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Flying Green For Sustainability: Transforming The Environmental Standard Through Net Zero Emission

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Abstract

The 2030 agenda for sustainable development adopted by United Nation member States shared a representation for peace and security and urgently called for an action to make a stand against climate change, and to protect the planet by sustainably managing the natural resources, but with just six years remaining we are off track to comply with the call for Paris Agreement's pursuing efforts to limit the temperature increase to 1.5 degree Celsius , persistently we are witnessing the increasing severity of natural disasters, loss of species, rising sea levels, and loss of human life. Fossil fuels- coal, oil, gas are the largest contributor to global climate change, accounting for over 75 per cent of global GHGs emissions and nearly 90 per cent of all carbon dioxide emissions, to this disaster, Aviation Industry is a significant contributor. Airplane burns fossil fuel which not only releases CO2 emissions but also has strong warming non-CO2 effects due to nitrogen oxide, vapor trails and cloud formation triggered by the altitude at which aircraft operate which is increasing faster. Unlike Kyoto protocol, which had specific emission targets only for developed countries, the Paris Agreement gave rise to international consensus and called all states to adopt "economy-wide" emission reduction targets. ICAO is responsible for sustainable growth of the global civil aviation system adopted a long-term aspirational goal of net-zero CO2 emissions by 2050, the goal reinforces industry and government commitment to aviation's decarbonization as expressed in the 2016 in CORSIA.

In this backdrop the paper will focus on the 2030 agenda for sustainable development to combat climate change, binding obligation of Paris Agreement for temperature reduction and roadmap towards achieving Net Zero emission for transforming environmental standard for sustainability.

Keywords: Airplane pollution, Carbon emission, environmental degradation and challenges, Paris Agreement, ICAO measures, flying green for sustainability.

I. Introduction

The 2030 agenda for sustainable development goal adopted by United Nation member States shared a representation for peace and security and urgently called for an action to make a stand against climate change, and to protect and save the planet by sustainably managing the natural resources for us and for our next generation. The 2030 agenda for sustainable development and the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCC) were adopted with an unparallel sense of ownership by the member states and both are universally applicable. The Paris Agreement is the only binding International Treaty which gave rise to international consensus in 'pursuing efforts to limit the temperature increase to 1.5 degree Celsius to combat goal 13 of 2030 agenda[1].

Unlike Kyoto protocol, which had specific emission targets only for developed countries, the Paris agreement calls all states to adopt "economy-wide" emission reduction targets based on five-year cycle to be submitted by the member countries with their climate action plan known as nationally determined contribution (NDC)[2].

Multiple reports suggest that the world is significantly off track to limit global warming to 1.5 degree Celsius resulting in a rise in temperature. The World Meteorological Organization (WMO) added a line of warning by declaring 2023 as the hottest year with the rising temperature of (1.4 degree Celsius) with an uncertainty of ± 0.12-degree Celsius above the preindustrial baseline. As a key message the report also added concentrations of the three main greenhouse gases – carbon dioxide, methane and nitrous oxide – which reached record-high observed levels in 2022 and continues in 2023[3].

According to NASA (Global Climate Change Report) the consequence of changing the natural atmospheric greenhouse effect is difficult to predict but some consequences are likely to happen like Global Warming, Higher rates of evaporation and precipitation, more striking greenhouse effect and impact on agriculture[4]. As per the International Energy Agency, global energy -related C02 emission hit record height in 2023 which require steep cut in CO2 emission mainly burning of fossil fuel to meet the challenges the scientist said[5]. Evidence abounds that human activity is the primary driver of what we are facing now worldwide, this type of climate change is referred to as anthropogenic, i.e. "caused by human beings."[6] The unchecked burning of hazardous gases including the other causes over the past few decades has acutely increased the presence

[1]Paris Agreement (12 December 2015), UNFCC COP, 21st Sess, Agenda Item 4(b), UN Doc FCCC/CP/2015/L.9/Rev.1 (entered into force 4 November 2016).
[2]United Nations Framework Convention on Climate Change, "Key Aspects of the Paris Agreement" (2024), online: UNFCCC <https://unfccc.int/most-requested/key-aspects-of-the-paris-agreement>.
[3] World Meteorological Organization, WMO Global Annual to Decadal Climate Update 2024-2028 (2024), online: WMO https://wmo.int/publication-series/wmo-global-annual-decadal-climate-update-2024-2028.
[4]NASA, "Climate Change: How Do We Know?" (2024), online: NASA Science <https://science.nasa.gov/climate-change/>.
[5]Global energy-related CO2 emissions hit record high in 2023: International Energy Agency" (2024), online: The Hindu <https://www.thehindu.com/news/international/global-energy-related-co2-emissions-hit-record-high-in-2023-international-energy-agency/article67902835.ece>
[6]Sara J. Green et al, "Addressing Climate Change with Sustainable Energy Initiatives" (2024) online: ScienceDirect <https://www.sciencedirect.com/science/article/pii/S0959378024000840>.

of atmospheric greenhouse gases, including CO_2[7] causing irreparable damage to the planet's ability to sustain life and humanity[8].

