Green Airports based on the good practices implemented in Dominican Republic international airports

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Introduction

An environmental management system (EMS) provides a structured approach for systematically identifying and managing significant environmental aspects of aviation operations and has proven effective across a wide range of aviation stakeholders, including airports, airlines, manufacturers, and government agencies. An EMS is one of the tools available for managing environmental issues at an airport, along with sustainability plans, certifications, compliance, and other processes. In accordance with ICAO's *Eco-Airport Toolkit e-Collection* document titled *An Environmental Management System for Airports*, Dominican Aeronautical Regulation (RAD) No. 14. on aerodrome design and operations requires that aerodromes with international operations establish an Environmental Management System. This system must address the most significant aspects associated with aerodrome operations, such as: consumption of non-renewable natural resources, atmospheric emissions from stationary and mobile sources, soil and water pollution, discharge of liquid and solid waste, and generation of hazardous substances.

The Dominican Republic generates more than 7 million tons of waste per year, or approximately 650 kg per inhabitant. The primary method used for the final disposal of solid waste is open-air sanitary landfills. By 2023, 358 open-air landfills had been registered in the country. Just in October 2020, Law 225-20 was enacted, which aims of preventing waste generation, ensuring the right of every person to live in a healthy environment, protecting public health, and reducing the greenhouse gases emitted by waste.

Electricity generation in the Dominican Republic relies primarily on conventional fossil fuel sources, notably coal and natural gas. Solid waste generation has been a concern for decades. This case study highlights the efforts made by airports have made to address these two issues. In the 4th edition of the action plan on reducing CO_2 emissions from international civil aviation, Dominican Republic airports committed to transitioning towards low-carbon and renewable energy sources for electricity generation.

Environmental Management System for Airports

Cibao International Airport (AIC)

Cibao International Airport (AIC), located in Santiago de los Caballeros, Dominican Republic's second-largest city, decided to seek an alternative to reduce the volume of waste directed to landfills. To this end, the airport acquired 31 garbage disposal stations and constructed the warehouse to serve as a centralized collection center.

FIGURE 1: Center for Collection and Segregation of Solid Waste at AIC.

A reinforced concrete warehouse measuring covering 197.64 square meters, is divided into several functional zones: reception and weighing, waste segregation, recyclable materials warehouse, hazardous waste warehouse, restrooms, and dispatch area. Thus, the AIC Solid Waste Management Plan was initiated in 2020, with the goal of reducing landfill waste by recovering recyclable materials. This project aligns with Law 225-20, the General Law on Comprehensive Management and Co-processing of Waste, which stipulates that waste producers are responsible for proper separation. The plan encompassessolid waste management across the entire airport terminal, including concessionaires and other customers. The following entities, in their role as stakeholders, have promoted the development of the project as an example of solid waste management: Cibao International Airport Administration, the Ministry of Environment, and Santiago City Council.

The Airport generates an average of 420 tons of solid waste annually, of which pproximately 11% is recovered for recycling each year. This reduction not only decreases waste management costs but also reduces the number of trips required to the final disposal site, as the airport owns and operates the compactor trucks used for transportation.

FIGURE 2: IDAC visit to AIC in 2023. In the photo: Mr. Miguel Mejía sub director del IDAC y Director de Desarrollo Sustentable, Ms. Wilma Paulino, Mr. Geldy Núñez, Ms. Carolina Joaquín, Mr. Jorge Salcé, Ms. Judit De León.

This solid waste management project involved an investment of approximately $290,000.00 USD. In 2021, the annual cost of solid waste management was approximately $16,000.00 USD, and in 2023, the annual cost of waste management was $16,500.00 USD. Although total waste generation period increased by 15%, during the 2021-2023, management costs management costs remained relative stable. This economic benefit is directly associated with the recovery of recyclable waste and a 35% reduction in landfill trips.

This waste recovery has also had a positive impact on emissions reductions, specifically carbon dioxide (CO_2) emissions, preventing the release of 142 tons of CO_2. Although the primary objective of this project is not to generate economic profit, but rather to solve an environmental problem, revenue from the sale of recyclable waste has so far amounted to $11 million over three years. The Airport's commitment is to continue implementing projects that align with sustainability criterial.

Clean Energy at Airports

Cibao International Airport (AIC):

FIGURE 3: Photo of AIC, the photovoltaic park.

