Viking Link

national grid

UK Onshore Scheme

Environmental Statement

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Chapter 03

Description of the UK Onshore Scheme

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ES Reference	Chapter	Chapter Title	
ES-2-A.01	Ch01	Introduction	
ES-2-A.02	Ch02	Development of the UK Onshore Scheme	
ES-2-A.03	**Ch03**	**The UK Onshore Scheme**	
ES-2-A.04	Ch04	Environmental Impact Assessment Methods	
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Glossary & Abbreviations

Glossary of Terms	
Term	**Meaning**
Alternating Current (AC)	Electric power transmission in which the voltage varies in a sinusoidal fashion. This is the most common form of electricity transmission and distribution.
base scheme design	The design of the UK Onshore Scheme for the purposes of the planning application.
connection point	This is the point on the GB electricity transmission system (Bicker Fen 400 kV Substation) where Viking Link connects to the network.
the Contractor	Party or parties responsible for the detailed design and construction UK Onshore Scheme.
converter station	Facility containing specialist equipment (some indoors and some potentially outdoors) for the purposes of converting electricity from AC to DC or DC to AC.
converter station site	The proposed site occupying approx. 30 ha containing the converter station and associated landscaping, drainage as well as land required for construction.
converter station zone	The proposed zone occupying approx. 8 ha containing the converter station buildings, outdoor electrical equipment and hardstandings within a security fence.
detailed scheme design	The design of the Scheme developed by the Contractor within the Limits of Deviation (AC and DC cables) and Rochdale Envelope (converter station).
Direct Current (DC)	Electric power transmission in which the voltage is continuous. This is most commonly used for long distance point to point transmission.
ducts	Pipes (typically plastic) which are pre-installed and through which underground cables are then pulled through.
joint bay	Buried concrete pit where adjacent sections of onshore cables are physically jointed together.
landfall	The area between Mean Low Water Springs and Mean High Water Springs where the Onshore and Offshore Schemes meet.
Limits of Deviation	These define the maximum extents of the corridor for which planning permission is sought and within which proposed DC and AC cable routes may be installed.
Open cut methods	Cable installation methods which require the excavation of a trench into which ducts or cables can be directly laid.
the Project	Viking Link, from the connection point at Revsing Substation in Denmark to the connection Bicker Fen Substation in Great Britain).
Rochdale Envelope	This defines the parameters of the proposed converter station for which planning permission is sought including its location, layout and dimensions.

Glossary of Terms	
Term	**Meaning**
the Scheme	UK Onshore Scheme from MLWS to the connection point comprising underground AC and DC cables, converter station and access road.
Temporary Construction Compound	Compound used by the Contractor for siting of offices, welfare facilities, storage and laydown.
Temporary Construction Facilities	All areas used for temporary construction requirements including compounds, working areas.
Temporary Works Area	Larger working area located on or adjacent to the working width used where construction activities requires a larger area for example at trenchless crossings.
Transition Joint Pit	Buried concrete pit where onshore and submarine cables are physically jointed together.
trenchless methods	Cable installation methods used to cross obstacles such as roads or watercourses and ensure less disturbance at the ground surface.
working width (AC cables)	The 50 m wide working corridor required for the installation of underground AC cables.
working width (DC cables)	The 30 m wide working corridor required for the installation of underground DC cables.

List of Abbreviations	
Abbreviation	**Meaning**
AC	Alternating Current
AONB	Area of Outstanding Natural Beauty
BBC	Boston Borough Council
CBS	Cement Bound Sand
DC	Direct Current
DK	Denmark
DTS	Distributed Temperature Sensing
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
ELDC	East Lindsey District Council
ES	Environmental Statement
EU	European Union
GB	Great Britain
ha	Hectare
HVDC	High Voltage Direct Current

List of Abbreviations	
Abbreviation	**Meaning**
IDB	Internal Drainage Board
km	Kilometre
km^2	Square kilometre
kV	kilovolt
LoD	Limits of Deviation
LPA	Local Planning Authority
MW	megawatt
NETS	National Electricity Transmission System
NGVL	National Grid Viking Link
NKDC	North Kesteven District Council
SHDC	South Holland District Council
TCC	Temporary Construction Compound
TJP	Transition Joint Pit
TWA	Temporary Works Area
UK	United Kingdom
VSC	Voltage Source Conversion

1 Introduction

1.1 Introduction

1.1.1 This chapter provides an overview of Viking Link (‘the Project’) and an overview of the UK Onshore Scheme (‘the Scheme’). It outlines the Project from Revsing in Jutland, Denmark (DK) to Bicker in Lincolnshire, Great Britain (GB) and provides a description of key social, economic and environmental drivers underpinning the need for the Project. It outlines the main components of the Scheme including details of their design, construction and operation.

