PAGERPOWER
Urban & Renewables

Solar Photovoltaic Viability Assessment

Stansted PV Scheme

The Manchester Airports Group

January 2022





ADMINISTRATION PAGE

Job Reference:	9455C
Date:	30th November, 2021
Author:	Andrea Mariano
Telephone:	[redacted]
Email:	[redacted]

Reviewers:	Michael Sutton; Danny Scrivener
Email:	[redacted]

Issue	Date	Detail of Changes
1	30th November 2021	Initial issue
2	31st January 2022	Second issue – minor amendments

Confidential: The contents of this document may not be disclosed to others without permission.

Pager Power Limited, Unit 2, Stour Valley Business Centre, Sudbury, Suffolk CO10 7GB

[redacted]

KEY FINDINGS

Background

Pager Power has assessed the extent to which Solar Photovoltaic (PV) can be safely developed on land owned by London Stansted Airport (specifically the land immediately surrounding the runway). The assessment considers the relevant aviation infrastructure and operations at Stansted Airport and solar panels with respect to glint and glare, Obstacle Limitation Surfaces (collision risk and frangible structures) and electromagnetic interference (high-level). The aim is to identify where solar PV could be safely deployed on the area surrounding the runway, or where further consideration would be required.

Identified Locations for Solar Development

Based on the review of the constraints, the areas where a solar development is predicted to have a high and a moderate impact are shown in Figure 1 below and Figure 2 respectively. The overlapping of these areas is shown in Figure 3 on the following page. Red areas are those areas where the development of solar panels is not possible, while orange areas are those areas where solar PV would prove difficult, especially with many orange areas overlapping. The division is provided by exclusion zones obtained following the ICAO (International Civil Aviation Organization) guidance, those obtained by the CAP (Civil Aviation Publications) guidance and those obtained by assessing the glint and glare effects upon the airfield receptors.

Figure 1 – Area available (blue) when hard constraints are considered

Figure 2 – Area available (blue) when moderate constraints are considered (left – ICAO, right – CAP)

Figure 3 – Area available (blue) when moderate and hard constraints are considered (left – ICAO, right – CAP)

Conclusions

The analysis has shown that when all constraints (hard and moderate) are considered cumulatively the available area for solar development is significantly reduced and, therefore, the development of a solar development of considerable size is very unlikely. Any solar developments that are proposed on the land of Stansted Airport should be first considered in the context of these constraints.

PAGERPOWER
Urban & Renewables

LIST OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

PAGERPOWER
Urban & Renewables

ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 51 countries within Europe, Africa, America, Asia and Australasia.

The company comprises a team of experts to provide technical expertise and guidance on a range of planning issues for large and small developments.

Pager Power was established in 1997. Initially the company focus was on modelling the impact of wind turbines on radar systems. Over the years, the company has expanded into numerous fields including:

- Renewable energy projects.
- Building developments.
- Aviation and telecommunication systems.

Pager Power prides itself on providing comprehensive, understandable and accurate assessments of complex issues in line with national and international standards. This is underpinned by its custom software, longstanding relationships with stakeholders and active role in conferences and research efforts around the world.

Pager Power's assessments withstand legal scrutiny and the company can provide support for a project at any stage.

1 INTRODUCTION

1.1 Overview

Pager Power has assessed the extent to which Solar Photovoltaic (PV) can be safely developed on land owned by London Stansted Airport (specifically the land immediately surrounding the runway). The assessment considers the relevant aviation infrastructure and operations at Stansted Airport and solar panels with respect to glint and glare, Obstacle Limitation Surfaces (collision risk and frangible structures) and electromagnetic interference (high-level). The aim is to identify where solar PV could be safely deployed on the area surrounding the runway, or where further consideration would be required.

The report includes:

- Overview of the potential developable area;
- Summary of relevant guidance;
- Assessment methodology;
- Relevant airport details (based on available information and reasonable assumptions);
- Obstacle Limitation Surfaces (OLS) assessment considering a single panel height;
- Review of Obstacle Free Zones (OFZ);
- Review of Building Restricted Areas for the relevant navigation aids;
- Glint and Glare assessment considering the above and standard parameters (20-degree elevation and azimuth angle at 170, 180 and 190 degrees, considering:
    - The ATC tower;
    - Location of the approach paths for runway 04/22.
- High-level consideration of additional possible aviation constraints including:
    - Jet blast/wake vortices;
    - Engine Failure after Take-Off;
- Presentation of the developable area considering aviation constraints and/or areas where further analysis is required;
- Conclusion and recommendations.

2 POTENTIAL DEVELOPABLE AREA

2.1 Overview

The following section presents the relevant information for the developable area.

2.2 Potential Developable Area

Figure 4[1] shows the area, which Stansted Airport boundary, considered for the assessment (red line blue area).

Figure 4 – Potential Developable Area

[1] Copyright © 2021 Google.

2.3 Potential Photovoltaic Panel Mounting Specifications

The details of the photovoltaic mounting system considered for the assessment are shown in Table 1 below. These mounting system specifications are the most common for solar development in the UK. Three of the most common panel azimuth angles have been considered (for glare only) because azimuth angle has a greater influence on where glare can occur. Discussed further in Section 8.

Specification	Configuration 1	Configuration 2	Configuration 3
Mid-Height	1.7m	1.7m	1.7m
Orientation (°)	170°	180°	190°
Tilt (°)	20°	20°	20°

Table 1 – *Potential Photovoltaic Panel Mounting Specifications*

3 LONDON STANSTED AIRPORT DETAILS

3.1 Overview

The following section presents details regarding London Stansted Airport.

3.2 Airport Information

London Stansted Airport is a Civil Aviation Authority (CAA) licensed aerodrome used predominately by fixed wing propeller and jet aircraft, as well as helicopters.

3.3 Runway Details

London Stansted Airport has one runway, the details of which are presented below:

1. 04/22 measuring 3,049m by 46m (asphalt).

The runway is shown on the aerodrome chart in Figure 5[2] on the following page.

3.4 Air Traffic Control Tower

The Air Traffic Control (ATC) Tower is located 1.2km to the east-southeast of the approximate centre point of runway 04/22 and is highlighted in Figure 5 on the following page.

3.5 ICAO recognized facilities

The following facilities have been considered for the identification of potential areas for solar photovoltaic power development:

- DME N;
- VOR;
- GBAS (VDB & Receiver stations);
- ILS (Localiser, Glide-path, & Markers);
- Primary Surveillance Radar (PSR);
- Secondary Surveillance Radar (SSR);

The details for these facilities are shown in Table 2 on page 15 and Figure 6[3] on page 16.

[2] Source: NATS AIP. Last accessed 04/11/21.
[3] Copyright © 2021 Google.

