Side-Event at COP28

Clean Energy and Capacity Building to Support Aviation's Journey towards Net-Zero 2050

Tuesday, 5 December 2023

Blue zone, Kenya Pavilion, 09:45 - 11:15

Clean Energy and Capacity Building to Support Aviation's Journey towards Net-Zero 2050

PROGRAMME

1. Overview of ICAO work on clean energy for aviation – ***ICAO Video for COP28***
2. Recent developments by ICAO, including the outcomes from the 3rd ICAO Conference on Aviation Alternative Fuels (CAAF/3) – ***Jane Hupe, Envoy of ICAO Secretary General to UNFCCC COP & Secretary of ICAO Committee on Aviation Environmental Protection (CAEP)***
3. Kenya`s work on SAF – ***Francis Mwangi, Kenya member and Vice-Chairperson of CAEP***
4. PtX-Hub approach to power to liquid (PtL), contribution to the ICAO ACT-SAF programme, and financing opportunities for aviation clean energy – ***Christoph Wolff, Professor Economics & Social Sciences at University of Cologne***

Questions & Answers Session

Overview of ICAO work by the Envoy of ICAO Secretary General to the UNFCCC COP

Ms. Jane Hupe

ICAO

Video

Special Environment Report

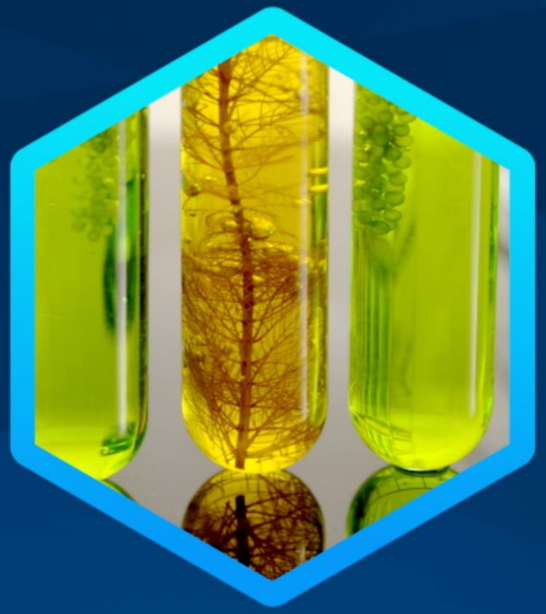
CAAF/3

2023

ICAO Global Framework for SAF, LCAF and other Aviation Cleaner Energies

Collective Vision

Regulatory Foundation



Implementation Initiatives

Facilitate Financing

Aviation Energy Transition in ON
Welcome on board!

CLEAN ENERGY AND CAPACITY BUILDING TO SUPPORT AVIATION'S JOURNEY TOWARDS NET-ZERO 2050
5TH DECEMBER, KENYA PAVILION IN DUBAI-COP28

Kenya's Status on Sustainable Aviation Fuels (SAF) Development

Francis Mwangi
Kenya CAEP member and Vice Chairperson of CAEP
Kenya Civil Aviation Authority / Hasselt University (Belgium)
05.12.2023

General

PRESENTATION OUTLINE

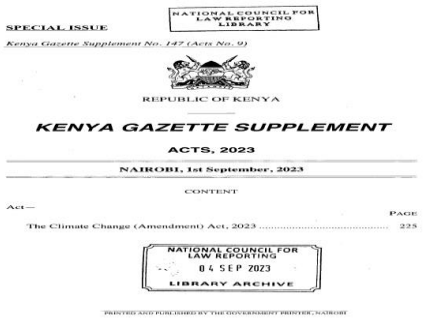
- KEY AVIATION NET ZERO COMMITMENTS
- KENYA SAF STATUS
- SAF STAKEHOLDER MAPPING
- SAF CHALLENGES
- SAF SUCCESS
- LESSONS LEARNT
- SAF PRIORITY ACTIONS

General

Kenya's Aviation Net Zero Commitments

Implementation of The Climate Change (Amendment) Act, 2023

Implementation of ICAO Annex 16 on Environmental protection by developing relevant regulations.


SPECIAL ISSUE

NATIONAL COUNCIL FOR LAW REPORTING LIBRARY

Kenya Gazette Supplement No. 147 (Acts No. 9)

REPUBLIC OF KENYA

KENYA GAZETTE SUPPLEMENT

ACTS, 2023

NAIROBI, 1st September, 2023

CONTENT

Act— PAGE

The Climate Change (Amendment) Act, 2023 223

NATIONAL COUNCIL FOR LAW REPORTING 04 SEP 2023 LIBRARY ARCHIVE

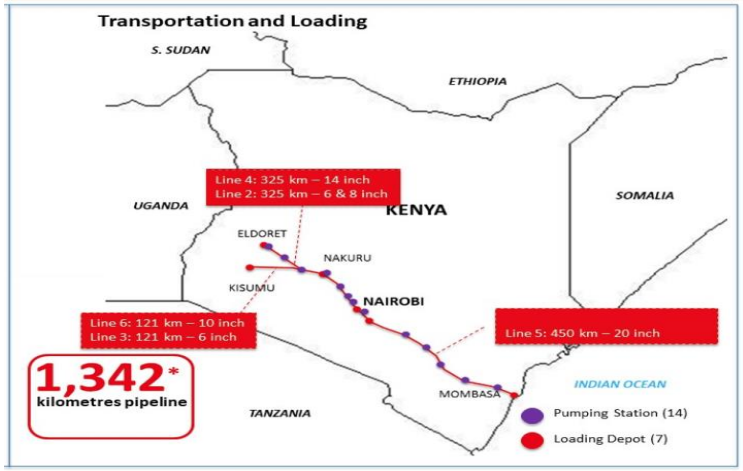
Created an Aviation environmental protection department in KCAA

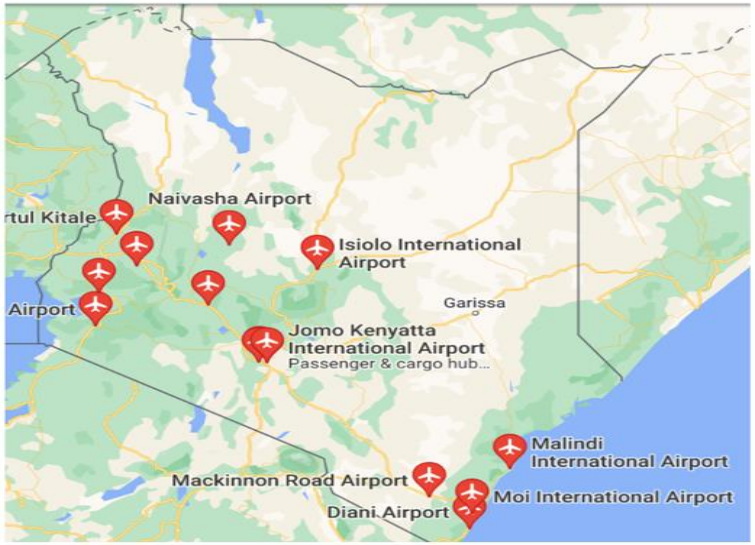
Development, implementation and review **of State Action plan for the environment.**

Kenya decided to **voluntarily participate in the CORSIA** scheme with effect from 2021 to 2023.

SAF feasibility study was conducted in 2018

Kenya SAF Status: Background





Kenya used to have a **refinery in Mombasa** that was closed for commercial reasons in 2013. All jet fuel used in Kenya is currently imported

Kenya has a **liquid fuel pipeline system** that connects the port of Mombasa and the old refinery with the **main airports**.

A study commissioned by ICAO and published in 2018 examined the feasibility of various **potential feedstocks for SAF** production in Kenya, including an initial assessment of key barriers. (UCO, MSW etc)

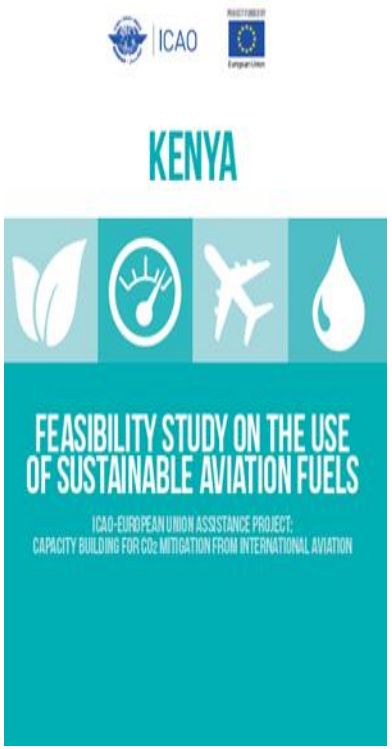
SAF workshop Held on **11 and 12th September 2023**

Kenya SAF Status

RESULTS FROM SAF FEASIBILITY STUDIES REPORT 2018

- One of the promising **mitigation measures identified** in Kenya's State Action Plan was the development and deployment of sustainable aviation fuels (SAF) for international aviation, that have the potential to reduce life-cycle CO2 emissions compared to current aviation fuel (Jet A).

- As part **of the ICAO-EU assistance project**, a study into the feasibility of a commercial SAF supply chain was conducted in Kenya in 2018

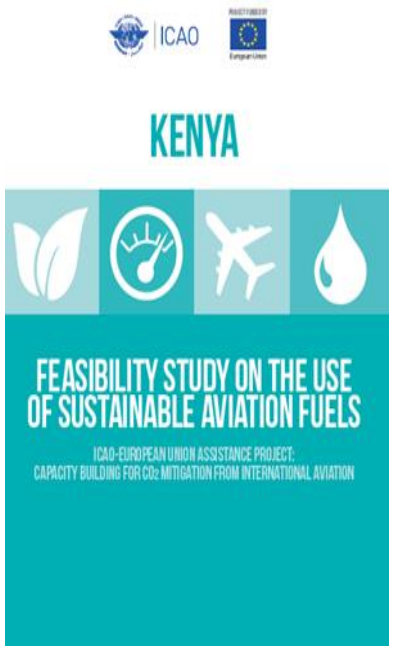


RESULTS FROM SAF FEASIBILITY STUDIES REPORT 2018 CONT.

1) The study examined the **feasibility of various potential** feedstocks based on conflicting uses, logistics, co-benefits, volumes and socio-economic factors.

2) It **identifies paths and required actions** that could be pursued by relevant stakeholders to develop a viable SAF industry.

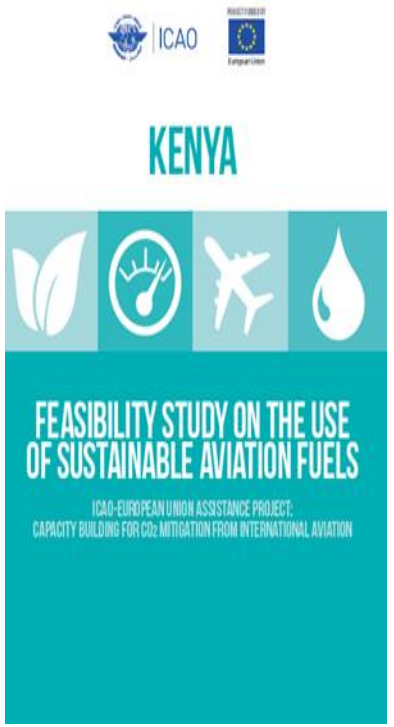
3) It identifies **key barriers** and presents fact-based outcomes to assist stakeholders in preparing business and policy recommendations.



RESULTS FROM SAF FEASIBILITY STUDIES REPORT 2018 CONT.

SAF STUDY FEEDSTOCK OPTIONS

Molasses	Bagasse	Cane Tops	Jatropha
Sweet Sorghum	Castor Seed	Coconut	Croton Nut
Cassava	Sunflower	Water Hyacinth	Municipal waste

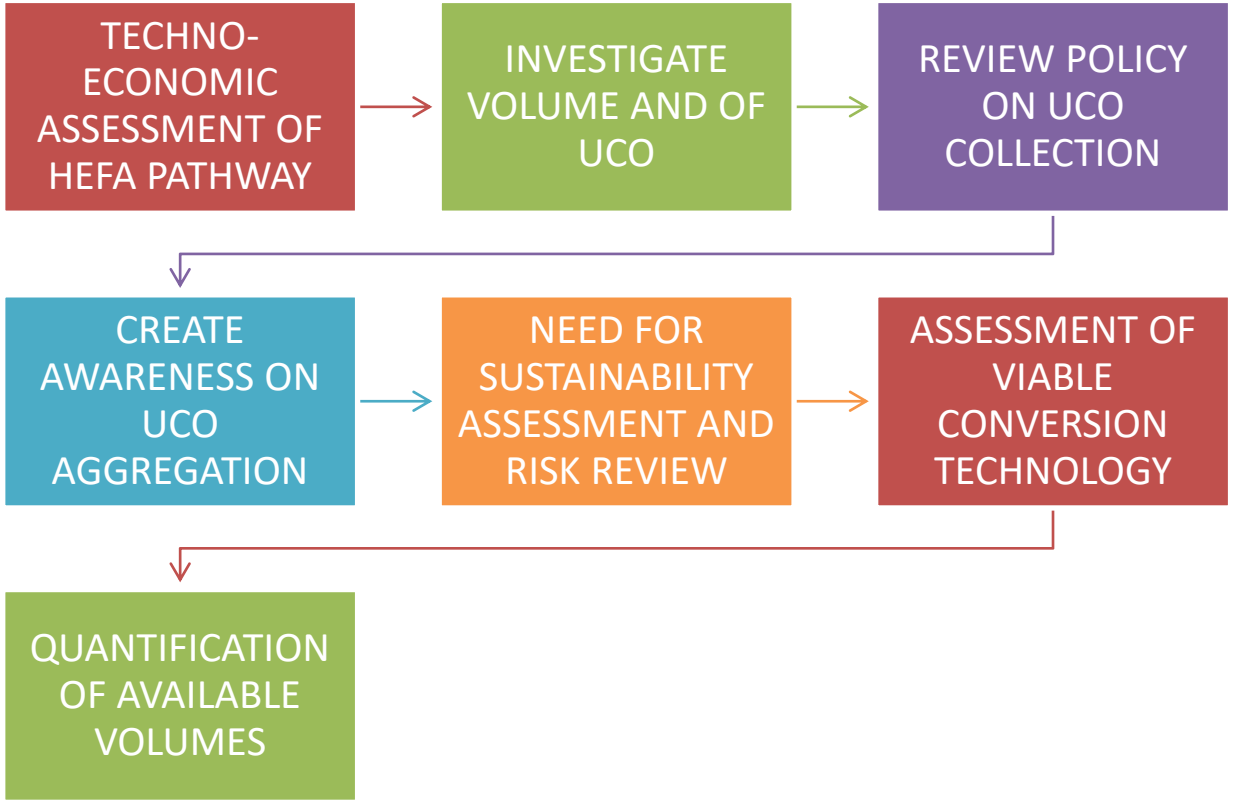


Results from SAF feasibility Studies report 2018 Cont.
SAF Recommendation in Kenya

Used Cooking Oil (UCO)	• Large volumes – high growth/energy dense • Proven conversion technologies/can utilise existing petroleum infrastructure • Sustainable/waste does not compete with food/improved environmental outcomes
Sugar Cane Tops	• Large volumes/NOT energy dense/region limited • Conversion technologies still to be commercialised/some conversion tech certified • Sustainable - does not compete with food/reward for farmer • Medium to long term option requiring further study
Municipal Solid Waste	• Very large volumes/Not energy dense • Conversion technologies still to be commercialised/some conversion tech certified • Sustainable - does not compete with food/social and environmental outcomes • Medium to long term option requiring further study
Water Hyacinth	• Medium to large volumes possible/region limited/low energy density/hi moisture • Would help solve significant social, environmental and economic issues • Difficult to harvest and process • Long term option requiring in-depth study

RESULTS FROM SAF FEASIBILITY STUDIES REPORT 2018 CONT.

