Chapter 9 – Glint and Glare Assessment

Postcombe and Lewknor Solar Farm Environmental Statement

Postcombe and Lewknor Solar Farm Limited

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Table of Contents

Tables

Supporting Appendices (Environmental Statement Volume 4)

Acronyms and Abbreviations

BNG	British National Grid
BRE	Building Research Establishment
DNI	Direct Normal Irradiance
G&G	Glint and Glare
MW	Megawatt
NPPF	National Planning Policy Framework
OP	Observation Point
PV	Photovoltaic
SAT	Single axis Tracker
SGHAT	Solar Glare Hazard Analysis Tool
SNL	Sandia National Laboratories

9. Glint and Glare Assessment

9.1 Executive Summary

9.1.1 A comprehensive glint and glare (G&G) assessment was carried out for the Proposed Development. This assessment quantifies both the magnitude and duration of G&G on receptors (i.e., objects impacted by G&G, such as dwellings, road users and air traffic), as well as highlighting the time of the year that the G&G occurs from the Proposed Development.

9.1.2 One out of the 40 ground-based receptors, observation point (OP) 25, and two of the three routes, route receptors (RR) 1 & 3, are subject to a minimal level of anticipated G&G. G&G is predominantly low magnitude (green classification) around sunset in December and January, and in the evenings of the summer months, up to 15 minutes per day in the worst case. This level of impact is considered acceptable and in line with UK guidance.

9.1.3 Existing screening is present to mitigate the impacts of G&G on OP25 due a tall tree row running along the perimeter of the road (A40) adjacent to the Proposed Development. This will be further mitigated by the landscape mitigation plan proposed planting scheme (Figure 5.10, Volume 3 of the Environmental Statement (ES)).

9.1.4 Both RR 1 & 3 experience G&G on the southern portion of the road, however many existing objects (tree lines and dwellings) are situated between the impacted portion of the road. Therefore, no material impacts are envisaged.

9.1.5 Considering the comparable intensity of reflections to metallic and glass-based surfaces (e.g. windows) in worst cases, coupled with the limited duration and narrow timeframes of G&G emissions given that these effects are only experienced during daylight hours, yellow magnitude (potential for some magnitude) G&G is not envisioned to pose a significant risk to the site. Therefore, while a solar reflection is geometrically possible, any impact is considered to be small such that mitigation is not required.

9.1.6 It is important to note that the simulation did not account for the presence of hedgerows and trees around some of these receptors. Consequently, in real-life conditions, the G&G assessment indicates that the Proposed Development will have no impact on the receptors identified.

9.2 Introduction

9.2.1 This chapter details the findings of a G&G assessment undertaken for a ground-mounted solar PV array at Postcombe and Lewknor. The assessment quantifies both the magnitude and duration of G&G on receptors (i.e., objects impacted by G&G, such as dwellings, road users and air traffic), as well as highlighting the time of the year that the G&G occurs. For receptors subject to G&G, recommendations are made on potential mitigation strategies.

9.2.2 This G&G study is informed by the design undertaken and information provided by the Applicant in December 2024 (37. Lewknor_Tracker_S2_54.8 MWp.dwg).

9.2.3 This chapter is supported by the following technical appendices in Volume 4:

- **Appendix 9.1** – ForgeSolar Glint and Glare Report; and
- **Appendix 9.2** - Glint and Glare Modelling Details and Assumptions

9.3 Legislation, Policy & Guidance

9.3.1 There is little formal guidance on G&G in the UK, although it is mentioned in a range of national planning guidance.

9.3.2 The National Planning Policy Framework (NPPF) under the planning practice guidance for Renewable and Low Carbon Energy (DLUHC - GOV UK 2023) notes that large scale solar farms '*could have a damaging effect on the landscape…particularly in undulating landscapes´* and that the '*visual impact of a well-planned and well-screened solar farm can be properly addressed within the landscape if planned sensitively*' (Paragraph 007: ID 5-007-20140306 & Paragraph 013: ID 5-013-20150327). There is no explicit guidance on the proximity of receptors to the development that should be considered for assessment.

9.3.3 The Building Research Establishment (BRE) (BRE 2013) state that '*the sensitivities associated glint and glare, and the landscape/visual impact and the potential impact on aircraft safety, should be a consideration. In some instances, it may be necessary to seek a glint and glare assessment as part of a planning application*'. However, BRE do not define a proximity to the development that receptors should be considered.

