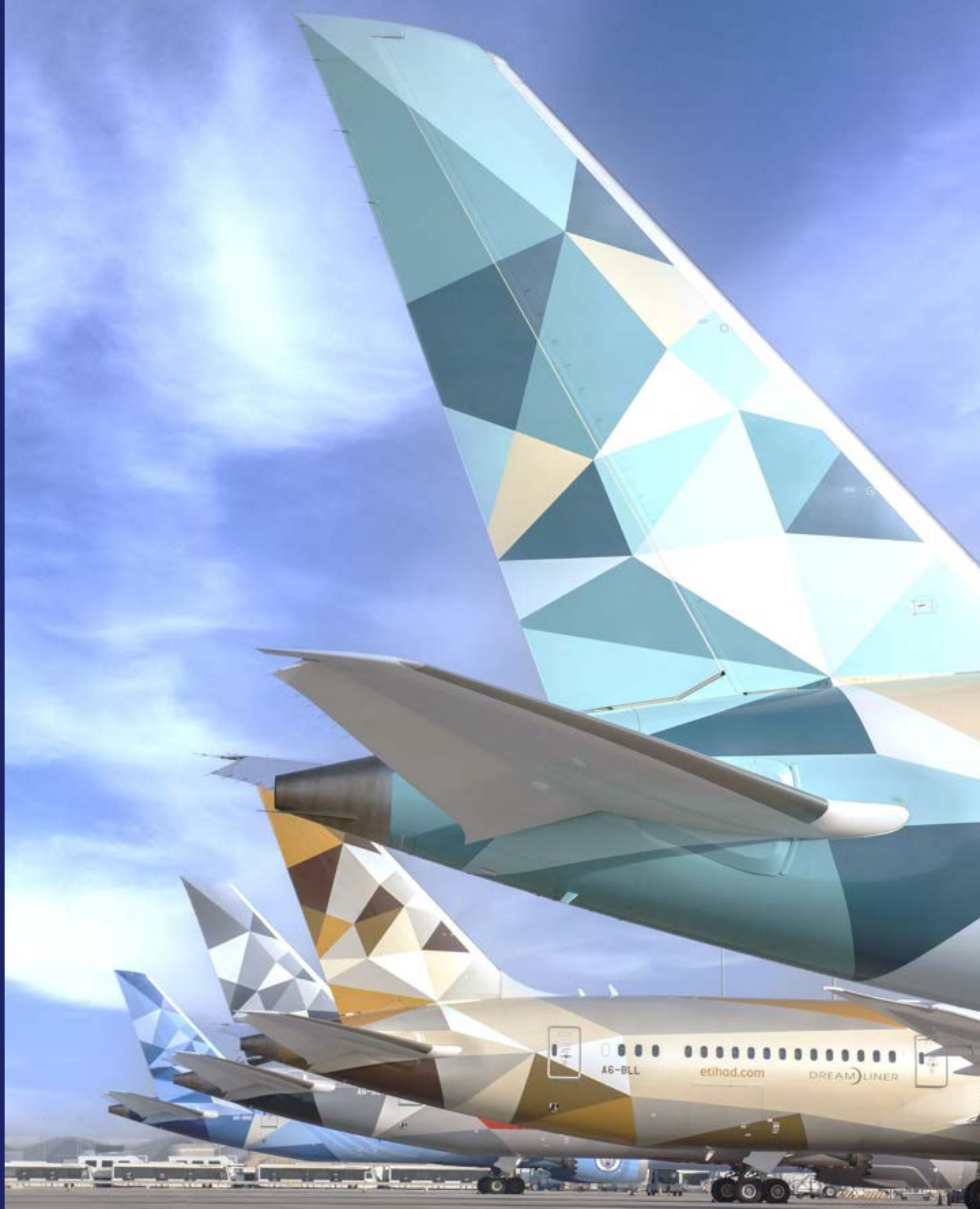


Etihad Airways Sustainability Report 2022

A million little things





Etihad Airways *Abu Dhabi* United Arab Emirates

Dear reader,

Etihad Airways, the national carrier of the UAE, has been operating from its home base in Abu Dhabi since November 2003. In 2022, Etihad connected to 68 destinations across 45 countries with a fleet of 71 Boeing and Airbus aircraft and led an extensive sustainability strategy focused on enabling industry wide transformation.

The purpose of this report is not simply to publish the accomplishments in sustainability for Etihad. It has been produced to keep us accountable and demonstrate transparently the duty we have to the environment for the impacts we are responsible for. We hope to share our learnings on the journey toward sustainable aviation as we endeavor to explore and trial viable solutions. Our position on topics in aviation sustainability aim to inform our peers in the hopes of making progress collectively; driving home the value of knowledge sharing and collaboration.

Throughout this document, the hope is that the insight offered can allow the reader, whatever their background, to understand our mission and think critically about what opportunities we may have missed, what ideas we haven't tried, and what challenges we must overcome.

This report should be read by anyone, anywhere, hoping to make a valuable and meaningful difference in the world. We certainly hope to humbly inspire the idea that change comes as the result of all minds thinking as one, relentless collective action, and an enduring belief in the goal.

We commit to leaving no stone unturned, commit to our call to arms and commit to celebrating the efforts of our peers both inside and outside the industry.

Etihad will, as it must, continue on this path.



Antonoaldo Neves

Group Chief Executive Officer



Table of Contents

Etihad	2022 Facts & Figures	4
Sustainability	Principles of Sustainability	5
	Outlining Sustainability	6
	Reporting Sustainability	7
	Measuring Sustainability	9
	Drivers of Sustainability	10
	Aligning Sustainability	11
	2050: Net Zero	12
	Etihad Sustainability – The Journey So Far	14
	Etihad Greenliner Programme	15
Sustainable Aviation Fuel	Sustainable Aviation Fuel	16
	An Un-Sustainable Solution?	17
	Solution Driven	18
	Book & Claim	19
	Testing Sustainability	20
	Etihad EY130 Net Zero Flight	22
For the World	Fleet	25
	Fuel Efficiency	27
	Guest Experience	29
	Innovation	30
	Biodiversity	32
	Conscious Choices	34
	On the Ground	35
Positioning	Benefits of Aviation	36
	The Power of Words	37
	For the World	38
Annex	Scope of Report	40
	References	41

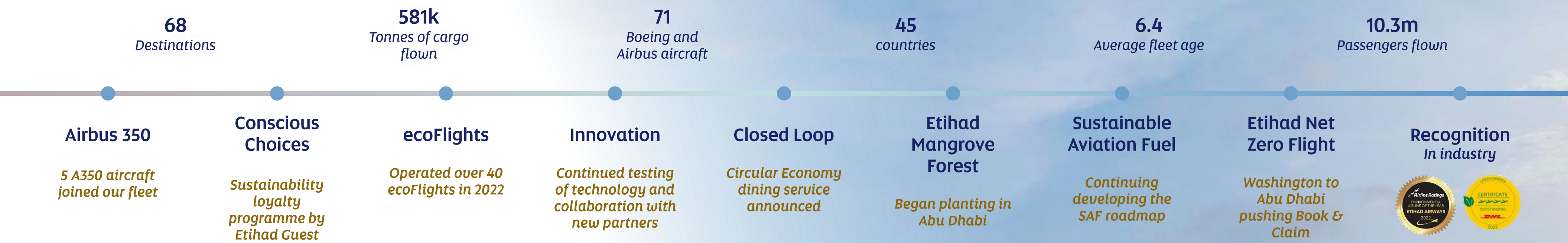


Etihad 2022

Established in **2003**, Etihad Airways is the national carrier of the **United Arab Emirates**.

Etihad connected the capital city **Abu Dhabi** to **68** destinations in 2022.

Operating **71** aircraft, the fleet is one of the **youngest in the world**, with an average age of **6.4** years.



Sustainability

FROM ABU DHABI *for* THE WORLD

Etihad is committed to achieving high standards of sustainability, aligned with global frameworks and the goals of the United Arab Emirates. Aiming to continually demonstrate excellence in sustainability under the banner of the UAE, Etihad proudly represents the Emirate of Abu Dhabi.

We are committed to maintaining thought leadership in innovation and sustainability. Etihad's strategy is built upon expertise gathered from partners, industry peers, experience, critics and local and global government policy.

With sustainability central to Etihad's long-term vision and strategy, and as a thought-leader in that space, Etihad reflects and bolsters the UAE Government's national efforts for humanitarian and environmental stewardship in its strategy.

For Etihad, "Sustainability" refers to the effort to reduce the impact of aviation on the environment through the pursuit of the four pillars: Decarbonisation, Waste Management, Biodiversity and Wildlife and Advocacy and Innovation (as defined in "Outlining Sustainability") while maintaining the ability to fulfil our obligations as a business.

Our Principles

- Achieve majority of emissions reductions through in-sector measures
- Align with industry voluntary roadmaps and frameworks
- Collaborate with UAE industrial ecosystems to maintain thought leadership
- Remain transparent and proactive in sustainability issues
- Continually develop strategic roadmap for targets

Our Objectives

- Achieve Net Zero by 2050
- Ensure economic viability in sustainability roadmaps toward 2050 target
- Create initiatives which positively contribute to guest experience and engagement
- Involve supply chain partners in roadmap through innovation and collaboration
- Support UAE and Abu Dhabi wildlife and biodiversity

Decarbonisation



Waste Management



Biodiversity and Wildlife



Advocacy and Innovation



Pillars	Decarbonisation	Waste Management	Biodiversity and Wildlife	Advocacy and Innovation
				
Sustainability Criteria	Initiatives which: - Reduce Etihad Airways carbon and greenhouse gas emissions directly - Reduce Etihad Airways reportable emissions through approved and monitored industry schemes May include initiatives which: - Can offer a direct reduction of emissions, or the potential reduction of emissions if the initiative matures (exploratory initiatives) - In-sector indirect emissions reductions Does not include initiatives which: - Reduce emissions from non-reportable scope areas - Cannot reduce emissions directly from Etihad's operations	Initiatives which: - Reduce single-use plastics and waste production directly - Support the streamlining of waste management processes - Reduce waste production through approved and monitored industry schemes May include initiatives which: - Reduce waste production and improve waste management not directly associated with Etihad - Reduce associated with excess consumption (if not directly reported as Etihad waste) Does not include initiatives which: - Cannot be proven to reduce waste (whether for lack of data, third party validation or otherwise)	Initiatives which: - Maintain compliance to Animal Welfare policies and other policies by Etihad - Improve environmental biodiversity by promoting and aligning with the environmental goals of the government of the UAE and globally - Reduce pollution impact by entities/persons other than Etihad (even if on behalf of) - Improve Etihad Airways biodiversity standards directly Does not include initiatives which: - Cannot be aligned to an internal or external policy, industry practice or other scientific method - Cannot be vetted in a robust and traceable way - Cannot be proven to improve areas under Etihad's influence	Initiatives which: - Focus on ESG trust building and improve compliance credentials of Etihad or its partners - Support initiatives with the intention of accelerating roadmaps - Improve reporting capability or secure accreditations or certifications for Etihad and its partners - Support reducing emissions from non-reportable scope areas - Demonstrate alignment, effort or participation with/in global targets Does not include initiatives which: - Do not align with the sustainability messaging of Etihad - Contradicts efforts in other spaces and cannot be accurately justified - Cannot be proven to improve supply chain or areas under Etihad influence

Governance

Organisation & Structure

An executive mandate to incorporate sustainability into organisational goals, cascading through every division, department, and individual employee.

Representation and Reputation

The airline has established a dedicated Sustainability Department responsible for coordinating the efforts of the entire organisation and representing the airline externally.

Comprehensive and Thorough

Encourage participation from external companies to work alongside Etihad in the exploration of opportunity, focused on the value of knowledge sharing to support the sustainability journey.

Collaborative and Innovative

The airline deploys several public-facing “brands” (such as Etihad Mangroves and Conscious Choices) to explore the technical and guest-focused opportunities. Combined efforts to identify the million little things that the entire ecosystem can affect for industry wide change.

Behaviours

“Sustaining Sustainability”

Responsible and Strategic

Supporting Etihad to fulfil other business objectives and develop viable sustainability transformation. This must be done to secure the long-term, meaningful integration of sustainability to reach Net Zero, and beyond.

“Managing Sustainability”

Deliberate and long Term

Ensuring initiatives are strategically planned and contribute to long term goals, and consider long-term opportunities/risks. Initiative lifecycle assessments must be done to maximise all environmental benefit possible.

“Protecting Sustainability”

Transparent and Trustworthy

Maintaining the governance required to remain resilient, act with integrity and honesty in all sustainability related efforts. To be held accountable, gain expertise and educate within the ecosystem.

“Corporate Sustainability”

Compliant and Aligned

Acting in full alignment to core divisional objectives (Safety, Service, Cost). Diversion from core company priorities will inevitably a) deter from genuine sustainability transformation and b) place any long-term strategy at risk.

Etihad Aviation Group

Etihad Airways Carbon Footprint

2019-2022 CO₂ emissions

TONNES CO₂/YEAR

SCOPE	SOURCE	UNIT	CONVERSION	2019	2020	2021	2022
1	Actual Aircraft Fuel Burn	kg	3.15tCO ₂ /tfuel	9,014,084	4,207,328	4,215,343	5,039,313
	Ground Vehicle	litre	2.7kgCO ₂ /litre	8,426	8,620	2,570	2,293
2	Property electricity – Stage 1	kWh	0.424kgCO ₂ /kWh	12,386	11,132	11,269	7,331
	Property electricity – Stage 2*						15,894
	Property district cooling water – Stage 1	kWh	0.615kgCO ₂ /kWh	9,673	8,505	9,352	12,708
	Property district cooling water – Stage 2*						31,100
	Property potable water – Stage 1	m ³	8.85kgCO ₂ /m ³	678	566	691	607
	Property potable water – Stage 2*						2,924
3	Waste to landfill – Stage 1	kg	487kgCO ₂ e/tonne	62,952	43,923	71,367	64,557
	Waste to landfill – Stage 2*	kg	487kgCO ₂ e/tonne				108,542.56
	Transport – Stage 2*	litre	2.7kgCO ₂ /litre				2293
Total Tonnes (CO ₂)				9,108,199	4,280,074	4,310,592	5,287,563

*Data displayed has been divided into Stage 1 and Stage 2 sources. Stage 1 relates to those which are consistent with previous year data reporting, while Stage 2 relates to additional sources added through enhanced data collection and reporting. Page 8 details the distribution of these sources.

Etihad uses fuel management systems to monitor and report fuel consumption after which the relevant conversion methodologies are followed for emissions reporting. Conversion methodology for fuel to CO₂ emissions is calculated as per the CORSIA¹ framework. The data published here is the airline's overall emissions without the exclusions which are applied through other emissions trading schemes; such as humanitarian flights or those to certain developing countries and is internally verified. Our fuel burn data is verified through internal and external audits which is a mandatory requirement for various emissions trading schemes and CORSIA.

Reporting on areas of environmental and sustainability impact is continually developed and with introduction of new reporting standards, industry and global frameworks and enhanced knowledge in the topic we aim to continually improve our reporting capabilities in accordance. Demonstrations for areas in which reporting has been enhanced is most visible in Scope 3 emissions. In 2022, Etihad made deliberate efforts to further the data and reporting processes.

Business Data

	2021	2022	Change
Flights	43,794	55,418	+27%
Passengers carried	6.8M	10.3M	>190%
Freight carried (tonnes)	729K	581K	-20%
Available Seat Kilometers		56 billion	+50%
Load factor		81.9%	+42pp
Carbon Intensity (g/RTK)	585	483	-17.4%
Operating Fleet			
A320 Family	15	15	-
A350 Family	0	5	+5
B787 Family	39	39	-
B777 Family	8	7	-1
B777 – Freighter	5	5	-
Total operating fleet	67	71	+4
Average operating fleet age	5.7yrs	6.4yrs	+.7
% Next Generation Aircraft	58%	62%	+5

Etihad Aviation Group

Etihad Airways Environmental Data

Site – Energy Consumption

Tonnes CO₂e

	Stage	Electricity	District Cooling	Potable Water
Offices, Training, Operational Buildings				
Etihad Headquarters Complex	1	4,538	6,999	469
Etihad Airways Centre	1	1,376	3,716	73
Etihad Crew Briefing Centre	1	1,121	N/A	54
Etihad Airways Plaza	1	296	1,993	11
Etihad Airways Plaza	2	2,991	1,980	48
Etihad Aviation Training	2	179	N/A	1
Etihad Warehouse	2	579	N/A	8
Residences				
Al Forsan	2	3,418	4,187	662
Masdar (1&2)	2	4,452	12,826	1,043
Etihad Plaza	2	4,275	31,100	2,924

Site – Waste

Tonnes CO₂e

Transport – Road

Tonnes CO₂e

	Stage	Waste	Stage 2	Net emissions
Etihad Headquarters Complex	1	64,556.72	Net transport data	2,293
Etihad Crew Briefing Centre	2			
Etihad Plaza	2	108,542.56		
Masdar (2)	2			

- Etihad Headquarters Complex includes the airlines' main offices, the Etihad Training Academy and car parking.
- Etihad Plaza is a large development with over 600 apartments, two medical centers, Etihad uniform store, retail spaces and two operational office functions. There are over 600 apartments housing over 2,000 shift employees.
- Where N/A is listed for District Cooling, these sites use alternative means of chilling, and the consumption data is included under Electricity.

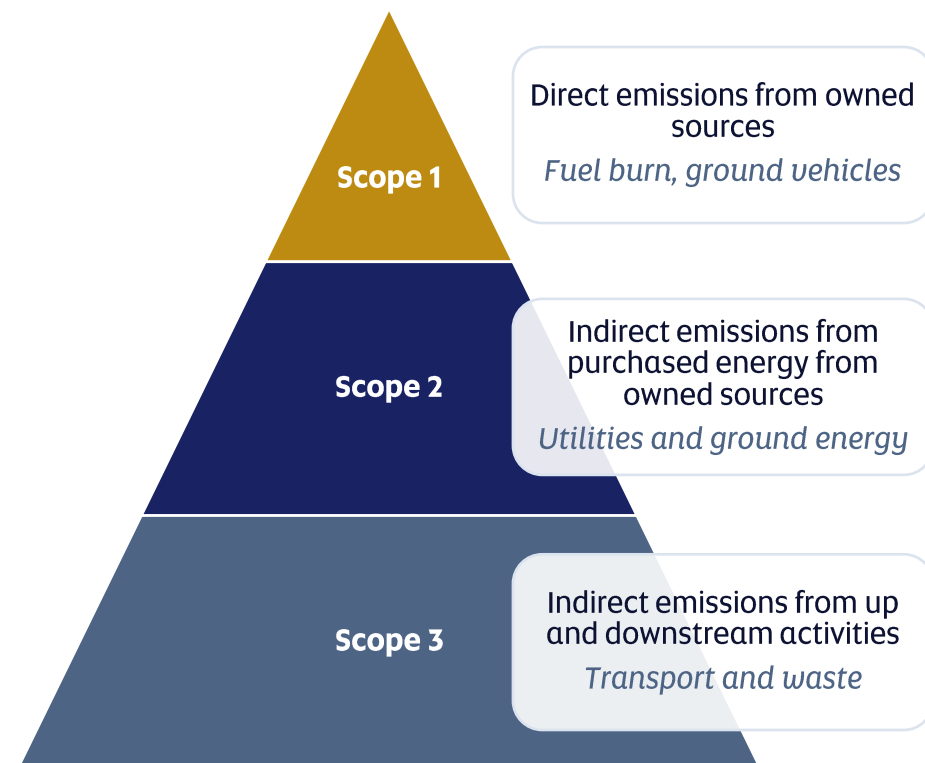
Additional sites, such as Airport facilities and Sales offices are under the control of the respective landlords.





