How to achieve sustainability in the aviation fuel production?

Carolina Grassi

Business Development Lead (Latin America)

RSB: A just transition to a net positive world

RSB is leveraging its community, resources and best-in-class sustainability standard as part of a global movement **to create a world of positive impacts and a thriving planet** with:

- 1.5C warming cap achieved
- Fossil left in the ground
- Maximum circularity
- Assured global nutrition and water access
- Guaranteed human & labour rights
- Productive and healthy ecosystems

This transition to a **new, climate resilient society** is done with the **voices of all people** – particularly the **marginalised** and **workers** in affected industries – at its core.

Principle 1
Legality

Principle 2
Planning, Monitoring & Continuous Improvement

Principle 3
Greenhouse Gas Emissions

Principle 4
Human & Labour Rights

Principle 5
Rural and Social Development

Principle 6
Local Food Security

Principle 7
Conservation

Principle 8
Soil

Principle 9
Water

Principle 10
Air Quality

Principle 11
Use of Technology, Inputs & Management of Waste

Principle 12
Land Rights


VINYTHAI
AGC Group
HALDOR TOPSOE
PECDC GROUP
AIRFRANCE
TROWEL DEVELOPMENT FOUNDATION, INC.
Building resilient communities through sustainable development solutions
Life Sciences Queensland
Sucre-Ethique
Saipol
GROUPE Avril
WESAF
ENERGY SOLUTIONS
TUI GROUP
National Wildlife Federation
nuseed
CATHAY PACIFIC
Amigos da Terra
world energy
SAS
steeper ENERGY
AIR NEW ZEALAND
PROJECT GAIA
ENERGY REVOLUTION
Solidaridad
American Chemistry Council
ewaba
European Waste-to-Advanced Biofuels Association
BRITISH AIRWAYS
UNITED
canopy
AIRBUS
tensei
N-BiG
Namibia Biomass Industry Group
SkyNRG
jetBlue
BOEING
MEMBER
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WWF
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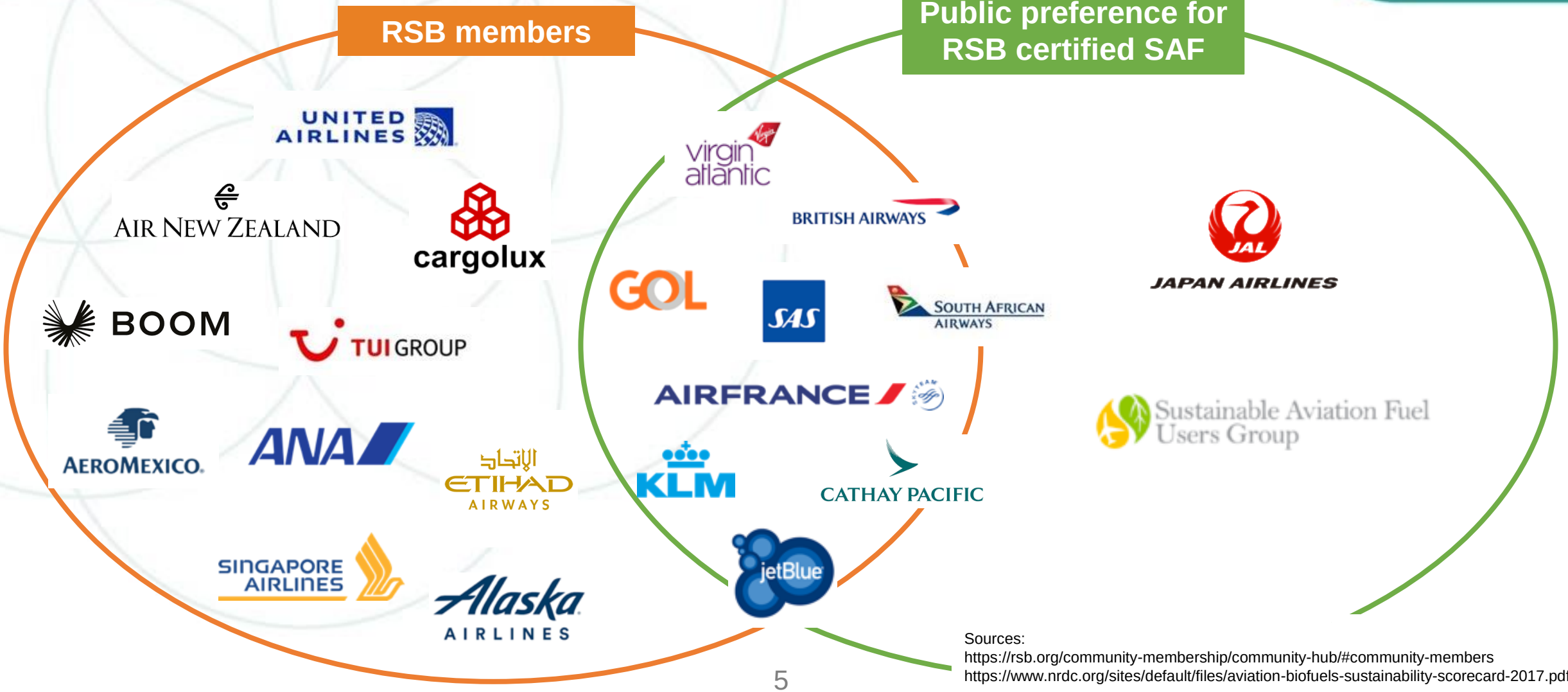
IfBB
Institut für Biokunststoffe und Bioverbundwerkstoffe
BIODIESEL
America's Advanced Biofuel
MANILDRA GROUP
TOTAL
xpansiv
AN XCHG COMPANY
sustainable shipping initiative
JGI
ECB GROUP
flightnook
Celtic Renewables
DB Tarımsal Enerji
Socicana
Shell
NRDC
GreenAviation
SA Canegrowers
QUANTAFUEL
gevo
P&G
GoodFuels
MBP Group
Innovative Business for Tomorrow's Environment
NREL
National Renewable Energy Laboratory
Ubrabio
União Brasileira do Biodiesel e Bioquerosene
SCHATZ ENERGY RESEARCH CENTER
european bioplastics
Driving the evolution of plastics
LanzaTech
capturing carbon.
IPIECA
IATA
TextileExchange
Creating Material Change
AERF
Applied Environmental Research Foundation
AAiT
ADDIS ABABA INSTITUTE OF TECHNOLOGY
ADDIS ABABA UNIVERSITY
The Bioeconomy Consultants
NNFCC
HERIOT WATT UNIVERSITY
cargolux
NESTE
BIOLEDGER
virgin atlantic
soleá
GOL
SunCHEM
MBA
Malaysian Biodiesel Association
GARDN
Green Aviation Research & Development Network
KEFRI
BOOM
道兰环能
MotionECO
BASF
We create chemistry
KLM
DUPONT
VELOCYS
SINGAPORE AIRLINES
ETIHAD AIRWAYS
ICENECDEV
INEOS
POWERED BY DUPONT-GENENCOR SCIENCE
wilmar
Gold Standard
Climate Security & Sustainable Development
MAERSK
tasma bio energy
ANN BLAKE, Ph.D.
Environmental & Public Health Consulting
ANA

Affiliated airlines

Flying on RSB certified SAF



Sources:
https://rsb.org/community-membership/community-hub/#community-members
https://www.nrdc.org/sites/default/files/aviation-biofuels-sustainability-scorecard-2017.pdf

RSB SAF ecosystem

Engaging all key SAF producers on RSB CORSIA certification

Certification of SAF supply chains in several EU H2020 projects

Developing top-up audit approaches for SAF traders and distributors

RSB's Aviation Work in Action

Fuelling the Sustainable Bioeconomy

Fuelling the Sustainable Bioeconomy

Boeing Project: 2019-2022

A collaboration between
RSB and WWF South Africa

RSB WWF

A project powered by Boeing's
Global Engagement Portfolio

BOEING

Support Development of the **Global SAF** Sector

Facilitate understanding & implementation of **sustainability across multiple sectors**

