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The official journal of the
Institute of Waste Management of Southern Africa

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A NEW WAY FORWARD FOR SUSTAINABLE WASTE MANAGEMENT IN SOUTH AFRICA

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Portable Batteries: 19/7/5/P/PRO/20230710/045 | Lubricant Oils: 19/7/7/L/PRO/20240429/053

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How far are you willing to go?

The fact that the planet is on proverbial fire, and that the poor and marginalised are the ones being offered for sacrifice to placate the wallets of an elite few businesses, should be enough to say, "let's maybe re-think how we do things."

There is a lot of talk, as there always is, about changing the economy, building resilience, helping our fellow men, etc. But talk is cheap. At a recent conference, I heard a panel member suggest "a global subsidised halt in production," and there was an audible discomfort among the suited and tied. For 30 minutes, we were all fine with vague platitudes about global consumption habits and uptakes along the downstream value chain, and the recycling opportunities of some waste streams. When confronted with a really radical idea, suddenly the world is allowed to burn.

I am not saying, "let the most obscure idea win," but perhaps we should be looking to new, uncomfortable, and even radical ideas for a crisis that literally threatens the lives of millions.

South Africa has an interesting history of being on the cutting edge. From small modular nuclear reactors to synthetic fuels, you will find South Africa included among some of the world's best and brightest innovative steps.

The new landscape is risk-averse, money is endlessly tightening, and the economy is growing at a pace where safe bets seem better. New ideas are treated as novel, and the current way of doing things plods along. This is not to undermine the vast efforts and truly committed people making the country work, but maybe the "old ways" need to be reexamined and scrutinised.

A complete ban on single-use plastic would be a logistical nightmare at first, but perhaps it's necessary. Your weekly or monthly grocery haul should not be equal parts food and plastic. I am forever hearing about innovation, but from what I can tell, innovation occurs around policy shifts. No one is going to willingly sacrifice profits for the hope of a better world if their competitors don't have to do the same.

In a very strange document, a group of American energy company CEO's wrote an open letter to then-President Bush, explaining that they were all aware of climate change, but could not act against it in their operations because the competition would overtake them in the pursuit of profit. They laid it out as follows: we have to make money, and damaging the environment is the easiest way to do so in our field. If an individual company tries to be more environmentally conscious, the extra costs and such would effectively close the business, as the competition could just undercut them. They begged Bush to change the laws which would force all energy companies to act on an equal footing. This group included DuPont and BP America, and expressly said, "We can and must take prompt action to establish a coordinated, economy-wide market-driven approach to climate protection."

Nowadays, this would seem inconceivable, but it illustrates a point: relying solely on competition and business-minded approaches cannot dig us out of the hole. How far are we willing to go to see a livable future, where we have not only made South Africa climate resilient, but have sustainability as a core function of our social system? The reality is, we need to go as far as we have to, which might be uncomfortable and difficult, but what is the alternative?

Duncan

COVER OPPORTUNITY

In each issue, **ReSource** offers companies the opportunity to get to the front of the line by placing a company, product or service on the front cover of the magazine. Buying this position will afford the advertiser the cover story and maximum exposure. For more information, contact Sindi Moni on +27 (0)82 212 4574, or email sindi@infrastructurenews.co.za.

BUILDING THE CIRCULAR FUTURE

The surge in consumer electronics has inadvertently led to a proportional increase in e-waste. This hazardous waste stream demands specialised handling, and with solar energy now firmly established in South Africa, the need for proper e-waste (including solar and battery) recycling has become even more critical.

EWaste Africa, a recycling company specialising in e-waste, has evolved alongside South Africa's waste regulatory framework. Initially focusing on lightbulbs, they strategically positioned themselves for what they identified as the future of South African recycling.

Pravashen Naidoo, CEO of EWaste Africa, credits regulation as a key driver for the sector. He explains, "In 2013, there was a ban imposed on all lighting waste being sent to landfill (suspended for 3 years until 2016). At the same time, electronic waste to landfill was suspended for 8 years to come into effect in 2021. The government deserves credit for this foresight; we would not have existed if that legislation hadn't materialised back then."

The ban compelled corporations to act. "What the ban did was bolster the business-to-business market. It really pushed corporate South Africa to ensure that waste, which could have easily gone to landfill, was now directed to a licensed recycling facility, and that became the core of our business."

Pravashen Naidoo, CEO of EWaste Africa

Dr. Mark Williams-Wynn, CTO of EWaste Africa

Ultimately recycling, reuse, refurbishment, and the diversion of waste from landfill pave the way for a broader circular economy

Volumes have steadily increased since the regulations took effect. "Initially, we only recycled lighting. By 2021, we started processing electronic waste as well, and once our Johannesburg operations were running, we intensified this focus on electronic waste, subsequently also introducing solar panel and electric vehicle component recycling as part of our service offering."

Collection: The master key to waste management

A pivotal moment arrived in November 2021 with the introduction of Extended Producer Responsibility (EPR). "It's the big buzzword right now, but it's more than that," says Naidoo. "For the first time, it shifted solely from the polluter-pays principle to include the producer-pays principle. This regulation injected funds into the value chain. Producer Responsibility Organisations (PROs) are tasked with funding the establishment of collection networks (such as deploying bins), creating jobs, and driving the end-of-life management of specified products like electrical and electronic equipment, lighting equipment, and portable batteries."

EWaste Africa, in collaboration with ERA (one of the PROs), helped initiate a consumer

collection scheme by placing drop-off boxes at Pick n Pay stores nationwide and is now expanding this network. "By October 14th (International E-waste Day), there will be 160 drop-off points for consumers to take their waste to. The plan is to reach 260 by the end of next year. We aim for over 1 000 drop-off points across the country. We're observing significant volumes from the Pick n Pay drop-off points; in fact, more than anticipated, which indicates that South Africans are eager to do the right thing."

Recycling is a business, yet it is a unique one because not all waste streams possess inherent commercial value. The EPR regulations have provided crucial financial support by subsidising recycling costs. Naidoo emphasises, "Our business was built on recycling light bulbs, which is a cost-negative stream. You do not generate enough revenue from a light bulb's components to cover the costs of compliant collection, transport, and recycling. Without EPR fees as a subsidy, the recycling of items like lighting waste wouldn't be viable."

Naidoo stresses the importance of looking beyond climate impact alone. "Climate impact is undeniably important, but it's only one of the nine planetary boundaries." These nine critical Earth systems, which regulate planetary stability, were first proposed by the Stockholm Resilience Centre in 2009. "We validated the CO_2 and energy savings achieved through e-waste processing early on, but we must also measure impacts on land and water. Sustainability needs to encompass more than just carbon."

Beneficiation

At its core, recycling involves perceiving waste differently, recognising its inherent value, and enhancing that value. While plastic often receives negative attention, EWaste Africa also found glass to be a major challenge. While ordinary consumer glass bottles are recyclable, much of the glass in South Africa, including that from solar panels, is not. This is why EWaste Africa prioritises beneficiation, or the creation of valuable components from waste. "We can now beneficiate up to 98 percent of materials from lighting and solar," Naidoo explains. "South Africa lacks a solution for the glass, so we've innovated solutions like eco-pavers. Approximately 90 percent of a solar panel's material is glass, and all of that is reused in our process. We have international recognition for our solar recycling technology, and this motivates us to continue to innovate and create new solutions."

The company integrates local inventions with international expertise. "We have a team of engineers, including two PhDs. We have not immediately sought global solutions, but have rather invented solutions in-house and then incorporated global technology to apply them. The world often looks to Europe for solutions, but with adequate investment, patience, and time, we can solve these problems ourselves in South Africa."

As solar panels come offline, the need to collection and storage becomes imperative

EWaste Africa collects e-waste directly from consumers through Pick n Pay drop off points, aided by the PRO, ERA

This 'home-grown attitude' also directly addresses South Africa's persistent economic and employment challenges. Naidoo states that the company is designing its future with social inclusion in mind. "My greatest passion has always been job creation. This is now evolving into examining our most struggling communities and exploring how we can integrate them through concepts such as micro-enterprise support. We are currently building new facilities in Johannesburg and Atlantis, and we are consciously designing them for gender equity and inclusive empowerment. Simple adjustments like lowering worktables or adding wheelchair ramps make the system more inclusive."

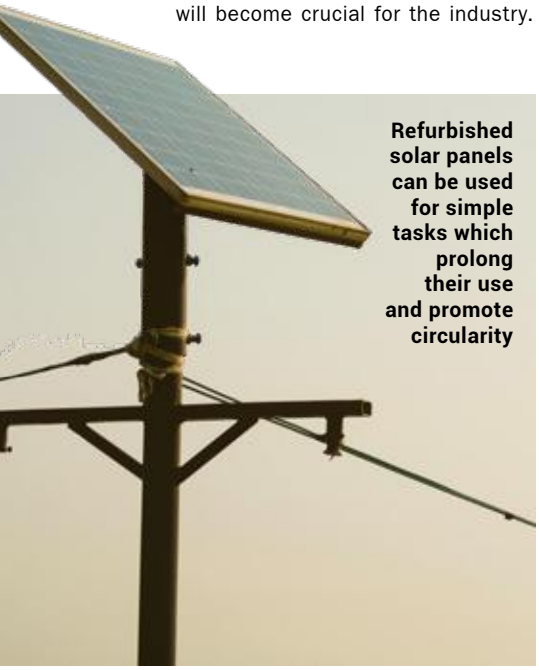
While there's public discourse on the value of e-waste, the reality is that most e-waste, including lighting and solar, holds little commercial value. This prevents these streams from being addressed by South Africa's robust informal economy, which typically drives the waste sector. Despite this, EWaste Africa is considering strategies to

Electronic waste is considered hazardous and is banned from landfills

integrate waste pickers as effectively as possible into their Johannesburg and Atlantis operations.

Solar Focus

EWaste Africa's commitment to tackling solar panels stems from the fact that these panels, with approximately 26 million installed in South Africa, have shorter lifespans than initially anticipated. Managing their end-of-life process will become crucial for the industry.



Refurbished solar panels can be used for simple tasks which prolong their use and promote circularity

Dr. Mark Williams-Wynn, chief technology officer of EWaste Africa, states, "Our PV module recycling operations are primarily driven by the need to divert waste from landfill. The amount of solar waste is increasing, and our main objective is to prevent it from ending up in landfill. Currently, the aluminium frame is the only component with real resale value, but we are continuously developing ways to increase the value derived from the modules."

A key part of this strategy is the solar PV module triage facility currently under development. "Value comes from reusing modules versus complete recycling. The opportunity for refurbishment exists, but the market still needs to be created," says Williams-Wynn. He points out that while new solar modules produce up to 700 watts, older models average less than 300 watts. "That doesn't mean they're useless. Farmers can use them to power boreholes or irrigation systems. There are also niche applications like portable kiosks, or even school donations and hubs in informal settlements. Lower efficiency can still be useful in contexts where the demand is lower." The triage plant, expected to come online in mid-2026, will utilise various industry-standard tests to determine whether modules are suitable for resale, refurbishment, or if they must be recycled.

Regarding circular economy applications, the company is already exploring ways to transform waste into new products. "We recover metals like aluminium and copper, but with few exceptions, glass cannot be recycled because there is no market. We are making interlocking eco-pavers from the glass, which can also contribute to a Green Star rating from the Green Building Council of South Africa," Williams-Wynn explains. "Recovery of materials from the silicon layer is more complex. Purifying silicon for new panels is not necessarily feasible, but there are other ways to extract value from the modules."

Service design is also critical. "All e-waste is considered hazardous and banned from landfill, so we provide a solution for compliance with these regulations," Williams-Wynn says. The company manages transport, storage, and recycling, with logistics often being the most expensive part. "Transport is the biggest cost. Moving e-waste requires properly trained staff and certified, fit-for-purpose vehicles. For other types of waste, there are no local solutions, necessitating export, in which case compliance with the Basel Convention becomes essential."

On the regulatory front, Williams-Wynn highlights the role of extended producer responsibility and national legislation. "We operate within the framework of the National Environmental Management: Waste Act of 2008 and its subsequent amendments, alongside norms and standards for classification, storage, and disposal of waste. Transport is governed

As electronic waste grows, so does the need to add value to the waste stream through sorting, recycling, and reuse

by the Road Traffic Safety Act, which requires hazardous-specifically registered vehicles for the transport of waste."

Looking ahead, he stresses that scaling up will prioritise social impact. "Manual disassembly is an ethical choice in South Africa. We could pursue automated separation or AI, but replacing jobs with machines is detrimental to society. One of our objectives is to create 200 jobs by 2030. Simultaneously, we are keeping up with global trends, where these are beneficial and create value, particularly in extracting precious metals, which require chemical processes. For now, we believe keeping everything manual for as long as possible makes sense in our specific context."

An interlocking paver made from recycled glass

Practicing what is preached

The company also applies sustainability internally. "We have taken our Pietermaritzburg facility completely off-grid. Taking a factory off-grid is no small feat, but we have to credit Sasol for supporting us in this process. Our Johannesburg facility will be completely off-grid by the end of next year, and our Atlantis facility will also be almost entirely off-grid. We do rainwater harvesting and use that for our paver production. We do not just sell sustainability; we live it as a company."

Education is another critical component. "At the moment, only about seven to ten percent of e-waste is recycled in South Africa. To get to 30 percent, we need a generational change. That means starting in schools right now," says Naidoo. "We do free activation days for corporates, but more importantly, we partner with organisations to run activations at schools. It is about creating a circular mindset early on during children's formative years."

Looking ahead

Naidoo says collaboration is key to scaling impact. "The more people that can recycle, the more volumes we can process, which drives more money into the circular economy. If one million of South Africa's 63 million citizens actively support the collection network, we can continue to roll out the infrastructure for the whole country. The culture needs to shift so that separation at source becomes second nature."

On solar panel recycling, he says demand is already here. "You cannot hide a solar panel. Once it reaches the end-of-life, you need a solution. We are already seeing massive amounts of stockpiles of end-of-life solar panels, and we are preparing for larger and larger waves of volumes to come. For the first time this year, solar will become a bigger waste stream in our facilities than lighting or electronic waste."

Reporting on data is a key metric of growth and transparency, and EWaste Africa has also invested in digital systems to address this. "We have been building our own system for the last 24 months," Naidoo explains. "We QR tag every stock item that arrives at our facility, capturing information such as serial numbers, brand, and weight. This enables us to generate data directly for reporting to the South African Waste Information System and individual PROs. We are also able to provide clients with reports on CO_2 impacts and energy savings. For us, it is about applying innovation not just to recycling, but to logistics and reporting too." The combination of collaboration, investment in local solutions, and effective monitoring is what EWaste Africa says, "will build the circular economy."

ewaste africa

www.ewasteafrica.net

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Institute of Waste Management of Southern Africa

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Health and environmental hazards from open waste burning

Uncontrolled waste burning poses significant health and environmental risks in South Africa, especially at illegal dumps and within informal communities. Burning tyres, plastics, and industrial waste releases harmful fumes and smoke that affects communities daily.

When formal waste collection is insufficient, open burning is often seen as the only option to reduce volume.

