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European Union Aviation Safety Agency

Handout Material

How to become SAF ready? How to make SAF happen?

SAF Training for ACI Africa & AFRAA

23.-25.04.2025, Arusha, Tanzania

Global Gateway

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SAF Training for ACI & AFRAA: Build Your Own Sustainable Aviation Fuels Case – How to become SAF ready? How to make SAF happen?

Day 01 **The fundamentals of SAF**

Section 1	Understanding the Fundamentals of SAF and Decarbonization of Aviation
Section 2	Value Chain & DSL - Our Guiding Principle for this Training

Day 02 **Central elements of the Direct Supply Line**

Section 3	Feedstock Supply, Preparation and Certification
Section 4	SAF Production and Project Development
Section 5	Role of Airlines' and Airports'

Day 03 **SAF Direct Supply Line enablers and supporting functions**

Section 6	SAF Business Case and Offtake
Section 7	SAF Financing
Section 8	Policies and Stakeholder Engagement

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Section 1: Understanding the Fundamentals of SAF and Decarbonization of Aviation

Session	Speaker
• Opening remarks and continental SAF policy and action plan, AFCAC/AUC	• AFCAC / AUC • ACI Africa / AFRAA
• Sustainable aviation fuel (SAF) as key value driver for sustainability in aviation	• EASA SAF Expert, Raphaela Spielberg-Daninos
• SAF Basics 1: Fundamentals of SAF and the role of hydrogen in decarbonizing aviation.	• EASA SAF Expert, Christoph Behrendt-Rieken and Dr. Fabian Schmitt
• Thought Leadership Talks: Best practice sharing through expert contributions	• Airbus - Claire Kaufmann, Schiphol - Denise Pronk, Lufthansa – Erin Beilharz, Boeing

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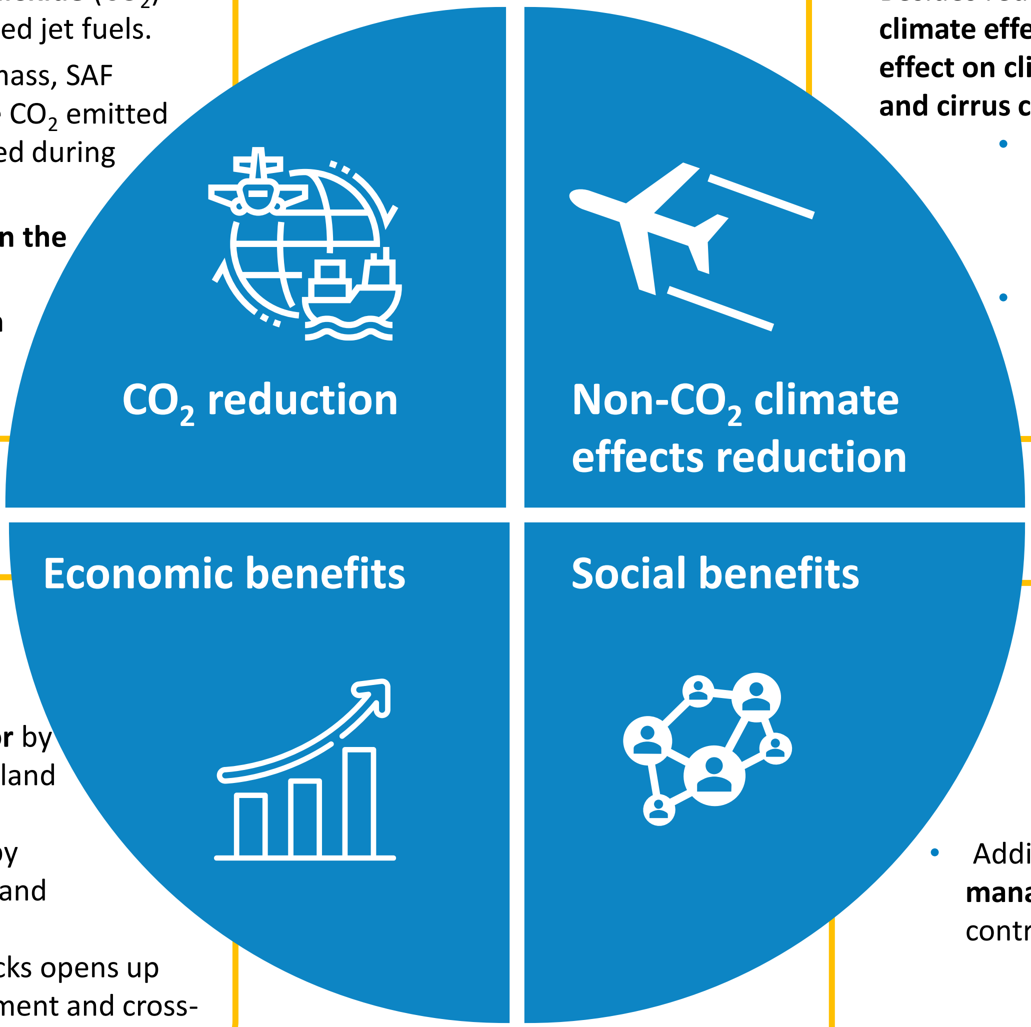
The multifaceted benefits of Sustainable Aviation Fuels

- **SAF enables significant reductions in carbon dioxide** (CO_2) emissions compared to conventional fossil-based jet fuels.
- By utilizing renewable feedstocks, such as biomass, SAF contributes to a closed carbon cycle where the CO_2 emitted during combustion is offset by the CO_2 absorbed during the feedstock's growth phase.
- The **GHG emission saving intensity depends on the feedstock and the process.**
- SAF is crucial for **aviation industry's transition** toward a low-carbon future and meeting international climate goals.



- Besides reducing CO_2 emissions, **SAF also mitigates non-CO_2 climate effects (which have on average a twofold intense effect on climate warming)**, such as the formation of **contrails and cirrus clouds**, which contribute to global warming.
  - **SAF contains fewer impurities** like sulfur and nitrogen oxides (NOx) than fossil jet fuel, which are responsible for producing aerosols that amplify atmospheric warming.
  - **SAF reduces soot and particulate matter** emissions further lessen the formation of these cloud contrails. SAF plays a critical role in addressing the broader climate impact of aviation.

- The adoption of **SAF stimulates economic growth**, particularly in **local communities** involved in **feedstock production**.
- SAF helps create **jobs in the agricultural sector** by repurposing marginal or otherwise non-viable land for growing feedstock.
- The use of SAF also supports **energy security** by reducing dependence on imported fossil fuels and promoting a diversified energy supply.
- The **integration of waste materials** as feedstocks opens up opportunities for innovation in waste management and cross-sector collaboration.