Measuring Sustainability

Etihad's emissions reporting includes Scope 1, 2 and 3 (figure 1, below). Aircraft fuel burn and ground vehicles are comprised under Scope 1, utilities and ground energy consumption in Scope 2, followed with Scope 3 emissions of downstream activities (such as waste).



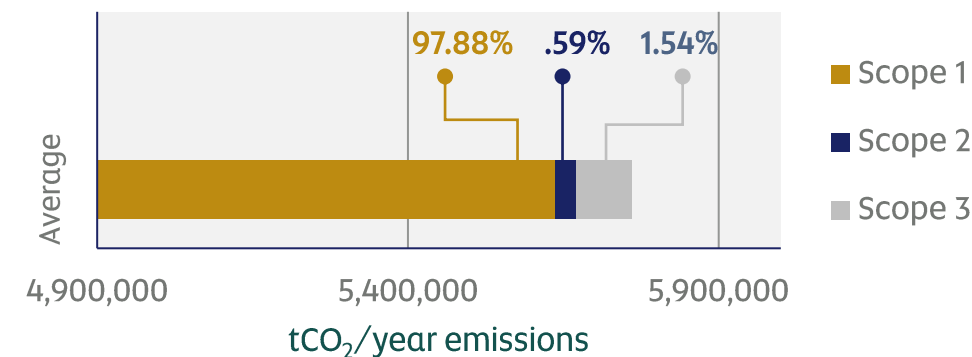
Scope 1, 2 and 3 – Figure 1

Reporting in each scope is based on Greenhouse Gas Protocol Standards², however as mentioned in 'Reporting Sustainability', we continually develop our reporting of the activities within each scope, and do not yet have an existing, comprehensive inventory of all activities.

This means while the split between scope 1, 2 and 3 emissions is not exact, a clear trend is evident (figure 2, 2.1).

It is important to note the significant reduction of emissions between 2019 and subsequent years is due to the industry wide impact of Covid-19 on travel.

Average Etihad Airways Carbon Emissions – Figure 2

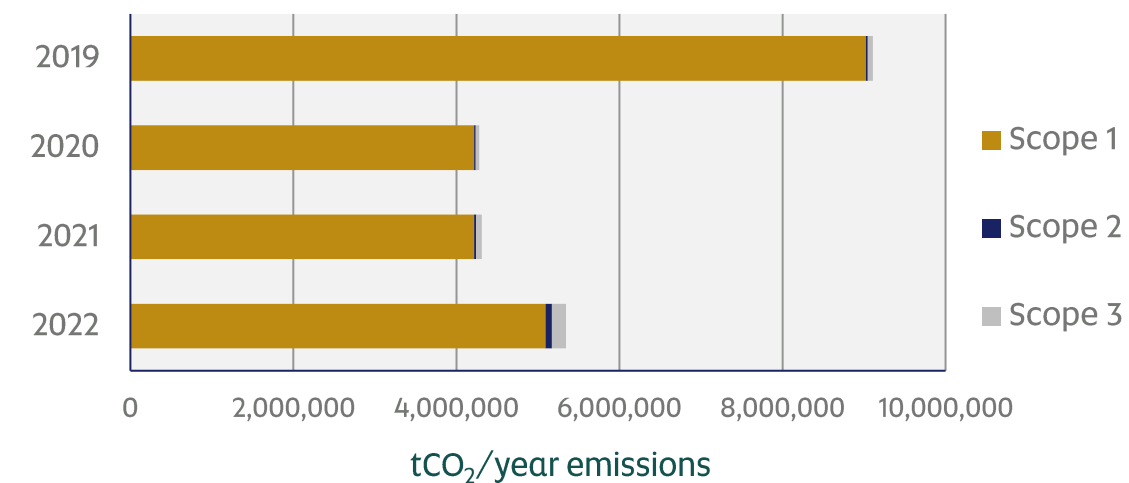


Carbon Emission Scope Distribution – Figure 2.1

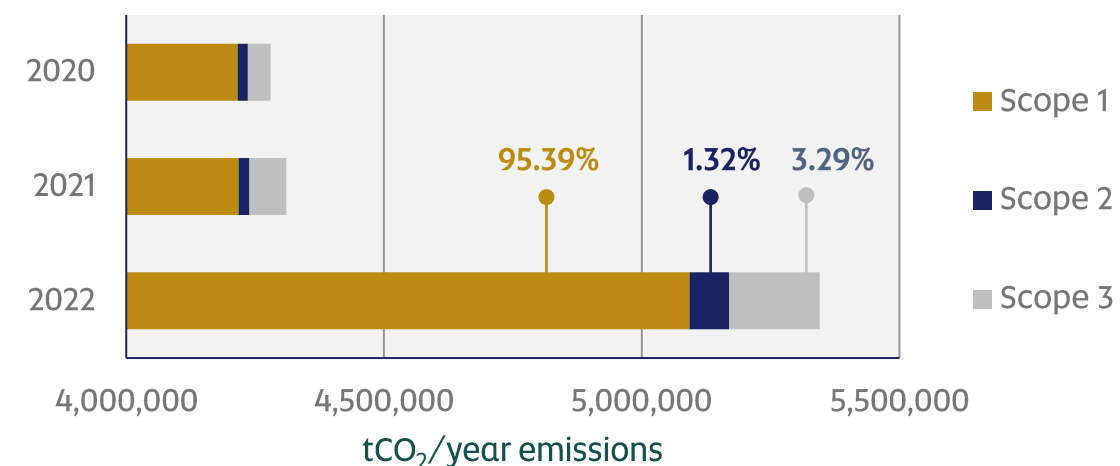
	Scope 1	Scope 2	Scope 3
2019	99.06%	0.25%	0.69%
2020	98.50%	0.47%	1.03%
2021	97.85%	0.49%	1.66%
2022	95.39%	1.32%	3.29%
Average	97.88%	.59%	1.54%

To better understand this distribution, 2020, 2021 and 2022 emissions are magnified (below, figure 3, 4). This demonstrates the vital importance of focusing on operational improvements, such as aircraft efficiency, alternative fuels, electrification, and so on, to target the Scope 1 emissions of aviation.

Emissions trends, all years – Figure 3



Focus 2020-2022 Emissions – Figure 4



This sheds light on where priority must be placed; it is certainly aspirational to achieve reductions in Scope 2 and 3 for the airline, but it is evident that this will have minimal impact on the airlines overall emissions reporting, and therefore plays into decision-making factors for best use of time, effort, or investment to output.

While the importance of initiatives which target Scope 1 reductions is clear, Etihad has deployed a number of brands which target more humanitarian and social elements of sustainability, such as Conscious Choices and Etihad Mangroves.

This is done in an attempt to ensure the encompassing nature of the strategy. If it is possible to encourage conscious and sustainable behaviors among travellers both when flying and in their day-to-day lives, while activating and building momentum around initiatives which could secure progress toward Scope 1 reductions, these innovations and consumer initiatives combined will offer the best chance to reach these goals.



As outlined in 'Aligning Sustainability' (page 11), frameworks are in place to ensure the setting of meaningful and deliberate targets, support the implementation of realistic roadmaps and measurement against strategic indicators.

With the goal to reduce overall emissions, industry specific frameworks are designed to make sure efforts in reduction are not detrimental to the operating capability of the airline.

One of the ways this is done with measures of efficiency which allow long term reduction strategies that are resilient against business growth or change. For aviation, this is 'CO₂ per RTK' or 'Carbon Intensity'.

Carbon Intensity – CO₂ per RTK

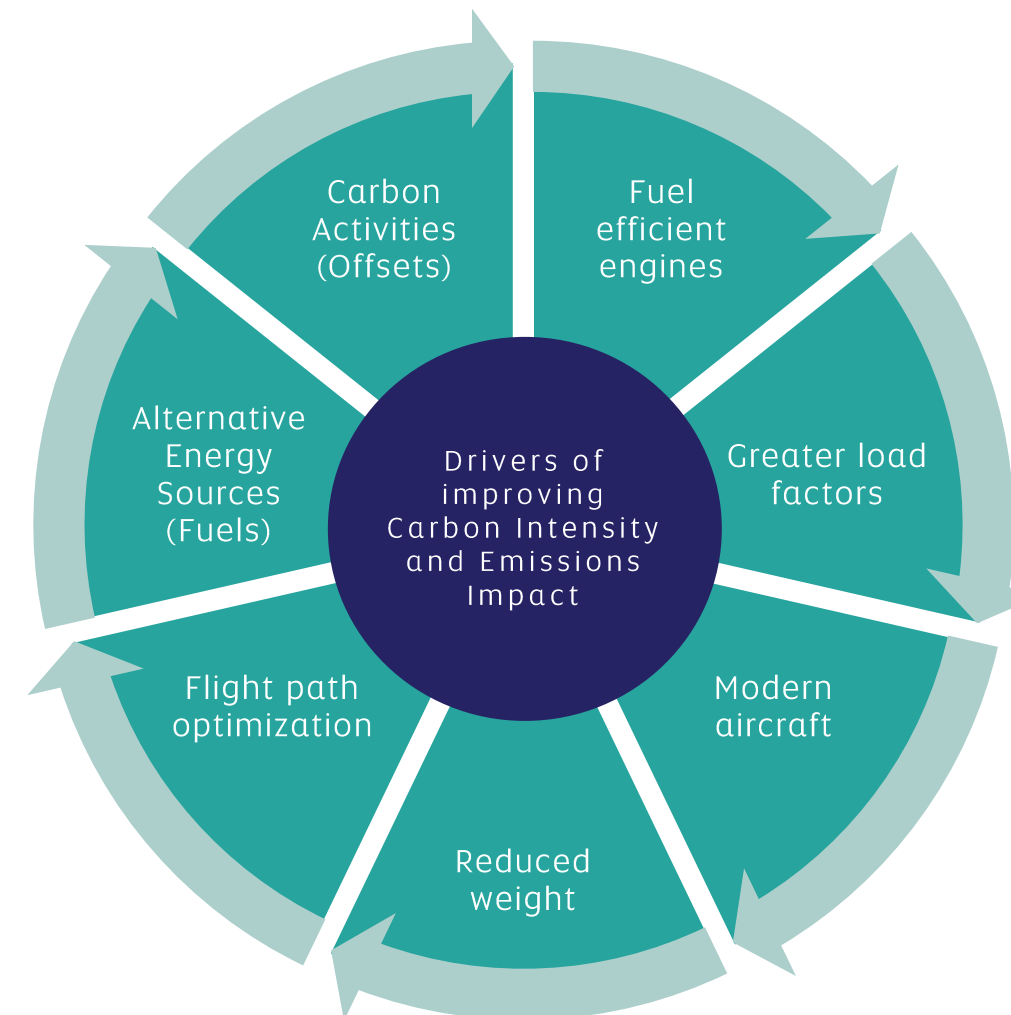
Carbon Intensity is a KPI measuring the efficiency of our operations against fuel usage. Tracking the evolution of the CO₂ intensity of our operations is essential to assess the impact of network planning decisions, operational efficiency measures, market conditions and policy frameworks on the overall sustainability credentials of Etihad.

Etihad has ensured it can remain consistent in environmental reporting by including this as the key performance indicator in securing ESG loans (page 11).

CO₂ per RTK refers to the volume of CO₂ released against the volume of energy produced to move one metric tonne one kilometer – in these terms, efficiency is ensuring the fuel used is maximised. CO₂ (Carbon Emissions) produced per RTK (Revenue Tonne Kilometer) – the value measure of overall carried volume.

In tandem with efforts to reduce overall emissions, the use of alternative fuels with lower GHG footprints or more efficient aircraft can help with carbon intensity.

Drivers to improve carbon intensity and emissions impact – Figure 5



Aligned with SBTi Sector Guidance, the general rule is 'the faster the sector is expected to grow, the faster its GHG [Greenhouse Gas] intensity must decrease.' Developed by the IEA (International Energy Agency), the ETP (Energy Technology Perspectives)⁵ model uses global datasets for the 'Sustainable Development Scenario' (SDS) to align energy balance, sector power generation, CO₂ emissions and global activity by sector.

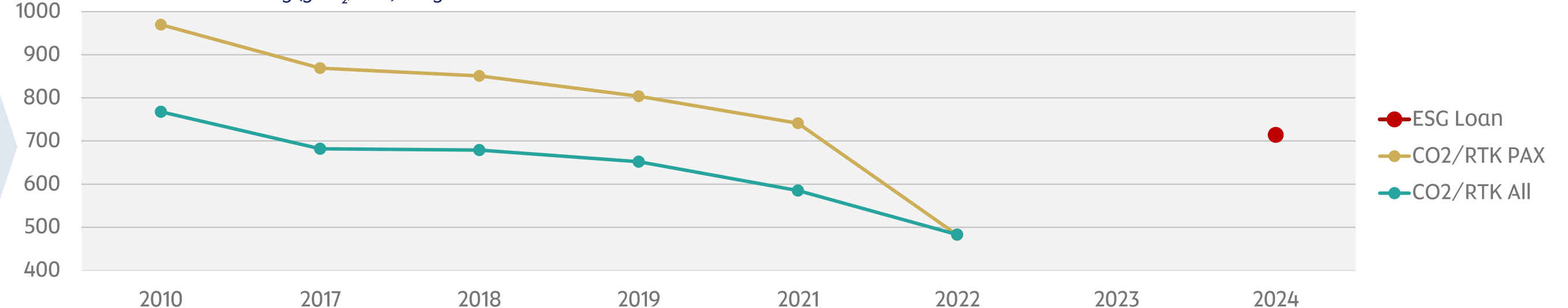
This is a valuable tool to converge the drivers for carbon intensity and carbon emissions reductions. Understanding the characteristics of a 'hard-to-abate-sector' is vital to identify where to maximise opportunities for improvement.

As summarised by the IEA, "reducing emissions in long-distance transport modes is particularly difficult because of their power and energy density requirements"⁶. The challenges oftentimes reveal solutions. This report will cover the identified 'drivers for improving carbon intensity' (left, figure 5) in aviation – and demonstrate our efforts and understanding of those solutions.

The drivers to reduce carbon intensity can support efforts to reduce overall emissions and environmental impacts of aviation.

Through fleet transformation and continuous fuel efficiency initiatives, Etihad's carbon intensity has demonstrably improved over the last 10 years (right, figure 6). Based on forecasts, there is confidence the targets set in ESG Loan Finance Frameworks^{3 4} will be met. The ESG Loan target is based on 'TtW' emissions – those which are produced directly from combustion of fuel. The Loan Framework^{3 4} document contains details on target structure set in 2020.

Etihad Carbon Intensity (g CO₂/RTK) – Figure 6



Sustainability is more than painting a plane green and conducting ecoFlights around the world. It is imperative that steps taken today for a better tomorrow continue down the road for a long time. We realise that true sustainability requires longevity and resilience. Alignment to industry and global schemes permits this, with thorough monitoring and performance indicators.

With the enduring sense of responsibility to the environment, we manifest this in blue-sky initiatives and innovative projects. We recognise that to truly lead, the mind of the strategy must ensure these targets are made with concerted deliberation, realism and the responsibility of transparency and accountability. Etihad has – as it must – committed to this due diligence through alignment to multiple industry schemes and continuous efforts to evolve our reporting capabilities.

Etihad Greenliner Programme

With the airline's commitment to sustainability through research and development, blue-sky initiatives and the dedication of the entire B787 'Greenliner' fleet to the mission, Etihad makes a point to expose the gaps that exist in validating and implementing the changes needed. This can be in the form of processes and procedures, policy and regulation, products and services, alignment and definitions.

In tandem with compliance to existing schemes, Etihad has also sought to develop solutions on its own, based on experience, expertise, studies and expert opinion from partners gained through the Etihad Greenliner Programme. The results of such efforts are shared in this report with the hopes of explaining the limitations which exist to fully validate the initiative/concept, and what the airline has done to propose solutions to overcome the lack of alignment.

Carbon Offset and Reduction Scheme for International Aviation (CORSIA)^{7 8}

CORSIA was the world's first global offsetting scheme for any single sector, led by ICAO (International Civil Aviation Authority) and IATA (International Air Transportation Authority). Aligning the aviation industry in setting the world-first targets for CO₂ reductions in 2008, CORSIA pledges carbon neutral growth by airlines from 2019, with net zero emissions by 2050. Following the UAE being among the first countries to agree to the scheme, Etihad has been a voluntary participant in CORSIA pilot phases. The KPI used under CORSIA is absolute emissions.

Etihad ESG Loan^{3 4}

Etihad has diligently sought sustainable ways to secure investment into its sustainability roadmap, including being the first airline to raise funds tied to UN SDGs in 2019. Following this, the airline was the first to issue a sustainability-linked transition Sukuk of \$600M. Investments of USD\$1.2 billion were raised in 2021 in the first aviation loan linked to ESG efforts. To secure investments, the Etihad Finance Transition Framework was produced to demonstrate the intentions for use of proceeds and valuation of these funds. The KPI used is CO₂ per RTK.

Emissions Trading Schemes^{9 10}

Emission Trading Schemes (ETS) are market-based measures to control emissions through economic penalties or incentives. The monitoring, reporting and verification of complete and correct data is extremely important for us to remain compliant and operational in Europe and the UK.

Science Based Targets Initiative (SBTi)¹¹

SBTi (Science Based Target Initiative) is a collaboration founded in 2015 to help businesses from different sectors set emissions reduction targets based on current climate science. It is an initiative focused on legitimizing net zero targets or sustainability related ambitions from organisations and is designed to keep them accountable through evaluations and approvals of roadmaps. Per SBTi framework, "to align with the Paris agreement, the aviation sector is required to reduce average carbon intensity by ~35-40% between 2019-2035, or ~65% from 2019-2050." In aviation, the designated KPI used is CO₂ per RTK. Etihad is currently assessing targets internally to ensure alignment.

As with all airlines, we have a unique position in the diversity of our audience; individual passengers, corporate customers, suppliers, manufacturers, regulators, and so on. With this global audience, we have the duty to articulate our efforts in their definition, intention and impact. We aim to fulfil that duty with transparency.



Terminology Explained

Sustainable Aviation

Any action taken with a goal to improve the sustainability credentials of an airline and/or industry against a determined strategy is an action taken *towards* sustainable aviation. Including but not limited to trials and testing related to financial viability of initiatives, Sustainable Aviation is, and always will be, an evolving definition, expanding and becoming more definite with each technological advancement and innovation. The airline refers to the term ‘Sustainable Aviation’ as the goal of all initiatives within the strategy.

“According to NASA, green aviation is the pursuit of reductions in noise pollution, greenhouse gas emissions, and fuel usage to lower carbon emissions and enhance the efficiency of aircrafts. For decades, aerospace has been considered a major polluter. However, these environmental impacts have not gone ignored by the industry. Today, civil aerospace spends roughly \$15 billion a year on sustainability-related research and technology development to help cut down the industry’s carbon emissions. As a result, big changes are infiltrating the industry of flight by pursuing technologies like green aviation development.”

Proponent¹²

As espoused by the encompassing nature of the Etihad Greenliner Programme, the efforts ‘toward Sustainable Aviation’ are not related to the current state as being environmentally friendly, and instead to the assignment of the intentions of relative initiatives. To be sustainable is to ensure longevity and value of both the environmental credentials and business capabilities. As Etihad does not consider the option to ‘stop flying’ as viable, the definition of Sustainable Aviation will be the goal of mitigating environmental impacts of operations without sacrifice to the ability to fulfil our obligations as a business.