To this climate change disaster, aviation is one of the important contributors, the effect of which is twofold as the profound shifts induced by climate change significantly affect the aviation sector which results in increased air turbulence and many other significant threats to the safety of air travel. On the other hand, emissions from aviation are significant contributors to climate change, as the aircraft engines burn fossil fuel which releases carbon di oxide, in air to create pollution the count of which is approximately 2% which is likely to increase beyond our expectation with projected growth of aviation industry with enhanced environmental impact unless scientifically informed mitigation measures are implemented[9].

On 2016 International Civil Aviation Organization (ICAO, the primary aim of which is to look after the sustainable growth of Global Aviation system), adopted Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) to support the Paris Agreement on climate change by contributing to the reduction of global greenhouse emissions, while synchronizing with the goal of limiting global temperature increase to below 2 degrees Celsius in case of International Flights.[10] Currently, the Earth is already about 1.1°C warmer than it was in the late 1800s, with rising temperature. To keep global warming to no more than 1.5°C as called for in the Paris Agreement – emissions need to be reduced by 45% by 2030 and reach net zero by 2050[11]. In response to this temperature rise the ICAO assembly reached an agreement on a global aspirational goal for international aviation of "net-zero carbon emissions by 2050" in support of the Paris Agreement's temperature goal while inviting all the states to work together to achieve the target as per their capabilities to contribute within the timeframe[12].

International Air Transport Association (IATA) is a trade association for the world's Airlines, which promotes safe, secure, and economical travel and to help formulate policy is also contributing towards Net Zero emission by 2050. The IATA is of opinion that sustainable Aviation Fuel can efficiently contribute 65% of the emission reduction needed for the industry to hit its 2050 Net Zero target.

In this backdrop this paper attempts to discuss the importance and significance of Paris Agreement on climate change over the other existing International protocols and Agreement and the binding obligations of the member states to comply with the same, the role of CORSIA to work in harmony with Paris agreement, for temperature control , urgency of flying with green wings as a target of Net Zero emission and how it can help

[7]Environmental Protection Agency, "Climate Indicators: Greenhouse Gases" (2024) online: EPA <https://www.epa.gov/climate-indicators/greenhouse-gases>.
[8]Intergovernmental Panel on Climate Change (IPCC), "IPCC Working Group II Sixth Assessment Report (AR6) Press Release," 28 February 2022, online: https://www.ipcc.ch/2022/02/28/pr-wgii-ar6/
[9] European Commission, "Reducing Emissions from Aviation," online: https://climate.ec.europa.eu/eu-action/transport/reducing-emissions-aviation_en.
[10]International Civil Aviation Organization, "CORSIA: Emissions Unit Criteria - Version IV," online: https://www.icao.int/environmental-protection/CORSIA/Pages/ETM-V-IV.aspx.
[11]United Nations, "Net-Zero Coalition," online: <https://www.un.org/en/climatechange/net-zero-coalition>.

[12]International Civil Aviation Organization, "Long-Term Aspirational Goals (LTAG)," online: <https://www.icao.int/environmental-protection/Pages/LTAG.aspx>

to transform the environmental standard, for sustainability and the work in progress for the achievement of the Net Zero, with conclusions.

I. Global Climate Change and an immediate call for Green Wings

Climate change at present has occupied the center of attraction as its effects are manifesting very significantly and affecting human lives. The IPCC (Intergovernmental panel on Climate Change) formed in the 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) with an aim of providing at all levels with scientific information that they can use to develop climate policies, is of the opinion that nearly 95% of the change is caused due to anthropogenic activities. There are many protocols and agreements that so far address the climate change issue including greenhouse gas emission and protection of ozone layer. Namely Kyoto Protocol which called few selected countries and the European Union to reduce their emissions of 6 greenhouse gases like CO2, methane, Nitrous Oxide, Hydro fluorocarbons, per fluorocarbon sand Sulfur hexafluoride[13]. The Montreal Protocol aims to protect the Ozone Layer by reducing the production and consumption of substances that deplete it. Stockholm Convention [14]is a global treaty that aims to protect human health and the environment from the effect of persistent organic pollutants, followed by Nayoga Protocol, and Cartagena Protocol[15] on biological diversity, the sustainable use of natural resources and fair and equitable sharing of benefits deriving from the use of genetic resources. Unlike all these the Paris Agreement specifically calls all states to take immediate measures in response to global climate change by limiting the increase in global average temperature to below 2 degree Celsius above pre-industrial level.

