

URBAN SOLUTIONS AND SUSTAINABILITY R&D CONGRESS 2023

BUILDING SUSTAINABLE, RESILIENT, AND LIVEABLE CITIES OF TOMORROW

4TH - 5TH OCTOBER 2023



OVERVIEW OF CIRCULAR ECONOMY AND FUTURE TRENDS

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National University of Singapore (NUS)



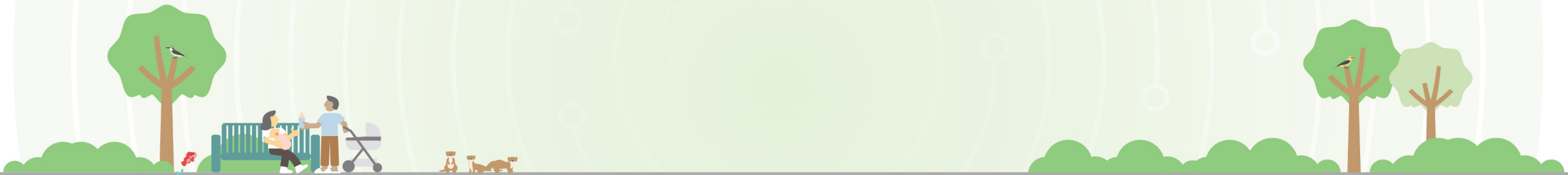
Overview of Circular Economy and Future Trends

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Chief Editor of Materials Circular Economy
Associate Editor of Circular Economy

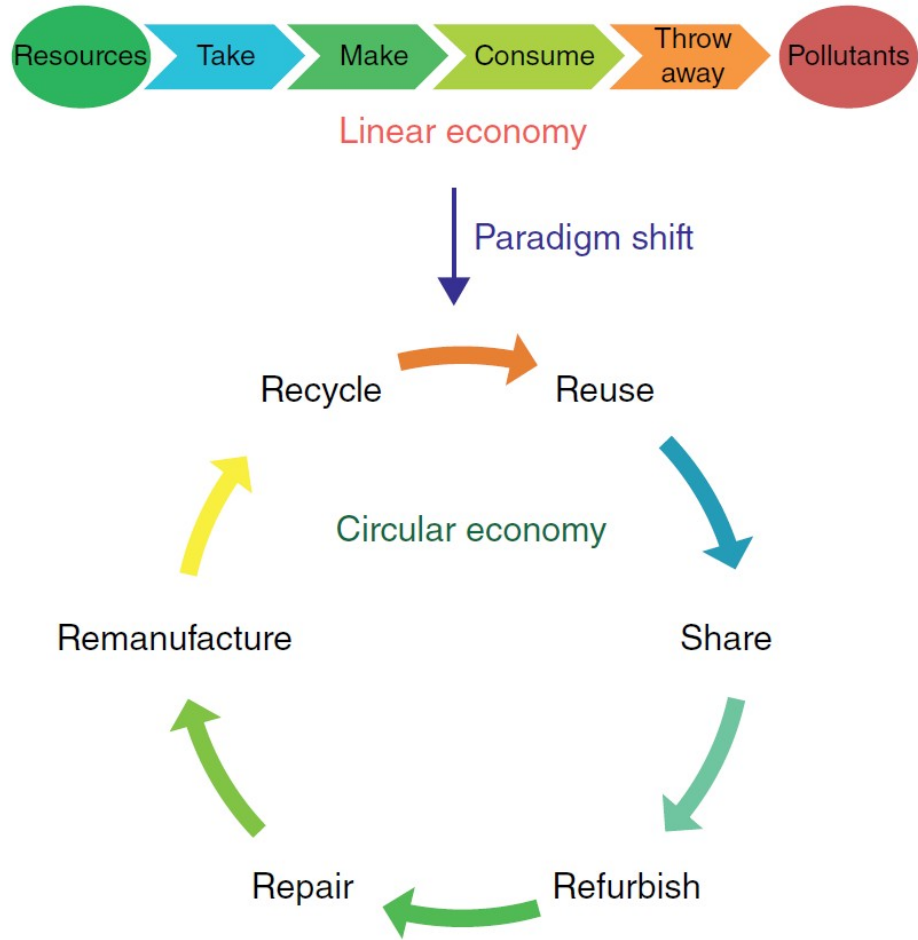
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- ❑ Sustainability | Circular Economy
- ❑ Current efforts of Singapore
- ❑ Future of Circular Economy



