Findings of University of Derby on initial investigation of the Environmental Statement V1 Chapter 7: Climate Change (APP-059)

Concentrating Solar Power (CSP) and Zero Carbon Theme, University of Derby, Kedleston Road, Derby DE22 1GB

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Abstract

This report constitutes the findings of the University of Derby's investigation into the Lime Down Solar PV Farm and focuses on Lime Down's Environmental Statement Vol 1 Chapter 7: Climate Change (AEP-059), referred to as the **ES**. It encompasses two phases: an initial investigation of the Scheme's energy output and Greenhouse Gas (GHG) emissions based on the given values in the ES, effectively an "as is" viewpoint using two approaches (levelized and event-based), followed by a re-assessment of lifecycle emissions and subsequent comparison of the operational phase of the Scheme (60 years) against several scenarios of varying Grid Carbon Intensity including; 49 gCO2e/kWh, 45 gCO2e/kWh and a decarbonising Grid.

The chief findings of the "as is" viewpoint are that:

- The quoted energy outputs of the Scheme appear conservative. However, there may be other factors relevant that we are not aware of.
- Tracker panels are reported as having a lower energy output than fixed panels. However, we understand this was confirmed to be the case at a recent hearing, so have proceeded with our analyses here on that basis.
- Levelized and event-based approaches of assessing given energy output and GHG emissions, indicate a carbon payback in:
  - Year 2075 (fixed panels)/2079 (tracker panels) for levelized approach
  - Year 2062 (fixed panels)/2070 (tracker panels) for event-based approach.

The main conclusions from the subsequent re-assessment of GHG emissions and a comparison of the Scheme against the National Grid's performance, using various scenarios for the Grid Carbon Intensity are:

- Construction GHG emissions for Cables and Concrete were found to be under-stated in the ES.
- Items were added to the operational GHG emissions inventory including: Sulphur Hexafluoride, on-site cable replacement, mounting and tracker panel moving components and substation refurbishment

- Revised emissions for whole-life carbon were 966,311 to 975,206 tCO_2e (compared to the ES given 933,145 tCO_2e)
- When the Grid scenarios are taken into account (in combination with the revised whole-life emissions), the Scheme is considered:
  - a net saver at constant values of 49 and 45 gCO_2e/kWh (representing operation commencing from 2029 and 2030 respectively) with carbon payback late in the operational period (2070s onward).
  - a net emitter throughout its operational lifecycle under a decarbonising grid scenario or below constant grid intensity values of less than approximately 40.03 gCO_2e/kWh (for fixed PV panels) and 39.83 gCO_3e/kWh (for tracker PV panels).

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1.0 Introduction

1.1 This report details the findings of the University of Derby's initial investigation into the proposed National Infrastructure Project at Lime Down Solar Park in Wiltshire (Work Package 1). It focuses on **Lime Down's Environmental Statement, Vol 1, Chapter 7: Climate Change (September 2025, Revision 1) [APP-059]**, **hereafter referred to as the ES in this document**. Our brief was to review and comment on the statements concerning energy output and Greenhouse Gas (GHG) savings in the information given. The approach is to:

1) initially accept data from the ES as a given and make estimations of both energy output and greenhouse gas emissions (carbon balance) on that basis, effectively an "as is" viewpoint of the potential payback of the Scheme and

2) thereafter, where we have questioned certain stated emissions values, we have made reasonable estimates and applied them to the same model, in doing this, we have accepted the fixed and tracker panel energy output values (i.e. 438 GWh and 415 GWh) as given in the **ES 7.10.73**.

1.2 The chief findings are that:

a) The given energy outputs according to ES Section 7.10.73 for the first year of **438 GWh** (for fixed solar panels) and **415 GWh** (for tracker panels) are marginally lower than values achieved using solar estimation models, Global Solar Atlas (GSA) and PVsyst for the same given locational coordinates ***(GSA, 2026 and PVSyst, 2026)***. Manipulating the year 1 figures and taking into account panel degradation and replacement, the ES indicates. **24.62TWh** and **22.99** TWh for the operational lifespan of the Scheme for fixed and tracker panels respectively, whereas Global Solar Atlas indicates **27.57 TWh** (for fixed) and PVsyst estimates between **30.44 to 35.72 TWh** (for monofacial & bifacial fixed and bifacial tracking). However, it may be that there are specific factors at play which reduce the output of the Scheme for which we are unable to account.

b) If the Scheme is taken to be 500 MWp, the ES reports a relatively conservative value regarding energy output over the 60 years of the Schemes operational life. It should be made clear that the ES only refers to 500 MW in the context of an "export capacity" in ***ES Section 7.10.18*** and in the National Infrastructure Project documentation website for the Scheme.

c) In addition, energy outputs for tracker panels are reported to be lower than those for fixed panels, which seems to be counterintuitive as literature generally reports tracker panels as being more efficient. However, we understand that the applicant has confirmed this at a recent hearing (and that it may be related to the layout of such panels) and we have conducted our analyses based on this fact.

d) As an initial "sanity-check" for greenhouse gas emissions (GHGs), two carbon-balance approaches have been applied:

- a levelized one where the whole-life performance is expressed as gCO_2e/KWh over time and net-zero is considered as having been reached when the net carbon balance goes into the realms of a positive number (i.e. ≥0). This approach indicates that net-zero for the plant will not be reached until 2075 for fixed panels and 2078 for tracker panels, which is within the last 10 years of the Scheme's lifecycle.

and

- an "event-based" approach which tracks the cumulative "avoided" emissions year-by-year against cumulative lifecycle emissions accruing from construction, operation & decommissioning activities, explicitly applying discrete "events" throughout the lifespan (this includes replacements of components such as BESS, panels, inverters and transformers at intervals). This approach yields an initial net-zero (first break-even) and a re-payback after major "replacement dips".

e) In a re-assessment of certain Greenhouse Gas emissions stated in the ES, we have:

- re-assessed construction emissions related to
  - Cabling from 876 tCO2e to 20,762 tCO2e
  - Concreting from 5 tCO2e to a revised base to high range of 1,526-3,509 tCO2e
  - Included a screening allowance of 2,500-3,500 tCO2e for construction plant fuel
  - Included an allowance of 2,500-3,700 tCO2e for a separate non-transformer substation
- re-assessment of operation emissions includes the addition of certain items of inventory, namely:
  - Sulphur Hexafluoride (SF_6) leakage at 1,830-6,542 tCO2e
  - On-site cable replacement at 1,660 tCO2e
  - Mounting/tracker-panel moving components at 862 tCO2e
  - Substation refurbishment to cater for wider 132 and 400 kV substation scope at 2,400 tCO2e
- This adjusts the Scheme's reported whole life carbon total from **933,145 tCO2e** to a range of **966,311tCO2e-975,206 tCO2e**

f) An investigation of Grid Carbon Intensity counterfactuals compares several scenarios against the Scheme's original scenario of a fixed or constant Grid Carbon Intensity value of 49gCO2e/kWh against which to compare the performance of the Scheme, taking the above emission reassessments into account simultaneously:

- The Scheme is a **net-saver** of carbon, under constant values of 45 and 49 gCO2e/kWh, with payback occurring late in the operating life (2070s onward). However, at values less than the break-even (approximately 40 gCO2e/kWh), the Scheme becomes a **net-emitter** over the operational period.
- Whole-life payback is not achieved under the scenario of comparing against a decarbonising Grid (where the Grid Carbon Intensity decreases over the years, as per **DESNZ, 2023 Table 1**)

2.0 Energy Output using solar resource estimation models

2.1 An assessment of the potential energy output for the given location of the Lime Down site using the online solar resource, Global Solar Atlas **(Figure 1)** gives an estimated **498 GWh per year** for an assumed Scheme capacity of 500 MWp (a fixed panel with a default tilt angle of 38° has been assumed and accepted within the GSA model).

Project	England
Location	Commonwood Lane, Sherston, SN16 0PY, United Kingdom
Geographical coordinates	51.561262°, -2.209390° (51°33'41", -002°12'34")
Time zone	UTC+00, Europe/London [GMT]
Elevation	120 m

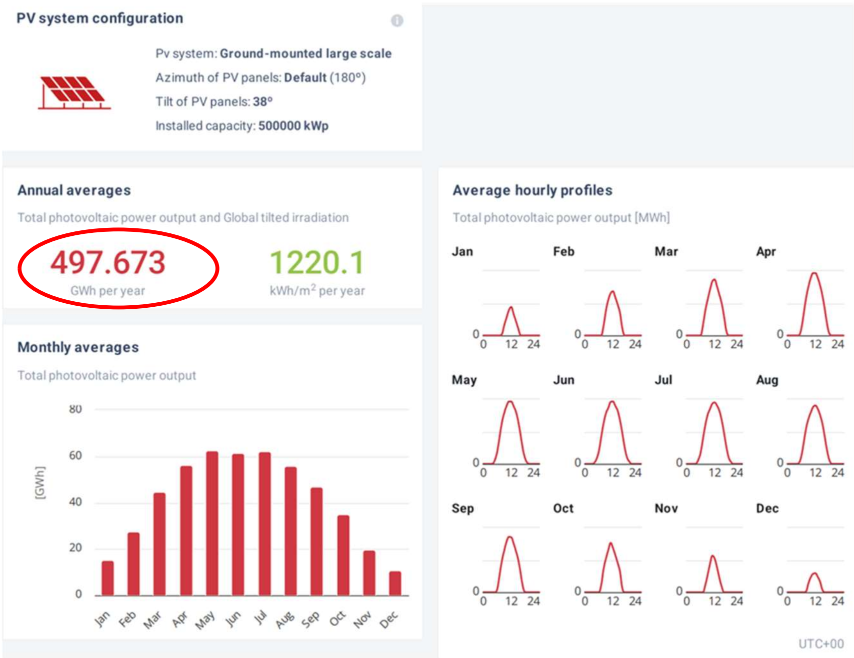
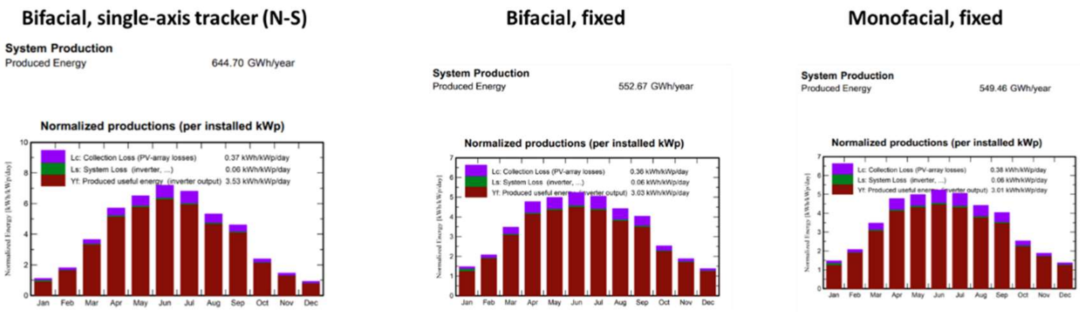


Figure 1: ***Screenshot of Global Solar Atlas model for the given location of the Lime Down Solar Park (Global Solar Atlas, 2026) –*** *annual PV output encircled in red.*

2.2 Likewise, when using PVsyst the following is achieved for a selection of tracker and fixed panels (**see Figure 2)**. This indicates **645, 553 and 550 GWh/year** for bifacial tracker, bifacial fixed and monofacial fixed respectively.



Item	Value
Orientation	Fixed plane, Tilt/Azimuth 38° / 0°
Ground albedo	0.20

Figure 2: ***PVsyst model for the given location of the Lime Down Solar Park (PVsyst, 2026):*** *38°(fixed) and ±60°(tracker)*

2.3 The ES states a generation of "around" **415,000 MWh/hr** in the first year of operation for tracker panels and "around" **438,000 MWh/yr** for fixed panels and a degradation schedule for the panels is described as **2% for the first year** of operation and then **0.45% per year thereafter** ***(ES Section 7.10.73)***. Values for the cumulative total are quoted in the ES as **23.54TWh and 24.26 TWh** for tracker and fixed panels respectively.

