The Keadby 3 Low Carbon Gas Power Station Project

Document Ref: 5.11

Planning Inspectorate Ref: EN010114

The Keadby 3 (Carbon Capture Enabled Gas Fired Generating Station) Order

Land at and in the vicinity of the Keadby Power Station site, Trentside, Keadby, North Lincolnshire

Indicative Lighting Strategy

The Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 – Regulation 5(2)(q)

Applicant: Keadby Generation Limited

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GLOSSARY

Abbreviation	Description
AGI	Above Ground Installation - installations used to support the safe and efficient operation of a pipeline; above ground installations are needed at the start and end of a cross-country pipeline and at intervals along the route.
AIL	Abnormal Indivisible Load - a load that cannot be broken down into smaller loads for transport without undue expense or risk of damage. It may also be a load that exceeds certain parameters for weight, length and width.
BS	British Standard - business standards based upon the principles of standardisation recognised inter alia in European Policy.
CAA	Civil Aviation Authority - responsible for the regulation of aviation safety in the UK.
CCGT	Combined Cycle Gas Turbine - a highly efficient form of energy generation technology. An assembly of heat engines work in tandem using the same source of heat to convert it into mechanical energy which drives electrical generators and consequently generates electricity.
CCP	Carbon Capture Plant – plant used to capture carbon dioxide (CO_2) emissions produced from the use of fossil fuels in electricity generation and industrial processes.
CCUS	Carbon Capture, Usage and Storage - group of technologies designed to reduce the amount of carbon dioxide (CO_2) released into the atmosphere from coal and gas power stations as well as heavy industry including cement and steel production. Once captured, the CO_2 can be either re-used in various products, such as cement or plastics (usage), or stored in geological formations deep underground (storage).
CEMP	Construction Environmental Management Plan – a plan to outline how a construction project will avoid, minimise or mitigate effects on the environment and surrounding area.
CIBSE	The Chartered Institute of Building Services Engineers - an international association within the building services industry.
DCO	Development Consent Order - made by the relevant Secretary of State pursuant to The Planning Act 2008 to authorise a Nationally

Abbreviation	Description
	Significant Infrastructure Project. A DCO can incorporate or remove the need for a range of consents which would otherwise be required for a development. A DCO can also include rights of compulsory acquisition.
ES	Environmental Statement – A report in which the process and results of an Environment Impact Assessment are documented.
HP	High Pressure
HRSG	Heat Recovery Steam Generator - an energy recovery heat exchanger that recovers heat from a hot gas stream. It produces steam that can be used in a process (cogeneration) or used to drive a steam turbine (combined cycle).
ILP	The Institute of Lighting Professionals – a professional body for lighting for the built environment.
LMP	Light Management Plan - accompanies the detailed Construction Environmental Management Plan (CEMP) which sets out the approach for use of lighting during the construction phase.
MW	Megawatt - unit of energy.
NEP	The Northern Endurance Partnership - a partnership between bp, Eni, Equinor, National Grid, Shell and Total to develop infrastructure to transport and store CO_2 emissions.
NLC	North Lincolnshire Council
NPPF	National Planning Policy Framework - the NPPF is part of the Government's reform of the planning system intended to make it less complex, to protect the environment and to promote sustainable growth. It does not contain any specific policies on Nationally Significant Infrastructure Projects, but its policies may be taken into account in decisions on DCOs if the Secretary of State considers them to be both important and relevant.
NPS	National Policy Statement - Statement produced by Government under the Planning Act 2008 providing the policy framework for Nationally Significant Infrastructure Projects. They include the Government's view of the need for and objectives for the development of Nationally Significant Infrastructure Projects in a particular sector such as energy and are used to determine applications for such development.
NSIP	Nationally Significant Infrastructure Project – defined by the Planning Act 2008 and cover projects relating to energy (including generating stations, electric lines and pipelines); transport (including trunk roads and motorways, airports, harbour facilities, railways and rail freight interchanges); water (dams and reservoirs, and the transfer of water resources); waste water treatment plants and hazardous waste facilities. These projects

Abbreviation	Description
	are only defined as nationally significant if they satisfy a statutory threshold in terms of their scale or effect.
SLL	Society of Light and Lighting - an authority on lighting.
SoS	Secretary of State - title typically held by Cabinet Ministers in charge of Government Departments.
ZCH	Zero Carbon Humber - a consortium of energy and industrial companies and academic institutions with a shared vision to transform the Humber region into the UK's first net-zero carbon cluster by 2040.

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1 Keadby Generation Limited (the 'Applicant') is seeking development consent for the construction, operation and maintenance of a new low carbon Combined Cycle Gas Turbine (CCGT) Generating Station ('the Proposed Development'). The Proposed Development is a new gas fired electricity generating station of up to 910 megawatts (MW) of gross electrical output with state-of-the art carbon capture technology and including cooling water, electrical, gas and utility connections, construction laydown areas and other associated works on land to the west of the existing Keadby 2 Power Station, under construction. The Proposed Development will therefore make a significant contribution toward the UK reaching its Net Zero greenhouse gas emissions target by 2050.

2 This Indicative Lighting Strategy discusses the lighting requirements of the Proposed Development, including a review of the relevant legislation, lighting standards and guidance to limit light pollution.

3 The main lighting design principles for the Proposed Development are:

- to ensure the health and safety of employees and visitors performing normal working duties;
- to ensure the safe movement of vehicular and pedestrian traffic around the Proposed Development Site during the hours of darkness;
- to minimise light pollution in terms of light trespass, sky glow and glare to the identified sensitive receptors, including the Keadby Ash Tip; and
- to ensure the security of the Proposed Development Site and its occupants including lighting suitable for the correct functioning of the preferred CCTV system.

4 The key features of the operational lighting equipment and controls are described, with the overarching philosophy being to have a reduced light site. Details will be developed at the detailed design stage, in accordance with the principles of this Strategy, and this is secured by a requirement in the draft Development Consent Order (DCO) (**Application Document Ref. 2.1**).

5 Construction lighting will also be required for safety and security purposes, but this will also be designed to avoid excessive glare and minimise light spill. Details of construction lighting will accord with the principles of this Strategy and be secured by a requirement in the draft DCO (**Application Document Ref. 2.1**).

6 In summary it is concluded that the Indicative Lighting Strategy provides an appropriate outline of the lighting requirements for the Proposed Development as part of the Application and identifies potential measures to adequately control obtrusive light through detailed design of the lighting scheme. The controls are secured through requirements in the draft DCO (**Application Document Ref. 2.1**).

1.0 INTRODUCTION

1.1 Overview

1.1.1 This Indicative Lighting Strategy (**Application Document Ref. 5.11**) has been prepared by AECOM on behalf of Keadby Generation Limited (the 'Applicant') which is a wholly owned subsidiary of SSE plc. It forms part of the application (the 'Application') for a Development Consent Order (a 'DCO'), that has been submitted to the Secretary of State (the 'SoS') for Business, Energy and Industrial Strategy, under section 37 of 'The Planning Act 2008' (the '2008 Act').

1.1.2 The Applicant is seeking development consent for the construction, operation and maintenance of a new low carbon Combined Cycle Gas Turbine (CCGT) Generating Station ('the Proposed Development') on land at, and in the vicinity of, the existing Keadby Power Station, Trentside, Keadby, Scunthorpe DN17 3EF (the 'Proposed Development Site').

1.1.1 The Proposed Development is a new electricity generating station of up to 910 megawatts (MW) gross electrical output, equipped with carbon capture and compression plant and fuelled by natural gas, on land to the west of Keadby 1 Power Station and the (under construction) Keadby 2 Power Station, including connections for cooling water, electrical, gas and utilities, construction laydown areas and other associated development. It is described in **Chapter 4:** The Proposed Development of the Environmental Statement (ES) (ES Volume I - **Application Document Ref. 6.2**).

1.1.2 The Proposed Development falls within the definition of a 'Nationally Significant Infrastructure Project' (NSIP) under Section 14(1)(a) and Sections 15(1) and (2) of the 2008 Act, as it is an onshore generating station in England that would have a generating capacity greater than 50MW electrical output (50MWe). As such, a DCO application is required to authorise the Proposed Development in accordance with Section 31 of the 2008 Act.

