
Landfall and Converter Station Site Selection Report Non-Technical Summary

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1. Introduction

Viking Link is a proposed 1,400 Mega Watt (MW) high voltage direct current (DC) electricity interconnector between Bicker Fen in Great Britain and Revsing in Denmark. The link will allow electricity to be exchanged between the two countries.

The project is being jointly developed by National Grid Viking Link Limited (NGVL) and its development partner Energinet.dk.

Viking Link will enable Great Britain to trade energy as a commodity within the European Energy Market. This will help improve Britain's security of electricity supply and provide access to cheaper, low carbon energy.

The interconnector will be approximately 760 kilometres in total length between Great Britain and Denmark. The submarine cables will cross through UK, Dutch, German and Danish territorial waters.

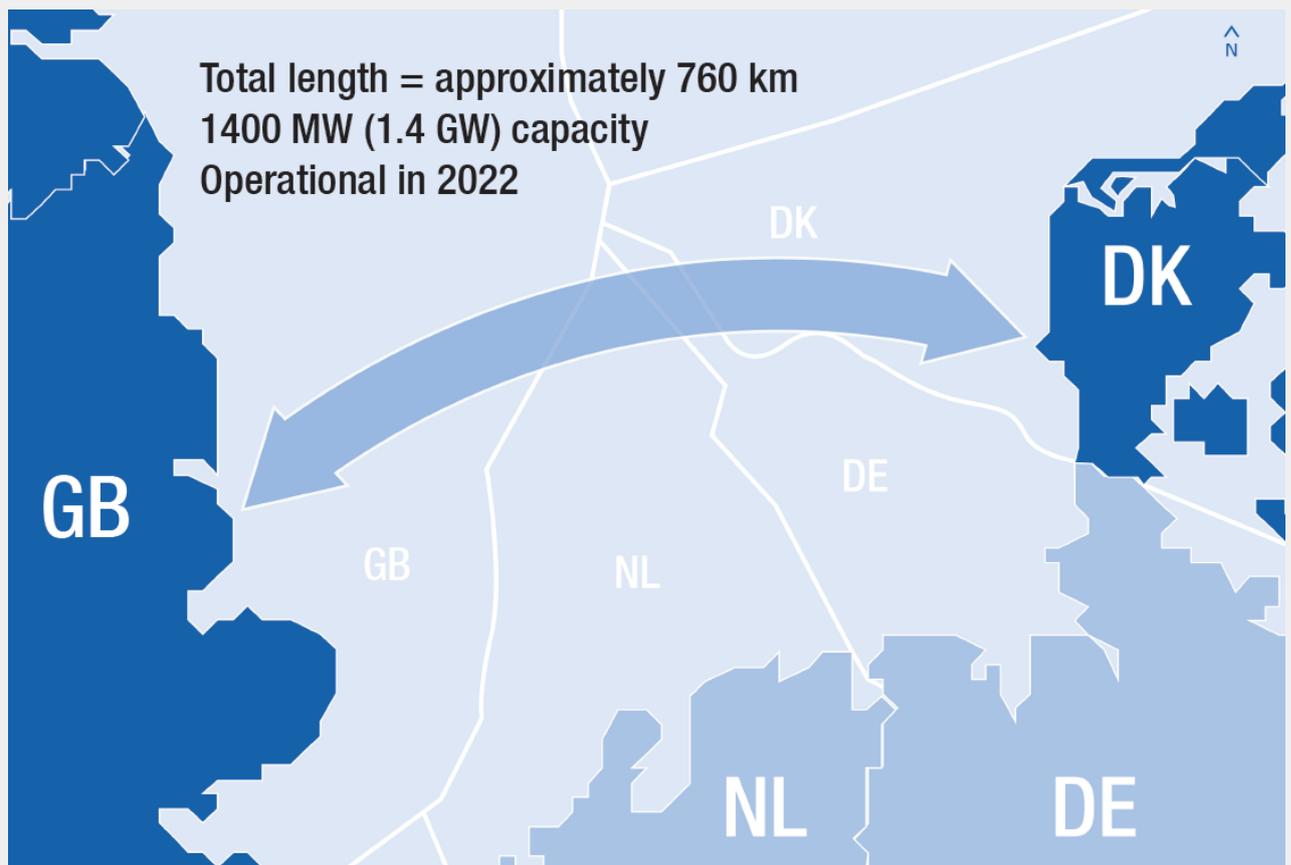


Figure 1.1 Map of territorial waters to be crossed

Viking Link will connect into the British high voltage electricity transmission network at the existing National Grid Electricity Transmission Limited (NGET) substation at Bicker Fen. More information on how Bicker Fen substation was selected is set out in the *Viking Link Strategic Options Report (April 2016)* which will be published on the project website¹.

Viking Link is also needed from a European Union (EU) energy policy perspective and will significantly contribute to market integration, sustainability, security of supply and competition.