9.3.4 Both the NPPF and BRE guidance highlight the additional importance of a G&G study if solar tracking systems are used, whereby solar PV modules rotate to follow the suns path to maximise power generation. These can cause '*additional impacts*' such as 'differential diurnal and/or seasonal' variations of G&G. The Department for Energy Security & Net Zero (DESNZ) (DESNZ 2023) also state that G&G studies may need to account for tracking panels as they may cause 'diurnal and/or seasonal impacts'.

9.4 Consultation

9.4.1 No consultation with regulatory bodies has been necessary for this assessment.

9.5 Assessment Methods & Significance Criteria

9.5.1 The study used the following methodology to assess the impacts of G&G arising from the Proposed Development.

- Identify receptors required for the assessment.

- Input receptors and solar PV array details (location, area of coverage etc.) into the ForgeSolar modelling tool and run the simulation.

- Assess results, identifying duration/magnitude of G&G on all identified receptors and account for software limitations (e.g., objects such as trees are not considered within the model).

Study Area

9.5.2 The study area is determined as a 1 km radius from the solar component of the Proposed Development for all ground-based receptors (buildings and roads); and 5 km for aviation receptors.

Desk Study

9.5.3 The desk study used GIS software to identify ground-based receptors within 1 km of the Proposed Development. For further details please refer to **Appendix 9.1**.

Receptor Identification

9.5.4 This section highlights the receptors considered for the assessment.

Ground-based receptors

9.5.5 The following ground-based receptors are considered for the assessment.

9.5.6 Observation Points (OP): 40 off-site building receptors. These are all to be assumed as two-story buildings, with an observation height of 4.5 m. Note that this will overestimate G&G as screening objects tend to exist at a lower height.

9.5.7 Route receptors: Three roads, including the M40 separating the western and eastern parcels. The observation height for vehicles is assumed to be 1.5 m. Table 9.1 in **Appendix 9.2** highlights the receptors details that serve as input to the G&G model. Off-site receptors were selected based on their proximity and position around the site.

9.5.8 **Graphic 9.2** below provides an aerial view of the Proposed Development area and identified ground-based receptors.

Graphic 9.2 – Aerial view of the main solar site (red) solar PV development areas (orange), route receptors (blue) and building receptors (green) (Source: Google Earth Pro 2024)

Air-based receptors

9.5.9 Chalgrove Airfield is located approximately 6 km west of the Proposed Development. However, this is a former Second World War airfield and is not currently in use. Therefore, it has not been considered during the G&G assessment. RAF Benson airfield is also located approximately 10 km south-west of the Site, this is therefore outside of the study area and does not need to be assessed.

Modelling Assumptions

9.5.10 There are a total of three sets of modelling assumptions required for the simulation, detailed in the Table 9.2, 9.3 and 9.4 of **Appendix 9.2**.

Field Surveys

9.5.11 No field surveys were required or conducted for this assessment.

Assessment of Likely Effect Significance

9.5.12 For the purposes of this assessment, the GlareGauge tool (by ForgeSolar) was used to assess the magnitude and duration of G&G. It is an industry standard tool that utilises the Solar Glare Hazard Analysis Tool (SGHAT) that was developed by Sandia National Laboratories (SNL 2024). SGHAT classifies G&G into the following categories:

- **Green** = low potential for after image, reflection occurs with lesser strength.
- **Amber (yellow)** = potential for after image, reflection can occur instantly with some disturbance to vision.
- **Red** = potential for permanent retinal damage, reflection occurs instantly with severe disturbance to vision.

9.5.13 The potential for a significant effect to arise from G&G impacts is dependent on the predicted magnitude of impacts as set out above, as well as the nature and sensitivity of the receptor, and the predicted duration and timing of potential G&G impacts. Green magnitude G&G is of lower intensity compared to G&G originating from reflective surfaces like windows, and would not normally be considered to result in significant effects. Yellow magnitude G&G is comparable in impact to reflective materials such as glass and metallic surfaces, and may in some cases result in significant effects, depending on the predicted duration and frequency of G&G on sensitive receptors. Red magnitude G&G, if predicted to affect sensitive receptors, would likely be considered to result in significant effects.

Requirements for Mitigation

9.5.14 Mitigation, where appropriate, can include inclusion of screening to limit G&G impacts. Mitigation measures are suggested based on the G&G simulation report generated by the modelling tool. This quantifies which portion of the array G&G emanates from onto specific receptors. A qualitative approach is used to indicate where screening may be required (e.g. hedgerows) and at what height based on elevation differences between receptors and the PV array.

Assessment of Residual Effect Significance

9.5.15 A qualitative assessment of residual effects is provided, taking account of committed mitigation measures.

Limitations to Assessment

9.5.16 It is important to consider the limitations of the software for this piece of analysis:

- The geometry of the entire system is not considered (i.e. gaps between modules and heights of the mounting structures and individual panels). Therefore, an average module height above of ground of 2.55 m assumes this is the only elevation at which sunlight reflects from the module (i.e. the lower and higher portions of the array are not considered).

