Mallard Pass

Solar Farm

Mallard Pass Solar Farm

Responses to Interested Parties' Deadline 2 Submissions - Climate Change

Deadline 3 - June 2023

EN010127

EN010127/APP/9.21

Applicant's Response to Interested Parties' Deadline 2 Submissions on Climate Change

Parties Raised	Sub-Theme	Issues Raised	Applicant's Response
REP2-193, REP2-220, REP2-129 REP2-171, REP2-209, REP2-116, REP2-105, REP2-211, REP2-128 REP2-090	Issues around carbon neutral	Issues around the Proposed Development not being able to achieve carbon neutrality due to the supply chain, manufacturing, materials, and shipping from China.	Chapter 13 Climate Change of the Environmental Statement (ES) [APP-043] presents the approach and findings of the assessment of potential climate change effects associated with the Proposed Development. Paragraphs 13.4.9 – 13.4.18 set out the assessment of Green House Gas (GHG) emissions and carbon savings. Paragraphs 13.4.11-13.4.13 describe the processes which involve CO2 emissions for construction, operation and decommissioning phases of the Proposed Development. The assumptions for calculating the carbon costs of the Proposed Development includes infrastructure and supply chain emissions for operation and decommissioning / disposal processes and are intentionally conservative, i.e. they overestimate the likely carbon costs of the Proposed Development, as explained below. The Applicants have also factored panel degradation into their carbon calculations using a conservative approach. Based on these conservative assumptions paragraph 13.4.18 of Chapter 13 of the ES concludes that the Proposed Development delivers a net carbon benefit vs. total lifetime carbon cost (I.e. carbon neutrality) after approximately 10.5 years of operation and all savings beyond that would be a net benefit of the Proposed Development to reducing climate change, relative to the baseline, I.e. the Proposed Development will exceed a carbon neutrality position. The IPCC (2014) estimated full life-cycle emissions of CO2 for a range of electricity generation types. For utility scale solar photovoltaic cells, it estimated an emission intensity of 48 kgCO2eq/MWh (based on the median value from a range between 18 and 180 kgCO2eq/MWh), which includes manufacturing, construction, operations and decommissioning carbon emissions. In 2014, solar farms

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			were expected to operate for 25 years, and the emissions data would have been based on this lifetime. The Mallard Pass DCO submission makes use of the IPCC’s median lifecycle (I.e. including manufacturing, construction, operation, maintenance and decommissioning) emissions value of 48 kgCO2eq/MWh in its conservative assessment of overall avoided emissions as a result of manufacturing, construction, 40 years of operation, maintenance and decommissioning of the project. The recently consented Longfield Solar Farm development (PINS Ref EN010118) includes a Lifecycle GHG Impact Assessment. The assessment considers the carbon emissions associated with the manufacture, construction, operation and decommissioning of the both PV Arrays and Battery Energy Storage System (BESS) along with transportation of materials from China, replacement of electrical components and changes in land use. The carbon intensity of the project, considering all of these factors, is 49.2gCO2e/kWh. It should be noted however that this carbon intensity value includes the embodied carbon of the Battery Energy Storage System element of the project. Mallard Pass does not include a BESS, By removing the emissions quoted in the Longfield Solar Farm DCO submission associated with the BESS from the total emissions, and dividing the resulting figure by Longfield Solar Farm’s expected lifetime generation gives a lifecycle carbon emissions intensity of 38.3 gCO2e / kWh. This is significantly lower than the IPCC median value of 48 gCO2e / kWh and if used would lead to a greater quantity of avoided emissions than quoted in this submission. In addition, the environmental product declaration for the 196 MW El Romero Solar project [Appendix H] identified an emissions intensity of 29.2 gCO2e/kWh which includes emissions arising from transportation of the solar panels.