1.1.2 For a more detailed description of the proposed Direct Current (DC) cable route refer to chapter 5 of the Environmental Statement (ES). For a more detailed description of the proposed converter station including the proposed Alternating Current (AC) cable route and permanent access road refer to chapter 17 of the ES.

2 About Viking Link

2.1 Viking Link

Overview

2.1.1 Viking Link is a proposed 1400 megawatt (MW) high voltage DC electricity link or interconnector between the British and Danish electricity transmission networks. The Project will enable Great Britain and Denmark to trade energy as a commodity within the European Energy Market. This will strengthen Great Britain's and Denmark's economies, improve the security of their electricity supplies and reduce wholesale electricity prices providing British and Danish consumers with access to more affordable low carbon energy.

2.1.2 Interconnectors such as Viking Link use DC technology because it is more effective at transmitting large volumes of electricity over longer distances with lower losses than an equivalent AC system and also because a DC system provides a greater degree of control over the magnitude and direction of power flow. This flexibility brings operational benefits, however, in order to transmit electricity in DC form, specialist electrical equipment contained within converter stations at each 'end' of an interconnector is required to convert from AC to DC (or vice versa).

2.1.3 Figure 3.1 provides a schematic overview of Viking Link. It comprises approximately 762 kilometres (km) of DC onshore and submarine electricity transmission cables between new converter stations which are in turn connected to the high voltage electricity transmission networks at existing substations at Revsing, Jutland in Denmark and at Bicker Fen, Lincolnshire in Great Britain. Figure 3.2 provides a geographic overview of the Project.

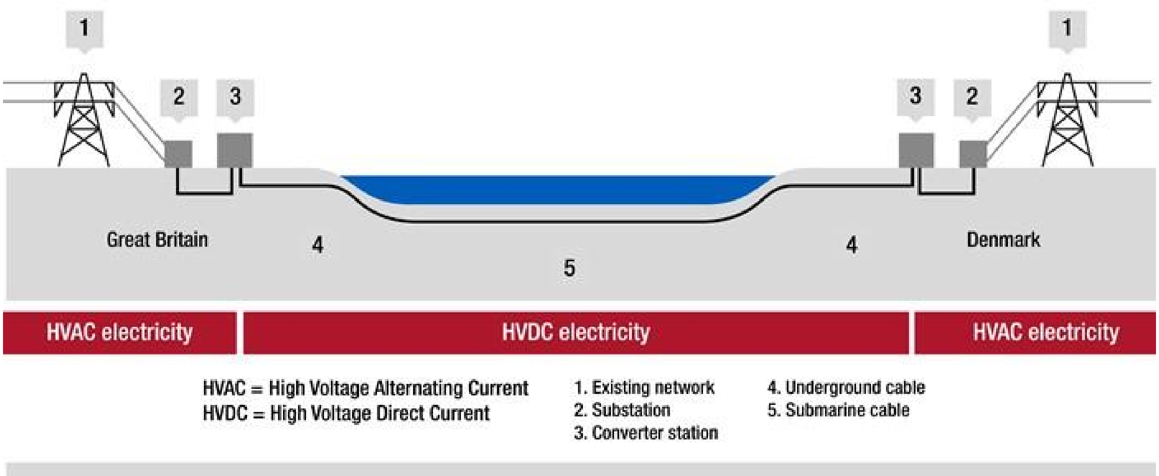

Figure 3.1 Viking Link: Schematic Overview

2.1.4 For the purposes of Environmental Impact Assessment (EIA) and seeking the necessary consents, licences or permissions, Viking Link has been split as follows below.

DK Onshore Scheme

2.1.5 The DK Onshore Scheme is located in Jutland, Denmark. It comprises new equipment within the existing Revsing 400 kilovolt (kV) Substation which is connected to a new converter station located adjacent to the Substation, as well as approximately 75 km of underground DC cable from the converter station to a landfall at Blaabjerg in the Municipality of Varde. An EIA of the DK Onshore Scheme has been undertaken and the results reported in an ES which accompanies an application to the Danish authorities.

Offshore Scheme

2.1.6 The Offshore Scheme comprises approximately 620 km of high voltage DC submarine cables from a landfall at Blaabjerg in Varde, Denmark to a landfall at Boygrift in Lincolnshire, Great Britain. The submarine cables which make up the Offshore Scheme cross Danish, German, Dutch and UK Exclusive Economic Zones (EEZs). The following has been undertaken as part of permit applications:

