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FLIGHT EMISSIONS REVIEW

OFFICIAL AIRLINE REPORT

APRIL 2026

Find out where the world's leading airlines rank in our new Emerald Performance Tier

emeraldsky by CIRIUM
LOW EMISSIONS
Gold
2025

emeraldsky by CIRIUM
LOW EMISSIONS
Silver
2025

emeraldsky by CIRIUM
LOW EMISSIONS
Bronze
2025

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INTRODUCTION

by **Jeremy Bowen**, Chief Executive Officer, Cirium

Global demand for air travel recovered strongly through 2025, with emissions surpassing pre-pandemic levels. As we publish this report, however, the industry faces severe disruption. The conflict in the Middle East has closed airspace across Iran, Iraq, Syria and parts of the Gulf, forcing widespread rerouting, flight cancellations and reduced operations at some of the world's largest hubs. Several of the carriers featured in this Review are directly affected.

The data in this report covers the 2025 calendar year and reflects a period before the current disruption. We have chosen to publish it because the need for accurate, comparable emissions data does not diminish during a crisis. If anything, it increases. When airspace closures force longer routings and higher fuel burn, when carriers must restructure their networks at short notice, understanding baseline efficiency becomes more important, not less. **The industry is not short of ambition when it comes to sustainability, but ambition needs measurement, and measurement needs standards.**

Sustainable Aviation Fuel is expected to account for a significant share of the industry's path to net zero by 2050, but production today still represents a small fraction of total fuel demand. Increasing supply and reducing cost will take years. **In the meantime, the operational decisions that airlines make every day, the aircraft they choose, the density of their cabins, the routes they fly, remain the most immediate factors they can act on.** Those decisions deserve to be measured consistently and independently.

That is what EmeraldSky provides.

EmeraldSky is Cirium's emissions intelligence framework. It applies a single, consistent methodology across the global airline industry so that carriers can be compared directly, regardless of their size, business model or geography.

The core measure is CO_2 per Available Seat Kilometre (ASK), which reflects how much fuel an airline burns relative to the passenger capacity it operates.

This year we have refined the methodology to improve accuracy, particularly in how we treat cargo carried on passenger aircraft and how we separate current efficiency from year-on-year improvement. The details of these refinements are covered in the analysis that follows.

The methodology has been independently assured under ISAE 3000 by PricewaterhouseCoopers. Cirium's EmeraldSky is also accredited by the Rocky Mountain Institute as a qualified flight emissions data provider under the Pegasus Guidelines, the first climate-aligned finance framework for aviation. These are not credentials we take lightly. They exist so that airlines, investors, regulators and passengers can use this data with confidence.

What follows is a detailed analysis of emissions performance across the industry. The rankings cover global performance, regional markets, ocean crossings, and individual routes. They are built on the most comprehensive aviation dataset in the world.

I encourage you to read the findings closely. Some will confirm what you expected. Others may not.


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The Emission Intel
empower a sustaina
Climate responsibility is no longer optional, it's a
data empowers aviation stakeholders with effec
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must. EmeraldSky accurate time-based aviation
ctive ways to monitor, manage and reduce CO_2.
CISION | INSIGHT
TALK TO AN EXPERT

GLOBAL AIRLINE RANKINGS

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GLOBAL AIRLINE RANKINGS

by **Mike Malik**, Chief Industry Officer, Cirium

Which Airlines Minimize Environmental Impact?

Last year's inaugural rankings had Wizz Air of Hungary in the top position. **This year, Scoot of Singapore takes that spot with 51.0 grams of CO_2 per available seat kilometre (ASK),** produced from an analysis of the world's 100 largest scheduled passenger airlines. **Wizz Air** moves to second at 52.9g, followed by **TUI Airways** of the UK at 53.6g, Spain's **Air Europa** at 53.9g and **Frontier Airlines** of the USA at 54.1g.

Introducing Gold, Silver and Bronze

This year we have formalised the rankings into three award tiers. The top five carriers earn **Gold** status for flight emissions. Positions six through ten receive **Silver**, and positions eleven through fifteen are awarded **Bronze**. We have created individual emblems for each tier that carriers can display in their marketing materials, investor presentations, or wherever they choose. A ranking table speaks to analysts. Gold, Silver and Bronze speak to everyone. **These tiers give carriers a status that passengers, media and non-technical audiences can immediately understand, and give airlines something concrete to communicate without asking their audience to interpret a spreadsheet.**

What the Results Tell Us

The Gold tier alone spans three continents and three business models, from Scoot's medium-haul, high-density operation in Southeast Asia to TUI Airways' leisure-focused network averaging 2,862 kilometres per flight.

Virgin Atlantic at number seven deserves particular attention. It achieves 54.5g CO_2 per ASK with an average flight distance of 6,566 kilometres. A long-haul carrier sitting in the Silver tier alongside short-haul, high-density operators shows that fleet renewal and cabin configuration matter regardless of route length. With a weighted average fleet age of 6.8 years and 291 seats per aircraft, Virgin Atlantic shows that long-haul operators can compete at the top of the efficiency table.

The patterns we identified in last year's Review hold firm: fleet age and seat density remain the two factors that matter most. Wizz Air's fleet averages 4.7 years. Frontier sits at 4.8. IndiGo, operating the largest number of flights in the top twenty at 796,000, earns its Bronze position with a fleet averaging 4.2 years. Carriers like Jet2 and AirAsia X show the other side of that equation: maximising seat count and route selection can offset older aircraft. Jet2 achieves 57.9g with a fleet averaging 13.6 years.

Year-on-Year Changes and Context

As with previous years, we show the percentage change in CO_2 per ASK alongside the absolute figure. This helps illustrate where carriers have reduced their emissions intensity with their current fleet. Cebu Pacific recorded the largest year-on-year improvement in the top twenty, cutting its CO_2 per ASK by 3.2%. Spirit Airlines followed at 2.8%, and Jet2 at 2.7%. We encourage readers to view these efficiency gains alongside total fleet emissions, which may have risen due to fleet expansion or additional flying. Pegasus, for instance, reduced its emissions intensity by 0.7% but grew its flight count by over 14%. Efficiency per seat and total output do not always move together.

The tables also display average seats, weighted average fleet age and average flight distance in kilometres. Passengers considering the emissions impact of their travel can use this data alongside the CO_2 per ASK figure to compare carriers operating similar routes.

Industry Implications

The spread between the most and least efficient carriers in the top twenty is 7.8 grams, from Scoot's 51.0g to Etihad's 58.8g. Across billions of ASKs, those grams become millions of tonnes of CO_2. Outside the top twenty, the spread widens considerably. With EU ETS already pricing carbon for intra-European flights and CORSIA expanding its coverage of international routes, airlines increasingly need to know where they stand relative to the rest of the industry. **For investors assessing environmental exposure across airline portfolios, that variance represents both risk and opportunity, and these rankings give them a standardised way to measure it.**

What Comes Next

The formula is established: fleet renewal, seat density and route optimisation. What this year's results confirm is that the formula applies across business models and geographies. As Sustainable Aviation Fuel begins to scale beyond its current fraction of total fuel demand, the carriers already performing well here are better positioned for what follows.

This is the second edition of the Cirium Flight Emissions Review. Our intention is to make it the reference standard for emissions performance in commercial aviation. As the dataset grows, the methodology matures and the industry's reporting obligations increase, we expect these rankings to become part of how airlines are compared, how investment decisions are informed and how progress is measured. **We publish this analysis because the industry needs a single, consistent, independently assured benchmark. We intend to be that benchmark.**

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Ranked by Lo

Rank		Operator (group)	Country	Passenger CO_2/ASK (g)		CO_2
				2025	% change vs 2024	202
1	Gold	**Scoot**	Singapore	51.0	-0.1%	2.
2		**Wizz Air**	Hungary	52.9	-2.2%	6.
3		**TUI Airways**	UK	53.6	-0.1%	2.
4		**Air Europa**	Spain	53.9	-0.6%	2.
5		**Frontier Airlines**	USA	54.1	-0.4%	3.
6	Silver	**TUIfly**	Germany	54.4	-1.4%	1.
7		**Virgin Atlantic**	UK	54.5	+0.7%	2.
8		**AirAsia X**	Malaysia	54.8	+2.1%	1.
9		**Pegasus**	Turkey	55.9	-0.7%	3.
10		**Jetstar**	Australia	56.0	-1.9%	3.
11	Bronze	**Condor**	Germany	56.1	-0.7%	2.
12		**Spirit Airlines**	USA	56.8	-2.8%	3.
13		**Iberia**	Spain	57.0	+0.9%	4.
14		**Volaris**	Mexico	57.3	-1.0%	3.
15		**IndiGo**	India	57.4	-1.0%	9.

AIRLINES

west CO_2/ASK

Pax Emissions (mt)		Flights (thousands)		Avg. Seats	Weighted Avg. Age (y)	Avg. Flight Distance (km)
25	% change vs 2024	2025	% change vs 2024	2025	2025	2025
0	+3.7%	65	+9.1%	242	6.7	2,157
2	+6.1%	335	+6.5%	227	4.7	1,547
2	-2.8%	66	-2.3%	207	9.7	2,862
1	+2.8%	69	+1.3%	218	10.0	2,023
5	-0.8%	208	-5.0%	209	4.8	1,470
6	-2.2%	58	-2.4%	192	10.6	2,475
8	+3.1%	27	+2.0%	291	6.8	6,566
6	+5.2%	20	+4.7%	356	14.0	4,177
8	+16.1%	233	+14.3%	212	5.0	1,372
7	+6.5%	183	+3.8%	200	11.1	1,623
3	+7.6%	55	+23.8%	224	11.2	2,883
8	-25.3%	218	-24.7%	199	6.4	1,535
5	+4.2%	100	-1.2%	220	11.5	2,831
1	+5.2%	180	+9.0%	196	7.5	1,532
8	+12.6%	796	+6.6%	185	4.2	1,082

emeraldsky by CIRIUM LOW EMISSIONS Gold 2025

emeraldsky by CIRIUM LOW EMISSIONS Silver 2025

emeraldsky by CIRIUM LOW EMISSIONS Bronze 2025

THE WORLD'S LARGEST AIRLINES BY ASK

The global top 20 ranks airlines by the lowest CO_2 per ASK. But efficiency and scale are not the same thing. An airline can be highly efficient per seat kilometre while producing relatively modest total emissions because of its size. Equally, a very large carrier may sit lower on the efficiency table but generate far greater total emissions simply because it operates more flights over longer distances.

We separately rank the ten largest airlines in the world by total ASK and show their emissions intensity alongside their total passenger CO_2 output. **Qatar Airways leads this group at 60.0g CO_2 per ASK, followed by Ryanair at 62.7g and Turkish Airlines at 64.2g.** What becomes clear from this table is how different these airlines are in their operations. Some fly over two million flights a year on short and medium-haul networks. Others operate fewer than 200,000 flights but cover far greater distances on widebody equipment. Efficiency and total output do not move together, and this table makes that visible.

