Ardagh Glass Packaging

Lightweighting:

a journey at the cutting edge of the glassmaker's art

It's a simple concept on the face of it: reduce the amount of glass used in bottle designs without compromising their strength. But Consol's 20-year pursuit of "lightweighting", as the process is known in the glass industry, is a tale of sacrifice, discipline, collaboration, art, science and an unrelenting quest for technical excellence.

Lighter bottles have compelling benefits: they require less raw material and energy, which means lower costs throughout the value chain and a lower carbon footprint.

It takes time and effort to develop the skills, people and technology needed to excel in the field, but over the last two decades lightweighting has become one of Consol's core competencies, a key competitive advantage and a point of considerable pride in the company.

Consol's lightweighting journey began in the late 1990s when South Africa's markets opened to the rest of the world and industries were pressured to innovate quickly to catch up. Beer brands were some of the first to see the potential of lightweighting to reduce costs and differentiate their products, and collaborations between Consol and SAB, and later Consol and Heineken, introduced best-in-class designs to their markets.

A breakthrough in Consol's lightweighting journey occurred when a new bottle-forming process – the narrow-neck press-blow (NNPB) method – was trialled at Consol's Clayville plant in the late 1990s.

NNPB has considerable advantages when your goal is to use less material while retaining exceptional control over the final product. But this control comes at a price, namely the requirement for astonishingly tight tolerances in the process. To get the desired results, for example, the level of molten glass in the vast furnaces that feed the forming machines can't deviate by more than half a millimetre. The temperature of the molten glass supplied to the forming machine, typically around 1 200°C, can't vary by more than a degree.

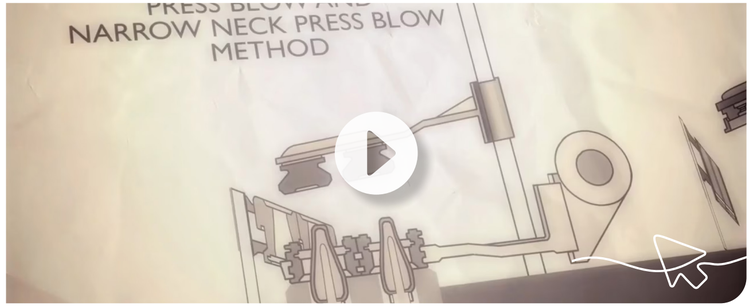
Seventy-two different moulds running across the glass-forming machine have to be meticulously aligned and maintained to precisely match so that each bottle manufactured meets the very tight specification tolerances. And because glassmaking is a non-stop process, these tolerances need to be achieved 24/7, 365 days a year, for the lifetime of the machinery.

This requires exceptional technological and human skills that are key competencies for Consol.

As a result of the fearful learning curve involved in this new technology, the introduction of NNPB was, in the words of Paul Curnow, Consol's Deputy CEO,

"fairly traumatic in the early days". Those tasked with the project made immense personal sacrifices to see it through to fruition. By the mid-2000s, however, it had become routine for Consol's smaller volume (340 ml range) beer bottles to be made in NNPB, and by the early 2010s the process had been rolled out to larger volumetric sizes (650 ml and 750 ml ranges) and then to wine and spirit bottles. Today Consol is one of the best exponents of the NNPB art in our markets.

Alongside technical skill and rigorous processes, collaboration is key to a successful lightweighting project. It is a deeply interactive process that might begin with Consol's analysis of market conditions and trends suggesting a new design to a customer, or with a customer



coming to Consol with a request to determine what's possible within a certain shape. Designs are drawn up, debated, and sent for stress analyses. Eventually a small trial run of physical samples will be produced, followed by a run of several thousand samples which can be tested for packing and transport.

The testing at every stage is exceptionally rigorous. It has to be: there's a lot at stake when designing a lighter bottle. Absolute control over bottle strength and quality must be assured. Most bottles carry products with carbonation, and their safety needs to be guaranteed until they are eventually recycled.