2.4 Table 2 and Figure 3 both arise from a calculation that takes the energy output in year 1 (from the ES or the two solar models for the varying panel types) and applies the panel degradation as detailed above with a "reset" at year 30 ***(ES Section 7.10.58)*** where the panels are replaced, hence 2% panel degradation in the first year and 0.45% thereafter is applied again. This produces cumulative energy output values of **22.99TWh** and **24.26 TWh** for tracker and fixed panels. The fixed total aligns closely with the ES's stated lifetime total (24.26 TWh), whereas the tracker recalculation is lower than the ES's stated 23.54 TWh, indicating that:

(a) the "around 415,000 MWh/yr" tracker value is rounded (***ES Section 7.10.73***) and not the exact value used in the ES lifetime calculation;

(b) additional internal rounding/inputs were used in the ES computation that are not fully transparent in the cited text and/or

(c) there are other factors at play that we are unable currently to take into account.

Table 2: Comparison of energy output (year one and lifecycle) between ES and solar resource models

Source / model	Configuration	Year-1 energy output (GWh/year)	Total at 60 years (taking into account panel replacement at 30 years) (TWh)
Environmental Statement (Vol 1, Ch.7)	Fixed panels	**438.00**	**24.26**
Environmental Statement (Vol 1, Ch.7)	Tracker panels	**415.00**	**22.99**
PVsyst	Monofacial, fixed	**549.46**	**30.44**
PVsyst	Bifacial, fixed	**552.67**	**30.62**
PVsyst	Bifacial, single-axis tracking	**644.70**	**35.72**
Global Solar Atlas model	Monofacial, fixed	**497.67**	**27.57**

Note: red value varies from that quoted in ES Section 7.10.73 (i.e. 23.54 TWh) – this appears to have been a rounding error, we have shown the corrected value here.

As can be seen in Table 2, the solar models result in a higher output for the given location of the Lime Down Scheme.

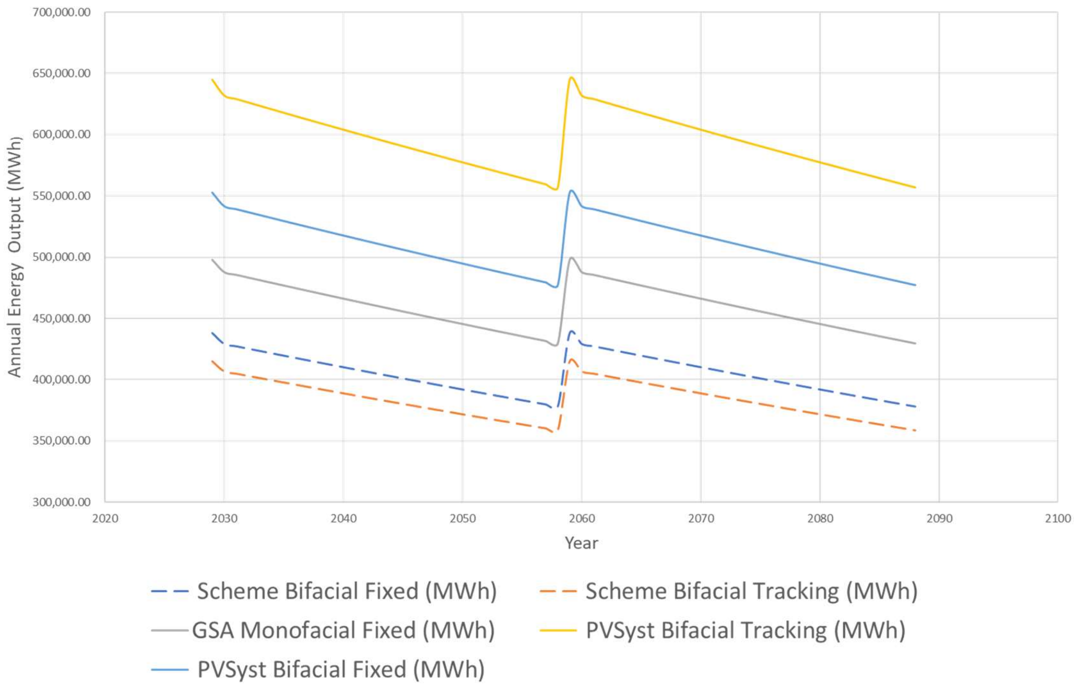


Figure 3: ***Lime Down Energy output over 60 years of Schemes lifespan (ES and solar resource model comparison).*** *This takes into account annual panel degradation and replacement of the panels at 30 years.*

It can be seen in Figure 3 that the Scheme's assessments (the two dotted lines) give lower values than either of the two models, GSA or PVSyst (denoted as solid lines). The sharp incline at 30 years represents the panel replacement.

2.5 Interestingly, the fixed panels are reported in the ES to have a better output than the tracker panels, which seems counterintuitive, as one would typically expect a tracker panel to be more efficient. Single-axis trackers are reported to achieve a 20-35% energy yield and dual-axis trackers, 30-45% compared to fixed-tilt panels, depending on geographic location and local climate (***Sadeghi et al., 2025***). However, we have subsequently been made aware that the applicant has confirmed this at a recent hearing, and that this may be as a result of layout constraints.

2.6 We would be interested to know the reasons for the lower than expected stated energy output given in the ES and feel that this would be valuable information to be included in the Scheme's future documentation. We have made an estimate of plant capacity as 390-420MWp with a mid-value range of 400-410Mwp in **Appendix A**.

3.0 Lifecycle Greenhouse Gases (GHGs)

3.1 As indicated by National Policy, all energy infrastructure projects include a GHG assessment as part of their Environmental Statement (NPS EN-1, **DESNZ, 2024**). Section 5.3.4 of this Policy states what should be included: a whole life GHG assessment i.e. construction, operational and decommissioning GHG impacts (including those impacts from change of land use), an explanation of the steps taken to reduce these impacts, inclusion of embodied GHG impact etc. Ultimately, this will determine the Secretary of State's response to the Scheme.

3.2 Using the GHG data presented in the ES, an "as is" approach i.e. taking Lime Down's given data, can be used to estimate when the plant will become net-positive in terms of carbon balance. Table 3 collates the necessary data presented in the ES document to model the GHGs over the lifecycle of the plant.

Table 3: Lifecycle GHG of the Lime Down scheme (data abstracted from ES)

Group	Parameter	Value	Units / Notes
Timeline	Construction start year	2027	Calendar year
Timeline	Construction duration	2	Years
Timeline	Operation duration	60	Years
Timeline	Decommission duration	2	Years
Generation	Year-1 generation (MWh)	415,000/	438,000.00
Generation	Annual degradation rate	0.45%	
Generation	Year 1 degradation	2.0%	
Baseline	Grid baseline intensity	49.0	gCO2e/kWh (Ch7 2029 projection = 49)
Lifecycle	Construction emissions total	237,149	tCO2e (Table 7-22 total)
Lifecycle	Operation emissions total (lifetime)	686,992	tCO2e (Table 7-26 total)
Lifecycle	Decommission emissions total	9,003	tCO2e (Table 7-27 total)

3.3 This data enables two approaches at looking at the lifetime GHGs of the Scheme and the period in which payback will be achieved:

- a **levelized** one where the whole-life performance is expressed as gCO_2e/KWh over time and net-zero is considered as having been reached when the net carbon balance goes into the realms of a positive number (i.e. ≥0). This approach indicates that net-zero for the plant will not be reached until 2075 for fixed panels and 2078 for tracker panels, which is within the last 10 years of the Scheme's lifecycle.

  and

- an **"event-based"** approach which tracks the cumulative "avoided" emissions year-by-year against cumulative lifecycle emissions accruing from construction/operation & decommissioning activities. This explicitly applies discrete "events" throughout the lifespan (this includes construction emissions, operational emissions involving replacements of components such as BESS, panels, inverters and transformers at intervals, non-component related operational emissions related to energy, water transport etc and decommissioning emissions). This approach yields an initial net-zero (first break-even) and a re-payback after major "replacement dips" as will be seen.

3.4 Levelised Approach

3.4.1 Starting from the basis of the quoted energy output for year 1 (438GWh/year and 415 GWh/year for fixed and tracker panels respectively ***(ES Section 7.10.73)***, the annual generation for each year can be calculated, taking into account panel degradation (2% for first year, 0.45% thereafter) and panel replacement at 30 years (resulting in a reset of the panel degradation to 2% for first year and 0.45% thereafter).

3.4.2 "Avoided" emissions are defined here as those emissions that would be produced by the National Grid for the same amount of annual electricity output as produced by the Scheme. These are calculated thus:

$$\textbf{Avoided emission}_{\text{year “n”}} = \textbf{Annual energy output}_{\text{year “n”}}\ \textbf{(kWh) x 49gCO}_2\textbf{e/kWh}$$

3.4.3 The 49gCO2e/kWh value is the GHG intensity attributed to the Grid based on average grid emissions forecasts in the UK, for the year 2029 when the Scheme begins to operate ***(Dept of Energy Security and Net Zero, 2023)***. The ES uses this value ***(Sections 7.4.21 and 7.7.4)*** for their "future baseline" against which they compare the Scheme. Whereas, the actual statistics cater for decarbonisation of the grid over time i.e. this value will decrease, the ES use the first operational year data to "avoid the inherent uncertainties and potential fluctuations that may arise in future years" and mentions that "This means that the effect of the scheme on future national grid intensity is not double counted" ***(ES Section 7.7.4)***. The current DESNZ decarbonising grid values until 2100 are given in **Appendix B.**

It should be noted here, that in section 5, we will investigate the effect of comparing against a decarbonising grid (as per DESNZ, 2023) and also comparing against alternative fixed values for Grid Carbon Intensity, such as 45 gCO2e/kWh to test the "sensitivity" of the GHG emissions performance.

3.4.4 If you compare the cumulative avoided emissions against a base line of 933,144 tCO2e (the given total emissions for the lifetime of the plant i.e. construction, operation and decommissioning emissions), Figure 4 is achieved. The raw data for this is shown in **Appendix C**.

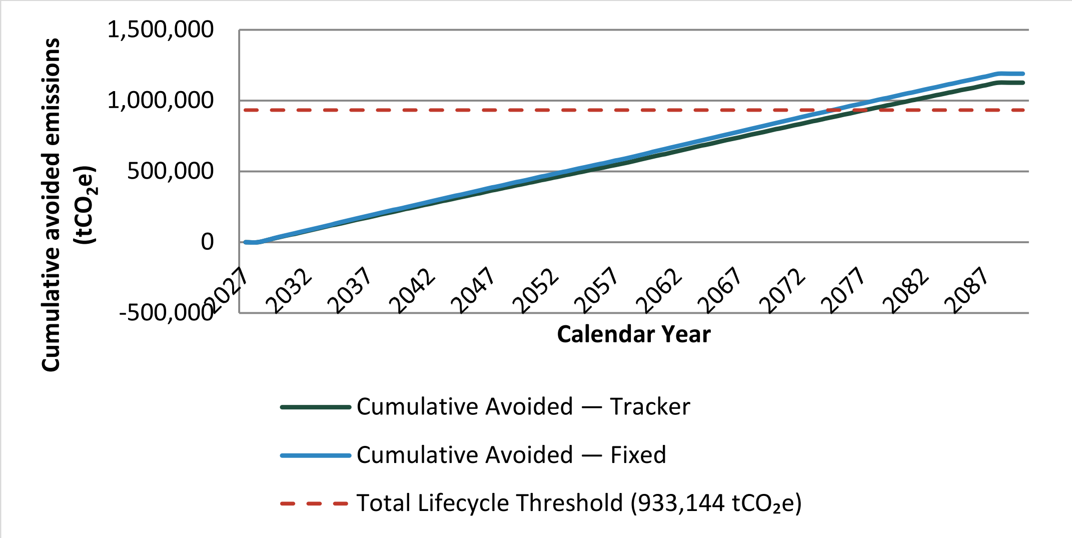


Figure 4: Levelized Carbon Emissions (annualised approach) showing Cumulative Avoided Emissions vs. Lifecycle Carbon Threshold

This shows that the cross-over point at which the avoided emissions equal or exceed the total lifetime emissions for the Scheme, where net-zero is effectively achieved, is at 2075 (for the fixed panel case) and 2078 (for the tracker panel case). This is quite late in the Scheme's lifecycle, as the Scheme ceases operation in 2089.