North-West University reports that nearly one-third of South African households lack regular waste collection. Without proper services, many resort to unsafe disposal methods like burning. The smoke produced is toxic, releasing fine particles, black carbon, dioxins, and harmful chemicals. These do not simply vanish into the atmosphere; people breathe them in, leading to severe health risks such as cancer, heart disease, respiratory problems, and circulatory issues, particularly among the elderly and the already ill. Children are especially vulnerable, facing long-term developmental damage.

The dangers of open burning extend beyond health concerns. Fires can quickly escalate, especially when hazardous waste explodes, endangering homes and causing fear and anxiety among residents. Many communities suffer not because of their own actions but due to illegal dumping by outsiders, which fuels the problem.

Nature also suffers; these fires emit greenhouse gases that accelerate climate change and disrupt local weather patterns. Ash and toxins seep into soil and water sources, endangering crops, wildlife, and food supplies.

This issue transcends environmental consequences; it is a matter of fairness and human rights. Clean air should always be a priority. Research by the Central University of Technology indicates high pollution levels stemming from poorly managed landfills in the Free State. In places like Kya Sands, Gauteng, residents have protested through petitions, legal action, and appeals to authorities. Despite compelling evidence of harm, assistance has been slow, leaving communities feeling abandoned. The CSIR warns that more than half of South Africa's plastic pollution comes from open burning, a problem that can no longer be ignored.

In the waste management sector, there is a moral and practical obligation to act. Stopping open burning requires not only enforcing regulations but also promoting education, improving infrastructure, and strengthening policies. Collaboration with local authorities is essential to develop safe and feasible disposal options. Communities need awareness programmes that empower them to make better choices, and support must be given to projects that formalise waste services in informal areas.

The Institute of Waste Management of Southern Africa advocates for zero tolerance towards open burning, promoting proven waste treatment technologies and encouraging sector-wide cooperation. This issue is more than environmental; it is about safeguarding public health, stabilising the climate, and fighting for environmental justice.

Patricia Schröder, President, IWMSA

IWMSA PATRON MEMBERS

IFAT Africa

IFAT 2025 brought the industry together and IWMSA saw many of its members giving presentations, hosting panels, and of course visiting the stand.

KZN Waste Management Awards

Celebrating and recognising the innovative solutions in waste management is vital for the progress of the sector. The 2026 awards were launch on June 12th 2025 at a breakfast event, where past winners shared their award experiences.

Entries are open for the 2026 awards, and the IWMSA has opened a new category that looks at businesses involved in waste beneficiation.

Celebrating women in waste

Nicolle de Bruyn, Executive Officer of the Institute of Waste Management of Southern Africa (IWMSA), was honoured with the prestigious Sustainability Champion of the Year award at the Women in MICE (which celebrates exceptional women across the Meetings, Incentives, Conferences and Exhibitions industry) Awards 2025.

This recognition celebrates Nicolle's unwavering commitment to sustainable development and environmental leadership within the waste management and events industries. Her efforts continue to drive awareness, innovation, and meaningful change across Southern Africa.

IWMSA welcomes Tshenolo Waste and Phambili Services as new and proud patron members

Tshenolo Waste (PTY) LTD provides total waste management solutions to health care practitioners and institutions (private and public), as well as residential, industrial and commercial customers.

Phambili Services (PTY) LTD is a leading Waste Management company established in 1996 in recognition of the growing need for sustainable integrated Waste Management solutions in the Waste Management sector in South Africa.

PHAMBILI SERVICES (PTY) LTD

TSHENOLO WASTE

KZN golf day

This year IWMSA partnered with The Litterboom Project NPC, a charity working to eliminate plastic pollution in KZN river catchments. We wish to thank everyone who participated in the golf, and congratulate the WPI fourball of Nash Dookhi, Vinay Dookhi, John Parkin and Anmol Rampaul for taking the prize of top fourball.

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Averda site visit

Part of the IWMSA's mandate is to visit patron members and ensure the entities understand and work in tandem with each other.

Nicolle de Bruyn, executive board member for IWMSA, recently visited Averda's City Deep ETD Plant and their Plastic Plant in Rosslyn.

At City Deep, their state-of-the-art Electro-Thermal Deactivation (ETD) plant runs 24/7, processing an impressive 1000 tons of medical waste per month. Their powerful shredder handles a staggering 2.5 tons of infectious waste per hour, while the ETD oven operates with zero emissions and an exceptional six-lock sterilisation system.

Not only do they achieve 100% diversion from landfill on the medical waste side, but 90% is treated onsite in Klerksdorp, with the remaining 10% directed to Vlakfontein for coblending, a remarkable sustainability achievement!

Averda also employs AI scanners to assess and illuminate incoming medical waste, and a Geiger Counter to monitor radiation levels, showcasing their commitment to safety, innovation, and compliance.

At the Rosslyn Plastic Plant, Averda continues to lead with a circular economy approach , focusing on waste minimisation, resource maximisation, and closing material loops through reuse, recycling, and recovery.

A truly inspiring example of innovation, sustainability, and leadership in waste management.

Nicolle adds,"Thank you once again to the Averda team for hosting me! your work is setting industry benchmarks!"

Upcoming Events

The 2025 Landfill and Waste Treatment Conference taking place in Durban from the 22nd to the 24th of October is not to be missed. This event brings experts together under the theme "Landfull- where to from here?" and is sure to be a pertinent and timely intervention.

The 26th edition of Africa's leading waste and resource management conference is on the horizon.

Next year is a milestone moment — the Institute of Waste Management of Southern Africa (IWMSA) proudly celebrates 50 years of driving change in the industry.

WasteCon 2026 will bring together trailblazers, innovators, and changemakers from across the sector to:

- Showcase the latest best practices and sustainable solutions.
- Reflect on 50 years of progress and lessons learned.
- Collaborate on shaping a cleaner, greener, and more sustainable future.

Be part of the conversation that defines tomorrow.

Registrations, abstract submissions, exhibition bookings, and sponsorship opportunities will open soon!

eWASA electric vehicle

Pushing for unity in South Africa's circular economy

South Africa is under pressure to reduce waste to landfill and build a circular economy. This comes at a time when landfills are filling up, climate change is increasing severe weather events, and the world is looking to more sustainable economic models that look to the future. **By Duncan Nortier**

Keith Anderson, CEO of the EPR Waste Association of South Africa (eWASA), believes Extended Producer Responsibility (EPR) is a turning point for South Africa, but only if it is enforced consistently and supported by collaboration.

Keith Anderson, CEO of eWASA

Anderson's own journey into sustainability begins not in waste but in technology. "My background is in IT," he explains. "In the early 2000's I served two terms as president of the ITA (Information Technology Association of SA), During that time I became curious about the growing mountains of electronic waste. Attending a sustainability summit at the time shaped my view; the five-capital model, a precursor to the circular economy, made me see waste as part of a bigger system."

Inspired by European models such as Switzerland's pioneering take-back scheme, Anderson helped draft South Africa's first industry waste management plan which was sent to the DFFE in 2010. Unfortunately, the then Minister could not consider the plan due to the lack of any related legislation at that point in time. By 2019, when EPR was under discussion, he was invited to sit on government committees shaping the framework. "The success of EPR internationally was undeniable." South Africa, while taking ideas from Europe, didn't copy the model exactly. In European countries, there is predominantly one Producer Responsibility Organisation(PRO) per waste stream, but in South Africa, there are multiple.

Businesses found EPR regulations difficult to navigate at first. Many companies initially resisted. "The bigger the company, the bigger the challenge," Anderson recalls. "Law firms even advised clients they didn't need to register."

There was confusion over who the EPR pertained to, and many saw EPR as an additional cost rather than an investment. Anderson's foresight meant eWASA was positioned as the only registered body handling e-waste at the time. However, the complexities of having to register with multiple PROs led Anderson to register eWASA to handle all the regulated EPR waste streams on behalf of their clients. "Firstly, having to explain and navigate the various PROs and waste streams would have been difficult. We offered our clients a "one-stop-shop" solution."

As a PRO, eWASA must walk a fine line between regulation and industry. "The shift to the producer is monumental," he says. "They have to trust us, and we have to prove ourselves. The cost of compliance is embedded into the product and ultimately carried by the consumer.

Transparency, he insists, is vital. "At one stage, our fees were higher than others, but

we committed to not changing our fees for five-year periods and have applied eco-modulation accordingly. Our fees now are the same as in 2021, and we show our members exactly where their money goes."

Anderson breaks these fees down as follows: Currently 60% is used for recyclers, 28% is used for waste pickers, take-back schemes, other SMME development, education and development and awareness campaigns. At first, 25% of the EPR fees were legislated to go towards covering the business administration expenses. This has now been reduced to 12%. Anderson adds, "So for every rand spent, 88 cents go directly towards circularity."

The free rider problem

One of Anderson's sharpest criticisms is reserved for free riders, companies placing products on the market without fulfilling their EPR obligations. "Free riders are a global problem," he warns. "Online platforms should theoretically comply, but enforcing responsibility on online marketplaces is difficult. Platforms themselves could ensure compliance of traders and suppliers or take on their responsibility."

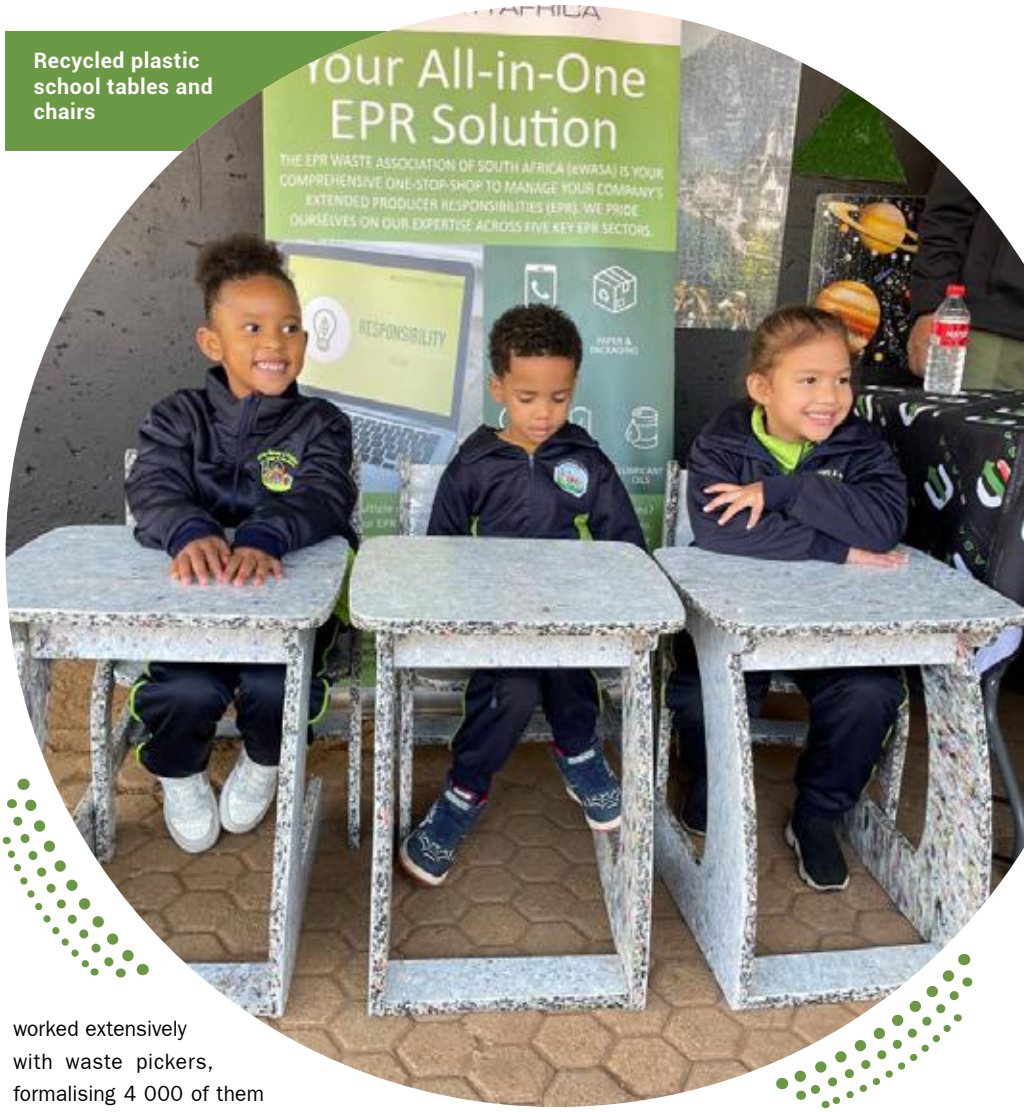
Government, he argues, needs to be more decisive. "The Department of Forestry, Fisheries and the Environment is slowly getting to grips with customs data. They can use that to pressure imports to pay their share. At present, ignoring EPR can carry a R5 million fine or five years in jail, but not a single fine has been issued, that we aware of."

Funding impact and grassroots change

Despite these challenges, Anderson says the EPR system is working.

"The impact is tangible. Since its inception, eWASA has diverted 47% of its waste from landfill. Our projects are designed to have both environmental and social value."

Some of eWASA's initiatives include partnering with schools to collect bread tags, which would fund wheelchairs for people who need them. Another partnership turns recycled plastic into school benches. eWASA has also worked extensively with waste pickers, formalising 4 000 of them with training, uniforms, tools, and trolleys, as well as developing the capacity to recycle lithium batteries.



Recycled plastic school tables and chairs

SMME development is central to the organisation's strategy. "This year alone, we've invested R47 million, created 206 direct jobs, launched 26 projects across eight provinces," Anderson notes. "It's about building local infrastructure to handle waste and keep it out of landfill."

Anderson is clear that the next phase must focus on problematic waste streams and stronger collaboration. "We cannot ignore difficult materials. We're piloting vape take-backs with Spar and looking at solutions for sticky plastic labels. We're also developing a hub in KwaZulu-Natal to handle multiple waste streams, with plans for Gauteng and the Western Cape."

He also suggests rethinking some of the policy. "Having five PROs for one waste stream makes no sense and creates duplication. One PRO per waste stream is far more efficient, however trying to consolidate the many PROs now would present challenges. Competition is not the way forward in this sector; collaboration and economies of scale are."

For Anderson, the vision is ambitious but achievable. "Every player in the value chain, producers, recyclers, municipalities, and consumers, must work together. If we do that, South Africa can stop seeing waste as a burden and start seeing it as a resource. That's how we build a truly circular economy."

eWASA partners with schools to collect bread tags, which funds wheelchairs for those who need them

eWASA
EPR Waste Association of South Africa

www.ewasa.org

WHEN PLASTICS WON'T PLAY NICE

Plastics are often described as the most stubborn of waste streams, essential to modern life yet resistant to recycling systems. South African plastic recyclers tend to focus on niches like PET, which is highly recyclable, and view a lot of the plastics in circulation as non-recyclable.' **By Duncan Nortier**

Garreth Russel, MD of RevoWaste

"We wanted to look at the challenging waste streams, the so-called 'non-recyclables'," says Gareth Russell, managing director of RevoWaste. "Four and a half years on, we're processing 10 to 20 tonnes of plastics a day."