The greenhouse effect is the primary cause of climate change, but this effect is natural phenomenon of the Earth's atmosphere that occurs due to greenhouse gases. These greenhouse gases allow sunlight to penetrate unrestrictedly from space further into the earth's atmosphere up to the level of the earth's crust. The greenhouse effect warms the planet which makes possible life on earth. Excessive burning of fossil fuel for energy is artificially amping up the natural greenhouse effect which results in global warming that is altering the planet's climate system[16]. For the last few decades, the concentration of per million molecules of air has increased tremendously due to huge burning of fossil fuels and deforestation. CO2 in the earth's atmosphere surpassed 400 parts per million –a concentration not seen on the planet for millions of years. As of 2023 it has reached more than 420 parts per million which is 50% higher than the preindustrial levels[17]. In 2022, global greenhouse gas emissions reached a new record of 57.4 gigatons of CO2 equivalent, according to the United Nations Environment Program's Emissions Gap Report 2023. According to NASA, the amount of

[13]United Nations Framework Convention on Climate Change, "Kyoto Protocol Targets for the First Commitment Period," online: https://unfccc.int/process-and-meetings/the-kyoto-protocol/what-is-the-kyoto-protocol/kyoto-protocol-targets-for-the-first-commitment-period.
[14]U.S. Department of State, "Stockholm Convention on Persistent Organic Pollutants," online: https://www.state.gov/key-topics-office-of-environmental-quality-and-transboundary-issues/stockholm-convention-on-persistent-organic-pollutants/.
[15]Convention on Biological Diversity, "Supplementary Protocol," online: https://bch.cbd.int/protocol/supplementary.
[16] Natural Resources Defense Council, "Greenhouse Effect 101," online: https://www.nrdc.org/stories/greenhouse-effect-101#whatis.
[17]National Oceanic and Atmospheric Administration, "Carbon Dioxide Now More Than 50% Higher Than Pre-Industrial Levels," online: https://www.noaa.gov/news-release/carbon-dioxide-now-more-than-50-higher-than-pre-industrial-levels

carbon dioxide produced by human activity is increasing more than two hundred and fifty times faster than the amount of CO2 produced from natural sources since the last ice age (Global Climate Change, 2022).

As per the scientist of NASA the consequences of changing atmospheric greenhouse effect are unpredictable but they are unlimited in numbers. About two thirds of emissions comprised CO2 from fossil fuel combustion and industrial processes. Except for transportation, emissions from all major sectors have rebounded since the pandemic and now exceed 2019 levels. The energy sector is responsible for 86 per cent of global CO2 emissions, driven by the expansion of coal- and gas-fired power generation. For a 2°C limit, a 28 per cent drop by 2030 is necessary.

The World Meteorological Organization (WMO) confirmed that 2023 was the hottest year on record, with global average temperatures soaring to approximately 1.45°C above pre-industrial levels. The 10 warmest years in the 174 years with records have all occurred during the last decade. Extreme weather events, including heatwaves, major floods, droughts, wildfires and tropical cyclones, have disrupted the lives of millions of people and caused billions of dollars in economic losses[18].

To this record of rising temperature with other responsible factors, aviation industry contributes nearly 2.5% of global Carbon di Oxide emission with most aircraft powered by jet gasoline, resulting inflight burning of fossil fuel which creates a largest impact on Climate followed by the emission produced by ground handling equipment's of private car passenger and staff to travel to and from Airport. The climate effects of aircraft are not just the result of CO2 emissions but also include effects associated with Nitrogen oxide emission, contrail formation and potential influence of contrails on cirrus clouds. These effects are complex with scientific proof, but Aircraft emissions are expected to increase with projected growth and will likely to increase beyond our imagination unless significantly informed mitigation measures are implemented[19].

The IPCC (Climate Change 2022 report) has estimated that the total climate impact of aviation due to these effects is approximately 2.7% times greater than the impact of CO2 alone. IPCC is also of the opinion that aviation is responsible for approximately 2.5% of all humans produced (anthropogenic) CO2 emissions and estimated that aviation's contribution could increase to 5% of the total contribution by 2050.

