



ICARUS Final Conference

Brussels, 25 September 2026

WP4: BEST PRACTICES AND CONCEPTS

Berta Matas Güell / SINTEF

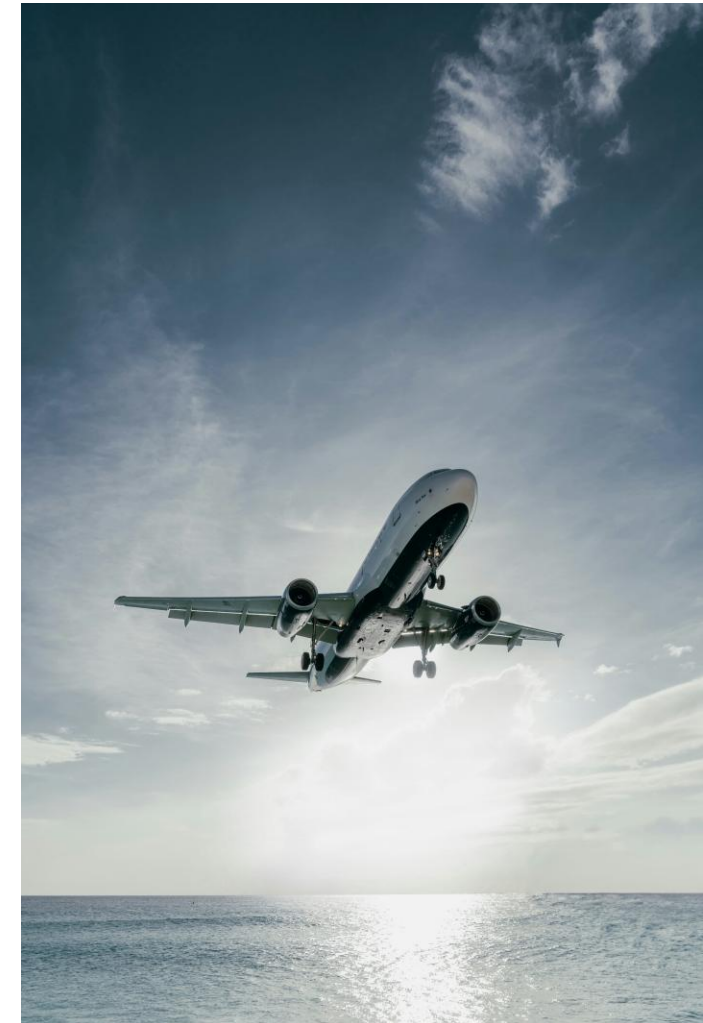
Eduardo Entrena & Esther Hegel / RSB

Kyriakos Maniatis / KM-IIC

WP4 - Objectives

To develop future best practices and concepts along the entire value chain for the three technological pathways selected in Icarus by fostering international cooperation.

- To propose a set of **recommendations to accelerate the scaling up** of the three value chains addressed within ICARUS
- Create strong **synergies** between the **private industry** and the **scientific community** by providing further **guidance for SAF certification** and coordinating the **engagement with oil industries, airports and end-users**
- Foster **international knowledge transfer** to establish long-lasting interactions on the upscaling of SAF, with special focus on the **MIC and Africa**



Activities on SAF Upscaling – The plan



Publicly available information



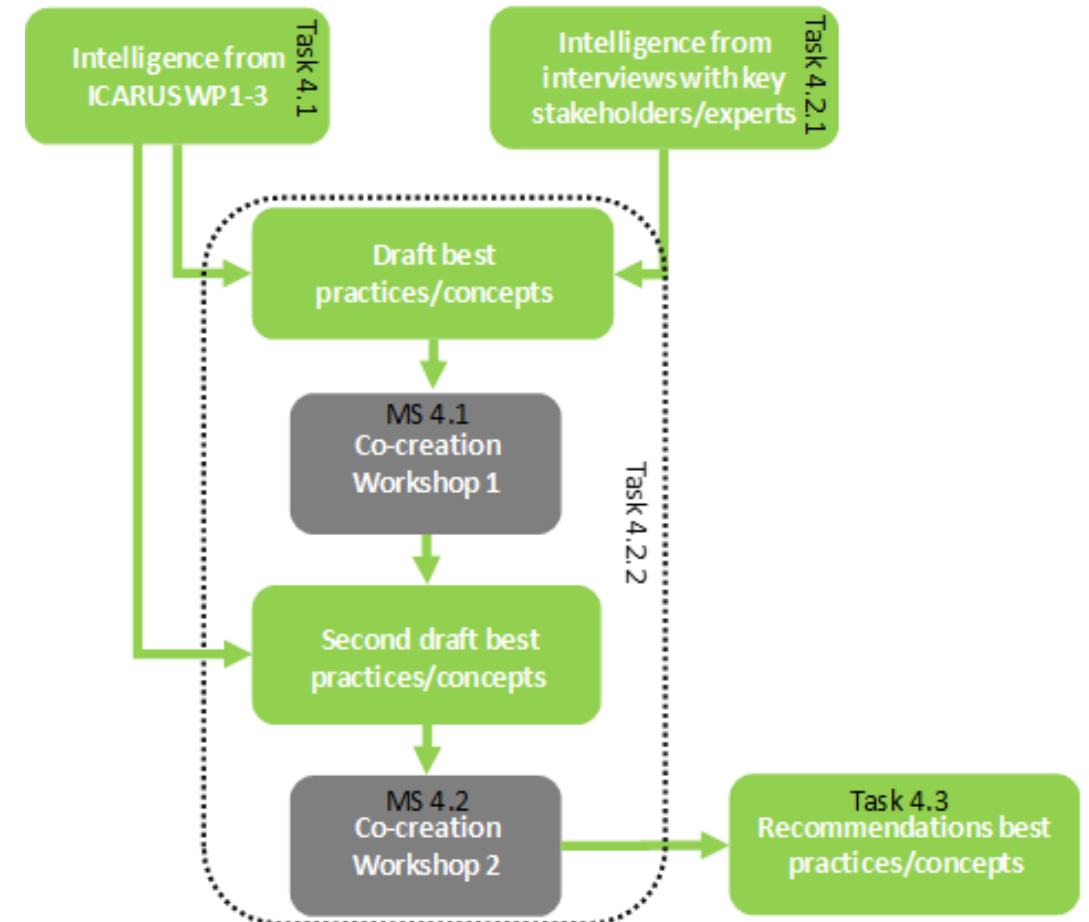
Extensive dedicated interviews with key stakeholders and R&I experts