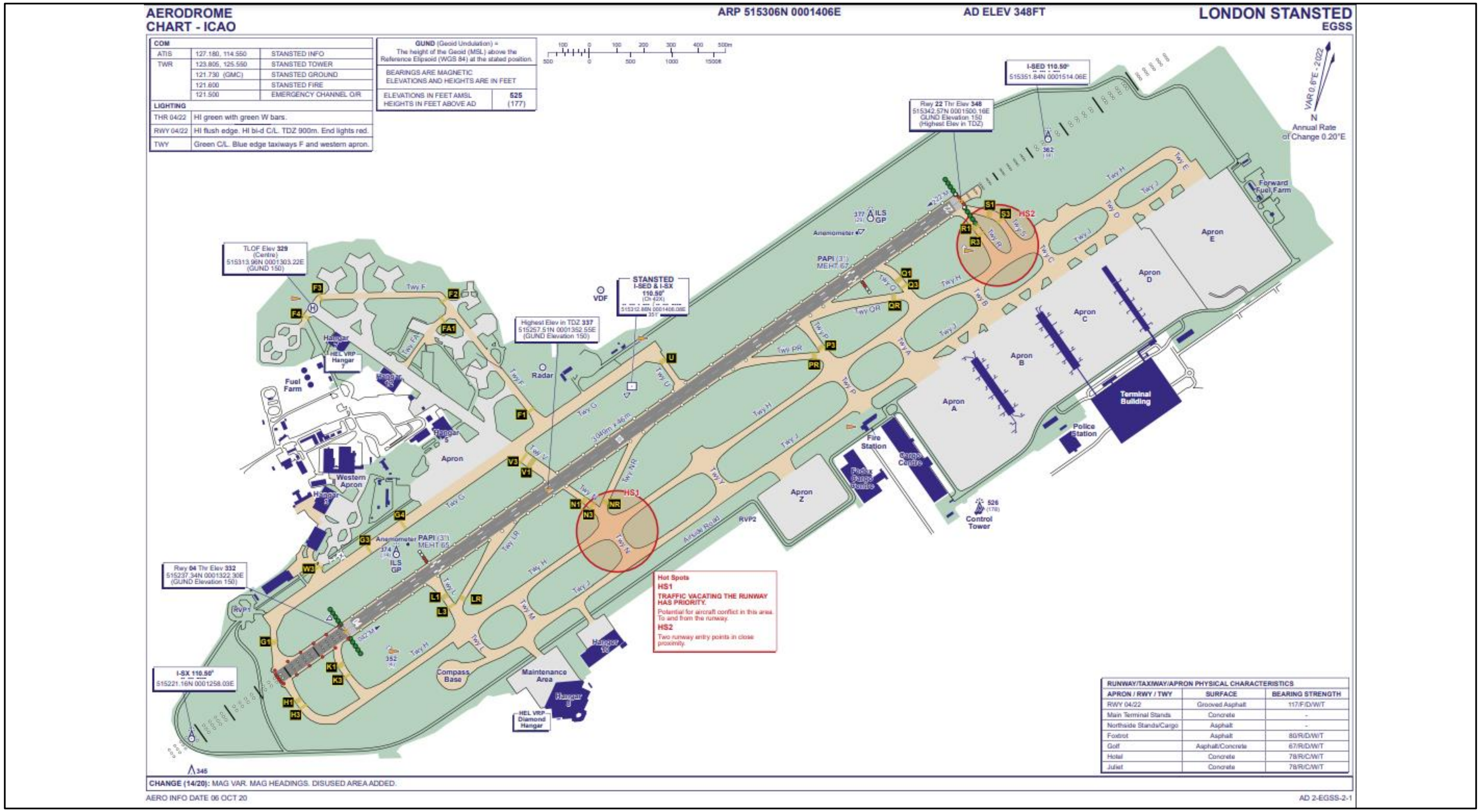

Figure 5 – *London Stansted Airport aerodrome chart*

3.6 ICAO recognized facilities at London Stansted Airport

The Table 2 below presents details regarding London Stansted Airport ICAO recognized facilities.

Facility Type	Facility	Easting	Northings	Latitude	Longitude	Elevation (Terrain Elevation)
DME N	VOR/DME N 0.23°E (2019)[4]	0005243.18E	505958.87N	50.99969	0.87866	9.1m (2.0m)
DME N	ILS/DME (ISX)	0001406.08E	515312.86N	51.88691	0.23502	106.9m (102.1m)
DME N	ILS/DME (ISED)	0001406.08E	515312.86N	51.88691	0.23502	106.9m (102.1m)
ILS	22/APPROACH 04/TAKE-OFF	0001514.06E	515351.84N	51.89773	0.25391	110.3m (102.8m)
ILS	ILS/LLZ III (ISED)	0001514.06E	515351.84N	51.89773	0.25391	110.3m (102.8m)
ILS	ILS/GP (ISED) (runway 04)	0001328.79E	515247.57N	51.87988	0.22466	(100.0m)
ILS	ILS/LLZ III (ISX)	0001258.03E	515221.16N	51.87254	0.21612	(90.2m)
ILS	ILS/GP (ISX) (runway 22)	0001443.91E	515338.22N	51.89395	0.24553	(101.9m)
Radar	PSR/SSR	0001348.62E	515312.84N	51.88690	0.23017	(101.5m)

Table 2 – ICAO recognized facilities at London Stansted Airport

[4] This facility is not within Stansted airport boundary therefore is not considered for the assessment.

Figure 6 – ICAO recognized facilities at London Stansted Airport

4 OBSTACLE FREE ZONES (OFZ) BUFFERS

4.1 Obstacle Free Zones (OFZ)

Obstacle free zone is a volume of airspace extending upwards and outwards from an inner portion of the Runway Strip to specified upper limits which is kept clear of all obstructions except for minor specified items required for air navigation purposes, of low mass and of a frangible mount[5].

4.2 Obstacle Free Zones Safeguarded Areas

London Stansted airport's runway follows the associated OFZ rules for a code 3/4 runway, and the associated OFZ plan is shown in Figure 7 below. It is understood that the OFZ extends:

- Across the runway width to a ground level for 60m on both sides from the centreline (*portion of the strip* in the image below) of the runway and after that a surface with a slope of 1:30 (*side surface slope* in the image below);
- Across the runway length: to a ground level for 60m on both sides of the runway (*portion of the strip* in the image below) and after only the most restrictive surface[6] has been used (portion of the approach surface in the image below) which has a slope of 1:50.