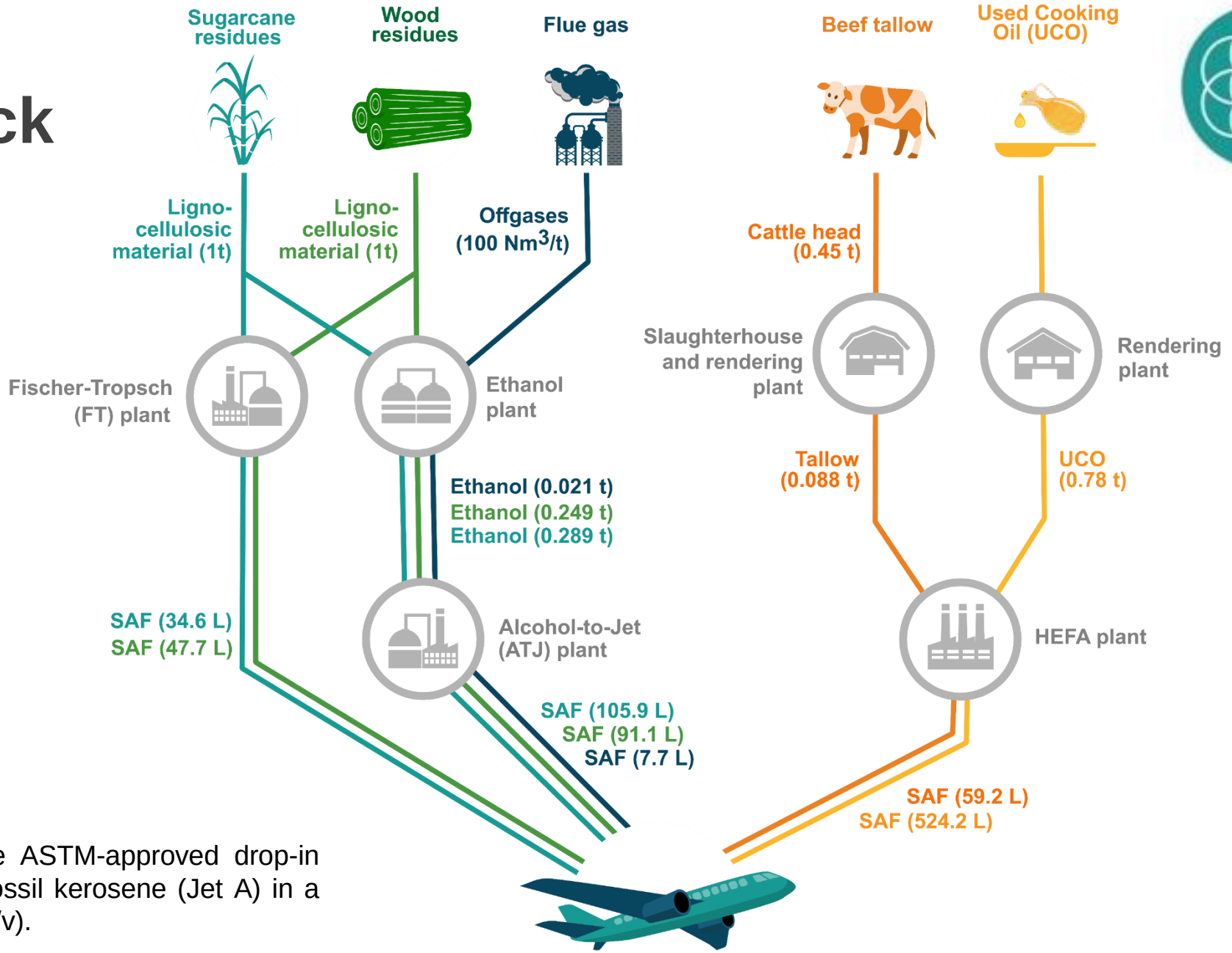
Support new **feedstock and technology** development

Encourage **transformation of traditional** commodity supply chains

Link with regional and global initiatives to **grow demand**

SAF Feedstock

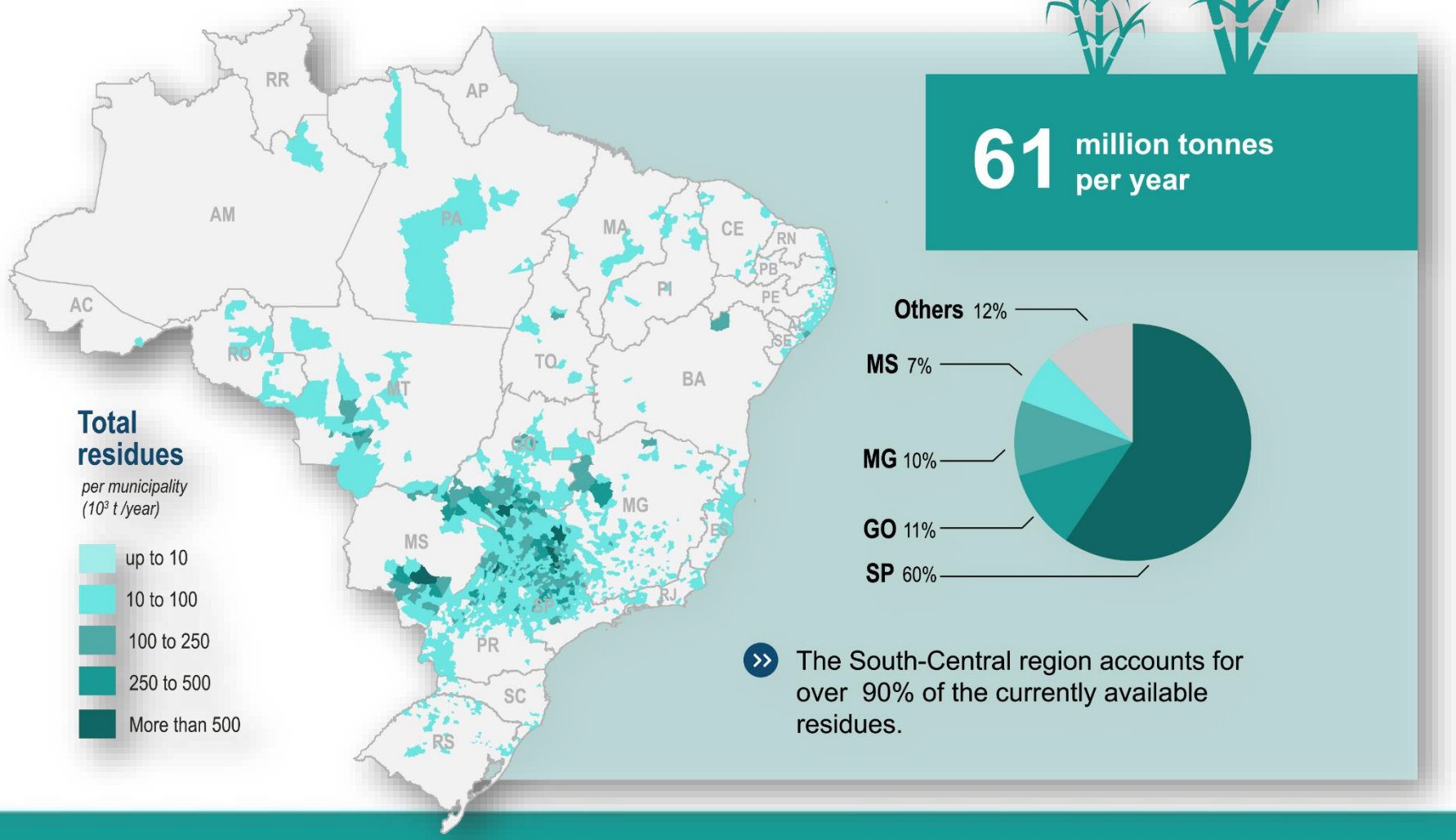
Waste and residues



*All pathways comprise ASTM-approved drop-in fuels to be used with fossil kerosene (Jet A) in a maximum 50% blend (v/v).