Conversely, climate change is also affecting Aviation; the main expected impact of climate change on aviation results from changes in temperature, precipitation, storms, sea level, wind, and occurrence of hazardous whether phenomena, changes in the jet streams have impact on the air transport and airport operation as well. Those impacts may include aircraft performance, changes in the structure of demand,

[18]World Meteorological Organization, "State of the Global Climate 2023," online: https://wmo.int/publication-series/state-of-global-climate-2023#:~:text=The%20WMO%20report%20confirmed%20that,ten%2Dyear%20period%20on%20record.
[19]Hannah Ritchie, "Global Aviation Emissions" Our World in Data (August 2023), online: https://ourworldindata.org/global-aviation-emissions#:~:text=While%20aviation%20accounts%20for%20around,other%20atmospheric%20gases%20and%20pollutants.

potential damage to airport infrastructure, airport capacity loss, flight schedule disruption and impact on air traffic safety. The Aviation industry is aware of this fact and is under pressure to reduce the same[20].

To combat the challenges the Aviation industry has adopted the goal of flying green by working on Projects Waypoint 2050 and Fly Net Zero by 2050. Net Zero means cutting carbon emission to a small amount of residual emission that can be absorbed and durably stored by nature and other carbon dioxide removal measures, leaving zero in atmosphere to keep global warming within its limits, the consensus is that the world must limit the global average temperature rise to 1.5 degree Celsius by reducing carbon dioxide emission by 2030 and reaching Net Zero[21].

However, there are some constraints, Net-Zero commitments are not an alternative to urgent and comprehensive emissions cuts. Indeed, Net Zero demands greater focus on eliminating difficult emissions sources than has so far been the case[22]. Net zero is essential, but the need for social and environmental integrity imposes certain constraints on the scope, timing and governance of both carbon dioxide removal and carbon offsets. The socio-political interpretation of net zero is therefore also a rich research agenda, and it will require input from many disciplines, from climate science, biology and geology to anthropology, law and economics. Transitioning to a Net -Zero world is one of the greatest challenges humankinds has faced. It calls for complete transformation of how to produce, consume and move about. Considering the heat wave transformation is indispensable for sustainability[23].

III. The Accountability of Paris Agreement on Parties

Unlike the Kyoto Protocol which only made for reducing greenhouse gas emission for developed countries, Article 2 of the Paris Agreement on climate change, viewed climate change as global problem with an aim to take global initiative invited all countries to commit to the same level of dedication to reduce the overall greenhouse gas emissions synchronizing with science and technology known as “Science based target initiative”. This is a legally binding International Treaty which was adopted by 196 Parties at the UN Climate Change Conference (COP21) in Paris, on 12 December 2015[24].

It aims to strengthen the global response to the threat of climate in the context of sustainable development and holding the increase in the global average temperature below 2°C above preindustrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change; increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in

[20]International Civil Aviation Organization, "Factsheet: Business and Economics" ICAO (2021), online: https://www.icao.int/environmental-protection/Documents/Factsheet%20Business%20and%20Economics%20Final.pdf.
[21]National Grid, "What is Net Zero?" National Grid (2024), online: https://www.nationalgrid.com/stories/energy-explained/what-is-net-zero
[22]Nature Communications, "Net-zero demands greater carbon dioxide removal and carbon offsets" Nature (2021), online: https://www.nature.com/articles/s41558-021-01245-w.
[23]Paul W. Brindley et al., "Global Warming and Climate Change: The Impact on Human Health and the Environment," International Journal of Environmental Research and Public Health, vol. 16, no. 11, 2019, online: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6360453/
[24]World Resources Institute, "Science-Based Targets Initiative" WRI (2023), online: https://www.wri.org/initiatives/science-based-targets.

a manner that does not threaten food production; and making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development. They also urged that this Agreement will be implemented to reflect equity and the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances[25].

The Paris Agreement works on a five-year cycle of increasingly ambitious climate action. Since 2020, countries have been submitting their national climate action plans, known as nationally determined contributions (NDCs). Each successive NDC is meant to reflect an increasingly higher degree of ambition compared to the previous version[26]. To better frame the efforts towards the long-term goal, the Paris Agreement invites countries to formulate and submit long-term low greenhouse gas emission development strategies. The Agreement provides a framework for financial, technical, and capacity building support to those countries who need it, with an affirmation that developed countries should take the lead in providing financial assistance as large scale finance to reduce emission. Although climate change action needs to be massively increased to achieve the goals of the Paris Agreement, the years since its entry into force have already sparked low carbon emission but more countries are establishing carbon neutrality target, zero carbon solution evident in power and transport sector[27].

Article 3 of the agreement provides that as nationally determined contributions to the global response to climate change, all Parties are to undertake and communicate ambitious efforts as defined in Articles 4, 7, 9, 10, 11 and 13with the view to achieving the purpose of this Agreement as set out in Article 2[28]. The efforts of all Parties will represent a progression over time, while recognizing the need to support developing country Parties for the effective implementation of this Agreement. The Paris Agreement provides a framework guiding the global effort for decades to come. It marks the beginning of a shift towards the Net Zero emissions world[29]. Implementation of the Agreement is also essential for the achievement of the Sustainable Development Goal.