What is it about Consol that allowed it to overcome the challenges lightweighting posed to become one of the world's few manufacturers at the forefront of the art? For Curnow, it was an unremitting commitment to excellence.

"On the one hand, there was the sense that if we didn't learn how to do it first someone else would and we'd lose our edge and our jobs. If our jobs are difficult we have a much better chance of keeping them!" he explains. "But there's also a certain mindset prevalent in the organisation that is excited by the challenge, by the continuous improvement of processes, and by becoming globally competitive at a very difficult task. We want to be better than our competitors, and we're willing to do what's necessary to achieve that."

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Consol's lightweighting successes

Consol's lightweighting achievements, in collaboration with partner Distell, include the Richelieu 750 ml, which is now one of the tallest NNPB bottles in the world, and the Klipdrift bottle with a push-up, which is unique for NNPB production and proudly made by Consol.

Richelieu 750 ml

The lightweighting collaboration between Consol and Distell has yielded sector-defining innovations. The spirits market had traditionally resisted lightweighting because of the sheer variety and complexity of bottles on offer. Many spirit bottle shapes and design features are not ideally suited to the NNPB process. With each brand attempting to differentiate itself through unique features, embossing and push-ups, the opportunity for a concerted lightweighting effort proved elusive.

Spirit bottles from Distell were initially returnable in design, and thus were particularly weighty to endure the refilling process. Distell began the process of revaluating the efficacy of their returnable bottles in trade and found that in many cases consumers chose not to return their bottles, meaning the extra weight was being wasted. Through a collaborative approach, Consol produced a range of lighter bottles in a non-returnable format across their spirit category.

Beer and AFBs

Beer and alcoholic fruit beverages (AFBs) comprise the most globally competitive glass packaging segment, and were the initial drivers of Consol's lightweighting expertise. Today, Consol proudly produces some of the lightest highly embossed and debossed beer and AFB bottles in the world, and has applied that expertise to larger-format bottles across categories.

The BN1348 wine bottle

Wine bottles have an interesting history with lightweighting. In some markets heavier bottles are still seen as indicating a premium product, and the trick is to mimic the appearance of a heavier bottle while reducing the actual mass of material used. Wine bottles also have unique requirements in terms of strength: since they are often manually packed and labelled, they need to withstand increased handling and – in the case of sparkling wines – significant internal pressure and high carbonation.

Soft drink 1.25 l

A prominent multinational soft-drink company requires bottles to conform to international standards, so that every bottle sold globally has the same specifications. They also need to be completely dependable and strong, particularly given the internal pressures that result from high carbonation. Their 1.25 l bottle used to weigh over a kilogramme in the early 2000s. Consol worked with the company to redesign it as an 880 g bottle with the same strength as the previous heavier design and this has been the global standard for that bottle for some time.

We hope to continue on this path and set new standards and keep pushing the boundaries of innovation and reengineering again in the future.

Our choices today will define the planet's future: Consol's 2050 campaign

We are living through a crucial and defining period in human history. Our growing awareness of the impact we have on our environment is driving urgent action. But are we being bold enough in our choices? Are we acting quickly and drastically enough to do what we must to prevent a future defined by environmental degradation?

According to a World Economic Forum (WEF) report published in 2016, by 2050 there could be more plastic waste in our oceans than sea life by weight if we don't act now.

According to the study, "Each year, at least 8 million tonnes of plastics leak into the ocean – which is equivalent to dumping the contents of one garbage truck into the ocean every minute.

If no action is taken, this is expected to increase to two per minute by 2030 and four per minute by 2050." As a result, the amount of plastic in our oceans will increase to more than 899 million tonnes by 2050 – the study's estimate of the biomass of fish in our seas.

To avoid this fate, we need to make responsible choices today as the choices we make today will affect our planet tomorrow.