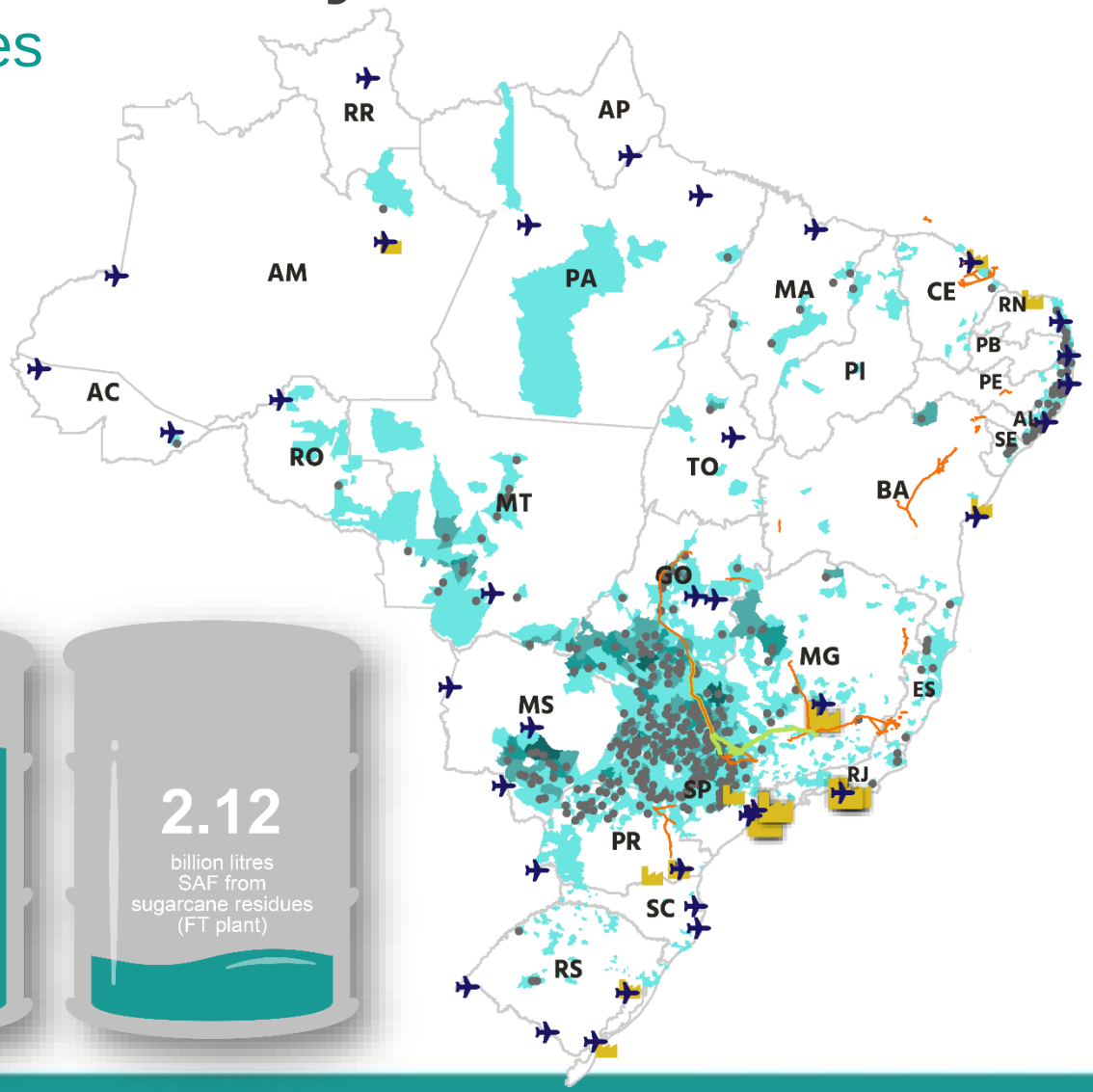
Feedstock availability

Sugarcane residues



Feedstock availability

Sugarcane residues



Total residues

per municipality
(10^3 t /year)

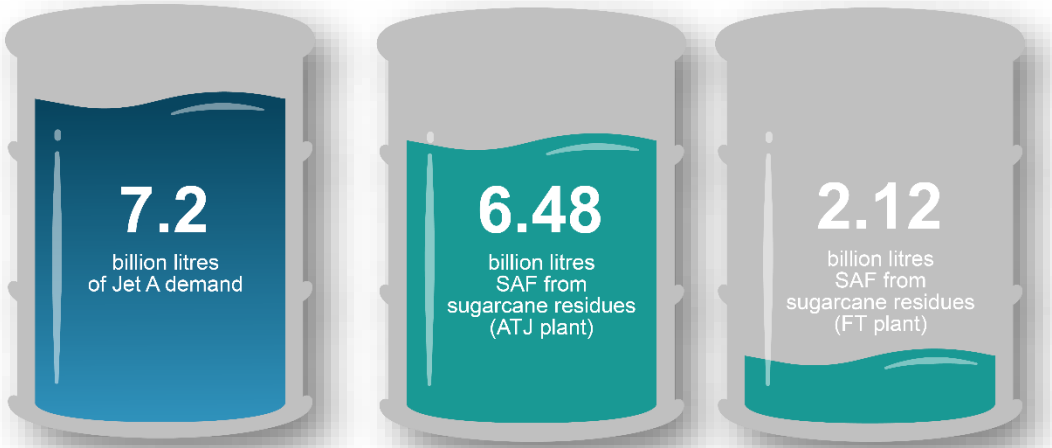
- up to 10
- 10 to 100
- 100 to 250
- 250 to 500
- More than 500

Jet A production refineries

(10^3 m^3/year)