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			This illustrates that the IPCC emissions intensity value is conservative. Therefore, the median figure of 48kgCO2eq/MWh is considered a conservative figure, i.e. it overestimates the likely carbon costs of the Proposed Development. This is demonstrated in reference Longfield and El Romero Solar referred to above. These are both comparable in scale to the Proposed Development and include international transportation of PV arrays. Furthermore, the 48kgCO2eq/MWh value has also been applied over 40 years, rather than the 25 year period assumed in the IPCC report. By calculating the estimated lifetime carbon cost of the Proposed Development at 48 gCO2e / kWh, multiplied by the expected first year electrical output (350,000 MWh = 350 MW x 8760 Hours/Yr x 11.4%, the solar load factor for the East Midlands that has been used for the purpose of the assessment), multiplied by a 40-year operational period, the total lifetime carbon emissions have been calculated at 672,000 tonnes CO2e. Each MWh generated will save carbon emissions versus the scenario that the same electrical output was generated at the national grid carbon intensity of 182 gCO2e / kWh, so it can be seen that even when factoring in year-on-year reductions in output associated with the degradation of solar panels, the project will deliver a net carbon benefit after approximately 10.5 years of operation. For the avoidance of doubt, these calculations include accounting for the supply chain emissions of the manufacture and transport of the solar panels.
REP2-228, REP2-129, REP2-218 REP2-215, REP2-209 , REP2-104,	Carbon benefit (not linked to shipping from China)	Concerned about the carbon benefit of the proposal, particularly the carbon footprint generated by the construction and maintenance of the proposed development (including replacement of panels), forecasting needs deeper looking into.	As referred to above, Chapter 13 Climate Change of the Environmental Statement (ES) [APP-043] presents the approach and findings of the assessment of potential climate change effects associated with the Proposed Development.

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REP2-127 REP2-178 REP2-237, REP2-116, REP2-114, REP2-169, REP2-128, REP2-126 REP2-090 REP2-145		Concerned that the total actual lifetime CO2 reduction from the grid for the project is lower than the lifetime CO2 of the facility.	Paragraph 13.4.14 of Chapter 13 refers to the IPCC (2014) estimated full life-cycle emissions of CO2 which for utility scale solar photovoltaic cells estimates an emission intensity of 48 kgCO2eq/MWh (based on the median value from a range between 18 and 180 kgCO2eq/MWh). The life cycle emissions for Solar PV within the IPCC report consider infrastructure and supply chain emissions for operation and decommissioning / disposal processes. The median figure of 48kgCO2eq/MWh is considered a conservative figure, i.e. it overestimates the likely carbon costs of the Proposed Development. This is demonstrated in reference Longfield and El Romero Solar projects which were assessed as having a lifecycle carbon emissions intensity of 38.3 gCO2e / kWh and 29.2 gCO2e / kWh respectively. These are both comparable in scale to the Proposed Development and include international transportation of PV arrays. The 48kgCO2eq/MWh value has also been applied over 40 years, rather than the 25 year period assumed in the IPCC report. Based on these conservative assumptions outlined above, paragraph 13.4.18 of Chapter 13 of the ES concludes that the Proposed Development delivers a net carbon benefit vs. total lifetime carbon cost (I.e. carbon neutrality) after approximately 10.5 years of operation and all savings beyond that would be a net benefit of the Proposed Development to reducing climate change, relative to the baseline, I.e. the Proposed Development will exceed a carbon neutrality position.
REP2-116 REP2-150	Carbon production by solar PV panels	The perception that energy created by PV panels does not release carbon is a myth as you cannot use energy of any sort without releasing carbon or radiation.	As set out in Table A.iii.2 of Annex III the IPCC (2014) report, the direct emissions for Solar PV (both utility and rooftop) is 0gCO2eq/kWh. Paragraph 13.4.12 of Chapter 13 of the ES confirms that during the operational phase, the Proposed Development will not emit substantial gases to the atmosphere, and hence not adversely contribute to climate change. The GHG emissions associated with the

