

Sustainability. Financed.



**AIREG – AVIATION INITIATIVE FOR
RENEWABLE ENERGY IN GERMANY E.V.**

SAF Production - Risk Analysis and Mitigation

02/24

Let's do some math on the back of an envelope ...



1

350bn liters of SAF are needed in 2050

2

350bn liters SAF correspond to 280mn tons of kerosine (conversion rate 0,8)

3

The average production unit will be about 75,000 tons production volume per year. PtL at 100,000 tons, BioSAF clearly below that. Let's assume at 50,000 tons per BioSAF production unit. One production plant can consist of several production units

4

CAPEX per 100,000 tons SAF output per year is EUR 1,5bn for PtL, about EUR 500mn for BioSAF, so EUR 1bn on average, if we assume a 50/50 split according to ReFuel EU

5

Thus, by 2050, approximately 3.733 units must be built at a cost of EUR 750mn million each, i.e., a total investment volume of EUR 2.8tn

6

If we subtract a planning and construction phase of 5 years until start of production, we still have 21 years (2029 to 2050) to build up the necessary SAF capacity

7

This corresponds to the construction of approx. 178 units per year with an overall investment volume of EUR 133,5bn of which ideally 75% should be financed with debt

8

To build these SAF plants at that pace requires an engineering and supplier capacity that is far from available today

SAF demand ramp-up (global)

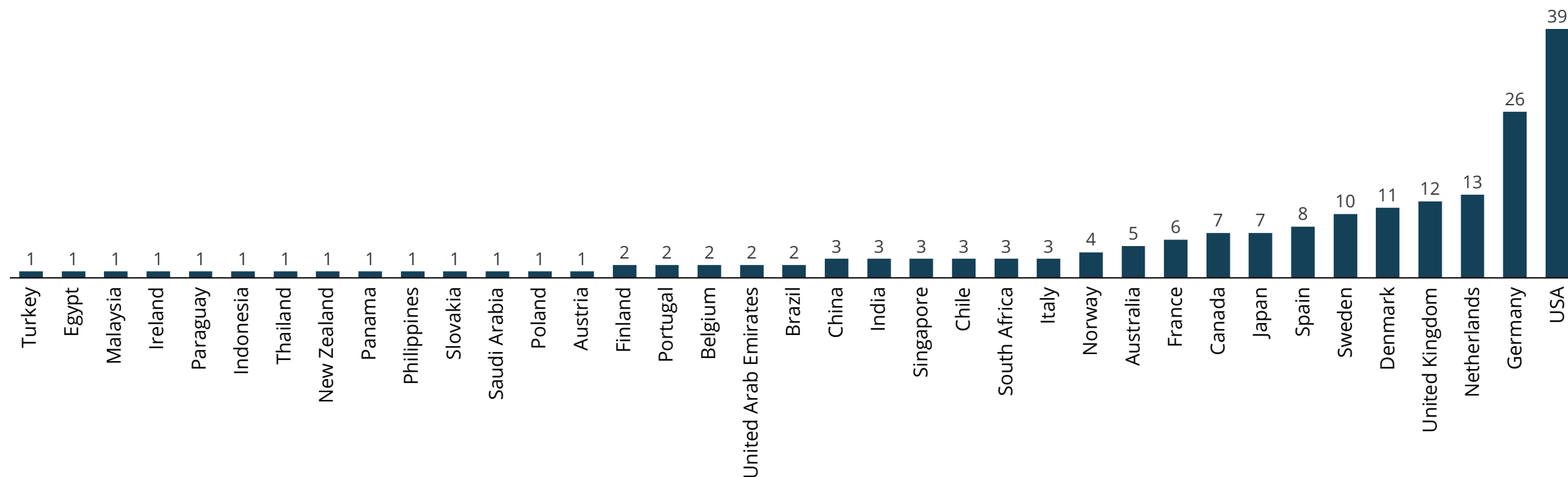


Year	2022	2025	2030	2035	2040	2045	2050
Total est. Jet Fuel demand (mt) (WEF – Clean Skies for Tomorrow)	250	364	407	446	479	503	520
SAF ramp-up (%) (Proposal blending mandate EU Parliament)	0.05%	2%	6%	20%	34%	42%	70%
SAF (mt)	0.125	7.28	24.42	89.2	162.86	211.26	364
Increase absolute (mt yty)		7.16	17.14	64.78	73,66	48,4	152.74
X increase (2022 base)			195				2912

USA with the most projects (approx. 20 percent)



Number of SAF and synfuel* projects recorded by location regardless of project status (191 in total)

