

Attaining Carbon Neutrality: A Critical Analysis of Sustainable Practices at the Indira Gandhi International (IGI) Airport

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Abstract: In 2010, at the 27th International Civil Aviation Organization (ICAO) Assembly, governments set goals to ensure that the growth of international aviation from 2020 would be “carbon-neutral.” All the aviation stakeholders have taken up initiatives such as use of new technology, efficient operational procedures, efficient infrastructure and market based mechanism which is also known as Carbon Offsetting and Reduction Scheme for International Aviation (CORSA).

While the ICAO is responsible for managing emission from international aviation, airports being a part of domestic aviation comes under the purview of UNFCCC. To enable Airports to adopt carbon management initiatives, Airports Council International (ACI) have developed Airports Carbon Accreditation (ACA) program, which is currently the only global framework for airports to effectively manage their emissions. The program provides accreditation to airports at four progressively ambitious levels of accreditation.

The Indira Gandhi International (IGI) Airport, New Delhi, India is the first airport in Asia Pacific region to achieve the highest level of accreditation, i.e., Level 3+, neutrality under this program. The airports has been steadfast in their approach not only towards carbon management but towards all aspects of sustainability and is a quintessential example of a successful model. By striking a balance between growth and sustainability, the airport is a testament to the fact that environmental stewardship and economic growth are not mutually exclusive.

A plethora of credible secondary sources has been referred to in the paper to highlight the general global trends in the emergence of sustainable airports through the lens of the Airport Carbon Accreditation (ACA) framework and delineate the common standards for measuring and mitigating carbon emissions. The research evaluates and focuses specifically on the environmental policies and initiatives employed by the IGI Airport, the challenges it faced in reducing emissions and its future sustainability plans, in an attempt to underscore how airports internationally can reduce carbon emissions and attain carbon neutrality.

Ultimately this paper concludes that attaining carbon neutrality in airports is a result of integrating sustainability into its everyday functioning, and ensuring that environmental initiatives and economic goals are given equal weightage. Additionally, integration of Governments objectives and the guidelines of international agencies like the ACI, ICAO, as well as the United Nations Sustainable Development Goals into Airport’s business strategy ensures that the airport is systematic in its approach to becoming sustainable. Lastly, involving all stakeholders of the airport in environmental initiatives is essential in order to attain long-term sustainability.

1. INTRODUCTION

The aviation industry plays a pivotal role and has been an integral part of the rapid progression of globalization. This industry has become deeply entrenched in the way goods and services make their way across the world, and the way in which nations facilitate their economic growth. It is self-evident that this industry will continue to grow in the years to come, with the world becoming increasingly interconnected and interdependent.

Even though this globalization has been undeniably beneficial for business, commerce and tourism, it has insidiously impacted the environment. Passenger air travel is contributing towards increased individual emissions, even though this industry is constantly employing more and more efficient technologies. From 2013 to 2017, CO₂ emissions from commercial aviation grew from 710 million tons to 860 million tons, a 21% increase in four years. In 2019, this number further increased to 915 million tons, evidencing the idea that this sector’s consistent growth is positively correlated with an increase in carbon emissions [1]. The ICAO projects a 2.2 to 3.1-fold increase in fuel consumption from 2015 to 2045. Therefore, there is a pressing need to ensure that the growth of the aviation industry is brought about sustainably.

CO2 emissions and carbon intensity from passenger transport in 2018, by regional route group

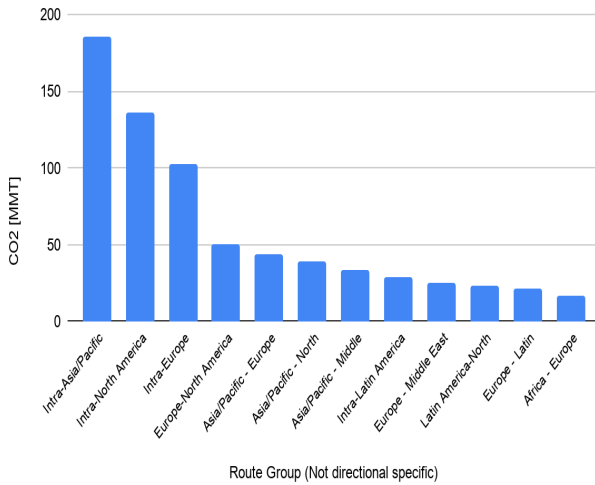


Fig. 1.1. Source: icct - the international council on clean transportation [5]

While analyzing the CO₂ emissions and carbon intensity from passenger transport in 2018 (shown in Fig. 1.1) by regional route groups, as defined by the ICAO, it can be seen the flights within the Intra-Pacific routes produced the largest amount of passenger transport related CO₂ (25% of the global total [2]). This region consists of 4 out of 10 of the nations with the most aviation RPKs (Revenue Passenger Kilometers), including India, Australia, China and Japan. Since this region is of prime importance to the growing aviation industry, in this paper, the carbon neutrality policies adopted by an airport in this region, particularly by the Indira Gandhi International Airport in New Delhi will be analyzed as it emerged as the first carbon neutral airport in Asia Pacific.

