

Carbios

Advancing towards commercialisation

Interim results

Industrial support services

H118 results were broadly in line with our expectations and Carbios retains sufficient cash to finance its business until H219. The company continues to make progress with its transformation from a research body to a commercial enterprise. We expect the first commercial revenues from Carbiolice in 2020. Our DCF indicates a valuation for Carbios of €15/share.

Year end	Revenue (€m)	PBT* (€m)	EPS* (c)	DPS (c)	P/E (x)	Yield (%)
12/16	8.9	3.6	128.0	0.0	5.7	N/A
12/17	1.0	(4.6)	(86.0)	0.0	N/A	N/A
12/18e	1.1	(4.6)	(86.0)	0.0	N/A	N/A
12/19e	1.2	(4.8)	(89.0)	0.0	N/A	N/A

Note: *PBT and EPS are normalised, excluding amortisation of acquired intangibles, exceptional items and share-based payments.

H118 results on track for full year

H118 revenue declined by 33% but remains broadly in line with our FY18 projection of €1.1m. Operating expenses rose by 15% versus H117, but operating losses of €2.3m were in line with our expectations for an FY18 operating loss of €4.6m. Net income was helped by a tax credit of €0.635m and at the net income level the loss of €1.7m shows that Carbios is well on track to meet our FY18 expectation of a loss of €3.9m. Cash of €6.7m was c €2m higher than H117, thanks to the equity issue in H217 (€4.2m), but €0.9m (due to cash burn) lower than FY17. Carbios believes its cash position is sufficient to cover its financing needs until H219.

Continued progress towards commercialisation

Carbios is successfully transforming from a research body to a commercial enterprise. Scientific progress continues to be made, as evidenced by Carbios's development of its enzymatic depolymerisation process so it can be used on PET polyester from textile waste, and its recent announcement that it had reduced the duration of PET enzymatic hydrolysis (on plastic bottles), to the point where it has attained a conversion rate of 97% in only 16 hours. The contract with TechnipFMC for scaling up its biorecycling process and the expected generation of revenues by Carbiolice from 2020 reinforce the view that Carbios is making significant strides in the commercialisation of its technology.

Valuation: Unchanged at €15/share

We continue to use a DCF-based valuation approach for Carbios, although the timing and scale of future cash flow projections remain uncertain, and will be dictated by the pace of technological development and the commercial environment. Our DCF indicates an unchanged valuation of €15/share although, at the current share price, the market appears to be assuming a 65% probability of Carbios achieving our revenue and margin projections. In addition to the uncertain nature of the cash flow projections, the valuation remains sensitive to assumptions on discount rates, perpetuity growth rates and long-term margins. An increase in the discount rate from 15% to 20% would reduce the valuation to €5/share.

15 October 2018

Price €7.35
Market cap €34m

Net cash (€m) at 30 June 2018	6.7
Shares in issue	4.6m
Free float	57.7%
Code	ALCRB
Primary exchange	Euronext Growth
Secondary exchange	N/A

Share price performance



%	1m	3m	12m
Abs	(14.5)	17.6	(9.0)
Rel (local)	(10.2)	25.0	(4.4)
52-week high/low	€10.1	€6.2	

Business description

Carbios develops enzyme-based processes for biodegradation and biorecycling of plastics, with a long-term aim of displacing current recycling and production processes.

Next events

FY18 results	March 2019
--------------	------------

Analyst

Graeme Moyse +44 (0)20 3077 5700
industrials@edisongroup.com
[Edison profile page](#)

**Carbios is a research client of
Edison Investment Research
Limited**

Investment summary

Company description: Creating a virtuous circle for plastic

Carbios develops processes for biodegradation, biorecycling and bioproduction of plastics, based on depolymerisation of monomers and subsequent re-polymerisation. The processes used by Carbios are based on naturally produced enzymes selected for their ability to degrade the polymers that make up plastic materials. The bioprocesses under development seek to create fully biodegradable plastics with a controlled lifespan (biodegradation), allow the infinite recycling of plastic waste with no deterioration in quality of the plastic (biorecycling) and produce biopolymers (bioproduction). The company was founded in 2011 and floated on Euronext in December 2013. Currently, Carbios possesses 26 patent families, three innovative bioprocesses and employs 20 people.

Valuation: Highly sensitive to discount rates

We continue to use a DCF-based valuation approach for Carbios, although the timing and scale of future cash flow projections remain highly uncertain, and will be dictated by the pace of technological development and the commercial environment. Our DCF is based on cash flow projections for the two principal business segments: biodegradation and biorecycling. We project cash flows to 2035, assuming a long-term EBIT margin of 60%, a discount rate of 15% and perpetuity growth rate of 2%. Using these unchanged assumptions indicates a valuation for Carbios of c €15/share. At current levels, the market appears to be assuming a 65% probability of Carbios achieving our revenue projections. In addition to the highly uncertain nature of the cash flow projections, the valuation remains sensitive to assumptions on discount rates, perpetuity growth rates and long-term margins. An increase in the discount rate to 20% would reduce the valuation to €5/share.

Financials: Funded until H219

We expect Carbios to generate its first commercial revenues in 2020, until which time it will generate only modest sums of revenue from the provision of research services to Carbiolice and remain loss making until 2022. At the recent interim results, Carbios revealed a healthy net cash position of €6.7m, in large part due to the equity issue, which took place in July 2017 (€4.2m). The company believes its current cash position is sufficient to fund the business until H219. At some stage before this date, Carbios will have to investigate the possibility of raising additional sources of finance.