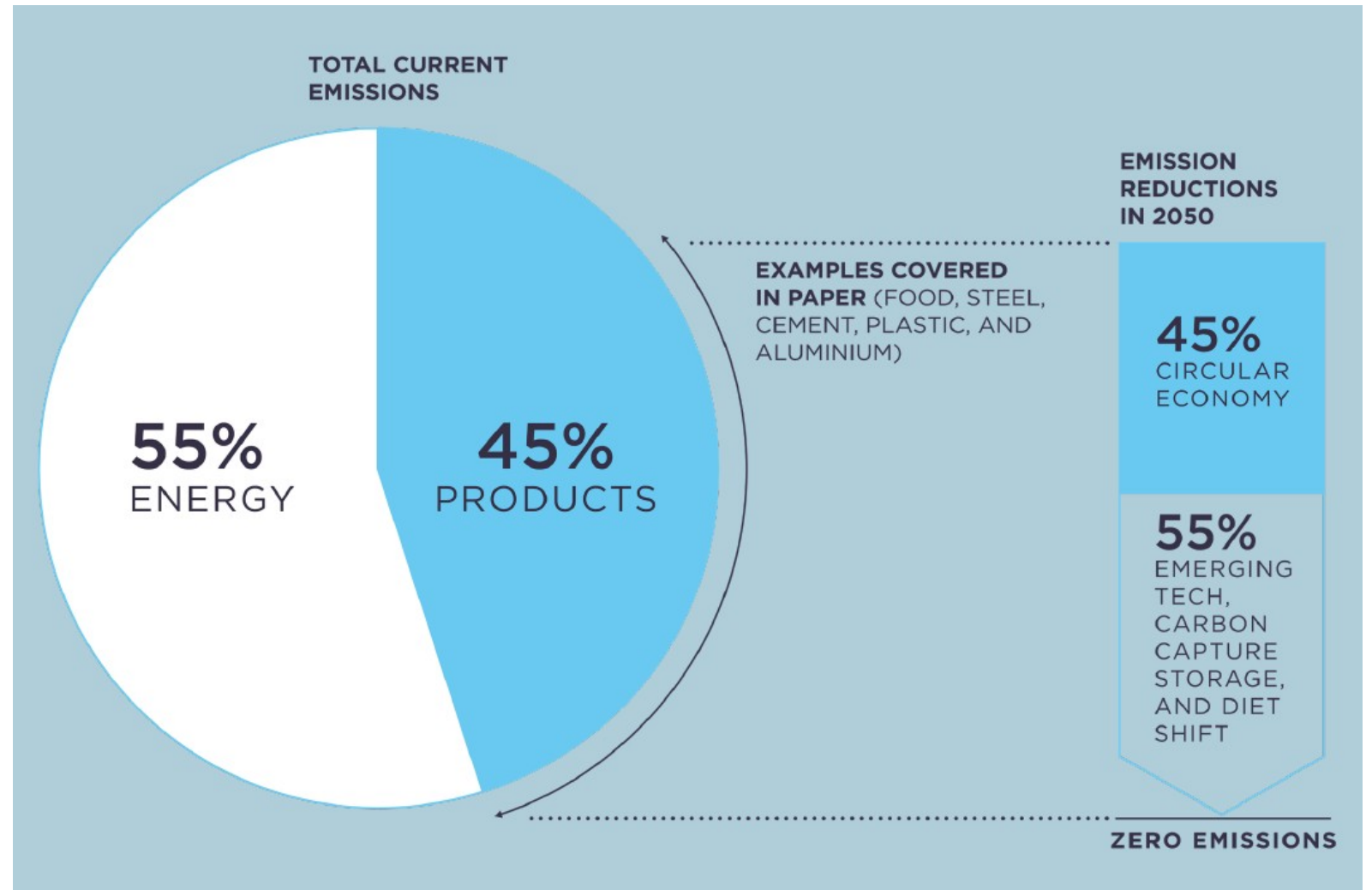
	Sustainability	Circular Economy
Definition	Sustainability is about meeting the needs of the present without compromising the ability of future generations to meet their own needs.	An economic system that uses a systemic approach to maintain a circular flow of resources, by regenerating, retaining or adding to their value, while contributing to sustainable development (ISO 59020)
Drivers	<p>In 2015, 193 nations have adopted the 17 Sustainable Development Goals (SDGs), which is known as the Paris Agreement.</p> <p>The SDGs embrace social progress, economic growth and ecological protection.</p>	Need to mitigate the depletion of resources and biodiversity loss; to eliminate or reduce pollution and ecological impact; and to avoid social costs and human health effects. Circular economy is a closed-loop economic system that targets zero waste and pollution throughout material product life cycle.
Indicator	169 targets of 17 SDGs	Circularity performance (degree of alignment with the principles for a circular economy)

SDG12 (Circular Economy) affects other SDGs



“The circular economy can help to tackle about 45% of global emissions”

Ellen McArthur Foundation



Drivers

- ❖ Pollution
- ❖ Solid waste accumulation
- ❖ Extreme weathers
- ❖ Forest fires
- ❖ Tsunamis
- ❖ Desertification
- ❖ Deglaciation
- ❖ Rising sea level
- ❖ Ocean acidification
- ❖ Biodiversity loss
- ❖ Human health effects
- ❖ Unbalancing of Nature's circularity (carbon cycle, water cycle, etc.)

