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Insights 2023

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Foreword by Ulrike Ziegler - Chairperson of impact Board



Dr. Ulrike Ziegler,
Chairperson of impact Board

On behalf of the Board of Directors I am pleased to share our first “impact – insights 1H2023” featuring a broad array of topics ranging from expert pieces on aviation’s decarbonization challenges, interviews with impact’s new advisory board members, and summaries of expert talks to impact members in the first half of the year.

As with our “impact – a year in review 2022” published at the start of this year, I would like to start on a personal note and share a piece of information which startled me:

Texas Comptroller Glenn Hegar “blacklisted” Blackrock and nine European banks by accusing them of “boycotting” the energy (i.e. oil companies – note of the author) industry ... because of their environmental policies.”¹ And claiming in the case of HSBC that – as per Reuters reporting – its “new energy policy is a prime example of a broader movement in the financial sector to push a social agenda and prioritize political goals over the economic health of their clients.”²

What a statement and an approach, and how out of sync with reality. Not willing to acknowledge that the climate crisis will not only negatively impact people and ecosystems but also translate into billions of stranded assets for oil majors? The above is testament to the fact that the road to decarbonization is long and winding and requires continued focus, dedication, and resolve.

Now to impact and our “in-” and “out-”sights – an update on our activities and observations.

¹ <https://www.reuters.com/business/sustainable-business/texas-may-offer-exit-path-sanctioned-financial-firms-2022-12-05/>

² <https://www.reuters.com/business/finance/texas-adds-hsbc-energy-sanctions-list-2023-03-21/>

impact “in”-sights

We are determined to assume lasting responsibility for aviation’s decarbonization by continuing to expand our know-how and aligning our strategy. Having covered substantial ground in 2022, our work is now centered on translating our methodology³ into sustainable finance frameworks for airlines and lessors (expected publication: 3Q23). Incentivized by the positive feedback from internal and external stakeholders, we are also looking to enhance our mission to include the enabling of, among others SAF and carbon capture projects – key levers for decarbonization.

Testament to such resolve is our membership in the EU’s Renewable and Low Carbon Fuel Alliance (“RLCF”), a key flanking measure to the ReFuelEU Aviation initiative. Last but certainly not least impact e.V. has rounded out its activities by appointing a Science Working Group featuring renowned climate and transportation scientists and establishing an Advisory Board with top industry experts who will further impact’s mission. The sails are set for a successful 2023!

impact “out”-sights

Early 2023 saw intense discussion on the inclusion (or the potential exclusion) of aviation screening criteria in the EU taxonomy for sustainable activities, which sent a shock wave through the industry. No doubt, aviation has a long way to go to be considered a largely “green” sector BUT the prospect of earmarking the aviation industry as “brown” irrespective of its efforts would have send the wrong signal and deprived this capital-intensive sector of funding sources –potentially stripping funding for much needed decarbonization technologies.

However, the European Commission on 13th June approved in principle the delegated act incorporating aviation criteria into the EU Taxonomy which - absent objections by the European Parliament - should begin to apply as of January 2024. But aviation finance is a global industry in need of global standards – not just European. In impact’s view, an industry-wide reporting standard on greenhouse gas emissions (“GHG”) paired with sustainable finance frameworks which incentivize GHG reductions and eradicate greenwashing are mandatory accompanying measures.

The findings of the IPCC 2023 synthesis report further emphasize the need for action:

- Earth’s global surface temperature has increased by 1.1 °C and current climate policies put the planet on track to cross 1.5 °C between 2030 and 2050;
- To keep within 1.5 °C, a GHG emissions reduction of at least 43% by 2030 vs. 2019 levels is required;
- The poorest and most vulnerable will be disproportionately affected by economic losses and physical damages;
- Climate finance levels fall short of what is needed to limit warming.

Dive into our impact insights publication and make your mark in the decarbonization of an essential industry.

³ <https://impact-on-sustainable-aviation.org/shared-files/879/?Impact-White-Paper-Three-Essential-KPIs.pdf>
https://impact-on-sustainable-aviation.org/shared-files/1023/?Impact-White-Paper_Milestone-Concept_February23-2.pdf

impact members' call presentations H1 2023

impact's bi-weekly members' call has the objective to build know-how and share information on relevant aviation sustainability topics. For this reason, impact invites expert speakers from different organizations and sectors who are all dedicated to foster aviation's decarbonization process.

In the first half of 2023, impact had the pleasure to have the following presentations by experts:

'Sustainable finance taxonomy for the aviation sector'

Peter Wiener



Peter Wiener, Associate and Senior member of the Aviation team at Steer

The 'Sustainable finance taxonomy for the aviation sector' is part of Steer's work for the European Commission on establishing criteria for the inclusion of certain aviation-related activities within the scope of the EU's Sustainable Finance Taxonomy (Regulation (EU) 2020/852). The recommendations of the report (published in 2021) are still being debated and it is not clear if they will be included in the latest version of the Commission's Delegated Act which operationalizes the criteria for inclusion in the taxonomy⁴.

⁴ Peter Wiener's presentation for impact took place in January 2023, when the European Commission was still deliberating Steer's recom-

'DG Fuels: A roadmap to scaling up SAF production'

Chris Chaput



Chris Chaput, President and CFO at DG Fuels LLC

SAF producer DG Fuels will initially focus on the production of synthetic jet fuel then later synthetic diesel fuel. The DG Fuels Program will be implemented over 15 years at multiple locations and in multiple phases at each location. The electric power for the manufacturing processes will come largely from renewable solar and wind energy initially to be produced by other entities but later installed directly by DG Fuels. Excess electricity produced may be sold into the commercial power grid. DGF's method modifies the established Fischer-Tropsch system with several mechanisms that will decrease the CO₂- life-cycle emissions and reduce the quantity of feed-stock required.

'Delivering zero-emissions hydrogen flight'

Richard Moody & Jenny Kavanagh



Richard Moody, Chief Investment Officer at Cranfield Aerospace Solutions



Jenny Kavanagh, Chief Strategy Officer at Cranfield Aerospace Solutions

Cranfield Aerospace Solutions (CAeS), a UK based company with a deep tradition in aerospace technology is seeking to deliver the world's first certified hydrogen aircraft by 2026. Richard Moody (CIO) and Jenny Kavanagh (CSO) detailed why Cranfield is uniquely positioned to deliver zero emissions hydrogen flight and explain the Project Fresson strategy, technology and engineering including why hydrogen is seen as the optimal energy source for regional aviation decarbonization.

'Transition pathways towards net-zero climate impacts in aviation'

Prof. Dr. Andreas W. Schäfer



*Prof. Dr. Andreas W. Schäfer,
Professor of Energy and Transport at University College London
and Director of the Air Transportation Systems Laboratory*

Aviation emissions are not on a trajectory consistent with Paris Climate Agreement goals. This talk evaluated the extent to which fuel pathways—synthetic fuels from biomass, synthetic fuels from green hydrogen and atmospheric CO₂, and the direct use of green liquid hydrogen—could lead aviation towards net-zero climate impacts. Together with continued efficiency gains and contrail avoidance, but without offsets, such an energy transition could reduce lifecycle aviation CO₂ emissions by 89–94% compared with year-2019 levels, despite a 2–3-fold growth in demand by 2050. Andreas W. Schäfer argues that the aviation sector could manage the associated cost increases, with ticket prices rising by no more than 15% compared with a no-intervention baseline leading to demand suppression of less than 14%. These pathways will require discounted investments on the order of US\$0.5–2.1 trillion over a 30-year period. However, these pathways reduce aviation CO₂-equivalent emissions by only 46–69%; more action is required to mitigate non-CO₂ impacts. The presentation is based upon a recently published study, conducted jointly between the UCL ATSlab, the MIT Laboratory for Aviation and the Environment, and the Imperial College London's Department of Civil and Environmental Engineering ⁵.

⁵ Dray, L. et al. (2022), Cost and emissions pathways towards net-zero climate impacts in aviation, <https://www.nature.com/articles/s41558-022-01485-4>

'Aircraft end-of-life: today situation, tomorrow's challenges'

Lionel G. Roques



*Lionel G. Roques,
Vice President Sales at Tarmac Aerosave*

The life-cycle of aircraft is a crucial part of aviation's sustainability transition. Tarmac Aerosave recycled more than 300 aircraft since 2007. In his talk Lionel covered the following: But how does the recycling process of aircraft and engines work? At what point is extending an aircraft's end-of-life actually more environmentally friendly than recycling it? In which way will new technologies affect aircraft and engine reuse?

'Carbon reduction airline network costs and changing strategies'

Nigel Addison-Smith



*Nigel Addison-Smith,
Aviation Advisor*

Carbon costs are potentially an existential threat for some airlines and at the very least will require business model changes. It is critical to understand how those carbon costs are developing over time and where. Developing strategies to evolve the network over time to mitigate risks and seize opportunities is vital to survival, continuing to deliver returns and manage stakeholders.

'Avoiding the greenwashing trap: Greenwashing, Activists and Aviation'

Dirk Singer



*Dirk Singer,
Head of Sustainability at SimpliFlying*

KLM, Lufthansa and Ryanair are just three of the airlines that have been accused of greenwashing by climate activists. Airlines' sustainability claims are getting more and more scrutiny, and environmentalists are quick to take action against claims that do not stand up to scrutiny. Dirk shed light on: Why is this happening? And what are the pitfalls to avoid?

'Overview and brief update on EU climate measures addressing aviation'

Damien Meadows



*Damien Meadows,
Advisor on European & International Carbon Markets
at the European Commission, DG Climate Action*

With its Emission Trading System (ETS), the EU established a tool to reduce economy-wide greenhouse gas emissions with the overall aim to achieve a climate neutral EU by 2050. The ETS is currently in its fourth phase which will have important key outcomes for the aviation industry. This includes the financial support for sustainable aviation fuels (SAF) and the appropriate implementation of ICAO's CORSIA scheme.

'Tackling aviation's non-CO₂ climate impacts: the role of contrail management'

Conor Farrington



*Conor Farrington,
Head of Communications at SATAVIA*

According to the United Nations IPCC AR6 (2021), contrails account for almost double the climate impact of direct CO₂ aircraft emissions. From 2025, airlines will need to report their non-CO₂ climate impacts (including contrails) under the EU ETS, creating MRV requirements alongside mitigation needs. In response to both, SATAVIA's DECISIONX:NETZERO platform forecasts and prevents aircraft contrails through flight plan modification, subsequently quantifying achieved climate benefit for MRV and/or voluntary carbon credit generation to incentivize adoption pre-regulation. After discussing the scientific backdrop, the presentation introduces SATAVIA's technological, scientific, and operational approach, explores a case study focused on a specific Etihad flight, and considers ways ahead for tackling non-CO₂ in commercial aviation.

'SAF development in Ireland'

Jan Melgaard



*Jan Melgaard,
Executive Chairman at FPG Amentum*

SAF is the most important pathway to net zero for aviation. Commercial scaling is that main challenge and strategic capital is one of the constraints. Lessors have a keen interest in taking a proactive role in facilitating and providing such capital. Aircraft Leasing Ireland (ALI) is working actively on developing SAF in Ireland as one of its work streams.