IV. The CORSIA and Decarburization of Aviation Industry

The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) is a carbon emission reduction scheme to help reduce the carbon impact of international flights on the environment created by United Nations' International Civil Aviation Organization (ICAO). CORSIA has been implemented into international Aviation and almost all Airlines are required

[25]World Resources Institute, "Science-Based Targets Initiative" WRI (2023), online: https://www.wri.org/initiatives/science-based-targets.

[26]World Resources Institute, "Science-Based Targets Initiative" WRI (2023), online: https://www.wri.org/initiatives/science-based-targets.

[27]World Resources Institute, "Science-Based Targets Initiative" WRI (2023), online: <https://www.wri.org/initiatives/science-based-targets. />

[28]World Resources Institute, "Science-Based Targets Initiative" WRI (2023), online: <https://www.wri.org/initiatives/science-based-targets./>

[29] World Resources Institute, "Science-Based Targets Initiative" WRI (2023), online: <https://www.wri.org/initiatives/science-based-targets./>

to share their annual Carbon dioxide emission. Carbon dioxide emissions from domestic air operations are covered under States' Paris Agreement commitments.

The main goal of CORISA is to encourage the efforts to decarbonize the aviation industry. CORSIA aims to accomplish this with three phases,pilot phase where emission reporting is voluntary lasting from 2021 to 2023, and a first phase where reporting carbon emissions will be mandatory in most states lasting from 2024 to 2026. Next phase starting in 2027 is when all international flights will be subject to offsetting requirements. However, flights to and from underdeveloped countries, small island states, and landlocked developed countries may be exempt from reporting and offsetting under CORSIA[30].

ICAO uses scientific methods to develop measures to address the environmental impact of aviation like Global CO2 standard that regulates fuel efficiency for new aircraft[31]. ICAO member states have an aspiration goal of a 2% annual fuel efficiency improvement. Based on such extensive scientific driven analysis of the aviation sector, in 2016, the ICAO Assembly agreed on the adoption of a global market-based scheme to limit international aviation CO2 equivalent (CO2e),[32] CORSIA requires airline to offset CO2e. Based on impact assessments and scientific available knowledge, CORSIA has been framed to allow offsetting either through credits or through the use of CORSIA Eligible Fuels (CEFs), such that international aviation achieves carbon neutral growth from 2020[33].

CORSIA allows the use of SAFs (i.e., drop-in alternative jet fuels that fulfill a setoff sustainability criterion and are derived from biomass or waste resources), to reduce airlines' carbon offsetting requirements. Under CORSIA, emissions reductions from the use of SAFs are calculated using a life-cycle assessment (LCA) approach, agreed upon at ICAO in 2018. With this agreement, the CORSIA LCA method has become the first internationally adopted approach for the calculation of life cycle GHG emissions of aviation fuels[34].

CORSIA will also seek to reduce the environmental impact created by the aviation industry by, encouraging the development of new technologies to help improve energy efficiency throughout the industry such as with more fuel-efficient aircraft, the development and use of biofuels and making use of other green technologies aiming to reduce carbon emission by 2040[35].

[30]Air Transport Action Group, "CORSIA Explained" Aviation Benefits Beyond Borders (2023), online: https://aviationbenefits.org/environmental-efficiency/climate-action/offsetting-emissions-corsia/corsia/corsia-explained/.

[31]International Civil Aviation Organization, "Environmental Report 2019" ICAO (2019) at 111-115, online: https://www.icao.int/environmental-protection/Documents/EnvironmentalReports/2019/ENVReport2019_pg111-115.pdf.

[32]International Civil Aviation Organization, "Historic Agreement Reached to Mitigate International Aviation Emissions" ICAO (2016), online: https://www.icao.int/Newsroom/Pages/Historic-agreement-reached-to-mitigate-international-aviation-emissions.aspx.

[33]Rokaya, A., M. B. Shrestha, and N. B. Karki, "Multi-Objective Optimization of the Parameters of Hybrid Renewable Energy Systems Using a Modified Genetic Algorithm," MDPI (2022), Sensors, 12(22), online: https://www.mdpi.com/2076-3417/12/22/11818.

[34]Schwerdtle, P. N., M. M. Milani, and H. A. Caruso, "The role of energy efficiency and renewable energy in achieving the 1.5°C climate goal," ScienceDirect (2022), Renewable and Sustainable Energy Reviews, online: https://www.sciencedirect.com/science/article/pii/S1364032121006833.

[35]Aviation Benefits: Offsetting Emissions—CORSIA Explained," Aviation Benefits, 2024, online: https://aviationbenefits.org/environmental-efficiency/climate-action/offsetting-emissions-corsia/corsia/corsia-explained/.