The Inland Sea or Khawr al Udayd in Qatar

Qatar Airways

60.0g

per ASK

A note on cargo: passenger widebody aircraft frequently carry belly cargo in addition to passengers. This is something we've always felt needed proper treatment in emissions analysis. If you attribute all fuel burn to passengers on an aircraft that is also carrying 20 tonnes of freight in the lower deck, you are overstating the passenger emissions and penalising the airline unfairly. **The EmeraldSky framework removes the impact of belly cargo from passenger emissions.** This adjustment improves fairness for airlines operating long-haul widebody fleets and ensures that the rankings throughout this Review reflect passenger operations rather than freight logistics.

WORLD'S LARGEST

Ranked by

Rank	Operator (group)	Country	Passenger CO_2/ASK (g)		CO_2 E
			2025	% change vs 2024	2025
1	**Qatar Airways**	Qatar	60.0	+0.3%	15.4
2	**Ryanair**	Ireland	62.7	-1.0%	17.4
3	**Turkish Airlines**	Turkey	64.2	-0.9%	15.8
4	**Southwest Airlines**	USA	67.8	-1.6%	19.7
5	**Emirates**	UAE	68.0	+1.4%	25.4
6	**United Airlines**	USA	69.9	-0.2%	37.4
7	**China Southern Airlines**	China	71.4	-2.3%	17.9
8	**Delta Air Lines**	USA	72.1	+0.3%	34.8
9	**American Airlines**	USA	75.0	+0.1%	36.2
10	**China Eastern Airlines**	China	77.6	-1.2%	18.1

T AIRLINES BY ASK

y CO_2/ASK

Pax Emissions (mt)		Flights (thousands)		Avg. Seats	Weighted Avg. Age (y)	Avg. Flight Distance (km)
5	% change vs 2024	2025	% change vs 2024	2025	2025	2025
4	+0.4%	198	-1.1%	278	10.2	4,221
-	+4.3%	1,148	+4.2%	191	10.1	1,264
3	+2.9%	428	-0.1%	204	9.7	2,332
7	-0.1%	1,422	-1.9%	161	11.7	1,252
4	+5.9%	181	+5.2%	408	11.1	4,902
4	+6.0%	1,728	+7.2%	131	14.6	1,735
)	+3.0%	792	+0.9%	182	9.5	1,603
3	+3.6%	1,801	+4.9%	138	14.8	1,517
2	+2.6%	2,245	+3.1%	124	14.4	1,354
	+6.1%	861	+3.2%	168	9.4	1,463

INTRA-REGIONAL HIGHLIGHTS: CO_2 EFFICIENCY BY GEOGRAPHY

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INTRA-REGIONAL RANKINGS: **NORTH AMERICA**

Emissions performance varies depending on the region in which an airline operates. **Fleet age, seat density, average route length and competitive dynamics all differ by market.** A carrier's position in the global table does not necessarily reflect how it compares against its direct regional competitors.

We present intra-regional rankings for four markets, starting with North America. These tables show the top ten carriers by ASK for flights operating entirely within each region, ranked by CO_2 per ASK.

In North America, Frontier Airlines leads at 54.5g, followed by Spirit Airlines at 57.4g. The US majors sit further up the scale, with Southwest at 68.0g performing best among them.

Waterton Lakes National Park - Alberta, Canada

The spread from first to tenth in this region is over 26 grams, which on identical routes translates to a substantial difference in emissions per passenger.

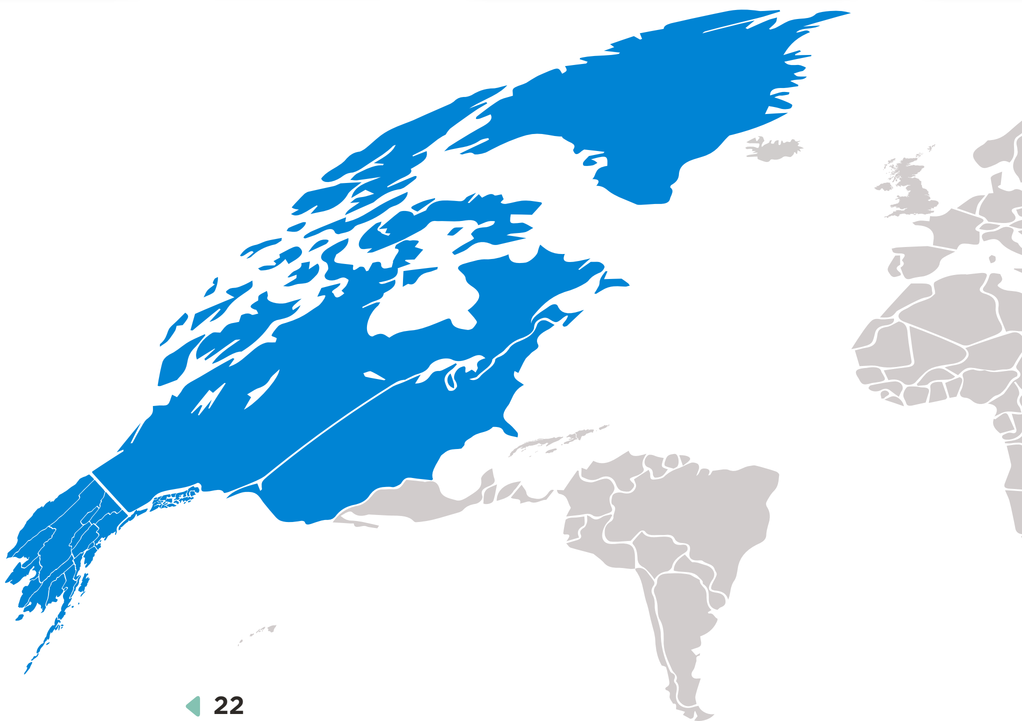
54.5g Frontier Airlines

57.4g Spirit Airlines

68.0g Southwest

NORTH AMER

Rank	Operator (group)	Country	Passenger CO_2/ASK (g)		CO_2 E
			2025	% change vs 2024	2025
1	**Frontier Airlines**	USA	54.5	-1.4%	3.0
2	**Spirit Airlines**	USA	57.4	-2.8%	3.1
3	**WestJet**	Canada	67.0	+0.7%	2.4
4	**Southwest Airlines**	USA	68.0	-1.7%	18.9
5	**Alaska Airlines**	USA	70.4	+0.9%	7.3
6	**Air Canada**	Canada	70.6	+0.9%	4.6
7	**JetBlue**	USA	73.0	-1.0%	4.5
8	**United Airlines**	USA	75.5	-0.3%	21.9
9	**Delta Air Lines**	USA	78.2	+0.7%	23.8
10	**American Airlines**	USA	80.7	+0.1%	25.7



RICA REGION

Pax Emissions (mt)		Flights (thousands)		Avg. Seats	Weighted Avg. Age (y)	Avg. Flight Distance (km)
5	% change vs 2024	2025	% change vs 2024	2025	2025	2025
	+0.3%	185	-4.1%	208	4.8	1,402
	-26.3%	185	-25.1%	198	6.5	1,463
	+2.6%	175	+8.9%	136	11.5	1,348
9	-0.1%	1,382	-1.9%	161	11.7	1,234
	+0.6%	433	+4.7%	129	8.4	1,573
	-1.4%	314	-1.2%	127	13.7	1,329
	-3.2%	205	-5.3%	153	11.9	1,905
9	+6.2%	1,500	+7.5%	120	14.6	1,295
3	+3.8%	1,651	+5.2%	130	14.8	1,216
7	+3.0%	1,996	+3.4%	117	14.6	1,148

INTRA-REGIONAL RANKINGS: **WESTERN EUROPE**

Western Europe produces a different set of results.

Wizz Air leads intra-European operations at 53.1g, with Jet2 at 57.9g and Transavia at 59.9g. Ryanair, the largest carrier by flights in the region with over a million departures, sits at 62.8g.

The spread from first to tenth in this region is 24 grams. **Fleet age explains much of that variation: the carriers at the top of the table operate significantly younger fleets than those lower down.** Jet2, which achieves second position despite a fleet averaging 13.6 years, compensates with longer average flight distances of 2,206 kilometres, where the fuel penalty of takeoff and climb is spread across more seat kilometres. That is worth noting because it shows there is more than one way to improve efficiency.

Etretat, North of Normandy, France

53.1g
Wizz Air

59.9g
Transavia

57.9g
Jet2

WESTERN EU

Rank	Operator (group)	Country	Passenger CO_2/ASK (g)		CO_2 E
			2025	% change vs 2024	2025
1	**Wizz Air**	Hungary	53.1	-2.1%	3.9
2	**Jet2**	UK	57.9	-3.1%	2.8
3	**Transavia**	Netherlands	59.9	-3.0%	2.0
4	**Norwegian**	Norway	61.3	-0.9%	2.2
5	**Ryanair**	Ireland	62.8	-1.3%	16.0
6	**EasyJet**	UK	67.4	-0.9%	7.4
7	**Eurowings**	Germany	68.4	+0.3%	2.4
8	**Vueling**	Spain	70.5	+0.6%	2.9
9	**British Airways**	UK	73.2	-3.8%	3.0
10	**Lufthansa**	Germany	77.1	-0.8%	3.4

ROPE REGION

Pax Emissions (mt)	Flights (thousands)		Avg. Seats	Weighted Avg. Age (y)	Avg. Flight Distance (km)
% change vs 2024	2025	% change vs 2024	2025	2025	2025
+8.3%	222	+7.9%	227	4.6	1,462
+4.2%	110	+7.4%	196	13.6	2,206
+5.4%	116	+7.2%	192	10.5	1,491
+0.9%	148	+0.1%	188	8.9	1,274
+3.6%	1,063	+3.6%	191	10.0	1,248
+4.7%	520	+1.6%	180	11.1	1,164
+5.4%	160	+1.8%	174	13.8	1,218
+4.0%	221	+1.8%	186	12.1	1,008
+1.8%	225	+1.6%	169	14.4	1,036
-3.4%	321	-6.4%	162	15.2	796

INTRA-REGIONAL RANKINGS: **SOUTHEAST ASIA**

Southeast Asia shows the narrowest spread of any region in this Review. **VietJet Air leads at 64.5g, Singapore Airlines sits second at 66.7g and Lion Air third at 67.1g.** From first to tenth, the gap is 14 grams, roughly half the spread seen in North America or Western Europe.

This tighter grouping reflects the relative consistency of fleet types and route lengths across the region's major carriers. It also means that small operational changes, whether in seat configuration, fleet renewal or route mix, can move an airline several positions in either direction. **Cebu Pacific**, for instance, reduced its CO_2 per ASK by 2.9% year on year, the largest improvement in this regional table.