Sensitivities: Technology, financing and competition

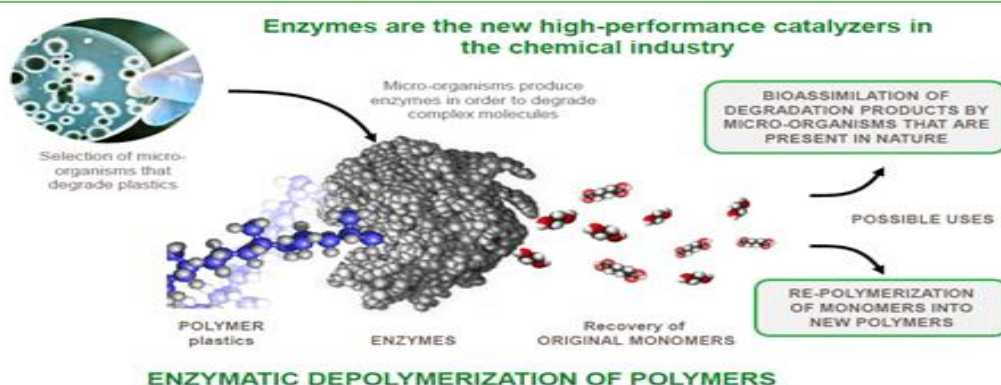
- Technology risk: Carbios's technology has yet to be deployed on an industrial basis. Given the early stage of its development, technological risks remain.
- Financing: commercial revenues are not expected before 2020. However, Carbios will continue to consume cash and will have to seek additional financing prior to H219.
- Patent protection: enforcement of its patents will be critical in protecting its industrial processes.
- Commercial competitiveness/licensing: there is no guarantee that Carbios's technology solutions provided will be more efficient or cost-effective than those developed by other market operators.

Reinventing the lifestyle of plastics

Biodegradation, biorecycling and bioproduction of plastics

Carbios develops enzymatic processes for biodegradation, biorecycling and bioproduction of plastics. A key part of its business is the development of enzymes to degrade (biodegradation) the polymers that make up plastic materials (both biosourced plastics and synthetic polymers derived from hydrocarbons). As part of this process, Carbios embeds enzymes into plastic materials, which facilitate the biodegradation of the plastics in the environment over a controlled lifespan, without compromising the quality of the original plastic materials. The use of enzymes is also fundamental to Carbios's approach to biorecycling, whereby it aims to achieve the de-polymerization of a single polymer via the action of highly specific enzymes mixed with the plastic recycle. At the conclusion of this process, the monomer or monomers produced by the de-polymerization process will be purified, with the aim of rendering them fit for re-polymerization. Carbios also claims to have developed, in collaboration with INRA and INSA, the first 100% biological pathway to synthesize polylactic acid (PLA). The process involves the enzymatic polymerization of lactic acid into a PLA polymer of high molecular weight without any intermediate step.

Exhibit 1: Carbios's market



Source: Company data

Scientific research to licensing

Carbios spans the entire process of technological product development from research to commercialisation. The research stage of the process involved the selection and optimisation of enzymes, after which the process moved to pre-pilot, pilot demonstration and finally commercialisation through licensing. These processes are commonly carried out with a wide variety of scientific, financial and trade partners (eg L'Oréal, Limagrain, Toulouse White Biotechnology, Bpifrance) with a view to reducing operating expenditure and capex. Once commercially proven, Carbios seeks to license its enzymatic technology and processes, as it has already done in the case of Carbiolice.

Management continuity

Martin Stephan joined as deputy CEO in February 2017, but otherwise there has been continuity in the management team (Executive Committee) in recent years. Jean-Claude Lumaret has served as CEO since 2011 and Professor Alain Marty as chief scientific officer since 2015 after a three-year collaboration as a member of the company's scientific committee. Mr Lumaret, who has a degree in chemical engineering, also has significant experience as a patent attorney, which is of great relevance to Carbios's business model as the company seeks to protect its technology. Professor Marty has wide-ranging academic and scientific experience in biotechnology, enzymology and bioengineering.

Progress towards commercialisation continues

The H118 results confirmed that Carbios's short-term financial performance remains in line with our FY18 expectations. For the more important long-term outlook, Carbios continues to demonstrate scientific progress and its subsidiary, Carbiolice, is expected to generate commercial revenue from 2020. The potential market remains significant, with most competing technologies in the nascent stage and none yet to achieve a dominant market position, and we believe Carbios is well placed to capitalise on the market opportunity.

H118 results

Carbios's has yet to generate commercial revenue from licensing its technology (we expect first revenues from 2020) and the majority of its revenue is derived from the provision of services to its subsidiary, Carbiolice. In H118 revenue declined by 33%, but remains broadly in line with our FY18 projection of €1.1m. Operating expenses rose by 15% versus H117, but operating losses of €2.3m were in line with our expectations for an FY18 operating loss of €4.6m. Net income was helped by a tax credit of €0.635m and at the net income level the loss of €1.7m shows that Carbios is well on track to meet our FY18 expectation of a loss of €3.9m. Cash of €6.7m was c €2m higher than H117, thanks to the equity issue in H217 (€4.2m), but €0.9m (due to cash burn) lower than FY17. Carbios believes its cash position is sufficient to cover its financing needs until the second half of 2019. Given that the results were broadly in line with our expectations, we have no adjustments to our forecasts.