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			operational phase are assessed to be primarily associated with the provision of potable water, wastewater treatment and material and waste associated with maintenance procedures. The estimated minimum, medium and maximum values for the full life-cycle emissions of CO2 for utility scale solar photovoltaic cells is derived from the infrastructure and supply chain emissions. .
REP2-116	The efficiency of solar PV panels	Photons from the sun that PV panels use are not available at night.	Section 7.7 of the Statement of Need [APP-202] explains how, through overplanting such as the case with the Proposed Development, the efficiency of the Proposed Development is able to be maximised to generate electricity over a longer period of the day. The expected annual load factor of the panels accommodates the varying output levels throughout the year including zero generation during dark hours. The Statement of Need [APP-202] sets out the Government's position in regard to the urgent requirement for solar energy generation as part of a sustainable energy mix in future energy scenarios, in particular at Section 7.6 where it is demonstrated that the Proposed Development delivers a large-scale solar generation asset which is consistent with the land use efficiency range set out in Government policy and produces an annual output per acre which is comparable to or exceeds that generated by other low-carbon generation technologies, even though solar panels do not generate power at night.
REP2-116 REP2-090	Lifecycle carbon emissions	An investigation into end-to-end use of energy has to consider the carbon released by:	As noted in response 1 above, the IPCC (2014) estimated full life-cycle emissions of CO2 for a range of electricity generation types. For utility scale solar photovoltaic cells, it estimated an emission intensity of 48 kgCO2eq/MWh

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		• the mining of the quarts, processed into usable silicon, • the manufacture of chemicals to produce the PV cells, • the process of manufacturing itself, • the manufacture of the infrastructure, • the transport of the infrastructure, • the assembly of the infrastructure, cable laying, fencing etc. • the manufacture of the inverters needed from DC to AC • the mining of cobalt and its manufacture into lithium-ion batteries, • the chemicals to produce flow batteries and all of the infrastructure to construct these on site, • the carbon released in decommissioning and disposal. This becomes a huge carbon footprint, all for a miniscule period of relative use of electricity production, 25 years of daylight hours multiplied by the poor light efficiency in the UK.	(based on the median value from a range between 18 and 180 kgCO2eq/MWh), which includes manufacturing, construction, operations and decommissioning carbon emissions. In 2014, solar farms were expected to operate for 25 years, and the emissions data would have been based on this lifetime. The Mallard Pass DCO submission makes use of the IPCC's median lifecycle (I.e. including manufacturing, construction, operation, maintenance and decommissioning) emissions value of 48 kgCO2eq/MWh in its conservative assessment of overall avoided emissions as a result of manufacturing, construction, 40 years of operation, maintenance and decommissioning of the project. Further, it is noted that the Proposed Development does not include a Battery Energy Storage System (BESS) so no carbon emissions related to the mining of cobalt and its manufacture into lithium-ion batteries, or the chemicals to produce flow batteries will be incurred. The literature sources for the life cycle emissions for Solar PV within the IPCC report consider Upstream (mining/material preparation, module manufacture, system/plant component manufacture & installation/ plant construction), Operation and Decommissioning / Disposal and are include in Appendix L In 2014, solar farms were expected to operate for 25 years, and the emissions data would have been based on this lifetime. The Climate Change Assessment [APP-043] makes use of this median lifecycle emissions value of 48 kgCO2eq/MWh in its assessment of overall avoided emissions during the lifetime of the project. By generating electricity at an estimated 48 gCO2e / kWh against the same electrical output being generated at the national grid carbon intensity of 182 gCO2e / kWh, it can be seen that the project will produce electricity with lower carbon emissions than would otherwise have been the case, which includes accounting for the supply chain

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			emissions of the manufacture and transport of the solar panels. For the purposes of the assessment, the ES has assumed an installed generation capacity of 350MW. The effects of degradation on the solar panels were factored in to produce the profile of emissions, from which the beneficial effect could be ascertained. By calculating the estimated lifetime carbon cost of the Proposed Development at 48 gCO2e / kWh, multiplied by the expected first year electrical output (350,000 MWh = 350 MW x 8760 Hours/Yr x 11.4%, the solar load factor for the East Midlands that has been used for the purpose of the assessment), multiplied by a 40-year operational period, the total lifetime carbon emissions have been calculated at 672,000 tonnes CO2e. Each MWh generated will save carbon emissions versus the scenario that the same electrical output was generated at the national grid carbon intensity of 182 gCO2e / kWh, so it can be seen that even when factoring in year-on-year reductions in output associated with the degradation of solar panels, the project will deliver a net carbon benefit after approximately 10.5 years of operation. For the avoidance of doubt, these calculations include accounting for the supply chain emissions of the manufacture and transport of the solar panels.
REP2-143	Carbon footprint	Concern that the project does not consider the carbon footprint associated with the transportation of food that would be needed as a result of the Proposed Development taking up agricultural land.	The consideration of the carbon footprint associated with the transportation of food has been scoped out of the carbon assessment for the Proposed Development. The Planning Inspectorate, as set out in the EIA Scoping Opinion [APP-050], stated that it does not consider that impacts on the economy or to carbon emissions resulting from a proposed change from arable to low intensity farming and/or the transportation/import of food and crops