- Offshore Scheme (Denmark): The marine works in the Danish sector are subject to an offshore installation permit under the Act of Energinet 2011 Paragraph 4a) regulated by the Danish Energy Agency. The offshore installation permit is not subject to the EIA process however, an environmental assessment has been undertaken.
- Offshore Scheme (Germany): The marine works in the German sector are subject to the permits under the Federal Mining Act (Bundesberggesetz). The authorisation for the laying of a submarine cable is in accordance with paragraph 133 Section 1 Nr. 1 and 2 about underwater cables and transit pipelines. The permit does not require EIA, however, an environmental assessment has been undertaken.
- Offshore Scheme (Netherlands): The marine works in the Dutch sector are subject to permits under the Water Act 2009 and the Nature Conservation Act 2017. An EIA for the Dutch marine works has been undertaken as part of the permit application.
- Offshore Scheme (UK): The submarine cables between Mean Low Water Springs (MLWS) and below Mean High Water Springs (MHWS) (the intertidal area) fall under the provisions of both the Town and Country Planning Act 1990 and the Marine and Coastal Access Act 2009 (MCAA). Under Part 4 of the MCAA the Marine Management Organisation (MMO) is responsible for licensing of activities related to construction or removal of any substance or object in English territorial waters (up to 12 nautical miles) and also for such activities where they are undertaken outside of UK territorial waters unless a relevant exemption applies. An EIA for the UK marine works has been undertaken and results reported in an Environmental Statement (ES) (Ref 3.1) which accompanies the marine licence application.

UK Onshore Scheme

2.1.7 The UK Onshore Scheme is located in Lincolnshire, Great Britain. It comprises a landfall at Boygrift and approximately 67.16 km of underground DC cable to a new converter station at North Ing Drove, South Holland which is then connected to new equipment in the existing Bicker Fen 400 kV Substation by approximately 2.34 km of underground AC cable. Figure 3.3 provides an overview of the application boundary for the UK Onshore Scheme. It extends from MLWS to the connection point at the existing Bicker Fen 400 kV Substation. A more detailed description of the UK Onshore Scheme follows in subsequent sections of this chapter and later chapters of this ES. The ES accompanies planning applications under the Town and Country Planning Act 1990 to the relevant Local Planning Authorities (LPAs).

2.2 Need for Viking Link

2.2.1 A detailed explanation of the need for and benefits of Viking Link is described in the Planning Statement (Ref 3.2) which accompanies the planning application.

2.2.2 It is recognised that in order to have a competitive, sustainable and secure supply of energy, there is a need to invest in new infrastructure and diversify the way in which the energy market operates. Interconnectors are a fundamental part of this enabling electricity to flow between countries and markets and can be used to both import and export power as required.

2.2.3 Great Britain currently has four interconnectors, linking to France, Ireland, the Netherlands and Northern Ireland. Denmark currently has three interconnectors linking Norway, Sweden and Germany and a fourth interconnector linking to the Netherlands is currently under construction.

2.2.4 The development of the Project provides benefits for both Great Britain and Denmark helping to meet national and European objectives:

- Affordability: Viking Link will connect electricity networks in Great Britain and Denmark and in turn connect both countries to the wider European electricity market. This should help create downward pressure on wholesale electricity prices in both Britain and Denmark through cross border trade in electricity and shared use of the cheapest generation sources. It will help stimulate competition in the European market and facilitate the optimal use of resources across European Union (EU) Member States. Viking Link will benefit both countries by increasing the market for electricity generators (i.e. providing access to larger pool of consumers) and by providing consumers with more affordable electricity (i.e. providing access to a larger pool of suppliers).
- Security of supply: Interconnection provides access to a wide range of electricity generation sources and is a means to import or bring in extra electricity when not enough is being generated to meet demand at that time (similarly when there is a surplus it is a means to export electricity). This increases energy continuity and security if demand rises or electricity generation falls suddenly in one country. It will also act as an important balancing tool helping to improve the stability of the British and Danish electricity transmission systems.

- Sustainability: Interconnectors are an important means to help manage the fact that electricity cannot be stored efficiently at a large scale and not all electricity sources can generate consistently and predictably. They do this by providing a means to transfer surplus energy between countries when too much is generated at once to be used domestically. This should make a significant contribution in the transition to a low carbon economy in Great Britain, Denmark and Europe by helping with the challenge of integrating low carbon and renewable sources of electricity and retiring fossil fuel and nuclear plants.

3 About the UK Onshore Scheme

3.1 Overview of the UK Onshore Scheme

3.1.1 The application boundary is illustrated in Figure 3.3. It starts at the proposed landfall site at Boygrift in East Lindsey. At the proposed landfall site it extends from Mean Low Water Springs (MLWS) across the intertidal zone with two submarine high voltage DC cables and one fibre optic cable. These will be installed in ducts below the existing flood defences and terminate at a buried transition joint pit (TJP). The TJP will be located inland (west) of the existing flood defences.

3.1.2 From the TJP the proposed underground DC cable route extends approximately 67.16 km inland in a broadly western or south western direction until it reaches the proposed converter station site at North Ing Drove, South Holland. This comprises two underground high voltage DC cables (for transmission of electricity) and up to three fibre optic cables (two for monitoring the performance of the DC cables using Distributed Temperature Sensing (DTS) and one for communications between the proposed converter stations in Great Britain and Denmark). It should be noted that the terms "proposed DC underground cable route" or "proposed DC route" are used throughout this ES to refer to both high voltage DC cables and fibre optic cables.