Mitigation Measures

- ❖ Energy efficiency
- ❖ Renewable energy
- ❖ Materials efficiency
- ❖ Resources efficiency
- ❖ Decarbonization of economy
- ❖ Decarbonization of society
- ❖ Circular economy
- ❖ Materials circular economy
- ❖ Restoration of the nature
- ❖ Disuse of hazardous chemicals
- ❖ Nature & human centrisms

Outcomes | Benefits

- ❖ Per capita emissions reduction
- ❖ Per capita materials reduction
- ❖ Per capita resources reduction
- ❖ Per capita waste reduction
- ❖ Per capita pollution reduction
- ❖ Human health | well-being
- ❖ Reduced conflicts | wars
- ❖ Restored biodiversity
- ❖ Food security
- ❖ Life sustenance on Earth

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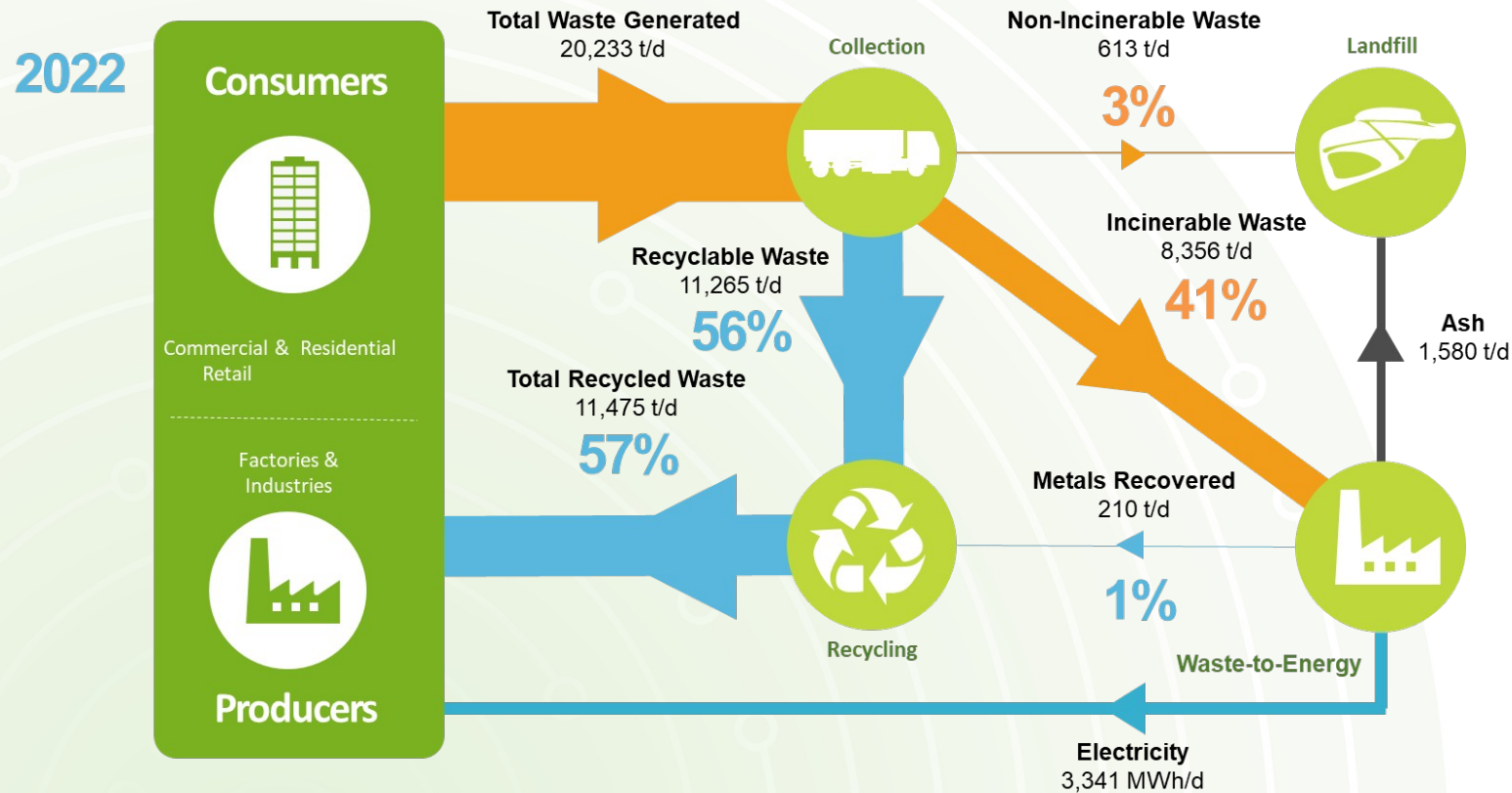
❑ Sustainability | Circular Economy

❑ Current efforts of Singapore

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Singapore Green Plan 2030 (<https://www.greenplan.gov.sg>)

Singapore Green Plan 2030 | Zero Waste Masterplan are aimed to a) reduce the amount of waste sent to the landfill each day by 30% by 2030, and b) develop a circular economy. This will complement Singapore's climate actions.



In 2022, Singapore generated 20,000 tons of waste per day – 57% Recycled and 41% Turned into Energy

Resource Sustainability Act (RSA) was enacted in 2019 to give legislative effect to the regulatory measures targeting the three priority solid waste streams of e-waste, food waste and packaging waste, including plastics.

