV, assumes that the cable constructions are identical and can therefore be used in the comparison. Due to commercial sensitivities, the contract values for export cable supply are not readily available in the public domain for many of the previous OFTO projects. These have been included where known. The conductor cross-section of the land cable has also not been identified for some projects; however, when compared to the submarine cable length the differences in cross-section of land cable does not have a huge impact on the cost.

The cable supply contracts for Walney 1 & 2 and for the Ormonde project all have very similar characteristics to WDS (approximately 40 km with 630mm^2 Copper conductors all supplied by Prysmian) and all have a contract value of [redacted] to [redacted] million. These similarities form a good basis for calculating reference values by scaling the conductor cross-section from 630 to 1000mm^2.

Based on the value of [redacted] million given in the Initial Transfer Value for the project's cable supply and installation costs, and on the signed contract value for the NKT cable supply contract of [redacted] million, we derived an overall cable price for the WDS 155kV 3-phase export cable of [redacted]; this includes all accessories but excludes the comparably short land cable portion.

The basis for deriving the cost of [redacted] is shown below:

	Price (millions)	Unit
NKT Contract Price	[redacted]	EURO
Deduction (armour change)	[redacted]	EURO
Revised contract price	[redacted]	EURO
Exchange Rate Adjustment	[redacted]	GBP/ EURO
Net contract price (overall)	[redacted]	GBP
Deduction (land cable	[redacted]	GBP
Offshore cable contract price	[redacted]	GBP
Offshore cable length 2x	[redacted]	KM
Derived Cable Price £/m	[redacted]	GBP
Derived Cable Price €/m	[redacted]	EURO

The benchmark data shown in the table below allows the determination of a price range between £700-£800/m. The table demonstrates that the WDS export cable supply cost is at the upper limit of the benchmarking range but is not a cost outlier. Further benchmark data is annexed in Appendix C.

Chart redacted

6.1.3 Detailed Calculation

In order to verify the order of the value for the cable price of [redacted], (derived from the ITV), a 'bottom-up' calculation has been performed.

The following assumptions were used in the calculation:

(1) An average copper value of $7250/tonne for May 2013 (London Metal Exchange (LME)); and

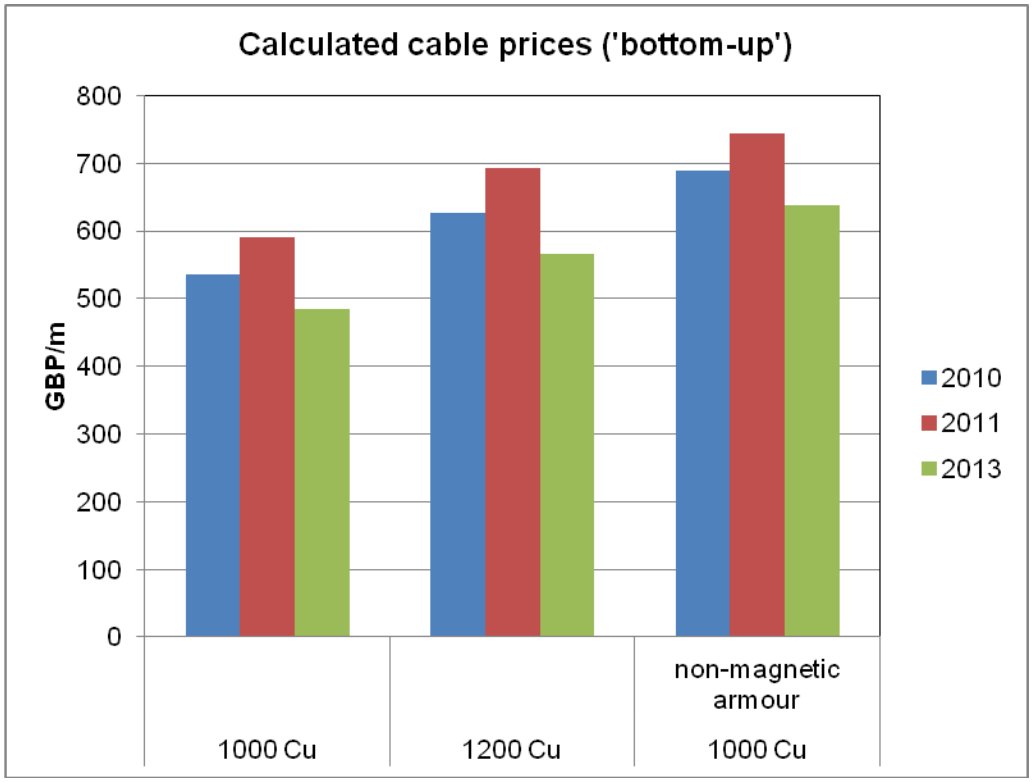
(2) Typical values for the manufacture of three phase 155 kV cables, based on current costs obtained by Fichtner:

   a) Total production cost in the range of €440 /m for 1000mm^2 to €520 /m for 1200 mm^2 cables with copper conductors;

   b) Assumed 10% contingency and 25% contract margin;

Taking account of the above assumptions the calculated cable prices for 2013 are in the range of £500-£600/m (€605-€715/m) for 1000mm^2 and 1200mm^2 cables respectively.

In order to compare these results with the previously mentioned reference data, the same calculation was performed based on a copper price of $8400 /tonne (11/2010; tender submission) and $9411 /tonne (07/2011; adjustment date). The results are shown in the following graph:



As can be seen from the above, the 2011 price for a 155 kV 3-core submarine cable with a 1000 mm^2 copper conductor is approximately £600/m. This cost does not include accessories[3], storage, installation of accessories (outside of VMSC scope), spares[4] and other expenses such as insurance. Fichtner has estimated the cost of these additional items to be circa £13.7 million i.e. [redacted] of the NKT contract value.

There are a significant number of uncertainties with the quantum of these additional items value, therefore we applied a conservative range of 15 to 25% to the calculated cable cost of £600/m to assess the impact of these additional items:

- 15% additional cost; £750/m.
- 20% additional cost; £780/m.
- 25% additional cost; £815/m

Therefore we conclude that for a 20% additional cost margin this 'bottom-up' benchmarking analysis provides a cable cost, of £780/m that is comparable to the 'top-down' analysis of [redacted].

6.2 Analysis of NKT Contract Value

6.2.1 Assessment of Procurement (Tender) Stage

Out of five pre-qualified suppliers, namely [redacted], [redacted], [redacted], [redacted] and [redacted], only Nexans, NKT and Prysmian submitted responses to DONG's tender invitation for Lot A, Export Cable Supply.

[3] From the contract documentation this is assumed to be at least 1 offshore cable joint, 1 GIS termination, 1 transition joint and link box (landfall section) per connection.

[4] [redacted].

Technical performance accounts for [redacted] of the scoring, which is adequate for a project of this type. There are only negligible differences in the scoring between the three suppliers for technical performance and all three suppliers were considered to have entered technically compliant offers with the employer's requirements.

The estimated award price for Lot A, without onshore accessories and termination work, is approximately €78 million (£66.8 million based on the exchange rate of 30 November 2010 stated by the Developers). The tender prices for Lot A were in the range of [redacted] million ([redacted]) to [redacted] million ([redacted]). The tender price accounts for [redacted] of the scoring.

The remaining evaluation accounts for [redacted] of the scoring with the delivery plan/ programme having the highest level of importance. Only Nexans and NKT received full points for this requirement.

The Developers confirmed in a teleconference on 8 May 2013 that a more competitive supplier environment would have been desirable but was not achievable, a trend that is currently apparent in the cable supply market. We would note that 5 European cable supply companies were pre-qualified by the Developers, which would suggest a strongly competitive environment, however only 3 companies submitted tenders. Therefore the environment was not as competitive as first implied at the pre-qualification stage

6.3 Contract Price Variations

Metal Price Adjustment

The tender deadline for the cable export supply contract was 30 November 2010. At this date the Copper price on the LME was $8400 /tonne. NKT Cables were initially notified of the contract award by a Letter of Intent dated 31 May 2011, when the Copper price on the LME was $9200 /tonne.

The signed contract between DONG and NKT cables describes the metal adjustment procedure as follows: "The cable prices will be adjusted acc. to the Currency exchange rate and the Metal notations on an agreed day immediately after award of contract."

With an approximate Copper tonnage of 30kg/m and a (preliminary) production length of 82km, we calculate a price increase of $2.860 million (€1.974 million). This value may be slightly inaccurate since the exact adjustment calculation has not been provided for assessment. However, the amount of adjustment appears to be in the correct range.

