

## Circling the Airplane along Economic and Legal Runways: A Discussion on Waste Reduction and Resource Efficiency in Airports and Aircraft

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### ABSTRACT

The aviation sector poses a dual challenge of high carbon emissions, green space and substantial waste. The principles of circular economies (CE) offer tools such as material reuse, waste-to-fuel, eco design, institutional frameworks which may be used to overcome this challenge. The article proposes to discuss a range of airport CE initiatives, covering also topics such as waste-to-SAF and eco-composite development. Aside from this, the article proposes to look at some economic and legal enablers. These are what have been implemented so far. Nonetheless, there is a lacking in the economic-law analysis of CE with regards to aviation. This is particularly about instruments such as carbon pricing, circular procurement, institutional governance, and regulatory treatment of recycled materials. The article suggests to use several methods such as the life cycle analysis and cost modelling. Aside from this, a legal and regulatory comparison shall be done along with institutional analysis. Finally, the article provides some proposals for policymakers such as economic incentives for SAF, legal frameworks to certify recycled materials, integrated waste procurement policies, and governance models for waste recovery.

**Keywords:** Circular economy, Sustainable aviation fuel, Airports, Waste management, Aviation law.

### INTRODUCTION:

The aviation industry is one which is a spectacle for human progress. This green space industry is one that goes past geographical boundaries, it propagates trade and also fuels the human ambition to be able to transcend borders. The inherent difficulty is that this has also incidentally led to environmental contradiction. As aviation contributes as much as 2-3% of CO<sub>2</sub> emissions, and the percentage may as far as triple if the trend continues (Chong et. al., 2023; Gazi et al., 2025). Airports as well are contributing significantly to solid waste and this is usually from cabin refuse and catering waste as well as decommissioned aircraft materials and construction debris.

From a philosophical perspective, the aviation industry can be understood not only as a technological system but also a moral phenomenon. Ontologically, it shows the human desire to push past their natural limits; axiologically, it presents to us the value of being efficient; epistemologically, it highlights the knowledge of engineering and finally teleologically, it helps to read progress in terms of speed and scale. Despite their individual meanings, these orientations have still managed to result in an unsustainable relationship with ecological systems. Hence what the circular economy (CE) wishes to do is to invert these values, and to redirect the telos of aviation from expansion to move instead towards regeneration.

This article proposes to say that the CE should not be viewed in its technical perspective but instead as an ethical horizon. By integrating the three perspectives of economics, law and philosophy and put together with mass communication, it helps reframe the picture of the purpose of aviation. Malaysia as well as other countries in the ASEAN region help to offer some relevance to this whereby state-linked airline companies and operators have begun efforts to align with CE principles. The stumbling block is that this is done often in the absence of deep ethical or communicative engagement.

### LITERATURE REVIEW

#### 2.1 The Circular Economy in Aviation

Since 2019, the concept of CE, which serves to close the loops in terms of material and energy flows has gained traction in aviation. This is seen in actions such as aircraft part reuse, composite recycling as well as waste to sustainable-aviation-fuel (SAF) initiatives (Yoo et. al., 2022; Pinto et. al., 2025). Some early participants include then Amsterdam Schiphol's circular-airport strategy as well as Malaysia Airports' waste-segregation programs. Despite this, the empirical analyses are still not cohesive because it is largely focussed on engineering and cost. There is still insufficient data and material on ethical or communicative foundations but perhaps from a positive viewpoint that there is at least some progress being made in the field.

#### 2.2 Sustainable Business and Communication

Communication serves more than just being a marketing tool. It helps organizations to justify their existence and actions. If a firm were to communicate openly about their sustainable practices for instance to publish data on carbon reduction, it shows transparency and this helps to build a sense of legitimacy as clients begin to form the perception that the company is indeed an ethical and responsible one. They will also avoid the risk of greenwashing. Being open about their practices helps clients see actionable practices and so there is consistency. If a firm is unable to prove that they are indeed subscribing to their projected traits, stakeholder trust will erode. This is a relatively high-stake element for aviation as it shapes people's view on carbon offsetting (people paying to offset emissions), SAF development and recycling programs (Guo et al., 2023). In Habermasian terms, great communication transforms sustainability information into shared understanding and then this becomes a community achievement. Hence this isn't just all about legitimacy but the philosophical coherence of sustainable aviation. Circulation aviation doesn't recycle materials solely. It in fact recycles the meaning, values and truth when it speaks to society.