- SAF contributes to various social benefits, including **job creation and community development**. As SAF production expands, it provides employment opportunities across several sectors, from agriculture to renewable energy and waste management.
- Additionally, SAF promotes **more sustainable waste management practices** by utilizing waste as a feedstock, contributing to **circular economy goals.**

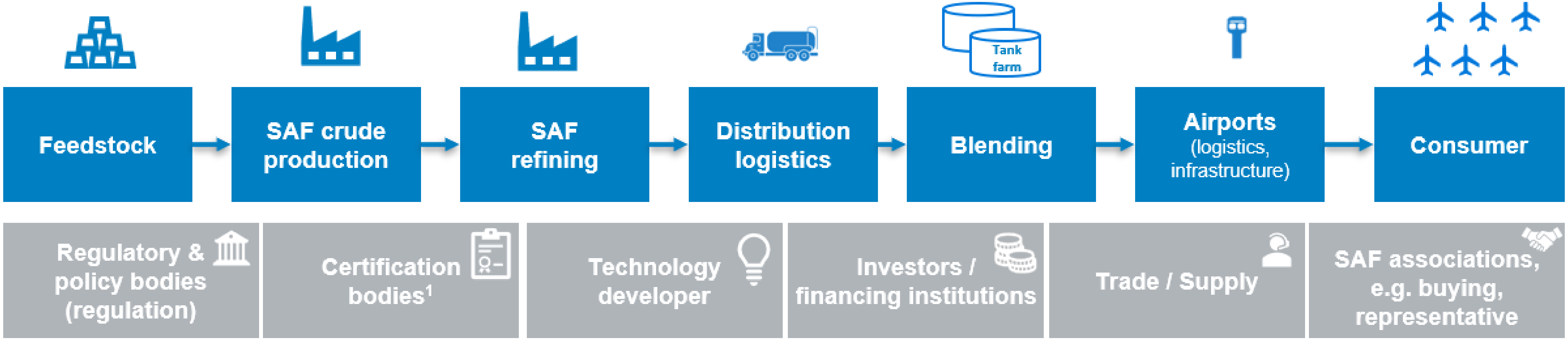
Direct Supply Lines are self-sustaining supply chains for Sustainable Aviation Fuels, fundamental to boost sustainability in aviation

Steps and actors *along* the SAF value chain: New possibilities, new feeds, new players and partnerships

A **Direct Supply Line** (DSL) for SAF is a **self-sustaining network** of **regional supply chains**, consisting of a **local feedstock**, a commercial fuel **production plant**, and long-term **offtake partners**.

Stakeholders *around* the SAF value chain: Leveraging existing infrastructures and industry best practices

This is a complex system involving **multiple stakeholders**. While such a supply chain is **not yet fully established for SAF**, **similar frameworks exist in fossil aviation**, and much of this existing infrastructure can be leveraged for sustainable aviation.



"The SAF journey is only as strong as its weakest link."

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Section 2: Value Chain & DSL - Our Guiding Principle for this Training

Session	Speaker
• The Direct Supply Line (DSL) concept: Rationale, strategic requirements and elements for establishing a Direct Supply Line in contemporary market conditions	• EASA SAF Expert, Raphaela Spielberg-Daninos
• Case Study: Partnerships along the SAF Value Chain	• *Interactive*
• The Producers‘ perspective	• RMI - Andrew Chen (Sustainable Aviation Fuel Buyers' Alliance – SABA)
• The Airlines‘ perspective	• Lufthansa - Erin Beilharz
• The Airports‘ perspective	• Heathrow Airport - Juliana Scavuzzi

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At first comes the DSL, covering phases 1 and 2 of project development.

Focus DSL

Phase 1

Mapping of SAF Potential along Supply Chain

- **Route** selection, first feedstock analysis and regional profile (demand, infrastr., projects, etc.)
- **Partner identification**, verification & (first) interviews
- **Heatmap** by SAF conversion pathway per country (option space, ranking, selection)

Phase 2

First Estimate: Technical & Economic Feasibility

- **Site** (location/area) **identification**, considering SAF value chain elements
- **Partner onboarding**, role definition and specific data provision
- **Simulation** of COP, CapEx and return range (model based)[1]

Phase 3

Site Selection & Partner Structure

- Final site selection, securing and concept design
- OSBL assessment, requirements list
- Partner consortia set-up[2]

Single SAF plant – Project Development: Financing, Engineering, Construction and Operations

Phase 4

Phase 4 a

Conceptual Design

- Technical concept
- Risk assessment
- Site plan & feedstock supply

Phase 4 b

Governance, legal and financing

- Build-up of consortium and contract management
- Regulatory advisory and permitting
- Financing structure and public funding

Phase 4 c

Business planning and project steering

- Financial modelling and business case
- Project organization (interface management)
- Cost management and scheduling

Phase 5

Feasibility Engineering

- Process Flow Diagrams
- Preliminary equipment layout
- Balances & data sheets

Phase 6

FEED (Front End Engineering Design)

- Final Scope & Execution plan
- Contracting & Licensing
- Design risk analysis (HAZOP)

Phase 7

EPC (Engineering, Procurement, Construction)

- HSSE and site management
- Detail & site engineering
- Procurement & construction

Phase 8

Commissioning & Operations

- Cold and hot commissioning
- Service and maintenance
- Plant efficiency optimization

