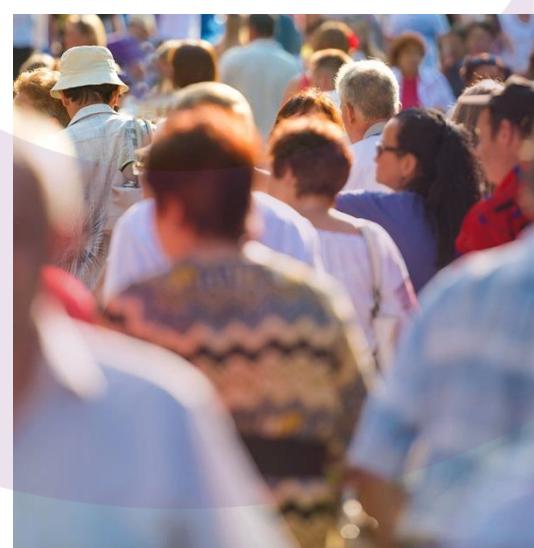
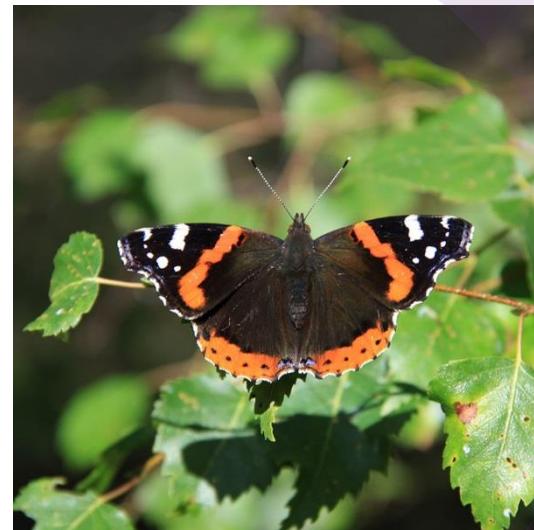


ScottishPower Renewables

Land Adjacent to Whitelee Windfarm – Solar PV, Green Hydrogen Production and Battery Storage Facilities

Glint and Glare Assessment



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Document revisions

No.	Details	Date
1	Draft Assessment	12/12/20
2	Finalised Draft Assessment	07/02/21
3	Final	31.03.21



1. Executive summary

Purpose of this report

- 1.1.1 This report has been produced for the purpose of assessing the possible effects of glint and glare from a proposed solar photovoltaic (PV) farm at a Site adjacent to the existing Whitelee Windfarm and Extension. In its totality, ScottishPower Renewables (UK) Limited (SPR/the Applicant) wishes to construct a solar PV farm comprising c. 62,000 solar PV panels, with a combined rated output of up to 40 megawatts (MW). This solar PV farm has the primary function of providing the main source of green electricity to a green hydrogen production facility which has a rated energy consumption of 20MW. For the avoidance of doubt, the proposed solar PV farm is being made as part of an application to the Energy Consents Unit (ECU) under S36 of the Electricity Act 1989.
- 1.1.2 The green hydrogen production facility, which is intended to be served by the electricity produced from the solar PV farm is being applied for under a separate application for Full Planning Permission under Section 32 of the Town and Country Planning (Scotland) Act 1997, as amended. This application is made to East Ayrshire Council (EAC). Any references within this report to the green hydrogen production facility are provided to aid in contextual understanding but should not be treated as the subject of this assessment, which remains solely focussed on the potential glint and glare implications of the solar PV farm.
- 1.1.3 The Site boundary of the Proposed Development is located immediately adjacent to Whitelee Windfarm and Extension and is wholly contained within the local authority area of East Ayrshire. This assessment considers possible effects upon aviation activity, nearby roads and dwellings.

Glint and Glare

- 1.1.4 Glint in this context refers to a momentary flash of bright light typically received by moving receptors or from moving reflectors.
- 1.1.5 Glare in this context refers to a continuous source of bright light typically received by static receptors or from large reflective surfaces.
- 1.1.6 Solar PV arrays are designed to absorb light, which is then used to generate electricity. For this reason, all solar PV arrays are fundamentally designed to absorb light rather than reflect it. The relative reflectivity of solar PV panels is therefore very low in comparison to other common surfaces.

