EAST PARK ENERGY

East Park Energy

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Environmental Statement

Volume 2 – Technical Appendices

Appendix 15-1: Greenhouse Gas Emissions Assessment

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TABLES

1.0 INTRODUCTION

1.1.1 This appendix has been written in support of **ES Vol 1 Chapter 15: Climate Change [EN010141/DR/6.1]**. This appendix details the inputs and assumptions within the calculation of Greenhouse Gas (GHG) associated with the Scheme.

1.1.2 The GHG emissions scoped into the assessment are summarised in Table 15.6 of **ES Vol 1 Chapter 15: Climate Change [EN010141/DR/6.1]**.

2.0 ASSUMPTIONS AND INPUTS

2.1 Construction Phase (2027-2030)

2.1.1 Subject to the Scheme securing development consent in Winter 2026/27 it is anticipated that works would start on site in early 2028 and be completed by mid-to late 2030 (although initial energisation of the Scheme is likely to commence prior to 2030 such that it aligns with national Clean Power 2030 objectives).

Embodied GHG emissions within the equipment and materials

2.1.2 Embodied GHG emissions include the extraction of raw materials, transportation of raw materials to the place of manufacturing, and the manufacturing process. These can make up a significant contribution to the GHG emissions associated with the Scheme. Manufacturers are increasingly carbon footprinting their products and reporting the embodied GHG emissions associated with their product. However, at this stage the exact manufacture of the equipment is not known. Therefore, the following assumptions have been made in relation to the embodied GHG emissions associated with the equipment and materials needed to construct the Scheme.

Table 1 – Source of Equipment and materials

Equipment / material	Source
Solar PV modules	Candidate solar PV module sourced from China
Mounting structure	Assumed total weight of candidate mounting structure is made up of steel and applied ICE database emission factor for engineering steel.
Cables	Manufacturer of a candidate cables from Prysmian.
Batteries	Swedish Environmental Research Institute paper (2019), associated with the manufacture of lithium-ion batteries. Range of 59-119 kg CO2e/kWh, with a mid-point of 89 CO2e/kWh. Applied the mid-point given the age of the paper and pushes from industry to reduce the GHG intensity of the manufacturing process.
Transformers	In lieu of any data from candidate equipment, assumed total weight of transformer is made up of steel and applied ICE database emission factor for electrogalvanized steel.
Inverters	In lieu of any data from candidate equipment, assumed total weight of inverter is made up of steel and applied ICE database emission factor for electrogalvanised steel. It has not been confirmed whether the Scheme will utilise string or central inverters. The weight and quantity of both string and central inverters has been outlined in Table 3 and Table 4 below. The assessment has assumed that the central inverters are utilised for a more conservative calculation.
Aggregates	Weight of aggregates multiplied by the density of gravel and multiplied by the emission factor for "aggregates and sand from secondary resources, bulk, loose" from the ICE database.
Concrete	ICE database emission factor for general concrete.
Cement bound sand	Cement bound sand required for backfilling along 400 kV grid connection. ICE database emission factor for general cement (UK average). There is no specific emission factor available for cement bound sand. As a conservative approach, the emission factor for 100% cement has been applied, as it is higher than that for sand.
Fencing	In lieu of any data from candidate equipment, weight of a candidate paladin fence and applied the ICE database emission factor for electrogalvanised steel.

Table 2 – Material / equipment emission factors

Material	Unit	Value
Aggregates and sand, from secondary resources, bulk, loose	$kgCO_2e/kg$	0.06
Concrete (general)	$kgCO_2e/kg$	0.10
Cement (general, UK average)	$kgCO_2e/kg$	0.81

Steel, engineering steel	$kgCO_2e/kg$	1.64
Steel, electrogalvanised	$kgCO_2e/kg$	2.71
Source: Circular Ecology, 2024, Inventory of Carbon and Energy V4.0		