“Any discussion on decarbonisation of the economy or a single sector inevitably raise the question on the associated costs and affordability without risking the growth or survival of the industry.”

ICAO¹³

As long as negative environmental impacts exist, Sustainable Aviation will remain the goal.

Net Zero

Maximized direct reductions supplemented by carbon offsets, ultimately reaching a position where an entity adds zero additional CO₂ to the atmosphere. When referring to Net Zero roadmaps, we are solely referring to decarbonisation. This is tracked through emissions reporting of Scopes 1, 2 and 3. Our Net Zero commitments are focused on Scope 1 & 2 emissions. Scope 3 emissions for aviation are not included in two key guidance frameworks (SBTi and EY ESG Loan).

With the commitments of the government of the United Arab Emirates and ICAO (International Civil Aviation Authority) Aviation to Net Zero by 2050¹⁴, Etihad has set the same goal. The airline has designed a sustainability strategy focused on achieving this target and, like many other airlines, has aligned to multiple industry frameworks designed to address CO₂ emissions from international aviation.

“The term is becoming a global rallying cry, frequently cited as a necessary step to successfully beat back climate change, and the devastation it is causing.”

United Nations on ‘Net Zero’¹⁵

The Paris Agreement^{16 17}, a legally binding international treaty on climate change, was launched in 2015 at the UN Climate Change Conference (COP21). 196 Parties, including the UAE, signed the agreement which holds each signatory nation accountable to support the overarching goal of *“limiting the global temperature increase to 1.5C above pre-industrial levels”*.

ICAO run CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation) is one of the key frameworks for climate action in aviation. Adopted by ICAO in 2016, the framework was the first time that a single industry sector agreed to a global market-based measure in the climate change field. International standards for implementation for CORSIA have been adopted as an Annex into the Chicago Convention, to which all 193 member states of ICAO must apply from 2019. CORSIA reporting is voluntary until 2027, after which it will become compulsory (with exceptions for some nations). With ICAO commitments backed by the United Nations, those 196 nations signatory to the Paris Agreement are therefore aligned under the Chicago Convention. This alignment endorses the commitments of the aviation industry.^{7 18 19}

The ambitious climate targets of the Paris Agreement require ambitious climate action; economic and social transformation, technological and scientific advancements, and redesign of industries. In many areas, the technology exists to reduce emissions and affordability of renewable energy sources is, in some cases, cheaper than fossil fuel counter parts.

Unfortunately, this isn’t the case for aviation – for now. Known as a hard to abate sector, aviation would benefit greatly by the introduction of low- or zero-carbon aircraft, however this likely won’t be realised for another 10-15 years. This makes the collective efforts of all members of the aviation ecosystem imperative to keeping airlines, like Etihad, committed to Net Zero roadmaps.

For aviation to be able to fly NetZero by 2050 – the industry aim – we will need the entire industry, the entire aviation ecosystem, to play a part. Between now and 2050, there is little chance of aircraft being able to operate with zero emissions, so there can be no rest from the rigor of finding more and better ways to find and normalize efficiencies in all parts of the gate-to-gate operations of airlines.

Executing a successful sustainability strategy requires deliberate and data-driven prediction models which consider the many drivers of emissions reductions. To achieve net zero, a combination of initiatives will be undertaken. This report demonstrates those initiatives, their alignment to industry schemes and, in certain cases, outlines challenges and risks to the loss of potential benefits if alignment isn't achieved.

As shown (right, figure 7), Etihad's forecasted emissions until 2065 take into consideration a growth factor of 3% (which factors in the adoption of all available fuel efficiency measures), with clear indication of when the airline will exceed the CORSIA baseline⁷ if no further action is taken.

Decarbonisation sits at the core of our strategy. With the definition of Net Zero encompassing both direct reductions and industry-backed offsetting, efforts are focused on intensive reduction opportunities that require significant effort – some which are known to us and some of which are yet to be discovered.

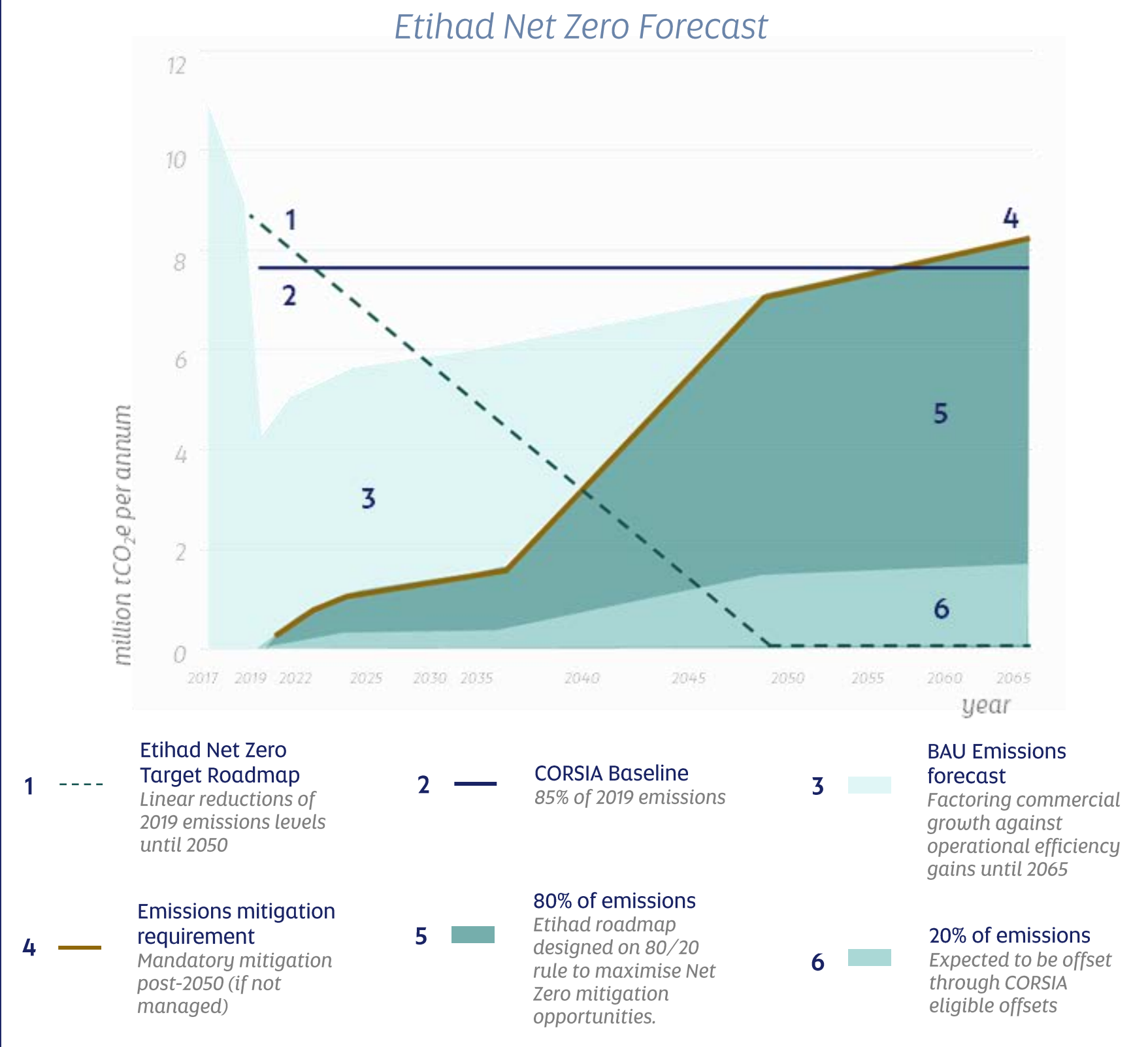
It is challenging to do an accurate assessment of the full cost of any long-term climate goal for the air transport sector. It relies on a range of forecasts and assumptions, building on top of other forecasts and assumptions as well as elements that are simply not known today.

ICAO¹³

Operating an efficient fleet can offer 15% improved fuel efficiency with each new generation aircraft. With air navigational service providers continuously seeking to optimize flight routes, estimates show possible improvement by another 5%. With all possible operational efficiencies in flight/technical ops, theoretically, combining these actions will allow us to achieve incremental reductions until new aircraft technologies or 100% SAF operations are available.

This is visualized in the delayed progress between now and 2035; as this report will demonstrate, the current economy for aviation fuel alternatives must improve. Etihad's efforts in 2022 were focused on this task, and actions were taken to prove the potential of Book & Claim. This gap will drag even further unless sufficient quantities become available on a global level and can be commercially viable.

Etihad Net Zero Forecast – Figure 7



As reported by the IEA Sustainable Development Scenario^{5 6}, in the case of the three sub-sectors of long-distance transport (trucking, maritime and aviation), “operational and technical innovations unlock energy efficiency gains in the short to medium term, while switching to low-carbon fuels and electric powertrains drives emissions reductions in the long term. Yet none of the three sub-sectors is decarbonized by 2070 when collectively they emit 1.0 GtCO₂”

As the airline has gained confidence in these areas, the focus now is on having our targets approved by reliable schemes while simultaneously continuing the path and adopting every available solution where possible.

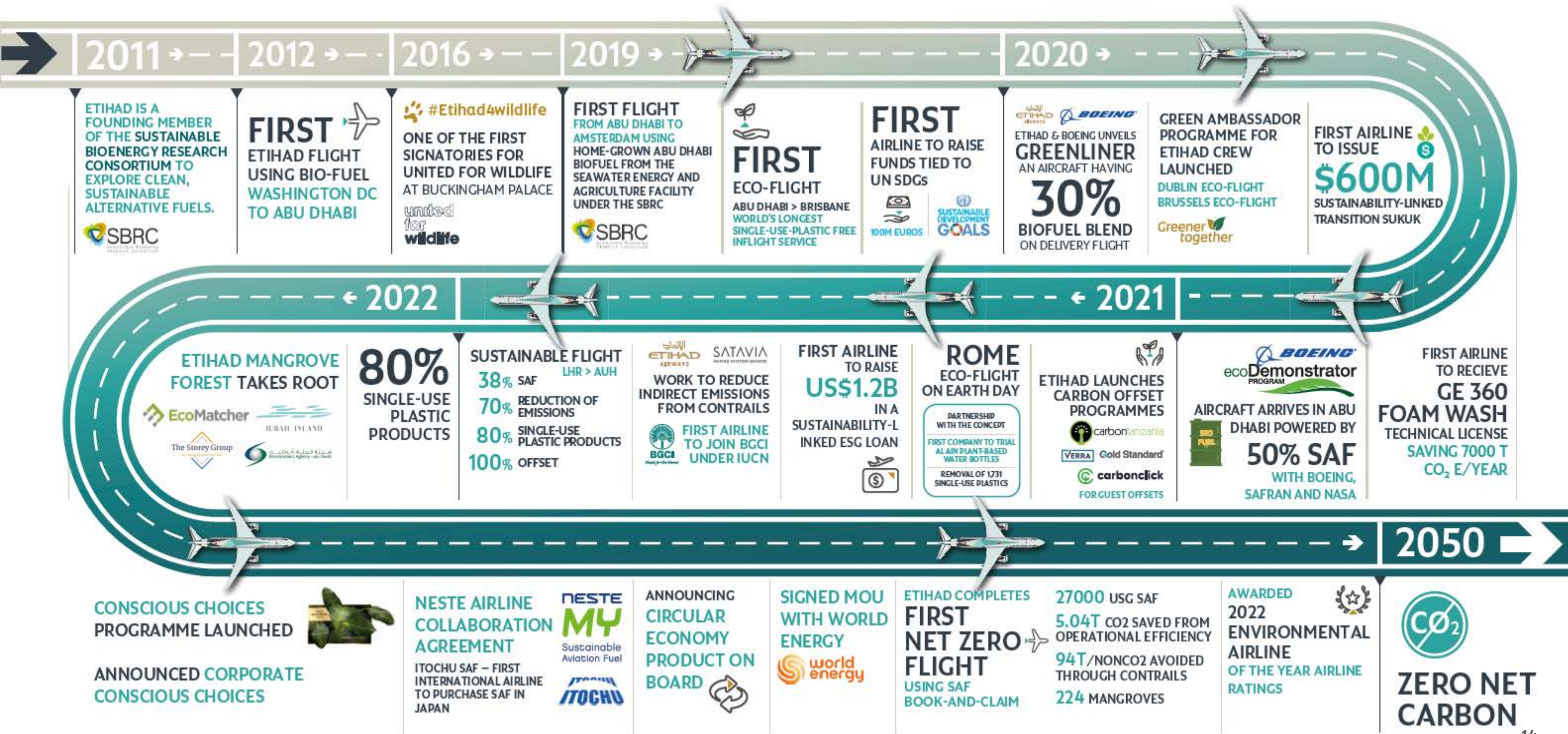
Demonstrably, this will be a whole industry effort and require constant testing. Etihad's Net Zero roadmap is designed on an 80/20 rule. By limiting reliance on CORSIA eligible offsets²⁰ to 20%, this manages the risk if technology-driven roadmaps are unable to reach their targets; CORSIA eligible offsets may still be an available opportunity without allowing the roadmap to rely on Carbon Neutral definitions. With the significant effort required in the development of Sustainable Aviation Fuels, this falls into the 80% mitigation space, despite the benefits only granted to airlines through SAF carbon credits. While the exact roadmap is unclear, and whether Sustainable Aviation Fuels should be classified as reductions or offsets, there are limitations on how certain we can be of how realistic a 2050 goal is, but there are certainly positive indicators to insist it can be possible.

*While 2050 may prove challenging, the ‘race to 2050’ may arm us with greater potential by way of urgency than if the finish line is pushed back another 20 years. To execute a strategy of doing what has not yet been done, we must go where we haven’t been; so, while we do not know exactly what the path looks like, we’re starting how we mean to go on: deliberately, strategically and optimistically. One thing is certain: **we will, because we must.***

ETIHAD SUSTAINABILITY - THE JOURNEY SO FAR

FROM ABU DHABI *for* THE WORLD

الإتihad
ETIHAD



Etihad Airways announced the Etihad Greenliner Programme in **2019**.

By the end of 2021, the programme had gained over **50** partners, and by the end of 2022, had operated over **40** ecoFlights.

The airline's fleet includes **39 'Greenliner'** Boeing 787's and **5 'Sustainable50'** Airbus 350's.

Etihad Airways was recognized as the **2022 Environmental Airline of the Year** by Airline Ratings

Knowledge sharing has been the key driver of the Etihad Greenliner Programme, bringing progress, innovation, and transformation to the industry, our partners, our competitors; and the world.

Identifying the million little things that will come together to see incremental, measurable, and overall beneficial change is most effective when contributed by all minds thinking as one.

With the programme's pillars of knowledge sharing, innovation and collaboration, transitioning solutions from theoretical to operational and validating the potential and success of initiatives can prove difficult.

With the philosophy of 'if it were easy, it would have been done', the airline has opted to seek out solutions to these gaps and go 'off the beaten path' instead of waiting to be given the answers or direction.

Most importantly, the enduring principle of the Etihad Greenliner Programme is that no one party can achieve success on its own, but that success is dependent on many parties, participating collaboratively to find not just one solution, but millions of little solutions that together will realise substantial change...

Etihad's "Call to arms"... join us for the world

Now, three years after the Greenliner Programme was launched, and the call to the world went out, we are proud of all those partners who responded so proactively and loudly!

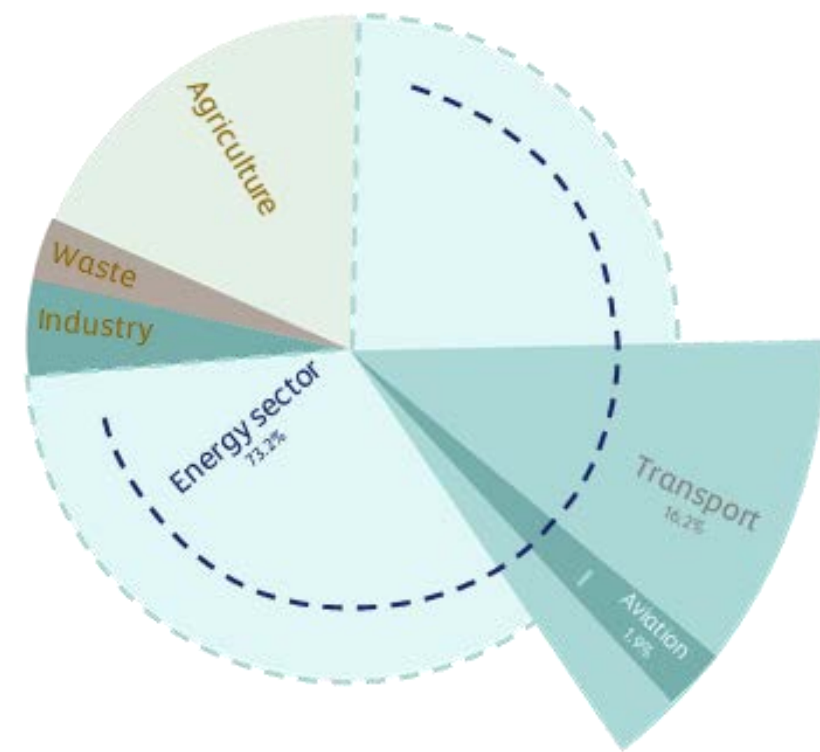




Sustainable Aviation Fuel



Sustainable Aviation Fuel, (“SAF”), is often seen as a core step in the decarbonisation roadmap for aviation. Alternative fuels offer an opportunity to accelerate the industry's progress toward net zero by 2050 goals.



Global Emissions Reporting (2016)
Our World in Data – Figure 7²¹

With 73%²¹ (left, figure 7) of global emissions produced within the Energy sector (created from the various industries within the sector), commercial, transport, manufacturing, and more stand to gain significant benefits from alternative energy sources. Those industries which rely on combustion of fossil fuels to operate look to solutions such as SAF (or their industry counterparts) to progress sustainability roadmaps.

What is SAF?

“SAF is an umbrella term referring to fuels derived from non-fossil sources or ‘feedstock’, where through its process of cultivation and production, works to close the carbon cycle and... achieve a significant reduction in life-cycle emissions relative to traditional jet fuel... 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.”
IATA²²

How is SAF used?

Irrespective of originating feedstock, certified SAF produced is similar in chemical structure to current Jet A1 (kerosene-based jet fuel) but has a significantly lower emission impact from aggregation and production pathways. By performing at operationally equivalent levels to Jet A1, SAF can be used as a ‘drop-in’ fuel; meaning it can be ‘blended’ into existing fuel infrastructure and be compatible with modern aircraft.

How do SAF production pathways differ?

“Beyond reducing significant CO₂ emission levels across its life cycle, SAF by design seeks to ensure a high level of integrity in broader sustainability criteria. This includes feedstock that do not cannibalize food production, utilize excess water, promote incremental land clearing or negative impact on the likes of soil fertility, deforestation and biodiversity.”
IATA²²

How are SAF benefits calculated?