2. CARBON NEUTRALITY

Carbon neutrality refers to a state of having a net zero carbon footprint through striking an equilibrium between carbon emissions and carbon removal or eliminating emissions in order to achieve net zero CO₂ emissions. On a global level, carbon neutrality has become an international goal we need to achieve in order to limit global warming to 1.5 degrees Celsius, as was laid down by the IPCC and the Paris Agreement. Currently, many individuals, businesses and countries across the globe have made a commitment of reaching a state of carbon neutrality by counterbalancing their emissions. This is usually achieved by taking strategic measures which reduce overall emissions, and then employing a measure called “offsetting” whereby reductions in emissions are made elsewhere in order to compensate for emissions which can’t be reduced internally.

In the context of airports, the practice of striving to achieve carbon neutrality has been increasingly growing. The Airport Carbon Accreditation (ACA) which is committed to reduce the carbon emissions of airports, is central to driving airports towards carbon neutrality. By setting guidelines and strategies to become carbon neutral, the ACA provides airports with tangible methods to measure their emissions and targets to reduce them. As per the ACA, 63 of their program participants have achieved carbon neutrality up as of September, 2020, which is the highest level of airport sustainability in their framework. As shown in figures below, the majority of the airports that have been accredited are from Europe, followed by Asia, North America, Latin America/ Caribbean, and finally Africa.

