How to Save 1,000 kilos of CO_2 per 333-litre Refrigerated Packaging –

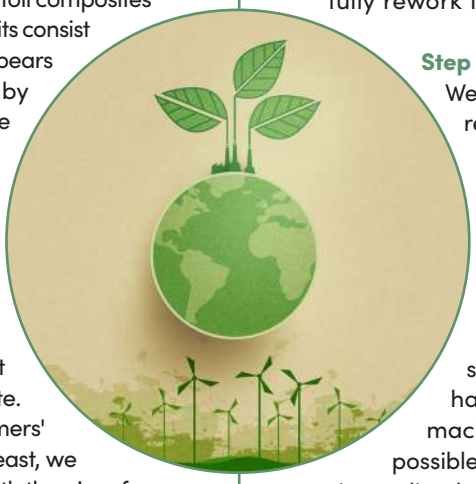
Thanks to the First-ever Circular Economy Pharmaceutical Packaging

2019 was a turning-point. It was the year when fears of palpable global climate change gripped society as a whole, including the worlds of business and industry. In 2020 the COVID-19 pandemic led to a second dramatic realisation. In order to increase the resilience of global supply chains there is a radical need for greater sustainability. eutecma's objective now is to tap into the enormous potential which climate-friendly, no-waste packaging can offer the temperature-controlled transportation of pharmaceuticals. At the end of a three-year process of evaluation and development, we have created, for example, the 333-litre PROTECT cooling box, estimated to be reusable 15 times and can save up to 1,000 kilos of CO2. This is possible thanks to the first-ever circular economy system in the pharmaceutical packaging sector. The so-called retecma Loop, which is based on artificial intelligence (AI), ensures that not a single gram of expanded polystyrene (EPS) material is lost.

eutecma's drive towards increased sustainability in the temperature-controlled transportation of pharmaceuticals began in 2019. Our strategic concept could be compared with that of a bifocal lens. Just as the lens is designed for both close-up and distance vision, eutecma's development projects have followed two directions. On the one hand, the challenge was to make existing products more sustainable quickly; on the other hand, the medium-term goal was to redesign the pharmaceutical supply chain packaging radically.

Bifocal – Close up: Rapid Successes with Sustainable Products

This has resulted in ecological product alternatives which became available as early as 2020. For example, the foil composites of our ICECATCH© passive energy storage units consist of 50% sugar cane waste material. The latter bears the quality seal "I'm green", developed by Braskem, the Brazilian producer of polyethylene based on sugar cane waste. In the case of the PROTECT packaging systems, the customer has a choice between packaging boxes made from conventional Virgin EPS/styrofoam and others made from recycled styrofoam (Styrofoam Ccycled). This secondary material consists of pyrolysis oil, which is produced by the world's largest chemical company BASF from plastic waste. Both innovative products improve our customers' CO_2 balance significantly. Last but not the least, we have launched an information campaign with the aim of informing customers how PROTECT packaging and ICECATCH© passive energy storage units can be used not just once but multiple times – without jeopardising the temperature integrity or the quality of the transportation.



Bifocal – the Distant View: Rethinking Pharmaceutical Supply Chain Packaging

While more rapidly sustainable product alternatives were being shipped from our company headquarters in the Port of Mannheim, we were at the same time working on a "big bang". This was because, we recognised that to achieve a drastic reduction in CO_2 levels and also in waste material, packaging in the pharmaceutical supply chain needs to be completely reconfigured. The fact that there were numerous requests for a "100% green and temperature-regulated packaging" indicated that customers would welcome such a development. All too often, supposedly sustainable products had turned out to the mere "greenwashing" in the marketplace. We interpreted these requests not only as confirmation that we are on the right track, but also as a challenge to fully rework the issue of pharmaceutical packaging.

Step 1: The Choice of Material

We began with the question: Must temperature-regulated high-tech packaging really have to consist of EPS? Can we not assume that wool, straw and hemp are much more sustainable materials? So, we launched a two-year evaluation process, to be conducted without any preconceived views. This presented no problems to us, since eutecma is not a producer of EPS, but simply a provider, which means that we don't have to bear the burden of production and machineries. Accordingly, it would have been possible for us to switch to an alternative material immediately without incurring losses. We investigated the following materials: paper, cardboard, wool, hemp, cotton, used textiles and various plastics.

A specific phenomenon appeared repeatedly. Although materials showed many good properties during testing, ultimately the problem was that they failed to meet all the evaluation criteria. Wool, for example, is an excellent material for insulated packaging, but as PROTECT packaging had to be

usable worldwide, and Australia forbids the import of wool, we had to rule out wool for our purposes.