3.5 Event-based approach

3.5.1 This approach to estimate carbon payback, tracks the avoided emissions year-by-year against cumulative lifecycle or "incurred" emissions, **while explicitly applying discrete "emissions events" when they occur** e.g. component replacements and end-of-life activities. The following Table 4 captures the relevant data for these events as supplied in the ES document.

Table 4: Event-based approach – relevant given data from ES document (Tables 7-4 and 7-26)

Item	Emissions (tCO2e)	No of replacements in Operational Phase	Emissions per replacement i.e. "event" (tCO2e)
BESS replacements incl. transport	530,853	5	106,170.6
PV modules replacement incl. transport	57,039	1	57,039
Inverters Replacement	15,206	5	3,041.2
Transformers Replacement	5,038	1	5,038.1

3.5.2 Using the above data, it is apparent that the following replacement "events" occur during the operational timescale (Table 5).

Table 5: Component replacement events during operational cycle

Year	What gets replaced?	Associated Emissions for this replacement or event (tCO2e)
Year 10 (2039)	BESS & Inverters	109,211.8
Year 20 (2049)	BESS & Inverters	109,211.8
Year 30 (2059)	Everything (PV Panels, BESS, Inverters & Transformers)	171,288.9
Year 40 (2069)	BESS & Inverters	109,211.8
Year 50 (2079)	BESS & Inverters	109,211.8

3.5.3 The term "Net Savings" is used here to represent the difference between avoided emissions (as seen in the levelized approach) and "incurred emissions". The latter are those emissions directly attributable to certain events occurring throughout the lifecycle of the Scheme. These include:

- the construction emissions given as 237,149tCO2e over 2 years ***(ES Section 7.10.45 Table 7-22)***
- major component replacements at specific times in the operational phase (as detailed above in Table 4)
- non-component items such as worker transport, energy usage, packaging, operational waste and water calculated as 1314tCO2e pa, based on given data ***(ES Section 7.10.71 Table 7-26)***
- and decommissioning emissions given as 9003tCO2e over 2 years ***(ES Section 7.10.84 Table 7-27)***.

Thus, in each year:

Net Savings$_{year\ “n”}$ (tCO2e) = Avoided Emissions$_{year\ “n”}$ – Incurred emissions$_{year\ “n”}$

3.5.4 Calculating the cumulative net savings in tCO2e for the fixed and tracker panel scenarios from the above gives rise to Figure 5 (raw data is shown in **Appendix C**).

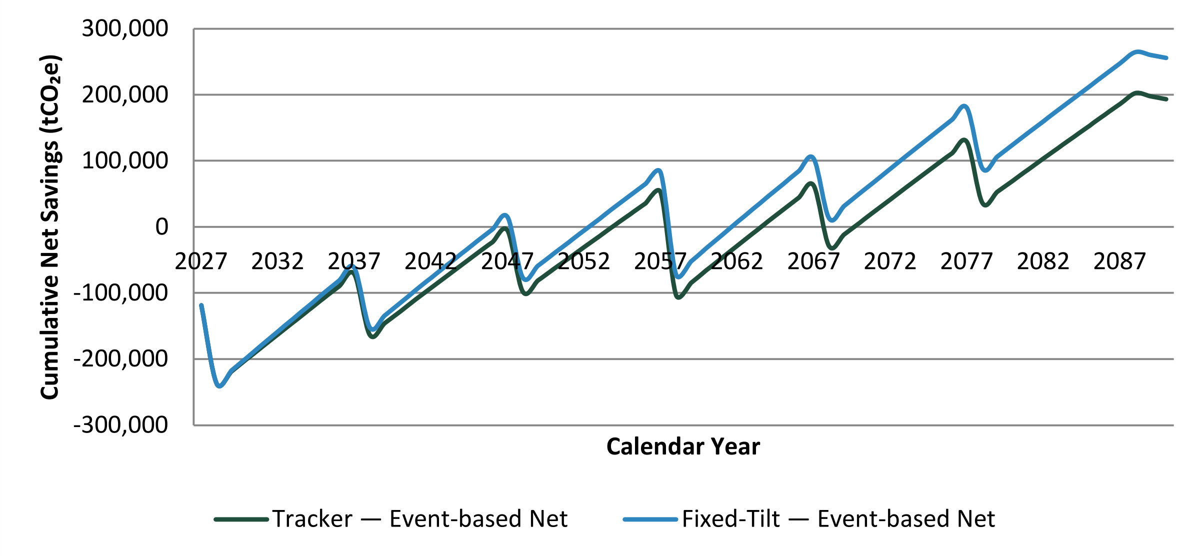


Figure 5: Event-based carbon balance – cumulative net savings overtime

Figure 5 shows "spikes" of carbon payback at different intervals throughout the Schemes lifecycle, offset by replacement events associated with critical components. This shows that the Scheme is truly positive (permanently above zero) in 2062 for fixed panels and 2070 for tracker panels.

4.0 Whole-life Carbon Assessment

4.1 Having looked at the "payback" based on the given data in the ES, we now look at revised GHG estimates and the effect of varying the Grid Carbon Intensity values. Again, the assessment is anchored to the ES. The applicant reports construction emissions of 237,149 tCO2e **(ES Table 7-22)**, operational emissions of 686,989 tCO2e **(ES Table 7-26)** and decommissioning emissions of 9,002 tCO2e **(ES Table 7-27)**. The applicant's whole-life total is treated as **933,145 tCO2e** for net-position testing.

4.2 For generation, this review uses the more favourable of the ES lifetime generation figures, 24.26 TWh **(ES 7.10.73)** over 60 years. This avoids a separate debate over yield assumptions and gives the project the benefit of the higher ES output case. For time-varying grid scenarios, the companion model uses a transparent annual generation proxy scaled to this ES lifetime total.

4.3 Table 6 summarises the "given" data provided in the ES.

Table 6: Applicant figures as submitted

Construction source	tCO2e
Products (BESS containers)	100,000
Products (Solar PV panels including mounting structures)	98,451
Transportation of materials by sea	17,011
Worker transportation and delivery vehicles	13,187
Products (transformers)	4,445
Products (inverters)	2,872
Products (cables)	876
Energy usage for construction phase	220
Packaging	76
Concrete feet	5
Water usage	3
Waste	3

Operational source	tCO2e
BESS replacement, inclusive of transportation	530,853
Worker transportation	74,859
PV modules replacement, inclusive of transportation	57,039
Replacement of inverters	15,206
Replacement of transformers	5,038
Energy usage for operation and maintenance	3,896
Packaging	52
Operational waste	45
Water usage	4

Decommissioning source	tCO2e
Decommissioning total	9,002

The carbon payback using the above values has been presented in section 3.0 of this report (see Figures 4 and 5).

4.3. Revised construction assessment

4.3.1 Table 7 presents a revised construction case. The reviewed construction case accepts the ES values for PV modules and mounting structures, BESS containers, sea transport, worker and delivery transport, transformers, inverters, packaging, water and waste where those entries are sufficiently supported by the ES calculation trail. The material changes are confined to cable materials, concrete and civil works, construction plant fuel, SF6 initial fill, and non-transformer substation scope.

Table 7: ***Revised construction case***

Construction line item	Applicant	Reviewed base	Reviewed high	Evidence basis
Products (BESS containers)	100,000	100,000	100,000	Accepted from ES Table 7-22
PV panels and mounting structures	98,451	98,451	98,451	Accepted from ES Table 7-22
Transportation of materials by sea	17,011	17,011	17,011	Accepted from ES Table 7-16 / Table 7-22
Worker transportation and delivery vehicles	13,187	13,187	13,187	Accepted from ES Table 7-17, Table 7-18 and Table 7-22
Products (transformers)	4,445	4,445	4,445	Accepted from ES Table 7-15 / Table 7-22
Products (inverters)	2,872	2,872	2,872	Accepted from ES Table 7-22
Products (cables)	876	20,762	20,762	Bottom-up cable reconstruction from HV route lengths, cable specs and material factors **(ES; ES APP-269; DEZNZ, 2024; SP Power Systems, 2026; Cable Services, 2026; GHG Protocol, 2024)**
Energy usage for construction phase	220	220	220	Accepted temporary electricity line
Construction plant fuel allowance	0	2,500	3,500	Screening allowance because construction plant fuel is not quantified in the ES **(DESNZ, 2024)**
Packaging	76	76	76	Accepted from ES Table 7-21 / Table 7-22
Concrete feet and principal civils concrete	5	1,526	3,509	Evidence-bounded concrete rebuild from ES waste statement and public design parameters **[(ES APP-269; DESNZ,2024)**
Water usage	3	3	3	Accepted from ES Table 7-19 / Table 7-22
Waste	3	3	3	Accepted from ES paragraphs 7.10.37-7.10.41
SF6 manufacture, initial fill	0	9	9	Small manufacture allowance tied to switchgear inventory screen **(GHG PROTOCOL, 2024;IEC, 2022)**
Non-transformer substation scope	0	2,500	3,700	Screening allowance for switchgear, control and non-transformer substation scope **(ES APP-269; DESNZ,2024)**
Reviewed construction total	237,149	263,565	267,748	

4.3.2 Revision of GHG emissions from certain components during the construction period are as follows:

a) Cables

ES Table 7-22 reports only 876 tCO2e for Products (Cables). The ES method states that indicative cable lengths are 2,755 km in total, but only 2.12 km are treated as high-voltage cable and only 50.95 tonnes are assigned to high-voltage cable mass **(ES 7.10.24).** That inventory does not provide a credible basis for a scheme that includes a 22 km underground 400 kV grid connection, internal 132 kV collection and extensive on-site DC and AC cabling. The reviewed cable value is therefore built up by voltage system and route length, using public cable specifications and material-level emission factors **(DESNZ, 2024; SP Power Systems, 2026; Cable Services, 2026; ICE Database, 2026)**

The reviewed cable value is approximately 20,762 tCO2e. This comprises 22.0 km of 400 kV XLPE route at 587 tCO2e per circuit-km, 11.88 km of 132 kV route at 300 tCO2e per circuit-km, 2,800 km of DC string cabling at 0.34 tCO2e/km, 350 km of low-voltage / AC collection cabling at 6 tCO2e/km, and cement-bound sand / trench materials for the 400 kV and 132 kV routes. This is a screening reconstruction and should be replaced by the applicant's cable schedule and supplier environmental product declarations if disclosed.

b) Concrete

ES Table 7-22 reports only 5 tCO2e for Concrete Feet. The ES narrative separately states that 78.5 tonnes of concrete are assumed to be wasted at a 5% wastage rate (**ES 7.10.40)**, implying approximately 1,570 tonnes of concrete in the relevant works before wastage. The 5 tCO2e entry therefore appears to count disposal of damaged concrete rather than the embodied carbon of concrete placed in the scheme. A definitive scheme-wide concrete total cannot be stated from public documents alone because final foundation drawings, BESS containment details, substation foundation schedules and drainage details are not published. The reviewed figure is therefore evidence-bounded rather than presented as a final design quantity.

The reviewed base concrete value is 1,526 tCO2e. It is built from public design parameters and conservative civil allowances for 33 kV conversion-unit foundations, BESS foundation pads, control and switch-room slabs, 400 kV joint-bay pads and minor chambers/local civils **(ES APP-059; ES APP-269; DESNZ 2024).** The reviewed high case is 3,509 tCO2e, reflecting a higher civil-works sensitivity. A separate module-footing stress test is included in the workbook but is excluded from the headline totals because the public documents do not establish that module foundations will be concrete across the site.

c) Construction plant fuel and substation scope

The ES states that construction plant fuel was not known at the time of writing and was not calculated, although it was assumed to represent less than 1% of total GHG emissions **(ES.7.4.4**) A screening allowance of 2,500 tCO2e in the base case and 3,500 tCO2e in the high case is therefore included. A separate non-transformer substation allowance is also included because a transformer line alone does not demonstrate that the wider 132 kV and 400 kV substation structural, switchgear, control and ancillary scope has been fully captured **(ES APP-269; DESNZ, 2024).**

4.4 Revised operational assessment

4.4.1 The main operational replacement lines are retained as submitted. The ES states that BESS replacement, PV module replacement, inverter replacement and transformer replacement include transport or shipment, so no further operational shipping uplift is applied (**ES 7.10.57-59)**. Additional operational allowances are included only where an emission source is acknowledged but not quantified, or where the ES replacement assumptions include an item that is not visible as a separate line in ES Table 7-26. Table 8 shows the revised assessment.