### 2.3 Philosophical Foundations of Circularity

As mentioned, it is important to view CE from a philosophical perspective. Ontologically, there is an assumption made that materials have a potential value instead of a terminal one, which changes the entire viewpoint of the situation. Axiologically, it redefines "waste" as opportunities instead. The concept of utilitarianism is included as CE shows how collective welfare is maximised by reducing total harm and hence it is worth pursuing. Virtue ethics propagates the case that incorporating circularity as a matter of practice, this would bring in values such as prudence and justice. This enables harmony with the biosphere (Questioning Anthropocentric Utilitarianism, 2025).

## METHODOLOGY

To facilitate a wholesome approach, this study attempts to use multiple methods in the philosophical-empirical approach. Circularity in aviation cannot be understood using environmental data alone; it must be interpreted through various dimensions including philosophical reasoning, institutional structures and good communication. This helps to combine both technical analysis as well as ethical reflection:

### 1. Life-Cycle Analysis (LCA)

The LCA approach is worth using because it is able to provide a better understanding of the situation. It helps to quantify data. In this case it would be to show clearly the environmental impact of products and processes over its life span, some of them as far as raw material extraction right up to the point of disposal or even reuse. Here the LCA was utilised in order to be able to assess the environmental benefits. Examples of this include waste-to-SAF conversion, reusing aircraft-parts and so on. Using this method, carbon dioxide equivalent emissions, energy intensity and material flows through the product-life-cycle could be quantified.

Using the LCA is a form of a cost-benefit analysis. The LCA evaluates for example what the potential SAF are. It can be done in a multiple pathway framework. For example, the LCA checks to see what the possible pathways for the SAF are. They may also evaluate the process regarding recycled composites and what eco-design innovations are available. An example of being able to have comparable data is a comparison for example of well-to-wake greenhouse gas emissions of fossil jet fuel as opposed to waste-derived or bio-based SAF. This study can evaluate the carbon intensity and prove if the SAF is a valuable alternative or not. The LCA can show overview of necessary data such as energy inputs, water use as well as waste generation for aircraft components and airport operations.

In comparing well-to-wake emissions of fossil jet fuel against SAF derived from waste streams, LCA has shown that this is one possibility of huge reductions given the right technological or policy conditions. Examples from studies (Yoo et. al., 2022) have shown this can be reductions as far as 60% to 80%. This provides the ontological system of where materials and processes are connected and form a complete circle. Moral Epistemology also plays a role where the right thing to do is combined with efficiency. Hence, using this, the LCA lends great support to the utilitarian theory of maximising environmental benefit for the most number of people.

### 2. Cost Modelling

To ensure that circular aviation initiatives stands the test of time, both financial and external costs, specifically environmental and social costs are considered. Using Total Cost of Ownership (TCO) and Life-Cycle Costing (LCC), conventional disposal, otherwise classified as linear production models are compared against circular alternatives. It helps to integrate direct costs and indirect benefits such as avoided landfill fees and reduced carbon liabilities. Using economic modelling, it is found that currently any efforts to go-green are limited and constrained by high capital costs as well as uncertain returns. By taking initiatives to internalize as much externalities as possible, this enables the models to present a more holistic picture. This shows also how policies such as carbon pricing and tax incentives could shift the focus towards efforts on sustainability.

From a philosophical point of view, here is a teleological dimension, whereby the financial decision-making is evaluated to see if it aligns with the goal or telos of sustainability. This is to say that profits are not dismissed but it is checked that it is obtained ethically. Deontological ethics is employed here because it reminds that sustainability is duty-bound, even when there are costs incurred.

