



GLINT & GLARE ASSESSMENT

WYTHENSHAW FORUM SOLAR ARRAY

Client: Ameresco Limited

Version 1.0

EXPERTISE | KNOWLEDGE | SUPPORT

Document Version Control

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1. INTRODUCTION

1.1. Project Details

Cogeo Planning & Environmental Services Ltd have been requested by Ameresco Limited to carry out a glint and glare assessment on the roof-mounted solar array at Wythenshawe Forum, Manchester, M22 5RX. Manchester City Council have confirmed that installation of the approved PV panels (Planning Reference: 130666/P14J/2021) shall not commence until a glint and glare assessment has been submitted to and approved by the City Council to confirm that the development will not present an ocular hazard to pilots. As such, this report provides a summary of the potential impact on the flightpaths and the Air Traffic Control Tower (ATCT) at Manchester Airport.

1.2. Project Specification

For the purpose of this assessment, the solar panels have been categorised into five separate solar arrays dependent on their location on the building, the location of each array is detailed within Figure 1.1. The parameters of each solar array used within the glint and glare analysis are detailed within Table 1.1.

Table 1.1 Solar Array Specifications

Array	Height of building (m)	Height of panels from roof (mm)	Angle of panels	Azimuth angle of the panels
1	7.0	310	10°	14°
2	7.0	310	10°	104°
3	9.8	310	10°	14°
4	7.0	310	10°	76°
5	7.0	310	10°	76°



Figure 1.1: Location of Solar Arrays

Manchester Airport is located approximately 1.7km southwest of the development site at Wythenshawe Forum. There are two dual asphalt runways located at the airport which have been used within this glint and glare assessment; details of the runways are highlighted in Table 1.2. Details of the ATCT used within the assessment are presented in Table 1.3.

Table 1.2 Manchester Airport Runway Details

Runway	Length (m)	Width (m)	Longitude	Latitude	Height AOD (m)
05L	3,048	45	-2.292754	53.345145	60.95
23R	3,048	45	-2.257237	53.362397	76.54
05R	3,050	45	-2.310668	53.331961	56.30
23L	3,050	45	-2.276856	23.348321	68.24

Table 1.3: Discrete Observation Receptors

Observation Receptor	Longitude	Latitude	Height (above ground)
ATCT	-2.279615	53.357819	62.81

1.3. Glint & Glare

Definitions of glint and glare relating to solar panels can vary, but it is generally accepted that they are defined as:

- Glint is a direct reflection of sunlight
- Glare is a less intense, continuous source of brightness

As solar panels are designed to absorb sunlight rather than reflect it, it is generally considered to be of low risk within the UK.

The 2010 FAA Guidance included a diagram illustrating the relative reflectance of solar panels compared to other surfaces. Surfaces in this figure produce reflections which are specular and diffuse. A specular reflection (those made by most solar panels) has a reflection characteristic similar to that of a mirror. A diffuse reflection will reflect the incoming light and scatter it in many directions. A table of reflectivity values, sourced from Figure 16 within the FAA guidance, is presented in Table 1.4.

Table 1.4 Surface Reflection Values

Surface	Reflection
Snow	80
White Concrete	77
Bare Aluminium	74
Vegetation	50
Bare Soil	30
Wood Shingle	17
Water	5
Solar Panels	5
Black Asphalt	2

It should be noted that the data above does not consider the reflection of the sun whether the surface type is specular or diffuse.

An important comparison in this table is the reflectivity compared to water which produces a reflection of very similar intensity to that from a solar panel. The study by Riley and Olsen (2011)¹ also concludes that still water has a very similar reflectivity to solar panels.

1.4. Assessment of Impact

There is no specific methodology for assessing the effect of glint and glare on a receptor and due to the unpredictability of weather patterns, movement of receptors within the landscape and minor variances in onsite topography and vegetation, there is no definitive threshold for acceptance or refusal. As such an accepted approach is to identify areas of potential issue and, where necessary, provide mitigation for the potential impact rather than attempting to provide non-permeable barriers to receptors.

As requested by Manchester City Council, this assessment will consider the glint and glare impacts associated with the flight paths and ATCT at Manchester Airport as detailed within section 1.2.

The FAA sets out the following essential criteria to be met for solar energy systems located on airport property:

- No 'yellow' glare for any flight path from threshold to 2 miles.
- No glare of any kind for Air Traffic Control Tower(s) at cab height.

