

## A potential **game changer** in the SAF landscape

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### Global warming, global warning

Human CO<sub>2</sub> emissions led in 50 years to a 1.5°C increase in temperature globally

Consequences are already obvious: deadly heatwaves, hurricanes, floods...

Actions are very insufficient: yearly CO<sub>2</sub> emissions still increasing If we don't really act, we will be at +4°C in 2100, in a dystopian scenario

The only viable path is a combination of sobriety and new technologies

Developing such new technologies is among the first priorities of humankind

 GLOBAL BIOENERGIES' MISSION IS TO DEVELOP AND DEPLOY ITS INNOVATIVE PROCESS TO REDUCE CO<sub>2</sub> EMISSIONS OF AIR TRANSPORT

#### 2024 ON TRACK TO BE THE WARMEST YEAR AND FIRST YEAR ABOVE 1.5°C





### Why focusing on Sustainable Aviation Fuels (SAF)?

#### AIR TRANSPORT ACCOUNTS FOR 5% OF GLOBAL WARMING

Impact comes from CO<sub>2</sub> emissions and from contrails

Impact should double by 2040 due to increase in air traffic

AIR TRANSPORT CUSTOMERS HAVE FINANCIAL MEANS TO PAY FOR DECARBONATION EFFORTS Only 10% of the world's population regularly flies

The richest 1% generate half of air transport global emissions

AIR TRANSPORT EMISSIONS ARE HARD TO ABATE Developing new technologies (electric, hydrogen) will take decades and entails tremendous infrastructure changes

SAF is the most important lever to reduce CO<sub>2</sub> emissions up until 2050

SAF MARKET IS ALREADY GETTING ON TRACK 0,3mT produced in 2023, 1mT in 2024, 250mT expected in 2050

Acceleration of national initiatives over the world to enhance SAF production



### Global Bioenergies at a glance



### A UNIQUE PROCESS TO PRODUCE SUSTAINABLE AVIATION FUEL (SAF)

&

### AMONGST THE VERY FEW TECHNOLOGIES WORLDWIDE ALREADY ASTM CERTIFIED

- Created in 2008
- ~ 40 FTEs
- 3 sites in France: R&D lab (Evry), demo plant (Pomacle), SG&A (Paris)
- Listed on Euronext Growth (ALGBE)
- Exclusive rights on 30 patent families



FRANCE







### A unique biological process

#### **GBE HAS DEVELOPED A UNIQUE ALTERNATIVE TO PETROCHEMISTRY** ....



### ... BY LEVERAGING BREAKTHROUGH RESEARCH

Process unique in the world



Drop-in substitute for petrochemical molecules



Produced from various renewable feedstocks



**Gradual improvement** of process performance



Process protected by numerous patents



**ASTM certified** "Approval to fly"



### Focus on the product

### **CHEMICAL PROPERTIES**

### C12/C16 isoalkanes (isoparaffins)

Specifically good cold flow properties (does not freeze at very low temperature)

#### Injection properties

Tests defined in collaboration with Safran Aircraft Engines and carried out by CERTAM → Conclusion : **GBE's SAF behaves similarly as** Jet A-1 fuel

SAFRAN

#### certam recherche technologique

### Combustion properties

Tests carried out by ONERA, French aerospace research center

→ Conclusion : GBE's SAF shows a 40-99% reduction in soot emissions compared with Jet A-1 fuel







#### **PRODUCT RANGE**

The same technology can produce two types of SAF:

### **Bio-SAF**

From agricultural and forestry byproducts (beetroot, corn, sugar cane, wood chips..)

### e-SAF<sup>(1)</sup>

### From captured CO<sub>2</sub> and renewable electricity, in our case through acetic acid

<sup>(1)</sup>Also named « Synthetic Fuel » or « RFNBO » or « Power-to-liquid » (PTL)



### **ASTM** Certified



ASTM IS THE ONLY REGULATORY BODY FOR AVIATION FUELS

5-years process to validate a new aviation fuel:

- 1. Work with FAA + two National Laboratories
- 2. Work with the OEMs (Airbus, Boeing, Safran, Pratt & Whitney, General Electrics, Rolls-Royce, Honeywell)
- 3. First Ballot with 500 voters (expert industrialists)
- Main Ballot >1,500 voters across all the aviation industry process certified when there is no negative vote

> ONLY 11 TECHNOLOGIES CERTIFIED WORLDWIDE

GBE'S SAF PROCESS WAS CERTIFIED IN OCTOBER 2023

Classified with Alcohol-to-Jet under Appendix 5 of D7566 regulation, now claiming that isobutene can be used as an intermediate to produce SAF

GBE'S SAF CAN NOW BE BLENDED UP TO 50% WITH JET FUEL AND USED IN ALL AIRPLANES WORLDWIDE

Without any change in equipment or infrastructure



### Massive upcoming business opportunity

### SAF ARE KEY TO DECARBONIZING THE GLOBAL AVIATION

SAF are the **main technological solution to** decarbonize aviation and have the potential to **reduce CO<sub>2</sub> emissions by up to 80%** 

#### ACHIEVING NET ZERO CARBON BY 2050



#### PUBLIC REGULATION WILL CAUSE THE SAF MARKET TO SOAR IN THE NEXT YEARS

Public regulations are driving an **exponential market growth from 2025 onwards**: ReFuelEU Aviation initiative in the EU, IRS financial incentives in the US

#### MANDATED SHARE OF SAF IN THE EU



2050

15%

2045

### HEFA IS THE ONLY TECHNOLOGY COMMERCIALIZED TODAY

Process is efficient in **CAPEX, OPEX and CI-score** But relies on used cooking oil harvested from restaurants which are limited in quantity

#### UPCOMING PLATEAU

Great solution BUT limited by the feedstock availability: production should plateau around 2030

The big question in the industry is: what comes next?



### Competition landscape

PATHWAY	Oleochemistry	Fermentation (Annex 5 of ASTM D7566)			Thermochemistry	
MANDATE		bio-SAF	• • • • •	e-S	5AF	bio-SAF
TECHNO	Hydrotreated Esters and Fatty Acids (HEFA)	Alcohol-to-Jet (ETJ-SPK)	GLOBAL BIO bio-IBN-SPK	DENERGIES + e-IBN-SPK	Power-to-Liquid (PtL)	Fischer-Tropsch (FT)
FEEDSTOCK	Used cooking oil, waste> and vegetable oils	1G (US only): co 2G: wood chips	orn, cane sugar (e.g., birch trees)	CO <sub>2</sub> + re elect	newable cricity	Household or agriculture waste, biomass, sawdust
MATURITY	2020	2024	202	28	2030	2030
	Technology already implemented at large scale	First 30kT plant project in commissioning	Unique, flexible and complementary solution to expand both in Europe and in the USA		First small-scale pilot plants starting	Several industrial scale projects
	$\odot$	$\odot$	$\odot$	$\odot$	$\odot$	$\odot$
	Production to plateau at ~10 million tons in 2030	Production expected ethanol-producing co As	to ramp up in sugar and ountries (USA, Brazil, SE sia)	The only long-term option for regions where vegetal resources are scarce (Europe, China)		Industrial scale-up difficulties



### Fewer steps than competitive technologies



# Business model: creating an ecosystem of multi-axis partners





### A first key partner



#### **CHARACTERISTICS**

Combination of GBE's process with the existing technology of a large international industrialist (undisclosed)

New combined process using existing biorefinery assets such as corn dry mills for IBN production

#### STATUS

Early proof of concept reached

Term sheet signed / Joint Development Agreement under discussion

Technology to be implemented at large scale by 2030

#### **ADVANTAGES**

**Much lower CAPEX: 4 times lower** than other competitive SAF technologies

Much lower OPEX

Improved CO<sub>2</sub> savings



### Niche cosmetics market is a steppingstone to ramp up the SAF process

THE PRODUCT DEVELOPED FOR SAF PURPOSES IS MADE OF BIOBASED IDD AND IHD. IT TURNS OUT THAT PETROCHEMICAL IDD AND IHD ARE WIDELY USED IN COSMETICS, AND OUR BIOBASED PRODUCT IS THE PERFECT NATURAL SUBSTITUTE FOR THESE OIL BASED INGREDIENTS

L'ORÉAL FIRST SHAREHOLDER OF THE COMPANY	ĽORÉAL	13	.5%	
IDD AND IHD ARE KEY PETROCHEMICAL INGREDIENTS IN COSMETICS	<ul> <li>IDD and IHD are among the most</li> <li>widely used ingredients in cosmetics</li> <li>20kT existing market</li> </ul>	MAKE-U	P	SKIN CARE
	IDD's strongest case is in long-wear, waterproof and no transfer in make- up and skin care	Mascara, lipsi foundation	tick, Ani	ti-ageing, moisturizing creams
ISONATURANE™ IS A PERFECT REPLACEMENT FOR PETROCHEMICAL IDD/IHD	With the same molecular composition and p GBE's Isonaturane™ can replace petrochemi IDD/IHD on a like-for-like basis and is also a alternative to cyclic silicones (CS)	Switching from petrochemical IDD to GBE's natural product enables a strong marketing claim and product differentiation for cosmetic brands		
SEVERAL LETTERS OF INTENTS AT HIGH PRICES ALREADY RECEIVED	Various cosmetics players worldwide have a sent us LOIs totaling a volume of 4,000 tons	Ilready s/year		





### Take home message

SAF IS MANDATORY TO DECARBONIZE AIR TRANSPORTATION A MAJOR INDUSTRIALIST IS CURRENTLY BUILDING A PARTNERSHIP WITH GLOBAL BIOENERGIES

(EXIT)

THE RESULTING SAF TECHNOLOGY HOLDS THE PROMISE TO BE THE BEST-IN-CLASS AND RELAY HEFA





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