FURTHER STUDIES RECOMMENDED FOR USED COOKING OIL



ASCENT Project 93: Regional Supply chain analysis

Objective:

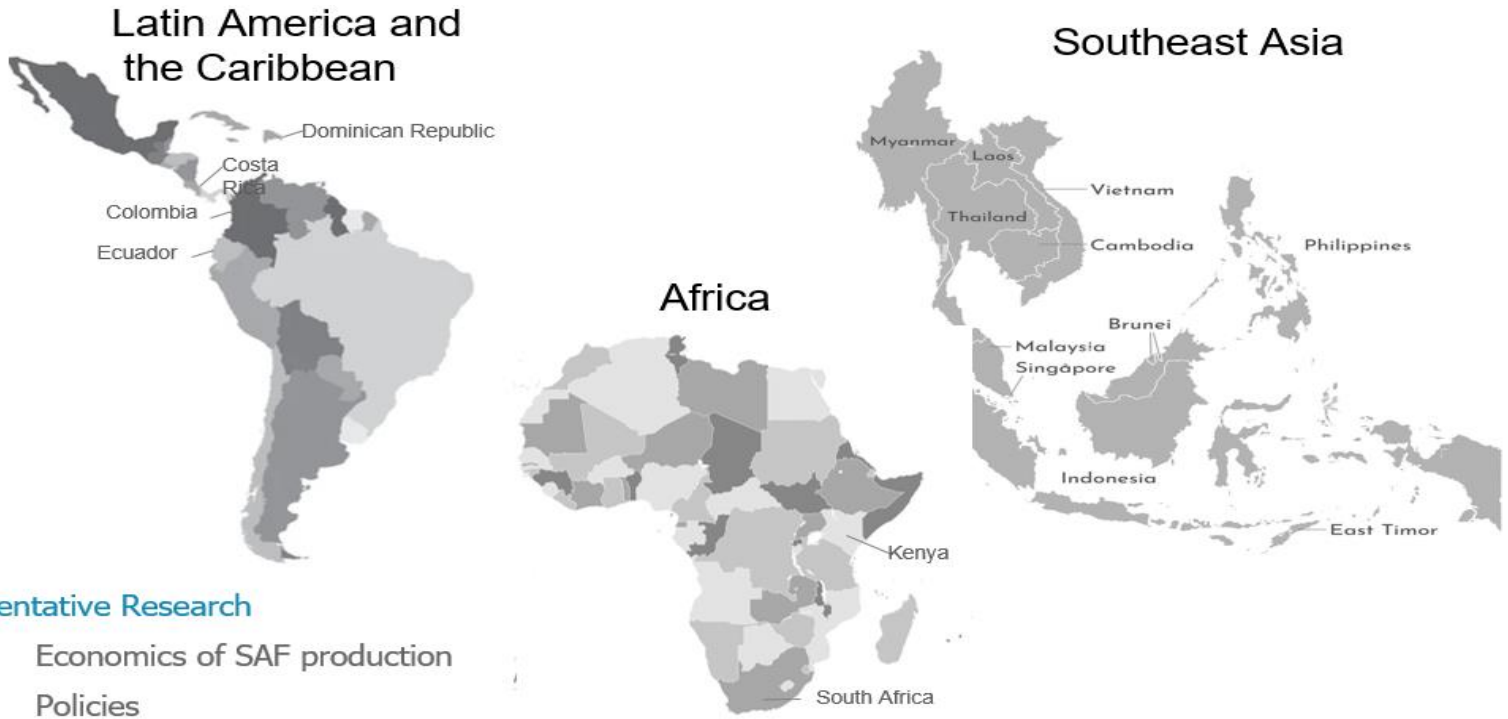
- Work with regional partners to design and analyze SAF supply chains in three regions: Latin America and the Caribbean, Africa and Southeast Asia.
- Create training modules/course/and graduate programs on the design and analysis of SAF production and supply chains.

Project Benefits:

- Identify potential for SAF production in the 3 regions that consider new pathways to optimize SAF production.
- The data collected will direct stakeholders to identify desired locations and potential for SAF production.

ASCENT – the Aviation Sustainability Center – is a cooperative aviation research organization co-led by Washington State University and the Massachusetts Institute of Technology. Also known as the Center of Excellence for Alternative Jet Fuels and Environment, ASCENT is funded by the FAA, NASA, the Department of Defense, Transport Canada, and the Environmental Protection Agency. ASCENT works to create science-based solutions for the aviation industry's biggest challenges.

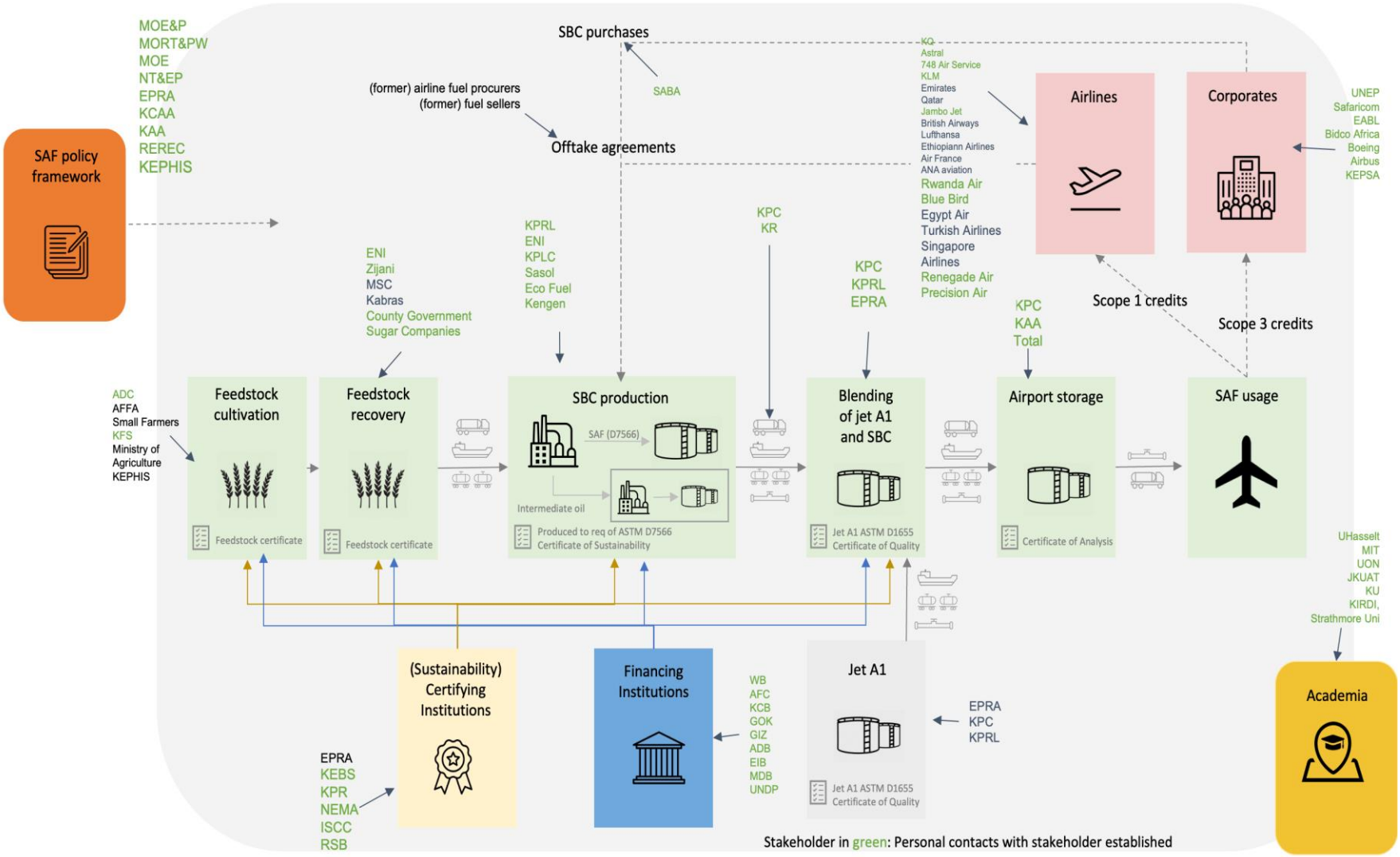
ASCENT Project 93: Geographical scope



Tentative Research

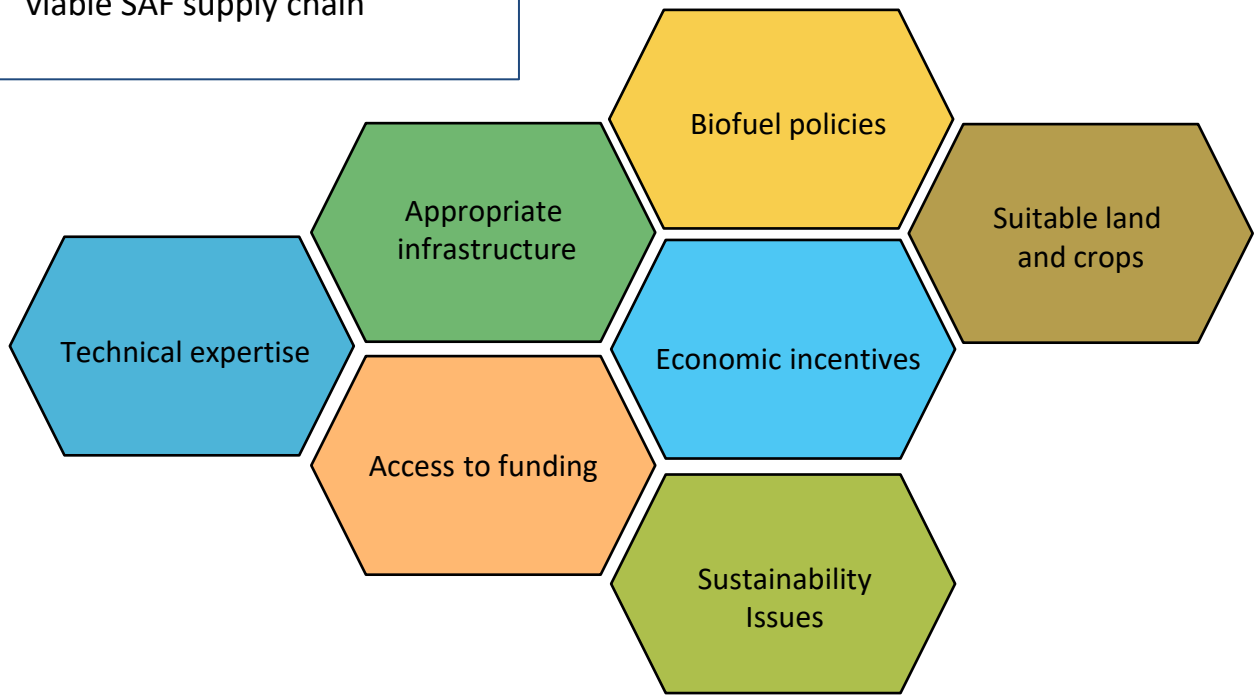
- Economics of SAF production
- Policies
- Finance
- Feedstock Challenge

