Topic

Introduction to Feedstock

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Project Manager

Raphaela Spielberg is a highly experienced professional in the field of sustainable finance, with a strong track record in strategy development and the execution of impactful projects and climate technologies. Her expertise extends to thematic investment consulting and climate risk management, particularly in overseeing ESG-compliant initiatives while driving sustainable financial solutions.

She is experienced in assessing and developing business cases in the PtX field, analysing climate challenges, executing the financial modelling and conducting deep-dive research of risk & sensitivity.

Consulting Focus @ CBR Sustainability Partners

- Project management and business planning, e.g., application support for EU funding programs for the demonstration of innovative low-carbon technologies (EU Innovation Fund)
- Sustainability (CSR) and ESG concept development and implementation (strategy, roadmaps, reporting, labels)

Education

Sustainability & Climate Risk Professional, GARP

Master in Sustainable Finance, NOVA SBE, Lisbon

Introduction to Feedstock

- Exploration of the certifications for SAF and different regulatory frameworks
- Classification of feedstocks under ICAO’s CORSIA sustainability framework
- Overview of CORSIA-defined methodology for GHG emissions calculation and sustainability criteria for SAF feedstocks
- Understanding feedstock related risks and the corresponding mitigation strategies

SAF as substitutes for fossil jet kerosene, are critical to decarbonising aviation as hard-to-abate sector.

Category	Feedstock	Technology pathway
Advanced biofuels	from biomass	**HEFA** (Hydrotreated Ester Fatty acid) **BtL** (Biomass to Liquid) **PBtL** (Power Biomass to Liquid)
Synthetic aviation fuels (e-SAF, RFNBO)	from e-H_2 and CO_2	**PtL** (Power to Liquid) **PBtL** (Power Biomass to Liquid)
Recycled carbon aviation fuels	from waste	**WtL** (Waste to Liquid)

Source: CBR (2025)

Regulatory Frameworks and SAF Sustainability Criteria

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

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.

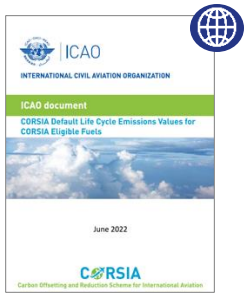
ASTM INTERNATIONAL

Source: ASTM (2022)

Feedstocks are subject to various regulatory schemes, resulting in additional complexity.

Feedstock philosophies according to RED III ANNEX IX A/B vs. examples of international schemes, e.g. CORSIA (ICAO)

CORSIA (ICAO)
Carbon Offsetting and Reduction Scheme for *International* Aviation



Eligible feedstock categories:
- Residues, Waste, By-Products, Co-Products
- Main Products: Sugarcane, Sugar beet, Soybean oil, Rapeseed oil, Palm oil, Corn, Primary biomass…

Minimum GHG saving
- >10 %

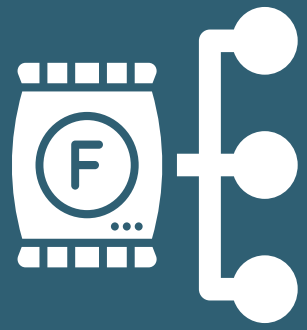
Renewable Energy Directive RED III
European Union

Eligible feedstock categories:
- Residues, Waste, By-Products
- *No "Main Products"*, especially no food and feed crops. Fuels from waste according to Annex IX/B are capped (1.7 % by energy).