¹ Riley and Olsen (2011) A Study of the Hazardous Glare Potential to Aviators from utility-Scale Flat-Plate Photovoltaic Systems

2. RESULTS

The results demonstrate the potential for the roof-mounted solar array at Wythenshawe Forum to impact upon Manchester Airport flight paths. It should be noted however that this assessment utilises bare-earth analysis only, no vegetation or built environment features are accounted for within the assessment of impact. The results have been derived from the parameter input data detailed in section 1.2 of this report. The impact on each flightpath route and ATCT is summarised per-month in Table 2.1 with the earliest and latest timings of potential effect.

Table 2.1 Glint and Glare summary of time potential of impact

Receptor	Month	Earliest	Latest	Date Range
05L	January	N/A	N/A	N/A
	February	N/A	N/A	N/A
	March	N/A	N/A	N/A
	April	N/A	N/A	N/A
	May	N/A	N/A	N/A
	June	N/A	N/A	N/A
	July	N/A	N/A	N/A
	August	N/A	N/A	N/A
	September	N/A	N/A	N/A
	October	N/A	N/A	N/A
	November	N/A	N/A	N/A
	December	N/A	N/A	N/A
23R	January	N/A	N/A	N/A
	February	N/A	N/A	N/A
	March	N/A	N/A	N/A
	April	16:59	18:56	3 rd – 30 th
	May	16:52	17:54	1 st – 31 st
	June	17:14	18:10	1 st – 30 th
	July	17:04	18:09	1 st – 31 st
	August	17:02	18:56	1 st – 31 st
	September	17:41	18:27	1 st – 8 th
	October	N/A	N/A	N/A
	November	N/A	N/A	N/A
	December	N/A	N/A	N/A
05R	January	N/A	N/A	N/A
	February	N/A	N/A	N/A
	March	N/A	N/A	N/A
	April	N/A	N/A	N/A
	May	N/A	N/A	N/A
	June	N/A	N/A	N/A
	July	N/A	N/A	N/A
	August	N/A	N/A	N/A
	September	N/A	N/A	N/A
	October	N/A	N/A	N/A

23L	November	N/A	N/A	N/A
	December	N/A	N/A	N/A
	January	N/A	N/A	N/A
	February	N/A	N/A	N/A
	March	N/A	N/A	N/A
	April	N/A	N/A	N/A
	May	N/A	N/A	N/A
	June	N/A	N/A	N/A
	July	N/A	N/A	N/A
	August	N/A	N/A	N/A
	September	N/A	N/A	N/A
	October	N/A	N/A	N/A
	November	N/A	N/A	N/A
ATCT	December	N/A	N/A	N/A
	January	N/A	N/A	N/A
	February	N/A	N/A	N/A
	March	N/A	N/A	N/A
	April	N/A	N/A	N/A
	May	N/A	N/A	N/A
	June	N/A	N/A	N/A
	July	N/A	N/A	N/A
	August	N/A	N/A	N/A
	N/A	N/A	N/A	N/A
	October	N/A	N/A	N/A
	November	N/A	N/A	N/A
	December	N/A	N/A	N/A

The overall results from the RM solar array are detailed in
Table 2.2. The ocular impact of solar glare is quantified into three categories²:

- Green - low potential to cause after-image (*flash blindness*)
- Yellow - potential to cause temporary after-image
- Red - potential to cause retinal burn (*permanent eye damage*)

These categories assume a typical blink response in the observer. Note that retinal burn is typically not possible for PV glare, since PV modules do not focus reflected sunlight³.

² Ho (2011) Methodology to Assess Potential Glint and Glare Hazards From Concentrating Solar Power Plants: Analytical Models and Experimental Validation, ASME J. Sol. Energy Eng., 133.

³ ForgeSolar Glint & Glare Analysis

Table 2.2 Glare analysis per receptor

Receptor	Minutes of Glare per annum		
	Green	Yellow	Red
05L	0	0	0
23R	27,615	0	0
05R	0	0	0
23L	0	0	0
ATCT	0	0	0

3. CONCLUSIONS

The predicted glare times are based on bare-earth terrain and utilise the current maximum solar area design and layout. No screening has been included in the calculation stage. The assessment summarises the predicted impact considering the orientation of receptor and angle of view based on a desk-based review of the available imagery.

Following assessment, green glare impacts are predicted for flightpath 23R, with no impacts predicted for flightpaths 05L, 15R, 23L or the ATCT. Green glare is deemed an acceptable impact for flightpath receptors and as such no further assessment is deemed necessary.

It is concluded that whilst there may be an impact from green glare on flightpath 23R at Manchester Airport, the development will not present an ocular hazard to pilots. Furthermore, the software assumes all-year-round sunshine however the reality of local climatic conditions combined with the mitigating factors of angle of view and orientation of the receptor, screening and topography, suggests that the impact on aviation receptors will be acceptable.