Exhibit 2: H118 vs H117 key figures				
€000s	H117	H118	% change	FY17
Revenues	632	425	-33%	983
Op. Exp	(2,383)	(2,733)	15%	(5,635)
Op. Loss	(1,751)	(2,308)	32%	(4,652)
Finance income	33	1	N/A	24
Loss before taxes & ext. items	(1,718)	(2,307)	34%	(4,628)
Ext items	(6)	(2)	N/A	(11)
Loss before taxes	(1,724)	(2,305)	35%	(4,639)
Income tax	(371)	(635)	71%	(702)
Net loss	(1,353)	(1,674)	24%	(3,937)
Cash At end of period	4,736	6,700	41%	7,547
Source: Carbios				

Of greater significance for the prospects of long-term value creation at Carbios is the scale of the market opportunity and the development of its technology. We examine both of these factors in the following section of the note.

Plastics market overview

According to EU figures, the global production of plastics reached 322 million tonnes in 2015. The 2015 figure represents a twentyfold increase since the 1960s and the production of plastics is expected to double again over the next 20 years. However, European production has remained flat in recent years (at c 60m tonnes), although Europe remains the second largest producer of plastics in the world (2014 market share 20% behind China with 26% of global plastic production). Today, the majority of plastics are manufactured from hydrocarbons, although alternative bio-based plastics are also being developed but at present account for a very small share of the market. In Europe, Germany accounts for c 25% of total demand, with Italy second (c 14%) and France third (c 10%). The largest proportion of plastics in Europe (39.5%) is used for packaging, with a further 20.1% used in the building and construction industry. Polyethylene terephthalate (PET) accounts for c 7% of the overall plastics market.

Plastic disposal and recycling

While Europe has managed to reduce the amount of plastic sent to landfill in recent years, according to the EU, reuse and recycling of plastics remains low in comparison to other materials. The rise in the use of plastics and the low recycling rate present a number of environmental issues. Some plastics are non-biodegradable, whereas others can take 200-300 years to degrade and are responsible for significant pollution in their manufacturing process. EU statistics indicate that c 25.8m tonnes of plastic waste are generated in Europe every year, with an estimated c 8m tonnes of plastic is sent to landfill (c 30% of plastic waste arising), an obvious environmental problem given the slow pace of biodegradation. Less than 30% of waste is recycled, of which 'a significant share' leaves the EU to be treated elsewhere, where lower environmental standards may apply. EU demand for recycled plastics accounts for only around 6% of demand. In recent years, the EU plastic recycling sector has suffered from low commodity prices and investment in new plastic recycling capacity has, as a consequence, been undermined. In addition, the EU estimates that plastics production and the incineration of plastic waste are responsible for c 400m tonnes of CO₂ a year. Globally plastic waste is estimated to total c 125m tons per year, with 9m tons per year deposited in the oceans.

Legislative drivers

Policy and legislative requirements suggest increased focus on addressing the issue of plastic waste. In early 2018, the EU published *A European Strategy for Plastics in a Circular Economy*, in which it set out a 'vision for Europe's new plastics economy'. In accordance with the vision, by 2030 all plastics packaging must be either reusable or be capable of being recycled in a cost-effective manner. Also by 2030, more than 50% of all plastic waste generated in Europe should be recycled. The EU believes this vision will require a fourfold increase in recycling capacity (2030 versus 2015), creating 200,000 new jobs, but enable recycled plastic to become a valuable feedstock, help reduce Europe's dependence on imported fossil fuel and cut CO₂ emissions. The EU believes that to fulfil its vision alternative and more sustainable feedstocks for plastic production will also need to be developed. Improving the economics and quality of plastics recycling is central to achieving its vision and the EU has called on key players to improve design to make plastics easier to recycle; expand and improve the separate collection of plastic waste, to ensure quality inputs to the recycling industry; expand and modernise the EU's sorting and recycling capacity; and create viable markets for recycled and renewable plastics. The EU has called for the industries involved to develop a set of voluntary commitments to back this strategy and vision for 2030. The European Commission (EC) itself has proposed new rules on waste management, including clearer obligations for national authorities to step up separate collection; targets to encourage investment in recycling capacity and avoid the construction of excess incineration capacity; and closer harmonisation of the rules of extended producer responsibility.

In addition, the EC has set the objective of reducing the amount of waste sent to landfill to 5% of all arising by 2030, emphasising the need to recycle (the preferred option) plastic. The French Energy Transition Law for Green Growth, which provides for the minimum level of bio-based plastics in plastic bags, increases the level from 30% in January 2017, to 40% in January 2018 and 50% in January 2020. We believe these legislative trends align with Carbios's business strategy

Limitations of recycling and bio-based plastics

Current thermomechanical processes are limited by a number of factors, including the diminished quality of the recycled material and the sensitivity to contamination by other polymers and external impurities. These difficulties restrict the reuse of recycled plastics for their original purposes so that, for example, in France (in 2013) only 27% of recycled PET is reused in bottles and flasks, with the majority (52%) used in fibres.