1.1.3 The DCO, if made by the SoS, would be known as 'The Keadby 3 (Carbon Capture Equipped Gas Fired Generating Station) Order' ('the Order').

1.2 The Applicant

1.2.1 The Applicant, Keadby Generation Limited, is the freehold owner of a large part of the Proposed Development Site and is a wholly owned subsidiary of the FTSE 100-listed SSE plc, one of the UK's largest and broadest-based energy companies, and the country's leading developer of renewable energy generation. Over the last 20 years, SSE plc has invested over £20bn to deliver industry-leading offshore wind, onshore wind, CCGT, energy from waste, biomass, energy networks and gas storage projects. The Applicant owns and operates the adjacent Keadby 1 Power Station and is in the process of constructing Keadby 2 Power Station. SSE operates the Keadby Windfarm which lies to the north and south of the Proposed Development Site and

generates renewable energy from 34 turbines, with a total installed generation capacity of 68MW.

1.2.2 SSE has produced a 'Greenprint' document (SSE plc, 2020a) that sets out a clear commitment to investment in low carbon power infrastructure, working with government and other stakeholders to create a net zero power system by 2040. This includes investment in flexible sources of electricity generation and storage for times of low renewable output which will complement other renewable generating sources, using low carbon fuels and/ or capturing and storing carbon emissions. SSE is working with leading organisations across the UK to accelerate the development of carbon capture, usage and storage ('CCUS') clusters, including Equinor and National Grid Carbon.

1.2.3 The design of the Proposed Development demonstrates this commitment. The Proposed Development will be built with a clear route to decarbonisation, being equipped with post-combustion carbon capture technology, consistent with SSE's commitment to reduce the carbon intensity of electricity generated by 60% by 2030, compared to 2018 levels (SSE plc, 2020b). It is intended that the Proposed Development will connect to infrastructure that will be delivered by the Zero Carbon Humber (ZCH) Partnership [1] and Northern Endurance Partnership (NEP)[2] for the transport and offshore geological storage of carbon dioxide.

1.3 What is Carbon Capture, Usage and Storage?

1.3.1 CCUS is a process that removes carbon dioxide emissions at source, for example emissions from a power station or industrial installation, and then compresses the carbon dioxide so that it can be safely transported to secure underground geological storage sites. It is then injected into layers of solid rock filled with interconnected pores where the carbon dioxide becomes trapped and locked in place, preventing it from being released into the atmosphere. Plate 1 shows what is involved in the process.

[1] https://www.zerocarbonhumber.co.uk/the-vision/

[2] https://www.zerocarbonhumber.co.uk/news/northern-endurance-partnership/

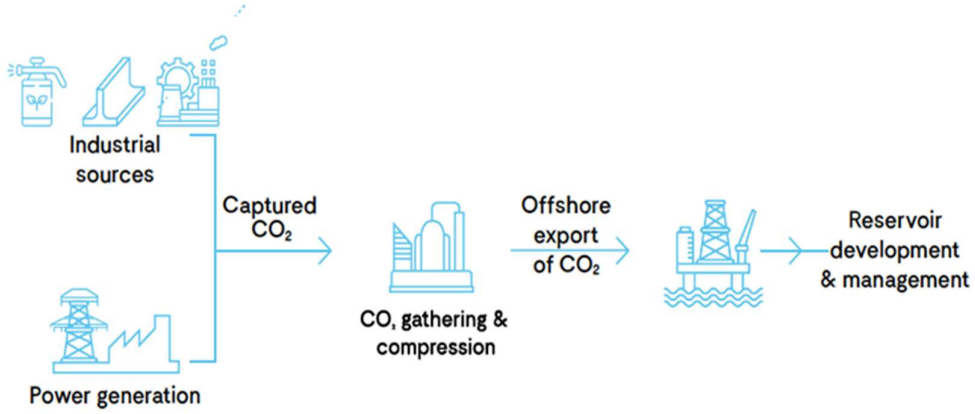


Plate 1: Illustration of the Carbon Capture, Usage and Storage

1.3.2 The technologies used in CCUS are proven and have been used safely across the world for many years. Geological storage sites are located far underground and are subject to stringent tests to ensure that they are geologically suitable. It is expected that the storage sites will be located offshore, in areas such as the North Sea. The NEP has been formed to develop the offshore infrastructure to transport and store carbon dioxide emissions in the North Sea.

1.3.3 CCUS is crucial to reducing carbon dioxide emissions and combatting global warming. The UK Government has committed to achieving Net Zero in terms of greenhouse gas emissions by 2050. This is a legally binding target. UK Government policy further states that the '*deployment of power CCUS projects will play a key role in the decarbonisation of the electricity system at low cost'* (HM Government, 2020a, page 47).

1.3.4 The Proposed Development will provide up to 910MWe (gross) of dispatchable capacity and capture some 2 million tonnes of carbon dioxide per annum, dependent upon the turbine equipment chosen and the running hours of the plant. The Proposed Development could be up and running by the mid-2020s and will facilitate the timely development of a major CCUS cluster in the Humber region, making an important contribution towards the achievement of Net Zero by 2050.

1.4 The Proposed Development

1.4.1 The Proposed Development will work by capturing carbon dioxide emissions from the gas-fired power station and connecting into the ZCH Partnership export pipeline and gathering network for onward transport to the Endurance saline aquifer under the North Sea.

1.4.2 The Proposed Development would comprise a low carbon gas fired power station with a gross electrical output capacity of up to 910MWe and associated buildings, structures and plant and other associated development defined in the

Schedule 1 of the draft DCO (**Application Document Ref. 2.1**) as Work No. 1 – 11 and shown on the Works Plans (**Application Document Ref. 4.3**).

1.4.3 At this stage, the final technology selection cannot yet be made as it will be determined by various technical and economic considerations and will be influenced by future UK Government policy and regulation. The design of the Proposed Development therefore incorporates a necessary degree of flexibility to allow for the future selection of the preferred technology in the light of prevailing policy, regulatory and market conditions once a DCO is made.

1.4.4 The Proposed Development will include:

- a carbon capture equipped electricity generating station including a CCGT plant (**Work No. 1A**) with integrated cooling infrastructure (**Work No. 1B**), and carbon dioxide capture plant (CCP) including conditioning and compression equipment, carbon dioxide absorption unit(s) and stack(s) (**Work No. 1C**), natural gas receiving facility (**Work No. 1D**), supporting uses including control room, workshops, stores, raw and demineralised water tanks and permanent laydown area (**Work No. 1E**), and associated utilities, various pipework, water treatment plant, wastewater treatment, firefighting equipment, emergency diesel generator, gatehouse, chemical storage facilities, other minor infrastructure and auxiliaries/ services (all located in the area referred to as the 'Proposed Power and Carbon Capture (PCC) Site' and which together form **Work No. 1**);
- natural gas pipeline from the existing National Grid Gas high pressure (HP) gas pipeline within the Proposed Development Site to supply the Proposed PCC Site including an above ground installation (AGI) for National Grid Gas's apparatus (**Work No. 2A**) and the Applicant's apparatus (**Work No. 2B**) (the 'Gas Connection Corridor');
- electrical connection works to and from the existing National Grid 400kV Substation for the export of electricity (**Work No. 3A**) (the 'Electrical Connection Area to National Grid 400kV Substation');
- electrical connection works to and from the existing Northern Powergrid 132kV Substation for the supply of electricity at up to 132kV to the Proposed PCC Site, and associated plant and equipment (**Work No. 3B**) (the 'Potential Electrical Connection to Northern Powergrid 132kV Substation');
- Water Connection Corridors to provide cooling and make-up water including:
  - underground and/ or overground water supply pipeline(s) and intake structures within the Stainforth and Keadby Canal, including temporary cofferdam (**Work No. 4A**) (the 'Canal Water Abstraction Option');
  - in the event that the canal abstraction option is not available, works to the existing Keadby 1 power station cooling water supply pipelines and intake structures within the River Trent, including temporary cofferdam (**Work No. 4B**) (the 'River Water Abstraction Option');