Phang Nga Bay, Thailand

64.5g
VietJet Air

66.7g
Singapore Airlines

67.1g
Lion Air

SOUTHEAST

Rank	Operator (group)	Country	Passenger CO_2/ASK (g)		CO_2 E
			2025	% change vs 2024	2025
1	**VietJet Air**	Vietnam	64.5	-1.7%	1.4
2	**Singapore Airlines**	Singapore	66.7	+0.4%	0.9
3	**Lion Air**	Indonesia	67.1	-0.3%	1.1
4	**Cebu Pacific**	Philippines	67.6	-2.9%	1.2
5	**AirAsia**	Malaysia	71.4	-0.9%	3.8
6	**Malaysia Airlines**	Malaysia	75.9	-1.9%	0.9
7	**Philippine Airlines**	Philippines	77.9	+0.5%	0.9
8	**Vietnam Airlines**	Vietnam	78.1	+0.1%	1.5
9	**Garuda Indonesia**	Indonesia	78.2	+0.8%	1.0
10	**Batik Air**	Indonesia	78.6	+2.0%	1.6

ASIA REGION

Pax Emissions (mt)		Flights (thousands)		Avg. Seats	Weighted Avg. Age (y)	Avg. Flight Distance (km)
5	% change vs 2024	2025	% change vs 2024	2025	2025	2025
	+10.0%	107	+12.3%	221	8.2	941
	+7.9%	45	+5.5%	235	5.9	1,181
	-6.0%	90	-7.4%	212	13.3	828
	+6.7%	108	+4.9%	212	6.5	765
	+8.1%	352	+9.0%	185	11.6	814
	+12.4%	87	+8.2%	145	11.9	847
	+5.7%	89	+4.5%	158	11.5	726
	+12.5%	126	+9.6%	193	11.3	752
	+0.9%	72	+4.0%	166	12.8	1,038
	+9.2%	129	+12.0%	159	10.2	973

INTRA-REGIONAL RANKINGS: **LATIN AMERICA**

Latin America's intra-regional results reflect the mix of low-cost and full-service carriers operating across the continent.

JetSmart of Chile leads at 57.9g with the youngest fleet in the table at 3.1 years, followed by Volaris at 58.8g and VivaAerobus at 61.4g.

LATAM Airlines, the largest operator in the region by flights, sits at 66.6g. **Azul** of Brazil recorded the largest year-on-year improvement in this table, reducing its CO_2 per ASK by 3.3%, consistent with its fleet modernisation programme. The spread from first to tenth is 16.9 grams.

Lake Pehoé and Guernos Mountain - Torres del Paine, Patagonia, Chile, South America

57.9g JetSmart

58.8g Volaris

61.4g Viva Aerobus

LATIN AMER

Rank	Operator (group)	Country	Passenger CO_2/ASK (g)		CO_2 E
			2025	% change vs 2024	2025
1	**JetSmart**	Chile	57.9	+0.8%	1.1
2	**Volaris**	Mexico	58.8	-0.4%	2.0
3	**VivaAerobus**	Mexico	61.4	+0.1%	2.1
4	**Azul**	Brazil	62.6	-3.3%	2.5
5	**Gol**	Brazil	63.9	-1.3%	3.0
6	**Copa Airlines**	Panama	66.0	-0.7%	2.3
7	**LATAM Airlines**	Chile	66.6	-2.0%	7.9
8	**Avianca**	Colombia	67.8	-2.7%	2.5
9	**Aeromexico**	Mexico	73.6	-0.6%	1.9
10	**Aerolineas Argentinas**	Argentina	74.8	-0.3%	1.5

RICA REGION

Pax Emissions (mt)		Flights (thousands)		Avg. Seats	Weighted Avg. Age (y)	Avg. Flight Distance (km)
5	% change vs 2024	2025	% change vs 2024	2025	2025	2025
	+25.9%	92	+32.5%	195	3.1	1,033
	+4.3%	137	+8.0%	196	7.6	1,297
	+5.3%	157	+8.2%	202	9.1	1,069
	+2.1%	285	-2.3%	135	6.7	917
	+12.1%	236	+12.3%	181	9.9	1,107
	+7.2%	104	+8.5%	160	10.5	2,043
	+8.6%	553	+5.9%	183	12.4	1,133
	+4.8%	218	-0.6%	175	11.0	915
	-3.9%	146	-4.9%	149	9.5	1,062
	+2.5%	104	+0.5%	140	10.8	1,247

INTER-REGIONAL HIGHLIGHTS:
CO_2 EFFICIENCY BY GEOGRAPHY

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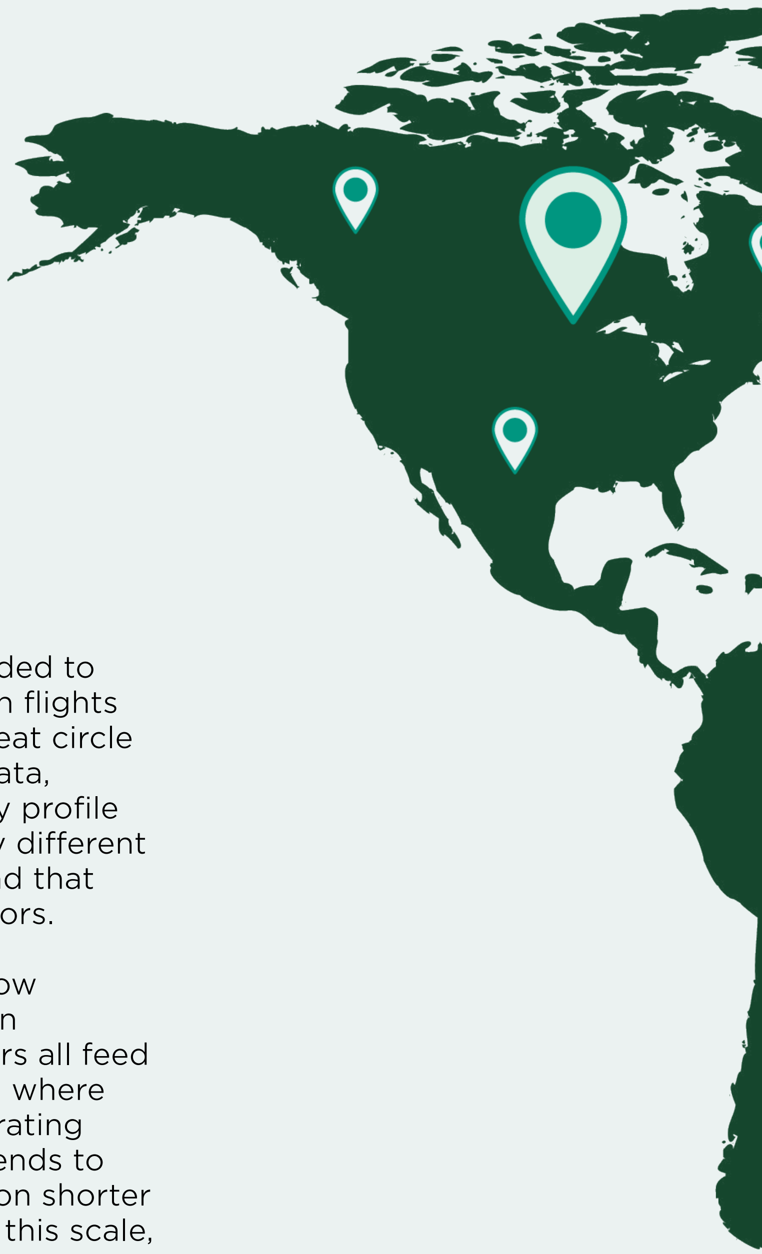
INTER-REGION RANKINGS

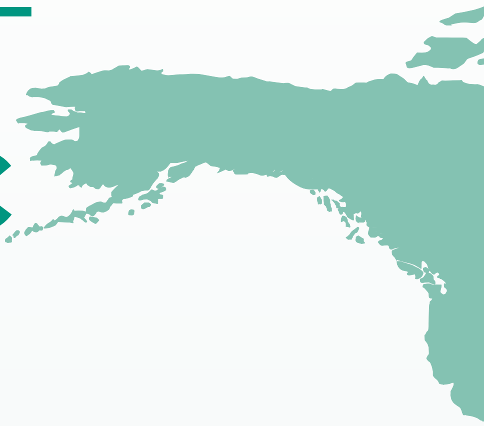
The regional breakdowns are valuable, but some of the most revealing efficiency dynamics appear when airlines are flying between regions. These are the longer routes where widebody aircraft, fuel load decisions, and network design all matter more.



These inter-region rankings measure average CO_2 per ASK for flights connecting two different global regions.

For an airline to appear in this section, it needed to have operated a minimum of 300 inter-region flights during 2024. We've also included average great circle distance per flight alongside the emissions data, because distance matters here. The efficiency profile of a six-hour transatlantic crossing looks very different from a twelve-hour transpacific operation, and that context is important when comparing operators.

This is where the bigger strategic choices show up. Fleet composition, route economics, cabin configuration, and load factors on long sectors all feed into the results. Because these are the routes where fuel burn represents the largest share of operating cost, the efficiency gap between operators tends to be both wider and more consequential than on shorter networks. When you have flight-level data at this scale, you can start to see those differences clearly.



INTER-REGIONAL RANKINGS: **TRANSATLANTIC**

For carriers operating across oceans, we present the top ten by ASK. This table introduces a data point not found in the intra-regional rankings: directional emissions intensity, showing CO_2 per ASK for eastbound and westbound flights separately.

This distinction matters because of prevailing wind patterns. Anyone who has flown the Atlantic will know that westbound takes longer. What the data quantifies is what that means in emissions terms. **Westbound flights operate against the jet stream and consistently burn more fuel than their eastbound counterparts.**

Virgin Atlantic, which leads the transatlantic table at 53.7g overall, records 50.4g eastbound and 56.9g westbound, a spread of 6.5 grams. Delta Air Lines shows a larger directional spread of 8.6 grams on the same ocean.

We include this directional breakdown because aggregate figures mask the operational reality of long-haul flying. For airlines benchmarking their transatlantic performance, and for investors evaluating route-level efficiency, the directional data matters.

53.7g Virgin Atlantic

54.9g Air Canada

56.2g Aer Lingus

TRANSA

Rank	Operator (group)	Country	Passenger CO_2/ASK (g			
			2025	% change vs 24	Eastbound	W
1	**Virgin Atlantic**	UK	53.7	+0.2%	50.4	
2	**Air Canada**	Canada	54.9	+1.8%	51.7	
3	**Aer Lingus**	Ireland	56.2	-0.4%	52.2	
4	**Air France**	France	57.6	+0.3%	53.9	
5	**KLM**	Netherlands	58.4	+2.6%	55.4	
6	**Delta Air Lines**	USA	61.7	-0.7%	57.4	
7	**American Airlines**	USA	62.5	+0.2%	58.4	
8	**United Airlines**	USA	64.6	+0.1%	60.4	
9	**Lufthansa**	Germany	66.2	+0.5%	62.1	
10	**British Airways**	UK	66.3	+0.7%	62.6	

TLANTIC

)	Pax CO_2 Emissions (mt)		Flights (thousands)		Avg. Seats	Weighted Avg. Age (y)	Avg. Flight Distance (km)
Vestbound	2025	% change vs 2024	2025	% change vs 24	2025	2025	2025
56.9	1.8	+1.5%	16.9	+0.6%	292	6.5	6,759
58.1	2.7	+3.9%	24.4	+1.9%	324	14.4	6,108
60.3	1.3	+7.6%	15.1	+11.1%	250	9.0	5,793
61.3	2.7	+4.3%	21.7	+3.8%	311	11.7	6,863
61.5	1.5	+6.8%	12.3	+6.7%	289	11.7	7,124
66.0	5.5	+0.8%	51.2	+0.9%	262	15.2	6,672
66.7	4.3	-0.6%	38.1	+0.6%	266	14.2	6,845
68.8	6.3	+5.3%	59.0	+6.7%	239	21.0	6,775
70.2	3.8	+5.0%	23.8	+4.1%	323	13.2	7,453
70.0	4.5	+1.0%	34.9	+2.4%	284	13.8	6,762

INTER-REGIONAL RANKINGS: **TRANSPACIFIC**

The transpacific table follows the same format, and the directional effect is more pronounced. **The greater distances and stronger headwinds on westbound Pacific crossings amplify the fuel burn differential.**

American Airlines records 56.0g eastbound and 66.0g westbound, a spread of 10.0 grams. **JAL** shows 11.7 grams of directional spread, and **Korean Air** records 13.5 grams, the largest in this table. These are not marginal differences. An airline's emissions profile on Pacific routes looks materially different depending on which direction the aircraft is flying, and any meaningful comparison between carriers on these routes needs to account for this.