The use of old textiles was also ruled out, in this case because all too frequently they are heavily contaminated by pesticides. A box made of straw can be pressed into any shape, but often has inferior insulation properties due to the development of moisture. In addition, it should be sealed with foil to prevent dust harming the pharmaceutical product.

In the end, two evaluation criteria proved critical: universal formability and complete recyclability. The eutecma system comprising ICECATCH© passive energy storage units and PROTECT boxes attains a high degree of reproducibility, since the former are secured in insertion slots throughout the transportation process and consequently supply energy to the products continuously and reliably. To achieve this result with other materials, these would need to be combined with a second material. For example, paper packaging requires a thin layer of plastic to prevent the formation of thermal bridges.

However, this type of hybrid packaging is almost impossible to recycle completely. This is because separation of the different components precedes the recycling process – and this calls for a huge amount of energy, which in turn can be saved if a mono-material is used. Therefore, the smaller the number of components contained in the packaging, the simpler the recycling process.

Step 2: The "Mental Paradigm Shift"

What would happen if from now on the used EPS packaging was no longer a waste material that had to be disposed of quickly? What would happen if from now on used EPS packaging was valuable raw material? Would it then not be logical to make every possible effort to ensure that the material EPS had as much "life" in it as possible? That was the initial thinking behind a strategy which is now resulting in the introduction of retecma: the first-ever AI-supported closed-loop material processing system in the pharmaceutical packaging sector. Of key importance here are the three success factors: digitalisation, regionalisation, and high-quality recycling.

Success Factor: Digitalisation

If EPS is a valuable material which should be reused as long as possible, then the packaging must not be regarded as a WHOLE; instead, it should be broken down into its component parts. Accordingly, each element in a PROTECT Box and an ICECATCH© passive energy storage unit will soon be clearly identifiable by way of an RFID chip. This RFID chip indicates not only the type of element (for example: L-shaped stacking frame) and the target weight but also the number of times the

element has already been used. In addition, each PROTECT Box is assigned a QR code which can be read out at the final destination by means of a eutecma app.

The eutecma App Offers the Following Options

1. **Reusing** the packaging >
   Click to get the handling instructions depending on the duration of transport and temperature profiles
2. Sending packaging to the **Refreshment Centre** >
   Click the address of the nearest Refreshment Centre
3. Sending packaging to **Recycling** >
   Click the address of the nearest recycling company

Option 2 is a new and unique feature: the components of all PROTECT Boxes and ICECATCH© passive energy storage units are overhauled in eutecma's Refreshment Centres and made ready for their next application. The AI-supported system performs two fully automated tests on the individual components and either one or two sanitising procedures:

1. **Weight test:** If the target weight is not reached, material damage is assumed, and the component is withdrawn.
2. **Photo-optical test:** If the camera detects damage, the component is withdrawn.
3. **Ultraviolet light** is used to sanitise each component.
4. **Steam cleaning (only if required):** If the camera detects severe contamination, the component is steam-cleaned.

All the Refreshment Centres operate with **Artificial Intelligence,** which means their knowledge increases from one day to the next. Thus, the system can distinguish between superficial scratches and defects which threaten the integrity of the product. In addition, since the Refreshment Centres can