KENYA SAF STAKEHOLDER MAPPING

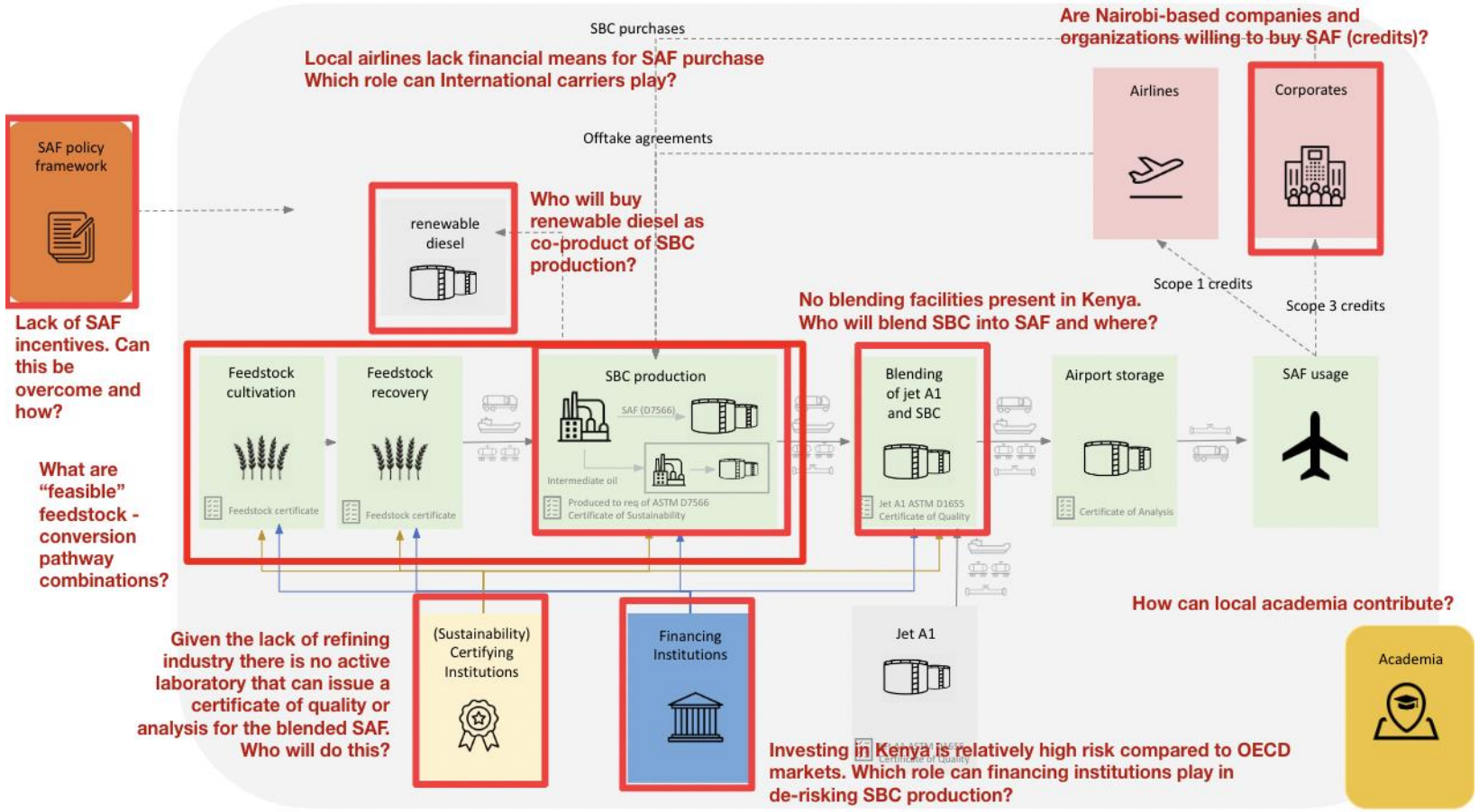


SAF Supply Chain Challenges in developing countries

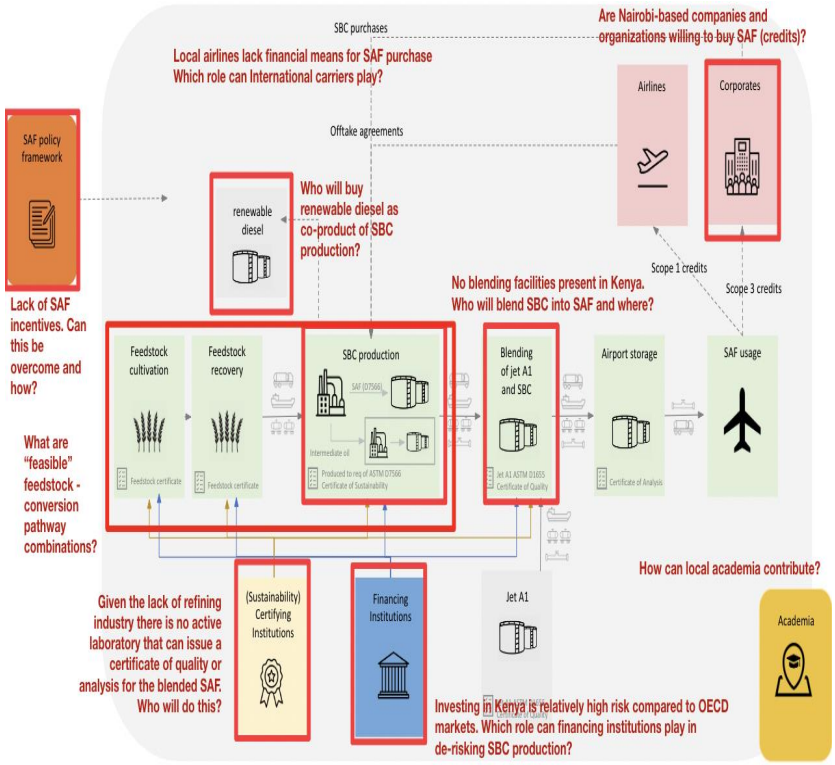
Every country and region has a unique set of challenges and opportunities that need to be carefully evaluated to build a viable SAF supply chain



KEY SAF CHALLENGES IN KENYA



KEY SAF CHALLENGES IN KENYA CONT..



Currently conducting deep dives on:

- Plant financing
- Offtakes (airlines and Corporates) – how to allocate the green premium
- Fuel testing, certification and blending
- Policies

Lesson Learnt- Green Premium Study

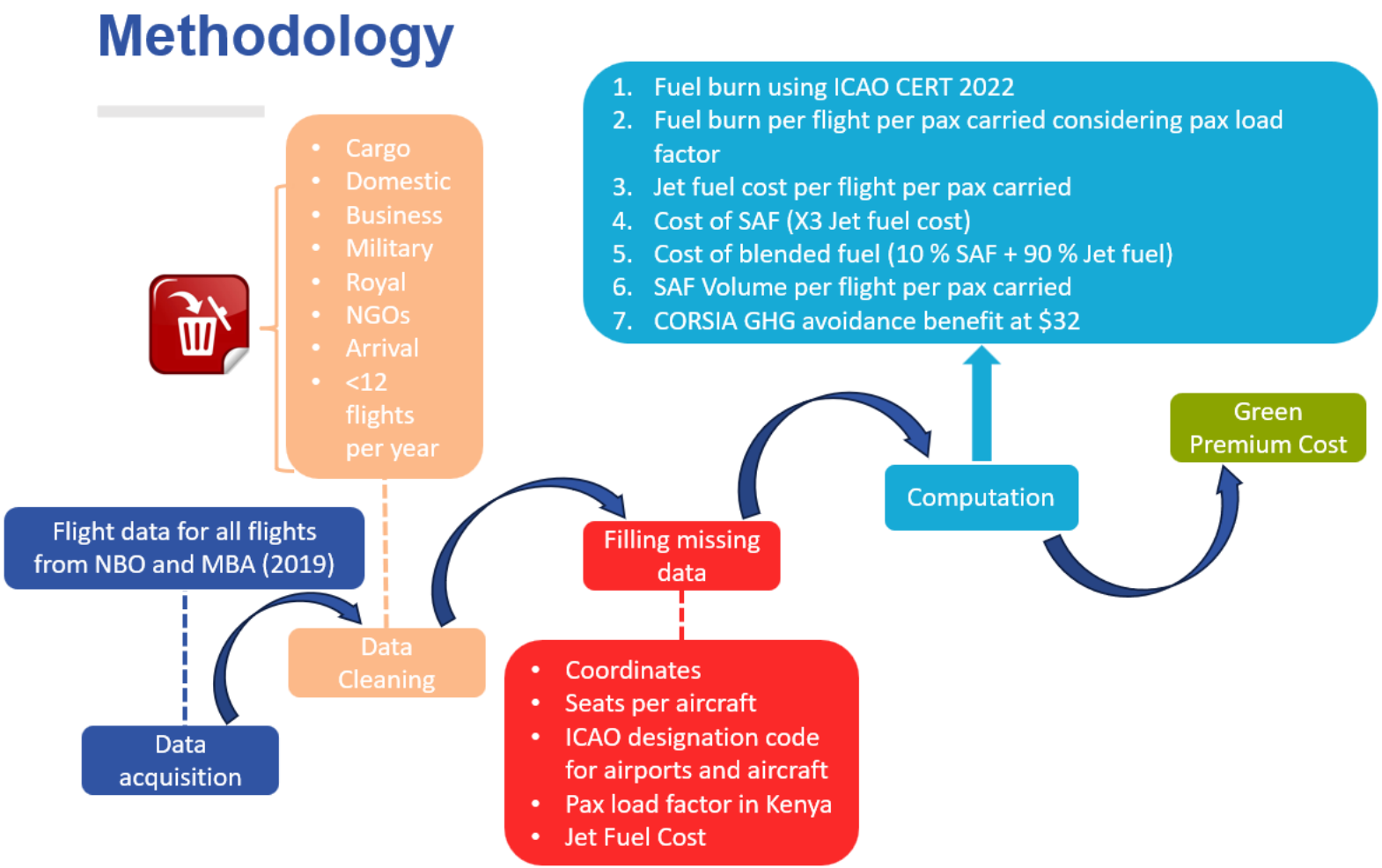
There is a **green premium** of SAF compared to conventional jet fuel that needs to be **covered** by someone.

Here we present how the green premium of a 2000 bpd SAF-producing facility with a green premium multiplier of 3 compared to conventional jet fuel impacts on **ticket prices** on **international** (or **intercontinental**) routes from **NBO** and **MBA**.

We account for **CORSIA credits** in our analysis based on forecasts about offset prices under CORSIA.

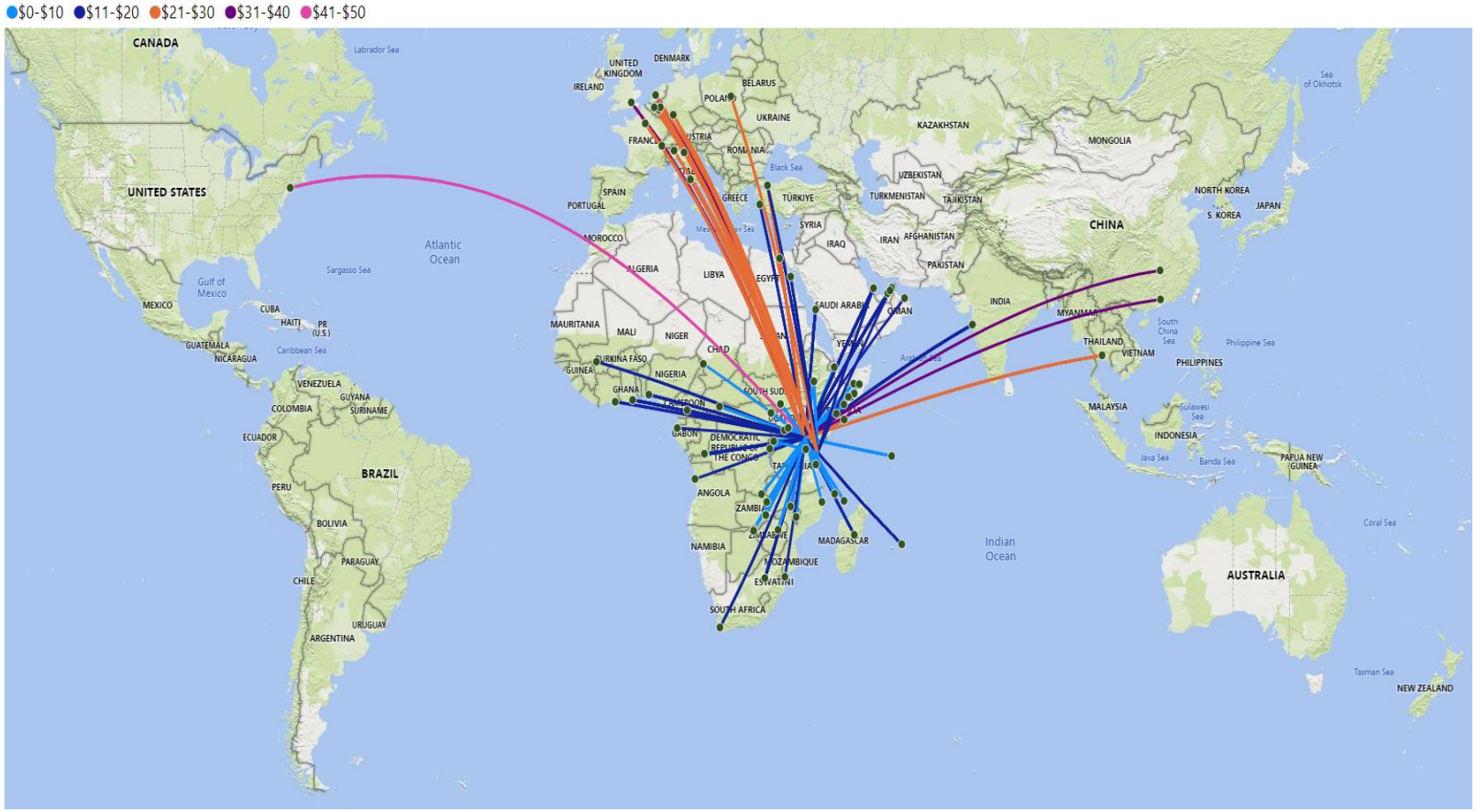
Source: Study results from Hasselt University

Green Premium Cost (allocated to all departing international flights)