CORSIA will Support the Paris Agreement and sustainable development goals in line with United Nations SDGs as a global effort. The countries that agree to participate in CORSIA are subject to few procedures like airlines will be asked to monitor and share their carbon emissions for international flights, they must follow a baseline and limit emission by following a methodology that is, if the participating countries in CORSIA exceeds an emission threshold, they will be required to offset their emission with a carbon offsetting Projects. These carbon offsets or carbon credits would need to be approved by ICAO for the participating airline or country to be in accordance with the standards presented by CORISA[36].

V. The Ground Plan to achieve Net Zero by 2050

The Aviation industry is trying to reduce CO2 emission approximately 1.8 gigatons in 2050 (International Air Transport Association, IATA 2021) and one of the embryonic ideas is 65% of the total target CO2 reduction is by using Sustainable Aviation Fuels (SAF)[37]. SAFs are liquid fuel that can reduce CO2 emissions by up to 80%. It can be produced from several sources (feedstock) including waste fats, oils and greases, municipal solid waste, agricultural and forestry residues, wet wastes, as well as non-food crops cultivated on marginal land. They can also be produced synthetically via a process that captures carbon directly from the air[38].

SAFs can be considered 'sustainable', as their feedstock's do not compete with food crops or output, nor require incremental resource usage such as water or land clearing, and more broadly, do not promote environmental challenges such as deforestation, soil productivity loss or biodiversity loss[39]. Whereas fossil fuels add to the overall level of CO2 by emitting carbon that had been previously locked away, SAF recycles the CO2, which has been absorbed by the biomass used in the feedstock during its life. SAF is much more expensive than conventional Jet Fuel. The aviation industry's Net-Zero carbon emissions target is focused on delivering maximum reduction in emissions at source, using sustainable aviation fuels (SAF), innovative new propulsion technologies, and other efficiency improvements (such as improvements to air traffic navigation). The largest acceleration is expected in the 2030s as policy support becomes global[40].

All Airbus aircraft can fly on a maximum 50% blend of SAF and Conventional Fuel. However, by 2030, all our aircraft and helicopters will be capable of flying with up to 100% SAF. As production expands SAF will

[36]Aviation Benefits: Offsetting Emissions—CORSIA Explained," Aviation Benefits, 2024, online: https://aviationbenefits.org/environmental-efficiency/climate-action/offsetting-emissions-corsia/corsia/corsia-explained/.
[37]IATA, Fact Sheet: Alternative Fuels," International Air Transport Association, 2024, online: https://www.iata.org/en/iata-repository/pressroom/fact-sheets/fact-sheet---alternative-fuels/
[38]IATA, Fact Sheet: Alternative Fuels," International Air Transport Association, 2024, online: https://www.iata.org/en/iata-repository/pressroom/fact-sheets/fact-sheet---alternative-fuels/

[39]IATA, Fact Sheet: Alternative Fuels," International Air Transport Association, 2024, online: https://www.iata.org/en/iata-repository/pressroom/fact-sheets/fact-sheet---alternative-fuels/
[40] IATA, Fact Sheet: Alternative Fuels," International Air Transport Association, 2024, online: https://www.iata.org/en/iata-repository/pressroom/fact-sheets/fact-sheet---alternative-fuels/

likely be able to compete on price, it requires collaboration between governments, industry, and regulators on a global scale.

Another 13% are to be the new propulsion technology improvements e.g. liquid Hydrogen technology introduction. The improvement in powertrain efficiency may result in another 3%, the rest by carbon capture and storage and other emerging solutions. The actual percentage distribution and target achievement will depend on which solution is most cost effective at any given time as per (IATA 2021)[41].

A growing coalition of countries, cities, businesses, and other institutions are assuring to get to net-zero emissions, most of the developed countries have set NZE covering about 88% of the target. To keep global warming to no more than 1.5°C – as called for in the Paris Agreement– emissions need to be reduced by 45% by 2030 and reach net zero by 2050.Achieving net-zero carbon emissions by 2050 will require substantial investment and financing and concrete means of implementation for developing countries and States having particular needs[42].

In this regard, ICAO has already launched its Assistance, Capacity-building, and Training for Sustainable Aviation Fuels (ACT-SAF) program[43] to provide support to States on SAF development and to facilitate partnership and cooperation around the world. While agreeing on the 2050 aspirational goal, States and the industry have been implementing the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), which complements aviation's CO2 reduction measures to achieve the ICAO aspirational goal of carbon neutral growth from 2020. Despite the challenges of the pandemic, the implementation of CORSIA continues to be on track, in accordance with its established timeline.