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			are likely to result in significant effects. On this basis, consideration of such effects in the EIA is not considered necessary.
REP2-098 REP2-090 REP2-051,REP2-053,REP2-158 REP2-227 REP2-145	Arable land is needed for food security in light of climate change	Concerns that climate change is already leading to a decrease in the production of the world's top 10 crops, this trend is projected to continue and rising temperatures could see the quality of land in the UK decline. Analyses of imports against climate change impacts suggest that several countries the UK imports from will face problems with food production. If more of the UK's farmland is lost to development (and particularly to solar development which requires large areas of land), it is highly likely that the UK will need to import more food, and this will become more difficult and more expensive as other countries feel the impact of climate change.	The consideration of the carbon footprint associated with the transportation of food has been scoped out of the carbon assessment for the Proposed Development. The Planning Inspectorate, as set out in the EIA Scoping Opinion [APP-050], stated that it does not consider that impacts on the economy or to carbon emissions resulting from a proposed change from arable to low intensity farming and/or the transportation/import of food and crops are likely to result in significant effects. On this basis, consideration of such effects in the EIA is not considered necessary.
REP2-109, REP2-191, REP2-153, REP2-203, REP2-149 REP2-198 REP2-116 REP2-120 REP2-165 REP2-206 REP2-115	Greenwashing, the efficiency of solar panels	Concern that the project is a greenwashing scheme which will only produce 11% of the 350MW, only benefitting developers	By calculating the estimated lifetime carbon cost of the Proposed Development at 48 gCO2e / kWh, multiplied by the expected first year electrical output (350,000 MWh = 350 MW (an assumed installed generation capacity) x 8760 Hours/Yr x 11.4%, the solar load factor for the East Midlands that has been used for the purpose of the assessment), multiplied by a 40-year operational period, the total lifetime carbon emissions have been calculated at 672,000 tonnes CO2e. Each MWh generated will save carbon emissions versus the scenario that the same electrical output was generated at the national grid carbon intensity of 182 gCO2e / kWh, so it can be seen that even when factoring in year-on-year reductions in output associated with the degradation of solar panels, the project will deliver a net carbon benefit after approximately

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			10.5 years of operation. For the avoidance of doubt, these calculations include accounting for the supply chain emissions of the manufacture and transport of the solar panels. . Table 7.1 of the Statement of Need [APP-202] shows the electricity generated per Ha by different low-carbon technologies. At an expected average load factor for the Proposed Development (11.4%), solar generation produces much more energy per Ha than biogas, and generates a similar amount of energy per Ha as onshore wind. Solar is now a leading low-cost generation technology and Figure 10.4 of the Statement of Need shows that on a levelized cost of energy basis, large scale solar is already cheaper than offshore wind, and Government's projections are that it will remain cheaper in the future. In 2021, GB sourced 42% of its electricity from renewables, of which approximately 9.4% was from solar.
REP2-090, REP2-150, REP2-200	Key figures	The key figures for the Proposed Development have been overstated. Revised calculations are provided in Figure 6 of MPAG's Written Representation. According to MPAG, the realistic best-case headline figures for the Proposed Development are: - The facility is likely to produce 253MWh, not 350MWh. This would be enough electricity for 67,000 homes (or 0.88% of the UK's electricity demand). - It is expected to start to benefit the planet from a CO2-reduction perspective in 18.2 years.	Chapter 13 Climate Change of the Environmental Statement (ES) [APP-043] presents the approach and findings of the assessment of potential climate change effects associated with the Proposed Development. Paragraphs 13.4.9 – 13.4.18 set out the assessment of Green House Gas (GHG) emissions and carbon savings. **Assumptions** Paragraphs 13.4.11-13.4.13 describe the processes which involve CO2 emissions for construction, operation and decommissioning phases of the Proposed Development. Paragraph 13.4.14 refers to the IPCC (2014) estimated full life-cycle emissions of CO2 which for utility scale solar photovoltaic cells estimates an emission intensity of 48 kgCO2eq/MWh (based on the median value from a range between 18 and 180 kgCO2eq/MWh). The life cycle emissions for Solar PV within the IPCC report consider