Co-creation webinars/workshops



Data generated within the project



Activities on SAF Upscaling – Co-creation workshop



EUBCE 2026
The Hague, May 2026
~ 60 participants

PROGRAMME

SAF Upscaling – Time for Action!	
OPENING	
14:00 – 14:10	Welcome and introduction about ICARUS and the work on Best-practices and concepts <i>Berta Matas Güell, Senior Research Scientist, SINTEF, Norway</i>
SESSION 1 – Feedstock, SAF production technologies, Sustainability assessment	
14:10 – 14:20	<i>Facilitated by Berta Matas Güell, Senior Research Scientist, SINTEF, Norway</i> Enabling scalable SAF production through feedstock innovation <i>Myrsini Christou, Head of the Biomass Department, CRES, Greece</i>
14:20 – 14:50	Breaking technological barriers and driving innovation
14:20 – 14:30	• Biocrude oils to SAF – <i>Judit Sandquist, Research Scientist, SINTEF, Norway</i>
14:30 – 14:40	• Isobutanol/alcohols to SAF – <i>Iker Aguirrezabal, Associate Professor, University of the Basque Country, Spain</i>
14:40 – 14:50	• Syngas to SAF – <i>Evert Boymans, Scientist, TNO, The Netherlands</i>
14:50 – 15:05	SAF production: cost analysis and environmental impacts <i>Marcos Djun Barbosa Watanabe, Senior Researcher, NTNU, Norway</i> <i>Niels Dögnitz, Research Associate, DBFZ, Germany</i>
Break (15:05 – 15:20)	

SESSION 2 – Policy, Market, Certification	
15:20 – 15:30	<i>Facilitated by Judit Sandquist, Research Scientist, SINTEF, Norway</i> Policy, Market, Financing needs <i>Kyriakos Maniatis, KM-IIC, Brussels, Belgium</i>
15:30 – 15:40	SAF Sustainability Certification <i>Esther Hegel, Technical lead for industrial decarbonisation, RSB, Switzerland</i>
15:40 – 15:55	Financing instruments for SAF Upscaling <i>Maria Georgiadou, Senior expert Renewable Fuels, Biofuels and Bioenergy, European Commission</i>
SESSION 3 – External insights through panel and Co-creation discussions	
15:55 – 16:25	Panel discussion with selected experts – Moderated by Judit Sandquist, Research Scientist, SINTEF, Norway • <i>Bart Suijkerbuijk, Global Head of Partnerships and Technology for Low-Carbon Fuels, Shell, The Netherlands</i> • <i>Claudia Esarte Relanzón, Product Design Technical Advisor - Specialist in renewable liquid fuels, transport decarbonization and energy transition, Repsol, Spain</i> • <i>Glauca Souza, Professor, University of Sao Paulo, Brazil (tbc)</i> • <i>Ib Johannsen, Founder and CTO, Circlia Nordic ApS, Denmark</i> • <i>Maria Georgiadou, Senior expert Renewable Fuels, Biofuels and Bioenergy, European Commission</i>
16:25 – 16:55	*Co-creation through open discussion with all participants – Facilitated by • <i>Esther Hegel, Technical lead for industrial decarbonisation, RSB, Switzerland</i> • <i>Franziska Müller-Langer, Head of Department, DBFZ, Germany</i> • <i>Kyriakos Maniatis, KM-IIC, Brussels, Belgium</i>
CONCLUDING REMARKS	

Activities on SAF Upscaling – The execution



Activities on SAF Upscaling – Key findings



The results: What determines successful SAF production



OVERARCHING TAKEAWAY

Scale-up is now a coordinated deployment challenge: match pathways to feedstocks, de-risk investment and maintain a diversified SAF portfolio.

Activities on SAF Upscaling – Key findings

Main take-aways – Biocrude oils to SAF

Converts wet, difficult waste streams that other routes cannot readily use.

FEEDSTOCK FLEXIBILITY

CIRCULARITY POTENTIAL

EARLY COMMERCIAL STAGE

1 Best fit is wet and problematic biomass

HTL expands the feedstock pool to sewage sludge, digestates, wastewater-derived biomass and other high-moisture residues, without drying.

2 Scale-up depends on stable continuous operation

Recurring bottlenecks are contaminants, corrosion, fouling, solids handling, phase separation and large process-water streams.

3 Value recovery is central to the business case

Priority innovations are aqueous-phase and by-product valorisation, salt separation, robust catalysts and integration with green hydrogen.



Figure and layout: MS Copilot

KEY IMPLICATION Demonstrate consistent biocrude quality over long campaigns and progress ASTM qualification before broad aviation deployment

Activities on SAF Upscaling – Key findings

Main take-aways – Alcohols to SAF

Strong global potential, but European deployment is constrained by eligible alcohol supply and economics.

ASTM-CERTIFIED

EXISTING ALCOHOL KNOW-HOW

EU FEEDSTOCK CONSTRAINT

1

The route builds on established alcohol systems

Existing ethanol experience, logistics and certification support scale-up; isobutanol offers attractive conversion and fuel-quality characteristics.

2

The limiting step is sustainable alcohol production

In Europe, eligible lignocellulosic alcohol is scarce. Isobutanol production still faces high feedstock and enzyme costs plus fermentation limitations.

3

Innovation should target higher yields and value-creation

Priorities include improved microorganisms, membrane-based recovery, lower-cost enzymes, selective catalysts and multi-product biorefineries.