Further information on interconnectors can be found in *Getting More Connected*², a paper prepared by National Grid setting out the opportunities presented by interconnector development as well as in *Smart Power*³, a report prepared by the National Infrastructure Commission to help ensure that the country's electricity system is fit for the future.

1.1 What is Viking Link?

Viking Link will involve the construction of a converter station in Great Britain (GB) and in Denmark, the installation of DC submarine and underground cables between each converter station and high voltage alternating current (AC) underground cables between the converter station and substation in each country. The different parts of Viking Link interconnector are shown below:

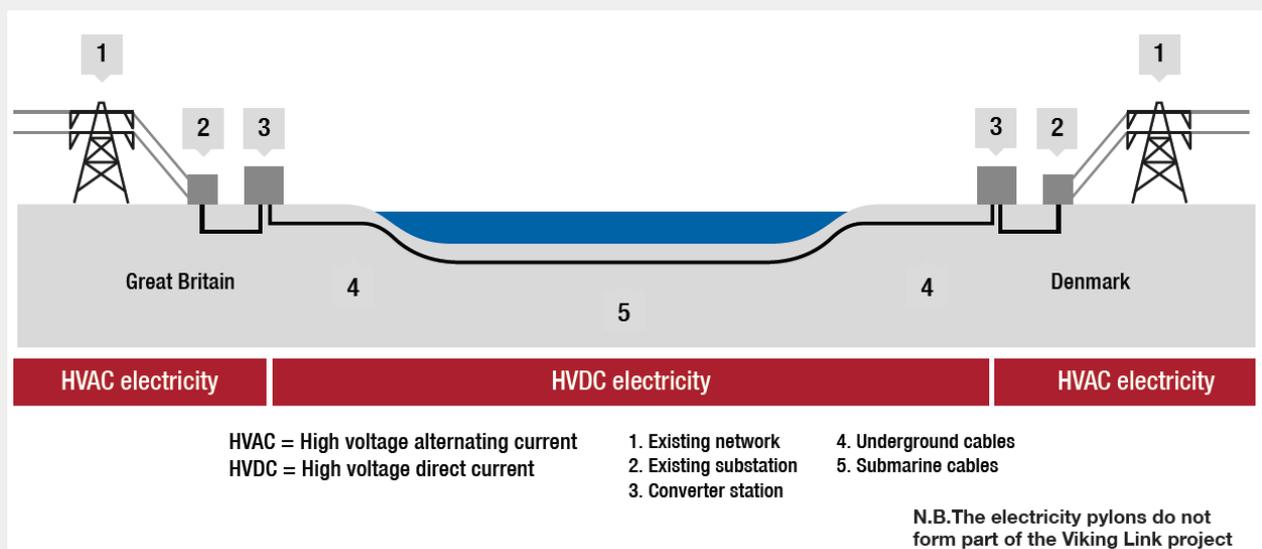


Figure 1.2 Overview of Viking Link

The onshore work in Great Britain will include bringing a pair of electricity cables onshore and running them underground to a new converter station before connecting into the existing NGET substation at Bicker Fen. This is known as the 'UK Onshore Scheme' and will include the following components:

- a landfall site where the two offshore (submarine) DC cables transition to onshore DC cables at a transition joint pit.
- an underground DC cable route (comprising two cables and fibre optic cable) from the landfall to a converter station (approximately 50 kilometres).

¹ <http://www.viking-link.com>

² <http://www2.nationalgrid.com/About-us/European-business-development/Interconnectors/>

³ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/505218/IC_Energy_Report_web.pdf

- a converter station within 5 kilometres of the existing Bicker Fen substation.
- an underground AC cable route (comprising six cables) from the converter station to Bicker Fen substation.
- specialist equipment within the existing Bicker Fen substation.

All the components of the UK Onshore Scheme will require planning permission under the Town and Country Planning Act 1990 and applications will be submitted to the local planning authorities as appropriate.

Potential options for the landfall point and a converter station site have been assessed. Discussions have been held with representatives from local authorities and statutory bodies and the Viking Link team met with parish councils and local residents near potential site options.

Feedback from the public consultation will be carefully considered as part of the process to select a preferred landfall site and converter station location. Once these have been determined, further assessments and public consultation will be undertaken to help identify where the underground cables could be routed.

1.2 Purpose of report

This report aims to provide a non-technical summary of the Viking Link Landfall and Converter Station Site Selection Report, dated April 2016, which outlines the steps taken to identify and assess a shortlist of potential site options to take forward for public consultation in between April and May 2016.