  - works to and use of an existing outfall and associated pipework for the discharge of return cooling water and treated wastewater to the River Trent (**Work No. 5**) (the 'Water Discharge Corridor');
- towns water connection pipeline from existing water supply within the Keadby Power Station to provide potable water (**Work No. 6**);
- above ground carbon dioxide compression and export infrastructure comprising an above ground installation (AGI) for the undertaker's apparatus including deoxygenation, dehydration, staged compression facilities, outlet metering, and electrical connection (**Work No. 7A**) and an above ground installation (AGI) for National Grid Carbon's apparatus (**Work No. 7B**);
- new permanent access from A18, comprising the maintenance and improvement of an existing private access road from the junction with the A18 including the western private bridge crossing of the Hatfield Waste Drain (**Work No. 8A**) and installation of a layby and gatehouse (**Work No. 8B**), and an emergency vehicle and pedestrian access road comprising the maintenance and improvement of an existing private track running between the Proposed PCC Site and Chapel Lane, Keadby and including new private bridge (**Work No. 8C**);
- temporary construction and laydown areas including contractor facilities and parking (**Work No. 9A**), and access to these using the existing private roads from the A18 and the existing private bridge crossings, including the replacement of the western existing private bridge crossing known as 'Mabey Bridge') over Hatfield Waste Drain (**Work No. 9B**) and a temporary construction laydown area associated with that bridge replacement (**Work No. 9C**);
- temporary retention, improvement and subsequent removal of an existing Additional Abnormal Indivisible Load Haulage Route (**Work No. 10A**) and temporary use, maintenance, and placement of mobile crane(s) at the existing Railway Wharf jetty for a Waterborne Transport Offloading Area (**Work No. 10B**);
- landscaping and biodiversity enhancement measures (**Work No. 11A**) and security fencing and boundary treatments (**Work No. 11B**); and
- associated development including: surface water drainage systems; pipeline and cable connections between parts of the Proposed Development Site; hard standings and hard landscaping; soft landscaping, including bunds and embankments; external lighting, including lighting columns; gatehouses and weighbridges; closed circuit television cameras and columns and other security measures; site preparation works including clearance, demolition, earthworks, works to protect buildings and land, and utility connections; accesses, roads, roadways and vehicle and cycle parking; pedestrian and cycle routes; and temporary works associated with the maintenance of the authorised development.

1.4.5 The Applicant will be responsible for the construction, operation (including maintenance) and eventual decommissioning of the Proposed Development,

with the exception of the National Grid Gas compound works (**Work No. 2A**), the works within the National Grid Electricity Transmission 400kV substation (part of **Work No. 3A**), the works within the Northern Powergrid 132kV substation (part of **Work No. 3B**), and the National Grid Carbon compound works (**Work No. 7B**), which will be the responsibility of those named beneficiaries.

1.4.6 The Proposed Development includes the equipment required for the capture and compression of carbon dioxide emissions from the generating station so that it is capable of being transported off-site. ZCH Partnership will be responsible for the construction, operation and decommissioning of the carbon dioxide gathering network linking onshore power and industrial facilities including the Proposed Development in the Humber Region. The carbon dioxide export pipeline does not, therefore, form part of the Proposed Development and is not included in the Application but will be the subject of separate consent applications by third parties, such as the Humber Low Carbon Pipeline DCO Project by National Grid Carbon[3].

1.4.7 The Proposed Development will operate 24 hours per day, 7 days per week with programmed offline periods for maintenance. It is anticipated that in the event of CCP maintenance outages, for example, it will be necessary to operate the Proposed Development without carbon capture, with exhaust gases from the CCGT being routed via the Heat Recovery Steam Generator (HRSG) stack.

1.4.8 Various types of associated and ancillary development further required in connection with and subsidiary to the above works are detailed in Schedule 1 'Authorised Development' of the draft DCO (**Application Document Ref. 2.1**). This along with **Chapter 4:** The Proposed Development in the ES Volume I (**Application Document Ref. 6.2**) provides further description of the Proposed Development. The areas within which each numbered Work (component) of the Proposed Development are to be built are defined by the coloured and hatched areas on the Works Plans (**Application Document Ref. 4.3**).

1.5 The Proposed Development Site

1.5.1 The Proposed Development Site (the 'Order Limits') is located within and near to the existing Keadby Power Station site near Scunthorpe, Lincolnshire and lies within the administrative boundary of North Lincolnshire Council (NLC). The majority of land is within the ownership or control of the Applicant (or SSE associated companies) and is centred on national grid reference 482351, 411796.

[3] https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/humber-low-carbon-pipelines/

1.5.2 The existing Keadby Power Station site currently encompasses the operational Keadby 1 and (under construction) Keadby 2 Power Station sites, including the Keadby 2 Power Station Carbon Capture and Readiness reserve space.

1.5.3 The Proposed Development Site encompasses an area of approximately 69.4 hectares (ha). This includes an area of approximately 18.7ha to the west of Keadby 2 Power Station in which the generating station (CCGT plant, cooling infrastructure and CCP) and gas connection will be developed (the Proposed PCC Site).

1.5.4 The Proposed Development Site includes other areas including:

- Previously developed land, along with gas, towns water and other connections, and access routes, within the Keadby Power Station site;
- the National Grid 400kV Substation located directly adjacent to the Proposed PCC Site, through which electricity generated by the Proposed Development will be exported;
- Emergency Vehicle Access Road and Potential Electrical Connection to Northern Powergrid Substation, the routes of which utilise an existing farm access track towards Chapel Lane and land within the existing Northern Powergrid substation on Chapel Lane;
- Water Connection Corridors:
  - Canal Water Abstraction Option which includes land within the existing Keadby Power Station site with an intake adjacent to the Keadby 2 Power Station intake and pumping station and interconnecting pipework;
  - River Water Abstraction Option which includes a corridor that spans Trent Road and encompasses the existing Keadby Power Station pumping station, below ground cooling water pipework, and infrastructure within the River Trent; and
  - a Water Discharge Corridor which includes an existing discharge pipeline and outfall to the River Trent and follows a route of an existing easement for Keadby 1 Power Station;
- an existing river wharf at Railway Wharf (the Waterborne Transport Offloading Area) and existing temporary haul road into the into the existing Keadby 1 Power Station Site (the 'Additional Abnormal Indivisible Load (AIL) Route');
- a number of temporary Construction Laydown Areas on previously developed land and adjoining agricultural land; and
- land at the A18 Junction and an existing site access road, including two existing private bridge crossing of the Hatfield Waste Drain lying west of Pilfrey Farm (the western of which is known as Mabey Bridge, to be replaced, and the eastern of which is termed Skew Bridge) and an existing temporary gatehouse, to be replaced in permanent form.

1.5.5 In the vicinity of the Proposed Development Site the River Trent is tidal, therefore parts of the Proposed Development Site are within the UK marine area. No harbour works are proposed.

1.5.6 Further description of the Proposed Development Site and its surroundings is provided in **Chapter 3:** The Site and Surrounding Area in ES Volume I (**Application Document Ref. 6.2**).

1.6 The Development Consent Process

1.6.1 As a NSIP project, the Applicant is required to obtain a DCO to construct, operate and maintain the generating station, under Section 31 of the 2008 Act. Sections 42 to 48 of the 2008 Act govern the consultation that the promoter must carry out before submitting an application for a DCO and Section 37 of the 2008 Act governs the form, content and accompanying documents that are required as part of a DCO application. These requirements are implemented through the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended) ('APFP Regulations') which state that an application must be accompanied by an ES, where a development is considered to be 'EIA development' under the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations).

1.6.2 An application for development consent for the Proposed Development has been submitted to the Planning Inspectorate (PINS) acting on behalf of the Secretary of State. Subject to the Application being accepted (which will be decided within a period of 28 days following receipt of the Application), PINS will then examine it and make a recommendation to the Secretary of State, who will then decide whether to make (grant) the DCO.

1.7 The Purpose and Structure of this Document

1.7.1 The Proposed Development will require the installation of a number of luminaires to provide visual comfort, safety and operational performance, which in turn will have the potential to result in obtrusive light at receptor locations.