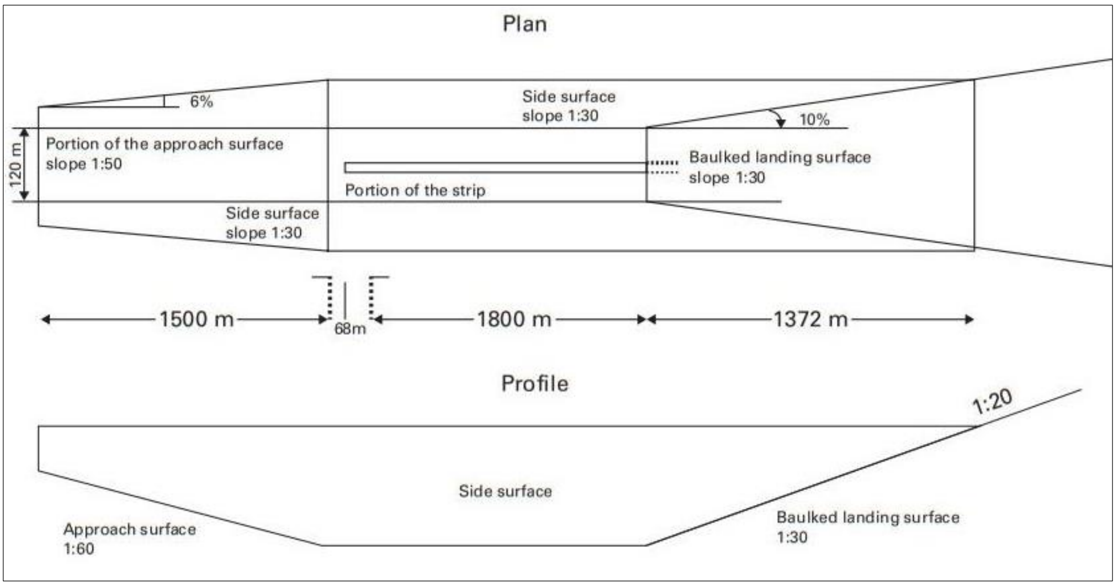

Figure 7 – Obstacle Free Zones Plan

[5] CAP 168, Licensing of Aerodromes, Civil Aviation Authority, Edition 11, date: 01/2019.

[6] While the slope is steeper for this surface compared to the other surface (bulked landing surface) the bulked landing surface at London Stansted Airport starts circa 1000m from the threshold. Therefore, at threshold this surface will have a height of circa 33m.

The obstacle free zones where no object of a height of 3m or less can be placed is shown in red in Figure 8[7] below.

Figure 8 –Obstacle Free Zones where panels cannot be installed (red area)

[7] Copyright © 2021 Google.

5 ENGINE FAILURE AFTER TAKE-OFF BUFFERS

5.1 Engine Failure After Take-Off (EFATO)

An engine failure after take-off can be considered as a failure of the engine to produce power any time from the point after the wheels leave the ground until the aircraft reaches 1000ft above the ground. It is a serious and potentially very dangerous situation and is the cause of many fatal accidents[8].

5.2 EFATO Buffer Areas

No guidance has been identified for areas where objects cannot be installed for safety. However, to guarantee the safety of pilots and passengers, an area locating solar panels should be carefully considered is presented. This area starts from the runway threshold and extends 45°[9] on each side. This area is shown in Figure 9[10] below.

Figure 9 – EFATO areas where panels should not be installed (orange areas)

[8] Engine Failure After Takeoff (EFATO), AviationKnowledge, date: n.d.
[9] To maintain air speed, it is recommended that turns greater than 45 degrees are avoided.
[10] Copyright © 2021 Google.

6 JET BLAST BUFFERS

6.1 Jet Blast

Jet blast is the phenomenon of rapid air movement produced by the jet engines of aircraft, particularly on or before take-off. A large jet-engine aircraft can produce winds of up to 100 knots (190 km/h; 120 mph)[11] as far away as 60 metres (200 ft) behind it at 40% maximum rated power[12]. Jet blast can be a hazard to people or other unsecured objects behind the aircraft.

6.2 Airbus A318

The Airbus A318 has been considered to determine the danger area affected by the jet blast[13]. Figure 10 below shows the Danger Area for an A318 at Take Off Power.

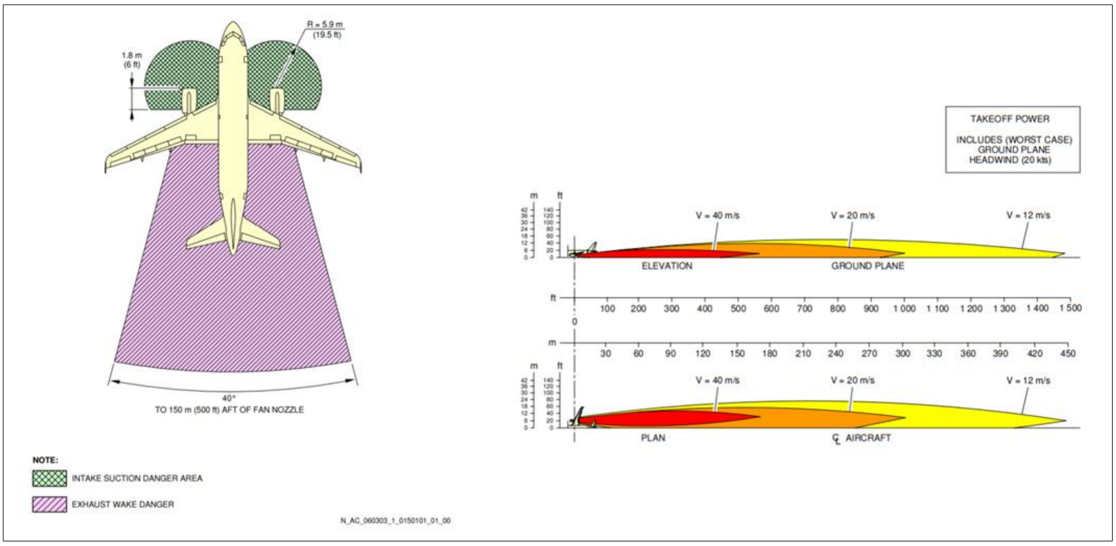

Figure 10 – Airbus A318 Jet Blast Area at Take Off Power and Exhaust velocities at Take Off Power

6.3 Jet Blast Buffer Areas

No guidance has been identified for areas where ground mounted solar panels cannot be installed for safety. Most solar panels can withstand up to 140 mph (63 m/s) winds, which is around 2,400 pascals (the unit in which solar panel wind resistance is measured)[14]. Therefore, the effect of jet blasts upon panels should not generate any safety concerns. However, a safety area equivalent to the length of the jet blast has been consider in order to avoid high speed debris damaging the panels. This area is shown in orange in Figure 11[15] on the following page.