Lesson Learnt- Green Premium Study

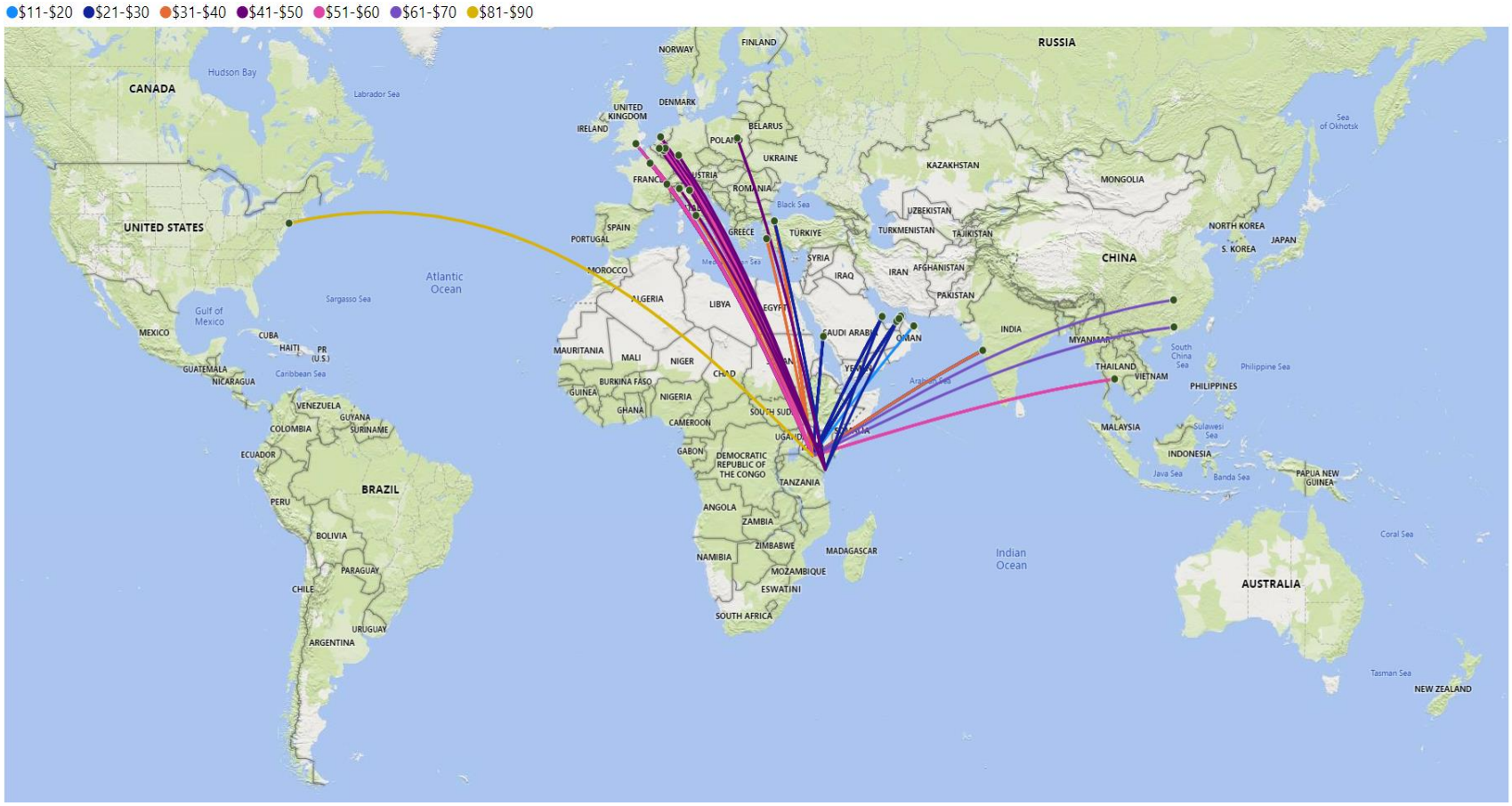
Green Premium Cost (allocated to all departing international flights)



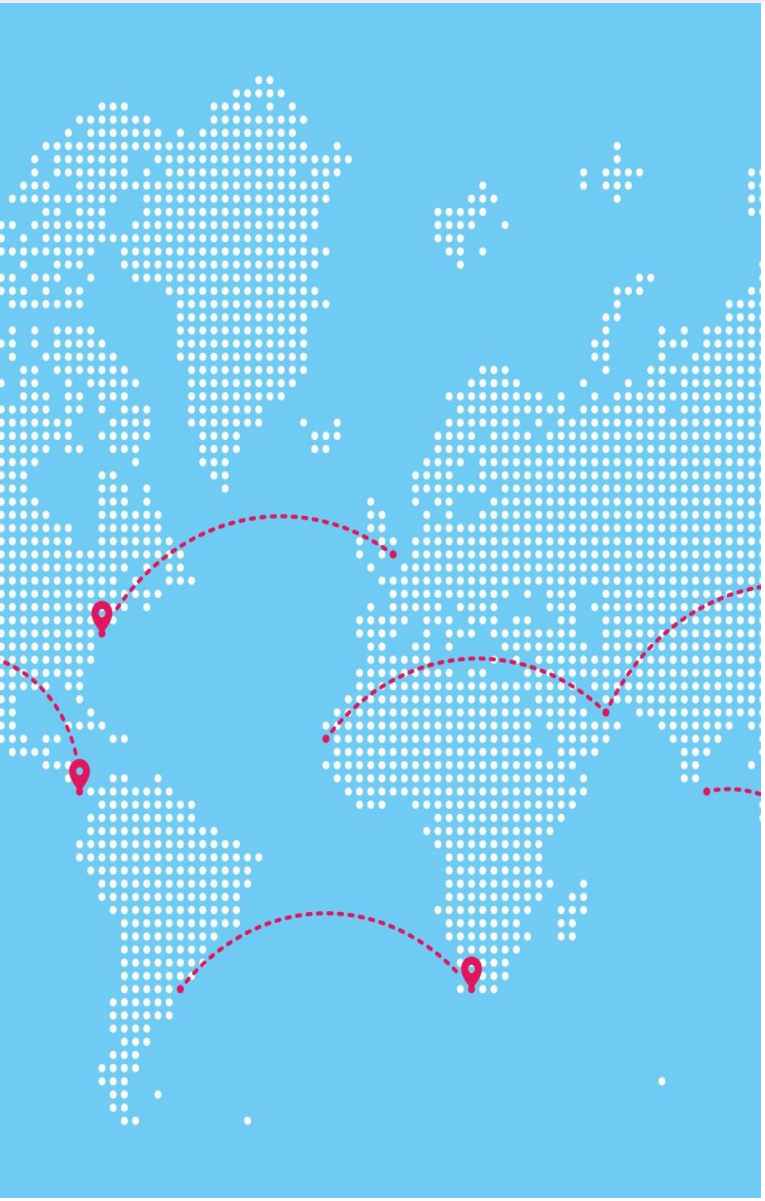
Source: Study results from Hasselt University

Lesson Learnt- Green Premium Study

Green Premium Cost (only allocated to international flights departing to other continents)



Lesson Learnt- Green Premium Study



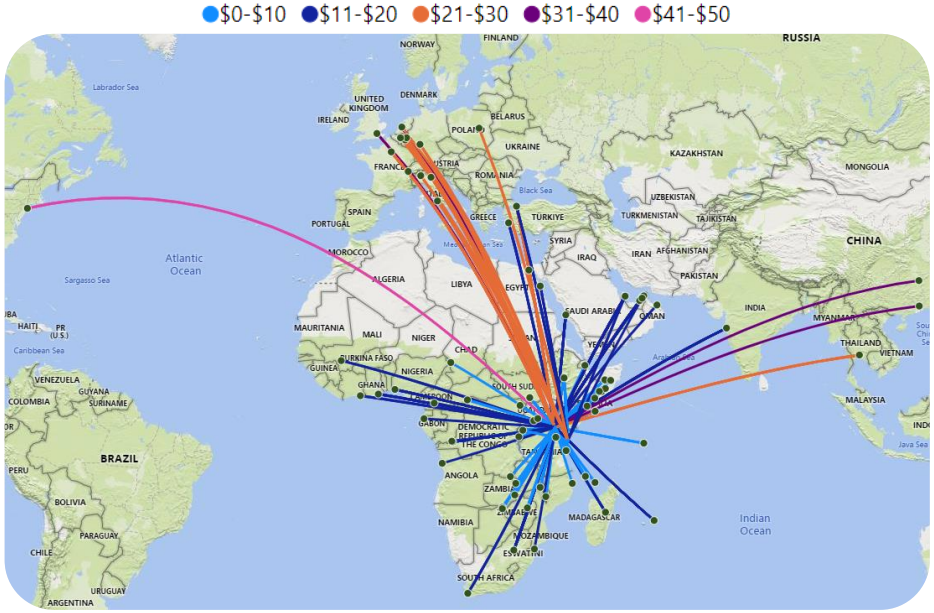
- **Using 10 % SAF** on all departing international flights from Nairobi and Mombasa, the fuel-related cost of tickets for each passenger increases by approx. 17 %.

- Using SAF only on departing international flights from Nairobi and Mombasa to other continents, the cost of tickets for each passenger increases **by approx. 29 %.**

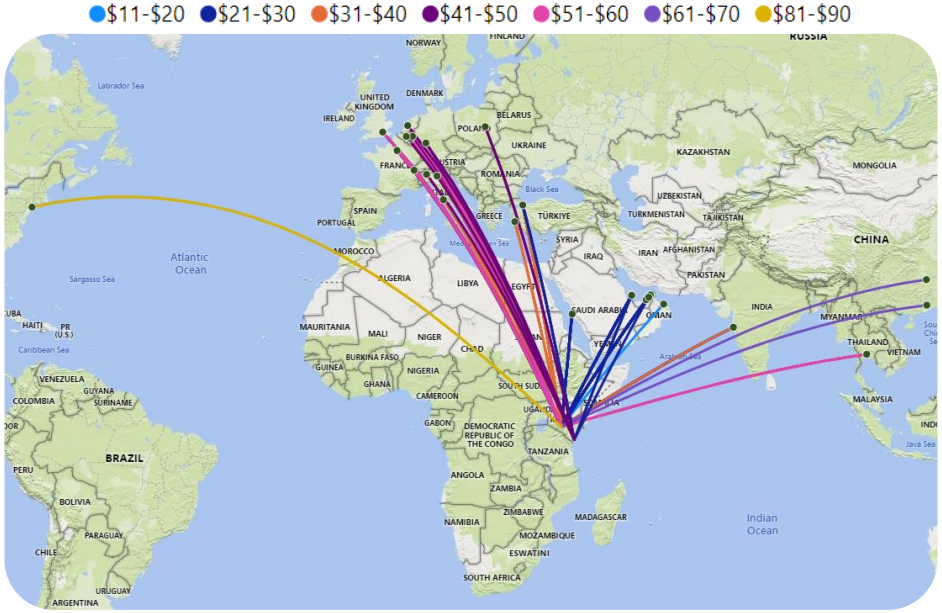
- CORSIA carbon credit benefits are limited for expected carbon prices.

Green Premium Cost Comparison

Green premium allocated only to **all international** flights

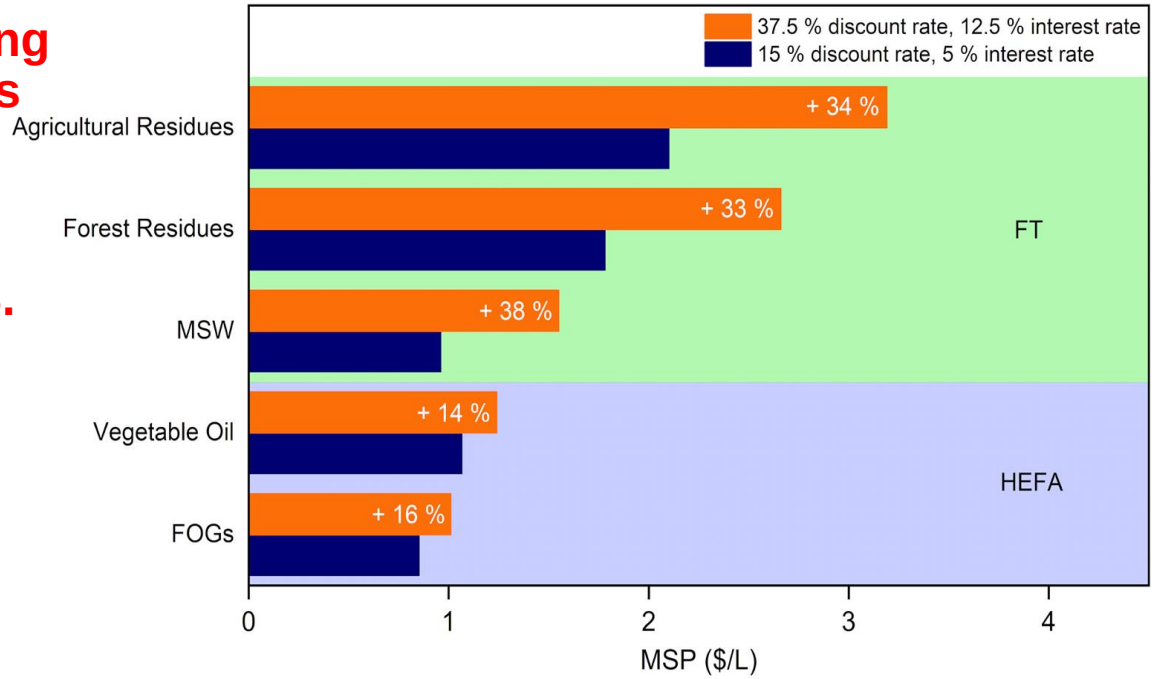


Green premium allocated **only** to **intercontinental** flights



The importance of de-risking SAF investment in developing countries

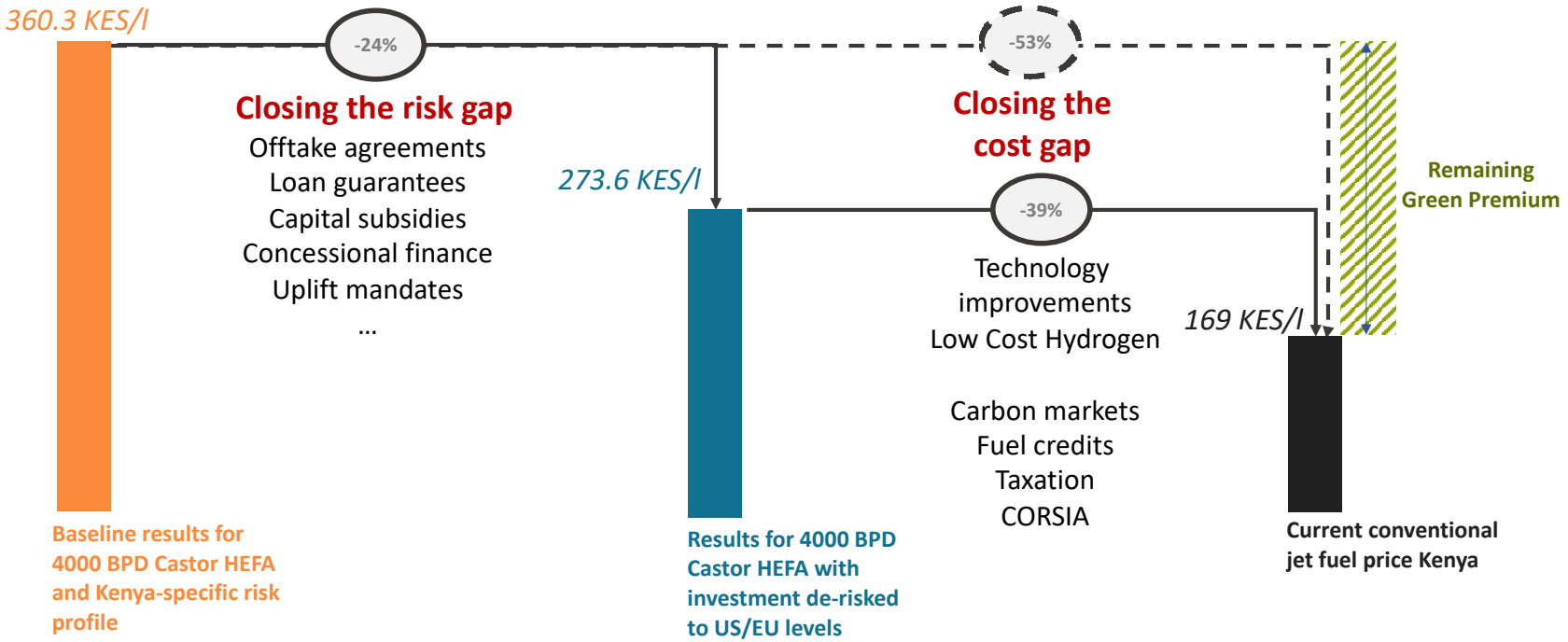
SAF production in emerging and developing economies carries a risk premium, making SAF production more expensive than, for example, the EU or the US.