Plastic pollution in our oceans

Each year, at least **8 million tonnes** of plastics leak into the ocean.

This is equivalent to dumping the contents of **ONE** garbage truck into the ocean every minute.

If no action is taken, this is expected to increase to **TWO** garbage trucks per minute by 2030 ...

... and **FOUR** per minute by 2050.

(Source: WEF)

This responsible choice is at the heart of Consol's "I changed 2050" campaign, which is bringing awareness to the plight of ocean life and encouraging South African consumers to make responsible choices while strengthening our position as an environmental conscious and active brand. To encourage the switch from single-use plastic to reusable materials, a range of three on-trend glass bottles has launched, each carrying the line "I CHANGED 2050". These reusable glass bottles are being sold through the Consol retail stores and our online shop, and a percentage of the proceeds from each bottle sold will be donated on behalf of consumers to ocean-life conservation projects – a declaration of Consol's commitment to ensuring a sustainable future for our oceans.

All five of the turtle species found along South Africa's coastline are threatened. These turtles often wash up on the beach as adults or sub-adults, after ingesting plastic, becoming tangled in fishing gear or being injured by boats. An astounding 63% of the turtles who arrive at the aquarium have ingested plastic and sadly many don't survive.

Consol is also a proud partner of Matrics in Antarctica, which gives promising South African students a once-in-a-lifetime opportunity to visit Antarctica to learn more about its diverse ecosystem and conservation, and prompts learners to think of ways to effect real environmental change in their communities.

Through these initiatives, Consol hopes to encourage consumers to pay closer attention to the repercussions of their choices when choosing packaging products, and to draw attention to the avoidable threats current consumption patterns pose to our precious environment.

The green future of glass furnaces

Stimulated by increasing demand from customers for lower-carbon packaging solutions, the glass industry is piloting projects that will test the viability and cost of renewable-powered furnaces.

Through initiatives such as lightweighting (page 2) and optimisation of processes, Consol has achieved a steady incremental reduction in our carbon footprint over the past 15 years. Net-zero commitments being made by various governments and customers will require a paradigm shift in the way glass is melted and could herald a step change in the decarbonisation of the industry. A new breed of furnaces is being designed to run on a greater ratio of renewable-energy-derived electricity, greener gases such as biofuels or hydrogen, or most likely a hybrid of several technologies. Given the commitment of governments and customers to zero-carbon solutions, this could usher in a future of zero-carbon glass.

The F4F project

In Europe an ambitious project is taking shape. A coalition of 19 independent companies representing over 90% of the total glass container production in Europe, and led by glass manufacturer Ardagh Group, has co-financed the construction of the "Furnace for the Future" (F4F).

The F4F is a large-scale, 350 tonnes/day hybrid electric furnace, able to melt reduced glass together with high levels of recycled glass. The F4F will cut direct furnace carbon dioxide emissions by 60%, and those of the whole facility by 50%, with the potential to exceed those numbers through future upgrades.

