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# Ecological Footprint Management in Indian Aviation Industry

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**Abstract:** Aviation is not only one of the worst emitters of greenhouse gases in the entire planet but it is also the source of 2 percent 1 of the total anthropogenic GHG Emission IPCC, 2004. As the changes of the atmosphere, caused by the hiking temperatures of the world, due to the release of greenhouse gases ICAO, 2016) Environmental Report (On Board A Sustainable Future2 ) will mirror on the ability of the airplane to fly, sea level, will influence the airports.

Keywords: atmosphere, Environmental, Emission, emitters.

**Ecological Footprint:**

Ecological footprint refers to the amount of nature to support a type of production necessary to provide required good and services to maintain a particular way of living.

**Carbon Footprint:**

Ecological footprint is mainly composed of carbon footprint. It is carbon dioxide that has been emitted to the intoxication due to the actions of a specific individual, organization, or community.

**Growth of Indian Aviation Industry:**

India is currently investing 72 bn into the Aviation industry DDP. In India, it has 464 airstrips and airports out of which 125 of the fairways lie in Airport Authority of India (AAI). These 125 AAI airports accommodate almost 78 percent domestic passenger traffic and 22 percent international passenger traffic 2. Nonetheless, the classification of aviation in India, along with the extent and scope of it, will rise exponentially with Government efforts in managing it through UDAN (Ude Desh Ka Aam Nagrik), RCS (Regional Connectivity Scheme), and increased disposable income levels of the middle classification.

**Need of Ecological Footprint Management:**

Due to the fact that it was known that Indian aviation industry would grow exponentially, it is important to look at the issue of environment and sustainability. To briefly conquer the concerns mentioned above to overcome these issues, a Green Civil Aviation Policy and proper management of the Ecological footprint has been envisaged with a succinct goal by ensuring effective accomplishment of the sustainability development of the civil aviation.

**Holistic Approach:**

Aviation Sector in India is one sector and it has so many stakeholders and in case of improvement towards approaching the aim of long-termed sustainability of the situation; comprehensive work by considering all the stakeholders is necessary so that the industry will be able to herald the future our future generation this way.

The paper is devoted to the discovery of role and duties of the different stakeholders of aviation industry. The paper lists the notable success of the aviation industry and at the same time illustrates the future developments

which can be made by the aviation industry so as to make the aviation industry in line with Indian national endeavor according to committed INDC of Environmental Protection in Paris climate agreement (2015).

## Ecological Footprint Management in Indian Aviation Industry

### Introduction

In these respects we shall, then, transmit this city not as narrower or even worse, but larger and more beautiful, than it was transmitted to our memory.

**-Ephebic Oath, Athens (480BC)**

Time well asks him: You shall give to our descendants of barren earth, of straining deserts, of stricken nature? Provided that we wish to repair the mistakes which we have committed upon this planet, then we should adhere to the concepts of sustainable development. This improvement in livelihood of the world population in billions, and innovative pricing of tickets by low-cost and currently ultra-low cost airlines, and quicker access to products in a globalised economy will drive growth in air travel and spearhead global aviation industry.

The growth of aviation industry in india is typically picturated as first commercial flight materialised in 1911, in Prayagraj. The country has aviation as one of the major boosters of the upward projectile of the economy of the nation. Business air transport is the fastest, the most secure as well as extended method of transportation throughout the world. Efficient utilization of time and faster administration of transportation are aviation effects that contribute to economic fortune of the world. Indian air transport company has described extremely high growth in the preceding years and likely to articulate more rapid growth in the years to come. India domestic aviation market has become the fastest expanding domestic markets in the world (using revenue passenger kilometre as measure). It is possible to define the magnitude of the consequent development of the Indian domestic market by the fact that the number of domestic trips carried out in 2017 constitutes only 7.3 of the whole population in India1. The fundamental motives behind the demand of air passengers e.g. population, demographics and increasing incomes are favourable and can lead to further increase which is assured to continue in coming days. In an average of the next 20 years the IATA is projecting a growth in the number of passengers by an average of 6.1 per annum - this is certain to increase the number of passengers which visit the air airways annually, close to 350million visits annually, to almost 520million journeys/day in 2037 2.

