



Carbios aims to be a leader in growing r-PET market with an ambition to capture 8 to 12% share by 2035 through licensing model

- Carbios has recently consolidated key partnerships with Indorama Ventures and Novozymes, and has announced funding and investment of over €150 million for the first PET biorecycling plant in the world, the cost of which has been re-estimated at €230 million¹
- Carbios intends to capture 4 to 8% share of global r-PET market by 2030 and 8 to 12% by 2035 while consolidating its science-based leadership
- Carbios outlines new strong market opportunities and plans to expand its innovation pipeline beyond PET and PLA for degradation of other types of plastic such as polyamides and polyolefins
- Carbios provides details on its business model for 2030 and 2035

Clermont-Ferrand, France, 6 June 2023 (06:45 CET). Carbios (Euronext Growth Paris: ALCRB), a biotech company pioneer in the development and industrialization of biological technologies to reinvent the life cycle of plastic and textiles, will hold its 2023 Strategic Update today at 2pm CET in which it provides details of its business model for 2030 and 2035. Carbios announces its ambition to be a leading player in the global r-PET market by capturing between 4 and 8% of market share by 2030 and between 8 and 12% by 2035.

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*Emmanuel Ladent – Chief Executive Officer
and the Carbios Leadership team*

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France Dial-in: +33 170918704 / UK Dial-in: +44 1 212818004

¹ Indorama Ventures plans to mobilize about €110 million for the Joint Venture in equity and non-convertible loan financing, pending final engineering documentation and final economic feasibility studies. The remaining amount will be financed by Carbios.

1. A VALUE-CREATING BUSINESS MODEL

Carbios' business model, based on the licensing of its unique PET biorecycling technology², relies on a CapEx lean approach and 3 sources of revenue (upfront payments and two recurring revenues streams detailed below). This business model will be applied to all plants, including the first plant in Longlaville:

- (i) **the granting of licenses for the use of its know-how and intellectual property: they will generate revenues in the form of upfront payments** paid by the licensee based on the installed capacity for an amount ranging from €100 to €200 per ton;
- (ii) **royalties from the sale by Novozymes of Carbios proprietary enzymes directly to manufacturers using Carbios' technology.** This revenue stream will result from a portion of the margin realized by Novozymes (according to mutually exclusive long-term partnership agreement) on the sale of the fully patented Carbios enzyme to the licensee. This revenue stream will be proportional to the volume of enzymes sold;
- (iii) **royalties from the premium generated by manufacturers from the sale of biorecycled PET.**

The two royalty streams (ii) and (iii) are estimated at around €250 or more per ton of r-PET produced³.

In a dynamic global r-PET market, Carbios' ambition is to position itself as a world leader to capture 4 to 8% of this market by 2030 and between 8 to 12% by 2035⁴.

In its constant efforts to expand its innovation pipeline and extend its proprietary technologies to other polymers, especially polyamides and polyolefins, with first patents expected from 2023, R&D and Industrial costs⁵ are expected to increase by 15 to 20% on a yearly basis until 2035 and SG&A (Selling, General & Administrative)⁶ expenses are expected to increase in the meantime by 8 to 10%, mainly to support the Company's licensing and commercial efforts.

From a licensing standpoint, payback is expected to be below 7 years from start of investment for a 100kt plant and provide an Internal Return Rate above 20%. The Company also expects its first plant in Longlaville to be cash positive from operations within the first year of commissioning, with commissioning due in 2025.

2. ADVANTAGES OF CARBIOS BIORECYCLING TECHNOLOGY

Carbios has defined 6 key advantages for its enzyme-based biorecycling technology compared with current recycling technologies:

- **“Plug & Play”**

Since PTA and MEG are used in more than 95% of existing PET production plants, PET producers can easily switch to Carbios PTA and MEG monomers derived from plastic waste as an alternative feedstock to petro-sourced monomers. This differs from chemical recycling, which produces DMT and MEG (or BHET) monomers which represent less than 5% of global capacities⁷. Consequently, Carbios' technology seamlessly integrates into the vast majority of existing PET manufacturing processes hence avoiding CapEx and significant environmental impact.