Russell's recycling career began at Reclite, a South African e-waste business. He joined as a driver before working his way up to general manager, where he first noticed the problem of plastic waste.

"When you deal with e-waste, plastics are unavoidable. They're often complex blends, sometimes containing hazardous flame retardants. The only option was exporting them to China. I felt we were throwing away a valuable resource that could and should be used locally."

RevoWaste accepts a wide range of plastics, from ABS to polypropylene and polystyrene. But this diversity brings complications.

"Customers often tell us they have one type of plastic, but when we arrive, it's something completely different," Russell explained. "Labels are often missing, so we rely on burn tests, float tests, even the smell and colour of the smoke. It's a bit like being a plastic sommelier."

Because manufacturers demand precise specifications, accuracy is crucial. "If you deliver the wrong spec, you lose that customer forever. That's why we train our sorters constantly. We hold monthly sessions, provide manuals, and even do spot tests."

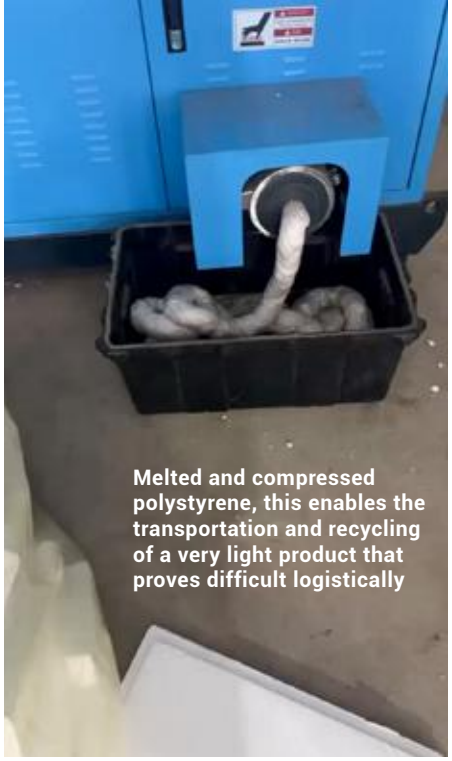
Problem plastics

Among the most difficult materials are flame-retardant e-waste plastics, polypropylene/PET strapping and non-bottle PET.

"The fumes released when you extrude flame-retardant plastics are toxic," Russell said. "We use activated carbon filters and water baths to capture emissions, so we can pelletise them safely."

Plastic strapping, widely used in packaging, caused a different headache. "If you put it through a normal granulator, it just wraps around the blades and melts. We worked with Circular Energy to design a custom-built system. One

RevoWaste prioritise staff training and rely on labour, rather than machines which are expensive and displace employment opportunities in South Africa



Melted and compressed polystyrene, this enables the transportation and recycling of a very light product that proves difficult logistically

customer alone produces 30 tonnes a month, material that used to be thrown away."

Even PET has untapped challenges. While bottle-grade PET is widely recycled, thermoform PET, used in cake trays and disposable cups, is not. "Locally, there's no demand for that grade. The volumes are staggering, yet they're simply thrown away. We've found export routes to India and Brazil where it's wanted."

Polystyrene: from air to ingots

Polystyrene is a prime example of a recyclable plastic hampered by logistics.

"The biggest challenge is not that it can't be recycled, it's that it's so light," said Russell. "A truck that could carry 30 tonnes only collects 100 kilos of polystyrene. The economics don't work, and the carbon footprint goes through the roof."

RevoWaste invested in a machine that shreds, melts and compresses polystyrene into dense ingots. "You go from transporting air to transporting 30 tonnes of usable material. Companies like Supreme Mouldings then remanufacture it into skirting boards and decorative wall panels."

The company is now exploring how to handle food-grade polystyrene containers, which are contaminated with oils. "Those oils are flammable during extrusion. We're developing a wash process that separates and recovers the oils, so the material can be safely recycled."

Russell is equally concerned about protecting workers. Shredding and granulating plastics create microplastics invisible to the eye.

"We don't want our operators breathing them eight hours a day," he said. "We issue respirators and ensure all processing happens indoors, in industrial zones, away from food or residential areas. Responsibility doesn't stop at recycling, it extends to how we do it."

While overseas recyclers increasingly rely on automated camera-based sorting, Russell insists the South African context calls for a human-centred approach.

Not all plastic is created equal, recycling plastic begins with sorting, and some plastics are skipped over entirely, something Russel wants the industry to overcome

"They cost millions, and the margins here are too tight. Even if we could afford them, I'd rather employ people than buy a machine that will be obsolete in two years. Our staff are loyal, and we're loyal to them."

Margins in plastic recycling remain slim, RevoWaste has responded by scaling volumes and planning to manufacture finished products.

"The next big step is to make our own products from recycled plastics, injection moulding for crates, buckets, chairs. That's where we're heading in the next 12 months. By manufacturing, we take full control of the value chain," Russell explained.

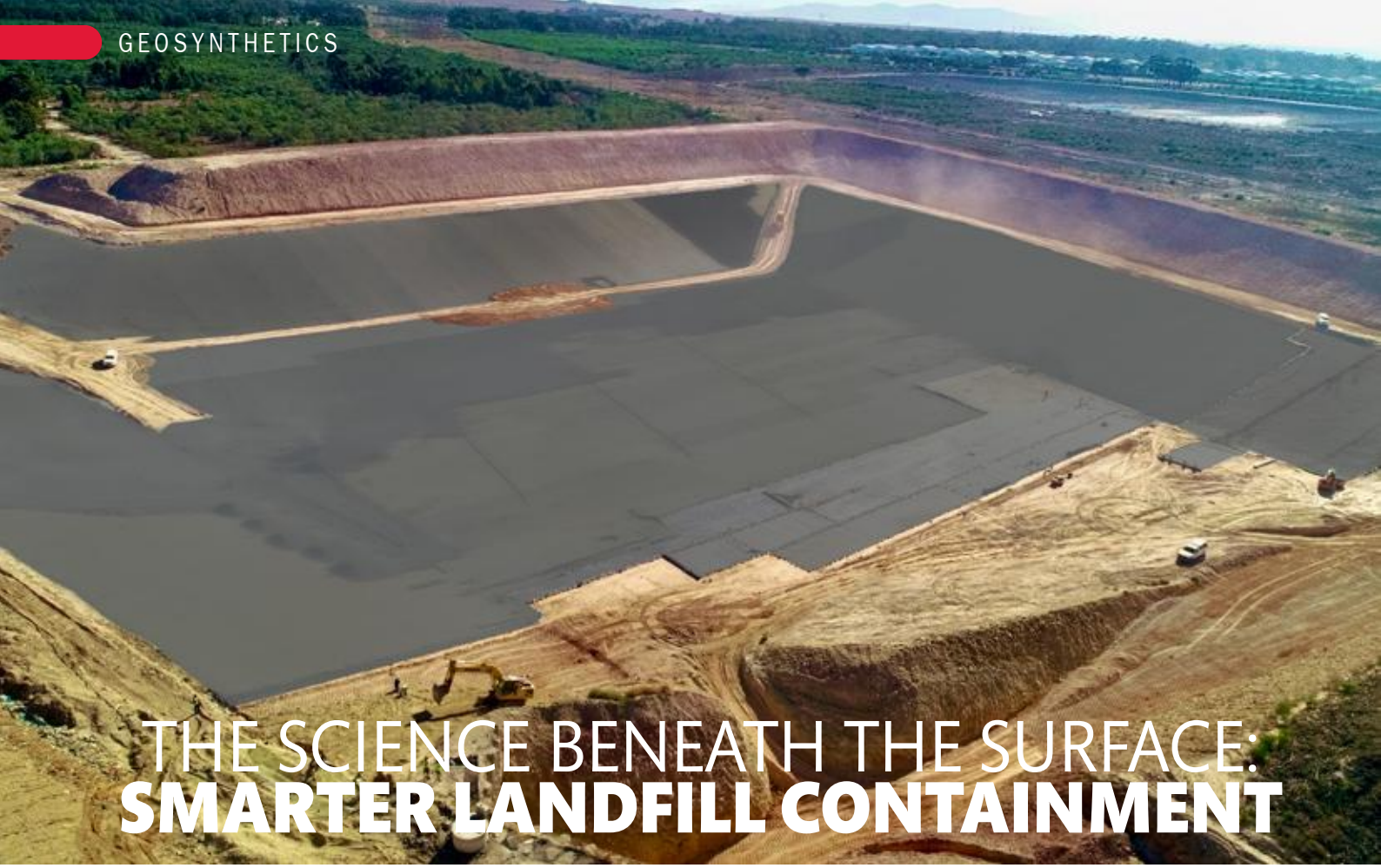
His ambitions stretch further. "My long-term goal is to tackle the plastics considered non-recyclable, the ones off beaches, out of rivers, mixed polymers nobody wants. With the right processes, we can turn them into tangible products. It's about more than business; it's about cleaning up the planet."

RevoWaste also benefits from South Africa's Extended Producer Responsibility (EPR) framework, which requires producers to support recycling systems.

"EPR has been nothing but beneficial," said Russell. "It's given us access to more waste and provided subsidies for collection. The partnership with Reclite is unique; even our international visitors find it unusual. By working together, both companies expand what they can offer customers."

For Russell, collaboration is as important as competition. "Everyone wants to hide their ideas, but that doesn't do anyone any favours. The industry is big enough for all of us if we share knowledge and experiences."

"Plastics are the toughest challenge," Russell said. "But with the right approach, they can be turned from a global problem into a valuable resource. For me, it's about more than running a business; it's about helping to clean up the planet."



THE SCIENCE BENEATH THE SURFACE: SMARTER LANDFILL CONTAINMENT

Geosynthetic linings are the barrier between a functional landfill and one that poses public health concerns. These linings are used to separate the waste from the earth underneath, preventing leachate and soil contamination.

AKS Lining Systems, a company supplying geomembrane linings to more than 30 countries, focuses on high-density polyethylene (HDPE) lining systems.

Peter Hardie, manager: technical and international sales, AKS Lining Systems, says, “HDPE offers the highest broad-based chemical resistance in terms of lining systems and remains the liner of choice in landfill sites and other aggressive containment structures, especially where you are not 100% sure what type of chemistry might be present.” HDPE, along with its chemical resistance, offers low permeability and long-term durability. Hardie notes the waste management sector relies on 1.5 mm to 2 mm linings, but there is a newer demand for textured HDPE linings.

Textured linings

“The addition of a textured surface allows the design engineers superior performance options when looking at side slope lining, slope stability and other design criteria,” says Hardie. AKS Linings offers a Micro/Mega product range that is manufactured with a high ‘asperity’ or spike on one side and a smaller asperity on the other side. These spikes are less than 1.1 mm on the bottom side and less than 0.65 mm on the top side. This gives design engineers the ability to create a preferential slip interface within the lining system. The larger asperity will offer a higher friction to the subgrade or soil than the small asperity offers to the top layer. Therefore, if there is any settlement inside the lined structure, due to waste being compacted or for any reason, the slip will occur on the top side of the liner, meaning that a liner or barrier system remains in place, protecting and containing the waste.

Linear Low-Density Polyethene (LLDPE)

AKS Lining Systems has recently produced a range of LLDPE liners for a local landfill site. LLDPE or Linear Low-Density Polyethene is a more flexible liner and when used in the right application, offers a few benefits over conventional HDPE.

Hardie explains, “On our co-extrusion machines, we are also supplying what is referred to as a ’reflective liner’. This is a liner which is extruded with a thin, light-colored surface on the top exposed side. This assists with reflecting sunlight and heat during the installation process and allows the liner to lie flatter, to assist with the placement of cover soil and protection layers.”

When linings are deployed on site, it is important to monitor each liner, and AKS rolls are individually labelled and numbered. The in-house manufacturing quality control system ensures traceability of each roll and its components right through from the incoming resin to the in-line production testing, quality control testing and final manufacturing quality control certification. Being ISO 9001:2015 certified ensures that management systems and quality procedures are maintained and reviewed at the highest possible levels. These systems and procedures follow through right from resin suppliers, shipping and logistics to finished product, testing and delivery.

Peter Hardie, manager: technical and international sales, AKS Lining Systems

Plastic remains a top priority for South Africa's recycling initiatives. Polyethylene terephthalate (PET) is a highly recyclable plastic and is the material of choice for plastic bottles.

BOTTLE-TO-BOTTLE PLASTIC RECYCLING TECHNOLOGY

The process of PET recycling varies, but usually follows collection, sorting, cleaning, shredding, melting into pellets, and for food-grade PET, the recycled material is sometimes crystallised and re-polymerised to restore molecular weight and strength.

Starlinger, a machinery company, has been involved with plastic recycling technology for 35 years, with a mission to make recycled plastic a viable alternative to virgin material. Starlinger recycling plants are used across the world, and many organisations in South Africa, like Alpla Recycling, Atlantic Plastic Recycling, and Extrupet. For Starlinger, PET beverage bottle recycling represents a closed-packaging cycle.

Bottle-to-bottle recycling

PET beverage bottles can be pelletised and used to make new bottles. This process of taking the existing bottle and recycling it into another one fit for use is one of the more sustainable ways that plastic bottles can avoid being landfilled and offer new product life as opposed to virgin plastics.

The recoSTAR PET art recycling line is the company's latest model in the field of PET recycling. This model builds upon Starlingers' established decontamination performance for food-grade applications and high-quality pellets by introducing a lower energy consumption unit with simplified maintenance processes.

Paul Niedl, commercial head at Starlinger recycling technology

Paul Niedl, commercial head at Starlinger recycling technology, compares the bottle-to-bottle recycling process to high art, he says, "It is a composition, a synthesis of experience combined with the latest scientific knowledge and high technological standards. The new recoSTAR PET art embodies more than 20 years of experience in the field of PET food-contact recycling. In addition, technical improvements have been made to make the plant easier to maintain and even more energy-efficient."

For Starlinger, this new system represents the culmination of ideals, specifically designing the recycling process to be as energy-saving and efficient as possible. The PET bottle-to-bottle recycling system recoSTAR PET art uses 25% less energy than the previous model, and requires 46% less maintenance time, has a 21% smaller machine footprint, and an increased output of 15%. In total, bottle-to-bottle recyclers saves approximately 21% in production costs with the new system.

One of the main changes in the new PET recycling system is the combination of formerly two separate process steps for drying – one for surface moisture, the other for embedded, hygroscopic moisture – into a single process step. Additionally, this model doesn't require vacuum degassing. Both of these innovations contribute to the reduction of energy consumption and reduced maintenance requirements. Additionally, the European Food Safety Authority (EFSA) has confirmed that the system complies with its decontamination standards.

Niedl explains, "This machine is the culmination of years of experience. Decreasing energy consumption while increasing output and ensuring easier maintenance involved analsying the entire PET recycling process and our technical solutions, finding ways to make both better at every point."

