CARBIOS

Biotechnology powering
plastic and textile circularity

STRATEGIC UPDATE

6 June 2023

Introducing Carbios

Emmanuel Ladent, CEO

CARBIOS

We all face the same challenges worldwide

> Limited fossil resources

460 million tons (1)
of plastic produced
per year (2019)

99% of virgin plastic
is **petrosourced**

1. OECD, 2022.

> Extensive plastic pollution

353 million tons (1)
of plastic waste
generated per year (2019)
<10% recycled today

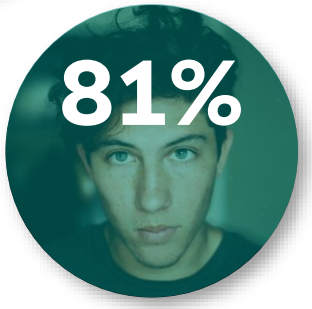
9 million tons (2)
end up in the oceans
every year

1. OECD, 2022.

2. Jenna Jambeck, 2015, ADEME 2012

Consumers and citizens call for change but feel helpless…

Plastic and ocean pollution ranked 2nd environmental issue after climate change



81% would like to use less plastic, but find it difficult as alternatives are not always available

Source: EU & US survey, April 2022

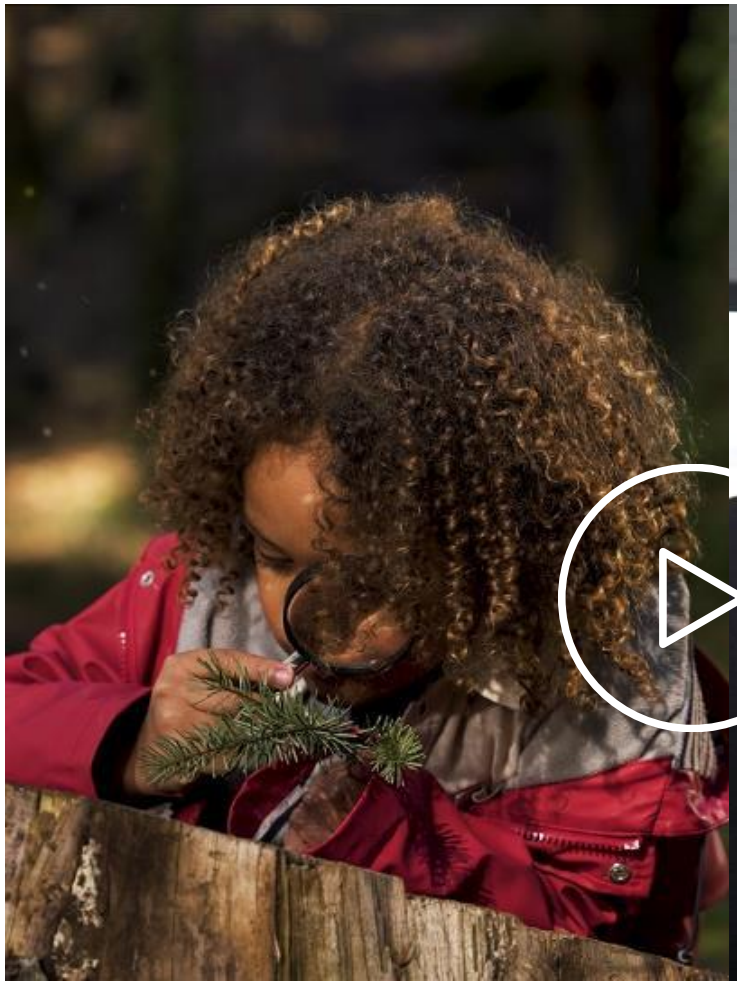
springvoice
sten feel analyse

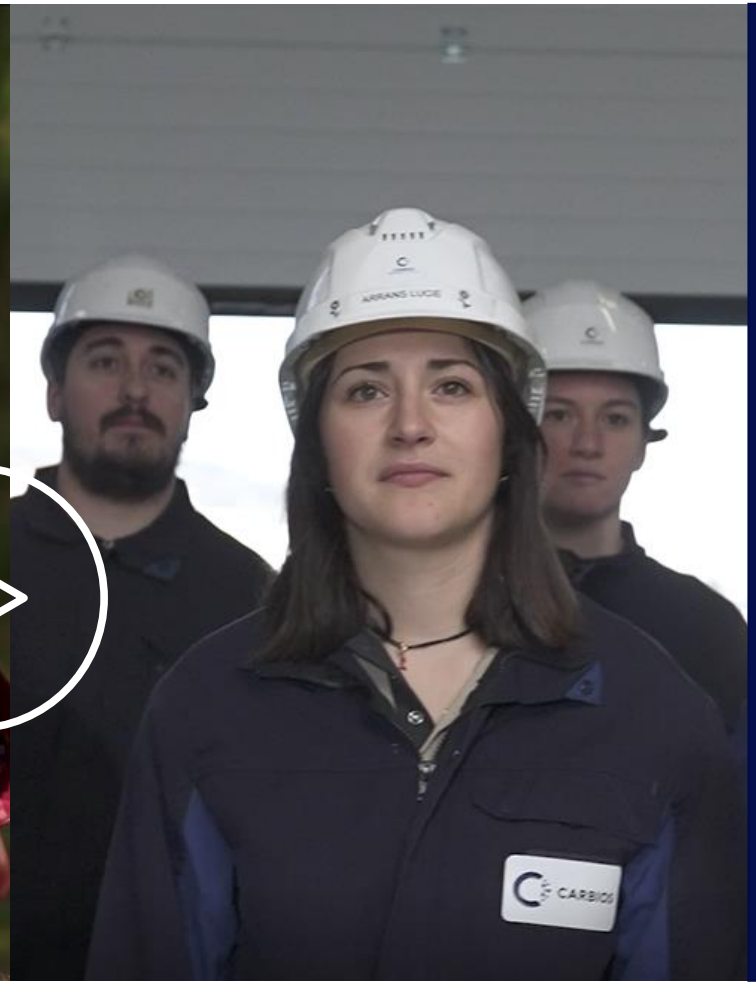
STRATEGIC RESEARCH

Reducing and Reusing are not enough to fundamentally reverse the trend…

…What if plastic and textiles entered the circular economy?

At Carbios, we are convinced that we can positively impact the future



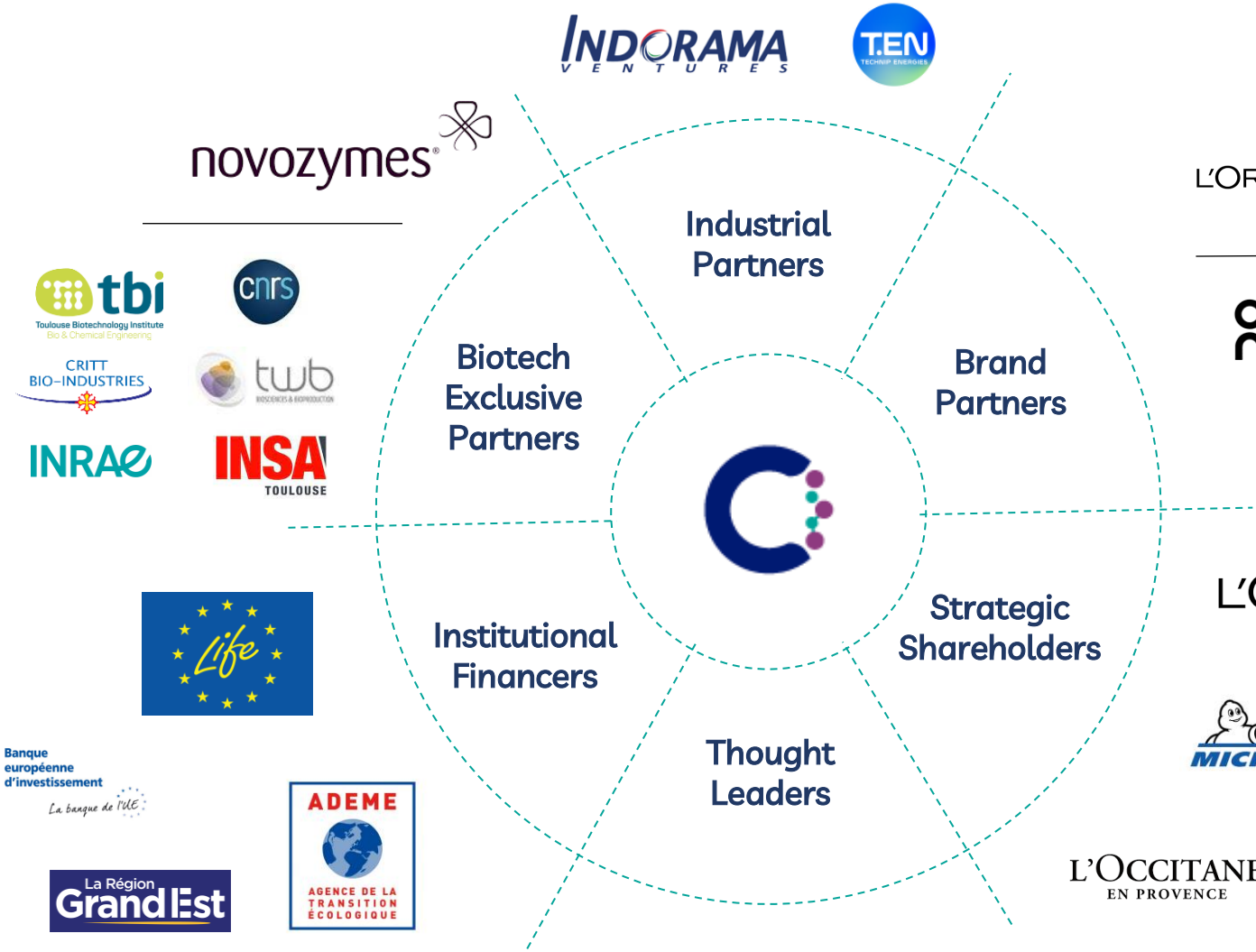


CARBIOS

We lead biotech expertise to catalyze plastic and textile circularity at scale

SUSTAINABLE DEVELOPMENT GOALS

Carbios unites an ecosystem of partners



INDORAMA VENTURES
T.EN
novozymes
tbi Toulouse Biotechnology Institute
cnrs
CRITT BIO-INDUSTRIES
twb
INRAE
INSA TOULOUSE
Life
Banque européenne d'investissement
ADEME AGENCE DE LA TRANSITION ÉCOLOGIQUE
La Région Grand Est
ELLEN MACARTHUR FOUNDATION Member
SOLARIMPULSE FOUNDATION

L'ORÉAL
Nestlé Waters
PEPSICO
SUNTORY BEVERAGE & FOOD EUROPE
patagonia
PUMA
PVH
SALOMON
L'ORÉAL
MICHELIN
L'OCCITANE EN PROVENCE

Video
Consortiums partners

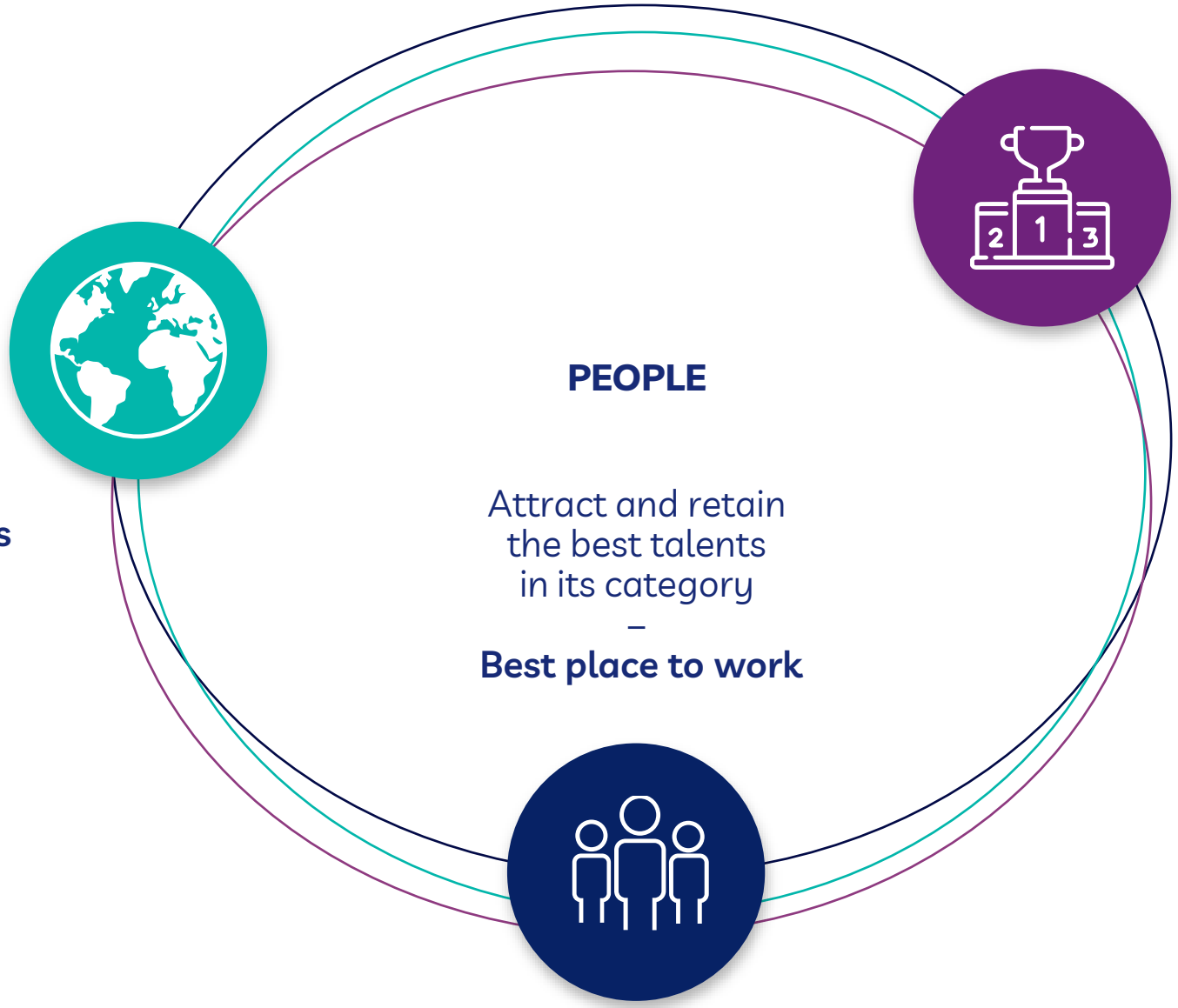
Carbios is driven by strong ambitions

PLANET

Provide the **most sustainable and most circular solutions** for the life cycle of plastic and textiles

–

ESG best-in-class



PEOPLE

Attract and retain the best talents in its category

–

Best place to work

PROFIT

Become the **world leader in PET recycling** by 2035

–

Develop **profitable business around PLA and other** major plastic polymers

Carbios has attained strategic achievements

Scientific milestones

- Production of a 100% enzymatically recycled **white fiber from colored textile waste** (March 2022)
- **Publications** in the prestigious **Biophysical Journal** (July 2022) and **Chemical Reviews** (March 2023)
- **Biocat Award** for Carbios' CSO, Prof. Alain Marty (August 2022)

Industrial scale-up

- **Demonstration plant completed** and operational (August 2022)
- **Long-term exclusive agreement with Novozymes** ensuring production and supply of Carbios' proprietary PET-degrading enzymes at industrial scale (January 2023)
- **Technical Information Summary** ready for licensing (April 2023)
- **Partnership with Indorama Ventures Ltd** to build the world's first biorecycling plant (June 2023)

Corporate

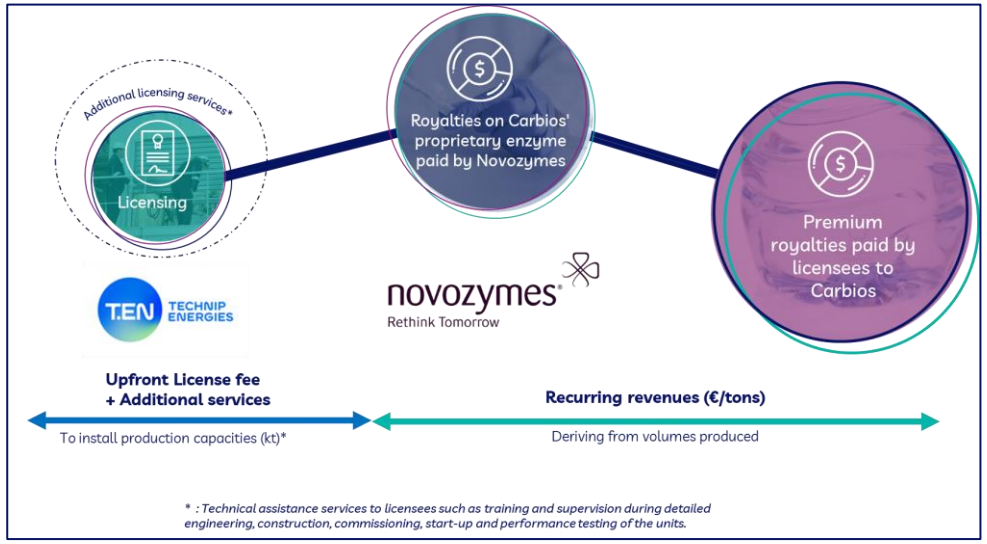
- Talent acquisition, starting with the Executive **Committee** and **Board of Directors** (May 2022-Jan. 2023)
- Launch of a textile Consortium with **On, Patagonia, PUMA, Salomon** (July 2022), and **PVH Corp.** (Feb. 2023)
- Publication of Carbios' first **Sustainability report** (Dec. 2022)
- Carbios joins **Ellen MacArthur Foundation's** circular economy network (March 2023)
- Carbios selected as one of the 10 flagship innovative companies at the **"Choose France" international summit,** entry in the **Coq Vert community** launched by Bpifrance with ADEME and the Ministry of Ecological Transition (May 2023)

Finance

- **30M€ EIB loan** to finance the demonstration plant (June 2022)
- **Annual result and Q1 2023** Investors presentation (April 2023)
- **First PET bioreclycing plant mostly financed by 54M€** obtained from the French State and the Grand-Est and **110M€** from Indorama Ventures Limited (May 2023)

A highly profitable business model

3 streams of revenues . . . . . .