2. Approach to site selection

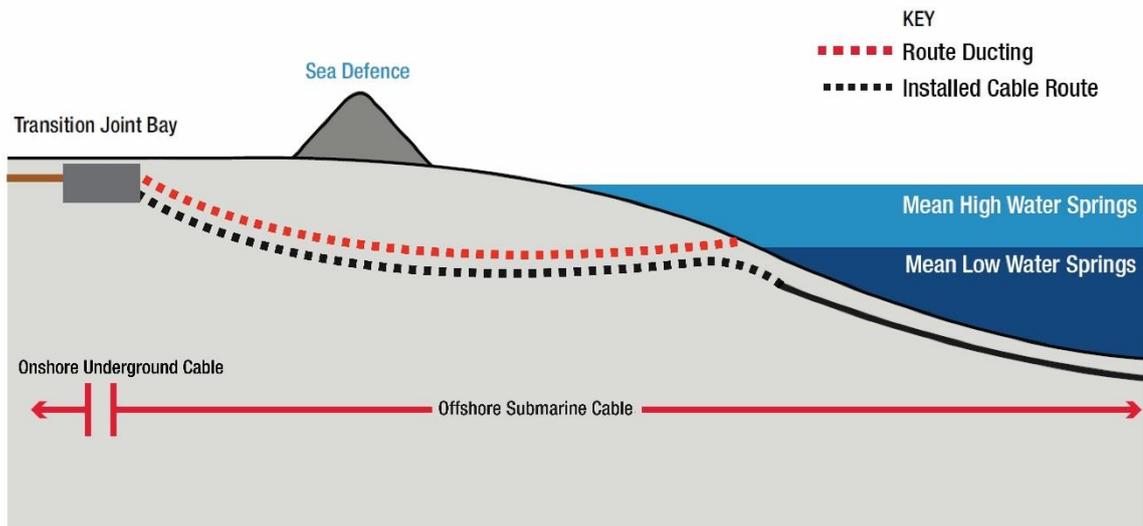
A staged approach to site selection was adopted which took into account potential impacts on the environment and the local community, relevant planning policy as well as technical and engineering design information. The aim of the approach was to balance consideration of these factors and identify potential sites for a landfall and converter station which could be developed.

The outcomes were a shortlist of three potential landfall sites and four potential converter station sites. They are all considered technically feasible and can be constructed. These sites are being taken forward to public consultation and NGVL will seek feedback from local communities and stakeholder organisations to help select a preferred landfall site and converter station location.

3. Landfall site options assessment

3.1 What is a landfall?

A landfall is where the offshore (submarine) cables come onshore and are connected to the onshore cables at a buried transition joint pit. There will be no permanent above ground infrastructure at the landfall for the Viking Link project.



Schematic of a typical landfall

Figure 3.1 Schematic of a typical landfall

3.2 Approach to landfall site selection

NGVL looked for potential landing points along the Lincolnshire coast, from Skegness in the south to Theddlethorpe in the north. The two-staged assessment approach shown below was followed:

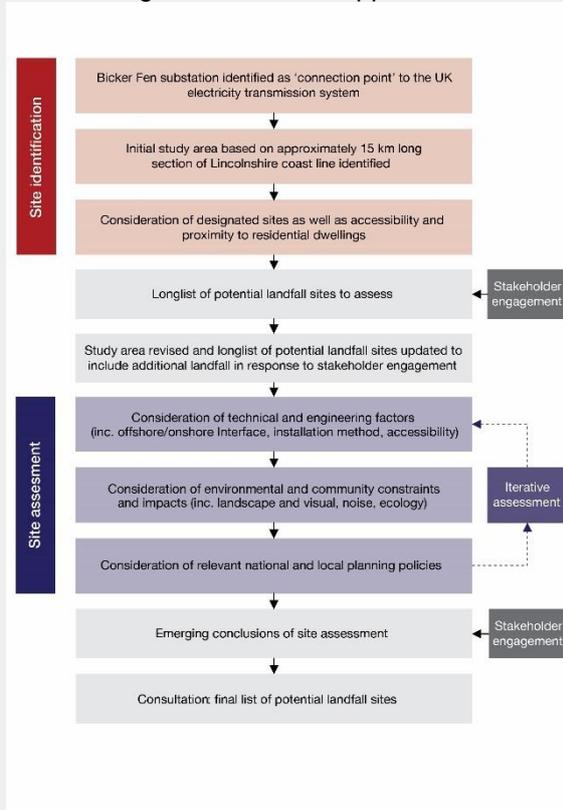


Figure 3.2 Two-stage identification and assessment approach for landfall sites

3.3 Identifying and shortlisting site options

When identifying potential landfall sites, a range of factors were considered, including:

- proximity to residential properties.
- offshore and onshore environmental constraints.
- accessibility and transport routes.
- submarine cable constraints.

The approach and findings were discussed with local authorities and other stakeholder groups. NGVL also met with parish councils and some local residents in the areas identified to find out what's important to the local community.

A list of five sites was taken forward for further assessment and are shown below in Figure 3.3.