### Literature Review:

The stakes are higher now than ever because science has proved that temperatures are rising to unprecedented levels, the greenhouse effect is growing, the sea is rising, and the unnecessary damage of natural calamities of all kinds is occurring more frequently and more frequently. Among the most obvious manifestations of environmental sustainability that is hue and cry amongst the academic and policy dialogue since the outset of the 90s was the ecological footprint.

### Ecological footprint

One of the sets of practices being suggested by the Global Footprint Network to measure human pressure on natural capital i.e. the pressure on nature necessary to support the people or an economy is ecological footprint. It oversees this need as environmental accounting system. The book is a comparison of the biological cost of human behavior. To conclude, it is an indicator of the impact of anthropogenic environment.

### Carbon footprint

Carbon footprint refers to the total equivalent of GHG emissions as a result of anthropocentric activity in their endeavors to produce carbon dioxide equivalent. Relevant sources of the green-house gases like the carbon-bearing air, containing the carbon dioxide and methane gases may be emitted by the means of utilization of fossil

cases and clearing of wood, farming along with food production, manufactured products and materials, wood, road, buildings, transportation and other services.

**Objective of the Paper:**

To expound on the influences of aviation on the ecological isostasy.

To offer an insight on the role and responsibilities of diverse stakeholders of aviation industry.

To show how the different stakeholders have gone about minimizing carbon footprint.

To plan new and innovative policies of optimum ecological footprint management of aviation industry in India.

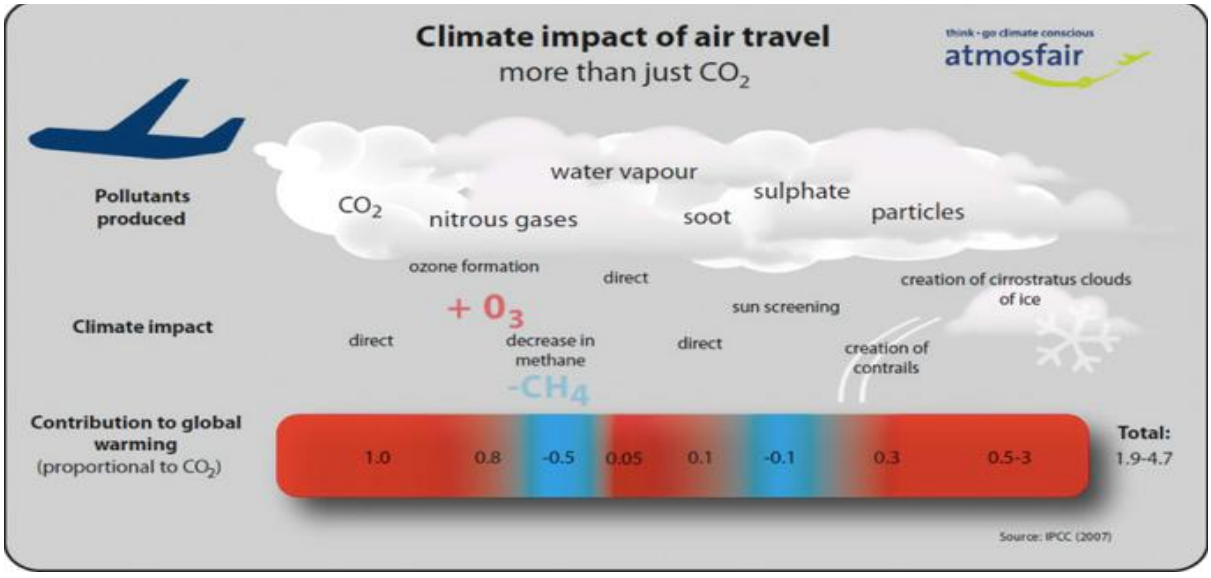
**Share of aviation industry in global carbon footprint.**

Aviation ranks in the list of the most rapidly increasing sources of greenhouse gases in the world and it is at present the source of 2 percent of total anthropogenic GHG Emission IPCC, 2004). According to the 2016 Environmental report published by ICAO (On Board A Sustainable Future2), modifications to the atmosphere, which are aided by the increasing global temperatures due to the emission of greenhouse gases, will ensure that airplane cannot fly and increasing sea levels will impact the airports.