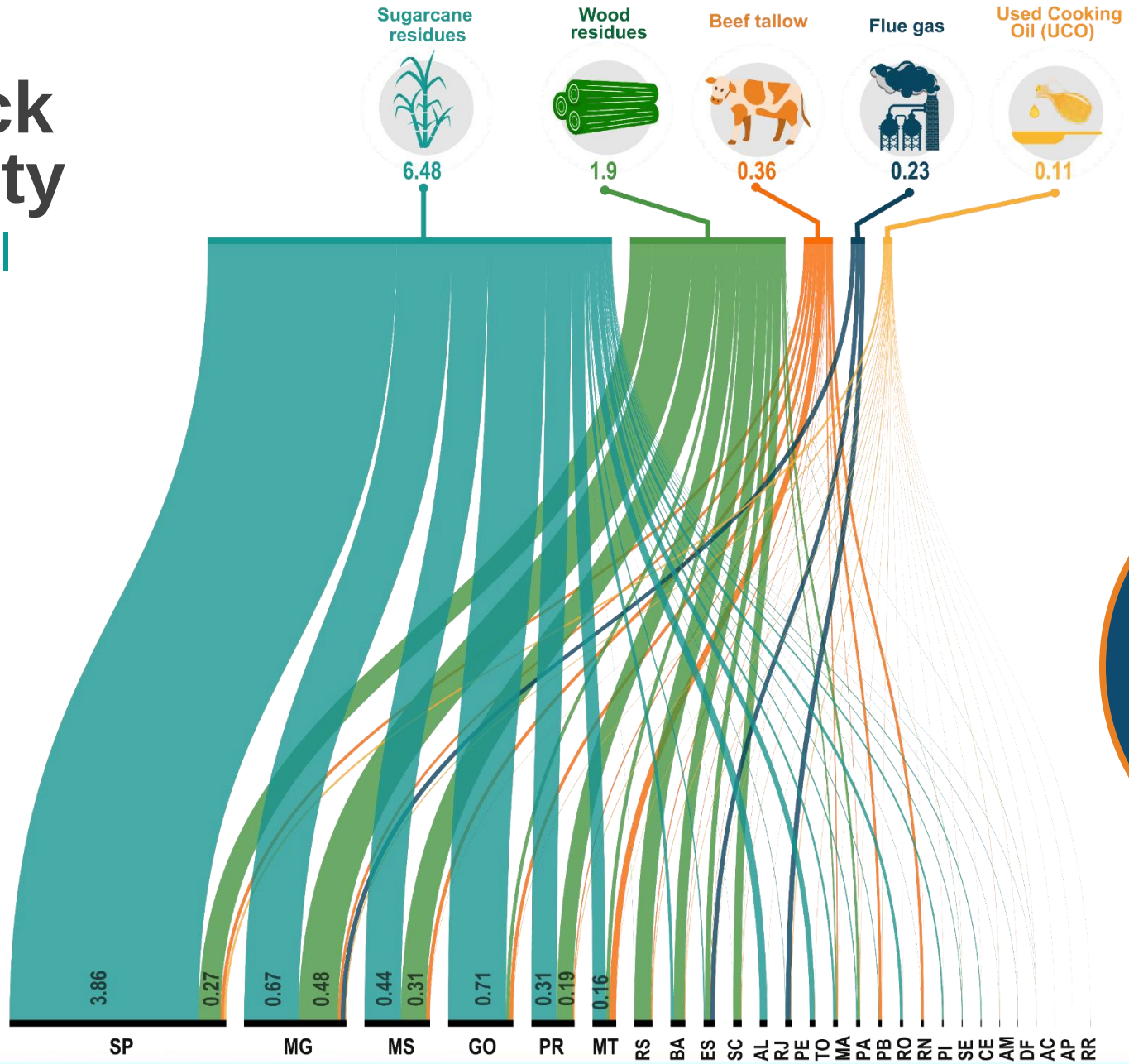
- up to 500
- more than 500

- International Airports
- Ethanol Mills
- Ethanol Pipeline
- Gas Pipeline



Feedstock availability

SAF potential production



Potential production

9 billion liters

Feedstock availability for SAF in Brazil

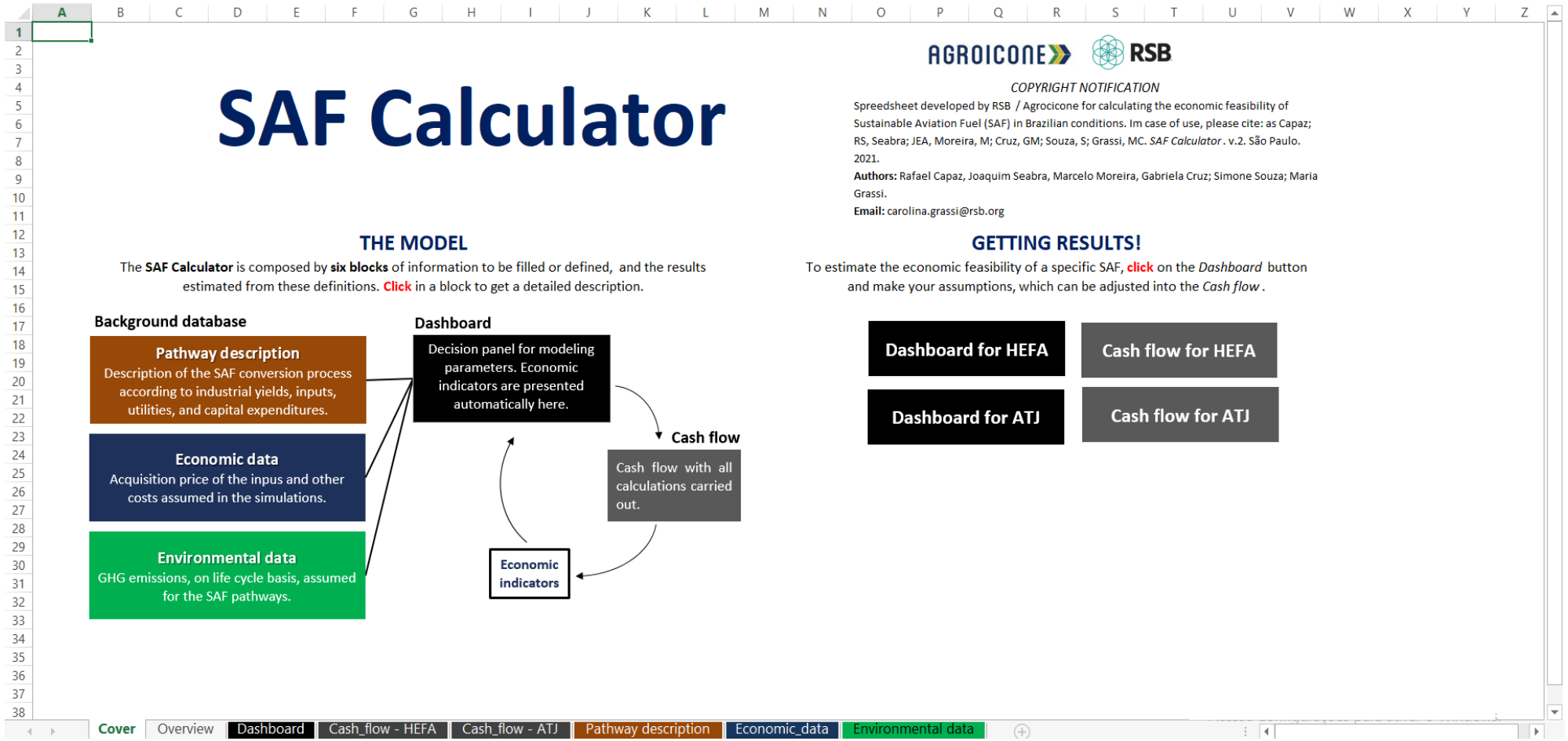
Factsheet

Designed by:

SEPIA STUDIO

Technical and economic feasibility

SAF calculator



Technical and economic feasibility

SAF calculator

Background database

Pathway description
- Reference plant (Capacity and CAPEX)
- Process yields
- Chemical inputs Utilities
- Physical data
- Cost of Growth (*for Pioneer plant*)

Economic data
- Feedstock
- Hydrogen
- Fossil fuels
- Utilities
- Transportation (freight cost)
- Production costs for SAF (for comparative purposes)
- Monetary rate

Environmental data
GHG emissions, on life cycle basis, assumed for the SAF pathways.

Dashboard

- Technology for SAF conversion
- Feedstock (based on the "*Economic data*")
- Reference technology (based on the "*Pathway description*")
- Production capacity (million m^3 distillate)
- N^{th} plant or Pioneer plant
- Equity / Interest rate / Payment time
- MARR
- Reference year for results