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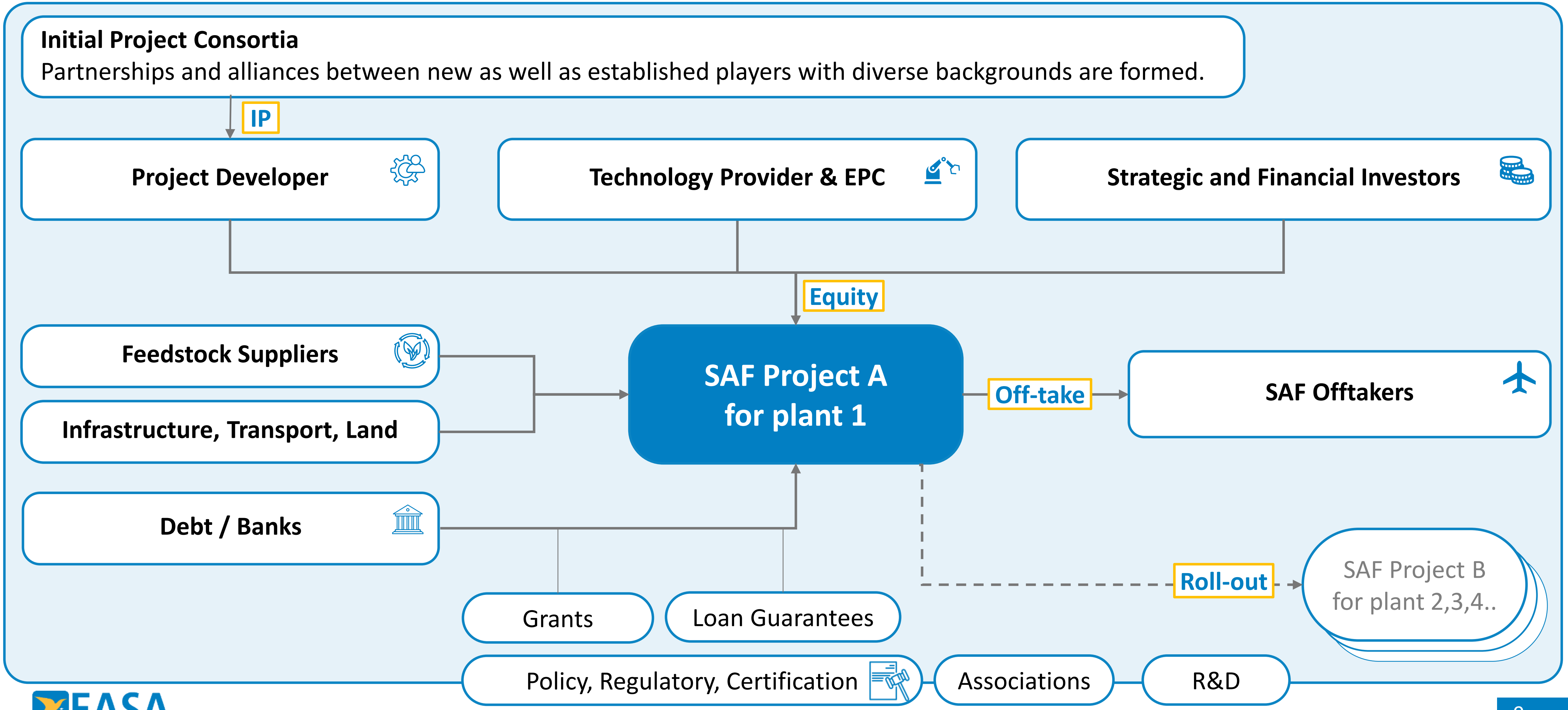
Source: CBR Sustainability Partners, 2025

[1] First high-level mass & energy balance and business model (sensitivities of techno-commercial feasibility);
[2] (On site) interviews with key stakeholders related to the various project dimensions, i.e., political entities, feedstock suppliers, industry park/site owners, airport owners/operators, technology providers (starting with Phase 3/4), etc.

The successful development of a Direct Supply Line for SAF depends on a robust partner ecosystem to lay the foundations for future plant roll-out



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Understanding the stakeholders’ role, challenges and business objectives

Challenges

1. Feedstock provider

Supplies used cooking oil (UCO) facing different challenges: (1) Unstable collection volumes from municipal areas; (2) competition from exports and (3) varying quality requiring intensive pre-treatment (costs)

2. SAF Producer

Operating bio refinery (HEFA pathway) facing challenges (1) to sign long-term, binding offtake agreements due to high prices, (2) plant performance due to varying feedstock supplies and (3) qualified labour for operations and maintenance

3. Airport

Keen to promote SAF adoption and provide SAF at the airport but facing (1) the problem of SAF access (availability), (2) infrastructure limits (logistics, storage, etc.) and (3) SAF quality assurance (blending, etc.)

4. Airlines

Keen to deploy SAF into its operations to respond to regulations (CORSIA, ReFuelEU) but facing challenges of (1) SAF availability, (2) high green premium and (3) unstable customer demand and willingness-to-pay

5. Regulatory bodies (industry policy makers)

Ambition to support local SAF production to create socio-economic benefits but challenges of (1) interdependencies of industry sectors (preferred use of feedstock, electrification, etc.), (2) variety of policy options and methodologies (mandates vs. incentives, GHG emissions reduction or volumes

Task

Time to take action: Fill out the collaborative solutions for relevant challenges

Time: 20 min

Stakeholder role	Stakeholder DSL interfaces
Feedstock provider Collects, pretreats and supplies used cooking oil (UCO) to the biorefinery	1. … 2. … 3. …

Challenges	Challenge description	Proposed solutions with required collaborators
A	Unstable collection volumes from municipal areas	1. … 2. … 3. …
B	Competition from exports	
C	Varying quality requiring intensive pre-treatment (costs, delivery delays)	
D	…	
E	…	

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* Please feel free to add more than challenges and solutions or stakeholder interfaces in the given boxes

Task

Time to take action: Fill out the collaborative solutions for relevant challenges

Time: 20 min

Stakeholder role	Stakeholder DSL interfaces
SAF Producer Operating bio refinery (HEFA pathway) to produce SAF and distribute it to selected airports by various transport modes	1. … 2. … 3. …

Challenges	Challenge description	Proposed solutions with required collaborators
A	Long-term, binding offtake agreements with airlines due to high prices and market uncertainty	1. … 2. … 3. …
B	Plant performance due to varying feedstock supplies	
C	Qualified labour for operations and maintenance	
D	…	
E	…	

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* Please feel free to add more than challenges and solutions or stakeholder interfaces in the given boxes

Task

Time to take action: Fill out the collaborative solutions for relevant challenges

Time: 20 min

Stakeholder role	Stakeholder DSL interfaces
Airport Promotion of SAF adoption and (physical) provision of SAF at the airport	1. … 2. … 3. …

Challenges	Challenge description	Proposed solutions with required collaborators
A	SAF access (availability)	1. … 2. … 3. …
B	Infrastructure limits (logistics, storage, etc.)	
C	SAF quality assurance (blending, etc.)	
D	…	
E	…	

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* Please feel free to add more than challenges and solutions or stakeholder interfaces in the given boxes

Task

Time to take action: Fill out the collaborative solutions for relevant challenges

Time: 20 min

Stakeholder role	Stakeholder DSL interfaces
Airlines Deployment of SAF in its operations to respond to regulations (CORSIA, ReFuelEU) and voluntary sustainability commitments	1. … 2. … 3. …

Challenges	Challenge description	Proposed solutions with required collaborators
A	SAF availability	1. … 2. … 3. …
B	High green premium	
C	Unstable customer demand and willingness-to-pay	
D	…	
E	…	

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* Please feel free to add more than challenges and solutions or stakeholder interfaces in the given boxes

Task

Time to take action: Fill out the collaborative solutions for relevant challenges

Time: 20 min

Stakeholder role	Stakeholder DSL interfaces
Regulatory bodies (industry policy makers) Ambition to support local SAF production to create socio-economic benefits (jobs, GDP growth, environmental protection, etc.)	1. … 2. … 3. …