Air Transport Action Group which is a non-profit association that fosters collaboration on issues of concern for Aviation society (ATAG) is working on Project Waypoint Report and explores how the sector could achieve net-zero CO2 emissions by 2050, with the support of governments and the energy industry. The initial Waypoint 2050 work was conducted in 2019 and 2020 among 70 aviation sector experts, led by ATAG, to explore how a long-term climate goal could be reached. It analyzed traffic forecasts and the role of technological operations.

In 2021, ATAG furthered the work of Waypoint 2050[44] and released an update to the report. This included the latest traffic and fleet data and an assessment of how the sector could achieve net-zero aviation by 2050. The report explores several potentials for decarbonization of Air transport, for example, pushing Technology Operation, Aggressive Sustainable Fuel development, aspirational and aggressive technology perspective.

[41]IATA, Fact Sheet: Alternative Fuels," International Air Transport Association, 2024, online: https://www.iata.org/en/iata-repository/pressroom/fact-sheets/fact-sheet---alternative-fuels/

[42]Net-Zero Coalition," United Nations, 2024, online: https://www.un.org/hi/node/134483#:~:text=Yes%2C%20a%20growing%20coalition%20of,about%2088%25%20of%20global%20emissions.

[43]Action Plan for Aviation Carbon Neutrality," International Civil Aviation Organization, 2022, online: https://www.icao.int/environmental-protection/Pages/act-saf.aspx#:~:text=On%201%20June%202022%2C%20the,further%20efforts%20for%20decarbonizing%20aviation.

[44]Waypoint 2050," Aviation Benefits, online:< https://aviationbenefits.org/environmental-efficiency/climate-action/waypoint-2050/>.

For each of the scenarios, offsets (mainly in the form of carbon removals by 2050) will be needed to compensate for any remaining shortfall in emissions above the goal[45].

The ICAO Assembly also reaffirmed the continuous commitment of States to implement CORSIA, while putting in place necessary adjustments to the CORSIA baseline and other design elements for future phases, with a view to maintaining the necessary and delicate balance among the design elements, as well as the scheme's integrity and level of ambition. ICAO will continue to follow up on further developments related to Article 6 of the Paris Agreement, particularly any implications for CORSIA[46]. ICAO remains fully committed to leading the sector's efforts towards supporting the temperature goal of the Paris Agreement[47]. The future of air travel lies in sustainable practices, resilient airport technologies, and a collective commitment to environmental responsibility. To achieve the target of NZE, ICAO and its Member States will work together with industry, civil society, and other stakeholders to strive to achieve this collective long-term goal, while recognizing that each State's special circumstances and respective capabilities will inform the ability of each State to contribute within its own national timeframe to match up with Paris agreement[48].

Over the last two years, the ICAO Committee on Aviation Environmental Protection (CAEP) undertook its technical work on the feasibility study on LTAG focusing on the attainability and readiness of aviation in-sector CO2 reduction measures, including innovative aircraft technologies, operations, and fuels, as it would be necessary to assess the in-sector CO2 reduction potentials before considering the need and extent of any complementary measure[49].

There are also options to focus on airports' greening. These met the latest sustainability criteria reduce impacts of airport activities on the environment and mitigate the impacts of climate change on related facilities and operations[50]. The Green Airports initiative should not only focus on the reduction of emission produced because of airport operations but also on other environmental and even social issues. Airport greeting has potential to contribute to the transition to neutral air transport from the point of view of greenhouse gas production by 2025[51].

The theme of green airport deals with innovative concepts and solutions for airports with the aim of rapidly reducing greenhouse gas emission from air transport and improving their resilience against climate change.

[45]Waypoint 2050," Aviation Benefits, online: https://aviationbenefits.org/environmental-efficiency/climate-action/waypoint-2050/.
[46]World Bank, "What You Need to Know About Article 6 of the Paris Agreement," World Bank, 17 May 2022, online:< https://www.worldbank.org/en/news/feature/2022/05/17/what-you-need-to-know-about-article-6-of-the-paris-agreement>.
[47]International Civil Aviation Organization (ICAO), "COP28: ICAO's 2023 Progress Report on Environmental Initiatives," ICAO, 2023, online: <https://www.icao.int/Newsroom/Pages/coP28.aspx>.
[48]International Civil Aviation Organization (ICAO), "ICAO Statement to the SBSTA 57," ICAO, 2022, online: https://www.icao.int/environmental-protection/Documents/SBSTA57_ICAO%20Statement_Final.pdf.
[49]International Civil Aviation Organization (ICAO), Proposals for a Long-term Global Aspirational Goal for International Aviation, WP/368, 41st ICAO Assembly, 2022, online: https://www.icao.int/Meetings/a41/Documents/WP/wp_368_en.pdf.
[50]Airports Council International Asia-Pacific (ACI Asia-Pacific), Green Airports Recognition 2022: Carbon Management,2022,online:<https://www.aciasiapac.aero/f/library/3198/Green%20Airports%20Recognition%202022%20-%20Carbon%20Management.pdf/>
[51]Airports Council International Asia-Pacific (ACI Asia-Pacific), Green Airports Recognition 2022: Carbon Management,2022,online:<https://www.aciasiapac.aero/f/library/3198/Green%20Airports%20Recognition%202022%20-%20Carbon%20Management.pdf/>

