



SIPA's philosophy for PET containers is a holistic one – it looks at the big picture of how low-weight, highperformance, aesthetically pleasing, consumerfriendly PET packaging fits best into the new circular economy.

SIPA is among the global elite of suppliers of equipment systems for producing (and filling) PET preforms and large and small containers. This offering is backed up by a comprehensive design service that helps customers take early ideas about containers all the way through drawings, virtual and real prototypes functional as well as decorative - testing and validation, through to the definite article. We are strongly focused on optimizing the use of PET in liquid packaging," says Sipa's Packaging Development Manager. "We identify and implement the proper lightweight solution, based on customer and market demands, transport and handling logistics, local scenarios, and other influencing factors. Secondary packaging may also play a part. It almost goes without saying that SIPA is a strong advocate of the use of post-consumer recycled materials."

### **DESIGN, ENGINEERING, AND PRODUCTION WITH 100% rPET**

PET bottles containing post-consumer recycled material – rPET – have in a relatively short time become a common sight, rather than the exception that they were just a few years ago; use of rPET is destined to increase further, with a growing number of bottles made in 100% rPET. SIPA has built up considerable experience through its expertise in bottle design and in process technologies to enable the use of rPET. This means not only creating designs that take into account differences and variations in processing characteristics of rPET, but also other less obvious factors such as the increased level of powder that rPET processing creates (more on this later).

Containers incorporating rPET will only be accepted by brand owners and consumers if they perform as well as containers made from virgin material. That means rPET arriving at the converter has to be clean and consistent, and with processability during preform production and bottle blowing that is almost, if not exactly, the same as virgin PET.

# A NEW BRAND -Awarpet

Sustainability has for many years been at the heart of SIPA thinking about everything it does, whether it is the way its equipment is built and works, or how its customers containers are produced, filled, used, disposed of, and, increasingly, recovered and converted back into containers again.

These days, SIPA's product design experts are involved in the development of 3000 or more new packaging designs every year. The three R – Reduce, Reuse, Recycle – are constant principles in all of these projects. SIPA has now established a new brand –AWAPET – which stands for an environmentally conscious approach to the design and production of PET packaging.



### RECYCLAS RULES

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SIPA strictly follows the Recyclass Design for Recycling guidelines established by EPBP, the European PET Bottle Platform. This voluntary industry initiative provides PET bottle design guidelines for recycling, evaluates PET bottle packaging solutions and technologies, and facilitates understanding of the effects of new PET bottle innovations on recycling processes. EPBP is supported by the European Federation of Bottled Waters (EFBW), the European Association of Plastic Recycling and Recovery Organizations (EPRO), Petcore Europe, Plastics Recyclers Europe (PRE) and European Soft Drinks Industry (UNESDA). It has established several test procedures in order to assess the impact on recycling of new packaging technologies. Products that pass the tests should not cause any problems during recycling.

## THE GREEN PLASTIC FACTOR

AWArPET bottles are very light. SIPA has for example been involved in one design project, code-named Mario, for a one-liter water bottle weighing just 16g, far lighter than most 1-L bottles currently on the market. The company believes that over the next three-to-five years, the weight could come down even more. However, low weight is not a be-all and endall. Consideration also needs to be given to the notion that a well-designed but heavier PET bottle, with a PET label, may actually in the end prove more sustainable than a lighter one that has a multilayer structure or a PVC label, both of which hinder recycling efforts. SIPA uses something called the Green Plastic Factor to show how light a bottle is in comparison with what it holds. The Green Plastic Factor (or GPF) is the ratio of the volume of the container contents in mL to the weight of the unfilled container in g. For a collapsible 10-L bottle, the GPF is around 125, while for a single-serve 500-mL bottle it is around 55. This clearly shows the high level of sustainability of large-format bottles, production of which SIPA has developed specific equipment.