Challenges	Challenge description	Proposed solutions with required collaborators
A	Interdependencies of industry sectors (preferred use of feedstock, electrification, etc.)	1. … 2. … 3. …
B	Variety of policy options and methodologies (mandates vs. incentives, GHG emissions reduction vs. volumes)	
C	Green transformation as a nice-to-have in relation to dynamic geopolitical developments	
D	…	
E	…	

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* Please feel free to add more than challenges and solutions or stakeholder interfaces in the given boxes

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Section 3: Feedstock Supply, Preparation and Certification

Session	Speaker
SAF Feedstock basics: Fundamental know-how, CORSIA eligibility and Sustainability Certifications	EASA SAF Expert, Nipun Jagtap and Dr. Fabian Schmitt
Feedstock potential in Africa	RSB - Yitatek Yitbarek
Case study: LCA for supply chain and interpretation	*Interactive*
Actionable tools for the iteration of key Direct Supply Line questions	EASA SAF Expert, Nipun Jagtap

“Sustainability” is not a universal word and is unique in each regulation

Sustainability certification for SAF

Certification about **compliance towards sustainable criteria** according to specific sustainability programs (e.g., CORSIA).

Key sustainable criteria for SAF production:

- Sustainable feedstock availability
- Direct / Indirect Land Use Change
- GHG Emissions
- Labour / Human rights
- Food security
- Traceability.

Regulations/initiatives

CORSIA RED III Sustainable Skies Act

Certifying bodies

RSB CERTIFIED ISCC International Sustainability & Carbon Certification

ASTM approval for SAF

Technical certification assuring that the **chemical properties** of the fuel are adequate and compliant with the use as jet fuel.

ASTM D1655: Key specification for JetA/A-1.

ASTM D7566: Quality standard required for each SAF production pathway, defining which feedstock must be used, the associated process and the properties and the output of each pathway.

ASTM D4054: the process for approval of new SAF production pathways.

ASTM INTERNATIONAL

Feedstock examples under CORSIA CEF categories


Agricultural residues (e.g. bagasse, nut shells, etc.)


Agricultural residues (e.g. corn cobs, straw, etc.)


Palm oil, Palm fatty acid distillate


Forestry residues (e.g. cutter shavings)


Soybean oil


Rapeseed oil


Municipal solid waste (MSW)


Corn oil, Corn grain


Sugar Cane


Molasses


Sugar beet


Switchgrass


Miscanthus


Used cooking oil (UCO)

Categories of the materials: Products, Co-products, By-products, Residues, Waste

Reference documentation for CORSIA eligible fuels

CORSIA Eligible Fuel – Reference Documentation
Five ICAO documents comprise the CORSIA Implementation Element for CEF, and they define the procedures and requirements needed for CEF consideration under CORSIA:

1. *CORSIA Eligibility Framework and Requirements for Sustainability Certification Schemes*
2. *CORSIA Approved Sustainability Certification Schemes*
3. *CORSIA Sustainability Criteria for CORSIA Eligible Fuels*
4. *CORSIA Default Life Cycle Emissions Values for CORSIA Eligible Fuels*
5. *CORSIA Methodology for Calculating Actual Life Cycle Emissions Values*

\+ *CORISA Annex 16 Volume 4: Environmental Protection*

Two types of CORSIA eligible fuels:

Sustainable Aviation Fuel

Renewable or waste-based fuel, meeting CORSIA criteria

Lower Carbon Aviation Fuel

CO_2

LCAF

Fossil feed
CORSIA criteria
Annex 16, Vol 4

\+ Energy efficiency
\+ Process gas management
\+ Renewable/low carbon power, gas, H2
\+ Carbon capture and storage
↳ 10% GHG reduction

Source: ICAO

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Section 4: SAF Production and Project Development

Session	Speaker
• The Portfolio of SAF Production Pathways: technology, maturity, relevant players and projects	• EASA SAF Expert, Dr. Fabian Schmitt
• Best Practice of Asset-heavy Project Development and Execution for Novel Technology and Production Concepts	• EASA SAF Expert, Christoph Behrendt-Rieken
• Case study: Technology landscape – from early stage to commercially mature	• *Interactive*

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Three ASTM standards ensure SAF production pathways to meet specifications and requirements in Aviation Turbine Fuels.

	Exemplary feedstock	Group	ASTM qualified conversion process (D7566, D1655)	Max. blend	Chemical composition	Technology used	ASTM
1	**Fatty acids or fatty acid esters** (from virgin or used fats and oils)	HEFA & Co-Processing	**HEFA-SPK**: Synthesized paraffinic kerosene from hydroprocessed esters and fatty acids	50%	Paraffins, no aromatics	Hydroprocessing for HEFA	D7566
2	**Fatty acids or fatty acid esters** (co-processed with fossil petroleum)	HEFA & Co-Processing	**Co-processed HEFA**: Co-hydroprocessing of esters and fatty acids in a conventional petroleum refinery	5%	Paraffins and aromatics contained in the jet fuels	Co-hydroprocessing	D1655
3	**Algae**	HEFA & Co-Processing	**HC-HEFA-SPK**: Synthesized paraffinic kerosene from hydrocarbon - hydroprocessed esters and fatty acids	10%	Paraffins, no aromatics	Hydroprocessing for HEFA	D7566
4	**Hydrocarbons** derived from **triglycerides or their derivates**	HEFA & Co-Processing	**Co-fractionation** using maximum 24% of bio-material, with result of maximum 10% bio-share in the jet fuel.	10%	Paraffins and aromatics contained in the jet fuels	Hydroprocessing for HEFA	D1655
5	**Syngas** (via gasification or from H_2/CO_2)	Fischer-Tropsch	**FT-SPK**: Fischer-Tropsch hydro-processed synthetic paraffinic kerosene	50%	Paraffins, no aromatics	Fischer-Tropsch synthesis	D7566
6	**Syngas** (via gasification or from H_2/CO_2)	Fischer-Tropsch	**FT-SKA**: Synth. kerosene with aromatics derived by alkylation of light aromatics from non-petr. sources	50%	Paraffins and aromatics	Fischer-Tropsch synthesis	D7566
7	**FT hydrocarbons** (co-processed with fossil petroleum)	Fischer-Tropsch	**Co-processed FT**: Co-hydroprocessing of Fischer-Tropsch hydrocarbons in a conventional petroleum refinery	5%	Paraffins and aromatics contained in the jet fuels	Co-hydroprocessing	D1655
8	**C2-C5 Alcohols** (various feedstocks)	Oligomerisation	**ATJ-SKA:** Alcohol to jet synthetic paraffinic kerosene with aromatics (Pure SAFSM)	50% - 100%	Paraffins and aromatics	Fermentation to alcohol, dehydration and oligorimerisation	D7566
9	**Ethanol, Iso/n-butanol, Isobutene** (from crops, 2G biomass, H_2/CO_2)	Oligomerisation	**ATJ-SPK**: Alcohol to jet synthetic paraffinic kerosene	50%	Paraffins, no aromatics	Fermentation to alcohol, dehydration and oligorimerisation	D7566
10	**Sugars** (from crops or 2G biomass)	Oligomerisation	**SIP**: Synthesised iso-paraffins from hydroprocessed fermented sugars	10%	Paraffins, no aromatics	Fermentation	D7566
11	**Fatty acids or fatty acid esters** (from virgin or used fats and oils)	other	**CHJ**: Catalytic hydrothermolysis jet fuel	50%	Paraffins and aromatics	Hydrothermal synthesis	D7566