1.7.2 At the time of submission of the Application, the engineering, procurement and construction (EPC) contractor(s) have not been appointed and detailed design work for the Proposed Development has not been carried out. Therefore, detailed information on the lighting to be used at the Proposed Development is not yet available. Nevertheless, it is recognised that to prevent potential nuisance from lighting, the Application should set out general proposals as to the purposes, types and levels of lighting required, to allow an appropriate level of control to be secured within the DCO; this is the purpose of the Indicative Lighting Strategy. The EIA (in particular the landscape and visual amenity assessment (LVIA) presented in **Chapter 14** and assessment of impacts on sensitive species and habitats presented in **Chapter 11**: Biodiversity and Nature Conservation – ES Volume I – **Application Document Ref. 6.2**) assumes that the measures to reduce obtrusive light at receptor locations as set out within this document are in place.

1.7.3 The Indicative Lighting Strategy is structured as follows:

- Sections 2 and 3 provide information on pertinent standards and guidance relating to obtrusive lighting and lighting design;
- Section 4 outlines design principles and obtrusive light impact avoidance measures;
- Section 5 describes the existing lighting baseline within the area of the Proposed Development Site;
- Section 6 describes the proposed lighting by area within the Proposed Development Site;
- Section 7 describes the operational lighting equipment and controls to be used within the Proposed Development;
- Section 8 describes the construction phase site lighting; and
- Section 9 provides a summary and conclusions.

2.0 OBTRUSIVE LIGHT STANDARDS AND GUIDANCE

2.1 Definition of Obtrusive Light

2.1.1 Obtrusive light, whether it keeps someone awake through a bedroom window or impedes their view of the night sky, is a form of pollution, which may also be a nuisance in law, and which can be substantially mitigated without detriment to the lighting requirements of the task.

2.1.2 Obtrusive light (sometimes referred to as light pollution) may be thought of as having three direct components; and are all forms of obtrusive light which may cause nuisance to others, adversely affect fauna and flora and waste money and energy. The three components of obtrusive light are as outlined below and illustrated on Plate 1, adapted from Figure 1 of 'Guidance Note 01/20: Guidance Notes for the Reduction of Obtrusive Light' (GN01/20) produced by the Institute of Lighting Professionals (ILP, 2020):

- sky glow – light that contributes to the brightening of the night sky;
- glare – the uncomfortable brightness of a light source when viewed against a darker background; and
- light intrusion – the spilling of light beyond the boundary of the property or area being lit.

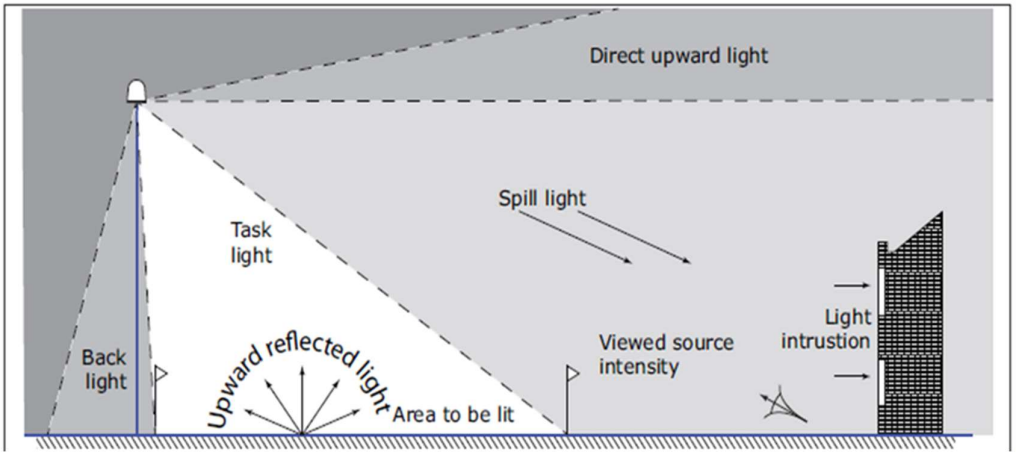


Plate 2: Types of Intrusive Light (adapted from Figure 1 in ILP, 2020)

2.2 Legislative Background

2.2.1 Light pollution was introduced within the Clean Neighbourhoods and Environment Act 2005 (UK Government, 2005) as a form of statutory nuisance under the Environmental Protection Act 1990 ('the EPA') (UK Government, 1990) which was amended in 2006 to include the following nuisance definition:

'(fb) artificial light emitted from premises so as to be prejudicial to health or nuisance'

2.2.2 Although light is described as having the potential to cause statutory nuisance (see also the Statutory Nuisance Statement (**Application Document Ref. 5.9**)), no prescriptive limits or rules were set for impact assessment purposes. ILP guidance GN01/20 (ILP, 2020) has, therefore, been referred to for the purposes of this assessment.

2.2.3 Guidance produced by Department for Environment, Food and Rural Affairs (DEFRA, 2006) within the document 'Statutory Nuisance from Insects and Artificial Light on Sections 101 to Section 103 of the Clean Neighbourhoods and Environment Act 2005' has also been referred to, which places a duty on local authorities to ensure that their areas are checked periodically for existing and potential sources of statutory nuisances – including nuisances arising from artificial lighting. Local authorities must take reasonable steps to investigate complaints of such nuisances from artificial light. Once satisfied that a statutory nuisance exists or may occur or reoccur, local authorities must issue an abatement notice (in accordance with Section 80(2) of the EPA 1990 (UK Government, 1990)), requiring that the nuisance cease or be abated within a set timescale.

2.2.4 It is a requirement of the Conservation of Habitats and Species Regulations 2017 (as amended) ('the Habitats Regulations') (UK Government, 2017) that plans, and projects are subject to an Appropriate Assessment if it is likely that they will lead to significant adverse effects on a European Site. Impacts from lighting are relevant to the Habitats Regulations Assessment Screening (HRA) and lighting is therefore considered in **Application Document Ref. 5.12**: Habitats Regulations Assessment Screening Report.

2.3 Planning Policy Context

National Policy Statement

2.3.1 The Overarching National Policy Statement (NPS) for Energy (EN-1) (Department of Energy and Climate Change, (DECC, 2011) states in section 5.6.4:

- *'The applicant should assess the potential for artificial light to have a detrimental impact on amenity, as part of the Environmental Statement.*
  - *In particular, the assessment provided by the applicant should describe:*
  - *the type, quantity and timing of emissions;*
  - *aspects of the development which may give rise to emissions;*
  - *premises or locations that may be affected by the emissions;*
  - *effects of the emission on identified premises or locations; and*
  - *measures to be employed in preventing or mitigating the emissions.'*

And

- *'The IPC* [now Secretary of State] *should satisfy itself that:*
  - *an assessment of the potential for artificial light…to have a detrimental impact on amenity has been carried out; and*

- *that all reasonable steps have been taken, and will be taken, to minimise any such detrimental impacts.'*

2.3.2 This Indicative Lighting Strategy for the Proposed Development considers the lighting requirements with reference to relevant standards and guidance, and measures to avoid adverse effects on sensitive receptors, as required by NPS EN-1.

National Planning Policy Framework

2.3.3 The National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government (MHCLG), 2019) is supported by the Planning Practice Guidance (PPG) (October 2019) on light pollution. Neither are applicable to NSIP where the requirements of the NPS apply however the PPG does constitute useful guidance for considering the lighting effects of development in general.

2.3.4 With regard to artificial lighting, the NPPF states the following which has been followed within the design of the lighting for the Proposed Development:

'c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.'

International Guidance

2.3.5 The purpose of Commission Internationale De L'Eclairage (CIE) 'CIE 150:2017 Guide on the limitation of the effects of obtrusive light from outdoor lighting installations' (CIE, 2017) is to aid in formulating guidelines for assessing the environmental effects of exterior lighting and to provide limits for relevant lighting parameters to control the obtrusive effects of exterior lighting to tolerable levels. CIE 150:2017 refers to the potentially adverse effects of exterior lighting on both natural and man-made environments.

2.3.6 'CIE 126-1997 Guidelines for Minimising Sky Glow' (CIE, 1997) gives general guidance for lighting designers and policy makers on the reduction of sky glow. The report gives recommendations about maximum permissible values for exterior lighting installations. These values are regarded as limiting values. Lighting designers should strive to meet the lowest criteria for the design. Practical implementation of the general guidance is left to national regulations.