Findings

- 1.1.7 **Aviation:** The Site is approximately 20 miles from either of Glasgow and Prestwick Airports and therefore not within UK Civil Aviation Authority (CAA) safeguarding zones for either. There is therefore no specific glint and glare concerns relating to aviation.
- 1.1.8 **Road users:** The Zone of Theoretical Visibility (ZTV) shows that the array may be visible to road users in the 5km section to the south of the array. Any reflections from the solar array will be to the west or east of the array, meaning that it is geometrically possible to see a reflection within a short section of the B764. However, due to the speed of vehicle movements on the road carriageway the effect is considered to be momentary and as a result would present a low impact with an extremely low likelihood of causing an accident. Furthermore, some screening of the array will be provided by



the trees and landform; further minimising impact on B764 road users. Wider screening from vegetation will prevent solar reflections affecting drivers on the M77.

1.1.9 **Residential dwellings:** There are five residential dwellings within 1km of the proposed solar PV farm. One of these is to the west of the array, and it is possible for the dwelling to see a solar reflection. However, this is classified as low impact given the partial screening provided by landform and trees in the direct line of sight.

Recommendations

1.1.10 In summary, no significantly visible solar reflections are projected from the proposed development. This is the case for aviation, road users and residential dwellings. No specific mitigation measures are therefore proposed specifically relating to glint and glare.



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2. Introduction

2.1 Overview

2.1.1 This assessment looks at the possible effects upon aviation activity, nearby roads and dwellings. It is structured to address:

- Definitions of glint and glare.
- Details of the solar development.
- Overview of assessment methodology.
- Results analysis.

2.2 Glint and Glare definition

2.2.1 The definition of glint and glare can vary however, the definition used throughout this report is:

- **Glint** – a momentary flash of bright light typically received by moving receptors or from moving reflectors.
- **Glare** – a continuous source of bright light typically received by static receptors or from large reflective surfaces.

2.2.2 These definitions are aligned with those of the Federal Aviation Administration (FAA) in the United States of America. The term 'solar reflection' refers to both reflection types.