In case of green airports, it is necessary to achieve reducing of greenhouse gas production in most of activities carried out on the airport area. Type of fuel change is also a valuable tool for emission reduction[52].

Airbus has the ambition to develop and build the world's first commercial aircraft powered by hydrogen fuel. Airbus project zero is investigating various configurations and hydrogen technologies that are potentially contributing to greenhouse gas emission reduction in their aviation industry. As part of this project the possibility of converting a classic turbine engine to an engine that burns liquid hydrogen will be investigated as well (AIRBUS, 2021)[53]. Another option is electric motors. Electric motors are more efficient than integral combustion engines and require much less maintenance as the high heat and friction of combustion chambers and pistons are replaced by coiled wires and magnets.

Conclusion

Climate change is one of the most complex issues facing us today which involves lot of dimensions like, science, economics, society, politics, moral and ethical questions, and is a global problem. Around the world, millions of people of all ages are trying to find solution for climate change to save the earth and make earth a better place to live in, countless along with indigenous peoples are most severely affected by both the cause and effects of climate change which makes their life difficult as they are often on the frontline facing different problems.

With just six years remaining, we are off track to meeting the call for The Paris Agreement on climate change to limit the global temperature to 1.5 degree Celsius. And the research reports reveal that the responsibility lies with the Aviation Industry and anthropogenic activities that are responsible for climate change throughout decades.

Identified that Aviation Industry as a significant accomplice to increase the temperature and will continue to increase with the projected growth of aviation. The aviation sector is growing fast and will continue to grow. The most recent estimates suggest that demand for air transport will increase rapidly over the next 20 years. If this growth path is achieved by 2036 the air transport industry will then contribute huge job opportunities and will contribute to GDP in trillions. It is very difficult to manage time without aviation, the industry provides rapid worldwide transportation network, generating growth and creating jobs and facilitated tourism. The industry is also being recognized by the international community as an enabler in achieving the United Nations sustainable Development Goal.

In Goal 13 of the 2030 agenda, we find special mention of integrating climate change measures into national policies, strategies and planning, and improve education and awareness -rising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning. To implement the

[52]Airports Council International Asia-Pacific (ACI Asia-Pacific), Green Airports Recognition 2022: Carbon Management,2022,online:<https://www.aciasiapac.aero/f/library/3198/Green%20Airports%20Recognition%202022%20-%20Carbon%20Management.pdf/>

[53]Airbus, Innovative Aviation Liquid Hydrogen Project Launched, 25 May 2024, online: <,https://www.airbus.com/en/newsroom/press-releases/2024-05-innovative-aviation-liquid-hydrogen-project-launched>.

same the state parties must take urgent action to make policies, planning and strategies and set up awareness programs and incorporate the same in their respective national policies.

In achieving Net Zero Emission by 2050 several effective steps are already taken of which the more effective one is the use of Sustainable Aviation Fuel which can help to reduce emission and can help to meet the target. SAFs could play a major role in contributing to reducing aviation sector's GHG emissions. An arrangement of Sheffield Universities Sustainable Fuels innovation Centre (SAF-IC) , a research facility is set up to allow synthetic fuels to be prepared and evaluated on a small scale before being put to a large scale.

Seeking international agreements is a complex task, and further effort will have to be spent to enhance harmonization with other regional and/or national schemes. The CORSIA method can serve as a template for other transportation sectors that are globally connected. Immediate Green flying may not be possible, but research is on so that the target of NZE can be achieved at the earliest as ICAO is steadily following up on various developments, with the extensive work associated with the feasibility of a long-term goal.

So, Aviation Industry must undergo changes to reduce the impact on the environment and the opposite of the same is also true. Aviation is a global industry and requires global solutions. Any environmental measures affecting aviation should be consistent with policies developed collaboratively by the 190 states Parties to the Chicago Convention through ICAO (International Civil aviation Organization). Transitioning to a net - zero world target by 2050 is no doubt challenging, and flying with green wings is time consuming as it calls for major technical and non-technical changes with huge financial support backed by the Government of the respective countries to support aviation Industry for Flying with green wings.