REPUBLIC OF SINGAPORE
GOVERNMENT GAZETTE
ACTS SUPPLEMENT

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[2019

The following Act was passed by Parliament on 4 September 2019 and assented to by the President on 23 September 2019:—

RESOURCE SUSTAINABILITY ACT 2019

(No. 29 of 2019)

Extended Producer Responsibility (EPR) framework:

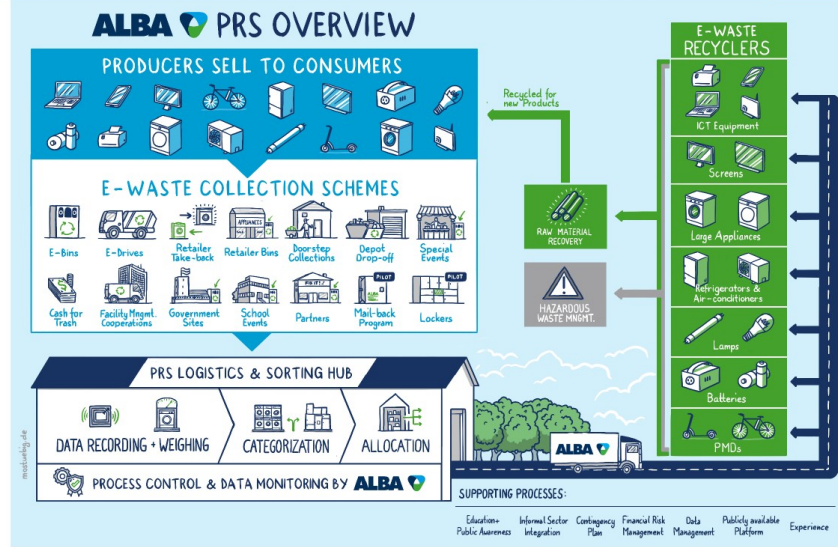
producers of regulated electrical and electronic products are made responsible for the collection and proper treatment of their e-waste. These producers are companies that manufacture or import regulated products for supply on the local market. All e-waste collected will have to be channelled to licensed e-waste recyclers for proper treatment.

ALBA Group plc & Co. KG. ALBA are licenced to operate a Producer Responsibility Scheme (PRS) and responsible for the e-waste collection targets set by NEA.

EPR

E-Waste

Singapore E-Waste PRS Overview



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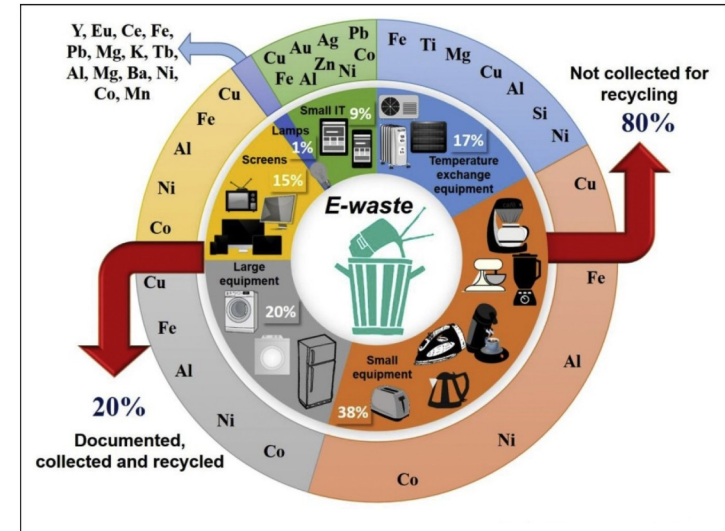


Recycling a refrigerator from start to finish

A recycling facility is now able to handle the recycling of large household appliances such as refrigerators and washing machines from start to finish and, with automation, is able to do so more efficiently. This is what happens to a refrigerator after it is sent to EWR2 in Tuas.

- The refrigerator is sent to EWR2, where it is dismantled. 
- Some parts, such as the motor, will be taken to specialised machinery such as a compressor and a motor cutter, where the copper coil is extracted and then recycled. 
- The refrigerator, now just a frame, will be placed inside the large household appliance recycling machine, where it is crushed into small pieces. The debris is then sorted into materials such as plastic, foam and metals, which are then sold off. 
- The circuit board of the fridge is sent to a chemical plant, where a robotic arm dips it into acids that are used to extract precious metals such as palladium. The used acid is then treated so it can be used again. 
- An oven is then used to press the precious metals into blocks which are sold off. These precious metals can be used in various ways, such as to make new electrical appliances. 
- Meanwhile, the other materials from the refrigerator such as plastic, foam and glass will also be sold to recyclers that deal with these materials. 

Source: EWR2 PHOTOS: ADELINE TAN, CHIA TI YAN STRAITS TIMES GRAPHICS



EPR for Food Waste from 2024 onwards: generators of large amounts of food waste are required to segregate their food waste and manage waste via on-site closed-loop food waste treatment systems, or send their food waste to an off-site facility for treatment. These new requirements will help ensure that food waste from being incinerated, is converted into products such as animal feed, compost/fertiliser, non-potable water or biogas for energy generation. Higher circularity of food system is the emerging future.

EPR for packaging waste and plastics by 2025: Producers of packaged products, such as brand owners, manufacturers and importers, as well as supermarkets are submitting packaging data and 3R (*Reduce, Reuse, Recycle*) plans to NEA. Further, they are required to submit details of key initiatives, key performance indicators (KPIs) and targets.

BCRS Scheme

Singapore aims to roll out the beverage container return scheme (BCRS) to encourage people to recycle drink containers such as plastic bottles and aluminum cans.

Canned, bottled drinks may cost 10 to 20 cents more in recycling scheme

Gena Soh

By mid-2024, consumers seeking to quench their thirst from a canned or bottled drink will likely have to fork out 10 cents to 20 cents more.