. . . . . driving Carbios economic vision

STRONG r-PET MARKET GROWTH

From x4 to x7 by 2050

r-PET MARKET SHARE 2025-2035 (volume)

4% to 8% by 2030

8% to 12% by 2035

REVENUES (MARGIN equivalent) *

Licensing upfront fees
between 100€/t and 200€/t

+

Recurring revenues >=250€/t

CAGR COST TO 2035

RDI +15% to +20%

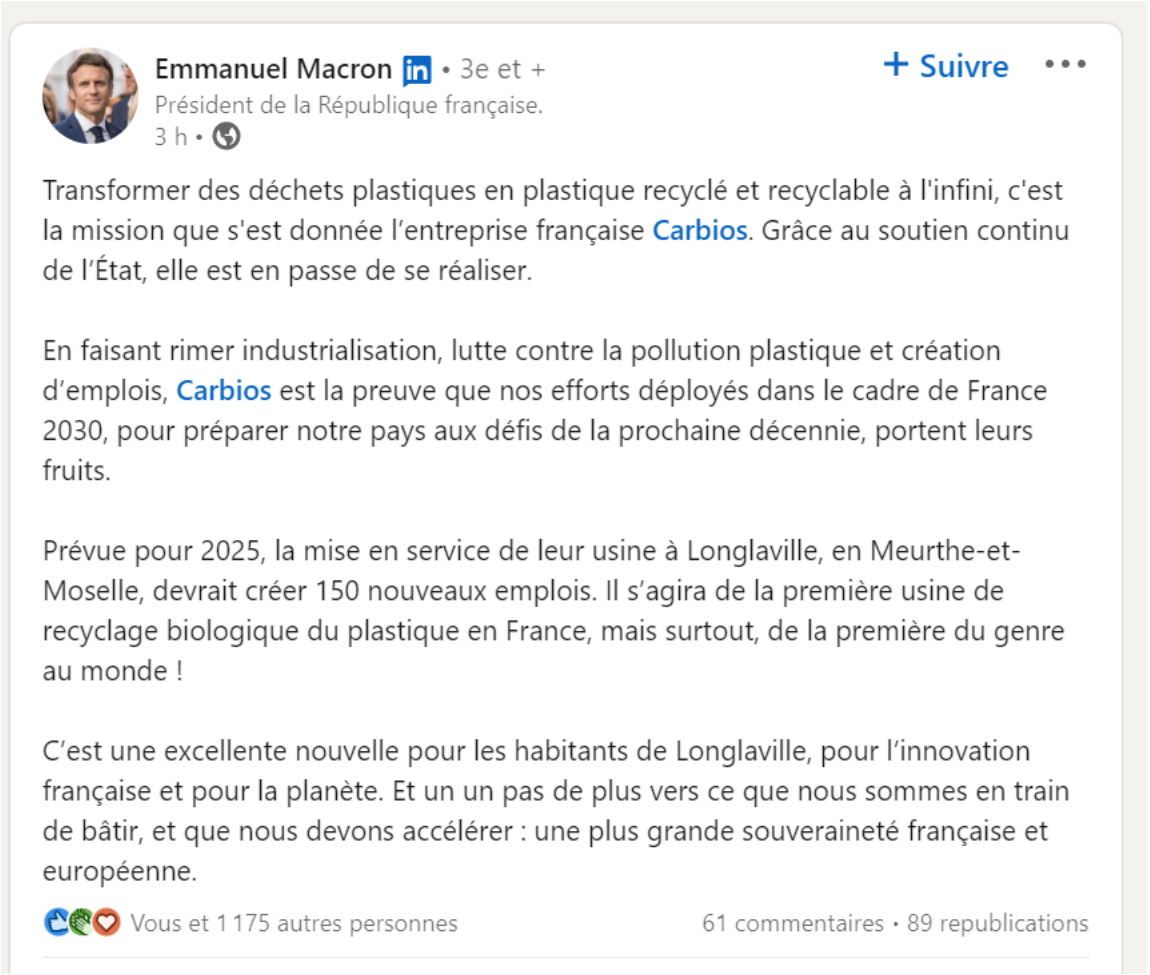
- Maintain & improve PET applications
- Develop new polymers such as Polyamids (PA) and Polyolefins (PE & PP)

SG&A +8% to +10%

- Licensing efforts (build commercial infrastructure to reach business goals)

* Applicable to all plants; PLA Revenues and Margins excluded

French State renews its support with new funding



Emmanuel Macron • 3e et +
Président de la République française.
3 h •
+ Suivre

Transformer des déchets plastiques en plastique recyclé et recyclable à l'infini, c'est la mission que s'est donnée l'entreprise française Carbios. Grâce au soutien continu de l'État, elle est en passe de se réaliser.

En faisant rimer industrialisation, lutte contre la pollution plastique et création d'emplois, Carbios est la preuve que nos efforts déployés dans le cadre de France 2030, pour préparer notre pays aux défis de la prochaine décennie, portent leurs fruits.

Prévue pour 2025, la mise en service de leur usine à Longlaville, en Meurthe-et-Moselle, devrait créer 150 nouveaux emplois. Il s'agira de la première usine de recyclage biologique du plastique en France, mais surtout, de la première du genre au monde !

C'est une excellente nouvelle pour les habitants de Longlaville, pour l'innovation française et pour la planète. Et un un pas de plus vers ce que nous sommes en train de bâtir, et que nous devons accélérer : une plus grande souveraineté française et européenne.

Vous et 1 175 autres personnes 61 commentaires • 89 republications

- **Carbios selected for 42.5M€ funding for the construction of the first PET biorecycling plant, based in France**
  - 30M€ from the French State via France 2030
  - 12.5M€ from the Grand-Est Region
  - Subject to ratification by the European commission
- **11.4M€ granted from the French State via France 2030 to Carbios and its research partners to accelerate R&D and innovation work** on its unique enzymatic technologies
  - 8.2M€ for Carbios, including 5M€ repayable advances
  - 3.2M€ for academic partners INRAE, INSA and CNRS partners via TWB TBI joint service and research units
- **French State and EU funding since Carbios' creation totaling ~70M€**

Carbios & Indorama Ventures reaffirm partnership to build first PET biorecycling plant

- **Memorandum of Understanding signed to form a Joint-Venture for the construction of the world's first PET biorecycling plant in France**
  - Equity split 75% Carbios / 25% Indorama Ventures
  - Indorama Ventures to mobilize about 110M€ for the Joint-Venture in equity and non-convertible loan financing
  - Carbios to acquire 13ha land from Indorama Ventures' existing PET plant in Longlaville, with possibility to double capacity
  - Indorama Ventures to ensure 100% of output repolymerization
  - Both partners to secure feedstock supply
- Contract documentation to be finalized before end of 2023
- Carbios' partner confirms intention to expand the technology to other PET sites for future developments

Video

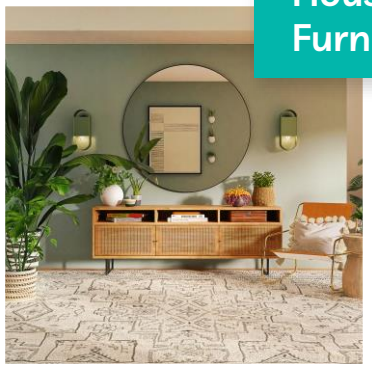
Market and Competitive Positioning

Stéphane Ferreira, Chief Business Officer

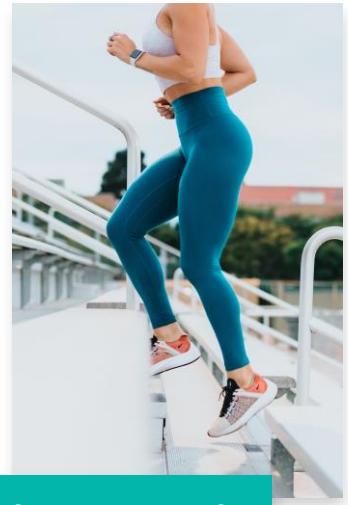
CARBIOS

PET, a versatile material with broad scope of applications

Housing
Furniture

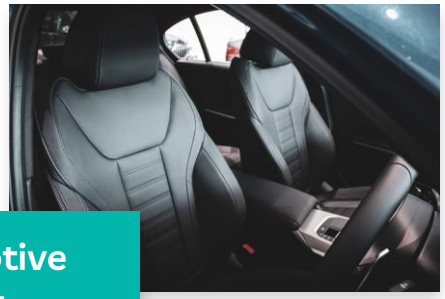


Cosmetics



Outdoor apparel
Shoes

Apparel
Textile



Automotive
Mobility

Medical
Healthcare

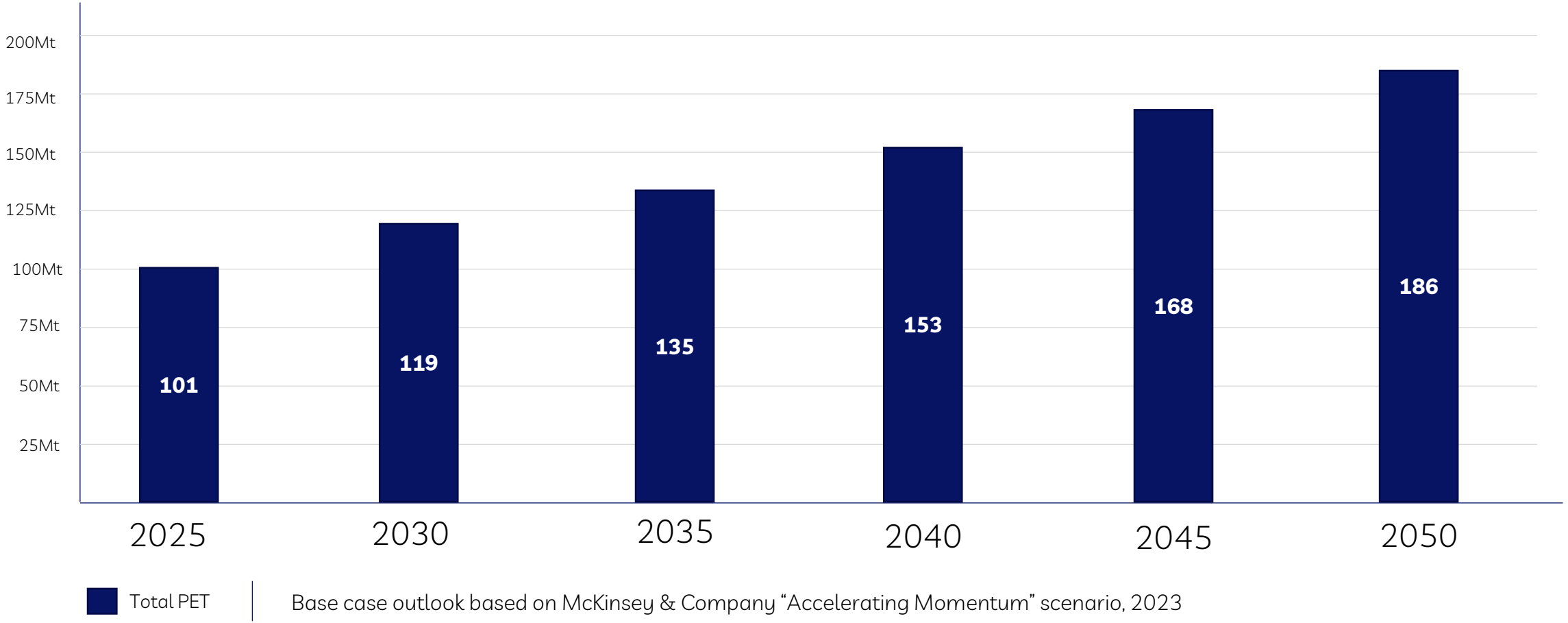
Beverage

Food

Industrial
packaging

Global PET market set to double over the next 25 years

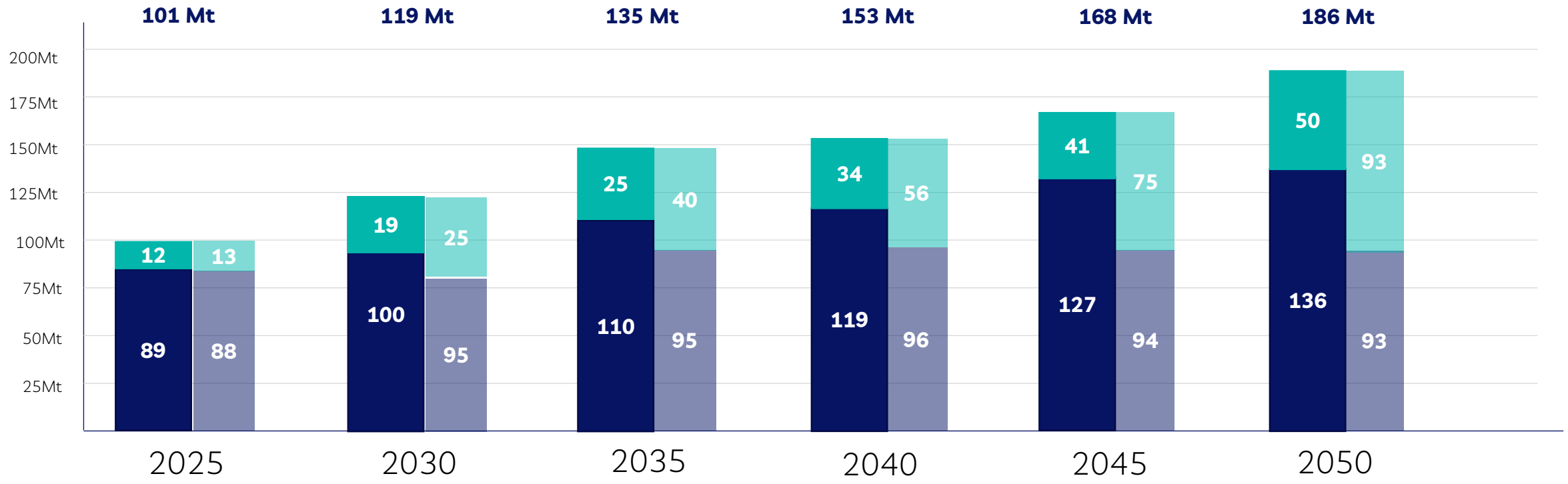
PET market growth 2.5% CAGR 2025-2050



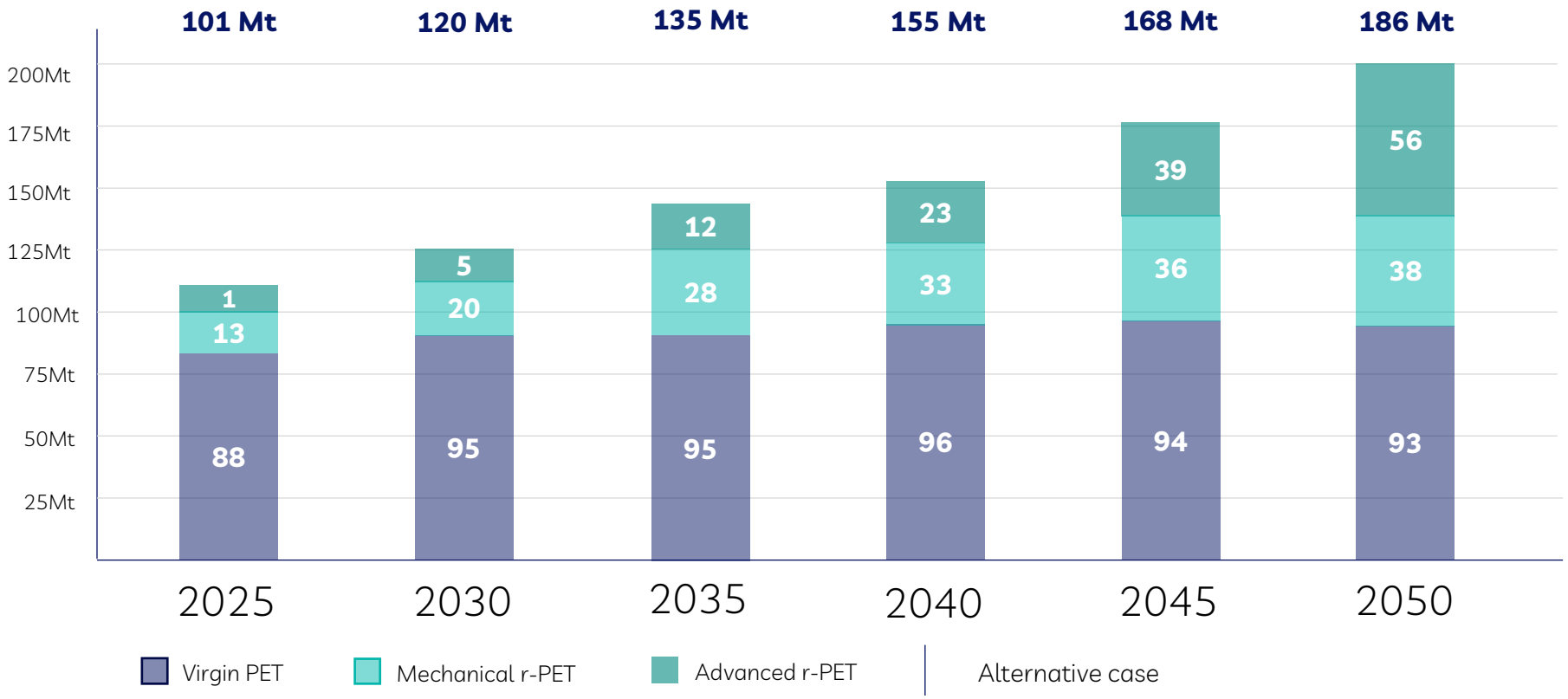
Base case outlook based on McKinsey & Company "Accelerating Momentum" scenario, 2023

Growth driven by significant r-PET contribution

Three main enablers for alternative scenario:
- Textile collection
- Feedstock use
- Advanced Recycling scale-up



Advanced r-PET is fastest growing segment



Advanced
56MT
€200B

Highly differentiated CAGR 2025-2050 per r-PET category:

- Total r-PET +8,4% CAGR
- Advanced r-PET +17% CAGR
- Mechanical r-PET +4% CAGR

Feedstock mix will limit mechanical r-PET growth *
Lower demand for petrosourced material will limit virgin PET growth

* Mechanical recycling allows lower PET waste recyclability

Multiple drivers for PET market growth

Demand factors

- Per capita consumption
- Consumer demand for greener solutions
- Consumer willingness to pay
- Brand Owner pledges
- Government regulations
- Plastic category shifts

Supply factors

- Growing post-consumer waste
- Resin waste collection & recycling optimization
- Technological advances (advanced r-PET)