ACCREDITED AIRPORTS IN THE DIFFERENT REGIONS OF THE WORLD

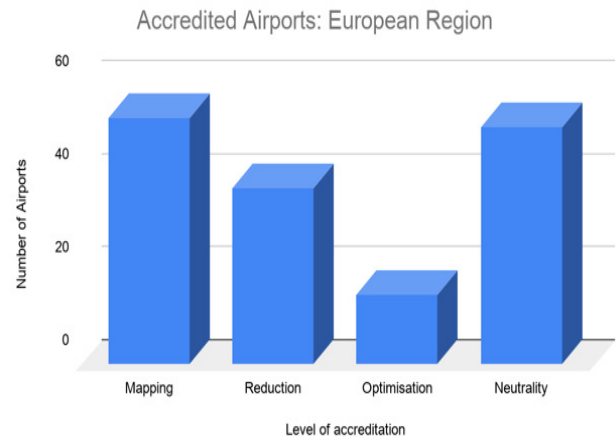


Fig. 1.2. The European Region has a total of 157 accredited airports

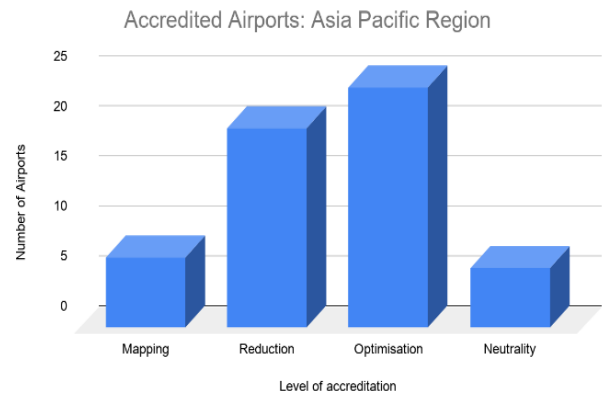


Fig. 1.3. The Asia Pacific Region has a total of 57 accredited airports

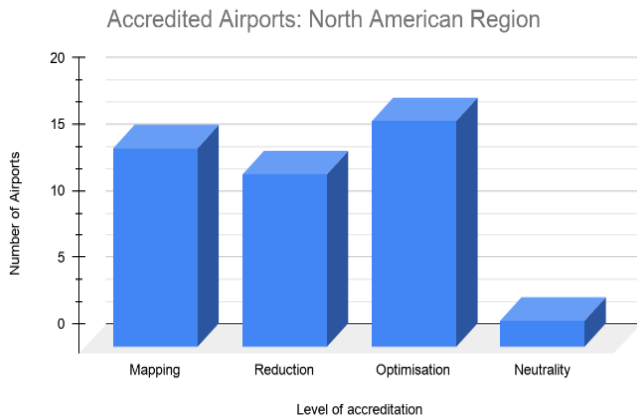


Fig. 1.4: The North American Region has a total of 47 accredited airports

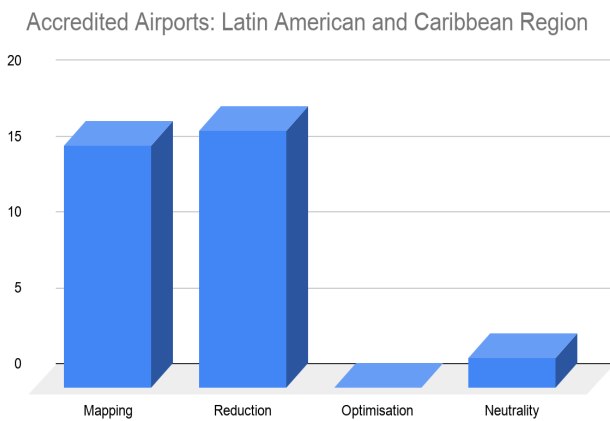


Fig. 1.5: The Latin American and Caribbean Region has a total of 35 accredited airports

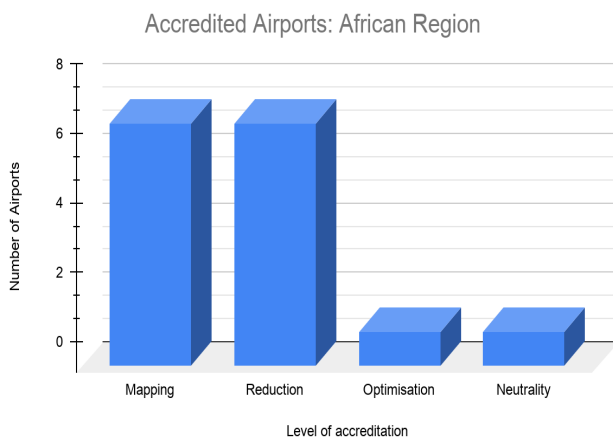


Fig. 1.6: The African Region has a total of 16 accredited airports

In all, 312 airports are part of the program and the popularity for programs like these is increasingly growing. Even though 312 may seem like a small number compared to the total number of airports worldwide, which amounts to around 17,000, in reality, the airports who are part of these programs tend to be the wealthiest and thus, have the most air traffic and passengers. As a result, the ACA has been able to reduce CO₂ emissions by 322,297 tonnes between July 2018 and June 2019. Fig. 1.7 displays the general trend of the reduction in CO₂ that the ACA has undertaken (measured in tonnes of CO₂). They have been able to reduce the CO₂ emitted almost every successive year, highlighting the success of the program.

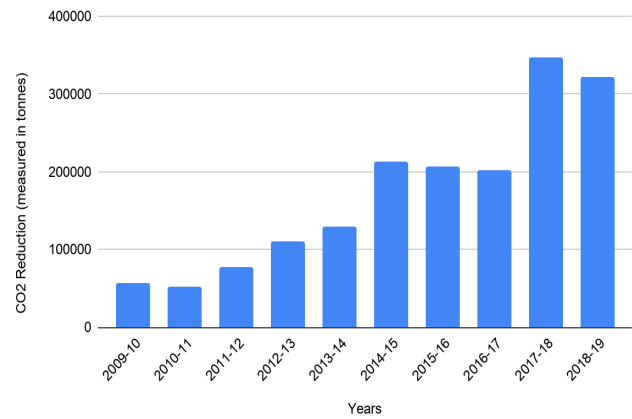


Fig. 1.7: Source: Airport Carbon Accreditation [3]

3. THE INDIRA GANDHI INTERNATIONAL AIRPORT

The Indira Gandhi International airport, a subsidiary company of the GMR group, is amongst the 63 airports in the ACA program that have achieved carbon neutrality. This airport is located in Delhi, India and it is amongst the top 20 busiest and fastest growing airports globally. However, its growth has been sustainably accompanied by environmental protection and social wellbeing.