However, this extra cost can be redeemed if consumers return their empty bottles and cans for recycling at any of the beverage container return points islandwide.

These return points can take the form of "reverse" vending machines, into which bottles and cans can be deposited to get money in return, or manned counters. There will be more than 400 such points on the island, up from the 50 reverse vending machines currently.

The new beverage container return scheme proposed by the National Environment Agency (NEA) was announced on Tuesday.

Under the proposed scheme, a small deposit of between 10 cents and 20 cents will be added to the price of all pre-packaged drinks in plastic bottles and metal cans between 150ml and 3 litres.

This deposit will be the same across beverages of the same size.

Drinks will be labelled with a deposit mark and consumers can claim a refund of the deposit

when they return their empty beverage containers to a designated point. This redemption will likely be in the form of cash or digital transfer.

Return points will be set up at all supermarkets that are larger than 200 sq m. Other possible return locations include convenience stores and community centres.

The proposed scheme comes after extensive public engagement and aims to increase the recycling rate of beverage containers in Singapore to 80 per cent.

This is NEA's latest idea to nudge people towards recycling, as only 6 per cent of all plastic waste was recycled in Singapore in 2021.

Many nations which have implemented such a scheme have been able to raise their recycling rates of beverage containers substantially. For example, in Germany, the recycling rate of beverage containers stands at 98 per cent.

Under the scheme, drink producers and retailers will be charged a fee by a non-profit administrator of the scheme for each drink manufactured or imported.

When consumers return the containers, the administrator will aggregate them and sell them to waste companies.

The revenue from this sale will be used to reimburse producers and retailers for the extra costs incurred.

Hence, the total amount reimbursed to the drink producers will depend on how effective they have been in encouraging their customers to recycle the containers.

NEA said the beverage container return scheme marks the first phase of the Extended Producer Responsibility system introduced to vest producers with greater responsibility in ensuring their products are recycled.

Such a scheme would promote accountability and efficiency in the industry and also minimise costs to run the scheme, said NEA.

Senior Minister of State for Sustainability and the Environment Amy Khor told reporters on Tuesday that she hoped the high volume of recyclables collected from this scheme would incentivise the setting up of domestic recycling facilities.

She added that the sale of high-quality recyclable material itself would also help fund a significant part of the scheme's implementation.

Ms Kathlyn Tan, a member of the work group that suggested the beverage container return initiative to NEA, said: "My hope for the scheme is that recycling rates will increase; we become more conscious of our environmental footprint; and negative impacts on the vulnerable will be minimised."

Encouraging consumers TO RECYCLE

A new beverage container return scheme was announced on Tuesday, where consumers will be charged 10 to 20 cents more for each canned and bottled drink as a deposit. Consumers will get the money back when they return the containers for recycling. Reporter **Gena Soh** explains how the scheme works.





-  Beverage producers and retailers are charged a fee by an administrator of the scheme for each drink manufactured or imported.
-  This fee is passed on to consumers via a 10- to 20-cent deposit added to the price of the drink.
-  When consumers return the containers for recycling at one of the over 400 collection points islandwide, they get the deposit back.
-  The scheme administrator collects these containers and sells them to waste companies.
-  Part of the revenue from the sale is used to fund the scheme's operating costs. The remainder of the funds is used to reimburse beverage producers and retailers as an incentive to encourage them to make recycling easier for consumers.



PHOTO: ONG WEE JIN STRAITS TIMES GRAPHICS

Associate Professor Jia Lile of the psychology department at the National University of Singapore, who is also a member of the work group, said: "The deposit provides only the seed of change."
Consistent messaging and management of the scheme are needed

to cultivate long-term behavioural change towards recycling, he said.
Public feedback on the scheme is being sought and can be given from now until Oct 14 at go.gov.sg/nea-bcrs
genasoh@sph.com.sg

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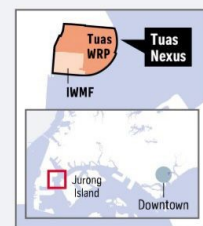


The Integrated Waste Management Facility and Tuas WRP form the Tuas Nexus.



Salvaging used water

Construction of the more than \$3 billion Tuas Water Reclamation Plant (WRP) is one-third complete and set to start operations by 2026. **Shabana Begum** and **Lim Yong** outline how the plant will treat used water.