Long-term drivers

- Fiber waste collection
- Timing to install recycling capacities

Brand pledges support r-PET market growth in all sectors

Housing

IKEA

"… renewable or recycled materials by 2030 – reaching **56%** renewable and 17% recycled materials …"

Sport & Apparel

PUMA

"… increase recycled polyester use to **75%** (apparel & accessories) by 2025…"

Automotive

BMW

"… secondary materials in the thermoplastics used in new vehicles from around 20% at present to an average of **40%** by 2030…"

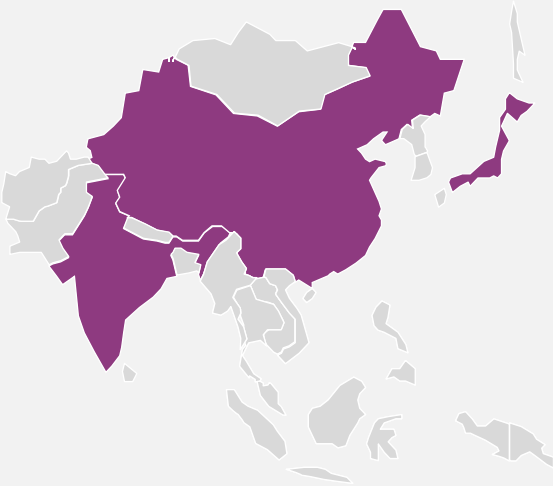
Food & beverage

PEPSICO

"… to **100%** recyclable / compostable / biodegradable / reusable packaging by 2025 …"

Quotes from annual Corporate ESG Report (2021 & 2022) – available on official websites

Expanding governmental regulations accelerate trend worldwide



North America

2018 – Canada
Consultation on "Moving Canada toward zero plastic waste" by 2030

July 2022 – USA
EPR* legal framework voted in California and Michigan
Similar bills in Maine, Oregon, Colorado, Washington, Tennessee and New Jersey since 2022

Europe

2022 – EU
Draft Packaging and Packaging Waste Regulation:
- All packaging to be recyclable
- Incorporation of recycled PET up to 30% in packaging in 2030 and **up to 65% in 2040**

2022 - UK
Plastic Tax implemented on virgin plastic

2023 Jan - France
Ambitious recycling targets set for 2028 by EPR* textile ReFashion

2023 – EU
Intensification of collection rate by further implementation of deposit scheme in EU States

Asia

2018 – China
Waste import ban

2022 - China
Ban on non-degradable plastic bags in shopping malls, supermarkets

2022 – India
National ban on single use plastic

2022 – Japan
New national law promoting recycling

** EPR: Extended Producer Responsibility*

Carbios enzymatic solution, a game-changing technology

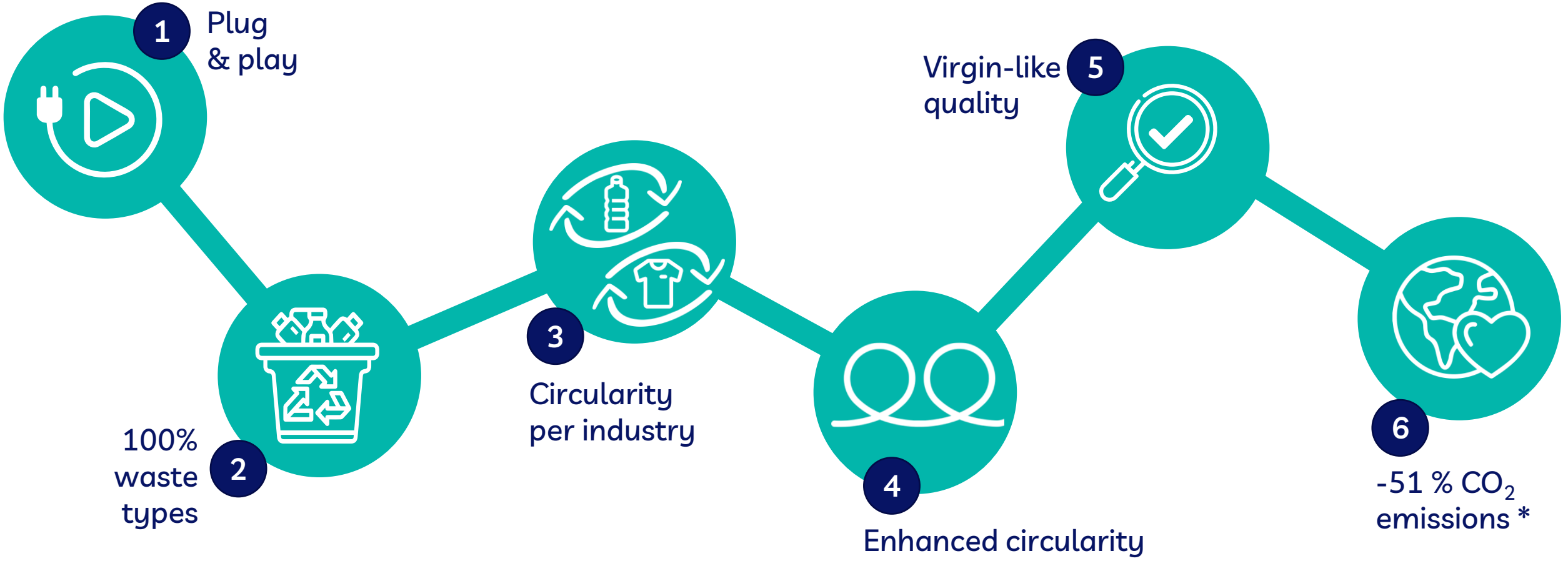
Delphine Denoizé, Innovation Programs funding,
Regulation and LCA Director

Stéphane Ferreira,
Chief Business Officer

Arnaud Tillon,
Marketing Director

CARBIOS

Carbios brings value along the chain while preserving the planet

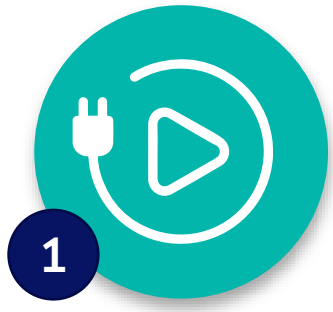


Carbios PET biorecycling process labeled
Solar Impulse Efficient Solution

Video Solar Impulse Foundation

* taking into account diversion of 50% PET waste from a conventional end-of-life. Virgin PET: 2.19kg CO_2/kg (cradle to gate)

Compatible with over 95% of existing PET plants



Plug & play for industrials

- PTA & MEG as outputs
- >95% of existing PET plants use PTA
- Same processability as virgin PET

Key Benefits for PET Producers

Fits existing large-scale plants

- ✓ CAPEX avoidance
- ✓ PET production cost competitiveness
- ✓ Better environmental footprint
- ✓ Investment interest in Carbios' technology
- ✓ No impact for converters

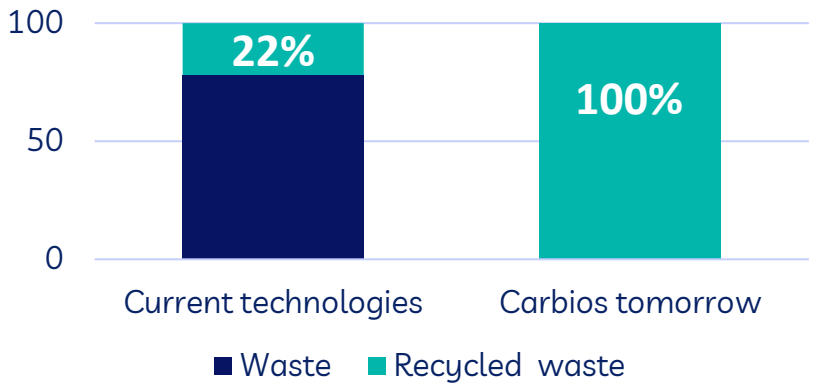
Value given to 78% of non-recyclable PET waste

2

100% waste types processed

- Colored, opaque, multi-layer packaging…
- Textile, fibers
- Low-grade feedstock upgraded to food-contact PET

Global PET waste types recyclability



Key Benefits for Carbios and Licensees

- Growth through maximized local sourcing
- High flexibility regardless of feedstock mix
- Competitiveness : **Waste mix average cost for Carbios Reference Unit - 50% to - 60%**

Key Benefits for Waste Players

- New commercial outlets for flakes producers

CARBIOS

Growing feedstock competitiveness

Feedstock Conventional Recycling

Clear bottles


2000€ per ton * ↗↗

Colored bottles


1500€ per ton * ↗

Feedstock Carbios Biorecycling

Conventional recycling residues (fines)

250€ per ton *

Food packaging trays mono/multilayer

300 – 500€ per ton *

Textile

<500 € per ton *

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* Average market prices, source Carbios, April 2023

Full circularity for each industry

Circularity per industry

- Fiber-to-fiber circularity
- Colored/opaque to clear
- Non-food to food-contact grade

Key Benefits

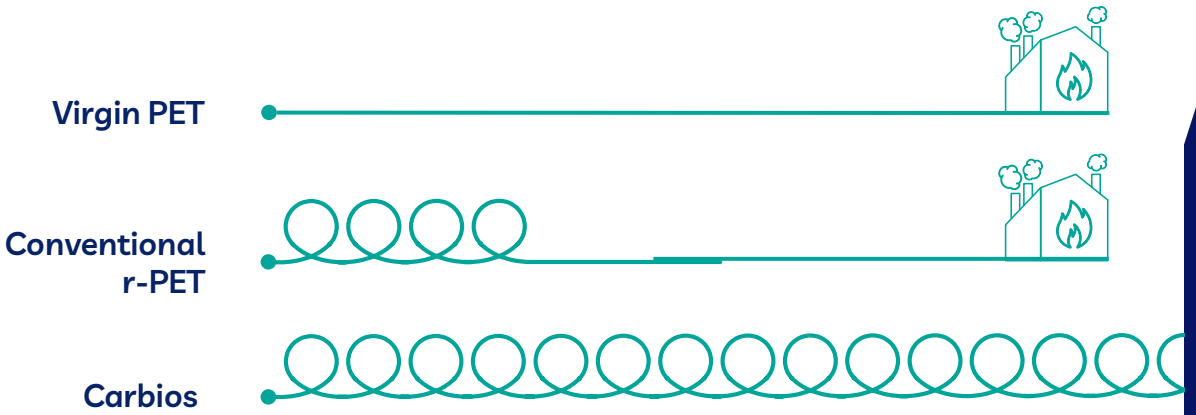
- No feedstock competition between textile and packaging industries
- No more downcycling of bottle waste into fibers
- Ability to produce transparent and high-grade bottles regardless of packaging flakes quality

The most circular technology

4

Enhanced circularity

- Monomers with virgin-like recovery
- No degradation of r-PET quality throughout cycles



Key Benefits

- Maximized number of cycles
- No compromise on quality
- Reduce extraction of fossil resources

Safe and high-performing r-PET, like virgin PET

Virgin-like quality

- Same mechanical and technical properties as virgin PET
- Water-based, no organic solvents used in the process
- Very efficient purification

Key Benefits

- High food-grade quality
- Health security ensured
- No bisphenol A
- Suitable for any PET applications

Life Cycle Assessment (LCA) high standards met

-51 % CO_2 emissions
vs one cycle of virgin PET production*

Natural & soft process

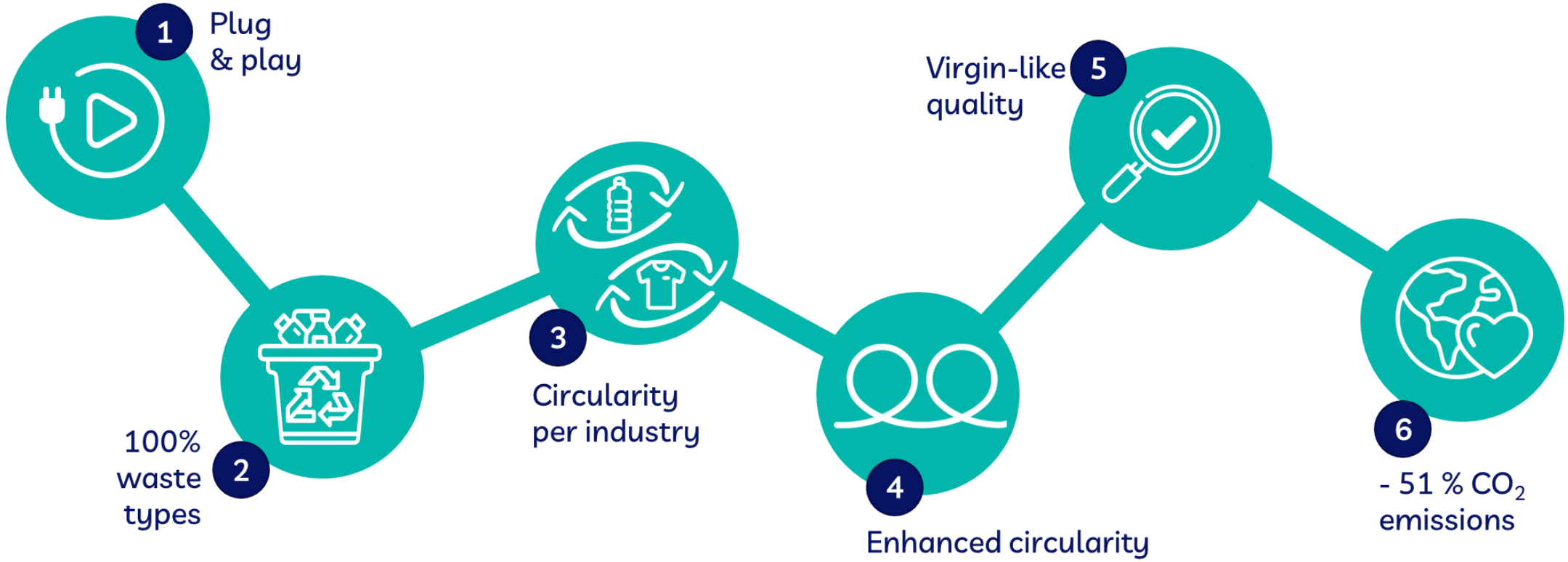
- Conventional end-of-life avoided
- Low temperature during depolymerization
- No pressure during depolymerization
- No use of organic solvents

Key Benefits

- Less GHG emitted
- Less energy consumption
- Minimized health and safety risks for operators
- ~500 KG = CO_2 savings per ton of r-PET produced and commercialized

* taking into account diversion of 50% PET waste from a conventional end-of-life
Virgin PET: 2.19kg CO_2/kg (cradle to gate)

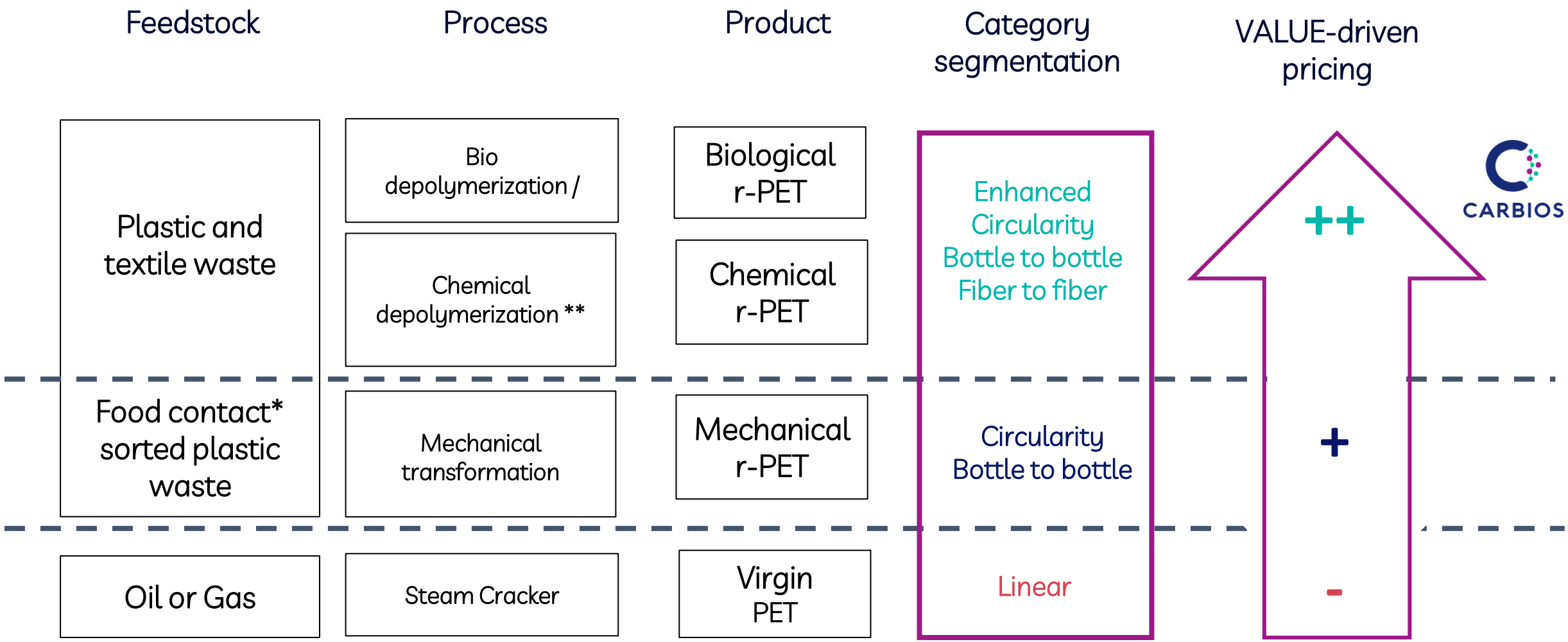
Carbios is best positioned to conquer r-PET market leadership



Carbios biorecycling technology creates an unparalleled competitive advantage, establishing a long-term leadership