3.1.3 The proposed DC cable route extends across the administrative areas of East Lindsey District Council (ELDC) (51.60 km), Boston Borough Council (BBC) (9.78 km), North Kesteven District Council (NKDC) (4.80 km) and South Holland District Council (SHDC) (0.98 km). The planning application boundary includes all of the land required during construction including at various locations along the proposed DC cable route areas that have been identified for temporary construction compounds (TCCs), temporary works areas (TWAs), land drainage and water management as wells as access.

3.1.4 The proposed converter station site including associated mitigation and land required for construction occupies a field approximately 30 hectare (ha) in size. At the converter station electricity will be converted from DC to AC (or vice versa depending on the direction of operation). The proposed converter station will be connected to the existing National Electricity Transmission System (NETS) at Bicker Fen 400 kV Substation by approximately 2.34 km of proposed AC underground cable which is routed in a broadly northern direction. Access to the proposed converter station will be provided by a new 2.8 km long permanent access road from the A52.

3.2 Level of Design Detail

3.2.1 Interconnectors are complex electricity transmission systems for which National Grid Viking Link (NGVL) do not undertake significant detailed design work. The detailed design of the Scheme is Contractor-dependent and subject to a competitive tender process. NGVL has developed a base scheme design for the purposes of seeking planning permission. This base scheme design establishes the maximum parameters within which the appointed Contractor will develop and construct the detailed design. The base scheme design comprises:

- For the high voltage DC and AC underground cables: Limits of Deviation (LoD) have been used which establish the maximum corridor in which underground cables will be installed whilst providing some flexibility to make minor routeing adjustments should they be required, for example if unforeseen ground conditions are encountered.
- For the converter station: a 'Rochdale Envelope' (Ref 3.3) has been used which establishes the proposed converter station's maximum parameters including the location, layout and height of buildings and electrical equipment as well as associated development, including perimeter roads, hardstanding areas, drainage and landscape planting.

3.2.2 Figure 3.4 illustrates the approach to design and how it will be taken forward from the base scheme design for which planning permission is being sought to the detailed scheme design which will be constructed following the appointment of a Contractor.