Electricity generation in the AIC currently results in emissions of over 600 $kgCO_{2e}$ per MWh based on National Interconnected Electric System.

In response, and as part of its sustainability and corporate responsibility policy, the shareholders of Cibao International Airport initiated a photovoltaic generation project for on-site consumption by the airport and its tenant companies. Launched in 2013, the project aimed to achieve energy independence and gradually reduce emissions, particularly those associated with grid electricity. The initiative was supported by incentives under Law No. 57-07 on Incentives for Renewable Energy and Special Regimes.

FIGURE 4: Photo of AIC, the photovoltaic park, and the TESLA battery bank.

FIGURE 5: IDAC visit to AIC. In the picture: Mr. Miguel Mejía sub director del IDAC y Director de Desarrollo Sustentable, Ms. Wilma Paulino, Mr. Geldy Núñez, Ms. Carolina Joaquín, Mr. Jorge Salcé,Ms. Judit De León.

The solar plant, located within airport grounds near the General Aviation area, integrates photovoltaic generation with energy storage. It was implemented in two phases. The first phase began in 2013 with a capacity of 1.5 MW, using 5,880 SW235 solar panels and three GT 500 inverters. The second phase began operations in 2019, adding another 1.5 MW for a total of 3.0 MW

Energy storage is achieved through a series of Tesla battery banks with a total capacity of 1,240 kWh. This capacity provides electricity for approximately two hours at night, in addition to supplying energy during peak demand throughout the day.

The photovoltaic plant required an investment of approximately $7.2 million. The payback period for the first phase was four years, while the second phase will be eight years. This project generates nearly 75% of the airport's energy consumption, leading to environmental and economic benefits. The project represents an average annual savings of $780,000.

Through these measures, complemented by certain energy efficiency initiatives, the Airport has achieved a reduction of nearly 25% in absolute greenhouse gas emissions compared to the 2016 baseline year, corresponding to approximately 1,700 tonnes of CO_2 equivalent (tCO_2e) annually. On a per-passenger basis, emissions have decreased from 1.49 $kgCO_2e$ to 1.0 $kgCO_2e$, reflecting a 33% improvement in emission intensity.

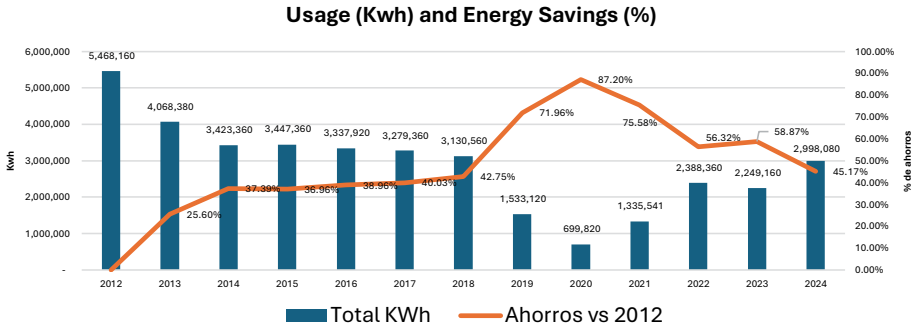

FIGURE 6: Usage (Kwh) and Energy savings (ahorros) expressed as a percentage. Source: prepared by the AIC.

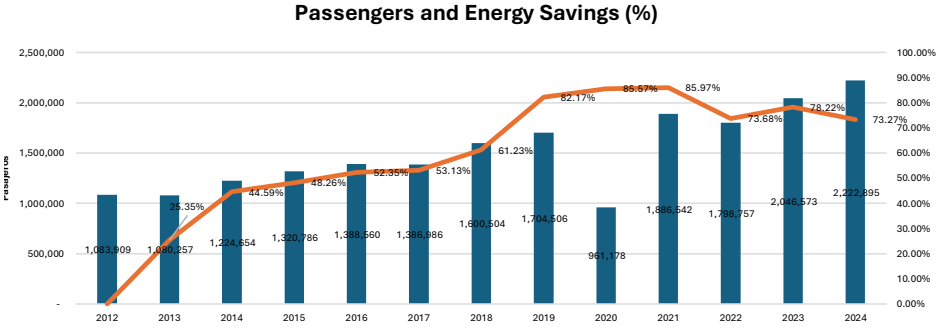

FIGURE 7: Passengers and Energy savings (ahorros) expressed as a percentage. Source: prepared by the AIC.