Starlinger's recoSTAR PET art bottle-to-bottle recycling systems combine top-quality output with the highest production efficiency and low operational costs

Standalone small wind farms may increase skills in the poorer areas, and add vital knowledge needed for the upkeep of these systems

INDUSTRY EYES EMISSION OFFSETS FOR CLEANER AIR IN POORER COMMUNITIES

Industries have committed to counterbalancing the impact of their industrial emissions by reducing air pollution in poorer areas via air quality offset programmes, according to SRK Consulting South Africa.

Low-income communities located around large industries in the Highveld and the Vaal Triangle are currently the main focus of these programmes, as they have been severely affected by air pollution," says Vis Reddy, chairman and principal environmental geochemist at SRK Consulting.

Reddy explained that this was due to a long legacy of reliance on fossil fuels in these communities, combined with pollution from ageing industries that were unable to comply with the Section 23 Minimum Emission Standards (MES) that were promulgated under the National Environmental Management: Air Quality Act 39 of 2004 (NEM:AQA).

Some companies have received an extension of the timeframe for certain plants to comply with the Minimum Emission Standards (MES) for specific emissions per activity. "However, this is contingent on them submitting a plan detailing how they will achieve compliance in the future. Additionally, the operators of such activities must prepare and submit a mitigation strategy to compensate for the relaxation of compliance with the MES. One available option is the implementation of interventions through air quality offsets," says Reddy.

Cleaner air in low-income areas

He explains that research is underway into various ways of offsetting their emissions by improving air quality in poor communities, as prescribed by the Air Quality Offsets Guideline under section 24J(a) of NEMA.

"The focus is on replacing traditional fuel sources used in these areas with cleaner fuels and energy sources, while also implementing measures that will reduce fuel and energy consumption, especially in the cold winter months. During this period, communities use more coal to heat poorly insulated houses, resulting in a marked increase in air pollution."

Considering the role that solar energy can play in addressing energy poverty in poorer communities in South Africa and other countries on the continent, it also presents a promising solution for air quality offset programmes.

"Solar micro-grids, for example, are especially suited to small remote communities and can supply a larger number of users, including schools and small businesses. They can also be easily incorporated into reconstruction and development programme (RDP) housing designs to power entire households," Reddy adds.

Vis Reddy, chairman and principal environmental geochemist at SRK Consulting

With their potential to power direct current lights, radios and small televisions for about five hours a day, solar home systems are also ideally suited to low-income areas, especially communities without access to any municipal electricity supply.

He emphasises that air quality offset projects also uplift communities by creating skills development and employment opportunities in communities.

"Solar 'agrivoltaic' farming projects, for example, have the potential to generate clean energy and produce food for communities, while also creating upskilling and employment opportunities in both renewable energy generation and agriculture," says Reddy. "Even standalone small wind farms or hybrid systems that incorporate small wind turbines need to be operated and maintained correctly by trained technicians, so training for local communities is essential."

Integrated waste management (IWM) programmes and air quality offsets are also complementary, considering their shared objective of protecting the environment. He elaborated that while air quality offsets aimed to balance the adverse effects of air pollution, IWM managed waste at source.

Reddy elaborates, "Moreover, many of these projects also create opportunities for

communities to earn revenues by converting waste into saleable products. A sound example is the production of a fertiliser from biogas slurry, which is a byproduct of converting animal waste to biogas, another potential alternative fuel."

He adds that municipal solid waste incineration, landfill gas capture and gasification also provide skills development and training opportunities, in addition to their ability to produce cleaner fuels for communities. They are also, therefore, being evaluated for possible inclusion in air quality offset programmes.

These interventions can also be complemented by waste recycling projects, such as the community composting centres that have been established in Tshwane, Johannesburg and Durban. "Residents dispose of their waste at these facilities, where it is composted and resold to households for gardening, generating revenue for local small businesses."

Small businesses could also be developed around waste recycling facilities in communities. These operations reduce waste pollution by diverting waste to landfills, which, in themselves, release harmful emissions into the air.

He notes that RDP houses were notoriously energy inefficient due to their low-quality materials, so house design was another critical aspect of air quality offset programmes. "Roof and wall insulation, smaller windows, and room partitioning will reduce heating requirements. Equipped with basic solar systems and water heaters, energy-efficient lighting, these interventions could have an impact on household air pollution."

Ensuring community buy-in

However, Reddy adds that to ensure wide uptake in communities, alternative fuels and energy sources have to be made more affordable, as coal and wood are more cost-effective and readily available than gas and municipal electricity.

"It is unlikely that these communities will be able to easily afford the high capital outlay required for renewable systems or to insulate their houses unless they can borrow at lower interest rates, of about 10% as opposed to 30%, for example," says Reddy.

Furthermore, alternative fuel and energy sources must be as easily accessible as coal and biomass. He noted that community members can buy coal from nearby small businesses in their communities, so they could make their purchases as and when needed.

Another potential obstacle is the extensive work involved in implementing these projects, such as insulating or upgrading homes so that they can accommodate other forms of space heating. He said that communities may find it more convenient to simply continue using energy sources that have proved to be effective over time, even if they contribute to high levels of air pollution.

Sound community-level emissions monitoring

Reddy emphasises that the success of air quality offset programmes relies on sound community-level emissions monitoring, which was not without challenges. The greatest obstacle is the high cost involved, as air monitoring equipment is expensive and, if large areas need to be monitored, more monitoring stations will also be required.

Alternative fuels and energy sources have to be made more affordable, as coal and wood are more cost-effective and readily available for poorer communities

"There are also practical and logistical challenges to consider, including the need for security to safeguard monitoring equipment against theft and vandalism," he says.

Timeous maintenance and repair of monitoring stations in remote communities may not always be possible, potentially interrupting data collection of large areas. Despite all these challenges, Reddy is confident that the achievement of clean air in poorer communities far outweighs the complexities involved in implementing these projects. "Many people underestimate what a privilege it is to breathe in clean air, which reduces their chances of getting sick, as well as developing lung diseases and cancer."

Research was underway into various ways of offsetting their emissions by improving air quality in poor communities

ARE YOU PROUD OF THE WORLD YOU'RE GIVING TO THE NEXT GENERATION?

River pollution represents a public health crisis. The polluted water is not only an immediate harm to informal settlements that rely on it, but also a threat to natural ecosystems, and the water infrastructure that was not designed to handle the volumes of waste within the water. **By Duncan Nortier**

Tarryn Johnston, founder and director of the Hennops Revival and Deep Water Movement, has made it a mission to create awareness about river water pollution, as well as provide a safe platform for individuals, educational institutions, and private sector volunteers South Africa's rivers. Hennops Revival organises clean-ups that bring people together for the common goal of environmental care. Deep Water Movement is the larger-scope sister company, Johnston says, "After years of organising river ups, and getting to know more about the world of water, I realised we are in 'deep water' and Hennops, which is so area-specific, could not tackle all the problems I have learned about and faced. Deep Water Movement is the response to South Africa's larger water problems." In 2024, Johnston organised the Crisis Intervention Convention, which brought together disparate parts of the water, waste, and energy sectors sector to discuss what the problems and solutions really are.

Part of Johnston's self-prescribed mandate is to find unique solutions for the waste they collect from the river. Early last year, she had developed a paint that is waterproof and fireproof, from this waste and is currently still testing it and accrediting the product. "The NGO structure relies on donations, and while that is great and we have had immense generosity, funding remains a struggle. The goal is to get this paint to market as a for-profit initiative that could help the funding gaps we experience in the NGO part of our operations."

There is also a focus on the social aspect of waste, Johnston says, "We are working on upskilling, reskilling programmes as well as other waste as resource projects like interlocking bricks."

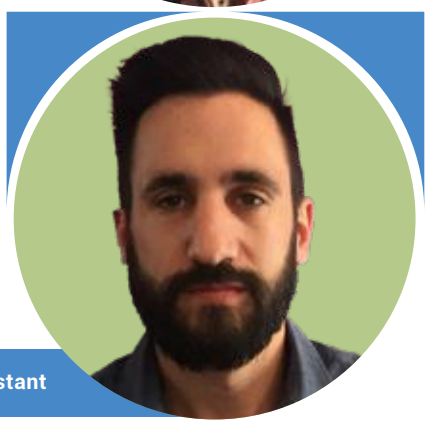
Speaking broadly, Johnston puts her years of experience on the ground into the root of the problems, "while everyone is blaming informal settlements, which do form part of the issue, no one is focusing on the broken waste management systems that allow private sector dumping and municipal failings. Transparency across the entire value chain will put an end to some of the illegal dumping, and while it is not popular, we need to sort out our landfills and waste services."

The ongoing effort of clean-ups

While there are plans to 'fix' the problems going on within South Africa, Johnston does expound on the need for clean-ups: "The task does seem never-ending, but right now, before we have tangible solutions and progress, there is a need to keep the clean-ups going."

The Mandela Day clean-up, a larger one considering government efforts to direct the public toward charitable causes, was a success both in terms of clean-ups and in trying out new strategies. Warren Rocchi, who works with Johnston, says, "Instead of an 'all systems go' approach, we tested cleaning up in waves with specific targets. We worked with arborists, who would go out with the team and mark invasive plant species, then

Tarryn Johnston, founder and director of the Hennops Revival and Deep Water Movement



Warren Rocchi, volunteer and admin assisstant

another wave would remove the plants, and other waves focused on the clean-up aspect." Rocchi states that this cleanup removed 2 077 bags of waste, 10 invasive trees, and 150 invasive shrubs.

Rocchi started as a volunteer, and when he noted that Johnston was inundated with admin, he took over some of the responsibility and aids the volunteer aspect of the operation. He works a full-time job and does this for free. He adds, "Right now, most of these bags are still being sent to landfill, which is still a step up from being in the river, but not ideal. We should be embarrassed by the world we are handing over to the next generation."

A river clean-up yields hundreds of bags of waste

Taking the efforts and lessons of Hennops, Johnston, and Rocchi came up with the "clean up in a box," which people can apply for these boxes for their clean-ups, and the box comes with all the necessary equipment. Rocchi adds, "clean-ups are harder than people realise, not just the labour, but the prep, and these boxes offer the right tools that might be overlooked and aim to spread to community spirit of Hennops Revival." These boxes also offer an opportunity for collecting additional water pollution and quality data from areas across the country,

Johnston adds, "We are currently testing out a citizen science test kit for monitoring South Africa's water from boreholes, taps, rivers, dams, lakes, estuaries, and the ocean. This kit is being developed so that the results are accurate enough to be used in court. We also offer to make these results understandable to the everyday person, because action comes from comprehension."

Beyond cleaning

The ongoing importance of clean-ups as an interim intervention is important, but Johnston is still aiming for a complete change. Adding emphasis to the urgency, she states: "According to the 2024 Annual Landfill Audit, which indicates that just 13% of audited Landfills meet the minimum basic requirements, and the rest simply don't. With the key function of landfills being fundamentally broken, we must ask 'now what?'

Moving beyond the clean-up, Hennops Revival, Deep Water Movement and Higherway Academy have partnered to host the 4th annual Africa Waste to Energy Symposium.

Johnston asks a pertinent question, backed by years of data and business records: "We have already removed over 5 million kilograms of waste from the Hennops River alone.

Will we continue to bury it, or will we use it for dignity and transformation?"

While the goal is to stop pollution at the source, river clean ups are still important in the interim

Sorting recycling is a crucial step in getting waste recycled

RECYCLING AT THE SOURCE:

A SMARTER WAY TO MANAGE WASTE

Recycling operations are context based, with no 'one-size-fits-all' approach. For recycling to be effective, it must be adapted to circumstance.

"We have no control over what the client wants us to get rid of, we have to deal with whatever is thrown away," says Reg Barichievy, team leader of Waste Synergy. "Where we differ from many of our colleagues is that they give clients a checklist. We prefer to go to site, look at the waste streams, and ask, what are your problems?"

Reg Barichievy, team leader of Waste Synergy

Barichievy emphasises that the source of the waste determines how it can be managed. Clean industries, such as retail, typically generate cardboard, pallet wrap and packaging, while production and construction environments produce 'dirtie'r waste, like steel offcuts, rubble and floor sweepings.

The company's strength lies in recycling on site. "If you have to pick it up and take it from site to another spot, you double-handle it, which doubles the cost and increases the risk of contamination," explains Barichievy.

A typical example is a shopping centre delivery yard, where Waste Synergy sets up containers and sorting tables. Staff separate recyclables such as cardboard, plastics, tins and glass from general waste. "We do not have the volumes or capital for sophisticated machinery like Europe. We use local labour, which is a very good solution. It creates jobs, and our staff sort manually with excellent accuracy."

Efficiency in practice

For Barichievy, efficiency is about how systems are set up. He gives an example of a shopping centre that insisted on 23 separate collection points. "If you have to go to 23 different points and collect everything, you employ two people just to walk around all day. That is inefficient. They are not recycling, they are fetching," he said. "A better system is to consolidate and sort in one place."

Clients are encouraged to recycle at source wherever possible. "If we can, we get the client's staff to recycle, because that is even more efficient," he added.

Waste Synergy's model is labour-intensive, which makes staff training central to

> **We cannot simply copy Europe. We need African solutions for African problems.** *Reg Barichievy, Waste Synergy*

its operations. “If I am talking to senior management, I will explain the financial benefits, maybe with a short presentation. But if I am working with staff on the ground we explain how and why things are done. Getting people to buy-in rather than having a new system imposed on them is essential to success.”

The training often takes the form of demonstrations, with bins emptied out to show what can be recycled and what must be discarded. “If we do not get people to understand why they are doing it, they will never buy in. We explain that waste is a global problem, and that by sorting properly we are helping ourselves and our children,” he adds.

Targets and reporting

To improve recycling rates, Waste Synergy relies on targets and regular monitoring. “Our staff have daily KPIs. If they have 15 bins, only five can go to general waste. They know what they are working towards, and they report on it. We in turn report to our clients,” Barichievy says.

Monthly reports break down general waste and recyclables into detailed streams such as cardboard, hard and soft plastics, polystyrene, glass and metals. Food waste is tracked by volume, with certification to prove it has gone to registered composters.

This data is not just for compliance. “Some clients actually use their waste data to manage their businesses,” Barichievy explains. One retailer used incoming and outgoing waste to track efficiency, while a hotel group used food waste data to adjust portion sizes and menu planning.

The biggest challenge to recycling remains cost. “The cost of landfill is going through the roof, particularly in the Western Cape. People are unwilling to pay more for waste services, but they are expecting more from us,” Barichievy notes.

Imported machinery is rarely appropriate. “We have seen many people bring in expensive equipment from overseas. It is inappropriately sized, too costly, and it does not work here. We are constantly looking for African solutions.”.

Waste-to-energy is often raised as an option, but Barichievy is cautious. “It is difficult and expensive. You need a reliable feedstock and infrastructure, which we do not have. For now, recycling, repurposing and alternative uses for materials remain the most practical solutions.”

Responsible waste management

For Barichievy, responsibility depends on the client’s mindset. “Some clients want nothing to do with their waste. They say, take it away and send us a bill. That is their choice, and at least they recognise the problem.”