### 3. Institutional Mapping

Institutional mapping refers to the process where the structures, policies and regulatory actors that help to shape CE in aviation are identified. This involves the review of frameworks and institutional relationship across the European Union (EU), the United States (US)

How to cite: Ann Marylin Horley Isaacs, *et. al.* Circling the Airplane along Economic and Legal Runways: A Discussion on Waste Reduction and Resource Efficiency in Airports and Aircraft. *Advances in Consumer Research*. 2025;2(5):2487–2494 and also ASEAN. A simple cross comparison is done between these regions on the governance models.

The EU for example emphasizes on legal compulsions where they have embedded CE within their practices by way of binding directives and taxonomies. This is an example of deontological governance where one would act from duty and principle and not from their own motive. The EU Taxonomy Regulation (2021) for example helps to put into perspective what sustainable economic activities are. This is important because by adhering to what has been outlined in the emission thresholds and waste management standards will it be possible for SAF production and aircraft recycling to receive the “green finance” classification. Similarly in the EU Circular Economy Action Plan (2020, updated in 2024) it places added responsibility on the manufactures to carry out production in a responsible manner. It in fact requires the element of traceability as well as recyclability to be proven in the material supply chains. Hence the circular design is linked up to public procurement where airports which are funded by the EU support must then meet the environmental performance criteria.

As for the US, a more capitalist based market, they rely on market incentives and private innovation. It follows a utilitarian philosophy as the outcomes are achieved using the market mechanisms as opposed to mandatory rules. The target is to make sustainability a voluntary goal by making it profitable. According to market incentives, this would make market agents participate voluntarily. One example practiced by the US is the State-Level Low Carbon Fuel Standard (LCFS) Programs where a number of the States in particular, California, Oregon and Washington operate the LCFS which actually complement federal credits. The SAF producers and users are able to earn tradable LCFS credits based on verified life-cycle carbon intensity. This is calculated using GREET. GREET refers to Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation where this model is used to determine the life-cycle carbon intensity (CI) of the SAF. Those who are able to achieve a low CI score will be eligible for tax and market credits. So since there is a financial qualification here, it is likely that there will be voluntary compliance in order to obtain the incentives. An example that can be given is that in California, the LCFS credits traded as much as between \$70 to \$120 for each metric ton of CO<sub>2e</sub> that was avoided and the SAF producers are able to earn approximately between 1.5 to 2 LCFS credit for each gallon. These credits can even be sold to the oil refiners or other emitters who require them for compliance in a trading scheme, which allows also for an additional income stream, allowing SAF producers to gain an additional \$1 to \$1.50 for each gallon in credit revenue. As mentioned, the utilitarian philosophy shows that the environmental welfare is preserved through incentive alignment. However it does pose the doubt that if virtue has a price tag when moral duty is commodified.

As for ASEAN countries, including Malaysia, many of them operate hybrid systems but though most of them contain high policy ambitions, they lack on the enforcement side of things and implementation is often inconsistent. Taking Malaysia as an example, through the National Energy Transition Roadmap (2023), it has identified SAF as a strategic growth sector for 2027. Whilst collaboration has been encouraged between PETRONAS, MAG as well as Neste for biofuel production, the blending mandates are not yet compulsory. Moreover it doesn't encourage other companies to follow suit when the certification frameworks are still being constructed. There is ethical purpose to this green growth but the governments in these countries struggle to institutionalise it. Hence it is important that there is governance maturity.

### 3.5 Communication Discourse Analysis

Aviation organisations have played a vital role in promoting the sustainability narrative. They often do this in their public communications, press releases and social media content. What they do is they take into account patterns such as innovation, competitiveness as well as how these and other concepts help to shape the understanding of CE.

Most aviation communication use a technocratic or promotional frame where there was a specific focus on technological innovation but at the same time incorporated ethical reflection and systemic change. This allows them to contribute towards “anthropocentric utilitarianism” which says that to act in ways that are sustainable will actually prove to be beneficial for human convenience.