Source: Own calculations based on publicly available DCFROR models for SAF (Hydroprocessed esters and fatty acids TEA V2.2 developed by Kristin Brandt et al. 2022, Fischer Tropsch TEA V2.2 developed by Kristin Brandt et al. 2022) . These are n-th plant estimates.Key Assumptions: Equity/loan split: 70/30, Duration 20 years, inflation: 2%. Discount rate and loan interest asssumed as mentioned above. No monetary incentives included. FOG: Fats, Waste Oils and Greases MSW: Municipal solid waste

Lesson Learnt

The importance of de-risking SAF investment in developing countries



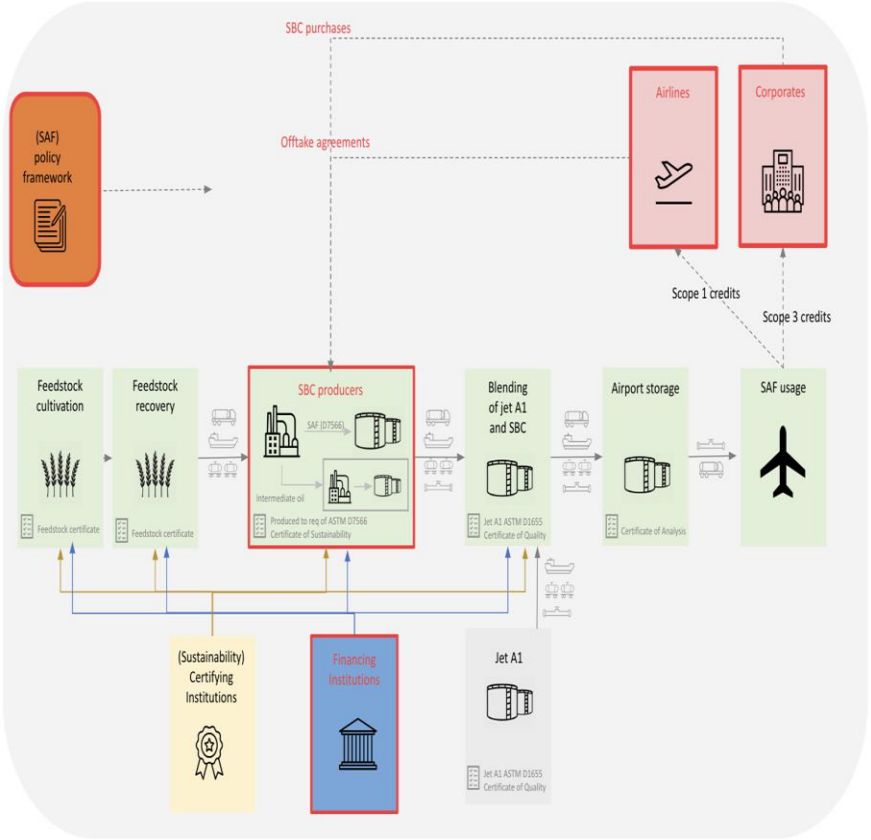
The importance of de-risking SAF investment in developing countries

”**Coalitions**” will be needed to drive down risk premiums and distribute the green premium – for each specific SAF investment case.

- **Financing agreements** with international development banks;
- **Offtake agreements** from (international) airlines;
- **Scope 3 credit purchases** by corporates;
- **Government commitments** (expertise, regulation)
- Training in SAF to Technical Experts

…

Many entities are active in building such coalitions at the moment.



Success

The SAF study recommended that focus be directed to waste-based feedstocks namely, **used cooking oil (UCO**) in the short to medium term, and municipal solid waste (MSW), ***sugarcane field byproducts (cane tops) and water hyacinth in the long term***.

Kenya has Agreed to Enter into **ICAO ACT-SAF** programme to scale up production of SAF

Hosted a workshop on **SAF scaling up** including Power to Liquid held in Nairobi on 3rd August 2022 & 11-12 Sept. 2023 in Collaboration with GIZ PtX Hub

Collaboration with other Partners on SAF production are under discussion.

Implementation of the **SAF toolkit** recommendation that was launched during COP 26 in Glasgow UK.

The Ministry of Energy has **done baseline studies** on the potential of biofuels production in the country to promote the use of SAF

SUCCESS Cont.

Main needs identified by the SAF workshop held on 11th and 12th September 2023 in Nairobi:

- **PUBLIC-PRIVATE SAF STEERING GROUP**, WITH **INTERNATIONAL STAKEHOLDER INVOLVEMENT**
- **SAF ACTION PLAN** / **ROADMAP** ALIGNED WITH THE AVIATION ENVIRONMENTAL ACTION PLAN
- **MODEL SAF FINANCE CASE** THAT ADDRESSES RISK AND GREEN PREMIUM COVERAGE
- **DOMESTIC SAF** POLICY TO HELP COVER THE GREEN PREMIUM AND REDUCE RISK PREMIUMS
- TECHNICAL ANALYSIS ON THE USABILITY OF THE **OLD REFINERY** AND OF **BLENDING INFRASTRUCTURE**, AND **DOMESTICATION** OF (CERTIFICATION) **STANDARDS**
- TARGETED **CAPACITY BUILDING** AND **KNOWLEDGE TRANSFER**
- CONDUCT STUDY ON **MACROECONOMIC EFFECTS** ON SAF PRODUCTION TO GDP

Success Cont..

Hosted SAF Capacity Training on 13th and 14th September 2023 in Nairobi:

52 STUDENTS PARTICIPATED IN THE SAF TRAINING FROM DIFFERENT GOVERNMENT DEPARTMENTS, AIRLINES, ACADEMIA AND PRIVATE SECTORS

SAF TRAINER FROM KCAA, GIZ, MIT AND HASSELT UNIVERSITY

OPPORTUNITIES IN THE IMPLEMENTATION OF SAF IN KENYA

large **volumes of wastes** and residues

Strong **government commitment** to renewable energy

Social, **environmental** and economic benefits

SAF Development Priority Actions

The following are the Key priority Actions/Collaborations for SAF development in Kenya

- Development of **National SAF policy**
- Develop SAF National **Strategy and Roadmap**
- Review of **incentive policy** to increase production of SAF
- **Capital investment** to scale up SAF production
- **Capacity building** through technical training to experts and Knowledge transfer.
- Support **SAF pilot** project development
- Support and collaborate in SAF through **research and development**.
- Creation of **stakeholder** awareness & Working Groups
- Establishment of local, **Regional and international partnerships to** Scale up SAF developments
- Establish a **National SAF steering** Committee

Collaborations and next steps

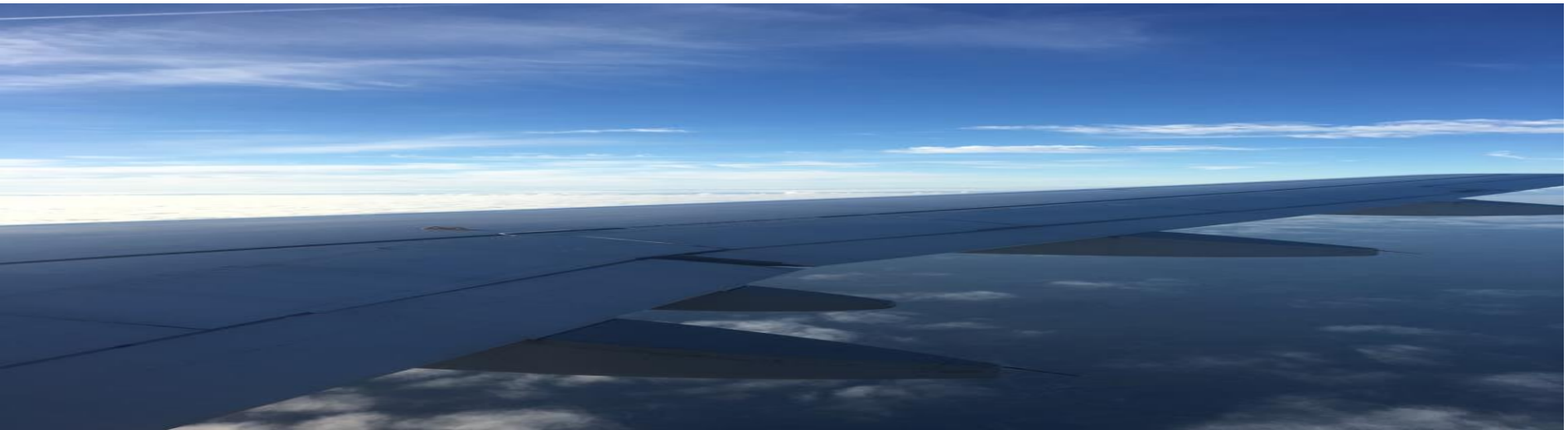
International Stakeholders include ICAO, GIZ, the World Bank, MIT/U Hasselt, Ascent 93

Established a working relationship to build a task force to **develop a <u>concrete</u> <u>roadmap</u> toward a SAF production plant in Kenya**

KCAA
efficiently managing air safety

CMK
CENTRE FOR
ENVIRONMENTAL SCIENCES
UHASSELT

Thank you for your attention !



Contribution to ICAO ACT SAF at COP28

Kenya as African Pioneer for SAF: The Road Ahead

Kenya Pavilion

Dubai, December 5, 2023

University of Cologne Business School

Implemented by

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Key Messagess:

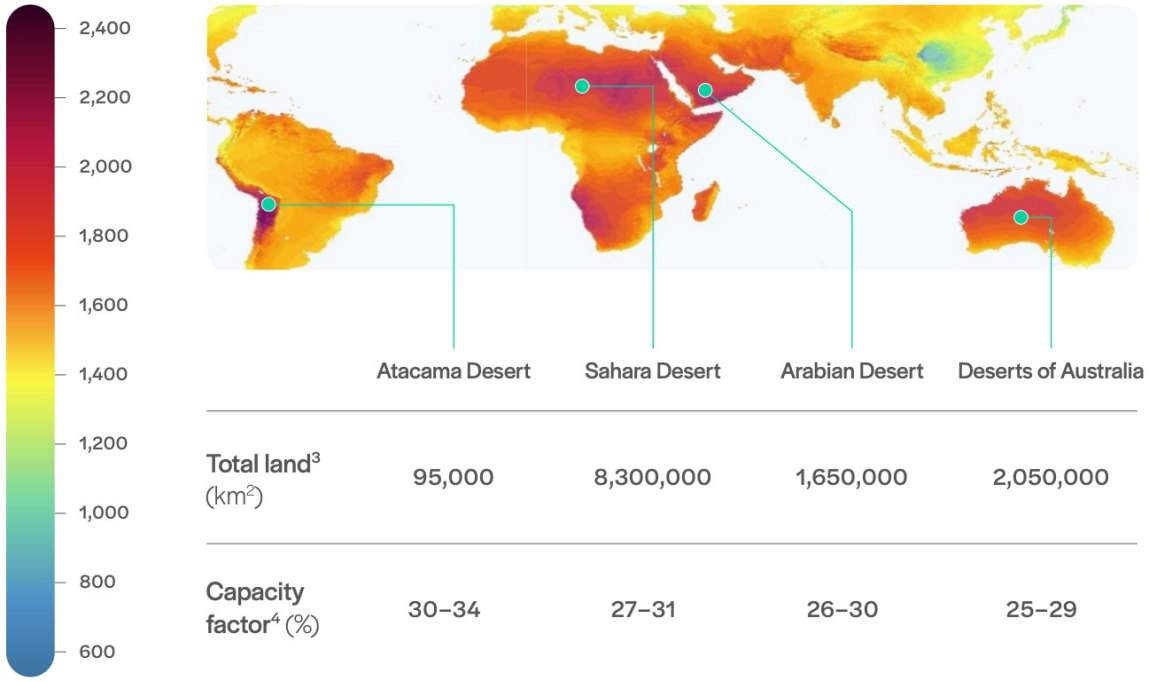
- While OECD countries are scaling SAF, emerging markets risk being left behind, despite favorable feedstock endowment and development co-benefits such as jobs and GDP.

- ICAO/EU/FAA and others have engaged in feedstock feasibility studies, but now a joint effort is needed beyond to create a SAF project pipeline in emerging markets: PtX is an important pathway and GIZ committed

- Finance is key and a portfolio of measures are needed: Market Based Measures and appropriate policy frameworks to be combined to de-risk offtake and make SAF projects investable

University of Cologne
Business School

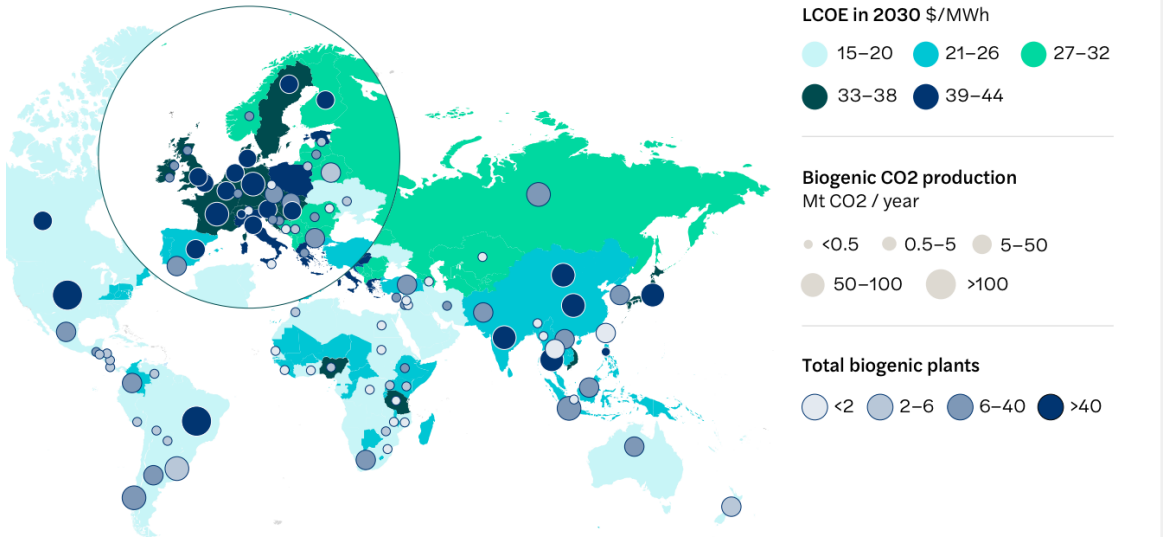
Emerging Markets have some of the best global SAF feedstock endowment….