Others take a more collaborative approach. “When we are on site, we understand them better, they understand us better, and together we create systems that work. The results are more efficient and everyone is happier,” he adds.

Ultimately, Waste Synergy’s work is about finding sustainable, practical solutions that create jobs, reduce landfill, and fit the South African context. Barichievy explains, “We cannot simply copy Europe. We need African solutions for African problems.”

Recycling often involves problem solving as waste is often mixed and uncategorised

Part of Waste Synergy's operations involves finding inefficiencies and rectifying them, in retail this involves consolidating waste collection points

CLOSING THE LOOP ON TEXTILE WASTE

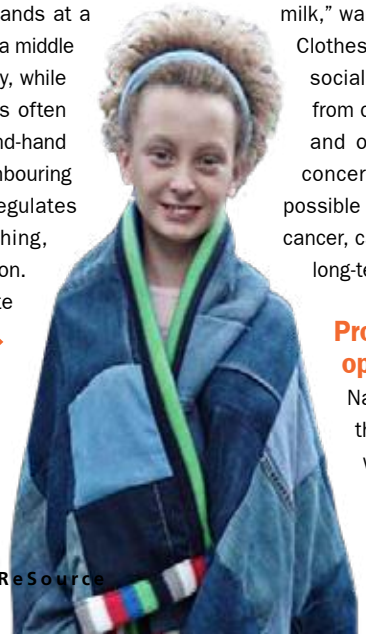
Jecendra Naidoo, founder of Clothes to Good and Tammy Greyling, operations director of Clothes to Good

The rise of the term "conscious fashion" suggests that much of the industry has been anything but conscious. For decades, fashion has been driven by overproduction, overconsumption, and waste, with little regard for the environmental and social consequences. **By Duncan Nortier**

Globally, the fashion sector produces around 100 billion garments a year, of which an estimated 85% end up in landfill. Greenpeace has reported that overconsumption in wealthier nations results in vast quantities of discarded clothing being shipped to the Global South under the guise of charity. Africa, in particular, has borne the brunt of this practice.

South Africa, however, stands at a complex intersection. It has a middle class that consumes heavily, while the working and underclass often rely on donations and second-hand clothing. Unlike some neighbouring countries, South Africa regulates the import of used clothing, which offers partial protection. Still, domestic textile waste remains a mounting problem. GreenCape's 2023 report found that textiles make up 6% of landfill in the Western Cape.

Beyond landfill space, textile waste is a growing health and environmental crisis. Fast fashion has accelerated the use of plastics in textiles and washing synthetic garments releases microplastics into water systems. "Microplastics have been identified in placentas and breast milk," warns Jecendra Naidoo, founder of Clothes to Good (C2G), a South African social enterprise. "The microplastics from clothing end up in water supplies and our bodies, and we should be concerned." Studies already suggest possible links between microplastics and cancer, cardiovascular disease, and other long-term health risks.



Weighted blankets made from repurposed denim help ensure neurodivergent children are cared for

Problems and opportunities

Naidoo is blunt about the scale of the issue: "The idea that clothes with tags on are hitting landfills in South Africa, a very unequal country, is horrendous. We must

Sorting is the most important element of textile recycling; each garment must be touched and assessed

turn these issues around." His organisation, Clothes to Good, has spent 14 years doing just that, diverting textiles from landfills and reimagining their use.

One breakthrough has been leveraging global fashion brands' commitments to Extended Producer Responsibility (EPR). While South Africa has yet to legislate EPR for textiles, global brands operating locally are bound by commitments made in Europe and elsewhere. "The benefit of global EPR is that it does help Africa," Naidoo explains. "Many countries ship out their downcycling, but in South Africa, we don't. We do the entire process here."

H&M was one of C2G's first partners, establishing collection points in its 28 South African stores. These alone bring in around 40 tonnes of clothing every month. Levi's has since joined, offering 20% discounts for denim donations. "The challenge is incentives," Naidoo says. "Too high and people abuse the system; too low and they don't engage. We've found models that work for different brands."

Sorting: The critical step

Once collected, the process begins with sorting, a task Naidoo calls "the most important part." He explains: "Textile recycling requires touching every garment. Each one must be assessed to determine what happens next."

The outcomes follow the EU waste hierarchy:

- Reuse & repair: Quality items are resold through microbusinesses, many run by mothers of children with disabilities.
- Upcycling: Denim is turned into weighted blankets for children with autism or anxiety disorders, or into other therapeutic products.
- Downcycling: Unusable clothing is shredded into fibre for automotive and construction industries.
- Destruction: As a last resort, items are responsibly incinerated, used only once in C2G's 14-year history.

Technology is adding precision to the process. C2G is piloting infrared scanning with UK partner MATOHA to identify fabric composition and integrating data with smart scales. "Sorting is critical," Naidoo says. "Tech like this ensures accuracy and efficiency while still being inclusive."

Partnerships extend into innovation. Trials with engineers have explored mixing shredded textiles into Zerocrete, a cement alternative, and even reprocessing crushed glass to lower costs of weighted products. "If we can bring the price of weighted blankets down from R50 to under R5, it makes them accessible to families who need them most," Naidoo says.

Social recycling

C2G calls itself a "social recycling company", and for good reason. One third of its workforce are people with disabilities, while its microbusiness model empowers parents, particularly mothers of disabled children, to earn a sustainable income by reselling pre-loved items in their communities.

Operations director Tammy Greyling, an occupational therapist by training, says this inclusion is fundamental: "Sustainability is about caring, for the planet and for people. Recycling creates the perfect kind of work for people with disabilities: structured, tangible, and meaningful."

Clothes to Good includes the social into the environmental and employs people with disabilities, providing them with dignity and an income

With textile extended producer responsibility regulations on the horizon, Clothes to Good are early adopters of the circular approach to fashion

The stories are striking. Steven, who secured his first job at age 54 through C2G, has since been named Employee of the Year multiple times. Another mother has supported her two children through higher education and purchased a home and car through income generated from reselling clothing.

Naidoo insists the link between social and environmental outcomes is inseparable: "We put just as much emphasis on the social as we do on the environmental, and when you join the two, you find a better way forward."

The road ahead

South Africa still lacks robust infrastructure for textile recycling, and much of the industry is under pressure to adapt. "Brands like H&M and Levi's have shown leadership," Naidoo notes. "But local retailers must step up. If South Africa introduces EPR for textiles, as it has for packaging and e-waste, we'll need collection systems, incentives, and collaboration in place."

He stresses that the challenge cannot be met competitively: "This is not a competitive space, it's a collaborative one. Reverse logistics is already reshaping supply chains. If brands can align on take-back schemes, we can scale solutions quickly."

As the world confronts the environmental cost of fashion, C2G demonstrates that waste can be turned into opportunity, and that inclusion can go hand in hand with sustainability. For Naidoo, the mission is clear: "Nobody is excluded from fashion. Unless you're walking around naked, you're part of it. That means we all share the responsibility for making it sustainable."

RE-INDUSTRIALISING COMMUNITIES THROUGH MUSHROOMS

South African rural and informal communities are poised to aid the circular economy. Daniel Motshwane, founder of Afrique Rising Trading (ART), a Pan-African social enterprise, aims to give communities the tools to bring income and 're-industrialise' these areas that need it most. **By Duncan Nortier**

Oyster Mushrooms are the second most grown mushroom in the world, and South Africa is catching up on this market

"When I talk about re-industrialising, I mean going back to a time when communities were vibrant with processing and employment opportunities," he explains. "Our old people were particularly good agro-processors, even though they were not called that. That is where I want to go with mushrooms, to industrialise these communities."

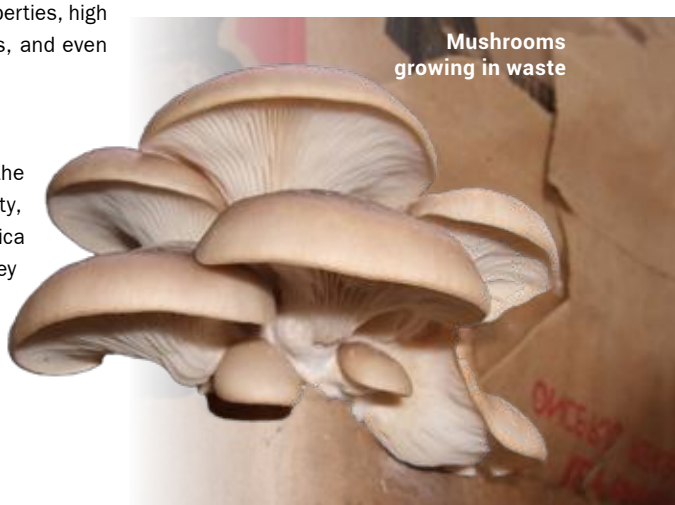
Daniel Motshwane, founder of Afrique Rising Trading

Motshwane's interest in mushrooms began in 2018 while visiting Malawi, where he encountered a couple training in mushroom farming. On his return to South Africa, he researches the sector extensively. "I saw a huge gap, especially for commercial farming within the black community," he says. "Mushrooms are labour-intensive, they bring social cohesion, and they have incredible nutritional properties, high in vitamins, proteins, antioxidants, and even anti-cancerous compounds."

Why oyster mushrooms?

Globally, oyster mushrooms are the second most widely grown variety, and Motshwane believes South Africa is only beginning to catch up. "They are natural decomposers. We can take many agricultural wastes and use them to grow mushrooms, which means we are also taking care of the environment and mitigating climate change," he says. "And you can harvest them from 21 days, which makes them an excellent starting point."

Oyster mushrooms present an innovative solution to the growing problem of organic waste. Long known as nature's recyclers, fungi break down tough organic matter and release nutrients in the process. Now, researchers and entrepreneurs, like Motshwane, are turning this natural ability into practical waste management strategies.



Mushrooms growing in waste

By growing mushrooms communities have access to training, and income in this growing market

Cultivating mushrooms on discarded materials such as coffee grounds, sawdust and crop residues diverts waste and creates value for those cultivating. Motshwane adds, "The communities we engage with source waste from their environment, many rural areas don't have good waste collection services and this way their waste becomes a resource."

This form of recycling embodies circular economy principles: waste is transformed into valuable products while reducing reliance on landfills and cutting greenhouse gas emissions. The approach is gaining particular interest in low-resource settings, where mushroom cultivation can create jobs, enhance food security and provide sustainable alternatives to conventional waste disposal.

More than mushrooms

Motshwane says that this goes beyond fresh produce. "I started with pastry products," Motshwane adds. "I developed bread and muffins with mushrooms, and now I am working on ready-mix premixes for hotels, as well as mushroom coffee. There is even interest in capsules, skincare products, and mushroom kebabs, because oyster mushrooms have a meaty texture."

Central to his mission is involving communities directly. "We advertise our programme through WhatsApp groups, which works very well. People spread the word," Motshwane explains. Once a group is mobilised, training follows, both online and in person. "Online training has really helped, especially across provinces and even in other countries. It also means I can provide ongoing mentoring."

The model is designed for scale. "I'm developing growing rooms that can be assembled on site in communities," he says. "We are also creating a franchise model, where people can produce mushrooms and make their own value-added products. That is where the real opportunity is, products that can be exported, extend shelf life, and create jobs."

Waste management and circular economy are at the heart of his work. "Mushrooms grow on different agricultural residues, sugarcane bagasse, maize stalks, sunflower husks, wheat straw, banana leaves, coconut husks. Most of these would be burnt, releasing carbon emissions. Instead, we capture that waste for food production," he explains.

The cycle continues after harvesting. The spent mushroom substrate, or SMS, is used to produce animal feed pellets, compost, worm farming inputs, and even bioplastics. "We can make bricks, packaging materials, and alternatives to polystyrene, all biodegradable," says Motshwane. "This is the circular economy in action."

Pan-African vision

Motshwane positions his business as Pan-African from the outset. "Before I even started the company, I created networks across the continent," he says. "I have travelled to many African countries, hosted entrepreneurs, and built relationships. People prefer doing business with someone they know personally, and I wanted to create that footprint."

His efforts are recognised with awards, including from the British Council in Ghana. Partnerships now stretch from Malaysia to India, with plans for biofuels, construction materials, and large-scale waste-to-value projects. "But first, I needed capacity. Farmers must be trained so that when we move into mushroom waste products, we have the volume required," he notes.

Motshwane is now preparing to scale up with government support and private partnerships. "The mushroom industry is huge, with over 14 000 known species. We are only working with one now, but as we grow, more opportunities will open for many other people."

Despite the challenges, his vision is unwavering: "Everything that is going to happen now is going to move very quickly. The model touches on all the points that government and communities want to see, jobs, sustainability, innovation, and African collaboration."

In East London, a company is changing how South Africa thinks about food waste. Nambu, founded in 2018, initially focused on farming insects as a protein source for livestock. Today, the business is positioning insects as an essential service in organic waste management. **By Duncan Nortier**

The role of insects in waste management

Lowell Scarr, CEO of Nambu

"We originally focused on insects as a protein source for livestock feed," says Lowell Scarr, Managing Director of Nambu. "That required high levels of biosecurity, which limited the waste streams we could use. Abattoir waste, catering leftovers and other high-risk materials were excluded because of the potential for disease transfer."

The company's early model produced high-quality protein meal, but Scarr says the South African market is not yet ready to adopt insect protein on a large scale. "The production costs are too high for it to be commercially viable right now. There are niche opportunities, but not enough to sustain us if that is the only focus."

Instead of walking away from the sector, Nambu has repositioned. "We realised that if we keep chasing revenue only from larvae sales, we would always be limited," says Scarr. "By shifting our model towards waste management, we can take in a much broader range of organic waste streams and generate revenue from managing those. The larvae become a tool to process waste, and what we harvest is then a by-product."

By products include frass and protein, adding value to waste

This shift allows the company to process post-consumer food waste, abattoir waste and meat scraps that were previously excluded. "We see the larvae less as the end product and more as the treatment tool," Scarr explains. "We can use them ourselves to feed our own poultry and pigs, instead of selling them off, which means we carry any biosecurity risk. Or we can sell them at a lower price to clients who are comfortable with that."

Insects as a Service

Scarr describes the pivot as moving from insects as a commodity to insects as a service. "It is about treating waste streams that would otherwise end up in landfill or low-value composting," he says. "This way, we can service more clients, increase our volumes and respond to the immediate need for sustainable food and organic waste management."

Black soldier fly larvae are at the heart of the system. They rapidly consume food waste and convert it into useful products. "By feeding

Storage and safe management is essential for this waste stream

waste to larvae, we produce proteins and fats that can be used in animal feed, biodiesel and even pharmaceuticals," says Scarr. "We also produce frass, which is a nutrient-rich soil enhancer with far greater value than basic compost."

The environmental benefits are significant. "Compared to composting, using black soldier fly larvae can cut carbon emissions by up to 50 percent," Scarr explains. "The process is also faster, taking about two weeks, whereas composting can take six months." This positions insect treatment for waste as an economically beneficial alternative to just composting, which Scarr says, "is still very important in the larger context of organic waste."