The GMR Group has clear environmental and sustainability goals, as highlighted in their sustainability reports. According to Douglas Webster, the Chief Operating Officer, “As the demand for air traffic continues to rise, we must ensure that our operations support the long-term development of the airport ecosystem and our stakeholders[4].” Therefore, the Delhi Airport strives to be receptive to increasing global demand for aviation, but at the same time ensures the highest levels of environmental sustainability. As per the Delhi International Airport Limited (DIAL) sustainability framework, they have four key sustainability pillars: Economic Prosperity, Service Excellence, Care for Environment and Enhancing Quality of Life. The success of

these pillars of sustainability is a result of their systematic approach to it. Each element consists of a specific program, management approach, activity, process and goal with Key Performance Indicators (KPIs). The sustainability at the Delhi Airport is ensured through the GMR Business Excellence Model (GBEM).



Source: 2018 Sustainability Report, GMR Group and the Indira Gandhi International Airport

The Strategic Planning Process at DIAL is a collaboration between the leadership team, senior executives, heads of various functions, as well as other stakeholders. These initiatives are also implemented through Cross Functional Team (CFT) or as a Functional Initiative with specific timelines. What strengthens their strategic planning process even more is that it takes account of “Blind spot analysis” to ensure that all business assumptions considered for preparing plans are verified and re-evaluated so that incomplete assumptions are avoided.

4. AIRPORT CARBON ACCREDITATION PROGRAM

The journey to achieving carbon neutrality involves a lot of changes to the day-to-day operations of an airport. The goal of becoming a zero-carbon airport is to essentially eliminate anthropogenic carbon emissions, or to minimize them to the extent that is possible. Specifically, in the context of airports, it is achieved by developing infrastructure and systems which emit minimum carbon, employing green technologies and energy, increasing available carbon sinks through plantations, using energy efficient systems, and adopting offsets to account for residual emissions which cannot directly be controlled.

The Airports Council International (ACI) monitors carbon emissions by airport through its comprehensive framework of the Airport Carbon Accreditation (ACA) Program. This program allows for the quantification and reporting of Greenhouse Gas emissions and removal and includes specific measures for the design, development, reporting and verification of an organization’s greenhouse gas inventory.

The ACA has levels of accreditation which range from Level 1: Mapping to Level 3+: Neutrality. Fig. 2.1 below outlines the levels and their respective requirements, according to the ACI.

Level	Requirements
Level 1: Mapping	<ul style="list-style-type: none"> - Determine emissions sources within the operational boundary of the airport company. - Calculate the annual carbon emissions. - Compile a carbon footprint report. - Engage an independent third-party to verify the carbon footprint report.
Level 2: Reduction	<ul style="list-style-type: none"> - Provide evidence of effective carbon management procedures. - Show that reduction targets have been achieved.
Level 3: Optimization	<ul style="list-style-type: none"> - Widen the scope of carbon footprint to include third party emissions. - Engage third parties at and around the airport.
Level 3+: Neutrality	<ul style="list-style-type: none"> - Offset remaining emissions to achieve carbon neutral operations for all emissions over which the airport has control.

The success of ACI’s program is at the hands of the comprehensive way by which the ACA divides its levels and provides the airports with carbon management technique with measurable results. It is a framework that can be applied to an airports everyday environmental practices and it is a long-term guide that motivates airports to continually improve and move up through the various levels in partnership with airport stakeholders [5].