² Carbios PET biorecycling technology converts any type of PET waste into its basic building blocks (monomers: PTA and MEG). These can then be used to manufacture PET that is 100% recycled and 100% recyclable, with no loss of quality

³ The core target for potential licensees for Carbios PET biorecycling technology are PET producers using PTA and MEG as feedstock to operate their plants. Other potential licensees will subcontract capacities offtakes or acquire the necessary equipment if they want to produce PET.

⁴ Global size of the market based on McKinsey & Company “Accelerating Momentum” scenario, 2023

⁵ In 2022, €13 million net

⁶ In 2022, €13 million

⁷ The core target for potential licensees for Carbios PET biorecycling technology are PET producers using PTA and MEG as feedstock to operate their plants. Other potential licensees will subcontract capacities offtakes or acquire the necessary equipment if they want to produce PET

- **100% PET waste types**

Thanks to its highly selective enzyme used in the process, Carbios PET biorecycling technology allows the processing of all types of PET waste, including waste that is difficult or impossible to recycle with current technologies (colored, opaque, multi-layer packaging, industrial textile and consumer clothing). This allows high flexibility in terms of feedstock mix, therefore maximizing the local sourcing potential and decreasing the waste mix average stock.

- **Circularity per industry**

Carbios' technology allows for circularity by industry, such as fiber-to-fiber circularity, which avoids feedstock competition between textile and packaging industries. Carbios' technology can transform low-quality feedstock into food-grade PET and produce transparent and high-grade bottles regardless of packaging flakes quality, therefore avoiding the downcycling of bottle waste into fibers.

- **Enhanced circularity**

Compared to current recycling technologies which only allow few cycles, Carbios PET biorecycling technology maximizes the number of cycles while preserving quality. There is no degradation of r-PET quality throughout cycles because Carbios' technology returns to the two monomer components (PTA and MEG), hence avoiding new oil and gas use to produce PET. At demo scale, the overall recovery of the process reaches 90% on plastic waste made of 100% PET content. The overall recovery will vary depending on the amount of PET content in the feedstock.

- **Virgin-like quality**

Carbios r-PET has the same mechanical and technical properties as virgin PET, including high food-grade quality. This means that Carbios r-PET is suitable for any PET applications. Bisphenol-A free and issued from a hydrolysis process, Carbios r-PET ensures consumer's health security.

- **-51% CO2 emissions vs one cycle of virgin PET production⁸**

Carbios' technology uses a soft process: it does not require organic solvents and the low temperatures during depolymerization, among other factors, result in a 51% reduction in CO2 emissions compared to the production of virgin PET (taking into account a conservative hypothesis of diversion of 50% PET waste from a conventional end-of-life).

3. LICENSING STRATEGY UNVEILED

The industrial demonstration plant, installed in Clermont-Ferrand in September 2021, has been fully operational since July 2022. The process documents required for the first industrial plant, and the Technical Information Summary needed for international prospection to license Carbios' PET biorecycling technology, were finalized in April 2023. This step marked the start of Carbios' licensing strategy global implementation.

The standard timeline for licensing is divided into two parts: prospects technology promotion (lasts approximately 12 to 18 months), and after the license has been granted until plant start-up (lasts approximately 36 months). Different fees are generated at different stages of the timeline, with the first license fee received upfront upon signature of the licensing contract. At this stage, engineering documentation including the Process Design Package and Process Book are delivered for the design and construction of licensed plants and to allow the transfer of Carbios PET biorecycling technology to license holders. Other fees will be received up to commissioning and beyond (for additional services such as training, engineering consulting, assistance for start-up).