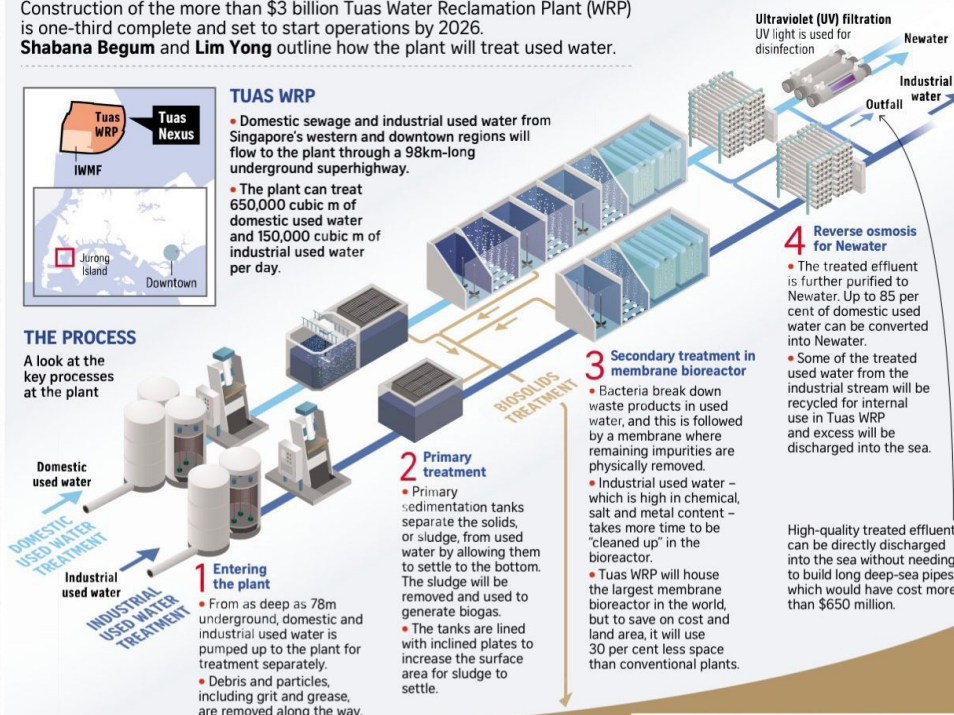


TUAS WRP

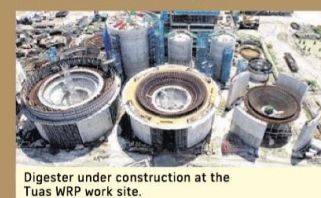
- Domestic sewage and industrial used water from Singapore's western and downtown regions will flow to the plant through a 98km-long underground superhighway.
- The plant can treat 650,000 cubic m of domestic used water and 150,000 cubic m of industrial used water per day.

THE PROCESS

A look at the key processes at the plant

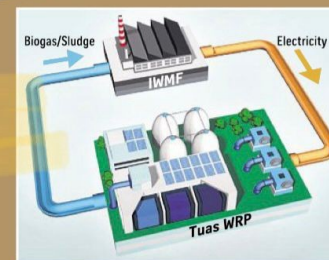


BIOGAS FOR ELECTRICITY



Digester under construction at the Tuas WRP work site.

- Sludge is treated at a biosolids complex – which includes 40m-tall digesters – to generate biogas.
- Pre-treated food waste at the National Environment Agency's Integrated Waste Management Facility (IWMF) next door will also be digested with the sludge to increase the biogas yield.
- The biogas produced will then be combusted at the IWMF. The electricity generated will be used to power the entire Tuas Nexus and excess will be exported to the electricity grid.



Water-energy-waste nexus allows food waste and used water sludge to be co-digested to generate up to three times more biogas than conventional sludge treatment processes. The biogas generated will boost electricity production. The Tuas Nexus facility is expected to be completed by 2027.



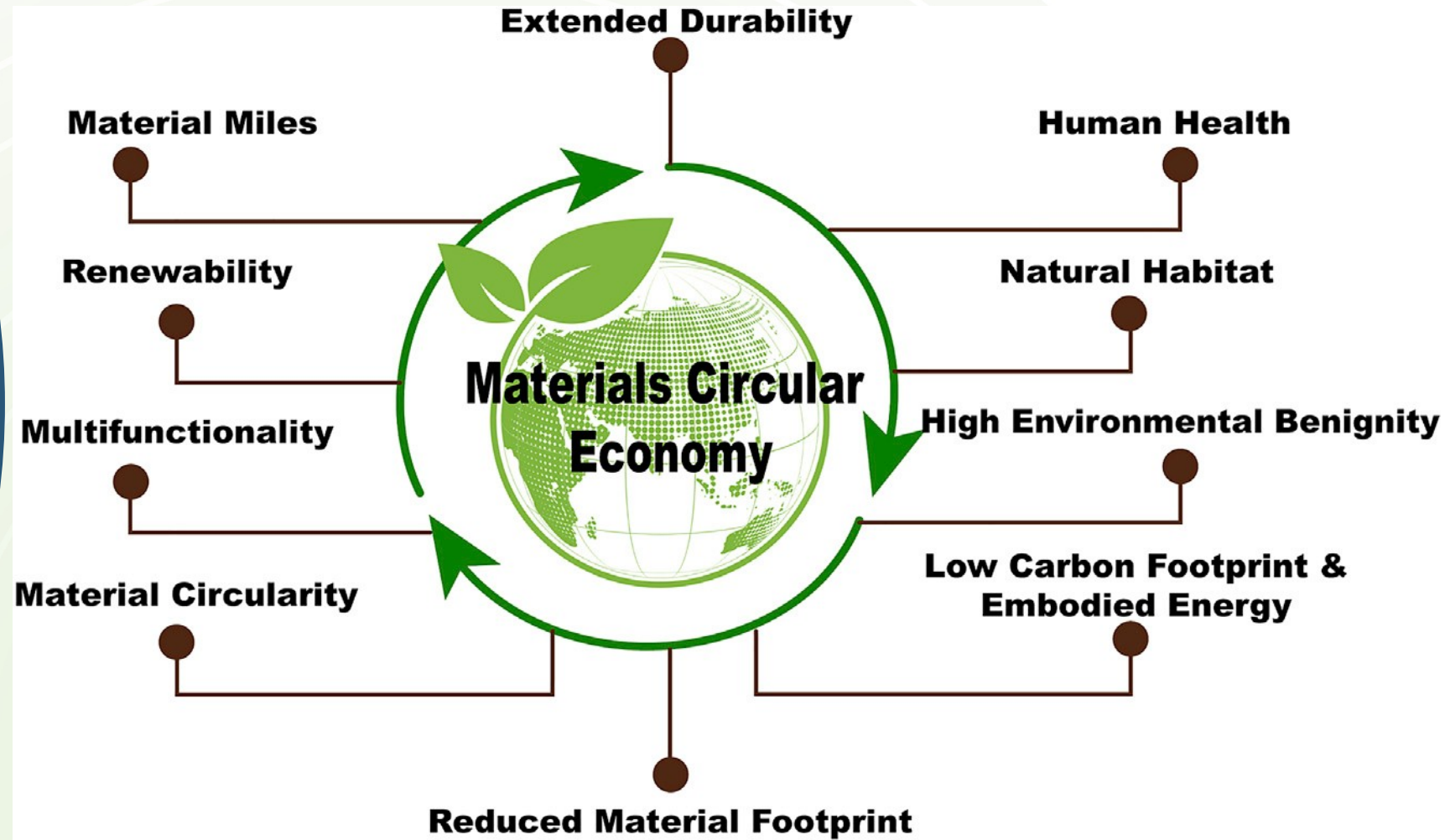
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Ten principles of Circular Economy