Table 8: Revised operational assessment

Operational line item	Applicant	Reviewed base	Reviewed high	Evidence basis
BESS replacement, inclusive of transportation	530,853	530,853	530,853	Accepted from ES Table 7-26
Worker transportation	74,859	74,859	74,859	Accepted in totals, but should be justified by applicant because the implied travel volume is large
PV modules replacement, inclusive of transportation	57,039	57,039	57,039	Accepted from ES Table 7-26
Replacement of inverters	15,206	15,206	15,206	Accepted from ES Table 7-26
Replacement of transformers	5,038	5,038	5,038	Accepted from ES Table 7-26
Energy usage for operation and maintenance	3,896	3,896	3,896	Accepted from ES Table 7-25 / Table 7-26
Packaging	52	52	52	Accepted from ES Table 7-24 / Table 7-26
Operational waste	45	45	45	Accepted from ES Table 7-26
Water usage	4	4	4	Accepted from ES Table 7-26
SF6 fugitive leakage	0	1,830	6,542	Added because the ES acknowledges SF6 but does not quantify fugitive leakage **(ES; GHG Protocol, 2024; IEC, 2022)**
On-site cable replacement allowance	0	1,660	1,660	Added because ES Table 7-4 includes up to 20% on-site cable replacement but Table 7-26 has no separate line **(ES; DESNZ, 2024)**
Mounting / tracker moving components	0	862	862	Modest mid-life allowance for moving components over a 60-year life **(ICE,2026)**
Substation refurbishment	0	2,400	2,400	Screening allowance for partial HV substation control/switchgear refurbishment **(ES APP-269; DESNZ, 2024)**
Reviewed operational total	686,989	693,744	698,456	

4.4.2 Operational additions are explained thus:

- SF6 leakage is included because the ES identifies sulphur hexafluoride as a relevant greenhouse gas and acknowledges that fugitive leakage has not been quantified (**ES 7.10.53-54**). The base estimate of 1,830 tCO2e uses a breaker-level screening inventory, annual leakage assumptions and the ES-cited GWP100 of 23,900 **(GHG Protocol, 2024; IEC, 2026)**. The high case of 6,542 tCO2e represents a broader GIS inventory screen.
- On-site cable replacement is included because **ES Table 7-4** allows up to 20% replacement of on-site low-voltage DC cabling during the scheme life, but **ES Table 7-26** does not show a separate cable-replacement line.
- The mounting/tracker moving-component allowance and substation refurbishment allowance are screening values for partial mid-life replacement of moving parts, controls, protection equipment and ancillary plant over a 60-year operating life **(ES APP-269; ICE, 2026)**.

Each of these additions is a screening allowance and should be replaced by an applicant-specific operation and maintenance replacement schedule if one is disclosed.

4.4.3 It should be noted here that plots to represent the re-assessed GHG emissions in combination with varying Grid Carbon Intensity values are incorporated together in section 5.0

5.0 Grid-intensity counterfactual and plant intensity

5.1 Regarding the energy-output basis, the ES greenhouse-gas assessment uses two annual output sequences: a 415 GWh Year 1 sequence and a 438 GWh Year 1 sequence **(ES 7.10.72)**. This review therefore uses the ES output figures as given for fixed and tracker systems.

Table 9: Given energy output for fixed and tracker panels

Output case	Year 1 GWh	Year 30 GWh	Year 31 GWh	Lifetime TWh
Fixed output case	438	378	438	24.27
Tracker output case	415	358	415	22.99

5.2 The carbon-benefit conclusion depends on the grid intensity assumed to be displaced. A constant grid factor avoids the circularity problem that can arise when a single project is tested against a future grid pathway that already assumes economy-wide renewable deployment. However, a constant factor can overstate long-term avoided emissions if it is presented as a 60-year forecast. A time-varying DESNZ grid-average pathway is therefore used here as a compatibility and stress test **(DESNZ, 2023 Data tables 1-19,** see also **Appendix B)**

5.3 This distinction is important. The constant-factor tests answer the question: how long would the scheme take to offset its whole-life carbon if each exported kWh displaced a fixed grid intensity? The DESNZ time-varying test answers a different question: is the scheme's whole-life carbon intensity clearly ahead of the official decarbonising grid pathway over the 60-year life? Both tests are informative, but they should not be confused.

5.4 The scenarios below retain both constant and a time-varying case so the Examining Authority can see the sensitivity transparently.

- **49 gCO2e/kWh** is based on the value used in the **ES 7.4.21, 7.7.4 and 7.10.91** (this is used for the reasons stated in section 3.4.3 of this report, as an attempt to avoid "double-counting" by the Scheme).
- **45 gCO2e/kWh** is used as an alternative fixed value to 49gCO2e/kWh. It represents the Grid Carbon Intensity for the year 2030 and has been used to show if, or how, the situation changes with the slightly different value, for example, if construction is delayed by a year as in this case **(DESNZ, 2023 Table 1,** see also **Appendix B** for full table of grid intensity values until 2100).
- "Grid-average time-varying" is again taken from the DESNZ Table 1 values (**DESNZ, 2023** and **Appendix B**). This shows the effect of the "decarbonising grid".

5.4 The various scenarios are presented in Table 10.

Table 10: Scenarios for varying grid-intensity counterfactuals

Energy case	Scenario	Lifetime avoided (tCO2e)	Net vs applicant (tCO2e)	Net vs base (tCO2e)	Net vs high (tCO2e)	Payback applicant (in year)	Payback base (in year)	Payback high (in year(
Fixed	49 g constant	1,188,994	255,849	222,683	213,788	2075	2077	2077
Fixed	45.1 g constant	1,094,360	161,215	128,049	119,154	2079	2081	2082
Fixed	DESNZ grid average	193,533	-739,612	-772,778	-781,673	Never	Never	Never
Tracker	49 g constant	1,126,558	193,413	160,247	151,352	2078	2080	2080
Tracker	45.1 g constant	1,036,893	103,748	70,582	61,687	2082	2084	2085
Tracker	DESNZ grid average	183,371	-749,774	-782,940	-791,835	Never	Never	Never

Under constant grid-intensity factors of 49 gCO2e/kWh and 45.1 gCO2e/kWh, both fixed and tracker output cases show lifetime savings, although offset dates move towards the later part of the operational life as the grid intensity decreases. Under the DESNZ time-varying grid-average pathway, neither output case offsets the applicant or reviewed whole-life totals within 60 years.

Figures 6 to 8 show the three grid scenarios (49, 45 and decarbonising grid as per DESNZ, 2024). It should be noted that at the scale of these graphs the revised lifecycle emissions thresholds, base (or low) and high, which are **966,311tCO2e** and **975,206tCO2e** respectively (construction plus operational plus decommissioning emissions), overlap. A similar exercise (not shown) for 40gCO2e/kWh shows that although the case for the fixed panels shows net saving in the year 2089, the tracker panels do not cross the threshold (and the Scheme under these conditions therefore represents a net-emitter).

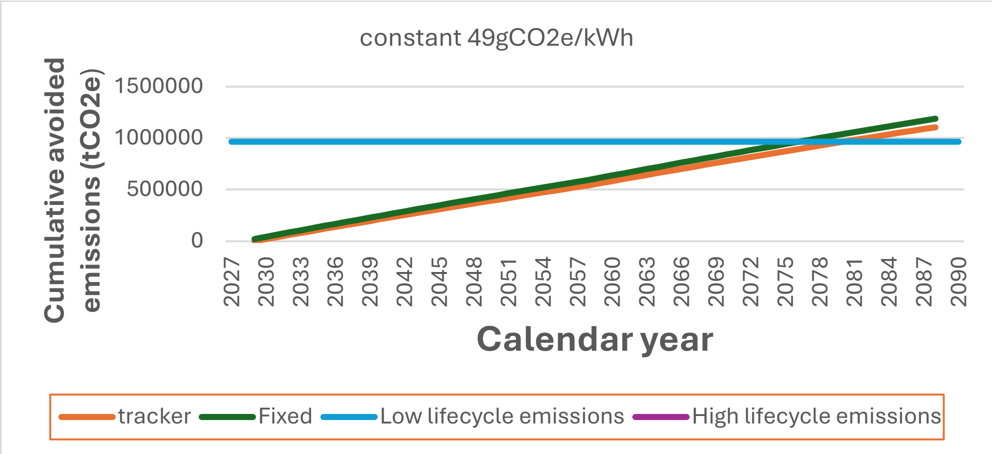


Figure 6: Cumulative avoided emissions vs year (for constant Grid Carbon Intensity of 49gCO2e/kWh)

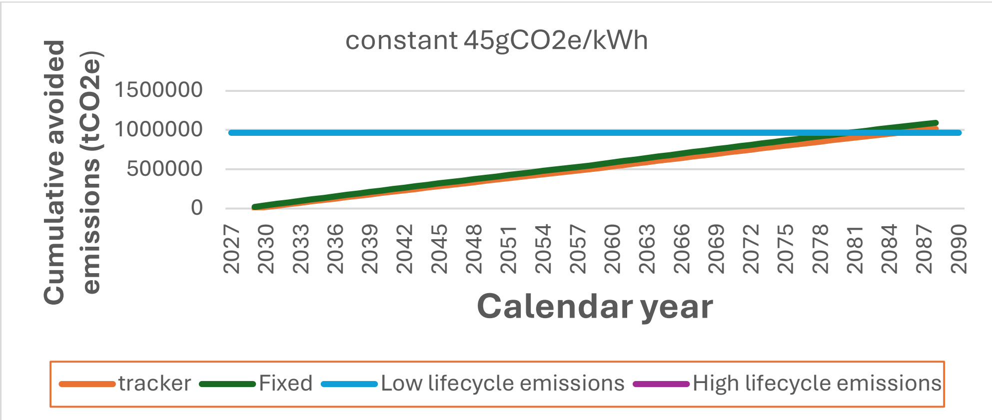


Figure 7: Cumulative avoided emissions vs year (for constant Grid Carbon Intensity of 45gCO2e/kWh)

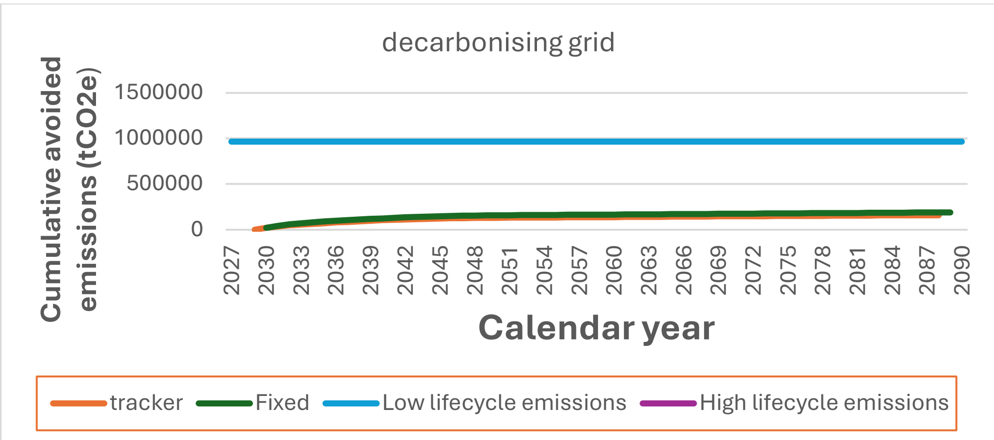


Figure 8: Cumulative avoided emissions vs year (for varying Grid Carbon Intensity as per DESNZ, 2023 Table 1)

5.5 Another way of representing the situation pictorially, is to show the net carbon position by grid intensity case as in Figure 9.

