# ISG Insights: How Technology Can Boost Profits and Drive Sustainability in Aviation

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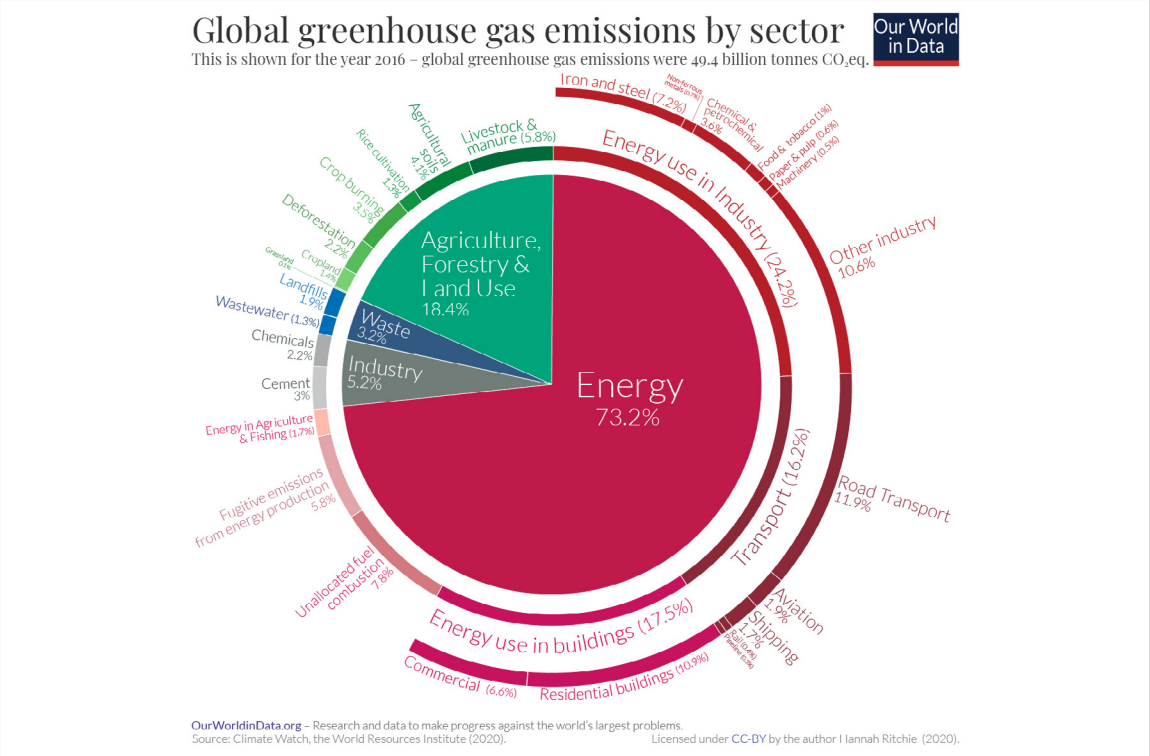
## Introduction

The World Economic Forum reports that aviation is responsible for 2.5% of global CO2 emissions. Given this statistic[1], is it fair to consider aviation an enemy of sustainability?

Let's look at the numbers. In 2023, 34.4M passenger flights – about 94,200 – took off each day. Military, private and cargo operations account for another 5,000 to 10,000 flights per day. All these flights contribute to global emissions.

How does this compare to other sectors? According to Our World In Data, transport accounts for 16.2% of global CO2 emissions. In comparison, passenger air transport accounts for only 11.7% of those emissions – meaning ground transport (cars, vans, trucks and buses, etc.) accounts for the remaining 88.3%.




Now, consider the impact of technology and the IT industry. IT products and services represent approximately 5% of global energy demand and 1.4% of global GHG emissions. These numbers are similar to those of aviation, and the demand for devices, technologies, and services is growing.

The aviation and technology sectors are both exploring ways to decrease their carbon footprints. By partnering and innovating together, the answer to lowering emissions could lie in how they use technology to reduce aviation's impact on the environment.

[1] Can the aviation sector get to net-zero emissions by 2050? | World Economic Forum (weforum.org)



## Aviation and sustainability

The aviation industry is already making strides to reduce fuel usage and emissions.

To level set, aircraft burn large amounts of fossil fuel (Jet A1) during flight, with fuel burn rates varying considerably by aircraft type (e.g., 2.8 tons/hour for A321 vs. 12 tons/hour for an Airbus A380).