The sustainability credentials of SAF are defined by the nature of feedstock aggregation and refining processes, which are certified by industry regulated methodology; ultimately classifying the fuel as CORSIA Eligible (among other standards). Calculations exist to convert the emissions reductions to carbon intensity. As mentioned, carbon intensity allows airlines to measure efficiency of operations.²³

What is CORSIA Eligible Fuel (CEF)?²⁴

Fuels which are certified as SAF must perform at operationally equivalent levels to Jet A1. Fuels with these credentials are known as ‘CORSIA Eligible Fuels’ (CEFs). CEFs are those are certified against CORSIA Methodology for calculating actual lifecycle emissions and meet minimum reduction requirements in production. This certification is issued by two regulatory bodies: RSB (Roundtable for Sustainable Biomaterials) and ISCC (International Sustainability and Carbon Certification).

Speaking from experience

Etihad’s history in SAF can be found at every touchpoint available along the production chain. In 2011, Etihad became a founding member of the SBRC (Sustainable Bioenergy Research Consortium), to explore clean sustainable fuels with Khalifa University, Boeing, and Honeywell UOP, and later ADNOC Refining, Safran, GE and Bauer Resources. The airline became founding partner of BioJET Abu Dhabi program in 2014, aimed at establishing the SAF supply chain in the UAE.

In 2019, the flagship SBRC project ‘SEAS’ (Seawater Energy Agriculture System) saw the first UAE home grown biofuel, made from Salicornia Plants from non-arable land, operated on an Etihad Airways flight to Amsterdam. These efforts were followed by participation in the Boeing ecoDemonstrator programme in 2020, where the delivery flight of the new aircraft was powered by the world’s highest volume of 50% SAF, avoiding 60 tonnes of CO₂. All test flights were conducted on 30%-50% SAF.

In the ecoFlight programme, SAF was used on the Etihad Sustainable Flight from London in 2021, exploring the infrastructure capabilities at airports and laying the foundation for continuous development of SAF supply chains locally and globally.



The Catch

Despite offering an 80% reduction in emissions, the direct benefits to airlines themselves are minimal. Reductions are relative to the ‘production’ lifecycle – which on average contributes approximately 18% of the total final impact of the fuel. An average of 82% of emissions generated by fuel are at combustion; the use of fuel in engines.

With SAF operating at operationally equivalent levels to JetA1, the emissions produced in combustion remain virtually unchanged. Aviation's 2.6%²⁵ contribution – in any reliable Net Zero terms – remains at 2.6% irrespective of how much fuel is used. For context, Etihad's Scope 1 emissions (direct operations – flight fuel burn) are on average 97-98% of the airlines entire carbon footprint (figure 2, page 9). In simple terms, through the feedstock aggregation, SAF avoids the addition of CO₂ to the atmosphere that would be generated by fossil fuel extraction; priority of emissions reductions versus improved carbon intensity must take into consideration the significant effort required of SAF introduction in any meaningful scale.

Our efforts in 2022 critically analysed the short-, medium- and long-term opportunities and risks of SAF; considering as concisely and realistically as possible, the reality of the challenges ahead.

The challenges

From the airline's experience in Sustainable Aviation Fuel at all touchpoints along the supply chain, three key challenges have been identified, and this report will demonstrate appropriate solutions to overcoming these hurdles.

Supply^{23 24 26 27}

Limited availability of eligible feedstock, development and certification of production, appropriate refining techniques and extensive sustainability criteria require significant investment, expertise, and rigorous testing to be considered viable even in theoretical operation. As with any highly regulated industry, and more so in aviation where safety is non-negotiable, alternative fuels must not only be CORSIA eligible (CEF), but they must also of course achieve technical regulatory certifications.

While vital to maintain integrity, safety and appropriate governance for claims to sustainability, the exclusivity of such fuels inevitably results in limited supply of SAF.

To meet global targets, forecasts expect a demand for 2-6 billion liters of SAF by 2026. The industry supply of SAF currently stands at 0.1% of demand.

In addition to the challenges of actual supply, there are different standards for SAF, such as REDII in Europe which, while similar, potentially creates inconsistency within the supply chain. Collaborating to achieve agreed upon standards will promote a harmonized economy for SAF.



Accessibility^{23 24 28}

There is also the fact that the value of the SAF, or the ‘Carbon Intensity’ would be negatively impacted, if expected to be transported to the airport where the airline was directly operating. The emissions from the ground transport would be unnecessary, and ultimately, there are not enough production facilities existing globally that would allow point to point access to all international airports.

Even once a quantity of SAF is secured, capabilities of airports to permit the delivery of SAF directly to the wing of the purchasing airline are insufficient; it is common practice that SAF purchased by one airline would likely be delivered to multiple airlines across an airport. International airports (for where 80% of aviation emissions – from flights over 1,500kms – are likely to depart from) are unequipped for direct to wing fuel supply.

Without a transition approach, the requirement to transport fuel from production/refineries to airports will undermine the overall sustainability credentials. Without appropriate infrastructure to resolve transport and delivery limitations, the sustainability criteria which must be met for a fuel to be certified as CEF will possibly fail to meet its target of reaching a minimum 10% carbon intensity reduction compared to conventional jet fuel.



Cost

Compared to traditional JetA1 fuel, SAF can be priced anywhere from 4 to 8 times more²⁵; this is largely due to costs for feedstock, renewable energies and capital costs for building production facilities, in addition to administrative fees for SAF certification. With such high costs, airlines themselves cannot support the development of a diversified SAF market.

As demand for SAF can also be influenced by target setting and net zero goals, incentives for producers to increase supply is vital – yet despite the goals of the industry for decarbonisation, the minimal benefits for airlines in reductions cannot be ignored when costs are so significantly high.

To facilitate the participation of the aviation sector in SAF uptake, frameworks such as CORSIA have developed ways in which reduction capabilities of SAF can be applied to airlines Scope 1 emissions reporting. With the frameworks, regulations and methodologies mentioned, this conversion makes it possible to include Sustainable Aviation Fuel into sustainability roadmaps.

Supply may improve with these conversion opportunities and potential to introduce incentives. Yet with the infancy of the market, without the appropriate monitoring practices or green-financing frameworks established, suppliers and off-takers are exposed to a highly unpredictable SAF economy. With most SAF deals to the tune of millions-to-billions of dollars, the risk of purchasing SAF at current prices for specific quantities (and therefore specific emission reduction benefits) should be considered.



So, why SAF?

Until recently, airlines have been unable to maximise the benefits of SAF. With costs significantly more expensive than Jet A1, a current industry supply of 0.1%, limited production facilities, and indirect emissions reductions for airlines, it is important perhaps to ask, “Why would any airline go in this direction?” Many large airlines have made financial commitments in the millions and billions to uptake of SAF, and yet the benefits remain contentious.

The risks are very real, and paint a very concerning picture. Conflicting public opinions about carbon offsets combined with celebratory media headlines about SAF purchases has compelled us to echo our sentiments from 2021 – ‘at what cost?’

However, as mentioned, with 73% of global emissions from the energy sector, the emissions reductions from production of alternative fuel are valuable on a global scale to many industries. Where aviation is less likely to realise electric or hybrid airframes in the same timespan as other forms of transport, alternative energies should be explored in the commitment to an the 'all of the above' approach.

2022

A key objective in 2022 was to collaborate with partners in testing and developing viable energy uptake pathways. This included gaining knowledge in alternative energy types, solidifying partnerships for offtake, financial feasibility studies and building resilience in SAF purchases through Book & Claim testing.

Neste Airline Collaboration Agreement

In 2022, Etihad signed the Neste Airline Collaboration Agreement, looking to facilitate cooperation between corporate organisations looking to offset their Scope 3 emissions using SAF credits. With the higher price of SAF, agreements such as this facilitate the sharing of costs between airlines and corporates, improving financial viability of SAF. In doing so, airlines are able to commit to the uplift of fuel with a lower risk than independent bulk orders.

Etihad first collaborated with Neste in 2021, working with VITOL and Neste to operate SAF on the Etihad Sustainable Flight from London to Abu Dhabi. Looking forward to 2023, Etihad has intentions to begin uplift of SAF with Neste and distribution partners.

CEPSA

This year, we partnered with CEPSA (*Compañía Española de Petróleos, S.A*) (a global energy company owned by Mubadala Investment Company Group and The Carlyle Group). With shared goals to drive the development and production of SAF from circular raw materials, and an ambition to lead in these fuels with an annual production of 800,000 tons by 2030, the partnership looks to explore other energy alternatives such as green hydrogen and electrification.

The partnership will also work on the development of new energy alternatives such as renewable hydrogen and the electrification of Etihad's ground fleets, which include supply vehicles, baggage loading and unloading operations and aircraft assistance.



ITOCHU Neste Collaboration

Etihad, in partnership with ITOCHU Corporation and Neste MY Sustainable Fuel, operated as the first foreign airline to receive SAF supply in Japan. The flight, operated in Q4 of 2022, was the first part-delivery of c.50,000USG of Neste produced fuel, and was distributed to Etihad by ITOCHU, reducing approximately 75 tCO₂ at a 39.66% blend. Supporting the Japanese government's goal of replacing 10% of aviation fuel consumption by Japanese airlines with SAF by 2030, ITOCHU has established a domestic SAF supply in country. However, key to supporting the entire industry is creating an accessible market to foreign airlines, and expanding SAF supply bases to allow increased demand. Simply, the continuous, global accessibility to SAF will improve the extremely high costs of the fuel, and drive offtake by airlines.



Memorandum of Understanding (MoU) with World Energy

2022 saw the signing of an MoU with World Energy; establishing a long-term strategic partnership to decarbonise flights through in-sector emissions reductions. Such long-term commitments are key to the incremental progress needed for SAF pathways; creating continuous demand in smaller quantities to support improved supply and provide access to the currently exclusive SAF market.

The MoU with World Energy aims to establish long-term supply with a transparent costing structure. This allows Etihad to engage with Corporates and work on strategies to jointly reduce EY Scope 1 emissions and Corporates Scope 3 emissions. Under the GHG protocol scope 1 emissions translate in the multiple scope 3 emissions for the supply chain.

In order to share the burden for increased cost and to avoid competitive disadvantages, a framework is required where voluntary contributions of corporate customers can be counted against the different scope 3 obligations. This concept, which will be developed further in 2023, is a key topic to discussed within the industry.

Net Zero Flight

Operated on the Etihad Boeing 787 'Greenliner', the flight leveraged SAF Book & Claim systems in partnership with World Energy to overcome logistical infrastructure challenges. This flight was about solving industry wide hurdles and testing the Book & Claim concept ahead of COP27 in Sharm El Sheik, Egypt.

As the first airline to participate in World Energy's net zero program, the flight aimed to validate the opportunities presented in SAF and demonstrate why virtual emissions reductions and ownership transfer are not only feasible, but essential, and should become an accepted practice for airlines in the SAF roadmap. A call to action for regulators and voluntary emissions systems to recognize the importance of Book & Claim was a key output.



Testing the theory

The Etihad Net Zero flight used the principles of Book & Claim, focusing on the improvements possible around the three key challenges. The flight, like all previous ecoFlights operated by the airline, was the culmination of background studies conducted by Etihad, in collaboration with the partners who have answered the call to arms of the Etihad Greenliner Programme.

Book and Claim methodology has existed for many decades to accelerate energy roadmaps for different sectors. The system has been innovated to enable adoption into the aviation industry and encourage uptake of alternative fuels by allowing the benefits to be shared. Book and Claim allows an external party (typically a corporate customer who travels on an airline) to 'book' the SAF quantities needed to offset the emissions of their flight, and 'claim' it against their own Scope 3 reporting. By 'adding' benefits to previously disconnected parties, the value of SAF credentials – which are, as mentioned, highly regulated by industry certifications – can be received by a more globalized audience.

As these systems develop, they inevitably become more complicated. While CORSIA Eligible Fuels may only be certified by RSB and ISCC, this earns the confidence of quality, and the same expectations exist for Book and Claim. Many of our partners have initiated Book and Claim methodology into their programs; such as Neste Airline Collaboration Agreement, the World Energy net zero program, and our own Etihad Corporate Conscious Choices, which was launched in 2022.

In developing these initiatives, we seek third party assurance of the mechanism from RSB – the wealth of knowledge that exists within the industry and among our partners is vital to introducing a legitimate, transparent and impactful SAF economy.

Book & Claim Infrastructure

There are key parties and processes which are fundamental in Book & Claim. Each element is vital to supporting the development of a successful SAF economy. The system is designed to maintain transparency and involvement from all parties under reliable governance. For an airline to rely on Book & Claim and valuably participate in the SAF pathway, trust and integrity in the exchange of carbon credits must be assured. With the conversion of SAF credentials to carbon credits, retroactively applied to emissions reporting to demonstrate the indirect reductions of SAF, the verification process is perhaps the most important of the entire system.



SAF Book and Claim Process²⁸

Tested on Etihad Net Zero Flight

**Fuel Suppliers;
producers, distributors**



Throughout the 'Well-to-Tank' (WtT) phase of fuel production, fuel suppliers work with regulators to meet criteria for SAF classification.

This factor includes emissions from extraction, production, and transportation of fuel feedstock, with emissions upstream of the supply chain and feedstock lifecycle. On average this accounts for 18% of all WtW impact.

In Book & Claim, an airline can participate in the purchasing and use of SAF without requirement to physically uplift fuel into its own aircraft. This grants access to airlines to SAF purchased irrespective of geographical or logistical challenges.

Tank-to-Wing: This factor is only emissions from the combustion of fuel and does not include upstream emissions from production. TtW emissions are the same for traditional Jet A1 fuel and SAF. On average, this accounts for 82% of total WtW impact.

Finally, relationships between corporate customers and airlines permit the purchase of emissions reduction units for verified Scope 3 credits.

Airlines are able to receive verified Scope 1 emissions reductions, and documentation verified independently by a third party is recorded in a registry.

Is SAF the only available alternative fuel?

Where lifecycle emissions are reduced for SAF at feedstock and production stages, there are alternative fuel types available which also “work to close the carbon cycle and... achieve a significant reduction in life-cycle emissions” but are not classified as ‘biofuel’ or SAF in its intended definition.

Hydrogen

One of the latest topics gaining attention around aviation propulsion is the use of Hydrogen to power aircraft. Hydrogen, a naturally occurring and abundant element, offers up an opportunity for innovators across many industries. With no CO₂ released from use and promising affordability, many OEM’s (such as Airbus) are looking at the potential of Hydrogen to get us to 2050.

The use of hydrogen power in aircraft will require a complete re-design of commercial airframes. Propulsion units today (jet engines) aren’t capable of retrofit for this new fuel source, and a lot of study needs to be done. Despite the ambitions, the question remains whether we will see these aircraft designed, tested and entered into service by 2050, and even then, airlines must then retire entire fleets and switch to new aircraft.

Because of this, we’re keeping our immediate focus on more readily available or maturing solutions. However, there is potential in almost any idea, even when it is just an idea, and there have been interesting developments with regards to using hydrogen fuel in APU’s (auxiliary power units) which create emissions from the aircraft when not connected to ground power.

LCAF – Low Carbon Aviation Fuels ^{8 23}

LCAFs, or Low Carbon Aviation Fuels, are one of the most recent topics to come out of the green energy conversation for aviation. Remembering that we’re the only industry up in the sky, we need to assess all solutions and grab opportunities where available. LCAFs, like regular SAFs, are focused on a reduced overall lifecycle emissions reduction. However, unlike SAF, the definition does not require a more ‘sustainable’ feedstock. The concept centers around the use of crude oil jet fuel – just like we use today – but uses targeted efforts to reduce the emissions created in the lifecycle. This means the collection of the oil, refinement (and energy used in refining), maximized use of outputs, and so on. Proposals show if production of fuel can display a comprehensive formula of lifecycle emissions reduction techniques, it can be categorized as an LCAF.

LCAF is Jet A1 with a lower carbon footprint once approved and certified. SAF, on average, will reduce greenhouse gas emissions by 80%, and LCAF will reduce the Jet A1 GHG emissions by at least 10%. After applying industry conversion methodologies for SAF to credits, SAF alone would reduce the carbon footprint of flying by 40%, and if blended with LCAF, it will reduce the carbon footprint by 45%.

It is because of this that we look to solutions like LCAFs as a transition fuel until 100% SAF available in sufficient quantities at a commercially viable price level.

Ultimately, reliance on fossil fuel-based energy is categorically criticized globally, and this solution on the surface appears to advocate for the opposite. However, sustainable development is a complex and serious task, and across the industry there is concern that the long-term financial sustainability of aviation will be impacted if airline operators are expected to shoulder the burden of alternative fuels, or brand-new aircraft designs.

We advocate for solutions such as this which need the voices of airlines and not just oil companies to demonstrate potential impacts, so LCAF’s can be certified and widely supported.





Supply

By bringing airlines, SAF distributors and suppliers, corporate and individual customers and, most importantly, regulators together through Book & Claim, the opportunity to access greater supplies of SAF from previously inaccessible locations improves immensely. As stated, there is only an estimated 0.1% supply of SAF based on global demand and suppliers themselves must justify the production of the fuel if they can guarantee offtake.

As mentioned, many airlines have made hefty statements of purchases of SAF, but most – while positive – span ten years or more. The facts outlined show that, without Book & Claim, there are not many more options for airlines to support a SAF economy without such purchases, yet the reality of realising those quantities falls short.

“The assumptions on price of SAF over time are based on a scenario where maximum policy support for SAF scale-up is provided by governments. Without these levers, SAF will be significantly more expensive and less available.”

ICAO¹³

That is not to say such headlines are not useful; the attention brought to the potential of SAF has certainly accelerated the development of mechanisms such as Book & Claim. What has also been learnt is that meaningful supply needs a consistent demand which, Etihad believes, is promoted through any quantity of SAF – no matter how big or how small.

By introducing Corporate Conscious Choices, the airline continues the message of the Etihad Greenliner Programme – knowledge sharing, collaboration and test-bed initiatives. The ecosystem is under construction, and flights such as the Etihad Net Zero Flight in 2022 look to begin quality testing.

Accessibility

The benefits of the fuel cannot be received if expected to only operate direct to wing SAF use and SAF feedstock producers, refiners and end users (in this case, airlines) face significant geographical challenges as a global industry.

With the World Energy SAF produced in California and the Etihad flight departing from Washington, the flight was a perfect opportunity to tackle the issue and take the opportunity to validate Book & Claim practice.

The resulting decision was to operate the Net Zero flight on Jet A1 fuel, while the quantity purchased by World Energy was delivered to LAX due to the proximity. This, for Etihad, is neither a secret nor a bypass.

In simple terms, even with a meaningful supply of SAF available, airlines operate on networks and no two are the same. Capability for SAF production is not a matter of scientific expertise or simply financial capabilities, but whether the existing energy supply chain can exploit the steps necessary to feasibly and realistically develop the eco-system. Without a full supply chain support system, it will remain impossible to develop SAF in enough reachable stations across the world.

Cost

Mechanisms such as World Energy’s Net Zero program permit the airlines to share the costs of SAF, which supports the Book and Claim principle of shared benefits.

The cost of SAF is currently three times the cost of a gallon of Jet A-1, a kerosene grade of fuel used by commercial airliners. Using 5% to 10% SAF could raise airline operating costs 2% to 4%

Oliver Wyman²⁵

In general, end users ultimately always need to bear the cost of all emissions reductions and compliance costs. Government mandates are not established in all countries. Individuals and companies are choosing to reduce their relevant emissions on a voluntary basis to meet the 1.5 degrees target. Etihad Airways supports this by collaborating to build production and supply. However, due to the currently higher costs to produce low carbon fuels versus high carbon, no airline can do this without the voluntary support of their customers.

By utilising resources available to airlines (namely, global audiences of clients, partners, guests, governments, and so on), mutual benefits can be defined to create a self-sustaining demand of SAF even in smaller quantities.