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Source: ASTM

Other process in the pipeline for ASTM approval: **Methanol-to-Jet**, **Synthesised Aromatic Kerosene** (Virent), **Integrated Hydropyrolysis and -conversion IH2** (Shell), **Pyrolysis of non-recyclable plastics** (OMV), **Coprocessing** of **pyrolysis oil**, **certification for flying with 100% SAF.**

State-of-the-art and expected development of SAF technologies

Early Stage
Technology Development & Proof

Pilot plant

Growth Stage
Commercialisation & Expansion

Demo plant

Profit Stage
Scaling & Optimisation

Full-scale plant

TRL 5 → TRL 6 → TRL 7-8 → TRL 9

Hybrid fuel (e.g. Methanol-to-Jet)
Competitive factors: Technology proof, feedstock access (e.g. biogas) and funding for roll-out.

Pro:
- Abundant feedstock
- Low cost of production

Cons:
- TRL4 (TRL8-9 indv. processes)
- High specific CAPEX
- Feedstock / process dependent

Waste to Liquid
Competitive factors: MSW sourcing and pre-treatment capabilities

Pro:
- Wide range of feedstock
- Low GHG emissions
- Feedstock/process dependent

Cons:
- not yet commercialized
- High specific CAPEX

Power to Liquid
Competitive factors: Access to renewable energy (Green H2) and CO2.

Pro:
- Hardly any restrictions
- Low GHG emissions

Cons:
- Not yet commercialized
- High specific CAPEX
- High cost of production

Alcohol to Jet
Competitive factors: Sustain-able Ethanol access and technological integration.

Pro:
- Low specific CAPEX
- Several feedstock available
- Depending on feedstock

Cons:
- Not yet commercialized
- Depending on feedstock

Biomass to Liquid
Competitive factors: Abundant, reliable biomass feedstock, e.g. forest residues.

Pro:
- Wide range of feedstock
- Low cost of production

Cons:
- Depending on feedstock
- Not yet commercialized
- High specific CAPEX

Hybrid fuels (e.g. PBtL)
Competitive factors: Technology proof, feedstock access (e.g. biogas) and funding for roll-out.

Pro:
- Abundant feedstock
- Low cost of production

Cons:
- TRL8-9 individual processes
- High specific CAPEX
- Feedstock / process dependent

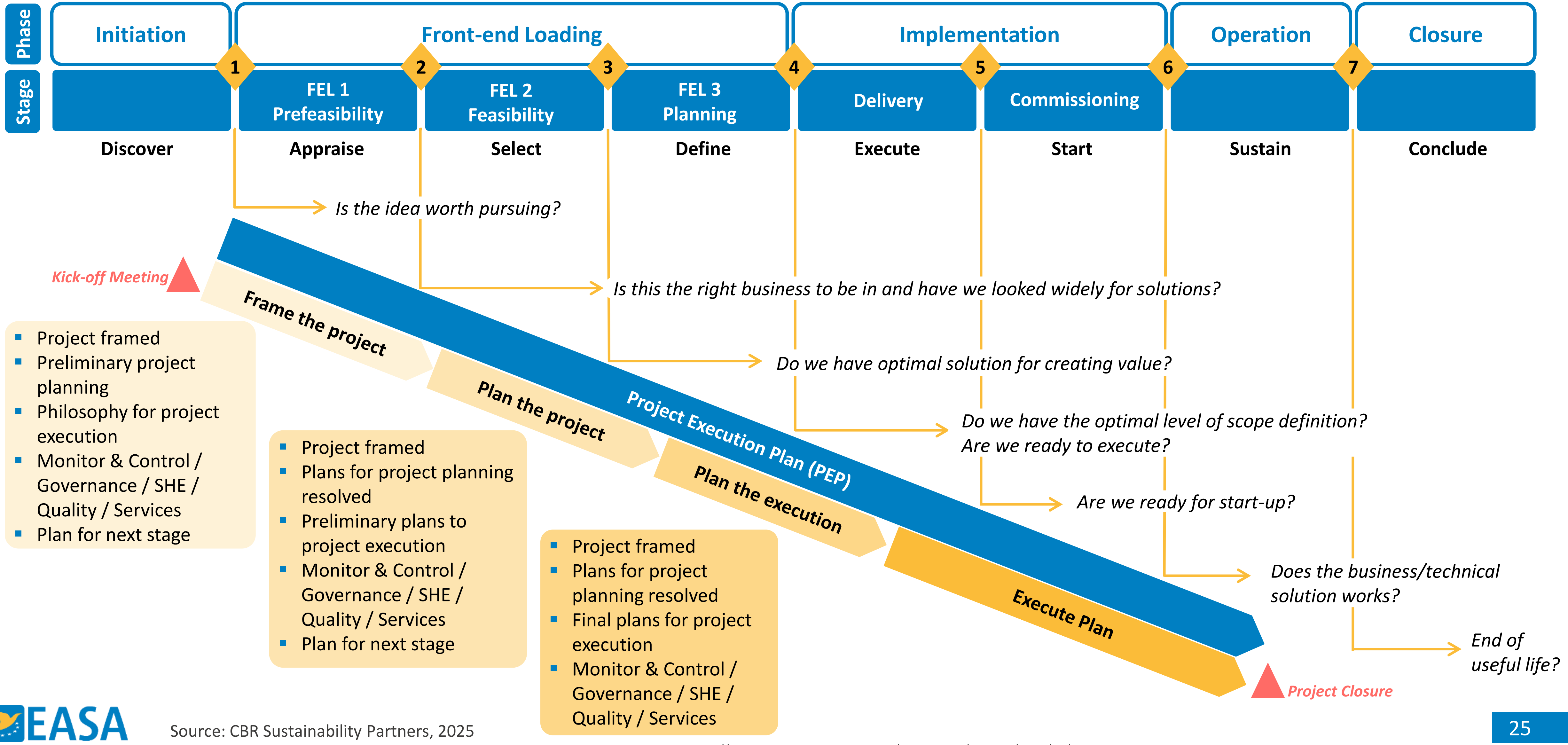
HEFA
Competitive factors: **Feedstock access** and **large-scale refinery infrastructure**.