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		- It should assist decarbonisation of the UK grid by 46,056 tonnes CO2 annually (or a reduction 0 0.013% of the UK annual Grid CO2). - It should produce a total reduction during its lifetime of 0.96m tonnes CO2. The Proposed Development is anticipated to have an installed capacity of 350 MWp, a capacity factor estimated at 10 % and would be available to operate for 8,760 hours per year. This means that the Proposed Development is anticipated to generate approximately 350,000 MWh of renewable electricity per year. I have some difficulty understanding this claim as there are only 8760 hours a year, implying that the solar farm will be generating electricity into the National Grid 24 hrs a day, 365 days a year. Is this really true? The Applicant has made an arithmetical mistake in calculating the output of the development. In ES Volume 1 Chapter 13: Climate Change, the Applicant correctly states that the calculation for the output is 350MW capacity x 8760 hours/year x 10% plant load factor. The Applicant calculates the result as 350,000MWh. The correct number is 306,600MWh. The corrected, lower output has a direct impact on the value of the development in meeting the net zero commitments of the Government. Taking the value for lifecycle emissions used by the Applicant of 48kgCO2eq/MWh and the corrected output of MPSF, including panel degradation, the	infrastructure and supply chain emissions for operation and decommissioning / disposal processes. The median figure of 48kgCO2eq/MWh is considered a conservative figure, i.e. it overestimates the likely carbon costs of the Proposed Development. This is demonstrated in reference Longfield and El Romero Solar projects which were assessed as having a lifecycle carbon emissions intensity of 38.3 gCO2e / kWh and 29.2 gCO2e / kWh respectively. These are both comparable in scale to the Proposed Development and include international transportation of PV arrays. The 48kgCO2eq/MWh value has also been applied over 40 years, rather than the 25 year period assumed in the IPCC report. Paragraph 13.4.15 refers to the Digest of UK Energy Statistics (DUKES) which indicates the average electrical output being generated at the national grid had a carbon intensity in 2020 of 182gCO2e/kWh. It is noted that this represents the operational carbon intensity of the mix of sources of electricity on the grid, it does not account for embodied carbon of the construction of those electricity generating stations. Paragraph 13.4.16 confirms the panel degradation assumptions include in the assessment, which states that power degradation for the first year will be no more than 2% followed by no more than 0.45 % in subsequent years. The above confirms that the assumptions underpinning the GHG calculations for the proposed development are conservative. **Conclusions** Paragraph 13.4.18 concludes that: • The CO2 emissions of the Proposed Development would therefore be displaced within approximately 10.5 years, and all savings beyond that would be a

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		savings would be 1.25m teCO2. Significantly lower the 1.9m teCO2 claimed by the Applicant. A higher, more realistic lifecycle emission for MPSF of 72kgCO2eq/MWh would reduce the lifecycle saving 0.96m teCO2	net benefit of the Proposed Development to reducing climate change, relative to the baseline. • Over 40 years, the saving is estimated at approximately 1.9 million tonnes of CO2 The Applicant has supplied at Appendix G to this response a GHG Calculations Table which sets out the assumptions referred to in Chapter 13 of the ES, and presents the following conclusions in direct response to MPAGs Written Representation: • The Proposed Development would have an indicative installed capacity of 350MW • Total carbon cost of the Proposed Development including construction, operation (negligible) and decommissioning = 672,000 Tonnes (Te) CO2 • Annual amortised carbon cost = 16,800 (te) of CO2/Year • The Proposed Development delivers a gross carbon benefit vs. current grid carbon intensity for every year of operation • The Proposed Development delivers a net carbon benefit vs. amortised lifetime carbon cost for every year of operation • The Proposed Development delivers a net carbon benefit vs. total lifetime carbon cost from Year 10.5 onwards • The Proposed Development delivers a total net carbon benefit of 1.6 million tonnes of CO2 over a 40 year period **Capacity / Solar Load factor** In preparation of this response, the Applicant has noted a typographical error in the assumption related to solar load factor. This is stated as 10% in paragraph 13.5.10. The