---

[11] Morrison, Rowena. ASRS Directline, Issue Number 6, August 1993. "Ground Jet Blast Hazard." Retrieved 13/11/2019.

[12] Ground Jet Blast Hazard. Asrs.arc.nasa.gov. Retrieved 05/07/2013.

[13] This plane has been considered because it is of similar size compared to the type of planes that land at London Stansted Airport

[14] Can My Solar Panels Withstand a Hurricane?, Isaac Ost, 07/07/2018.

[15] Copyright © 2021 Google.

Figure 11 – Jet blast buffer areas where panels should not be installed (orange areas)

7 NAVIGATION AIDS BUFFERS

7.1 Overview

The key navigation aids identified in Section 3 on page 13 have been assessed following the guidance from CAP 168 and ICAO Doc 15.

7.2 Primary and Secondary Surveillance Radar (PSR/SSR)

Both, a primary and a secondary surveillance radar are located at London Stansted Airport.

7.2.1 CAP Guidance

There is no associated area within CAP guidance with regards to safeguarded areas around radar.

7.2.2 ICAO Guidance

EUR DOC 015 also contains specific parameters for safeguarding both types of radar. These are shown in Figure 12 below and the shape of the buffer area is shown in Figure 13.

*Type of **surveillance** facilities*	*Alpha (a – cone) ( )*	*Radius (R- cone) (m)*	*Radius (r – cylinder) (m)*	*Origin of cone*
PSR	0.25	15000	500	Base of antenna at ground level
SSR	0.25	15000	500	Base of antenna at ground level

Figure 12 – Harmonised guidance figures for the omnidirectional Surveillance facilities

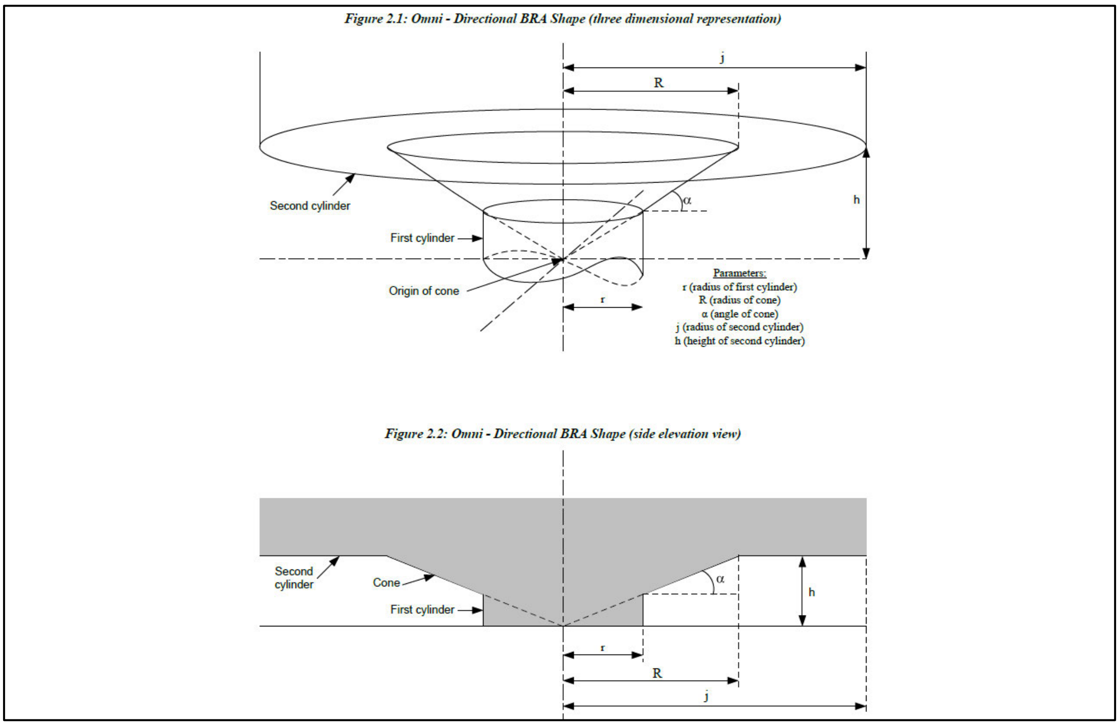

Figure 13 – Omni-Directional BRA Shape

7.2.2.1 ICAO Buffer

Considering a panel height of 3m the buffer area for the radar at London Stansted Airport is shown in Figure 14 on the following page.

Figure 14 – Omni-Directional BRA Buffer for London Stansted Airport

7.1 Distance Measuring Equipment (DME)

The safeguarding criteria with respect to DMEs are presented in the following section.

7.1.1 CAP Guidance

CAP 670 details the safeguarding criteria for the DME. The following text is taken from GEN02.15 to GEN02.19:

'DME associated with ILS or MLS

GEN02.15 An inverted cone of 500 m radius with a 2% (1:50) slope, originating at the base of the DME aerial.

…

'Elevation Systems

GEN02.17 A sector of 500 m radius, centred at the base of the elevation aerial, ±30° about a line parallel to the approach runway centreline.

VOR

GEN02.18 At ground level a circle of 230 m radius from the site centre with a further slope at 2% (1:50) out to 900 m radially from the site centre.

DME

GEN02.19 The foregoing VOR constraints where co-located with a VOR otherwise a 2% (1:50) slope surface originating at the site ground level extending 300 m radially.'

7.1.1.1 CAP Buffer

Within this area it is recommended that no physical obstructions of a height of 3m are placed within 150m from the DME.

7.1.2 ICAO Guidance

EUR DOC 015 details specific parameters for safeguarding the DME. The document also describes the safeguarding area. This is described in the extract below.

'3.2 Building Restricted Area (BRA)

3.2.1 In the context of AWO[16]*, the BRA is defined as a volume where buildings have the potential to cause unacceptable interference to the signal-in-space in the service volume of CNS facilities for AWO. All CNS17 facilities have BRA defined which are not limited to actual site boundaries of the facility but extend to significant distances from the facility.'*

The text presented below describes the BRA:

'6. BRA for omni-directional facilities

---

[16] All Weather Operations
[17] Communication, Navigation and Surveillance

6.1 The cylinder is referenced to the ground terrain; the cone is referenced to a horizontal plane. Where irregular terrain is present the BRA shape is adapted.

6.2 The BRA is considered to provide worst case protection.'

The following is general text from the document concerning the DME:

'General notes for omni-directional and directional facilities

8.1 Where facilities are co-located the most stringent BRA volume applicable should apply.

8.4 Annex 14 surfaces are applicable and should also be taken into account.

8.5 The shapes are applicable from ground terrain upwards.

8.6 Local terrain and environmental constraints (e.g. humped runways) may modify the application of the shapes.'

Figure *15* below presents the associated parameters for the DME BRA.