Air Canada leads the transpacific table at 56.2g overall, followed by Delta at 57.5g and Cathay Pacific at 59.8g.

56.2g Air Canada

57.5g Delta Air Lines

59.8g Cathay Pacific

TRANSI

Rank	Operator (group)	Country	Passenger CO_2/ASK (g			
			2025	% change vs 24	Eastbound	W
1	**Air Canada**	Canada	56.2	+0.8%	51.7	
2	**Delta Air Lines**	USA	57.5	+0.1%	52.7	
3	**Cathay Pacific**	China	59.8	+1.4%	56.2	
4	**United Airlines**	USA	60.9	+0.2%	56.1	
5	**American Airlines**	USA	61.0	+0.8%	56.0	
6	**Qantas**	Australia	66.1	+3.7%	62.2	
7	**JAL**	Japan	66.3	+0.9%	60.4	
8	**Singapore Airlines**	Singapore	70.3	+1.8%	66.3	
9	**ANA**	Japan	70.9	+2.4%	64.8	
10	**Korean Air**	South Korea	74.8	-4.3%	68.0	

PACIFIC

)	Pax CO_2 Emissions (mt)		Flights (thousands)		Avg. Seats	Weighted Avg. Age (y)	Avg. Flight Distance (km)
Vestbound	2025	% change vs 2024	2025	% change vs 24	2025	2025	2025
60.7	1.6	+3.7%	8.9	+6.6%	322	10.2	10,178
62.3	1.9	+6.9%	11.3	+7.7%	288	6.1	9,945
63.5	2.5	+37.9%	10.8	+33.8%	327	9.0	11,933
65.8	3.9	+5.1%	21.7	+7.1%	281	12.1	10,516
66.0	1.1	+14.7%	6.5	+8.1%	269	11.5	10,688
70.0	1.3	+9.7%	5.5	+4.4%	286	8.8	12,149
72.1	1.6	+10.2%	13.2	+8.3%	221	8.7	8,511
74.4	1.0	+1.7%	5.2	+1.7%	216	6.5	13,437
77.1	1.8	+0.9%	12.2	-1.6%	246	9.1	8,945
81.5	2.7	-3.7%	11.5	+2.5%	313	7.8	9,909

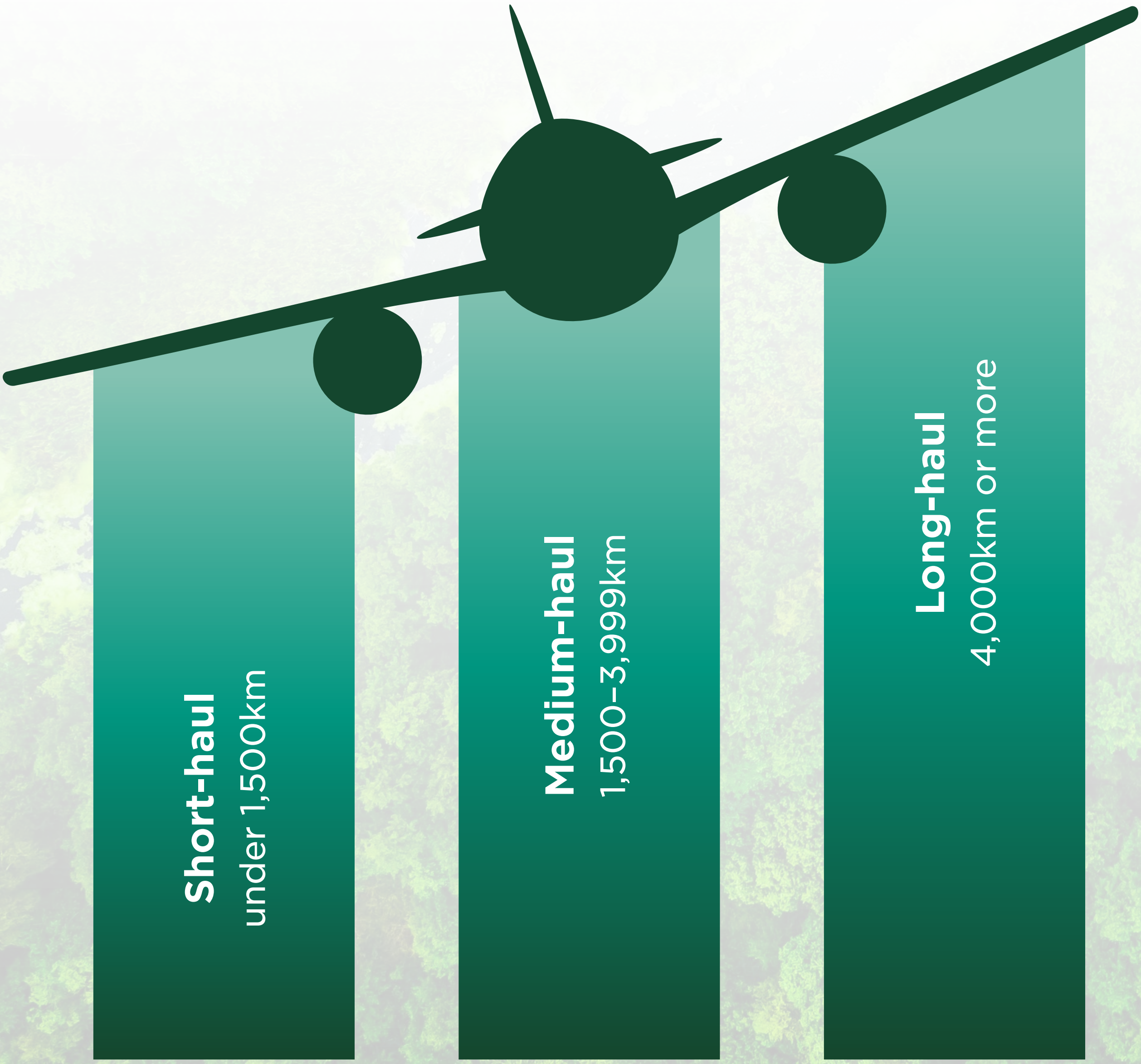
ROUTE ANALYSIS:
TOP 10 PERFORMERS BY ROUTE EFFICIENCY

48

IMPROVEMENT BY ROUTE RANKINGS

This section takes a closer look at where real progress is being made—on individual routes. Here, we've ranked specific airport pairs flown by individual airlines based on their year-on-year reduction in CO_2 per ASK.

To make comparisons meaningful, we've grouped routes into **three distance bands:**



While these bands are defined by great circle distance for categorization, Cirium's emissions estimates go further. Rather than relying purely on distance, **we factor in real-world operating data like tracked air time and taxi time, giving a more accurate reflection of flight-level emissions.**

To qualify, a route must have been flown at least 300 times in 2024 by a single airline—roughly equivalent to 82% of a daily schedule. That means we're focusing on consistent, high-volume routes where meaningful efficiency gains are visible. In fact, **about 77.4% of global flights last year fell into this qualifying category.**

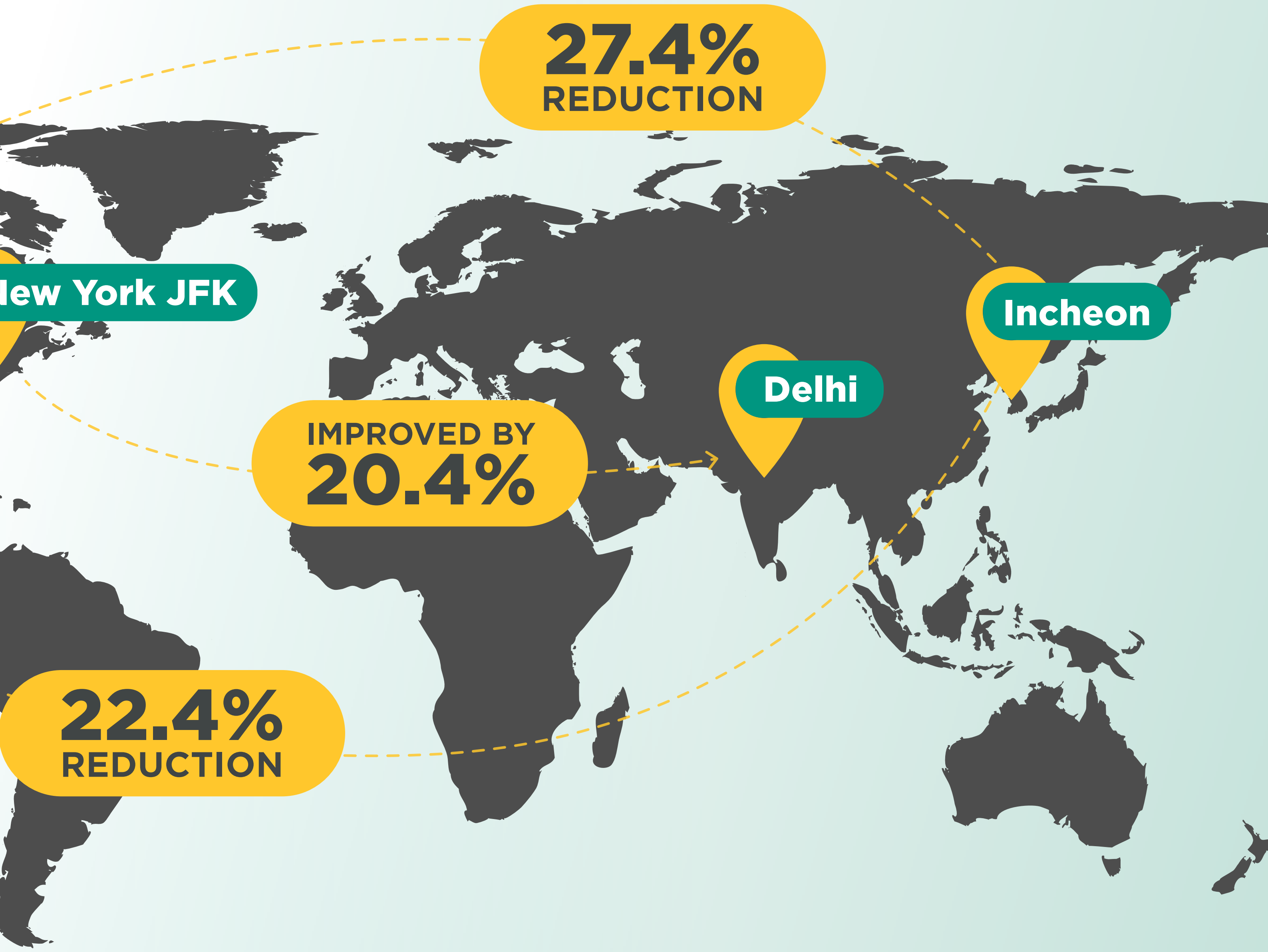
The most significant drops in emissions intensity tend to come from two areas: the introduction of new-generation aircraft and seat densification strategies. To help interpret the changes, we've included an equipment trend column that highlights key fleet updates on each route. While not exhaustive, it gives a useful snapshot of what's driving the improvement.