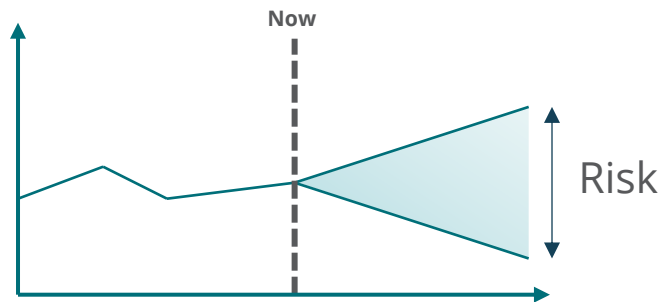


*Synfuel projects include all synthesis products, including methanol, which could be further processed into SAF (as feedstock) in whole or in part.

Uncertainty: Risk in Finance



Historical and future volatility



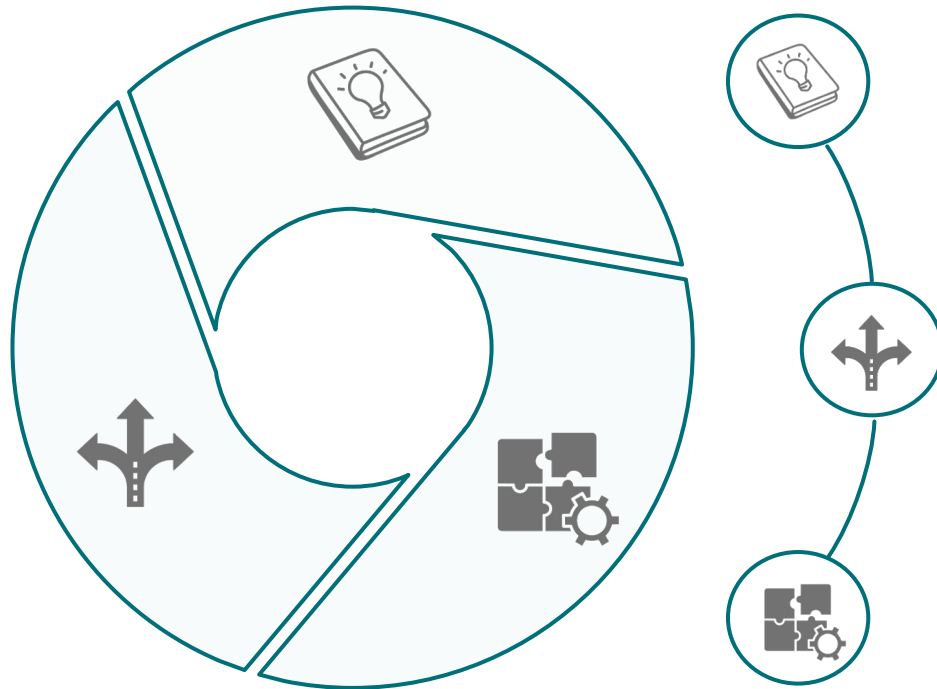
Risk is assessed by **historical volatility**. Since SAF is an absolute pioneering technology, there is **no historical data** available. Consequently, the market struggles to assess the **risks** and determine an **efficient price**.

We believe that market intelligence can create over proportionally more value in such market conditions than in other more traditional investment classes.

Investing Into SAF Production – The Main Challenges



Project sponsors will have to carefully consider several crucial aspects



Early-phase technology

- Many project developers **underestimate challenges from technology integration** for large-scale application
- There are **very few engineering companies** with sufficient experience
- There are **no turn-key projects** yet; multi-contracting with complex interfaces

Selection of right production pathway

- Thorough consideration of **local infrastructures and utilities** as well as early involvement of **local authorities and stakeholders** necessary
- The carbon **feedstock market is very challenging** in terms of long-term availability as well as evolving sustainability considerations

Integrated approach

- To achieve scalability, an **integrated SAF strategy will be required** to benefit from synergy potential. The selected **production pathway** should ideally be applicable at various sites, yet adaptable to local conditions
- Implementation of a holistic SAF project should be well aligned with a **specific marketing strategy**

The SAF industry is still in its infancy and project developers will face a variety of complex and significant challenges. Many of the announced projects will therefore not materialize, causing the SAF supply issues for the foreseeable future.