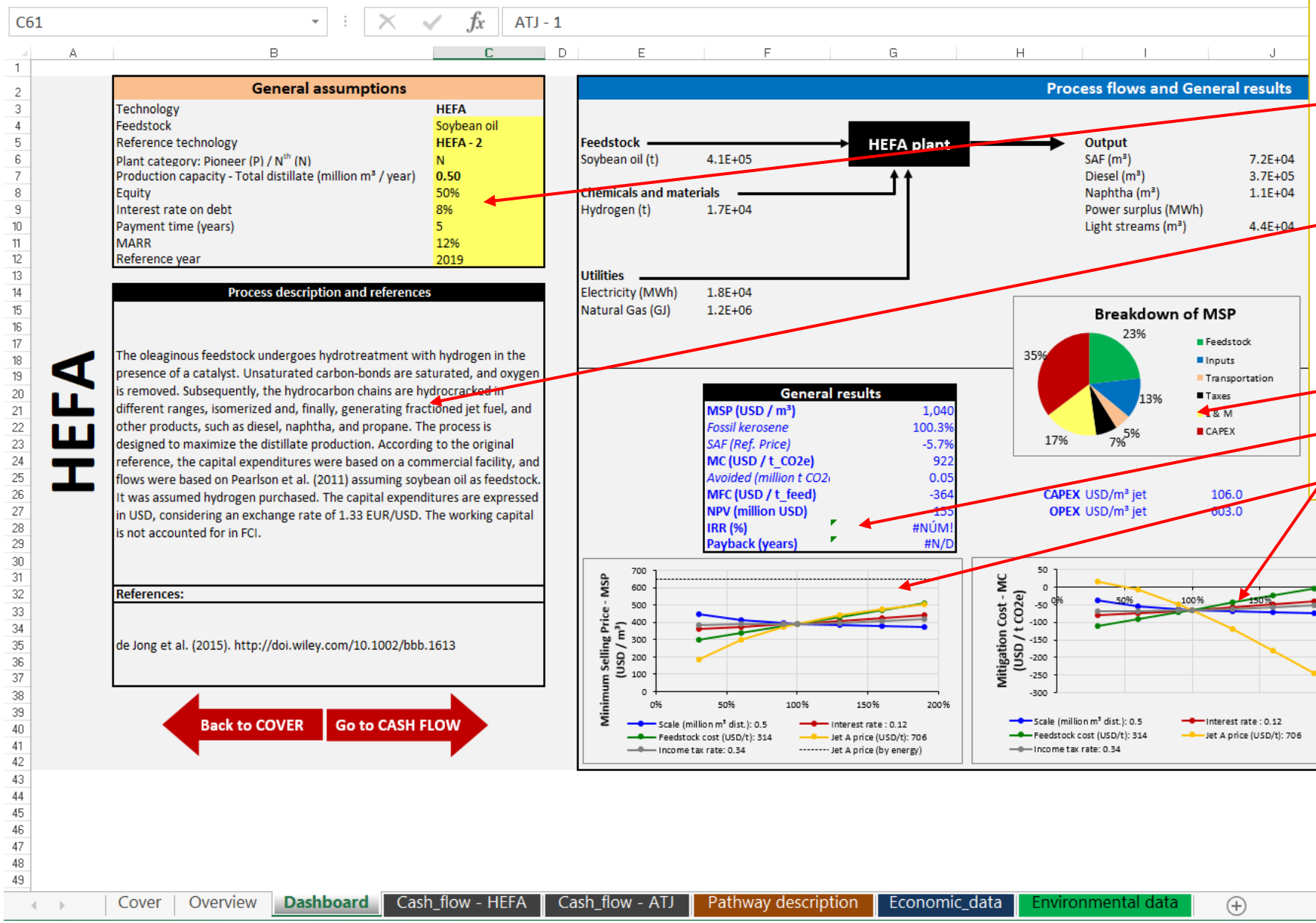
Economic indicators

- **Minimum Selling Price** (MSP), USD/m^3
- **Mitigation Costs** (MC), USD/tCO_{2e}
- **Maximum Feed Cost** (MFC), USD/t_{feed}
- **Net Present Value** (NPV), million USD
- **Internal Return Rate** (IRR), %
- **Payback** (PB); years
- **Sensitivity Analysis**

Cash flow

Parameters for **decision**:
- Transportation (distance / freight cost)
- OPEX: Labor / Maintenance / other…
- Income tax
- Investment plan (schedule)
- availability (schedule)
- Location Plant factor

Dashboard spreadsheet



Dashboard spreadsheet

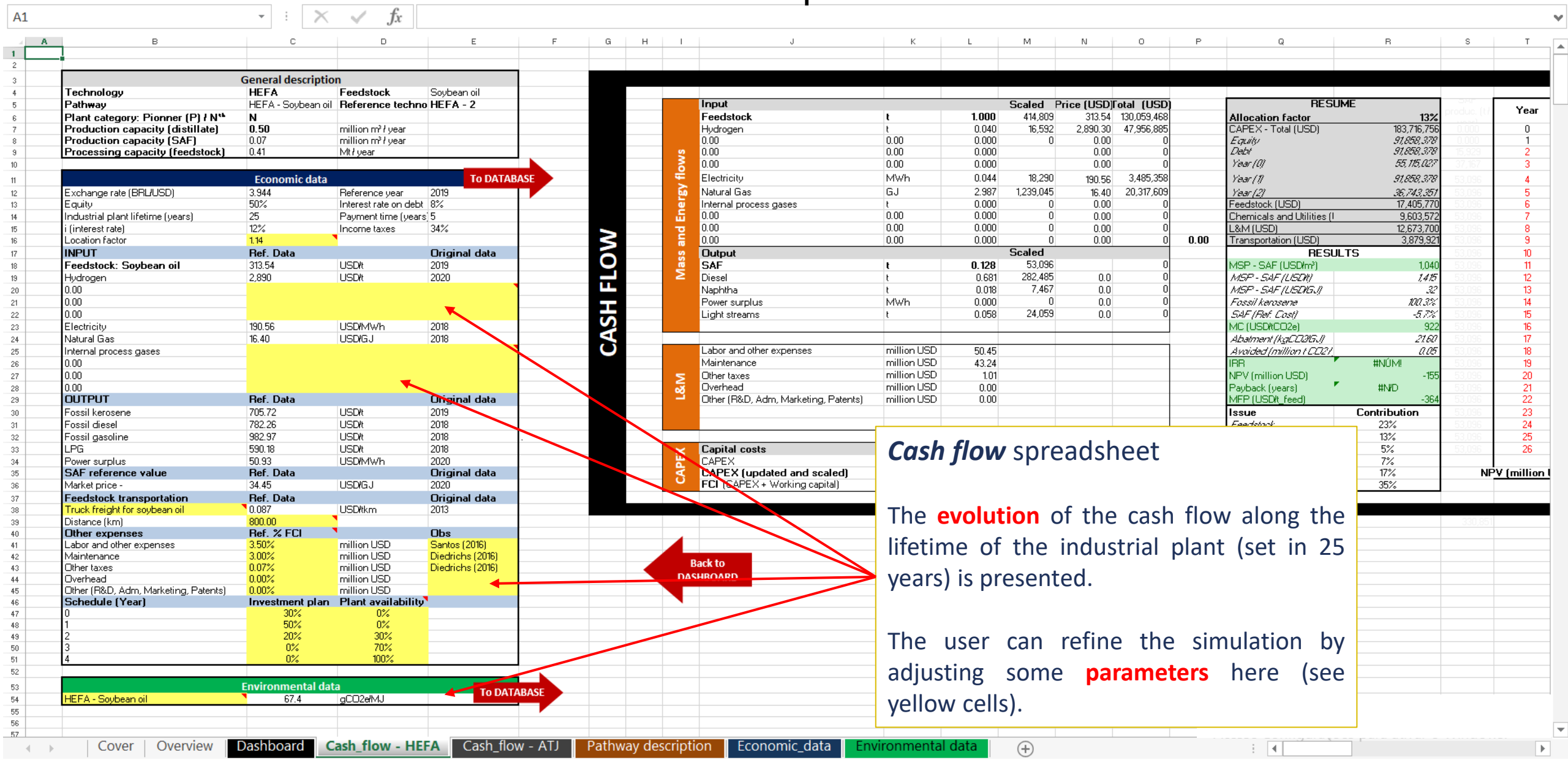
The user defines the **main parameters** for the simulation (see yellow cells)

The **description** of the technology assumed here and the reference is also presented, with the **mass/energy flows**.

The results are also shown comprising:

i) Costs composition;
ii) Economic indicators;
iii) Sensitivity analysis.

Cash flow spreadsheet



General description			
Technology	**HEFA**	**Feedstock**	Soybean oil
Pathway	HEFA - Soybean oil	**Reference techno**	**HEFA - 2**
Plant category: Pionner (P) / Nth	**N**		
Production capacity (distillate)	**0.50**	million m³ / year	
Production capacity (SAF)	0.07	million m³ / year	
Processing capacity (feedstock)	0.41	Mt / year	

Economic data			
Exchange rate (BRL/USD)	3.944	Reference year	2019
Equity	50%	Interest rate on debt	8%
Industrial plant lifetime (years)	25	Payment time (years)	5
i (interest rate)	12%	Income taxes	34%
Location factor	1.14		
INPUT	**Ref. Data**		**Original data**
Feedstock: Soybean oil	313.54	USD/t	2019
Hydrogen	2,890	USD/t	2020
0.00			
0.00			
0.00			
Electricity	190.56	USD/MWh	2018
Natural Gas	16.40	USD/GJ	2018
Internal process gases			
0.00			
0.00			
0.00			
OUTPUT	**Ref. Data**		**Original data**
Fossil kerosene	705.72	USD/t	2019
Fossil diesel	782.26	USD/t	2018
Fossil gasoline	982.97	USD/t	2018
LPG	590.18	USD/t	2018
Power surplus	50.93	USD/MWh	2020
SAF reference value	**Ref. Data**		**Original data**
Market price -	34.45	USD/GJ	2020
Feedstock transportation	**Ref. Data**		**Original data**
Truck freight for soybean oil	0.087	USD/tkm	2013
Distance (km)	800.00		
Other expenses	**Ref. % FCI**		**Obs**
Labor and other expenses	3.50%	million USD	Santos (2016)
Maintenance	3.00%	million USD	Diedrichs (2016)
Other taxes	0.07%	million USD	Diedrichs (2016)
Overhead	0.00%	million USD	
Other (R&D, Adm, Marketing, Patents)	0.00%	million USD	
Schedule (Year)	**Investment plan**	**Plant availability**	
0	30%	0%	
1	50%	0%	
2	20%	30%	
3	0%	70%	
4	0%	100%	

Environmental data		
HEFA - Soybean oil	67.4	gCO2e/MJ

To DATABASE

To DATABASE

CASH FLOW

	Input			Scaled	Price (USD)	Total (USD)
Mass and Energy flows	**Feedstock**	t	1.000	414,809	313.54	130,059,468
	Hydrogen	t	0.040	16,592	2,890.30	47,956,885
	0.00	0.00	0.000	0	0.00	0
	0.00	0.00	0.000		0.00	0
	0.00	0.00	0.000		0.00	0
	Electricity	MWh	0.044	18,290	190.56	3,485,358
	Natural Gas	GJ	2.987	1,239,045	16.40	20,317,609
	Internal process gases	t	0.000	0	0.00	0
	0.00	0.00	0.000	0	0.00	0
	0.00	0.00	0.000	0	0.00	0
	0.00	0.00	0.000	0	0.00	0
	Output			**Scaled**		
	SAF	t	0.128	53,096		0
	Diesel	t	0.681	282,485	0.0	0
	Naphtha	t	0.018	7,467	0.0	0
	Power surplus	MWh	0.000	0	0.0	0
	Light streams	t	0.058	24,059	0.0	0
L&M	Labor and other expenses	million USD	50.45			
	Maintenance	million USD	43.24			
	Other taxes	million USD	1.01			
	Overhead	million USD	0.00			
	Other (R&D, Adm, Marketing, Patents)	million USD	0.00			
CAPEX	**Capital costs**					
	CAPEX					
	CAPEX (updated and scaled)					
	FCI (CAPEX + Working capital)					

0.00

RESUME		Year
Allocation factor	**13%**	
CAPEX - Total (USD)	183,716,756	0
Equity	*91,858,378*	1
Debt	*91,858,378*	2
Year (0)	*55,115,027*	3
Year (1)	*91,858,378*	4
Year (2)	*36,743,351*	5
Feedstock (USD)	17,405,770	6
Chemicals and Utilities (I	9,603,572	7
L&M (USD)	12,673,700	8
Transportation (USD)	3,879,921	9
RESULTS		10
MSP - SAF (USD/m³)	1,040	11
MSP - SAF (USD/t)	*1,415*	12
MSP - SAF (USD/GJ)	*32*	13
Fossil kerosene	*100.3%*	14
SAF (Ref. Cost)	*-5.7%*	15
MC (USD/tCO2e)	922	16
Abatement (kgCO2/GJ)	*21.60*	17
Avoided (million t CO2)	*0.05*	18
IRR	#NUM!	19
NPV (million USD)	-155	20
Payback (years)	#N/D	21
MFP (USD/t_feed)	-364	22
Issue	**Contribution**	23
	23%	24
	13%	25
	5%	26
	7%	
	17%	NPV (million
	35%	

Back to DASHBOARD

Cash flow spreadsheet

The **evolution** of the cash flow along the lifetime of the industrial plant (set in 25 years) is presented.

The user can refine the simulation by adjusting some **parameters** here (see yellow cells).

Cover | Overview | Dashboard | Cash_flow - HEFA | Cash_flow - ATJ | Pathway description | Economic_data | Environmental data

Fuelling the Sustainable Bioeconomy

Main outcomes

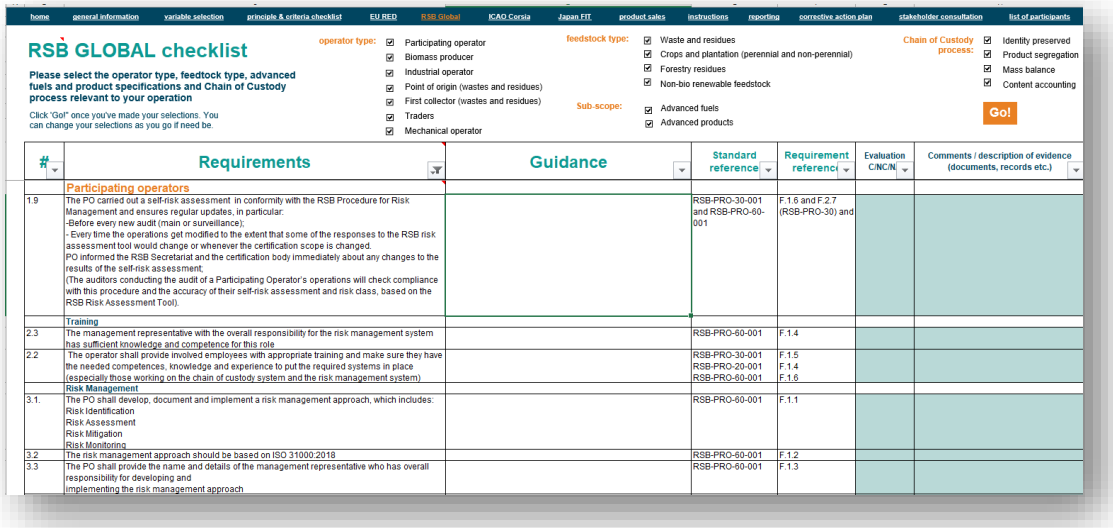
iLUC sudy to support new SAF routes under CORSIA

Guidelines for sustainable cultivation of Macauba

Guideline for sustainable cultivation of Sugarcane

Fuelling the Sustainable Bioeconomy

Main outcomes



home | general information | variable selection | principle & criteria checklist | EU RED | RSB Global | ICAO Corsia | Japan FIT | product sales | instructions | reporting | corrective action plan | stakeholder consultation | list of participants

RSB GLOBAL checklist

Please select the operator type, feedtock type, advanced fuels and product specifications and Chain of Custody process relevant to your operation

Click "Go!" once you've made your selections. You can change your selections as you go if need be.

operator type:
- Participating operator
- Biomass producer
- Industrial operator
- Point of origin (wastes and residues)
- First collector (wastes and residues)
- Traders
- Mechanical operator

feedstock type:
- Waste and residues
- Crops and plantation (perennial and non-perennial)
- Forestry residues
- Non-bio renewable feedstock

Sub-scope:
- Advanced fuels
- Advanced products

Chain of Custody process:
- Identity preserved
- Product segregation
- Mass balance
- Content accounting

Go!

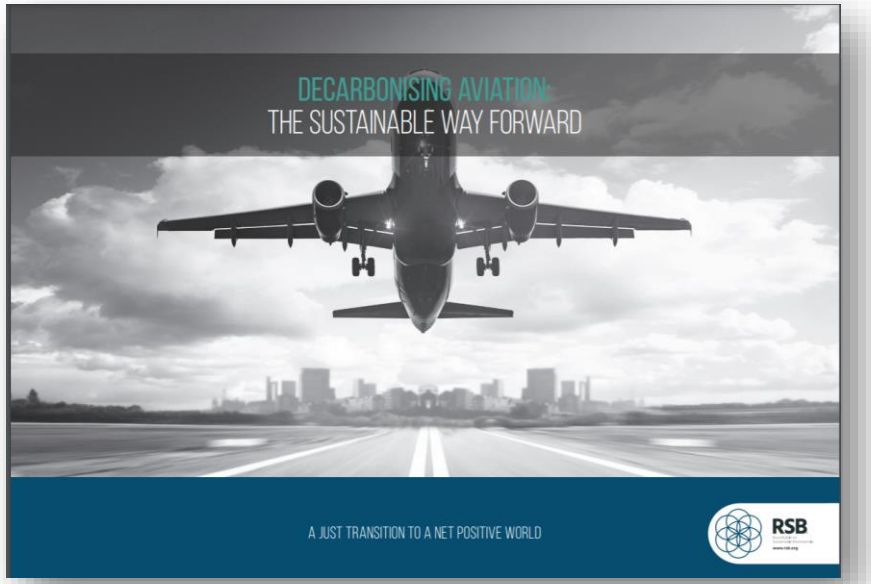
#	Requirements	Guidance	Standard reference	Requirement reference	Evaluation C/NC/NA	Comments / description of evidence (documents, records etc.)
	Participating operators					
1.9	The PO carried out a self-risk assessment in conformity with the RSB Procedure for Risk Management and ensures regular updates, in particular. -Before every new audit (main or surveillance); - Every time the operations get modified to the extent that some of the responses to the RSB risk assessment tool would change or whenever the certification scope is changed. PO informed the RSB Secretariat and the certification body immediately about any changes to the results of the self-risk assessment; (The auditors conducting the audit of a Participating Operator's operations will check compliance with this procedure and the accuracy of their self-risk assessment and risk class, based on the RSB Risk Assessment Tool).		RSB-PRO-30-001 and RSB-PRO-60-001	F.1.6 and F.2.7 (RSB-PRO-30) and		
	Training					
2.3	The management representative with the overall responsibility for the risk management system has sufficient knowledge and competence for this role		RSB-PRO-60-001	F.1.4		
2.2	The operator shall provide involved employees with appropriate training and make sure they have the needed competences, knowledge and experience to put the required systems in place (especially those working on the chain of custody system and the risk management system)		RSB-PRO-30-001 RSB-PRO-20-001 RSB-PRO-60-001	F.1.5 F.1.4 F.1.6		
	Risk Management					
3.1.	The PO shall develop, document and implement a risk management approach, which includes: Risk Identification Risk Assessment Risk Mitigation Risk Monitoring		RSB-PRO-60-001	F.1.1		
3.2	The risk management approach should be based on ISO 31000:2018		RSB-PRO-60-001	F.1.2		
3.3	The PO shall provide the name and details of the management representative who has overall responsibility for developing and implementing the risk management approach		RSB-PRO-60-001	F.1.3		

New RSB Checklist for certification

RSB Regional Indicators

Fuelling the Sustainable Bioeconomy

Main outcomes



SAF production and decarbonization booklet

RenovaBio

Benchmarking RenovaBio and RSB Standard

RSB Certification
Schemes and main requirements

Principle 1
Legality

Principle 2
Planning, Monitoring & Continuous Improvement

Principle 3
Greenhouse Gas Emissions

Principle 4
Human & Labour Rights

Principle 5
Rural and Social Development

Principle 6
Local Food Security

Principle 7
Conservation

Principle 8
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Principle 9
Water

Principle 10
Air Quality

Principle 11
Use of Technology, Inputs & Management of Waste

Principle 12
Land Rights

RSB Certification

RSB Certification schemes relevant to SAF

	Core standard	Regulatory adaptations		
	RSB Global	**RSB EU RED I**	**RSB EU RED II***	**RSB CORSIA**
Type of claim	Voluntary claim	Regulatory claim that meets EU RED targets	Regulatory claim that meets EU RED targets	Regulatory claim that meets CORSIA targets
Product Scope	Energy and non-energy products (fuels, energy, chemicals, materials)	Biofuels	Renewable fuels and energy	SAF
Feedstock scope	All, including bio-based, RCF (recycled carbon), and RFNBO (Renewable Feedstock of non-Biological Origin, incl. PtX, efuels, green hydrogen)	Only bio-based	Currently only bio-based. EU Delegated act to list requirements for RCFs and RFNBOs yet to be published	Currently only bio-based. ICAO Guidance on RCFs and RFNBOs yet to be published

*Currently waiting for final recognition by the European Commission, expected by October 2021

RSB Certification

RSB Certification schemes relevant to SAF

	RSB Global	RSB EU RED I	RSB EU RED II*	RSB CORSIA
Sustainability requirements	<---------- RSB Principles & Criteria ---------->			
GHG reduction threshold compared to fossil baseline	50% 60% for new installations that started production after 5 Oct 2015	50% 60% for new installations that started production after 5 Oct 2015	Same as I and: 65% after 1 Jan 2021 70% fuels of non-biological origin	50% on core LCA 10% LCA+ILUC
Chain of Custody options	Mass balance, book & claim	Mass balance	Mass balance	Mass balance
Renewable input allocation	Across all outputs, based on economic value.	Across all outputs, based on energy value	Across all outputs, based on energy value	Across all outputs, based on energy value
Additional voluntary claims	Low ILUC Risk			

*Currently waiting for final recognition by the European Commission, expected by October 2021

RSB Certification

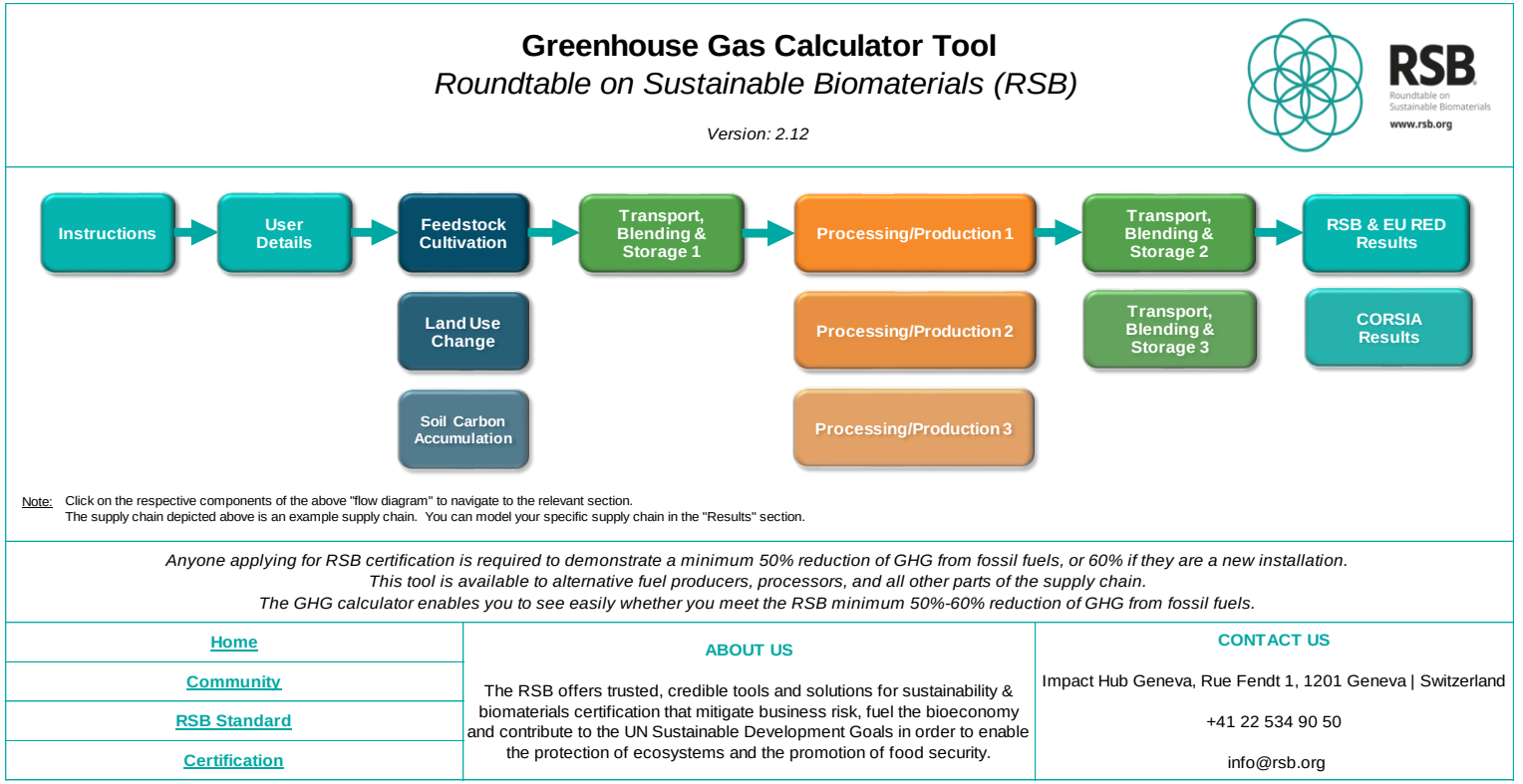
GHG methodology differences between RSB Global, EU RED and CORSIA