According to variation order (VO) #2, the agreed date for adjustment of the cable prices was 18 July 2011 (not 4 July 2011 as mentioned in the signed contract) and the value of metal adjustment was [redacted] million. From a purchasing point of view, the selection of the date of 4 July 2011 produced a significant impact on the cable price due to high copper prices.

Other price adjustments

Aside from some other minor adjustments related to the scope of supply, there was a price decrease of the contract value Variation Order (VO) #2 of [redacted] million. This VO was a result in the change of armour wires as detailed in Section 2.1.1. Based on our research and discussions with potential suppliers, non-magnetic armour wires are in the region of 3 to 4 times higher in price than "normal" stainless steel wires. Therefore we can confirm that the price reduction is in the correct range.

6.4 Cost Analysis of Export Cable Installation Contract

The tender process for the export cable installation and the contract phase started before all geotechnical and geophysical surveys were completed. The VSMC contract is dated 2011, and the last survey reports were finished in February 2013. Fichtner therefore assumes that the relatively high prices for the cable installation contract cover potential unknown ground risks for the Contractor. Additionally, the final cable route had not been defined at the contract execution date.

Other risks include the availability of vessels and equipment. As long as potential risks and the resulting delays have not been defined, no complete and reliable timeline can be made and therefore the availability of vessels and equipment might not guaranteed.

On basis of all submitted documents, and the experience of Fichtner, the following key cost drivers have been identified:

(1) Complicated soil conditions which lead to special ploughing techniques and time consuming installation;

(2) Unavailability of relevant geotechnical/ geophysical reports during the contract tender phase;

(3) High potential risk of boulders, wrecks and slope instabilities in the landfall section;

(4) Additional anticipated Route Clearance and Pre-Lay Grapnel Run (PLGR) operation along the proposed installation route by VSMC;

(5) Third Party Service Crossings of the Barrow OWF export cable, 2 pipelines and the Walney 2 export cable, combined with a lack of clarity on contractual interfaces;

(6) Jointing operation with additional barge and burial of the cable with extra mass flow excavating tool; and

(7) No clear defined point for loading of the cable strings (Rotterdam or other suitable port in Northern Europe).

Comparing benchmark costs of reference offshore projects within the UK and North Sea, we would expect to see installation costs for subsea export cables to be in the range of £0.8-0.95 million/ km. Based on the approximate length of 41km for the two cable trenches at WDS, we would conclude that the submitted contract price appears reasonable and is below the expected benchmarked range.

6.5 Offshore Substation Costs

The total price of the physical components of the offshore substation quoted in the Initial Transfer Value spreadsheet are shown below. This is excluding figures for contingency and engineering hours.

Item	Price given in Initial Transfer Value spreadsheet
Offshore Substation and Platform	[redacted]
Other Costs: HV switchgear, E/A transformers, Neutral earthing resisters, MV switchgear (Schneider), Power transformers (CG Power Systems), HV cables and terminations, MV cables and terminations and Spare parts Equipment installation	[redacted]
Total	[redacted]

A breakdown of the cost split between major items as drawn from our research into the contracts is shown in the following table.

Item	Scope	Contractor	Contract Price	Contract price (assuming exchange rate of 0.83)
Four storey steel topside module mounted on a jacket foundation.	Supply	Fabricom	[redacted]	[redacted]
	Installation	Scaldis	[redacted]	[redacted]
	Total supply & installation		[redacted]	[redacted]
Electrical Items	Supply & Installation	Various- see table below	[redacted]	[redacted]

Our analysis of the offshore substation costs is given in the following sections.

6.5.1 Offshore Substation (Fabricom and Scaldis Contracts)

A detailed analysis of the offshore substation platform costs was undertaken. The relevant contracts are summarised in the following table.

Table redacted

Based on reference prices from Germany and the UK, the cost of topside and substructure package supply, excluding installation, ranges between €40 million to €50 million (depending on water depth and substation concept). We therefore consider that the ITV value is low compared to the benchmark. This could be partly explained by the deeper water conditions in the German reference cases. We conclude that the cost is not an outlier.

Scaldis has been contracted for the installation of the Offshore Substation and the substructure for a contract sum of €11.4million. A variation order has been submitted for the changing of levelling equipment totalling € 0.2m. Based on German reference cases the installation benchmark is €12-18m. Therefore the cost is considered reasonable by Fichtner.

