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Agenda Item 7: Airport Environmental Initiatives

AIRPORT ENVIRONMENTAL INITIATIVES BY COCHIN INTERNATIONAL AIRPORT

(Presented by INDIA/COCHIN INTERNATIONAL AIRPORT LIMITED)

SUMMARY

This paper presents the environmental sustainability initiatives undertaken by **Cochin International Airport Limited (CIAL), India**, to promote low-carbon, climate-resilient and environmentally responsible airport operations. It outlines CIAL's integrated approach encompassing renewable energy, green hydrogen, Airport Carbon Accreditation, electric mobility, environmental monitoring, resource conservation, circular economy practices, biodiversity management and climate adaptation measures. The initiatives demonstrate how innovative technologies and sustainable operational practices can enhance environmental performance while ensuring safe, efficient and resilient airport operations, providing a replicable model for airports worldwide.

1. INTRODUCTION

1.1 Cochin International Airport is located around 28 kilometres northeast of Kochi city which serves as a critical gateway to the southern part of India. It holds the distinction of being the first airport in India developed under a Public-Private Partnership model. Renowned for its sustainability efforts, it became the world's first fully solar-powered airport in 2015. The airport is a major hub, handling significant passenger traffic and connecting Kerala to numerous domestic and international destinations.



1.2 The aviation sector plays a vital role in supporting economic growth and global connectivity while simultaneously addressing the environmental challenges associated with climate change, resource consumption and ecosystem conservation. Airports worldwide are therefore adopting sustainable infrastructure, cleaner technologies and improved environmental management practices to reduce their environmental footprint while maintaining operational safety and efficiency.

1.3 Over the years, CIAL has implemented several innovative environmental initiatives covering renewable energy generation, carbon management, climate resilience, sustainable mobility, resource conservation and circular economy practices. These initiatives support India's climate commitments, align with the International Civil Aviation Organization (ICAO) environmental objectives, and contribute towards the United Nations Sustainable Development Goals (SDGs).

1.4 The purpose of this paper is to present CIAL's environmental sustainability initiatives and share practical experiences that may assist other airports in developing and implementing similar programs suitable for their operational and geographical conditions.

2. DISCUSSION

Renewable Energy Development

2.1 Recognizing that electricity consumption is one of the major contributors to airport greenhouse gas emissions, Cochin International Airport Limited (CIAL) has adopted a diversified renewable energy strategy to achieve energy self-sufficiency, reduce greenhouse gas emissions and support India's transition towards clean energy. The airport has invested in multiple renewable energy technologies, including solar photovoltaic systems, hydroelectric power generation and green hydrogen production, demonstrating an integrated approach to sustainable airport operations.

Green Hydrogen Plant

2.2 As part of its long-term strategy to decarbonize airport ground operations and diversify its renewable energy portfolio, Cochin International Airport Limited (CIAL), in collaboration with Bharat Petroleum Corporation Limited (BPCL), is establishing the world's first airport-based Green Hydrogen Plant, which is expected to be commissioned shortly. The project represents a significant milestone in the adoption of hydrogen as a clean energy source for airports and positions CIAL among the pioneers in integrating green hydrogen production within airport infrastructure.



2.3 The facility is based on a 1 MW alkaline electrolyser powered entirely by renewable electricity generated from CIAL's solar power plants. Through electrolysis, demineralized water is split into hydrogen and oxygen, producing approximately 200 kg of green hydrogen per day (around 73 tonnes annually) with a purity of 99.997%. The project includes hydrogen purification, compression up to 500 bar, high-pressure storage, dispensing facilities and SCADA-based monitoring systems to ensure safe and efficient operations.

2.4 Initially, the green hydrogen will be used to fuel airport buses, with future plans to expand its application to Ground Support Equipment (GSE) and other airside operational vehicles. The project is expected to significantly reduce dependence on diesel and other fossil fuels, lower greenhouse gas emissions and improve local air quality by eliminating tailpipe emissions from hydrogen-powered vehicles. It also enables surplus renewable electricity to be converted into hydrogen, enhancing energy utilization and providing a sustainable energy storage solution.



2.5 The initiative aligns with India's National Green Hydrogen Mission and ICAO's environmental objectives for aviation decarbonization. Once commissioned, it is expected to become the world's first operational airport-based green hydrogen production plant, demonstrating the feasibility of integrating renewable hydrogen into airport operations and providing a replicable model for airports worldwide seeking to transition towards low-carbon and energy-resilient ground operations.

Solar Power Generation

2.6 CIAL is internationally recognized as the world's first airport to operate entirely on solar power. Over the years, the airport has progressively expanded its solar photovoltaic capacity through a combination of ground-mounted and rooftop installations located both within and outside the airport premises.