APPENDIX 1 – Navigational facilities

Table 1: Harmonised guidance figures for the omni-directional navigational facilities in accordance with Figures 2.1 and 2.2

Type of navigation facilities	*Radius (r – Cylinder) (m)*	*Alpha (a – cone) (°)*	*Radius (R- Cone) (m)*	*Radius (j – Cylinder) (m) Wind turbine(s) only*	*Height of cylinder j (h -height) (m) Wind turbine(s) only*	*Origin of cone and axis of cylinders*
DME N	300	1.0	3000	N/A	N/A	Base of antenna at ground level

Figure 15 – *DME BRA parameters*

7.1.2.1 ICAO Buffer

Under the ICAO guidance it is recommended that no physical obstructions of a height of 3m are placed within 300m from the DME.

Figure 16[18] on the following page shows the two buffer areas. The most restrictive one is provided by the ICAO guidance.

[18] Source: Copyright © 2021 Google.

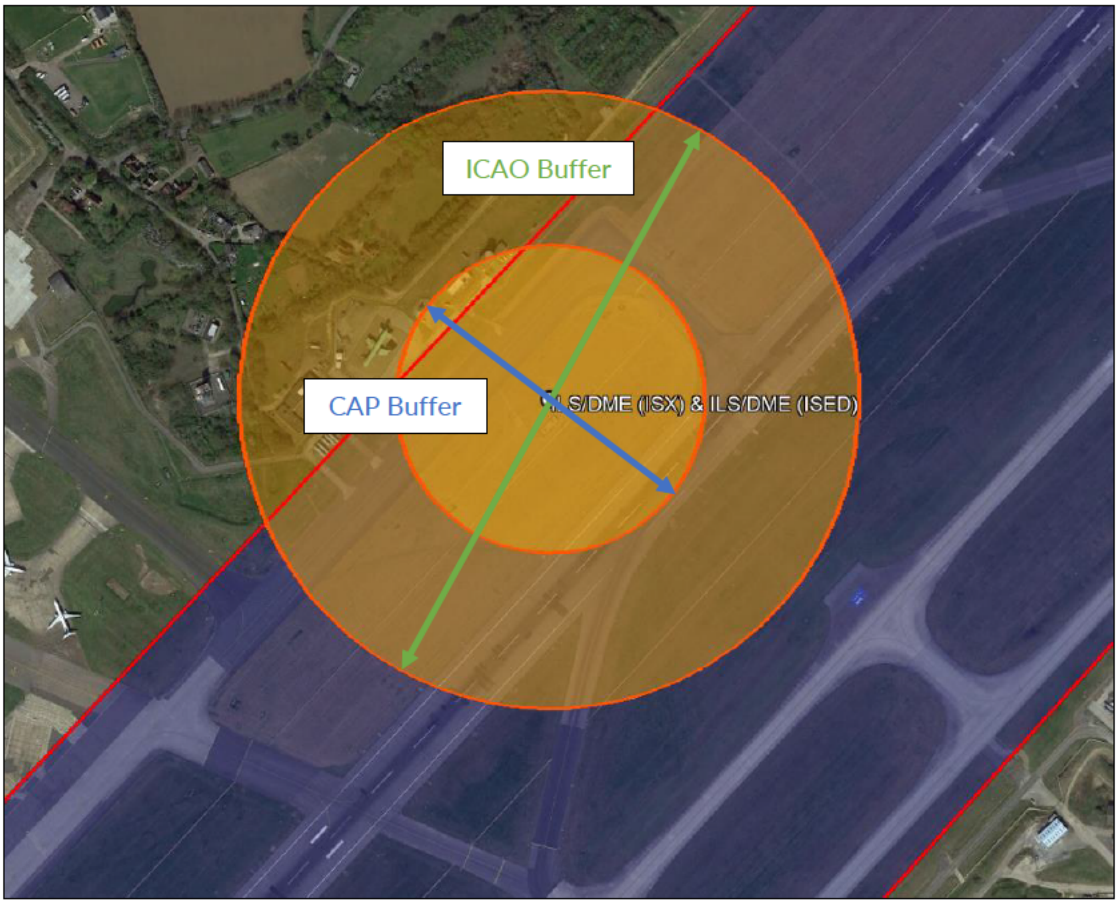

Figure 16 – DME BRA safeguarded area – ICAO and CAP

7.2 Glide Path (ILS/GP) and Safeguarded Area

London Stansted Airport has two ILS/GP located west of the runway.

7.2.1 CAP Guidance

CAP 670 details the safeguarding criteria for the Glide Path. The following text is taken from GEN02.13 and Gen02.14 regarding the recommended safeguarded area:

'ILS Glide Path

GEN02.13 This sector is defined with respect to the glide path aerial mast.

GEN02.14 A sector of 750 m radius ±60° about a line originating at the base of the glide path aerial parallel to the approach runway centreline.'

7.2.1.1 CAP Buffer

Figure 17[19] below shows the safeguarded area for the Glide Path as per CAP 670 for an obstacle of maximum height of 3m.

Figure 17 – Glide Path safeguarded area (CAP)

[19] Source: Copyright © 2021 Google.

7.2.2 ICAO Guidance

EUR DOC 015 also contains specific parameters for safeguarding the Glide Path also stating:

'7. BRA for directional facilities

7.3 The end fire array glide-path will require a narrower protection zone due to the directivity of the antenna system.'

7.2.2.1 ICAO Buffer

The guidance dictates safeguarding a zone at ground level measuring 800m from the Glide Path aerial and 250m either side. It is then safeguarded by a 6km long zone formed by a sector 10 degrees either side of the aerial up to a height of 70m.

Figure 18[20] below shows the safeguarded area for the Glide Path as per EUR DOC 015 for an obstacle of maximum height of 3m.

Figure 18 – Glide Path safeguarded area (ICAO)

[20] Source: Copyright © 2021 Google.

7.3 Localiser Safeguarded Area

There are two localisers at London Stansted Airport. The safeguarding criteria with respect to localisers are presented in the following section.

7.3.1 CAP Guidance

CAP 670 details the safeguarding criteria for the Localiser. The following text taken from GEN02.11 is regarding the recommended safeguarded area:

'*ILS Localiser Cat I/II*

GEN02.11

The frame can be defined as two separate sectors:

1. A sector of 750 m radius centred on the localiser and ±60° about the runway centreline at ground level, in the direction of the runway threshold.

2. A sector, centred on the localiser, ±15° about the runway centreline and 1500 m along the runway, at ground level, in the direction of the runway threshold.'

7.3.1.1 CAP Buffer

Figure 19[21] below shows the safeguarded area for the Localiser for runway 22 and 04 as per CAP 670.