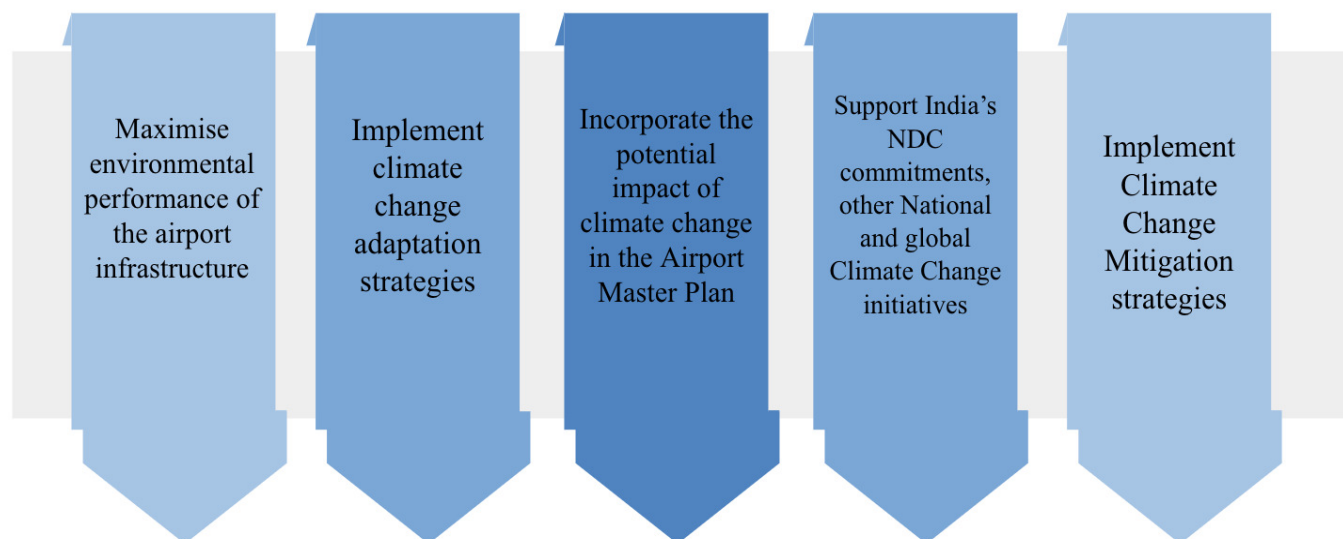
While reducing emissions, an important consideration is to identify the source of emissions, as airports are instructed to do in the “Level 1: Mapping” phase. The carbon emissions are divided into 3 scopes, and this division helps a company delineate how and where they need to start reducing emissions. Fig. 2.2 shows the scope of emissions and its sources in the context of an airport.

Scope	Description	Sources in Airports
Scope 1	These are direct GHG emissions and are controllable	<ul style="list-style-type: none"> - Vehicles/ground support equipment belonging to the airport - On-site waste management - On-site wastewater management - On-site power generation - Firefighting exercises - Boilers, Furnaces
Scope 2	These are indirect GHG emissions from purchased electricity, but are still controllable	<ul style="list-style-type: none"> - Off-site electricity generation <ul style="list-style-type: none"> - Heating - Cooling - Lighting
Scope 3:	These are emissions from other sources related to the activities of an airport, which can be influenced or guided by the airport operator.	<ul style="list-style-type: none"> - Aircraft landing - Aircraft taking off - Aircraft ground movements - Auxiliary power unit - 3rd party vehicles/ground support equipment - Passenger travel to the airport - Staff commute - Off-site waste management - Off-site water management - Staff business travel

5. THE DELHI AIRPORT: ENVIRONMENTAL INITIATIVES

The Delhi Airport adopted several key measures in order to achieve its ‘Level 3+ Neutrality’ Accreditation from ACI in 2016, including the development of green infrastructures by following green building standards, energy management, renewable energy use, adopting operational excellence measures in collaboration with aviation stakeholders and by the use of carbon offsetting programs as per ACI Accreditations guidelines.

DIAL’s Carbon Neutrality Objectives are as follows:



Airports are the nodal point of aviation activities, whether it comes to airline flights, passenger and public access or third-party operations - they play a key role in establishing the guidelines for emission reductions. The Key Greenhouse Mitigation Initiatives of the Delhi Airports include the following:

1. **Green building program:** Delhi Airport has integrated green building principles in all the existing and upcoming infrastructures within the airport. Currently Terminal 3 is LEED NC Gold certified and IGBC EB Platinum Certified. Terminal 3 has also adopted LEED Arc and is the first airport terminal globally to be certified at Platinum Level in LEED Arc. Terminal 3 has most recently also received "Platinum Level" in Performance Excellence in Electricity Renewal (PEER) certification system from United States Green Building Council (USGBC).

Some of the key features of Terminal 3 are-

- a. Energy efficient infrastructure and technology adoption
 - b. Water efficient air conditioning, plumbing and irrigation
 - c. Reduction in pollution and waste due to construction activity by effective site and waste management
 - d. Provision for eco-friendly vehicles
 - e. Rainwater harvesting and reuse of treated wastewater
 - f. Use of no chlorofluorocarbon-based refrigerators
2. **Environmental Management System and Greenhouse Gas reporting:** The Delhi Airport has an Environmental Management System (EMS) that is certified under ISO 14001:2015. This is an extremely beneficial tool as it provides an organized and formal approach for environmental action. In addition to this, the Delhi Airport is also certified under ISO 14064:2011 for its GHG emission inventory and management.
 3. **Energy Management System (EnMS):** Delhi Airport is the first Airport in the world to be certified for ISO 50001:20018 energy management system. This means that the airport have all its processes well mapped, regularly reviewed and constantly improved to meet Delhi Airport's Energy Management and Environment Management Policies which greatly helps reduce carbon emissions.
 4. **Renewable Energy Program:** The DIAL solar power plant was the first airport power plant to be set up in the airside area, in 2014. The current capacity of the plant is 7.84 MW which fulfills approximately 10% of the airport's overall energy. Delhi Airport also uses off site

renewable energy through its open access program. The overall share of renewable energy in the overall gross energy mix of DIAL was more than 44% in the year 2019-20.