Minimum GHG saving
- >70 % for RFNBO-SAF; >65 % for all other SAF

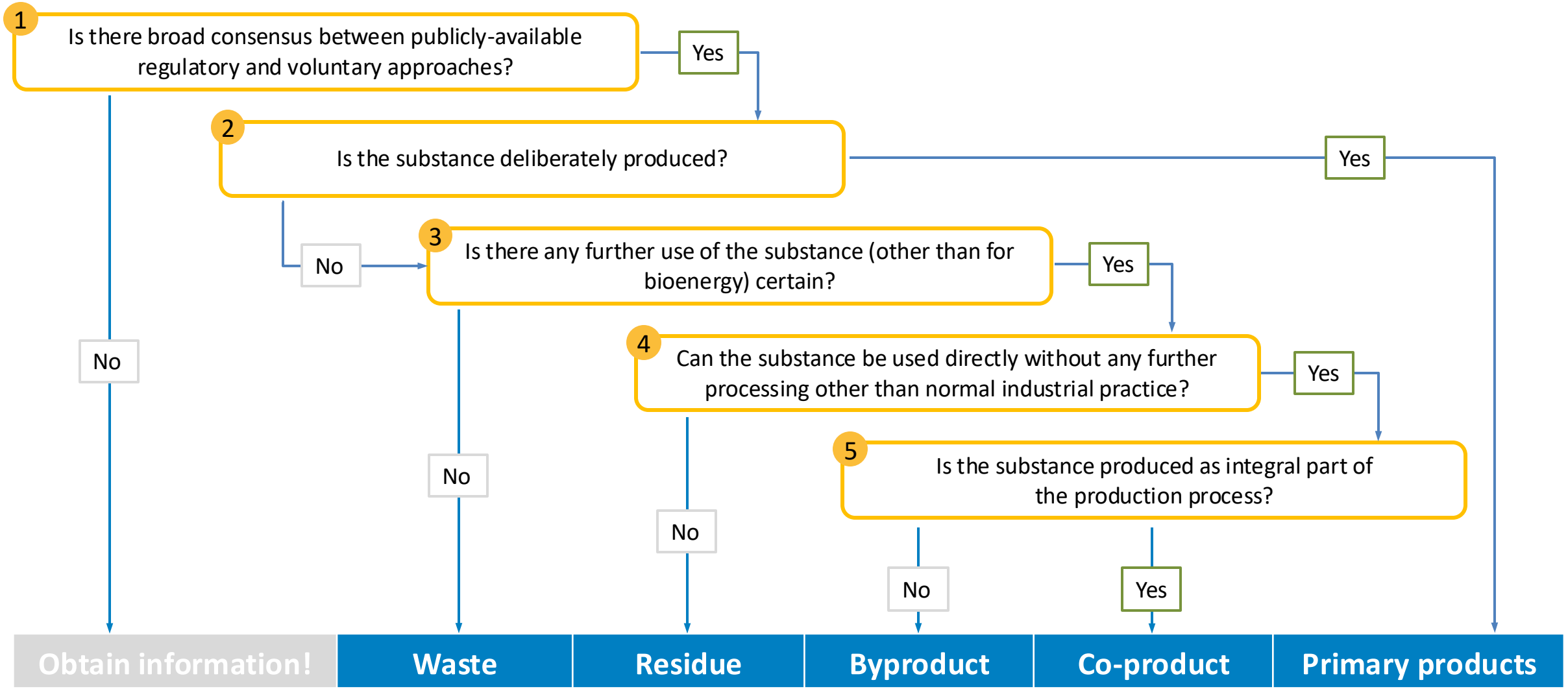
List of eligible feedstocks **determines their availability** and thus the **price developments**.
Sustainability criteria, especially regarding treatment of food and feed crops and regarding minimum GHG savings is currently highly region-dependent.

Source: ICAO(2024), EU (2025)