Video Jean-Marc Boursier

Grade-driven pricing in a competitive PET environment

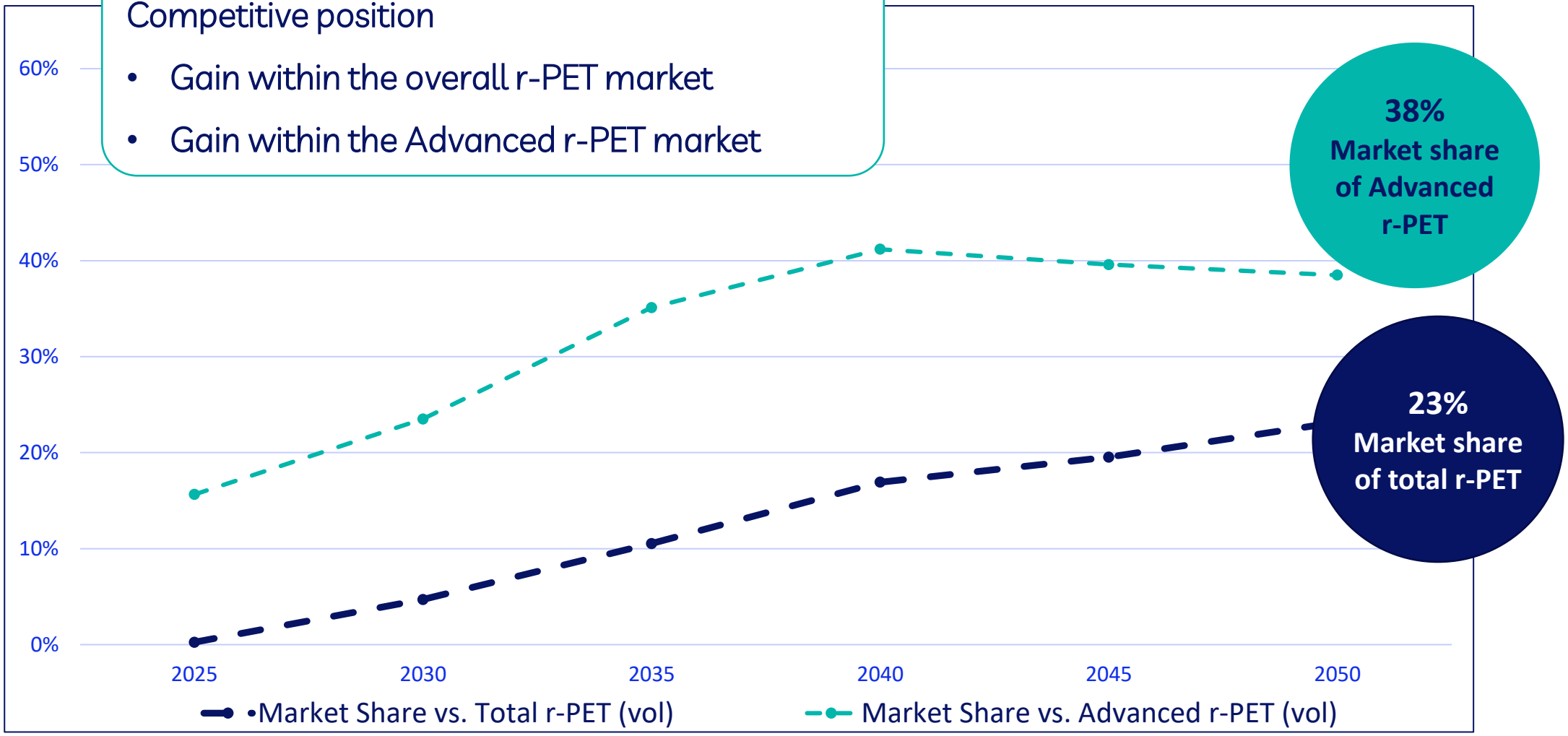


* Where production of food grade is possible EU/USA, ** not industrial yet

Carbios will take lion's share of Advanced r-PET market

Competitive position

- Gain within the overall r-PET market
- Gain within the Advanced r-PET market



Source: Carbios

Despite challenges, consumers adopt more eco-friendly behaviors

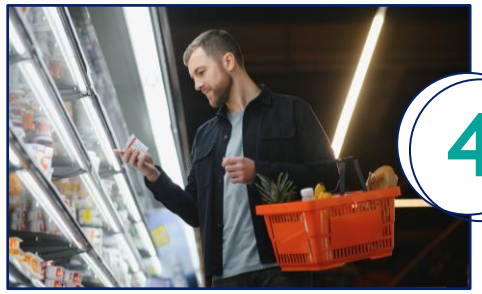
Despite **limited knowledge** and **confusion** about plastic types
80% of consumers are commited to sort for recyling

68% of consumers don't **trust** the effectiveness of current recycling

57% of consumers don't believe their efforts to recycle make a difference. They **are afraid** it is too late to revert plastic pollution and **feel that too much responsibility lies on their shoulders**

Source : CARBIOS Quantitative research in partnership with Strategic Research (May 2022 N=6038. USA, FR, GE, IT, UK, JP) CARBIOS Qualitative research in partnership with Spring Voice research Institute (July 2022. USA)

Consumers are willing to pay more for eco-friendly circular solutions(1)



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Consumers expect solutions from **institution** and mostly from **brands**. Meanwhile they take back control through their **purchase decisions**.

Eco-friendly Packaging is an increasingly important criteria to guide purchase decisions across multiple categories...

	ecoconscious							
	All. Cat.		Mineral Water		Pers. Care		Soft drinks	
Product quality	51%	(1)	52%		48%		53%	
Price	44%	(2)	42%		47%		42%	
Eco-friendly packaging	42%	(3)	47%	(2)	39%	(3)	38%	(4)
Taste/Flavor/Fragrance	38%		39%		25%		51%	
Product composition/ingredients	31%		22%		41%		29%	
Product origin	25%		31%		24%		17%	
Convenience of the pack	20%		18%		23%		20%	

...For which consumers are willing to pay more

	EUROPE		USA	
	All	Eco-Active	All	Eco-Active
Net Yes (%)	**87**	**93**	**93**	**98**
Yes, definitely	40	57	53	74
Yes, probably	47	36	40	25
Concept	Circularity	Circularity	Circularity	Circularity

IMAGE: GUSTAVO FRING/PEXELS

A recent survey of over 1,000 US adults revealed striking evidence that two-thirds (66%) are willing to pay more for sustainable products, despite a growing gap in consumer trust of corporations.

(1) CARBIOS Quantitative research in partnership with Strategic Research (May 2022 N=6038. USA, FR, GE, IT, UK, JP)
CARBIOS Qualitative research in partnership with Spring Voice research Institute (July 2022. USA)
(2) Business of sustainability index, PDI sustainable solutions (June 2022 N=1062 adults, USA)

“Carbios Inside” to win back consumer trust and sustain behavioral change

Insignificant impact on consumer purchasing power

Material cost impact of Advanced PET vs Mechanical PET *

Soft drinks	50cl
Selling Price **	0,5€
PET weight	25gr

+ 0,03€ / Unit

Sunscreen	200ml
Selling price **	15€
PET weight	20gr

+ 0,02€ / Unit

Fleece jacket (100% polyester)	
Selling price **	192€
PET weight	775gr

+ 0,91€ / Unit

Formal jacket (90% polyester)	
Selling price **	205€
PET weight	450gr

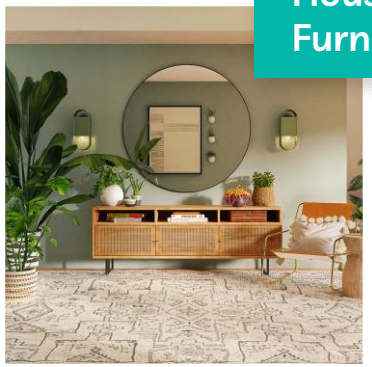
+ 0,53€ / Unit

* Assumptions on April 2023: Virgin PET price index (€/metric ton) 100; Mechanical r-PET 200; Advanced r-PET 300

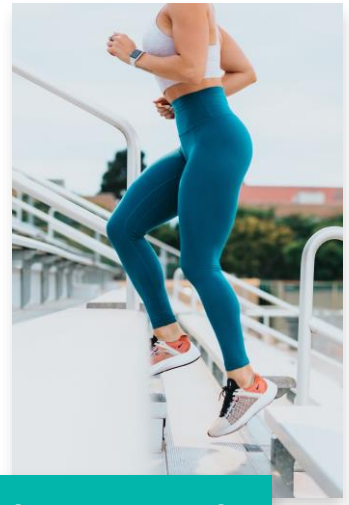
** Unit. Excluding VAT

Our offer is relevant to all market applications

Housing
Furniture



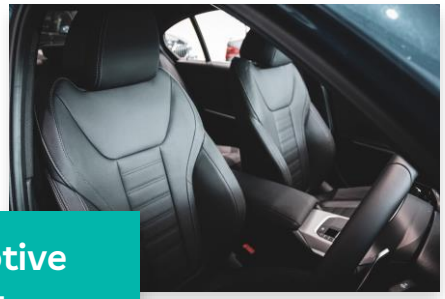
Cosmetics



Outdoor apparel
Shoes

Apparel
Textile

Automotive
Mobility



Medical
Healthcare

Beverage

Food

Industrial
packaging

Lise Lucchesi, Intellectual Property Director

Carbios at the frontier of enzymatic innovations

Prof. Alain Marty, Chief Scientific Officer

CARBIOS

Nature 2020 was already a breakthrough…

Article

An engineered PET depolymerase to break down and recycle plastic bottles

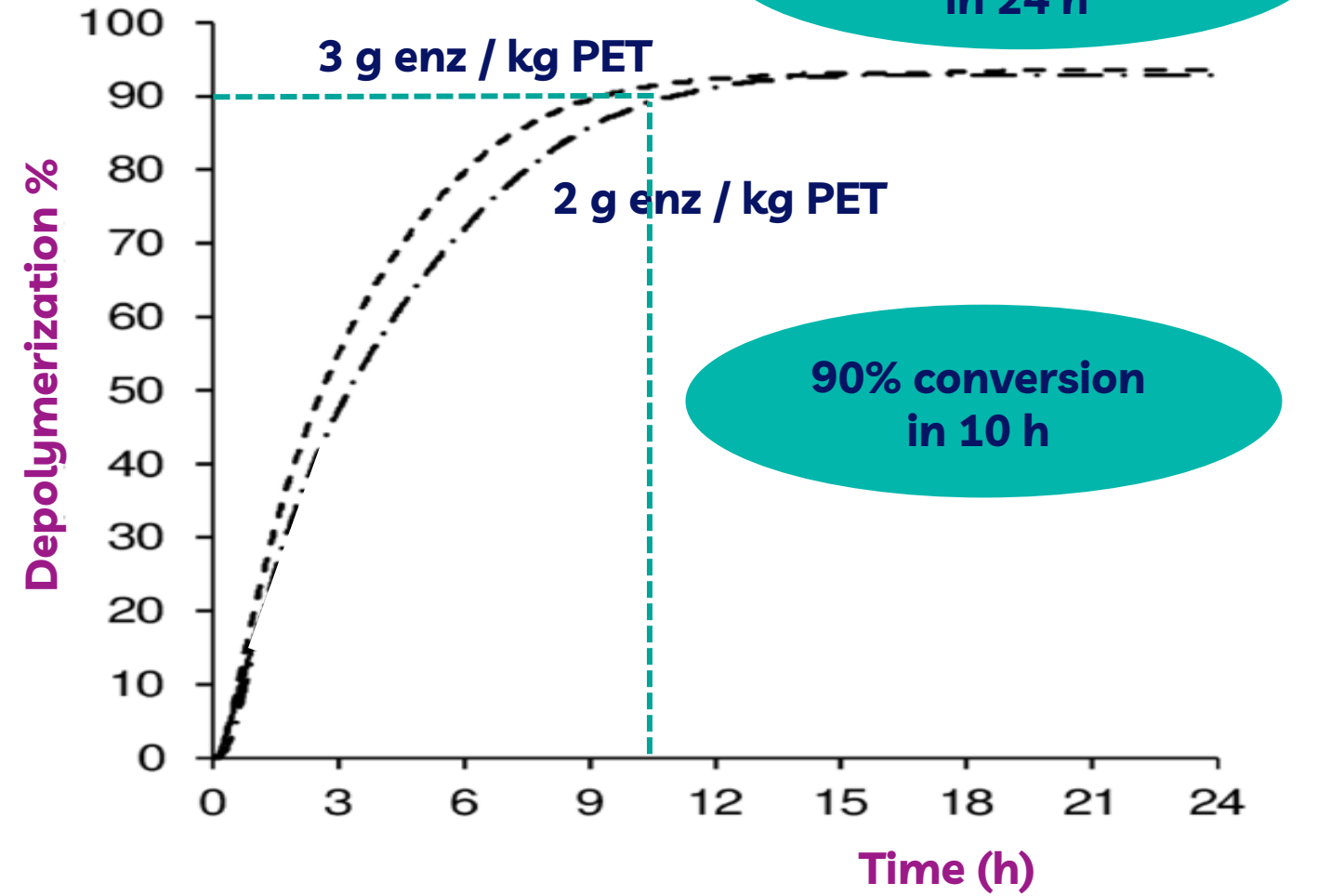
https://doi.org/10.1038/s41586-020-2149-4
Received: 27 June 2019
Accepted: 19 February 2020
Published online: 8 April 2020
Check for updates

V. Tournier[1,4], C. M. Topham[1,4], A. Gilles[1], B. David[1], C. Folgoas[1], E. Moya-Leclair[1], E. Kamionka[1], M.-L. Desrousseaux[1], H. Texier[1], S. Gavalda[1], M. Cot[1], E. Guémard[1], M. Dalibey[1], J. Nomme[1], G. Cioni[1], S. Barbe[1], M. Chateau[1], I. André[1,2], S. Duquesne[1,2] & A. Marty[1,3]

Present estimates suggest that of the 359 million tons of plastics produced annually worldwide[1], 150–200 million tons accumulate in landfill or in the natural environment[2]. Poly(ethylene terephthalate) (PET) is the most abundant polyester plastic, with almost 70 million tons manufactured annually worldwide for use in textiles and packaging[3]. The main recycling process for PET, via thermomechanical means, results in a loss of mechanical properties[4]. Consequently, de novo synthesis is preferred and PET waste continues to accumulate. With a high ratio of aromatic terephthalate units—which reduce chain mobility—PET is a polyester that is extremely difficult to hydrolyse[5]. Several PET hydrolase enzymes have been reported, but show limited productivity[6,7]. Here we describe an improved PET hydrolase that ultimately achieves, over 10 hours, a minimum of 90 per cent PET depolymerization into monomers, with a productivity of 16.7 grams of terephthalate per litre per hour (200 grams per kilogram of PET suspension, with an enzyme concentration of 3 milligrams per gram of PET). This highly efficient, optimized enzyme outperforms all PET hydrolases reported so far, including an enzyme[6,8] from the bacterium *Ideonella sakaiensis* strain 201-F6 (even assisted by a secondary enzyme[9]) and related improved variants[10–14] that have attracted recent interest. We also show that biologically recycled PET exhibiting the same properties as petrochemical PET can be produced from enzymatically depolymerized PET waste, before being processed into bottles, thereby contributing towards the concept of a circular PET economy.

Post-consumer flakes (98 % PET)

PET : 200 g/L
72°C, pH8



tbi Toulouse Biotechnology Institute Bio & Chemical Engineering

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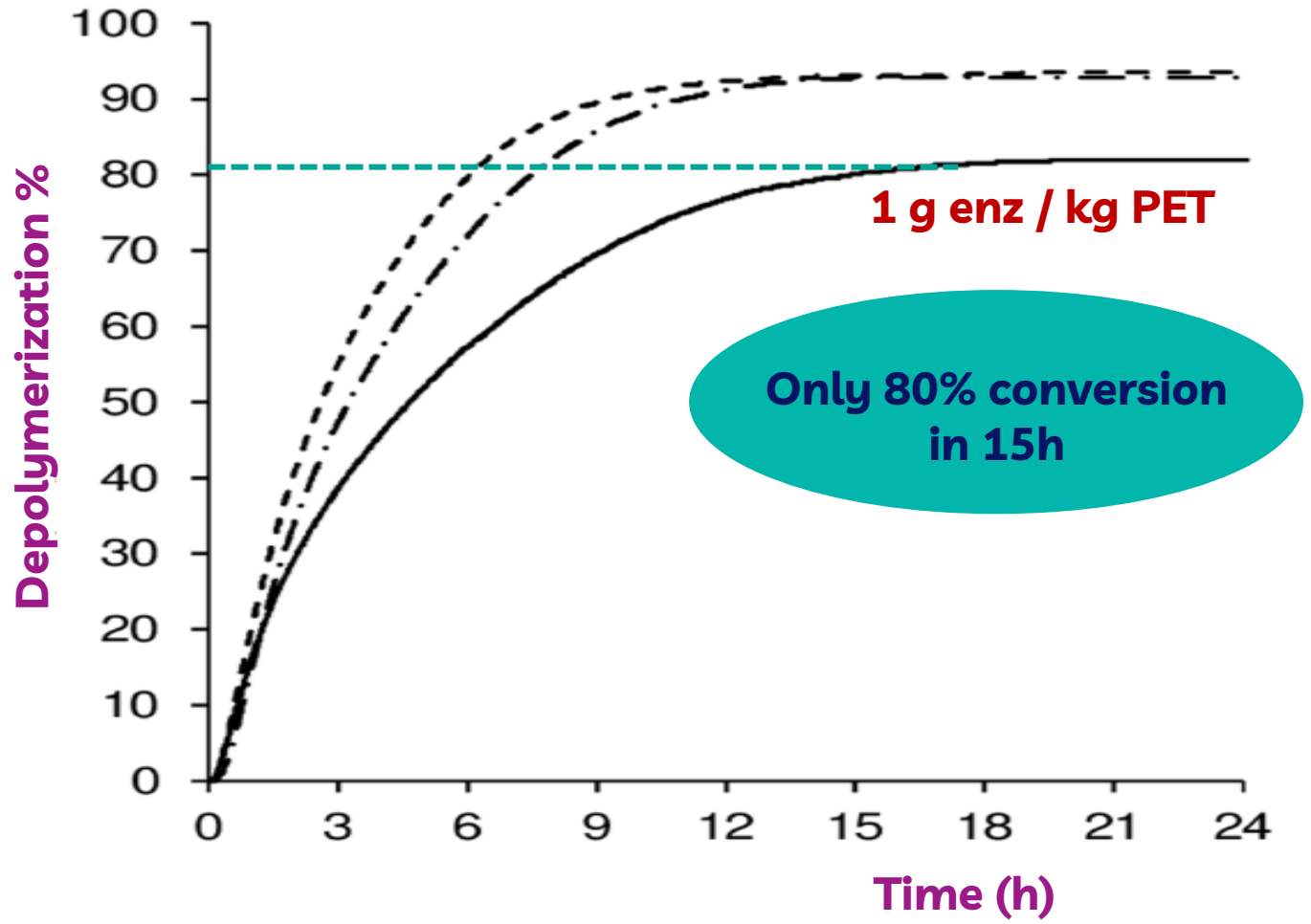