In an attempt to reduce the level of plastic waste leakage into the environment, biodegradable and compostable plastics have been developed. However, at present these new types of plastics represent less than 1% of the total market. A number of reasons have been advanced as to why biodegradable/compostable plastics have not achieved higher rates of market penetration, including their inability to replace all types of plastic material (poor mechanical qualities), high costs, lack of control over the length of biodegradation but, perhaps most importantly, the fact that plastics are only biodegradable in certain conditions (industrial compost at above 50°C), rather than in the environment more generally (20-30°C). At present, Carbios estimates that biosourced polymers are two to four times more expensive than conventional plastics produced from oil. Despite drawbacks, the growth in biodegradable plastics is expected to continue at c 10-20%.

Biodegradation

A key part of Carbios's business is the development of enzymes to degrade the polymers that make up plastic materials (both biosourced plastics and synthetic polymers derived from hydrocarbons). As part of this process, Carbios embeds enzymes into plastic materials, which facilitate the biodegradation of the plastics in the environment over a controlled lifespan, without compromising the quality of the original plastic materials. The plastics are degraded into the original base molecules, which in turn can be assimilated by the micro-organisms in nature. Carbios's biodegradation process is estimated to take around three months, compared to 200-400 years for conventional plastics. The specificity of the enzymatic activity inherent in Carbios's biological process also allows it to degrade all kinds of single-use plastics (bags, films, food packaging etc) and enables it to be adapted to the expected time of use for each application.

The biodegradation research began in 2013 and in 2014 Carbios achieved the key milestone of producing a plastic material (from polycaprolactone, PCL) as the result of the activity of an embedded enzyme capable of biodegradation. The polymer saw a loss of mass of 50% within 15 days and complete biodegradation within three months. The following year, the biosourced polymer, PLA, was similarly degraded as a result of the enzymatic process. In 2016, Carbios commenced the industrial development of this process via the creation of a joint venture, Carbiolice. Currently, Carbios has developed biodegradation processes that are capable of processing both PET and PLA to eco-friendly biodegradable PLA and PLC.

Carbiolice

Carbiolice is an industrial and commercial joint venture with Bpifrance and Limagrain Céréales Ingrédients (a global seed producer). Created in September 2016, the project has a financing budget of €18m, including €11m from Bpifrance. The €18m is scheduled to be released in three phases, over four years, on completion of technical and commercial objectives. The three partners of the project invested €4m in 2016 and in July 2018 a second round of financing of €3.35m (€1.1m Carbios) was announced.

In the short term, Carbiolice produces corn-based compounds and biopolymers for plastic manufacturers involved in the production of bags/mulching films. From 2020 Carbiolice will operate patented enzymatic biodegradation technology (licensed from Carbios) to produce enzymated pellets (compound and masterbatch) to be used to produce biodegradable plastics. According to Carbios, the incorporation of its pellets leaves the performance of the polymers unchanged and does not require any modification to the plastic production facilities. Carbiolice will target the market for bags and packaging – 17.5m tons/yr (\$28bn), mulching films – 2m tons per year (\$5bn) and technical films – 500,000 tons per year (\$4bn). Carbiolice will operate one industrial plant capable of producing 4,000 tons per year and will ultimately target a third of the market in the EU for soft biodegradable plastics.

On the formation of Carbiolice, Carbios received an upfront payment of €8m, which was converted into shares in the joint venture. Carbios will also receive R&D collaboration revenues of c €2.5m over a three-year period, which will help support the industrial development of Carbiolice and serve as an additional source of income for Carbios. Commercial launch, expected in 2020, will provide the first commercial revenues for Carbios.

Biorecycling

Once again, the use of enzymes is key to Carbios's approach to biorecycling. Carbios's process aims to achieve the de-polymerization of a single polymer via the action of highly specific enzymes mixed with the plastic recycle. At the conclusion of this process, the monomer or monomers produced by the de-polymerization process will be purified, with the aim of rendering them fit for re-polymerization. The low-energy consumption bioprocess should enable the recycling of complex and opaque plastics via a process of continual recycling without any deterioration in the quality of the plastic material produced, and without resorting to the costly mechanical and heating process involved in current thermomechanical recycling processes. Carbios is particularly interested in PET plastic and polyester fibres (its main market focus), but also in PLA and polyamides. These polymers have chains of monomers that are easily identifiable by the enzymes and are thus easier to de-polymerize. Carbios believes that this technology is particularly appropriate for application with plastic bottles, packaging and textile fibres.

Bioproduction

Carbios claims to have developed, in collaboration with INRA and INSA (partners in the Thanaplast programme), the first 100% biological pathway to synthesize PLA. The process involves the enzymatic polymerization of lactic acid into a PLA polymer of high molecular weight without the usual expensive intermediate step, which normally requires the condensation of lactic acid into a lactide (the intermediate step) and then its polymerization to obtain PLA. Currently, global demand remains modest (c 190,000 tons per year) but is expected to grow at 15% per year until 2020.

Two target markets: PET, PLA

As we have noted, Carbios has focused its scientific endeavours on two polymers: PET and PLA.