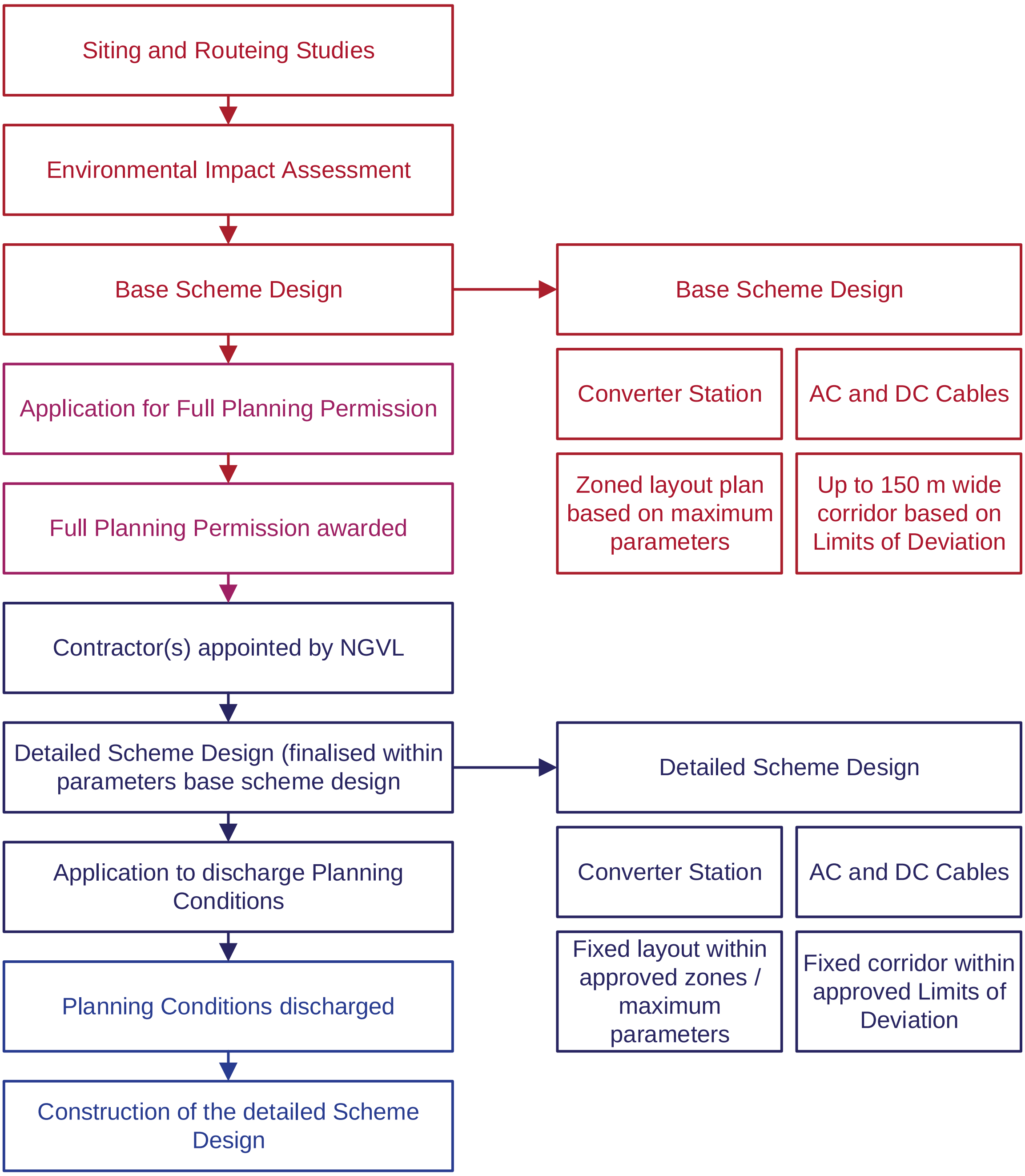

Figure 3.4 Viking Link: Approach to Design

3.3 DC Underground Cables

Overview

3.3.1 Viking Link will comprise what is termed a "bipole converter station configuration" with two high voltage DC cables installed alongside each other. Bipole systems transmit power through two high voltage conductors of opposite polarity, in this instance + 525 kV and - 525 kV. The UK Onshore Scheme will comprise two DC cables and up to three fibre optic cables all laid within a single trench. Cables could be laid directly into the trench or duct may be laid in the trench and the cables pulled through these. The exact configuration of the DC and fibre optic cables is subject to detailed design.

3.3.2 The following sections provide a high level description of the proposed DC underground cable route including its design, construction and operation. A more detailed description of the proposed DC route is contained in chapter 5 of the ES.

Route Description

3.3.3 With the exception of some minor deviations the proposed DC route has been designed within the preferred route corridor described in chapter 2 of this ES. It begins at Mean Low Water Springs (MLWS) at Boygrift in East Lindsey where it overlaps with the Offshore Scheme. As noted above a buried TJP (where the submarine cable is connected to the land cable) will be installed on the west side of the existing flood defences. From the TJP the proposed DC route heads in a generally western direction for approximately 9 km through a predominantly low lying coastal area until it reaches the A1104. At this location the proposed DC route bears mainly south west or south for approximately 20 km through more elevated land including crossing the Lincolnshire Wolds Area of Outstanding Natural Beauty (AONB) and continuing south west until it reaches the A16. From here the proposed DC route crosses the low lying fens in a mainly south western or southern direction for 37 km. At South Forty Foot Drain it turns east to cross it before continuing south / south east entering the proposed converter station site at its south western corner.

3.3.4 For the purposes of the EIA the proposed DC cable route has been split into four sections (described from the proposed landfall site to the proposed converter station) as set out in Table 3.1 and illustrated in Figure 3.5.

Table 3.1 Proposed DC Cable Route Sections

Section	Description	Length	Relevant LPA
1	Proposed landfall to Well High Lane	13.04 km	ELDC
2	Well High Lane to A16/Keal Road	16.85 km	ELDC
3	A16/Keal Road to River Witham	22.06 km	ELDC, BBC
4	River Witham to the proposed converter station	15.21 km	BBC, NKDC, SHDC

Physical Description

3.3.5 Table 3.2 provides a summary of the key characteristics of the proposed DC route. The exact configuration of the proposed DC cable route is subject to detailed design following appointment of a Contractor, however, the general characteristics below have informed the identification of the base scheme design on which the EIA is based.

Table 3.2 Proposed DC Underground Cable – Key Characteristics	
Characteristic	**Description**
Operating voltage	525 kV
Route length	Approximately 67.16 km
Working width	Typically 30 m (apart from at TWAs)
Permanent easement	Typically 15 m (apart from at crossings)
No. of cables	Two high voltage DC cables and up to three fibre optic cables
DC cable diameter	Approximately 150 mm
No. of trenches	One trench containing two DC cables and up to three fibre optic cables
Trench width	Typically 1.5 m
Trench depth	Typically 1.5 m (subject to local ground conditions and obstacles present)
Minimum depth of cover	Agricultural land – typically 0.9 m (900 mm) Watercourses – typically 2.0 m (2000 mm) Roads – typically 0.75 m (750 mm) Railways – typically 5 m (5000 mm) Footpaths and non-agricultural verges – typically 0.6 m (600 mm)
Backfill material	Soil and cement bound sand (CBS) or other thermally suitable material
Cable section length	Typically 800 m to 1.5 km (subject to detailed design)
Cable joints	Buried concrete base or pad (up to 84 required)