This view helps pinpoint where airlines are making operational decisions that lead to measurable environmental benefits—route by route. It's another example of how detailed tracking can uncover the small changes that, when scaled, add up to a big impact.

ROUTE-LEVEL IMPROVEMENTS: **LONG-HAUL**

The final three tables take a different approach. Rather than ranking airlines, **they rank individual routes by the greatest year-on-year reduction in CO_2 per ASK**. To qualify, a route must have at least 300 round trips in the year. We then identify what changed on that route, specifically the equipment transition that generated the improvement. This is shown in the final column.

On long-haul routes, **Korean Air's** Incheon to Seattle service recorded a 27.4% reduction after transitioning from 777-300ERs to 787-9s and 787-10s. Korean Air also takes second position with Incheon to Honolulu, where retiring 747-8s and 777-300ERs in favour of 787-10s produced a 22.4% reduction. **American Airlines'** New York JFK to Delhi route improved by 20.4% after moving from 777-300ERs to 787-9s. The composite airframe and next-generation engines on the 787 were designed for exactly this kind of fuel efficiency gain, and the data confirms it is being delivered in operational service. **The pattern across all ten long-haul routes is consistent: carriers replacing older widebody equipment with new-generation aircraft are achieving reductions of 16% or more on individual routes.**


27.4%
REDUCTION
lew York JFK
Incheon
Delhi
IMPROVED BY
20.4%
22.4%
REDUCTION

LONG-HAU

Rank	Operator, route	Passenger CO_2/ASK (g)		Pax CO_2 Emissions (kt)	Fli
		% change vs 2024	2025	2025	2
1	**Korean Air, ICN<>SEA**	-27.5%	53.6	101	7
2	**Korean Air, ICN<>HNL**	-21.5%	52.3	100	7
3	**American Airlines, JFK<>DEL**	-20.2%	59.8	139	6
4	**Icelandair, KEF<>SEA**	-20.1%	57.9	84	1,
5	**American Airlines, JFK<>GRU**	-16.9%	51.5	81	7
6	**British Airways, LHR<>HKG**	-16.9%	64.3	135	7
7	**Delta Air Lines, BOS<>LHR**	-15.4%	60.0	61	7
8	**Delta Air Lines, MSP<>LHR**	-15.4%	57.2	75	7
9	**Lufthansa, MUC<>BOM**	-14.9%	55.5	75	7
10	**Cathay Pacific, HKG<>CDG**	-14.6%	62.8	125	7

UL ROUTES

ghts	Avg. Seats	Weighted Avg. Age (y)	Avg. Flight Distance (km)	Equipment trend
025	2025	2025	2025	
730	308	2.3	8,376	777-300ERs to 787-9/10s
792	327	1.9	7,354	747-8s & 777-300ERs to 787-10s
592	285	7.6	11,756	777-300ERs to 787-9s
347	186	7.0	5,810	757-200s to A321neos
725	284	7.8	7,663	777-200ERs to 787-9s
720	303	4.8	9,631	777-200/300ERs & 787-8/9s to A350-1000s
725	268	6.8	5,241	A330-200s to A330-900neos
721	281	3.4	6,443	A330-200s to A330-900neos
726	293	6.4	6,312	A340-600s to A350-900neos
721	287	7.0	9,590	777-300ERs to A350-900neos

ROUTE-LEVEL IMPROVEMENTS: **MEDIUM-HAUL**

On medium-haul routes, the improvements are driven by narrowbody transitions. United Airlines' Newark to Mexico City service reduced CO_2 per ASK by 21.9% after replacing 737-700s with 737 Max 8s. Three of the top four medium-haul improvements involve the 737 Max 8 as the replacement aircraft, whether retiring older 737 variants or replacing previous-generation A319s.

One result in this table is worth noting separately. **Qatar Airways' Doha to Beirut route achieved an 18.2% reduction without changing aircraft type. The improvement came from a reduction of approximately 41 minutes in average flight time following the reopening of Syrian airspace, which shortened the routing. Emissions intensity is not always determined by equipment. Airspace availability, routing efficiency and air traffic management all contribute.**

United Airlines

Newark

service reduced CO_2 per ASK by

21.9%

Mexico City

Qatar Airways

Doha

achieved an

18.2%

reduction

Beirut

MEDIUM-HA

Rank	Operator, route	Passenger CO_2/ASK (g)		Pax CO_2 Emissions (kt)	Fli
		% change vs 2024	2025	2025	20
1	United Airlines, EWR<>MEX	-21.9%	57.6	46	1,
2	American Airlines, DFW<>SBA	-20.8%	63.7	15	6
3	United Airlines, IAD<>STT	-20.5%	58.7	16	6
4	China Southern Airlines, SHE - NRT	-19.4%	74.3	16	6
5	EVA Air, TPE<>CGK	-18.4%	51.5	56	7
6	Etihad Airways, AUH<>ATH	-18.4%	58.4	38	1,
7	Qatar Airways, DOH<>BEY	-18.2%	68.2	69	1,
8	United Airlines, IAH<>XPL	-17.8%	64.7	17	9
9	American Airlines, DFW<>SBP	-17.1%	68.7	15	6
10	Spirit Airlines, FLL<>AUS	-16.3%	53.3	14	7

UL ROUTES

ghts	Avg. Seats	Weighted Avg. Age (y)	Avg. Flight Distance (km)	Equipment trend
025	2025	2025	2025	
439	166	2.5	3,342	737-700s to 737 Max 8s
675	169	12.2	2,113	A319ceos to 737-800s/Max 8s
537	166	2.0	2,590	737-700s to 737 Max 8s
596	193	4.9	1,601	179-seat A321ceos to 200-seat A321neos
730	284	1.7	3,811	777-300ERs to 787-9s
043	191	8.0	3,263	A320/A321ceos to A321neos
980	280	11.7	1,824	Avg. 41min flight time reduction due to availability of Syrian airspace
902	157	11.3	1,903	737-700s to 737 Max 8s
536	157	17.7	2,185	A319ceos to 737-800/Max 8s
712	211	5.9	1,776	A319ceos to A321neos

ROUTE-LEVEL IMPROVEMENTS: **SHORT-HAUL**

On short-haul routes, **KLM's Amsterdam to Belgrade service achieved the largest reduction of any route in the entire Review: 38.1%**, driven by a transition from E190s to E195 E2s. **Royal Jordanian's** Amman to Beirut route followed with a 32.8% reduction after replacing A319s and E175s with E195 E2s.

Across all three route-level tables, the pattern holds. The aircraft transition determines the result. Whether it is a widebody replacement on a 10,000-kilometre sector or a regional jet swap on a 400-kilometre hop, the emissions reduction follows the equipment change. We find these tables particularly fascinating because they connect the engineering decisions made by manufacturers to the real-world emissions outcomes that passengers and regulators care about. To identify these patterns across thousands of routes worldwide requires flight-level records, fleet composition data and emissions modelling across every scheduled passenger operation. There are millions of rows behind each of these tables.

Amsterdam

Belgrade

ACHIEVED THE LARGEST REDUCTION OF ANY ROUTE IN THE ENTIRE REVIEW

38.1%

KLM

SHORT-HAU

Rank	Operator, route	Passenger CO_2/ASK (g)		Pax CO_2 Emissions (kt)	Fli
		% change vs 2024	2025	2025	20
1	KLM, AMS<>BEG	-38.1%	57.4	15	1,
2	Royal Jordanian, AMM<>BEY	-32.8%	184.5	12	1,
3	Sriwijaya Air, CGK<>TJQ	-28.6%	96.3	5	7
4	SAS, ARN<>TLL	-24.9%	83.3	9	2,
5	Colorful Guizhou Airlines, KWE<>HIA	-23.7%	63.1	11	7
6	Wizz Air, TIA<>DTM	-22.8%	47.3	11	6
7	Sriwijaya Air, CGK<>PGK	-22.2%	95.9	6	[illegible]
8	Azul, REC<>FOR	-20.9%	71.0	18	3,
9	Volaris, SJO - GUA	-20.3%	61.9	7	7
10	JetBlue, BOS<>PIT	-19.9%	88.8	20	2,

UL ROUTES

ghts	Avg. Seats	Weighted Avg. Age (y)	Avg. Flight Distance (km)	Equipment trend
025	2025	2025	2025	
423	131	2.4	1,409	E190s to E195 E2s
,831	143	6.4	238	A319s & E175s to E195 E2s
713	187	16.6	396	737-500s to 737-800s
,269	126	8.4	388	CRJ900s to A320neos and ATR 72 600s
746	166	3.6	1,431	E190s to A320neos
582	239	1.4	1,452	A320ceos to A321neos
811	186	16.7	445	737-500s to 737-800s
,081	133	3.9	628	E195s to A320neos, E195 E2s & ATR 72 600s
733	179	5.3	856	A319ceos to A320neos
230	128	6.4	797	A319ceos to A320neos

EMERALDSKY: HOW WE CALCULATE FLIGHT EMISSIONS

by **Andrew Doyle**, Senior Director, Market Development, Cirium

Measuring aviation emissions accurately is harder than it looks. The industry has historically relied on simplified fuel burn models or distance-based approximations that do not reflect what actually happens on a given flight. Different calculation approaches applied to the same flight can produce different results, which makes regulatory reporting inconsistent, benchmarking unreliable and investment decisions harder to support with confidence. EmeraldSky exists because the industry needed a single methodology applied consistently to every carrier.

The Calculation Methodology

EmeraldSky produces emissions calculations by combining multiple data sources that simpler models either ignore or approximate

.

- **Flight operations data:** We use actual flight tracking data, including gate and runway departure and arrival times. This replaces the theoretical great circle distance calculations used by many existing tools. Real flights do not follow straight lines. They are subject to air traffic control routing, weather deviations, holding patterns and ground delays, all of which affect fuel burn and all of which EmeraldSky accounts for.

- **Aircraft performance models:** We incorporate aircraft-specific fuel consumption models that reflect individual aircraft characteristics, engine type and configuration. These models consider aircraft age and operational weight, both of which significantly affect fuel burn rates. Two aircraft of the same type can produce different emissions depending on their age, engine variant and how they are configured.