Low tech for local context

Scarr stresses that Nambu has developed a model suited to South Africa's conditions. "Our approach is pragmatic and relatively low tech. We rely less on expensive machinery and more on available labour. That is not a disadvantage in South Africa, where there is a need for more job creation and less reliance on unstable energy supply."

Instead of expensive HVAC systems and automated machinery, Nambu uses simple equipment and adaptable processes. "We look at what can be bought locally, what can be operated by staff with training, and what can function without heavy reliance on water or electricity," says Scarr. "It makes the business more resilient and allows us to scale in contexts where capital is scarce."

He points out that interest rates and financing conditions make capital-intensive projects more difficult in South Africa than in Europe or North America. "Here, borrowing is more expensive, so building systems that are less capital-heavy makes sense. We have to adapt to the reality we are in, not the one we wish we had."

The black soldier fly, a natural solution to manmade problems

Overcoming the "Yuck Factor"

Insects and waste come with stigma, but Scarr believes curiosity outweighs disgust. "People do find insects and food waste unpleasant, but they are also intrigued. Even those who recoil at first are often fascinated once they see what we are doing. We have had visitors who start by refusing to step into a facility, and end up with their hands in a container of larvae because they are so interested."

The challenge, he says, is often with waste producers themselves. "There is still a tendency to treat waste and those who handle it with disdain. If you are providing a paid service, you are treated with respect. If it is a free service, you are treated like waste yourself. That culture needs to change. Waste is the producer's responsibility. We are there to help them deal with it."

Nambu is exploring waste treatment using black soldier fly larvae

Nambu's shift reflects a wider movement in the insect protein industry. "Many of us started with a pure focus on insect protein," says Scarr. "But the market has shown us that in South Africa, it is premature. A pragmatic choice is to move towards waste management. That way, the industry keeps developing, the businesses stay viable, and the technology improves."

He remains optimistic about the future. "At some point, the market for insect protein will mature, and then we may see a shift back towards a protein-first model. For now, we are following the money, and the opportunity that we see is in waste. It is the best way to keep the lights on and to keep building the sector."

WHERE MEDICAL WASTE ENDS – and responsible disposal begins

Every day, healthcare facilities create volumes of waste that must be disposed of safely and effectively. **Kirsten Kelly** recently visited Averda's City Deep Electro-Thermal Deactivation (ETD) plant that receives around 1000 tonnes of medical waste each month.

The facility came under Averda's control in 2016. Since then, it has been extensively refurbished to become South Africa's largest and most advanced medical waste treatment plant.

"We have a powerful shredder that handles a staggering two to five tonnes of infectious waste per hour as well as an ETD oven that does not release CO_2 emissions," says Waldo Jansen Van Rensburg, business unit manager, Averda South Africa.

He adds that the ETD process uses heat generated by electricity to sterilise or deactivate pathogens and hazardous components in the waste, often leading to volume reduction and the potential for material recovery. "The ETD oven is currently achieving a 6.5 log. South African regulations typically require at least a log 5 reduction to consider waste properly decontaminated before disposal."

A log is a technical benchmark for sterility assurance in medical waste treatment. It refers to a logarithmic reduction of microorganisms – a measure of how effectively a treatment process (like sterilisation or deactivation) kills or inactivates pathogens. The scale is from 1–7 and a log 6.5 indicates that over 99.999% of the microbes have been destroyed. The ETD oven is highly effective at sterilising infectious medical waste.

Unlike many competitors who shred waste after treatment, Averda pre-shreds the waste. "This exposes pathogens within items like blood-stained linens, gloves, or nappies, allowing more effective sterilisation by ensuring heat reaches the waste core," explains Jansen Van Rensberg.

The facility uses a PLC-controlled conveyor system for automated waste movement. An auger pushes the shredded waste through an enclosed conveyor into an electrothermal deactivation system that sterilises waste at ±110 °C for 35–45 minutes. While most

Medical waste is one of the most tightly regulated waste streams in the country, with steep fines for any compliance failures

The Averda ETC facility receives roughly 50 tonnes of medical waste a day, which is equivalent to 30 full-sized waste trucks

From the moment waste is generated to its final disposal or repurposing, the entire process is tightly controlled

of the waste is wet by nature, a boiler is used to add additional moisture where needed. However, too much moisture can cause arcing and uneven heating.

The sterilisation process uses biological indicators (ampoules containing microorganisms) to test effectiveness – sterility is confirmed when the bacteria do not survive.

From shredding to heat treatment and compaction, the entire process is enclosed to prevent environmental contamination or worker exposure. The result is a fluffy, safe-to-handle output that is compacted and prepared for disposal or repurposing.

Types of waste received

Operating at 95% capacity, the City Deep ETD facility receives waste from both the public and private sector, with a strong focus on:

- Infectious waste: This makes up about 90% of the total waste processed at the facility. It includes blood-soaked swabs, dressings, gloves, masks, nappies, and other items contaminated by bodily fluids or patient excretions.
- Pharmaceutical waste: These represent a smaller portion (around 5–10%) of the waste stream.

Anatomical waste includes limbs or tissue, which must be incinerated rather than treated via ETD, autoclaves, hydroclaves.

Interestingly, medical waste is determined by the point of origin. For instance, used nappies at your house is general waste, but used nappies at a hospital is medical waste. Often, waste from laboratories cannot be classified as chemical waste as they may be testing biological samples like blood and organs. This cannot go to landfill but must be incinerated.

The Averda ETD facility does not treat radioactive, chemical, or anatomical waste through the ETD system, but it does screen for these and redirects them to appropriate treatment methods, including incineration at their Klerksdorp plant. The Klerksdorp facility is the biggest incinerator in the country where 800 tonnes of waste is treated every month. Both Averda plants are open 24 hours a day to accept and handle the large volumes of medical waste on a daily basis.

"Incineration reduces the volume of medical waste by at least 90%, and Averda South Africa diverts 100% of that waste, some of which is used directly by Averda as a co-blending treatment to solidify chemicals before sending them to their Vlakfontein landfill," states Jansen Van Rensberg. He adds that Averda are about to roll out a project whereby they will also divert 100% of their treated medical waste from landfill, which will be a first in South Africa. Treated medical waste has a better environmental profile than coal – it contains no mercury, sulphur, or arsenic, making it more suitable for energy applications.

Challenges in medical waste management

Medical waste is one of the most tightly regulated waste streams in the country, with steep fines for any compliance failures.

"Therefore, we see ourselves as not just managing medical waste – we proactively shield our clients from legal risk, address

> **"With on-site shredding, advanced heat treatment, AI-driven scanning, radioactive monitoring, and access to both incineration and landfill facilities, Averda ensures a seamless and fully compliant cradle-to-grave solution."**

From shredding to heat treatment and compaction, the entire process is enclosed to prevent environmental contamination or worker exposure

The ETD process uses heat generated by electricity to sterilise or deactivate pathogens and hazardous components in the waste, often leading to volume reduction and the potential for material recovery

If sharps are mistakenly placed in the infectious waste bin, they are isolated and sent to Averda's Klerksdorp plant for incineration

At the heart of Averda's medical waste treatment process, the ETD oven quietly delivers high-impact results – sterilising waste without combustion, smoke or odour

systemic compliance challenges, and help set the standard for responsible medical waste management in the country," adds Jansen Van Rensburg.

Another challenge is separation at the source. "Errors at hospitals – such as mixing sharps with general infectious waste – increases risk and non-compliance. We train hospital personnel in best practice methods to correctly segregate and containerise waste, but there is often a high staff turnover at hospitals. Additionally, overwhelmed and overworked staff may put the incorrect items in the incorrect waste bin. Fortunately, we do try to accommodate our clients as much as possible. We have in-house facilities that can handle all types of waste. For instance, if sharps are placed in the infectious waste bin, we isolate them and send them to our Klerksdorp plant for incineration," he states.

Averda's AI-powered scanner plays a crucial role in enhancing the safety and compliance of its medical waste treatment process. Installed at the point where waste enters the facility, the scanner uses advanced imaging and artificial intelligence to inspect red medical waste bags for non-conforming or hazardous items. This technology can detect anomalies such as cell phones, metal implants, anatomical waste, or radioactive materials – items that should not enter the ETD treatment stream. When such objects are identified, the bags are isolated and redirected to appropriate disposal methods, such as incineration. By identifying and removing unsuitable waste before processing, the AI scanner reduces equipment damage risk, improves treatment efficiency, and ensures adherence to regulatory standards.

To enhance safety and regulatory compliance, Averda uses an in-house Geiger counter to scan incoming medical waste for radioactive contamination. This handheld device is particularly useful for detecting radiation in waste streams from radiology departments or laboratories. It measures radiation levels in microsieverts and flags any waste that exceeds the permitted threshold of 75 microsieverts. Such waste is immediately isolated and redirected for specialist incineration. By using this technology, Averda ensures that only compliant waste enters the treatment process, safeguarding both staff and infrastructure.

From the moment waste is generated to its final disposal or repurposing, the entire process is tightly controlled. With on-site shredding, advanced heat treatment, AI-driven scanning, radioactive monitoring, and access to both incineration and landfill facilities, Averda ensures a seamless and fully compliant cradle-to-grave solution.

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4TH ANNUAL AFRICA'S WASTE TO ENERGY SYMPOSIUM

THEME: UNLOCKING THE WASTE TO ENERGY TRANSITION (FINANCE, TECHNOLOGY AND PROJECT DEVELOPMENT)

The future of waste to energy in the age of AI

Speakers

KeyNote Speaker

Marvelous Nengovhela
Director/Specialist of Waste Management
SALGA South Africa

Pravashen Naidoo
Founder & Chief Executive Officer
EWaste Africa

Aeren Young
Director,
Ammonite Environmental

Simon Bere
Solid Waste Mgt expert

Victor Manavhela
National Programme Manager
NCPC-SA

Tarryn Johnston
Environmental Strategist
Regenerative Waterscapes Initiative
Hennops Revival

Ms. Noxolo Mtembu
Renewable Energy & Climate
Change Mitigation Specialist
GIFA-SA

Eric Shunmagum
General Manage
ESKOM generation

Chisakula Kaputu
Snr Energy Specialist
Industrial Development Corporation

Hein Fourie
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Zero Waste Technologies

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M.D. Rowtar Holdings & AquaMoov
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South Africa faces a growing waste management challenge. With urban populations expanding, consumption patterns shifting, and recycling rates still relatively low, the pressure on landfill sites to perform is high.

Aerial view of an engineered landfill site after construction

EXTENDING THE LIFE OF LANDFILLS:
Engineering, Compliance, and Smart Operations

While public discourse often rightly focuses on recycling, diversion and alternative waste treatment technologies, the reality is that landfills will remain a necessary part of the integrated waste management lifecycle for years to come. The question, then, is how to extend their lifespan in a way that is both technically sound and environmentally responsible.

For Reon Pienaar, a professional civil engineer at the specialist waste management consulting company JPCE (Pty) Ltd, this challenge lies at the intersection of engineering, regulation, and day-to-day operational practice. "Landfills are designed with a limited capacity," he explains. "Every site has a finite amount of airspace. The job of engineers, license holders and operators is to manage that airspace as intelligently as possible, without compromising compliance or the environment."

Reon Pienaar, a professional civil engineer at the specialist waste management consulting company JPCE (Pty) Ltd

The problem is often referred to as the 'airspace crisis,' and Pienaar says, "Landfills are excavated and lined with the disposed waste volumes then dispersed across the operational area of the site or cell. This gets compacted and covered with soil, and eventually the waste body increases to above natural ground level up to the maximum allowable height. Airspace refers to the volume that is available to be filled with waste in the excavated and built-up waste body above ground level, and is constrained by the maximum licensed height and safe, stable final landfill outer slopes." The landfills in South Africa are filling up, and the airspace, while crucial, is limited.

While diversion, separation at source, and recycling have received a big push as of late, the data suggest that as much as 80% to 90% of South Africa's waste is still heading for landfill sites. Pienaar adds, "While it is important to aim high and look at countries with a high landfill diversion rate, we need to look at and understand our context in South Africa. Many rural and informal spaces do not even receive a basic waste collection service, and most collected waste is often taken directly to landfills. It is also important to note that even with a high recycling and diversion rate some waste remain unrecoverable and landfills will still need to exist to accommodate this."

Engineering from the Ground Up

The issue becomes 'how does South Africa extend the life of its current landfills' in order to accommodate waste, and continue basic waste removal?

Extending landfill life begins even before the landfill is operational. From the design stage, engineers must anticipate how the site will behave over decades. This involves a complex interplay of geotechnical, hydrological, social, economic, and structural considerations.

"If you don't design a landfill properly from the start, you immediately shorten its sustainable life," Pienaar emphasizes. "The slopes must be engineered to remain stable as waste accumulates. Your drainage systems must be designed to handle both stormwater and leachate and your lining system must be designed to protect the underlying groundwater. If any one of these elements are compromised, the whole sustainable lifespan of the facility is affected."

Pienaar adds, "Waste management is still a relatively new field of engineering in South Africa, only really starting to gain importance in the 1980s. Dumps, as opposed to engineered landfills, were the dominant way of handling waste and these have a horrid impact on the environment. Comparing them to what we have

The airspace crisis means that landfills will have to be operated more efficiently if they are to continue receiving waste

today, in engineered landfills, is night and day. South Africa is always improving in the management of our waste, and most importantly we have good and strong regulations to assist us."

The life span of a landfill site is dependent on the license conditions issued for each facility.

Stormwater is a particular challenge in South Africa's variable climate, where heavy downpours can overwhelm poorly designed systems. Pienaar notes: "To aid in the optimization of sustainable landfill life, landfills need to be designed and operated to ensure separation of clean and dirty water. Engineered stormwater channels need to keep clean stormwater from entering the waste body end engineered drainage systems need to manage the rainwater within the landfill." Modern engineered landfills include the use of geosynthetic materials in the liner design, some of which act as a barrier between the underlying soil and the waste, preventing leachate from contaminating groundwater resources. Other geosynthetics assists with drainage of leachate which is essential to keep the landfill efficient."

The complex engineering of modern landfills means that these sites are built to perform as sustainably as possible

Equally important is compaction. The density of waste, achieved through the right compaction methods and machinery, directly translates into extended airspace. "The difference between poor compaction and optimal compaction is measured in years," says Pienaar. "You can gain years of additional life in the landfill just by ensuring proper compaction techniques are consistently applied."

Operations: Daily decisions, long-term impacts

Even the best-designed landfill can fail prematurely and become a risk for pollution if operations are weak. Pienaar highlights the role of daily cover, cell management, and strict operational discipline in maximising lifespan.

"Every day, operators are making decisions that affect the long-term viability of the site," he says. "If cover material is not applied sufficiently or done inconsistently, you can end up with odours, vermin, and fire risk as well as pollution from wind-blown litter. If you allow trucks to tip waste randomly, instead of managing a controlled cell, you can lose compaction efficiency and airspace. These small decisions add up over the years."

He stresses that landfill life extension is not simply about stretching the available airspace, but also about ensuring compliance and safety. "We should not be extending lifespan for the sake of it. We need to be extending landfill lifespan in a way that protects the environment, prevents contamination, and keeps the landfill aligned with regulatory standards."