'Decarbonising aviation'

Chris Brown



*Chris Brown,
Head of Aviation Strategy at KPMG Ireland*

Chris provided us with a frank overview of the decarbonization challenge facing aviation, including opportunities and risks learnt through our work in the sector, and what that means for passive investors and the financial sector. This includes the overall CO₂e picture for the sector, demand supply imbalance for SAF as well as the realistic fleet evolution, and what AAM does and doesn't mean for decarbonizing aviation.

'EU Taxonomy'

Emma Giddings



*Emma Giddings,
Partner at Norton Rose Fulbright*

This presentation discussed the EU Taxonomy Regulation and the recent draft Delegated Act containing proposed technical screening criteria for aviation finance and financing. We discussed the operation of the EU Taxonomy and its relationship to non-financial reporting, the new proposed technical screening criteria and recent updates for example, with respect to the use of sustainable aviation fuel. We also discussed some of the practical challenges for the industry when seeking to categorise transactions by reference to the proposed technical screening criteria.

Status and progress of impact working groups H1 2023

The number of active working groups by impact members grew from five to six at the start of 2023 following a realignment to mirror findings obtained in 2022 and to reflect impact’s revised priorities for 2023.

The tables below depict the objectives, status, challenges and next steps of each of the six working groups:

WORKSTREAM – AIRLINE FINANCE FRAMEWORK	
Objectives	<ul style="list-style-type: none"> • Provide high level recommendations and guidelines as to the practical use of scoring system and implementation of the Milestones concept in credit and lease agreements from a commercial standpoint. • Once the concept agreed, implementation of high-level drafting of the related provisions to the documentation
Status	<ul style="list-style-type: none"> • First draft concept for finance framework (“Proposed Framework”) ready to be circulated among impact workstreams • Finalization of airline feedback questionnaire on the Proposed Framework
Challenges	<ul style="list-style-type: none"> • The Proposed Framework needs to be tested among airlines as well as rating agencies to ensure the feasibility and the credibility • The alignment of the Proposed Framework to Net Zero 2050 needs to be further explored with Science Workstream
Next steps	<ul style="list-style-type: none"> • Contact selection of airlines – and ideally rating agencies as well - from different regional contexts for their feedback on the first version of the finance framework draft • Revision of the first draft based on external / internal feedback and publication of the white paper externally
WORKSTREAM – LESSOR FINANCE FRAMEWORK	
Objectives	<ul style="list-style-type: none"> • Define reporting standards and create finance framework for leasing companies
Status	<ul style="list-style-type: none"> • Compile overview of lessor’s current ESG reporting practices • Brainstorming on first draft concept for finance framework • Identify overlaps with Airline Finance Framework workstream
Challenges	<ul style="list-style-type: none"> • Identify reporting target: asset portfolio vs. lessee client, or both? • Data source used: airline sustainability data reported vs. carbon calculators: evaluate benefits
Next steps	<ul style="list-style-type: none"> • Create first draft concept for lessors finance framework: identify key aspects that apply for leasing companies

WORKSTREAM - ENABLER

Objectives

SAF and CC

- Understanding technologies
- Collecting data incl supply and demand
- Drive discussions with law-makers to enhance bankability

Overall objective: identify needs re SAF demand and supply sides and formulate/take respective action

Status

- Overview on SAF production projects
- Contact with airlines to learn about their SAF strategies
- Global overview on regulations status quo regarding SAF and new tech in aviation

Challenges

- Connect relevant stakeholders of SAF supply and demand sides

Next steps

- Redefine workstream targets
 - Create to do list and distribute responsibilities
 - Gather information on carbon capture, hydrogen and electric projects
 - Identify finance and funding opportunities for new technologies
 - Contact SAF project representatives and learn about their business strategies as well as necessities in order to execute their project successfully: learn about lacks and deficits on regulatory side
-

WORKSTREAM – SCIENCE

Objectives

- Scrutinize feasibility of 1.5°C trajectories of other initiatives (e.g. SBTi, ATAG)
- Explore alignment of impact's methodology with 1.5°C target

Status

- Data analysis to be finalised
- First draft scientific publication ongoing

Challenges

- Terms of use for data analysed: permission to use for publication to be verified
- 1.5°C target realistic? Application of findings to impact concepts and in finance frameworks

Next steps

- Define hypotheses on 1.5°C target
 - Draft main part of scientific paper and include results of the data analysis
-

WORKSTREAM – REPORTING

Objectives	<ul style="list-style-type: none"> • Create impact’s biannual publications feat. latest industry developments and expert views
Status	<ul style="list-style-type: none"> • Content for ,impact insights’ half-year report 2023 collected and prepared – publication early July 2023
Challenges	<ul style="list-style-type: none"> • Procuring a interesting mix of reports, interviews and essays covering a variety of topics relevant to the industry and providing added value thus broadening impact e.V.’s reach
Next steps	<ul style="list-style-type: none"> • Collect ideas and topics for the impact final report ,year in review 2023

WORKSTREAM – FUNDRAISING

Objectives	<ul style="list-style-type: none"> • Broaden/diversify funding base
Status	<ul style="list-style-type: none"> • Evaluation of funding opportunities ongoing
Challenges	<ul style="list-style-type: none"> • Limited opportunities in Germany • Unsolicited applications often not considered • Aviation might not be considered eligible
Next steps	<ul style="list-style-type: none"> • Continue search • Draft “pitch book”

Event and congress participation H1 2023

- Ishka Investing in Aviation London, March 28
- Ishka ESG: Playing your Part in Sustainable Aviation London, March 29
- AIREG SAF Conference 2023 Berlin, May 4-5
- Airline Economics Aviation & the Environment Summit 2023 Dublin, May 11-12
- Airline Economics Sustainability Award Ceremony Dublin, May 11
- CENA Hessen Berlin, May 16
- Ishka Aviation Finance Festival Dublin, May 23
- Sustainable Aviation Futures Congress Amsterdam, June 7-9



Airline Economics Sustainability Team Award ceremony, 11th May 2023, Dublin. From left to right: Anna Münch (impact), Chris Brown (KPMG), Dr. Ulrike Ziegler (impact), Jörg Schirmmacher (Helaba), Claudia Ziemer (Azorra), Hugo Kanters (ING), Katharina Fischer (KfW), Florian Müller (ING), and Philip Greene (HSBC).



Dr. Ulrike Ziegler, President of impact and Jörg Schirmmacher, Head of Transport Finance at Helaba and Board member of impact at the Airline Economics Aviation & the Environment Summit, May 11th-12th, Dublin



Dr. Peter Smeets, CEO of 360 Asset Finance and Board member of impact, at the Sustainable Aviation Futures Europe Congress, 7th-9th June, Amsterdam



Dr. Ulrike Ziegler, President of impact, at the Sustainable Aviation Futures Europe Congress, 7th-9th June, Amsterdam

External contributions on aviation’s decarbonization challenges

Disclaimer: The following contributions are the views of the authors and do not necessarily reflect impact’s view.

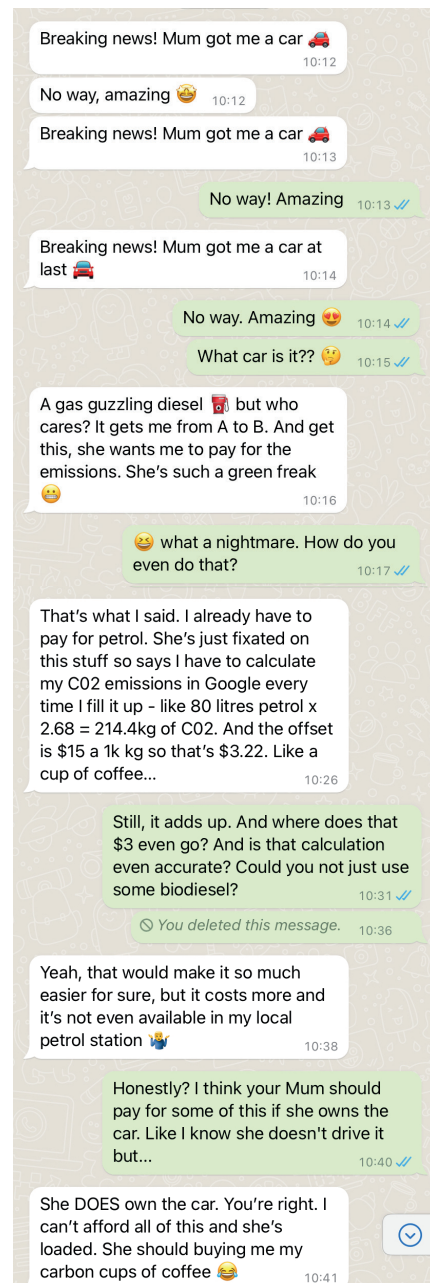
‘Aviation’s biggest challenge this century: What does the E in ESG mean for Aircraft Lessors?’

Lynn Guiney



Lynn Guiney, Principal,
SolÉir

Let’s start with a little WhatsApp prologue:



Just consider for a minute that the mother here is the Lessor, the son is the Airline and Biodiesel is Sustainable Aviation Fuel (SAF).

- Should the Lessor have accountability?
- Should the Airline pay for all the CO₂ emissions (and presumably pass it on as part of the ticket price)?
- Should the fuel producer not have accountability too? Is taxing the polluter the right approach?
- How is CO₂ measured and how reliable are carbon credits? Is that not just greenwashing?
- Should we not just wait for SAF distribution to increase? Surely that must be coming downstream?
- Isn't asset acquisition the only thing Lessors control? Should we not just buy new technology assets?
- Should governments subsidize SAF and ban domestic flights when a viable alternative is available (e.g. high speed train)?

All are good questions and no doubt there are many more. Indeed, Lessors have largely been bystanders in the CO₂ emissions debate until comparatively recently. As stakeholders in the aviation industry, there is a strong sense from most market participants that this has to change and increasingly Lessors believe that the E in ESG must become an integral part of their business strategy.

But what does that really mean? What do Lessors need to do? The reality is that Lessors cannot greenwash their way around this one, nor can they solve it alone. However, we do need to face up the scale of the challenge and accept, as key industry stakeholders, that we must play a role in the road to net zero.

There is no Planet B.

Measure • Innovate • Invest • Collaborate

The answer lies in those four words.

Measure

Drucker famously said 'if you can't measure it, you can't manage it'.

It's one of life's truisms and equally human nature is such that you often prefer not to know the truth. Like stepping on the scales in the New Year. We know the challenge is there, but we don't necessarily want to deal with the scale of the challenge.

To date, Lessors are not obliged to offset their carbon emissions, be them direct or indirect. When they do so, it is on the basis of being good corporate citizens and as part of their sustainability values or strategy. However, Stakeholders, such as shareholders and financiers, increasingly insist on CO₂ emission metrics, and it appears inevitable that a requirement to measure emissions will become a market norm for Lessors, and in turn between Lessors and Lessees. For airlines based in Europe, reporting GHG (Green House Gas) emissions as part of the EU ETS (Emissions Trading Scheme) is already the norm, and likely to become so in the U.S., although still at a discussion stage. Moreover, with the EU CSRD (Corporate Sustainability Reporting Directive) coming onstream, European-based lessors will have significant compliance requirements in relation to reporting on ESG in the future.