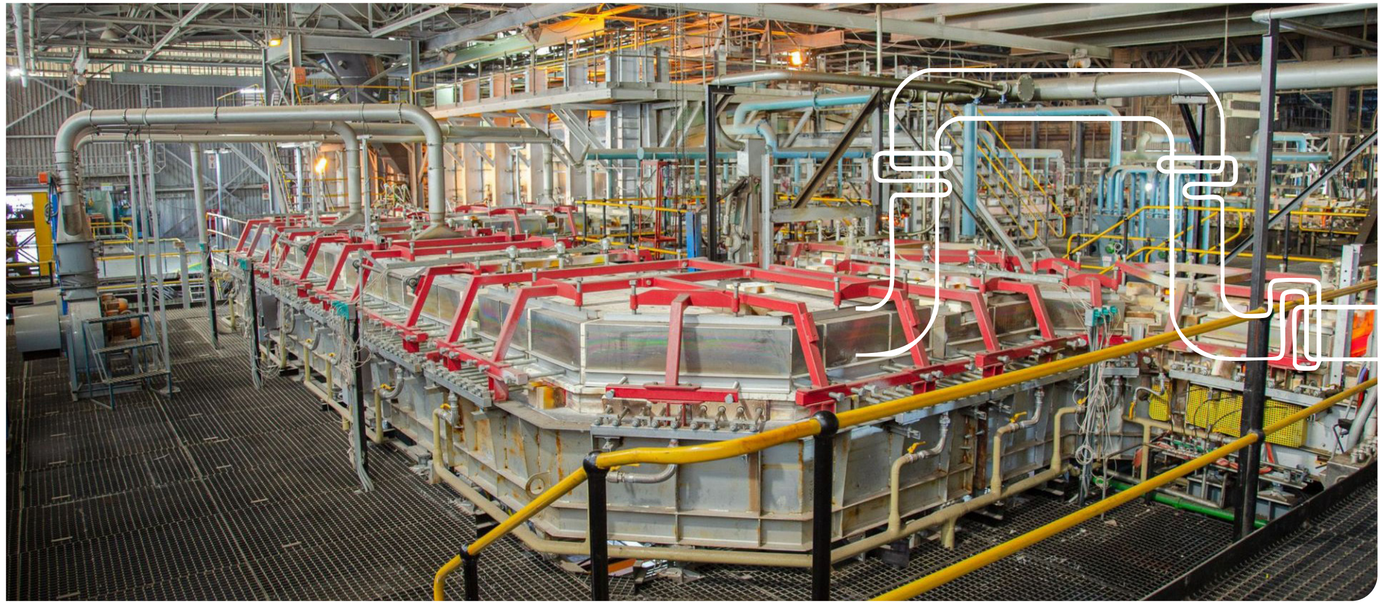
The F4F will be able to operate on a commercial basis to test both technical and market efficiency. Construction of the project is expected to take place by 2022, with first glass produced in 2023. The F4F was selected in March 2021 to progress to the second phase of the EU Innovation Fund, one of the world's largest funding programmes for the demonstration of innovative, low-carbon technologies.

F4F technology will cut direct furnace CO, emissions by 60%, as 80% of the natural gas is replaced with renewable electricity.

“The world’s most sustainable glass bottles”

Glass container producer Encirc, which has sites in England, Northern Ireland and Italy, alongside industry research and technology organisation Glass Futures, conducted trials in 2021 which are planned to result in “the world’s most sustainable glass bottles”. The bottles will be made entirely from recycled glass, and by using ultra-low-carbon biofuels to fuel the furnace.

The project forms part of the UK Government’s Department for Business, Energy and Industrial Strategy (BEIS) Energy Innovation Programme, to help determine the most effective route to switch the glass sector to low-carbon fuels.



Zero-carbon glass in South Africa

Consol is among the few glass manufacturers in the world with proven expertise in running all-electric furnaces for commercial production of a range of bottles in various colours. The traditionally limited availability of natural gas in South Africa meant that several Consol furnaces ran wholly on electricity in the past.

The future of zero-carbon glass in South Africa is, however, dependent on the broader renewable energy discussion in the country, and the appetite from customers to support the effort. Consol is currently looking at the feasibility of building a pilot facility that would produce 100% zero-carbon glass within the next few years.

Once sufficient renewable energy is available and suitable energy-storage solutions are in place, zero-carbon glass is a viable model, and one which Consol is uniquely positioned to take advantage of.

Women in Glass

To honour the diverse, talented and dynamic women who work in the glass industry, Consol Glass took the opportunity to catch up with some of the incredible women who work in glass to get their views on the value that women bring to the business.

Consol's "Women in Glass" initiative has been designed specifically to facilitate an ongoing empowerment process.