In this sense, compliance with the National Environmental Management: Waste Act (Act 59 of 2008) becomes more than just a box-ticking exercise. It becomes a driver of innovation. "South Africa's regulations are very

Installation of geosynthetic materials as part of an engineered landfill liner, a key piece of tech that helps prevents environmental damage

clear on landfill licensing, lining, monitoring, and rehabilitation," Pienaar explains. "That framework pushes us as engineers to find smarter ways to design and plan. Compliance is what forces us to innovate."

No discussion of landfill lifespan can ignore the role of waste diversion. While engineering and operations can squeeze more years out of a site, the ultimate solution is to reduce what goes into the landfill in the first place.

"The less you put in, the longer the site lasts. It really is that simple," says Pienaar. "Separation at source, material recovery facilities, composting of organics, crushing and beneficiating builder's rubble, these are all essential tools for reducing the volumes that reach landfill."

Pienaar points out that organic waste is particularly problematic. "Organic waste breaks down and generates methane, which is both a greenhouse gas and a fire risk if not responsibly managed. By diverting organics, we not only extend landfill life but also reduce emissions and safety risks." There is an entire industry dedicated to managing organic waste, using it for a range of technologies from composting to Anaerobic Digestion, which is much better than ending up in landfill sites where it can become a problem.

Recycling rates remain a challenge in South Africa, with only a fraction of potentially recyclable materials currently being recovered. For Pienaar, this represents both a challenge and an opportunity. "Every tonne of recyclables we recover is a tonne less waste into the landfill and directly results in airspace saved. That is why we see recycling not only as an environmental imperative, but as an engineering strategy for landfill life extension."

South Africa's new extended producer responsibility laws (EPRs) have taken effect, and while optimistic Pienaar says, "It's too early to tell the full scope of impact, but it's promising and a very important part of managing the waste lifecycle to minimize waste to landfill."

The lifecycle of a landfill is dictated by licensing and legal obligation

Technology and the future of landfills

As the waste sector modernises, technology is playing an increasing role in extending landfill lifespan. Data-driven monitoring systems allow for real-time tracking of compaction density, leachate levels, and gas emissions. Gas-to-energy projects convert methane into a usable energy source while reducing environmental risks.

Lengthening the life of a landfill begins with diverting waste from the landfill

Pienaar says. "The landfill itself has very little in the way of tech on site, but the correct compacting techniques and equipment, measuring and monitoring tools, and on-site recovery all aid in extending the lifespan of a landfill." For Pienaar, the technological advancement is the way engineers design the landfill to make it as efficient as possible in protecting the surrounding environment.

He believes that a cultural shift is also needed. "We must stop thinking about landfills as the only option. They are part of a broader, integrated system that includes recycling, treatment, and energy recovery. The landfill of the future is not just a hole in the ground; it is an engineered facility that sits within a circular economy."

Rehabilitation: Planning for the end at the start

Extending landfill life also means planning for closure. Rehabilitation is a legal and environmental requirement, but Pienaar sees it as more than that. "When we design and operate a landfill with rehabilitation in mind, we are already extending its effective lifespan. We are reducing risks that could shorten its usable life, and we are creating a plan for what comes after." In effect, the land can be rehabilitated and used long after closure, meaning the landfill's real-life extension goes beyond the operational phase.

He explains that post-closure land use, whether as green space, solar farms, or other community assets, depends on how well the landfill has been managed during its operational phase. "If you cut corners during operation, you leave a legacy of problems. If you operate properly, you leave behind opportunities."

Ultimately, extending the life of landfills is about balance. Engineers must balance capacity with environmental protection, compliance with practicality, and short-term costs with long-term sustainability.

"Every decision, from the design table to the daily cell operations, affects the life of the site," Pienaar concludes. "We must see landfills not as dumping grounds, but as highly engineered systems that require expertise, discipline, and forward thinking. If we do that, we can extend their lifespan in ways that benefit both the environment and society."

FROM WASTE TO RESOURCE MANAGEMENT:

INSIDE THE TONKMETER RESOURCE FACILITY

As South Africa embraces circular economy principles and pushes for higher recycling rates, landfills remain a cornerstone of national waste management. Yet, their role is evolving. Modern facilities are no longer just about disposal, they are about minimising impact, recovering value, and managing waste as a resource.

This is the vision behind the Tonkmeter Resource Facility, a new-generation landfill in Gauteng. Since opening in March 2025, Tonkmeter has positioned itself not only as a site of waste burial, but as an integrated resource recovery hub.

A long road to reality

Alan Clarke, Director at Verref Capital, traces Tonkmeter's origins back more than a decade. "Verref was originally part of Anglo American's non-core assets," he explains. "We operated one of the largest refractory businesses in Africa until 2012, then pivoted to property and infrastructure development, ranging from retail to renewable energy."

The idea for Tonkmeter began in 2011. By 2017, Verref had secured a waste management licence, but struggled to find a buyer. That's when a strategic decision was made. "Instead of selling, we partnered with Leon Grobbelaar, CEO of Raalebborg Environmental, and built the first phase ourselves," Clarke explains. The result: Tonkmeter Resource Facility, a venture with Verref as majority shareholder and Raalebborg as operating partner.

Engineering for environmental protection

Tonkmeter is classified as a Class B facility, meaning it accepts general and non-hazardous waste streams. Its engineering, designed by Peter Legg Consulting, goes far beyond regulatory compliance.

"The first cell includes a compacted clay liner (CCL) consisting of four layers of 150 mm each, combined with a high-density polyethylene (HDPE) liner and a 300 mm stone drainage blanket," explains Grobbelaar. "This ensures

Leon Grobbelaar, CEO of Raalebborg Environmental

that leachate is captured and diverted to sumps and storage dams, protecting groundwater." The construction of the first cell and the associated infrastructure was completed by Jodan Construction in December 2024.

Crucially, the site's own clay was suitable for liner construction, rare in the industry. "It has infiltration rates as low as 10^{-8} cm/s," Grobbelaar says. "Some of the best clay our engineers have seen. It allows us to build a durable, natural barrier without relying solely on synthetic liners."

Further innovations include subsoil drains installed two metres below the liner to relieve groundwater pressure, and embedded instruments to monitor stress, temperature, and chemical balance in real time. "It's not just about tracking seepage," Grobbelaar adds. "We monitor the conditions that affect the liner's lifespan and share that data to inform future designs."

Despite robust infrastructure, unexpected challenges have emerged. Over 4 000 cubic metres of water, a large amount of this from a leaking Rand Water pipeline, had to be pumped and treated like leachate and subsoil water. "It's clean water, but we have to manage it as if it could be contaminated. That's the reality of designing for resilience," says Grobbelaar.

Operations with a circular ethos

Tonkmeter is engineered for operational efficiency and environmental care. Waste is compacted and covered daily to control odours and prevent wind-blown litter. Aeration systems assist in treating contaminated stormwater.

Transport logistics are carefully managed: large 'walking floor' trucks deliver bulk waste from transfer stations, reducing traffic, emissions, and risk. The facility currently processes 6 500 tonnes per month, with capacity to scale up to 20 000 tonnes.

But the ultimate goal isn't volume, it's value recovery. "Airspace is expensive," Grobbelaar explains. "We recover as much as we can before anything is buried. That's why we call it a 'Resource Facility.'"

Strict compliance and community accountability

Tonkmeter's journey wasn't without hurdles. "Our original waste licence was declined," Grobbelaar recalls. "We appealed, won, and now operate under tight conditions: annual external audits, quarterly community meetings, and regular compliance reviews."

Community transparency is a cornerstone of operations. Located near to a municipal landfill, local residents are familiar with waste issues and demand accountability. "We report regularly on volumes, environmental performance, challenges, and corrective actions," says Grobbelaar. "It builds trust."

Towards an integrated resource facility

Tonkmeter was always meant to be more than a landfill. The facility is transitioning into a full resource recovery hub, with a recycling and recovery centre expected to be operational in 2026. This will enable on-site material recovery, job creation, and support for local waste pickers.

Future plans include:

- Solar power generation on capped landfill cells
- Gas-to-power systems that capture methane for energy
- Employment and SMME development via waste-based enterprises

"We're building a circular model," Grobbelaar explains. "Disposal is the last resort. We prioritise recovery, energy generation, and community support."

Economic and social inclusion

Tonkmeter also plays a broader economic role. "This facility doesn't just manage waste, it creates jobs and supports local businesses," Grobbelaar stresses. Plans include formalising waste picker operations, providing training, safety gear, and reliable income.

"It's about building an ecosystem where waste is managed responsibly, and livelihoods are supported."

Challenges and expansion

Despite its strengths, Tonkmeter faces challenges. The Rand Water leak continues to be a burden, adding infrastructure and operational costs. Additionally, extreme weather tested the site early on, with over 500mm of rainfall within the first three months of operation. "Our systems were stress-tested from day one, and passed," Grobbelaar says.

Expansion is already in the pipeline. The first extension begins in 2026, followed by Cell Two in 2027. Tonkmeter is designed for a 35- to 40-year lifespan, with capacity to scale as waste volumes and recovery operations grow.

A new standard for South Africa

For Grobbelaar, Tonkmeter represents a shift in thinking. "This isn't a dump site. It's a fully integrated waste management facility," he says. "From the liners and leachate systems to our future recovery centre – every part of this facility is about protecting the environment, recovering value, and building a circular economy."

As South Africa continues to struggle with municipal landfill failures and illegal dumping, Tonkmeter offers a new model: technically advanced, environmentally sound, and socially inclusive.

"This is the direction we need to go," Grobbelaar concludes. "Waste is not going away but we can change how we deal with it. Tonkmeter shows that it can be done, and be done properly."

Compaction on-site

Overview of the first developed cell

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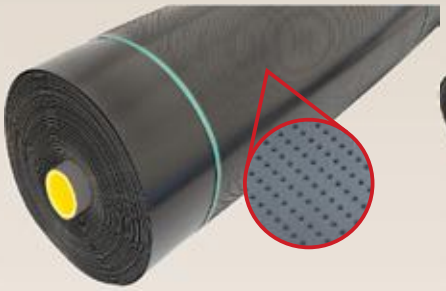

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RECYCLING E-WASTE:

Barriers to effective recycling

The rapid rise in the global population, coinciding with the manufacturing, mining, processing and demand for consumer goods, has placed additional pressure on waste management.

Whilst there is an ongoing effort to divert waste, both municipal and industrial, through policy, guidelines, stakeholder engagement by government, sustainable development goals (SDGS), environmental, social, and governance (ESG) indicators, and a general push towards sustainability, there are still fundamental gaps that need addressing.

Adding to this growing gap in recycling improvement is the advent of technology and digital products, creating another recycling challenge of its own. Among all the waste streams, e-waste stands out as one of the fastest-growing and most problematic due to its hazardous nature and recycling challenges. With electronic waste recycling, the following aspects can hinder recycling and effectively be barriers:

- Complex composition of materials – you find motherboards are glued together, making it difficult to separate recyclable parts
- Some materials like Cadmium, Mercury, and PFAS (Polyfluoroalkyl substances, a group of synthetic chemicals having resistance to heat, oil and water) in some coatings pose a challenge for separation and re-use.
- The complexity of some hazardous materials means that the research and development of new technology to treat such materials can be very expensive and could require numerous steps before being able to be recycled or reused.

FIGURE 1: Role of education and awareness in the recycling chain

- The competitive push to develop the best products means there is a continuous drive to have the leading technology out in various products; however, little thought is given to the "end of life" management of these products. This creates the burden of building stockpiles of used products with electronic components where no recyclable solutions are commercially available. This links directly to the Extended Producer Responsibility (EPR), and this is largely lacking and fragmented, as mainstream manufacturers of these products are situated in various parts of the world where compliance and commitment to recycling are variable.
- The economics of recycling can easily outdo the costs of manufacturing an electronic component in a product. The investment costs in recycling may not prove to be feasible for the producer.
- The lack of awareness and education towards promoting recycling and re-use of materials is a fundamental problem across the entire value chain of e-waste. As shown in figure 1, there is an opportunity to create education and awareness in the recycling chain.

Looking at it together, these barriers illustrate why global e-waste recycling rates remain stubbornly low despite advances in sustainability frameworks.

Further to this, it is also worth noting the socio-economic and environmental dimensions in the recycling of e-waste:

Neeraj Mannie, strategic infrastructure and sustainability executive

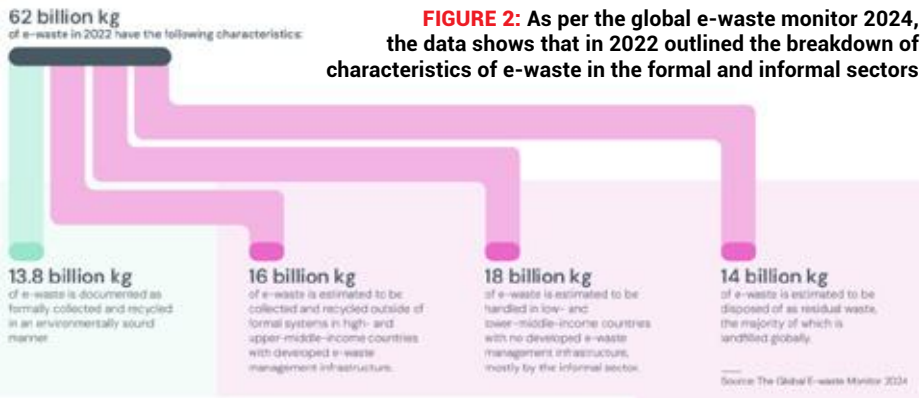

FIGURE 2: As per the global e-waste monitor 2024, the data shows that in 2022 outlined the breakdown of characteristics of e-waste in the formal and informal sectors

Most e-waste is managed outside formal collection and recycling schemes. As a result of non-compliant e-waste management, 58 thousand kg of mercury and 45 million kg of plastics containing brominated flame retardants are released into the environment every year. This has a direct and severe impact on the environment and people's health.

- Human health: Informal sector workers (often children and women) are heavily exposed to toxins from manual dismantling, open burning, and acid leaching.
- Economic shrinkage/loss: The lost value of raw materials in e-waste (gold, rare earths, copper, palladium) is huge. The Global E-waste Monitor estimates this to be over USD 60 billion annually.
- Environmental persistence: Hazardous additives like brominated flame retardants, PFAS, and heavy metals not only affect soil and water but also accumulate in ecosystems and food chains.

In terms of recycling data in e-waste, the following indicates the trend:

As per the global e-waste monitor 2024, the data shows that in 2022 outlined the breakdown of characteristics of e-waste in the formal and informal sectors in figure 2. Interestingly, the estimates still show that 14 billion kg is disposed of as residual waste in landfills. These statistics indicate an estimated 22,3% of e-waste was formally collected and recycled.