Table 3 – Equipment weight assumptions

Equipment	Unit	Value	Source
400kV transformer	t	150	Candidate transformer
Transformer	t	36	Candidate transformer
String Inverter	t	0.12	Candidate string inverter
Centralised Inverter	t	20	Candidate centralised inverter
Solar PV module	kg	38	Candidate bifacial module
Battery	t	23	Candidate battery
Mounting structure	t	0.25	Candidate mounting structure
Cables – low voltage	kg/km	470	BS 5467 1kV, round, 2 cores, $2.5mm^2$
Cables – high voltage	kg/km	5,600	BS 5467 1kV, round, 2 cores, $500mm^2$
Cables – extra high voltage	kg/km	11,400	BS 5467 1kV, round, 2 cores, $1000mm^2$
Fencing	kg/100 m	750	Candidate paladin fencing

2.1.3 The following table sets out the quantity of equipment and materials required to construct the Scheme.

Table 4 – Equipment and materials required to construct the Scheme

Equipment	Unit	Value
Cables - extra high voltage	m	18,000
Cables - high voltage	m	423,000
Cables - low voltage	m	2,146,000
Solar PV modules	-	695,760
Solar PV mounting structure	-	23,192
Transformers	-	52
String inverters	-	1,375
Central inverters	-	52
Batteries	-	96

400kv transformer	-	2
Aggregates	m^3	60,000
Fencing	km	60
Concrete	t	26,400
Cement Bound Sand	t	17,500

Transportation of equipment and construction materials

2.1.4 To calculate the GHG emissions associated with the transportation of the equipment from the place of manufacture and materials to the Scheme the total weight equipment / material, and the distance to the Scheme has been calculated. The GHG emissions have been calculated by applying the appropriate emission factors from DESNZ. Where appropriate well-to-tank (WTT) emission factors have also be applied.

2.1.5 The following assumptions have been used for the place of manufacture for equipment and source of materials.

Table 5 – Place of manufacture of equipment, source of material

Equipment / material	Source
Cables	Europe – assumed central Poland
Solar PV modules	China – assumed central China
Solar PV mounting structure	Europe – assumed central Poland
Transformers	China – assumed central China
Inverters (string and central)	China – assumed central China
Batteries	China – assumed central China
Aggregate	UK – assumed local to Scheme – Bradshaw Sand and Gravel
Fencing	UK – assumed local to Scheme
Concrete	UK – assumed local to Scheme
Cement bound sand	UK – assumed local to Scheme

2.1.6 The following assumptions have been used for the transportation of equipment and materials from their source of manufacture.

Table 6 – Transportation assumptions

Equipment / material	Leg 1		Leg 2		Leg 3	
	Route	Method	Route	Method	Route	Method
Solar PV modules	Central China to Shanghai	HGV	Shanghai to Felixstowe	Cargo	Felixstowe to Site	HGV
Half table mounting structures	Central Poland to Rotterdam	HGV	Rotterdam to Felixstowe	Cargo	Felixstowe to Site	HGV
Low voltage cables	Central Poland to Rotterdam	HGV	Rotterdam to Felixstowe	Cargo	Felixstowe to Site	HGV
High voltage cables	Central Poland to Rotterdam	HGV	Rotterdam to Felixstowe	Cargo	Felixstowe to Site	HGV
Extra high voltage cables	Central Poland to Rotterdam	HGV	Rotterdam to Felixstowe	Cargo	Felixstowe to Site	HGV
Battery	Central China to Shanghai	HGV	Shanghai to Felixstowe	Cargo	Felixstowe to Site	HGV
Transformer	Central China to Shanghai	HGV	Shanghai to Felixstowe	Cargo	Felixstowe to Site	HGV
400kV transformer	Central China to Shanghai	HGV	Shanghai to Felixstowe	Cargo	Felixstowe to Site	HGV
Concrete	Eastern Concrete Limited to Site	HGV				
Aggregate	Bradshaw Sand and Gravel to Site	HGV				
Cement bound sand	Mick George to Site	HGV				

2.1.7 The weight of each equipment / material has been multiplied by the distance of the leg and the sum of the appropriate DESNZ emission factor and DESNZ WTT emission factor for that leg.

2.1.8 The following assumptions relating to the distances travelled have been applied.

Table 7 – Distance travelled

Parameter	Unit	Value	Source
Central China to Shanghai	km	1,000	Google maps
Central Poland to Rotterdam	km	1,000	Google maps
Shanghai to Felixstowe	km	22,052	Ports.com, Port of Shanghai to Port of Felixstowe
Rotterdam to Felixstowe	km	248	Ports.com, Port of Rotterdam to Port of Felixstowe
Felixstowe to Site	km	130	Google maps
Bradshaw Sand and Gravel to Site	km	40	Google maps
Eastern Concrete Limited to Site	km	40	Google maps
BW Fencing specialists to Site	km	70	Google maps
Mick George to Site	km	10	Google maps

Plant vehicles and generators

2.1.9 The GHG emissions associated with the on-site plant vehicles and generators during the construction period have been calculated from the expected diesel fuel use and applying the appropriate DESNZ emission factor (including WTT emission factor).