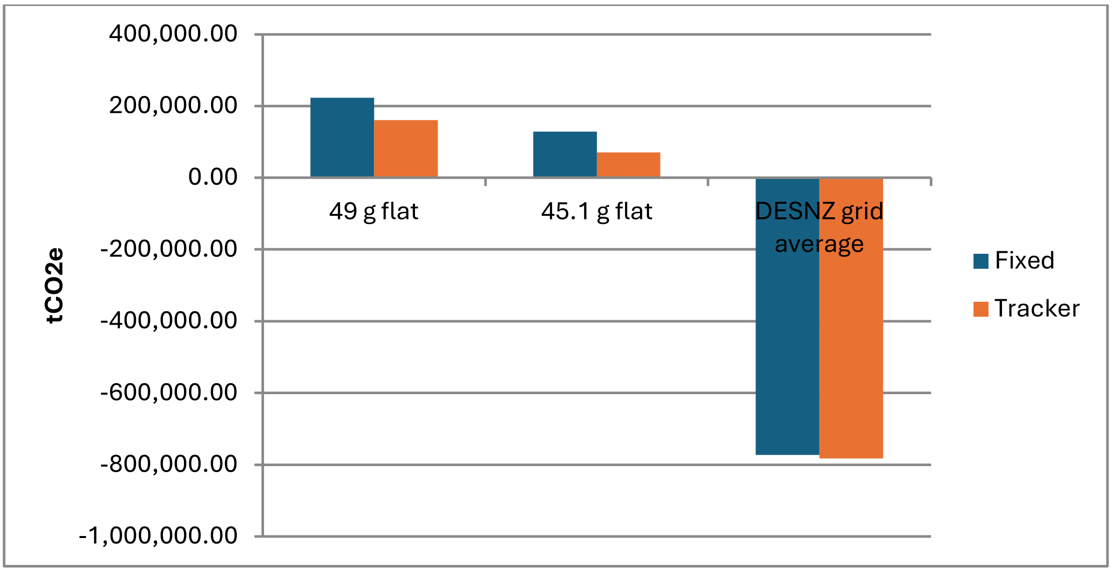


Figure 9: Net carbon position by grid-intensity case

5.6 Table 11 lists the Scheme's Intensity metric (emissions divided by energy output), based on: the applicant's given whole-life intensity values, the reviewed base and reviewed high whole-life values, the applicant's given operational intensity and the reviewed base and high intensities.

Table 11: Scheme intensity metrics (for fixed and tracker panels)

Scheme intensity metric	Fixed output case gCO2e/kWh	Tracker output case gCO2e/kWh
Applicant headline whole-life intensity	38.46	40.59
Reviewed base whole-life intensity	39.82	42.03
Reviewed high whole-life intensity	40.19	42.42
Applicant operational-only intensity	28.31	29.88
Reviewed base operational-only intensity	28.59	31.17
Reviewed high operational-only intensity	28.78	30.38

The reviewed base whole-life intensity is approximately 39.82 gCO2e/kWh for fixed panels and 42.03 gCO2e/kWh for tracker panels. The reviewed high whole-life intensity for fixed and trackers panels is 40.19 gCO2e/kWh and 42.42 gCO2e/kWh respectively. The DESNZ grid-average pathway is above these values in 2029 and 2030 but falls below them from 2031(see **Appendix B**). This does not mean that the Scheme has no renewable value, it means that the ES should not rely only on a frozen 2029 grid factor to demonstrate a whole-life carbon benefit. Figure 10 represents this situation.

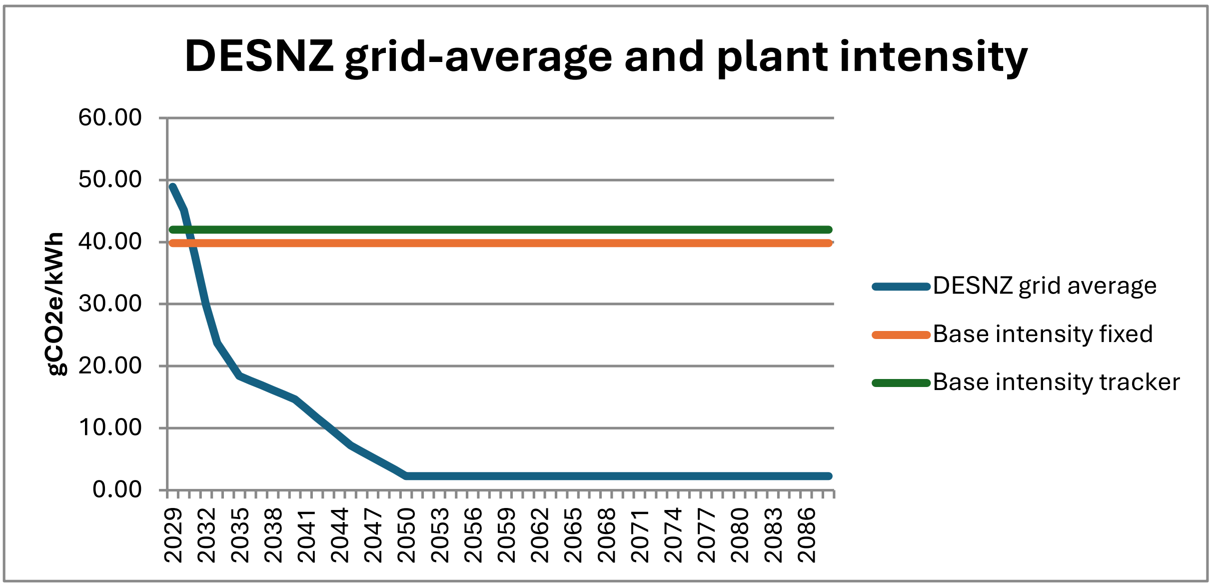


Figure 10: The scheme's whole life intensity compared to the varying grid-intensity as per DESNZ, 2023 (see Appendix B).

5.7 Table 12 shows the offset year (year in which the Scheme becomes Net Zero) under a range of constant grid intensity values. This is not a forecast of the UK grid. It is a sensitivity table showing the flat displacement factor required for the Scheme to repay its whole-life carbon within the 60-year operational period.

Table 12: Constant-factor offset sensitivity

Constant grid factor	Energy case	Lifetime avoided (tCO2e)	Payback applicant (in year)	Payback base (in year)	Payback high (in year)	Net vs base
49.00	Fixed	1,188,994	2075	2077	2077	222,683
49.00	Tracker	1,126,558	2078	2080	2080	160,247
45.10	Fixed	1,094,360	2079	2081	2082	128,049
45.10	Tracker	1,036,893	2082	2084	2085	70,582
42.00	Fixed	1,019,138	2083	2085	2086	52,827
42.00	Tracker	965,621	2086	Never	Never	-690
40.20	Fixed	975,460	2086	2088	2088	9,149
40.20	Tracker	924,238	Never	Never	Never	-42,073
39.83	Fixed	966,482	2086	2088	Never	171
39.83	Tracker	915,731	Never	Never	Never	-50,580
38.46	Fixed	933,239	2088	Never	Never	-33,072
38.46	Tracker	884,233	Never	Never	Never	-82,078
35.00	Fixed	849,281	Never	Never	Never	-117,030
35.00	Tracker	804,684	Never	Never	Never	-161,627
30.00	Fixed	727,955	Never	Never	Never	-238,356
30.00	Tracker	689,729	Never	Never	Never	-276,582

The break-even constant grid factor is approximately:

- 38.46 gCO2e/kWh for the applicant headline case (fixed panels) and 42.03 gCO2e/kWh for the applicant headline case (tracker panels).

- 39.83 gCO2e/kWh for the reviewed base case (fixed panels) and 40.03 gCO2e/kWh (tracker panels).

Any constant displacement factor below these values fails to offset the relevant whole-life total over 60 years.

6.0 Conclusions

6.1 This investigation took place in two phases, an initial investigation of the Scheme's energy output and GHG emissions based on the given values in the ES being effectively an "as is" viewpoint using two approaches (levelized and event-based), followed by a re-assessment of lifecycle emissions and inclusion of a comparison against various Grid Carbon Intensity values; 49 gCO2e/kWh, 45 gCO2e/kWh, and a decarbonising Grid as per most recent figures **(DESNZ, 2023 Table 1,** also duplicated in **Appendix B)** and a sensitivity analysis over arrange of flat or constant grid intensity values.

6.2 This "as is" review of the ES document has looked at "given" energy output and GHG emissions data. The following conclusions have been drawn:

- the quoted energy outputs in year 1 for both fixed and tracker panels seem conservative if the Scheme is an assumed 500 kWp. Our estimates suggest 390-420MWp, with an emphasis on 400-410MWp. However, there may be other factors at play that we are not aware of.
- tracker panels are reported as having a lower energy output than fixed panels, which is at odds with current thinking. However, we understand this was confirmed to be the case at a recent hearing and have proceeded with our analyses on this basis and accepted the given values in the ES.
- The two factors above suggest a definitional or constraint mismatch for reasons which are not clearly obvious in the ES as it stands.
- An initial "sanity check" on GHG emissions using two different approaches suggests:
    - Levelised approach: a carbon payback in the year 2075 for fixed panels or 2079 for tracker panels scenarios

  or
    - Event-based approach: a carbon payback in 2062 and 2070 (for fixed and tracker panels respectively)

6.3 A re-assessment of certain emissions stated in the ES was made, namely,

a) Construction GHG emissions:

- The reviewed construction total is **263,565 tCO2e** in the base case and **267,748 tCO2e** in the high case, compared with the applicant's **237,149 tCO2e**.
- The cable line remains the strongest material undercount. The ES value of 876 tCO2e is not credible against the 400 kV route, 132 kV route and site cabling described for the scheme. 20,762 tCO2e is the reviewed cable value.
- The concrete line is materially understated at a stated 5 tCO2e, a value which is inconsistent with the implied amount of concrete before wastage. However, a definitive final concrete total cannot be stated from public documents alone. The reviewed base and high cases (1526 tCO2e and 3509 tCO2e respectively) are evidence-bounded screens rather than final design quantities.
- Screening allowances were also made for:
  - Construction plant fuel – not included in ES
  - Non-transformer substation

b) Operational GHG emissions: we have added to the inventory as follows:

- Fugitive Sulphur Hexafluoride (SF_6) leakage - this was mentioned in the ES but no quantifying value was given. We estimate a value of 1,830 – 6,542 tCO2e.
- On-site cable replacement was referred to but not included in the ES emissions, a 20% replacement rate being mentioned. We estimate a value of 1,660 tCO2e for this.
- Mounting/tracker-panel moving components, mid-life allowance for drives, actuators, controllers and associated moving parts over a 60-year life is estimated at 862 tCO2e.
- A substation refurbishment allowance is included to cater for the wider 132 and 400 kV substation scope at 2,400 tCO2e.
- Operational replacement shipping is already included in the ES replacement lines and is not double counted in this review

c) Regarding construction and operational issues, the appropriate examination request is for the applicant to disclose the cable schedule, supplier EPDs, concrete schedule, foundation design, SF6 inventory, leakage guarantees and replacement schedule so the whole-life carbon account can be verified on project-specific quantities.

d) Life-time emissions:

The applicant's reported whole-life carbon total is **933,145 tCO2e**. The revised base and high cases are approximately **966,311 tCO2e** and **975,206 tCO2e** respectively.

6.4 Regarding an investigation of the Grid Carbon Intensity counterfactuals:

- The ES carbon-benefit conclusion is robust only under constant grid-intensity assumptions. Under the DESNZ time-varying grid-average pathway, the scheme does not offset its whole-life carbon within the 60-year operational life.
- The scheme is considered a net saver regarding lifetime carbon emissions under frozen 49 g and 45.1 g grid-intensity assumptions, but only with payback late in the operating life (2070s onwards).
- The break-even is approximately 39.83 gCO2e/kWh for the reviewed base case (fixed panels) and 40.03 gCO2e/kWh (tracker panels).
- Any constant displacement factor below these values fails to offset the relevant whole-life total over 60 years.

Statement of independence by the authors:

We confirm that the opinions expressed here are our own true and professional opinions, irrespective of by whom we are instructed. The evidence we have prepared and provided is true.