Polyethylene terephthalate (PET) is a resin of the polyester family and consists of polymerized units of ethylene glycol and terephthalic acid. PET is a strong, naturally transparent and semi-crystalline plastic, and is one of the most commonly used polymers in the world. PET is deployed in fibres for clothing (accounting for c 60% of global demand and is known as polyester in the textile industry), and plastic containers for food and liquid (c 30%). PET's strong, stable, durable and lightweight characteristics make it a popular choice in the packaging sector (water and soft drinks).

PET is not biodegradable, but is widely recycled. According to figures produced by the PET Resin Association, approximately 1.5bn lbs of used PET bottles are recycled in the US every year, making PET the most recycled plastic in the US, with a recycling rate of approximately 31%. The recycling rate in the EU is reported to be even higher, at 52%.

Carbios first achieved the 100% depolymerisation of PET into its original monomers, terephthalic acid and ethylene glycol in December 2015, and in November 2016 this technology was made applicable to crystalline PET. Subsequently (in June 2017), Carbios synthesized PET oligomers from terephthalic acid and in October 2017 produced virgin PET from terephthalic acid produced from its biorecycling process of PET bottles. In June 2018, Carbios announced that it had improved the enzymatic hydrolysis step of its process, achieving a conversion rate of 97% within 16 hours (previously 24 hours in April 2018). Carbios is currently seeking to move towards the industrialization of this technology and has been working with TechnipFMC to construct a demonstration plant.

Poly(lactic acid) (PLA) is a thermoplastic polymer produced from lactic acid ($C_3H_6O_3$) or lactide monomers, derived primarily from renewable resources like corn starch or sugar cane, whereas the majority of plastics are derived from the distillation and polymerization of petroleum reserves. PLA is termed a bioplastic as a result of its biomass origins and is biodegradable. Common applications of PLA include plastic films, bottles and biodegradable medical devices. Currently, bioplastics comprise only a small (but rapidly growing) proportion of all plastics produced on an annual basis and, according to Plastics Insight, total production capacity of bioplastic in 2017 was 2.05m tones, of which PLA has a market share of 10.3% of the raw material used for bioplastics production. According to figures used by Carbios, production of PLA in 2014 totaled 114,000 tonnes.

Carbios first demonstrated its ability to depolymerise PLA in 2013 and has now refined the process, allowing for 90% depolymerisation of PLA in 24 hours to obtain lactic acid. It has now effectively closed the loop and demonstrated the circularity of the process, producing virgin PLA from lactic acid obtained from the biorecycling of the plastic (PLA). Given the limited production of PLA, the recycling of PLA remains, at present, a relatively small but nevertheless emerging market with strong growth characteristics (10%+). Although work on PLA remains in the development stage, Carbios is discussing the potential licensing of its technology with industrialists.

Competitive landscape

As we have seen, there is a significant need from a regulatory and environmental perspective to increase the rate of recycling, and the market for plastic recycling is sizeable. Carbios aims, via its holding in Carbiolice, to produce enzymated plastic pellets from 2020 which, when incorporated into plastic, will leave its properties undiminished and allow the plastic to biodegrade.

Given the scale of the potential market, there are a number of players developing products and processes in the market for biodegradable and recyclable plastics. Ioniqa, based in Holland, is building its first PET plastic upcycling factory (10,000 tons per year), with a view to commencing production in H119. Ioniqa has signed a partnership agreement with Unilever. Meanwhile, Loop is developing its own depolymerisation technology and is currently in the process of designing a fully integrated manufacturing facility to upcycle waste. It also has an agreement in place with L'Oréal to supply it with PET resin.

The market and competitive technologies remain at the nascent stage and no single approach appears to have established a dominant market position. Given the scale of the market opportunity, we believe ultimately that there is scope for the co-existence of a number of alternative technologies.

Management

Martin Stephan joined as deputy CEO in February 2017, but otherwise there has been continuity in the management team (Executive Committee) in recent years. Jean-Claude Lumaret has served as CEO since 2011 and Professor Alain Marty as chief scientific officer since 2015 after three years' collaboration as a member of the company's scientific committee. Mr Lumaret has significant experience as a patent attorney, which is highly relevant to Carbios's business model as the company seeks to protect its technology. He also has longstanding experience of the starch industry and a scientific background with a degree in chemical engineering. Professor Marty has wide-ranging academic scientific experience in biotechnology, enzymology and bioengineering. In addition, Carbios has a board of directors with eight members and a scientific advisory board with four members. In total, Carbios employs 20 people.

Sensitivities and risks

- Technical risk: although Carbios has successfully concluded the Thanaplast research project, its technology has yet to be displayed on an industrial basis. Given the early stage of its development, technological risks remain.
- Financing: Carbios will generate some RED and technical service revenues from Carbiolice in the short term, but commercial revenues are not expected before 2020. In the absence of grants from the Thanaplast project, Carbios will continue to consume cash and will have to seek additional financing in FY18/19.
- Patent protection: the CEO has significant experience as a patent attorney and Carbios has taken out a number of patents to protect its intellectual property. Enforcement of its patents will be critical in protecting its industrial processes.
- Commercial competitiveness/licensing: the market for recycled and biodegradable plastic remains significant, but there is no guarantee that the technology solutions provided will be more efficient or cost-effective than other market operators.

Valuation

We remain of the view that, in the absence of short-term commercial revenues, the announcement of collaborative deals with brand owners to develop Carbios's technology will act as the key share price driver. Clearly, there is a low degree of visibility on the scale and timing of such announcements.