Producing PtL using only 1–2%[1] of the land in four regions could meet 100% of aviation fuel needs[2] in 2030

	Atacama Desert	Sahara Desert	Arabian Desert	Deserts of Australia
Total land[3] (km^2)	95,000	8,300,000	1,650,000	2,050,000
Capacity factor[4] (%)	30–34	27–31	26–30	25–29

FIGURE 9 | **South America and regions in the US and China have biogenic carbon sources in locations suited to PtL production**



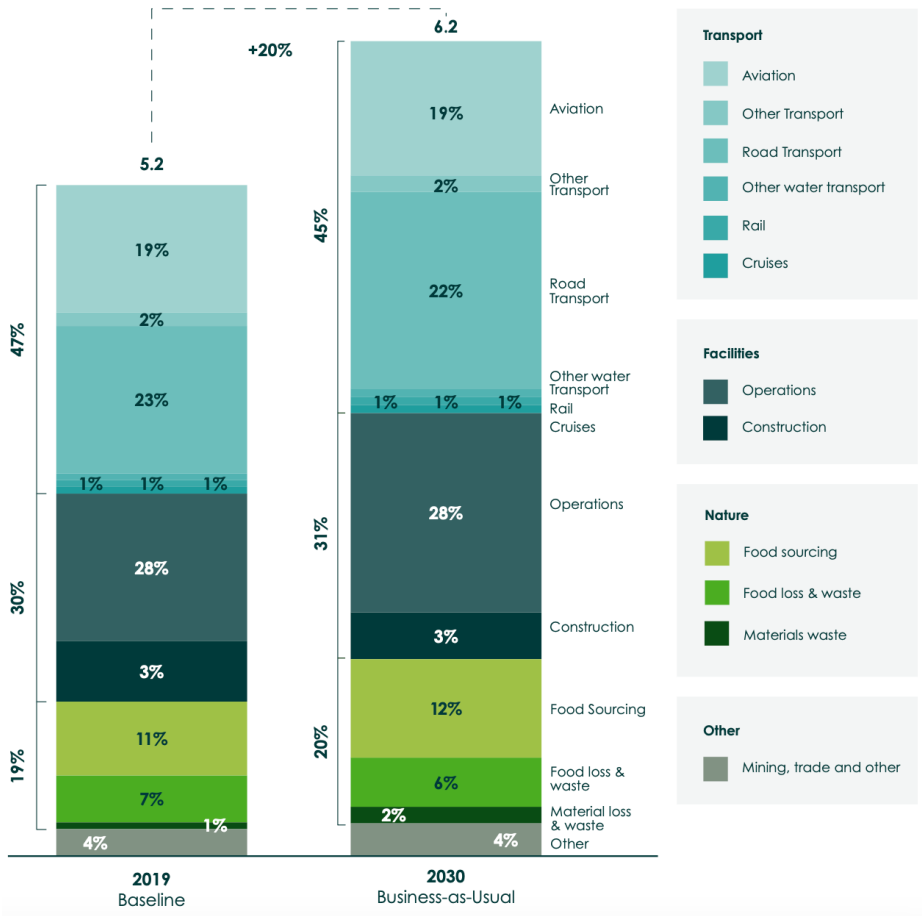
- Best Conditions for PtL (e-fuels) SAF in global deserts; for biogenic sources in Latinamerica, S-E Asia, US, East Africa
- Decentral network of SAF plants feasible; fuel transport costs limited

University of Cologne Business School

Source: WEF – McK Report: Clean Skies of Tomorrow: Delivering on PtL Ambition, May 2022

Emerging Markets depend on aviation for tourism and for tourism on development

FIGURE 3: GLOBAL GHG EMISSIONS OF THE TRAVEL & TOURISM SECTOR
Gt CO_2eq, 2019 and 2030 BAU



- Tourism 8-11% of Global GDP, in tourist dependent nations > 40% (e.g. small islands); aviation essential;

- Aviation 19% of tourism GHG emissions; access to SAF key to protect traveller loyalty; local SAF industry (e.g. waste based) would have co-benefits for destination development

- Emerging Markets risk being „left behind“ on SAF, as no Institution focuses on developing „SAF for Emerging Markets“

- Key mission: establish coalition and process to evaluate SAF potential for accelerated deployment in emerging markets

Source: „Better Travel Tourism, Better World“ STGC – Report, November 2022

University of Cologne Business School

India has developed a Blueprint for SAF ramp up with 80+ stakeholders: resulting in legislative process

Rough estimates based on ~360,000 tons of SAF in 2030

The SAF industry will create five main benefits…

Guaranteed additional income for farmers
By selling agricultural residues to raise incomes by 10–15%

Cleaner skies with less open-air burning
Reducing air pollution and associated health risks

120,000+ new green jobs
Across production plants and collection systems, related supply chains and induced effects

Enhanced energy security
Domestic feedstock would substitute fossil jet fuel and create export opportunity (yielding $210 million reserves for 10% blend of SAF)

Catalyst for efficient waste management
Also reducing landfilling significantly by supporting demand for better segregated waste

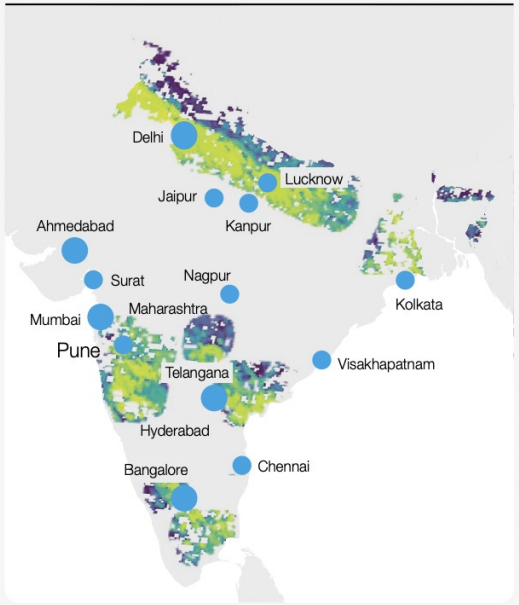
Approx. $2.8 billion GDP impact

…and addresses the UN SDGs

Source: United Nations; Shyamsundar et. al., 2019; expert interviews; McKinsey Global Institute

FIGURE 9 | **Geographical concentration of municipal solid waste and agricultural residues**

Rough estimates



Agriculture residues (t/100km²)
2
50
150
250
600
1,000
2,000
4,000
8,200
65,000

MSW availability*
Mt of SAF output
0.1–0.3
>0.3

Significant potential for SAF production

200 GAS-FT plants using MSW feedstock closely located to seven large cities

200 Plants based on agricultural residues in six major hotspots (average of AtJ-Gas-FT)

12 Million tons SAF output[1]

Sustainable energy sector in total will benefit–

- Aviation and road fuel are synergistic, not competitive: SAF and road diesel can be produced together, based on the same feedstock
- Surplus of feedstock available; scaling effective collection systems will benefit the economics of all bio-based energy production
- Current SAF vision requires a fraction of total feedstock

1 Assuming average of 77% yield for AtJ and 55% for Gasification + FT and total output of 100 KLPD

*Analysis is sourced from expert input and McKinsey's ACRE solution. Other sources indicate a higher range from 150 million tons (India's Press Information Bureau) to 387 million tons (World Bank)

Source: McKinsey ACRE solution

Source: World Economic Forum: Clean Skies of Tomorrow June 2021

University of Cologne Business School

6 dimensions must be considered…

…with key guiding questions

1. What sustainable feedstock is available? Which production pathways are viable?
2. What ecosystems must we build for feedstock collection and management?

   What type of production capacity is required (greenfield, brownfield, repurposed) and feasible to meet demand, and in what locations?

   How will we need to change infrastructure and operations from production site to the wing?
3. What is the demand for SAF and by-products? How can we market and sell by-products, and to whom?
4. How large a price premium are private and corporate customers willing to pay for SAF?
5. How can we get funding to produce SAF at scale?
6. What regulatory and tax measures can support SAF scale-up?

University of Cologne Business School

- SAF ramp up needs smart policy to **foster investment security**

- SAF still is 2-5 times more expensive, but blending at increasing levels keeps **total cost in check**

- Kenya is part of the „SAF Ambassador Group“ that launched the **„SAF Policy Toolkit“ at COP26**

- Global Policy „Blueprint“ is emerging and **Kenya could be a frontrunner** in SAF deployment

University of Cologne Business School

Demand and supply mechanisms to incentivize scale-up of SAF[1]

	Demand side		Supply side	
	Direct demand for SAF	**Increase cost of fossil fuel**	**Subsidies for SAF production**	**Low-cost loans /green bonds**
Description	A certain minimum share of sustainable jet fuels is prescribed. Minimum penalty for non-compliance with blending requirements	Price discovery via predetermined maximum of allowances Additional taxation of fossil jet fuel	Tax credits for SAF that reduce GHG (by at least 50%)	Grants or low-cost loans (or possibly loan guarantees) to support sustainable infrastructure, innovation, research and development
SAF incentivization	Achieving large-scale SAF production and supply at competitive cost, thereby lowering production cost	"Zero-emissions rating" for SAF portion of jet fuel usage Taxation of fossil jet fuel results in reduced price differential between SAF and fossil jet fuel	Tax exemption/credit for SAF portion of jet fuel usage results in reduced price differential between SAF and fossil jet fuel	Promotion of SAF uptake and production by reducing the investment risk, increasing investment returns and demonstrating government support to help secure third-party investment
	ReFuelEU Aviation Initiative[2] **Blend mandate** **GHG reduction mandate**	**EU ETS** **Energy Taxation Directive[3]**	**Low Carbon Fuel Standard** **Sustainable Skies Act[4]** **Sustainable Aviation Fuels Act[5]**	**Horizon Europe, InvestEU, etc.** **Green Fuels, Green Skies** **Blender's Tax Credit** **Sustainable Aviation Fuel Grand Challenge**

Notes: 1 Mechanisms are not mutually exclusive and can be combined, ideally with coherent sustainability criteria and reporting requirements. **2** Legislative proposal of EU Commission; yet to be approved by the European Parliament. **3** Part of EU "Fit for 55"; in discussion. **4** Introduced to Congress only; yet to be approved, after which it will be sent to the Senate. **5** Supports the tax credit provided as per the Sustainable Skies Act; yet to be approved by all of the Houses

Sources: Government websites, ReFuelEU, web search

SAF Recommendation in Kenya

Used Cooking Oil (UCO)

- Large volumes – high growth/energy dense
- Proven conversion technologies/can utilise existing petroleum infrastructure
- Sustainable/waste does not compete with food/improved environmental outcomes

Sugar Cane Tops

- Large volumes/NOT energy dense/region limited
- Conversion technologies still to be commercialised/some conversion tech certified
- Sustainable - does not compete with food/reward for farmer
- Medium to long term option requiring further study

Municipal Solid Waste

- Very large volumes/Not energy dense
- Conversion technologies still to be commercialised/some conversion tech certified
- Sustainable - does not compete with food/social and environmental outcomes
- Medium to long term option requiring further study

Water Hyacinth

- Medium to large volumes possible/region limited/low energy density/hi moisture
- Would help solve significant social, environmental and economic issues
- Difficult to harvest and process
- Long term option requiring in-depth study

Source: ICAO/EU Feasibility Study for Kenya, 2018

University of Cologne Business School

2. High-Level Workshop Nairobi, September 2023:

Main Needs identified for Next Phase :

- **Public-private SAF steering group**, with **international stakeholder involvement**
- **SAF Action Plan** / **Roadmap** aligned with the Aviation Environmental Action Plan
- **Model SAF Finance Case** that addresses risk and green premium coverage
- **Domestic SAF** policy to help cover the green premium and reduce risk premiums
- Technical analysis on the usability of the **old refinery** and of **blending infrastructure**, and **domestication** of (certification) **standards**
- Targeted **Capacity Building** and **Knowledge Transfer**
- **Quantify economic benefits of domestic SAF production in Kenya.**

HARAMBEE

KCAA efficiently managing air safety

ASCENT AVIATION SUSTAINABILITY CENTER

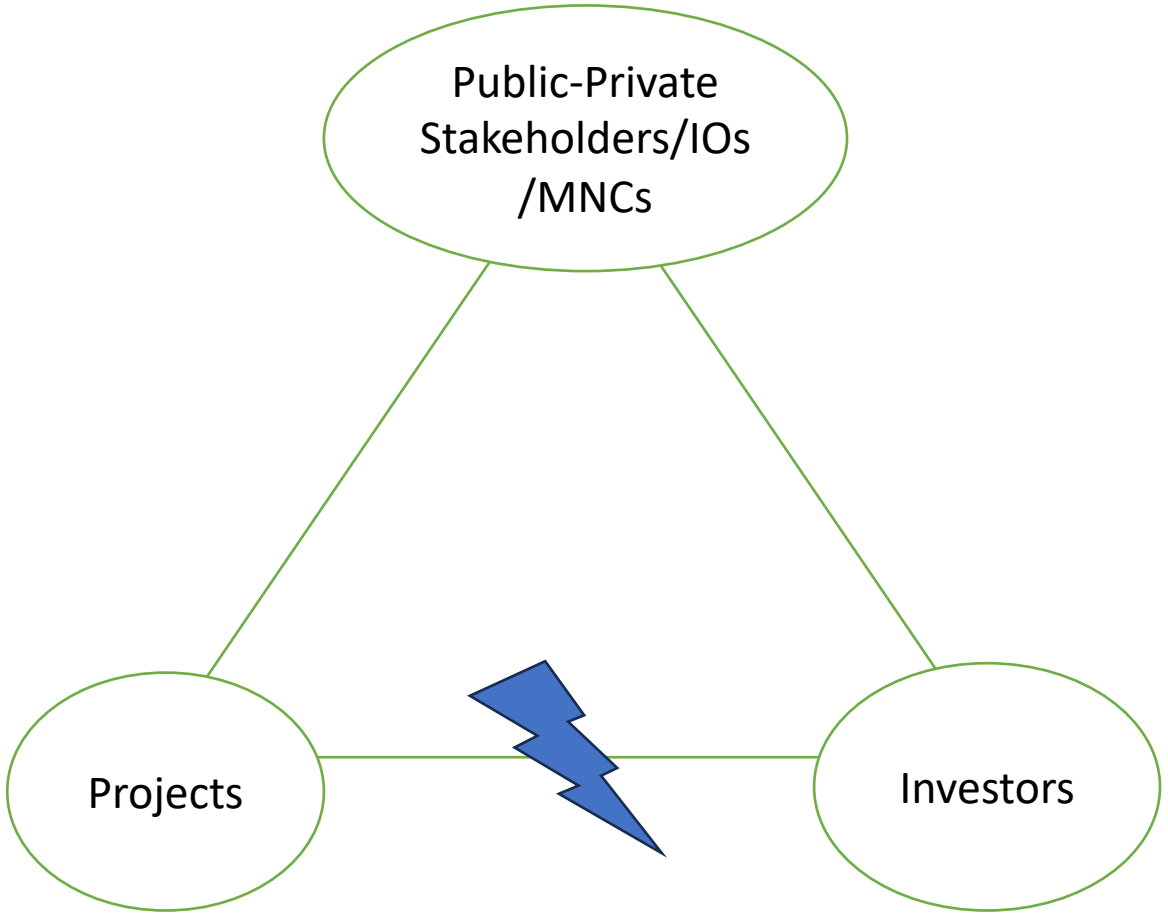
PtX Hub

On behalf of: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety of the Federal Republic of Germany