⁸ Deloitte was the expert in charge of this Life Cycle Assessment

- **Multiple industries interested in Carbios' technology**

PET producers and chemical companies are natural potential customers for a technology that allows a true circularity for PET with alternative feedstock to petro-sourced monomers, and that is fully compatible with existing polymerization plants. By providing value to all possible sources of PET feedstock including complex plastic packaging and textile waste, Carbios also aims to reach out to other players in the value chain such as waste management companies and public entities. Carbios' technology also provides a solution to brand owners in order to meet growing regulatory requirements as well as their own ambitious sustainability objectives for the inclusion of r-PET in their products and packaging. Public entities municipalities, impact and infrastructure funds as well as sovereign funds could also be interested in investment opportunities.

Depending on the targeted prospects, Carbios intends to adapt its portfolio of plant capacities operated under license with varying sizes: small plants around 20ktpa unit for specialty polymer players, medium plants at 50ktpa for regional partnerships, and large plants at 200ktpa for main production hubs.

Carbios is targeting three regions for its licensing prospection: EMEA, North America and South-East Asia.

4. R-PET MARKET

- **Advanced r-PET market forecast**

Carbios presents today its mid-term vision for the r-PET market forecast, and it is confident to take the lion's share of the advanced r-PET market, predicting +/- 38% market share of advanced r-PET by 2050, equivalent to 23% of the total r-PET market.

In a booming global r-PET market, where market growth is expected to almost double in 25 years from 101mt in 2025 to 186mt by 2050⁹, r-PET could represent 50% of the total PET market by 2050 (according to Carbios' estimates taking into consideration improved textile collecting and sorting, use of textile feedstock and advanced recycling scale-up). Within the r-PET market, advanced r-PET is the fastest growing segment with annual growth expected to be more than 17% (vs total r-PET market growth of 8,4%)¹⁰. By 2050, advanced recycling could represent 56mt, equivalent to more than 200€ billion market value.

Carbios predicts that growth in mechanical r-PET will be constrained by limited availability of feedstock able to be processed by this technology. Virgin PET will also be limited due to lower demand for petro-sourced materials led both by brands' sustainability ambitions and governmental regulations worldwide.

- **Consumer behavior and cost impact**

Consumers are also pushing brands, and eco-friendly packaging is an increasingly important factor guiding consumer purchasing decisions. Consumers are willing to pay more for such packaging, and Carbios estimates that the impact of including advanced r-PET will be insignificant on consumer purchasing power, ranging from a few cents for a bottle of water to less than 1€ for a 100% polyester fleece jacket.¹¹

⁹ Base case outlook based on McKinsey & Company "Accelerating Momentum" scenario, 2023

¹⁰ According to Carbios estimates

¹¹ Based on (i) CARBIOS Quantitative research in partnership with Strategic Research (May 2022 N=6038. USA, FR, GE, IT, UK, JP); (ii) CARBIOS Qualitative research in partnership with Spring Voice research Institute (July 2022. USA); (iii) Business of sustainability index, PDI sustainable solutions (June 2022 N=1062 adults, USA)

5. FIRST INDUSTRIAL PLANT TO START CONSTRUCTION IN 2023

• Joint Venture with Indorama Ventures

Carbios and Indorama Ventures recently jointly announced the signing of a non-binding Memorandum of Understanding ("MOU")¹² to form a Joint Venture for the construction of the world's first PET biorecycling plant. This plant will be built in the Grand-Est Region of France. The Joint Venture equity will be split 75% Carbios and 25% Indorama Ventures. The main objectives of the industrial plant will be to generate revenue from industrial and commercial activities, deliver first tons to partnering Brand Owners and other market players, and train future licensees at large scale. Indorama Ventures confirms intention to potentially expand the technology to other PET sites for future developments. The business model for this plant will be identical to Carbios' licensing model (see section 1 above).