- **Operational context:** Taxi times, ground delays, air traffic control routing changes and holding patterns all contribute to total fuel burn but are often excluded from simplified calculation methods. We include them because they are part of what the aircraft actually consumes.

- **Cargo treatment:** Passenger widebody aircraft frequently carry belly cargo in addition to passengers. In 2025, we refined the methodology to separate the fuel burn attributable to cargo from passenger emissions. Without this separation, airlines operating long-haul widebody fleets are penalised in passenger emissions comparisons because a portion of their fuel burn is supporting freight operations, not passenger transport. The rankings and emissions figures in this Review now reflect passenger operations only.

- **Validation and calibration:** We validate our calculations against actual reported fuel consumption data where available, using machine learning techniques to refine the models and improve accuracy over time. On a specified set of mission, aircraft and payload inputs, EmeraldSky achieves an independently calculated accuracy rate exceeding 99%.

Who Uses This Data and Why

The depth of EmeraldSky's calculations makes the data applicable well beyond this annual Review.

Airlines use it to benchmark emissions against competitors, to evaluate fleet deployment strategies and to meet the reporting standards that regulators and investors now require. Corporate travel departments and travel management companies use it to track Scope 3 emissions at the level of individual flights, with seat-level granularity that means offset purchases and sustainability reporting reflect what actually happened rather than what was estimated. Lessors and aircraft finance firms use it to assess the emissions characteristics of specific aircraft, which increasingly factors into fleet acquisition and portfolio decisions. Booking platforms use it to display flight-level emissions to passengers.

In each case, the value depends on the methodology being consistent, transparent and independently verified. EmeraldSky's methodology is assured under ISAE 3000 by PricewaterhouseCoopers, the highest level of assurance available under the International Standard on Assurance Engagements.

BUILDING CONFIDENCE IN EMISSIONS DATA: THE IMPORTANCE OF ISAE 3000 ASSURANCE

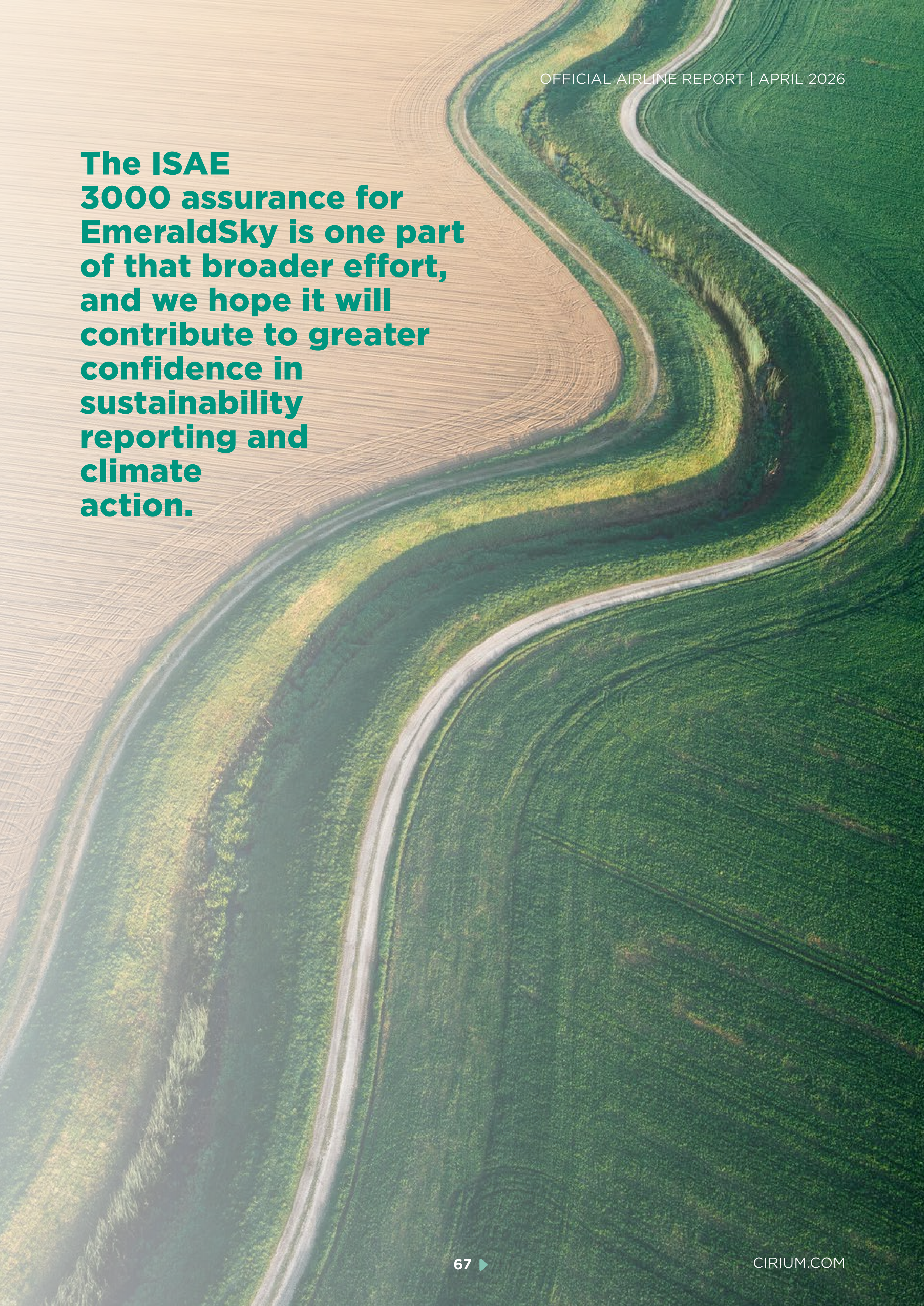
Accurately measuring aviation's carbon footprint is a complex challenge—but it's also essential. That's why Cirium sought independent validation of its EmeraldSky Flight Emissions methodology. The recent achievement of ISAE 3000 Reasonable Assurance, following a detailed review by PricewaterhouseCoopers LLP (PwC), is an important step in helping the industry rely on data it can trust.

ISAE 3000 is a globally recognized standard for assurance of non-financial information. Achieving Reasonable Assurance—the highest level available—means that EmeraldSky's methodology, internal controls, and data processes have been thoroughly assessed and found to meet the standard's rigorous requirements. For those using the data, it brings greater confidence in how emissions are modeled and reported.

EmeraldSky is built on a combination of robust modeling and detailed aviation data. It accounts for a wide range of variables, including aircraft type, engine specifications, payload, taxi times, and fuel burn. These factors are not based on broad assumptions but are tied to operational data, including verified airline inputs where available. The result is a methodology designed to reflect actual performance as closely as possible.

For airlines, airports, and corporate sustainability teams working to report Scope 3 emissions, evaluate environmental performance, or support carbon reduction efforts, reliable data is essential. While no model is perfect, the assurance provided by ISAE 3000 offers added transparency and accountability. It also supports broader industry goals—such as improving decision-making and progressing toward long-term emissions reduction targets.

At Cirium, the aim has always been to provide the aviation industry with tools that are practical, grounded in data, and independently verified wherever possible. The ISAE 3000 assurance for EmeraldSky is one part of that broader effort, and we hope it will contribute to greater confidence in sustainability reporting and climate action.



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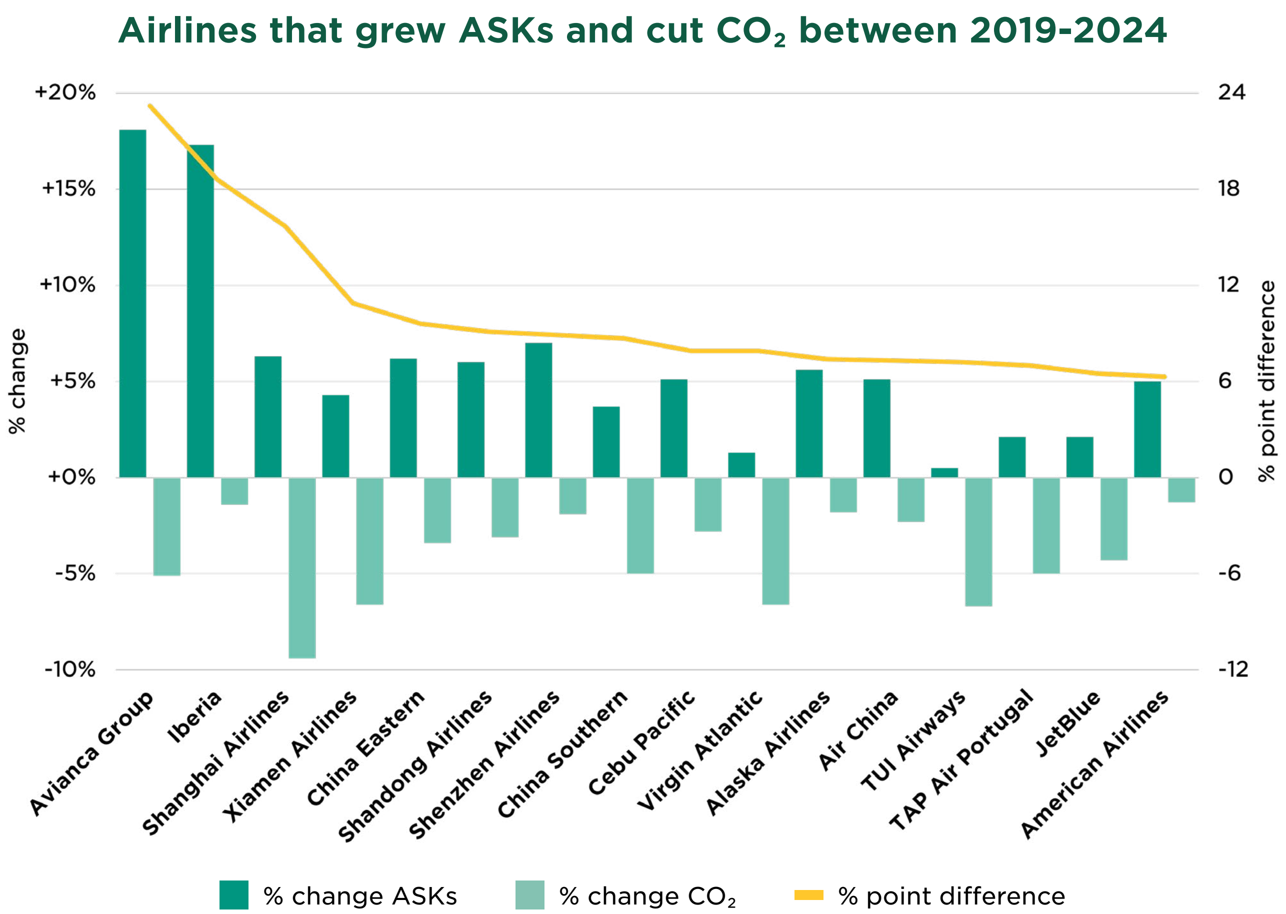
EMISSIONS SUCCESS STORY

68

AVIANCA SCALES CONNECTIVITY WHILE CUTTING EMISSIONS

In commercial aviation, growth and emissions usually move in the same direction. Airlines add more flights, burn more fuel, and produce more carbon. This pattern has held true for decades, which is why Avianca's performance since 2019 is so striking.