Sustainable aviation fuels will make up most of the incremental costs to getting to net-zero by 2050. However, SAF from most next-generation sources will reduce in price as economies of scale are exploited.

ICAO¹³

Etihad EY130 NetZero Flight

On 13 November, Etihad partnered with World Energy to operate a NetZero flight from Washington DC to Abu Dhabi removing 100% of the CO₂ emissions through a Book & Claim system.



FROM ABU DHABI for THE WORLD

Disclaimer: data is based on estimated impacts and subject to post-flight data analysis with a 5% margin for deviation.



SATAVIA





Net Zero Flight

The culmination of the Etihad Greenliner Programme

Etihad has operated several ecoFlights since the inception of the Etihad Greenliner Programme in 2019.

The program was introduced to activate vital relationships throughout the aviation ecosystem between suppliers, manufacturers, operators and so on.

In this time, 'ecoFlights' have been operated to Brisbane (Australia), Brussels (Belgium), Dublin (Ireland) and from Rome (Italy), Charleston (USA), Narita (Japan) and more.

Each flight operated is accompanied with data driven narratives to add value to the sustainability roadmap for the industry. With the nature of Etihad's Sustainability strategy relying heavily on collaboration, knowledge sharing, trials and testing, each ecoFlight profile is unique. These flights are strategically planned to 'showcase' or otherwise verify background studies in operational efficiencies, sustainable aviation fuel, eco-friendly products, and other R&D initiatives.

To do this requires in-depth knowledge of every step of the flight journey, from aircraft preparation to touch down at the destination. Each ecoFlight operated demonstrates how vital each member of the ecosystem is on this journey. The expertise and support of teams across the entire business and external stakeholders is vital to successful operations.

When viewed as a microcosm for the wider industry, the planning and execution of ecoFlights shows how vital close collaboration is to creating legitimate impact.

2021

In 2021, Etihad operated the 'Etihad Sustainable Flight', operating from London to Abu Dhabi on the flagship B787 Greenliner aircraft. The flight reported a net 72% emissions reduction when compared to the airline's baseline of the same route from 2019 on the A380. A key output from the flight was the acknowledgement of over 50 partners from within the supply chain who had contributed to the ongoing programme.

2022

Operated on Etihad's Boeing 787 "Greenliner" the flight leveraged SAF Book & Claim systems in partnership with World Energy to overcome SAF logistical and infrastructure challenges.

"This isn't about solving only Etihad's emissions, but about supporting the entire industry to address the biggest challenge we face over the next three decades."

Gene Gebolys, CEO, World Energy

The flight demonstrated fuel efficiency measures, testing of SATAVIA contrail management and continued growth of the Etihad Mangrove forest. This report outlines each of the initiatives on the 2022 ecoFlight throughout the document.



Sustainable Aviation Fuel

Putting Book and Claim to the test, 216 tonnes CO₂ offset from 27,000 USG SAF from World Energy.

Biodiversity

224 Mangroves Planted for each guest on board

Fuel Efficiency

Demonstrating the potential of fuel saving initiatives, 5.04 tonnes CO₂ reduced by operational efficiencies and flight optimizations.

Fleet

Operated on the Boeing 787 'Greenliner' aircraft, the flagship of the Etihad Greenliner Programme.

Innovation

94 tonnes of non-CO₂ impacts avoided through SATAVIA contrail avoidance.

Knowledge Sharing and Lessons Learned

Insight and experience gathered over the years of the Etihad Greenliner Programme have offered several principles, or philosophies, which assist in how we approach efforts such as ecoFlights.

Introducing new initiatives or identifying areas for improvement is often difficult due to the complex nature of aviation infrastructure.

- *Etihad's Sustainability Strategy is designed to combine key OEMs and encourage the collaboration between stakeholders effectively*

With such complexities, quantifying impacts from incremental efficiencies/improvements remains a considerable challenge

- *A vital area of focus is the use of technology to promote alignment and connect service providers, air traffic controllers, airlines and so on.*

Initiatives which disrupt day-to-day operations, require 'ad-hoc' processes, incur greater cost or effort are less likely to achieve a proportionate improvement or benefit

- *Diligent assessment and working groups can maximise impact against effort. This allows prioritisation of commercial and operational implications and permits the endorsement of higher-value initiatives.*

Being a hard to abate sector, a challenge is balancing opportunities for reductions in such a diverse landscape; difficulty, contribution, impact, time, investment, etc.

- *Investment in maturity of existing technologies or processes with incremental benefits should not be forgotten in favor of long-term industry aspirations.*

The path to Net Zero will be made up of a million little things; a combination of efforts, and not one silver bullet to make significant change... Here are a few of ours.

The sum of many parts

The work of many hands

A million little things



FROM ABU DHABI *for* THE WORLD



Modern and Efficient Fleet

With between 98-99% of the airline’s emissions from aircraft fuel burn in Scope 1, the greatest opportunities for direct emissions reduction come from an advanced and fuel-efficient fleet. ‘Next Generation’ aircraft are those which offer 15% greater fuel efficiency when compared to previous models of the same type.

Reductions are often achieved incrementally, with continuous modifications and efforts to maximise the capabilities of an aircraft to reduce fuel burn. With fuel standing as the highest operating cost, the crossover of financial benefit and environmental benefit is a great motivator across all areas of an airline’s business.

“In the last 30 years, airlines have spent \$4.3 trillion on fuel. In the last decade, airlines have spent \$1 trillion on new aircraft. Industry is spending \$15 billion a year for research and development.”

ICAO¹³

Investment and Financing

Etihad has, over the years, issued several green financing deals with frameworks in place to monitor the use of proceeds and implementation of efficiency measures to indicate success. Securing investment requires extensive efforts around trust building, transparency and strategy, which Etihad has committed to.

Aircraft make up the most expensive and prominent asset of an airline, and fleet credentials present the foundation of our sustainability strategy. Leading the industry as the first airline to raise funds tied to SDG’s, issuing the first sustainability-linked transition sukuk and subsequently raising \$1.2 billion in a sustainability-linked ESG loan^{3,4}, we hope to insist upon the importance of our fleet transformation efforts in our sustainability strategy.

2022

In 2022, Etihad continued a path of Fleet Transformation with a focus on maximizing the fuel efficiency credentials of next generation aircraft types and supporting the airlines business to manage renewed air travel demand.

To execute a long-term fleet strategy which can support sustainability goals, modern and young aircraft types allow an airline to drive fuel efficiency initiatives from a strong foundation. For Etihad, 2022 saw the Boeing 787 and Airbus 350 push the percentage of next gen aircraft from 58% to 62%.



Boeing 787 ‘Greenliner’

The backbone of the airline’s fleet and the flagship of the Etihad Greenliner Programme is the Boeing 787 ‘Dreamliner’. Constructed primarily of lightweight materials, seeing significant reduction in weight, increased flying range and improved aerodynamics for fuel efficiency, the GE powered aircraft offers at least 15-25% more fuel efficiency than previously operated aircraft. In the region, Etihad operates the largest fleet of Boeing 787’s.



Airbus 350-1000

In 2022, Etihad introduced 5 Airbus 350-1000 to its fleet, demonstrating the efforts to ensure that all fuel efficiency efforts made leverage the advanced capabilities of the aircrafts the airline operates.

Streamlined and Adaptable Fleet

The opportunities presented by next-gen aircraft are a priority for the airline, and in 2022, Etihad phased out 25 old-generation aircraft. These included Boeing 777s, Airbus 330s and 320/21 aircraft types.

As the industry recovers from the impacts of Covid-19, passenger demands for travel are returning. However, some of the challenges to global supply chains have endured, and Etihad has been able to leverage the adjustments made to its fleet during the pandemic to maintain resilience. Etihad had planned to add a number of aircraft, including more Boeing 787s, to our fleet. With delays in delivery, the airline converted 5 Boeing 777 aircraft which had been adapted into freighters in 2020 back into passenger aircraft. Despite the return of older aircraft types, the average fleet age went from 5.7 to 6.4 years, aging less than a year, made possible with the introduction of the Airbus 350 and phase out of older models.



With CO₂/RTK as a valuable indicator of efficient operations, fleet planning principles exist that can improve the fuel efficiency of an aircraft.

Modern and young fleet

Modern aircraft types are equipped with the latest software and computing technologies which enable comprehensive data collection. Younger aircraft in a fleet offer greater fuel efficiency. With newer engines, fewer maintenance requirements mean a longer time on wing and greater fuel efficiency.

Densification

Whether through aircraft type or cabin design, an aircraft with a greater configuration of seats carries a greater load from point to point with less fuel than multiple flights of fewer seats

Mixed carriage

By operating passenger and freight flights, focusing on maximizing aircraft loads ensures the best use of fuel per flight.

Flying range

Particularly for international airlines, capabilities to extend flying range of aircraft (particularly with higher seat capacity) follows the philosophy to ‘carry a greater weight further with less fuel’

Next Generation types:

‘Next Generation’ aircraft are those which offer 15% greater fuel efficiency when compared to previous models of the same make.



Looking forward

Boeing 787 ‘Greenliner’

In 2023, Etihad has planned to enter three Boeing 787-9 aircrafts into service, bringing the total number of operating aircrafts to 42.

Densification

Further maximising the carbon intensity potential of the next-gen aircraft, the delivery of the three new aircraft includes a densification program to add 13 additional seats to the configuration. By Q4 of 2023, existing B787’s will have 9 seats added to the current configuration.

Airbus 380-800 – 2023

In 2023, Etihad will see the return of a four A380 aircraft to its fleet. Re-introducing the A380 is necessary as a short-term solution to manage the extensive delays of aircraft from suppliers, and subsequent inability to meet capacity demands. With the airlines flagship B787 fleet, A320/321 types, and new A350s, the temporary reappearance of four A380’s into the airline’s fleet intends to act as a stop-gap solution until deliveries of new aircraft resume.



Airbus A380 – sustainability impacts

It is vital to address the sustainability related impacts associated with the return of the A380 aircraft as the airline acknowledges the responsibility to strategically operate the aircraft, prioritise fuel efficiency and remain focused on its long-term sustainability targets.

Despite the truth that any aircraft with two engines is more efficient than four, a clear and resilient position has always been that environmental sustainability must be achieved simultaneously with business and commercial sustainability.

The decision to reintroduce the A380 has been made following diligent assessment of fleet type and aircraft lifecycle, allowing Etihad to maintain confidence in the sustainability credentials of its fleet. Therefore, Etihad’s intention would be to use these aircraft on high load factor routes with historically high demands, where fuel burn per passenger can be efficiently minimized to a reasonable standard. The continuous efforts of the airline’s sustainability strategy makes this a realistic objective, in addition to compliance frameworks the airline has voluntarily undertaken. A similar strategic benefit is the ability to assign routes efficiently to aircraft types, maximizing engine capability against distance. Taken in a vacuum, Etihad can demonstrate the emissions balance for extending the lifecycle of an existing and available aircraft model for 4-6 years against the production, delivery and operational emissions of newer aircraft; irrespective of number of engines.

The seating capacity offered by the A380 allows a manageable forecast for the airlines’ fleet intensity reporting. With the introduction of the 494-seater aircraft, Etihad anticipates reduced performance for carbon intensity against targets between 5-8%, however mitigates this with an obligation to monitor and respond where necessary to maintain its sustainability commitments.

As demonstrated in 2021, Etihad reacted to the Covid-19 pandemic and elevated its fleet transformation plans to be a key solution in long-term decarbonisation. With a modern and fuel-efficient fleet chosen based on demand, capacity, network and operations, as of 2019, Etihad’s business plan had committed the A380 aircraft to its fleet for a minimum 12-15 years. By returning the aircraft to service temporarily, the airline may rely on an existing asset to overcome aircraft delivery delays and having committed to the A380, has reliable forecasts to make informed decisions on impacts to intensity data.

The challenges faced throughout the entire aviation supply chain must not be resolved through sacrifice or regress of any business model, as such actions have continuously proven to be unsustainable in any long-term capacity. This undermines the learnings and efforts which have, in the last two years, proven to offer more by way of industry transformation than the ‘easy’ solution of reduced business capability.

Future Fleets

With airframe redesign and development to zero-emission aircraft on the horizon, there is real potential for electric and hydrogen powered aircraft to resolve a significant amount of aviation emissions.

However, even with positive outlooks, entry-into-service for such aircraft is unlikely to be realised for another 10-15 years. Omitting the value of operational efficiencies will result in a crucial delay in progress for the industry and airlines investments into modern, fuel-efficient, and advanced aircraft cannot be made redundant in hopes of procuring zero-emission craft.

“The cost of developing new aircraft technology to reach net-zero may range from \$180 billion to \$350 billion over 30 years (\$6-11bn a year on average). This is comparable with current aerospace annual expenditure on efficiency research (around \$15bn a year average).”

ICAO¹³

While airlines can forecast and consider their fleet purchases in the coming decades to incorporate low- or zero-carbon aircraft, the industry cannot rely on them to resolve issues – in other words, it is unwise to wait for the silver bullet and neglect the effort it would take to make incremental reductions available today.

Moreover, as demonstrated, fleet deals are the strongest tool available to operators to demand more efficient aircraft. If well managed, with fuel standing as the highest operating cost for airlines, and the extreme (though necessary) carbon reductions expected of airlines in the next few decades, it is feasible to expect that the development of such aircraft would in fact greatly benefit the operators.



Efficient Operations

Having outlined the value of efficient aircraft, there is a duty to ensure that all other areas of operations are analysed to identify any opportunity for and to achieve incremental reductions. Efficiency is key to operational excellence, and fuel is no exception.

From Etihad's very first flight, it's taken the collective efforts of teams across the organisation to introduce meaningful processes and achieve industry leading fuel efficiency.

Achieving operational excellence requires the collaboration of many internal departments within an airline and the external stakeholders who are vital to successful operations of an airline. For Etihad, these parties are aligned within the 'Fuel Efficiency & Sustainability Working Groups', and report to the Steering Committee of the same name.

It is within this working group that identifying, forecasting, monitoring and reporting of all efforts for improved operations are managed. Stakeholders from all areas contribute to realising the reductions possible from initiatives. Often, this requires theoretical and live operation testing to demonstrate the capabilities available.

The savings are calculated based on historic 12 month burn and regression proxies for new route/aircraft type combinations.

Flight planning

Using the world leading LIDO flight planning system, routings are optimised, including vertical profiles and are based on a cost-index methodology, which facilitates automatic variation of the aircraft's speed during the flight depending on head or tail winds experienced.

Use of the FliteDeck Advisor produced by Boeing and Jeppesen has been regularly trialed by Etihad, building on the importance of data driven flight modeling technology. In 2022, the software permitted 11,141.55 tonnes of CO₂ savings in the reduction of 3,537 tonnes of fuel.

Efficient Airspace

Global airport capabilities are continuously reviewed, ensuring the closest operationally and commercially feasible option is used as diversion options during flights. Flight Operations work closely with Air Traffic partners at Abu Dhabi airport to redesign the airspace structure and ensure fuel efficiency was a central consideration from the outset. Slightly further field, collaboration also extends to neighbouring countries, like Bahrain and Oman, coordinated through Sheikh Zayed Centre.



Efficient Flying

Our pilots prioritise safety above all, and train extensively to ensure the highest level of competence in operations. Standard Operating Procedures are also continually reviewed to incorporate new technologies or industry best practices to reduce fuel consumption, such as reducing the altitude at which pilots reduce take-off thrust to climb thrust and accelerate to climb speeds.

Reduced engine taxi operations, especially at busy airports with long taxi routings, negotiating routing shortcuts with Air Traffic Control, flying efficient approaches with continuous descent profiles, utilising efficient GPS based approaches, landing with reduced flap settings and a more aerodynamic wing are all within the practice.

Weight Reduction

Reducing aircraft weight by replacing manuals, documents and logbooks with electronic devices, minimizing equipment such as crew rest seats. On average, 100kgs in weight requires 15kg fuel, which is 47kg of CO₂ emissions.

Proactive Maintenance

Use of GE 360 Engine Foam Wash procedures and airframe wash prior to flight offer improved aerodynamic performance. With annualized reductions of 7,000 tonnes of CO₂ GE's engine wash maximizes fuel efficiency and protects lifespan of engines. In 2022, use of the GE 360 wash on B787 aircraft resulted in a 4,347 tonne CO₂ reduction through integration in regular maintenance cycles.

Efficient Loading

Focus by Load Control to ensure efficient loading of aircraft. Fuel burn can be reduced by actively targeting optimum trim through improved payload forecast during flight planning stage.

Etihad Cargo replaced 3,000 containers from our original aluminum unit load device (ULD) fleet with environmentally friendly lightweight versions. On the average wide-bodied flight, utilisation of these lighter ULDs can provide a weight-saving of over 200kgs, which can lower fuel consumption by 30kg and CO₂ emissions by 94kgCO₂.



Fleet

Fuel Efficiency

Guest Experience

Innovation

Biodiversity

Conscious Choices

On the Ground



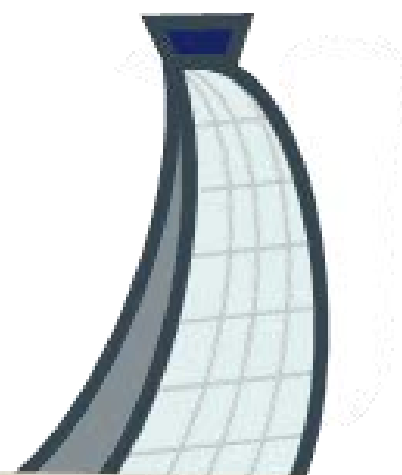
Extensive testing

By understanding the principles of fuel efficiency and utilising the expertise of teams across the organisation, initiatives are tested rigorously for proof of concept and help inform more efficient operating procedures.

In 2022, we continued to explore the benefits from various initiatives in fuel saving and emissions reductions. Please note, the savings outlined are isolated to the initiatives alone, and not the net savings on each flight.

The intention is to prove the value of the initiatives to endorse them for adoption into standard operating practice. With improved data processing, the hope is to study fuel consumption and emissions produced at different phases of flight, permitting a more comprehensive flight profile.

These efficiencies are have consistently proven to offer fuel reductions and are regularly demonstrated on ecoFlights for their potential.



Flight Planning
Careful planning to operate as efficiently as possible.
Initiative: Use of FliteDeck Advisor, a software developed by Jeppesen, and Boeing has been regularly trialed by Etihad.

Savings:

3,537
t/fuel

11,141.55
t/CO₂

Efficient Airspace
Coordination between ANSPs, ATC, airports, and airlines.
Initiative: Airspace Optimization

Savings:

2,726
t/fuel

8,586.9
t/CO₂

Efficient Flying
Reductions from the operation of aircraft themselves
Initiatives: Reduced Engine operations, Continuous Descent, Reduced Flaps landing

Savings:

264
t/fuel

831.6
t/CO₂

Flight Operations

In Flight Operations, Sustainability has been part of our DNA since we launched the first Etihad aircraft, 19 years ago. Efficiency is key to operational excellence, and fuel is no exception.

From our very first flight, the on-going efforts of teams across the entire operation, and beyond to our partners, allowed us to build the foundation of the Etihad Greenliner Programme. Our shared expertise has been brought together over the years to contribute proudly to our sustainability journey.

“My team and I work with specialist fuel management system software to analyse all aspects and opportunities around fuel consumption. As well as supporting fuel analysis, we provide feedback to pilots regarding fuel consumption on their flights. This is achieved through the MyFuel application, to which every pilot has access.