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			corrected value should be 11.4% which has been used to derive the output calculation. This is clarified in the assumption set out in the GHG Calculations Table (Appendix GX). This does not result in any change to the assessment outcomes of Chapter 13 of the ES. All calculations within the chapter were based on the 11.4% value, which is clarified in the GHG Calculation Table. Solar load factor can vary between technologies (i.e. Fixed South Facing or Single Axis Trackers), different inverter configurations and meteorological and geographically. 11.4% represents a conservative assumption for the solar load factor at Mallard Pass based on a range of factors, including actual historical average hours of sunlight per year specifically registered at the locality of the Proposed Development.. The solar capacity factor includes allowances for losses in the equipment and connection to provide the produced energy of the PV System. It is also noted that the approximate 1.9 million figure did not account for panel degradation. The corrected figure is presented in the GHG Calculations Table as 1.6 million tonnes of CO2 over a 40 year period. Finally, it is noted that even if utilising the figures presented in the Figure 6 of MPAG's Written Representation, the Proposed Development would still generate significant levels of renewable electricity, recover its total lifetime carbon cost well within the operational period of the development and provide a significant overall carbon reduction over its operational lifetime.
REP2-090	Output	With 8,760 maximum hours per year available, the annual energy production 35MW*8,760 = 306,600MWh, not the stated 350MWh. This is an overstatement of	Noted. As stated above, the 10% figure referred to in paragraph 13.5.10. of Chapter 13 of the ES was included as a typographical error. The corrected value should be 11.4% which has been used to derive the output

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		production of 43,400MWh or 14.2%. This corresponds to the unqualified increase in Capacity factor to 11.4% used by the Applicant in their 'Homes' calculation. This reduced output figure means that the CO2 savings and embodied CO2 for the Proposed Development is lower than stated by the Applicant.	calculation. This is clarified in the assumption set out in the GHG Calculations Table (Appendix G). Utilising the correct 11.4% load factor, the calculation which has been used to inform the output calculation in Chapter 13 of the ES is as follows: 350,000 kW (installed capacity (350 MW * 1,000)) * 8,760 (number of hours in a year) * 0.114 (solar load factor) = 349,524,000 kWh (350,000MWh)
REP2-090	Annual output	The real-world losses from DC energy production to available AC energy for the grid generate, caused by inverter losses, distribution losses and maintenance and grid outage losses, a new revised annual energy production for the grid of 282,072MWh. These real-world losses mean that the figures for annual output, CO2 savings and emissions displacement for the Proposed Development are lower than stated by the Applicant.	The Proposed Development does not include a fixed design, Chapter 5 of the ES and Appendix 5.1: Project Parameters [APP 053] set out the flexibility sought with regard to inverter choice and configuration of PV arrays. As such, there is not a technical specification or configuration to run a detailed assessment on potential transmission loss. However, the solar load factor (11.4%) incudes an allowance for typical transmission loss. As such, Chapter 13 of the ES accounts for this in its calculations and conclusions. All generators connecting to the UK's electricity systems incur losses associated with the transmission of the power they generate, to where that power is needed. Transmission losses are of the order 1%. The CO2 savings analysis derives an operational benefit from the Proposed Development through the displacement of carbon intense generation. It is appropriate to carry out this analysis at the "station gate" (I.e. not considering transmission losses) because it is the generation of electricity and not its transmission, which incurs the carbon cost. Therefore 1 MWh generated at the Proposed Development will displace 1 MWh of carbon intensive generation, as measured at its station gate.