2.7 The airport operates 38 MW of solar photovoltaic installations within the airport campus and an additional 12 MW solar power plant at Payyanur in Kannur District, Kerala. Together, these facilities generated approximately 54,210 MWh of renewable electricity during 2025, enabling CIAL to meet its operational electricity requirements through clean energy while significantly reducing dependence on conventional grid power and lowering greenhouse gas emissions.

2.8 CIAL's pioneering solar initiative has received international recognition for demonstrating the successful integration of renewable energy into airport operations. In 2018, the airport was honoured with the **United Nations Champions of the Earth Award**, the UN's highest environmental honour, in recognition of its leadership in sustainable development and its innovative use of solar energy to achieve carbon-neutral airport operations. The award acknowledged CIAL as a global benchmark for integrating renewable energy into aviation infrastructure and promoting environmentally sustainable airport development.

2.9 Further reinforcing its leadership in airport sustainability, CIAL received the **Silver Award at the Airports Council International (ACI) Asia-Pacific & Middle East Green Airports Recognition (GAR) 2025** in the category of 6–15 million passengers per annum. The award recognized CIAL's innovative **terrain-based solar photovoltaic project** at Payyanur, which was developed by preserving the site's natural topography and minimizing ecological disturbance. The project demonstrated how renewable energy infrastructure can be successfully integrated with environmentally sensitive land management practices while maximizing clean energy generation.



2.10 CIAL's solar energy programme demonstrates that large-scale renewable energy projects can be effectively integrated into airport infrastructure without compromising operational safety or environmental sustainability. The initiative has substantially reduced the airport's carbon footprint, enhanced energy security and provides a replicable model for airports worldwide seeking to transition towards clean energy and low-carbon operations.

Hydroelectric Power Generation

2.11 To further diversify its renewable energy portfolio and enhance long-term energy security, CIAL owns and operates a 4.5 MW Small Hydroelectric Power Plant at Arippara, located on the Iruvanjipuzha River in Kozhikode District, Kerala.

2.12 The Arippara project is a run-of-the-river (RoR) hydroelectric scheme, which generates electricity by utilizing the natural flow and available head of the river without the construction of a large storage reservoir. Unlike conventional hydroelectric projects that require extensive impoundment of

water, the run-of-the-river system diverts a portion of the river flow through an intake structure and conveys it via a water conductor system to the powerhouse. The water drives hydro turbines to generate electricity before being discharged back into the river downstream, thereby maintaining the river's natural flow regime.

2.13 By avoiding the creation of large reservoirs, the project minimizes land acquisition, ecological disturbance, forest submergence and displacement of local communities while preserving the natural landscape and aquatic ecosystem. The limited environmental footprint of the run-of-the-river configuration makes it one of the most environmentally sustainable forms of hydropower generation.

2.14 The 4.5 MW hydroelectric facility generated approximately 13,568 MWh of renewable electricity during 2025, contributing significantly to CIAL's diversified renewable energy portfolio. The project complements the airport's solar power programme by providing renewable electricity during periods when solar generation is reduced, particularly during cloudy conditions and at different times of the day. This diversification improves the reliability and resilience of CIAL's renewable energy supply.



Contribution to Airport Decarbonization

2.15 The combination of solar power, hydroelectric generation and the upcoming green hydrogen facility forms the cornerstone of CIAL's renewable energy strategy. Together, these initiatives support the airport's carbon reduction objectives by minimizing dependence on fossil fuel-based energy, enhancing energy resilience and promoting the adoption of clean technologies. The integrated renewable energy programme also contributes to Airport Carbon Accreditation objectives, national climate commitments and the broader decarbonization goals of the global aviation sector.

Airport Carbon Accreditation

2.16 CIAL has initiated implementation of the Airport Carbon Accreditation (ACA) programme developed by Airports Council International (ACI) to systematically measure, manage and reduce greenhouse gas emissions associated with airport operations. The programme includes defining organizational and operational boundaries, identifying emission sources, establishing greenhouse gas inventories in accordance with ISO 14064-1 and the GHG Protocol, implementing carbon reduction measures and progressively expanding stakeholder engagement to address Scope 3 emissions. Participation in ACA provides a structured pathway for continual improvement in airport carbon management and supports long-term decarbonization objectives.

Climate Change Adaptation

2.17 Located in a tropical region prone to intense monsoon rainfall and flooding, Cochin International Airport Limited (CIAL) has adopted a proactive approach to climate change adaptation by integrating resilience measures into airport planning, infrastructure development and operational management. Following the unprecedented floods in Kerala during 2018, which disrupted airport operations for nearly two weeks, CIAL conceptualized and implemented “**OPERATION PRAVAH**”, a comprehensive flood mitigation and climate resilience programme designed to enhance the airport's ability to withstand extreme weather events.