Take Virgin Atlantic as an example of an innovator. In November 2023, a Virgin Atlantic Boeing 787 completed a historic flight using 100% sustainable aviation fuel (SAF), demonstrating SAF as a viable replacement for fossil-derived jet fuel. As a result, SAF could play a significant role in decarbonizing long-haul aviation and provide the pathway to net-zero emissions by 2050.

The quest for electric and hydrogen fuel technologies for aviation is still decades away, but progress is happening – and does not have to be limited by the type of fuel used.

## Fuel usage and pricing

Aviation fuel is different from the fuel used in cars. Like the fuel used in Formula One racing, aviation fuel is measured by weight rather than volume. This is because the relative volume of fuel can change based on factors such as temperature and the specific type of fuel (e.g., Jet A1, JP-4, etc.). This weight-based measurement is especially critical at high altitudes, where temperatures can reach minus 40 to minus 50 degrees Fahrenheit.

Furthermore, fuel is burned based on mass rather than volume. Therefore, all calculations for fuel burn rates must be done in units of weight, such as kilograms or US pounds. Currently, the average global price for aviation fuel is $0.92113 USD per kilogram, which may seem like a good deal compared to car fuel in the UK, which costs around $1.70 per liter.

However, the issue lies in the significant fuel burn during the typical aircraft cycle, which includes a turnaround at its destination. For larger aircraft, this turnaround process can result in a fuel burn ranging from 110 to 400 kilograms per hour. That means an aircraft can burn nearly half a ton of fuel per hour during this phase.

While the per-unit cost of aviation fuel may seem low compared to car fuel, the sheer volume consumed during various phases of flight operations, including turnarounds, makes it a significant expense for airlines and a significant contributor to greenhouse gas emissions.

It is also important to note that aircraft don't just burn fuel when in the air. They burn it when on the ground too. When sitting at a gate, aircraft still need power, so they remain connected to a ground power unit that consumes fuel to keep vital systems running. And when larger systems are needed or cargo or passengers are on board, many airplanes will start their auxiliary power unit hidden in the tail and consume vastly more fuel than the ground power unit. All of this requires local fuel from the airport. So, when pre-start up delays, such as during the loading process happen, the aircraft burns more fuel.



## Cargo Operations

Proper loading operations and using unit load devices (ULDs) are vital for aviation safety and efficiency. ULDs protect the cargo contents from loss and damage while maximizing the available space in an aircraft's hold.

Cargo loading is typically done off-site at cargo warehouses, where consignments are unitized and grouped into ULDs. This process, known as aircraft pre-loading, eliminates the need for manual loading and unloading of aircraft, minimizing on-ramp time. The computer-generated load pattern ensures that cargo is placed in the correct orientation and tied down at the right points in the cargo bay.

Accurate cargo loading is crucial because an aircraft in flight is essentially balanced on the center of gravity (COG), like a four-way seesaw. Any shift in weight can change the plane's flying characteristics, increase fuel burn, cause directional shifts, or potentially lead to catastrophic consequences if the weight distribution falls outside safe COG parameters.

This is why getting ULD and pallet loading correct is vital for the success of the operation and the lives of those on board. However, changes in cargo or missing items can disrupt the carefully planned load pattern. Previously, such situations required redoing the entire loadout, rebalancing and shifting cargo locations within the plane, a process that could take hours.

By ensuring proper cargo loading and utilizing ULDs, airlines can maximize efficiency, protect cargo integrity and maintain safe weight distribution, which is essential for the safety of the aircraft and everyone on board.

## Flight Delays

According to Eurocontrol, the average flight delay is 19 minutes for arrivals and 21 minutes for departures. These delays are part of regular flight operations and result in additional fuel burn from jet engines during extended flight times for arrivals and from engines, auxiliary power units (APUs) or ground power units (GPUs) during departure delays.

For commercial passenger flights, such delays are considered routine. However, cargo operations typically operate on tight schedules due to the nature of the business. Companies like FedEx, UPS and other freight forwarders or logistics firms offer overnight shipping, same-day delivery and other time-sensitive services. As a result, they cannot afford to wait around for delays or incorrect loadouts. In such cases, they may choose to depart with empty space in the cargo bays, resulting in a reduced transport load and higher operational costs for the airline.