The year-long programme targets young women at supervisory and junior management levels to enhance retention and drive skills development. As Consol aims to nurture the next generation of leaders, the first group of 20 young women will build competencies in various areas such as the ecosystem of influence, cultivating allies through communication, emotional intelligence, seeking opportunities, resilience and creating personal leadership characteristics.

In addition, several other programmes, such as apprenticeships and learnerships, have a strong bias towards growing the number of young women who are recruited to participate.

Consol's focus on inclusivity extends to two external programmes that the company sponsors in nearby communities. A New Venture Creation (NVC) Learnership project for unemployed youth with disabilities, and farming learnerships for emerging farmers from disadvantaged backgrounds, have both included a notable number of women among the beneficiaries.

Through initiatives such as these, Consol hopes to inspire, motivate and encourage women within the business to be the best they can be so that every woman's success is an inspiration to another.

"Men just want to get the job done! Women pay attention to the finer details."

– Nothando Mhlongo

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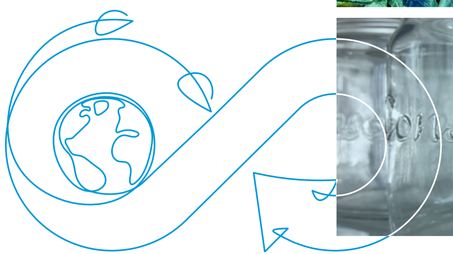
South Africa's EPR: a positive step towards a circular economy

South Africa has introduced new legislation that defines "extended producer responsibility", or EPR, for paper and packaging.

EPR is a policy principle that extends producers' responsibility for their products and packaging across the entire lifecycle of their product, with a particular focus on the end-of-life stage. EPR plays a critical role in minimising the amount of waste that ends up in a landfill, ensuring sustainable waste management and supporting South Africa's transition to a circular economy. "Producers", according to the legislation, are defined as stakeholders who hold responsibility over the design and production of packaging products (i.e. the packaging manufacturer), and who place those products on the market (i.e. brand owners), as well as importers and retailers of the products. The EPR legislation requires all producers to form, or join, a Producer Responsibility Organisation (PRO). Initially there will be a separate PRO for each of the material streams (glass, plastic, cardboard, etc.) in South Africa. The various PROs will be responsible for reaching certain material-specific targets in terms of waste management, and producers will contribute EPR fees to the various PROs to assist them to reach these targets.

Although newly enshrined in law, the ideas behind the EPR are not new to Consol. Since 2005, Consol has been a member of The Glass Recycling Company (TGRC), which has been a voluntary EPR scheme for glass packaging over the past 16 years.

TGRC is currently establishing itself as a PRO in line with the new regulations, which will come into effect from 5 November 2021, and Consol will continue to support circular-packaging initiatives as a member of the new organisation. According to TGRC, approximately 44% of glass used in South Africa is recycled. The EPR targets for the sector are set at 65% collection of glass used by 2026. This target will be reached through, among other initiatives, transport subsidies being granted for recyclers in provinces without processing facilities, and a R100 million investment by Consol into expanded processing facilities in the Western Cape. Glass is infinitely recyclable, which makes it almost unique among packaging materials, and its recycling value chain is already circular in design. A recycled glass container becomes a new glass container, with no alteration of the material's molecular structure. Consol therefore believes that glass will be a key pillar of any truly circular economy, and is proud to support South Africa's EPR legislation and other initiatives that advance this goal. For more information and frequently asked questions relating to the EPR, click here.



Webinar brought to you by Consol

10 November 2021

Unpacking the new EPR legislation

According to the South African Government's extended producer responsibility (EPR) legislation, membership of EPR schemes will be mandatory for brand owners, importers, retailers and manufacturers from November 2021.