Dated: 30th April 2026

Biographies of authors:

Prof Chris Sansom: Professor Christopher Sansom gained his BSc from Liverpool University, and his PhD from Sussex University for research into the optical properties of infrared detectors. During a research career in industry and academia that has spanned over twenty-five years he has also gained two postgraduate diplomas, one in "Manufacturing Management and Technology" and a second in "Higher Education Teaching and Learning" and is a Black-Belt Six Sigma practitioner. He is Professor of CSP (Concentrating Solar Power), and Lead the Zero Carbon Theme, at the University of Derby. After his PhD, he worked in research labs for Plessey, GEC, Marconi, and PerkinElmer, before entering Academia with Cranfield University where he remains a Visiting Professor. (Prior to 2021, he was the Professor of CSP and Head of the Centre for Renewable Energy Systems (CRES) at Cranfield). He has also been an Open University (OU) course tutor and Associate Lecturer for over 35 years. He is the sole UK representative on the EERA-Joint Committee on CSP which steers EU research in CSP and heads up the Line-Focus research group with the JC-CSP. He is a member of the International Solar Energy Society (ISES), a Fellow of the Higher Education Academy (FHEA), and a Fellow of the Royal Geographical Society (FRGS). He has considerable teaching experience and is a former MSc Course Director and lecturer on low carbon and renewable energy topics. His current CSP research includes concentrating solar power for electrical power generation, solar collector characterisation and ageing evaluation, polymer films for solar power plant heliostats and line-focus solar collectors, linear Fresnel community-scale CSP, heliostat design and manufacture, solar thermal heating and cooling, solar-driven desalination and water purification, thermal storage, and nanostructured thermoelectric devices for energy harvesting. Within the broader "zero-carbon" field he is active in the decarbonisation of UK power generation (renewable energy, energy storage in particular), low carbon built environment and smart cities, carbon capture and storage, low carbon transport, as well as the environmental and social impact of zero-carbon technologies on local communities.

Dr Zaharadeen Hussaini: Zaharaddeen Hussaini is a Researcher in CSP (Concentrating Solar Power) and a member of the Zero Carbon theme at the University of Derby. Zaharaddeen's first degree was in mechanical engineering from Bayero University, Nigeria. He then proceeded to attain his second degree in Sustainable Energy Engineering from the University of Nottingham before finally obtaining a PhD in CSP from Cranfield University. Zaharaddeen has been closely associated with several CSP research projects right from his MSc, where an assessment of a Parabolic Trough CSP system for power generation was made in sub-Saharan Africa. In his PhD study, a novel Power Tower CSP system was developed that showed great potential for improving field efficiency and lowering the total system cost. As a PostDoc with the University of Cranfield, related research involved the UKRI-funded program to develop a zero-emission energy generation and storage system using Thermal Electric Generators (TEG) and a parabolic trough CSP system. Zaharaddeen has had several years of work experience in practical solar systems and acted as a consultant in Solar PV-related projects. Current projects include Multi-

Tower CSP development, large solar PV plant assessments and CSP for electrical power generation.

Dr Heather Almond: Heather gained her BSc in Technology with Industrial Studies at Bristol Polytechnic in 1984 (with one year spent as a student-engineer with the Atomic Energy Authority) and her MSc in Advanced Manufacturing Technology at Cranfield University in 1986, after which she worked as a Development Engineer on the manufacture of Nuclear Magnetic Resonance scanners for Oxford Instruments Ltd for two years. She returned to Cranfield University to undertake her PhD, researching into the recovery of heavy metals from spent etching solutions, which she completed in 1995. She worked at Nottingham University for two years, involved in Rapid Manufacturing and particularly the conversion of plastic rapid-prototyped artifacts to metal through investment casting. She returned to Cranfield University in 1998 as a Research Fellow in non-conventional machining working on photochemical machining, electrolytic etching (as an alternative more environmentally friendly technique to etch complex components from exotic metals), micro electro-discharge machining and associated electroplating and forming techniques. In addition to her research, she lectured, supervised both MSc and PhD student projects and was the Course Director for Microsystems and Nanotechnology and Precision Engineering MSc courses and Learning Support Officer for the University. Over the last 15 years at Cranfield University, she has been involved in research on Concentrating Solar Power (CSP), working in: erosion, durability and cleaning of mirrors, novel biomimicry-based concentrator systems, socio-economic aspects of siting CSP plant, gender based issues in temperature-controlled environments, Building Integrated Solar Technologies and greenhouse gas emissions related to solar plant. She has recently retired from being a Research Fellow in the Centre for Renewable and Low Carbon Energy, where in addition to her research work, she lectured on: sustainability courses, mirror-durability, solar powered cooking and water treatment, non-conventional machining and supervised MSc and PhD students. She was the Deputy Course Director of the MSc in Renewable Energy and MSc in Advanced Chemical Engineering.

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Appendix A Plant size and energy output analysis

In **ES Chapter 3 (3.3.4)** it mentions that "The Applicant does not propose a limit on the generating capacity of the Scheme in the DCO Application as the environmental effects associated with the Scheme are determined by the relevant design parameters and not capacity." This means no MW figure is formally committed to in the DCO.

Since the ES does not state the installed DC capacity, we have applied four independent methods to triangulate a best estimate from the available data. All four methods are based on the following data (Table A1) :

Table A1: Data from the Environmental Statement used to estimate nameplate capacity

Parameter	Value	ES Reference
Number of modules	598,260	Ch.7 7.10.11
Module weight	38.3 kg	Ch.7 7.10.13
Cells per module	156	Ch.7 7.10.13
Silicon per cell	11 g	Ch.7 7.10.14 (Ref 7-41)
Module surface area	3.10 m²	Ch.7 7.10.15
Export capacity	500 MW	Ch.7 7.10.18
Year-1 generation (fixed)	438,000 MWh	Ch.7 7.10.73
Year-1 generation (tracker)	415,000 MWh	Ch.7 7.10.73
Panel type	Bifacial monocrystalline	Ch.3 Table 3-1
Tracker row separation	≥2.5 m at closest point	Ch.3 Table 3-1
Fixed panel tilt	10° to 35° from horizontal	Ch.3 Table 3-1
Site area Lime Down A	94 ha	Ch.3 3.2.8
Site area Lime Down B	70 ha	Ch.3 3.2.8
Site area Lime Down C	241 ha	Ch.3 3.2.8
Site area Lime Down D	212 ha	Ch.3 3.2.8
Site area Lime Down E	131 ha	Ch.3 3.2.8
BESS compound area (max)	5.5 ha	Ch.3 Table 3-1
400 kV substation area (max)	4.25 ha	Ch.3 Table 3-1

Approach 1: Module Count × Module Wattage (Weight Check)

The ES states that there are 598,260 modules weighing 38.3 kg each. The module wattage is not stated, but can be inferred from the weight. Modern bifacial monocrystalline modules in the 650–700 Wp range typically weigh 34–42 kg, making a 38.3 kg module highly consistent with this wattage class. Modules below 600 Wp are typically lighter (22–28 kg) and would be inconsistent with the stated weight.

Table Approach 1: Module data based on various panels

Wp	Weight (kg)	Technology	Notes	38.3 kg consistent?
450	22–25	72-cell mono PERC	Earlier UK projects (2020–2022)	No
550	27–31	Large bifacial PERC	2022–2023 transitional	Borderline
600	30–34	Bifacial TOPCon Panels	Current mainstream (2023–2024)	Borderline
650	34–38	Very large TOPCon/HJT	Consistent with 38.3 kg	Yes
700	38–42	Ultra-large format	Upper bound for 38.3 kg	Yes

Source: Yingli, Jinko etc panels

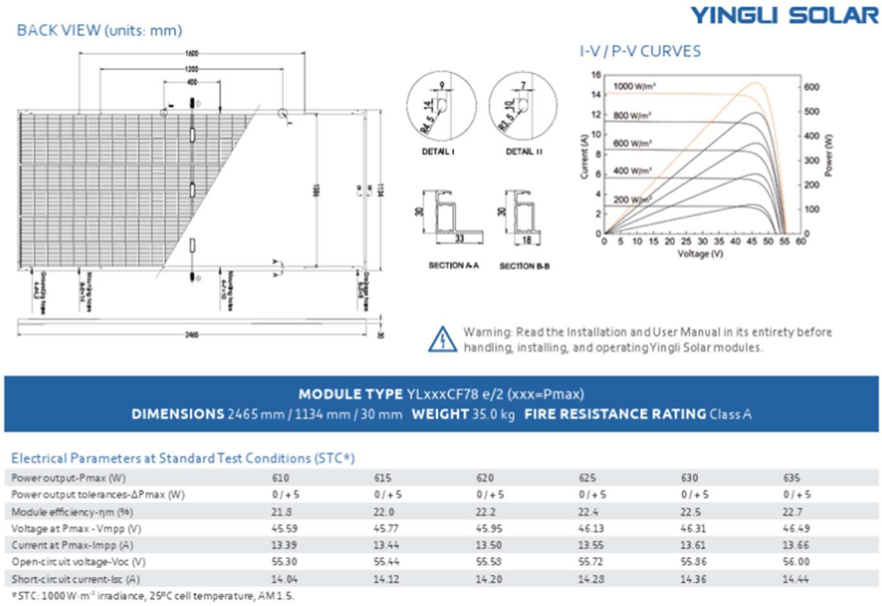


Figure Approach 1 : Example Solar Panel Specification (Yingli Solar)

598,260 modules × 650 Wp = 388.9 MWp.

598,260 modules x 700 Wp = 418.8 MWp.

Therefore, Approach 1 range is: 389–419 MWp.

Approach 2: Energy Output ÷ Capacity Factor

The Capacity Factor is the Energy Output over a given time divided by the maximum possible output (i.e. the nameplate MWp of the Scheme).

If the Year-1 generation is known, the installed capacity can be back-calculated using the formula:

Nameplate MWp = Annual generation (MWh) ÷ (No. of hours of operation in a year × Capacity Factor)

Assuming 24/7 operation, the number of potential hours in the year is 8760. UK ground-mount solar typically achieves capacity factors of 10–12% for fixed-tilt and 11–14% for single-axis tracking **(DESNZ, 2026, PVGIS data for Southern England)**

Using the ES Fixed (or tracking) generation of 438,000 MWh/yr:

Capacity Factor	Implied MWp	Specific Yield (kWh/kWp)	UK Benchmark	Assessment
10%	500	876	950–1,100	Below benchmark
11%	455	963	950–1,100	Low end of range - marginal
11.5%	435	1,007	950–1,100	Consistent with 435 MWp
12%	417	1,050	950–1,100	Consistent with 420 MWp
12.5%	400	1,095	950–1,100	Good performance, consistent with 400 MWp
13%	385	1,139	950–1,100	Strong performance, consistent with 390 MWp

The ES Fixed figure is consistent with 390–420 MWp at plausible capacity factors (12–13%). At 500 MWp, the specific yield (876 kWh/kWp) falls approximately 8% below the lower UK benchmark.

Approach 2 range is: 390–455 MWp.

Approach 3: Silicon Content

Silicon mass in the array amounts to:

598,260 modules × 156 cells × 11 g/cell = 1,026.6 tonnes of silicon (**ES 7.10.14).**

Dividing by the silicon intensity (grams of silicon per Watt) for the relevant technology generation gives an implied capacity **(Fraunhofer, 2025).**

Modern TOPCon/HJT modules (consistent with the stated bifacial monocrystalline specification) use approximately 2.3–2.8 g/W of silicon.

- At 2.5 g/W: 1,026,614,160 g ÷ 2.5 g/W = 411 MWp.
- At 3.0 g/W (bifacial PERC): 342 MWp.

This approach is directional rather than precise, as the 11 g/cell figure likely refers to active silicon content only (excluding kerf losses). It provides a supporting indicator consistent with the other approaches.

Approach C range is : 342–411 MWp.

Approach D: Site Area and Power Density

ES Chapter 3 (3.2.8) states that the five Solar PV Sites have a combined area of approximately 748 ha (Lime Down A: 94 ha, B: 70 ha, C: 241 ha, D: 212 ha, E: 131 ha).

Not all of this area is available for panels . Deductions are required for the BESS Area (5.5 ha), 400 kV substation (4.25 ha), 132 kV substations (3.6 ha), internal access tracks, ecological mitigation areas, hedgerow buffers, and setbacks from boundaries. Assuming 55–65% of the gross site area is available for panel installation. UK large-scale solar Nationally Significant Infrastructure Projects (NSIPs) typically achieve power densities of 0.4–0.6 MWp per hectare of gross site area.