Cargo operations have the option to wait on the ramp and rebalance cargo loads to maintain the correct COG when last-minute or unforeseen issues arise. However, overall, last-minute changes or issues with cargo loading can add time and delay to a flight. Replanning a load can take up to seven hours, forcing airlines to decide whether to send a half-empty plane into the sky, losing potential revenue, or have it sit on the ground, burning fuel while connected to a GPU or running its APU if on a remote stand.



Fortunately, there is a solution that addresses both scenarios. By leveraging cutting-edge technology and innovative logistics optimization, airlines, freight forwarders, and ground handlers can now minimize delays, reduce fuel consumption and streamline cargo loading processes.

## Optimizing logistics with AI, analytics and quantum

Unisys Logistics Optimization helps airlines, freight forwarders and ground handlers optimize capacity and recompute loadouts when unexpected situations arise, saving time and fuel. By incorporating AI, analytics and quantum computing, it allows for near-real-time decision-making.

The solution's 3D visualization capabilities expedite building plans and shipping processes by utilizing multiple data sources to pinpoint the optimal route for shipments. For ULD build plans, the platform used by load masters and freight forwarders displays all ULDs being built, those that have been built and optimized, and any aircraft slot constraints.

Unisys has created a mass-customized approach in near-real-time, considering equipment, routes, cargo and capacity. This means any changes to loads or capacity can be handled in an instant for optimized routing or backup routes if equipment changes.

## Two-phase process for efficient ULD handling

The process involves two phases. First, as the ULDs are created and preloaded in a warehouse away from the plane, they can be built in real time. Each item is scanned, imaged, and optimized for space, ensuring that a bespoke pallet or ULD can be created and ready for shipping, regardless of which items are being loaded.

The second phase happens when items are placed in 3D space, and their condition is recorded in case of any pre-existing damage. This also shows where to place the ULD on the aircraft to maintain the correct COG.

## Benefits and fuel savings

While this cutting-edge digital business innovation doesn't directly lead to fuel or sustainability savings, the benefits of this use become apparent when last-minute changes or freight forwarding issues occur. For instance, if freight is delayed and cannot be configured, different freight can be loaded with rebalancing done simultaneously. Previously, this process would have taken several minutes or hours. If it occurred at the aircraft side during loading, the auxiliary power unit (APU), running at up to 400kg/hr of fuel, would burn considerable Jet A1.



Fuel can be saved through route optimization, which is incorporated into Unisys' solution. It takes all available routes and associated rates and uses AI and quantum computing to access weather and other third-party information to show the top three routes. The solution determines these routes by considering minimum transit time, maximum capacity utilization and proper distribution of defense and volumetric shipments.

Once booked in the system, any delays that occur will automatically display a re-routing option to maintain maximum capacity by route. This is a win-win for the cargo firm and the environment. The solution helps reduce fuel burn on the ground for GPUs and APUs while traditionally keeping vital aircraft systems protected during delays. Because the more optimized the route, the less fuel used; this not only slashes operational costs but also significantly reduces carbon footprint. It's a powerful equation: smarter routes mean lower fuel consumption, which translates to substantial cost savings for airlines and a measurable reduction in greenhouse gas emissions, aligning profitability with environmental responsibility.

## Turnaround assumptions

To calculate the potential fuel-saving benefits using a solution like Unisys', some assumptions are necessary. The first assumption is that no calculations have been made when the aircraft is in the air, whether delayed or not. The anticipated benefits result from minimizing the fuel burned during ground operations, whether it's Jet A1 or SAF. Only two systems burn fuel before the plane departs: the GPU and the APU, which is where we will focus.

Let's look at the typical loading cycle. When the aircraft arrives, it is immediately connected to ground power through a GPU. This can be a generator sitting next to the plane or, at larger airports, one or two hoses coming off the jet bridge and connecting to the front of the aircraft. These GPUs burn an average of 20 kilograms of fuel per hour.

Assuming the average turnaround for large jets is about three hours; we can assume that the plane is on ground power for approximately two hours. However, when more power is needed to power internal loading systems, such as avionics for balance or fuel systems, the APU is usually started to maintain electrical stability for these delicate systems. This typically occurs when most of the work has been done, and the plane is in the final stages of preparation, reducing noise issues.