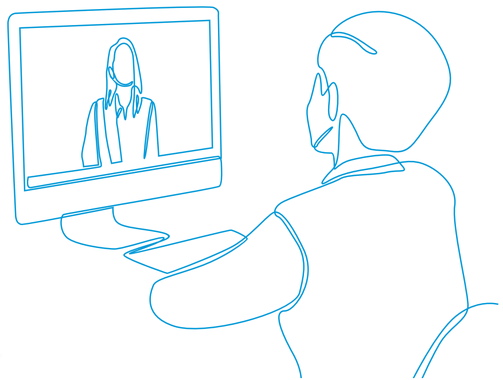
Consol Glass and Isanti Glass, in association with The Glass Recycling Company, would like to invite you to participate in unpacking this new legislation.

Topics for discussion:

- An overview of South Africa's EPR legislation
- Implications for brand owners, manufacturers and other producers
- The proposed structure of a glass industry PRO
- Glass packaging targets
- Next steps

If you are interested in attending, please **click here** to register for the event.

Thank you! Further details will be provided in due course.

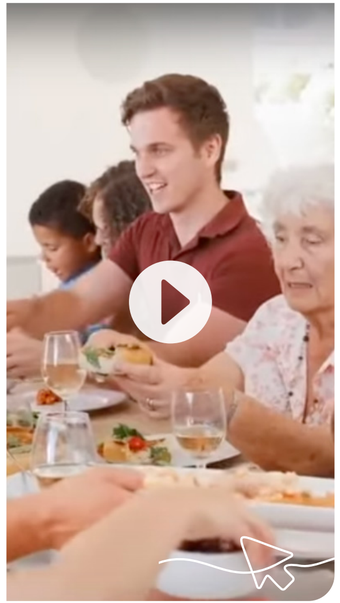


The Future of Food Packaging: Food Packaging Forum

We are exposed to thousands of man-made chemicals every day. Many of these come from the materials that are in contact with our food and beverages. Some of them are hazardous and can damage our health.

Simple choices around food packaging can have significant effects on our wellbeing. The more we understand the effect that packaging can have on the food and beverages we consume, the more we love glass. Glass is impermeable and inert, which means that it has no effect on its contents. In order to make responsible choices in an informed way, we need reliable, expert advice on the chemical composition of food packaging; the types of chemicals that migrate from food packaging into food and beverages; the health consequences of chronic exposure to low levels of food contact chemicals, and many other topics of active research.

The Food Packaging Forum (FPF), to which Consol is a donor, is a non-profit science-communication organisation dedicated to aggregating and sharing scientific research on the effects of food and other packaging. The FPF, based in Zurich, Switzerland, employs technical specialists who are involved at a global level in cutting-edge packaging science, and who report on exemplary scientific studies from around the world. For an introduction to the FPF and the valuable work they do, see the video below. In future issues of Clarity we will be reporting on some of this research, and its implications for consumer choices.



Consol commissions new furnace expansion after COVID-19 delay

Consol has made the strategic decision to continue with a significant expansion of our Nigel plant and has recently reintroduced the commissioning of a second furnace at this facility, which should come online in the 2nd quarter of 2022.

Progress on the furnace expansion

The furnace expansion, known as N2, was previously suspended after alcohol bans were instated in 2020 in response to the Covid-19 pandemic. The bans significantly impacted the demand for glass packaging, but a combination of reduced stock levels due to the alcohol bans and a buoyant recovery in demand for glass bottles is driving the need for additional capacity. The R1.5 billion N2 expansion project will see an additional c. 100 000 tonnes of annual production capacity introduced, and will set the furnace up for production over an anticipated lifespan of at least 12 years. The expansion is anticipated to create 120 direct jobs and approximately 2 600 additional employment opportunities across the value chain, from waste pickers to truck drivers, CNC machine operators, glass machine operators, fitters, electricians and managers. Feeding the furnace will require additional locally sourced raw materials including silica sand, lime, feldspar and cullet (recycled glass) and is also expected to support new investments in the mining industry.

For more information or to sign up for this digital magazine,
please email agp-a.marketing@ardaghgroup.com

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