5. **Fixed Electrical Ground Power (FEGP) & Pre-Conditioned Air (PCA):** Fixed Electrical Ground Power (FEGP) units prevent the use of Auxiliary Power Unit (APU), resulting in reduced emissions from fuel combustion and related noise from aircraft APU. Aircrafts using FEGP on ground instead of APU benefit in reducing significant emissions, especially since emissions would multiply more than 400 times for a short haul, consuming more than 100 liters/house and 600 times for long haul aircraft which would consume more than 250 liters/hour of aviation turbine fuel for APU to run [6].
6. **Clean Development Mechanism (CDM):** The energy efficient measures at Terminal 3 have been registered with the United Nations Framework Convention on Climate Change (UNFCCC). The Delhi Airport is the first airport in the world that achieved CDM registration with the UNFCCC, and the components of the CDM project are as follows:
 - a. Energy Efficient Chillers
 - b. VFD's in Secondary Pumps and CT Fans
 - c. Tempered Cooling System
 - d. Low U-Value Building Envelope and Roof
 - e. VVFD and Radar sensor based Travellators and Escalators
7. **Green Co Platinum Certificate:** The GreenCo rating system aims to promote and champion the conservation of natural resources in Indian Industry without compromising on high and accelerated growth. It assesses environmental performance through 8 parameters: Energy efficiency, Water Conservation, GHG emission, Renewable Energy, Waste Management, Material conservation and Recycling, Green Supply Chain and Innovations. The Delhi Airport was one of the first airports in India to achieve the GreenCo Platinum Rating for its environmental excellence.

The aforementioned initiatives are some of the key initiatives implemented by the Delhi Airport, and are an integral part of how they finally received the *carbon neutrality* status.

In addition to their own initiatives, The Delhi Airport keep up with developments in environmentally friendly practices by carrying out a benchmark analysis of their performance against airports of similar capacity. They ensure that there is a

comparable number of passengers and cargo volume handled and the performance can be compared in terms of size or area of the airports/terminal buildings. The organization looks at other airports' performances by comparing energy consumption, greenhouse gas emission, renewable energy use and alternative fuel use. This has definitely allowed the airport to not only emulate the successful aspects of other airports, but also learn from their drawbacks.

6. CALCULATING CARBON EMISSIONS AS PER ACA

The Delhi Airport, as mentioned before, fulfills the Level 3+ requirements as per the ACI. While calculating the carbon footprint, an airport first has to define its organizational and operational boundaries. DIAL has adopted "operational control" approach as per ACA guidelines for setting organisational boundary. When an airport has operational control over a source of emissions, it should account for these emissions and include them within their organizational boundary. The Delhi Airport is responsible for DIAL's infrastructure and administrative buildings, IGIA operations, Cargo facilities, Airlines, Government agencies and security forces within the IGI Airport boundary.

The operational boundary defines the scope of direct and indirect emissions based on a company's established boundary and, if applicable, their joint ventures and subsidiaries.

The ACI requires to set a benchmark in order to compare footprints on a year on year basis. This can be measured on an absolute basis or using a relative benchmark, IGI Airport uses the Relative Basis. The denominator used by them is the "Number of Passengers" as the emissions depend on the number of passengers using the airport facilities.

The airport is required to provide the ACI with written evidence of policy commitment to emission reductions and engage an independent third-party to verify the report before submission, to ensure that the carbon footprint calculation is in accordance with ISO14064 and accreditation requirements.

Thus, the process of becoming verified by the ACA is rigorous and requires extremely detailed applications verified by a third party. That being said, it is essential that every airport goes through this process because it is the need of the hour. Engaging an airport with this process allows us to understand how much carbon it emits every year, and which activities contribute most to it. Every step of the ACA provides a deeper insight into how to identify and reduce emissions, and finally attain the status of a carbon neutral airport.

In addition to the Airport Carbon Accreditation framework which gives them a systematic and action oriented approach, DIAL also follows a number of documents such as the Airport

Carbon Accreditation Guidance Document, ACI GHG Manual, ISO 14064 and ICAO Doc 9889. Based on these guidelines, they have developed their in-house excel based GHG management tool.