Pro:
- State of the art technology
- Low specific CAPEX
- Low cost of production

Cons:
- Limited oils / fatty acids supply
- Depending on feedstock

Source: CBR Sustainability Partners, 2025

Technical Project Management (TPM) – Key elements of FEL



Source: CBR Sustainability Partners, 2025

https://www.ownerteamconsult.com/wp-content/uploads/2020/03/Insight-Article-058-Introducing-the-Project-Execution-Plan.pdf

Case Study: Technology landscape – from early stage to commercially mature

	Project Developers	Eni	LanzaJet	Uniper
1	Who is that player? What is the player's **background**?			
2	Where / in which **phase** does the project stand and what is the **timeline**?			
3	Which **location** is chosen for the plant? Why?	Gela, Italy	Soperton, Georgia, US	Långsele, Sollefteå, Sweden
4	Which **feedstock** shall be used?			
5	Which **technology** is used and is there an according ASTM pathway?			
6	What is the technological **readiness** level? What is the target **capacity**?			
7	Who are the **partners**? Who are these partners/sponsors?			
8	What are potential **risks** and **limitations** to this project? Why?			
9	What is **unique** about this project? How do the aspects fit together?			

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Section 5: Stakeholder Exchange between Airlines and Airport Experts in the Room

Session	Speaker
• Key stakeholder discussion: The role of airports • Key stakeholder discussion: The role of airlines	• *Interviews and discussion*

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Section 6: SAF Business Case and Offtake

Session	Speaker
• Economic principle and perspectives on SAF Implementation	• SAF Expert, Raphaela Spielberg-Daninos and Nipun Jagtap
• Case study: Techno-economic analysis	• *Interactive*, RSB - Esther Hegel
• Book & Claim: Fundamentals & the outlook on market effects and opportunities for airlines and airports	• RSB - Gill Alker

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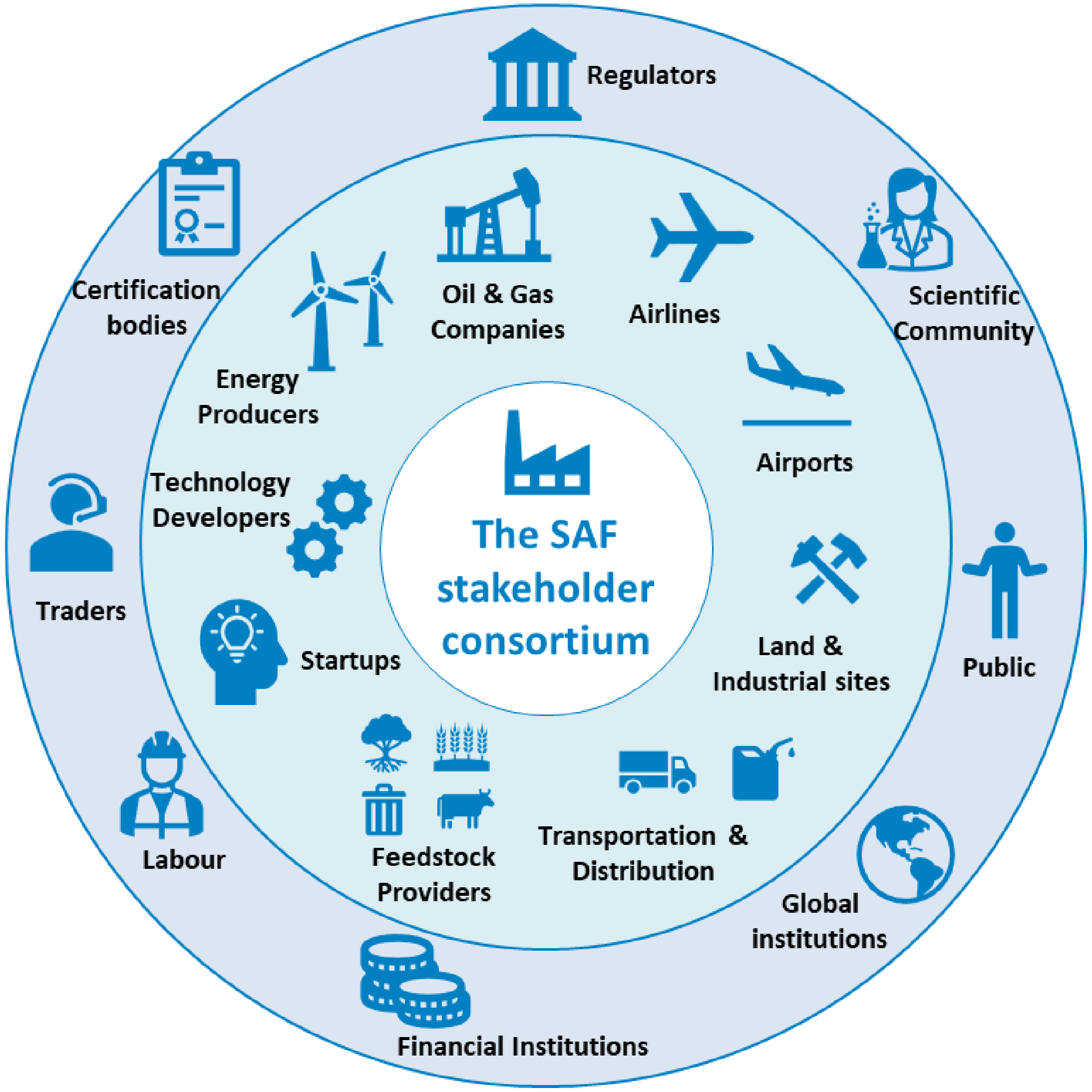
The stakeholder perspective: Changing players with changing roles



Established players

O&G

Current: Focus on HEFA
(+) Need to defossilize their current business
(-) High capex, threat of product cannibalization

Airlines

Current: Shifting role from offtaker to strategic shareholder
(+) Influence on project bankability through comofftakes
(-) Green premium of SAF impairs their businesses margin

New stakeholders

Chemparks

Current: Decarbonization and expertise of by-products
(+) Allocation of product slate into other industries
(-) Traditional industry, not willing to take on the innovation risk

Start-ups

Current: Chance to tap into huge markets for SAF
(+) Faster than the industry taking early technology bets
(-) High initial costs, project risks, lack of expertise

Institutionals

Current: SAF risk-return profile not convincing yet
(+) Interested in aligning portfolios with ESG criteria
(-) "Wait and See" attitude until regulation undermines business case

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Not only a lot of stakeholders, but a lot of variables need to be evaluated to build a profitable project.