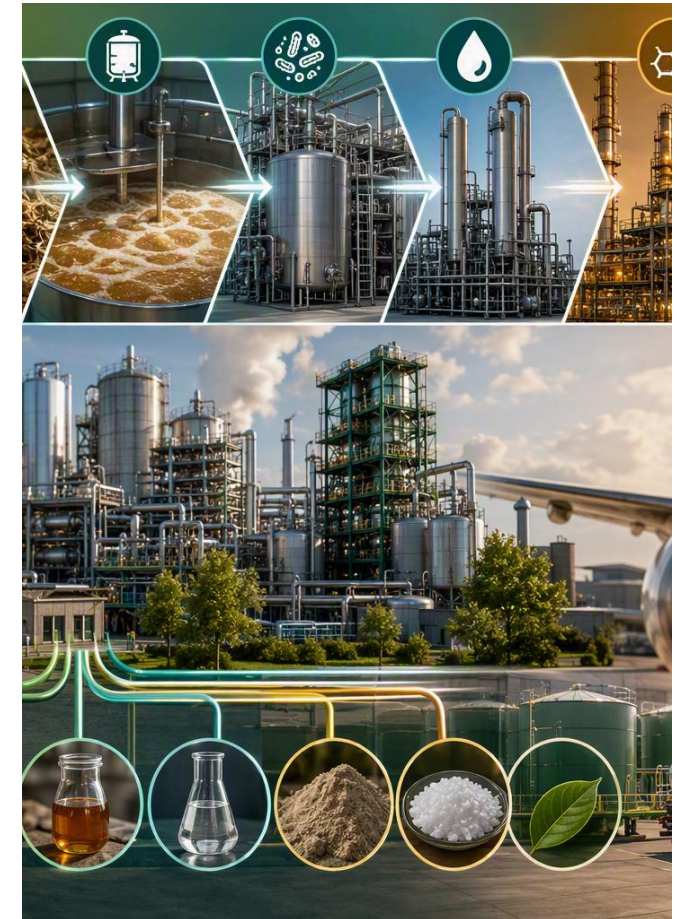


Figure and layout: MS Copilot

KEY IMPLICATION

Focus on competitive 2G alcohol supply and integrated biorefineries

Activities on SAF Upscaling – Key findings

Main take-aways – Syngas to SAF

The most consistently supported candidate for large-scale SAF production in Europe.

ASTM-CERTIFIED

LARGE-SCALE POTENTIAL

HIGH CAPEX

1 Maturity and feedstock range provide momentum

Gasification-FT can use agricultural and forestry residues, wastes and other eligible feedstocks; FT synthesis is established and market-ready.

2 Capital intensity and sufficient system integration dominate risk

Recurring constraints are high CAPEX, dispersed feedstock logistics, gas cleaning, contaminant-sensitive catalysts and the absence of integrated commercial biomass-to-SAF plants.

3 Improvement must target the whole system

Priorities are robust gasification and cleaning, better catalysts, renewable-hydrogen integration, CO2 by-product valorization

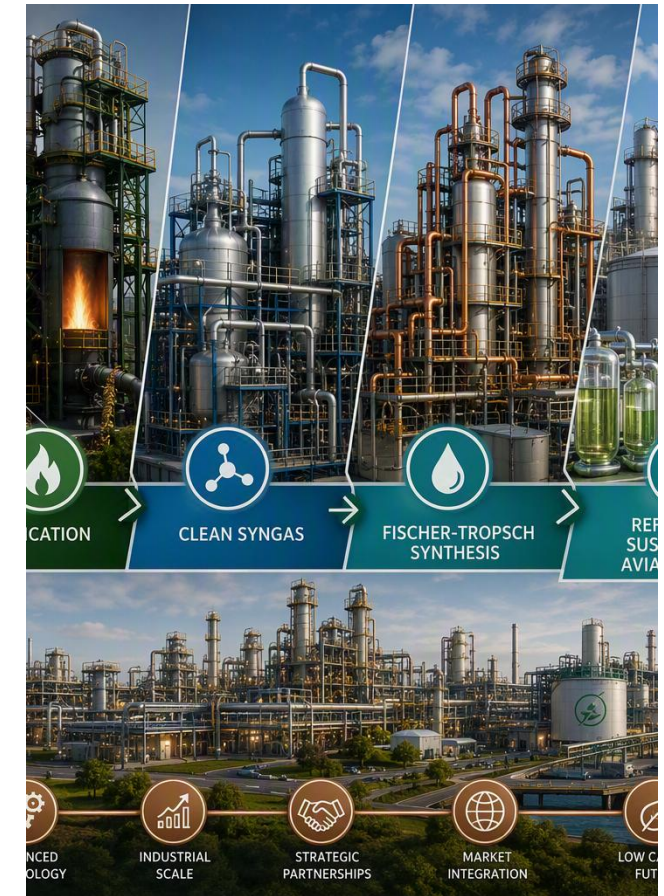


Figure and layout: MS Copilot

KEY IMPLICATION

Align plant scale with realistic regional biomass supply and de-risk integrated demonstration