2.18 The initiative involved detailed hydrological assessments, restoration and widening of drainage channels, desilting of canals, removal of flow obstructions, enhancement of storm-water drainage systems and strengthening of critical drainage bottlenecks to improve runoff capacity and reduce flood risk. These measures have significantly improved storm-water management, reduced water stagnation and enhanced the airport's resilience against heavy rainfall, thereby minimizing the risk of operational disruptions while ensuring the continuity, safety and efficiency of airport operations.



2.19 In recognition of its innovative approach to climate resilience, CIAL was conferred the **Gold Award at the Airports Council International (ACI) Asia-Pacific & Middle East Green Airports Recognition (GAR) 2026** under the theme "**Climate Change Adaptation**" in the 6–15 million passengers per annum category. The award acknowledged Operation PravaH as an exemplary climate adaptation initiative that strengthens airport infrastructure against extreme weather events.

2.20 Operation PravaH demonstrates a practical and replicable model for airports vulnerable to climate-induced flooding, highlighting the importance of integrating engineering solutions, environmental management and long-term climate adaptation strategies to build resilient and sustainable airport infrastructure.

Sustainable Airport Mobility

2.21 As part of its strategy to reduce greenhouse gas emissions from airport ground transportation and promote low-carbon mobility, Cochin International Airport Limited (CIAL) has developed a comprehensive electric mobility ecosystem within its premises. CIAL has commissioned two public EV charging stations at the Terminal 1 (T1) and Terminal 3 (T3) car parks, each equipped with two 60 kW DC fast chargers featuring dual CCS2 connectors, providing a total of four 60 kW charging units capable of simultaneously charging multiple vehicles. The charging stations are integrated with the ChargeMod digital platform, offering users a seamless cashless charging experience through a mobile application.



2.22 To encourage EV adoption, CIAL has introduced a public charging tariff of ₹15 per kWh, making it one of the most economical DC fast-charging facilities in Kerala. To support the electrification of airport operations, CIAL has also installed two 240 kW and one 120 kW DC fast chargers dedicated to charging electric airport buses and future Ground Support Equipment (GSE), enabling rapid charging and minimizing operational downtime. Complementing this infrastructure, CIAL has partnered with Kochi Metro Rail Limited (KMRL) to operate electric feeder buses connecting the airport with the Kochi Metro network.

2.23 These buses provide seamless multimodal connectivity for passengers and airport employees, encouraging greater use of public transport, reducing dependence on private vehicles and taxis, easing road congestion, and lowering greenhouse gas emissions associated with airport surface access.



2.24 The EV charging infrastructure, integrated with CIAL's renewable energy programme and the upcoming Green Hydrogen Plant, supports the airport's long-term objective of transitioning towards low- and ultimately zero-emission ground transportation.

2.25 Further strengthening its green airport infrastructure, Terminal 3 has been provided with ten Boarding Bridge Equipment (BBE) systems integrated with Pre-Conditioned Air (PCA) and Ground Power Units (GPU), which are currently awaiting commissioning. Once operational, these systems will enable parked aircraft to receive conditioned air and electrical power directly from the terminal instead of operating their onboard Auxiliary Power Units (APUs). This will significantly reduce aviation fuel consumption, greenhouse gas emissions, local air pollutants and aircraft noise while improving airside environmental quality and passenger comfort.

2.26 Together, these initiatives demonstrate a scalable and replicable model for sustainable airport mobility, contributing to improved air quality, reduced fossil fuel consumption and the decarbonization of airport operations in line with ICAO's environmental sustainability objectives.

Air Quality Management

2.27 To continuously assess environmental performance, CIAL has installed a Continuous Ambient Air Quality Monitoring System (CAAQMS) that monitors key pollutants in real time. The monitoring system enables continuous compliance assessment against national air quality standards while providing valuable data for environmental planning and operational decision-making. Continuous monitoring facilitates early identification of emission trends and supports implementation of corrective measures wherever necessary.

Aircraft Noise Management

2.28 Recognizing aircraft noise as a key environmental concern, Cochin International Airport Limited (CIAL) has implemented a comprehensive noise management programme in accordance with the ICAO Balanced Approach to Aircraft Noise Management. The airport has adopted Continuous Descent Approach (CDA) procedures and optimized aircraft departure profiles to reduce engine thrust during flight operations, thereby minimizing aircraft noise, fuel consumption and greenhouse gas emissions.