• Construction timeline on schedule

The construction timeline is on schedule with planning permission filed in December 2022, start of construction, recruitment and training of plant staff planned for end of 2023, and commissioning of the plant due in 2025.

The plant is designed to maximize circularity with high product quality, energy and waste minimization and improvement add-ons such as increasing textile feedstock, the reuse and recycling of process water.

• Feedstock sourcing

Carbios secured an initial source of supply for its future plant by winning part of the CITEO tender for the biorecycling of multilayer trays. The consortium consisting of Carbios, Wellman (a subsidiary of Indorama Ventures) and Valorplast has been selected for 30% of the tonnages proposed by CITEO. The part of the stream consisting of multilayer food trays will be handled by Carbios starting from 2025 at its plant in Longlaville.

Carbios is in discussions with other players to secure the yearly 50kt of waste expected for the plant's full capacity. Carbios estimates that the feedstock potential for the Longlaville plant could reach 400kt in 2023 and is expected to increase to 500kt in 2030 due to higher rates of selective collection.

The overall sourcing strategy for Carbios is to minimize the use of bottles as this is an expensive feedstock, and to diversify the mix to include food trays, fines and textile waste for increased competitiveness.

• Total capital expenditure re-estimated at €230 million

The total capital expenditure for the new plant has been re-estimated at €230 million, versus initial estimation at 200M€, considering recent impact from inflation. This increase reflects the macroeconomic situation and the effects of inflation impacting the industry as a whole but remains competitive with a much lower CapEx per ton compared to other advanced recycling projects announced in France. Moreover, Carbios believes that future sites could benefit from potential CapEx optimization.

Based on and subject to the comprehensive terms set out in the MOU, Indorama Ventures plans to mobilize about €110 million for the Joint Venture in equity and non-convertible loan financing¹³, pending final engineering documentation and final economic feasibility studies.

Furthermore, Carbios has been selected for €42.5 million in funding from the French State via France 2030 (€30 million of the total amount) and the Grand-Est Region (the remaining €12.5 million). The implementation of this funding is conditional the European Commission's approval of the corresponding state aid scheme, followed by the conclusion of national aid agreements.

¹² Contract documentation to be finalized before end of 2023

¹³ Both equity and non-convertible loan financing by Indorama Ventures shall only be made in the Joint Venture and not in Carbios

Longlaville project costs shall be financed for €152,5 million (i.e 65%) by the sums mobilized by Indorama Ventures and the French State and Grand-Est Region aids available for the project. The remaining amount shall be financed by equity capitalization of the Joint Venture by Carbios. Part of Carbios' equity injection into the Joint Venture shall be financed by a portion of Carbios' current cash position (i.e. €86 million as of 30 April 2023).

- **Potential Equity Financing**

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.

6. ENZYME PERFORMANCE UPDATE

Since the publication of an article in Nature in 2020, Carbios has continued to optimize and improve its enzyme performance, notably to be more thermostable and more active. The final conversion reached at depolymerization phase is 98% to date (versus 93% published in Nature), which represents an increase in production of 5%.

At 98%, Carbios' enzyme continues to largely outperform published academic ones.

This proprietary enzyme will be used in 2025 in the first industrial plant, and Novozymes will optimize the micro-organism that produces the enzyme for full-scale enzyme production during the second half of 2023.

To pursue its research into the optimization and continuous improvement of its enzymatic technology, Carbios has recently been granted total funding of €11.4 million by the French government as part of France 2030, including €8.2 million directly for Carbios (o/w €5 million in the form of a repayable advance) and €3.2 million with its academic partners INRAE¹⁴, INSA¹⁵ and CNRS¹⁶ via the TWB¹⁷ joint service and TBI¹⁸ research units.

The total of French aids in 2023 is 54 million euros, following the 30 million euros loan obtained in 2022 from the European Bank of Investment.