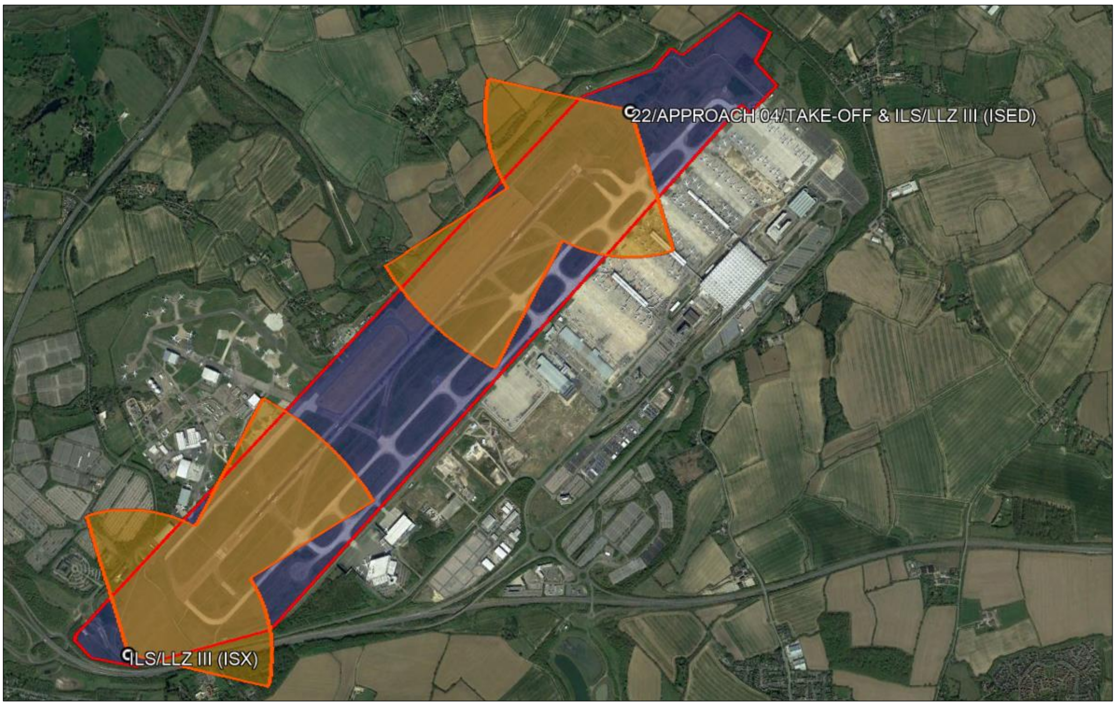

Figure 19 – *Localiser safeguarded area (CAP)*

[21] Source: Copyright © 2021 Google.

7.3.2 ICAO Guidance

EUR DOC 015 details specific parameters for safeguarding the Localiser. The document also describes the BRA (or Building Restricted Area) which applies to safeguarding the Localiser. This is described in the extract blow:

'7. BRA for directional facilities

7.1 The directional BRA dimensions for variants of localiser systems will differ significantly, this is due to the aperture and antenna designs.

7.2 Wide aperture arrays (typically 24 / 25 element) will have additional protection through the use of the medium aperture BRA figures. Hence the guidance figures presented in table 2 only represent the BRA figures for medium aperture antenna arrays for facility performance category III facilities.

7.3 The end fire array glide-path will require a narrower protection zone due to the directivity of the antenna system.

7.4 MLS operations are to be taken as straight in approaches only, with narrow beam antennas. Advanced operations are not yet covered in the guidance material and hence Out of Coverage Indication (OCI) and back azimuth protection are not given. If advanced operations are planned then appropriate protection should be established.

7.7 It is recommended that buildings such as , skyscrapers, large excavating works, TV towers and other high towers should be assessed at all times even outside the BRA for directional facilities. Particular attention should be paid to clusters of buildings and overhead power lines.'

Figure 20 below shows a figure taken from the guidance which shows the safeguarded area criteria.

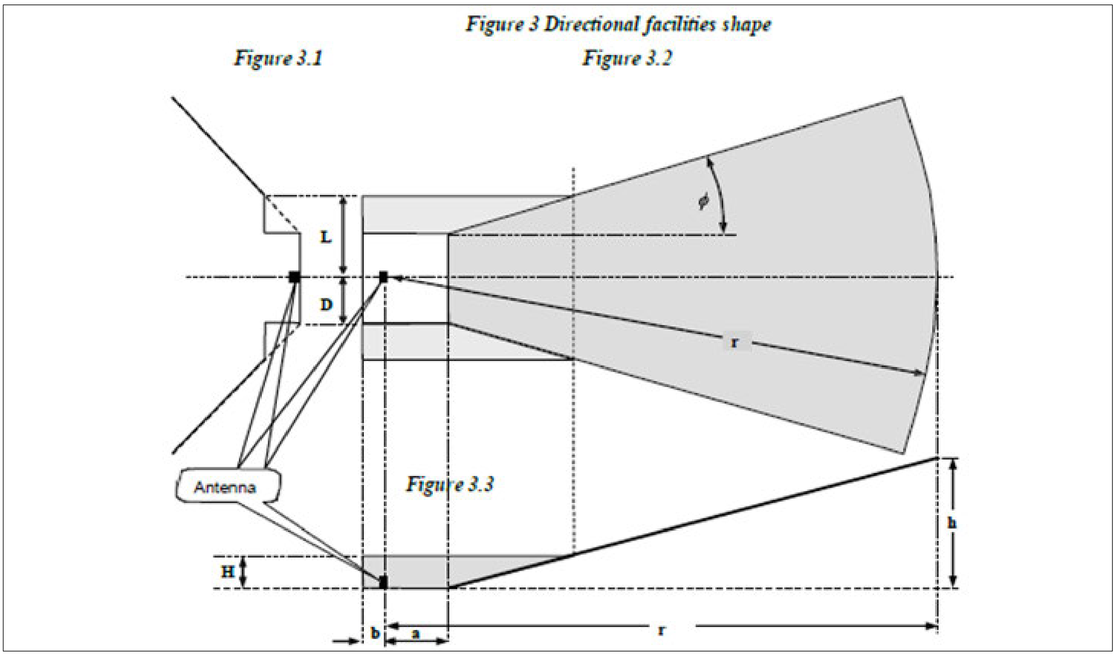

Figure 20 – *Localiser safeguarded area example (ICAO)*

Figure 21 below shows the associated safeguarding criteria.