7. WHAT CAN WE TAKE AWAY FROM THE IGI AIRPORT?

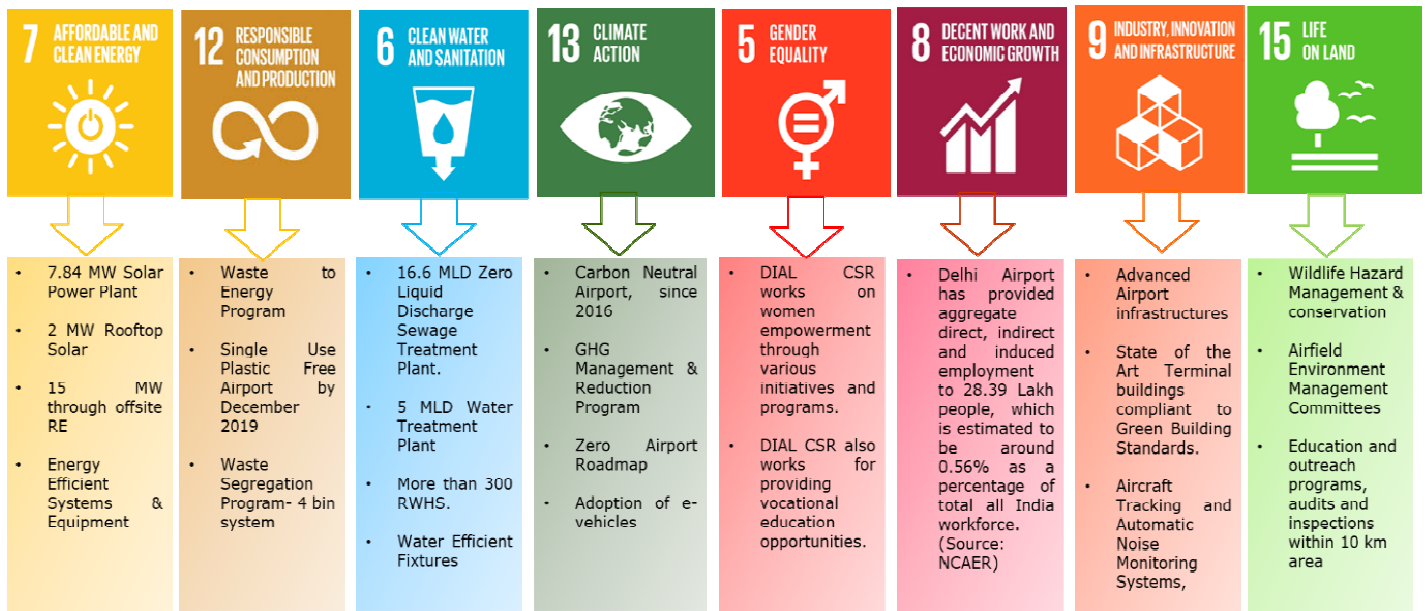
The general view amongst individuals today is that businesses cannot grow economically and be sustainable at the same time. However, the truth is that we aren't in a situation where we can choose to pursue one or the other; we are instead in a situation where the two need to be reconciled into a harmonious whole. The IGI Airport is thus the prime example of an institution that came to the realization that this is not a zero-sum game. They managed to balance the two, reaching an equilibrium that all airports should strive to attain. Their approach was systematic and followed the specific procedures suggested by the aviation bodies and GHG management strategies.

The IGI Airport ensured that it had the necessary green infrastructure and buildings. In addition to this, all operational practices were altered and adapted to achieve the highest level of operation excellence and sustainability. As previously mentioned, DIAL has a comprehensive business excellence model and pillars of sustainability which are followed by them on a daily basis, allowing them to have an integrated approach towards improving their performance and adopting the best practices.

When it comes to DIALs structure of sustainability governance, it follows a clear approach. DIAL's senior leadership consists of the Group Holding Board (GHB), led by the Group Chairman (GCM). Each business is headed by the Respective Business Chairmen (BCMs) who are supported by the Sector Chief Executive Officer (CEO). Then, each airport operation is headed by a Chief Operating Officer (COO) who works with the Chief Officers (CXOs).

In addition to this, for the effective functioning of DIAL, a Steering Committee Members (SCM) has been formed which takes part in collaborative decision making and review of business functions related to social, environmental and economic decisions of the company. This comprehensive structure and various layers of organizations ensures that the main objective of the Board of Directors, that is, the long-term success of environmental, social and economic factors, is kept in mind.