According to EmeraldSky data, Avianca stands apart from every other large carrier. During the past five years, the airline increased its overall capacity by more than **eighteen percent (18.1%)** while also reducing total carbon emissions by **more than five percent (5.1%).** This combination simply does not happen often.



The natural question is how Avianca achieved something that most airlines still describe as a long-term aspiration rather than an immediate reality.

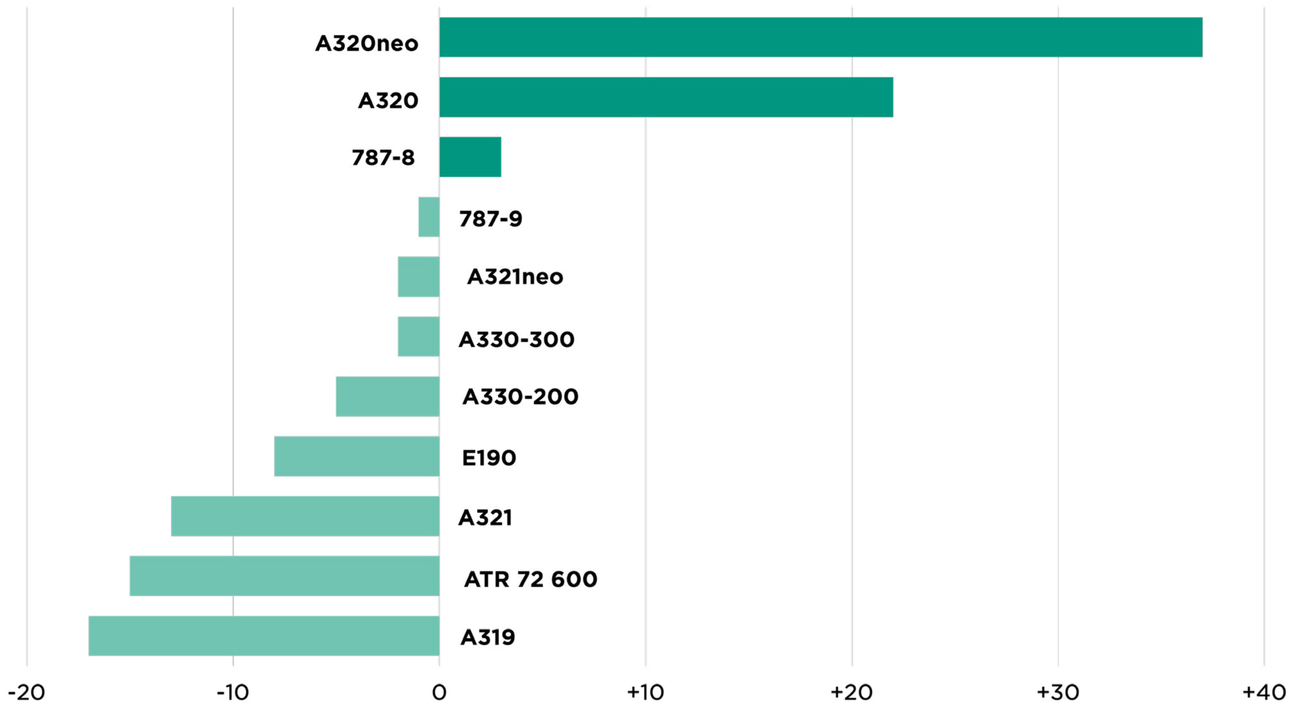
A Fleet That Looks Very Different Today

Every story about emissions begins with the fleet. Avianca made a series of bold and disciplined choices that reshaped the aircraft it flies. Nearly two thirds of its Airbus A319 aircraft left the operation along with its entire group of A321 aircraft. In their place the airline introduced a significantly larger number of A320neo aircraft and additional A320ceo aircraft.

The long-haul operation changed as well. Older A330 aircraft departed while the Boeing 787 fleet grew. Avianca also left behind its regional jet and turboprop operations, choosing to simplify and focus on aircraft that deliver stronger fuel performance.

One of the most important results is the increase in average aircraft size. The typical Avianca aircraft carried 144 seats in 2019. Today that figure is 181. This was achieved by reconfiguring all its fleet, both narrow and wide bodies airplanes. Although the average age of the fleet increased slightly to nine and a half years, which reflects global supply chain issues that affected all airlines, the overall efficiency of the fleet still improved meaningfully.

Change in number of aircraft in service/storage, 2024 vs 2019



More Seats and More Efficiency

By 2024 Avianca had restored its flight activity to the same level it operated in 2019. The difference is that the airline generated far more capacity because it was flying larger aircraft and flying them slightly farther on average. The removal of turboprop flying also meant that flight time did not materially increase even as stage length grew.

This resulted in an 18.1% increase in available seat kilometers. At the same time the shift toward newer and more efficient aircraft produced a reduction in absolute carbon emissions of 5.1%.

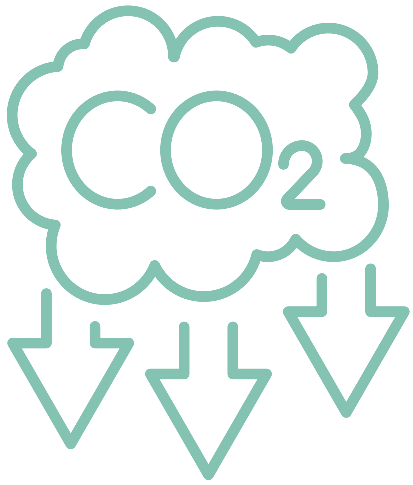
Year	Flights (1000s)	Average seats	Average aircraft age (flight weighted)	Average pax. load factor	Average air minutes	Average great circle flight dist. (km)	CO_2 emissions (mt)	% change CO_2 vs 2019	Available seat km (ASK) (bn)	% change ASK vs 2019	CO_2/ ASK (g)	% change CO_2/ASK vs 2019
2019	258	144	7.6	81.6%	108	1,258	4.49	0.0%	54.4	0.0%	82.6	0.0%
2020	76	144	7.8	73.1%	103	1,202	1.23	-72.7%	15.1	-72.3%	81.4	-1.5%
2021	126	143	8.9	75.5%	87	998	1.61	-64.2%	19.1	-64.9%	84.1	+1.8%
2022	189	151	9.1	81.6%	108	1,296	3.12	-30.6%	39.5	-27.5%	79.0	-4.3%
2023	218	168	9	82.2%	110	1,333	3.75	-16.5%	52.6	-3.3%	71.3	-13.6%
2024	260	181	9.5	81.3%	108	1,293	4.26	-5.1%	64.3	+18.1%	66.3	-19.6%

When combined, these factors created a major improvement in carbon intensity. **Avianca moved from 82.6 grams of carbon per available seat kilometer to 66.3 grams. This represents a reduction of nearly 20%, which very few global airlines have managed to achieve on this scale.**

A Model for Responsible Growth

Avianca's experience shows that it is possible to grow and still reduce the environmental impact of flying. It requires discipline in fleet planning, a willingness to retire older aircraft, and a long-term commitment to efficiency.

The journey for the aviation industry is not finished, but **Avianca has shown what is possible when strategy and execution come together with clarity of intent.** The airline is not only growing. It is growing in a more responsible way, and that achievement deserves attention.



66.3g

carbon (CO_2) per available seat kilometer (ASK)

APPENDIX

74

AIRLINE CODES

Aegean Airlines	A3
Aeromexico	AM
Aeromexico Connect	5D
Aer Lingus	EI
Air Canada	AC
Air China	CA
Air Corsica	XK
Air Europa	UX
Air Europa Express	X5
Air France	AF
Air India	AI
Air New Zealand	NZ
Air Premia	YP
Air Swift	T6
Alaska Airlines	AS
American Airlines	AA
Asiana Airlines	OZ
ASL Airlines France	5O
Austrian	AU
Avianca	AV
Avianca Ecuador	2K
Avianca El Salvador	TA
Azores Airlines	S4
Azul	AZ
Batik Air	ID
Binter Canarias	NT
British Airways	BA
Brussels Airlines	SN

Bulgaria Air	FB
Capital Airlines	JD
Cathay Pacific	CX
Cebu Pacific	5J
China Eastern Airlines*	MU
China Southern Airlines	CZ
Copa Airlines	CM
Condor	DE
Contour Aviation	LF
Croatia Airlines	OU
Delta Air Lines	DL
EasyJet Group**	U2
Edelweiss Air	WK
EgyptAir	MS
Emirates	EK
Enter Air	E4
Etihad Airways	EY
Eurowings	EW
Finnair	AY
Flynas	XY
Frontier Airlines	F9
GOL	G3
GX Airlines	GX
Hawaiian Airlines	HA
Iberia	IB
Iberia Express	I2
IndiGo	6E
Indonesia AirAsia	QZ

ITA Airways	AZ
JAL	JL
JetSmart Peru	JZ
Jetstar	JQ
Jetstar Asia	3K
Jettime	JP
Juneyao Air	HO
Korean Air	KE
Kuwait Airways	KU
Lao Airlines	QV
LATAM Airlines Brasil	JJ
LATAM Airlines Colombia	4C
LATAM Airlines Group**	LA
Lion Air	JT
Loganair	LM
Loong Air	GJ
LOT Polish Airlines	LO
Lufthansa CityLine	CL
Malaysia Airlines	MH
Norwegian Air Sweden	D8
Pegasus	PC
Pelita Air Service	IP
Qantas	QF
Qatar Airways	QR
Ryanair***	FR
SAS	SK
SAS Link	
Saudia	SV

Scoot	TR
Shandong Airlines	SC
Shanghai Airlines	FM
Shenzhen Airlines	ZH
Sichuan Airlines	3U
Singapore Airlines	SQ
Sky Express	GQ
Southwest Airlines	WN
Spring Airlines	9C
Sunclass Airlines	DK
Super Air Jet	IU
Swiss	LX
TAP Air Portugal	TP
Thai Airways International	TG
TransNusa	8B
TUIfly Netherlands	X3
United Airlines	UA
US-Bangla Airlines	BS
Vietravel Airlines	VU
Virgin Atlantic	VS
Virgin Australia	VA
Vietnam Airlines	VN
Volaris	Y4
WestJet	WS
Wizz Air	W6
Wizz Air UK	W9
Xiamen Airlines	MF