The timing and scale of future cash flows also remain highly uncertain and will be dictated by the pace of technological development and the commercial environment. We use a DCF methodology to provide an indicative valuation for Carbios although, given the nature of the business, the projections remain highly uncertain. We recently (see our note [Transition year and strengthened balance sheet](#) published on 9 July 2018) updated our DCF methodology to reflect the acquisition of a majority interest in Carbiolice in 2016, and the issue of equity and the additional contribution of €1.1m to Carbiolice in 2018. Our revised DCF is based on cash flow projections for the two principal business segments: biodegradation and biorecycling. We project cash flows to 2035, assuming a long-term EBIT margin of 60% (for the period 2031-35 we assume the margin remains at 60%), a discount rate of 15% and perpetuity growth rate of 2%. By 2035 we project revenues of c €127m. Using these assumptions indicates an unchanged valuation for Carbios of c €15/share. At current levels, the market appears to be assuming a 65% probability of Carbios achieving our revenue projections and margins.

In addition to the highly uncertain nature of the cash flow projections, the valuation remains sensitive to assumptions on discount rates, perpetuity growth rates and long-term margins. Exhibit 3 shows the sensitivity of our valuation to long-term margin projections to 2031 (we assume a continuation of the 2031 margin for the period 2032-35) and, in particular, discount rates.

Exhibit 3: Margin projection scenarios 2022-31 and valuation using a 15% or 20% discount rate

Scenario	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Discount rate Value (€/s)	
											15%	20%
1	20%	30%	40%	50%	60%	70%	80%	80%	80%	80%	22	8
2	20%	30%	40%	50%	60%	70%	70%	70%	70%	70%	19	7
3	20%	30%	35%	40%	45%	50%	55%	60%	60%	60%	15	5
4	20%	25%	30%	35%	40%	45%	50%	50%	50%	50%	11	3
5	20%	25%	30%	35%	40%	40%	40%	40%	40%	40%	7	1
6	20%	25%	30%	30%	40%	30%	30%	30%	30%	30%	4	0

Source: Edison Investment Research

Financials

Our estimates remained unchanged.

- Revenue: for FY18 and FY19 we expect only modest growth in revenue at €1.10m and €1.22m respectively. Revenue is driven by the research service agreement with Carbiolice and complemented by additional, smaller miscellaneous sources. We expect commercial revenue from Carbiolice to commence in 2020.
- Operating profit: we expect overall costs to remain broadly stable in FY18 and FY19, producing operating losses of €4.6m and €4.8m, respectively.
- Capex: we assume capex of €0.7m for FY18 and FY19.
- Cash flow/cash: as at the end of FY17 Carbios had net cash of c €7.5m and €6.7m at H118. Given its stage of development and the lack of commercial revenues, we expect the company to continue to consume cash. For our modelling purposes, we assume Carbios raises debt but, in reality, it is likely there will be further equity issuance. Carbios says it has sufficient funds to finance the business until H219.