Having a technocratic frame is a way of privileging technical expertise, measurable outputs and also innovation narratives. Hence it can be found in airline sustainability reports, press releases and also industry conferences, one of the highlighted themes showcases quantifiable achievements such as the tonnes of CO<sub>2</sub> which has been offset or the litres of SAF blended. The change in mindset of sustainability of just being a moral relationship is converted into an actionable initiative where it becomes a technical problem to be solved. This blends into the philosophical lens of instrumental rationality (Horkheimer & Adorno, 1944), using reason is used as a tool to control. As such, sustainability therefore becomes a performance of progress, leading companies to actually voluntarily perform and tailor their activities in line with this. In a Habermasian sense, communication goes beyond being purely communicative but now becomes strategic. However in order to be truly successful, these companies should be transparent. Kantian logic shows that it is to one's gain to report transparently, even if it seemingly undermines self-interest. Ethical reporting means that the uncertainties, failures and trade-offs should be included because then this provides a true picture and shows the aviation firms where the pitfalls lie. It is from there that they may strategize to overcome these issues.

## RESULTS

### 4.1 Material and Technological Practices

Aside from the earlier mention that Waste-to-SAF conversion technologies have significantly reduced life-cycle emissions, other measures such as composite recycling have also seen advancements using pyrolysis and solvolysis. This actually allows recovery of carbon fibers from aircraft structures which cannot be further used. These materials can then be reused in ground equipment, cabin interiors and so on (Pinto et al., 2025). Aside from this, there are also eco-design initiatives e.g. recyclable thermoplastics which help to extend the lifecycle of the product and simultaneously reduces energy intensity during manufacturing (Habib et al., 2025).

On a larger scale, airports such as the Oslo Gardermoen have set up biogas plants. They convert and process terminal waste into energy. The Gatwick Airport also has a waste-to-energy facility which actually powers airport operations. MAG has also put forward initiatives such as single-use plastics and waste segregation (MAG, 2023).

### 4.2 Economic and Legal Dynamics

#### 4.2.1 Economic Structures and Incentive Mechanisms

The economic dimension of circular aviation is defined both by market imperatives as well as policy-induced incentives. Economics also recognises that some activities result in externalities and market failures. Hence instruments such as the European Union Emissions Trading System (EU ETS) and ICAO's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) act to internalize environmental externalities. They do this by attaching a monetary value to carbon emissions. Hence these frameworks help to translate ecological harm into market signals where firms who lower their emissions are effectively rewarded, turning this into voluntary acts and further plans for the future to keep acting if for no other reason, at least for a profitable reason.

There are some difficulties in all aviation firms being able to achieve this. Carbon prices are still priced relatively low where there isn't a justifiable difference between fossil jet fuel and SAF for most companies to consider making the switch. In fact, SAF is still at the very least, double to cost of conventional jet fuel (Seiple et. al., 2023). Despite credit provisions and subsidies, many firms are hesitant to invest due to uncertain demand. The tension that exists here may prove to be problematic where market systems measure value in terms of price but ecological systems to it in terms of persistence and continuity.

Another mechanism used is circular procurement. For example, placing a requirement that airports and airlines should purchase products that is made from recycled or bio-based materials, then this would create a guaranteed demand which helps to stabilise the supply chain. However, the difficulty is that procurement is rarely made mandatory.

Based on a philosophical perspective, a teleological paradox can be seen. Whilst the circular economy can offer a corrective telos, which is to ensure that there is growth in value as opposed to just volume, this can be done on condition that profit is redefined. A sustainable business should move with the focus of regenerative prosperity, where financial rationality is aligned along with moral purpose.

#### 4.2.2 Legal Frameworks and Regulatory Harmonization

From a legal perspective, the governance on circular aviation is still considered to be fragmented across the various jurisdictions as can be observed above. One easy example that can be cited is that of the certification of recycled materials. As a safety precaution, aviation safety regulations would require strict documentation on material traceability but the current laws do not offer much depth on what constitutes as recycled composites or reclaimed metals. In the absence of harmonised testing and certification, it is hard to certify these recycled components with airworthiness approvals, therefore innovation is slow in developing.

