Catalysing Sustainable Aviation Fuel Deployment

SMBC

SMBC AVIATION CAPITAL

Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
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Executive Summary

Sustainable Aviation Fuel *(SAF)* deployment in aviation is constrained by interlinked technological, financial, and policy barriers. Despite growing demand, supply remains limited due to complexities associated with raising sufficient funds resulting in delays in investment at scale. Mobilising equity and debt capital remains challenging due to unattractive risk–return profiles, constrained access to fit-for-purpose public funding, and uncertainty over long-term pricing and regulatory frameworks. Focused advocacy is needed to harmonise global rules, reduce policy risk, and strengthen the strategic prioritisation of SAF within governmental agendas.

This paper is developed from a cross-industry roundtable convened by SMBC, SMBC Aviation Capital, and Trinity College Dublin in December 2025. It reflects a multi-stakeholder perspective on SAF deployment, drawing on insights from industry, finance, and academia. The analysis adopts a systems-level view, recognising SAF scale-up as a sociotechnical transition constrained by interacting technological, financial, and regulatory factors.

Thank you to all those from across the SAF value chain who took part in the discussions at SMBC Aviation Capital offices on 4th December 2025.

The current situation: Scale-up drivers and hurdles

01

01 The current situation: Scale-up drivers and hurdles

Revenue and Investment Progression

Demand for SAF exists in part by the phased blending mandates under ReFuelEU Aviation, yet evidence suggests that supply remains structurally constrained. Industry data indicates that Europe has roughly 30 greenfield SAF production projects announced, yet none have reached final investment decision with most being in feasibility and pre-FEED stages, reflecting challenges to secure early funding. The projects in FEED are heavily reliant on equity or bespoke offtake structures while many lack predictable revenues.

Technology Qualification Bottlenecks

Stakeholder feedback indicates that technical bottlenecks remain significant. Limited early-stage validation capacity and restricted access to specialised rig and engine testing facilities constrain the progression of novel pathways. In particular, the OEM-driven evaluation process for the performance and safety of alternative fuels (*standard ASTM D4054*) can extend over several years, particularly for first-of-a-kind *(FOAK)* pathways. This process also governs the technical assessment required for inclusion as a new annex under ASTM D7566 that would allow SAF to be re-identified as a conventional Jet A fuel. Variation in data requirements, testing throughput, and engine manufacturer engagement creates uncertainty in qualification timelines. This increases development risk and slows the advancement of otherwise promising pathways. As a result, certain pathways may achieve high technology readiness yet remain commercially constrained by qualification throughput limitations.

Feedstock and Hydrogen Constraints

Feedstock and hydrogen constraints also hinder scale, with intensifying competition for biomass across sectors and infrastructure gaps in green hydrogen logistics. The constraint is not absolute biomass scarcity, but the allocation of limited sustainable feedstocks across competing end uses, including road transport, maritime fuels, chemicals, and power generation. In the absence of a cross-sectoral carbon efficiency framework, biomass may not consistently be directed toward its highest lifecycle emissions abatement value.

In parallel, available data suggests that hydrogen availability remains a structural constraint for synthetic and e-fuel pathways, where production depends on access to large volumes of cost-competitive renewable electricity and associated electrolysis capacity. Infrastructure limitations in hydrogen production, transport, and storage therefore compound feedstock allocation pressures and slow pathway scale-up.

01 The current situation: Scale-up drivers and hurdles *(continued)*

Infrastructure and Scale Limitations

Transparent, standardised technical datasets remain scarce, making SAF technologies appear high-risk "black boxes" for financiers.

Infrastructure at ports and airports remains insufficient to manage additional storage and blending needs as well as access to existing facilities. SAF deployment requires dedicated storage and blending systems, traceability controls and quality assurance procedures that are not uniformly available across existing fuel logistics networks.

Current project configurations suggest that production volumes are geographically dispersed, typically sited closer to feedstock sources rather than the demand centres characteristic of fossil-based supply chains. This dispersion reduces economies of scale in both production and distribution, increases transport costs, and complicates aggregation into large, bankable supply volumes required by major airlines.

Regulatory Signal Design under RED III

Current sustainability rules under RED III may inadequately reflect lifecycle climate performance by using fixed minimum GHG reduction thresholds that create binary pass/fail outcomes. This could unintentionally sideline pathways with strong carbon-intensity abatement potential. Such discontinuous incentive signals may reduce investment visibility for emerging pathways that demonstrate strong long-term carbon intensity reduction potential but require further optimisation to surpass threshold levels. This structure can narrow innovation optionality and increase perceived regulatory risk during early deployment phases.

A complementary carbon intensity-based valuation approach *(similar to Refuel EU Maritime)*, applied alongside existing thresholds, could introduce a more continuous incentive gradient, rewarding incremental lifecycle emissions reductions and appropriately valuing fuels with very low or negative carbon intensity profiles. This would better align investment signals with the objective of maximising lifecycle emissions abatement across the aviation sector but also aligning with other existing frameworks.