7. FIRST SALES OF PLA BIODEGRADATION SOLUTION EXPECTED BY 2024

The PLA market is expected to grow with global production increasing from 400kt in 2022 to 700kt in 2026. Carbios plans to make its first sales in the US at the end 2023 or beginning of 2024.

Food Contact Notification is in the final stages with approval from the US Food and Drug Administration (FDA) before end of 2023 and will enable commercial roll-out of this proprietary technology. Approval from the European Food Safety Authority (EFSA) will follow.

¹⁴ French National Research Institute for Agriculture, Food and the Environment

¹⁵ French National Institute of Applied Sciences

¹⁶ French National Center for Scientific Research

¹⁷ Toulouse White Biotechnology - UMS INRAE 1337 / UAR CNRS 3582

¹⁸ Toulouse Biotechnology Institute - UMR INSA/CNRS 5504 / UMR INSA/INRAE 792

8. PIPELINE EXPANSION TO OTHER PLASTICS

Carbios' mission is to bring all types of plastics into the circular economy. Carbios recently published an article entitled *"Enzymes' power for plastics degradation"* in Chemical Reviews, one of the 10 most influential scientific journals in the world, in collaboration with its academic partners Toulouse Biotechnology Institute (TBI¹⁹) and the University of Bordeaux. This article marks a turning point for Carbios in the search for enzymes to degrade plastics other than PET and PLA.

With its strong R&D infrastructure and established partnerships, Carbios can develop its portfolio of innovations on different types of plastic more rapidly. Future polymers of interest, such as polyamides (including nylon) or polyolefins (polyethylene/polypropylene), will benefit from this acceleration of the R&D phase. These types of plastic will open up to other markets, such as, for polyamides, automotive and electronics markets, and a growing global market estimated to be 30 billion dollars with currently very few recycling technologies available.

- **Protection of innovations**

From 2023, one of the key focus areas for the Intellectual Property team will be to protect innovation related to enzymatic degradation of other polymers and ensure that Carbios stays ahead of the game. Carbios' proactive policy with regards to IP ensures that innovations are protected all along their lifetime.

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About Carbios:

Carbios is a biotech company developing and industrializing biological solutions to reinvent the life cycle of plastic and textiles. Inspired by nature, Carbios develops enzyme-based processes to break down plastic with a mission to avoid plastic and textile pollution, and accelerate the transition to a circular economy. Its two disruptive technologies for the biorecycling of PET and the biodegradation of PLA are reaching industrial and commercial scale. Its biorecycling demonstration plant has been operational since 2021 and a first industrial plant, in partnership with Indorama Ventures, is due to be commissioned in 2025. Carbios has received scientific recognition, notably with the cover of Nature, and is supported by prestigious brands in the cosmetics, Food & Beverage and apparel industries to enhance their products' recyclability and circularity. Nestlé Waters, PepsiCo and Suntory Beverage & Food Europe are members of a packaging consortium founded by Carbios and L'Oréal. On, Patagonia, PUMA, PVH Corp. and Salomon collaborate with Carbios in a textile consortium.

Visit www.carbios.com/en to find out more about biotechnology powering plastic and textile circularity.

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Information on Carbios shares:



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¹⁹ Toulouse Biotechnology Institute, joint research unit associating INSA of Toulouse, CNRS and INRAE

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For additional information, please contact:

CARBIOS
Melissa Flauraud
Press Relations
melissa.flauraud@carbios.com
+33 (0)6 30 26 50 04
Benjamin Audebert
Investor Relations
contact@carbios.com
+33 (0)4 73 86 51 76

Press Relations (France)
Iconic
Marie-Virginie Klein
mvk@iconic-conseil.com
+33 (0)1 44 14 99 96

Press Relations (U.S.)
Rooney Partners
Kate L. Barrette
kbarrette@rooneyco.com
+1 212 223 0561

Press Relations (DACH & UK)
MC Services
Anne Hennecke
carbios@mc-services.eu
+49 (0)211 529 252 22