A second difficulty is when there is regulatory uncertainty, which can be a result of a lack of uniformity. This can actually hinder investment. Comparative institutional mapping show that jurisdictions which have clarity and predictability are able to attract private investments in SAF and recycling facilities. As an example, the EU Emissions Trading System (ETS) provides predictable carbon pricing. Due to this, companies like Neste (Finland) and TotalEnergies (France) have invested billions of euros in SAF refineries. Investors know exactly what regulations will apply, how credits will be calculated, and how long the policies will last — so risk is manageable. One contributing factor may be because the EU is an economic union and as such, whenever the EU passes binding directives and regulations, these would apply uniformly across all 27 states. It is fantastic for investors because they do not need to navigate across different national rules. In the United States for example, the laws differ across different states and regions. So whilst the Inflation Reduction Act (IRA) helps to grant large federal tax credits for SAF, there are also state programmes such as California's Low Carbon Fuel Standard that practice different calculation methods. This does create some uncertainty among investors as to the interaction of these systems and whilst investment still does take place, it is considerably slower than what could be observed in the EU.

### 4.3 Communicative Patterns: Sustainability Communication and Public Legitimacy

Communication has a far more important role than merely transmitting information. It also helps to cement legitimacy. As airlines are able to provide data (on sustainability) or otherwise transparently, this helps to showcase truthfulness. If however, sustainability is not practiced properly but instead used merely to project a good image of the firm, then this turns into greenwashing. A Harbermasian point of view



emphasizes that authentic sustainability communication creates trust. It also helps to engage stakeholders (passengers, employees, communities etc.) in open dialogue. In the past, some airports such as Schiphol used multi-channel reports but others had only a limited amount of communication.

## DISCUSSION

Herein is a discussion on the individual perspectives of the various philosophical outlooks and how it ties in to aviation.

### 5.1 Ontology: What Aviation Is

Ontology looks at the essence of aviation and what it stands for. Traditionally, whenever one speaks of aviation, the first thing that comes to mind are the machines and the mechanisms of physics governed also by economics and business: a network of engines, airports, and market exchanges designed to transport bodies and goods efficiently through airspace.

CE however offers a different angle of this ontology, which is to see aviation as an ecological actor within its biophysical and moral spheres. This shift moves aviation to become an agent of reciprocity. Drawing on Marting Heidegger's notion of 'being-in-the-world', this frames aviation to "dwell" responsibly in the atmosphere. A systems ontology viewpoint, developed by Capra and Luisi (2014) emphasizes again aviation as a living system and so CE helps aviation with cyclical participation. This can be done by eco-design, recycling and SAF development.

### 5.2 Axiology: What Aviation Values

Axiology looks at what is considered to be valuable, and also what aviation then considers to be good or worthy. Traditionally, in its mechanical and economical aspect, the axiology of aviation would have been about efficiency, profitability and expansion. Whilst this makes perfect economical sense, this can conflict with ecology stability.

This means from a business perspective, there is therefore a shift from shareholder to stakeholder capitalism and it shifts from short-term optimization towards long-term stewardship. Hence from even a philosophical perspective, there is a shift from utilitarianism which focuses on maximizing benefits to Aristotle's eudaimonia, which is the pursuit of virtuous practice. Extending this to corporate life, this shows if done correctly, a flourishing aviation sector can harmonize prosperity with planetary health. Hans Jonas further argued that there must be an adoption of foresight and restraint as moral imperatives for the future.

### 5.3 Epistemology: How Aviation Knows

Epistemology considers the manner in which knowledge is produced, validated and communicated. Traditionally, in this sense, aviation uses a positivist and quantitative because it is measured using metrics, algorithms and predictive control. On one hand, this is great to ensure that safety and precision but it causes a moral and communicative deterioration unfortunately.