6.5.2 Offshore Substation Major Electrical Equipment

The major components for the offshore electrical equipment as defined in the contracts are set out below. Fichtner has provided an estimated range of benchmark prices based on our experience in the UK and European market. The analysis shows that all of the major components for the offshore electrical equipment are within the range that we would expect with the exception of the GIS switchgear where the price is lower than the Fichtner estimated ranges. We can conclude that there are no cost outliers identified in our review.

Item	Contractor	Contract price	Fichtner Estimate
2 x 240MVA 155/34kV transformers	CG Power	[redacted]	€ 3,600,000.00 - €4,000,000.00
2 x 170kV GIS switchgear	Alstom	[redacted]	€ 1,000,000.00 - €1,200,000.00
Auxiliary transformers (E/A transformers)	Siemens A/S	[redacted]	€ 60,000.00 - 75,000.00
MV Switchgear	Schneider	[redacted]	€ 800,000.00 - €900,000.00
Neutral Earthing Resistors	CHS Controls	[redacted]	€ 25,000.00 - 30,000.00

6.6 Onshore Cable Supply

The onshore cables linking the shore landing transition joint to the Heysham onshore substation are as follows;

- 2 x 2.7km 170kV 3x1-core 1600mm^2 Al XLPE cable in trefoil ducts;
- 2 x optical fibre cables; and
- 2 X 225m 420kV 3x1-core 1000mm^2 Al cables in trefoil.

The onshore cable supply forms part of the export cable supply contract with NKT. The price quoted for this in the Initial Transfer Value spreadsheet is [redacted].

The cable costs including fibre cables, earthing material, ducts and joint bays are considered reasonable by Fichtner. Our estimate of an acceptable price range is given in the table below, and shows the WDS supply cost is within acceptable limits. This is based on information from other reference sites, both in the UK and Germany, and internal database information.

Item	Contract Price	Fichtner Estimate
Land cable supply	[redacted]	£3,541,900 - £3,380,900

6.7 Onshore Substation

6.7.1 Onshore Substation Civils Works and Land Cable Installation

The civil work lot for the onshore substation includes the installation of the 2.7 km onshore cable run. The table below shows the contract price and the Initial Transfer Value price for the onshore substation civil works and land cable installation to be constructed by [redacted].

Item	Contractor	Scope	Contract Price	Initial Transfer Value spreadsheet
Civils Works	[redacted]	Supply & Installation	[redacted]	[redacted]
Land cable installation	[redacted]	Installation	[redacted]	

It is unclear why there is a discrepancy between the contract price and the price quoted in the Initial Transfer Value spreadsheet. We have been advised that this issue will be addressed in the financial forensic audit.

A benchmarking approach referencing onshore substation civil costs from other projects was considered unsuitable for cost comparison due to the bespoke nature of the buildings and the dependency on ground conditions. Therefore, a cost evaluation was conducted based on industry standard material and labour costs. The results of the Fichtner analysis are given in the table below.

Item	Contract Price	Fichtner Estimate
Preliminaries	[redacted]	£ 1,418,000.00
Site strip and clearance	[redacted]	£ 182,000.00
GIS building	[redacted]	£ 720,000.00
Reactors, transformers, filter and SVC compound	[redacted]	£ 890,000.00
Walls	[redacted]	£ 870,000.00
Lightning protection	[redacted]	Included with earthing
Drainage and services	[redacted]	£ 268,000.00
Ducting and earthing	[redacted]	£ 700,000.00
External works	[redacted]	£ 785,000.00
Electrical works	[redacted]	£ 725,000.00
Various (design fees, newt fence, risk and insurance)	[redacted]	£ 880,000.00
TOTAL	[redacted]	**£ 7,438,000.00**

This costing analysis estimates the cost of the onshore civil works at approximately [redacted] million. Although this is less than the WDS contract price we do not consider the WDS onshore civil works cost to be unacceptable or, therefore, a cost outlier. This conclusion can be explained by a review of the following items in the WDS price which are higher than the Fichtner estimate:

(1) The preliminary costs are [redacted] of the overall price. We would normally expect preliminaries in the order of 20-25%. However, the level of preliminaries is dependent on how contractors allocate their costs and therefore can vary considerably;

(2) The costs for fencing and gates also appear high, however this is a minor cost item;

(3) The concrete costs for the GIS building appear high, however at £200,000 this is not a major cost item;

(4) [redacted] has been allowed for stone chippings to compound areas. We consider this price to be high for an area of this size however at [redacted] this is not a major cost item;

(5) The cost of surface water drainage appears high at [redacted], although this may be reasonable depending on the complexity of the network; and

(6) The cost for ducting, [redacted], appears high, although this may be reasonable depending on the quantity of ducting.