Activities on SAF Upscaling – Publication

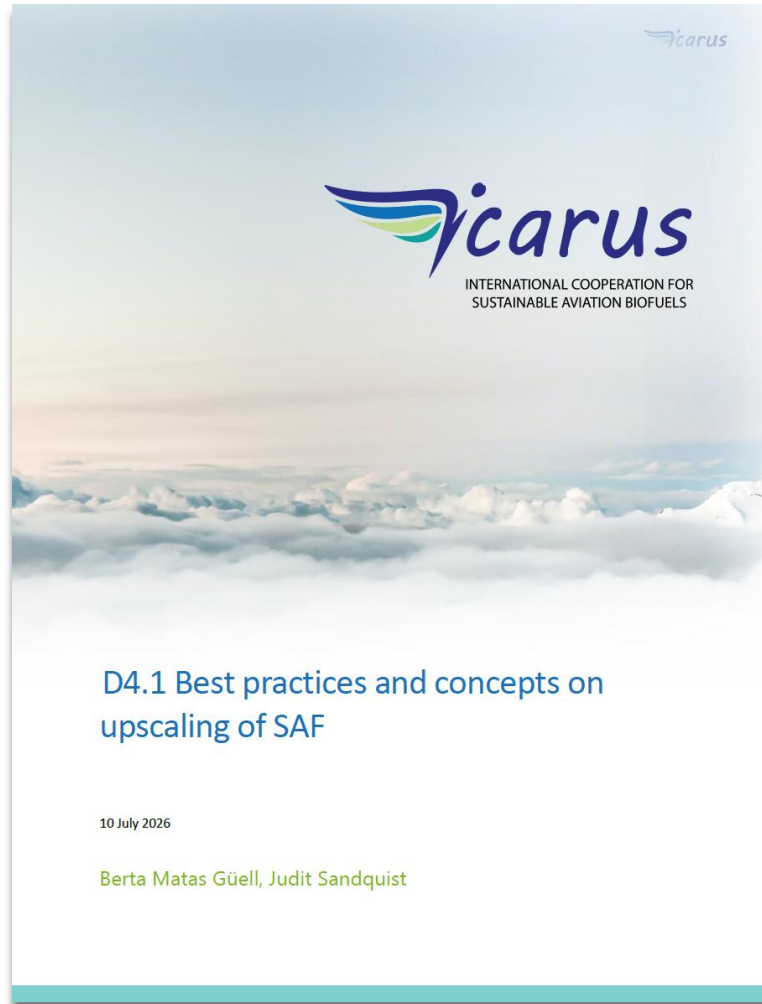
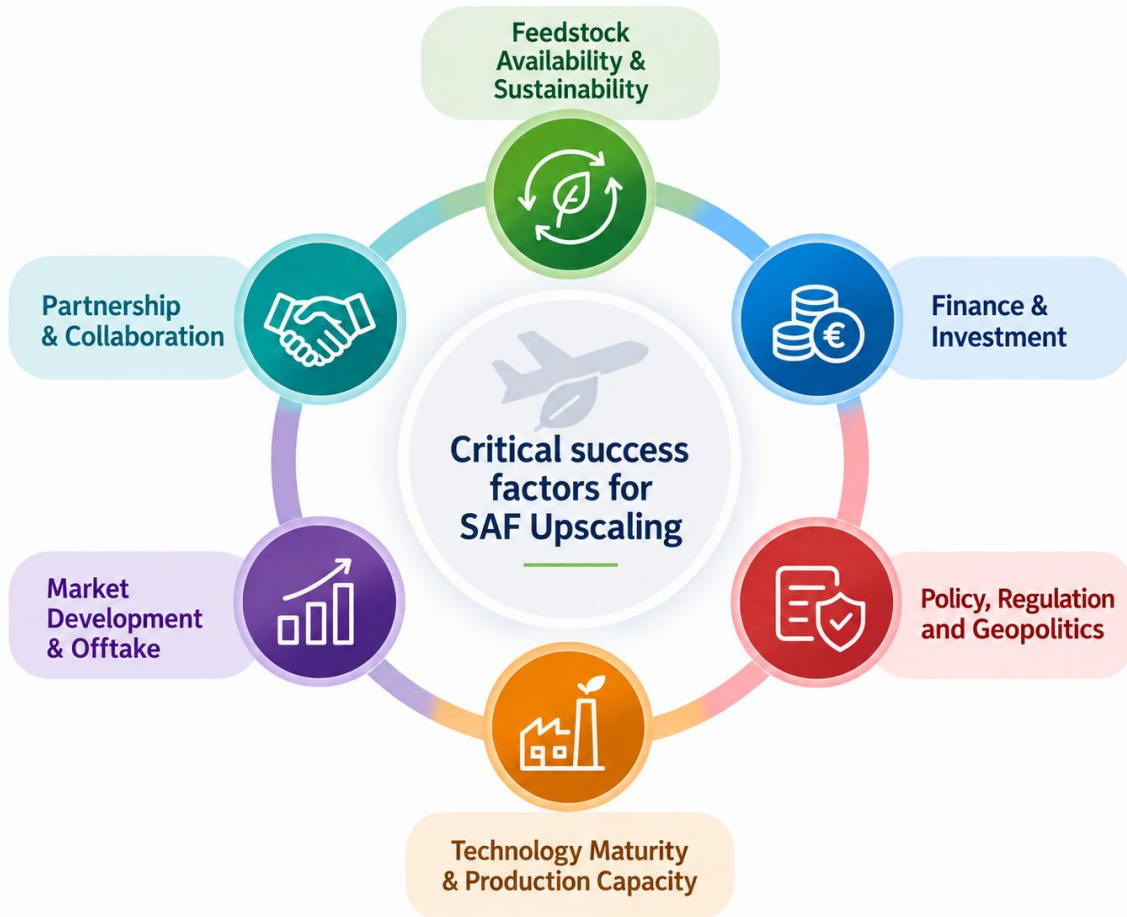


Table of Contents	
List of acronyms	7
Executive summary	9
1 Introduction	12
2 Feedstocks.....	12
2.1 Drivers	13
2.2 Barriers/Constraints	13
2.3 Innovations.....	13
3 Biocrude oils to SAF.....	14
3.1 Drivers	15
3.2 Barriers/Constraints	16
3.3 Innovations.....	17
4 Isobutanol to SAF	17
4.1 Drivers	18
4.2 Barriers/Constraints	19
4.3 Innovations.....	20
5 Syngas to SAF	21
5.1 Drivers	21
5.2 Barriers/Constraints	22
5.3 Innovations.....	22
6 Key messages from cost-effectiveness and sustainability project assessments	23
6.1 Techno-economic assessment	23
6.2 Environmental assessment	24
6.3 Social assessment.....	25
7 Policy and market.....	25
7.1 Drivers	25
7.2 Barriers/Constraints	26
8 Insights from extensive interviews with key stakeholders	28
8.1 Feedstocks.....	28
8.2 Biocrude oils to SAF.....	29
8.3 Isobutanol to SAF	30
8.3.1 Ethanol to SAF	30
8.4 Syngas to SAF.....	31
8.5 Across value chains	31
8.6 Policy and market.....	32
8.7 Future production and upscaling of SAF in Europe and beyond.....	33