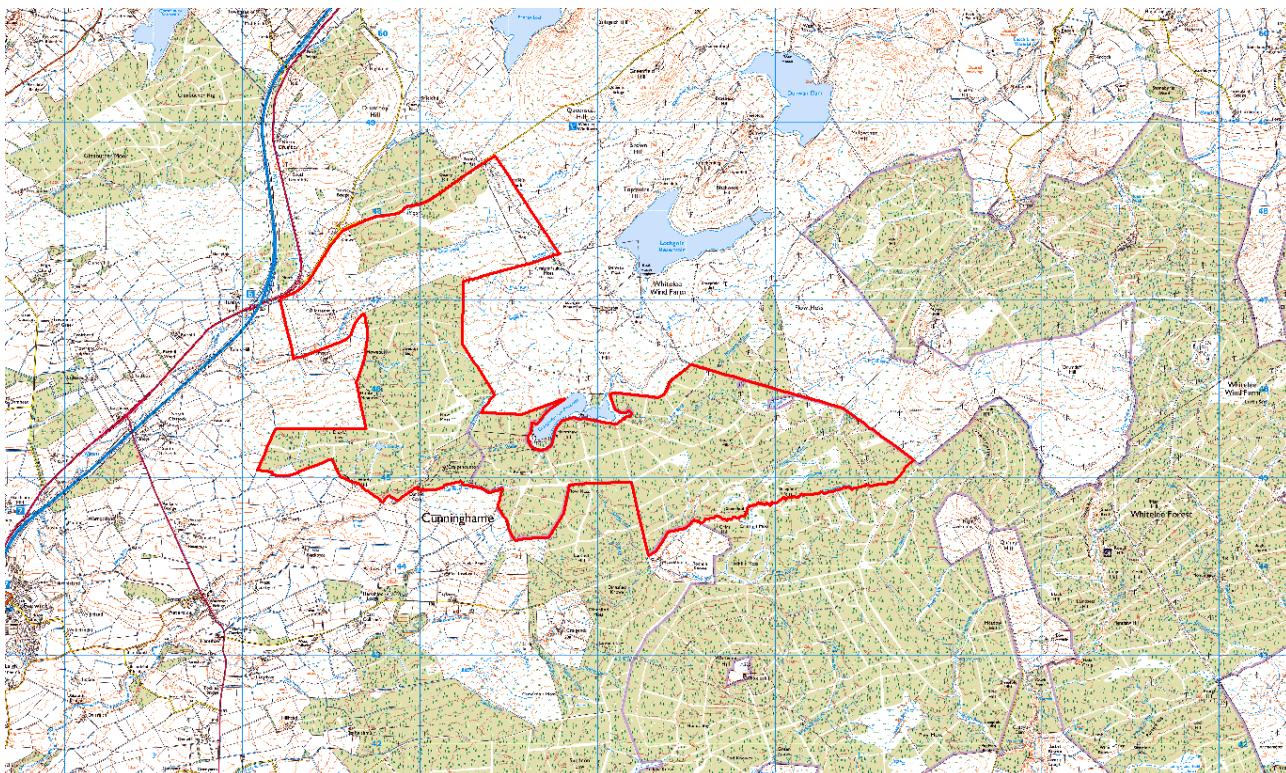


3. Proposed development and location

3.1 Proposed location

- 3.1.1 The Site is located immediately adjacent to Whitelee Windfarm and Extension and is wholly contained within the local authority area of East Ayrshire. Overall, it encompasses a total area of approximately 1,000+ hectares, with 40 to 50 hectares considered as a net developable area for the solar PV array.
- 3.1.2 The Site is located c. 6.8km (4.25 miles) from the nearest settlements of Eaglesham (East Renfrewshire, to north east), c. 7.4km (4.6 miles) from Fenwick (East Ayrshire, to south west), c. 5.8km (3.6 miles) from Waterside (East Ayrshire, to south west) and c. 8km (5 miles) from Moscow (East Ayrshire, to south).
- 3.1.3 The Site is located within an area adjacent to the B764 which is located to the north of the Proposed Development boundary with access to the strategic motorway network from the M77 within close proximity to the west.
- 3.1.4 Further detailed description of the proposed solar PV farm as well as the Project as a whole can be found within **Section 2** of the accompanying Supporting Statement (document ref. 43122-WOOD-XX-XX-RP-T-0003_S0_P01.1).

Figure 3.1 Site location

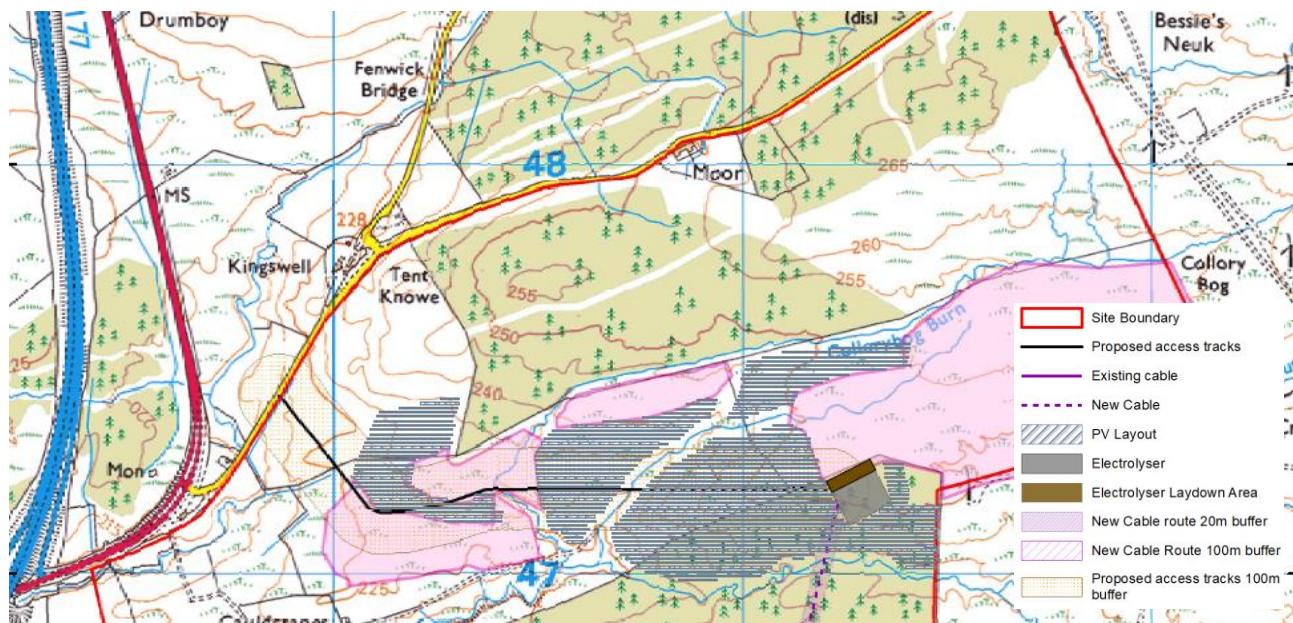


3.2 Proposed indicative layout

- 3.2.1 It is anticipated that the solar PV farm will comprise c. 62,000 solar panels, constructed as a series of arrays. At their highest point, the panels will be <3 m tall.