**Analysis:**

**Impact of Indian aviation sector on Environment:**

Because of the increase in the aviation sector and the likely reduction of the fossil fuel emission to other industries by the year 2050, the fossil fuel emission of the aviation industry would under the assumption of a 3-5% contribution to the overall global emissions3. In addition to the influence that the natural conditions of climate that high altitude flying could create and the influence that the emissions had caused Climate Change. An example: depending on the kind of jet engines which are being used, the black carbon aerosol (soot) and the water vapour in this case could also act as a nucleus trapping in the water within the atmosphere. This can cause change in the natural clouds or can also be made out of contrials which can be persistent. They are less known; and are practically impossible to model after.




**Comparison of Indian Aviation industry with Global Aviation:**

In 2013, there was 705,000,000 tons of CO2 emitted by global airlines activities, or about 2%- 3% of global anthropogenic emissions. By contrast, Indian scheduled domestic/international operational airline emissions to/from domestic/international destinations and foreign airline emissions to international destinations (i.e. 15.630,000 tons of CO2) contributed to less than 1% of the anthropogenic emissions in India.4

**Stakeholders:**

Aviation includes and incorporates innumerable agencies. The role, duties and responsibilities of stake holders that would influence the effect of the aviation industry on the ecology should be explicated independently. The following are the stakeholders of aviation industry:

**Airlines:**

Players in the airlines sector include, private players such as spice jet, Indigo along with a government player such as Air India, Pawanhans etc. They are governed by the rules of operation control and regulatory standards of Director General of Civil Aviation.

**Airport Operators:**

Airport operators give facilities of passenger and parking bays etc. to movements of flights. They include private players such as Delhi Airport GMR, Mumbai Airport GVK, Mundra Airport Adan etc. although most of the airports are under state PSU Airports Authority of India (AAI). They fall under operations control which are in regulations that are given to them by Director General of civil Aviation.

**ANSP (Air Navigation Service Providers):**

It is also the part of the operational wing of AAI and the primary provider of en route and landing facilities and also the provision of the navigation support to aircrafts. They will be subject to the measures and the regulations stipulated by DGCA on operation control and requirements on grounds of operations.

**Aircraft Manufacturer:**

They supply the aircraft carriers and they fall under the DGCA regulations.

**Government (Regulator):**

India is the signatory of CCICA 1944. The MoCA has assigned the duty of committee the DGCA to offer regulatory framework and their observation to civil aviation in India.

**Environmental challenges faced by Aviation stakeholders:**

The environment and the constraints have affected aviation and vice versa. Environmental constraints require aviation to encounter numerous challenges in improving and adjusting to increased demand and expansion of its capacity management. The most frequently raised issues are the following:

**Land constraint:** Airports need large land resources that are geographically and climatically sensitive. Some of the diversity costs to be measured on environment (which includes the lost opportunity cost) are to be properly evaluated before the expansion of airports.

**Noise Reduction & GHG emission:**

The mobility of flights has also been a significant means of managing air and noise pollution at the urban level. As the possibilities of high rates of city growth and development and the growth of the aviation sector emerge, the process of noise abatement and GHG emissions curtailment become extremely important to aviation.

**Technological Impediments & Safety concerns in Fuel:**

Uncertainty as to the policies entertained on biofuels and their safety concerns once their uses are implemented are limiting the environmental management performance of the aviation industry.

**Role and responsibilities of Stakeholders:** Ecological degradation by aviation must be defeated through holistic approach. The white paper on the applied management of ecological footprint, 2018, which is already published by DGCA and presented to ICAO as Annex 16, clearly spells out the exact role and duty of the individual stakeholders. The key stakeholder roles are the following:

**Airlines:**

It is the sole duty of the airlines operators to ensure that the majority of the green practices it has been operating under such that by use of biofuels like use of biofuels which has been shown to be the most at least the greenest alternative check and it becomes the ability of these aircrafts in adapting to this kind of situation which will provide it with a sense of ecological efficiency.