Mohamed Alhur Manager Fuel Efficiency – Flight Operations Quote

Our pilots are trained and mentored on the latest techniques for fuel savings initiatives, whilst always prioritising the safety of the aircraft... and they take great pride in deploying these techniques during line operations.

Captain Mimmo Catalano, B787 Technical Pilot

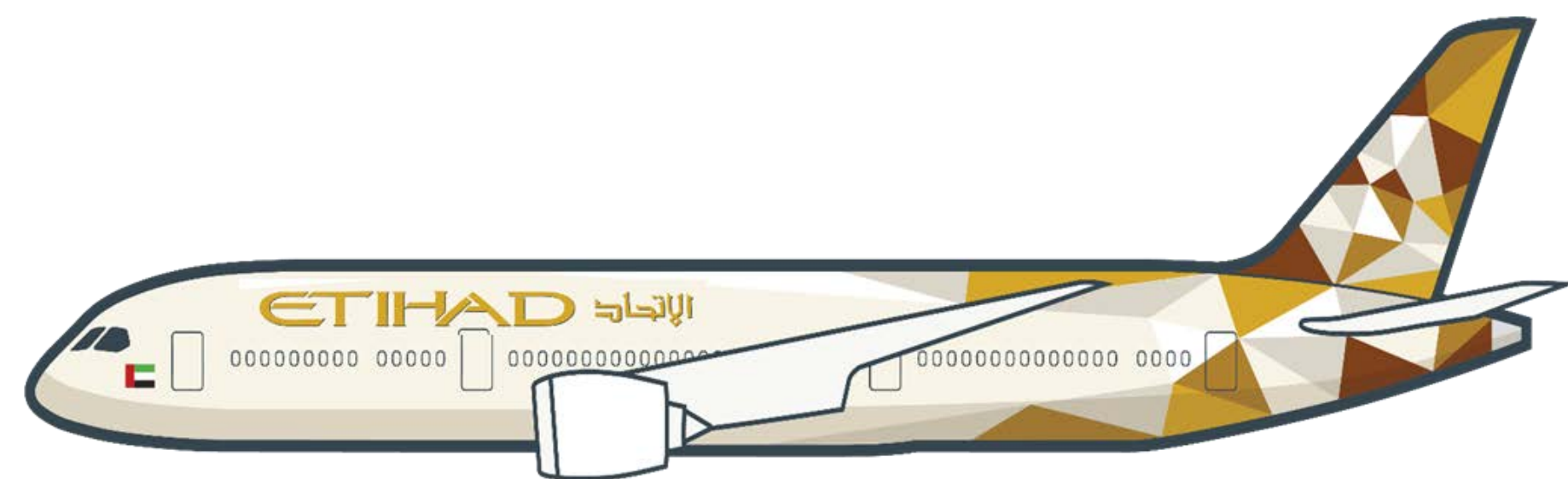
We represent Etihad within the IATA Air Traffic Management Working Group, lobbying for new airways and direct routing options globally, where this is advantageous for Etihad.

Rashid Al Mazrouie, Manager Air Traffic Operations

Etihad is committed in its pursuit of thought leadership and operational excellence in the sustainability sphere. Be it through continually building on the vast portfolio of historic work in this area or looking forward through exciting partnerships and innovative research and development projects, Flight Operations will remain central to this endeavor.

We know that it will take all minds thinking together to achieve meaningful environmental change. We operate on the philosophy of a million little things, and for Flight operations, these are ours.

Captain Mohamed Anwahi, Director Flight Operations



Dynamic Loading
The distribution of weight within the aircraft
Initiative: Optimized loading of potable water on B787

Savings:

275
t/fuel

866.25
t/CO₂

Proactive Maintenance
Maintenance permits optimised performance of aircraft.
Initiative: GE Engine Wash on Boeing 787 aircraft

Savings:

1,380
t/fuel

4,347
t/CO₂

Weight Reduction
More weight equals more fuel burn and more emissions
Initiative: Seat removal in B787

Savings:

201
t/fuel

633.1
t/CO₂



2022

2022 saw the announcement of the new Etihad Economy Class product. Built on a philosophy that Sustainability can also be high quality, the programme revolves around rotatable products that are part of a circular economy and closed loop recycling, reducing the overall use of single use plastic.

Looking Back

In 2019, Etihad operated its first ‘ecoFlight’ from Abu Dhabi to Brisbane on Earth Day. The flight, the world’s longest single-use plastic free flight and the first of its kind in the region, was the first step for the airline in creating a sustainable travel experience for guests.

Echoing the importance of collective efforts, many teams within the organisation have spent the last three years focusing on developing a service offering which maximizes sustainability while demonstrating a high level of quality, aligned with the Etihad brand.

Over the years, the airline’s many ecoFlights have given the opportunity to test products in live operations, allowing guests to share their feedback on the products and experience, and teams behind the scenes conducted extensive testing and trials as well as research into environmental impact and lifecycle properties of different items.

Purpose fit products

Aviation’s unique qualities make it a challenging industry to convert to zero waste. Focusing on the on-board guest experience, there are some cases in which single use plastics are both the least environmentally harmful option and only material available to carriers.

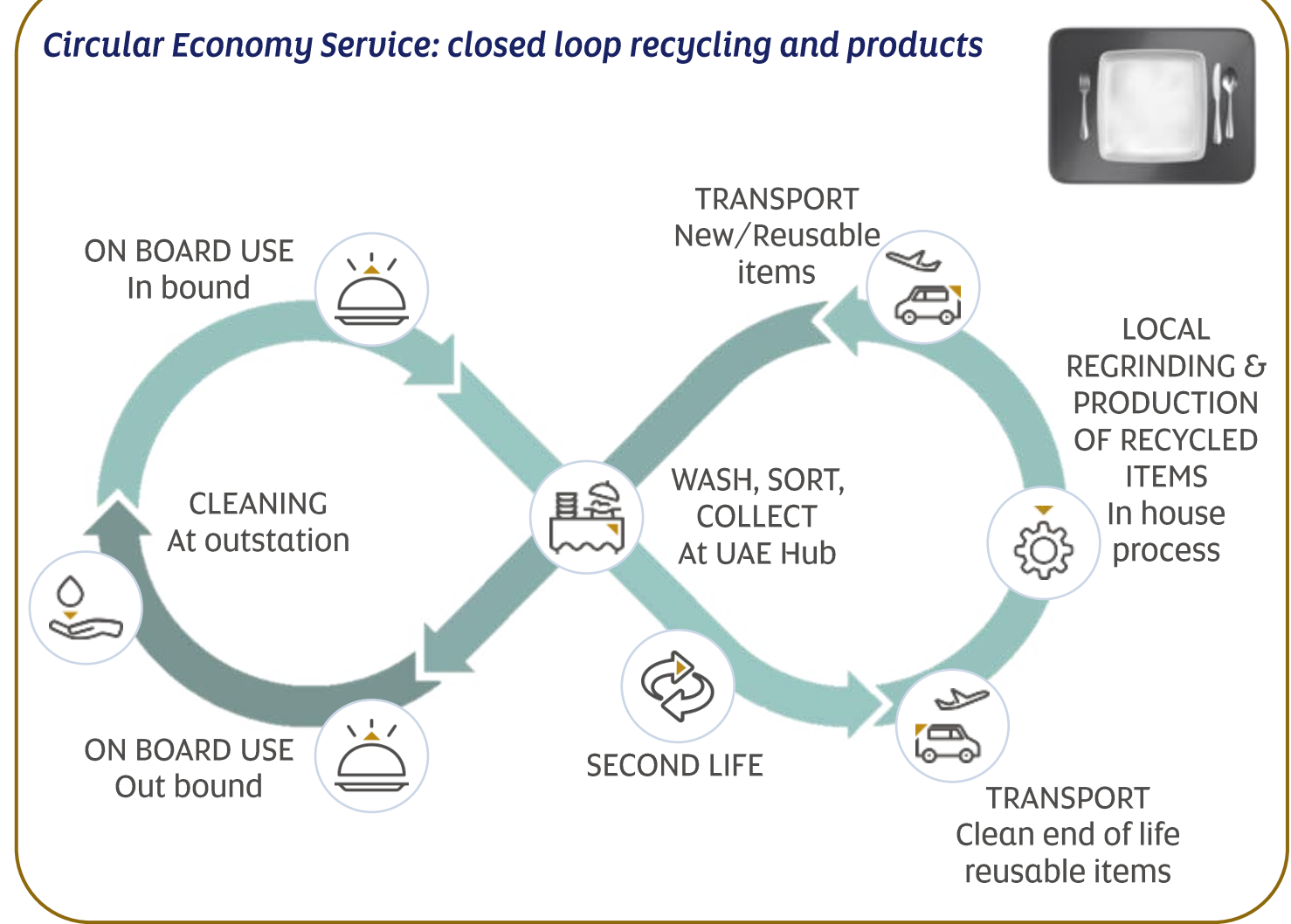
With less weight as a key driver in reducing carbon emissions and improving carbon intensity, many items have few alternatives to their single use plastic counterparts, such as water bottles. To replace the quantity of SUP with glass, aluminum or other materials, the choice becomes one between more emissions or more weight.

In circumstances in which a bamboo, paper or lightweight metal alternative is available, these may not support the intended experience resulting in a poor guest experience like eating from a flimsy bamboo cutlery with a wooden aftertaste.

Additionally, as an international carrier, many countries have strict regulations on how international waste is handled. In most cases, waste must be incinerated regardless of the nature.

Ways around this would be to carry the waste back to the airline’s home country for appropriate waste management, however once again the challenge is added weight and more emissions. In most cases, a more sustainable product will be more expensive and as explained, it is hard to justify a greater cost when incineration is likely to occur after a single use, irrespective of the material.

These are the layers of challenges that the service aimed to overcome.



- Fully rotatable, **no single use plastic** on the main dining tray
- Closed loop recycling/** circular economy of all reusable plastic products
- First** in the region with **100% reusable dining tray** including lids
- 35% larger pillow** with soft cotton pillow cover
- Move towards **locally produced equipment**
- Focus on **high quality experience** and enhancement across all sectors

2022

TIACA Blue Sky Verification

In 2022, Etihad was the first Middle Eastern carrier to join the TIACA Blue Sky sustainability verification program. TIACA (*The International Air Cargo Association*) launched the program in response to the air cargo industry's call for industry specific, fit for purpose functions to measure, benchmark and accelerate sustainability progress. The multi-tiered program renews every two years, and in signing up, Etihad has entered the first phase of the program, allowing us to assess our progress against eight critical sustainability criteria via an evidence-based desktop verification process. This will enable us to more effectively measure our sustainability efforts and performance, benefiting Etihad Cargo's customers and the wider air cargo industry.



Partnering with IATA for CO₂ calculation tools

In 2022, we worked with IATA (*The International Air Transport Association*) in trialing a CO₂ emissions calculation tool specifically developed for cargo flights. To effectively manage and report on sustainability progress, the entire value chain – shippers, forwarders, investors and regulators – along with consumers are asking for reliable and trustworthy data calculations. This trial will provide a valuable proof of concept for the cargo component of the IATA CO₂ Connect carbon calculator.

IATA has been successfully providing IATA CO₂ Connect for passenger flights since June 2022, with actual fuel burn data of 57 aircraft types representing ~98% of the active global passenger fleet . By using airline specific data on fuel burn and load factors, it is the most accurate in the market.

SATAVIA DECISIONX: NetZero

Throughout 2022, Etihad and SATAVIA continued to test contrail avoidance technology, most extensively seen throughout a week of trials coinciding with Earth Day.

55 flights were operated with SATAVIA software modifications between February and November 2022. The most intensive testing was conducted over a week - long period leading up to Earth Day in April 2022, where 30+ flight plans were modified for contrail avoidance.

Almost a year after the world first trial of SATAVIAS DECISION X: NET ZERO on the Etihad Sustainable Flight in 2021, the software was deployed on another landmark ecoFlight. Showcasing the potential of contrail avoidance on the 2022 Etihad Net Zero Flight. 94 tonnes non-CO₂ impacts were avoided on the flight from Washington.

By continuously testing the software, the focus is to build as much data and research for scientific proof of contrails – of the impact of contrails themselves and the non-CO₂ avoidance potential. Doing so will allow greater involvement both from the industry and regulatory bodies. With close collaboration with SATAVIA, our Flight Operations department dedicates these test flights to progressing business as usual introduction. Work continues in improving adaptation into existing flight planning software.

Roll out of contrail avoidance software could enable the entire industry to significantly reduce non-CO₂ effects as well as direct climate impacts. The road to net zero is long, and innovations such as SATAVIA play a vital role in the discovery of a million little things.

55
flights modified

74,000
trajectories analysed

6,540 t non-CO₂e
avoided in successfully
modified flights

109 t non-CO₂e
average benefit per
modified flight

Equivalent to
32.5 days
of continuous widebody
flight

60%
Success rate

Contrail Management²⁹

Contrails form in specific atmospheric conditions, and the warming impact can be translated directly into CO₂e (carbon dioxide equivalent), a metric measure that is used to compare emissions from various greenhouse gases based on their global warming potential. Aircraft-generated condensation trails, or contrails, cause surface warming responsible for up to two-thirds of aviation's climate impact, significantly outweighing direct CO₂ emissions from aircraft engines. While indirect emissions from contrails are not reported, studies show that they can be responsible for up to 60% of aviation's total climate impact.

By avoiding atmospheric conditions that produce contrails, we can reduce the residual effects from flying, and minimize the impact to the planet, which will help us reach a true net zero goal.

Work with SATAVIA began in 2021, where a world's first trial of the software was deployed on the Etihad Sustainable Flight on 23 October 2021. The flight was the first of many in depth trials of the DECISIONX:NETZERO software, adding valuable data to the contrail prevention platform.

Etihad subsequently signed a Memorandum of Understanding (MoU) with SATAVIA at the end of 2021 formalising the alliance which lay the foundation for efforts in 2022.

SATAVIA DECISIONX: NetZero

As outlined, there are two primary goals of the collaboration with SATAVIA in contrail avoidance.

- Using continuous testing to build the scientific proof of non-CO₂ impacts from aviation
- Develop efficient introduction into existing flight planning software

Scientific Proof

The partnership between Etihad and SATAVIA commits to carrying out proof of concept trials to test and validate the SATAVIA contrail forecasting ability. A report by the European Commission on non-CO₂ climate impacts of aviation aimed to analyse climate impacts and potential policy measures to address those effects.

The report acknowledged the impacts of non-CO₂ climate impacts, and referenced the complexity of equivalency measurements and the challenge of introducing mitigation efforts into policy.

“The significance of non-CO₂ climate impacts from aviation activities, previously estimated to be at least as important in total as those of CO₂ alone is fully confirmed... the complexity of non-CO₂ climate impacts relative to CO₂ ones and the trade-offs between various impacts, poses a challenge to policy measures...”

Secondly, there is a clear need for additional research, to increase knowledge and certainty of the various non-CO₂ impacts.... This requires measuring emissions at the different stages of flights and related to different types of fuels.”

European Law Report Non-CO₂ impacts³⁰



Additionally, based on the SBTi Aviation Sector Guidance as of August 2021, *‘Despite the clear importance of these “non-CO₂ factors: on aviation induced warming, the science... remains nascent... Mitigation levers targeting these factors remains untested, limiting the ability for individual companies to both measure the impacts and take action.”*¹¹

Per this document, the impact of aviation non-CO₂ factors on warming is acknowledged but not included in quantitative target setting due to scientific uncertainty and lack of mitigation solutions. Per the SBTi guidance:

- “To raise awareness of non-CO₂ impacts of aviation, airlines are encouraged to participate in data sharing, collaboration and include non-CO₂ factors in other climate commitment
- Incorporation of non-CO₂ ERF into additional targets, e.g., airlines are encouraged to include the full impact of non-CO₂ ERF in other target setting processes e.g., Net Zero commitments.”

Effective introduction

For Etihad and SATAVIA to progress from proof-of-concept into business-as-usual operating procedures, close collaboration is imperative to maintain operational efficiencies and seamless software enhancement. This is done primarily with Etihad’s Flight Operation department.



Original Flight Plan

Etihad Flight Operations shares flight plans with SATAVIA without modifications



Collaboration

SATAVIA and Etihad coordinate development of modified flight plans based flight plan vertical profile and contrail evolution maps. These maps are developed using SATAVIA’s software which uses huge volumes of data to forecast atmospheric conditions likely to cause contrails.



Modified Flight plan

Etihad adapts flight plan to existing software for route and fuel efficiency. The challenges testing seeks to overcome are instances in which contrail avoidance by aircraft generates additional fuel burn (and direct emissions) which would be avoided with original flight plans.



Flight reporting

Pilots operating modified flight plans monitor and report for post-flight analysis. Monitoring includes instances where flight plans must be altered for air traffic, weather or other reasons.



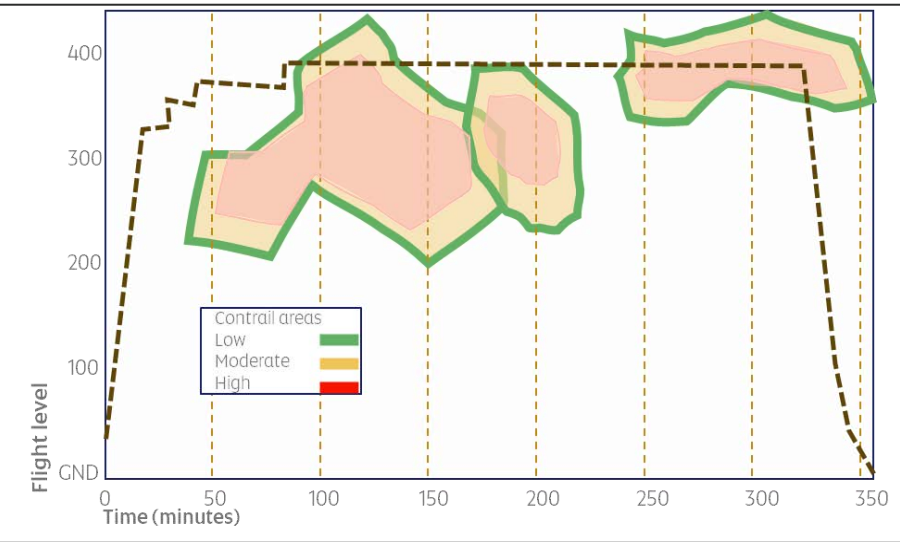
Post-Flight reporting

Comparisons of original and modified flight plans are made and calculations for contrail avoidance success conducted. SATAVIA software uses methodology to report CO₂e (CO₂ equivalent) impacts from the modified flight plans. Fuel penalties are calculated within our SATAVIA final reports and the software aims to use data driven flight planning to minimize this as much as possible.



SATAVIA
MAKING AVIATION SMARTER

Original Flight Plan	321 t non-CO₂ equivalent
Modified Flight Plan	53T t non-CO₂ equivalent
Total Saving Potential	268 t non-CO₂ equivalent



Fleet

Fuel Efficiency

Guest Experience

Innovation

Biodiversity

Conscious Choices

On the Ground



The Etihad Mangrove Forest^{31 32}

With the global shift in mindsets to valuing and prioritising sustainability in business and in day-to-day life, Etihad strives to be an example of making “conscious choices”.

Given the nature of the business, carriers engage with all manner of customers – from individual guests to business travelers, freight forwarders and corporate clients. Particularly with an audience with a range of needs, this initiative is an attempt to diversify the opportunities available to create positive environmental impact, even if that impact is not attributable against a scheme or framework and purely to positively benefit the planet through collective action.