Another assumption, based on a broad average, is that the aircraft runs on the APU for around one hour, with or without ground GPU power connected. This is the whining noise you hear when boarding a plane, coming from the back, where the APU is located. The APU can burn between 110 and 400 kilograms of fuel per hour, depending on the aircraft type.



By understanding these assumptions and the fuel burn rates during the turnaround process, you can better evaluate the potential benefits of solutions aimed at reducing fuel consumption and emissions during ground operations.

## How aviation can save fuel using technology

Technology presents a significant opportunity for the aviation industry to reduce fuel consumption and associated costs and emissions. Leveraging solutions like Unisys Logistics Optimization, airlines and cargo operators can optimize operations and minimize fuel burn during ground operations.

Based on the assumptions outlined earlier – a three-hour turnaround using two hours of ground power at 20kg of fuel per hour and one hour of auxiliary power consuming between 120-400kg of fuel per hour – the fuel cost alone for a turnaround ranges from $147 to $405 USD, assuming an average fuel price of $0.92 USD per kg. This calculation does not account for any delays, which can further increase fuel consumption and costs.

The average outbound delay is about 21 minutes, which presents an opportunity for substantial cost savings by minimizing unnecessary fuel burn during these delays.

For cargo operations, where margins are tight, and cost pressures are significant, technology solutions like Unisys Logistics Optimization can be instrumental in alleviating these pressures. By enabling near-real-time planning and replanning of cargo plans and ULD loadouts, issues during loading can be addressed without having to reroute shipments or ground delays to reconfigure cargo.

According to the International Air Transport Association (IATA), there are approximately 5,750 cargo flights per day, equating to 2,098,750 cargo flights in 2023 (excluding passenger flights with cargo in the hold). IATA data further shows that the average delay rate for these aircraft is around 20%.

Assuming an average delay of one hour, Unisys' solution could provide potential fuel cost savings of $46.4M USD. If the average delay extends to four hours, the potential fuel cost savings could reach a staggering $618.6M USD or over half a billion USD. Even with an average delay of 2.5 hours, the fuel cost savings could amount to nearly $400M USD.

Translating these cost savings into weight, the Unisys solution can potentially reduce global fuel consumption by 368,000 tons if widely adopted by cargo firms and freight forwarders.

Furthermore, IATA states that the combustion of 1 kilogram (kg) of jet fuel produces 3.16 kg of carbon dioxide ($CO_2e$). This means that, on average, the Unisys solution has the potential to reduce global $CO_2$ emissions by an impressive 1.163B tons if widely adopted.

This example demonstrates how technology and sustainability can work hand in hand, enabling the aviation industry to optimize operations, reduce costs and significantly decrease its environmental impact by reducing fuel consumption and emissions. **Click here to calculate how much fuel you could save by investing in load optimization.**



## ABOUT THE AUTHOR

### ISG Insights – How Technology can Drive Sustainability and Boost Profits in Aviation

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Director

Iain Fisher (@Iain_D_Fisher) is ISG's head of industry research and market trends. With over 20 years in consulting and strategic advisory, Iain now focuses on cross industry research with an eye on technology led digital innovation, creating new strategies, products, services, and experiences by analysing end-to-end operations and measuring efficiencies focused on redefining customer experiences.

Fisher is published, known in the market and advises on how to achieve strategic advantage. A thought leader on Future of Work, Customer Experience, ESG, Aviation and cross industry solutioning he provides major market insights leading to changes to business models and operating models to drive out new ways of working. Fisher works with enterprise organizations and technology providers to champion the change in customer focused delivery of services and solutions in challenging situations. Fisher is also a regular Keynote speaker and online presenter, having authored several eBooks on these subjects.



 

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## ABOUT UNISYS

**Unisys** guides organizations to reimagine what's possible. Our team dives deep to proactively assess the right opportunities for you, and we dream big when it comes to solutions. We turn our clients' objectives into real business value. Pragmatism and bold ideas aren't mutually exclusive. We prioritize and deliver both while choosing to do what's right over what's easy.

Unisys Logistics Optimization™ is the result of Unisys' four decades of experience in the air cargo industry and a history of innovation. The solution is designed to help logistics companies optimize freight processes in near-real-time. This load and route optimization solution combines AI with a diverse compute approach to improve how companies build pallets and route shipments, helping you maximize profit margins and meet your on-time performance goals. To take advantage of Unisys Logistics Optimization, **learn more** or **contact Unisys today**.



 