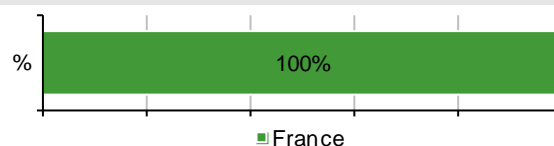
Exhibit 4: Financial summary

	€m	2014	2015	2016	2017	2018e	2019e	2020e
Year end 31 December		IFRS	IFRS	IFRS	IFRS	IFRS	IFRS	IFRS
INCOME STATEMENT								
Revenue		0.66	0.84	8.87	0.98	1.10	1.22	1.40
Cost of Sales		(2.91)	(3.15)	(2.98)	(2.31)	(2.95)	(3.20)	(2.92)
Gross Profit		(2.25)	(2.31)	5.89	(1.33)	(1.85)	(1.98)	(1.52)
General and Administrative Expenses		(0.74)	(1.10)	(1.36)	(1.65)	(1.24)	(1.25)	(1.26)
EBITDA (norm)		(3.45)	(4.23)	3.34	(4.89)	(4.84)	(5.04)	(4.71)
Reported Operating Profit		(3.36)	(4.06)	3.55	(4.65)	(4.60)	(4.79)	(4.46)
Net Interest		0.05	0.08	0.08	0.02	(0.01)	(0.01)	(0.02)
Profit before tax (reported)		(3.32)	(3.98)	3.63	(4.63)	(4.61)	(4.80)	(4.48)
Reported tax		1.09	0.94	1.32	0.70	0.70	0.73	0.68
Profit after tax (reported)		(2.23)	(3.05)	4.95	(3.93)	(3.91)	(4.07)	(3.80)
Extraordinary gain or loss		0.02	(0.02)	(0.03)	(0.01)	0.00	0.00	0.00
Net income (reported)		(2.21)	(3.07)	4.92	(3.94)	(3.91)	(4.07)	(3.80)
Basic average number of shares outstanding (m)		3.75	3.78	3.85	4.57	4.57	4.57	4.57
EPS - basic reported (€)		(0.59)	(0.81)	1.28	(0.86)	(0.86)	(0.89)	(0.83)
Dividend (c)		0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stock price		12.9	12.9	8.4	8.1	7.5	7.5	7.5
Revenue growth (%)		-26.2%	26.1%	959.7%	-88.9%	11.9%	10.7%	14.9%
Gross margin (%)		-338.6%	-275.7%	66.4%	-135.4%	-168.2%	-162.7%	-108.5%
Normalized EBITDA Margin (%)		-518.8%	-505.1%	37.7%	-497.6%	-440.3%	-413.6%	-336.6%
Normalized operating margin (%)		N/A	N/A	N/A	N/A	N/A	N/A	N/A
BALANCE SHEET								
Total Current Liabilities		0.67	0.91	1.17	2.26	1.56	1.62	1.55
Accounts payable		0.20	0.34	0.49	1.43	0.71	0.77	0.70
Other current liabilities		0.47	0.57	0.67	0.83	0.85	0.85	0.85
Total Non-Current Liabilities		1.95	3.01	3.15	3.71	8.71	13.71	18.71
Debt/Repayable advances		1.95	3.01	3.15	3.71	8.71	13.71	18.71
Total Liabilities		2.62	3.92	4.32	5.97	10.27	15.33	20.26
Total shareholders' equity		11.12	8.13	13.11	14.55	10.62	6.55	2.75
Common stock / Capital		2.63	2.65	2.68	3.20	3.20	3.20	3.20
Additional paid-in capital/Share premium		13.65	13.70	13.74	18.59	18.59	18.59	18.59
Retained earnings		(2.96)	(5.17)	(8.24)	(3.32)	(7.26)	(11.17)	(15.24)
Other reserves and surplus		(2.21)	(3.05)	4.94	(3.94)	(3.91)	(4.07)	(3.80)
Total liabilities and equity		13.73	12.04	17.43	20.52	20.89	21.87	23.01
Total assets		13.73	12.04	17.43	20.52	20.88	21.87	23.00
Total current assets		12.64	10.38	6.16	9.17	9.11	7.46	5.82
Cash and cash equivalents		11.10	9.01	3.99	7.55	8.53	6.83	5.13
Accounts receivable		1.40	1.22	1.95	1.46	0.41	0.45	0.52
Inventories		0.02	0.01	0.02	0.01	0.02	0.02	0.02
Prepaid expenses		0.12	0.13	0.22	0.15	0.15	0.15	0.15
Total Non-Current Assets		1.09	1.67	11.27	11.35	11.77	14.41	17.18
Property Plant and equipment, net		0.74	1.25	1.21	1.11	1.48	1.87	2.27
Other intangible assets		0.13	0.23	0.37	0.57	0.61	0.67	0.74
Other non-current assets		0.22	0.19	9.69	9.68	9.68	11.88	14.18
CASH FLOW								
Cash Flow from Operations								
Net income (loss)		(2.21)	(3.07)	4.92	(3.94)	(3.91)	(4.07)	(3.80)
Depreciation and Amortization		0.07	0.17	0.22	0.23	0.24	0.25	0.25
Other items		(1.36)	0.39	(0.51)	1.49	0.32	0.01	(0.13)
Total		(3.50)	(2.52)	4.64	(2.22)	(3.35)	(3.81)	(3.68)
Cash Flow from Investing								
Purchases of fixed assets		(0.85)	(0.79)	(0.30)	(0.33)	(0.67)	(0.69)	(0.72)
Other Investing Activities		(0.02)	0.00	(9.53)	0.02	0.00	(2.20)	(2.30)
Net cash used in investing activities		(0.87)	(0.79)	(9.83)	(0.31)	(0.67)	(2.89)	(3.02)
Cash Flow from Financing								
Change in Debt		0.15	0.07	(0.04)	(0.05)	5.00	5.00	5.00
Change in Capital Stock		0.17	0.06	0.07	5.38	0.00	0.00	0.00
Other Financing Activities		0.55	1.08	0.14	0.77	0.00	0.00	0.00
Total		0.87	1.22	0.17	6.09	5.00	5.00	5.00
Net Changes in Cash and Cash Equivalent		(3.50)	(2.09)	(5.02)	3.56	0.98	(1.70)	(1.70)
Effect of Exchange Rates On Cash		0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash and Cash Equivalents - Beginning		14.60	11.10	9.01	3.99	7.55	8.53	6.83
Cash and Cash Equivalents - End		11.10	9.01	3.99	7.55	8.53	6.83	5.13

Source: Company accounts, Edison Investment Research

Contact details

Biopôle Clermont-Limagne
63360 Saint-Beauzire
France
+33 (0)4 73 865 176
www.carbios.fr

Revenue by geography

Management team
CEO: Jean-Claude Lumaret

Mr Lumaret has been CEO of Carbios since 2011. He has a degree in chemical engineering and is a French patent and trademark attorney for the EU. He spent almost 30 years with Roquette Groupe, a leading participant in the starch industry.

Deputy CEO: Martin Stephan

Mr Stephan is a graduate of École des hautes études commerciales in Paris HEC and has spent his career in the chemical industry with financial positions at Elf/Total and DuPont. He joined Carbios in February 2017.

Chief Scientific Officer: Alain Marty

Professor Marty has been chief scientific officer at Carbios since 2015 after spending three years as a member of the company's scientific committee. Professor Marty has a doctorate in biochemical engineering from INSA Toulouse. His areas of research include biotechnology, biocatalysis, enzymology, molecular engineering of enzymes and metabolic engineering.