- The shape of surrounding obstacles and obstructions (i.e. trees, electricity poles, fences, etc.) are not fully considered. For example, a tree is considered as uniform in its circumference from its tip to the ground as opposed to thinner at the bottom from the trunk and widest in the middle. This can lead to an obstacle's ability to shield a receptor from G&G being both under and overestimated. Furthermore, the precise height of shading obstacles is not known, and estimates are therefore made.

- The model does not consider daily variations in weather conditions (e.g. cloud cover) and instead uses a typical clear day as a default. This also overestimates the impacts of G&G.

- Only 40 static OPs can be modelled within a single simulation. Therefore, the 40 OPs selected are considered the most representative of those within the 1km radius of site.

- Only ten obstructions can be modelled. As a result, many existing obstructions such as tree and hedgerows and other buildings may not be present in the model. G&G is therefore overestimated in this instance, as the rest of the modelled area is considered flat with no obstacles.

9.6 Baseline

9.6.1 Baseline conditions of G&G are considered zero as the PV array is not yet operational and G&G arising from nearby developments is unknown.

9.7 Standard Mitigation

9.7.1 Mitigation by design has included including appropriate set-back of the solar PV development from nearby residential properties, and a Landscape Masterplan (refer to Figure 5.10, Volume 3 of the ES), which includes planting and/or strengthening of hedgerows and trees around essentially the entire perimeter of the Proposed Development.

9.8 Assessment of Potential Effects

Construction

9.8.1 Assessment of construction phase effects has been scoped out due to the factors noted below.

- Temporary nature of activities: The construction phase will involve the use of temporary materials and equipment, which are not highly reflective or positioned in a manner that would result in glint or glare impacts.

- Lack of fixed reflective surfaces: Solar panels, the primary source of potential G&G impacts, are not operational during this phase.

- Low risk to receptors: Temporary equipment or construction activities are unlikely to create significant visual impacts on receptors, such as nearby roads or residences. Any reflections would be momentary, minor, and mitigated through standard construction practices.

Operation

9.8.2 Only the operational phase has been considered in this assessment. Furthermore, all mitigation measures presented in this section apply solely to the operational phase.

9.8.3 The analysis reveals that only three receptors are subject to G&G and that emanates from a small proportion of the eastern and western parts of the Site. Only one out of the 40 ground-based receptors, OP25; and two of the three routes, Route 1 and Route 3, are subject to potential G&G effects.

Table 9.1 – Summary of Modelled G&G Impact on Receptors

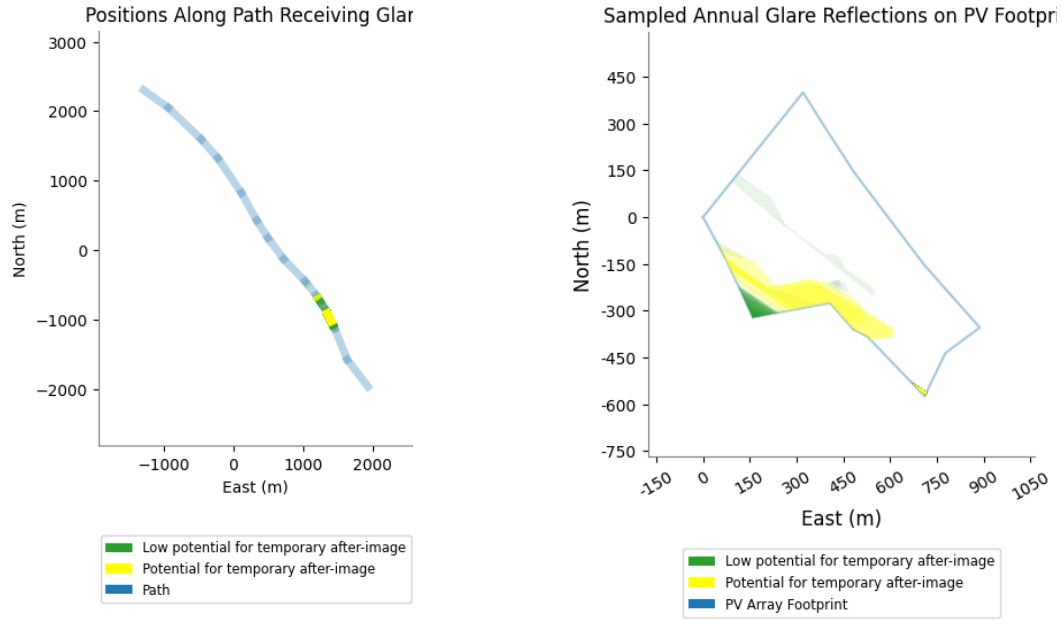
Receptor ID	Annual Green Glare (Minutes)	Annual Yellow Glare (Minutes)	Hazard Summary
Route 1	771	42	Green (minimal/negligible)
Route 2	0	0	None
Route 3	51	0	Green (minimal/negligible)
OP25	47	0	Green (minimal/negligible)
All other OP's	0	0	None

Table 9.2 - Duration and diurnal/seasonal patterns of G&G.