So, what is the scale of the challenge?

As a caveat to that which follows and, despite an array of CO₂ calculators, it should be noted that the industry has yet to settle on standardized CO₂ measurements for reporting purposes. Moreover, few airlines today report their emissions, hence requirements for measuring CO₂ emissions in leases have yet to become a reality and airlines might readily view a new reporting requirement as an unnecessary burden.

Nevertheless, let us attempt to demystify the per-annum cost of CO₂ emissions for a new-generation narrowbody aircraft and consider its Scope 1 emissions.

Aircraft Emissions: 1x Airbus A320neo CO₂ p.a. Emissions

Using PACE calculations (<https://www.pace-esg.com/>) for the 2022 utilization of a typical A320neo operating in Europe in a benign environment, the CO₂ emissions were 20.8k metric tonnes (MT). For the Lessor, this means that the Scope 3 emissions (i.e., indirect CO₂ emissions) were also 20.8k MTs. Hence, Scope 1 (the so-called 'polluter') for the airline and Scope 3 for the Lessor. If the airline were to buy EU ETS credits for all of its CO₂ emissions on this aircraft, the cost in 2022 would have been €1.67m (average price of €80 per MT in 2022). That's almost €140k a month. Under ICAO's CORSIA, the cost would be <20% of that amount although prices of CORSIA credits vary widely. At current prices of >€100, buying EU ETS credits for European airlines will require significant fare increases to be financially sustainable. Furthermore, as allowance caps are phased out by the EU, Lessors will increasingly need to calculate airlines' EU ETS financial exposure as part of their risk assessment.

Lessor Emissions: Scope 3 Downstream Emissions

Again, in an attempt to illustrate the challenge, we used PACE calculations to simulate a typical Lessor fleet (see Figure 1 below). This sample fleet is based on 112 aircraft with an average age of 5.5 years operating leased to 82 operators. Like actual Lessors, this simulated fleet reflects a Lessor with predominantly narrowbody aircraft, including new technology assets, and 15% (by unit) wide-bodies. Whilst the lessor is not real, the aircraft data is real, based on actual MSNs and their CO₂ emissions in the 2022 calendar year.

Many lessors currently offset their direct emissions and some of their indirect emissions, such as business travel, using verified carbon credits. They have also made real efforts to ensure their offices are carbon neutral where possible. However, as illustrated, it is the indirect Scope 3 airline emissions that represent the biggest challenge.

Consider the CO₂ emissions and offsets:

- 20,800MT on 1x A320neo p.a.
- Sample Lessor: 3,141,728 p.a. Scope 3 Downstream Indirect Emissions.
- Typical Lessor Voluntary Offset as a percentage of Scope 3 emissions: 0.00002% (based on current sustainability reporting from Lessors). If this Lessor were to purchase offsets for only 1% of its owned fleet's Scope 3 emissions using verified carbon credits at US\$20 a credit, the offset cost would be a not insignificant US\$628,346 p.a.

In essence, Lessors voluntary offsets via carbon credits are de minimus when stacked against their downstream Scope 3 emissions. This begs the question as to whether, given their financial strength, Lessors can pivot their thinking and look to facilitate the reduction of airline Scope 1 emissions through their investment activities, thereby taking on some ownership of the challenge. In 2022, SMBC Aviation Capital went so far as to state in their ESG report that “we are also committing to scope 3 net zero emissions by 2050, meaning that our portfolio will be made up of aircraft powered by SAF, electric propulsion and/or hydrogen fuel”.

Irrespective of a Lessor's view of its emissions accountability, most observers would agree that accurate CO₂ measurements of the sector's emissions make sense, and that over time it will become a prerequisite.

Hence, in the first instance, the leasing industry should ideally enhance its governance of downstream emissions through:

- Lobbying for standardization of measurement metrics e.g., deciding on which calculators and tools are acceptable for CO₂ emissions, and what way emissions should be reported
- Measuring and reporting of its Scope 1, 2 and – most importantly - downstream Scope 3 emissions.
- Introducing lessee emission reporting requirements within lease agreements

However, agreed-upon measurement metrics in and of itself will not bring change in the absence of targets – i.e., just because you have endeavored to religiously weigh yourself each week doesn't inherently give you a healthy lifestyle. The industry therefore needs to innovate to develop science-based targets around its activities to which it is then held accountable.

Innovate

Edward de Bono, the father of so-called 'lateral thinking' once said "It is better to have enough ideas for some of them to be wrong, than to be always right by having no ideas at all".

True innovation in aircraft leasing is not easy. Significant change for our industry during our own 'useful lives' will only come with major investment in carbon offsets/capture, SAF and/or hydrogen-electric technology (see 'Investment' below).

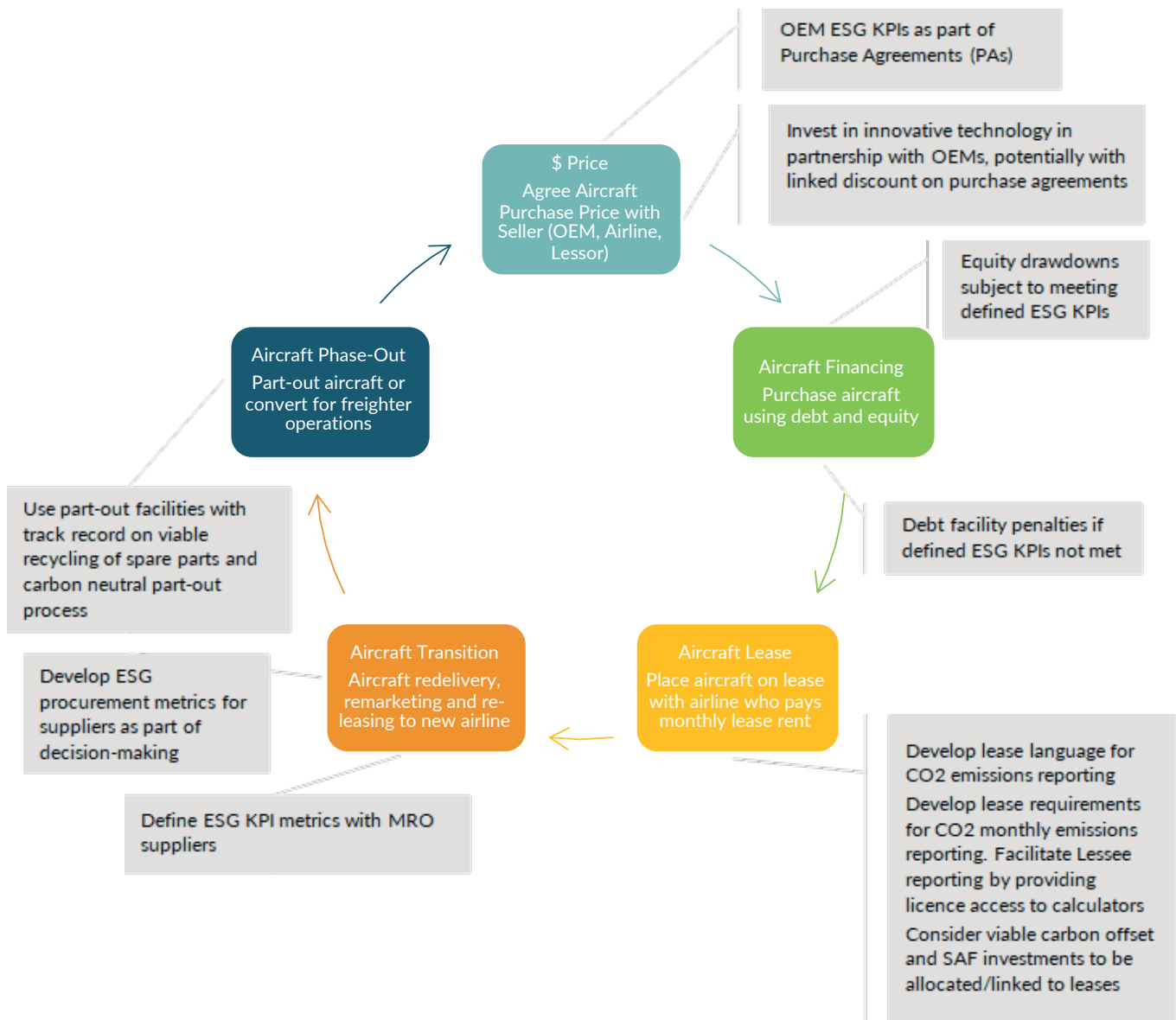
However, this should not impede Lessors from integrating ESG KPIs across their value chain to facilitate the industry's sustainability journey. We have seen in the area of Diversity, Equity and Inclusion (DEI) that when detailed measures and targets are put in place, reported on transparently, and accompanied by action plans, this ultimately facilitates change. As such, change occurs when the measures and targets are meaningful and the company makes itself accountable to its leadership, such as the Board and C-suite, for their achievement. Put another way, if the ESG initiative is placed 'downstream' in the company as a CSR initiative and not seen as a strategic issue, there will be little progress.

Leasing 101: Referring to the diagram below, we can see that Lessors can implement best-practice 'E' KPIs across the asset life cycle. As illustrated, at every point in this journey, not only are there opportunities to promote industry best-practice to facilitate CO₂ emissions reduction, the Lessor plays an essential part in advocating for measurement and accountability, incentivizing all stakeholders, including suppliers, lessees and employees in its supply chain.

Implementing “E” KPIs through the Asset Life Cycle

Overall

- Implement full ESG strategy
- Set meaningful sustainability targets and measures and make ESG a Board item
- Advocate for/Adopt ESG measurement norms in the industry
- Implement visible sustainability company events with employees and local communities
- Develop job performance KPIs with respect to ESG progress
- Work collaboratively with other industry stakeholders (ALI, impact, AWG etc.)



As outlined above, there is no panacea, but best practice will only evolve as lessors begin to demonstrate real leadership and accountability.

