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DIRECTORS GENERAL OF CIVIL AVIATION
ASIA AND PACIFIC REGION**

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AGENDA ITEM 7: AVIATION AND ENVIRONMENT

**COLLABORATIVE CARBON REDUCTION EFFORTS AT
MACAU INTERNATIONAL AIRPORT**

(Presented by Macao, China)

INFORMATION PAPER

SUMMARY

This Paper presents the collaborative carbon emission reduction initiatives undertaken by the Macau International Airport (MIA) and airport operators. It highlights the operational measures, infrastructure upgrades, and strategic planning efforts that have contributed to significant emissions reductions, including MIA's successful upgrade to Level 3 of the Airport Carbon Accreditation (ACA) Program under the Airports Council International (ACI), in November 2025. The Paper also outlines future commitments aligned with ICAO's Long-term Strategic Plan 2026-2050 and the global goal of achieving net-zero carbon emissions by 2050.

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1. INTRODUCTION

1.1 Environmental sustainability has become a strategic priority for the global aviation industry. ICAO's Long-term Strategic Plan for 2026-2050 sets an ambitious goal of achieving net-zero carbon emissions by 2050 for international civil aviation operations.

1.2 Macao, China, as a Special Administrative Region of the People's Republic of China and an active participant in the Asia Pacific aviation community, is fully committed to contributing to these global environmental objectives. Given that Macao's economy is heavily tourism-driven, the sustainable development of its airport is of strategic importance to its long-term prosperity. Macau International Airport (MIA) has undertaken a series of collaborative measures to reduce carbon emissions across its operations. This Paper provides an overview of these efforts, the achievements realized to date, and future plans that will further advance the decarbonisation of aviation in Macao.

2. DISCUSSION

2.1 Macau International Airport's Carbon Reduction Initiatives

2.1.1 MIA has been a participant in the Airport Carbon Accreditation (ACA) Program since 2014. ACA Program is governed by ACI EUROPE in close cooperation with four ACI regions and with support of ACI World. Through continuous efforts to reduce annual carbon emissions, the airport has maintained its accreditation and, in November 2025, successfully upgraded to Level 3 of the ACA Program. This milestone requires airports to actively engage third parties – airport operators, in managing and reducing the wider carbon footprint of airport activities. Emissions from airport operators are the main carbon emissions at the MIA. Airport operators cover airlines, ground handling agents, catering service provider and other on-site service entities within the airport boundary.

2.1.2 To achieve carbon emissions reductions, MIA has implemented a range of operational and infrastructure measures, including:

- (i) **Reducing Heat Gain:** The use of solar shading devices and high-performance glazing in the Passenger Terminal Building (PTB) and other buildings to reduce cooling demand.
- (ii) **Replacement of Air Conditioning Systems:** Replacement of the PTB air conditioning system with four energy-efficient chillers, expected to reduce at least 500–600 tonnes of carbon emissions per year.
- (iii) **Lighting Replacement with LED:** Replacement of conventional lighting with LED in various areas, including the PTB, make-up Area, B747 Hangar, and airfield ground lighting, estimated to reduce at least 500 tonnes of carbon emissions per year.
- (iv) **Use of Environmentally Friendly Vehicles:** Continuous replacement of aging unleaded/diesel vehicles by low- or no-emission vehicles. By the end of 2025, MIA had deployed 8 hybrid vehicles, 18 electric vehicles, and 81 electric ground support equipment within its premises.
- (v) **Waste Audit:** Conducting waste study/audit to identify opportunities for improvement to reduce waste and carbon emissions from airport operators.
- (vi) **Seasonal Lighting Adjustment:** Adoption of seasonal on/off schedules for PTB lighting in accordance with flight schedules to save energy.

- (vii) **Installation of EV Chargers:** Installation of EV chargers in different areas, including the make-up area and apron, to facilitate operational needs.