8.7.1 SAF production in Europe.....	33
8.7.2 SAF production outside Europe.....	34
8.8 Key insights and future recommendations	34
9 Outcomes from the co-creation webinar series	35
9.1 Co-creation webinar on biocrude oils to SAF	36
9.1.1 Insights from the external presentations	36
9.1.2 Additional gains from the co-creation exercise.....	38
9.2 Co-creation webinar on syngas to SAF.....	44
9.2.1 Insights from the external presentations	44
9.2.2 Additional gains from the co-creation exercise.....	47
9.3 Co-creation webinar on alcohols to SAF	53
9.3.1 Insights from the external presentations	53
9.3.2 Additional gains from the co-creation exercise.....	55
10 Outcomes from the onsite co-creation workshop.....	61
10.1 Updates from the European Commission.....	63
10.2 Insights from the panel discussion.....	63
10.3 Additional gains from the co-creation exercise	64
10.3.1 Station on Policy & Market.....	64
10.3.2 Station on SAF Sustainability Certification	67
10.3.3 Station on Technical Innovations	68
11 Conclusions	74

Activities on SAF Upscaling – Additional ongoing work

6 guidelines for SAF upscaling



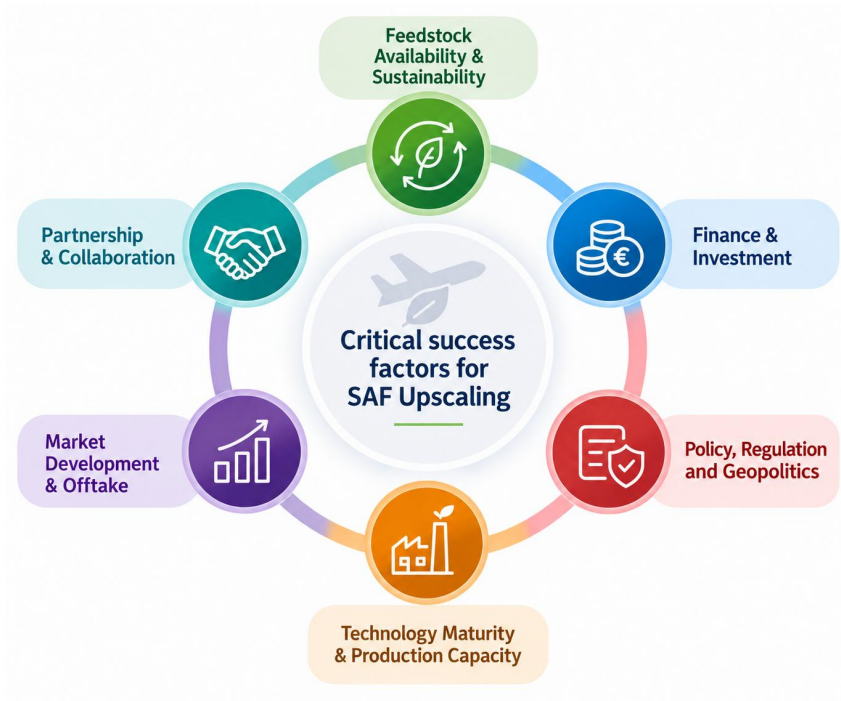
Challenge

Key enabling actions

Stakeholder responsibility

Activities on SAF Upscaling – Additional ongoing work

6 guidelines for SAF upscaling



Secure Resilient Sustainable Feedstock Supply



Improve Project Economics and Mobilize Capital



Accelerate Technology Commercialization and Capacity Expansion



Create Stable and Resilient Framework Conditions

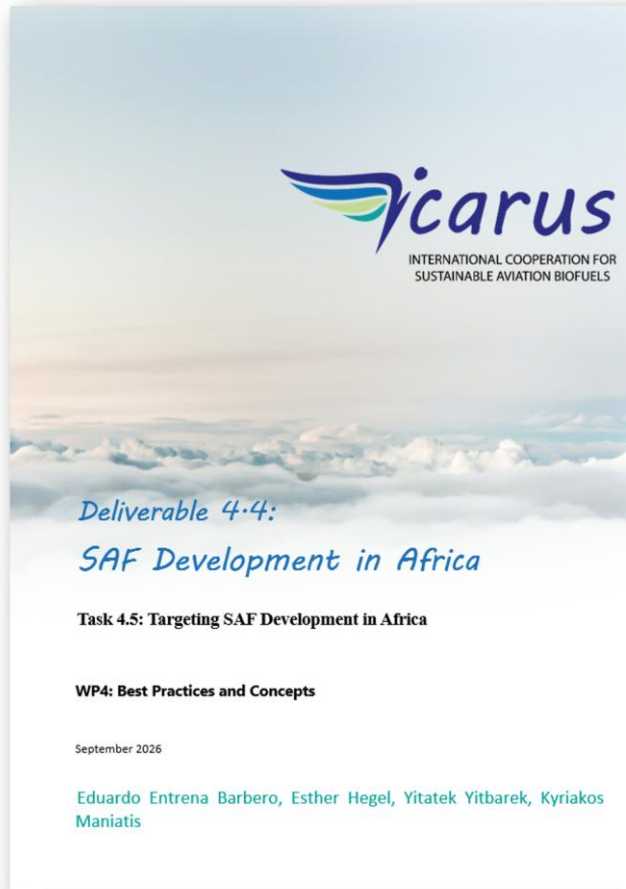


Strengthen Market Confidence and Revenue Certainty



Strengthen Value-Chain Partnerships and Collaboration

Activities on SAF Development in Africa (Task 4.5)



Goal

Provide a **high-level overview** of SAF readiness in Africa beyond feedstock potential, providing research, policy, and **strategic discussions** on SAF in **non-EU contexts**