Interdependencies across the SAF Deployment System

These constraints are interdependent. Revenue uncertainty affects access to funding sources, which in turn slows investment in qualification, infrastructure, and scale. Technical bottlenecks increase perceived project risk, reinforcing cautious capital allocation, while regulatory signal design shapes both pathway selection and investor confidence. As a result, announced capacity does not automatically translate into deployable, scaled production without coordinated progress across technological, financial, infrastructure, and policy domains.

Recommendations and Immediate Actions (next 12–24 months)

02

02 Recommendations
Technology and Supply Chain

Boost Early Fuel Validation Capacity

Fund early-stage fuel validation capacity and throughput *(ASTM D4054 pre-screening, rig and engine testing)*. Prioritise laboratory infrastructure capable of handling low-volume novel fuels.

Increased funding for independent validation platforms, such as the EU SAF Clearing House, is essential to support early-stage producers in refining fuel quality and process design through pre-screening and testing, reducing downstream risk and enabling a more efficient, right-first-time progression through ASTM and OEM approval pathways.

Secure Blending and Storage at Hubs

Prioritise coordinated investment and planning approvals to secure space for SAF blending and segregated storage infrastructure at ports/ airports and improve supply chain access and competence to enable growth.

Shift to Carbon Intensity (CI) Based Valuation

Adopt a carbon intensity-based metric alongside existing thresholds to provide a more continuous incentive signal, so promising pathways are not excluded by binary pass/fail rules and fuels with low or negative carbon intensity profiles are appropriately rewarded. Detailed carbon lifecycle assessments are essential to verify the true sustainability of any fuel. This ensures that progress towards decarbonising aviation is genuine and that investment is directed toward technologies that deliver meaningful emissions reductions.

Maintain Transparency of Technical Data

Standardise independently generated technical datasets and reporting formats to enable benchmarking across SAF pathways, to improve the comparability for investors and to reduce the perceived first-of-a-kind risk, thereby addressing information asymmetry between developers and financiers.

Form LCPC Pathway Cohorts

Pilot a Low-Carbon Platform Commodities *(LCPC)* grouping approach, whereby chemically comparable intermediates such as ethanol, syngas, methanol, pyrolysis oil are evaluated through coordinated qualification pathways. Where technically appropriate, grouping similar intermediates could enable shared data generation and reduce duplication in testing requirements so families of feedstocks advance through qualification collectively, shortening approval timelines.

02 Recommendations
Finance and Bankability

Design a Government-Backed Guarantee Facility

Establish a government-backed guarantee framework co-designed with commercial lenders and DFIs to de-risk construction/early operations and unlock senior debt.

Ring-Fence SAF Public Funding and Expert Triage

Ring-fence EU and national public funds specifically for SAF deployment *(demo/FOAK and full value chain projects)* with expert triage *(e.g. EU SAF Clearing House)* to enable fast de-risking that could deliver technically robust and bankable proposals.

Facilitate Portfolio (Not Single-Project) Deployment

Develop mechanisms enabling commercial debt providers and equity providers to deploy debt/equity across portfolios of SAF plants spanning multiple production pathways, thereby mitigating concentration risk associated with single-project exposures, consistent with portfolio diversification principles.

Develop a SAF Aggregator Model

Support the development of a neutral SAF aggregator model to pool multi-pathway supplies and sell on a weighted average price basis, analogous to aggregation mechanisms used in renewable energy markets to stabilise supply and pricing. This would give airlines long-dated, bankable offtake arrangements, reduce counterparty and delivery risk through supply diversification and minimise fuel pricing competition. An initial aggregator model will likely require some form of government-backed guarantee until sufficient SAF supplies come online to represent market pricing. A guarantee would underpin the bankability of such platforms.

02 Recommendations
Advocacy and Policy

Elevate Political Priority

Secure political attention and prioritisation of aviation and SAF to set the direction of travel by highlighting them on the agenda during Ireland's EU Presidency *(Jul-Dec 2026)*. Take this opportunity to share with other regulators the SAF Policy Roadmap published in Aug 2025 by the SAF Taskforce in Ireland, to be updated with actionable concepts.

Align Global Rules and Metrics

Advocate for closer alignment between the EU's blending requirements and other major international SAF frameworks through shifting to carbon intensity-based metric, to reduce competition between sectors and level the playing field between the various international schemes.

Foster Multisector Partnerships

Advance collaboration with other sectors competing for bio-feedstocks using Life Cycle Assessments *(LCA)* and Techno-economic Analysis *(TEA)* to inform allocation of limited sustainable biomass toward its highest climate value uses.

Promote Book-and-Claim Systems

Advocate for well-governed book-and-claim systems, which will provide flexibility and revenue certainty for many SAF producers who are geographically dispersed and operate at relatively smaller scale, while reducing logistical costs to reach SAF demand centres.

Key Takeaways

- Coordinated cross-sector action is required to unlock SAF deployment at scale to derisk deployment while providing attractive proposition for capital providers.
- Qualification of production pathways/feedstocks, financing, and logistics infrastructure remain the primary bottlenecks to scale-up.
- Multi sector feedstock competition and hydrogen constraints limit pathway scalability.
- Current policy frameworks focus mainly on volume and price risks but lack support for continuous innovation and project de-risking.

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