We consider the site clearance costs to be low, and it is not clear if they include the stoning of the site to form a working platform and earthworks.

We have reviewed the land cable installation contract price against industry standard costs and we do not consider this to be a cost outlier.

6.7.2 Onshore Substation Electrical Works

The onshore substation and reactive compensation equipment costs are broken down in the Initial Transfer Value spreadsheet as follows.

Item	Price given in Initial Transfer Value spreadsheet
C) Shunt reactor:	
1) Shunt reactor	[redacted]
D) Connection Bay equipment:	
1) Feeder bay – NGET	[redacted]
E) Filter arrangement:	
1) Filter arrangement	[redacted]
F) Switchgear:	
1) GIS switchgear	[redacted]
Reactive Compensation Equipment	[redacted]
TOTAL	[redacted]

The naming and grouping used in the contracts and the Initial Transfer Value spreadsheet is not consistent. For the purposes of the cost evaluation the groupings in the following table have been assumed.

Item (as named in contract)	Contract price (assuming exchange rate of 0.83)	Item (as named in spreadsheet)	Price in spreadsheet
400/155kV transformers	[redacted]	Shunt Reactor	[redacted]
SVCs	[redacted]		
13.9kV reactors			
170kV shunt reactors	[redacted]	Reactive Compensation Equipment	[redacted]
170kV GIS switchgear	[redacted]	GIS Switchgear	[redacted]
Harmonic filters	[redacted]	Filter Arrangement	[redacted]
TOTAL	[redacted]		[redacted]

The contract prices for these items are given in the table below.

Item	Contractor	Scope	Contract Price	Fichtner Estimate
400/155kV transformers	SMIT Transformatoren BV	Supply & Installation	[redacted]	€ 6,900,000.00 - €7,940,000.00
SVCs	Siemens STDL	Supply & Installation	[redacted]	£ 6,608,000.00 - £6.938,400.00
13.9kV reactors				£1,125,700.00- £1,157,200.00
170kV shunt reactors	SMIT Transformatoren BV	Supply & Installation	[redacted]	€ 2,450,000.00 - €2,700,000.00
170kV GIS switchgear	Alstom	Supply & Installation	[redacted]	€ 2,000,000.00 - €2,300,000.00
Harmonic filters	Alstom	Supply & Installation	[redacted]	£1,405,200.00- £1,570,500.00

Overall the prices indicated for the subcomponents are considered to be consistent with the range that we would expect and have not been identified as cost outliers. Therefore, a further analysis of these costs has not been undertaken as part of this review.

6.8 Project Management, Engineering and Consultancy

The Developers outlined a number of costs related to their management, engineering and consultancy costs in the Initial Transfer value Spreadsheet. A breakdown of these costs is provided in the following table.

Item	Value in Initial Transfer value Spreadsheet
Common Costs	
Hours from project management and support	[redacted]
Consultancy Costs related to Legal advices and Environmental consents	[redacted]
Project Management support cost for Insurance	[redacted]
Project Management and support travel costs and landowner agreements	[redacted]
Site Support costs	[redacted]
Project Management and support costs for public relations	[redacted]
Development Costs: Project development costs, overhead from project management and support, site, travel, environmental study, insurance etc.	[redacted]
Offshore Substation	[redacted]
external consultancy cost, site costs related to offshore substation	[redacted]
Engineering hours related to offshore substation	[redacted]
Submarine Cable	[redacted]
Consultants costs related to submarine Cable	[redacted]
Engineering hours related to subsea cables	[redacted]
Land Cable	[redacted]
Engineering hours to land cable	[redacted]
Onshore Substation	[redacted]
Engineering hours to Onshore Substation	[redacted]
Total	[redacted]

These costs represent approximately [redacted] of the total proposed transfer value. In order to evaluate if the apportionment of project management costs appears to be reasonable between contracts, further detailed breakdown is required under each of the headings in the table above. The Developers have stated that more detailed project management cost breakdown has previously been supplied to the financial advisors undertaking the ex ante forensic accounting investigation. This detailed breakdown was not provided to Fichtner. Therefore, we have not included more detailed analysis of the breakdown.

6.9 Wider Cost Analysis

A wider cost analysis of the initial transfer value, excluding the subsea cable supply and installation costs, has been undertaken.