National Guidance

2.3.7 The ILP GN01/20 (ILP, 2020) proposes lighting guidance and criteria for local authorities with a recommendation that these are incorporated at the local plan level.

2.3.8 GN01/20 reflects the changes in international guidance regarding obtrusive light as detailed in CIE 150:2017 (CIE, 2017). It also considers industry comment regarding the assessment and definition of obtrusive lighting.

2.3.9 The ILP also provides guidance on lighting and effects on bat species within 'Guidance Note 08/18: Bats and artificial lighting in the UK' (GN08/18) (ILP and Bat Conservation Trust, 2018) which is intended to raise awareness of the impacts of artificial lighting on bats and provides potential solutions to avoid and reduce this harm.

2.3.10 The Chartered Institution of Building Services Engineers (CIBSE) Society for Light and Lighting (SLL) provide further guidance in terms of the standard of road lighting used and population density within their guidance document Guide to Limiting Obtrusive Light (CIBSE SLL, 2012a) (SLL/LOL). This provides a more qualitative common-sense consideration for the interpretation of the character of illuminated areas.

2.3.11 This Strategy has been based upon ILP guidance and informed by considerations presented by SLL LOL (CIBSE SLL, 2012a). GN01/20 (ILP, 2020) should be used in conjunction with CIE 150:2017 (CIE, 2017) and CIE 126:1997 (CIE, 1997) (described in the International Guidance sub-section above) and not as a replacement for the procedures contained therein.

2.3.12 Further information on application of the policy and guidance documents is provided in Sections 2 and 3 of this document.

3.0 LIGHTING DESIGN STANDARDS AND GUIDANCE

3.1.1 The British Standards Institute (BSI) provides published standards and guidance for most lighting tasks, adherence to which will help mitigate obtrusive lighting aspects. These are referred to in establishing the expected lighting requirements for the Proposed Development during construction and operational phases.

3.1.2 Described below are relevant extracts of standards and guidance expected to be used when developing the detailed exterior lighting design for the Proposed Development.

3.2 British Standards

BS EN 12464-2: 2014 'Light and lighting – Lighting of workplaces. Part 2: Outdoor work places'

3.2.1 BS EN 12464-2:2014 (BSI, 2014) specifies lighting requirements for outdoor work places, which meet the needs for visual comfort and performance.

The Society of Light & Lighting Handbook

3.2.2 Aimed at lighting practitioners, specifiers and students of lighting, the 'SLL Handbook' (CIBSE SLL, 2018) summarises the fundamentals of light and vision, the technology of lighting and guidance on a wide range of applications, both interior and exterior. It is intended to act as a link between the SLL 'Code for Lighting' (CIBSE SLL, 2012b) and the SLL Lighting Guides (such as the SLL LOL (CIBSE SLL, 2012c))). The Handbook also includes a chapter dedicated to exterior workplace lighting (Chapter 24) which has been referred to in the preparation of this Strategy.

The Society of Light and Lighting Code for Lighting

3.2.3 The SLL Code for Lighting (CIBSE SLL, 2012c) provides information on three areas of lighting practice and complements the SLL Lighting Handbook (CIBSE SLL, 2018). This includes:

- a summary of the effects of lighting on task performance, behaviour, safety, perception, health, and its financial and environmental costs;
- a compendium of lighting recommendations relevant to the UK; and
- detailed descriptions of the calculations required for quantitative lighting design.

3.2.4 The lighting requirements for workplaces as set out in the SLL Code are very much aligned with those as set out in BS EN 12464-2: 2014 (BSI, 2014) and so are not expanded on in this section.

3.3 Aviation Lighting Requirements

3.3.1 The CAA was formally consulted on the Proposed Development to review any requirements for aviation lighting on the stack(s) within the Proposed Development and to enable the Proposed Development to be charted in future, if required. The CAA has confirmed that it has no specific comments to make on the project itself but provided the Applicant with aviation related guidance that has been taken into account in the drafting of requirements within the draft DCO (**Application Document Ref. 2.1**).

Civil Aviation Authority (CAA) Policy Statement 'Lighting of En-Route Obstacles and Onshore Wind Turbines'

3.3.2 The CAA Policy Statement (CAA, 2010) provides an overview of the more generic need for aviation warning lighting on 'tall structures' and onshore wind turbines as set out at Article 219 of the UK Air Navigation Order 2009 (UK Government, 2009) (superseded by Article 222 within UK Air Navigation Order 2016). The CAA Policy Statement clarifies, 'Notwithstanding the Article 219 (now Article 222 within UK Air Navigation Order 2016) requirements, some structures of a height of less than 150 metres might need aviation warning lights'. Whilst structures of such heights are not routinely lit for civil aviation purposes, it is possible that aviation stakeholders, including the CAA, may make a case for aviation warning lighting where a structure is considered, by virtue of its location and nature, a significant navigational hazard.

The Air Navigation Order 2016 (UK Government, 2016)

3.3.3 Article 222 of the Air Navigation Order sets out the requirements for the lighting of en-route obstacles and is reproduced below:

- *'(1) The person in charge of an en-route obstacle must ensure that it is fitted with medium intensity steady red lights positioned as close as possible to the top of the obstacle and at intermediate levels spaced so far as practicable equally between the top lights and ground level with an interval of not more than 52 metres.*
- *(2) The person in charge of an en-route obstacle must, subject to paragraph (3), ensure that by night the lights required to be fitted by this article are displayed.*
- *(3) In the event of the failure of any light which is required by this article to be displayed by night the person in charge must repair or replace the light as soon as reasonably practicable.*
- *(4) At each level on the obstacle where lights are required to be fitted, sufficient lights must be fitted and arranged so as to show when displayed in all directions.*
- *(5) In any particular case the CAA may direct that an en-route obstacle must be fitted with and must display such additional lights in such positions and at such times as it may specify.*

- *(6) A permission may be granted for the purposes of this article for a particular case or class of cases or generally.*
- *(7) This article does not apply to any en-route obstacle for which the CAA has granted a permission to the person in charge permitting that person not to fit and display lights in accordance with this article.*
- *(8) In this article, an "en-route obstacle" means any building, structure or erection, the height of which is 150 metres or more above ground level, but it does not include a building, structure or erection:*
  - *(a) which is in the vicinity of a national licensed aerodrome or an EASA certificated aerodrome; and*
  - *(b) to which section 47 of the Civil Aviation Act 1982 (warning of presence of obstructions near licensed aerodromes) applies.'*

3.3.4 Article 224 of the Air Navigation Order sets out the restrictions on lights liable to endanger and is reproduced below:

- *'(1) A person must not exhibit in the United Kingdom any light which:*
  - *(a) by reason of its glare is liable to endanger aircraft taking off from or landing at an aerodrome; or landing at an aerodrome; or*
  - *(b) by reason of its liability to be mistaken for an aeronautical ground light is liable to endanger aircraft.*
- *(2) If any light which appears to the CAA to be a light described in paragraph (1) is exhibited, the CAA may direct the person who is the occupier of the place where the light is exhibited or who has charge of the light, to take such steps within reasonable time as are specified in the direction:*
  - *(a) to extinguish or screen the light; and*
  - *(b) to prevent in the future, the exhibition of any other light which may similarly endanger aircraft.*
- *(3) The direction may be served either personally or by post, or by affixing it in some conspicuous place near to the light to which it relates.*
- *(4) In the case of a light which is or may be visible from any waters within the area of a general lighthouse authority, the power of the CAA under this article must not be exercised except with the consent of that authority'*

3.3.5 Article 225 of the Air Navigation Order sets out restrictions on lights which dazzle or distract and states that 'a person must not in the United Kingdom direct or shine any light at any aircraft in flight so as to dazzle or distract the pilot of the aircraft'.

CAP 393: Regulations made under powers in the Civil Aviation Act 1982 and the Air Navigation Order 2016

3.3.6 CAP 393 (CAA, 2015) provides an overview of the Civil Aviation Act 1982 and the Air Navigation Order 2016 and was highlighted for reference by the CAA during consultation. This will be considered within the detailed design of the Proposed Development Site lighting.