Invest

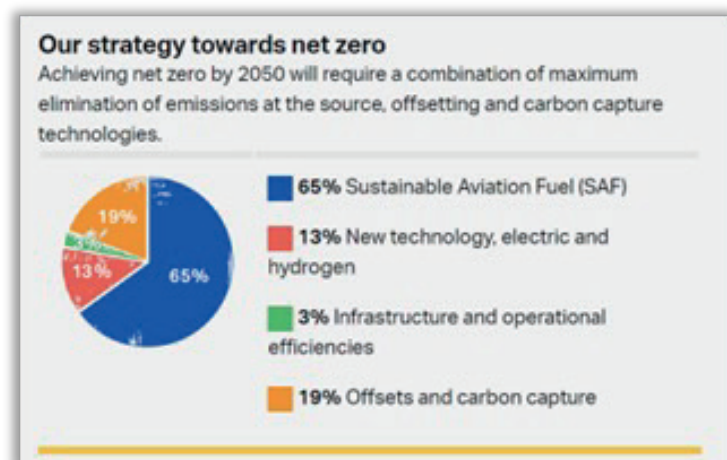
“The first rule of an investment is don’t lose (money). And the second rule of an investment is don’t forget the first rule. And that’s all the rules there are.” Warren Buffet

“This supersedes political parties, race, creed, religion, it doesn’t matter. If we do not solve the environment, we’re all damned.” — Elon Musk [speaking on Tesla development and sustainable transportation]

Love or hate Musk or Buffet and their capitalist ways, the reality is that Lessors are financial service companies. They live and die by the return on investments (fossil fuel-dependent assets) to their stakeholders. For that reason many believe that, despite their access to capital, investing in SAF or development of new technology is not part of their modus operandi. But what if they were taxed for their ownership of fossil fuel-dependent assets, or, more appealingly, received tax incentives to invest in SAF or new technology as part of their business strategy? What does it take for Lessors to feel accountable?

Lessors argue that their strength lies in investment in new-technology assets such as the Airbus A320neo Family and Boeing 737 MAX equipment. These assets reduce CO₂ emissions by up to 20% compared to their previous generation. However, with 3.5%+ industry growth per annum, the reality is that total industry CO₂ emissions will simply not reduce. Moreover, with a typical 25-year aircraft economic life, premature asset phase-outs is not a viable industry strategy, not least given the constraints of manufacturer supply and from a social and market ecosystem perspective, as emerging markets often rely on older aircraft and simply cannot afford newer assets.

What investment is required? And who should fund it?



Consider what investment we know is required today.

IATA advises that 65% of the road to net zero will be SAF (see below). ICAO too under their LTAG’s (Long-Term Aspirational Goal) most-ambitious scenario of 87% of CO₂ reduction by 2050 similarly agree that SAF has the greatest potential to reduce CO₂ emissions.

Secondly, carbon credits including carbon capture, are currently the main way of offsetting carbon emissions, although increasingly they are perceived negatively despite CORSIA having strict criteria for verifying offsets. We have seen many lessors, such as AerCap and SMBC Aviation Capital offsetting Scope 1 emissions via credits, with SMBC AC going a step further via its airline-oriented carbon credit program, investing US\$53m with Southwest Airlines as its launch customer.

Thirdly, we know that new technology investment in the long-term with electro-hydrogen assets has the potential to eradicate aviation’s carbon footprint, but this requires completely new technology and fuel supply infrastructure at airports. In this respect, Lessors such as Aviation Capital Group (ACG) and Avolon have pioneered efforts in eVTOL investment as a complementary activity to facilitate technological innovation.

Investment Options for Lessors

 CO ₂	 Sustainable Aviation Fuel	 Technology
<ul style="list-style-type: none"> • Buy certified offsets to offset Scope 1, Scope 2 and Scope 3 (pertaining to staff business travel) • Participate in a bespoke Carbon Offset program • Participate in a bespoke Carbon Capture program 	<ul style="list-style-type: none"> • Invest in SAF long-term off-take contracts via direct agreements with SAF suppliers or through a SAF investment fund • Invest in the development of a SAF production facility 	<ul style="list-style-type: none"> • Set portfolio investment targets for new technology assets which lower lessor’s portfolio carbon emissions • Invest in new technology e.g. eVTOLs, hydro-electric etc. 

SAF is projected to be 65% of the decarbonization solution, yet very few lessors have (so far) taken meaningful action to advance its scale-up. To date, we have seen an offtake agreement by Avilease and the feasibility study by Avolon / Boeing / Orix in Ireland, with the majority of lessors favoring the other two forms of investment i.e. CO₂ offsets/capture and Technology.

Understanding SAF

SAF is very similar in its chemistry to Jet A and Jet A-1 fossil fuel and is thus a 'drop-in' solution using existing infrastructure. However, unlike fossil fuels, it can be made from a variety of carbon feedstocks including – in time – solid municipal waste. The secret of SAF is that it reduces CO₂ lifecycle emissions of fuel by up to 80% as the source material, such as from plants, or in the case of waste, prevents GHG emissions (from incinerators). Note - the 20% delta represents the CO₂ emissions of the refinery process as well as transport of feedstocks.

Scaling SAF is a massive challenge for the aviation industry. SAF is still in its infancy, with less than 0.05% of the aviation fuel market, no commodity index, and a complex supply chain. Currently, SAF from HEFA (a process that uses hydrogen to transform oils and fats into fuel, including used cooking oil) is the only scaled SAF process and its available waste feedstocks are limited. Other Biogenic SAF with more stable and predictable supply will come onstream in due course, such as ATJ (Alcohol-to-Jet) which relies on agricultural and forest residues or starch crops. Thereafter, non-biogenic synthetic solutions, with an even larger CO₂ reduction, such as Power-to-Liquid (PtL) SAF will develop and scale, but at a much later stage. What is clear is that SAF suppliers need huge forward investment to ramp up their infrastructure to meet demand. Players like Neste and Gevo are front-runners in SAF production, and the US has been proactive in providing a range of tax credits to the industry. The EU, on the other hand, has taken a more 'stick' approach, which will ultimately enforce SAF blending mandates for fuel supplied to EU airports.

SAF Solutions

To accelerate the nascent SAF industry, many stakeholders, such as large airlines, are looking to build SAF funds. In United's US\$100m Sustainable Flight Fund, investors include OEMs such as GE and Boeing, but also JP Morgan, with the stated objective to fund the research and production of SAF.

Other SAF funds will follow suit but may simply seek to forward-purchase long-term offtake agreements across a pool of suppliers, thus speculating on the future cost of SAF vs Jet Fuel but mitigating the supply risk through a diversified portfolio of suppliers, SAF types (HEFA, ATJ) as well as accessing sector specific tax credits. In this respect, the Rocky Mountain Institute (RMI.org) has announced plans to launch a digital registry this year for SAF certificates (SAFc) to facilitate industry investment and transparency as part of its Sustainable Aviation Buyers Alliance.

For a Lessor, there may well come a point where SAF investment risk could work well as a complementary activity – e.g., investing in a SAF Fund alongside other industry stakeholders in its supply chain, such as OEMs, large airlines and, in some cases, sister shareholder companies that invest in renewables.

Moreover, assuming SAF demand continues to outstrip supply, lessors could potentially sell their investment to their lessees, such as smaller airlines, the majority of whom would not have the financial ability to forward purchase SAF, thus facilitating their achievement of ESG KPIs. When you consider how Lessors freely allocate pilot training credits as an incentive in lease negotiations, allocation of SAF supply from an offtake agreement, such as the Avilease investment, suddenly doesn't appear to be so unreasonable.

Finally, Lessors could also consider vertical investment in SAF facilities in their home countries, with some Lessors already carrying out feasibility studies. Unlike a fund, the risk would not be spread in this instance, hence the investor is taking on development risk and SAF supply risk (as it is relying on only one type of SAF e.g., HEFA).

In conclusion, Lessors' vast market share as owners of most of the world's commercial aircraft, their financial ability to invest, and their competitive cost of capital places them at a significant advantage to other stakeholders in evaluating investment opportunities. Whilst the risk and reward dynamics remain unclear, they can be mitigated through collaboration with other industry stakeholders, tax incentives and/or government backstops. Taking unfamiliar investment risk should therefore be considered by stakeholders and form part of a Lessor ESG strategy. This requires real leadership. "Need to put footprint of courage into stirrup of patience" as Shackleton said.

Collaborate

Finally, with a multitude of stakeholders, collaboration to accelerate the path to net zero is fundamental. Examples include:

- Aircraft Leasing Ireland (ALI) which outlined a sustainability charter in October 2022 with more than 30 industry participants signing up to it.
- Aviation Working Group (AWG), an industry group with a history of forward thinking in relation to industry policy, has assessed ESG regulations, disclosure requirements, and government policies and has acted as representative voice for the industry on issues such as the EU taxonomy.
- impact, an independent non-profit, has brought together more than 30 financial and leasing institutions to chart a course to industry stability, in particular advocating the need for consistency in emissions measurements and acting collectively to pre-empt governmental action that could hamper the industry and asset values.

Acting as 'one voice' has multiple benefits, not least with respect to standardization of reporting, through advocating for best practice principles in measuring and reporting, but also through collective action to accelerate the industry's response to this challenge and equally protect the industry by steering government as well as related stakeholders and entities to legislate in order to facilitate, rather than punish, the sector.

Conclusion

Lessors can no longer be bystanders in the road to net zero carbon emissions. Lessors' biggest strength is their access to capital and their market dominance. They need to find ways to use that muscle to facilitate real industry change to ensure they are firmly on the path to net zero.

As a first step, no matter their size, Lessors need to put ESG front and center of their strategic agenda, with CEO responsibility and Board accountability. Acting collectively, and not dissimilar to Cape Town legislation, Lessors must also aim to make reporting requirements (including downstream Scope 3 emissions) a norm. In first instance, accountable to their shareholders and stakeholders, and secondly, through integration of standardized airline emission reporting requirements in leases.

As part of their strategy, Lessors must innovate their day-to-day business to implement ESG KPIs throughout their asset investment life cycle, thereby ensuring ESG accountability with all stakeholders, including their employees.

As owners of around 50% of the most popular narrow and widebody aircraft, Lessors must view themselves as critical stakeholders on the road to net zero. This requires them to consider ways to use their superior access to (and cost of) capital to invest in technologies that will rapidly reduce aviation's carbon footprint. As illustrated, investments must prioritize SAF technologies, as they are the main path to decarbonization by 2050. Such investments will require Lessors to take on unfamiliar risk, which could be mitigated through collaborative investment with other stakeholders, such as OEMs and airlines, and tax incentives.

Finally, working collaboratively will pave the way for coordinated action. Collaboration is key as it allows the industry to coordinate its voice, as well as protecting it from sanctions (e.g. capacity limits and flight bans) and promoting the need for investment tax incentives in sustainable technologies that complement the Lessors' activities.

In short, Lessors must Measure, Innovate, Invest and Collaborate.

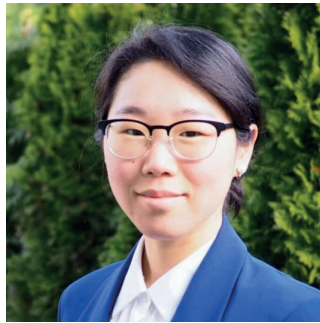
There is no Planet B.

'Carbon Engineering: Direct Air Capture'

Anna Stukas & Caroline Jung



Anna Stukas,
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In recent years, the International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA) have committed to achieving net zero emissions from aviation by 2050, uniting nations and industry members toward a common goal of deep decarbonization. Achieving net zero aviation will require a multifaceted approach, including efficiency improvements, sustainable aviation fuels (SAF), carbon dioxide removal (CDR), and alternate propulsion technologies. Collaboration between governments, industries, and financial institutions is crucial to implementing these solutions.