This is reflected in the Etihad Mangrove Forest as being more than a tree planting initiative.

The insight gained from appropriate and thorough management of biodiversity projects is integral to developing a suite of options for our guests and partners to engage in. From species and habitat selection to land management, and from sowing the first seed to transporting seedlings, there is an intangible value of trust Etihad is striving to continuously build.

More valuable to the airline is the true understanding of how any high-quality carbon or biodiversity related project is managed. With the ambitious targets set towards a Net Zero future, the undertaking of defining sustainable aviation for the industry is massive. In addition to every effort made towards direct carbon reductions, there will be a reliance on carbon offsets (or ‘carbon neutrality’) to mitigate some of the harder to reach areas – at least until zero carbon technology is available.

With the reality of needing to purchase offsets, there is a necessity and responsibility to understand how such projects are developed and managed.

While the initiative offers no direct impact to carbon related reporting, the Etihad Mangrove Forest has contributed a wealth of knowledge and understanding around the management, monitoring and implementation of biodiversity related projects.

This offers confidence in the decisions we make, and through all means possible, aims to execute our strategy with integrity and transparency.

While the very nature of aviation makes it difficult to decarbonise, there are opportunities for airlines to make meaningful impacts. A challenge is balancing these opportunities; how difficult they are to achieve, how significantly they will contribute to goals, how long it will take to realise the impacts.

Etihad has committed to seeking the million little things that come together to make a difference. The Etihad Mangrove Forest simply hopes to be a few thousand of those things, for anyone who wishes to participate.

Looking forward

With the successful launch of the Etihad Mangrove Forest in 2022, next steps include following the collaborative philosophy of the Etihad Greenliner Programme and bringing even more partners to the story. By placing such importance on research and maintenance of the initiative, we hope to build a robust and trustworthy ecosystem which can expand and sustain the forest long after a mangrove is first planted.

Through the exploration of a million little things initiatives often take shape because of the many hands which reach in to help. In 2022, Marriott and Breitling, global companies who share our goals joined the story to develop their own forests with us. The Etihad Marriott Mangrove Forest will grow throughout 2023 and intentions to introduce mangrove adoption options into our guest platforms look to expand.

Why Mangroves?

Did you know...?

About Mangroves^{32 33 34 35 36}

Ecosystems of coastal vegetation which store and sequester carbon are known as ‘Blue Carbon’ ecosystems. These include mangrove forests, salt marshes and seagrass beds.

Approximately 50% of the world’s mangrove forests have disappeared over the past 50 years, with reports stating an additional 1% is lost each year.

Mangrove species differ across the world, specific to the climate features of their habitat. The *Avicennia marina* mangrove species is native to the UAE and, when compared to terrestrial forests and soils, is capable of sequestering and storing carbon at relatively high rates.

The species in the UAE is particularly robust, due to the arid climate of the country where temperatures fluctuate between 12-50°C and annual rainfall is <100 mm on average. Studies by the Environmental Agency of Abu Dhabi and partners show carbon sequestration rates of mangroves at 0.5 tonnes per hectare per year.

For the Etihad Mangrove Forest, Sequestration rates are based on species specific calculations by Eco Matcher. Carbon sequestration ‘potential’ for mangroves uses an average 25-year lifetime and factors include species, survivability rates, region, maintenance and ecosystem.³³

68,916

In 2022, our guests and partners planted 68,916 mangroves in the Etihad Mangrove Forest



384.7kg CO₂

384.7kg CO₂ was captured by mangroves planted by our guests and partners in 2022

3-5X

Mangroves store three to five times more carbon per equivalent area than tropical forests^{34 36}



10X

Mangroves and coastal wetlands annually sequester carbon at a rate ten times greater than mature tropical forests^{34 36}

14%

Mangroves sequester 14% of carbon sequestration by the global ocean³⁶



The Etihad Mangrove Forest

Fleet

Fuel Efficiency

Guest Experience

Innovation

Biodiversity

Conscious Choices

On the Ground

Preparing to plant^{31 32 33 34 37}

In 2021, Etihad was the first airline to join the Botanical Gardens Conservation Initiative (BGCI) under the International Union for Conservation of Nature (IUCN). The initiative aims to promote and develop plant conservation efforts and with its members forms the world's largest plant conservation network.

The Arabian Gulf and Sea of Oman make up 2,390 km of the country's coastline, offering a diverse and rich coastal and marine ecosystem – one of the three main ecosystems within the UAE (desert, mountain and coastal).

The principles of the BGCI's Global Biodiversity Standard inform on the importance of research and maintenance of planting and reforestation efforts, such as promotion and conservation of native and threatened species, and land evaluation and management.

Sowing the seeds

Sowing the seeds of the Etihad Mangrove Forest began in 2021, after the launch of 'Conscious Choices'. A priority for the airline was to offer guests meaningful opportunities to engage in sustainability related activities both when flying and in their day to day lives.

Coinciding with the launch of the BGCI at COP26 in Glasgow, the UAE Ministry of Climate Change and Environment unveiled a nationwide plan to plant 100 million mangroves by 2030. The Abu Dhabi Mangrove Planting initiative was then implemented by the Environmental Agency of Abu Dhabi (EAD) creating a pathway for local, regional and international partners to support these goals.

Taking root

With our Sustainability efforts driven by the 'Etihad Airways, from Abu Dhabi for the World' message and our long running MoU with the Environmental Agency of Abu Dhabi, the Abu Dhabi Mangrove Planting Initiative was a key milestone in supporting the goals of the Etihad Mangrove Forest.

As the national carrier of the UAE, based in Abu Dhabi, Etihad's efforts for biodiversity fully support the emirate's plans to *"establish Abu Dhabi as a global hub for research and innovation in support of the conservation of mangroves"*.

With decarbonisation as a key focus of our sustainability strategy, the importance of mangroves for carbon sequestration to combat climate change is highly relevant.

Starting to sprout

The nature of being an international airline offers Etihad a global audience. The hope for the Etihad Mangrove Forest was to offer our guests a connection to nature in return.

Having signed an MoU with The Storey Group and Jubail Island the year before, Etihad first tested the adoption of mangroves on the Etihad Sustainable Flight.

Eco Matcher, a digital tree planting platform and software, became pivotal in making the initiative possible, allowing our guests to adopt a mangrove in the forest from anywhere in the world. The platform allows guests to virtually watch their mangroves grow, see how much CO₂ they sequester, learn about their environment and more – no matter where they are in the world.

Watching them grow

The efforts made in 2021 allowed the Etihad Mangrove Forest to grow in 2022.

Starting with Etihad employees, 200 mangroves took root in Jubail Island, joining the 350 adopted on the Etihad Sustainable Flight the year before. Testing the platform was an important step in ensuring our guests' experience remained a priority and to ensuring the entire process could meet the expectations of appropriate planting standards.

A life of its own

Following extensive testing of the process and continuous management with our partners including the Environmental Agency of Abu Dhabi and EMEC (Emirates Marine Environmental Group), mangroves were introduced to the Etihad Economy Space Seat ancillary option in our booking systems.

With the cost of a mangrove built into the upgrade option, the intention was to seek ways to financially sustain the forest without additional cost to the guest or hidden profit goals. As the CO₂ captured within the forest is not certified to any standards, the airline does not claim the carbon sequestered.

The hope is that the initiative can grow based on the willingness of people across the world to participate, trusting the many partners and Etihad to meaningfully manage the project. With this mentality, valuable insight can also be gained on how to enhance these processes and improve the experience, hopefully encouraging and innovating our community-based approaches to biodiversity and wildlife goals.

Fleet

Fuel Efficiency

Guest Experience

Innovation

Biodiversity

Conscious Choices

On the Ground



Conscious Choices

The Conscious Choices programme was launched by the airline as a platform to motivate, incentivise, educate and enable our guests in sustainability-related activities.

The Conscious Choices proposition is built around the power of collective effort and bringing the Etihad Guest community into our journey. The platform is a demonstration of how we believe sustainability can be integrated into any corner of the business and simply needs the creative minds of the subject matter experts of any area of business to take the principles of sustainability and design fit-for-purpose initiatives.

By integrating gamification features into the platform, Conscious Choices aims to provide Etihad Guest members who sign up with high-quality and engaging solutions with environmental benefits. This includes a suite of ecofriendly lifestyle products in the Etihad Reward Shop and the ability to collect badges for making conscious choices when traveling, such as packing lighter. Guests can earn tier miles, allowing them to experience enhanced Etihad Guest membership benefits, and use their Etihad Guest Miles to offset their footprint or purchase products.

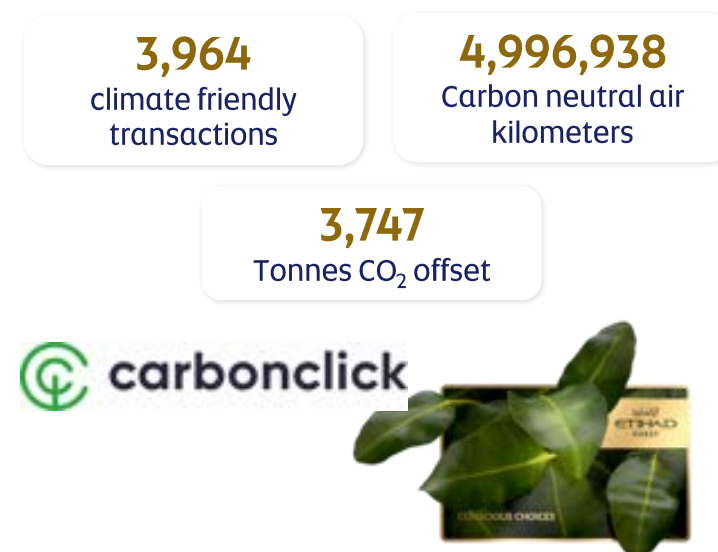
A key benefit of the program is in gaining insight into consumer behaviors; learning what travellers want, what is important to them and how they want to engage. As Conscious Choices develops, we look for meaningful ways to enhance the guests individual experience, and continually strive to offer high-quality and transparent opportunities.

CarbonClick^{38 39 40}

Since 2021, Etihad has partnered with CarbonClick in providing high quality carbon offsets for our guests. They work to empower businesses and their customers to tackle climate change by making carbon offsets simple, trustworthy and cost effective. In developing Conscious Choices, CarbonClick worked closely with the airline in curating a diverse suite of offset options and gaining consumer insights in monthly reports. **Etihad does not claim or report these offsets against its carbon footprint.**

CarbonClick demonstrate excellence in carbon offset standards and offer a trusted methodology for calculating flight emissions, which is available to all guests when booking flights on Etihad.com. Additionally, the Etihad Guest reward shop offers offset options for day-to-day activities, such as driving.

Since the launch of the program in August 2021:



Corporate Conscious Choices

In early 2022, Etihad began the expansion of the Conscious Choices programme to recognize and reward corporates and their employees.

Built on the same principles of the guest-facing programme, Corporate Conscious Choices allows the airline to work closely with corporate partners to deliver solutions which facilitate their organisational sustainability-related goals.

Designed specifically for those committed to reducing emissions and operating sustainably, the programme includes incentives and rewards around carbon offsets and Sustainable Aviation Fuels, and greatly supports our long running efforts around Book & Claim.

The airline's Global Sales team ran a campaign with Trip.com, with Etihad offsetting the emissions from all flights booked with the site free of charge. The campaign provided valuable insight into what customers care about and how we can positively match their priorities in ways that is meaningful to them, while sustaining business.

Working together

Throughout 2022, Etihad diligently consulted with corporate partners to develop a value proposition which maximizes opportunity, fit for purpose to the needs of our customers:

- Aviation sector specific carbon projects

By ensuring the projects meet the specific needs for aviation, we remain confident in the quality and standards of our offerings.

- Corporate interest driven

By curating the programme to cater to the interests of Corporate customers, we build the programme on healthy business relationships which can continually evolve

- Sustainable Aviation Fuel offerings

With the challenges to meaningful introduction of SAF as outlined earlier in the report, developing the programme to include SAF purchasing allows a drive in demand which we hope to improve supply.



Fleet

Fuel Efficiency

Guest Experience

Innovation

Biodiversity

Conscious Choices

On the Ground



Looking back

At the end of 2021, Etihad successfully completed Stage 2 of IATA's Environmental Assessment Programme, making Etihad Airways one of only nine airlines in the world to pass the evaluation.



2022

Maintaining our efforts around energy and waste from facilities and transport, Etihad's Asset Management team commenced a diverse and innovative program of initiatives in 2022. These included activities to engage and encourage Etihad employees to make 'conscious choices' in their day to day lives and at the office.



Empowering the workforce

In 2022, a sustainability-dedicated training course was introduced to our employees' learning platforms, focusing on educating colleagues on the crucial elements of sustainability in aviation. 10,772 employees took the course throughout the year, and an additional 147 employees completed the IATA Sustainability training course organised by the Sustainability team.

Energy-saving systems

We installed motion sensors in all meeting rooms, 'Flight Mode' smart home setups in our company provided accommodation, more efficient elevators and are exploring opportunities for water recycling systems.

Additionally, the continuous roll out of smart LED lighting panels installed in our facilities offer annual savings of 75.2 tonnes CO₂ by consuming 64.9% less energy to non-LED lights.

Reduced food waste

We introduced a food waste reduction campaign at our 7ate7 Cafés (along with offering bamboo cutlery to replace single-use forks and knives).



On the move

Continuously working with our suppliers, the Transportation team introduced waterless bus washing. From March to December, 776,440 liters of water was saved from the initiative.



DGrade⁴¹

In August, we partnered with DGrade to recycle plastic waste. DGrade uses special technology to turn PET plastic into Greenspun® yarn, which can be woven or knitted to make clothing and other items. In tandem with single use plastic reduction efforts, the partnership allows us to provide solutions which avoid sending SUP to landfill and make use of the material.

From August to December, 29,150 bottles were collected from various locations and given new life by DGrade, producing approximately 1,940 t-shirts.

DGrade's recycling efforts save 20% water, produce 55% fewer CO₂ emissions and save 50% of the energy when compared to use of raw materials. While the goal is to remove single use items, solutions such as DGrade allow us to explore alternative opportunities when it can't be avoided.



Representing Etihad

Since 2021, Etihad has made it a priority to ensure sponsorship and event activations integrate sustainability related elements and reflect the company's strategic direction around sustainability.

First used at Dubai Airshow and Etihad Airways Formula 1 Abu Dhabi Grand Prix in 2021, Etihad's stands at events were constructed using eco-friendly materials such as cork board, repurposed cardboard and use of live plants. Throughout 2022, we were able to minimize new materials as much as possible and focused on reusing stand materials for multiple events.

Looking forward, the focus is making conscious efforts to assess all impacts of stand production at events; such as energy consumption, material lifecycle and continual reuse of stands.



As Etihad continues its journey down the net zero aviation flight path, it would be disingenuous not to address the concerns related to certain claims, describe the complex nature of the task, or justify – to be held accountable – for certain necessary decisions.

Flying will always pose a more difficult challenge in decarbonisation. While the oxymoron shall exist of a commitment and wholehearted pledge to environmental protection expressed against the significant negative impact from aviation, the debate to stop flying is unrealistic. With passenger demand forecasts rising, consumer behavior insights will provide vital tools to uncover innovative solutions for emissions reduction.

To take a bold approach to the topic of Sustainable Aviation is to acknowledge that the industry's very license to operate is called into question when confronted with the reality of the climate crisis. Etihad is no exception, and as such, to acknowledge the benefits of aviation is necessary to insist upon the true intentions of Sustainability strategies.

The UN SDGs alone are not explicitly related to Environmental development, and indeed focus on humanitarian, social and economic development. In fact, the mobility strategy of the United Nations 2030 Agenda for Sustainable Development³⁹ deems 'safe, reliable, efficient and cost-effective air transport as an essential component'. The fine equilibrium is compounded with conflicting narratives, misguided efforts, and veiled intentions. Therefore, without full transparency of company and industry goals, obligations on all fronts will not be met; and progress toward true environmental sustainability will fail.

Such benefits both insist upon the value of the industry, and further offer an opportunity to apply critical thinking, learn from and innovate alongside the efforts made. The importance of conducting a sustainability strategy relies on the critical, analytical, and realistic perspectives of the whole industry.

To be bold is to be honest, transparent, and willing to face criticism. Indeed, this has formed the basis of the airlines' 'call to arms': to be joined by, and challenged by, peers across the industry. This path cannot be walked alone, and no singular action will solve this problem.

The path to Net Zero will be made up of a million little things. This report is simply a few of ours.



Innovation^{12 13}

With aircraft today operating with greater fuel efficiency than an average sedan, aviation existentially presents a canvas for technological advancements that affect industries beyond its own. The feat of engineering that is flight was achieved through the need discover and explore. Airframes like the B787 demonstrate the disruptive technology developments that enforce the continuous transformation of aircraft design.

The use of composite materials, such as carbon fibre, and the development of technologies such as 3D printing were researched, developed, and pioneered by aerospace and have since been further advanced outside the industry.

In addition to the educational benefits derived – with many research institutions involved with airlines, manufacturers, air navigation service providers, and so on – aerospace companies spend an average of \$15 billion on research for aircraft technology efficiency.^{12 13}

The globalization benefits are compounded here when looking at available global skillset improvements, and opportunities for youth to enter such a technical and complex industry.

Economic^{43 44}

In 2019, 4.1% of global GDP was contributed to by aviation, carrying 4.5 billion people across the world and supporting 87.7 million jobs. To contrast, COVID-19 inflicted a 94.4% drop in 2020 passenger traffic compared to 2019. While offering respite in CO₂ emissions, this resulted in the loss of 46 million jobs and \$1.8 trillion in global economic activity.

As echoed in the 2020-2021 Sustainability Report, the saying goes that in times of crisis, families can either pull themselves together, or pull themselves apart. And as the world grappled with the impacts of COVID-19, aviation offered solutions impossible by any other means. 39,200 repatriation flights by airlines carried 5.4 million people home when travel restrictions left them stranded. 1.5 million tonnes of cargo, including medical equipment, were carried on 46,000+ special cargo flights. The world remained connected, and relief was made available through air travel. It is somewhat easier to insist upon the value of aviation when displayed against the background of challenges Covid-19 presented, and this section acknowledges the benefits are derived from a novel circumstance.



Tourism^{21 43 44}

Oil-reliant countries seeking to create more sustainable and diverse economies will inevitably turn to tourism as a valuable opportunity; particularly if such nations do not have the climate characteristics for industry such as food production or export. The UAE is one such example, and this is demonstrated in the significantly high proportion of emissions from flights departing the region. Being in the red will inevitably draw pointed fingers, but with summers up to 50C and desert making up 80% of the country's landmass, opportunity for continued development is scarce.

Despite higher per capita emissions from passengers, the UAE operates virtually no domestic flights, and yet scores extremely high for emissions due to international aviation. This is a predictable statistic but draws attention to the 60-40 split of global aviation from international and domestic flights, respectively. It is the benefits of a rich oil economy and the 'hub'-nature of the UAE in connecting passengers to the world that afford the access to innovations and entitle organisations like Etihad to fulfil and deliver the transformation needed for sustainability. With this responsibility in mind, studies show 58% of international tourists travelled by air in 2019, and closer to home, the same year generated some \$87 billion in tourism linked GDP in the Middle East.

To permit oil-reliant regions to maintain sustainable development outside the energy sector, tourism as an alternative industry relies on air travel to grow – with 44.8 million jobs in tourism supported by air transport, 19.6 million of which were supported directly by spending power of foreign tourists visiting by air. Not to solely insist upon the value of leisure travel, aviation is often affectionally referred to as the business of freedom. With the goal to leave behind nothing more than memories of travel and a connected world, there is still greater weight to the argument of tourism than meets the eye.