CAP 1096: Guidance to Crane Operators on Aviation Lighting and Notification

3.3.7 CAP 1096 (CAA, 2021) sets out the requirements for aviation warning lighting to cranes and sets out the potential requirement for crane activity to be notified to the aviation community which the Proposed Development will follow.

3.3.8 As the details of aviation lighting requirements are set out in legislation and CAA guidance, and will be secured by a requirement of the draft DCO(**Application Document Ref. 2.1**) , aviation lighting is not discussed further in this Indicative Lighting Strategy.

4.0 DESIGN PRINCIPLES AND OBTRUSIVE LIGHT IMPACT AVOIDANCE MEASURES

4.1.1 In accordance with the relevant legislation, standards and guidance noted in Sections 2.0 and 3.0 above, the main overarching lighting design principles for the Proposed Development are:

- to ensure the health and safety of employees and visitors performing normal working duties;
- to ensure the safe movement of vehicular and pedestrian traffic around the Proposed Development Site during the hours of darkness;
- to minimise light pollution in terms of light trespass, sky glow and glare to the identified sensitive receptors; and
- to ensure the security of the Proposed Development Site and its occupants including lighting suitable for the correct functioning of the preferred CCTV system.

4.1.2 The overarching philosophy underpinning the design of the lighting for the Proposed Development is to have a reduced light site. Lighting will be restricted to focussed point use where reasonably practicable. Permanent lighting will be for general pedestrian movement, safety and security purposes only. Any lighting that may be required for maintenance purposes will be produced by temporary lighting sets specific to the required task. Lighting shall be further reduced to only critical lighting from 23:00 to 05:00 hours to reduce the impact of obtrusive lighting on the local environment (i.e. 23:00 hrs as per recommendation from the ILP GN01/20 (ILP, 2020) and 05:00 hrs as per the usual recommendation from local authorities and the PPG). Lighting will be designed so as not to illuminate foraging habitats adjacent to the Proposed Development Site of greater potential value to bats including the former Keadby Ash Tip, habitat being created to maintain habitat connectivity between the Ash Tip, and adjacent habitats including the Stainforth and Keadby Canal habitat corridor).

4.1.3 Lighting required during the construction and operation stages of the Proposed Development will be designed to reduce unnecessary light spill outside of the Proposed Development Site boundary.

4.1.4 External operational lighting has potential to affect bats where it coincides with their foraging and commuting habitats. This Indicative Lighting Strategy outlines recommendations from BS EN 12464-2:2014 (BSI, 2014) and the ILP GN08/18 (ILP and Bat Conservation Trust, 2018) which will be followed to minimise the impact of lighting adjacent habitats. Such recommendations include:

- the types of lighting to minimise upwards spread of light;
- the mounting heights and angles to minimise obtrusive glare; and
- guidance on light limitations for different environments.

4.1.5 All luminaires will have the necessary optical control and be appropriately aimed to minimise direct upward light emission. The lighting design will utilise LED lanterns which provide safety (reduced maintenance) and environmental advantages (more control than conventional light sources). Advantages of LED luminaires are:

- low power consumption and long and predictable lifetime;
- high colour rendering;
- quick turn on and off;
- reduced energy consumption (cost saving); and
- reduced carbon footprint.

4.1.6 The luminaires chosen will, wherever practicable, have no light emitted above the horizontal to ensure the lighting is well controlled and will not directly contribute to any sky glow or cause light pollution/ obtrusive light.

4.1.7 Luminaires shall also be positioned and aimed so that peak light intensities from any fitting do not unintentionally illuminate any building or structural façade.

4.1.8 If overhead lines are present in the vicinity of any proposed lighting, lighting columns will be hinged to be lowered for maintenance purposes.

4.1.9 The following design principles will be followed:

- adopting a lighting control strategy that turns lights off or dims as necessary for site safety and security;
- using photocells as a primary means of control to prevent light from being used when sufficient daylight is available;
- where possible, adopting LED luminaires to control obtrusive light due to their high directionality and accordingly the achievable ratio of useful light to spill light;
- lighting will be designed not to affect aviation activity and where required the Proposed Development will include aviation warning lighting;
- careful consideration of placement of lighting column and luminaire positioning;
- adopting luminaires with minimal upward lighting ratio and full cut-off, where possible;
- not tilting luminaires to have uplift above the horizontal, if this is not possible add shielding, hoods baffles, louvres as necessary to ensure potential upward light is controlled;
- optimising column heights to allow for sufficient light coverage and minimal tilt of luminaires;
- minimising building mounted luminaire heights;

- adopting lamps with similar correlated colour temperatures;
- using lamps with a limited UV spectrum in locations which might affect ecological receptors;
- using shields and baffles to luminaires;
- lighting the site boundaries with low power periphery lighting with an asymmetric forward optic having good back-light cut-off characteristics; and
- directing luminaires away from ecologically sensitive receptors.

4.1.10 As part of the detailed design, the related viewpoints of local emergency service Air Support Units will be established.

5.0 Baseline Conditions

5.1 Existing Baseline

5.1.1 The Proposed PCC Site, on which the built development associated with the combined cycle gas turbine (CCGT) and carbon capture plant (CCP) is proposed, is located approximately 4.1km to the west of the town of Scunthorpe. The village of Keadby is the nearest settlement which lies immediately adjacent to the Proposed Development Site boundary and approximately 1km east of the Proposed PCC Site at its closest point (refer to **Figure 3.2** - ES Volume III). Both Scunthorpe and to a lesser extent, Keadby Village and sources along the River Trent are key sources of lighting emanating from the east of the Proposed Development Site. Areas west of the Proposed Development Site are agricultural and less well lit.

5.1.2 Parts of the existing Proposed Development Site are currently lit (including Keadby 1 Power Station car parking areas and internal roadways). There is also currently a temporary lighting scheme in place associated with the Keady 2 Power Station construction phase. Post construction, in 2022, permanent lighting for the operational Keadby 2 Power Station will replace the temporary lighting including aviation warning lighting. Light associated with Keadby 1 Power Station and Keadby 2 Power Station operational lighting will therefore be the future baseline for the Proposed Development. That future baseline may also be influenced by future plans for Keadby 1 Power Station, but given the uncertainty of plans at this time, no further consideration has been given to other future baseline scenarios in this Indicative Lighting Strategy.

5.1.3 Lighting will be focussed for safety and operational purposes around the Proposed PCC Site (including the Main Site where the CCGT and CCP will be located), whereas during the construction phase, task lighting may be required for temporary works at other areas, including the connection corridors within the Proposed Development Site. The closest residential receptors and other light sensitive receptors to these areas include:

- an isolated property at Vazon Bridge, approximately 450m south of the Main Site (40m south of the Proposed Development Site), adjacent to the Stainforth and Keadby Canal;
- an isolated property at Roe Farm located approximately 465m south of the Main Site (55m south of the Proposed Development Site) adjacent to the Stainforth and Keadby Canal;
- North Moor Farm located approximately 740m north of the Main Site (475m north of the Potential Electrical Connection to the Northern Powergrid 132kV Substation);
- a pair of semi-detached residential properties ‘Holly House’ and ‘Hawthorn House’ located 815m east of the Main Site (0 - 35m west of the Water Discharge Corridor);

- Keadby Grange, approximately 920m south of the Main Site (510m east of the Construction Laydown Areas, within the agricultural fields north of A18);
- properties along Chapel Lane, located 1km east of the Main site (50m east of the Water Discharge Corridor);
- a single residential property (No. 5 Trent Side), approximately 1.3km east of the Main Site (35m east of the Additional Abnormal Indivisible Load Route);
- South Pilfrey Farm, approximately 2.1km south of Main Site (250m east of the A18 junction improvement;
- farms along Bonnyhale Road including Ealand Warpings and North Pilfrey Farm; the latter located 1.6km south-west of the Main Site (225m west of North Pilfrey Bridge);
- Boskeydyke Farm located approximately 2km north-east of the Main Site (1.1km north of the Water Discharge Corridor);
- Amcotts Grange located approximately 1.4km north of the Water Discharge Corridor; and
- Ealand Poultry Farm, located on Bonnyhale Moor Road, approximately 1.6km west of the Main Site (1.2km north-west of the construction laydown areas).