Scenario	MWp	Site (ha)	MWp/ha	Comparable?
Cleve Hill Solar Park (Kent)	350	900	**0.39**	Final NSIP
Sunnica Energy Farm (Suffolk)	500	1,000	**0.50**	Final NSIP
Mallard Pass (Rutland)	350	900	**0.39**	NSIP examination
Lime Down @ 390 MWp	390	748	**0.52**	Consistent with comparables
Lime Down @ 420 MWp	420	748	**0.56**	Consistent with comparables
Lime Down @ 500 MW	500	748	**0.67**	Higher than all comparables

Additionally, the total module area can be calculated directly:

$$598{,}260 \text{ modules} \times 3.10 \text{ m}^2 = 185.5 \text{ ha of panel surface.}$$

This is consistent with a ground coverage ratio of approximately 38–46% of usable solar area, which is within the typical range for utility-scale PV (35–50%).**(Bolinger & Bolinger, 2022,**

At 390–420 MWp, Lime Down's power density (0.52–0.56 MWp/ha) is consistent with comparable UK NSIPs. At 500 MW, the density (0.67 MWp/ha) would be significantly higher than any comparable project, which would require an unusually high packing density for the available land.

Approach D range is: 370–420 MWp (at NSIP densities).

Note on a Fifth Approach: Back-calculation from Equivalent Homes

It has been suggested that the developer's claim that the Scheme would supply approximately 115,000 homes could be used to back-calculate the installed capacity. While this method has been considered, we note two significant caveats:

(a) The result is highly sensitive to the assumed household consumption figure.

(b) The Scheme includes a 1,000 MWh BESS system. The ES states the BESS is "primarily charged from the solar farm's generation and discharged back into the grid once per day" (7.10.66). Depending on the assumed number of charge/discharge cycles and the BESS operational strategy, the implied annual energy output from the BESS alone could vary significantly. This makes any back-calculation from total energy supply to homes unreliable as a measure of panel capacity.

For this reason, Approach 5 is noted but not included in the consensus estimate.

Convergence of Approaches

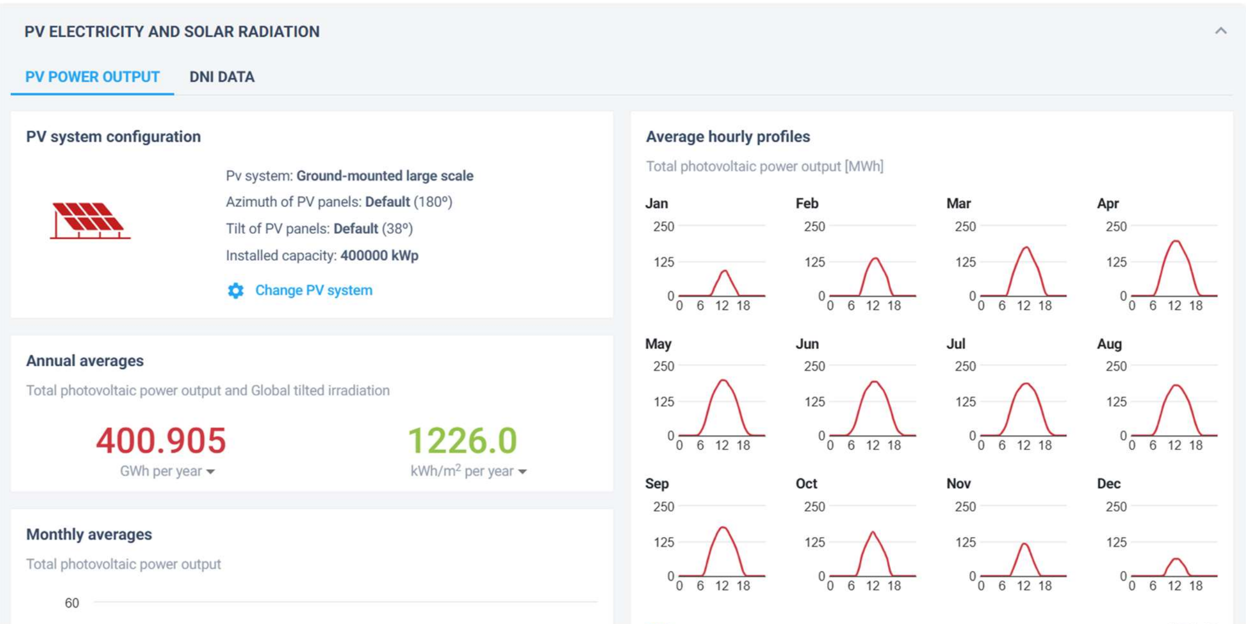
Approach	Method	Low (MWp)	Central (MWp)	High (MWp)
A: Module × Wattage	Weight-implied Wp	389	**407**	419
B: Generation ÷ CF	ES Fixed ÷ UK CF range	390	**420**	455
C: Silicon Content	Si mass ÷ g/W	342	**380**	411
D: Site Area Density	Comparable NSIP densities	370	**400**	420

Approximately 390–420 MWp, with a central estimate of approximately 400–410 MWp.

3. Energy Output Assessment

Using a median value 400MW name plate he energy out using GSA comes to about 401GWh/Yr

For a 400MW non bifacial panel and non-tracking, the output comes to 400.905Gwh



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PVGIS: European Commission, Joint Research Centre, Photovoltaic Geographical system (PVGIS): Available at: **https://joint-research-centre.ec.europa.eu/photovoltaic-geographical-information-system-pvgis_en** and **https://re.jrc.ec.europa.eu/pvg_tools/en/** Accessed: March 2026

Appendix B: Duplication of Table 1 – Electricity emissions factors to 2100 in kgCO2e/kWh (DESNZ, Data tables 1 to 19)

The following Table is taken from the “Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal”.

The last column gives the Grid Carbon Intensity value. The Scheme assumes commencement of generation in 2029 and therefore use the value of 49 kgCO2e/kWh in the ES for their estimations of the Scheme’s performance. Generation in later years or the use of decarbonising grid values, as shown below, could make a difference to the overall performance values and is therefore useful in testing the sensitivity of the performance.

Table 1: Electricity emissions factors to 2100, $kgCO_2e/kWh$

Consumption and generation-based emissions factors.

Analysts should use **consumption-based emissions factors** for measuring GHG emissions per unit of final energy demand. These emissions factors include transmission and distribution losses, **including significant losses due to power station inefficiency**. **Generation-based emissions factors** measure GHG emissions per unit of electricity generated.

Long-run marginal emissions factors should be used for measuring *small changes* in consumption or generation. **Grid average** emissions factors are used for footprinting.

	Long-run marginal				Grid average			
	Consumption-based			Generation-based	Consumption-based			Generation-based
	Domestic	Commercial/ Public sector	Industrial		Domestic	Commercial/ Public sector	Industrial	
2010	0.389	0.382	0.375	0.357	0.499	0.490	0.480	0.457
2011	0.384	0.377	0.370	0.351	0.479	0.471	0.462	0.438
2012	0.377	0.370	0.364	0.344	0.530	0.520	0.510	0.483
2013	0.368	0.362	0.355	0.337	0.493	0.484	0.475	0.450
2014	0.362	0.355	0.348	0.329	0.443	0.434	0.426	0.403
2015	0.351	0.345	0.338	0.320	0.370	0.364	0.357	0.338
2016	0.340	0.334	0.328	0.311	0.296	0.291	0.285	0.271
2017	0.330	0.324	0.318	0.302	0.265	0.260	0.255	0.242
2018	0.319	0.313	0.307	0.291	0.246	0.241	0.237	0.224
2019	0.307	0.301	0.295	0.280	0.222	0.218	0.214	0.203
2020	0.293	0.288	0.283	0.268	0.197	0.194	0.190	0.180
2021	0.279	0.274	0.269	0.255	0.217	0.213	0.209	0.198
2022	0.264	0.259	0.254	0.241	0.158	0.155	0.152	0.144
2023	0.248	0.243	0.239	0.226	0.146	0.143	0.140	0.133
2024	0.230	0.226	0.222	0.210	0.151	0.149	0.146	0.138
2025	0.211	0.207	0.203	0.193	0.131	0.129	0.127	0.120
2026	0.191	0.187	0.184	0.174	0.098	0.096	0.095	0.090
2027	0.169	0.166	0.163	0.154	0.073	0.072	0.070	0.067
2028	0.145	0.143	0.140	0.133	0.063	0.062	0.061	0.058
2029	0.120	0.118	0.116	0.110	0.054	0.053	0.052	0.049
2030	0.093	0.091	0.090	0.085	0.049	0.049	0.048	0.045
2031	0.071	0.070	0.069	0.065	0.042	0.041	0.040	0.038
2032	0.055	0.054	0.053	0.050	0.033	0.032	0.032	0.030
2033	0.042	0.041	0.041	0.038	0.026	0.025	0.025	0.024
2034	0.032	0.032	0.031	0.029	0.021	0.020	0.020	0.019
2035	0.025	0.024	0.024	0.023	0.020	0.020	0.019	0.018
2036	0.019	0.019	0.018	0.017	0.020	0.019	0.019	0.018
2037	0.015	0.014	0.014	0.013	0.018	0.018	0.018	0.017
2038	0.011	0.011	0.011	0.010	0.018	0.018	0.017	0.016
2039	0.009	0.008	0.008	0.008	0.017	0.017	0.016	0.015
2040	0.007	0.006	0.006	0.006	0.016	0.016	0.015	0.015
2041	0.006	0.006	0.006	0.006	0.015	0.015	0.015	0.014
2042	0.004	0.004	0.004	0.004	0.015	0.014	0.014	0.013
2043	0.003	0.003	0.003	0.003	0.009	0.009	0.009	0.008
2044	0.002	0.002	0.002	0.002	0.008	0.008	0.008	0.008
2045	0.001	0.001	0.001	0.001	0.008	0.008	0.008	0.007
2046	0.001	0.001	0.001	0.001	0.008	0.008	0.007	0.007
2047	0.001	0.001	0.001	0.001	0.005	0.005	0.005	0.005
2048	0.002	0.001	0.001	0.001	0.005	0.005	0.005	0.005
2049	0.002	0.002	0.001	0.001	0.003	0.003	0.003	0.003
2050	0.001	0.001	0.001	0.001	0.003	0.002	0.002	0.002
2051	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2052	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2053	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2054	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2055	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2056	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2057	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2058	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2059	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2060	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2061	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2062	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2063	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2064	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2065	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2066	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2067	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2068	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2069	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2070	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2071	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2072	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2073	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2074	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2075	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2076	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2077	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2078	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2079	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2080	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2081	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2082	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2083	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2084	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2085	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2086	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2087	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2088	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2089	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2090	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2091	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2092	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2093	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2094	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2095	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2096	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2097	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2098	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2099	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002
2100	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002

Note: GHGs include CO_2, CH_4 and N_2O.