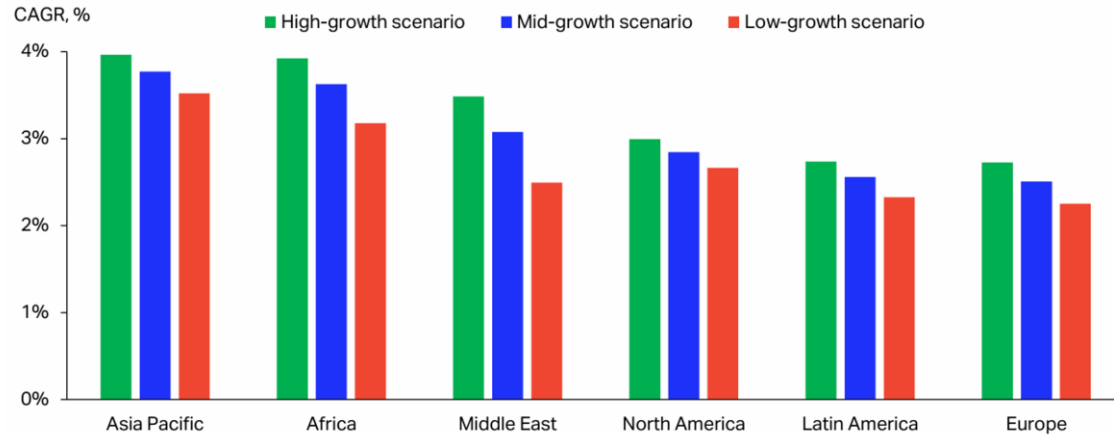
Process

Developed in close collaboration and engagement with **expert stakeholders**, including 3 webinars, 2 conference presentations and 1 Expert Deep-Dive workshop (including representatives from ICAO, IATA, AFCAC, Univ. Of Hasselt, AfriSAF, African Union and others)

Contents

1. Africa's emerging role in a growing global aviation market
2. Analysing the status quo of SAF development in Africa
3. Findings and strategic discussion
4. Priorities and recommendations

Findings on SAF Development in Africa (Task 4.5)

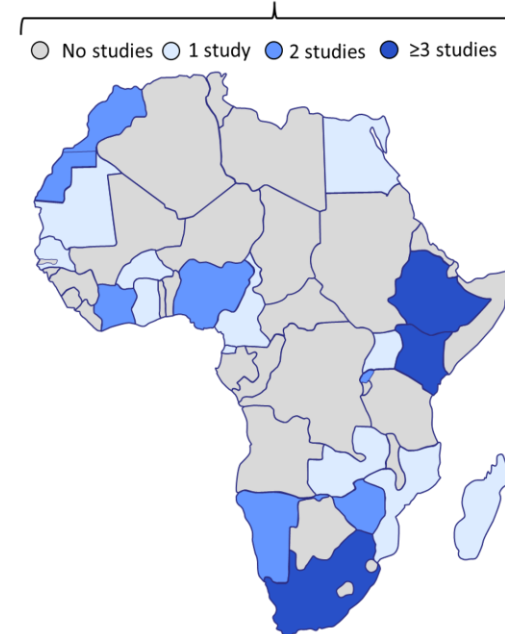


Source: IATA Sustainability and Economics

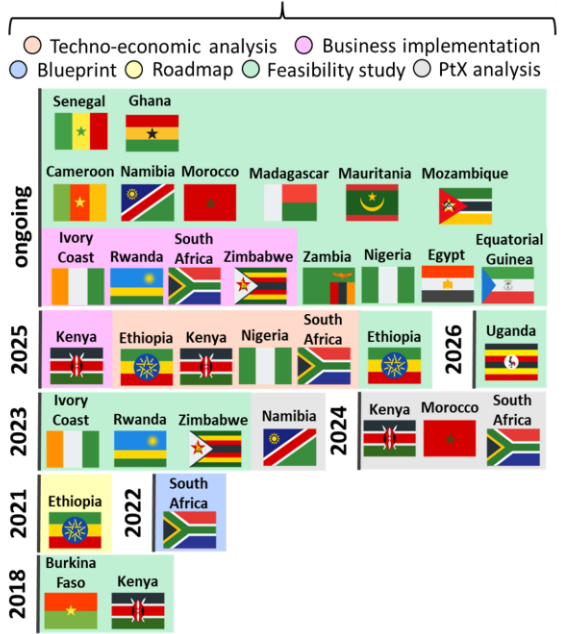
- Africa is among the world's fastest growing aviation markets to 2050
- 3.6% annual growth; intra-African travel grows 4.9% (mid growth scenario)
- Yet Africa is only ~2% of global air traffic today

--> Growth is both an economic opportunity and a climate challenge

Number of SAF-related studies by country



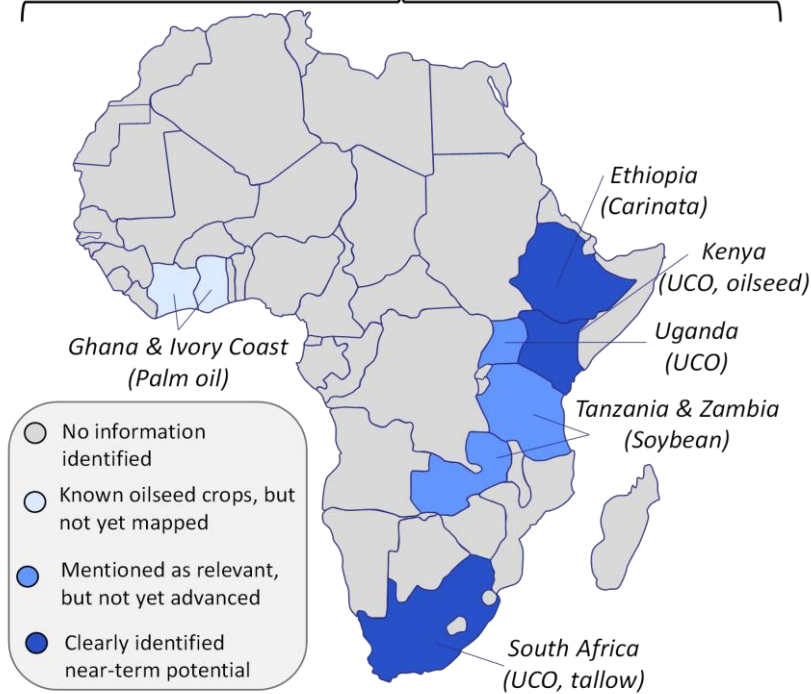
Types of SAF-related studies by country in a timeline



- SAF Assessments have expanded rapidly across Africa in the past years
- However, central Africa, landlocked and island states are less covered
- Overall, no harmonised continental assessments available