**Airport Operators:**

Airport operators must create the terminals building with the help of eco-sustainable technologies such as solar cells and water reuse. They need to offer smooth aircraft and passenger business through cost saving methods.

**ANSP:**

The task of operation of flights with optimum fuel profile and minimum delay to the aircraft is assigned to Air Traffic and communication service providers to reduce fuel use and carbon emission.

**Aircraft Manufacturers:**

Manufactures of aircrafts are requested to produce aircrafts that contain sustainable material, manufacture aircrafts that include modern technologies that are friendly to the environment.

**Government (Regulator):**

Government must clean up and offer business premise and regulation system on production of environmentally friendly methods comparative to bio fuels and make sure that rules and regulations are properly followed in order to create favourable results.

**Environmental initiatives implemented by various Aviation stakeholders:**

Since its commencement as a viable form of public transport, aviation has been genuine in its endeavors towards managing the environment. As its coverage increases, it has also demonstrated its desire to protect the environment by fulfilling various milestones by its stakeholders.

**Key achievements of stakeholders**

**Airport Operators:**

The Cochin under the Cochin International Airport of Kerala in India was the first in the entire world in which the entire power of the airport was used in its solar power. The overall power of the sun is 12 megawatts; this is achieved after consuming about 46000 solar cells 5.

ACI a non-profit organization that represents global airports announced that four AAI airports - NSCBIA, Kolkata; BPIA, Bhubaneswar; LBSIA, Varanasi and TIA, have satisfied all required criteria to become Level 2: "REDUCTION" through developing CMP and reducing carbon emissions at airports according to the ACA Programme6.

Effective land use map such as implementation of new Miyawaki technique in Rajkot Airport to enable afforestation and creation of different water preserving techniques under its social welfare fund.

**Airlines Operators:**

Solar Impulse 2 which used solar powered aircraft completed the first flight around the world on no fuel in the year 2016 using a Solar Impulse 2 aircraft by Pilots and founders of solar impulse foundation7.

On 28th August 2018, Spice Jet flew the first bio jet flight flight in India, the test flight operated by the airline between Dehradun and New Delhi.8

The addition of Pratt and Whitney Eco Power engine wash to clean the aircraft engine fuel path and the blades of the turbine is likely to cut the fuel consumption of an average by 1.2%.9.

Blue Dart has been operating on single engine taxi routings, and has offered awareness generation and training on planning and implementation of constant descents profile.

The switch to sharklets on new planes by IndiGo and Go Air has allowed these two carriers to save on fuel by 3-4%10.

**Air Navigation Service Providers:**

Application of GNSS-centred performance-based navigation so as to strategize a consistent, harmonised and cost effective navigational offering of departure to end approach of an aircraft flight operation.

Implementation of Flexible Use of Airspace to minimize the overall distance covered by the aircraft and thereby use minimal fuel.

Execution of operation of PBN (Performance Based Navigation) which gives air craft optimum flight path.

Adoption of Air Traffic Flow Management that minimizes the average holding that happens in congested airports to minimize the fuel that is consumed.

**Regulatory Framework:**

Adoption of the ICAO rule (International Civil Aviation Organisation) annex 16(Environmental Protection).

Publication of White Paper on NGAP by MoCA, India in March, 2019 to integrate Indian aviation industry into national mission of climate change.

**Improvement opportunities for ensuring Sustainable development in Aviation:**

Protection of the environment and ecological footprint is an ongoing process. Aviation broadly have enormous opportunities to enhance their efficiency in providing their share of contribution towards making the world a better place. The areas of improvements are as follows:

**Infrastructure:**

Airport development must be done under the ideology of sustainability of the ecological footprints i.e. application of the Green Building specifications, recycled waste usage in construction projects, energy conservation, offer infrastructure amenities methods i.e. FEGP and PCA units to airlines, effective rain water harvesting method. Proper ancillary equipments such as charging stations must be made available to advance electric motored automobiles as an alternative to traditional automobiles. Efficient use of solar power.