2.29 To support these operational measures, CIAL has implemented a state-of-the-art Aircraft Noise Monitoring System (NMS) comprising two permanent Noise Monitoring Terminals (NMTs) strategically located near the approach paths of Runway 09 and Runway 27. The system continuously monitors aircraft noise, correlates individual noise events with flight movement data and maintains a comprehensive historical database for analysis and reporting.

2.30 The system also includes a portable noise monitoring unit for temporary deployment to investigate community noise complaints and conduct site-specific assessments. It supports the generation of noise contour maps, environmental reports and long-term trend analyses, enabling CIAL to evaluate the effectiveness of noise mitigation measures and ensure regulatory compliance. The integrated monitoring and reporting framework strengthens evidence-based decision-making, enhances stakeholder engagement and demonstrates CIAL's commitment to minimizing the environmental impacts of aircraft operations while maintaining safe and efficient airport operations.

Water Conservation and Wastewater Management

2.31 Water conservation is an integral component of CIAL's environmental sustainability strategy, with emphasis on reducing freshwater consumption through efficient wastewater treatment and reuse. Wastewater generated from airport terminals and associated facilities is treated in a modern Sewage Treatment Plant (STP) designed to meet applicable environmental standards before reuse.

2.32 To enhance treatment efficiency and environmental performance, the STP has been upgraded with covered collection tanks to minimize odour emissions, an activated carbon-based odour control system for hydrogen sulphide (H₂S) removal, and sludge dewatering through filter press

technology. An anoxic treatment system is also being introduced to improve nutrient removal, while the installation of an ultrafiltration system is planned to further enhance the quality of treated water.

2.33 The treated wastewater is reused for irrigation of the CIAL Golf Course, substantially reducing the demand for freshwater for landscape maintenance. This large-scale reuse programme enables productive utilization of treated wastewater while conserving valuable freshwater resources.

Circular Economy and Solid Waste Management

2.34 CIAL has implemented an integrated solid waste management programme emphasizing waste minimization, segregation, recycling and resource recovery.

2.35 Solid waste is segregated at source using colour-coded collection systems and processed through a Material Recovery Facility (MRF). Organic waste is processed through composting and biogas generation, while recyclable materials are recovered and residual waste is managed through controlled incineration or future Refuse-Derived Fuel (RDF) production.

2.36 These initiatives promote circular economy principles while reducing waste disposal requirements.

Biodiversity Conservation and Photovoltaic Farming

2.37 CIAL integrates biodiversity conservation with renewable energy generation through sustainable land management practices across its airport premises. Extensive green belt development using native and adaptive plant species has been undertaken along airport perimeters, internal roads and buffer zones to enhance landscape aesthetics, improve local air quality and support ecological balance while maintaining aviation safety requirements.

2.38 A key innovation adopted by CIAL is photovoltaic farming (agrivoltaics) within its ground-mounted solar photovoltaic installations. This approach combines renewable energy generation with controlled vegetation management by allowing the cultivation of low-growing grasses and suitable vegetation beneath and between solar panels. The vegetation helps suppress soil erosion, improves soil moisture retention, reduces dust generation and minimizes weed growth, while eliminating the need for extensive mechanical vegetation control. At the same time, the vegetation contributes to carbon sequestration, supports soil health and provides habitat for beneficial insects and other small fauna without attracting wildlife that could pose a risk to aircraft operations.



2.39 By integrating photovoltaic farming with solar energy production, CIAL optimizes land utilization and demonstrates that renewable energy infrastructure can coexist with environmentally responsible land management. This approach contributes to biodiversity conservation, enhances

ecosystem resilience and promotes sustainable airport development while maximizing the environmental benefits of large-scale solar photovoltaic installations.

2.40 CIAL's experience demonstrates that integrating renewable energy, environmental management, climate adaptation and stakeholder participation into airport operations can substantially reduce environmental impacts while improving operational resilience. Long-term planning, strong institutional commitment, continuous monitoring and adoption of innovative technologies have been key factors contributing to the successful implementation of these initiatives.

2.41 CIAL intends to further strengthen its sustainability program through expansion of renewable energy capacity, wider deployment of green hydrogen technologies, electrification of airport ground support equipment, enhancement of circular economy initiatives, implementation of advanced environmental monitoring systems and progression towards higher levels of Airport Carbon Accreditation.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) note the information presented in this paper regarding environmental sustainability initiatives implemented at Cochin International Airport Limited (CIAL);
- b) recognize the role of integrated renewable energy, carbon management, climate adaptation and resource conservation in supporting sustainable airport development;
- c) encourage the exchange of similar environmental best practices among ICAO Member States and airport operators; and
- d) discuss any related matters as appropriate.

— END —