- 3.2.2 It is proposed to locate the solar PV farm to the north west of the Site, in an area c. 45-50 ha centred on NS 50955 47366. This area sits south of Kingswell and Tent Knowe, and east of Cauldstanes at Collory Bog. This area allows the solar PV arrays to be arranged so that they can be optimally integrated into the landscape, with minimal regrading of the land or changes to its natural topography.

Figure 3.2 Indicative site layout



3.3 Glint and glare receptors

- 3.3.1 In terms of potential receptors for solar reflection there are three areas of interest:

- Aviation and associated impacts on air traffic control.
- Road users.
- Residential dwellings.

Aviation

- 3.3.2 The Site is not within CAA safeguarding zones for either of the closest commercial airports. The nearest private airfield is also noted here.

- Commercial - Glasgow Airport is approximately 20km (12.4 miles) north west of the Site.
- Commercial - Prestwick Airport is approximately 25km (15.5 miles) south west of the Site.
- Private - Strathaven Airfield is approximately 16km (9.9 miles) east of the Site.

Road users

- 3.3.3 The nearest road is the B764 running adjacent to the Site. Access to the M77 is further west of the B764.

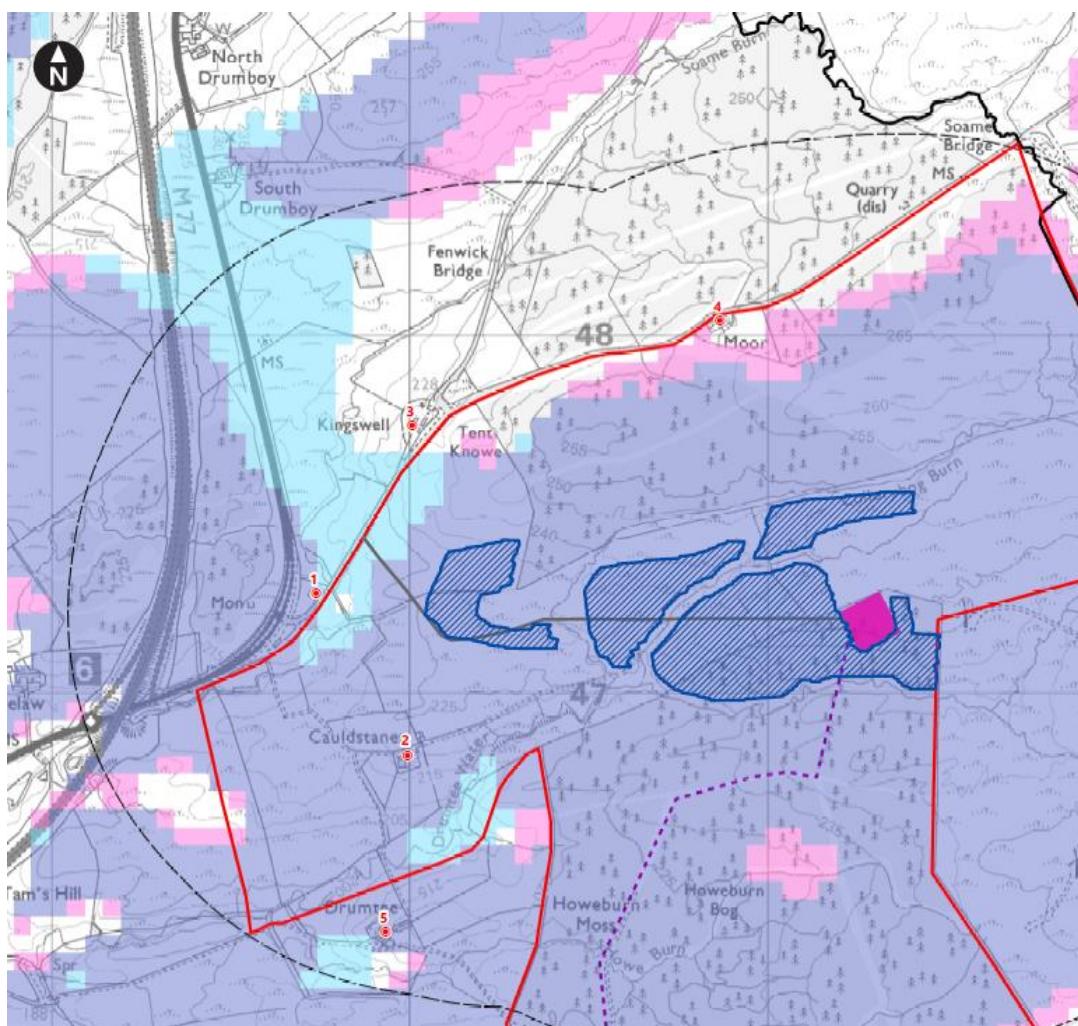
- 3.3.4 The pale blue area in **Figure 3.3** below shows the maximum theoretical visibility of the solar PV array as generated in a ZTV assessment.