5.1.4 A number of these locations correspond with the viewpoints agreed with North Lincolnshire Council (NLC) for the purposes of the LVIA presented in **Chapter 14**: Landscape and Visual Amenity (ES Volume I – **Application Document Ref. 6.2**) which includes an assessment of effects of night-time lighting. Table 1 below outlines the existing lighting in place at these sensitive receptor locations.

Table 1: Existing Lighting

Viewpoint	Location	Existing Lighting
1	Chapel Lane West, Keadby	Street lighting is present along the eastern section of the road. Existing aviation warning lighting is present on the wind turbines, the stacks associated with Keadby 1 Power Station and cranes associated with the construction of Keadby 2 Power Station. In general, there are low levels of night-time lighting.
2	Gate Keepers Residence, (Vazon Bridge) Keadby	Existing aviation warning lights on the wind turbines, the stacks of Keadby 1 Power Station and the cranes associated with the construction of Keadby 2 Power Station are visible. In general, there are low levels of night-time lighting at this location.
3	Keadby Lock	There is street lighting and high-level flood lighting associated with the Lock at this

Viewpoint	Location	Existing Lighting
		location. In general, there are medium levels of night-time lighting visible within Viewpoint 3.
4	PRoW (KEAD9, KEAD10), north of Keadby	Street lighting along Chapel Lane and aviation warning lights on the wind turbines, Keadby 2 Power Station stacks and the cranes associated with the construction of Keadby 2 Power Station are visible. There are low levels of night-time lighting at this location.
5	PRoW (GUNN179), north-east of Gunness	Street lighting from Gunness is visible, creating sky glow to the south-east. The lighting located in the Lock and aviation warning lighting will be visible to the south-west. There are low levels of lighting visible in the night sky from this location.
6	Trunk Road, Keadby	Street lighting from Althorpe is visible as the closest source of lighting. Lighting from Keadby and Keadby Port creates a low-level of sky glow and aviation warning lighting is clearly visible from this location. There are overall low levels of lighting visible in the night sky from this location.
7	PRoW (CROW11) east of Ealand Poultry Farm	Aviation warning lights on the wind turbines, Keadby 1 Power Station stack and the cranes associated with the construction of Keadby 2 Power Station are visible from this location. Task lighting is present at the nearby industrial unit. There are low levels of night-time lighting at this location.
8	PRoW (East8) Eastoft	Street lighting is present in Eastoft. Distant sky glow is visible from the northern area of Scunthorpe. Overall there are low levels of night-time lighting at this location.
9	Meredyke Road, Luddington	Street lighting is present in Luddington. Distant sky glow is visible from the northern area of Scunthorpe. Overall there are low levels of night-time lighting at this location.
10	Middle Lane, Amcotts	Street lighting is present in Amcotts. Distant sky glow is visible from the northern area of Scunthorpe. Overall there are low levels of night-time lighting at this location.
11	PRoW (BURT171)	No direct light sources are present. Sky glow from Burton upon Stather and the north

Viewpoint	Location	Existing Lighting
	accessed off Chafer Lane, Burton upon Stather	of Scarborough would be visible from this location. Overall there are very low levels of night-time lighting at this location.
12	Mill Road, Crowle	Street lighting is present in Crowle. Very distant sky glow is visible from Scunthorpe. Overall there are low levels of night-time lighting at this location.
13	PROW (BELT30/ BELT 34) Isle of Axholme	Street lighting is visible from within Belton. Aviation warning lighting is visible from wind turbines on the horizon. Overall there are very low levels of night-time lighting at this location.

5.1.5 Directly adjacent to the west and to the south of the Proposed PCC Site, foraging habitats of greater potential value to bats include the Stainforth and Keadby Canal habitat corridor and the former Keadby Ash Tip. Each of these habitats is considered ecologically sensitive to potential lighting effects.

5.2 Future Baseline

5.2.1 One operational, Keadby 2 Power Station will introduce new lighting into the Proposed Development Site. This will include lighting on the Keadby 2 Power Station HRSG stack which is to be fitted with a minimum intensity 25 candela omni directional flashing red light.

5.3 Environmental Zone Classification

5.3.1 The ILP has developed an Environmental Zone classification system for the categorisation of location brightness characteristics presented in GN01 (ILP, 2020). These characteristics are broadly summarised in Table 2 below.

5.3.2 SLL LOL (CIBSE, 2012c) provides additional consideration for other factors that can be considered alongside the examples provided for the overarching local area character and consider that as a general rule, zone E1 has no road lighting and a low population density; zone E2 has road lighting lit to the standards of residential roads and a moderate population density; zone E3 contains roads lit to traffic route standards and a high population density. Zone E4 is more suitable for areas of high activity after dark, such as out-of-town shopping centres and urban areas with a high concentration of restaurants and clubs.

5.3.3 There is one other class, (E0), which is associated with dark-sky preserves, reserves or parks recognised by the International Dark-Sky Association (IDA). These are locations where the use of light outside at night is not advised and generally should be limited. Lighting may be allowed under some circumstances, but only after great care is taken to minimise obtrusive effects, particular sky glow which could harm a dark night sky condition.

5.3.4 It is important to appreciate that an environmental zone does not necessarily coincide with an administrative boundary, such as a city, town or village. While an overarching lighting character may describe an area, each of these locales can be subdivided into a number of sub-environmental zones which depend on the activities expected to be undertaken in each area and reflecting the lighting characteristics that are and should be applied to them. This may include areas of specific ecological concern or particular features which would be detrimentally affected by a change in lighting condition as well as areas where industrial activities are present which are present within the same overall setting.

Table 2: ILP 2020 Environmental Zone Classifications

Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark (SQM 20.5+)	UNESCO Starlight Reserves, IDA Dark Sky Parks Astronomical Observable dark skies, UNESCO starlight reserves, IDA dark sky places
E1	Natural	Dark (SQM 20 to 20.5)	Relatively uninhabited rural areas, National Parks, Areas of Outstanding Natural Beauty, IDA buffer zones etc.
E2	Rural	Low district brightness (SQM ~15 to 20)	Sparsely inhabited rural areas, village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Well inhabited rural and urban settlements, small town centres of suburban locations
E4	Urban	High district brightness areas	Town/ city centres with high levels of night-time activity

5.3.5 The Proposed Development Site is located within zone ILP Zone E2. ILP provide obtrusive light limits for exterior lighting installations are specified for light intrusion (to windows), sky glow (upward light ratio) and glare for each Environmental Zone (ILP, 2020). The design of the Proposed Development Site lighting will follow the limits provided.

6.0 EXTERNAL LIGHTING BY AREA

6.1 Overview

6.1.1 The internal roads within the Proposed PCC Site would be lit by column mounted LED road luminaires. The overall lantern mounting height would be up to 12m. During night-time hours, a partial lighting strategy would be applied to reduce the total output from the lighting scheme.

6.1.2 The Proposed PCC Site would be predominately lit by the columns located on the site access road at the perimeter of the area. This lighting would be supplemented with additional lighting within the laydown areas. A combination of LED luminaires mounted on the buildings and/or enclosures if part of the design and on columns up to 12m is required to achieve the appropriate lighting levels. Critical operation infrastructure will be lit to ensure critical maintenance can occur at any time of day.

6.1.3 The level of lighting within the Proposed PCC Site and laydown areas would be sufficient to allow the safe movement of pedestrians and vehicles (using their headlights) in areas that they might reasonably be expected to negotiate at night. It is not intended to facilitate planned or unplanned maintenance activities for which additional localised portable equipment would be required.

6.1.4 The lighting in this area would be group switched, so the lighting is operated only when required.

6.1.5 Operational lighting, including aviation warning lights on the stacks will marginally increase lighting levels on the Proposed PCC Site.

6.1.6 Lighting of open compounds such as the gas receiving area would use column mounted equipment at no more than 10m above the ground level.

6.1.7 At the detailed design stage, a computational light modelling exercise will be undertaken. This will demonstrate that the Proposed Development Site will be adequately lit and allow obtrusive light to be suitably controlled, in accordance with this Strategy.

6.1.8 Within the Proposed PCC Site, lighting would be designed to minimise light disturbance on adjacent sensitive ecological areas including the former Keadby Ash Tip and Stainforth and Keadby Canal, being directed to working areas so as not to illuminate these features, as far as reasonably practicable.