3.3.6 As note above there will be two DC cables installed as part of the proposed UK Onshore Scheme, each of which will be approximately 150 mm in diameter. These cables will be installed within a single cable trench or within ducts. They will be laid approximately 0.5 to 0.55 m apart to prevent overheating and ensure that the required cable rating is achieved. Two fibre optic cables (one per each DC cable) will be installed in order to monitor the temperature and performance of the DC cables during operation using DTS with a third fibre optic cable enabling communications between the converter stations in Great Britain and Denmark.

3.3.7 The proposed DC cable route will be laid in sections approximately 800 m to 1.5 km in length. These will be connected at buried joint bays. The exact number of joint bays will depend on the detailed design but it has been assumed up to 84 could be required.

3.3.8 There will be no above ground infrastructure required along the proposed DC cable route with the exception of small marker posts. These may be installed at field boundaries, crossings and other locations as appropriate to highlight the presence of the underground DC cable to landowners, asset owners and those undertaking works within the vicinity.

Installation of Underground DC Cables

Installation Methods

3.3.9 Installation of the proposed DC cable route will typically be undertaken within a 30 m wide working width. Figure 3.6 provides an overview of the proposed DC cable route installation. The exception to this is where engineering constraints mean additional land is required such as where the proposed DC route is required to cross obstacles such as roads or watercourses. In these locations TWAs will be established as the proposed working width is required to be larger in order to accommodate the larger construction equipment required to undertake installation works.

3.3.10 A detailed description of cable installation is contained in chapter 5 but in summary the main activities comprise:

- Open cut methods: These will typically be utilised in open agricultural land. This involves the excavation of a trench into which the cables could either be directly laid, or a duct could be laid through which cables will then be pulled through.
- Trenchless methods: These will typically be utilised where obstacles (watercourses, roads, railway lines, flood defences or other utilities) require to be crossed. This would involve the installation of ducts below the obstacle. The cables would then be pulled through the ducts.
- Jointing methods: These will be utilised where two adjacent sections of cable meet. This requires clean and dry conditions, so covers or cabins will be temporarily erected at joint bay locations. Due to the precise nature of engineering works undertaken, joint bays could remain open for several weeks to allow for trench and joint bay excavation, cable pulling, jointing and reinstatement. No permanent above ground structures will be required at joint bays.

3.3.11 Cable installation does not require to be undertaken sequentially; as a result installation could occur in multiple sections along the length of the proposed DC route in parallel. This will limit the extent and duration of construction activity at any given location including the length of time that land remains disturbed for. The exact programme will depend on a number of factors including the underlying ground conditions and installation methods used.

3.3.12 Typically the construction of a 1 km length of cable will take approximately 4 to 9 months dependent on the complexity of the installation. This timeframe includes for the pre-construction site set up as well as the reinstatement of the land following completion of installation. This assumes that the season after cable burial is completed is suitable for undertaking reinstatement. For the purposes of the EIA it has been assumed that installation of the proposed DC cable route will take between two and three years.

Other Construction Requirements

3.3.13 In order to install the proposed DC cable route there will be a requirement to establish temporary construction facilities on and off the proposed DC route. This includes TWAs where a larger works area is required for example at trenchless crossings, and TCCs where site offices, storage and other temporary facilities will be located. Up to sixteen (16) TWAs and nine (9) TCCs have been included within the base scheme design, however, the exact number required will depend on the Contractor.

3.3.14 In addition, the planning application boundary also includes areas for dewatering, temporary and permanent land drainage and temporary access roads. Where access for land drainage surveys has not been agreed prior to submission of the planning application, the boundary encompasses the fields which are crossed by the proposed DC route. This is to provide some flexibility in reinstating land drainage following construction.

Operation of Underground DC Cables

3.3.15 Once operational activity along the proposed DC cable route would generally be limited to non-intrusive inspections and cable repairs. The latter would only be required in the unlikely event of a cable fault. Where a fault does occur the location of the fault would be identified and the faulty section of cable replaced. The activities involved in cable repair would be similar to those outlined above for installation albeit over a much smaller section.

Decommissioning of Underground DC Cables

3.3.16 In the event that Viking Link ceases operation the proposed underground DC cable route could be decommissioned. Dependent on specific requirements the redundant cables could either be left in-situ, or all or parts of the cable could be removed for recycling. Where this is not possible removed cables would be disposed of in accordance with the relevant waste disposal regulations at the time of decommissioning.