Residential dwellings

3.3.5 There are five residential dwellings within 1km of the Proposed Development as shown in **Figure 3.3** below:

- Best Friends (350 m west of the Proposed Development, point 1 on Fig 3.3 below).
- Cauldstanes (350 m south of the Proposed Development, point 2).
- Kingswell (370 m north of the Proposed Development, point 3).
- Moor (540 m north of the Proposed Development, point 4).
- Drumtee (840 m south of the Proposed Development, point 5).

Figure 3.3 Site layout 1km buffer and residential receptors

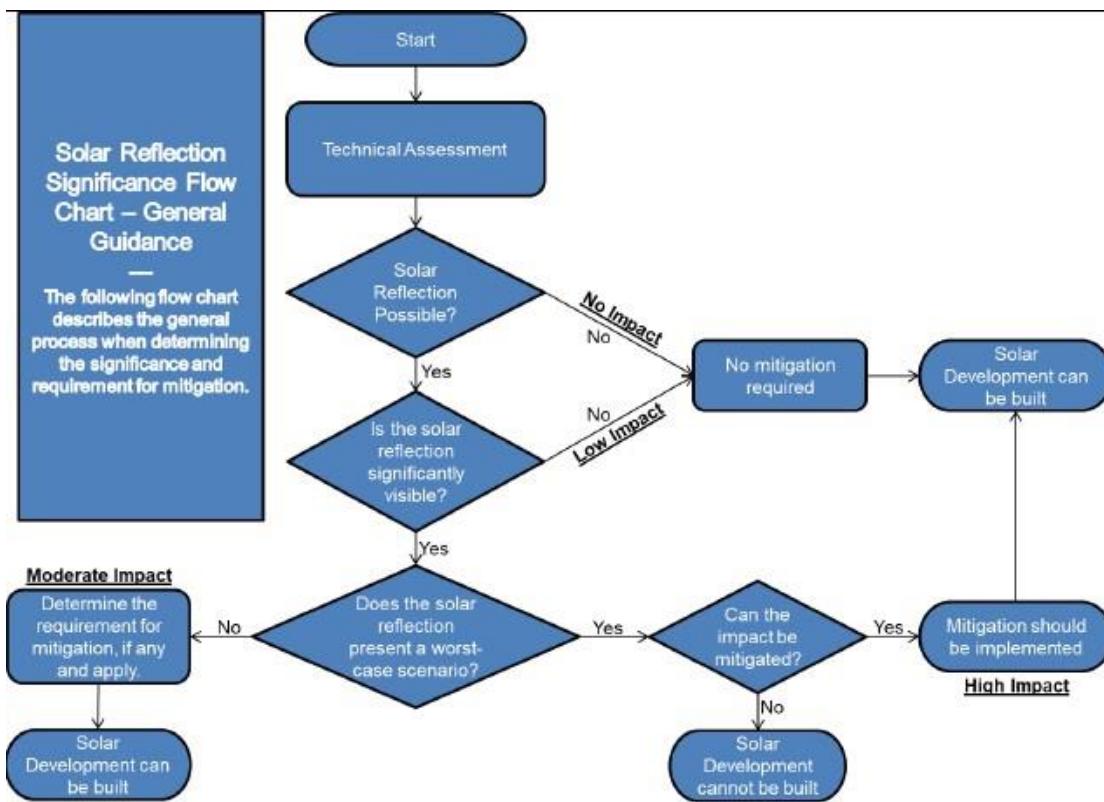


4. Methodology

4.1 General approach

The general approach to assessment here follows guidance provided elsewhere¹. This is summarised in the following flowchart.