2.2 Achievements

2.2.1 MIA has been regulating emissions from sources under its operational control since 2014. The emission scope covers mobile, stationary and fugitive emissions¹ (Scope 1 emissions) , as well as indirect emissions generated from airport-purchased electricity consumption (Scope 2 emissions). In 2025, the MIA's Scope 1 and Scope 2 emissions decreased by 21.97% against the 2012 baseline level.

2.2.2 Commencing in 2024, MIA expanded its emission management boundary to cover third-party operational emissions generated at the airport (Scope 3 emissions). Scope 3 emissions far exceed the volume of Scope 1 and Scope 2 emissions in scale. Covered under Scope 3 are waste generated in operations, business travels, employee commuting, passenger activities, aircraft full-flight emissions, vehicles and ground support equipment, as well as electricity consumed by all the airport operators². In 2025, MIA delivered a 5.43% reduction in Scope 3 emissions compared with the 2024 baseline.

2.2.3 Thanks to the joint efforts of all on-site airport operators, MIA successfully obtained ACA Level 3 accreditation in November 2025. This key milestone fully reflects the airport's sustainability commitment: beyond managing and cutting emissions within its direct operational jurisdiction, MIA proactively engages third-party participants to mitigate the overall carbon footprint of airport-related activities. In furtherance of this commitment, MIA has established a new carbon reduction target: *"Reduce Carbon Emissions per Movement by 20% in 2034 from 2024 Level"*.

2.3 Future Plans

2.3.1 MIA has identified and is advancing several key initiatives to further reduce emissions in the coming years:

- (i) **Fixed Ground Power Unit (FGPU):** Promote and incentivize the use of FGP instead of aircraft Auxiliary Power Units (APU).
- (ii) **Airport Collaborative Decision Making (A-CDM) and Advanced-Surface Movement Guidance and Control System (A-SMGCS):** Implementation of these systems to achieve better coordination and reduce fuel consumption of Follow-Me and service vehicles.
- (iii) **Environmentally Friendly Refrigerants:** Transition to refrigerants with lower Global Warming Potential (GWP) to reduce CO₂ emissions.

¹ Mobile emissions include direct emissions from the combustion of fuels in mobile equipment and vehicles. Stationary emissions include direct emissions from the combustion of fuels in stationary equipment such as generators. Fugitive emissions include unintentional releases of GHGs from equipment and systems such as refrigerants and chemicals.

² Waste generated is referring to all wastes collected within the airport boundary. Business travel includes emissions from employees' business-related travel in vehicles owned or operated by third parties, such as aircraft, trains, buses, taxis, and boats. Employee commuting includes emissions from airport staff traveling between their homes and the airport worksite. Aircraft full-flight emissions include emissions from jet fuel combusted in aircraft main engines during the LTO and CCD phases, as well as from APU operations. Vehicles and ground support equipment refer to emissions from vehicles and ground handling equipment owned and operated by other entities working within the airport. Electricity consumed by all the airport operators include tenants, ground handling agents, catering, oil supply company, airlines offices etc. within the airport boundary.

- (iv) **Energy Audit:** Conduct an energy audit for MIA to identify possible areas for improvement and implement further energy-saving measures.
- (v) **Expansion of EV Charging Infrastructure:** The detailed design and planning of a new power substation and EV chargers at MIA has been completed. Additional EV chargers will be installed in the apron, the two outdoor car parks, and the restricted area. The total number of EV chargers at MIA is projected to reach 53 by 2027.
- (vi) **Further LED replacements:** Continue the replacement of conventional lighting with LED within MIA perimeter, such as car parks, runways, taxiways, substations, and post guardhouses.

3. CONCLUSION

3.1 Macau International Airport's progression to ACA Level 3 in November 2025 represents a significant milestone in the airport's decarbonisation journey. Through a combination of infrastructure investment, operational improvements, and collaborative engagement with airport stakeholders, MIA has demonstrated that meaningful emissions reductions are achievable even in a growing aviation market. The collaborative engagement with all airport operators will remain central to achieving the ambitious targets aligned with ICAO's 2050 net-zero vision.

4. ACTION BY THE CONFERENCE

4.1 The Conference is invited to note the information contained in this Paper.

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