Source: DESNZmodelling

Further guidance on the use of marginal and average emissions factors are available from the appraisal guidance (Chapter 3) and the background documentation (Chapter 2) which can be downloaded from the Green Gook supplementary guidance section of GOV.UK webpage:
https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

Appendix C : Spreadsheet for assessment of GHG emissions performance, levelized and event-based approaches (based on ES given data and given GHG emissions values)

Year	Phase	Cum Avoided Tracker	Cum Avoided Fixed	Lifecycle Threshold (933,144)	% Offset Tracker	% Offset Fixed	Cum Net [Event] Tracker	Cum Net [Event] Fixed	Cum Net [Levelised] Tracker	Cum Net [Levelised] Fixed	Annual Avoided Tracker	Annual Avoided Fixed	Annual Net [Event] Tracker
2027	Construction	-	-	933,144.0	0.0%	0.0%	(118,574.5)	(118,574.5)	(118,574.5)	(118,574.5)	-	-	(118,574.5)
2028	Construction	-	-	933,144.0	0.0%	0.0%	(237,149.0)	(237,149.0)	(237,149.0)	(237,149.0)	-	-	(118,574.5)
2029	Operation	20,335.0	21,462.0	933,144.0	2.2%	2.3%	(218,128.3)	(217,001.3)	(228,263.9)	(227,136.9)	20,335.0	21,462.0	19,020.7
2030	Operation	40,263.3	42,494.8	933,144.0	4.3%	4.6%	(199,514.2)	(197,282.8)	(219,785.4)	(217,554.0)	19,928.3	21,032.8	18,614.0
2031	Operation	60,101.9	63,432.9	933,144.0	6.4%	6.8%	(180,989.9)	(177,658.9)	(211,396.7)	(208,065.7)	19,838.6	20,938.1	18,524.4
2032	Operation	79,851.3	84,276.8	933,144.0	8.6%	9.0%	(162,554.8)	(158,129.3)	(203,097.2)	(198,671.7)	19,749.3	20,843.9	18,435.1
2033	Operation	99,511.7	105,026.9	933,144.0	10.7%	11.3%	(144,208.6)	(138,693.5)	(194,886.6)	(189,371.5)	19,660.5	20,750.1	18,346.2
2034	Operation	119,083.8	125,683.6	933,144.0	12.8%	13.5%	(125,950.8)	(119,351.0)	(186,764.4)	(180,164.6)	19,572.0	20,656.7	18,257.7
2035	Operation	138,567.7	146,247.3	933,144.0	14.9%	15.7%	(107,781.2)	(100,101.5)	(178,730.4)	(171,050.7)	19,483.9	20,563.8	18,169.7
2036	Operation	157,963.9	166,718.6	933,144.0	16.9%	17.9%	(89,699.2)	(80,944.6)	(170,784.0)	(162,029.4)	19,396.3	20,471.2	18,082.0
2037	Operation	177,272.9	187,097.7	933,144.0	19.0%	20.1%	(71,704.5)	(61,879.7)	(162,924.9)	(153,100.1)	19,309.0	20,379.1	17,994.7
2038	Operation	196,495.0	207,385.1	933,144.0	21.1%	22.2%	(163,008.5)	(152,118.4)	(155,152.7)	(144,262.6)	19,222.1	20,287.4	(91,304.0)
2039	Operation	215,630.6	227,581.2	933,144.0	23.1%	24.4%	(145,187.2)	(133,236.6)	(147,467.0)	(135,516.4)	19,135.6	20,196.1	17,821.3
2040	Operation	234,680.0	247,686.4	933,144.0	25.2%	26.5%	(127,452.0)	(114,445.6)	(139,867.4)	(126,861.0)	19,049.5	20,105.2	17,735.2
2041	Operation	253,643.8	267,701.1	933,144.0	27.2%	28.7%	(109,802.5)	(95,745.1)	(132,353.5)	(118,296.1)	18,963.7	20,014.8	17,649.5
2042	Operation	272,522.2	287,625.8	933,144.0	29.2%	30.8%	(92,238.3)	(77,134.7)	(124,924.9)	(109,821.3)	18,878.4	19,924.7	17,564.1
2043	Operation	291,315.7	307,460.9	933,144.0	31.2%	33.0%	(74,759.1)	(58,613.9)	(117,581.3)	(101,436.1)	18,793.5	19,835.0	17,479.2
2044	Operation	310,024.5	327,206.6	933,144.0	33.2%	35.1%	(57,364.5)	(40,182.4)	(110,322.3)	(93,140.2)	18,708.9	19,745.8	17,394.6
2045	Operation	328,649.2	346,863.5	933,144.0	35.2%	37.2%	(40,054.1)	(21,839.8)	(103,147.5)	(84,933.2)	18,624.7	19,656.9	17,310.4
2046	Operation	347,190.1	366,432.0	933,144.0	37.2%	39.3%	(22,827.5)	(3,585.6)	(96,056.5)	(76,814.6)	18,540.9	19,568.5	17,226.6
2047	Operation	365,647.6	385,912.4	933,144.0	39.2%	41.4%	(5,684.3)	14,580.5	(89,048.9)	(68,784.1)	18,457.5	19,480.4	17,143.2
2048	Operation	384,022.0	405,305.1	933,144.0	41.2%	43.4%	(97,836.0)	(76,552.8)	(82,124.4)	(60,841.2)	18,374.4	19,392.7	(92,151.7)
2049	Operation	402,313.7	424,610.6	933,144.0	43.1%	45.5%	(80,858.5)	(58,561.6)	(75,282.5)	(52,985.6)	18,291.7	19,305.5	16,977.4
2050	Operation	420,523.1	443,829.2	933,144.0	45.1%	47.6%	(63,963.4)	(40,657.3)	(68,523.0)	(45,216.9)	18,209.4	19,218.6	16,895.1
2051	Operation	438,650.5	462,961.3	933,144.0	47.0%	49.6%	(47,150.2)	(22,839.5)	(61,845.4)	(37,534.7)	18,127.5	19,132.1	16,813.2
2052	Operation	456,696.4	482,007.3	933,144.0	48.9%	51.7%	(30,418.6)	(5,107.7)	(55,249.4)	(29,938.5)	18,045.9	19,046.0	16,731.6
2053	Operation	474,661.1	500,967.6	933,144.0	50.9%	53.7%	(13,768.2)	12,538.3	(48,734.6)	(22,428.1)	17,964.7	18,960.3	16,650.4
2054	Operation	492,544.9	519,842.6	933,144.0	52.8%	55.7%	2,801.4	30,099.0	(42,300.6)	(15,003.0)	17,883.8	18,875.0	16,569.6
2055	Operation	510,348.3	538,632.6	933,144.0	54.7%	57.7%	19,290.5	47,574.8	(35,947.1)	(7,662.8)	17,803.4	18,790.0	16,489.1
2056	Operation	528,071.5	557,338.1	933,144.0	56.6%	59.7%	35,699.4	64,966.1	(29,673.8)	(407.1)	17,723.2	18,705.5	16,409.0
2057	Operation	545,715.0	575,959.4	933,144.0	58.5%	61.7%	52,028.7	82,273.1	(23,480.1)	6,764.3	17,643.5	18,621.3	16,329.2
2058	Operation	563,279.1	594,497.0	933,144.0	60.4%	63.7%	(103,010.3)	(71,792.4)	(17,365.9)	13,852.0	17,564.1	18,537.5	(155,039.0)
2059	Operation	583,614.1	615,959.0	933,144.0	62.5%	66.0%	(83,989.6)	(51,644.7)	(8,480.8)	23,864.1	20,335.0	21,462.0	19,020.7
2060	Operation	603,542.4	636,991.7	933,144.0	64.7%	68.3%	(65,375.6)	(31,926.2)	(2.4)	33,447.0	19,928.3	21,032.8	18,614.0
2061	Operation	623,381.0	657,929.8	933,144.0	66.8%	70.5%	(46,851.2)	(12,302.4)	8,386.4	42,935.2	19,838.6	20,938.1	18,524.4
2062	Operation	643,130.4	678,773.7	933,144.0	68.9%	72.7%	(28,416.1)	7,227.3	16,685.9	52,329.3	19,749.3	20,843.9	18,435.1
2063	Operation	662,790.8	699,523.8	933,144.0	71.0%	75.0%	(10,069.9)	26,663.1	24,896.5	61,629.5	19,660.5	20,750.1	18,346.2
2064	Operation	682,362.8	720,180.5	933,144.0	73.1%	77.2%	8,187.8	46,005.5	33,018.6	70,836.3	19,572.0	20,656.7	18,257.7
2065	Operation	701,846.8	740,744.3	933,144.0	75.2%	79.4%	26,357.5	65,255.0	41,052.7	79,950.2	19,483.9	20,563.8	18,169.7
2066	Operation	721,243.0	761,215.5	933,144.0	77.3%	81.6%	44,439.5	84,412.0	48,999.1	88,971.6	19,396.3	20,471.2	18,082.0
2067	Operation	740,552.0	781,594.6	933,144.0	79.4%	83.8%	62,434.2	103,476.8	56,858.2	97,900.8	19,309.0	20,379.1	17,994.7
2068	Operation	759,774.1	801,882.0	933,144.0	81.4%	85.9%	(28,869.8)	13,238.2	64,630.4	106,738.4	19,222.1	20,287.4	(91,304.0)
2069	Operation	778,909.6	822,078.1	933,144.0	83.5%	88.1%	(11,048.5)	32,120.0	72,316.1	115,484.6	19,135.6	20,196.1	17,821.3
2070	Operation	797,959.1	842,183.4	933,144.0	85.5%	90.3%	6,686.7	50,911.0	79,915.7	124,140.0	19,049.5	20,105.2	17,735.2
2071	Operation	816,922.9	862,198.1	933,144.0	87.6%	92.4%	24,336.2	69,611.4	87,429.6	132,704.8	18,963.7	20,014.8	17,649.5
2072	Operation	835,801.3	882,122.8	933,144.0	89.6%	94.5%	41,900.3	88,221.9	94,858.1	141,179.7	18,878.4	19,924.7	17,564.1
2073	Operation	854,594.7	901,957.8	933,144.0	91.6%	96.7%	59,379.5	106,742.6	102,201.7	149,564.8	18,793.5	19,835.0	17,479.2
2074	Operation	873,303.6	921,703.6	933,144.0	93.6%	98.8%	76,774.2	125,174.1	109,460.8	157,860.7	18,708.9	19,745.8	17,394.6
2075	Operation	891,928.3	941,360.5	933,144.0	95.6%	100.9%	94,084.6	143,516.8	116,635.6	166,067.8	18,624.7	19,656.9	17,310.4
2076	Operation	910,469.2	960,928.9	933,144.0	97.6%	103.0%	111,311.2	161,770.9	123,726.6	174,186.3	18,540.9	19,568.5	17,226.6
2077	Operation	928,926.7	980,409.3	933,144.0	99.6%	105.1%	128,454.4	179,937.1	130,734.2	182,216.9	18,457.5	19,480.4	17,143.2
2078	Operation	947,301.0	999,802.1	933,144.0	101.5%	107.1%	36,302.7	88,803.7	137,658.7	190,159.7	18,374.4	19,392.7	(92,151.7)
2079	Operation	965,592.8	1,019,107.5	933,144.0	103.5%	109.2%	53,280.2	106,794.9	144,500.6	198,015.3	18,291.7	19,305.5	16,977.4
2080	Operation	983,802.2	1,038,326.1	933,144.0	105.4%	111.3%	70,175.3	124,699.3	151,260.1	205,784.1	18,209.4	19,218.6	16,895.1
2081	Operation	1,001,929.6	1,057,458.2	933,144.0	107.4%	113.3%	86,988.5	142,517.1	157,937.7	213,466.3	18,127.5	19,132.1	16,813.2
2082	Operation	1,019,975.5	1,076,504.2	933,144.0	109.3%	115.4%	103,720.1	160,248.8	164,533.7	221,062.4	18,045.9	19,046.0	16,731.6
2083	Operation	1,037,940.2	1,095,464.6	933,144.0	111.2%	117.4%	120,370.5	177,894.9	171,048.5	228,572.9	17,964.7	18,960.3	16,650.4
2084	Operation	1,055,824.0	1,114,339.5	933,144.0	113.2%	119.4%	136,940.1	195,455.6	177,482.5	235,998.0	17,883.8	18,875.0	16,569.6
2085	Operation	1,073,627.3	1,133,129.6	933,144.0	115.1%	121.4%	153,429.1	212,931.4	183,835.9	243,338.2	17,803.4	18,790.0	16,489.1
2086	Operation	1,091,350.6	1,151,835.1	933,144.0	117.0%	123.4%	169,838.1	230,322.6	190,109.3	250,593.8	17,723.2	18,705.5	16,409.0
2087	Operation	1,108,994.1	1,170,456.4	933,144.0	118.8%	125.4%	186,167.3	247,629.7	196,302.9	257,765.3	17,643.5	18,621.3	16,329.2
2088	Operation	1,126,558.2	1,188,993.9	933,144.0	120.7%	127.4%	202,417.2	264,852.9	202,417.2	264,852.9	17,564.1	18,537.5	16,249.8
2089	Decommissioning	1,126,558.2	1,188,993.9	933,144.0	120.7%	127.4%	197,915.7	260,351.4	197,915.7	260,351.4	-	-	(4,501.5)
2090	Decommissioning	1,126,558.2	1,188,993.9	933,144.0	120.7%	127.4%	193,414.2	255,849.9	193,414.2	255,849.9	-	-	(4,501.5)