Investing into SAF production – The main benefits

A direct investment into SAF production addresses various aspects of the airline business



Regulatory compliance by proactively reducing carbon footprint and meeting stringent SAF targets to avoid potential penalties, fines, or operational restrictions on the long-term

Enhance brand image and reputation by positioning as sustainability leader in the industry. This attracts environmentally conscious customers and boosts brand loyalty

By curbing GHG emissions, airlines **mitigate their environmental impact** and lower their carbon footprint. This demonstrates their commitment to sustainability and achieving industry-wide "net zero"

Airlines investing in SAF production capacity can **access government incentives, grants, and subsidies**, receiving financial support and reducing the required initial capital expenditures and thereby derisking investments



By making investments in production capacity, airlines can mitigate the risks of volatile fossil fuel prices, minimize exposure to market fluctuations, and ensure **long-term cost stability**

By directly investing in SAF production capacity, airlines can reduce their reliance on traditional fuel suppliers and **mitigate supply chain risks**. This enables airlines to have greater **control over their fuel supply**

By spearheading **innovation and technological advancement**, airlines can establish themselves as technology leaders in the industry and future-proof their business

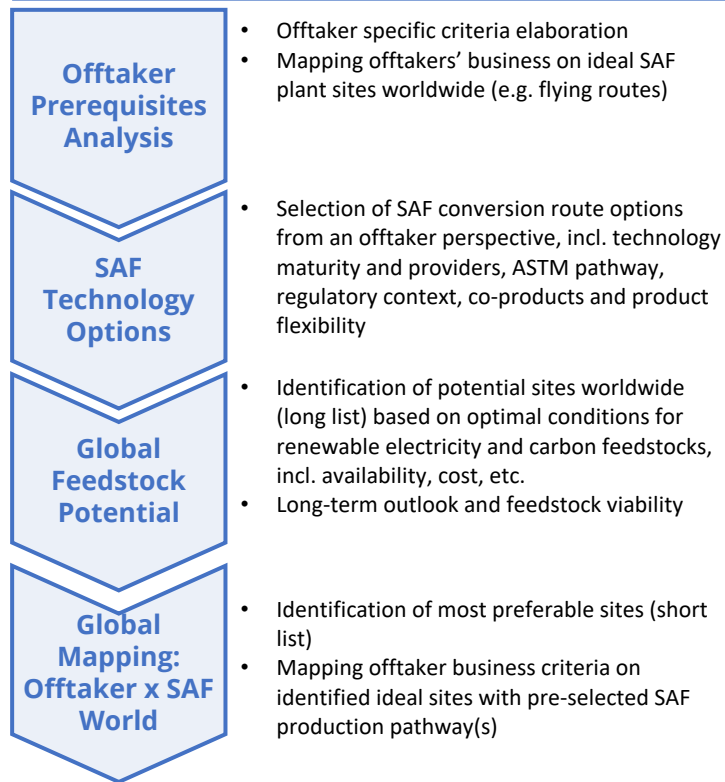
Investing in SAF demonstrates a clear commitment to a sustainable transition which provides **beneficial access to capital markets with increasing focus on ESG aspects**. Many investors also require compliance with SBTi's SAF recommendations

Investing in a robust SAF supply chain empowers airlines with greater control, minimizing disruptions and ensuring a reliable and resilient operation

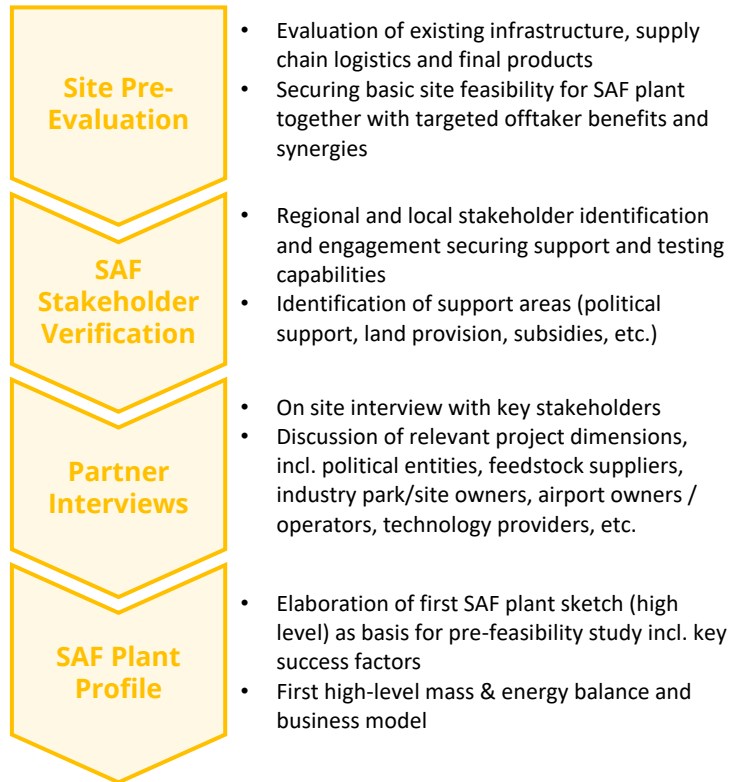
The project life-cycle: From careful site selection to execution