7.0 OPERATIONAL LIGHTING EQUIPMENT AND CONTROL

7.1.1 All luminaires will be designed to minimise upward light spill and have no light above the horizontal.

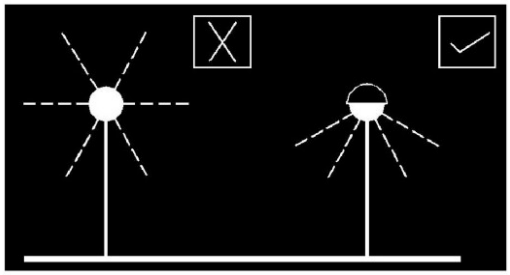
7.1.2 Luminaires will, where appropriate, be controlled by a site wide lighting control system to minimise waste light output.

7.1.3 All external luminaires will be ingress protected to a minimum standard of IP65 and will be chosen to suit any hazardous areas as identified during detailed design.

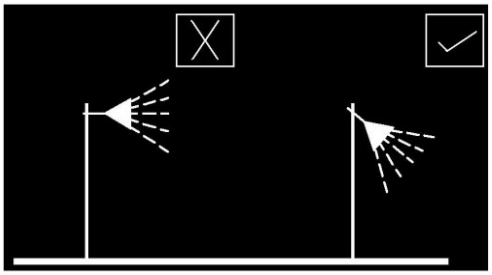
7.1.4 Lighting equipment in the gas receiving area will be of a design to conform with the hazardous area rating.

7.2 Generic Equipment and Installation

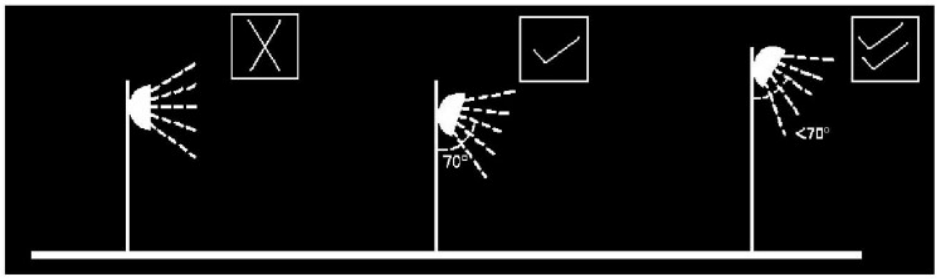
7.2.1 Lighting reflected off buildings could have a significant impact on the level of light spill produced. Equally important is the choice of lighting equipment and lighting techniques. This general guidance will be followed when selecting equipment and lighting techniques.



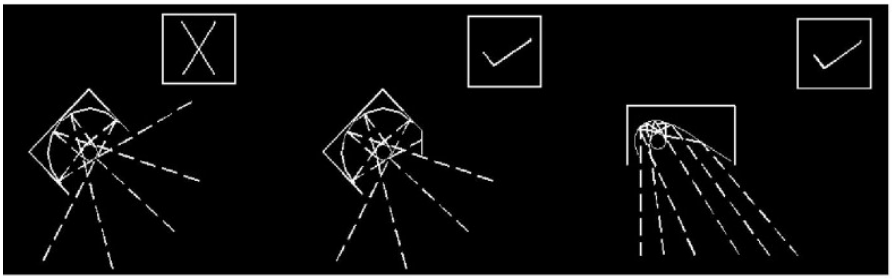
7.2.2 Fixed head lanterns will not emit any direct light above horizontal.



7.2.3 Movable luminaries will be tilted so that no light is being emitted above horizontal.



7.2.4 Lantern heights will be increased where feasible to reduce tilt angles.



7.2.5 Quality luminaire optics will be used which accurately control light distribution and do not spill light into the atmosphere.

7.3 Lighting Control

7.3.1 External lighting control will form part of the overall lighting control system. Operators would have the ability to override any lighting circuit and, where appropriate, individual luminaires from a central location. The general lighting control philosophy is for the lighting to be controlled by a combination of time clock and photocell arrangements with additional local control where appropriate.

8.0 CONSTRUCTION SITE LIGHTING

8.1 Overview

8.1.1 Construction lighting will be required in areas where natural lighting is unable to reach (sheltered/ confined areas) and prior to permanent lighting being installed. Lighting may also be required around the Proposed Development Site for night-time construction and during normal working hours within winter months.

8.1.2 Artificial lighting shall be provided to maintain sufficient security and health and safety for works whilst adopting the mitigation principles outlined in this Strategy to avoid excessive glare and minimise spill of light to nearby receptors.

8.1.3 Task lighting and aviation warning lighting will be provided on relevant cranes during construction in line with the CAA (2021) guidance – CAP 1096.

8.1.4 A Light Management Plan (LMP) will accompany the final Construction Environmental Management Plan (CEMP) which sets out the approach for use of lighting during the construction phase. While a primarily daylight schedule is assumed for construction phase works, it is recognised that some activities may take place outside of these core working hours, during hours of darkness. This may include scheduled work in winter months or emergency works taking place at night after standard working hours.

8.1.5 Lighting is also anticipated to be required for equipment compounds during the construction phase, presenting a static lighting presence throughout the night to support safety and security.

8.1.6 A representative calculation for lighting of compounds or lighting plan with indicative equipment to be used on site will be developed supporting the LMP and presented to North Lincolnshire Council for approval prior to construction works taking place.

8.1.7 Details of all external lighting, for both construction and operation are proposed to be secured by a Requirement of the draft DCO (**Application Document Ref. 2.1**). The draft DCO includes the following in regard to aviation warning lighting:

'33.—(1) No part of the authorised development comprised within Work No. 1 or Work No. 10B may commence, save for the permitted preliminary works, until details of the timetable for construction and retention of tall structures or the placement and retention of mobile cranes, and the specification and installation timetable for aviation warning lighting for that part have been submitted to and, after consultation with the Civil Aviation Authority and Ministry of Defence Safeguarding, approved by the relevant planning authority.

(2) The aviation warning lighting approved pursuant to paragraph (1) must be installed, maintained and operated in accordance with the approved details.'

9.0 CONCLUSIONS

9.1.1 This Indicative Lighting Strategy has been prepared in order to support the Application for the Proposed Development.

9.1.2 At the time of submission of the Application, the EPC contractor(s) have not been appointed and detailed design work for the Proposed Development (including lighting design) has not been carried out. Notwithstanding this, it is recognised that potential nuisance from lighting of the Proposed Development may be a concern for local communities and lighting could affect sensitive ecological receptors such as bats and therefore requires control. Therefore, the Applicant has commissioned this Strategy in order to set out the design principles that will be employed at the Proposed Development.

9.1.3 The overarching philosophy for the lighting design will be to have a reduced light site. This Strategy provides the principles, guidance and the recommended type of equipment that is required to illuminate the Proposed Development Site. When determining the lighting requirements, an indicative site layout has been used to assess the requirements for specific plant equipment. For each area, the level of lighting is proposed and fixture mounting guidance is provided to ensure adequate light whilst minimising light spill and glare.

9.1.4 In summary, the key principles that shall be adopted when developing the detailed design include:

- to ensure the health and safety of employees and visitors performing normal working duties;
- to ensure the safe movement of vehicular and pedestrian traffic around the Proposed Development Site during the hours of darkness;
- to minimise light pollution in terms of light trespass, sky glow and glare to the identified sensitive receptors; and
- to ensure the security of the Proposed Development Site and its occupants including lighting suitable for the correct functioning of the preferred CCTV system.

9.1.5 This Strategy therefore sets out the outline lighting requirements specification for lighting at the Proposed Development Site during both construction and operational phases. It also addresses obtrusive lighting by means of specifying off-site obtrusive lighting constraints. The report also identifies potential measures and guidance that may be taken to control obtrusive light through the detailed design of the Proposed Development lighting scheme and management of lighting used during the construction phase.

9.1.6 In summary, it is concluded that the Indicative Lighting Strategy provides an appropriate outline of the lighting requirements for the Proposed Development as part of the Application and identifies potential measures to adequately control obtrusive light through detailed design of the lighting scheme. The controls are

secured through requirements in the Draft DCO (**Application Document Ref. 2.1**).

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