Table 8 – Energy usage

Parameter	Unit	Value
Diesel usage	l	864,000

Provision of clean water and treatment of wastewater

2.1.10 The GHG emissions associated with the energy consumption from the provision of clean water has been calculated by taking the sum of the water

used for cleaning the solar PV modules and the water required during construction and applying the DESNZ water supply emission factor.

2.1.11 The GHG emissions associated with the energy consumption from the treatment of wastewater has been calculated by taking the water requiring treatment during construction and applying the DESNZ water treatment emission factor.

Table 9 – Water usage

Parameter	Unit	Value
Water used in construction, including solar PV module cleaning, wheel washing etc.	Million litres per annum	1.3
Water requiring treatment	Million litres per annum	3.4

Travel of construction workers

2.1.12 The GHG emissions associated with the travel of construction workers has been calculated using the number of construction workers on-site per month as set out in **ES Vol 2 Appendix 2-1: Indicative Construction Phasing and Resource Scheduled [EN010141/DR/6.2]**. Given the source of workers is unknown, a reasonable conservative assumption that a worker would travel 50 km to the site (and then return) has been made. This has conservatively assumed each worker would travel to site as an individual, but assumed 19 days on average per month travel to and from site. The DESNZ emission factor for average car emission factor (unknown fuel) and the DESNZ WTT average car emission factor (unknown fuel) have been applied.

Table 10 – Construction workers distance travelled

Parameter	Unit	Value	Source
Distance to work	km	50	Assumption, unknown location of workers assumed 50 km each way

2.2 Operation Phase (2030-2070)

2.2.1 It has been assumed that the Scheme would be commissioned in 2030 and operate for 40 years.

Provision of clean water and treatment of wastewater

2.2.2 The GHG emissions associated with the energy consumption from the provision of clean water has been calculated by taking the sum of the water used for cleaning the solar PV modules, the water required for the welfare facilities, and the landscaping proposals during operation and applying the DESNZ water supply emission factor.

2.2.3 The GHG emissions associated with the energy consumption from the treatment of wastewater has been calculated by taking the water requiring treatment during operation and applying the DESNZ water treatment emission factor.

Table 11 – Water usage

Parameter	Unit	Value
Water used on site for cleaning of solar PV modules etc	Million litres per annum	0.09
Water used for landscaping proposals	Million litres per annum	0.5
Water requiring treatment	Million litres per annum	0.1

Leakage of GHGs

2.2.4 Sulphur hexafluoride (SF_6) is one of the seven GHGs identified by the Kyoto Protocol which has an extremely high Global Warming Potential (GWP) of 23,900 for the 100-year time horizon. While SF_6 is a potential source of GHG emissions over the lifetime of the Scheme (i.e. derived from certain electric items such as gas-insulated switchgear and gas-insulated transformers during production, operation through leakage, and dismantling), it is difficult to quantify fugitive emissions from the leakage of SF_6 as there is insufficient research data available. Additionally, manufacturers are now increasingly

able to offer SF_6-free components, and those that do continue to use SF_6 are sealed-for-life with extremely low leakage rates. For this reason, it is assumed that emissions of SF_6 from this Scheme will be minimal and not material to this GHG assessment.

Emissions displaced by energy generated

2.2.5 The electricity generated by the Scheme will be exported to the national grid. The following table sets out the assumptions used to calculate the energy generated.

Table 12 – Energy generated

Parameter	Unit	Value
Gross energy generation no degradation	kWh/year	433,200,000
Degradation rate	%	1st year – 2% 2nd to 20th year – 0.45% per year

Travel of workers to the Scheme

2.2.6 The GHG emissions associated with the travel of workers has been calculated based on 20 operational staff (based off the creation of 20 full time equivalent roles outlined in **ES Vol 1 Chapter 2: The Scheme [EN010141/DR/6.1]**) working 232 days per year (based on the number of working days in a year minus eight bank holidays and assuming 25 days annual leave per worker). Given the source of workers is unknown, a reasonable conservative assumption that a worker would travel 50 km to the site (and then return) has been made. The DESNZ emission factor for average car emission factor (unknown fuel) and the DESNZ WTT average car emission factor (unknown fuel) have been applied.