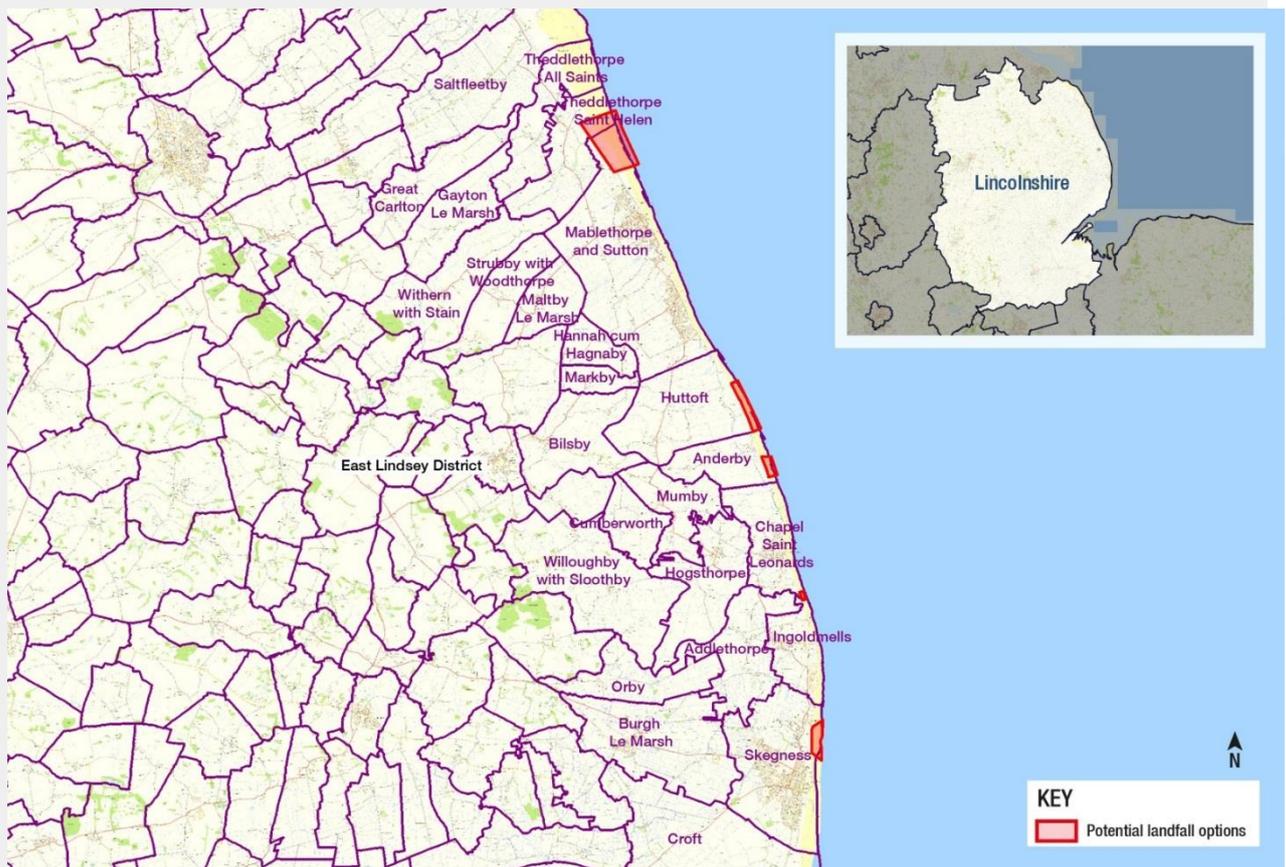


Figure 3.3 Potential identified landfall options

During assessments of these sites, a further potential landfall site was identified which was named LF1A. It is outside of the Lincolnshire Coastal Grazing Marshes, a key constraint.

3.4 Discounted landfall sites

Three landfall sites were discounted as shown below:

Potential site	Location	Key features
LF3	Between Chapel St Leonards to the north and Ingoldmells to the south	<ul style="list-style-type: none"> • Close proximity to caravan park/holiday homes • Constraints to onshore cable routeing due to existing holiday parks to the south of Chapel St Leonards • Restricted beach access due to substantial sea defences • Unsuitable road access from A52
LF4	Adjacent to the North Shore Golf Club in Winthorpe, north of Skegness	<ul style="list-style-type: none"> • Engineering constraints from other existing cables make this site not feasible • Close proximity to settlements, including Skegness • Additional engineering constraints for submarine and onshore cable routeing • Historic landfill site would need to be crossed
LF5	North of Mablethorpe	<ul style="list-style-type: none"> • Highly designated area – both onshore and offshore • Seasonal restrictions on construction work to avoid over wintering birds • Onward land routeing for cables heavily constrained – length of Lincolnshire Coastal Grazing Marshes to be crossed is greater than length of some trenchless techniques that could be utilised

3.5 Shortlisted landfall sites

The sites shortlisted to take forward to consultation were those which were considered to best balance impacts on the environment and the local community, and those with technical and engineering feasibility. They are as follows:

Potential site	Location	Key features
LF1	3.5 kilometres east of Huttoft Village	<ul style="list-style-type: none"> • Distant from major residential settlement • Trenchless construction methods could cross under sea defences and Lincshore area • Impact on Lincolnshire Coastal Grazing Marshes could be avoided by using trenchless construction methods
LF2	South of Anderby Creek	<ul style="list-style-type: none"> • More distant from residential properties • Sea defences limited to natural sand dune defence • Impact on narrow section of Lincolnshire Coastal Grazing Marshes could be avoided by using trenchless construction methods
LF1A	Adjacent to Sandilands Golf Club	<ul style="list-style-type: none"> • Avoids impact on Lincolnshire Coastal Grazing Marshes • Trenchless construction methods could cross under sea defences and Lincshore area • Trenchless construction methods could avoid other ecological impacts

A map showing the shortlisted landfall sites is shown overleaf.