Our initial view, based on the research undertaken, is that the initial transfer value costs, excluding subsea cable components, appear reasonable when benchmarked against reference projects and analysed from an engineering perspective. Therefore, none of these costs have been identified as significant cost outliers.

Appendix A – Additional Documents Received

Document	Date Received
Comparative Costs of WDS Sea Cables	22/04/2013
OFGEM_DATA_ROOM_REPORT 15.04.2013	22/04/2013
WDS – Initial Transfer Value	22/04/2013
WDS Export Cable Letter – signed PDF	22/04/2013
WDS initial value – signed PDF	22/04/2013
WDS PIM	22/04/2013
Capita WDS Recommendation_of_best_tender_LOT A Export cable supply_310	01/05/2013
DE Procurement Policy_March 2012	01/05/2013
WDS – offshore substation – Fabrication – Recommendation for Contract Award	01/05/2013
WDS offshore substation installation – Recommendation for Contract	01/05/2013
WDS OFTO Export cable report	01/05/2013
WDS OFTO Information Data Room file paths	01/05/2013
WDS Project Authority Matrix	01/05/2013
West of Duddon Sands – Information Memorandum – Final- 14-03-2013	01/05/2013
West of Duddon Sands VDD Report V1.0 05-03-13	01/05/2013
Captia WDS - Export Cable Installation Lot B - Recommendation of best	01/05/2013
WDS Civil Recommendation	06/05/2013
Dong Queries version 4	08/05/2013
Fichtner query no.14 - Common Costs - Project Development - Pre FID Breakdown	10/05/2013
Capita WDS Recommendation_of_best_tender_LOT B Export cable supply	13/05/2013
WDS - Rec for Contract Award SVC_Siemens	13/05/2013
Recommendation for Signing – onshore substation Harmonic Filters - Alstom...	13/05/2013
Captia WDS - onshore - rec for Contract award - Harmonic Filters (DOR1140345)(S)	13/05/2013
Fichtner query no. 17 - contingency	13/05/2013
130513 WDS updated queries	13/05/2013
120510 WDS updated queries	13/05/2013
WDS - onshore - rec for contract award Transformers Reactors	13/05/2013
120514 WDS updated queries	14/05/2013
160513 WDS updated queries	16/05/2013
WDS Recommendation for Signing- 170kv Switchgear - Alstom [DOK982686]	22/05/2013
Fichtner query no. 30	23/05/2013

Document	Date Received
120520 WDS updated queries	23/05/2013
2013-05-23 WDS ex ante cost review 2nd draft report	23/05/2013
Data Room Index	29/05/2013
WDS Letter of Appointment Geophysical Consultancy Services	29/05/2013
WDS Procurement Policy March 2012.pdf	29/05/2013
WDS - Preliminary Information Memorandum Final 041012v1	29/05/2013
WDS Survey Report West Duddon Vol I	29/05/2013
FUGRO Geotechnical LAB REPORT 2012	29/05/2013
WDS Method Statement_rev1	29/05/2013
WDS OFTO Related Programme - May 2013 Rev 2	29/05/2013
WDS Survey Report West Duddon Vol II	29/05/2013
Ergebnisbericht Duddon Sands 2011 06 22	29/05/2013
Topographic Survey Beach UXO Operations Report C12031 Vol1 Rep01 Orisis November 2012 FINAL	30/05/2013
Geophysics Cable Route Report Orisis 01 February 2013	30/05/2013
Geotechnical Report Cable Route Fugro Contract Part C 29 October 2011 Final	30/05/2013
Export Cable Route Survey July 2011 Gardline Report Final_part_A	30/05/2013
Export Cable Route Survey July 2011 Gardline Report Final_part_B	30/05/2013
Export Cable Route Survey July 2011 Gardline Report Final_part_C	30/05/2013
FW Offshore HV switchgear contract	31/05/2013
FW Recommendation for Contract Award - Onshore Substation 170 kV Switchgear - Alstom.msg	31/05/2013
WDS 240 MVA transformers - Recommendation for contract award 23032011 DO....pdf	31/05/2013
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2.14.5 - WDS_10-HL024-MST-TOP-21 rev 1 Topside Lift method statement signed	03/06/2013

Appendix B – WDS Query List

Appendix redacted

Appendix C – Export Cable Benchmarking Projects

Appendix redacted

Appendix D – Summary of Main Supply and Installation Contract

Appendix redacted

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