Figure 4.1 Glint and glare – overall assessment approach



4.1.1 The technical assessment in determining whether there are any impacts follows a six-condition process:

- Whether there is line of sight between the observer (receptor) and the reflecting solar panel.
- The location of the receptor relative to the solar reflection.
- The time of day when the sun is in the position to produce a solar reflection from a solar panel towards an assessed receptor.
- Whether the path between the sun and reflector is clear of obstruction.
- The angle of incidence of the solar reflection relative to the position of the sun.
- The duration of any potential solar reflections.

¹ <https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/projects/EN010085/EN010085-000605-Appendix%202017%20Glint%20and%20Glare%20Guidance.pdf> (Accessed December 2020)

4.1.2 To assess the scale of impact here the following definitions are used:

- *High* – A solar reflection is geometrically possible and significantly visible under conditions that will produce a significant impact. Further consultation required to determine appropriate mitigation measures.
- *Medium* - A solar reflection is geometrically possible and significantly visible; it is not a worst-case scenario but some mitigation may be appropriate.
- *Low* - A solar reflection is geometrically possible; however, any impact is considered to be small such that mitigation is not required.
- *None* – A solar reflection is not geometrically possible or will not be visible from the receptor.

4.2 Reference guidance and studies

4.2.1 FAA guidance regarding solar PV development notes the relative reflectivity of solar panels when compared to other common surfaces². These details are reproduced in **Table 4.1** below.

Table 4.1 Relative reflectivity of different surfaces

Surface	Approximate percentage of light reflected
Snow	80
White Concrete	77
Bare Aluminium	74
Vegetation	50
Bare Soil	30
Wood Shingle	17
Water	5
Solar Panels	5
Black Asphalt	2

Note: Extrapolated data based on 1,000 W/m² for incoming sunlight

4.2.2 This data shows that the relative reflectivity of solar PV arrays is similar to that of water.

² https://www.faa.gov/airports/environmental/policy_guidance/media/FAA-Airport-Solar-Guide-2018.pdf (Accessed December 2020)