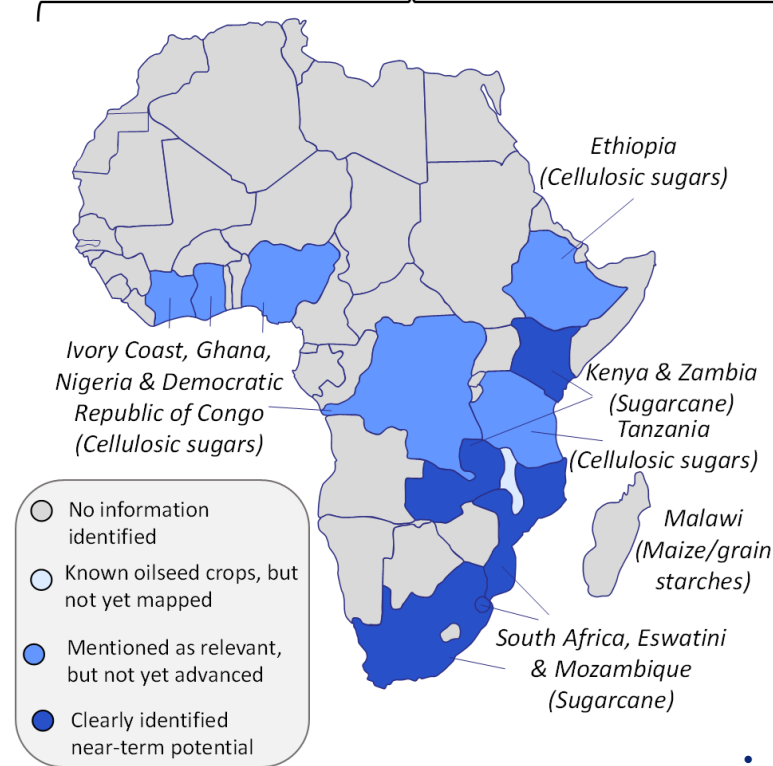
Findings on SAF Development in Africa (Task 4.5)

Oil-based feedstocks status by country



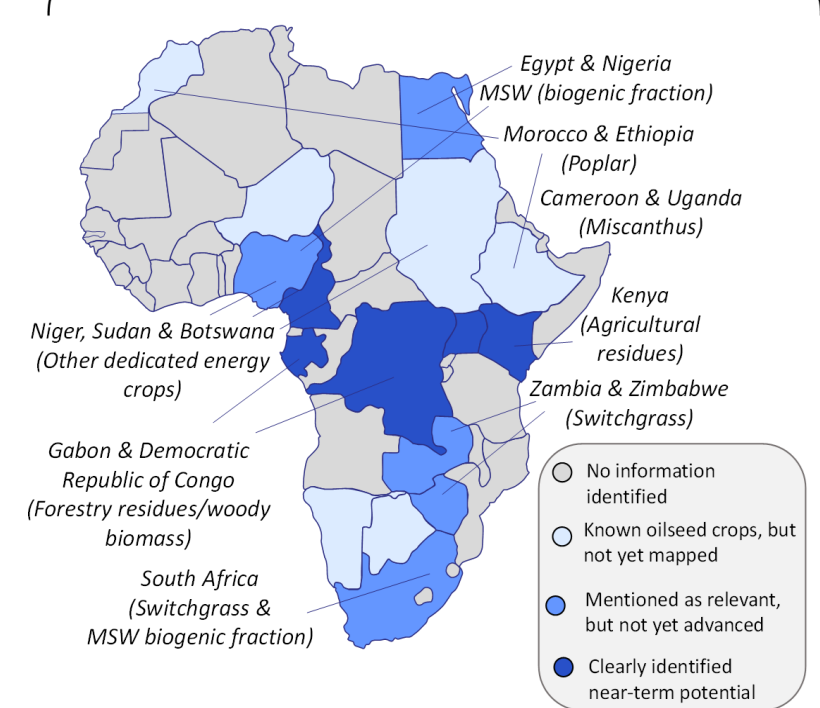
- UCO, tallow and oilseeds are the main HEFA feedstocks
- Strongest near-term potential: South Africa, Kenya, Ethiopia
- Deployment depends on logistics and traceability, not volumes alone

Sugar & starch feedstocks status by country



- AtJ is strongest where sugar mills and ethanol exist
- South Africa, Mozambique, Kenya, Zambia, Eswatini lead
- Cassava adds West African potential, with food-security care

Lignocellulosic biomass feedstocks status by country

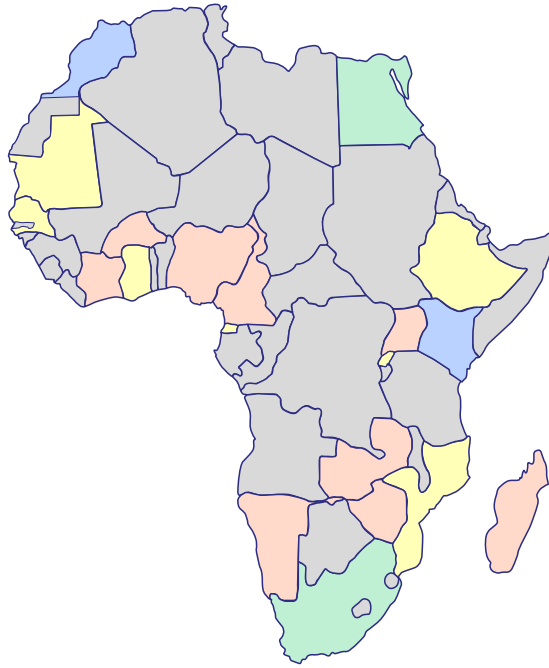


- Residues and perennial grasses: largest long term base
- Strong potential in Central, Eastern and Gulf of Guinea Africa
- Mozambique, Tanzania and Zambia gain from forestry growth
- Needs removal guidelines, aggregation hubs and logistics

Findings on SAF Development in Africa (Task 4.5)

SAF readiness profiles by country

- No SAF-related studies to date
- Structural opportunity
- Export-oriented development
- Capital-enabled deployment
- Early industrial implementation