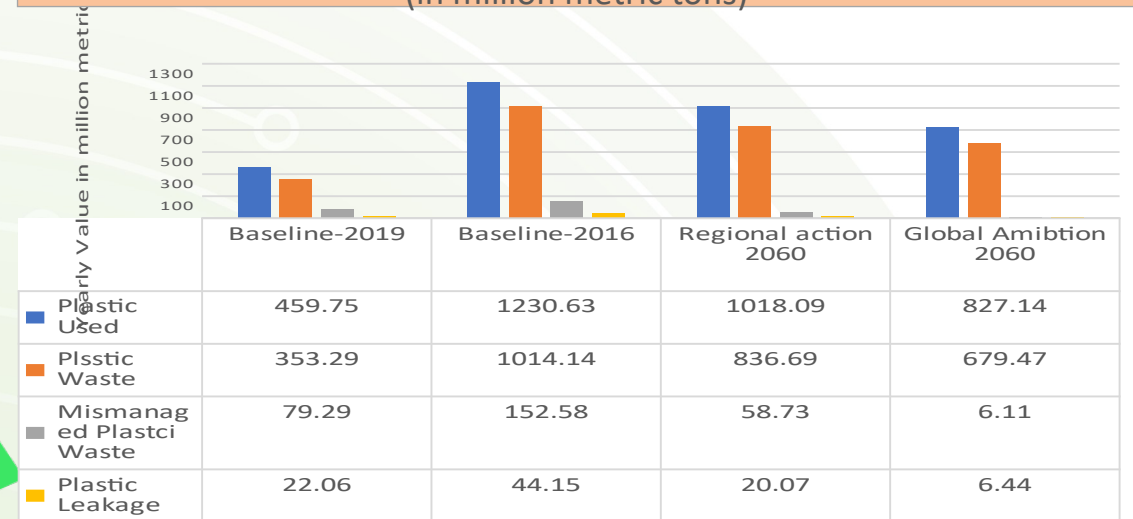
Plastics & circularity

we produce about 400 million tonnes of plastic waste every year.

Global production of primary plastic is forecasted to reach 1,100 million tonnes by 2050.

36% of plastics are used in packaging, and approx 85% of single-use food containers end up in landfills.

Plastic use & Waste projection scenarios worldwide in 2060 by types (in million metric tons)



*Source: Initiatives to Reduce Plastic Pollution | NYU SPS



Global Plastic Stats In numbers

8.3 bn-9 bn tones plastic waste produced globally

*Source: science advances journal

Globally 500 Million Plastic bags are used every min .

Annually, approximately 500 billion plastic bags are used worldwide.