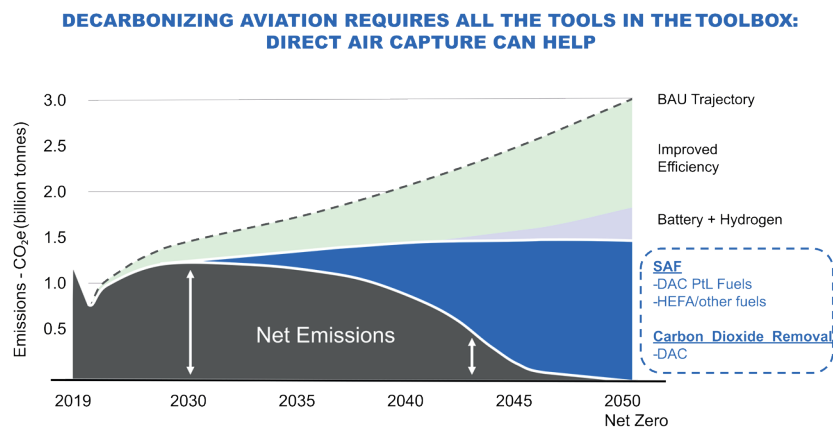


Figure 1: Decarbonizing aviation requires a multi-faceted approach using all the tools in the toolbox. Direct air capture can help. Based on data from data from Mission Possible Partnership¹. (BAU=business-as-usual, HEFA=hydroprocessed esters and fatty acids, DAC=Direct Air Capture, PtL=Power-to-Liquid).

Scientists, policymakers, and industry recognize that technology and operational improvements and SAF alone will not be sufficient to achieve net zero aviation.⁶ It is imperative to scale up CDR today, specifically Direct Air Capture (DAC), to support the aviation ecosystem to decarbonize both sustainably and economically⁷.

DAC can serve two roles in helping to decarbonize aviation: by removing carbon dioxide (CO₂) from the atmosphere and storing it safely and securely underground (DAC+S) to create carbon dioxide removal, and by providing CO₂ as a feedstock for producing synthetic sustainable aviation fuel in the form of power-to-liquids (PtL) SAF.

Governments have been introducing regulations and incentives to drive DAC industry growth, and industry members have been incorporating DAC into their strategies through investments and purchases of carbon removal credits.

This article provides a brief on how DAC technology works, how it can be used as a decarbonization tool, and updates on recent developments.

Direct Air Capture (DAC) Application in Aviation Decarbonization

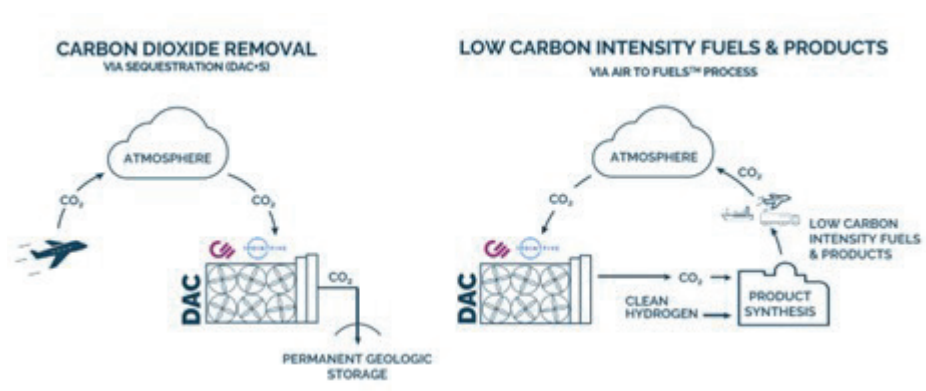


Figure 2: Use cases for Direct Air Capture to decarbonize aviation. (Left): DAC can extract CO from the atmosphere and store it underground, known as DAC+S, for durable carbon dioxide removal. (Right): DAC can supply CO₂ as a feedstock for producing synthetic sustainable aviation fuel in the form of Power-to-Liquid fuels.

⁶ 45 Mt of SAF/year is needed in 2030 to be on track for net zero by 2050, yet there is only 8 Mt of SAF/year in the project pipeline; production capacity and feedstock are in tight supply. (Mission Possible Partnership, "Making Net-Zero Aviation Possible: an industry-backed, 1.5°C-aligned transition strategy", 2022.)

⁷ The Intergovernmental Panel on Climate Change (IPCC) and leading experts have emphasized the importance of permanent CDR in counterbalancing emissions from hard-to-abate sectors and achieving the goals of limiting global temperature rise as per the Paris Agreement. Industry players who specifically include carbon capture in aviation decarbonization strategy include IATA, Airbus, and several major airlines.

How DAC works

Direct Air Capture (DAC) is a technology that captures carbon dioxide directly from the air with an engineered, mechanical system. DAC technology does this by pulling in atmospheric air then, through a series of chemical reactions, extracts the carbon dioxide (CO₂) from it while returning the rest of the air to the environment. This is what plants and trees do every day as they photosynthesize, except Direct Air Capture technology does it much faster and with a smaller land footprint.

DAC can effectively address CO₂ emissions from any source, decoupling the point of emission from the point of collection. This makes DAC a powerful tool the aviation sector can utilize as it works to reach net zero.

Geologic Sequestration

DAC paired with geologic sequestration (DAC+S) removes CO₂ from the atmosphere. Geological carbon sequestration involves injecting CO₂ deep underground for long-term storage in suitable geological formations such as depleted oil and gas reservoirs and saline aquifers. Once injected, the CO₂ is trapped in the rock formations through various mechanisms including physical trapping and chemical reactions that lead to mineralization. Over time, the CO₂ becomes permanently stored and isolated from the atmosphere, reducing its contribution to climate change.

Frameworks that govern and support carbon sequestration projects are already in place, including international standards, national regulatory frameworks and project certification and verification.

DAC for SAF production

Atmospheric CO₂ captured through DAC can also be combined with renewable hydrogen to produce a synthetic jet fuel that can be used as a drop-in replacement for conventional jet fuel. The overall process is often referred to as Power-to-Liquid (PtL), referring to the renewable electricity needed for green hydrogen production.

PtL SAF is an important component a portfolio-based approach to SAF sourcing. Sustainable quantities of waste fats and agricultural feedstock for SAF production are in tight supply today, with hydro-processed esters and fatty acids (HEFA) feedstocks forecasted to cap out by 2030^{8,9}. By contrast,

PtL SAF can be produced with only air, water, and renewable electricity - highly scalable feedstocks for production. It also does not compete for arable land and uses significantly lower amount of water than agricultural feedstocks¹⁰.

Synthetic jet fuels have been approved for use since 2009¹¹, and Carbon Engineering demonstrated production of SAF from DAC CO₂ as a part of a Government of Canada SAF challenge in 2021.

⁸ HEFA SAF is produced from fat-based feedstocks, such as vegetable and used cooking oil.

⁹ SkyNRG, "A Market Outlook on Sustainable Aviation Fuel", May 2022,
<https://skynrg.com/a-market-outlook-on-sustainable-aviation-fuel-may-2022/>

¹⁰ P. Schmidt and W. Weindorf, "Power-to-Liquids: Potentials and Perspectives for the Future Supply of Renewable Aviation Fuel", German Environment Agency, 2016,
https://www.umweltbundesamt.de/sites/default/files/medien/377/publikationen/161005_uba_hintergrund_ptl_barrierrefrei.pdf

¹¹ US Department of Energy Office of Energy Efficiency & Renewable Energy, "Sustainable Aviation Fuel: Review of Technical Pathways", 2020,
<https://www.energy.gov/sites/prod/files/2020/09/f78/beto-sust-aviation-fuel-sep-2020.pdf>

Key Benefits of using DAC

CO₂ is evenly distributed throughout the atmosphere, which means that DAC facilities need not be co-located with the emission source; this is particularly useful for the aviation industry, where point-source capture is often not an option. Instead, DAC facilities can be located proximate to appropriate geologic storage locations, and, ideally, where renewable electricity potential is plentiful. Several regulations including the California and British Columbia low carbon fuel standards (LCFS), recognize that one ton of emissions removed with DAC is equivalent to one ton of emissions reduction achieved by renewable fuels.

Three features of DAC are key to this equivalence:

- 1) Permanence:** DAC with sequestration is a durable method of carbon removal, with permanence measured in geologic timescales. There already exist stable and naturally occurring geologic stores of CO₂ around the world, and industrial storage has been safely and effectively executed for over 50 years¹²; in the US, nearly 40 Mt has been sequestered and reported to date under the US Environmental Protection Agency's (EPA) Greenhouse Gas Reporting Program (GHGRP)¹³.
- 2) Measurability:** As a technical method of removal, measurement, reporting and verification (MRV) of the amount of carbon captured by DAC is straightforward compared to biological methods. Flow meters on the facilities capture the exact amount of CO₂ extracted from the air, while monitoring wells measure the amount of CO₂ that remains underground. In the US, the regulatory framework for CO₂ injection and MRV is mature; since the EPA issued the GHGRP regulations for facilities injecting CO₂ for geologic sequestration or enhanced oil recovery in 2010, the number of US facilities with approved MRV plans for CO₂ injection has grown to 17^{14 15}.
- 3) Additionality:** DAC+S and PtL cause a climate benefit above and beyond what would have happened in a no-intervention baseline scenario, which can be difficult to prove for other types of climate solutions.

¹²US Department of Energy National Energy Technology Laboratory, "Carbon Dioxide Enhanced Oil Recovery", March 2010, https://www.netl.doe.gov/sites/default/files/netl-file/co2_eor_primer.pdf

¹³US Environmental Protection Agency, "Greenhouse Gas Reporting Program: Supply, Underground Injection, and Geologic Sequestration of Carbon Dioxide", December 2023, <https://www.epa.gov/ghgreporting/supply-underground-injection-and-geologic-sequestration-carbon-dioxide>

¹⁴US Congressional Research Service, "Reporting Carbon Dioxide Injection and Storage: Federal Authorities and Programs", 2021, <https://crsreports.congress.gov/product/pdf/R/R46757>

¹⁵US Environmental Protection Agency, "Greenhouse Gas Reporting Program: Subpart RR – Geologic Sequestration of Carbon Dioxide", April 2023, <https://www.epa.gov/ghgreporting/subpart-rr-geologic-sequestration-carbon-dioxide>

Scaling DAC

DAC technology has only recently started to be deployed at scales relevant to the aviation industry. As one example, construction has begun on the world's largest DAC facility, STRATOS, by 1PointFive, a subsidiary of Occidental's Low Carbon Ventures business. The facility uses Carbon Engineering (CE) technology and startup is expected in mid-2025. Once fully operational, STRATOS is expected to capture up to 500,000 metric tons of CO₂ per year. 1PointFive has announced a scenario to deploy 100+ DAC facilities worldwide by 2035 under current compliance and market scenarios.



Figure 3: Artist's rendering of STRATOS, currently under construction in West Texas by 1PointFive, deploying Carbon Engineering's DAC technology.

Despite its relative nascency, the cost of decarbonizing aviation¹⁶ through DAC is competitive today with that of SAF, and it is anticipated that further scaling will significantly reduce costs.