Characterization of feedstock defined under ICAO-CORSIA

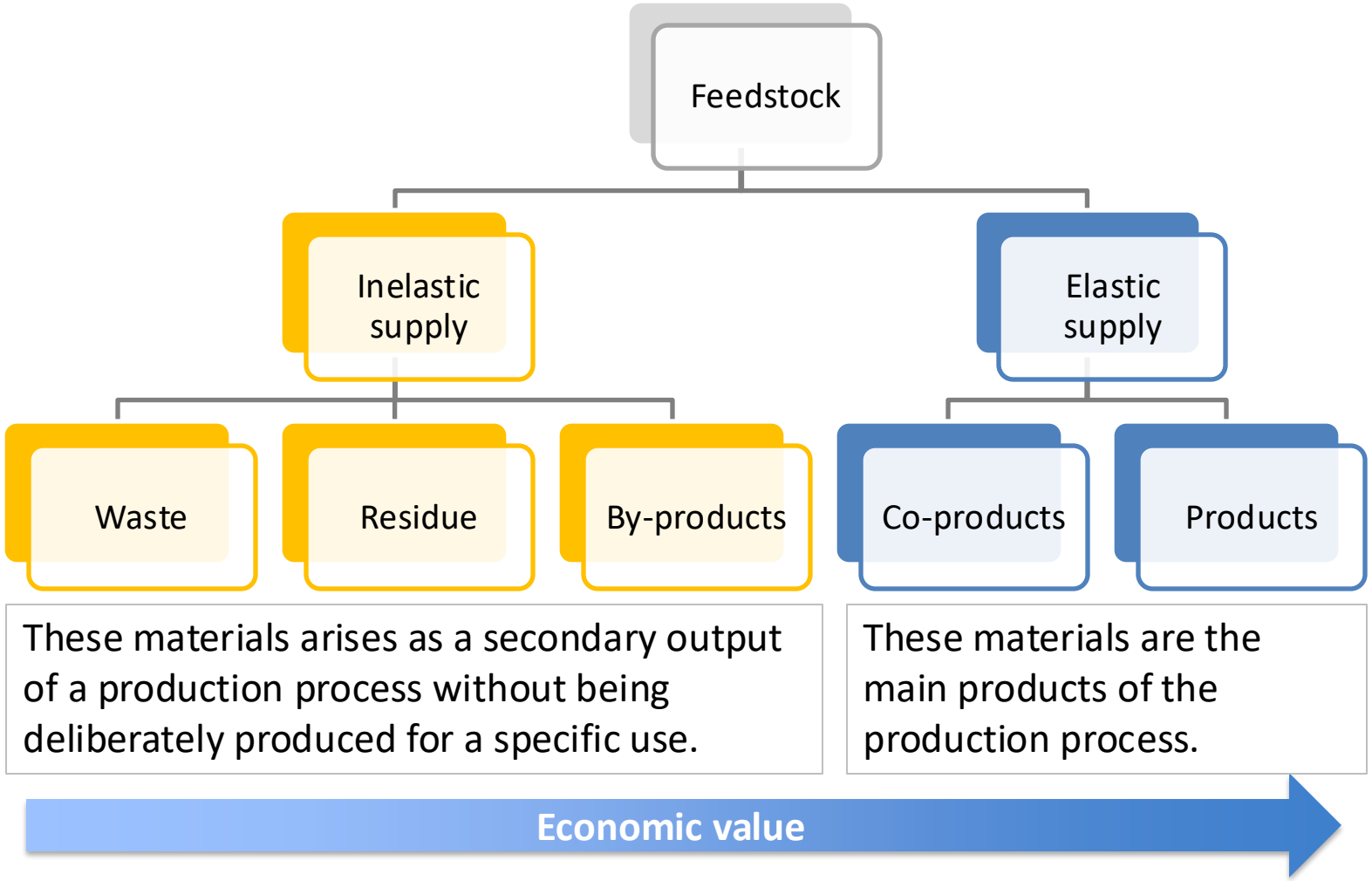
Five feedstock categories and five step schema to determine the feedstocks



Source: CBR (2025)

CORSIA Eligible Feedstocks categorization on economic basis

Different feedstock under defined categories can be used for CORSIA Eligible Fuels (GHG emission saving >10%).



Source: ICAO(2024)

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

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Source: ICAO (2024)

CORSIA has recognized 48 feedstock types under five categories

Waste	Residues		By-products	Co-products	Primary products
Municipal solid waste (MSW)	Bagasse	Straw	Palm fatty acid distillate	Molasses	Brassica carinata oilseed
Waste gases	Cobs	Bark	Technical Corn oil		Camelina oilseed
Used cooking oil	Husks	Branches	Mixed Animals Fat		Corn grain
	Manure	Cutter shavings	Non-Standard Coconuts		Jatropha oilseed
	Nut shells	Leaves	Beef Tallow		Miscanthus (herbaceous energy crops)
	Stalks	Needles	Poultry Fat		Palm fresh fruit bunches
	Stover	Pre-commercial thinnings	Lard Fat		Poplar (short rotation woody crops)
	Slash	Crude tall oil	Tallow		Rapeseed oilseed
	Tree tops	Empty palm fruit bunches			Soybean oilseed
	Crude glycerine	Forestry processing residues			Sugar beet
	Palm oil mill effluent	Tall oil pitch			Sugar cane
	Sewage sludge	Wheat starch slurry			Switch grass (herbaceous energy crops)

Source: ICAO (2024)

Sustainability criteria and GHG emission calculation methodology under CORSIA

Life cycle emissions value of the feedstock is crucial for the sustainability criteria

Why the type of feedstock is important?