Receptor Id	G&G Hazard Summary	Time/Maximum Duration Of Daily G&G	PV Area
Route 1	Green (minimal/negligible)	From 19:00 to 20:30 from May to Aug up to 15 min per day	Western
Route 3	Yellow (moderate)	From 19:00 to 20:15 from May to Aug up to 5 min per day	Western
OP25	Green (minimal/negligible)	From 15:00 to 16:00 in Dec and Jan up to 5 min per day	Eastern

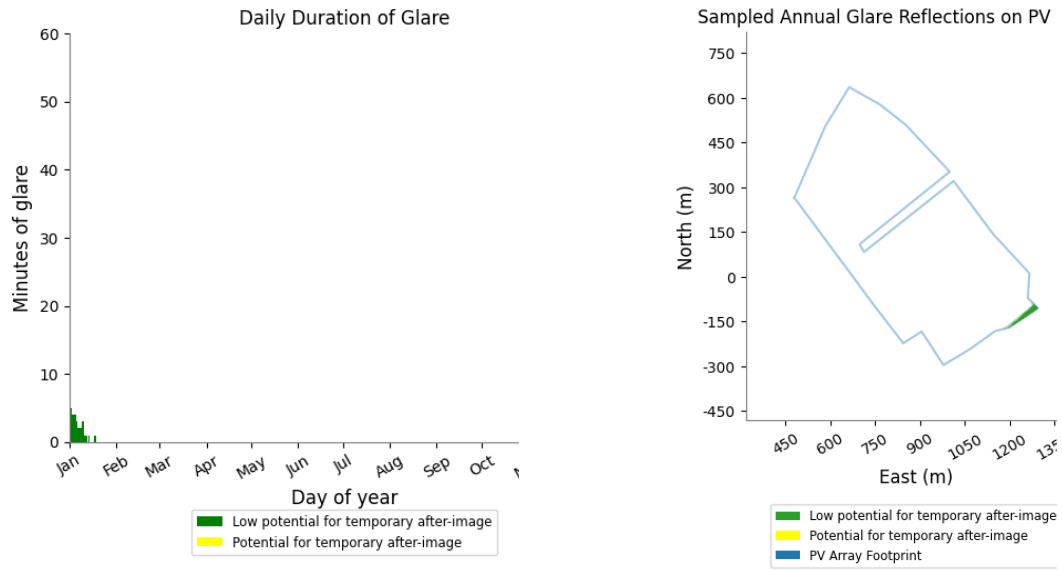
9.8.4 Route 1 is mainly affected by green magnitude of G&G. However, it is also subject to yellow G&G, which is similar in impact to reflective materials such as glass and

metallic surfaces. Route 3 is only affected by green G&G. In both cases, the G&G emanates from the Western parcel during the evenings of summer months up to 15 minutes per day in the worst-case scenario. Due to the momentary nature of G&G effects on route receptors as vehicles approach or move away from the PV array and the existing hedgerows along much of the road perimeters, the overall impact under real world conditions is deemed to be minimal to none. See Error! Reference source not found. **9.3** below for more detail.



Graphic 9.3 - Position along Route 1 that receives G&G (left); and part of the solar PV array area where G&G emanates from (right).

9.8.5 Building receptor OP25, which is located near the southeast corner of the eastern part of the Site, is affected by green magnitude of G&G. The impact occurs from 15:00 to 16:00 in December and January up to 5 minutes per day, when the sun settles in the west and reflects from the southwest across the modules eastwards, as shown in **Graphic 9.4** and **Graphic 9.5**.



Graphic 9.4 - Daily duration glare (left) and sampled annual glare reflection on the Eastern solar PV array footprint (right) for OP25.

Graphic 9.5 - Demonstration of reflectance across the array towards OP25 in the winter afternoons (yellow arrow).

9.8.6 The G&G simulation has not considered all the existing trees and hedgerows around the Proposed Development and around the building receptors. See **Error! Reference source not found. 9.6** below. Therefore, in real-life conditions, it is envisaged that the G&G impact will be negligible to none.