For a returnable 2-L bottle, the GPF is also low, at around 20. But if such a bottle fulfils its purpose and makes multiple trips, it can be assigned a "virtual" GPF, which can be close to 200.

Green Plastic Factor is just one tool that SIPA uses in its design projects: it is a means rather than an end. So, for example, an ultra-light 5-L water bottle may have a high GPF – possibly around 85 – and also have very good performance as indicated by high top-load strength, but these have to be weighed against factors that are not so positive, such as the fact that it is single-use, and it requires the implementation of good logistics.

#### FROM FLAKE TO PREFORM IN A SINGLE STEP

One issue still in the balance is just how all tOne issue still in the balance is just how all those used PET bottles are converted back into new ones. Reducing them to flake, converting the flake into granules and then reprocessing the granules into preforms and then bottles is the obvious solution is the most obvious one – but it is not necessarily the most economic one.

The joint development between SIPA and Erema on the XTREME Renew process incorporates ground-breaking technologies that enable rPET to be converted in a fully integrated system directly into injectioncompression molded preforms. XTREME Renew eliminates an entire section of the heat history of rPET, making it considerably more cost-effective than alternative systems, while also offering extra benefits in terms of carbon footprint. SIPA believes that for converters considering the use of high volumes of rPET, it is a highly attractive proposition. At the same time, SIPA acknowledges that **XTREME** Renew does require investment in equipment that many converters are unfamiliar with. This is why it also supplies more conventional XFORM injection molding systems, and SFL or XTRA linear and rotary stretch-blow molding systems, incorporating

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special features that make processing with rPET a relatively simple affair. In many cases, customers will not even have to invest in new systems, but rather make highly affordable adjustments to equipment they already have. But they will still be able to produce bottles with up to 100% rPET if they so choose (and if the application allows).

### MODIFIED HOT RUNNERS

For converters producing preforms, for example, it will make a lot of sense to use hot runner systems that have been upgraded to prevent accumulation of PET powder. SIPA has developed XActive-Cleaning, a patented system, which adapts the compressed air flows, normally used to move the hot runner valves stems, to also blow out the very few plastic particles that deposit inside the actuators each cycle.

#### Cleanliness is an issue not only in hot runner systems, but also in the injection molds that they feed.

So SIPA has also been developing ways to keep mold cavities as clean as possible. A system incorporating innovative vacuum technology reduces the need for maintenance and increases line efficiency.





### PULLING A VACUUM DURING INJECTION

All molds incorporate tiny vent holes at key points on the surfaces of the cavities, to allow the escape of air in the cavities when the PET is injected. But the vents can become dirty if the air flowing through them is not completely clean – impeding the passage of the air. SIPA has patented a solution that pulls the air out of the mold during injection. Net result is that the need for operations to clean the vents is also drastically reduced.

#### ACCOUNTING FOR COLOR VARIATIONS IN rPET

Not all rPET preforms are the same. Because the raw material usually comes from a variety of sources, it is quite possible that there will be, for example, slight variations in color. This may affect behavior when the preforms are heated in infrared ovens, since different colors absorb different amounts of infrared energy. SIPA has developed ways to take account of such variations – making automatic adjustments to the oven settings for example – making it possible to have a very high level of consistency in the way the preforms behave when they are formed into their final blown shape.

Preform heating can be adjusted from one batch of preforms to another, based on the

variation in color. Related to this, special vents, known and patented as X-Vents®, can be inserted into the bottle molds, making it possible to manage pressure changes in the cavities caused by the process adjustments relating to the different levels of energy absorption of the preforms. SIPA's Product Manager for Blow molding Systems, says:

The specification of any container can always be ensured. The use of X-Vents<sup>®</sup> is particularly useful for managing these situations when bottles with complex geometries are being produced, or for controlling the bases of bottles for carbonated soft drinks.

He also points out that the extra wide processing angle on the new generation of XTRA rotary stretch-blow molding machines provides further help in processing 'difficult' materials like rPET.

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