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REP2-090	Output degradation	Using the figures supplied, energy output will be degraded by 5.6% over the first 10 years, 12.35% by 25 years (realistic panel lifetime) and by 19.1% by the stated installation end-of-life. This degradation over time means that the real-world annual output, CO2 savings and emissions displacement for the Proposed Development are lower than stated by the Applicant.	Panel degradation is accounted for in the conclusions of Chapter 13 of the ES and presented in the GHG Calculation Table (Appendix G). As such, they are accounted for in the calculation of annual output, CO2 savings and emissions displacement for the Proposed Development presented in Chapter 13 of the ES.
REP2-090	Lifetime of solar infrastructure	The lifetime of panels, inverters and infrastructure has been understated. Failure rates for panels operated for 40 years will be higher than those within the typical warranty period of 25 years. No assurances have been given that degraded panels will be replaced with 'upgraded' newer panels around this time, and no allowance has been made in the CO2 calculations for effectively doubling the lifecycle CO2 of the facility, effectively halving any expected low-carbon benefits.	Assumptions on panel degradation are conservative, the maximum degradation values have been assumed in Chapter 13 of the ES and the GHG Calculation Table. No systematic upgrading or re-powering of the Solar PV arrays are proposed as part of the Proposed Development such that it would influence the CO2 calculations.
REP2-090	Displacement of embodied CO2	Due to grid decarbonisation, the embodied CO2 will not be displaced during the lifetime of the Proposed Development. If the facility were not built, and the grid decarbonised through other forms of low carbon production, there would be less CO2 released into the atmosphere.	Paragraph 13.4.17 of Chapter 13 of the ES recognises that Grid decarbonisation will reduce the average emissions of CO2 and therefore the total reduction of savings above associated with the Proposed Development correspondingly. However, to achieve decarbonisation of the grid, energy sources such as the Proposed Development are required to meet Government targets relating to GHG emissions. Therefore, whilst the decarbonisation of the grid would reduce the savings associated with the Proposed Development, infrastructure such as the Proposed Development is a pre-requisite to such decarbonisation.

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REP2-090	CO2 cost of input into grid	Fossil-fuel power stations are required to balance grid voltages from the variable output of utility solar PV schemes. The CO2 cost of this has not been considered in any part of the climate assessment.	The Applicant accepts that fossil-fuel power stations are still required to balance grid voltages, as they always have been, but draws attention to Chapter 11 of the Statement of Need [APP-202] which describes potential low-carbon flexibility and integration measures which will "keep the lights on" as renewable generation increases as a share of total electricity supply in the UK. Paragraph 8.8.2 of the Statement of Need [APP-202] cites the Cost of Energy Review (2017) which succinctly states that "The system is typically better off with intermittent capacity than without it" Chapter 11 of the Statement of Need [APP-202] describes hydrogen, interconnection and storage as three potentially low-carbon integration measures, the later two of which are already operational in the UK and other markets, and all three of which are expected to grow to support the fight against climate change. Figures 8.1 and 8.2 and Table 8.2 of the Statement of Need [APP-202] and related text, illustrate that together, large and geographically diverse portfolios of wind and solar can increase generation dependability and inter-seasonal generation capacity efficiencies, reducing the need for short-term and long term "balancing" actions. Critically, 100% low-carbon operation of the grid (Government has unveiled plans to achieve this by 2035, see Statement of Need [APP-202], Para 8.9.3) will occur as a result of a significant roll out of both low-carbon generation technologies, such as the Proposed Development, and low-carbon flexibility and integration measures. The CO2 cost of fossil powered flexibility solutions was not analysed in detail as part of the assessment. It is not typical industry practice to undertake such an assessment, based on the Applicants technical teams collective experience. New flexibility solutions have a clear role to play in the future energy system. Many of these are

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			expected to be – if not required to be – low carbon, for example BESS.
REP2-090	Water usage	The amount of water required to clean the PV panels has not been stated. It is expected that with 530,000 panels, it will require approximately 2.4 million litres of water to clean all panels each time. It has not been stated how the waste water will be managed or whether cleaning agents will be used and what their impact will be on the environment.	The displacement of other forms of energy generation with solar energy, which is water efficient, significantly reduces the water consumption associated energy supplied by the national grid. Only non-hazardous cleaning agents will be used to clean the PV panels and as such water used to clean the panels will infiltrate into the ground. In terms of waste water that requires treatment, the outline Surface Water Drainage Strategy sets out that due to the rural setting discharge to a foul sewer is assessed as being unfeasible and that foul water associated with the Proposed Development will therefore be stored via an onsite foul solution (e.g., cesspits, porta-loo) which will then either be taken offsite by a licensed carrier or managed through an appropriate permit. Should foul water be stored via cesspits they will be managed, inspected and drained by a licensed courier who will then dispose of the waste offsite. The cesspits will either meet the general binding rules for the operation of a cesspit or the EA will be consulted to obtain a permit for the operation of the cesspits.