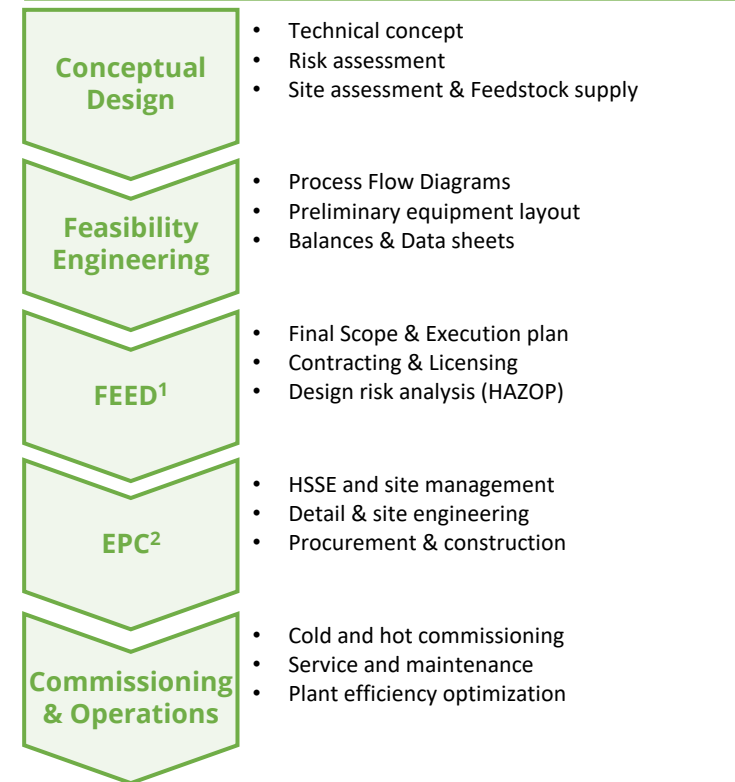
Phase 1: Site Pre-selection



Phase 2: Site Selection



Phase 3: Realization



Short list of **3-5 ideal SAF plant sites** from a global long-list of c. 20-30 sites based on offtaker's global business footprint matched with ideal SAF production locations

Identification of preferred SAF plant site for pre-feasibility study with verified local conditions, e.g., feedstock availability & costs, land availability, required partners, product logistics, high-level economic feasibility, etc.

Final development and successful implementation of the SAF production facility using state-of-the-art technology, employing strong and experienced contractors while implementing robust risk management systems

¹ Front End Engineering Design; ² Engineering, Procurement, Construction

The Competitiveness of the Project is Determined by the Combination of its Details



Technology, process & production	1. Technological maturity, scalability & applicability ¹ (TRL/FRL level system/components, technical risks, ASTM certified, technology providers)
	2. Minimum plant capacity per SAF conversion pathway as basic prerequisite for techno-economic feasibility (CAPEX-efficiency, Offtake demand)
	3. Product mix flexibility (in terms of main and by-products)
	4. Cost of Production (COP) incl. major drivers (ranges based on simplified mass & energy balances and technical efficiency per pathway/site)
	5. Infrastructure availability and site readiness (COP) incl. OSBL/utilities production site, feedstock pre-processing and in-/outbound logistics ²
Feedstocks & certification	6. Feedstock eligibility (sustainability criteria ³ according to CORSIA combined with ReFuelEU Aviation minimum GHG reduction of 65%)
	7. Feedstock availability (accessible volumes per SAF conversion pathway per site, value chain depth, e.g. access to Green H ₂ , Methanol)
	8. Feedstock cost estimates (first high-level sourcing price levels per major feedstocks per SAF conversion pathway per site)
	9. Feedstock supply stability (range of alternative feedstock sources and feedstock processing flexibility per SAF conversion pathway per site)
Offtaker fits & Financials	10. National SAF related policies, regulation and political support
	11. 3rd party investability (partners, most suitable SPV structure)
	12. Return and risk profile (boundary conditions/operational and managerial accessibility/level of experience/interest level)
	13. Country risk and legal stability (mid-to-long-term invest stability)
	14. Access to (national/local) public funding, grants , etc.
	15. "Best Fit" offtaker footprint (demand, internal by-products use, corporate synergies with maritime/hospitality, SBTi fulfillment, etc.)