Circular aviation has a plural epistemology which allows the integration of empirical science together with ethical interpretation and participatory communication. This Jürgen Habermas's theory of communicative rationality where the elements of truth and sincerity as well as rightness are constructed through dialogue. An example is where when sustainability reports for example convey results, this becomes a space through which people learn about sustainability, they see results and start becoming more convinced, socially negotiated and morally filtered.

### 5.4 Teleology: What Aviation Aims For

Teleology looks at the purpose or end. Hence in the traditional scope for aviation, this would refer to speed, expansion and leading up to economic growth. The problem is that this has created remarkable progress but as mentioned, there can be ecological degradation. Whereas in aviation, the ultimate purpose is more towards the continuity of existence, that is to sustain flight without compromising the planet and its resources. This therefore helps to reimagine the metrics of success by evaluating not the total number of passengers but instead of carbon efficiency and social inclusion. The purpose now turns to balance and not just acceleration of profits and growth. This then becomes aviation's "moral horizon".

### 5.5 The Malaysian and ASEAN Perspective

In the ASEAN region, the topic of sustainable aviation showcases a range of opportunities as well as complex issues. Countries such as Malaysia, Singapore and Indonesia have all participated in various initiatives regarding environmental responsibility. The prominent factor standing as a huge challenge was institutional fragmentation and cultural heterogeneity.

Philosophically, Southeast Asia, which is rich with moral traditions, uses Islamic stewardship (khalifah), Buddhist interdependence etc to act as a cultivation point to reinterpret and grow circular economy principles. Given the specific nature of this region, putting these ethics within the aviation discourse could in fact create legitimacy and public resonance. SAF therefore need not be viewed as purely a technological innovation but now as a form of moral guardianship and now sustainability which is aligned with together with spiritual and communal values.

## 6. Policy and Practical Implications

### 6.1 Economic Measures: Aligning Incentives with Collective Good

Economic mechanisms act as the practical levers where they will accelerate these transformations. From a utilitarian point of view, the best outcome is where the incentives will be collected so that the purpose of profits turns into one of sustainability.

#### 6.1.1 Fiscal Support for Circular Infrastructure

Fiscal provisions such as tax credits, green bonds as well as concessional loans should be directed towards recycling plants, waste-sorting systems as well as renewable-energy installations at airports. This is a

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model that can generate returns and is a worthwhile project in the long run. There is indeed a high initial upfront capital expense that is required but this will be offset by the long-term savings so this still abiding by Aristotle's cardinal virtue of prudence.

### **6.1.2 Lifecycle Costing and Procurement Reform**

For procurement, life-cycle costing (LCC) evaluations changes the main point of focus from immediate price towards intergenerational value. Jonas' ethics of responsibility show that decision-makers are obligated to foresee and prevent foreseeable harm. Hence LCC helps to integrate this by converting moral foresight into accounting procedure.

## **6.2 Legal Measures: Codifying Duty and Justice**

### **6.2.1 Harmonized Certification and Regulatory Convergence**

As mentioned earlier, in some areas, there are differing standards that are applied to recycled composites and SAF. Hence developing internationally aligned certification protocols will help to eliminate the regulatory uncertainty. Kant's viewpoint on universalizability can be incorporated here where he notes that norms should be valid for all actors if they are to be morally coherent.

### **6.2.2 Institutional Governance Councils**

It is suggested that there should be a centralised council at the national or regional level so that the various stakeholders can be coordinated. This is easier to carry out under a shared governance framework because then there is a unified approach to work with. As the stakeholders are diverse: airlines, regulators, recyclers etc., which means each of them come with their individual strengths. This helps to enact the Aristotelian value of phronesis which refers to practical wisdom. This involves balancing technical knowledge with ethical judgement in collective decision-making.