Table 2: Harmonised guidance figures for the directional navigational facilities in accordance with Figure 3

Type of navigation facilities	*A (m)*	*b (m)*	*h(m)*	*r (m)*	*D (m)*	*H (m)*	*L (m)*	*ϕ (°)*
ILS LLZ (medium aperture single frequency)	Distance to threshold	500	70	a+6000	500	10	2300	30
ILS LLZ (medium aperture dual frequency)	Distance to threshold	500	70	a+6000	500	20	1500	20
ILS GP M–Type (dual frequency)	800	50	70	6000	250	5	325	10
MLS AZ	Distance to threshold	20	70	a+6000	600	20	1500	40
MLS EL	300	20	70	6000	200	20	1500	40
DME (directional antennas)	Distance to threshold	20	70	a+6000	600	20	1500	40

Notes:

- The parameters (a) and (b) originate from the base of the antenna and follow the terrain.
- (r) originates from the base of the antenna and is referenced to the horizontal plane.
- ϕ is measured in a horizontal plane.
- Other specific notes pertaining to omni- or directional shapes are included in the respective section of the procedure.
- In case of advanced operations supported by either MLS or GNSS, specific adaptation to the respective BRA will have to be made.

Figure 21 – *Localiser safeguarded area dimensions (ICAO)*

7.3.2.1 ICAO Buffer

Figure 22[22] below shows the safeguarded area for the Localiser as per ICAO.

Figure 22 – *Localiser safeguarded area (ICAO)*

[22] Source: Copyright © 2021 Google.

7.4 Identified Buffer Areas for Facilities at London Stansted Airport

7.4.1 CAP Buffer

The safeguarded areas where the presence of an objects of a height of 3m should be further assessed are shown in Figure 23[23] below. No safeguarding area has been identified for the radar. However, these are not hard constraints and infringement of these areas might be possible on a case-by-case evaluation.

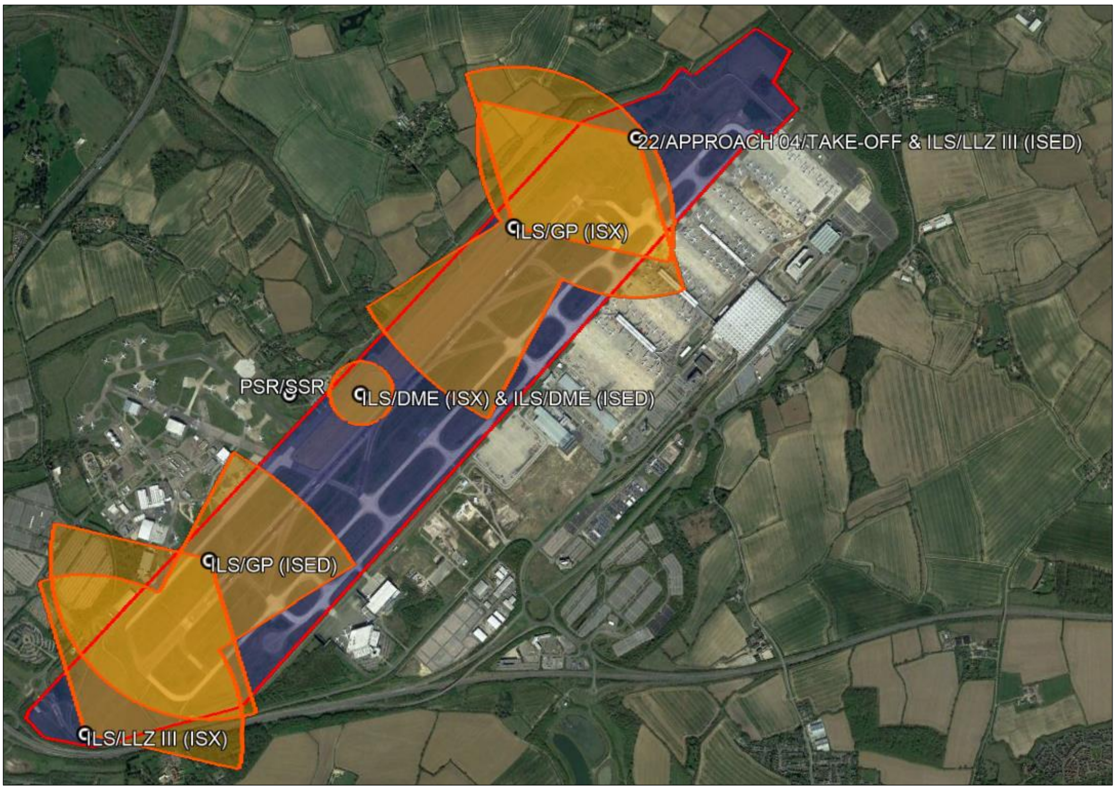

Figure 23 – CAP safeguarded areas for objects of height of 3m or below

[23] Source: Copyright © 2021 Google.

7.4.2 ICAO Buffer

The safeguarded areas where the presence of an objects of a height of 3m should be further assessed are shown in Figure 24[24] below. However, these are not hard constraints and infringement of these areas might be possible on a case-by-case evaluation.

Figure 24 – ICAO safeguarded areas for objects of height of 3m or below

[24] Source: Copyright © 2021 Google.

8 GLINT AND GLARE ASSESSMENT

8.1 Glint and Glare Definition

The definition of glint and glare is as follows:

- 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.

These definitions are aligned with those of the Federal Aviation Administration (FAA) in the United States of America. The term 'solar reflection' is used in this report to refer to both reflection types i.e. glint and glare.

8.2 Glint and Glare Assessment

8.2.1 ATC Tower

The analysis has shown that a solar reflection generating from the potential proposed development[25] towards the ATC tower is geometrically possible for all three configurations (170°, 180° and 170°) (see Figure 25 below and Figure 26 and Figure 27 on the following page). Any predicted glare towards an ATC tower is not acceptable based on the FAA guidance therefore the areas in red will not be suitable for solar development under the considered panel's characteristics. It is also unlikely that changing the mounting system characteristics (tilt and orientation) will eliminate glare. And it is likely that if a layout will eliminate glare will be sub-optimal for energy production

Figure 25 – Solar reflections towards the ATC Tower for panels oriented 170deg

[25] The entire developable area has been considered in the analysis. This is conservative assessment since as it is unknown the location of the potential solar development and the fact that solar panels will not fully cover this area. This analysis is to exclude solar panel locations.

Figure 26 – Solar reflections towards the ATC Tower for panels oriented 180deg

Figure 27 – Solar reflections towards the ATC Tower for panels oriented 190deg

8.2.2 Approaches

The analysis has shown that a solar reflection generating from solar panels towards both approaches are geometrically possible. For all three configurations solar reflections are expected to be generated by the northern (approach 22) and southern (approach 04) portion of the assessed area (see Figure 28, Figure 29 and Figure 30 on the following page). Any predicted glare with potential for temporary after-image towards pilots approaching London Stansted Airport is not acceptable based on the FAA guidance.

Figure 28 – Solar reflections towards aircrafts approaching at London Stansted Airport for panels oriented 170deg

Figure 29 – Solar reflections towards aircrafts approaching at London Stansted Airport for panels oriented 180deg

Figure 30 – Solar reflections towards aircraft approaching at London Stansted Airport for panels oriented 190deg

9 OBSTACLE LIMITATION SURFACES ASSESSMENT

9.1 Overview

The Obstacle Limitation Surfaces for London Stansted Airport has been considered with respect to the proposed development.

Obstacle Limitation Surfaces are imaginary planes defined in three dimensions for physical safeguarding purposes (i.e. ensuring that physical structures do not present a safety hazard at an airfield) and are defined around licensed airfields. The dimensions and geometry of the surfaces are constructed based on detailed rules defined in the UK Civil Aviation Authority's Civil Aviation Publication 168 for civil aerodromes.

Obstacle Limitation Surfaces are established for the purpose of physical safeguarding i.e. minimising the risk of a collision between an aircraft and a tall object on the ground.

The physical parameters of the surfaces are dependent on factors including the runway type, the runway dimensions and the procedures carried out at the aerodrome.

9.2 Obstacle Limitation Surfaces

The potential proposed development's main structure will lie below both the transitional surface and the approach/take-off surfaces at London Stansted Airport. Since the maximum height of the solar panels assessed will be 3m, and there are more restrictive surfaces presented (the OFZ), it is expected that the potential proposed development will lie below these surfaces and no infringement is possible.

10 ELECTROMAGNETIC INTERFERENCE

10.1 Emissions

All electrical equipment emits electric and magnetic radiation. Any power cable located within the potential development will therefore emit magnetic radiations which can affect negatively the infrastructure at London Stansted Airport. Furthermore, power cables produce both electric and magnetic fields which can potentially affect human health. Radiation from underground cables is generally less than radiation from overhead lines because emissions from adjacent conductors within a cable tend to cancel each other out. When assessing the impacts of overhead power lines it is important to consider the impact of both electric and magnetic fields.

Underground cables generally cause a negligible electric field above ground but can cause a

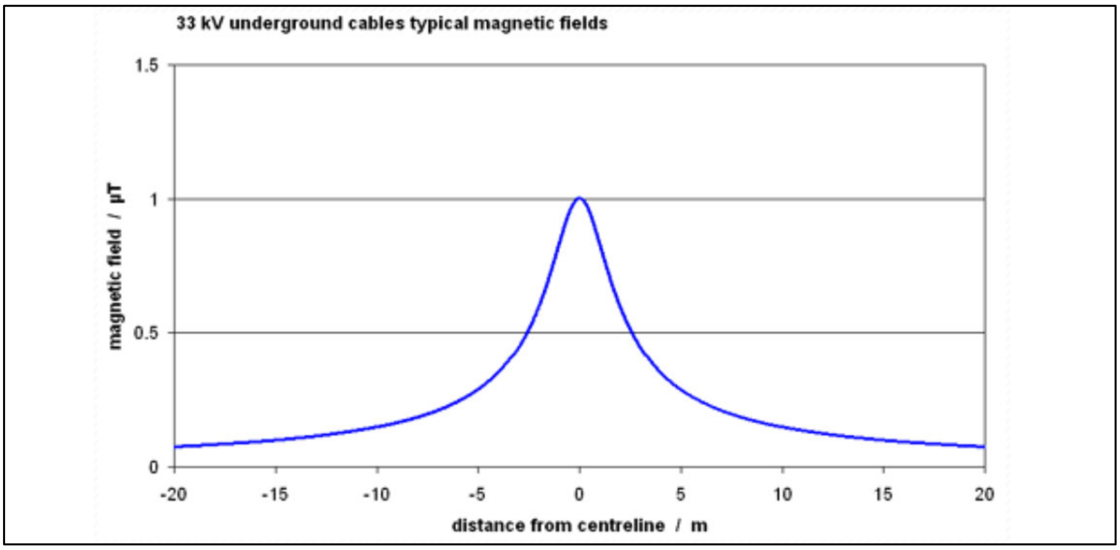

Figure 31 – Typical magnetic fields associated with 33kV underground cable

10.2 Radiation Reduction with Distance

Radiation levels reduce with distance which means, for example, the typical magnetic field from a vacuum cleaner reduces from 800 micro Teslas to 2 micro Teslas when separation distance increases from 3 centimetres to 100 centimetres.

This means radiation levels from the cables will tend to reduce with distance in any direction – including towards a receptor.

10.3 Conclusions

It is unlikely that power cables and other electric equipment (transformers, inverters and potentially batteries) used in a potential solar development within the identified area will have a technical or operational effects upon the facilities at London Stansted Airport. However since it is unknown where this infrastructure will be located within the potential developable area no buffer has been produced.

11 CONCLUSIONS

11.1 Overview

Pager Power has assessed the extent to which Solar Photovoltaic (PV) can be safely developed on land owned by London Stansted Airport (specifically the land immediately surrounding the runway). The assessment considers the relevant aviation infrastructure and operations at Stansted Airport and solar panels with respect to glint and glare, Obstacle Limitation Surfaces (collision risk and frangible structures) and electromagnetic interference (high-level). The aim is to identify where solar PV could be safely deployed on the area surrounding the runway, or where further consideration would be required.

11.2 Identified Locations for Solar Development

Based on the review of the constraints, the areas where a solar development is predicted to have a high and a moderate impact are shown in Figure 32 below and Figure 33 respectively. The overlapping of these areas is shown in Figure 34 on the following page. Red areas are those areas where the development of solar panels is not possible, while orange areas are those areas where solar PV would prove difficult, especially with many orange areas overlapping. The division is provided by exclusion zones obtained following the ICAO (International Civil Aviation Organization) guidance, those obtained by the CAP (Civil Aviation Publications) guidance and those obtained by assessing the glint and glare effects upon the airfield receptors.

Figure 32 – Area available (blue) when hard constraints are considered

Figure 33 – Area available (blue) when moderate constraints are considered (left – ICAO, right – CAP)

Figure 34 – Area available (blue) when moderate and hard constraints are considered (left – ICAO, right – CAP)

11.3 Conclusions

The analysis has shown that when all constraints (hard and moderate) are considered cumulatively the available area for solar development is significantly reduced and, therefore, the development of a solar development of considerable size is very unlikely. Any solar developments that are proposed on the land of Stansted Airport should be first considered in the context of these constraints.

PAGERPOWER

Urban & Renewables

Pager Power Limited
Stour Valley Business Centre
Sudbury
Suffolk
CO10 7GB

[redacted]