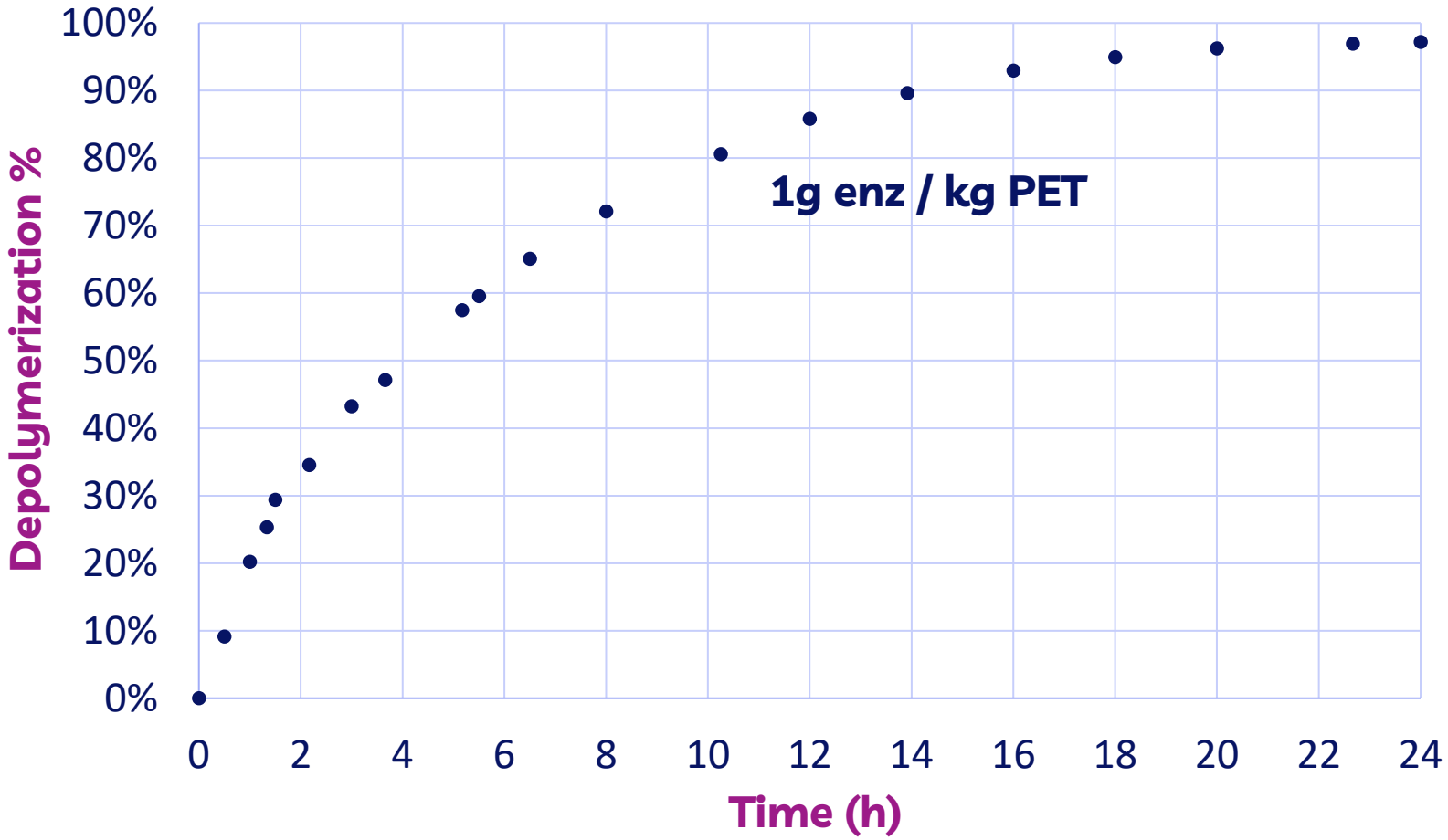
tbi Toulouse Biotechnology Institute Bio & Chemical Engineering

CARBIOS

Since then, we have maximized reaction conditions

- Post-consumer Flakes
- (98 % PET)

PET : 200 g/L
68°C, pH8

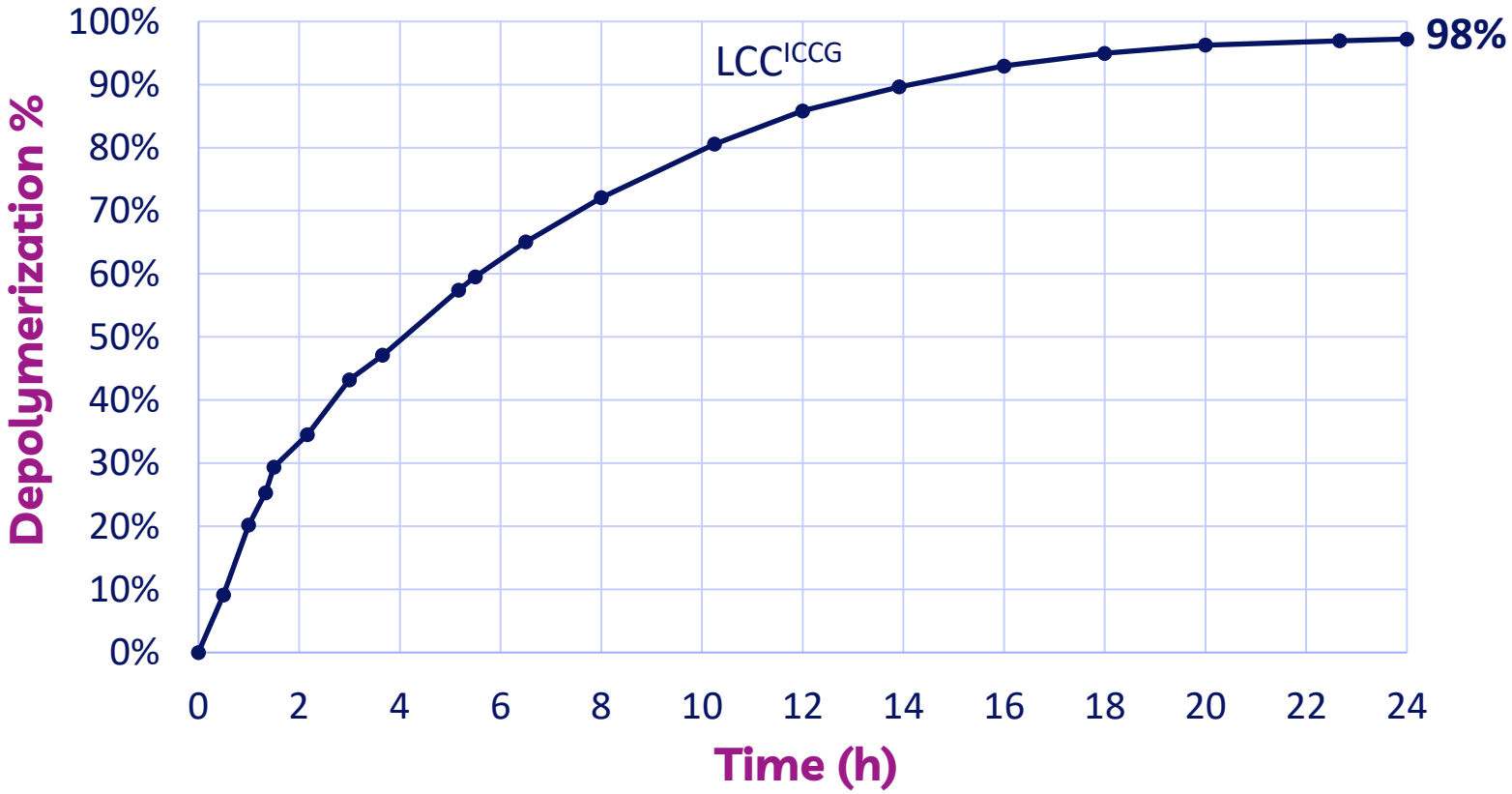


Final conversion 98 %

- Increase in production by 5%
- Decrease in waste treatment cost
  Economy of 0.5 to 1 M€/year for the 50kt plant

Carbios enzyme outperforms published academic ones

LCC^{ICCG}	Tournier *et al.*, Nature 2020
HOT-PETase	Bell *et al.*, Nature Cat. 2022
FAST-PETase	Lu *et al.*, Nature, April 2022
PES-H1$^{L92F/Q94Y}$	Pfaff *et al.*, ACS Cat. 2022



Post-consumer Flakes
(98 % PET)

- PET : 200g/L
- Enzyme: 1g/kg PET
- pH8
- Optimal T° of each enzyme

Carbios enzyme outperforms competitors' conversion rate

LCC^{ICCG}	Tournier *et al.*, Nature 2020
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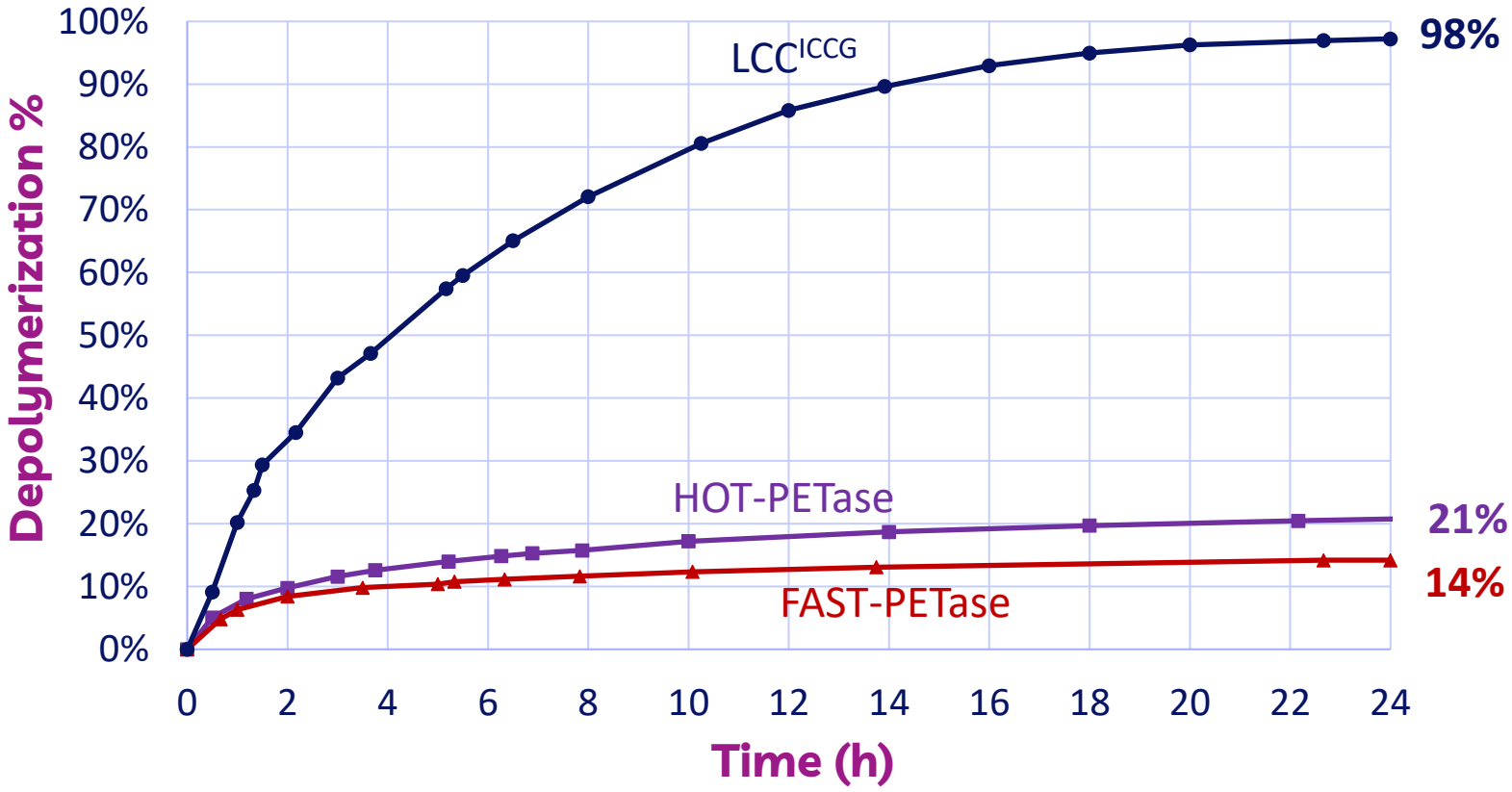

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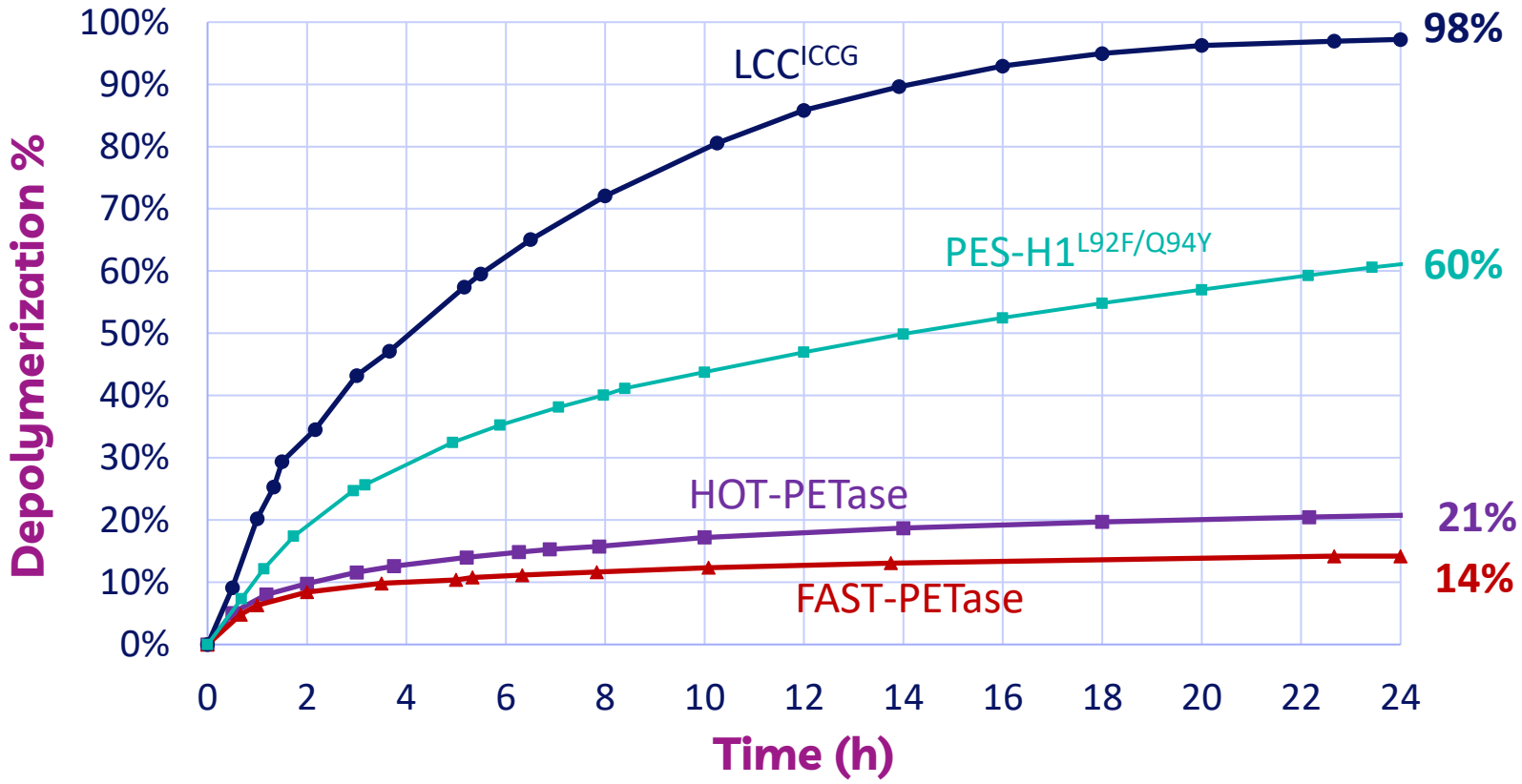


Post-consumer Flakes
(98 % PET)

- PET : 200g/L
- Enzyme: 1g/kg PET
- pH8
- Optimal T° of each enzyme

New optimizations to secure long-term leadership

Over the past 2 years, the enzyme's efficiency has been improved

More thermostable
More active

98% Conversion

Optimization of the µ-organism for enzyme production by Novozymes during 2nd semester 2023

This enzyme will be used in 2025 in the first industrial plant

Long-term supply of Carbios enzyme ensured at industrial scale

- **Exclusive and global agreement with Novozymes,** world leader in enzyme production, derived from initial partnership established in 2019
- Development, optimization, production and supply ensured for Carbios' proprietary enzyme