Graphic 9.6 - Trees screening OP25 (green arrow), Route 3 (blue) and red-line boundary (red) for reference. (Source: Google Earth Pro 2024).

Decommissioning

9.8.7 Assessment of decommissioning phase effects has been scoped out due to the factors noted below.

- Removal of reflective surfaces: The primary reflective surfaces, i.e., the solar panels, will be removed during this phase, eliminating the potential for G&G impacts.
- Temporary and managed activities: Similar to construction, decommissioning activities are temporary and involve equipment that is unlikely to generate significant glint or glare effects.

9.9 Mitigation

9.9.1 Given that no significant effects are anticipated, taking account of embedded and standard mitigation including the implementation of the Landscape Mitigation Masterplan, no additional mitigation is required.

9.10 Assessment of Residual Effects

9.10.1 The residual effect is considered negligible to none and not significant.

9.11 Assessment of Cumulative Effects

Assessment of Cumulative Effects

9.11.1 There are four solar projects identified within 5 km from the Proposed Development. These include:

- Harlesford Solar (operational) - ~3.1 km north-north-west of the Site;
- Dodwells Solar (consented, awaiting construction) - ~3.2 km north of the Site;
- Cornwell Solar (operational) - ~4 km north-west of the Site; and
- Chalgrove Solar (operational) - ~ 4.7 km west of the Site.

9.11.2 According to their respective G&G assessments, once their mitigation plans are in place, there are no residual impacts at any receptor. Therefore, there would be no cumulative effects with the Proposed Development.

9.12 Summary

9.12.1 A comprehensive G&G assessment was carried out for the Proposed Development. The study identified a total of 40 building receptors and three road receptors that could are within the study area and therefore have the potential for G&G from the solar PV array.

9.12.2 The assessment used the GlareGauge software (by ForgeSolar) to identify the impacts on identified receptors by both magnitude and duration of G&G across the year, and highlight the likely diurnal and seasonal impacts of G&G. The GlareGauge tool has some limitations (which are discussed in the report) such as treating the circumference of trees at ground and tip height as uniform, despite the trunk of tree being much smaller than the body of the tree. This can lead to an under/overestimation of the impact of obstacles in mitigating G&G on sensitive receptors.

9.12.3 Among the three route receptors, a combination of predominantly green with some limited yellow G&G magnitudes was observed, although G&G was. Nevertheless, due to the momentary nature of G&G effects on route receptors as vehicles approach or move away from the PV array and the existing hedgerows, the overall impact is deemed to be minimal to none particularly in a real-life setting.

9.12.4 Of the 40 building receptors, only OP25 is subject to green magnitude of G&G in the simulation and is only affected by a very small proportion of the eastern part of the Site. The impact occurs for up to 5 minutes in the afternoon of December and

January. The total duration and magnitude of these impacts is significantly lower than comparable fixed-mounted systems.

9.12.5 It is important to note that the simulation did not account for the presence of hedgerows and trees around some of these receptors. Consequently, in real-life conditions, the G&G assessment indicates that the Proposed Development will have no impact on the receptors identified.

9.12.6 The Landscape Mitigation Masterplan for the Proposed Development includes hedgerow planting or reinforcing around essentially the entire site perimeter. Considering the comparable intensity of reflections to metallic and glass-based surfaces in worst cases, coupled with the limited duration and narrow timeframes of G&G emissions and the mitigation afforded by the Landscape Mitigation Masterplan, no significant effects are predicted to arise due to G&G impacts from the Proposed Development.

Table 9.3 – Summary Table

Description of Effect	Significance of Potential Effect		Mitigation Measures	Significance of Residual Effect	
	Significance	Beneficial / Adverse		Significance	Beneficial / Adverse
During Construction & Decommissioning					
Based on the nature of the project and surrounding receptors, the construction and decommissioning phases have been scoped out.					
During Operation					
Effect on Fixed Receptors: OP25	Minimal to negligible	Adverse	N/A	Minimal to negligible	Adverse
Effect of Route 1	Minimal	Adverse		Minimal to negligible	Adverse
Effect on Route 3	Minimal to negligible	Adverse		Minimal to negligible	Adverse
Cumulative Effects					
No potential cumulative schemes have been identified.					

9.13 References

BRE (2013) Planning guidance for the development of large-scale ground-mounted solar PV systems. Available at https://www.bre.co.uk/filelibrary/pdf/other_pdfs/KN5524_Planning_Guidance_reduced.pdf

NPPG (2023) National Planning Policy Framework: Renewable and low carbon energy. Available at

https://www.gov.uk/guidance/renewable-and-low-carbon-energy