Country examples by readiness profiles

Capability exists, but is inactive	
Nigeria  Active in SAF research, co-processing potential and hosting capacity-building workshops, but lacking concrete commercial-scale SAF facilities to date.	Cameroon  Identified in the continental SAF strategy pilot list; limited domestic conversion projects yet.
Zimbabwe  Ivory Coast  Included in SAF strategy plans but no major operational SAF projects reported.	
Feedstock scaling, limited domestic processing	
Ethiopia  ATJ SAF from molasses and sugarcane is under development, and a large SAF facility investment was announced in 2025, but production is still emerging.	Ghana  SAF projects announced (e.g., SAF plant phases), but largely driven by international players and pilots rather than domestic manufacturing.
Senegal  Rwanda  Involved in ACT-SAF, but with limited industrial deployment.	
Capital committed, projects emerging	
Kenya  Large-scale investments by development financiers like IFC and international partners building agri-hubs and processing capacity indicate concrete deployment readiness.	Morocco  Government-led renewable energy and green hydrogen partnerships, including planned SAF plants and commercial SAF flights, signal serious capital-backed scale-up.
Industrial base and implementation underway	
South Africa  Expertise in FT and green hydrogen underpins e-SAF development, with projects like HyShiFT at SASOL Secunda aligned with the 2021 Hydrogen Society Roadmap targeting 10 GW electrolysis and 500 kt hydrogen by 2030.	Egypt  Included in ICAO SAF capacity-building partnerships and pursuing biofuel strategic initiatives, with early industrial planning and feasibility work underway.

Findings on SAF Development in Africa (Task 4.5)

Cross-cutting insights from the six building blocks of the SAF value chain

High potential, Low Mobilisation

Large feedstock and energy potential, but only a small share can currently be mobilised



Uneven Readiness Across Countries

Capabilities differ widely; countries fall into distinct readiness profiles



Infrastructure & Certification Bottlenecks

Storage, pre-treatment, blending and sustainability verification remain limited



Markets Driven by External Demand

Little domestic SAF demand; early opportunities depend on EU/CORSIA markets



Pathway Feasibility Varies Over Time

HEFA is near-term; AtJ medium-term; FT/PtL long-term, but capital-intensive



Early but Fragmented R&D Activity

Growing research and pilots, but concentrated in few countries and not yet connected



Key Messages on SAF Development in Africa (Task 4.5)

1. Africa has strong long-term potential, but near-term progress depends on closing mobilisation and infrastructure gaps
2. SAF strategies should build on regional strengths, not a single pathway for all countries
3. HEFA and selected AtJ offer early entry points; FT and PtL need longer-term industrial development
4. Feedstock, sustainability, logistics, certification, LCA and MRV capacity are prerequisites for credible market access
5. Policies and market instruments must be sequenced with certified supply, and progress requires coordinated action across government, industry, finance, research and international partners

Tasks 4.6 & 4.7: Coordination with Concawe, & End Users

Coordination with Airlines proved very difficult and, in the end, failed.

Coordination with Concawe and Airports was effective and constructive.

To facilitate coordination it was decided to invite Concawe and Airports Regions Council to join the EEAB so that the number of meetings would be reduced but most importantly the external advisors to ICARUS would also meet. This proved very effective during the discussions and webinars.

External Executive Advisory Board Key expertise	Contribution in the project
Dr Robert Baldwin, National Laboratory of the Rockies (NLR) Expert in catalysis, reaction engineering, biomass gasification, liquefaction, upgrading of bio-oil,	Innovation in Syngas-SAF Value Chains
Dr Marisol Berti, North Dakota State University (NDSU) Expert in forage, cover crops, bioenergy crops and cropping systems.	Innovation in feedstock
Prof. Glaucia Souza, FAPESP Bioenergy Research Program Coordinator University of São Paulo, IEA Bioenergy TCP Task 39 Co-Leader on Biofuels for Transport	Capacity building globally
Tomas Ekbom, Program Director, BioDriv, Svebio – Swedish Bioenergy Association IEA Bioenergy TCP Task 39 Co-Leader on Biofuels to Decarbonize Transport	
Marco Buffi and Anne Bouter, JRC Experts in GHG emissions calculations of SAF for both REDIII and ICAO CORSIA' initiative	Sustainability assessments
Themistoklis Neokosmidis and Abinash Ramasary, Concawe Low Carbon Pathways Science Associate	Coordination with the Oil Sector
Stephen Dooley and Yuan-His Chier, Trinity College Dublin, Experts in SAF Standardisation process at the EU SAF Clearing House	Standardization of biofuels
Sergi Alegre and Andrea Ivasivka General Director and Policy Expert in Airport Regions	Coordination with the Aviation sector

Tasks 4.6 & 4.7: Coordination with Concawe & End Users

Seven webinars with the EEAB were organised after the ICARUS work had progressed enough to deliver high-value information and data for meaningful discussions:

28 November 2025	Isobutanol to SAF (Johan Thevelein)
05 December 2026	Crude to SAF (Paula Costa)
11 December 2026	Syngas to SAF (Berend Vreugdenhil)
26 March 2026	SAF Policies (Kyriakos Maniatis)
23 April 2026	SAF Market developments (Kyriakos Maniatis & Esther Hegel)
29 May 2026	SAF Certification (Esther Hegel)
15 September 2026	ICARUS Results

Overall the coordination with Concawe, Airports Regions Council and EEAB was effective and valuable suggestions and recommendations were provided by the participants to ICARUS.

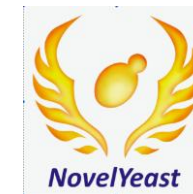
Key messages from Concawe, Airports & EEAB

- The types of resources, value chains and process steps selected by ICARUS are highly relevant and important for the global deployment of SAF in the medium term to long term.
- The information, data and updates on SAF policies and SAF markets development compiled by ICARUS are valuable and supportive in having a clear view of the global developments. The Work on SAF in Africa provide a clear and rare picture of the situation in this continent.
- The technical and overall results presented in the webinar of 15/09/2026 are very promising and work should continue in all 3 value chains as well as policy and market development.

Thank you



Partners



Associated Partners



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