¹ connectiveness to next airport (pipeline, truck, rail), blending facilities, etc.; ² applicable at various sites, yet adaptable to local boundary conditions; ³ renewable electricity/carbon

01	Construction Risk	<ul style="list-style-type: none">• Permits, licenses• Contractor (experience, soundness...)• EPC contract• Costs overrun• Delays• Technical performance of the asset• Third parties (Project on Project Risk)
02	Operational Risk	<ul style="list-style-type: none">• Operating contract• Performance (technology,...)• Maintenance
03	Revenues Risk	<ul style="list-style-type: none">• Volume Risk / Resource Risk (renewables...)• Price Risk• Logistics
04	Financial Risk	<ul style="list-style-type: none">• Funding during the construction phase• Default of a Lender
05	Environmental & Social Risk	<ul style="list-style-type: none">• Compliance with Equator Principles and other environmental & social policies

06

Regulatory and Political Risk

- Change in Law / change in regulatory framework
- Inherent Risks in the host country

07

Macro-economic Risk

- Inflation
- Interest rates
- FX rates

08

Legal Risk

- Litigations
- Validity and enforceability of the contracts
- Arbitrage rules
- Gaps / inconsistencies between jurisdictions

09

Force Majeure Risk

- Acts of God and other unpredictable events

Types of Risk Mitigation Instruments



Type	Providers	Risk Areas Covered
Equity / Cash / Grants / Subsidies	Sponsors Private Investors Public Investors Public Sector	Construction and technology Risk Financial Risk
Revenues Support Mechanisms (e.g. Contracts for difference, concessions, buyer of last resort, grandfathering, etc.)	Public Sector	Revenues Risk Legal Risk
Insurance	Insurance companies Export Credit Agencies	Force Majeure Risk Third party liability Risk Construction and technology Risk
Guarantees	Sponsors Other financial institutions Public entities	Construction and technology Risk
Liquidated Damages / Penalties / Warranty	EPC Contractors Licensors Other counterparts in commercial contracts (e.g. feedstock provider)	Construction and technology Risk Operational Risk Revenues Risk
Letters of Credit (« LCs ») / Securities	Commercial Banks Surety Providers	Counterparty Risk

Our Line-Up



Background

1

Experience:

We are investment bankers and lawyers and have many years of experience in structuring and financing of major projects both for corporates, private equity funds or institutional investors

2

Legal & Regulatory:

We have a deep understanding of the regulatory background of SAF, the EU Taxonomy, SFDR and CSRD/CSDDD as a necessary basis for holistic advice

3

Memberships:

We are an active part of all relevant Net Zero aviation initiatives: Sustainable Aviation Working Group of the German Government, RLCF, ICAO ACT SAF, Aireg, CENA, Mission Possible Partnership etc.

4

Commitment:

We are a founding member of the non-profit association Impact on Sustainable Aviation e.V. – with 40 major international banks, asset managers, lessors and investors as members, one of the leading voices within the financial industry to support the decarbonization of aviation

impact

ON SUSTAINABLE AVIATION

Our Areas of Competence



Corporate Finance Advisory

- Advice on commercial strategies of SAF and CCS/U facilities
- Equity and debt advisory
- Consulting on subsidies/ public financing support for SAF and CCS/U projects



Greenfield, Brownfield

- Advice on all issues relating to the development and implementation of greenfield and brownfield SAF projects
- Site and potential analyses
- Development of technological designs for the construction of production plants



Offtake Agreements

- Advice on the procurement and conclusion of SAF offtake agreements
- Information on worldwide SAF and CCS/U projects and their technical and commercial developments



Sustainability Consulting

- Provide added value by tracking and appraising commercial, regulatory & legal developments concerning SAF and CCS/U
- Communication about SAF/Net-Zero strategy (internally/externally) to regulator, financial market and public

Our Service Offering



SAF advisory services

1

Strategic and Financial Advice:

We advise in the role of strategic and financial project managers sponsors, investors, financial institutions and airlines in the field of SAF production and procurement. We help our clients to ensure efficient and perfectly fitting equity and debt finance for their SAF projects.

2

Analytical Work Organization:

We provide support in organizing and conducting analytical work for SAF projects. This includes data collection, analysis, and interpretation to facilitate informed decision-making and drive the project's success.

3

Regulatory Framework Support:

Our team is well-versed in the intricacies of the regulatory landscape surrounding SAF. We offer assistance in addressing regulatory framework topics, such as sustainability criteria, to ensure that projects meet all necessary requirements.

4

Global Aviation and Finance Community Connection:

Our strong connections both within the global banking and aviation community enable us to provide clients with valuable networking opportunities. By linking clients to key industry players and global financing institutions, we facilitate collaboration and knowledge-sharing that can accelerate the development and adoption of SAF.



THANK YOU!

Contact us



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