Opportunities and solutions for improving e-waste recycling

To meet the e-waste barriers:

- Manufacturers should focus on design for the end of life of electronic components. With this focus, they follow a circular approach towards effective product stewardship and recycling.
- As a producer, develop a common thread approach towards extended producer responsibility globally, you follow the relevant policies across the various countries, but also ensure that you demonstrate a commitment towards EPR.
- Establish strategic relationships with innovation hubs, technology manufacturers, eg, Plastic recycling, metal recycling, specialised technology suppliers like pyrolysis and others.
- Working closely with the informal sector to educate them further on how to work better with electronic components and products to reduce risks, improve working conditions, especially around health impacts and environmental contamination.
- Active awareness campaigns with consumers to get them to learn and practice how to dispose of and recycle electronic components safely.

Despite several campaigns and global initiatives, e-waste recycling still remains fragmented, and with global recycling figures as low as 22.3% as formally collected and recycled, the situation indicates that there is a lot more work to be done well into the future. A fundamental shift is required in attitude, behaviour, mindset and commitment to want to have a risk-free and healthy environment. Recycling e-waste is not a one-man job; it's a collective effort by all parties to achieve the success we all seek.

Complex components make e-waste recycling difficult and labour-intensive

GREEN JOBS OFFER HOPE IN SOUTH AFRICA

Resell is a programme offers women a chance at their own business

Unemployment and poverty are major challenges for South Africa, and while relatively new, the circular economy offers tangible economic benefits and capitalises on the entrepreneurial spirit of South Africa. **By Duncan Nortier**

For Taking Care of Business, TCB, a non-profit that seeks to train and aid unemployed people to escape poverty through sustainable practices, the circular economy is socially as well as environmentally beneficial.

The Repair programme diverts waste from landfill and offers a new life for consumer electronics while generating income for communities who need it

Tracey Gilmore, co-founder of TCB, says, "South Africa's unemployment level is obviously a huge problem. We need to relook at how we solve this crisis, and the potential to create sustainable employment is linked to the transition to the circular economy."

Instead of focusing on creating jobs, TCB focused on equipping people with skills and giving them the support to start their own businesses. "This focus lessens marginalised people's reliance on others for work and creates a safe space for people to heal and focus on deep relational work enables us to feel connected to our common humanity," adds Gilmore.

The programmes

TCB breaks their overarching initiative into programmes that aim to help different people at differing skill levels:

Resell: Launched in 2010, equips unemployed mothers to become successful clothing traders during a 2-year Enterprise Development programme. Their businesses are fueled by the, generous impact focused, donations of excess clothing and merchandise sourced from within the retail and manufacturing sector, which reduces fashion waste. TCB partners include Woolworths, MRP, Truworths, PicknPay Clothing, TFG, PEP, CottonOn, My Runway, and Steve Madden.

Repair: Gilmore explains, "When Clicks approached us in 2014 we were inspired to launch TCB Repair. We equip unemployed South Africans, mainly men, with the skills to repair appliances and run their own appliance repair and trading businesses in this 2-year training programme. Damaged, broken and excess stock is donated by retail partners and the public. It is then repaired and sold to reduce e-waste. TCB partners include Clicks, Shoprite, Home of Living Brands and @Home.

Remake: Clothing off-cuts represent a sizeable waste stream within the clothing manufacturing industry. Gilmore adds, "We equip seamstresses to run financially viable micro-manufacturing businesses. Donations of fabric, off cuts, cut samples, and haberdashery sourced from within supply chain partners support this circular economy programme. TFG, Truworths and a few CMT factories support our expansion potential."

Tracey Gilmore, co-founder of Taking Care of Business

The informal economy, and microbusinesses are vital to the economic activity of poorer communities

There is also a Redistribute programme, which takes in direct donations and helps distribute resource to charities This programme supports 80 registered not-for-profit companies and donates 1.2-million-rand worth of products annually.

Social and environmental impact

Gilmore explains, "Whenever we address sustainability, we are also addressing socio-economic issues. As a country, we need to see how they go hand in hand; if we forget the social impact and don't plan for it, we are missing an opportunity, and if we address social issues without taking the environment into account, we exacerbate the problem." This line of thinking runs through TCB, where the social impact and environmental impact rely on each other. South Africa's high unemployment means that those most affected by climate change are often not thinking about sustainability because they are focused on surviving. "TCB starts as a social empowering project and as people go through the programme, they are also educated on the environment and how this work helps the broader communities they are a part of," adds Gilmore.

TCB's 2025 annual report indicates that over a 15-year period of equipping people with these skills has generated R564 million in profits from waste items by their circular economy entrepreneurs. It also reports that 7 927 people have been recruited through their programmes. This has led to 23 million items being diverted from landfills. "The items diverted from landfills encompass a large number of waste streams, and because these items are still adding value, it really demonstrates that what we are willing to throw away can be a vital resource for others. This mindset change of seeing waste as a valuable resource can really help shape the South Africa of tomorrow. One that is more sustainable and circular," says Gilmore.

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Leachate is a contaminated liquid formed when rainwater or moisture percolates through waste, absorbing various pollutants. Its complex and variable nature makes treatment difficult. **Kirsten Kelly** speaks to Dr Nthabiseng Motsoane, EnviroServ's national technical manager, to discuss the challenges of leachate treatment and methods used to manage it effectively.

When you've conquered leachate, everything else is easy

Leachate management often begins before the leachate is even produced. "In our landfill cells, we have a network of collection pipes, sumps, geomembranes and grid-net detection systems that are designed to protect the environment from leachate. Furthermore, we often pre-treat any liquid waste before it is disposed of at our landfills. For example, oils are stabilised with natural additives to form a solid mixture," says Motsoane.

EnviroServ has also adopted progressive capping of its landfills. This is the covering of a landfill area with a barrier layer during its operational life. The progressive capping minimises the area of waste exposed to water and so reduces precipitation ingress as well as emissions from a landfill area. Any rainwater on top of the barrier layer is then collected through a stormwater drain as it is not contaminated by waste. This significantly reduces the volume of leachate that EnviroServ landfills generate.

The variable nature of leachate

Motsoane explains that each landfill or in EnviroServ's case, integrated waste management facility, produces a unique type of leachate, which requires a tailored treatment approach. "The chemical composition of leachate differs from site to site depending on the waste streams accepted. Leachate at our Holfontein waste management facility differs to that at our Chloorkop waste management facility."

An added complexity is the changing chemical composition of leachate over time, with chemical oxygen demand (COD) and biological oxygen demand (BOD) levels diminishing as the leachate ages. Increased levels of salts, heavy metals, ammonia, and nitrogen may be

Dr Nthabiseng Motsoane, EnviroServ's national technical manager

observed during the later stages of leachate development.

Each landfill must be assessed on a case-by-case basis, considering its operational history and the nature of the waste it has received – whether organic, inorganic, or a combination of both. The chemical composition of the resulting leachate should be thoroughly analysed for each site before deciding on a treatment option – keeping in mind that the end product after treatment must legally comply with discharge standards. These discharge standards often differ from province to province.

Treatment options

Motsoane strongly recommends the pretreatment of leachate before using reverse osmosis. "Typically, a biological treatment would be applied to leachate before using membranes where one would use micro filtration, followed by ultra-filtration, nano filtration and lastly reverse osmosis (RO). RO membranes are semi permeable, extremely sensitive and can easily foul. While RO membranes extract most salts, they cannot completely remove ammonia. Therefore, biological treatment should be used at the beginning to break down the nitrogen."

A biological treatment method used by EnviroServ at one of their sites is an anaerobic sequencing batch reactor (SBR). This is well suited to leachate that is high is ammonia. The ultra-filtration membranes remove the suspended solids, and total dissolved solids (TDS).

"Other pre-treatment options (before RO) include chemical or physical precipitation. In Uganda we receive both water-based and synthetic-based slops from a client that we must treat before sending it to a landfill. We coagulate the water-based slops using a polymer and chemical, where the solids sink to the bottom and the water rises to the top and is then extracted. Synthetic-based slops that contain oil has a lighter density than water, so the water has to be extracted from the middle," adds Motsoane.

EnviroServ uses a leachate evaporation system as well as membrane technology at their sites.

As a SUEZ company, EnviroServ has gained even more intellectual property, skills and knowledge into leachate management, with global references and broader expertise. "We engage with international technical experts on almost a daily basis," says Motsoane.

Leachate treatment plant in Uganda

EnviroServ recently commissioned a leachate treatment plant in Uganda in order to ensure high-quality water recovery while adhering to stringent National Environment Management Authority (NEMA) regulations. The facility utilises advanced two-stage RO technology, designed to process up to 450 m^3 of wastewater per day. The recovered water is used for dust suppression and flushing toilets, providing significant value given the landfill's remote location and limited water access. Some of the treated water is even sold to nearby businesses.

"Although the water quality after the first RO treatment is already high and meets or exceeds discharge standards, we installed a second RO system to provide an additional level of assurance," states Motsoane.

This commitment to quality is matched by an equally strong focus on safety.

Safety first

EnviroServ has an excellent health and safety record and is aligned with best-practice global standards. "If untreated, leachate can be hazardous substance, and anyone handling it is trained accordingly and always wears the appropriate personal protective equipment. I am very focused on keeping all treatment plants clean, with everything clearly labelled. Safety incidents are usually caused by the simplest of errors, and a clean site is a safe site," emphasises Motsoane.

The circular economy is not just about waste management, it's about enabling sustainable practices at the heart of social systems

What does the circular economy actually mean?

While the 'circular economy' is often discussed within the context of waste management, it is not just about waste management. Professor Linda Godfrey, principal scientist at the CSIR, says, "The circular economy is not a synonym for recycling, nor is it just waste management. It is about sustainable resource management."

Professor Linda Godfrey, principal scientist at the CSIR

This circular approach contrasts with the linear economy, which follows a 'straight line' of use from extraction to disposal. Prof Godfrey adds, "The circular economy is about national resource-security in support of socioeconomic development – through sustainable resource utilisation." This approach to the economy sees a radical shift in resource extraction, design, manufacturing, and end of life, and has been gaining popularity in the face of climate change and global shifts in carbon minimisation.

Why change is needed

Godfrey says, "The circular economy emerged as a response to the current economic system which takes resources for granted and uses them in an unsustainable manner. The global research is quite clear that the demand for finite natural resources is rising amidst the depletion of said resources. we have seen four main drivers of a circular economy transition, emerge globally: resource scarcity, environmental (climate mitigation, halting biodiversity loss and reducing water stress), economic recovery, and socio-economic development."

According to the International Resource Panel (2019), resource extraction and processing is responsible for 50% of climate impacts, 90% of water stress, and 90% of biodiversity loss due to land use. This is the context that underpins the urgency for the circular economy. If we are to address the big planetary crises facing us, with must rethink our resource use.

The continued demand for resources led to the European Commission identifying 14 Critical Raw Materials (CRM) in 2011. These are considered a constraint to European industry and value chains and in 2023 the list was updated to include 34 CRMs. South Africa has also published its list of CRMs in a 2025 document titled, "Critical Minerals and Metals Strategy which also includes mitigation strategies. Godfrey adds, "We are likely to see the first depletion of key resources in our lifetime. The warnings signs are clear."

South Africa's informal sector is already aiding the circular economy, but it is not as efficient as it could be. This image is shared under creative commons licensing

Growing resource constraints are now affecting manufacturing around the globe., In 2025, we have seen the impact of China's squeeze on rare earth exports, causing major disruptions across automotive and electronics supply chains, causing businesses to either change their operations or shut down.

The threat of climate change is also a major driver of the circular economy. The World Economic Forum suggests that climate change is currently the second biggest threat to the world's economic system but will become the biggest threat in the coming 10 years. Along with climate change, its various effects such as permanent changes to the earth, biodiversity loss and natural resource loss emerge as

The coming years will see resource depletion if no action is taken, which necessitates new approaches to the economy

greater threats than the current biggest threat, mis, and dis-information.

Godfrey says, "What we see happening now is the result of years of adhering to an unsustainable economic practice that sees access to inexpensive material, energy, and labour as infinite and necessary.

A case study for the circular economy

Godfrey points to our current attitudes, both personally and commercially, to consumer electronic products (CEPs) as an example of the problems associated with the linear economy and a path towards circularity, "The current approach to CEPs follows a highly linear process, where devices are typically used once and then discarded. Only a modest fraction of end-of-use products are collected for recycling, and an even smaller portion of materials, mainly high-value metals, is recovered. This system is further strained by accelerating demand for new products, driven by shorter product lifecycles, rapid technological change, and limited repair options. As a result, many CEPs are replaced long before they become technologically obsolete, despite still retaining significant functional value at the end of their first use."

In opposition to the "throw away" system, the circular economy emphasises Value Retention Processes (VRPs) which preserve value, prolong use, and delay disposal. Godfrey notes, "interestingly, value retention of products in the global south is more frequently observed, typically driven by higher levels of poverty and unemployment, and a more active informal sector. The informal economy practices a consumer-to-consumer model that repairs and directly reuses CEPs. "This reuse and repair of products such as laptops, smartphones, and televisions offer a significant opportunity for growth," adds Godfrey.

The current reuse model found in the informal economy has its own issues particularly that it does not provide the greatest socio-economic, environmental benefit, or product performance. Godfrey highlights a study done by the Waste and Society SARChI Chair hosted by the University of Western Cape waste and society. This study interviewed 832 repairers and refurbishes in 11 cities and towns, in all 8 provinces and found:

- 74% of VRPs occurred within the informal sector, and 26% in the formal sector
- 765% of those interviewed dismantled products
- 799% repaired products
- 745% said they refurbished the products

The study also noted that the majority of these informal repair businesses were done by non-South African citizens who had previous training before arriving in South Africa, and that this training was informal and often familial.

In other African countries like Ghana, VRP represents a sizable area of economic growth. A study done by the Rochester Institute of Technology found that in Ghana, particularly, the smartphone market represents the highest potential for industry employment growth, due to the unique combination of its high VRP uptake potential and substantial expected market growth.

Extended producer responsibility

Introduced in 2021, Extended Producer Responsibility (EPR) regulations state that those who produce or import electrical and electronic equipment are responsible for the management of that product at end of life. This means that brand owners must put mechanisms in place to allow everyday consumers to safely dispose or recycle the products they consume.

As policy, EPR has changed the waste management landscape in South Africa, but these laws are still in their infancy and Godfrey notes, "EPR laws specifically address downstream waste and emphasise collection and growing the recycling sector. While recycling is vital, it represents a lower value approach than reuse, repair, and remanufacturing."

While EPR is growing the recycling sector and aiding in waste diversion, EPR laws can provide incentives to brand owners to design with reuse and repair in mind. "Products seem to be designed for obsolescence, and repairs can be expensive to the point that it makes little sense to do so. EPR as a policy instrument can help to drive design-for-circularity, through for example eco-modulated fees. However, there may be a need to consider other types of policy instruments to help facilitate greater consumer right-to-repair,' as we are now seeing in other parts of the world, such as the European Union.

Godfrey concludes, "Value retention for consumer electronic products is happening in South Africa, mostly informally, but not in a way that maintains greatest product value or creates greatest socio-economic benefit for the country. Scaling VRP adoption will require significant changes in product strategies and business-to-consumer (B2C) models. The circular economy is going to drive disruption, and businesses can either try to wait it out, or be first to move and use circular economy principles to drive greater competitiveness."

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