	RSB Global	EU RED I	EU RED II	CORSIA
Fossil Baseline	90 g CO2 eq/MJ	83.8 g CO2 eq/MJ	94 g CO2 eq/MJ	89 g CO2 eq/MJ
ILUC value	Voluntary module for low ILUC risk claim	No	Not yet	Yes, default provided
Co-product allocation	Energy value (LHV) or Economic value	Energy value (LHV)	Energy value (LHV)	Energy value (LHV)
CoC allocation	Ratio of MJ feedstock to produce 1 MJ of intermediate product			
Target reduction	• 50% • 60% for new installations that started production after 5 Oct 2015	• 50% • 60% for new installations that started production after 5 Oct 2015	Same as EU RED I and: • 65% after 1 Jan 2021 • 70% fuels of non-biological origin	• 50% on core LCA and • 10% LCA+ILUC

RSB Certification

The RSB GHG Calculator

- Excel based calculator
- Embeds all GHG methodologies – RSB Global, EU RED & CORSIA
- Simple navigation to move between supply chain steps
- Instruction notes built into the tool – no user manual needed
- Emissions factors from Ecoinvent and Biograce included, but can be overwritten with actual values (to be verified by auditors)



Greenhouse Gas Calculator Tool

Roundtable on Sustainable Biomaterials (RSB)

Version: 2.12

RSB Roundtable on Sustainable Biomaterials www.rsb.org

Note: Click on the respective components of the above "flow diagram" to navigate to the relevant section.
The supply chain depicted above is an example supply chain. You can model your specific supply chain in the "Results" section.

Anyone applying for RSB certification is required to demonstrate a minimum 50% reduction of GHG from fossil fuels, or 60% if they are a new installation.
This tool is available to alternative fuel producers, processors, and all other parts of the supply chain.
The GHG calculator enables you to see easily whether you meet the RSB minimum 50%-60% reduction of GHG from fossil fuels.

Home	**ABOUT US**	**CONTACT US**
Community	The RSB offers trusted, credible tools and solutions for sustainability & biomaterials certification that mitigate business risk, fuel the bioeconomy and contribute to the UN Sustainable Development Goals in order to enable the protection of ecosystems and the promotion of food security.	Impact Hub Geneva, Rue Fendt 1, 1201 Geneva | Switzerland +41 22 534 90 50 info@rsb.org
RSB Standard		
Certification		

RSB Book & Claim

Book & Claim Solution

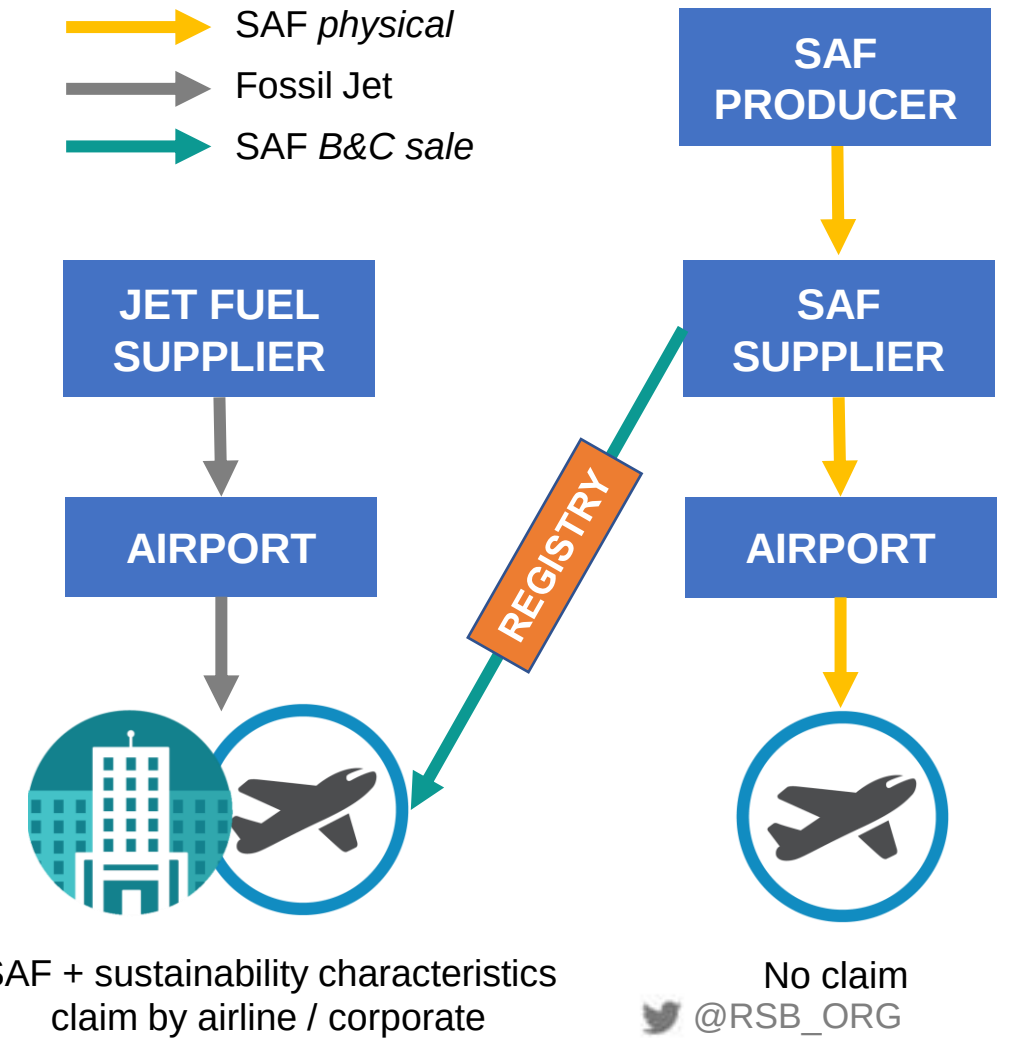
Credible Chain of Custody Solution to Bring SAF to Market

Challenge

- ✕ Limited SAF supply in few physical locations
- ✕ Access limited to carriers in a few hubs with limit on offtake levels
- ✕ Cost + emissions of transporting SAF to customers

RSB's Book & Claim Solution

- ✓ Allows SAF purchase without a physical connection to the supply site
- ✓ No matter where SAF is purchased the net environmental effect is the same
- ✓ Enables the attribution of GHG emission reductions through SAF use to corporates to reduce their scope 3 emissions
- ✓ RSB provides assurance that transactions are credible, traceable and don't lead to double counting



RSB Membership Initiatives

Membership Initiatives

SAF Policy Platform and PtX Working Group

SAF Policy Platform

- ✓ Assessment of SAF policy and legislation in key jurisdictions
- ✓ Assessment of sustainability criteria for SAF legislation at national and global level
- ✓ Development of a strategy for working with relevant policymakers

- ✓ **Exclusive for RSB members**

PtX Working Group

- ✓ Expert-led learning sessions on PtX
- ✓ Developing knowledge on current approach to sustainability
- ✓ Exploring key sustainability issues and providing advice

- ✓ **Exclusive for RSB members**

THANK YOU!

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