<table>
<tr><td>Feedstock</td><td>Biogas</td><td colspan="2">Energy Crop</td><td colspan="2">Residues</td><td colspan="2">MSW</td><td>Oil/Fat</td></tr>
<tr><td>Renewable Energy</td><td colspan="2">Wind</td><td colspan="2">Solar</td><td colspan="2">Water</td><td colspan="2">Geothermic</td></tr>
<tr><td>CO_2</td><td colspan="2">Biogenic</td><td colspan="2">CCU</td><td colspan="2">CCS</td><td colspan="2">DAC</td></tr>
<tr><td>Technology</td><td>HEFA</td><td colspan="2">PtL</td><td colspan="2">WtL</td><td colspan="2">BtL</td><td>AtJ</td></tr>
<tr><td>Maturity</td><td colspan="2">Lab Level</td><td colspan="2">Pilot Plant</td><td colspan="2">FOAK</td><td colspan="2">Commercial</td></tr>
<tr><td>Project Partner</td><td>O&G</td><td colspan="2">Energy Prod.</td><td colspan="2">Tech. Dev.</td><td colspan="2">Startup</td><td>Off-Taker</td></tr>
<tr><td>Refinery</td><td colspan="4">Central</td><td colspan="4">De-Central</td></tr>
<tr><td>Region & Land</td><td colspan="2">Africa</td><td colspan="2">Asia</td><td colspan="2">Americas</td><td colspan="2">Europe</td></tr>
<tr><td>Regulation</td><td colspan="2">Mandates</td><td colspan="2">Incentives</td><td colspan="2">Tax Benefits</td><td colspan="2">Certificates</td></tr>
<tr><td>Costs</td><td>Feed</td><td colspan="2">Products</td><td colspan="2">Utilities</td><td colspan="2">Equipment</td><td>EPC</td></tr>
</table>

- **Number of parameters** are a challenge for **project assessment.**
- There is not a single answer to defined which solution is the best globally. **Careful considerations should be done in order to assess the best option for a specific site**.
- Solid **knowledge** (technology, feedstocks, regulatory, emissions, R&D/ engineering, financing) **needed to assess SAF business cases.**

Source: CBR research 2023; ASEAN Sustainable Finance Taxonomy, 2023

Non-exhaustive

Excel based, freely available models, tools and studies facilitate a TEA

Freely available, excel based models:

Project SkyPower:

- AtJ and FT: https://project-skypower.org/news-publications/open-source-techno-economic-model-e-saf-production

ASCENT Techno-Economic Analyses (Washington State University):

- ATJ: https://doi.org/10.7273/000001461
- FT: https://doi.org/10.7273/000001459
- HEFA: https://doi.org/10.7273/000001460
- CH: https://doi.org/10.7273/000002564

Software options:

Microsoft Excel

ASPEN Plus

CHEMCAD

DWSIM

ORACLE CRYSTAL BALL

@RISK

Sensitivity Analysis

Publicly available feedstock studies:

Publicly available interactive PtL tools:

H_2Atlas-Africa

JÜLICH Forschungszentrum

Bundesministerium für Bildung und Forschung

WASCAL West African Science Service Centre on Climate Change and Adapted Land Use

SASSCAL Southern African Science Service Centre for Climate Change and Adaptive Land Management

PtX global ATLAS

Global PtX Atlas by Fraunhofer

South African Green Hydrogen Atlas

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RSB. For feedback on the TEA tool by RSB, please reach out to Esther Hegel.

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Section 7: SAF Financing

Session	Speaker
• Project financing for SAF: Challenges for bankability and potential solutions	• EASA SAF Expert, Raphaela Spielberg-Daninos
• Case study: Offtake agreement fundamentals and financing mechanisms for airlines to access SAF volumes, considering the interplay with policy.	• *Interactive*

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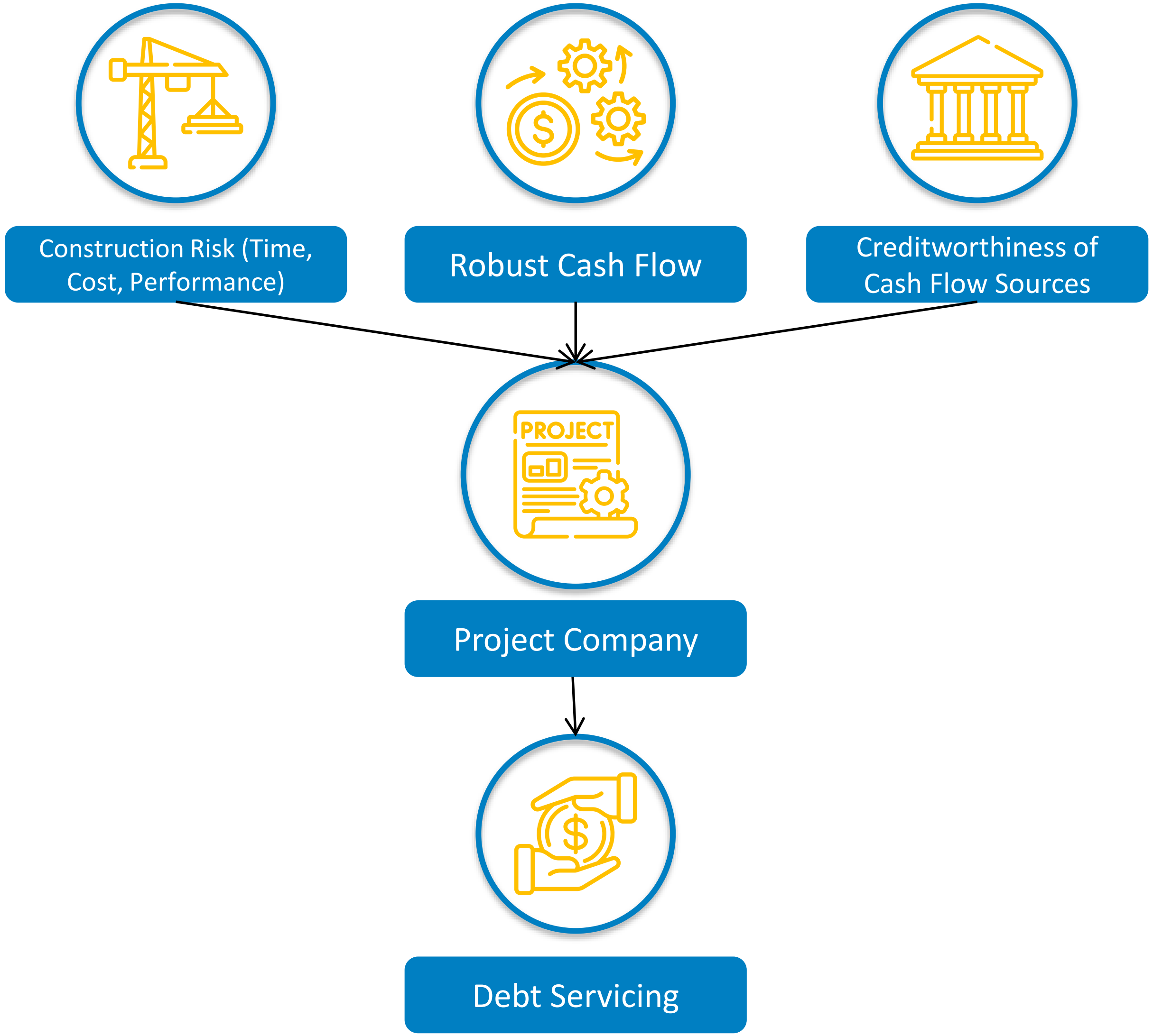
Securing project credit: Key drivers for financial structuring