This report opened with a statement to acknowledge the negative impacts of the aviation industry and insist that, rather than celebrate achievements, we report our progress with the intention to demonstrate we are taking responsibility.

From the moment we painted a plane green, named it the Greenliner and put pen to paper in writing the story of Etihad Sustainability as 'For The World', we have had one consistent message – we will, because we must.

This report has outlined arguments for aviation; not to defend our right to pollute, not to claim entitlement of growth at any cost – to the planet, or otherwise. The case for aviation's very existence must be made, so that it is understood there is no other choice but to keep going – to evolve to the industry we must become.

For all efforts made, we accept that what cannot be overcome is the scrutiny that follows any bold, loud statements.

We accept that we should be challenged and analysed and double-checked to make sure we are making the necessary progress. We accept that we must go through the extra effort of explaining every choice and decision made and accept that we must continually defend our intentions.

However, it is crucial that we foster an environment of collaboration and understanding, where every meaningful effort is acknowledged. Let us acknowledge that progress takes time, and it is by working together, hand in hand, that we can bring about real change.

As echoed in our last sustainability report, the sentiment of 'if it were easy, it would have been done' remains. It holds true when we understand that if there were any one answer – the perfect airframe, the perfect energy source – there would be no need for reports such as this, because it would be done.

We are part of a global community that must work together for collective action to encourage and embrace positive change. Let us engage in constructive dialogue, inspire innovation, and encourage all sectors to collaborate on this remarkable journey towards a more sustainable and harmonious world. Together, we can accomplish great things.

As we navigate the vast challenges of our global sustainability journey, it is essential that the temptation is resisted to vilify any particular industry - including aviation - in the effort to develop solutions. We must remember that this challenge extends far beyond any single sector. To vilify and attack is to discourage the very innovations that are needed. The required discoveries that depend on investment or offtake to scale up can only be impeded by unproductive criticisms.

By fostering an inclusive and supportive environment, we can unlock the immense potential for cross-industry collaboration, paving the way for groundbreaking discoveries and the emergence of new technologies. This must be built on a shared vision of progress, where every individual and sector is welcomed with open arms and minds, propelling us toward a brighter, more sustainable future together.

While we fully acknowledge the historic and current negative impacts of the aviation industry, we firmly believe that celebrating every milestone along this most necessary transformative journey is vital to fostering sector-wide momentum and sustaining unwavering commitment.

As this report attempts to show, the foundation of our efforts are knowledge sharing, collaboration and rigorous testing. We at Etihad remain steadfast in our commitment to transparency, taking full accountability for our impacts, and embracing criticism as an opportunity for growth on the journey for Sustainable Aviation.

It is clear that flying presents a significant challenge in decarbonization, however the aviation industry offers endless opportunities by way of economic and social development, technology, innovation and globalization – all of which hold the key to the environmental outcomes we seek.

The nature of air travel is to fulfil the need to explore, learn, grow and share – breaking down barriers and evolving as a global community. The very ingredients we need as a planet to solve the challenges of sustainability. A physically connected world holds the key to uncover the required innovative solutions for emission reductions. We are committed to playing our part.

Despite the potential for unwarranted accusations, we remain steadfast in narrating our genuine sustainability journey with transparency and sincerity.

We understand that speaking out might attract some criticism, but it's a necessary step to ensure that those who are truly committed to the cause can discern our efforts and join us in our mission.

We will continue to do so, because the foundation of our efforts supersedes all material gains: we will continue to do it...

For the world.



There is no *enough*

The airline has built a narrative on a 'million little things' to remember it is a combination of efforts, and not one silver bullet to make significant changes.

Reducing current and future emissions means defining an informed baseline, identifying opportunities to manage existing impacts, accelerating roadmaps for technology advancement and continually evolving through innovation. We maintain that true, valuable sustainability is defined as the synchronized protection of the environment while sustaining commercial, operational, and social objectives.

It is imperative that the industry and beyond do not look too far ahead to 2050, we miss opportunity today. It is also imperative not to focus too much on today, that we don't see the great potential of advancements that will come by 2050. We must exploit all possible technologies available while simultaneously driving roadmaps to support the industry infrastructure.

Call to arms

We've pushed a narrative of collaboration over competition, and our experience continues to show progress in sustainable aviation requires a focus on extending theoretical research and development into live operations. The research, development and testing conducted has only been possible with the contribution, guidance, support and expertise of our partners. Without them, the industry will be inhibited by disconnection, lost innovation and more severely, independent success.

One airline with the world's most sustainable operations will effectively create no impact for the planet; one manufacturer or one airframe, one engine or one product cannot alone solve the crisis, and Etihad considers true success only when all airlines, all OEM's, all suppliers and all travellers may reliably offtake the solutions the industry is dedicated to researching.

There is no glory in becoming the world's most sustainable airline. Instead, we are committed to becoming an airline leading sustainability. We seek for reports such as this to purely insist upon the integrity of our strategy, for awards such as Environmental Airline of the Year 2022 to acknowledge we are on the right track, and for publishing of CO₂ reductions to demonstrate successful proof of concept.

A million little things

In the world of a million little things, it is important to remain fixated on a specific goal to which any nature of initiative can be directed. The hopes of realising Net Zero by 2050 are coordinated under the principle to "Achieve majority of emissions reductions through in-sector measures".

Understanding the financial and commercial implications of SAF, the challenges do not overcome the responsibility... or urgency. With emissions from aviation expected to rise as much as 20% by 2030, maintaining 2019 levels would require a 15% substitution of SAF.

As this report attempts to demonstrate, this infrastructure requires financial, logistical stability and access to production and supply of each solution. It also requires regulation, particularly in areas of complex science and indirect reductions.

The exposure to carbon offset projects and experience with managing the development of them prioritises the importance of fully traceable and governed carbon credit systems. Thankfully, this landscape has matured but all participants must be well versed in methodology frameworks, reputable registries, verification processes of non-additionality, permanence, and non-double counting.



Uncomfortable Truth

Net Zero will rely on offsets

Until such a time as there are commercially-viable, realistic, reliable, and scalable technologies to reduce aircraft emissions, we will rely on CEF and offsets to meet targets

We cannot do this alone

Airlines are the last step in a long, complex system and will rely on improvements along the entire supply chain. Achieving Net Zero with a combination of reductions and offsets will rely on a whole industry effort.

We still have a responsibility

Despite the clear and undeniable proof that airlines are left with a burden that is not entirely of our own making, and arguably less commercially fit to shoulder the investments needed alone...

We still cannot wait for someone else to solve the problem, as our consumers are calling for action.

Therefore, we will, as we must

We designed the Etihad Greenliner Programme to allow us to access the entire aviation ecosystem - to enable, consult and collaborate on the necessary advancements to unlock this roadmap...

Join us... *for* **THE WORLD**

الإتجاه
ETIHAD
AIRWAYS



FROM ABU DHABI *for* THE WORLD

Etihad Principal Activities

Etihad's core business activities at the start of 2022 included passenger and cargo operations (Etihad Airways, Etihad Cargo), engineering and technical, catering (Etihad Airways Catering Services) and ground operations (Etihad Airways Airport Services).

In mid-2022, Etihad Aviation Group underwent organisational transformation and redistribution of subsidiaries was carried out. The reporting of Etihad's carbon footprint shall follow the principles of Scope 1, 2 and 3 reporting based on this restructure and adjustments have been made to the scope of reporting for the airline.

With these changes, there are some instances in which Etihad Airways will continue to report emissions impacts for entities for which is no longer retains ownership. In such instances, we will continue to report the emissions data as we are the primary tenants of certain facilities.

There are also instances in which the removal of certain entities may 'reduced' data reported against previous years which is therefore unrelated to direct sustainability initiatives. A goal for the airline is to enhance emissions reporting across all scopes, allowing a more accurate snapshot of areas to improve and the endorsement of more initiatives to reduce environmental impacts. As the data will show, despite the removal of entities, the airline has enhanced data reporting in Scopes 2 and 3, reporting higher than in previous years.

Ultimately, with the data distribution of Etihad Airways, aircraft emissions (Scope 1) account for on average 97.8% of impact and therefore the changes of Scope 2 and 3 emissions owed to restructure ultimately are less significant in comparison.

Changes to organisation – dates of transfer

Etihad Airways Training	May 2022
Etihad Airways Services – Ground	May 2022
Etihad Airways Services – Cargo	May 2022
Etihad Airways Services – Catering	May 2022
Etihad Secure Logistics	May 2022
Etihad Holidays	June 2022

Reporting Period

The Etihad Airways 2022 Sustainability Report covers the full calendar year for 2022. The release of the Sustainability Report on Earth Day, April 22, 2023, permits the gathering of data and information from January 1, 2022, to 31 December 2022, as it has done for previous years. Where data or initiatives from past calendar years are referenced, this is noted and used to demonstrate continuity of efforts over time.

This report outlines the airline's 'identity' (fleet size, network size, organisational goals) as of December 2022.

Scope of report

This annual report aligns to the airline's strategy of ecosystem sustainability and therefore references activities beyond the mandatory reporting scope of the airline. While the contents of the report will include efforts beyond the airline's own operations, all data relating to Etihad's environmental performance will be highlighted, and compliant to all standards, where relevant.

Acknowledging this report only focuses on the environmental performance of the airline, Etihad intends to capture social and governance (ESG) performance in future reports to align with industry ESG metrics recommended by IATA.

Redefining Sustainability Impact related to Etihad Airways

Scope 1	Area	As of 2022
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Reported in tCO₂ emissions from fuel usage data. Aligned against CORSIA, ETS (Emissions Trading Schemes) and finance data. Average 97.7% emissions.

Aircraft generated emissions	Operations	Yes
Ground transportation	Network Operations and Technical	Yes
Airside Ground Transportation	Etihad Airways Services – Ground	No

Scope 2

Reported in tCO₂ emissions from utilities consumption data. (1) Electricity – kWh, (2) District Cooling Water – kWh/hr, (3) Potable Water – m³. Aligned against IEnvA reporting standards. Average .66% emissions.

Etihad Airways Headquarters	Main campus, offices	Yes
Etihad Airways Plaza	Accommodation and retail	Yes
Etihad Airways Centre	Offices	No
Etihad Crew Briefing Centre	Offices and crew logistics	Yes
Etihad Training Academy	Training and offices	No
Etihad Airways Medical Centre	Medical Facility	Yes

Scope 3

Reported in kgCO₂e, includes waste to landfill of Etihad owned properties, and to include transportation data for airside activities outside of Scope 1 data for entities no longer within Etihad Airways business activities. Average 1.66% emissions.

Waste to landfill	Etihad Complex	Yes
Transportation – landside	Asset Management – Crew and employee transportation	Yes - new



References

Ref	Source	Title	Link	Page
1	ICAO	ICAO CORSIA CO ₂ Estimation and Reporting Tool (CERT)	Link	7
2	Greenhouse Gas Protocol	Protocol Standards	Link	9
3	Etihad Aviation Group	Transition Finance Framework: September 2020	Link	10
4	Vigeoeiris	Second Party Opinion on Etihad Airways' Sustainability-Linked Financing Framework	Link	10
5	IEA – International Energy Agency	Energy Technology Perspectives 2020	Link	10, 13
6	IEA - Energy Technology Perspectives 2020	Technology needs in long-distance transport Innovation needs in the Sustainable Development Scenario	Link Link	10, 13
7	IATA (International Air Transport Association)	Factsheet: CORSIA	Link	11, 13
8	ICAO – International Civil Aviation Organization	Update on the work on the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)	Link	11, 20
9	European Commission	Aviation and the EU ETS	Link	11
10	UK Government	Guidance: UK Emissions Trading Scheme for aviation	Link	11
11	SBTi – Science-Based Target Initiative	Science-based target setting for the aviation sector	Link	11, 31
12	Proponent	What does 'Green Aviation' mean?	Link	12, 36
13	ICAO – Working Paper	Assembly: The Cost of Achieving Net-Zero Carbon in Aviation	Link	12, 13, 21, 36
14	IATA ICAO	TrackZero 2050	Link	12
15	United Nations – UN News	The race to zero emissions, and why the world depends on it	Link	12
16	United Nations	The Paris Agreement	Link	12
17	UNFCCC – United Nations Framework Convention on Climate Change	Paris Agreement	Link	12
18	ICAO – International Civil Aviation Organization	Convention on International Civil Aviation - Doc 7300	Link	13
19	IATA (International Air Transport Association)	Offsetting CO ₂ Emissions with CORSIA	Link	13
20	ICAO – International Civil Aviation Organization	CORSIA Eligible Emissions Units	Link	13
21	Our World in Data ATAG – Air Transport Action Group	Emissions by sector Facts & Figures	Link Link	16
22	IATA (International Air Transport Association)	Developing Sustainable Aviation Fuel (SAF)	Link	16
23	ICAO – International Civil Aviation Organization	CORSIA Methodology for Calculating Actual Life Cycle Emissions Values (CEF)	Link	16, 17, 20
24	ICAO – International Civil Aviation Organization	ICAO – CORSIA Eligible Fuels	Link	16, 17

Ref	Source	Title	Link	Page
25	Our World in Data	Aviation/Aviation's Emissions Problem	Link Link	17, 21
26	IEA – International Energy Agency	Are conditions right for biojet to take flight over the next five years?	Link	17
27	Blue Sky	SAF demand to increase more than 30-fold by 2025 as industry decarbonises	Link	17
28	World Economic Forum Clean Skies for Tomorrow	Sustainable Aviation Fuel Certificate (SAFc) Emissions Accounting and Reporting Guidelines White Paper	Link	17, 19
29	Environmental and Energy Study Institute	Issue Brief The Growth in Greenhouse Gas Emissions from Commercial Aviation (2019, revised 2022)	Link	30
30	EUR – European Union Law	Report from the commission to the European parliament and the council Updated analysis of the non-CO2 climate impacts of aviation and potential policy measures pursuant to EU Emissions Trading System Directive Article 30(4)	Link	30
31	Environmental Agency of Abu Dhabi	Abu Dhabi Mangrove Initiative, Environment Agency – Abu Dhabi plants one million mangrove seeds by drone	Link	32
32	AGEDI – Abu Dhabi Global Environmental Data Initiative	Trial Assessment of UAE Mangroves Soil Carbon Sequestration Final Report	Link	32
33	Eco Matcher	How to calculate CO ₂ sequestration	Link	33
34	IUCN – International Union for Conservation of Nature	My Mangroves, My Livelihood	Link	32
35	Future Science Group	Carbon sequestration in mangrove forests	Link	32
36	NOAA – National Oceanic and Atmospheric Administration	Coastal Blue Carbon	Link	32
37	BGCI – Botanical Gardens Conservation Initiative	Site	Link	33
38	CarbonClick	Site	Link	34
39	Carbon Click	Aviation	Link	34
40	Carbon Click – Etihad	Etihad Carbon Click portal	Link	34
41	DGrade	Technology – Greenspun® Yarn	Link	35
42	United Nations Department of Economic and Social Affairs	International Civil Aviation Organization (ICAO) Q&A	Link	36
43	ATAG – Air Transport Action Group	Aviation: Benefits Beyond Borders	Link	36
44	ATAG – Air Transport Action Group	Middle East	Link	36
45	IATA	Global Passenger Survey	Link	37
46	McKinsey	Opportunities for industry leaders as new travelers take to the skies	Link	37
47	IUCN – International Union for Conservation of Nature	My Mangroves, My Livelihood	Link	32

Etihad Airways Alignment

Accreditation & Compliance

RATING

IATA IEnvA (Environmental Assessment) – Stage 2	Stage 2 – highest level
DHL Go Green Carrier Evaluation (SAFA)	Outstanding
CDP (Carbon Disclosure Project)	C
EU 2019/904 SUP Directive	Compliant

Industry/Global Initiatives

STATUS

SBTi (Science Based Targets Initiative)	Interim Assessment
SAFA (Sustainable Air Freight Association)	DHL Outstanding Evaluation

Accolades

Environmental Airline of the Year	Airline Ratings Awards
Environmental Sustainability Innovation of the Year	CAPA – Centre for Aviation
Best Airline for Sustainability	Business Traveller USA
Sustainability Award	Nat Geo Traveller China
Sustainability Pioneer In Aviation	TAGS Arab Green Summit

Link

Airline Ratings	Etihad Airways named 2022 Environmental Airline of the Year 2022
CAPA Centre for Aviation	Environmental Sustainability Innovation of the Year 2022
Business Traveler USA/Times Aerospace	Best Airline for Sustainability 2022
Etihad – IENVA release	Etihad Airways IATA Environmental Assessment stage 2 Accreditation
Etihad Transition Finance Framework	Etihad ESG Loan Transition Finance Framework
Vigeoeiris	Etihad Airways Sustainability-linked Financing Framework
Etihad Aviation Group	ESG Policy

Press Releases

Link Date

Etihad Airways Ends The Year With Two Prestigious Sustainability Awards	Link	7 December 2022
Etihad Airways and World Energy partner to demonstrate the future of net-zero aviation, making book & claim real	Link	16 November 2022
Etihad Airways and SATAVIA collaborate to implement contrail prevention for the first time on an Atlantic crossing	Link	10 November 2022
CEPSA and Etihad join forces to accelerate the decarbonisation of air transport	Link	2 November 2022
First Etihad Airways flight using sustainable aviation fuel as part of deal with ITOCHU and NESTE departs Tokyo Narita	Link	27 October 2022
Etihad Airways and World Energy collaborate to demonstrate the future of Net Zero aviation with zero emissions flight to COP27	Link	20 October 2022
Etihad Airways commits to adopt a mangrove tree for every guest who books Economy Space	Link	25 August 2022
Etihad Airways becomes first airline to partner with University of Cambridge Aviation Impact Accelerator	Link	19 July 2022
Etihad Airways named airline ratings 'Environmental Airline of the Year 2022'	Link	15 July 2022
Etihad Airways partners with Junk Kouture	Link	13 July 2022
Etihad Airways 'Sustainable 50' A350 makes inaugural flight to New York	Link	01 July 2022
Etihad Airways unveils new sustainability-driven economy experience	Link	09 May 2022
Etihad Airways performs 42 EcoFlights including 22 contrail flights over five days	Link	06 May 2022
Etihad publishes 2020-2021 sustainability report showcasing achievements of Greenliner programme	Link	22 April 2022
Etihad Airways leads sustainable aviation with week of intensive flight tests to reduce carbon emissions	Link	20 April 2022
Etihad Airways unveils new 'Sustainability50' Airbus A350 on inaugural flight to Paris	Link	31 March 2022
Etihad Airways launches the Etihad Mangrove Forest in collaboration with Environment Abu Dhabi	Link	25 February 2022
Etihad Guest partners with First Abu Dhabi Bank and Visa to create the world's first Visa co-branded sustainable credit card proposition to reward sustainable choices	Link	03 February 2022
Etihad Airways awarded IATA Environmental Assessment stage 2 accreditation	Link	01 February 2022
Etihad Guest and Talabat expand partnership to offset carbon emissions	Link	25 January 2022
Etihad expands green loyalty offering with corporate programme to reward organisations and their staff for making sustainable choices	Link	19 January 2022
Etihad Airways Ends The Year With Two Prestigious Sustainability Awards	Link	7 December 2022
Etihad Airways and World Energy partner to demonstrate the future of net-zero aviation, making book & claim real	Link	16 November 2022