DIALs sustainability framework and goals are strongly aligned with the United Nations Sustainable Development Goals (SDGs), covering all the 17SDGs. However it contributes in a major way to 8 of the SDGs as outlined below:



By adhering to the UN SDGs, DIAL is able to keep clear goals in mind. Additionally, as stakeholder expectations around the SDGs evolve, they keep refining their work and reporting in order to contribute to the goals through their business vision.

8. OBSTACLES FACED WHILE REDUCING EMISSIONS

The Indira Gandhi International Airport is the major hub for international aviation in New Delhi, as well as in India as a whole. In 2020 alone, the IGI Airport handled more than 67 million passengers, and in 2019 it became the 12th busiest airport in the world, taking over mega-hubs like Frankfurt, Dallas Forth Worth, Guangzhou and Istanbul Ataturk Airports [7]. Their growth rate is more than 13%, and therefore, balancing their sustainability goals with infrastructure expansion has been challenging. In terms of attaining zero emissions, optimizing resource usage and managing the existing operations, while at the same time executing airport expansion and meeting with deadlines is a balance that is difficult to strike. However, the organization was still successful in attaining its goals because of the way they went about planning their goals. Following the directive of top management, planning in the airport is done at functional and cross-functional level. The objectives, road map and strategy involving the action plan is prepared as part of this planning and it is shared with the top management for approval, and to ensure that everyone is on the same page. In addition to this, since there are a number of stakeholders, all of which have to be involved in environmental initiatives, it often becomes a challenge to communicate to all. Therefore, it is important to ensure that there is robust stakeholder engagement and communication processes in place to address such challenges.

9. CONCLUSION

The GMR Airports are committed to both upholding and furthering their sustainable and carbon neutral status, and this goal has been inscribed into the very DNA of the organization. Airports across the world have something to learn from the way in which the GMR Group has handled the sustainable development of the Indira Gandhi International Airport. Since the year 2010, when they adopted the Airport Carbon Accreditation program, the GMR group realized the importance of not only becoming ‘carbon neutral,’ but also achieving ‘zero carbon emissions.’ Thus, they adopted a ‘Zero Emissions Airport’ program in 2018-19. According to a recent interview by the GMR Airports, it was stated that they place great importance on not only reducing their “direct emissions” (scope 1) and “energy indirect emissions” (scope 2), but they also endeavor to reduce their “other indirect emissions” (scope 3). Scope 3 emissions may seem like they are out of an organizations control, and while they may be harder to reduce than scope one or two emissions, the Indira Gandhi International Airport is an example of how influencing and guiding your stakeholders to become more eco-sensitive is possible and this is what differentiates the GMR Airports from the rest. They ensure that all internal and external stakeholders are part of their program and to ensure that there is no communication gap, they have regular reviews on a monthly basis involving all the heads of departments, regular email communications, training and knowledge sharing sessions to create awareness and involve employees in this program.

Under their ‘Zero Emissions Program,’ the GMR group has identified key strategy areas to work on, and by delineating the key areas that they need to focus on, they are able to take on a

more streamlined approach. These areas- enhanced green building program, renewable energy integration, fuel switch program, energy conservation, adoption of efficient technologies and increased sink by planting native and adaptive tree species.

In terms of their future plans, the airport is specifically looking at expanding its renewable energy program. Currently the capacity of onsite solar power plants under the renewable energy program at the Delhi Airport is 7.84 MW, which is owned by DIAL. There is another rooftop plant of capacity 2 MW within the airport, which is owned by cargo terminaloperator's M/s Celebi. Thus, the overall installed capacity at Delhi Airport is almost 10 MW. Apart from onsite renewable energy programs, Delhi Airport is also getting renewable energy supply through "open access." Going forward, the airport intends to increase their off-site renewable energy supply to the airport. In addition to this, they are strongly looking at implementing electric/hybrid vehicles within the airport.

The IGI Airport has benefited from reducing its emissions through direct economic impacts such as adopting a 'life cycle cost approach' which has helped them evaluate all their initiatives in a more systematic manner, not only in terms of their environmental impact, but also in terms of financial gain. Therefore, striving towards becoming more environmentally conscious and eco-friendly has benefits that trickle down to several areas of an airport, and taking the example of the IGI Airport and implementing the Airport Carbon Accreditation framework in order to be aware and in control of emissions are steps airports globally should implement.

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