Prominent figures in the aviation industry and beyond recognize the role and opportunities CDR will play in a net zero economy and have demonstrated their commitment through investments and off-take. Airbus and Air Canada have demonstrated their support for DAC technology through investments in CE¹⁷. In addition, Airbus has pre-purchased 400,000 tons of CDR from 1PointFive and is leading a CDR collaboration effort with major airlines to explore carbon removal solutions for aviation^{18,19}.

¹⁶ Cost of emissions reduction is measured by cost per tonne of CO₂ abated by an activity.

¹⁷ Airbus, "Airbus invests in climate solutions company, Carbon Engineering Ltd. to support world's largest direct air carbon capture R&D facility,"

¹⁸ Occidental Petroleum, "1PointFive announces agreement with Airbus for the purchase of 400,000 tonnes of carbon removal credits," Occidental Petroleum, 17 March 2022,

<https://www.oxy.com/news/news-releases/1pointfive-announces-agreement-with-airbus-for-the-purchase-of-400000-tonnes-of-carbon-removal-credits>

¹⁹ Airbus, "Airbus, Air Canada, Air France-KLM, easyJet, International Airlines Group, LATAM Airlines Group, Lufthansa Group and Virgin Atlantic sign Letters of Intent to explore carbon removal solutions for aviation," 18 July 2022,

<https://www.airbus.com/en/newsroom/press-releases/2022-07-airbus-air-canada-air-france-klm-easyjet-international-airlines>

Conclusion

The aviation industry's commitment to achieving net zero emissions by 2050 presents an ambitious but achievable goal, especially with the deployment of DAC technologies. DAC, alongside the adoption of SAF and efficiency improvements, can serve a dual purpose of removing atmospheric CO₂ for geological storage and providing the feedstock for SAF production. This technology is key for its scalability, additionality, permanence, and measurability.

There has been notable progress with DAC implementation, such as 1PointFive's large-scale DAC facilities, and Airbus and Air Canada's investments in Carbon Engineering. Further scaling of DAC is expected to reduce costs significantly, making it a competitive solution for decarbonizing the aviation industry.

Ultimately, achieving net zero aviation will require significant collaboration and commitment from governments, industry, and financial institutions, alongside the innovative use and development of technologies such as DAC.

'Airline carbon costs'

Nigel Addison-Smith



*Nigel Addison-Smith,
Aviation Advisor*

Airlines, particularly in Europe, are experiencing growing carbon related costs for their aircraft operations. This is the start of a long and significant cost increase towards net zero in future decades. Airlines, their suppliers and providers of capital need to act now to understand these costs and try to mitigate the worst of the impact.

Key trigger dates in Europe for cost increases are 2030 and 2035 due to SAF regulation but also SAF use commitments by airlines, often in excess of the regulation. Meanwhile there are creeping increases in carbon taxes and ETS costs. For at least the next few years, these costs will be significantly in excess of SAF costs relative to Jet-A1 due to the low percentage of SAF being used. So, with all the focus on SAF, these other costs could go unnoticed, but not by the airlines incurring them.

Before and after the pandemic

Before COVID, only really Ryanair – whose largely intra-EEA operations translate into a high ETS exposure - had noticed the growing cost of the ETS. Its March 2020 accounts for its last pre-COVID year reported significant and rising carbon costs for the first time. Because ETS is paid on the growth in emissions, Ryanair's growth rate was triggering these payments. COVID has disguised the underlying growth of these costs because of the lower carbon emissions during the recent period of depressed passenger demand relative to 2019. Other than high-growth airlines like Ryanair, many airlines will also have lower emissions in 2023 partly due to fleet replacement. So, 2024 onwards are the start of the cost escalation for the majority.

As for airports, prior to COVID airports with environmental landing charges or with emission restrictions were the only ones having a material impact on airline emission reduction. Heathrow is the prime example where the use of latest-generation aircraft is proportionately more than double that of other major European hubs (even ones with environmental charges).

Main environmental cost factors for European airlines

The three primary airline carbon costs are the European Tax Directive, ETS (EU / UK / Swiss) and SAF usage. CORSIA charges for the foreseeable future are likely to be so low as to be all but meaningless.

EU ETS currently applies to intra-EEA flights (excluding certain protected destinations). Until recently there were significant (but now slowly declining) free allowances given to long-standing operators. These go completely from 2027, significantly increasing carbon costs for flights within the continent.

The big unknown is whether the EU removes the dispensation of not charging ETS on all departing flights. This means that currently there are no charges on flights departing to non-EEA destinations. Given the longer lengths of the extra-EEA flights (thus greater emissions), this is currently a huge cost saving for airlines. The EU deferred the decision about whether to remove the dispensation from 2027. This delay is not necessarily news since the airlines need years to plan for such a large cost increase.

Efficiencies, fleet replacement, and SAF

Switching to mitigation, ATAG and many others have analyzed and written about how airlines can reduce emissions. The big three measures are operational improvements, fleet replacement and SAF. Starting with ATC efficiency optimization, this carries the largest environmental (and cost) benefit but international cooperation to reduce emissions has been slow.

Fleet replacement is the most cost-efficient means of carbon reduction since replacement aircraft can often be cheaper to operate than existing aircraft. However, both Boeing and Airbus and their supply chains are struggling to ramp up production to meet huge demand particularly for narrow-body aircraft. Airbus is struggling to increase A320 rates towards 75 per month from around 40 and have sold the difference in orders. Boeing keeps experiencing issues on its 737 MAX production lines but also needs to increase.

For widebodies, which due to their size and average flight length cause a large proportion of emissions relative to their number, both manufacturers have unused capacity on their production lines and could get production rates up. Airlines have been slow to reorder widebodies post-COVID, but this could change. Freighters are also a key opportunity, such as replacing 747s, MD11s and other older large freighters.

SAF will be the single biggest means of reducing emissions but the technology at industrial scale is taking time to develop. More capital is needed for this market. Feedstock is the other main concern, which whilst available now may not be at an affordable price in future due to the anticipated demand. SAF is complex with seven technologies requiring differing feedstocks, making it complex for airlines to understand.

Unlike in the past where the oil majors provide Jet-A1, for SAF the airlines are having to invest directly into SAF plant adding a complexity to airlines' business models. The 2030 regulations and commitments have the airlines focused on rapid development of plant.

The complexities of getting the SAF from the plant into the airline's aircraft is not yet an area of focus. The same infrastructure at an airport feeds all aircraft so how does an airline access its SAF that it has made?

SAF is referred to as three to nine times more expensive than Jet-A1 but given recent variability of Jet-A1 prices due to Russian sanctions, this can be confusing.

Use of SAF obviously mitigates against ETS and Tax Directive costs, so there is a relative saving.

The key thing is for airlines to develop a strategy to reduce emissions and at least cost but also successfully portray their plan to consumers and other stakeholders like investors.

impact interviews aviation's next generation

impact sits down with the aviation industry's next generation of leaders to understand their sustainability motivations, personal interests, and the role their firms can play.

Ana Magdalena



Ana Magdalena,
VP in Research & Analysis, FPG Amentum

Q1. The Dublin aircraft leasing sector often attracts people with engineering and business degrees, but your background is slightly different – academia. What attracted you to join aviation?

I pivoted my career towards aviation leasing in a serendipitous way in 2013. I took a course on aviation finance one summer – out of curiosity. I did not know that aircraft leasing existed; the industry was still a bit of a hidden gem, even in Ireland. It was fascinating to discover it. The most intriguing aspect is how interconnected people are and how far back some relationships go. It is a very collegial environment, and everybody seems to know everybody else. The next interesting aspect was the global reach of the industry and the role it plays on every continent, financing and investing in aircraft operated by airlines everywhere. Lessors own and manage more than 50% of the world's global fleet of commercial jets. Where else can we see such a concentration of assets and capital?

Also, as any field that sits at the intersection of different industries, in this case, aviation and finance, there is plenty of opportunity to explore mathematical or statistical models. Most aviation finance data is not public and hence it is not mainstream in scholarly research. Once you are in, it is easier to access information and data points, and once you gain access to that, there are plenty of opportunities to apply complex and innovative modelling techniques. Although it is often not possible to make these results public, it is part of our competitive edge.

Q2. At FPG Amentum you have published several research papers examining questions relevant to the whole industry, including sustainability. What is your personal motivation around sustainability?

There is an immense opportunity for learning and discovery in the field. I, like most people, am taking part in this synchronous learning on sustainability. My personal motivation is to normalize conversations on this topic and unravel very specific issues in our industry. How much would it cost to operate an Airbus A321neo on 10% SAF? How much would it cost to make a 'ceo' as green as a 'neo' equivalent? Who can afford to carry such a cost – the airlines, the passengers, or the investors? A good part of the research and communication on aviation sustainability targets airlines.

For example, NGOs produce very interesting statistics and articles, but they are talking to airlines, not financiers. We are motivated by figuring out such specific answers. This drives my research – this and the fear of climate change and the impact it will have on Ireland. Sea level rise and coastal erosion are real worries when you live on an island.

Q3. Across your research into aviation sustainability questions, what findings surprised you the most and which has sparked the most debate?

Perhaps the most surprising element is realizing investors' widespread acceptance that they have a role to play in steering the aviation industry towards sustainability. Most participants in the industry believe they have a role to play. Figuring out how to best perform this task is still in progress, but the prevailing sentiment is one of responsibility.

And most debate is perhaps generated by how diverse some of our views can be on sustainability. Individually, we see this topic in unique ways. We are not homogenous in our thinking, and the truth is we need a bit of consolidation. This is why concentrated efforts to give the industry a common stance is essential. ALI and impact are great examples of efforts to give aviation a common and stronger voice.

Q4. Your most recent research endeavor is unique: mathematically grouping perceptions of ESG issues among aviation finance executives into four differentiated camps. How did this occur to you?

Thank you for mentioning it. Several years ago, I came across this exciting methodology (Q-sort) to analyze qualitative data, but I did not know precisely where to apply it in aircraft leasing. When the discussions around sustainability intensified – particularly during the COVID-19 crisis – there was an opportunity to apply this methodology to uncover the major themes in our collective thinking. This somewhat unusual survey found four major underlying themes.

One theme was defined by a strong sense of responsibility and a good understanding of sustainability issues, but also impatience regarding the need to act soon without further waiting for external solutions. Another theme was dominated by a fear of external accountability and a sense of being overwhelmed by the new challenge of figuring out sustainability and the vast amount of information available on the subject. The third theme was interesting in that it contrasted with the others in the rejection of the relevance of ESG for our business – at the time – and the belief that investors need to wait for more robust policy frameworks before acting on anything. The fourth theme was characterized by the admission of lacking the required knowledge to make impactful decisions, and the need to learn and understand more before meaningful sustainability-linked deals can be made.

Not everyone is aligned with these views. As I pointed out earlier, many of us are still too diverse to put in a box. A good percentage of us, about 20%, do not fit the four patterns of thinking described above – and I include myself here because I do not know where I fit. This diversity of attitudes towards sustainability endorses the need for a united approach.