2.2.7 The GHG emissions associated with the energy consumption from the provision of clean water has been calculated by taking the sum of the water used for cleaning the solar PV modules and the water required during construction and applying the DESNZ water supply emission factor.

2.2.8 The GHG emissions associated with the energy consumption from the treatment of wastewater has been calculated by taking the water requiring treatment during construction and applying the DESNZ water treatment emission factor.

Table 13 – Operational workers distance travelled

Parameter	Unit	Value	Source
Distance to work	km	50	Assumption, unknown location of workers assumed 50 km each way

Replacement of equipment

2.2.9 The life expectancy of the equipment (solar PV modules, transformer, inverters, batteries and fencing) has been factored into the calculation of the GHG emissions during the operational phase. The GHG emissions have been assumed to occur in year 20 – i.e. after the typical warranty of the equipment.

2.2.10 The GHG emissions include those associated with:

- the manufacture of the replacement equipment (embodied GHG emissions);
- transport to the replacement equipment Scheme;
- transport of the replaced equipment to recycling and disposal; and
- Recycling and disposal of replaced equipment.

Table 14 – Life expectancy of equipment

Equipment	Life expectancy (years)
Cables	40+
Solar PV modules	20
Solar PV mounting structure	40+
Transformers	20
Inverters	20
Batteries	20
Access track	40+
Fencing	20

Equipment	Life expectancy (years)
Concrete	40+
Cement bound sand	40+

2.3 Decommissioning Phase (2070 – 2072)

2.3.1 It has been assumed that the Scheme would be decommissioned in 2070 and decommissioning would take 2 years. It has been assumed that 50% of the equipment and materials used to construct the Scheme would be sent to landfill and 50% would be sent to a licenced recycling centre.

Plant vehicles and generators

2.3.2 The GHG emissions associated with the on-site plant vehicles and generators during the decommissioning period has been assumed to be the same as construction period.

Provision of clean water and treatment of wastewater

2.3.3 The GHG emissions associated with the energy consumption from the provision of clean water has been assumed to be the same as the construction period.

Transportation of waste materials

2.3.4 To calculate the GHG emissions associated with the transportation of waste materials, the following assumptions have been applied.

Table 15 – Distance to licenced disposal / recycling centre

Parameter	Unit	Value	Source
Distance to licenced landfill	km	100	Assumption, unknown location conservative assumption
Distance to licenced recycling centre	km	100	Assumption, unknown location conservative assumption

2.3.5 The weight of equipment / material to be disposed of has been determined and The DESNZ emission factor for HGV (all diesel) emission factor and the DESNZ WTT HGV (all diesel) emission factor have been applied.

Disposal / recycling of waste materials

2.3.6 To calculate the GHG emissions associated with the disposal / recycling of waste materials, the DESNZ emission factors have been applied.

Travel for workers

2.3.7 The GHG emissions associated with the travel of workers has been assumed to be the same as construction.

2.4 Lifetime of the Scheme

Land use change

2.4.1 During the lifetime of the Scheme, the land use will no longer be used for agricultural purposes and would be under long term management. The Natural England Report 2021[1] shows that the carbon flux of undisturbed semi-natural grassland under long-term management is negligible, compared to a net carbon loss from the land of 0.29 $tCO_2e/ha/yr$ for arable land. Therefore, the land use change associated with the Scheme will be an additional net carbon benefit. As detailed in **ES Vol 1 Chapter 12: Ground Conditions [EN010141/DR/6.1]**, peat is not suspected to be at the Site. As such, there is not expected to be any loss of peatland as a result of the Scheme or any associated GHG emissions.

[1] Natural England. (2021). *Carbon Storage and Sequestration by Habitat 2021 - NERR094.* [Last Accessed: 07 August 2025].