**Technology:**

Only efficient technology can enable seamless integration of environment-friendly solutions with the existing system. Better ecological management in aviation requires development of the required technology that supports the applications of biofuels, use of MIS (Management Information system) to enhance the effectiveness of

operations of the flight operations, application of MIS infrastructure to convey the perfect weather forecasts to provide the best decision making, is necessary.

**Operational:**

Apply its efficient operation is the key to expanding aviation and is also a key sector in reaching their goal to protect the environment. Operational factors play a vital role in the pursuit of desirable competency of aviation. The key points to focus on would be implementation of strategic ACDM (Airport Collaborative Decision Making) throughout India with the aim of achieving fuel efficiency, route optimization and cutting down of time in holding patterns around the busiest airports, proper implementation of noise alleviation processes should be undertaken, Computerized Slot approval management should be applied so that the mean holding time per a single aircraft could be reduced as well as implement the software to provide the optimal level as far as saving fuel was concerned.

**Regulatory Framework:**

Effective control and surveillance is key to success of ecological footprint management of aviation sector. Positive environment of standardisation and harmonization of all stakeholders are achieved through efficient regulations and their execution. Implementation of ISO 14001:2015 and ISO 14064:2006 to the operators of airline, agencies that are handling ground and MRO(Maintenance Repair & Overhaul) organizations, formation of policy through Aviation specific environment policy, proper coordination amongst various organs of government toward efficient utilization of airspace such as as FUA (Flexible Use of airspace), regular monitoring on policy implementation by key stakeholders, provision of Green Tax, Carbon credit policies to promote the use of bio fuels and uncertainty in the regulatory environment have been.

**Way ahead**

The Land use along with the areas surrounding the airports should be planned properly in cooperation with Developments. The presence of Agencies, Authorities, Public Transport Departments and Metro Rail Corporations etc. where special concentrating at Airport and better connectivity will be part of necessary Airport actions with reduced environmental effects and will be positive to sustainable aviation.

Increasing pace in the intensity with which the aviation sector is consuming resources has also been provoked by increasing growth of civil aviation in India with the help of increased infrastructure growth. The resource requirement is high and all the stake holders need to include resource conservation, concept of green building etc.

There is need to provide and stimulate exploration and exploitation of sunlight and other renewable energy in the civil Aviation space in India.

Modify the aviation infrastructure/system used in home conventional into the more advanced environment friendly and resource efficient system that will be withstandable and therefore sustainable such as solar powered terminal, a replacement of ATF (Aviation Turbine Fuel) usage by bioethanol usage.

Design and organize the process of developing skills in environmental arbitration considering all the aviation stakeholders with detachable functions and duties in the job and the individual aviation entity such as Airports, Airlines, Air Navigation Services, Ground Support System etc.

Establish favourable regulatory climate in relation to clearances of aviation ventures in an endeavor to ensure anticipated growth in Indian Civil Aviation as per environmental sustainability.

**Conclusion:**

Boost in carbon emissions by the civil aviation industry is helping to increase green house gases that contribute towards climate change as more air passenger booms are constructed.

The ICAO speculates that the carbon discharge of the international aviation sector will increase seven times by 2050. Considering it is the duty of the sector to contribute to protecting the planet, IATA has set the goal of improving fuel efficiency by 1.5 percent per year between 2009 and2020 and stabilize carbon dioxide emission in advance of a 50 percent reduction by 2050.11.

The key to the understanding and managing of the environment is systematic environmental management. negative environmental effects of the aviation business establishment and operations. purpose, and to secure the backing of the highest to the lowest in the airport organization structure. The entire stakeholders of aviation such as the Airline, Airports and GSSA, ANSP, etc. will be best energy, and fuel efficient technically feasible, economically viable and environment friendly solutions to enhanced GIG release and averting climate change. The total view and optimality of the resources to make the aviation industry climate change-oriented is the necessity.

As Mahakavi Jayshankar Prasad says, we can win the ecological degradation war as long as human beings are able to use well the resources that we currently have.

"शक्ति के विद्युतकण जो व्यस्त विकल बिखरे हैं हो निरुपाय

समन्वय उनका करें समस्त विजयिनी मानवता हो जाय"

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