Implemented by giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

University of Cologne Business School

At early scale-up stage, 3rd party public-private stakeholders can help de-risking to make SAF projects in Emerging Markets „investable/bankable“



e.g. SAF in Emerging Markets

Source: WEF Project: „Scaling Large-scale Finance for Sustainable Infrastructure, 2021

- Investors often argue lack of bankable projects, while sustainable infrastructure projects are searching for capital
- Significant efforts are required to overcome „structural gap“ between investors and projects
- In practice, SAF-projects in emerging markets have a range of risks (market, technology, political, policy etc), that need to be addressed

Idea: Public/private partner coalition (Development Banks, governments, MNCs) to create a process: to select eligible SAF projects and lead them to bankability

University of Cologne Business School

American Airlines and Deloitte Pioneer Market-Based Solution to Reduce Carbon Emissions from Air Travel

Boeing, Netflix and Microsoft among founders of new business alliance on sustainable aviation fuels

Why Microsoft Is Buying Sustainable Jet Fuel For Alaska Airlines

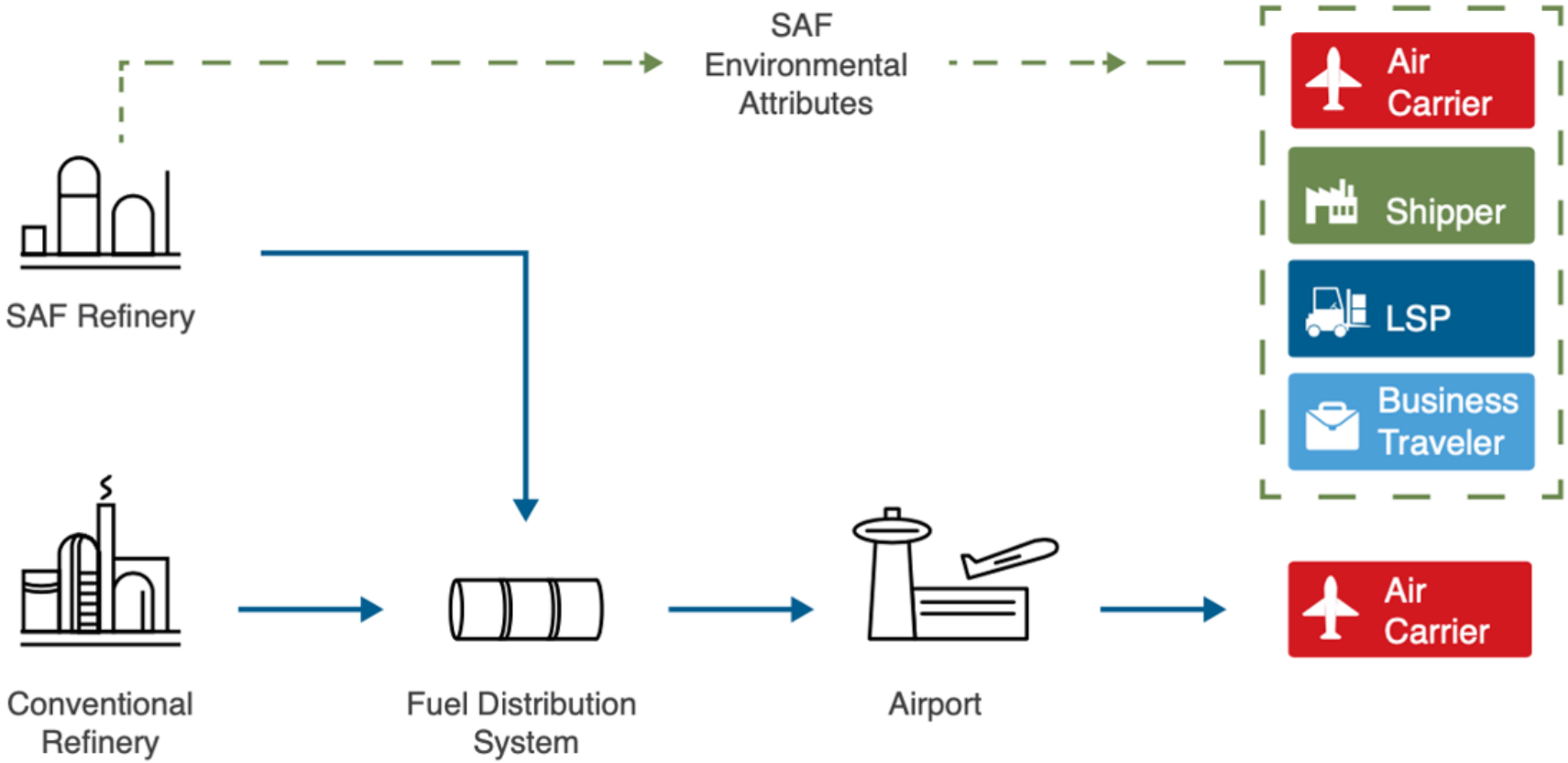
Tech giant Microsoft announced a partnership with Alaska Airlines this Thursday to cut its CO_2 emissions through sustainable jet fuel. The agreement involves Microsoft purchasing sustainable aviation fuel (SAF) on routes popular with its employees.

United partners with corporate America to ramp up sustainable fuels

Through a new partnership with some of the country's largest corporations, the Eco-Skies Alliance, United will triple its use of sustainable aviation fuel this year.

University of Cologne
Business School

Book & Claim – Chain of Custody System (simplified)



Why Book & Claim?

- **Book & Claim works like „Green Electricity“** –Utilities supply (book)/ Consumers buy green power (claim)

- Avoids bureaucracy, logistics and costs through **efficient supply chain**

- Stimulates fuel suppliers and customers to **supply more SAF** into system

- Eliminates exemption/**transition period for smaller airports**

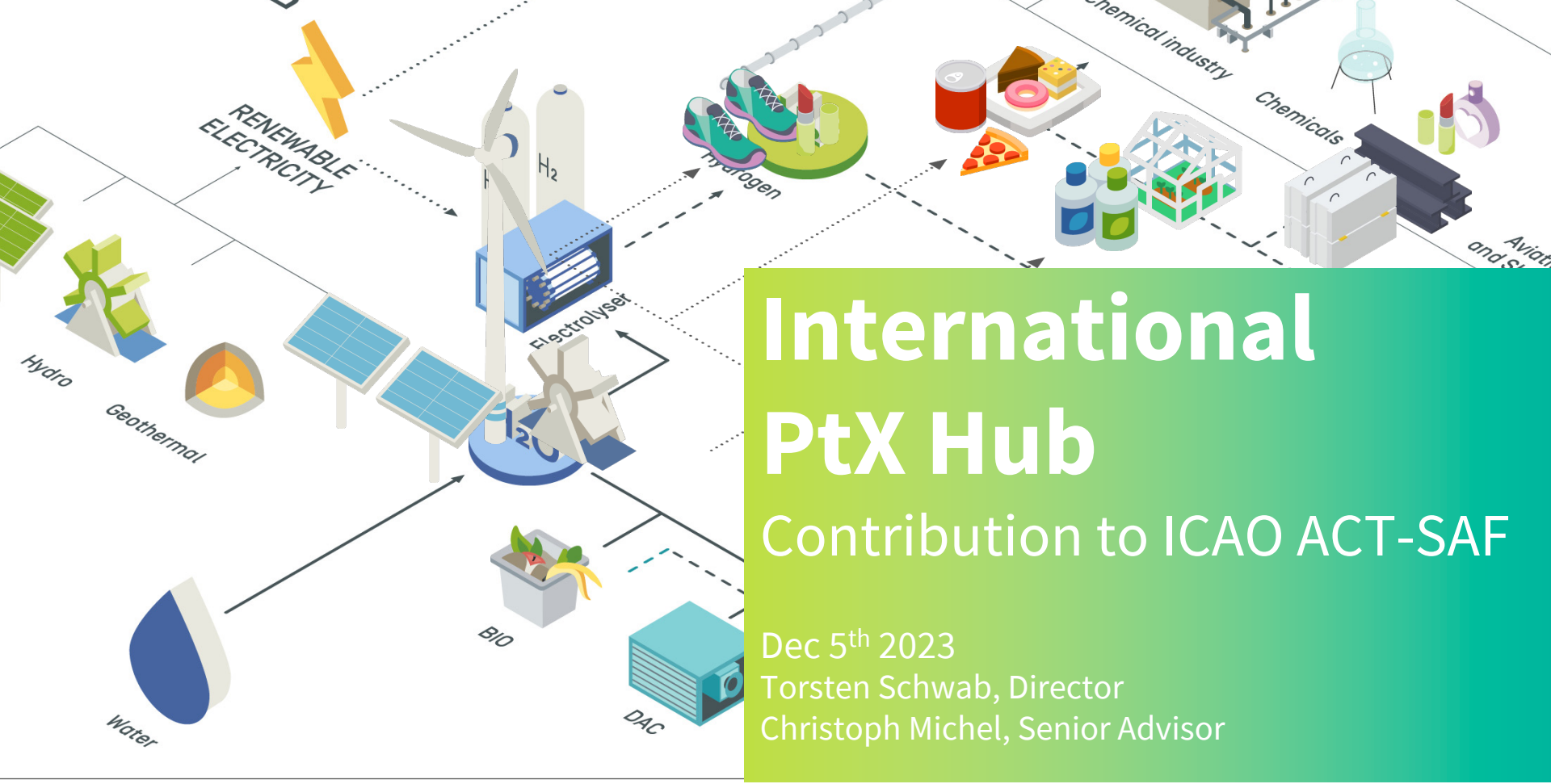
- enables decentral producers at low cost locations to enter SAF closeby **(i.e. emerging markets**)

..but…

- requires additional accounting tools (i.e. **central SAF registry**) to avoid double counting

- requires in situ **checks of fuel quality compliance** with RED 2 or other e.g. ICAO sustainability criteria

University of Cologne Business School



International PtX Hub

Contribution to ICAO ACT-SAF

Dec 5th 2023

Torsten Schwab, Director
Christoph Michel, Senior Advisor

International PtX Hub
Supported by: Federal Ministry for Economic Affairs and Climate Action
on the basis of a decision by the German Bundestag
IKI International Climate Initiative
Implemented by giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

International PtX Hub

Centre of **EXPERTISE** and **COLLABORATION**

With strong international networks for a sustainable market development

Supported by:

Federal Ministry for Economic Affairs and Climate Action

on the basis of a decision by the German Bundestag

IKI INTERNATIONAL CLIMATE INITIATIVE

Implemented by

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

PtX Hub
Partner countries

… plus access to over 120 more partner countries via giz

Updated: Dec 2023

Legal disclaimer: This geographical map is for informational purposes only and does not constitute recognition of international boundaries or regions; GIZ makes no claims concerning the validity, accuracy or completeness of the maps nor assumes any liability resulting from the use of the information therein.