Q5. What role can aircraft lessors like FPG Amentum play in helping aviation transition towards a more sustainable future?

At FPG Amentum, we recognize the importance of environmental sustainability and contribute on multiple levels to bringing the subject of sustainability from the periphery to the center of the conversations. We actively participate in industry-specific conferences, where ESG and sustainability topics have grown exponentially. We contribute by sharing the knowledge we accumulate through research papers on sustainability topics, where we understand the need to communicate how sustainability impacts specific issues – not by holding generic discussions on sustainability. We know that generic narratives can fail, and the industry may face criticism from investors or climate activism.

Above all, we participate in the united efforts of the leasing community by volunteering our expertise to Aircraft Leasing Ireland. Jan Melgaard, Executive Chairman of FPG Amentum, is also the founding and acting chair of ALI's Sustainability Committee; in this way, FPG Amentum is deeply involved in the efforts of the aircraft leasing community to help raise awareness and improve understanding of sustainability in our industry and, most importantly, to act on this shared knowledge.

Introducing impact's Advisory Board members

impact is delighted to welcome Shanan Gibson, Jihong He, Jan Melgaard, and Andreas W. Schäfer as the first members of the impact Advisory Board established in the first half of 2023. Together they bring a wealth of experience in academia, consulting, financial leadership, aircraft leasing, and climate research to inform and support impact's mission. Jan Melgaard will assume the role of Advisory Board chairperson with Shanan Gibson as Vice Chairperson.

Shanan Gibson



*Shanan Gibson, Dean David B. O'Maley College of Business,
Embry Riddle Aeronautical University*

Shanan G. Gibson, Ph.D., joined the O'Maley College of Business as Dean and Professor of Management in April 2020 after having served as the Dean of the College of Business at Texas A&M - Commerce for nearly three years. Prior to this, she was the Associate Dean for Student & Faculty Development in the College of Business at East Carolina University (2012 -2017) where she was a member of the ECU faculty for 16 years. Shanan earned both an MS (1998) and PhD (2001) in Industrial & Organizational Psychology from Virginia Tech.

Your academic focus has been on industrial psychology and entrepreneurship, how are these two fields interlinked with aviation's sustainability goals?

Industrial and organizational psychology takes what we understand about both individuals and groups: how they learn, what motivates them, how do you get them to work together towards shared goals, and then ideally helps organizations apply this in the best way possible. And I think that's essential to what we have to do if we're going to make inroads towards greater sustainability in aviation and in general. There's no one-size-fits-all and there's no magic bullet. We're going to have to have coordinated approaches that consider the needs of multiple stakeholders and then aligned them with this better vision for tomorrow.

My research over the years also segued toward entrepreneurship, largely because I was interested in the psychological attributes that encourage people to become entrepreneurs. Entrepreneurs are the risk-takers in industry. And the reality is, sustainable aviation is only going to happen in conjunction with significant innovation. I think entrepreneurs and their focus on smart risk-taking and innovation and implementation of new ideas before other people perfectly align with what we need to do here.

What motivated you to join impact's Advisory Board?

That kind of flows from what I just said, because I do think sustainability as a concept is inherently social. impact's Advisory Board gives me the opportunity to contribute both as a business person, a person, and as an educator. My hope is that I can harness my knowledge as a person, but more importantly, harness the knowledge of the very smart people I am surrounded by every day at Embry Riddle and within the aviation industry toward moving the needle. And more than that, I hope it puts me in a position to model the behavior for future generations of aerospace leaders.

The second reason I joined impact was that I appreciated the fact that they were taking a fairly pragmatic and reasonable approach to sustainability, by delineating standards that are hopefully achievable across a broad array of companies. It's not a pie in the sky approach. It is a stepwise, well considered smart approach that will move the needle in a way that I think many organizations can get behind.

As Dean of Embry-Riddle's College of Business, what role does sustainability play in the curriculum?

It's growing, as it is across schools all over the world. But in a business school, we're obviously interested in issues such as sustainable finance, sustainable supply chains, sustainable operations, and naturally we tend to look at these as both a question of the business case for. But also we want to marry them with our belief that business should be a force for good in society.

Which lessons can European aviation learn from the USA in terms of sustainability?

I think the US has been more pragmatic in our approach to trying to move organizations towards sustainable aviation. We set goals around sustainable aviation fuel because in some ways, despite supply chain issues, that might be a good first attainable step as we also work towards more efficient engines and other things.

I think nations have to prioritize industry actions in a pragmatic way. That means sometimes as a nation or as a company, you go for the biggest culprit to have the biggest impact, but sometimes the way you prioritize is you pick the low-hanging fruit so that you can have a win that motivates the team to keep pursuing the harder goals. I think the US is doing a pretty good job of trying to find ways to offer incentives to build up the supply chain and move people forward in a way that won't disrupt our economies and our lives. That's my hope at least.

What role does sustainability play in your personal life?

Sustainability is important to me without a doubt, but I look at it as one piece of good citizenship.

I personally don't think I can get people to listen to me talk about carbon emissions if they don't have food, shelter, and basic human needs met. It's just not practical, it's not smart. I'm not as sustainable as I should be, but a lot of people doing small things adds up. I think that's how we move the needle forward.

Consistent with my personal beliefs. I've built social responsibility as a whole into my college's mission because I know the things that I do that are most meaningful to me towards – making the world better – build in that sustainability piece. So, it's in our classes and it's in our extracurricular: last year I took groups of students and their parents down to the beach four times to pick up trash, we also collect food for the food pantry, and we're going to be growing vegetables hydroponically on the back patio of my college starting this summer. So, I look at it this much more holistic way.

Embry-Riddle has a long history of cooperation with the aerospace sector, what is the scope for academia and industry to work together on matters of sustainability?

It's unlimited, but this is one of those things where both industry and academia are going to have to flex. Companies bring projects in and they're used to saying: 'well, this will be done in two weeks.' I'm like, 'no, you're working with students. Students are used to working in 15-week blocks, and faculty have multiple competing priorities.' Industry has to be willing to fill the gap in many cases, I think, where government research dollars aren't available yet, but they need to understand that academia is a separate industry that works differently than they're accustomed to.

I also think organizations need to collaborate with one another instead of competing. If they're going to partner with industry company A versus company B, they're not used to sharing their secrets and working together. They're going to have to work together to work with academia because there's just not enough good universities for each company to have someone different. The last thing is, industry leaders need to come back and spend time at university with students.

You need to engage in the life of students so that you serve as the role model, and you help them understand why industry now so worried about sustainability. Students love to hear from people who they believe know more than their faculty and their teachers do. So please, if you're a company, go back and share time with your local university by talking with students. You're setting us up for future success.

What key piece of advice do you have for impact?

It is advice for impact, but it's also a hope for myself as an advisor we have to continue being smart and reasonable in our approach. Going back to the things I've said: we have to prioritize, and we have to continue to remember that this is going to be a flex. Everyone's going to have to bend some, you can't be rigid because in order to move forward, everyone has to be willing to give a little bit. And the last part of my advice is something that I know we'll move to at some point, but we have to start asking the question of 'what next?'. And specifically, as it relates to finance. What role does finance need to play towards sustainability with regard to investment in R&D and unproven technologies? My experience is most finance companies play it safe, and we're going to have to help them be a bit more entrepreneurial in their approach into how they invest in truly moving sustainability forward. And I think impact can play a role in that.

Jihong He



*Jihong He,
Chief Financial Officer at H World Group Ltd*

Jihong He works as CEO for International Business for HWorld. Prior to joining the company, Jihong was the Chief Corporate Strategy Officer and CEO of Data Center of CapitaLand (SGX: C31) from July 2019 to August 2021. Prior to that, she worked with Temasek, including serving as a director and a managing director, successively, of Temasek International from July 2013 to March 2018, and as the chief strategy officer and chief investment officer of Ascendas-Singbridge, a Temasek portfolio company, from June 2015 and June 2019. Prior to that, she worked for Roland Berger Strategy Consultants ("Roland Berger"), with the latest position as a principal and a member of the Asia Leadership Team. Before joining Roland Berger, Jihong worked as a senior manager in global investments & terminal operations at Fraport AG from January 2002 to August 2005. She started her career as a product manager of the global marketing chemicals division at BASF SE in Germany in 1997. Jihong obtained her MBA degree from the University of British Columbia in Canada.

A vast percentage of all air travel ends or begins with a hotel stay. What role does sustainability play in hospitality?

In hospitality, air travel is what we call 'a demand that you have to satisfy.' So, the only way the hospitality sector can promote sustainability is to make the hotel stay as sustainable and as green as possible. There are a few different aspects to what we do: firstly, we use sustainable materials in the construction and renovations of our hotels as well as other materials, such as the bedding. For all the consumables, we also try to use as much sustainable materials as possible. That is the first line of defense.

The second line of defense is what you can do to educate guests to be as green as possible. For example, produce less waste if you stay longer, do not ask to change shower towels and bedding daily, and to not demand single-use plastic products. All of these measures are what we would call 'green living' or 'green stay' in hotels. Also educating guests to use less energy, such as turning off lights or avoid turning on the air conditioning if it is not necessary. It's little everyday things.

From the hotel management perspective, you can also educate your staff on energy efficiency practices, to watch out for potential savings, and not to use single-use plastics. There are lots of touch points that you can pay attention to.

How large is the interdependency between aviation and hospitality?

One-to-one almost. We have other means of transport, but quite a big part of hospitality depends on aviation. Of course, in large countries like China or the US you would do more land travel through rail or road. But aviation is a very important part of the hospitality industry.

China is the world's largest travel outbound market. How important are aviation sustainability levers such as SAF or carbon credits in China?

I don't think the aviation industry in China has put sustainability on top of its agenda yet. There are things airlines may examine, such as looking into the fuel efficiency of their airplanes, but China by and large does not produce many airplanes. So, the technology side is completely dependent on imports.

The Chinese government and airlines are trying to educate passengers, encouraging them to pay for the damage done to the environment through flying. At the moment, carbon credit trading is not big in China but that is changing with the introduction of certified voluntary carbon credits -- China Certified Emission Reductions, or CCERs—and the enrolment of the aviation sector into the national carbon market by 2025. The country is also examining and researching alternative fuels.

What approach are financiers taking towards decarbonization in hospitality?

Hospitality financing is mostly used for facility expansion, so using finance for buying buildings and doing construction work. Among financing options, green financing is one: if you do not meet certain criteria in your building or in your construction, you will not be able to get the loan or you will not be able to get a good loan. A lot of banks, certainly in Singapore, are now offering green loans and there are a quite a lot of sustainability metrics attached to them. I think in China green finance for hospitality is starting, but it's not that prevalent yet.

How can we foster cooperation across countries with regards to climate policy and aviation sustainability?

I think advocacy is most important – make people aware of the problem. That's really the baseline. A lot of people around the world are not aware of the issues and not doing anything about them. Secondly, to get key players to play their part. For example, we just talked about green financing, the KPIs attached to green financing should be set KPIs and set targets.

What motivated you to join impact's Advisory Board?