Video Voice of Partners - Novozymes

Strong, global protection of Carbios enzymes and processes

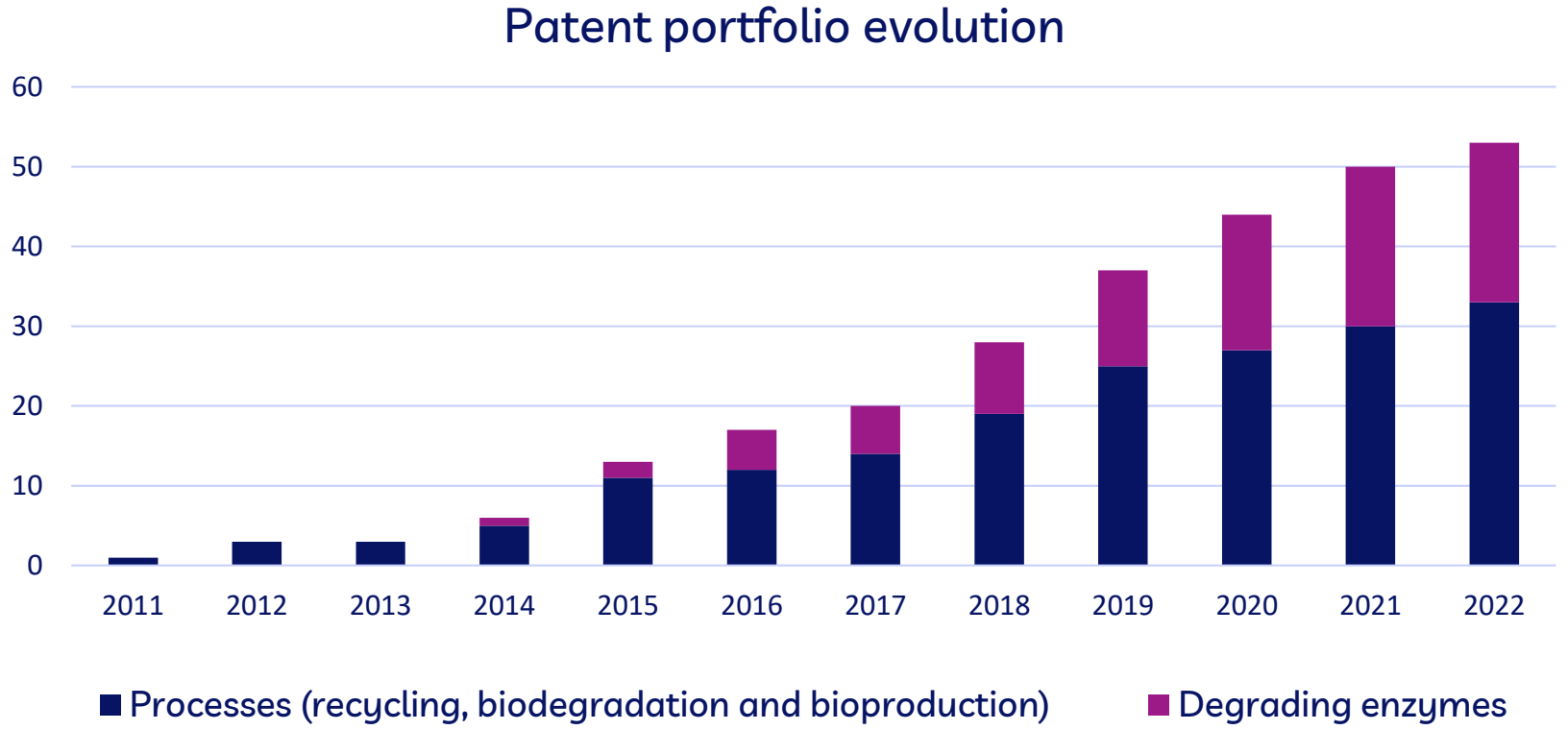
336 patent applications worldwide
In Europe, United States, Canada, Mexico, Brazil, China, Japan, India, South Korea…

As of 31 December 2022

53 patent families

Number of granted patents doubled in 2 years

Proactive policy secures innovations “for life” : from lab to plant



20-year protection from filing date

2022 Patent applications → Protection until 2042

New polymers

From 2023 : focus on protecting innovation related to enzymatic degradation of other polymers

Industrial assets

Lionel Arras, Industrial Development Director

CARBIOS

Last demonstration step achieved before commercial scale

Pre-treatment

Depolymerization

Filtration steps

Separation of TA and MEG

Purification of TA

Purification of MEG

Best PET reaction conditions achieved

- PET selective
- Not inhibited by feedstock contaminants
- Limited degradation products because of low temperature and no solvent

Recovery yields at commercial scale target

- 95% depolymerization yield *
- 90% overall recovery on PTA **

* On reference feedstock (mixed colored flakes)
** Purified TA

Monomer of virgin-like quality

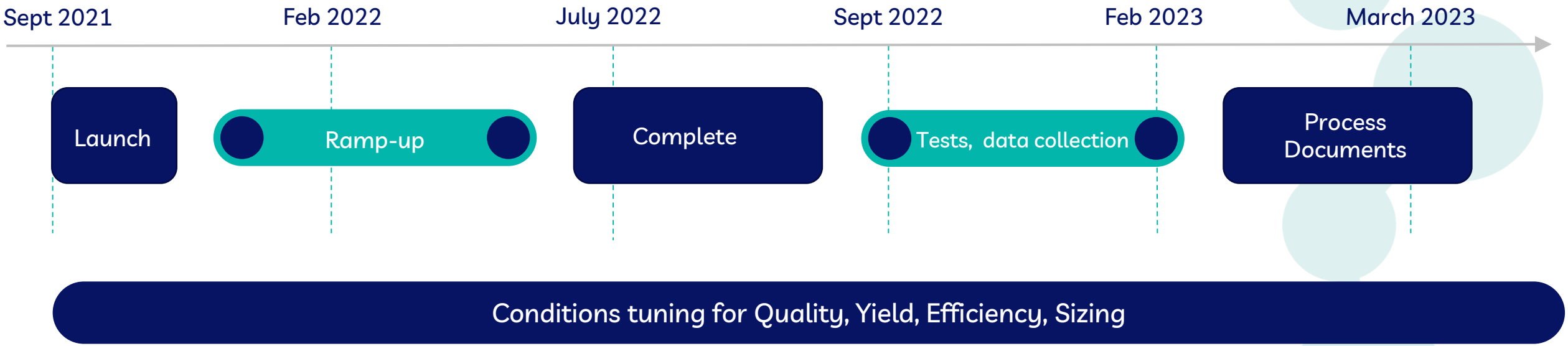
- Very high purity allowing food-contact applications

Highest Technology Readiness Level achieved >=7

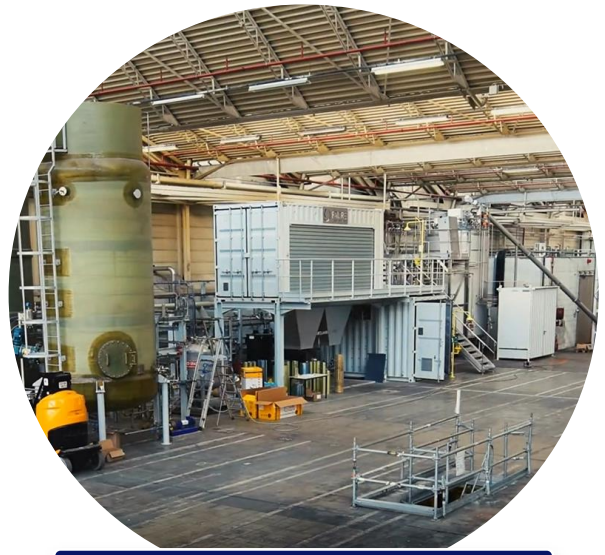
CARBIOS

Demo plant is fully operational to start licensing

- 20 Million € project , > 120 equipment, 2500 m^2 for process technology
- 25 field technicians, engineers, and PhDs
- Designed in collaboration with Technip and best experts in the field
- Capacity : 2 tons / batch



Construction of Carbios Industrial Demonstration Unit



Video timelapse

Countdown to Reference Unit and First License

Carbios Reference Unit

Demonstration plant fully ready

Technology Licensing

Objectives:

- Generate revenue from monomers sales
- Deliver first tons to partnering Brand Owners and other market players
- Train future licensees at large scale

PET first biorecycling plant in Longlaville

CARBIOS

50k tons PET feedstock capacity
Plant commissioning : 2025

Longlaville (54), Grand Est
Green Field project
70 000 m^2 with room for expansion

5 shifts – 24 hours, 7 days a week
150 new jobs (66 employees + indirect)

Reference Unit designed for maximized circularity and best LCA

Design Principles :

Product quality

- Design margins
- Materials selection

Energy minimization

- Water vaporization (MVR)
- Heat integration

Improvements Add-ons

- Increase textile proportion
- Reuse and recycle process water
- Minimize waste

First plant on schedule and backed up

Dec 2022 — April 2023 — H2 2023 — 2024 — 2025

Permits application

Land preparation

Commissioning
Production Start-up

Technology definition at scale

Design and planning

Procurement
Detailed Engineering

Plant staff :
recruitment and training

Construction

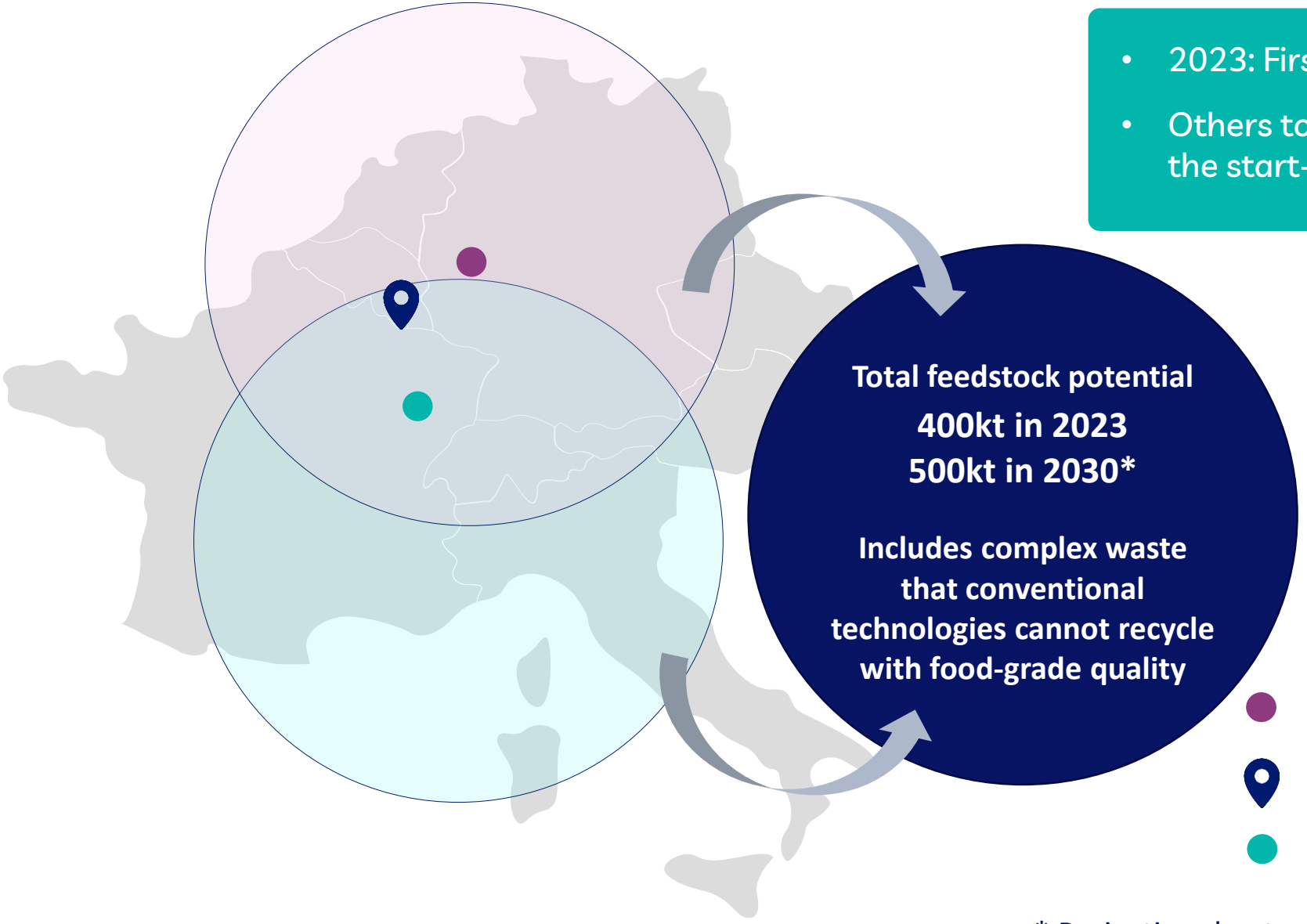
70%

Integrated teams
- Carbios and consultants ~15
- Technip Energies ~ 65

Video Technip Energies

Feedstock volumes for Longlaville plant secured locally

- 2023: First contract signed with Citeo.
- Others to follow to prepare the start-up and the ramp-up



Total feedstock potential

400kt in 2023
500kt in 2030*

Includes complex waste that conventional technologies cannot recycle with food-grade quality

Flakes producer (Northern EUR)

Carbios, Grand-Est Region (FR)

Flakes producer (FR)

* Projection due to selective collection increase

Longlaville plant's CAPEX updated at 230M€

Main variances since previous estimate:

- Inflation
- Additional construction requirements specific to the Longlaville site + contingencies

New estimate is competitive:

- Much lower Capex-intensive than other French announced advanced recycling projects
- Potential Capex optimization for future sites

65% to be funded by Indorama Ventures investment and aids coming from the French State and the Grand-Est Region.

Licensing Scope and Roadmap

Frédéric Alarcon, Licensing Manager

CARBIOS

License Offer Standard Timeframe

Prospects Technology Promotion

- Presentations
- Site visits
- Product Sampling

12 to 18 months

License Effective Date

Granted License Technology Disclosure

- Process Design Package Development (PDP)
- PDP transfer meeting with EPC contractor *
- Technology Manuals for plant operations

Project Execution Technical Services

- Design review
- Technology Training
- Plant As Built Check

Plant start-up Technology performance

- Plant Commissioning
- Reliable Operations support
- Technology Performance Tests

36 months

€ License Fee

€ Engineering Fee

€ Technical Services Fee

€ Training Fee

€ License Fee

€ Technical Service Fee

€ Expansion Fee **

€ Retrofit Fee **

CARBIOS

* Engineering, Procurement and Construction

** Beyond 36 months

High licensing potential

Targeted profiles for Carbios PET biorecycling Technology

Core target

PET Producers

- Sustainable offer with highest value

Chemicals Groups

- Production diversification with highest value

Enlarged targets

Waste Management Companies

- Downstream integration
- Feedstock valorization

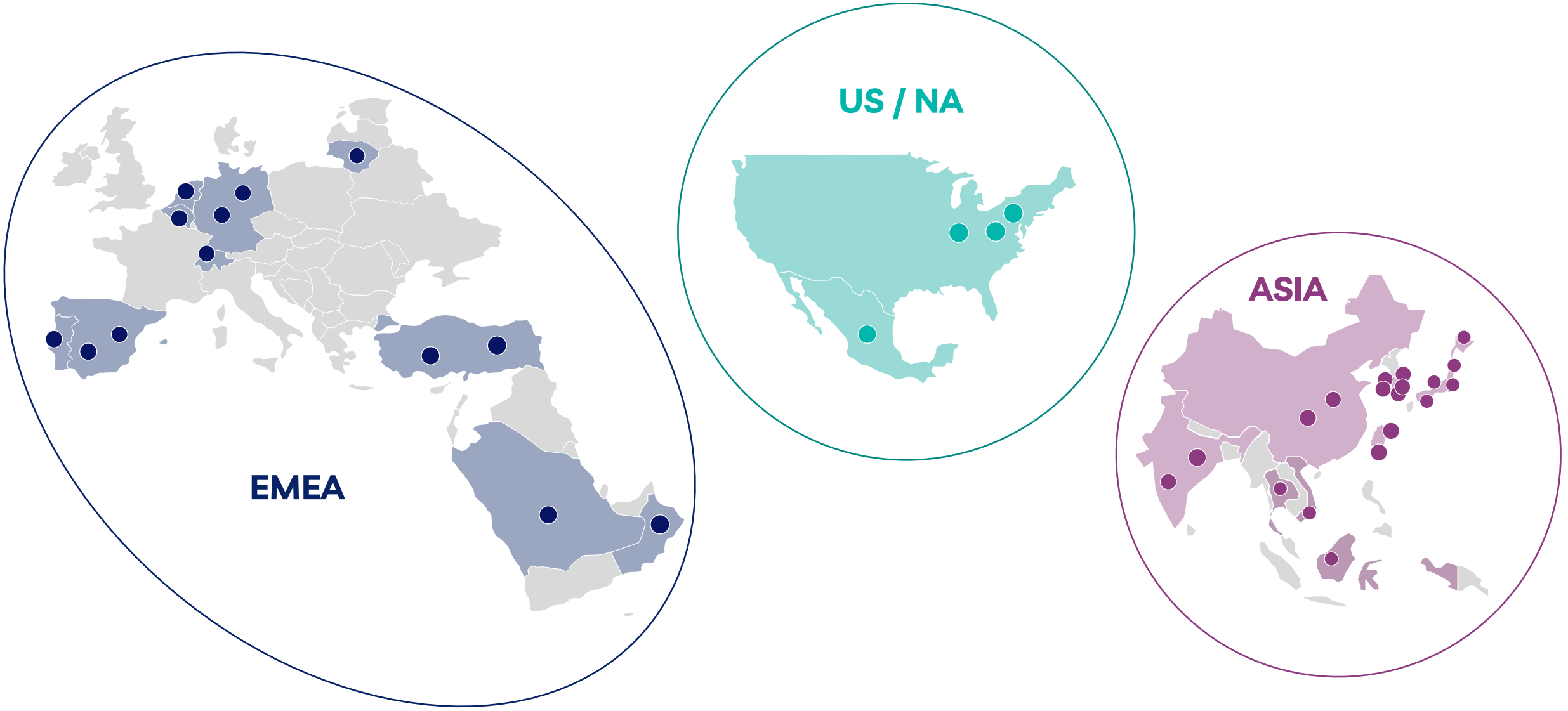
Brand owners

- Upstream integration
- Feedstock securization

Public Entities municipalities & sovereign funds

- Investment opportunities

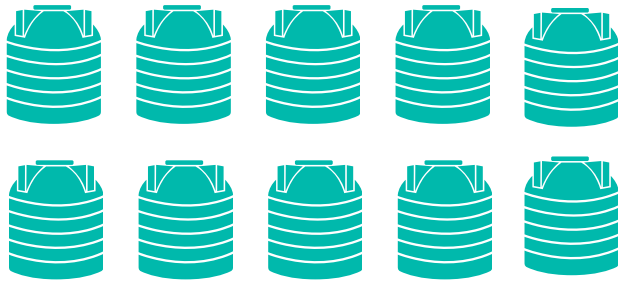
First geographical licensing pipeline



Robust means to deploy a portfolio of 3 models

Design & Engineering

 # 200 ktpa
Main Production hubs



 # 50 ktpa
Regional Partnership

 # 20 ktpa
Specialty polymer players

Documentation

Presales > Technical Information Package

Post-signage > Process Design Package, Technology Manuals (Process Book, Operations guidelines, Quality Control Book)

Organization

Key operational functions within Carbios

> Regional Licensing Managers, Technical Proposal leader, Project Managers, Commissioning Managers