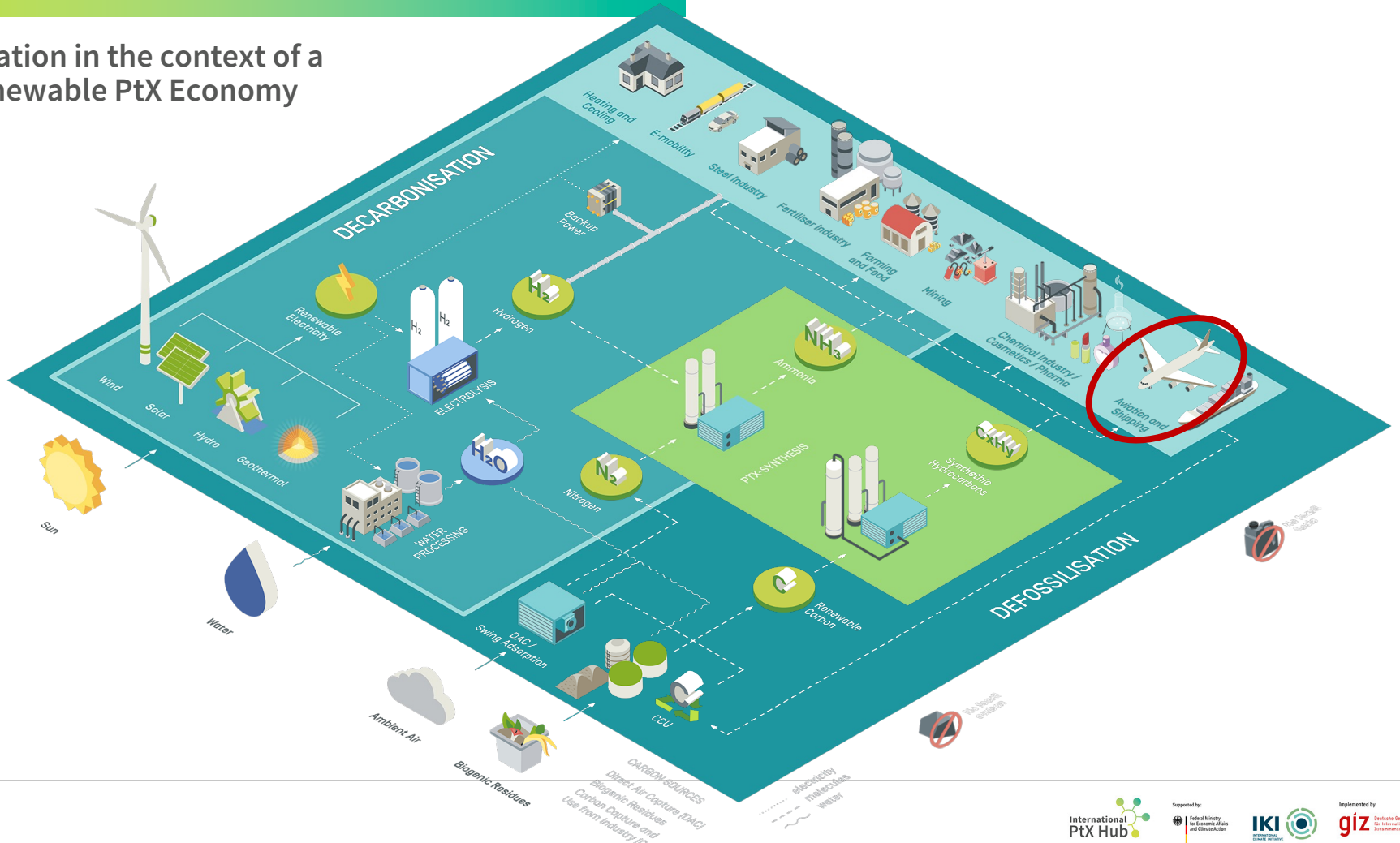
International PtX Hub

Supported by: Federal Ministry for Economic Affairs and Climate Action on the basis of a decision by the German Bundestag

IKI International Climate Initiative

Implemented by giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Aviation in the context of a Renewable PtX Economy



International PtX Hub

Supported by: Federal Ministry for Economic Affairs and Climate Action on the basis of a decision by the German Bundestag

IKI International Climate Initiative

Implemented by giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

PtX routes for SAF

SAF Pathways in the pipeline

- ✓ Virent SAK
- ✓ Shell IH2
- ✓ Global Bioenergies
- ✓ Swedish Biofuel
- ✓ Indian CSIR-IIP
- ✓ **Methanol**

ASTM D4054

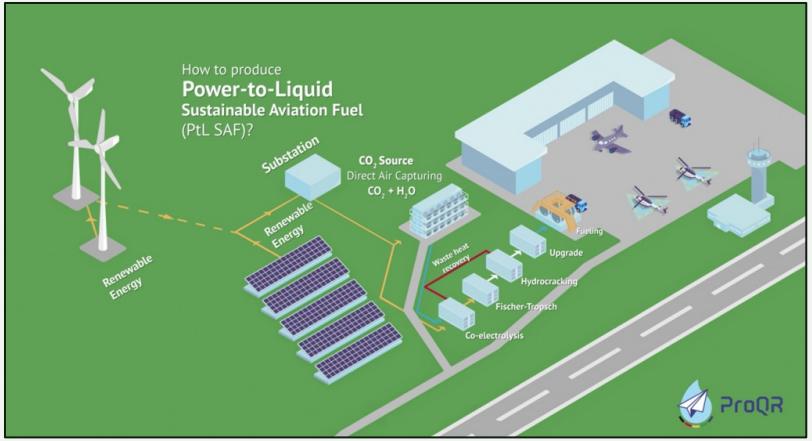
International PtX Hub focus

Product	Certification	Input	Blending ratio by volume
Jet A-1	D1655		100%
Fischer-Tropsch (FT-SPK)	D7566 Annex 1		50%
Fischer-Tropsch with aromatics (FT-SKA)	D7566 Annex 4		50%
Alcohol to jet (ATJ- SPK)	D7566 Annex 5		50%
Hydroprocessed esters and fatty acids (HEFA)	D7566 Annex 2		50%
Catalytic hydrothermolysis jet fuel (CHJ)	D7566 Annex 6		50%
Hydrocarbon - hydroprocessed esters and fatty acids (HC-HEFA-SPK)	D7566 Annex 7		50%
Synthesized iso-paraffins (SIP)	D7566 Annex 3		10%

Source: ENVReport2022_Art49.pdf (icao.int)

International PtX Hub
Supported by: Federal Ministry for Economic Affairs and Climate Action, on the basis of a decision by the German Bundestag
IKI International Climate Initiative
Implemented by giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

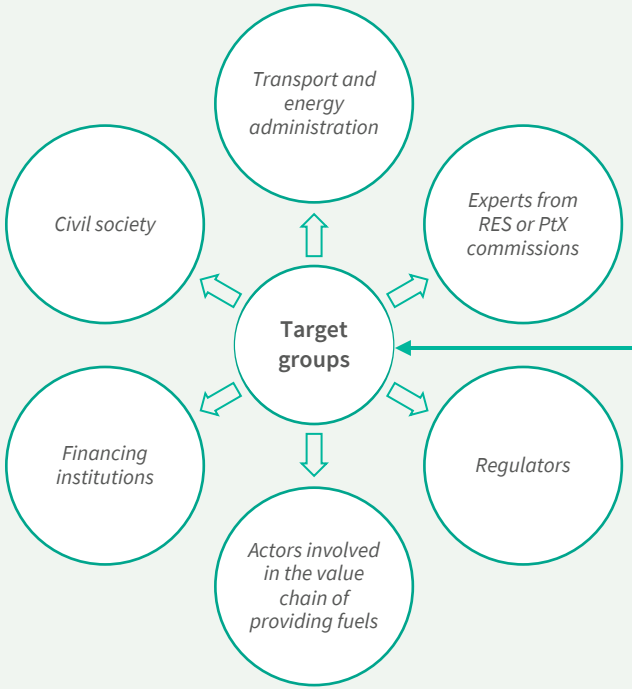
PtX Hub Aviation
contributing to ICAO ACT-SAF



- Technical assistance to countries on their SAF strategy, e.g. identifying opportunities for Kenya as a pilot country
- Aviation deep dive training, train of trainer programme
- Creation of studies, papers, and more in collaboration with experts and consultants
- Discussions and stakeholder dialogues for new pathways with partner countries and collaboration organisations
- Capacity building for decision-makers as contribution to the ACT-SAF programme by the International Civil Aviation Organisation (ICAO)
- Orchestrating innovative financing for selected large scale SAF projects

International PtX Hub
Supported by: Federal Ministry for Economic Affairs and Climate Action
on the basis of a decision by the German Bundestag
IKI International Climate Initiative
Implemented by giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

PtX Hub Aviation Training



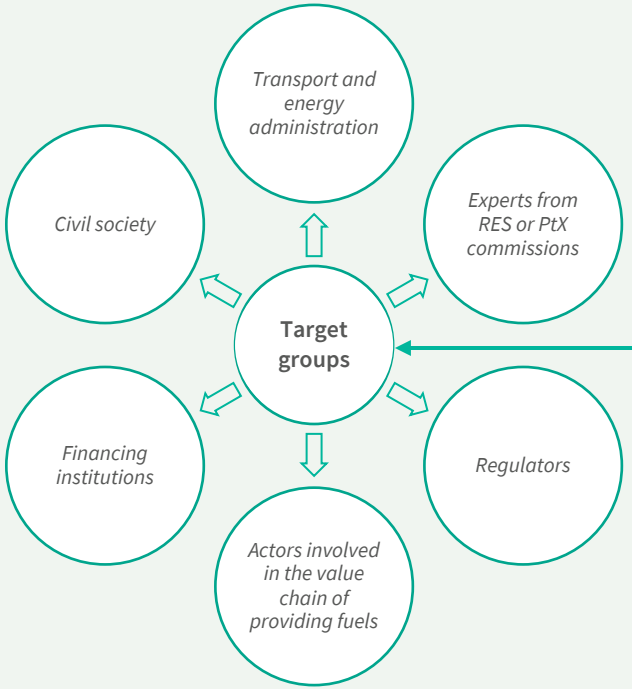
International PtX Hub

Training content

- Status quo in the aviation sector (volumes, current fuels)
- International climate change policy and regulation regarding the aviation sector
- PtL SAF Feedstocks
- Production processes
- Synthesis processes
- Fuels post processing
- Regulatory concerns and certification
- Sustainability concerns
- Policy instruments
- Engineering, procurement and construction
- Operation & Maintenance (O&M), End of Life
- Transfer Workshop

International PtX Hub
Supported by: Federal Ministry for Economic Affairs and Climate Action
on the basis of a decision by the German Bundestag
IKI International Climate Initiative
Implemented by giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

PtX Hub Finance Training



International PtX Hub

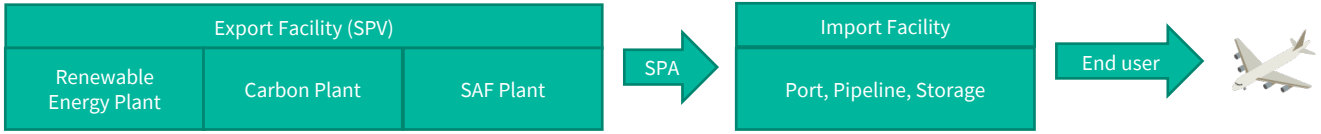
Training content

- Contextual economic framing)
- Developing PtL projects
- View on stakeholder and their interests
- Project Finance/PPP/Contracts
- Risk and Analysis
- Basics of financial modeling
- Quantitative evaluation
- Qualitative evaluation
- PtX Ecosystem

International PtX Hub
Supported by: Federal Ministry for Economic Affairs and Climate Action
on the basis of a decision by the German Bundestag
IKI International Climate Initiative
Implemented by giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

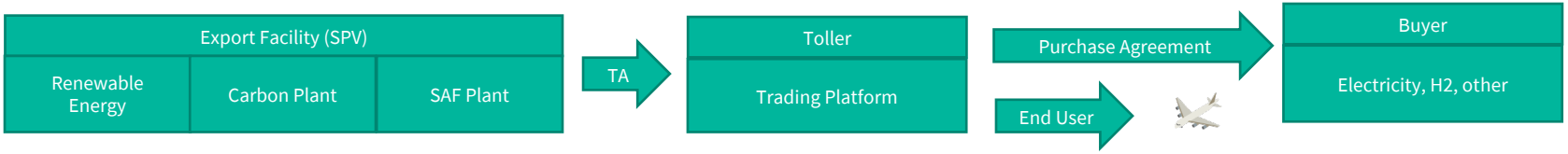
Orchestrating innovative financing for selected large scale SAF projects
CapEx sensitive approach via Merchant Model

Integrated Merchant Model

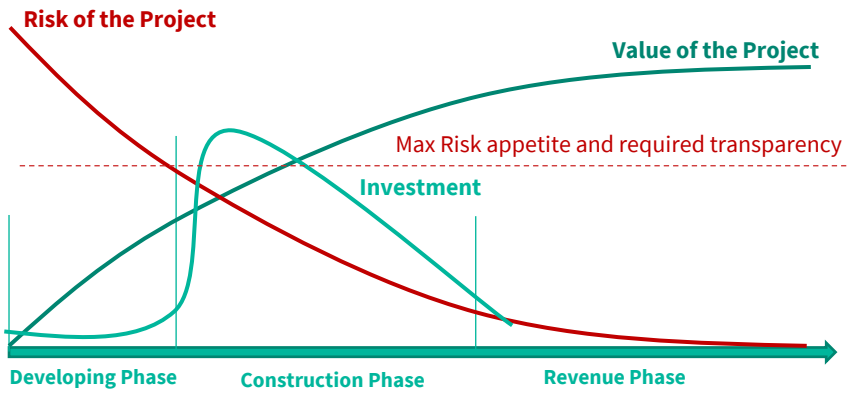


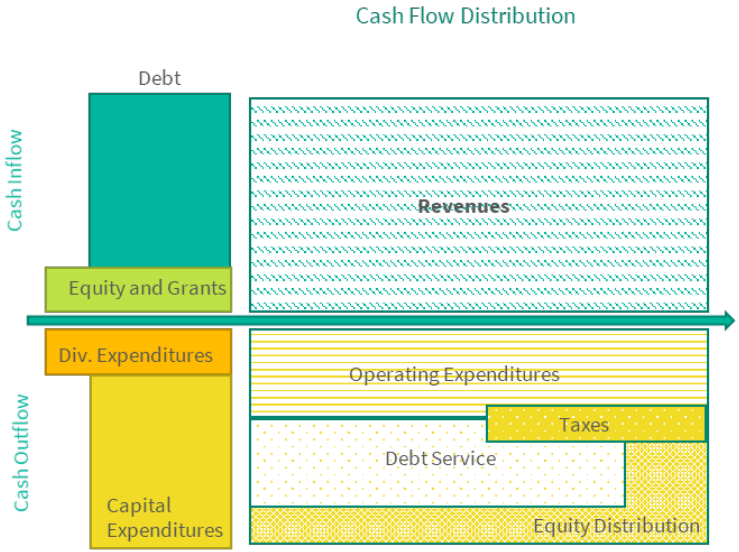
Segregated Merchant Model

Tolling Model



Orchestrating innovative financing for selected large scale SAF projects
Finding investors with the appropriate risk appetite over time





Orchestrating innovative financing for selected large scale SAF projects
De-risking projects through innovative financial structuring

Five critical risk factors influencing cost of financing

- Uncertain market demand
- Limited credible off-takers
- Uncertain SAF price (bid/offer, production cost development, etc.)
- Limited enabling infrastructure (carbon source, book&claim, certification, etc.)
- Country risk (social unrest, rating, stability, …)

International PtX Hub

Supported by: Federal Ministry for Economic Affairs and Climate Action

on the basis of a decision by the German Bundestag

IKI International Climate Initiative

Implemented by giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Thank you!

Dec 5th 2023

Torsten Schwab, Director of PtX Hub
torsten.schwab@giz.de

© PtX Hub– Catalysing defossilisation globally | info@ptx-hub.org

International PtX Hub
Supported by: Federal Ministry for Economic Affairs and Climate Action on the basis of a decision by the German Bundestag
IKI International Climate Initiative
Implemented by giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH