International Civil Aviation Organization

Sixth Meeting of the Asia/Pacific Aerodrome Design and Operations Task Force (AP-ADO/TF/6)

Langkawi, Malaysia, 18 - 21 February 2025

Agenda Item 4: Planning, Design and Construction of Aerodromes

ADDRESSING GLARE ISSUES FROM SOLAR PANELS AT AIRPORT TERMINAL

(Presented by Malaysia)

SUMMARY

This paper presents the challenges posed by glare from photovoltaic (PV) solar panels installed on airport terminal buildings. While promoting sustainability through energy efficiency, their reflective surfaces may disrupt aviation safety, affecting pilots, air traffic controllers, and ground personnel. Aligned with ICAO Annex 14, Volume I, Chapter 5, it proposes mitigation strategies such as optimal panel placement, anti-reflective coatings, and periodic glare monitoring. The paper advocates for the development of standardized global guidance to ensure that environmental benefits are achieved without compromising operational safety.

1. INTRODUCTION

1.1 The adoption of PV solar panels at airport terminal buildings is a critical step toward achieving sustainable aviation goals. These installations reduce carbon footprints and operational energy costs, aligning with global environmental standards.

1.2 However, solar panels' reflective properties may cause glare, creating visual disturbances for:

- Pilots during critical flight phases (approach, landing, and taxiing);
- Air Traffic Control (ATC) personnel monitoring aircraft movements;
- Ground personnel working on aprons and taxiways.

1.3 This paper examines these issues, references ICAO's standards on lighting and glare (Annex 14, Volume I, Chapter 5.3.24.2) and suggests mitigation strategies to balance safety and sustainability.

2. DISCUSSION

Operational Challenges

2.1 Solar panels can cause disability glare, reducing the ability to recognize objects, and identification glare, interfering with clear visual identification of critical aeronautical lights.

2.2 The impact areas include:

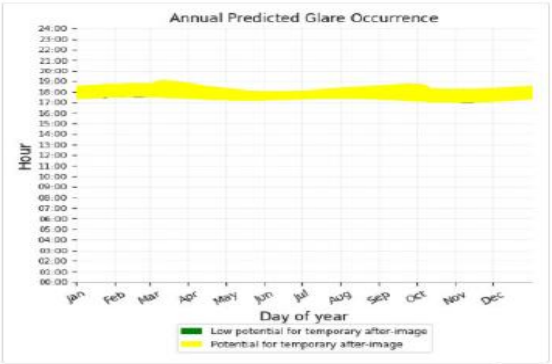
- Runways and taxiways: Reflection may impair pilots' visibility;
- Air Traffic Control Towers: Glare can disrupt situational awareness;
- Aprons: Ground personnel may face safety hazards from diminished visibility.

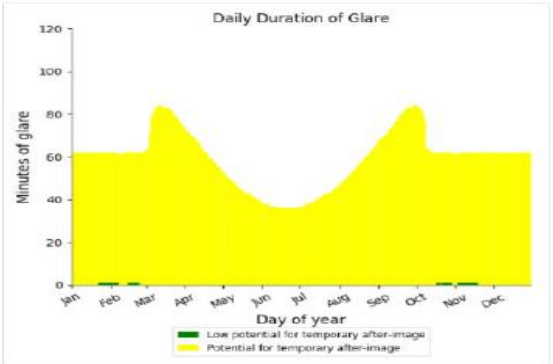
2.3 These challenges necessitate risk assessment in accordance with ICAO's Safety Management Manual (Doc 9859) and Annex 14 provisions.

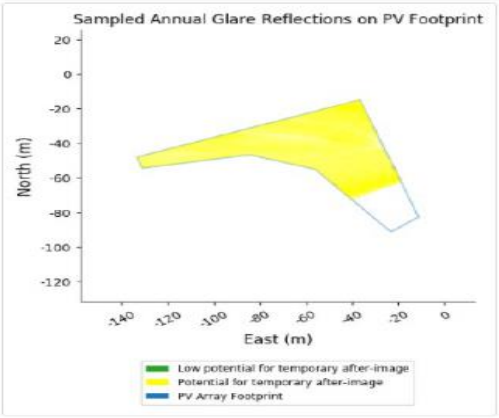
Findings from Glare Studies

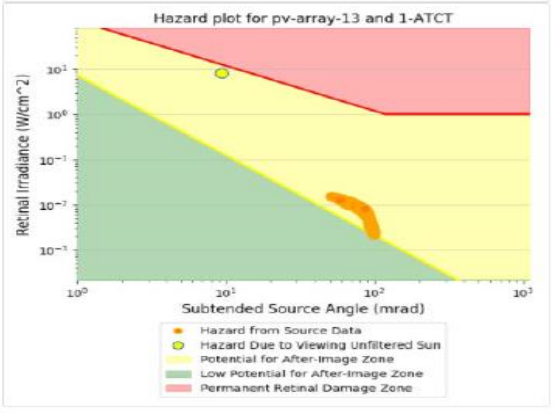
2.4 First study conducted in 2021 initially identified significant glare risks from PV arrays at Senai International Airport:

- Flight Paths: No glare was observed on RWY 16 and RWY 34.
- Air Traffic Control Tower: Both "green" and "yellow" glare were detected, with significant durations of glare from PV Arrays 4–8 and 13–14.



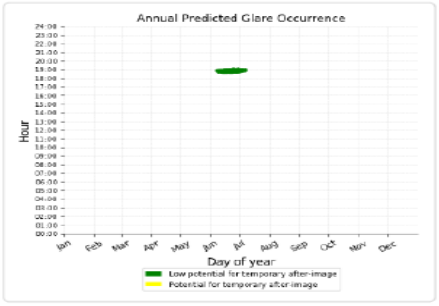


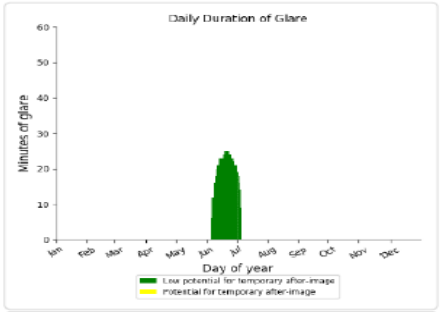


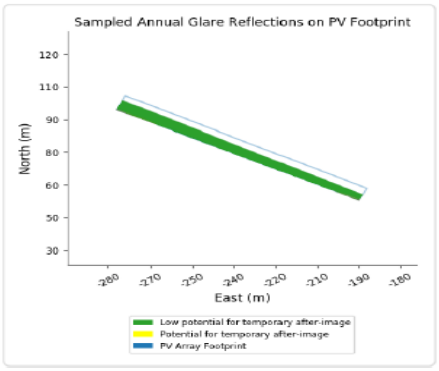


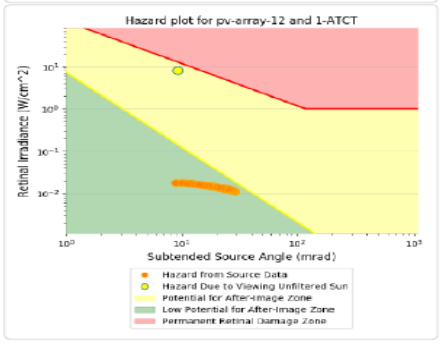
2.5 A second study revised the findings based on adjusted PV configurations:

- Flight Paths: No glare impact remained consistent.
- Air Traffic Control Tower: "Green" glare persisted but with reduced severity, observed primarily from PV Arrays 12–16 during late-April to mid-August, from 18:00 to 19:00.









Current Standards and Best Practices

2.6 ICAO Annex 14, Volume I, Chapter 5.3.24.2 highlights the need to manage glare from non-aeronautical lights (apron floodlights) to prevent safety risks. Though specific to floodlighting, this recommendation is applicable to reflected glare from solar panels.

2.7 Best practices include:

- Conducting optical hazard analyses during design and installation phases;
- Orienting panels to minimize reflections toward operational areas;
- Applying anti-reflective coatings to panel surfaces.

Proposed Mitigation Strategies

2.8 Mitigation strategies focus on addressing the specific risks identified with solar panel installations at airport to ensure both operational safety and environmental sustainability:

- Aligning solar panels to direct reflections away from runway, taxiways, and ATC tower;
- Using advanced coatings to reduce reflectivity while maintaining energy efficiency;
- Implementing light simulation tools during planning to predict and mitigate glare risks;
- Integrating glare checks into regular aerodrome maintenance inspections.

Encouraging Global Guidance Development

2.9 ICAO has a vital role in establishing consistent methods for evaluating and addressing glare risks caused by solar panels at airports. By collaborating with member States, ICAO can promote the sharing of best practices and ensure safety measures are standardized across the aviation sector.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper;

b) encourage ICAO to develop guidance materials specifically addressing glare risks from solar panels;

c) share best practices and lessons learned from implementing solar panels at airports; and

d) discuss any relevant matters as appropriate.

— — — — — — — —

<table>
<tr><td colspan="3">Conclusion AP-ADO/TF/6 – X: GUIDANCE DEVELOPMENT FOR SOLAR PANEL GLARE MITIGATION</td></tr>
<tr><td colspan="2">What: ICAO to develop and disseminate comprehensive guidance on assessing and mitigating glare risks from solar panels at airports.</td><td>Expected impact:
☒ Political / Global
☐ Inter-regional
☐ Economic
☒ Environmental
☒ Ops/Technical</td></tr>
<tr><td>Why: To enhance operational safety while promoting sustainability initiatives.</td><td colspan="2">Follow-up: ☐Required from States</td></tr>
<tr><td>When: 4-Jul-25</td><td colspan="2">Status: Draft to be adopted by PIRG</td></tr>
<tr><td colspan="3">Who: ☒Sub groups ☒APAC States ☒ICAO APAC RO ☒ICAO HQ ☐Other: XXXX</td></tr>
</table>

—END—