Beyond PET, Carbios is developing other sources of revenue

> Enzymed PLA, a major step in the biodegradation offer

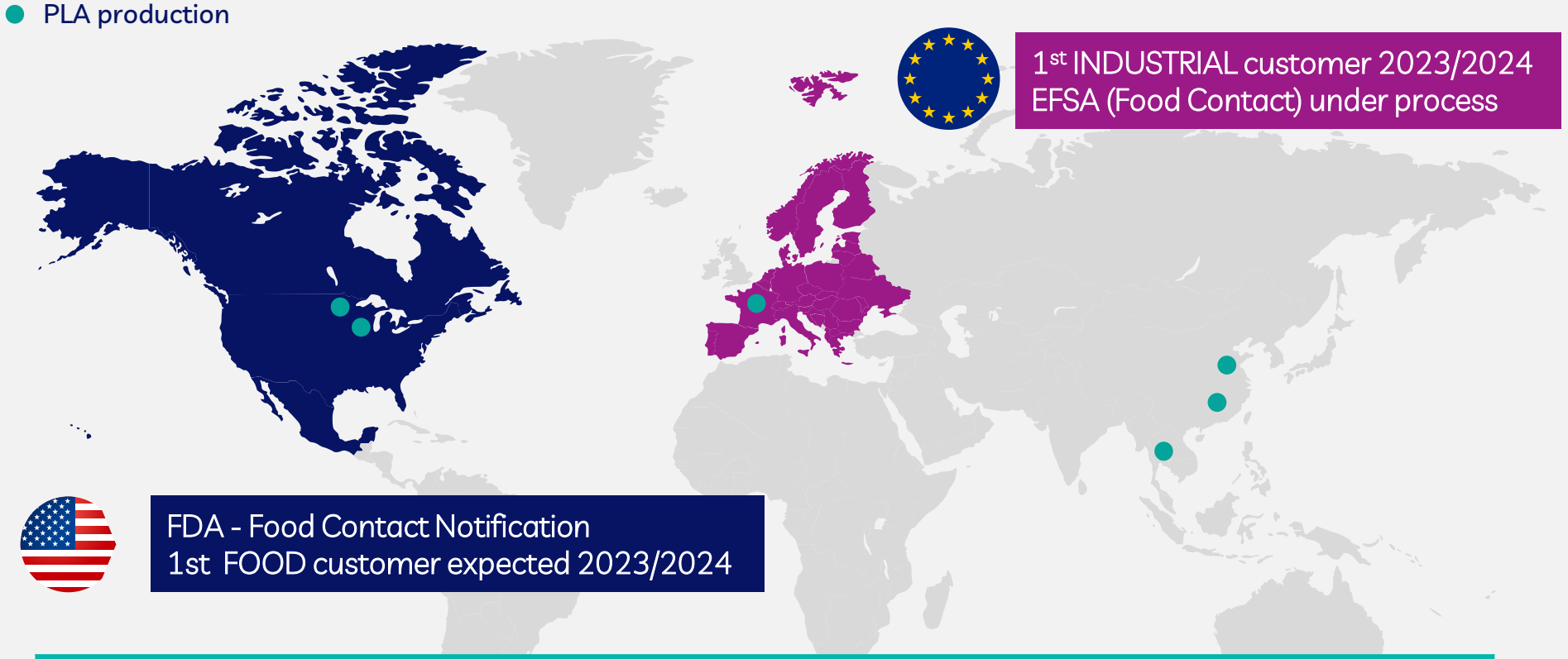
Martine Brisset,
Managing Director Biodegradation Division &
Senior Vice President of Carbios Group

Carbios' unique biodegradation solution will enable PLA growth

From Plant to Plant !

Carbios guarantees PLA full compostability, even at ambient temperature

Consumer market test & first sales in North America in 2023/2024



PLA Production Global Market	2022	2026
Capacities	400 KT	700 kT
Location	USA, Thaïland, China	USA, France, Thaïland, China

Video Fromm

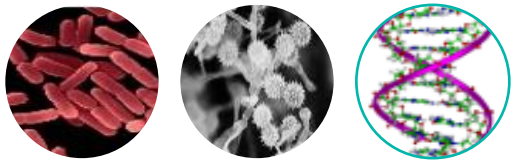
Lise Lucchesi, Intellectual Property Director

Innovations Outlook

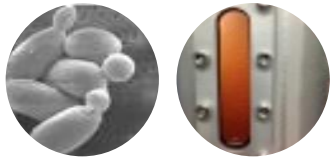
Prof. Alain Marty, Chief Scientific Officer

CARBIOS

Carbios has the capabilities to advance faster for new polymers

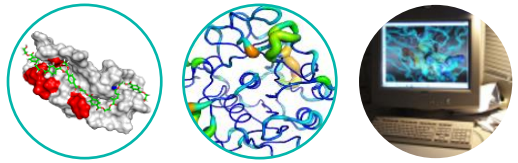


Screening of biodiversity
Database analysis
metagenomic

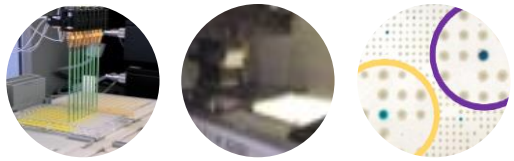


Enzyme production by fermentation

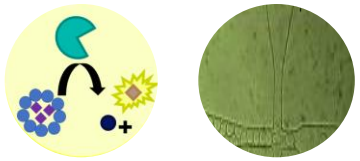
Biochemistry, analytics and molecular biology



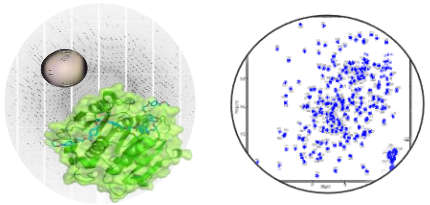
Molecular modeling



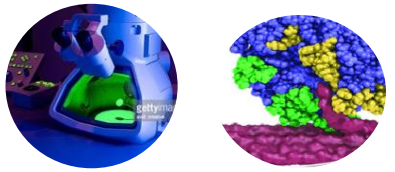
Robotic platform for enzyme screening



Microfluidic screening



Biophysic analysis (X-rays, NMR…)

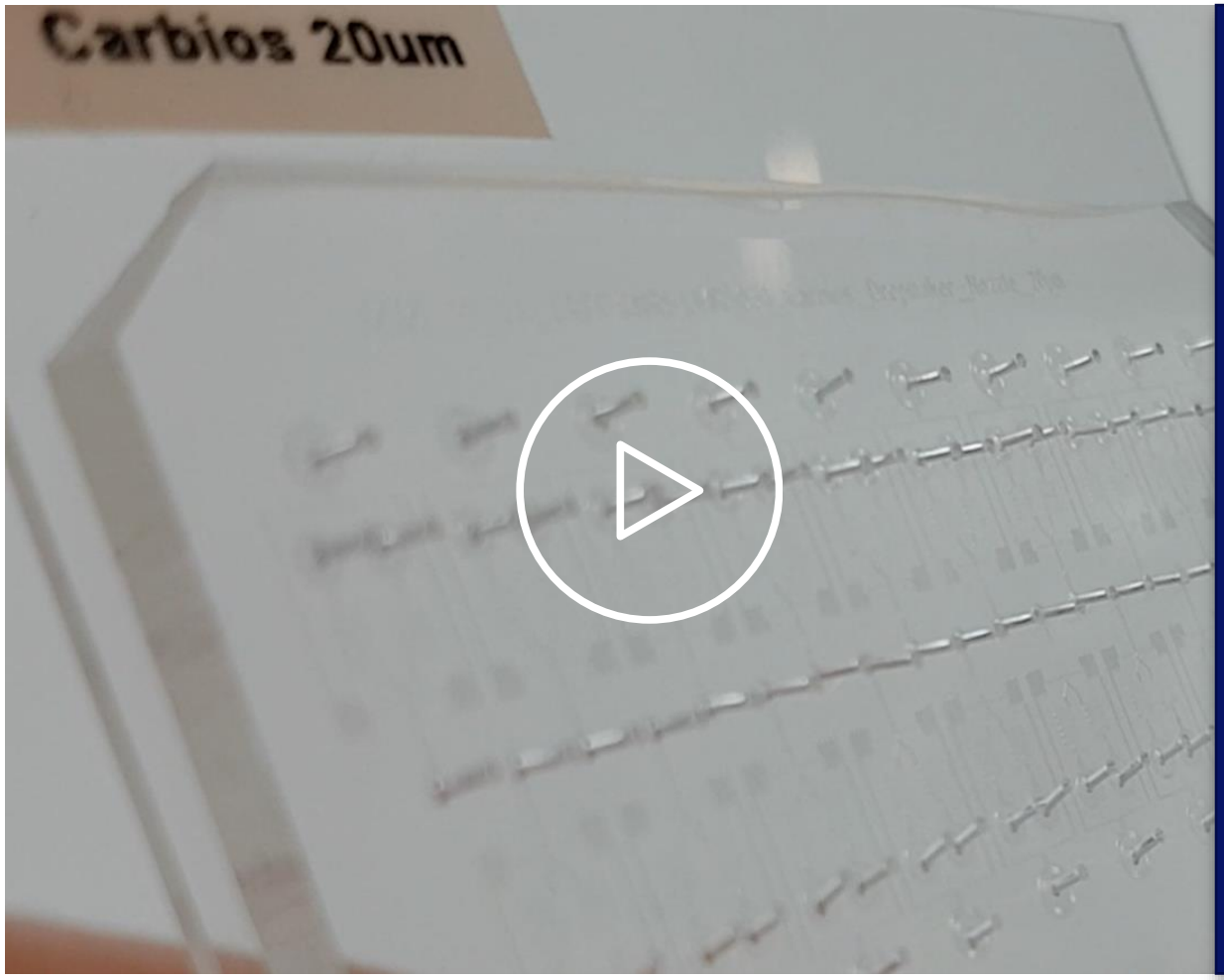


Atomic force & Cryogenic electron microscopy

And the most crucial: great researchers !!!

17 PhD
8 engineers & technicians

High throughput microfluidic screening



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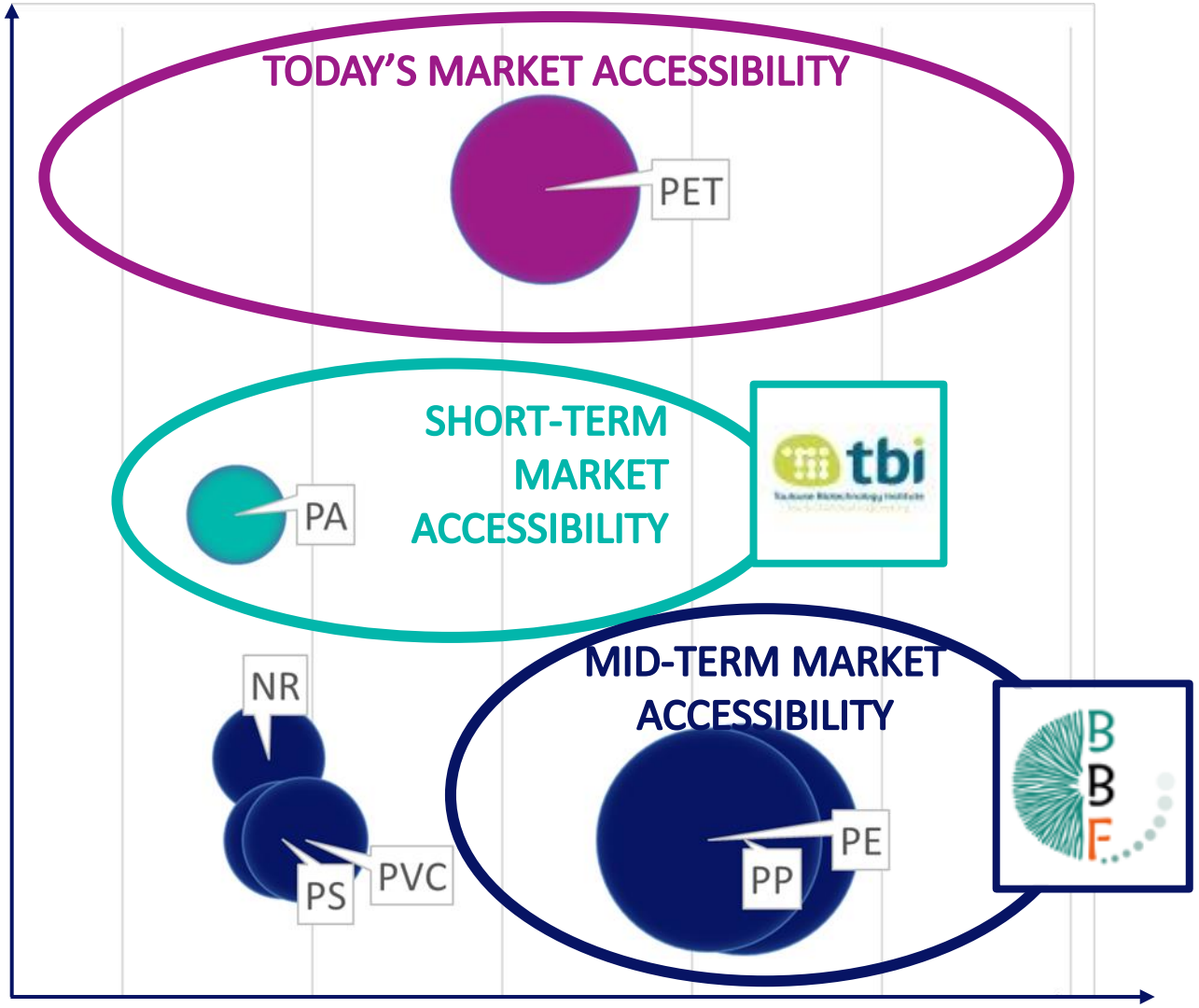
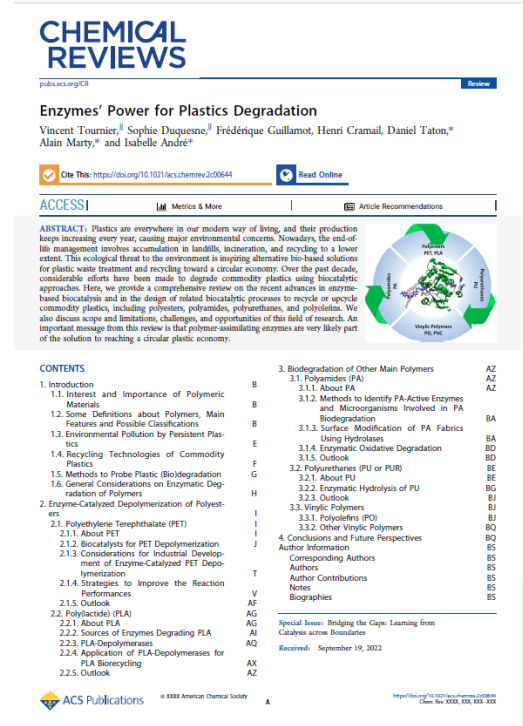
Millions of
enzyme variants
screened per hour

Carbios expands its pipeline to other petro-based polymers

Enzymatic readiness



Market value



CHEMICAL REVIEWS

Enzymes' Power for Plastics Degradation

Vincent Tournier,[‖] Sophie Duquesne,[‖] Frédérique Guillamot, Henri Cramail, Daniel Taton,* Alain Marty,* and Isabelle André*

Cite This: https://doi.org/10.1021/acs.chemrev.2c00644 Read Online

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ABSTRACT: Plastics are everywhere in our modern way of living, and their production keeps increasing every year, causing major environmental concerns. Nowadays, the end-of-life management involves accumulation in landfills, incineration, and recycling to a lower extent. This ecological threat to the environment is inspiring alternative bio-based solutions for plastic waste treatment and recycling toward a circular economy. Over the past decade, considerable efforts have been made to degrade commodity plastics using biocatalytic approaches. Here, we provide a comprehensive review on the recent advances in enzyme-based biocatalysis and in the design of related biocatalytic processes to recycle or upcycle commodity plastics, including polyesters, polyamides, polyurethanes, and polyolefins. We also discuss scope and limitations, challenges, and opportunities of this field of research. An important message from this review is that polymer-assimilating enzymes are very likely part of the solution to reaching a circular plastic economy.