The amount of emissions reductions generated by the use of CEF depends on its life cycle emissions value (LS_f)

Actual Core LCA value + ILUC – Emission credits = **LS_f**

LS_f = Total Life Cycle emissions in gCO_2eq/MJ of fuel produced and combusted in an aircraft

Core LCA value = Core Life Cycle emissions value of a fuel pathway

ILUC = Induced Land Use Change value

CORSIA Default Life Cycle Emission Values for CORSIA Eligible Fuels produced with the Hydroprocessed Esters and Fatty Acids (HEFA) Fuel Conversion Process

Region	Feed Feedstock	Core LCA Value	ILUC LCA Value	Emission credits	LS_f (gCO_{2e}/ MJ)
Global	Tallow	22.5	0	0	22.5
Global	Used cooking oil	13.9	0	0	13.9

Source: CORSIA Methodology for Calculating Actual Life Cycle Emissions Values (2024), Default Life Cycle Emission Values (2024)

Feedstock related risks and mitigation strategies

4 major types of risks related to feedstocks – Regulatory, Market, Infrastructure and Technology

Regulatory uncertainty

- **Lack of harmonized sustainability criteria** for feedstock eligibility across different regions of the world
- **Shifts in policies structures** such as **changing incentives** may affect project viability
- **Hinderance in feedstock eligibility** and certification **due to stricter sustainability standards**

Competitive market

- **Inconsistency in accessibility of feedstocks** due to their demand for other applications
- Growing **dependence on** other **compatible feedstocks**
  - **Risk of land use conflicts** and ILUC

Demand and supply driver

- **Fluctuation in market** causes **feedstock cost instability** – affecting long term planning and investment certainty
- **Inconsistency in feedstock production** hindering the stable supply
- **Lack of supplier diversity** weakens negotiation leverage

Infrastructure challenges

- **Discrepancies between feedstock activation** & innovation **and technology maturity** of feedstock treatment
- **Unavailability of resilient infrastructure** for waste feedstock collection
- **Lack of feedstocks diversity due to lacking compatibility** in coprocessing technologies

Source: CBR (2025)

Potential risk mitigation strategies

1	CORSIA standards	➢ Following the CORSIA defined sustainability standards initially to ensure regulatory compliance with regards to sustainability standards and **acceptance of SAF feedstock globally**
2	Feedstock diversification	➢ Diversifying feedstock suppliers from different geographies **reduces the dependency on a single provider**, mitigating the risk of unavailability or bargaining power of a supplier
3	Purchase agreements	➢ Establishing long term purchase agreements with the feedstock suppliers to **stabilize costs and reduce exposure to price volatility**
4	Standards harmonization	➢ Supporting the initiative of harmonization of international sustainability standards to **streamline compliance and certification standards as well as reduce market fragmentation**
5	Infrastructure development	➢ Supporting infrastructure development initiative for resilient supply of feedstocks, including waste collection, aggregation, and pre-treatment to **improve feedstock accessibility**
6	Technological advancement	➢ Investing in advancing the maturity of the other low TRL based conversion pathways suitable for diverse, compatible and non-food feedstocks, **encouraging diversification of feedstocks**
7	Strategic partnerships	➢ Forming strategic partnerships with feedstock suppliers to secure input streams and align project objectives, **mitigating issues with long term planning and investment certainty**
8	Inventory management	➢ Investing in robust inventory management systems to buffer supply disruptions and enhance operational reliability, allowing for **better accessibility to feedstocks**

Source: CBR (2025), CORSIA Sustainability Standards (2024)

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