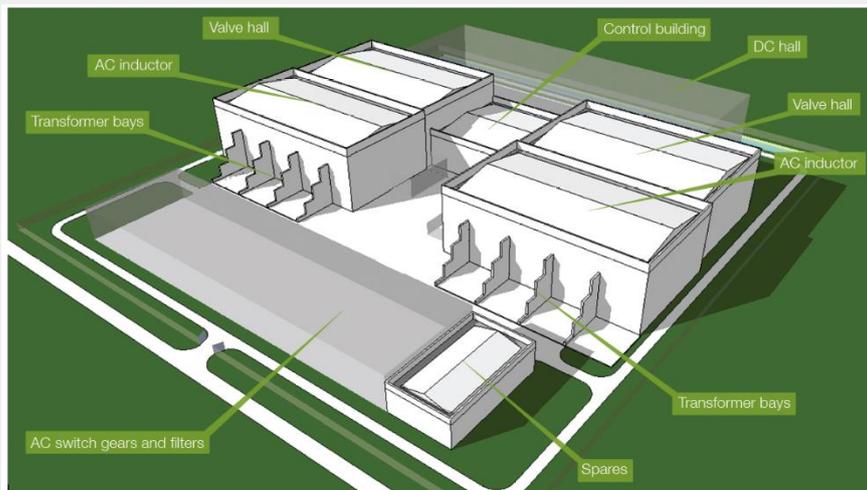
Figure 3.4 Map of shortlisted landfall sites

NGVL did not identify any preference between these three sites and the selection of a preferred site will be informed by feedback provided during the consultation period.

4. Converter station site options assessment

4.1 What is a converter station?

A converter station changes electricity between AC, which we use in our homes, and DC which is more efficient for transporting electricity long distances.



This diagram is not a proposed design but illustrates the main elements of a converter station, which could be arranged differently.

Figure 4.1 Typical layout of a converter station

A typical converter station includes a range of specialist equipment, some of which must be located indoors a series of buildings, some of which could be up to 24 metres tall. A typical converter station includes a control room, transformers, equipment similar to a typical substation, and technology to convert between DC and AC electricity.

NGVL needs to find a suitable site to build a converter station and associated works. These will include:

- sufficient space for the operational footprint of the converter station - around four hectares.
- up to two hectares for the temporary construction facilities including a compound and laydown areas. The construction compound will include a number of temporary facilities, including site offices, staff welfare facilities and parking within a secured compound. It will be needed for the duration of construction which is estimated to be two to three years.
- permanent, 24/7 access to the converter station will be needed for both operational activities.
- a suitable cable route for six underground AC cables from the converter station to the substation at Bicker Fen.

4.2 Approach to converter station site selection

NGVL carried out a three-stage assessment, shown in Figure 4.2 below, to identify potential converter station sites. This approach took into account the following:

- environmental considerations.
- impact on communities.
- planning constraints.
- technical and engineering feasibility.
- safety.