CONTENTS

Special Issue: Bridging the Gaps: Learning from Catalysis across Boundaries

Received: September 19, 2022

ACS Publications © XXXX American Chemical Society

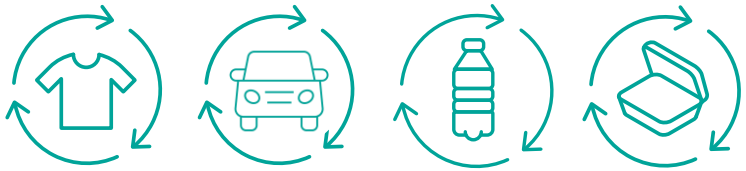
Video innovation

Polyamides, the new frontier for Carbios

A 30-billion dollar growing market

Almost non-existent recycling technologies

Mainly used as fibers or resins in automotive, electronics and packaging applications

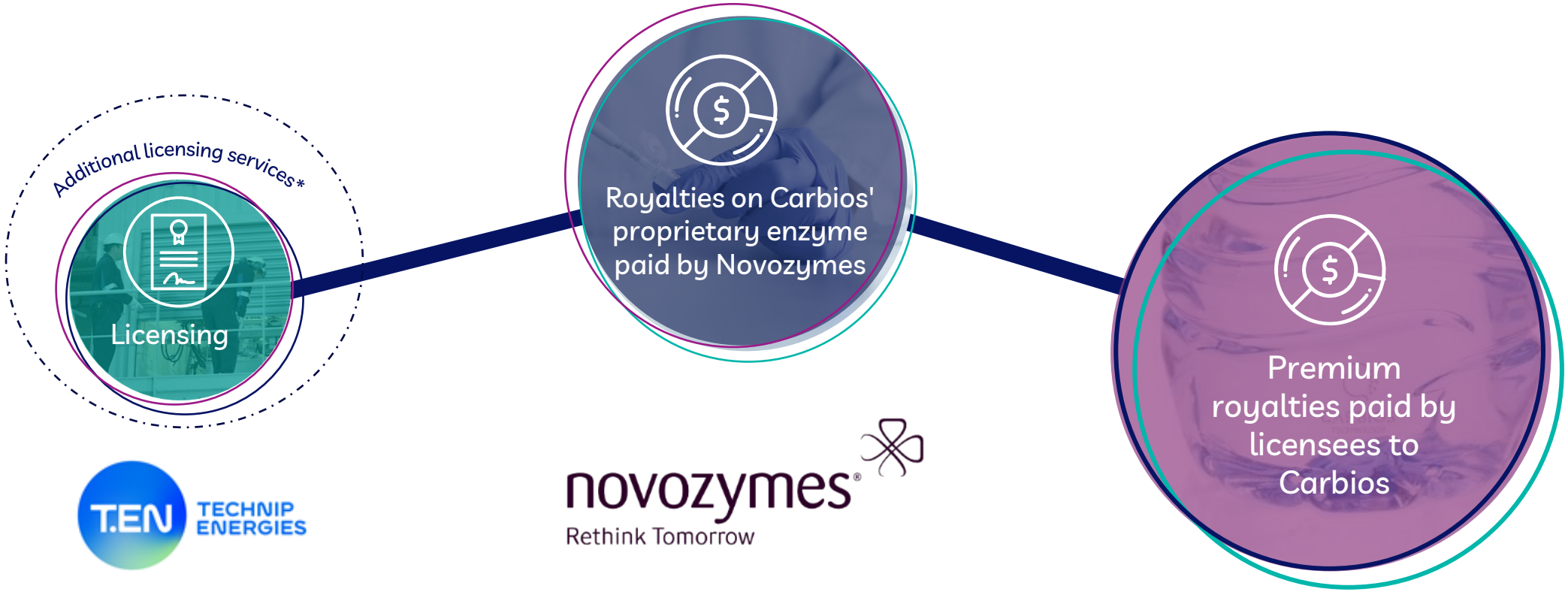


Carbios' Strategy & Finance

Pascal Bricout, Chief Financial and Strategy Officer

CARBIOS

CAPEX-lean business model and mostly recurring revenues



Upfront License fee + Additional services

To install production capacities (kt)*

Recurring revenues (€/tons)

Deriving from volumes produced

** : Technical assistance services to licensees such as training and supervision during detailed engineering, construction, commissioning, start-up and performance testing of the units.*

Carbios' vision

STRONG r-PET MARKET GROWTH

From x4 to x7 by 2050

r-PET MARKET SHARE 2025-2035 (volume)

4% to 8% by 2030

8% to 12% by 2035

REVENUES (MARGIN equivalent) *

Licensing upfront fees
between 100€/t and 200€/t

+

Recurring revenues >=250€/t

CAGR COST TO 2035

RDI +15% to +20%

- Maintain & improve PET applications
- Develop new polymers such as Polyamids (PA) and Polyolefins (PE & PP)

SG&A +8% to +10%

- Licensing efforts (build commercial infrastructure to reach business goals)

* Applicable to all plants; PLA Revenues and Margins excluded

Plant Key Financial Features

Ramp-ups and Returns: Quick and High

- Cash positive from operations within the first year after commissionning
- Payback below 7 years from start of investment for a 100Kt plant
- IRR >20%

Carbios may consider other plant projects funded by infrastucture and/or impact funds

Key take aways and future milestones

Emmanuel Ladent, CEO

CARBIOS

Overview of Carbios financing needs

Financing needs

- Construction of the plant, with an estimated production capacity of 50,000 tons per year and an estimated investment of around **230M€**
- Support increased R&D efforts to continuous improvement on PET and development beyond such as PA and PP, PE
- Support annual cash burn especially SG&A and commercial spendings efforts

Sources

Plant

- c.110M€ from Indorama Ventures
- 30M€ from French State
- 12.5M€ from Grand-Est Region

Corporate development

- 8.2M€ from French State

Part of Carbios' equity injection into the Joint Venture shall be financed by a portion of Carbios' current cash position (i.e. 86M€ as of 30 April 2023). Carbios is also actively examining the best options to finance its remaining equity injection into the Joint Venture and will choose the most appropriate solution and timeline based on market conditions. In the event of any decision to use equity financing, the Company's shareholders will be given priority.

Next milestones

	2023	2024	2025	2026-2029
Industrial PET	• Textile pre-treatment line at demonstration plant fully operational • First Feedstock contracts • Start of Longlaville plant construction	• Reference unit Plant key staffing completed	• Feedstock ramp up fully secured • Reference unit Plant (UR) commissioning	• 2027: Longlaville plant at full capacity
Commercial PET PLA	• First Brand Owners off-take agreements on r-PET volumes • Start of NA staffing and prospection • Carbios branding first test with Brand Owners	• First PET biorecycling licence(s) signed • Start of Asia staffing and prospection • New Consortiums in other industries • First PLA sales in NA	• Recycling textile module ready for licensing • Reference unit capacity fully reserved • Other international expansions	• Licensing further expansion
R&D Others	• Extend R&D teams • First patents on new polymers	• 2nd Scientific Summit	• Additional patents on new polymers	• New polymers pre-industrialization
ESG	• 40% female Board members • Over 60% independent Board members	• ISO 14001 & 9001 • First circular LCA published	• Major CSR certification	
Financial	• Public subsidies granted	• First PET licence revenues	• PET licence revenues ramp-up	• 2027 Operational Cash positive

Key takeaways

MARKET

- R-PET Market is booming and Advanced recycling will have the fastest growth
- Feedstock scarcity for conventional recycling is driving market price up

CARBIOS POSITIONNING

Best positioned to lead the recycling market with its unique biological solution:

- Plug-and-Play with the existing PET industry
- Access to the most competitive feedstock sourcing
- The most circular solution
- A high-standard LCA (including CO_2 emissions)
- Virgin-like quality
- High potential for price premium across industries with insignificant impact on retail price

CARBIOS STRENGTHS

- Technological Readiness to license
- High profitable and Capex-lean model
- R&D already engaged to expand Carbios innovations on new polymers (polyamide & polyolefins)

Questions & Answers

Appendix

CARBIOS

FY 2022 Consolidated statement of income

Consolidated statement of Income (in thousand euros)	December 31, 2022	December 31, 2021	December 31, 2021	
	12 months	12 months	*proforma* 12 months	
Income	**70**	**105**	**126**	(5)
Net Research and Development expenses	**(12,993)**	**(7,727)**	**(8,998)**	(1)
Research and Development expenses	(19,057)	(11,732)	(13,377)	
Subsidies and other income from activities	4,776	3,597	3,971	
Capitalisation of development costs	1,287	409	409	
Sales and marketing expenses	**(4,373)**	**(1,976)**	**(2,300)**	(2)
General and administrative expenses	**(8,807**	**(6,251)**	**(7,001)**	(3)
Operating expenses	**(26,173)**	**(15,954)**	**(18,300)**	
Other operating income and expenses	2	21,211	(20,104)	(4)
Operating income (2)	**(26,101)**	**5,363**	**(1,931)**	(6)
Financial income	**(1,640)**	**(454)**	**(504)**	(7)
Income before tax	(27,741)	4,908	1,426	
Income tax	-	-	-	
Share and profit (loss) of equity affiliates (3)	**-**	**(1,128)**	**-**	
Net income (loss) for the period (4)	**(27,741)**	**3,780**	**1,426**	
IFRS accounting impact related to the takeover of Carbiolice:				
Other operating income and expenses (1)	-	21,211	20,104	
Share of profit (loss) of equity affiliates (3)	-	(1,128)	-	
Operating income (loss) « adjusted » of the IFRS impacts related to the takeover of Carbiolice (2)-(1)	**(26,101)**	**(15,848)**	**(18,173)**	
Net income (loss) « adjusted » of the IFRS impacts related to the takeover of Carbiolice (4)-(1)-(3)	**(27,741)**	**(16,303)**	**(18 678)**	

(1) R&D expenses

- Full-year operation of the demo plant versus 1Q in 2021, use of external services in connection with the reference unit project and sustained efforts in R&D

(2) Sales and Marketing

- Increased efforts to secure the commercial roll-out of Carbios technology

(3) G&A expenses

- Increase in the number of employees in 2022 to further structure the Company's functions, consulting services and one-offs

(4) Other operating income and expenses (2021)

- Takeover of Carbiolice (P&L 2021)

(5) Income

- Some of Carbios' contracts for the supply of goods and services do not fall within the definition of revenue under IFRS (notably consortium contracts and research collaboration contracts). These revenues are presented as a deduction from the charges incurred by Carbios

(6) Operating income

- For 2021, sales and operating expenses from Carbiolice are fully consolidated as of June 4, 2021
- For 2022, sales and operating expenses from Carbiolice are fully integrated.

(7) Financial income

- Increase in financial expenses related to the new EIB loan

FY 2022 Consolidated statement of financial position

Consolidated statement of financial position (in thousand euros)	December 31, 2022	December 31, 2021	
ASSETS			
Goodwill	20,583	20,583	(1)
Intangible assets	22,457	23,188	(2)
Tangible assets	24,965	16,466	(3)
Right-of-use assets	6,765	6,989	(4)
Equity accounted securities	-	-	
Financial assets	906	388	(5)
Non-current assets	**75,674**	**67,614**	
Trade receivables	57	16	(5)
Other current assets	7,670	6,128	(5)
Cash and cash equivalents	100,557	104,956	(5)
Current assets	**108,284**	**111,120**	
Total assets	**183,959**	**178,734**	

(1) Goodwill

- Calculated between the market value of Carbiolice and the net asset acquired in 2021 – no impact as of Dec. 22

(2) Intangible assets

- R&D capitalization (demo plant) for €1 M and subsidies
- At Carbiolice, € 1.7 M amortization of intangible assets resulting from the Carbiolice purchase price allocation exercise [Technologie Masterbatch technology €9.8 M/ Reacquired rights (licence agreement) €12.5 M]

(3) Tangible assets

- €6.5 M investment at Carbios (demo plant) and €2 M at Carbios 54 (Reference Unit).

(4) Right-of-use assets

- Lease assets at Carbios and Carbiolice - € 4.3 M related to the Cataroux site (Michelin)

(5) Other current and non-current assets

- Variations explained by the activity of the three consolidated entitites

FY 2022 Consolidated statement of financial position

Consolidated statement of financial position (in thousand euros)	December 31, 2022	December 31, 2021	
EQUITY AND LIABILITIES			
Share capital	7,870	7,826	
Share and contribution premium	146,968	146,337	
Consolidated reserves	(5,482)	(10,604)	EIB €4.2 M
Retained earnings	(3,826)	(600)	
Net income – share attributable to equity holders of the parent company	(27,741)	3,780	
Shareholders' equity	125,441	146,739	(1)
Provisions – Non-current portion	184	202	(2)
Loans and financial liabilities – Non-current portion	35,395	11,941	(3) EIB €25.5 M
Lease liabilities – Non-current portion	5,142	5,358	(4)
Other liabilities – Non-current portion	546	-	(5)
Deferred tax liabilities	1,694	1,694	(6)
Non-current liabilities	42,961	19,194	
Provisions - Current portion	-	76	(2)
Loans and financial liabilities – Current portion	2,782	1,376	(3) EIB €0.3 M
Lease liabilities – Current portion	1,346	1,256	(4)
Trade payables	4,021	5,137	(5)
Other current liabilities	7,408	4,956	(5)
Current liabilities	15,557	12,801	
Total liabilities and equity	183,959	178,734	

EIB Total €30 M

(1) Shareholders' equity

- Mainly impacted by :
  - Capital transactions €0.7 M
  - Issuance of equity instruments:
    - EIB loan warrants €4.2 M
    - Employees warrants plans €1.4M

(2) Provisions

- Provision for retirement indemnities for the entire Group

(3) Loans and financial liabilities

- New €30 M EIB loan partly offset by:
  - Warrants relating to the loan are recognized in equity for €4.2 M
  - Repayment of other loans for €1 M

(4) Lease liabilities

- Counterpart to the « right of use » recognized as an asset in the balance sheet, relates to the lease liabiities of Carbios and Carbiolice leases

(5) Trade payables and other liabilities

- Variations explained by the activity of the three consolidated entitites

(6) Deferred tax liabililities

- Net position relating to assets recognized following the purchase price allocation exercise

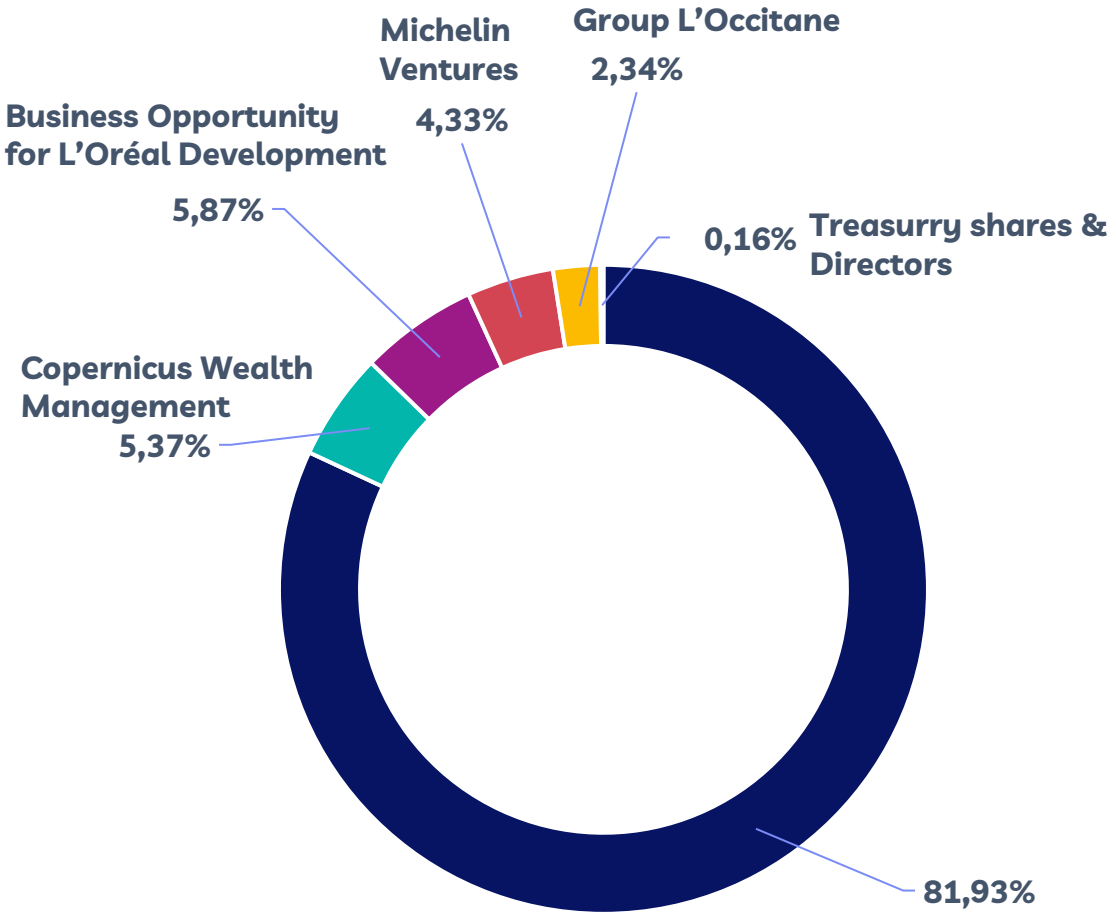
FY 2022 Consolidated cash-flow statement

Consolidated cash flow statement (in thousand euros)	December 31, 2022	December 31, 2021
Cash at beginning of year	**104,956**	**29,077**
Cash flow from operating activities	(21,820)	(9,044)
Cash flow from investing activities	(9,327)	(22,837)
Cash flow from financing activities	26,747	107,761
Change in cash position	**(4,399)**	**75,880**
Cash at end of year	**100,557**	**104,956**

Share & Shareholders as of December 31, 2022

Listing	Euronext Growth Paris
Ticker	ALCRB
ISIN Code	FR0011648716
Number of shares	11,207,356
ICB classification	Chemistry / Speciality chemistry

Analyst coverage	
ODDO BHF	Jeremy Garnier
BRYAN GARNIER	Paul de Froment
GILBERT DUPONT	Alexandre Letz
KEPLER CHEUVREUX	Baptiste de Leudeville
BNP PARIBAS EXANE	Laurent Gelebart



~ 1/2 Institutional holders and 1/2 retail holders

An experienced management team

Emmanuel LADENT

CEO

30 years' experience in the automotive sector

Pascal BRICOUT

Head of Strategy & Finance

30 years of international experience in finance

Martine BRISSET

Senior Vice-President

30 years' experience in the food and packaging industry

Lionnel ARRAS

Industrial Development Director

25 years' experience in the chemical industry & process engineering

Prof. Alain MARTY

Chief Scientific Officer

International expert in enzymology & biological processes

Lise LUCCHESI

Intellectual Property Director

Biotechnology engineer & intellectual property expert

Mathieu BERTHOUD

Sourcing and Public Affairs Director

30 years' experience in the chemical & recycling industry

Stéphane FERREIRA

Director of Operations

More than 20 years' experience in the chemical industry

Delphine DENOIZE

Innovation Programs funding, Regulation and LCA Director

Agricultural engineer & innovation funding expert

Our Board of Directors

DR. PHILIPPE POULETTY

Chairman

- Co-Founder & Executive Director of Truffle Capital

PROF. KARINE AUCLAIR*

- Prof. of Chemistry at McGill University
- Tier 1 Canada Research Chair in Antimicrobials and Green Enzymes

SANDRINE CONSEILLER*

- Former CEO of Aigle
- Former Marketing and Branding Vice-President at Lacoste

VINCENT KAMEL *

- Managing Director of the Solvay Polyamide Division
- Director of Coatis Business Unit
- Asia Director for Engineering plastics

JUAN DE PABLO *

- Prof. in Molecular Engineering at the University of Chicago's Pritzker School

ISABELLE PARIZE *

- Chairman of the Supervisory Board of DELSEY Paris
- Board member of Air-France KLM

AMANDINE DE SOUZA *

- General Manager Leboncoin
- Ex-General Manager of Le BHV Marais, Eataly and Home, DIY and Leisure Purchasing at Galeries Lafayette Group

MATEUS SCHREINER GARCEZ LOPES *

- Global Director for Energy Transition and Investments at Raizen
- Former Global Manager in Renewable Chemicals at Brasken

EMMANUEL LADENT

- CEO of Carbios
- 30 years' experience in the automotive sector

BOLD
Business Opportunities for L'Oréal Development

LAURENT SCHMITT

- BOLD, venture fund created by L'Oréal to support the development of innovative start-ups

MICHELIN

NICOLAS SEEBOTH

- Michelin Venture, fund created by Michelin in order to materialize Michelin's open innovation approach and to invest in high-tech materials that include a sustainable development dimension

ALEN VUKIC

Observer

- CFO of Copernicus Wealth Management
- Chairman of Thalia Capital Advisors and of Finpartner Financial Services, Board member of different AIFM and UCITS funds

CARBIOS

*: **Independent Directors (7/11 + 1 Observer)**

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