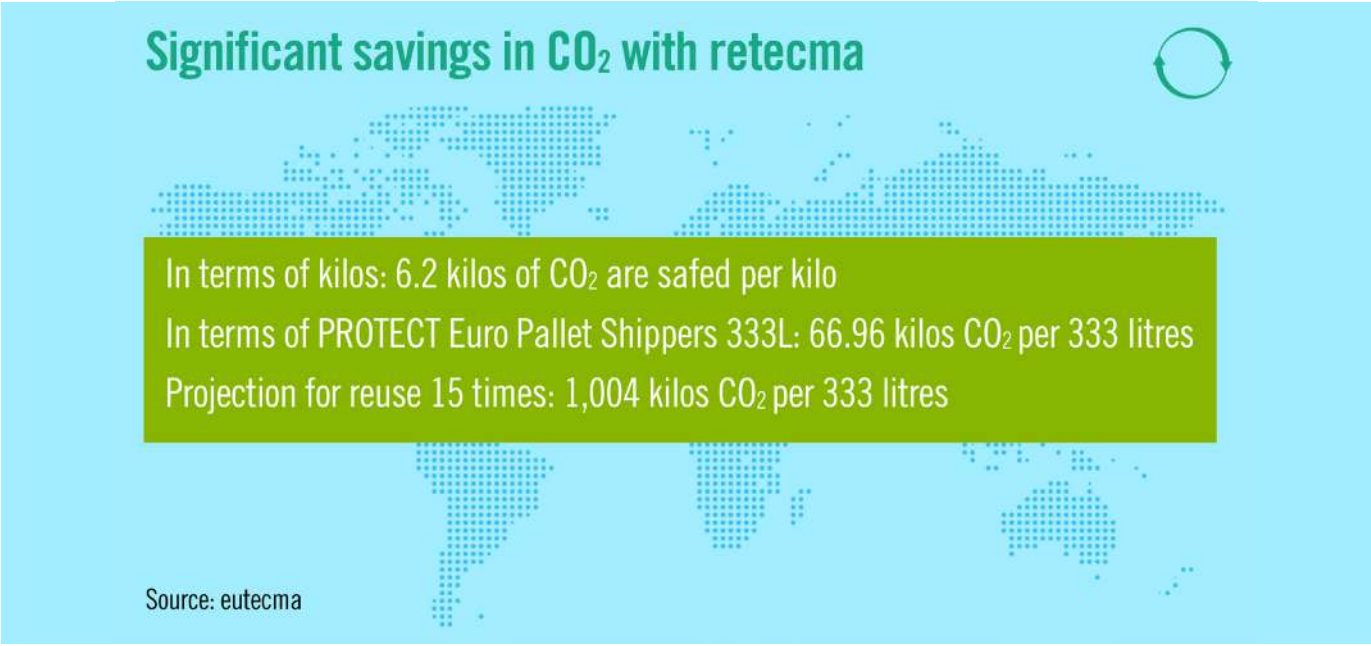
be networked with one another across different continents, this acquisition of know-how takes on a global dimension. The aim of the refreshment process is to ensure that the elements are reusable as far as possible.