## **6.3 Communicative and Ethical Measures: From Information to Understanding**

### **6.3.1 Ethical and Philosophical Training**

Another proposal would be to embed ethics modules within most curricula across aviation institutions – this can be in engineering, business or even communication disciplines. This would help to nurture moral literacy whilst boosting technical expertise. Inclusion of practical case-based learnings would also help students to inculcate and foster responsible thinking and behaviour from the onset whilst encouraging reflexivity.

### **6.3.2 Participatory and Reflexive Media Practices**

It is also suggested that airlines and airports should move towards dialogical engagement which include open forums and digital town halls. This move would decentralize epistemic authority whilst being able to embody epistemic justice. Ethically this also acknowledges that sustainability communication is not just a performance but done in a manner that shows true intention to achieve some results.

## **6.4 Conclusion of Policy Section**

The challenge that lies before policy makers is not so much as to conjure up new ideals but instead to operate with values including prudence, justice and honesty in the modern domain of technological systems and governance. Whilst there is always the aim to achieve economic efficiency, this study has demonstrated that without a moral compass, this aim can risk becoming acceleration without destination. Similarly, legal frameworks without a heartbeat can turn into bureaucracy and communication turns into mere noise. This defeats the purpose of the framework entirely.

Hence the future of sustainable aviation is dependent on philosophically informed governance. This is where every policy instrument can be both technically effective and morally intelligible. It is only then that circular aviation will be able to fulfil its highest calling, that is to transform flying as a symbol of human dominance into planetary stewardship instead.

## **CONCLUSION: TOWARD A PHILOSOPHY OF SUSTAINABLE FLIGHT**

### **7.1 Re-centring the Question of Being**

The circular transformation of aviation is an ontological event. The act of designing, regulating and communicating differently is re-defining aviation. The historical identity of the industry, traditionally considered as mastery, speed and globalization, but these should now look into evolving. This ontological shift helps to reframe every aircraft, airport and policy instrument as a moral artefact.

### **7.2 Re-imagining Knowledge and Communication**

Data alone will not be able to secure legitimacy and so this requires communicative rationality. There should always be on-going conversation amongst the various stakeholders. In communicating ethically, it is crucial that uncertainty is acknowledged, constructive criticism is permitted and knowledge to be shared. This would provide the most optimum outcome for everyone.

### **7.3 Cultural and Regional Resonance**

In the ASEAN context, sustainable aviation will be able to acquire unique philosophical texture. Regional ethics, including the Islamic amanah (trusteeship) and Buddhist karuṇā (compassion) help to reflect the global virtues of stewardship, care and justice. This also provides an easy platform to integrate these traditions into corporate communication. Hence when airlines are able to demonstrate these in action e.g. SAF fuel, these are looked upon as acts of trust and compassion rather than just purely technological novelty. There is, therefore, moral translation.

### **7.4 From Compliance to Conscience**

The cumulative insight of this study is that sustainable aviation must evolve from compliance to conscience. Whilst compliance satisfies regulation; conscience satisfies responsibility. Compliance calculates; conscience contemplates.

The circular economy will reach maturity only when the aviation sector's moral imagination expands to see each

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kilogram of recycled composite or litre of SAF as a gesture of care.

This requires courage: the courage to disclose imperfection, to balance ambition with humility, and to view communication not as image protection but as truth-telling in motion.

### 7.5 The Moral Horizon of Sustainable Flight

Looking ahead, the success of circular aviation will depend less on new engines than on new ethics. Economic models can predict cost curves; only philosophical reflection can orient purpose. If aviation can integrate these dimensions—material, institutional, and moral—it may yet transform its greatest liability into its greatest contribution.

Every aircraft that departs an airport powered by waste-derived fuel, certified by just regulation, and celebrated through truthful storytelling enacts a miniature reconciliation between technology and nature.

The final horizon of sustainable business, therefore, is philosophical integration: to ensure that every act of production, regulation, and communication reflects not only efficiency but wisdom.

When that wisdom guides the skies, the airplane ceases to be a symbol of excess and becomes an emblem of ethical modernity—a testament that humanity, having learned to fly, has also learned to care.

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