I'm quite passionate about sustainability. I fly a lot and for long distances across Asia, the Atlantic, the Pacific... so this is my way of giving something back. I think it's important to make people aware of the ESG issues in the aviation industry and I would love to do something to promote them. Air travel is a very important part of our life, we cannot do without aviation.

Do you have a key piece of advice for impact?

First of all, a focus on advocacy... to make as many people as possible aware of the key issues and to involve all the key players along the value chain. This is a very big industry covering many countries, and nothing is too big to do. So many people have to play a part together. But at the same time, I do think we need to nail down. We need to find anchor players to negotiate with and see results.

Jan Melgaard



*Jan Melgaard,
Executive Chair of FPG Amentum and Chair of ALI's Sustainability Committee*

Jan Melgaard has worked with financing, leasing and investing in commercial jet aircraft throughout his career. Prior to joining FPG Amentum in 2010 Jan was CEO of Nordic Aviation Capital and President/CEO of Volito Aviation (spearheaded a joint venture with Goldman Sachs). Jan has been an active speaker at several industry events and conferences and has co-authored articles appearing in industry publications such as The Aviation Economist and Airfinance Journal. Jan is chairing the Sustainability Committee of Aircraft Leasing Ireland (ALI). He received his MBA from Columbia University in New York.

Your aviation finance career spans several decades, how has sustainability in aviation evolved in recent years?

Dramatically. You don't have to go back many years, even in 2019 and 2020 it was still a fairly low priority and there was not a lot of awareness. I was surprised at the lack of awareness at that point in time. But during Covid it took off in a dramatic fashion. Awareness was not high; yet as an industry, we were out fairly early.

Something like the CORSIA framework (adopted in 2016) was quite visionary when it was launched. Having said that, it has only been implemented now and unfortunately we are seeing something which is not fit for purpose for 2023 or 2024.

Since 2021 you have taken on the role of steering Aircraft Leasing Ireland's (ALI) sustainability committee, what motivated you to focus on sustainability?

When speaking to investors, which are key to the aircraft leasing industry, it became very clear that it was important for individual lessors to take a very proactive role when it comes to sustainability, but it was almost equally important that we had a stakeholder group which was relevant, which could speak on behalf of individual lessors. And to that end, there was simply a question of where do we have the most relevant body? And as far as I'm concerned, ALI is the trade organization with the best coverage and most tailored towards lessors. We then launched the Sustainability Committee of ALI.

With regards to sustainability, what sets apart other industries from aviation? Or, in other words: What does aviation lack?

I'm very focused on aviation and hence not the best at comparing to other industries. Having said that, I think some of the steps that we are now taking aviation are fairly similar to those taken by other industry groups. Aviation's challenge is that we are very hard to abate and hence are and will continue to be behind several other industries. On the positive side we have a fairly clear picture as to our pathway to net zero, not all industries can say that today.

What role should lessors play in supporting the industry's climate objectives?

We are very much part of the ecosystem. We own more than half of the global aircraft fleet, so what we are bringing to the table is capital and influence. Capital has power, and we should use that power to aid the transition of aviation. That's really the way we think about it.

As to ALI's involvement, one area where we can play a role with our capital is to be involved in the most important pathway to net zero of aviation: SAF. We are in a situation where there's a tremendous demand for SAF, and we are lacking dramatically on the supply side. And as strange as it may sound, part of the reason we are lacking supply is driven by a lack of capital. That's an area where lessors could play a very meaningful role.

Do you see a concerted effort across the aviation stakeholder groups to achieve decarbonization?

Definitely. I think it's fair to say that today we have a number of stakeholder groups working towards net zero, impact of course being one and ALI being another. What we will benefit from is coordinating our actions going forward. And I think that's part of what is going on as we speak.

What is the risk of banks and investors exiting aviation absent noteworthy progress?

That risk is part of the reason why we take a very proactive role. Having said that, I also think that it is important to note a couple of things: there is no alternative to aviation except for the last few percentages of our activity – very short-haul routes that could be replaced with other means of transportation – and we have just gone through a pandemic where we actually saw governments support the aviation industry to the tune of more than \$200 billion. And why did they do that? Because aviation is critical infrastructure. I have no doubt that you will see capital be part of that solution, but we have to show meaningful progress now.

What key piece of advice do you have for impact?

A key piece of advice is to stay at 40,000 feet. In other words, make sure to see the complete picture and take a holistic approach. No stakeholder group can bring us to net zero on their own, collaboration across groups is critical. That goes for all stakeholders: we need to realize that we are part of an ecosystem.

Looking back at the 14 months of impact's existence, what takeaways do you have from impact's activities so far?

I'm very impressed by how rapidly impact has moved. Today, impact is a very well recognized stakeholder group and very relevant. So, in many ways, impact can say that it has gone from zero to where it is today in a very short space of time, in a very effectful manner. And, of course, not least when it comes to metrics. Where I think there is room for improvement going forward is for impact to take on a broader scope.

Andreas W. Schäfer



*Prof. Dr. Andreas W. Schäfer
Professor of Energy and Transport at the UCL Energy Institute and Director of the
Air Transportation Systems Laboratory (ATSLab.org)*

Andreas W. Schäfer is a Professor of Energy and Transport at the UCL Energy Institute, University College London, where he is also Director of the Air Transportation Systems Laboratory (ATSLab.org). Previously with the International Institute for Applied Systems Analysis, the Massachusetts Institute of Technology, Stanford University, and the University of Cambridge. Andreas' advisory roles include the UK Airports Commission, the Aerospace Technology Institute, and the Industrial Strategy Challenge on Future Flight, among others. Schäfer holds a MSc in Aerospace Engineering and a PhD in Energy Systems Analysis / Energy Economics, both from the University of Stuttgart, Germany.

Understanding the environmental impacts of air transport is central to your work. What drives this curiosity and interest in sustainability?

The trends in consumer demand for a whole range of goods and services are not sustainable, and perhaps this challenge is most pronounced in air transportation, which has experienced one of the highest rates of growth, certainly before the pandemic. The growth in aviation will continue, especially in the Eastern hemisphere, which is catching up economically and experiencing enormous population growth.

Is aviation taking the right measures to reduce its environmental burden? How realistic are these?

Low-carbon fuels will have to play a major role in reducing the environmental impact. This begs the question – what can we do to enhance the adoption of alternative fuels? At the moment we have got a mix of measures, market-based measures in the US, such as the SAF blenders tax credit, and market-based plus emerging regulatory measures in the EU. Whether the ambition of these incentives will be sufficient remains to be seen. But it is certainly a first step.

Is closing the gap between SAF demand and supply realistic in the next few years?

The World Economic Forum has specified a target to satisfy 10% of aviation fuel demand in 2030 by SAF globally. It's a long way to go, but it's not impossible. The danger I see is that hydrogenated vegetable oil (HVO, also known as HEFA) is essentially the only commercial pathway available today. But waste feedstock-based HVOs can generate only about 10% of total jet fuel supply. So if you put these two together, then the danger is that industry will go after HVO/HEFA and, after 2030, increasing SAF production will not be possible because other, more scalable pathways will not be sufficiently developed. What the various pieces of SAF policy need to include is investment incentives for these alternative, more scalable SAF production pathways.

Will aviation manage to obtain the amount of renewable energy required to produce the alternative fuels needed for its decarbonization?

If we went after biomass-based fuels, the electricity requirements would be very modest and could easily be accommodated. But biomass feedstocks are most likely to be limited and split across different sectors, and so we need to look for alternatives, power-to-liquids or liquid hydrogen, which are very electricity intensive. Given the scale of the aviation sector, we will run into a massive power generation challenge.

Another question is whether the levelized cost of electricity (LCOE) generation that we have seen significantly declining for solar and wind power over the last 10 or 20 years is going to continue along its past trend. Some of the rare earth minerals required to build renewable power capacity are becoming more expensive because of increasing demand. So, we could also envision a future in which the anticipated future LCOE decline ceases to exist and may actually come to a halt, if not increase.

What do you appreciate about impact and how do you think impact can aid sustainability in aviation?

We need to look at all options for reducing the environmental footprint in general and greenhouse gas emissions (GHG) in particular. impact looks at what can the finance industry do to mitigate emissions, so incentivize airlines to make greener choices, and that's incredibly important.

What will it take to speed up the process of decarbonizing aviation?

It's ultimately about generating a business case. Unlike many technology transitions of the past, this one will not be driven by prevailing economics. If you look at the transition from piston engines or jet engines, it was a no-brainer to invest in the jet engine aircraft because of their higher productivity. That's not the case here. Once a business case has been created, I suspect there's enough capital around just waiting to be invested in a profitable way.

What motivated you to join impact's Advisory Board and what key piece of advice do you have?

It's satisfying to write journal articles and give seminars at other academic institutions, but at one point you want to have a little bit of 'impact', and this is a good opportunity to interact with the real world. Many impact members also have complimentary expertise on areas in which I know very little, such as financing.

Closing remarks

Approximately \$40 billion to \$50 billion in funding annually through 2030 and \$175 billion through 2050 would be required for aviation to achieve carbon-neutral growth, according to a McKinsey²⁰ study, but we have yet to connect the dots to put us on track to achieve this.

Having participated in multiple conferences on SAF – aviation’s biggest lever to decarbonize without sacrificing growth –, we observe that discussions are often centered on the maturity of technologies, availability of feedstock, and the supply-demand gap. These considerations are important, but the discussion must be broadened to encompass the relevant pockets of liquidity for aviation’s decarbonization pathway. Finance is not fully roped in: build-up of know-how is required and sponsors, producers, off-takers, regulators and infrastructure providers must cooperate to chart a risk map and develop respective mitigants.

A growing level of interaction between the various stakeholder groups is discernible but has yet to translate into concrete action plans on large enough scale. As per the latest IPCC report²¹, “public and private finance flows for fossil fuels are still greater than those for climate adaptation and mitigation” – and this must quickly become a thing of the past.

Yet, let me conclude on a positive note. At the recent Sustainable Aviation Futures 2023 conference in Amsterdam a substantial number of panelists made a strong point that they will not let go of being an optimist despite the myriad of challenges associated with the build-up and scaling of SAF. I derive hope from the following quote:

“Perpetual optimism is a force multiplier” – Colin Powell

Let us translate such optimism and positivity into timely, tangible, and effective actions. Investors, lenders, and insurers across all regions must align and assist their airline and lessor clients in their transition to a net-zero aviation future. A global challenge calls for a global answer! Chart the future of sustainable aviation - join the impact e.V. alliance!

²⁰ <https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/decarbonizing-the-aviation-sector-making-net-zero-aviation-possible>

²¹ https://report.ipcc.ch/ar6syr/pdf/IPCC_AR6_SYR_SPM.pdf

impact is a non-profit platform for investors in- and financiers of airlines and aviation infrastructure aiming to be at the forefront of a new reality in aviation finance. Impact is comprised of five collaborative working groups designed to deliver a credible and transparent roadmap to reduce CO₂ emissions from aviation to net-zero by 2050. impact is funded by the pro bono contributions of members, including a group of leading global financiers in aviation.

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