Principal shareholders (As at 1/10/18)

	(%)
Truffle Capital	24.64
Holding Incubatrice Chimie	17.42
Natixis	5.07

Companies named in this report

Ioniqa, Loop, Bpifrance, Limagrain, L'Oréal

Edison is an investment research and advisory company, with offices in North America, Europe, the Middle East and AsiaPac. The heart of Edison is our world-renowned equity research platform and deep multi-sector expertise. At Edison Investment Research, our research is widely read by international investors, advisers and stakeholders. Edison Advisors leverages our core research platform to provide differentiated services including investor relations and strategic consulting. Edison is authorised and regulated by the [Financial Conduct Authority](#). Edison Investment Research (NZ) Limited (Edison NZ) is the New Zealand subsidiary of Edison. Edison NZ is registered on the New Zealand Financial Service Providers Register (FSP number 247505) and is registered to provide wholesale and/or generic financial adviser services only. Edison Investment Research Inc (Edison US) is the US subsidiary of Edison and is regulated by the Securities and Exchange Commission. Edison Investment Research Pty Limited (Edison Aus) [46085869] is the Australian subsidiary of Edison. Edison Germany is a branch entity of Edison Investment Research Limited [4794244]. www.edisongroup.com

DISCLAIMER

Copyright 2018 Edison Investment Research Limited. All rights reserved. This report has been commissioned by Carbios and prepared and issued by Edison for publication globally. All information used in the publication of this report has been compiled from publicly available sources that are believed to be reliable, however we do not guarantee the accuracy or completeness of this report. Opinions contained in this report represent those of the research department of Edison at the time of publication. The securities described in the Investment Research may not be eligible for sale in all jurisdictions or to certain categories of investors. This research is issued in Australia by Edison Investment Research Pty Ltd (Corporate Authorised Representative (1252501) of Myonlineadvisers Pty Ltd (AFSL: 427484)) and any access to it, is intended only for "wholesale clients" within the meaning of the Corporations Act 2001 of Australia. The Investment Research is distributed in the United States by Edison US to major US institutional investors only. Edison US is registered as an investment adviser with the Securities and Exchange Commission. Edison US relies upon the "publishers' exclusion" from the definition of investment adviser under Section 202(a)(11) of the Investment Advisers Act of 1940 and corresponding state securities laws. As such, Edison does not offer or provide personalised advice. We publish information about companies in which we believe our readers may be interested and this information reflects our sincere opinions. The information that we provide or that is derived from our website is not intended to be, and should not be construed in any manner whatsoever as, personalised advice. Also, our website and the information provided by us should not be construed by any subscriber or prospective subscriber as Edison's solicitation to effect, or attempt to effect, any transaction in a security. The research in this document is intended for New Zealand resident professional financial advisers or brokers (for use in their roles as financial advisers or brokers) and habitual investors who are "wholesale clients" for the purpose of the Financial Advisers Act 2008 (FAA) (as described in sections 5(c) (1)(a), (b) and (c) of the FAA). This is not a solicitation or inducement to buy, sell, subscribe, or underwrite any securities mentioned or in the topic of this document. This document is provided for information purposes only and should not be construed as an offer or solicitation for investment in any securities mentioned or in the topic of this document. A marketing communication under FCA Rules, this document has not been prepared in accordance with the legal requirements designed to promote the independence of investment research and is not subject to any prohibition on dealing ahead of the dissemination of investment research. Edison has a restrictive policy relating to personal dealing. Edison Group does not conduct any investment business and, accordingly, does not itself hold any positions in the securities mentioned in this report. However, the respective directors, officers, employees and contractors of Edison may have a position in any or related securities mentioned in this report. Edison or its affiliates may perform services or solicit business from any of the companies mentioned in this report. The value of securities mentioned in this report can fall as well as rise and are subject to large and sudden swings. In addition it may be difficult or not possible to buy, sell or obtain accurate information about the value of securities mentioned in this report. Past performance is not necessarily a guide to future performance. Forward-looking information or statements in this report contain information that is based on assumptions, forecasts of future results, estimates of amounts not yet determinable, and therefore involve known and unknown risks, uncertainties and other factors which may cause the actual results, performance or achievements of their subject matter to be materially different from current expectations. For the purpose of the FAA, the content of this report is of a general nature, is intended as a source of general information only and is not intended to constitute a recommendation or opinion in relation to acquiring or disposing (including refraining from acquiring or disposing) of securities. The distribution of this document is not a "personalised service" and, to the extent that it contains any financial advice, is intended only as a "class service" provided by Edison within the meaning of the FAA (ie without taking into account the particular financial situation or goals of any person). As such, it should not be relied upon in making an investment decision. To the maximum extent permitted by law, Edison, its affiliates and contractors, and their respective directors, officers and employees will not be liable for any loss or damage arising as a result of reliance being placed on any of the information contained in this report and do not guarantee the returns on investments in the products discussed in this publication. FTSE International Limited ("FTSE") © FTSE 2018. "FTSE®" is a trade mark of the London Stock Exchange Group companies and is used by FTSE International Limited under license. All rights in the FTSE indices and/or FTSE ratings vest in FTSE and/or its licensors. Neither FTSE nor its licensors accept any liability for any errors or omissions in the FTSE indices and/or FTSE ratings or underlying data. No further distribution of FTSE Data is permitted without FTSE's express written consent.