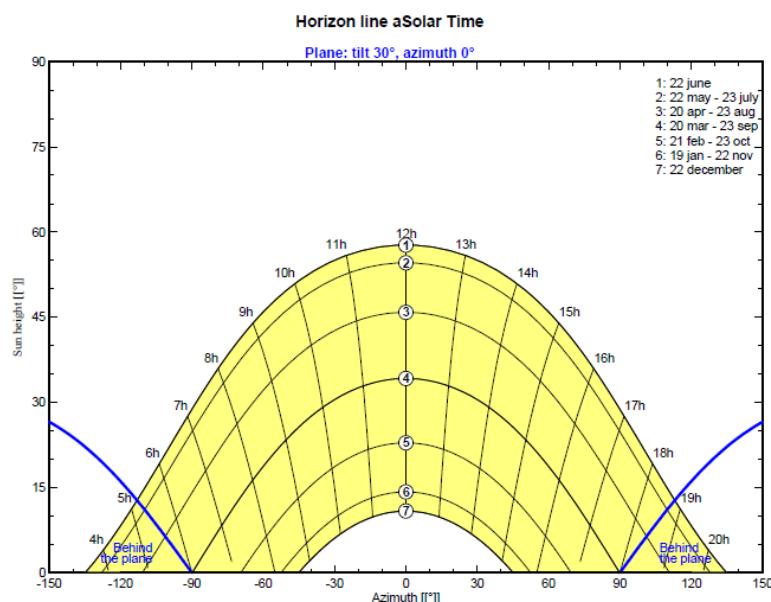


5. Analysis

5.1 Solar data

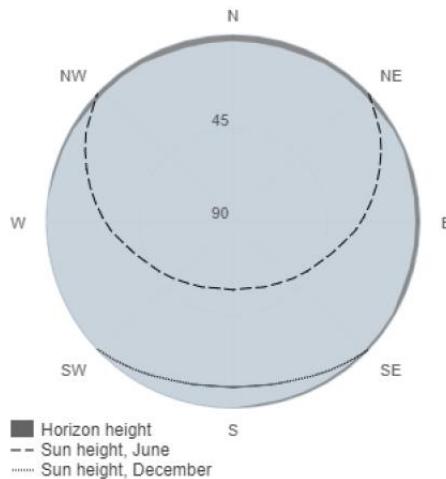
- 5.1.1 In order to consider the extent of any solar reflections it is important to consider the horizon line for the Proposed Development. This provides an indication of the height of the Sun across the seasons and throughout the day, as it tracks across the Site. The peak height is at the summer solstice (22nd June) and the lowest height at the winter solstice (22 December). In this case the maximum height is 55° and lowest height 10° (**Figure 5.1**).

Figure 5.1 Solar horizon line



- 5.1.2 The horizon path tracks both the height of the sun for a given day and its angle (azimuth) relative to an observer looking from due South. This provides sufficient detail to determine typical patterns of incident light and any periods of time when solar reflections may occur. The outline of the horizon for the current site is shown in **Figure 5.2**. Details for June and December are marked on the diagram for the purposes of illustration.

Figure 5.2 Outline of horizon



5.2 Findings

Aviation

- 5.2.1 Glasgow Airport is approximately 20km north west of the Site, while Prestwick Airport is approximately 25km south west of the Site. This means that the Proposed Development is not within CAA safeguarding zones for either airport. There is therefore no specific glint and glare concerns relating to commercial aviation.
- 5.2.2 CAA guidance relating to safeguarding of aerodromes notes that '*In the United Kingdom there has been a further increase in SPV cells, including some located close to aerodrome boundaries; to date the CAA has not received any detrimental comments or issues of glare at these established sites*'³.
- 5.2.3 Strathaven Airfield is a private airfield approximately 16km east of the Site. There is no significant impact on users of the airfield from any potential solar reflection from the solar PV array, given the distance from the airfield.

Road users

- 5.2.4 Any reflections from the solar array will be to the west or east of the array.
- 5.2.5 The ZTV (**Figure 3.3** above) shows that the array may be visible to road users on the B794 in a short section to the west of the array (c. 1km). This visibility diminishes along the 5km section to the south of the array. It is also geometrically possible to see a reflection within a short section of the B764.
- 5.2.6 The impact of solar reflection from the array on these road users is deemed low impact. The visibility will be transient given that the vehicles are moving. Some screening of the array will be provided by the existing vegetation, trees and landform.
- 5.2.7 Wider screening from vegetation will prevent any significant reflections affecting drivers on the M77. The higher speeds of vehicles on the M77 mean any experience of solar reflections will be

³ <https://publicapps.caa.co.uk/docs/33/CAP738%20Issue%203.pdf> (Accessed December 2020)

transient and of no greater impact than general glare effects experienced by motorists in everyday driving conditions.

Residential dwellings

- 5.2.8 There are five residential dwellings within 1km of the proposed solar PV array (**Figure 3.3** above). Two of these (Kingswell and Moor) are located to the north of the array. It is not geometrically possible for them to experience any reflection from the array. Further details are provided in the Residential Visual Amenity Assessment (RVAA) which is contained within Appendix B of the associated Landscape and Visual Assessment (document ref. 43122-WOOD-ZZ-XX-RP-L-0001_S0_P01.1). It is noted that Moor is currently unoccupied. It is owned by the Applicant and would remain unoccupied for the lifetime of the Proposed Development.
- 5.2.9 There are two properties to the south of the array (Cauldstanes and Drumtee). It is not geometrically possible for them to experience any reflection from the array.
- 5.2.10 One property is to the west of the array (Best Friends). It is possible for the dwelling to see a solar reflection. However, this is classified as low impact given the limited extent of affected field of view (further details can be found within the associated RVAA as referenced above in para. 5.2.8) and benefit of natural topography in limiting the direct line of sight. The low-level horizon vision from the property means any extent of solar reflection is short-lived (being much less common during the majority of time when the sun is at higher elevations).



6. Conclusions

6.1 Summary of findings

- 6.1.1 In summary, no significant visible solar reflections are projected to arise from the Proposed Development. This is the case for aviation, road users and residential dwellings. No specific mitigation measures are therefore proposed specifically relating to glint and glare.



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