AIRPORT CODES

Aarhus Airport	**AAR**
Atlantic City International Airport	**ACY**
Hartsfield-Jackson Atlanta International Airport	**ATL**
Zayed International Airport – Abu Dhabi	**AUH**
Belem/Val-de-Cans International Airport	**BEL**
Grantley Adams International Airport	**BGI**
Suvarnabhumi Airport	**BKK**
Kempegowda International Airport Bengaluru	**BLR**
Nashville International Airport	**BNA**
Brisbane Airport	**BNE**
El Dorado International Airport - Bogota	**BOG**
Chhatrapati Shivaji Maharaj International Airport	**BOM**
Boston Logan International Airport	**BOS**
Patrick Leahy Burlington International Airport	**BTV**
Buffalo Niagara International Airport	**BUF**
Baltimore/Washington International Airport	**BWI**
Cairo International Airport	**CAI**
Guangzhou Baiyun International Airport	**CAN**
Netaji Subhash Chandra Bose International Airport	**CCU**
Charles de Gaulle Airport	**CDG**
Marechal Rondon Cuiaba International Airport	**CGB**
Charlotte Douglas International Airport	**CLT**
Colombo Bandaranaike International Airport	**CMB**
Belo Horizonte/Confins-Tancredo Neves Intl Airport	**CNF**
Copenhagen Airport	**CPH**
Cam Ranh International Airport	**CXR**
Denver International Airport	**DEN**
Dallas/Fort Worth International Airport	**DFW**

Doha Hamad International Airp
I Gusti Ngurah Rai Internationa
Dubai International Airport
Newark Liberty International A
Pinto Martins – Fortaleza Intern
Frankfurt Airport
Hangzhou International Airpor
Dulles International Airport
George Bush Intercontinental A
Incheon International Airport
Bir Tikendrajit International Air
Ilheus/Bahia-Jorge Amado Air
Istanbul Airport
John F. Kennedy International
Kashgar Airport
Klagenfurt Airport
Kualanamu International Airpo
Kuala Lumpur International Air
Kuwait International Airport
Los Angeles International Airp
London City Airport
London Heathrow Airport
Jorge Chavez International Air
Milan Linate Airport
Murtala Muhammed Internation
Chennai International Airport
Kansas City International Airpo
Orlando International Airport

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	DXB
irport	EWR
national Airport	FOR
	FRA
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	IAD
Airport	IAH
	ICN
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port	IOS
	ISL
Airport	JFK
	KHG
	KLU
rt	KNO
rport	KUL
	KWI
ort	LAX
	LCY
	LHR
port	LIM
	LIN
nal Airport	LOS
	MAA
rt	MCI
	MCO

Muscat International Airport	MCT
Benito Juarez Mexico City International Airport	MEX
Miami International Airport	MIA
Mitiga International Airport	MJI
Munich International Airport	MUC
Chicago O'Hare International Airport	ORD
Palm Beach International Airport	PBI
Beijing Capital International Airport	PEK
Passo Fundo Airport	PFB
Pacific Harbour Airport	PHR
Phoenix Sky Harbor International Airport	PHX
Beijing Daxing International Airport	PKX
Frederick Douglass Greater Rochester Intl Airport	ROC
El Salvador International Airport	SAL
San Francisco International Airport	SFO
Shenyang Taoxian International Airport	SHE
Singapore Changi Airport	SIN
Luis Munoz Marin International Airport	SJU
Sao Luis-Marechal Cunha Machado Intl Airport	SLZ
Cyril E. King Airport	STT
Shenzhen Bao'an International Airport	SZX
Sydney International Airport	SYD
Syracuse Hancock International Airport	SYR
Qingdao Jiaodong International Airport	TAO
Chengdu Tianfu International Airport	TFU
Vienna International Airport	VIE
Vancouver International Airport	YVR
Zurich Airport	ZHR

DEFINITION OF TERMS

A · B · C · D · **E** · F · **G** · H · **I** · J · K · **L** · **M**

A

AVAILABLE SEAT KILOMETERS (ASKs)

The number of seats available multiplied by the number of kilometers between origin and destination.

E

ESG REPORTING

The disclosure of information by companies regarding their performance and impact across three key areas: Environmental, Social, and Governance. It's a way for organizations to communicate their commitment to sustainability and responsible business practices to various stakeholders, including investors, customers, employees, and regulators.

G

GLOBAL AIRLINE RANKINGS

Comparing the world's 100 largest carriers by CO_2 per ASK, split into 'Major' and 'Mainline' categories for clearer peer benchmarking.

I

INTER-REGION RANKINGS

The interregion rankings focus on average CO_2 per ASK for flights that span two different global regions.

INTRA-REGION RANKINGS

These rankings focus on average CO_2 per ASK for flights that take place entirely within a single region—providing a closer look at how airlines are performing on short- and medium-haul networks.

ISAE 3000

These rankings focus on average CO_2 per ASK for flights that take place entirely within a single region—providing a closer look at how airlines are performing on short- and medium-haul networks.

L

LONG-HAUL ROUTE

Typically intercontinental flights (e.g., across the Atlantic or Pacific, from Europe to Asia, North America to South America). Distances are usually greater than 4,000 km (around 2,200 nautical miles).

M

MEDIUM-HAUL ROUTE

Can be transcontinental within large countries or international flights to neighboring continents (e.g., within Europe, or between Europe and North Africa/ Middle East). Distances often range from 1,500 km to 4,000 km (around 800 to 2,200 nautical miles).

S

SHORT-HAUL ROUTE

Typically domestic or regional flights, often within the same country or to very close neighboring countries. Distances are usually less than 1,500 km (around 800 nautical miles).

SUSTAINABLE AVIATION FUEL (SAF)

An alternative fuel made from non-petroleum feedstocks that reduces emissions from air transportation.

T

TAXI TIME

The period an aircraft spends moving on the ground at an airport, either before takeoff or after landing, under its own power.

CIRIUM HISTORY

Cirium brings together powerful data and analytics to keep the world moving. Delivering insight, built from decades of experience in the sector, enabling travel companies, aircraft manufacturers, airports, airlines and financial institutions, among others, to make logical and informed decisions which shape the future of travel, grow revenues and enhance customer experiences. Cirium is part of RELX PLC, a global provider of information-based analytics and decision tools for professional and business customers.

1909

Launched the world's first weekly aerospace magazine.

1985

Launched airline-specific insights to airline C-suite with the title Airline Business.

2016

The pioneer in global, real-time flight status data, FlightStats, brought into the group.

Expanded the group's offering with Diio's fares, traffic and schedules analysis tools.

2019

New aviation analytics brand Cirium launched showcasing the industry's largest data store and an advanced solutions portfolio.

2020

Added live flight and navigational data to the Cirium portfolio, bringing in initiatives for System Wide Information Management (SWIM), with Snowflake Software.

2023

Introduced new aviation analytics tools to accelerate digital transformation and support the industry's sustainability goals under five product brands.

Extended partnership with Aireon to offer satellite-based aircraft positional analytics.

1997

Created online news and data service for aerospace and airports (formerly known as ATI).

2004

Expanded in aerospace with the most comprehensive technical fleet database (known previously as ACAS).

2011

Grew portfolio with the addition of aircraft finance services with historical fleet and valuations data with acquisition of Ascend.

2014

Added historical airline schedules data to business with acquiring Innovata.

2024

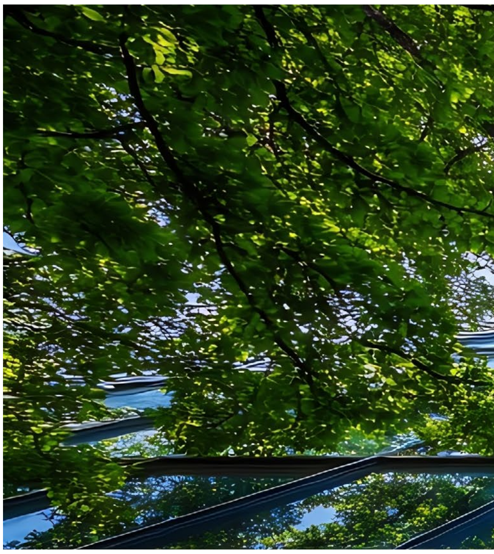
Launched EmeraldSky with a unique and unparalleled methodology, data and analytics to provide the world's most accurate measure of aircraft and flight emissions.

Introduced the On-Time AI Assistant, designed to enhance exploration of on time performance data, streamline data discovery, uncover insights, and answer operational questions.

2025

OTP Improvement AI is the first generative AI-powered solution designed specifically for the aviation industry to transform On-Time Performance (OTP) analysis. Enabling airlines and airports to enhance situational awareness, improve operational efficiency and proactively manage disruptions.

CIRIUM GLOBAL OFFICES



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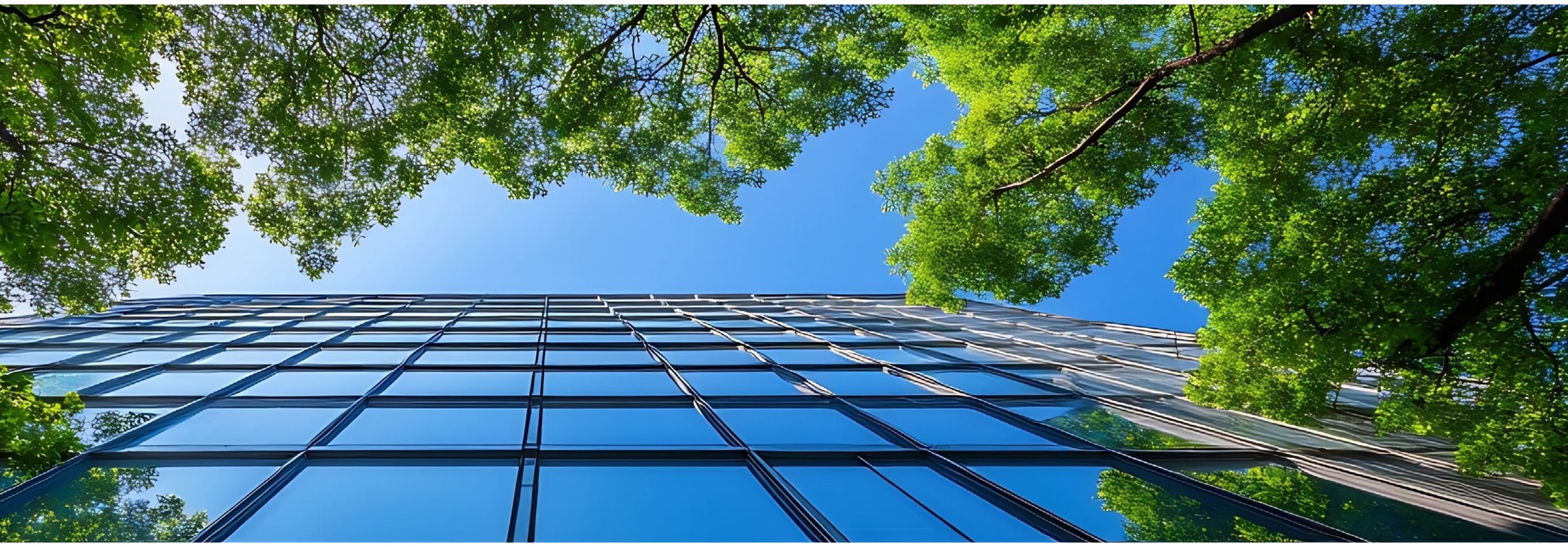

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emeraldsky

BY CIRIUM

Making the skies greener