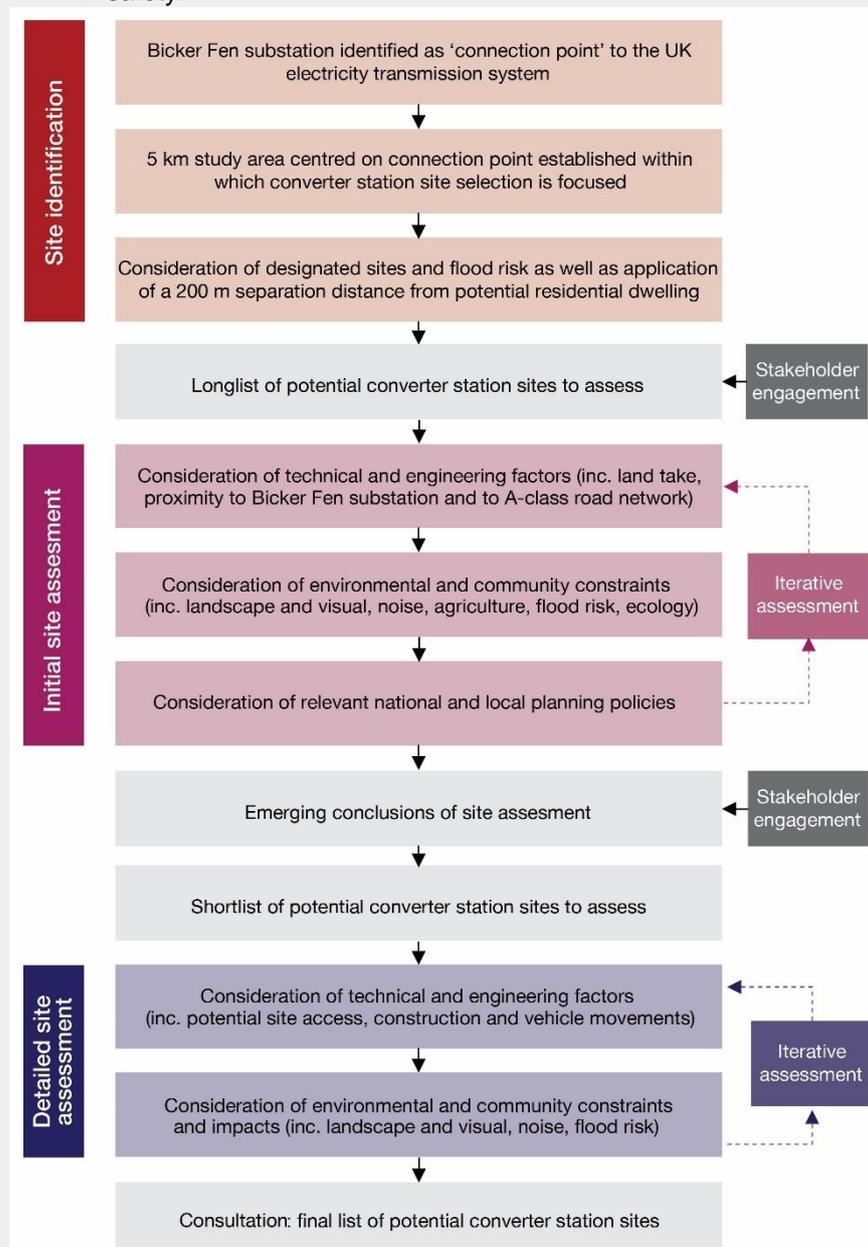


Figure 4.2 Three-stage identification and assessment approach for converter station site

The search area for potential converter station sites was limited to five kilometres from Bicker Fen substation for two key reasons:

- size of converter station – 5 kilometres is the limit that minimises the equipment required and, consequently, the land needed for the converter station.
- impact of AC cables - six underground cables need to be installed between the converter station and Bicker Fen substation. Minimising distance helps reduce any disruption and the land take.

4.3 Identifying and shortlisting site options

Twenty-one potential converter sites were identified within 5 kilometres of Bicker Fen substation.

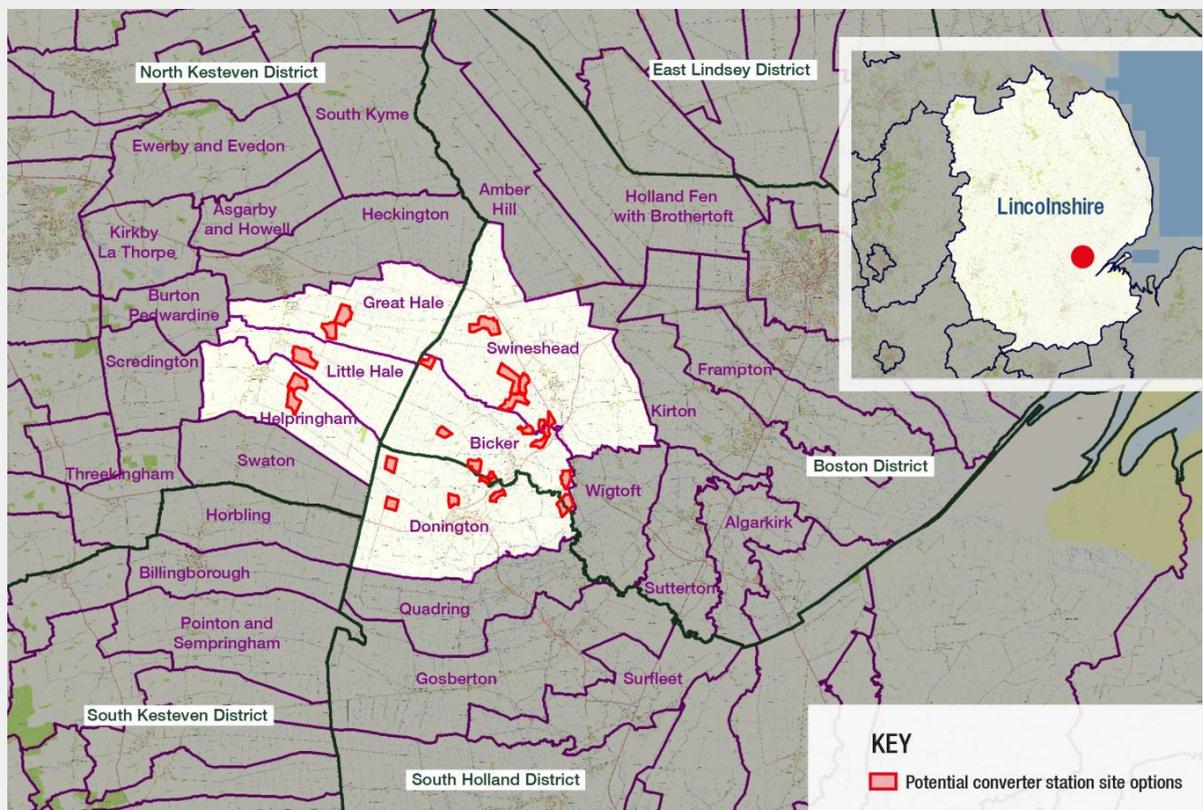


Figure 4.3 Potential identified converter station site options

The approach and findings were discussed with local authorities and other stakeholder. NGVL also met with parish councils and some local residents in the areas identified to find out what’s important to the local community.

Following these discussions, further site visits and desktop assessments as part of stages one and two of the approach, eight potential converter station sites were identified.

The detailed assessment of these eight sites during stage three did not result in a clear preference for one particular site option compared to the others.

Technical and engineering issues were considered alongside potential impacts on the environment and the local community, and four options (listed below as CS1, CS3, CS5 and CS9) emerged as more preferable. These four sites were shortlisted for public consultation.

Four other options (CS4, CS6, CS10 and CS17) are technically feasible but are either more constrained or have the potential for greater impact on the local community or landscape.

The key features of all the sites which were not shortlisted are given below:

Potential site	Location	Key features
CS2	Donington Parish	<ul style="list-style-type: none"> • High risk of flooding • Challenges arising from proximity to railway line
CS4	Swineshead Parish	<ul style="list-style-type: none"> • Potential for disturbance to larger number of people • Greater environmental impact than alternative sites
CS6	Swineshead Parish	<ul style="list-style-type: none"> • Potential for disturbance to larger number of people • Land available for development is more constrained reducing flexibility for design
CS7	Helpringham Parish	<ul style="list-style-type: none"> • Limited accessibility requiring significant improvement work • Potential for disturbance to larger number of people • Distance from Bicker Fen substation meaning longer AC cable route
CS8	Little Hale Parish	<ul style="list-style-type: none"> • Limited accessibility requiring significant improvement work • Potential for disturbance to larger number of people • Distance from Bicker Fen substation meaning longer AC cable route
CS10	Swineshead Parish/Bicker Parish	<ul style="list-style-type: none"> • Potential for disturbance to larger number of people • Land available for development more constrained reducing flexibility for design
CS11; CS12; CS13	Bicker Parish	<ul style="list-style-type: none"> • Existing utilities significantly constrain the amount of land available, not possible to develop site
CS14	Bicker Parish/Donington Parish	<ul style="list-style-type: none"> • Existing utilities significantly constrain the amount of land available, not possible to develop site • Potential for disturbance to larger number of people
CS15	Helpringham Parish	<ul style="list-style-type: none"> • Limited accessibility requiring significant improvement work • Potential for disturbance to larger number of people • Distance from Bicker Fen substation meaning longer AC cable route

Potential site	Location	Key features
CS16	Bicker Parish/Donington Parish	<ul style="list-style-type: none"> • Greater environmental impact than other sites • Distance from Bicker Fen substation meaning longer AC cable route
CS17	Bicker Parish	<ul style="list-style-type: none"> • Potential for disturbance to larger number of people
CS18	Great Hale Parish	<ul style="list-style-type: none"> • Limited accessibility requiring significant improvement work • Potential for disturbance to larger number of people • Distance from Bicker Fen substation meaning longer AC cable route
CS19	Great Hale Parish	<ul style="list-style-type: none"> • Limited accessibility requiring significant improvement work • Potential for disturbance to larger number of people • Distance from Bicker Fen substation meaning longer AC cable route
CS20	Donington Parish	<ul style="list-style-type: none"> • Potential for disturbance to larger number of people
CS21	Donington Parish	<ul style="list-style-type: none"> • Land available for development is more constrained reducing flexibility for design

4.4 Shortlisted converter station sites

The potential sites shortlisted to take forward to consultation were those which were considered to best balance impacts on the environment and the local community and those with technical and engineering feasibility. They are as follows:

Potential site	Location	Key features
CS1	Donington Parish	<ul style="list-style-type: none"> • No constraints on orientation or layout • Remote from larger settlements and communities reducing potential disturbance • Proximity to existing development in area allows for better landscape 'fit' • Closeness to Bicker Fen substation reduces length of AC cable needed - reducing impact on archaeology, ecology and agriculture • Permanent land take for all infrastructure could be contained in one field • No significant environmental constraints aside from flood risk • Potential to develop a new access road to avoid use of local roads through Northorpe village

