



A potential game changer  
in the SAF landscape

Euronext Paris: ALGBE



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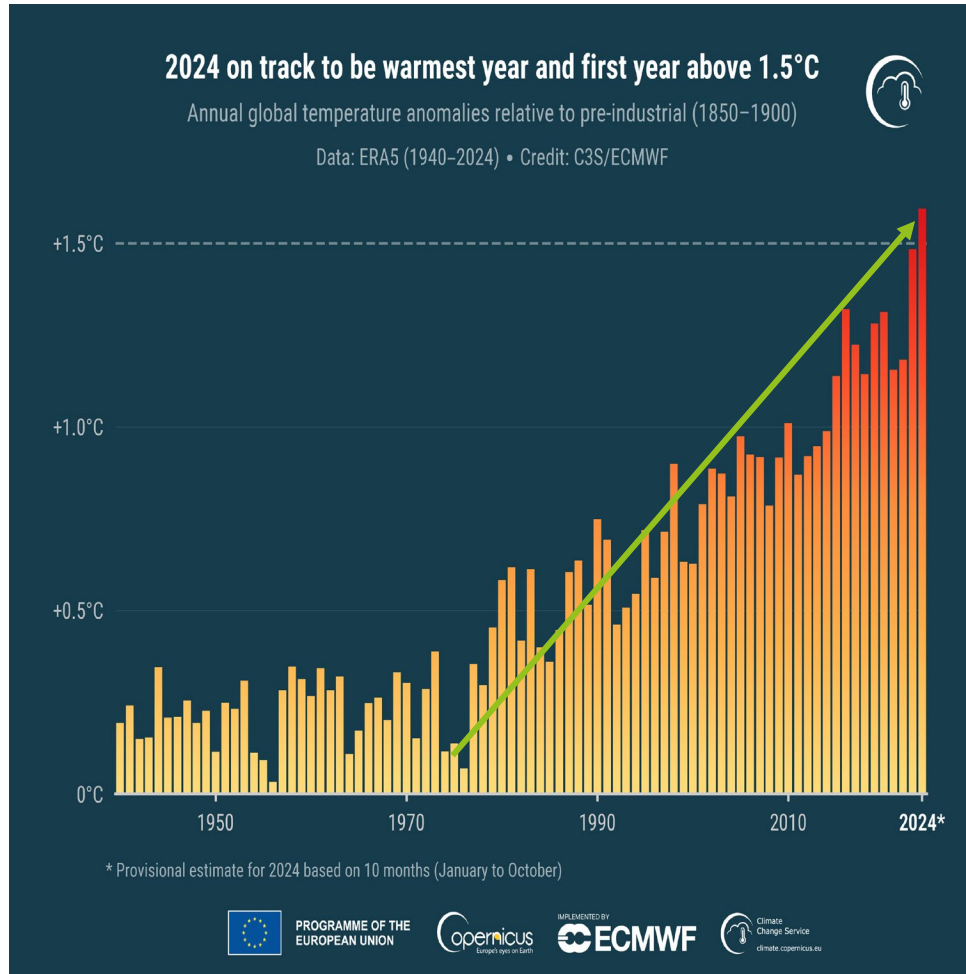
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# Global warming, global warning



- 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 distopian scenario
- The only viable path is a combination of sobriety and new technologies
- Developing such new technologies is among the first priorities of human kind
- **Global Bioenergies' mission is to develop and deploy its innovative process to reduce CO<sub>2</sub> emissions of air transport**

# Why focusing on Sustainable Aviation Fuels (SAF) ?

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- **Air transport accounts for 5% of global warming**
  - Half of the impact comes from CO<sub>2</sub> emissions and the other half from contrails
  - Impact should double by 2040 due to increase in air traffic
- **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
- **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
- **SAF market is already getting on track**
  - European Union: dedicated incorporation mandates starting in 2025
  - USA: global incentive policies already in place

# Global Bioenergies at a glance

**A unique process** to produce **Sustainable Aviation Fuel (SAF)** based on renewable resources

&

amongst the **very few technologies worldwide** already **ASTM certified**



- Created in 2008
- ~ 45 FTEs
- 3 sites in France: R&D lab (Evry), demoplant (Pomacle), SG&A (Paris)
- Listed on Euronext Growth (ALGBE)
- Exclusive rights on 30 patent families



# A unique biological process

GBE has developed a unique alternative to petrochemistry ...

Renewable  
feedstocks

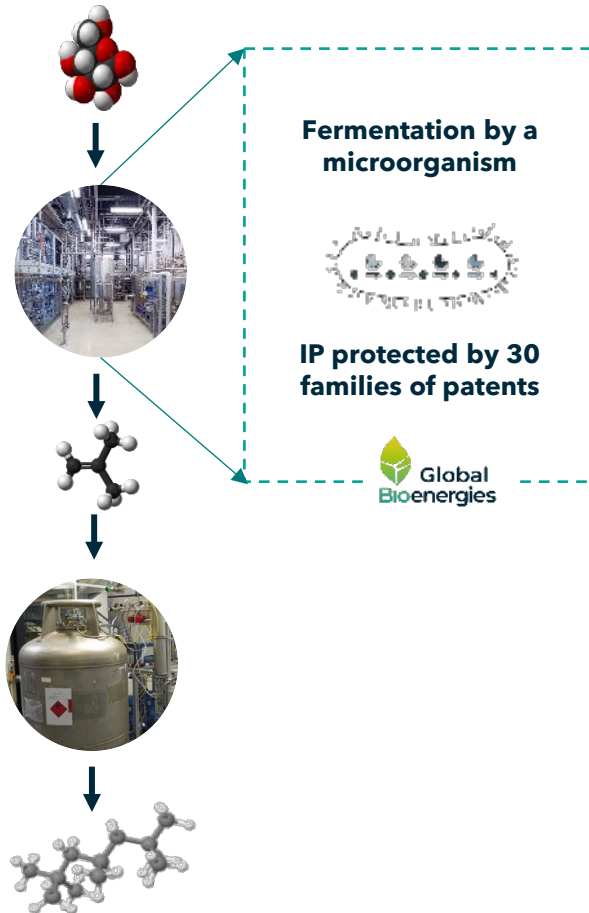
**Biology**

*(innovative process)*

Isobutene (IBN)

**Green chemistry**

*(conventional technology)*



**Sustainable Aviation Fuels (SAF)**

**"IBN-SPK"**

... 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"

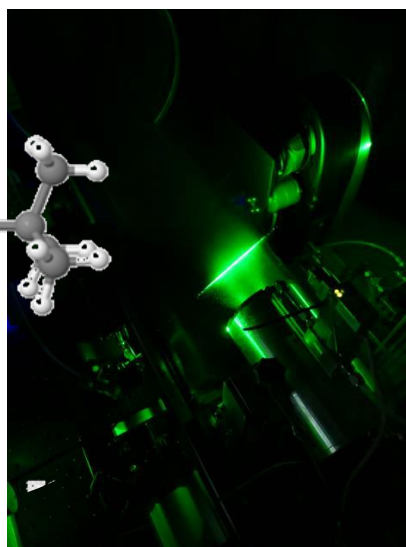
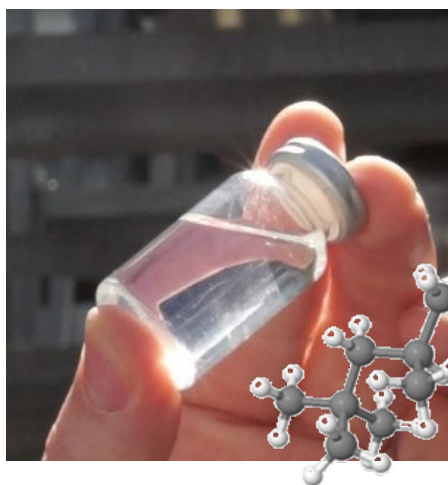


# Focus on the product

## Chemical properties

C12/C16 isoalkanes (= isoparaffins)

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



## Product range

The same technology can produce two types of SAF:

### Bio-SAF:

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

→ Targeting the US market

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

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

→ Targeting the EU market

# ASTM Certified

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## **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)
  4. Main Ballot >1500 voters across all the aviation industry - process certified when there is no negative vote
- ✓ **60 parameters monitored**
- ✓ **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





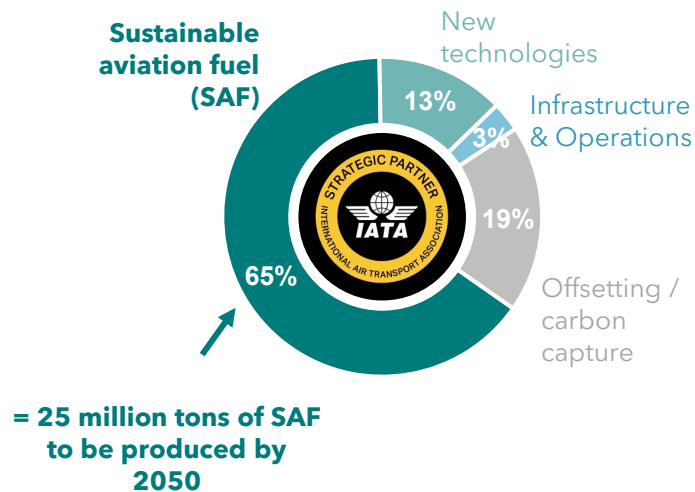
# Business opportunity: €45 bn in 2030

## 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

% of contribution to carbon mitigation

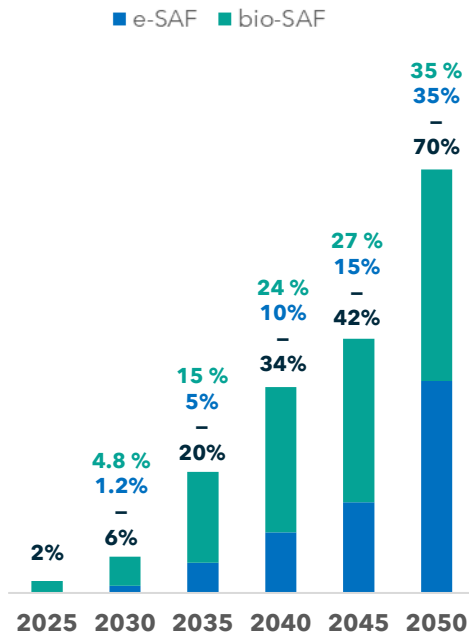


**Note:** (1) assuming a sales price of 3 €/kg  
**Sources:** IATA, SkyNRG 2023 SAF Market Outlook

## Public regulation will cause the SAF market to soar in the next years

Public regulations are driving an **exponential market growth from 2030 onwards**: ReFuelEU Aviation initiative in the EU, IRS financial incentives in the US

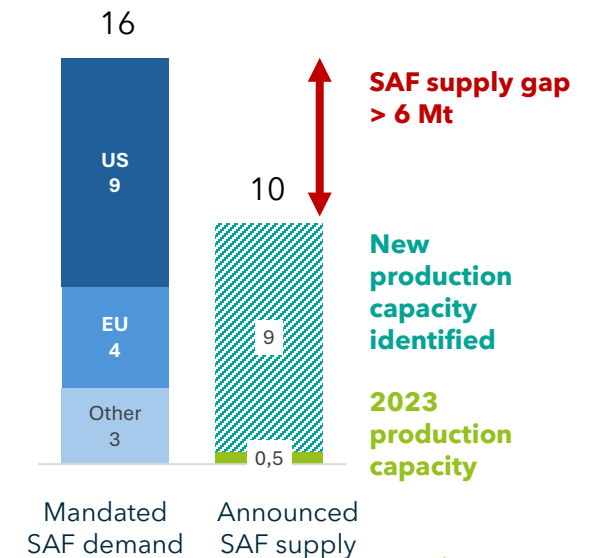
### Mandated share of SAF in the EU



## The SAF market is massive and largely unaddressed

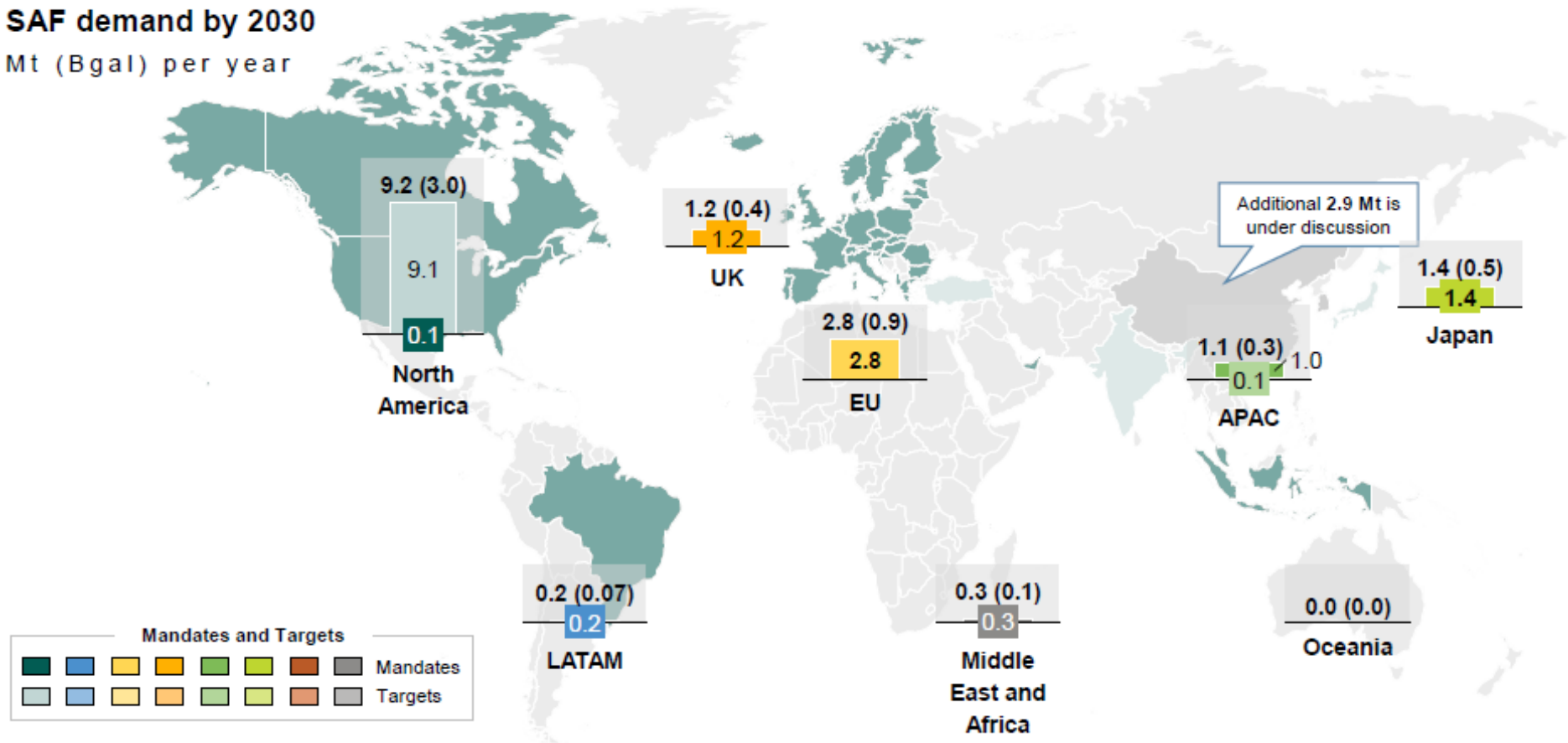
The **global SAF market will amount to c.€45bn in 2030<sup>(1)</sup>**. Out of those, **€16bn are not identified today**. In Europe, reaching 2050 objectives means deploying **c.150 SAF refineries**

### Global SAF supply gap in 2030 (in Mt)




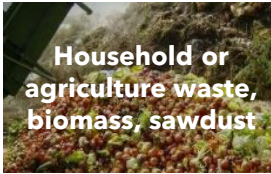







# The SAF market is created by policy: mandates and targets now add up to 16 Mt (5.3 Bgal) SAF demand by 2030

**SAF demand by 2030**  
Mt (Bgal) per year



# Competition landscape

Pathway	Oleochemistry	Fermentation (Annex 5 of ASTM D7566)		Thermochemistry	
Mandate	bio-SAF		e-SAF	bio-SAF	
Techno	Hydrotreated Esters and Fatty Acids (HEFA)	Alcohol-to-Jet (ETJ-SPK)	<b>GLOBAL BIOENERGIES</b> bio-IBN-SPK + e-IBN-SPK	Power-to-Liquid (PtL)	Fischer-Tropsch (FT)
Feedstock					
Maturity	 2020 Technology already implemented at large scale	 2024 First 30kT plant project in commissioning	 2028 Unique, flexible and complementary solution to expand both in Europe and in the USA	 2030 First small-scale pilot plants starting	 2030 Several industrial scale projects
Production to plateau at ~10 million tons in 2030		Production expected to ramp up in sugar and ethanol-producing countries (USA, Brazil, SE Asia...)		The only long-term option for regions where vegetal resources are scarce (Europe, China...)	
				Industrial scale-up difficulties	

# Current market analysis - worldwide

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- **HEFA technology** based on used cooking oil (UCO):
    - Is the only technology commercialized as of today
    - Process is efficient in CAPEX, OPEX and CI-score
    - But relies on used cooking oil harvested from restaurants which are limited in quantity
- **Great solution but limited by the feedstock availability: production should plateau around 2030**

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

### USA

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Focus on biofuels mainly from Alcohol-to-Jet to convert corn into SAF  
→ **bio-IBN-SPK** addresses this market

### EU

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Focus on e-SAF, produced from captured CO<sub>2</sub> and green electricity  
→ **e-IBN-SPK** addresses this market

# USA: we ambition to become best-in-class in bio-SAF

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## SAF 2030 Grand Challenge Target 3bn gallons, i.e. 9 million tons by 2030



### How to get there?

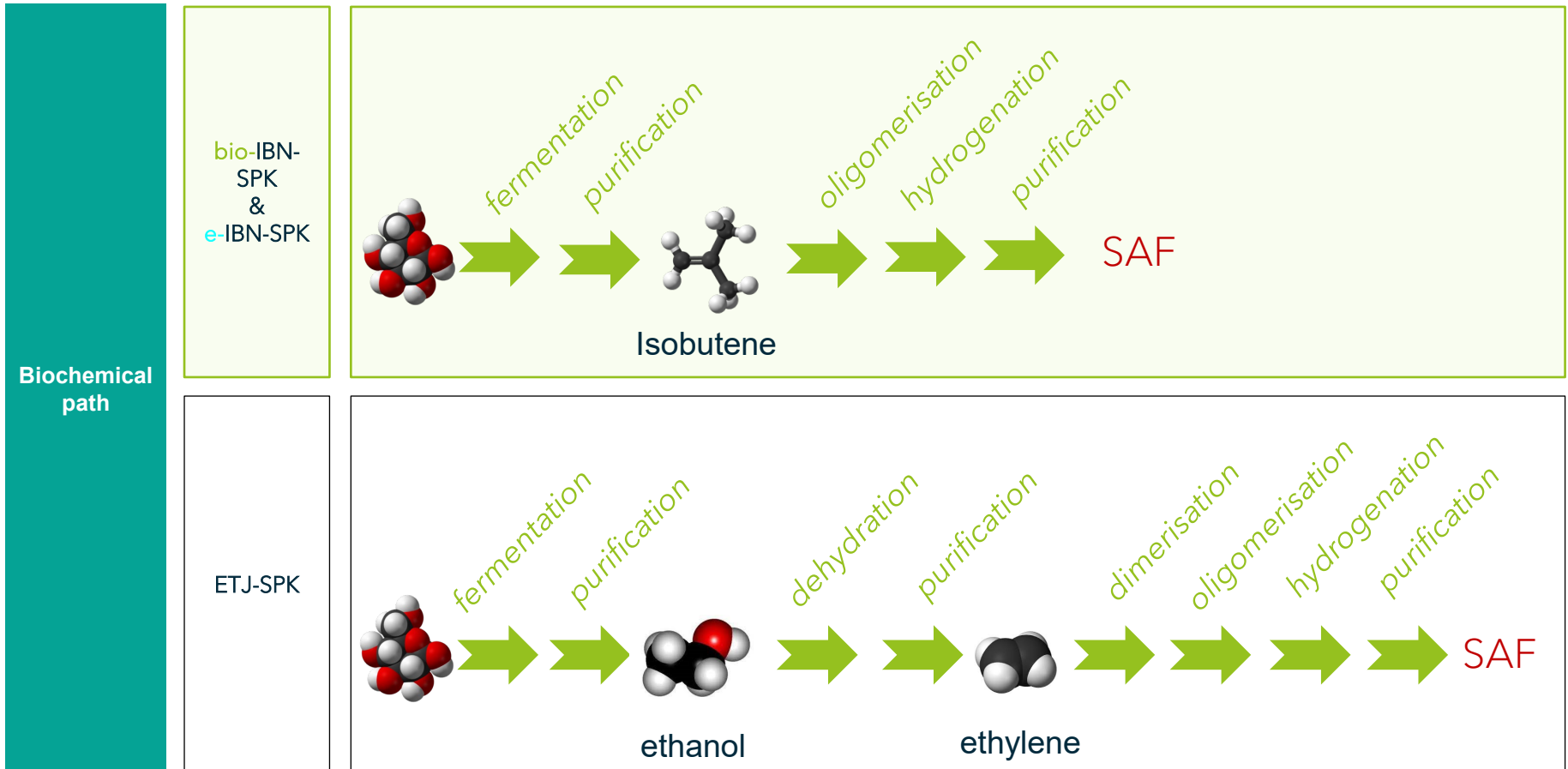
**Ethanol-to-Jet** (ETJ-SPK) is currently more advanced than we are:

- LanzaJet is presently commissioning the very first ETJ plant (30kT plant in Georgia)
- Gevo just got a \$1.4b loan guarantee to build a large FOAK plant

**But our bio-IBN-SPK has the potential to become the Best-in-class option**

- CAPEX significantly reduced
- OPEX lowered due to less production steps
- CI-Score improved through reduced energy consumption

# USA: Fewer steps than competitive technologies





# European Union: priority on e-SAF

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## RefuelEU

Due to scarce bio-resources, the EU is highly promoting e-SAF with a specific submandate  
**e-SAF should represent 50% of SAF in the EU by 2050**

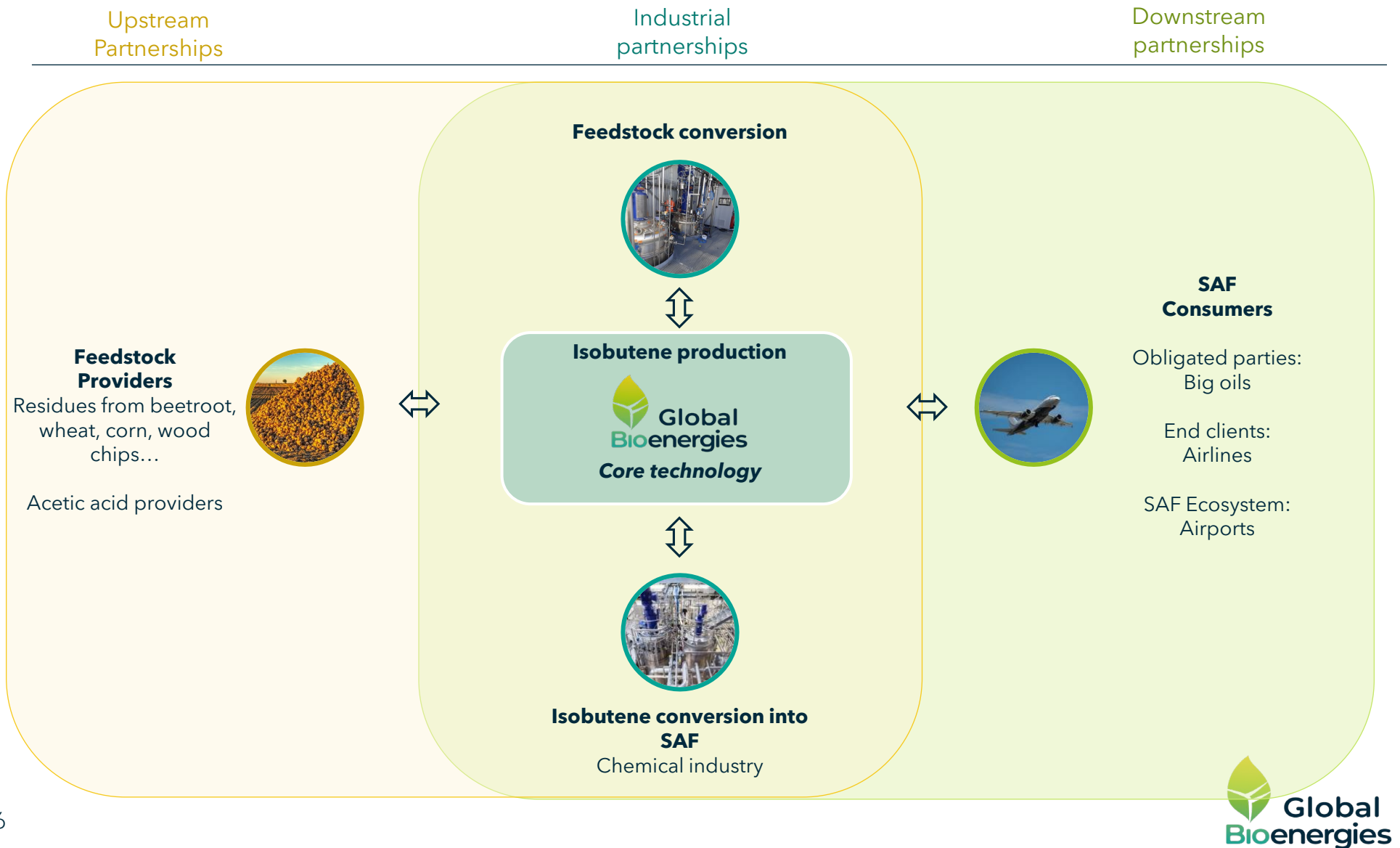
## ReFuelEU Aviation



### How to get there?

- e-SAF is very challenging because of the cost of electricity
- No-one knows as of today if e-SAF will really happen, i.e. if the cost of e-SAF will really be compatible with demand
- But if it happens, the best-in-class technology, associated with the lowest cost, should win the game
- The market will open in 2030 with the 1.2% e-SAF submandate in Europe (i.e. market of about 500 ktons/year), and we expect to be part of this emerging market

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



# 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

L'ORÉAL

13,5%

(1)

IDD and IHD are key petrochemical ingredients in cosmetics

IDD and IHD are among the **widest used ingredients** in cosmetics → **20kT** existing market

Make up

Mascara, lipstick,  
foundation



Skin care

Anti-ageing,  
moisturizing creams



IDD's strongest case is in **long-wear, waterproof and no transfer** in make-up and skin care

Isonaturane™ is a perfect replacement for petrochemical IDD/IHD

With the **same molecular composition and properties**, GBE's Isonaturane™ can replace petrochemical IDD/IHD **on a like-for-like basis** and is also a good 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 Intent at high prices already received

Various cosmetics players worldwide have already sent us **LOIs totaling a volume of 4,000 tons/year**

ISONATURANE™



Powerful  
solvent



Highly  
volatile



Aerial  
emollient



ISO  
16128

## Take home message

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- **Our SAF technology is already ASTM certified and ready to be incorporated worldwide:**
  - bio-IBN-SPK for the US
  - e-IBN-SPK for Europe
- **Our SAF technology has the potential to be the best-in-class after HEFA on all 3 key parameters:**
  - CAPEX
  - OPEX
  - CI Score
- **Our SAF technology is highly scalable and made to be replicated widely:**
  - Niche cosmetics market is a steppingstone to ramp up the SAF process
  - Asset light model through licensing



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