3.4 Converter Station

Overview

3.4.1 Converter stations are key parts of a DC electricity transmission system. They convert electricity from AC to DC and vice versa depending on the direction of operation of the interconnector. Viking Link will utilise self-commutated voltage source conversion (VSC) technology. This technology allows for greater control over reactive and active power and also allows for a more compact converter station layout reducing the operational land take required.

3.4.2 The following sections provide a high level description of the proposed converter station including its design, construction and operation. A more detailed description is contained in chapter 17 of the ES.

Site Description

3.4.3 The proposed converter station site is illustrated in Figure 3.7. It is located in South Holland and occupies a 30 ha field which is bounded by drains and hedgerows. The proposed site and surrounding area is predominantly rural with the majority of the land used for agriculture. Currently the proposed site is accessed via North Ing Drove, however, as part of the UK Onshore Scheme it is proposed to construct a new 2.8 km long permanent access road between the A52 and the proposed site. In addition, a 2.34 km long underground AC cable is proposed to connect Viking Link to existing Bicker Fen 400 kV Substation. Both the proposed permanent access road and AC cable are routed entirely within agricultural land.

Physical Description

3.4.4 The base design has been developed taking into account examples of previously constructed converter stations in order that it can accommodate the final detailed design. It will comprise specialist electrical equipment, some of which must be located within buildings as well as some which can be located outdoors. Both the buildings and outdoor electrical equipment range in size up to a maximum of 24 m high. A detailed description of the main components and their maximum dimensions is contained in chapter 17.

3.4.5 As part of the base scheme design development zones have been identified based on the location and size of building units and outdoor electrical equipment as well as other requirements such as landscape planting and drainage. The base design is illustrated in Figure 3.8. It comprises the following:

- Zone (1) Building and outdoor electrical equipment zone in which the main components of the converter station will be located according to their height and whether they are buildings or outdoor electrical equipment.
- Zone (2) Perimeter road zone which will contain a permanent perimeter road which would form a continuous circuit around the converter station to facilitate movement of vehicles and access.
- Zone (3) Security zone which establishes a 8 m wide ‘buffer’ zone within security fencing up to 3.5 m tall will be erected.
- Zone (4) Additional hardstanding zone which will contain a permanent area for car parking and laydown. Part of this will be within the security fence and part outside of it.
- Zone (5) Reinstated zone which contains all of the areas temporarily used during construction which are not required during operation.
- Zone (6) Attenuation zone which will contain an attenuation pond as part of the permanent drainage scheme.
- Zone (7) Landscape planting zone which will comprise landscape planting and earthworks around the site in order to provide permanent screening.

3.4.6 Zones (1), (2), (3) and part of (4) comprise the proposed converter station zone which comes to approximately 8 ha. This is all of the development which would be located within the security fence. Part of Zone (4) and Zones (5), (6) and (7) comprise the ancillary zones which come to approximately 22 ha. This is all of the development which would occur outside of the security fence.

Access to the Converter Station

3.4.7 Access to the proposed converter station will be provided by a new 2.8 km long permanent access road from the existing public highway network (A52) as shown in Figure 3.7. The proposed permanent access road includes a new junction with the A52, a new bridge crossing of the Hammond Beck, culvert crossings of other drains and a new junction with North Ing Drove. This will be constructed at the beginning of the works in order that it can be used by all construction traffic.

Construction of the Converter Station

3.4.8 Construction of the proposed converter station is planned to be undertaken over a period of 24 to 36 months from approximately 2019 to 2022. The exact phasing of some activities will depend on the Contractor and detailed design but the main construction activities will typically include:

- Preliminary works;
- Access road construction;
- Site establishment;
- Earthworks;
- Civil engineering works;
- Building works;
- Cable installation;
- Provision/installation of permanent services;
- Mechanical and electrical works;
- Commissioning; and
- Site Reinstatement & Landscape Works.

Operation of the Converter Station

3.4.9 Following a period of commissioning and testing the proposed converter station will operate continuously throughout the year. Whether it is importing electricity (converting DC to AC) or exporting electricity (converting AC to DC) will depend on supply and demand of and for electricity in Great Britain and Denmark.

3.4.10 The proposed converter station will be operated by a small team based on site with a minimum of two operators present at all times. During normal operation there will be approximately six personnel on site, divided between three shifts over a 24-hour period. During maintenance (planned and unplanned) the number of personnel present on site would increase with the number of staff proportionate to the nature of the maintenance works being undertaken.

Decommissioning

3.4.11 The anticipated operational life of the proposed converter station is approximately 40 years. It is likely that during this period refurbishment and plant replacement will extend the life of the converter station rather than decommissioning. In the event that Viking Link ceases operation the proposed converter station would be decommissioned. The main components would be dismantled and removed for recycling wherever possible. Where this is not possible disposal would be undertaken in accordance with the relevant waste disposal regulations at the time of decommissioning. It is anticipated that the permanent access road would be left in-situ.