Potential site	Location	Key features
CS3	Bicker Parish	<ul style="list-style-type: none"> • Site is large enough and allows for some flexibility of layout and orientation • Additional suitable land is available next to the site, if required for landscape screening or construction purposes • Closeness to Bicker Fen substation reduces length of AC cable needed - reducing impact on archaeology, ecology and agriculture • Proximity to existing and proposed infrastructure development allows for better character 'fit' • Remote from larger settlements and individual properties, reducing potential disturbance • Permanent land take for all infrastructure could be contained in two fields • No significant environmental constraints within the site • Potential to develop a new access road to avoid use of local roads and bridges
CS5	Swineshead Parish	<ul style="list-style-type: none"> • Site is large enough and allows for flexibility of layout and orientation • Additional suitable land available next to site, if required for construction purposes • Close to A17 with direct public road access avoiding residential properties • Potential to build new access road to A17 if required • No significant environmental constraints within site
CS9	Bicker Parish	<ul style="list-style-type: none"> • Site is large enough and allows for flexibility of layout and orientation • Enough space to allow for potential landscape and drainage requirements as well as temporary construction facilities • Closeness to Bicker Fen substation reduces length of AC cable route needed - reducing impact on archaeology, ecology and agriculture • Proximity to existing electricity infrastructure allows for better landscape 'fit' • Remote from larger settlements and individual properties, reducing potential for disturbance • No significant environmental constraints within the site

A map showing the shortlisted converter station sites is shown in Figure 4.4.



Figure 4.4 Map of shortlisted converter station sites

NGVL did not identify any preference between these sites and the selection of a preferred site will be informed by feedback provided during the consultation period.

5. Next Steps

5.1 Public consultation

There will be two phases of public consultation as part of the Viking Link pre-application process. This follows months of early engagement with a wide range of statutory stakeholders, local authorities, parish and town councils and local residents.

During the first phase of consultation, NGVL will consult on the shortlisted site options for a landfall and converter station. Phase one consultation will take place from Monday 11 April until Friday 20 May 2016 (inclusive) with public exhibitions scheduled as follows:

Public consultation events: converter station areas

Venue	Date	Time
Swineshead Village Hall	Thursday 14 April 2016	12pm-8pm
Bicker Village Hall	Saturday 16 April 2016	10am-4pm
Donington, The Ruby Hunt Centre	Friday 22 April 2016	12pm-8pm

Public consultation events: landfall areas

Venue	Date	Time
Anderby Village Hall	Thursday 21 April 2016	12pm-8pm
Huttoft Village Hall	Saturday 23 April 2016	10am-4pm
Sandilands, Grange & Links Hotel	Wednesday 27 April 2016	12pm-8pm

The consultation feedback will be carefully considered, along with analysis from technical and environmental assessments and will be used to identify preferred landfall and converter station sites.

The feedback analysis and conclusions will be published in a consultation feedback report as part of the second phase of consultation. The report will outline how the feedback from the phase one consultation influenced Viking Link's choice for its preferred landfall and converter station sites.

The second phase of consultation, expected to be held later in summer 2016, will focus on the onshore cable route corridor options between the preferred landfall and converter station sites.

NGVL will also consult on the AC cable route corridor options between the converter station and Bicker Fen substation. During phase two, consultation will also be carried out on design options for the converter station building.

A similar feedback exercise will take place following the conclusion of phase two consultation. The two feedback reports will form the basis of the final Consultation Report which will be submitted to the local planning authorities as part of the Viking Link planning applications.

5.2 Project timeline

An indicative timeline is shown overleaf. NGVL expects Viking Link to be operational in 2022.

Project timeline

2014

- Cooperation agreement between National Grid and Energinet.dk
- NGVL granted interconnector licence

2015

- Ofgem 'cap and floor' regulatory regime confirmed
- PCI status confirmation

2016

- | | |
|---|---|
| <p>Spring</p> <ul style="list-style-type: none"> ▪ First stage consultation ▪ Marine surveys start | <p>Summer</p> <ul style="list-style-type: none"> ▪ Energinet.dk hold similar consultation events in Denmark ▪ Second stage consultation ▪ Environmental surveys start |
|---|---|

2017

- Consent applications**
- Onshore elements of project to Local Planning Authorities
 - Marine elements to Marine Management Organisation
 - Danish offshore and onshore work
 - Netherlands and Germany permits for offshore route through territorial water

2018

- Financial Investment Decision
- Construction Contracts Awarded

2019

- DC cable manufacture and installation
- Commence construction

2022

- Testing, commissioning and operating

6. Glossary

Definition of terms

AC	Alternating current
CS	Potential converter station site option reference
DC	Direct current
DE	German (from Figure 1.1)
DK	Denmark (from Figure 1.1)
EC	European Commission
EU	European Union
GB	Great Britain
LF	Potential landfall site option reference
NGET	National Grid Electricity Transmission plc
NGVL	National Grid Viking Link Limited
NL	Netherlands/Dutch (from Figure 1.1)
UK	United Kingdom

Units

MW	Mega Watt (1,000,000 Watts = 1×10^6 Watts)
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