3.0 RESULTS

3.1.1 The total GHG emissions over the lifetime of the Scheme are summarised in the following table.

Table 16 – GHG emissions over the lifetime of the Scheme

Parameter	Unit	Value
Construction Phase		
1. Embodied within equipment and materials	tCO_2e	334,957
2. Transportation of equipment and construction materials to the Scheme	tCO_2e	21,021
3. Plant vehicles and generators	tCO_2e	2,760
4. Provision of clean water and treatment of wastewater	tCO_2e	3.7
5. Travel of construction workers	tCO_2e	6,061
Total Construction Phase	**tCO_2e**	**364,803**
Operational Phase		
1. Provision of clean water and treatment of wastewater	tCO_2e	6.0
2. Leakage of GHGs	tCO_2e	-
3. Travel of workers to site	tCO_2e	3,921
4. Replacement of equipment		
i) Embodied GHG emissions associated within the replacement of equipment	tCO_2e	268,942
ii) Transportation of replacement equipment to Scheme	tCO_2e	17,447
iii) Transportation of replaced equipment to recycling and disposal	tCO_2e	4,382
iv) Disposal and recycling of relaced equipment	tCO_2e	3,292
Total Operational Phase	**tCO_2e**	**297,990**
Decommissioning Phase		
1. Plant vehicles and generators	tCO_2e	2,760

2. Provision of clean water and treatment of wastewater	tCO_2e	3.7
3. Transportation of waste materials	tCO_2e	6,120
4. Disposal of waste materials	tCO_2e	3,592
5. Travel for workers	tCO_2e	6,061
Total Decommissioning Phase	**tCO_2e**	**18,537**
Total lifetime emissions	**tCO_2e**	**681,329**

3.1.2 As shown, using the conservative assumptions the total emissions over the lifetime of the Scheme are **~681,000 tCO_2e**.

4.0 EMISSIONS FACTORS

Table 17 – Energy source emission factors

Parameter	Unit	Value
Coal	g/kWh	919
Natural Gas	g/kWh	382
Nuclear	g/kWh	0
Renewables	g/kWh	0
Other	g/kWh	948
Overall average	g/kWh	154

DESNZ, 2025, Fuel Mix Disclosure Table

Table 18 – GHG conversion factors

Parameter	Unit	Value
HGV (all diesel) Articulated (>33t) (100% laden)	$kgCO_2e$/tonne.km	0.076
HGV (all diesel) All HGV (100% laden)	$kgCO_2e$/tonne.km	0.073
Cargo ship General cargo (average)	$kgCO_2e$/tonne.km	0.013
Cargo ship Container (average)	$kgCO_2e$/tonne.km	0.016
Open loop recycling of electrical items (WEEE-mixed)	$kgCO_2$/tonne	4.686
Landfill of electrical items (WEEE - mixed)	$kgCO_2$/tonne	8.983
Open loop recycling of batteries	$kgCO_2$/tonne	4.686
Landfill of batteries	$kgCO_2$/tonne	8.983
Open loop recycling of aggregates	$kgCO_2$/tonne	1.008
Landfill of aggregates	$kgCO_2$/tonne	1.263
Open loop recycling of concrete	$kgCO_2$/tonne	1.008
Landfill of concrete	$kgCO_2$/tonne	1.000
Open loop recycling of scrap metal	$kgCO_2$/tonne	4.686
Landfill of scrap metal	$kgCO_2$/tonne	8.983
Diesel emission factor	$kgCO_2$/L	2.571
Water supply	$kgCO_2e$/million litres	191
Water treatment	$kgCO_2e$/million litres	171
Average car emission factor (unknown fuel)	$kgCO_2e$/km	0.167
Diesel emission factor WTT	$kgCO_2$/L	0.624

Parameter	Unit	Value
WTT HGV (all diesel) All HGV (100% laden)	$kgCO_2e$/tonne.km	0.018
WTT Cargo ship General cargo (average)	$kgCO_2e$/tonne.km	0.003
WTT Cargo ship Container (average)	$kgCO_2e$/tonne.km	0.004
WTT cars (average car) unknown	$kgCO_2e$/km	0.044

DESNZ, 2025, GHG Conversion Factors

Table 19 – Conversion factors

Parameter	Unit	Value	Source
Density of gravel	kg/m^3	2,200	Standard assumption
Density of concrete	kg/m^3	2,400	Standard assumption