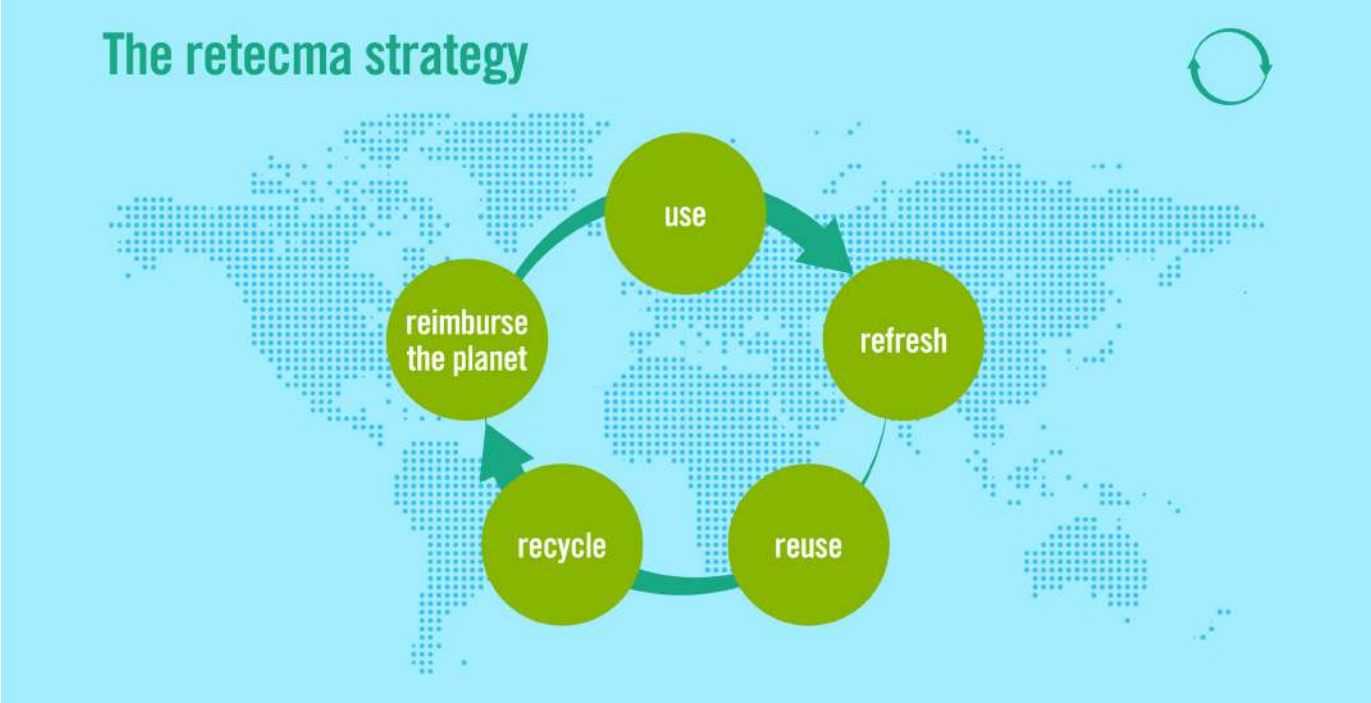
Success factor: Regionalisation

To keep the CO_2 footprint as small as possible and to restrict unnecessary journeys by empty delivery vehicles over long distances to a minimum, retecma will as soon as possible be available on those continents where the main flows of goods are destined, namely Europe (Germany), Asia, South America, North America as well as Middle East. Up until now standard practice has been either to dispose of packaging at the destination or to return it empty to the point of origin. With the retecma Loop system the procedure is different: in the future all PROTECT Boxes and ICECATCH© passive energy storage units will remain in the destination region. If the recipients have no use for them, they will be collected in the destination region and can then be transported either to the Refreshment Centre or to authorised recycling partners.

Success Factor: Top-quality Recycling

All too often, however, discarded EPS components end up on a rubbish tip. This will not happen with eutecma's Reverse Logistic System, because part of the retecma pledge is that unusable EPS components are to undergo a high-quality recycling process. To this end we are working with certified regionally based partners who are carefully selected and audited. These regional partners ensure that by means of mechanical or chemical recycling it is possible to produce new valuable, high-quality EPS raw material from EPS which had previously been discarded in a manner detrimental to the environment. This new EPS raw material can be used, for example, in the production of new PROTECT boxes.





Step 3: Saving Up to 1,000 Kilos of CO_2 with a 333-litre Cooling Box

According to the trend study "Pharma Management Radar" undertaken by Camelot Management Consultants, the interviewees consider product packaging to be an important means of achieving ecological improvements. Nevertheless, the survey, carried out in 2020, indicated that these efforts are thwarted by the lack of alternatives. However, all that has now changed with retecma Loop, the first-ever circular economy for pharmaceutical packaging. Instead of a piecemeal solution to augment their supply chain, retecma enables pharmaceutical companies with an interest in sustainability to leverage the enormous CO_2 potential. Our calculations show that with a predicted quota of 15 reuses/usage cycles the PROTECT Europallet box with a capacity of 333 litres saves up to 1,000 kilos of CO_2. Similar forecasts have been made for all other boxes in the PROTECT range.

Thus, each reused PROTECT Box and each reused ICECATCH© passive energy storage unit saves energy and resources, CO_2 and waste. In addition, thanks to the AI-based Refreshment Centres, retecma will soon know how many lifecycles the individual components pass through and therefore will also be able to utilise the last kilometre that is still possible with the EPS packaging. And even after their final usage, no EPSs are lost in the retecma system. Thanks to sophisticated recycling processes, valuable new material is produced, from which high-quality EPS products can in turn be obtained.

And what's more: eutecma will in future be doing even more to help protect the planet. We are measuring our direct and indirect emissions to determine the complete CO_2 footprint which our company and our products are leaving on the planet. In those areas in which we can achieve direct effects, for example by converting to green energy, we will do so, while in those areas in which CO_2 emissions are unavoidable, for example during the initial production of PROTECT packaging and ICECATCH© passive energy storage units, we will compensate for this by specifically promoting climate protection projects.

Conclusion

The time for greater sustainability in the pharmaceutical supply chain is not just ripe – it is over-ripe. For quite some time now, companies have been coming to realise that improving one's brand image is not the be-all and end-all. Ecological sustainability can also be used to make the global supply chains more robust. And this is a powerful asset in times of unexpected pandemics, sudden declarations of war and skyrocketing inflation. That's why eutecma is now acting as a pioneer and investing substantial amounts in the introduction of retecma, the first-ever closed-loop material recycling system for pharmaceutical packaging. We are firmly convinced that only an intentional scarcity of goods as a result of strict multiple usage, supported by digitalisation, regionalisation and high-quality recycling, will make the pharmaceutical supply chain climate-friendly and waste-free. And thus, also counteract risks which threaten the pharmaceutical industry worldwide. According to the Camelot study, this includes growing cost pressure and supplier stability – factors mentioned by 86% and 52% of interviewees respectively.

Sven Rolle

Sven Rölle has been on the staff of eutecma from its earliest days. Having held various posts in the packaging industry, including SCA Packaging, he has played a key role in numerous milestones in the history of the eutecma company. The economics graduate is Head of Sales and is in close contact with many of the global players who do business with eutecma. With his deep understanding of intelligent solutions, characterised by "out-of-the-box" thinking, he and his team are making significant strides in the development of new groundbreaking cooling systems and supporting services.