3.5 AC Underground Cables

Overview

3.5.1 Viking Link will be connected to the existing NETS at Bicker Fen 400 kV Substation by approximately 2.34 km of proposed underground AC cable. The UK Onshore Scheme will comprise six AC cables and two fibre optic cables all laid within two separate trenches (or where constraints dictate could be pulled through pre-laid ducts similar to the DC cables). Each trench contains a circuit which will be connected to a switch bay in Bicker Fen 400 kV Substation. It should be noted that the terms “proposed AC underground cable route” or “proposed AC route” are used throughout this ES to refer to both AC cables and fibre optic cables.

3.5.2 The following sections provide a high level description of the proposed AC underground cable route including its design, construction and operation. A more detailed description of the proposed AC route is contained in chapter 17 of the ES.

Route Description

3.5.3 The proposed AC cable route leaves the converter station site in a broadly eastern direction and exits the proposed site at its north eastern corner. From here it bears crossing Middle Fen Drove and then is routed north. The first circuit turns west entering Bicker Fen 400 kV Substation at its southern extent and the second circuit continues north for a further 0.25 km and turns west entering Bicker Fen 400 kV Substation at its northern extent.

Physical Description

3.5.4 Table 3.3 provides a summary of the key physical characteristics of the proposed AC route. The exact configuration of the proposed AC cable route is subject to detailed design following appointment of a Contractor, however, these general characteristics below have informed the identification of the base scheme design on which the EIA is based.

Table 3.3 Proposed AC Underground Cable – Key Characteristics	
Characteristic	**Description**
Operating voltage	400 kV
Route length	Approximately 2.34 km
Working width	Typically 50 m (wider at locations of trenchless crossings)
Permanent easement	Typically 25 m (wider at locations of trenchless crossings)
No. of cables	Six high voltage AC cables and two fibre optic cables
AC cable diameter	Approximately 150 mm
No. of trenches	Two trenches, each containing three AC cables and one fibre optic cable
Trench width	Typically 1.5 m
Trench depth	Typically 1.5 m
Minimum depth of cover	Agricultural land – typically 0.9 m (900 mm) Watercourses – typically 2.0 m (2000 mm) Roads – typically 0.75 m (750 mm)
Backfill material	Soil and cement bound sand (CBS) or other thermally suitable material
Cable section length	Typically 700 m to 1 km (subject to detailed design)
Cable joints	Cable joints and above ground earthing link pillars (up to 4 required)
Fibre optic cable pits	Buried box with inspection cover (up to eight required e.g. every 250 m)

* Note one fibre optic cable which provides communications between the proposed converter station and the existing Bicker Fen 400 kV Substation will be laid separately.

3.5.5 There will be six AC cables and two fibre optic cables installed within two trenches (three AC cables and one fibre optic cable per trench). The proposed fibre optic cables (one per circuit) will enable the temperature and performance of the AC cables to be monitored during operation. The third fibre optic cable will enable communication between the proposed converter station and Bicker Fen 400 kV Substation.

3.5.6 The proposed AC cables will be laid in sections approximately 700 m to 1 km in length. These will be connected at joint bays with above ground earthing link pillars. The exact number of these will depend on the detailed design but it has been assumed up to four could be required. Buried inspection boxes for the fibre optic cable will also be required (it has been assumed up to eight could be required), however, these will be flush to the ground or buried at the same depth as the cables.

Installation of Underground AC Cables

3.5.7 Installation of the proposed AC cable route will typically be undertaken within a 50 m wide construction easement or working width. The exception to this is where the proposed AC route is required to cross obstacles such as roads or watercourses. In these locations the working width may be extended. TWAs are proposed within the proposed converter station site and adjacent to Bicker Fen 400 kV Substation.

Operation of Underground AC Cables

3.5.8 Similar to the proposed DC cable route operational activity along the proposed AC cable route would generally be limited to non-intrusive inspections and cable repairs. The latter would only be required in the unlikely event of a cable fault. Where a fault does occur the location of the fault would be identified and the faulty section of cable replaced. The activities involved in cable repair would be similar to those outlined above for installation albeit over a much smaller section.

Decommissioning of Underground AC Cables

3.5.9 In the event that Viking Link ceases operation the proposed underground AC cable route could be decommissioned. Dependent on requirements the redundant cables could either be left in-situ, or all or parts of the cable could be removed for recycling. Where this is not possible removed cables would disposed of in accordance with the relevant waste disposal regulations at the time of decommissioning.

4 References

Ref 3.1 National Grid Viking Link (March 2017) Offshore Scheme (UK) Environmental Statement

Ref 3.2 National Grid Viking Link (August 2017) Viking Link: Needs Case

Ref 3.3 Infrastructure Planning Commission (February 2011) Advice Note Nine: Rochdale Envelope

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