1. **Ring-Fencing of Project**: The project is ring-fenced within a special purpose vehicle (SPV) to separate business risks and limit exposure.
2. **Debt Servicing from Project Cash Flow:** Debt is repaid using the project's revenue streams after construction is complete, reducing reliance on external funding.
3. **Key Credit Quality Drivers:**
   - **Allocation of Construction Risks**: **Time, cost, and performance risks** are well-defined and mitigated.
   - Robustness of Cash Flows: Project cash flow withstands sensitivities and unforeseen events.
   - **Creditworthiness**: Confidence in the **reliability of cash flow sources.**



Collaborative approach in partner consortia to de-risk for bankability

Technology Risk: Developing technologies with unproven Technology Readiness Levels (TRL) or complex integration challenges, potentially affecting performance and reliability.

Completion Risks: Delays or cost overruns caused by project complexity, unforeseen challenges, or resource shortages, which may prevent timely or budget-compliant completion.

Feedstock Arrangements: Potential disruptions in the supply chain or availability of necessary raw materials, impacting continuous production and project viability.

Offtake Arrangements: Challenges in securing long-term buyers for the products or energy generated, affecting revenue stability.

Project-on-Project Risk: Dependencies on the success or timeline of other projects that could directly impact the progress or outcomes of the current project.

Government Support: Insufficient policy backing or financial support from government entities, which can weaken the project's financial stability and market presence.

Stability of Frameworks: Shifting regulations or market conditions that may undermine project operations or increase compliance costs.

Equity: Insufficient capital investment by sponsors, limiting the project's ability to cover initial costs and making it less attractive to financiers..

Book and Claim Models: Complexity in tracking, verifying, and documenting sustainable credits, which may affect the project's credibility or compliance with sustainability standards.

Competitive Industries: Increased competition from other projects or players within the same sector, threatening the project's market share or profitability.

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Section 8: Policies and Stakeholder Engagement

Title	Speaker
• Global SAF policies: Rationale, status & challenges	• EASA SAF Expert, Christoph Behrendt-Rieken
• Stakeholder collaboration for SAF roadmaps	• EASA SAF Expert, Christoph Behrendt-Rieken and Raphaela Spielberg-Daninos, • Copenhagen Airport - Sabrina Jensen
• General SAF case study	• *Interactive*
• Wrap-up and Closing of the Training	

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Policies and regulation as driver and booster to promote SAF in the market

SAF roadmap building blocks

- **Feedstock Innovation**

- **Conversion Technology Innovation**
- **Building Supply Chains (DSL)**
- **Policy and Valuation Analysis**
- **Enabling End Use**

- The **costs of SAF production** are typically **much higher than for fossil kerosine.**
- **Innovative technologies** for SAF production beside HEFA approach the market, but they need **to achieve maturity and be de-risked**.
- The **development of technologies, production capacities and SAF demand** is currently driven by **global, regional or national regulatory** schemes based on **mandates, incentives and/or self-commitments** either for **SAF volumes or related GHG savings**.
- **Regulations and policies constitute an important base to accelerate and incentivise SAF production**, such as try to overcome: cost differential, financing gap, level playing field, technology maturity, feedstock allocation, final product usage, i.e., the **de-risking role** of SAF policies.
- **The policy and self-commitment landscape** is very heterogeneous. **Harmonization** of **SAF regulation, policies** and **standards** on supranational and national will be of **key importance in order to create a level playing field.**

Recommendations as starting point for policy drafting

1 **Harmonization**	➢ A **harmonization** of SAF regulation, policies and standards on **supranational** and **national** will be of key importance to create **a level playing field**, preferably building coherent national SAF policies aligned with international aviation regulation (e.g., ICAO level)
2 **SAF Roadmaps**	➢ **National SAF roadmaps** defines a **mid-to-long term vision** requiring a **multi-stakeholder approach**. Getting informed on other examples of SAF roadmaps exist may be beneficial (experiences and supportive activities by EASA on drafting SAF roadmaps).
3 **Feedstock**	➢ Making national SAF policy should take in consideration the **regional context** of SAF (e.g., feedstock types and availability). Evaluate **feedstock availability/ feasibility** and potential studies.
4 **Global policies**	➢ Having an **informed position** on **global scenarios** will facilitate the design of appropriate and targeted SAF policies.
5 **Synergies**	➢ The **national policy system** and **interdependencies** with other **industry sectors should be taken in account** (other transportation modes, chemical industry, existing energy mix and national energy policies, existing renewable fuel sector, carbon emission legislation, Direct Supply Line Scenarios (DSL), etc.)
6 **Data-based decisions**	➢ **Collect/retrieve data** and analysis which may be relevant in the **design and monitoring of planned and established SAF policies** to ensure **highest effectiveness and efficiency** with focus on sustainability

SAF Roadmap requires a Vision and Mission as cornerstones for the strategic goals and action plan

Vision

- Contribution of SAF Roadmap to **national decarbonization and net zero goals**
- Portion of SAF in the **national renewables mix**
- **Economic** and **social** beneficial **contribution**

Mission

- Creation of **SAF awareness** and **momentum** in the country
- Being a facilitator **connecting SAF value chain stakeholders**
- Being a **focal point of expertise** and capacities for SAF

Strategic goals

- Expansion of **SAF supply** and **end use**
- **Reduction** of **SAF cost**
- Enhancement of **SAF sustainability**

Action plan

- **Defined actions** with targeted **deliverables** linked to the **strategic goals** (contribution)
- **Defined timelines**, here 360 days plan plus strategic timeline covering three to five years

Examples

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Source: CBR, 2023

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Thank you for your attention!

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