*Source: Harvard T.H Chain

Singapore Plastic Stats In numbers

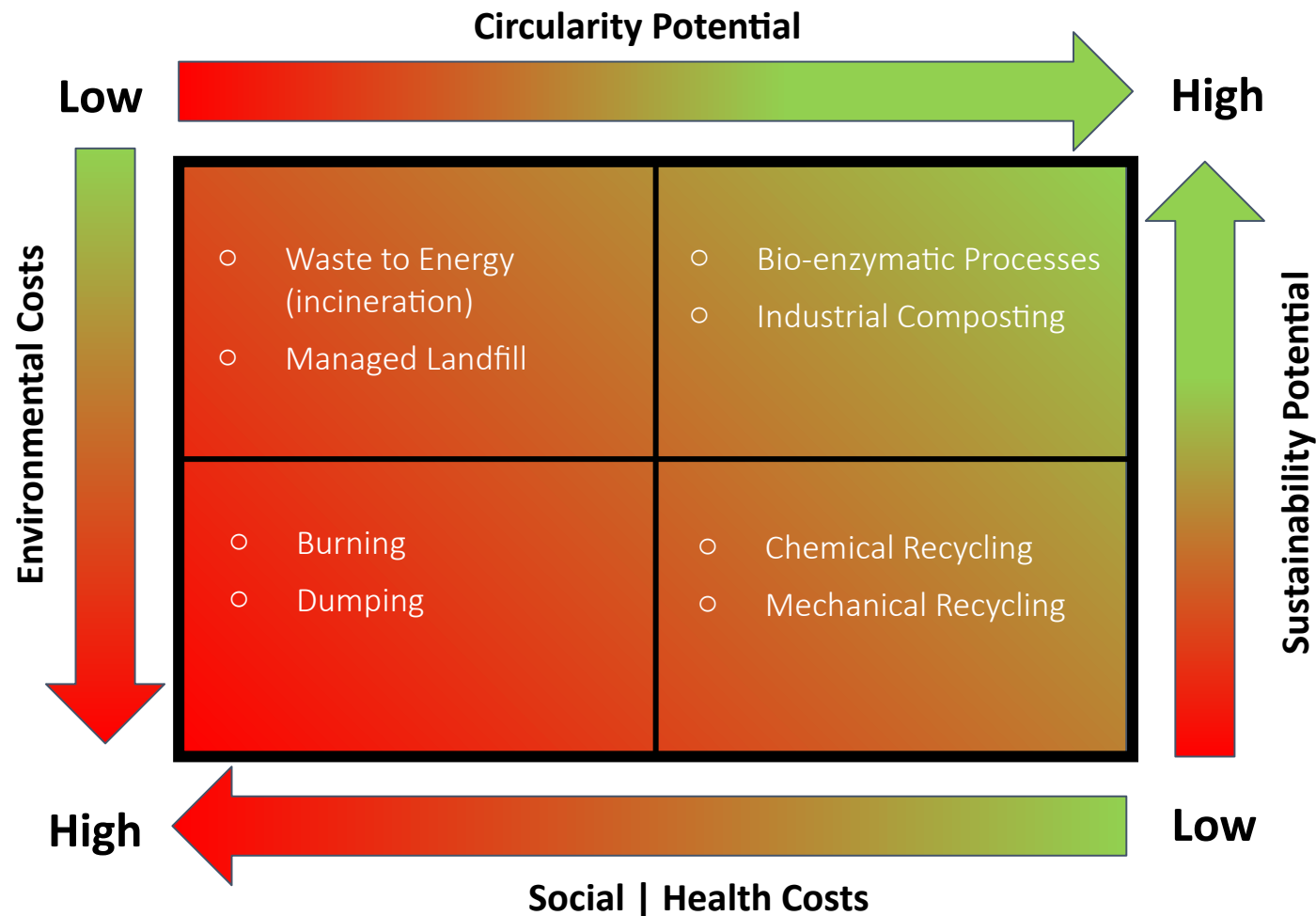
Plastic packaging industry in Singapore amounted to US\$42.5 billion in 2013 and expected to grow with a compound annual growth rate (CAGR) of 4.2% between 2019-2024.

Source: Singapore environmental agency

Singapore generated about 7.39 million tonnes of solid waste in 2022, of which plastic waste makes up around 15%

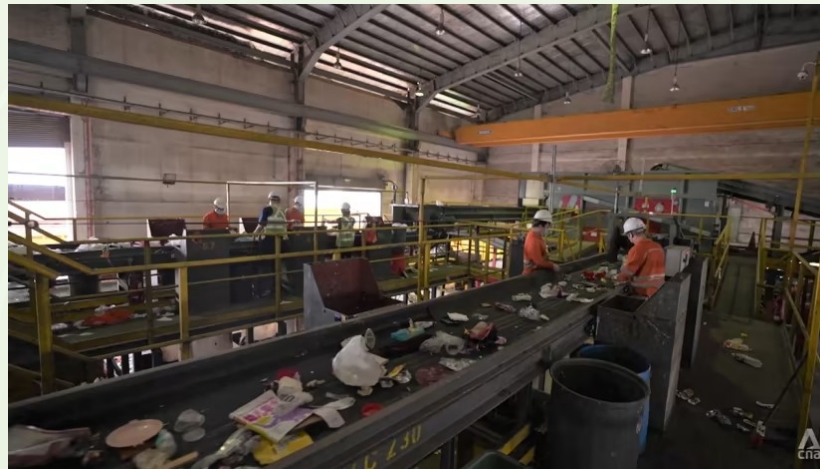
Source: National environmental agency

Plastic waste management strategies



Commingling ☹️

Contamination ☹️

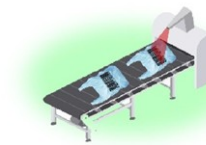
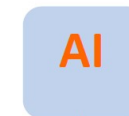
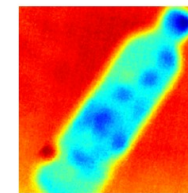


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https://www.channelnewsasia.com/cna-insider/plastic-recycling-rate-singapore-exports-bottled-water-safe-3723811?cid=internal_sharetool_iphone_27082023_cna

AI to improve plastic recycling infrastructure

Multispectral AI for sorting plastics into different resin types



Identification and sorting

Recycling

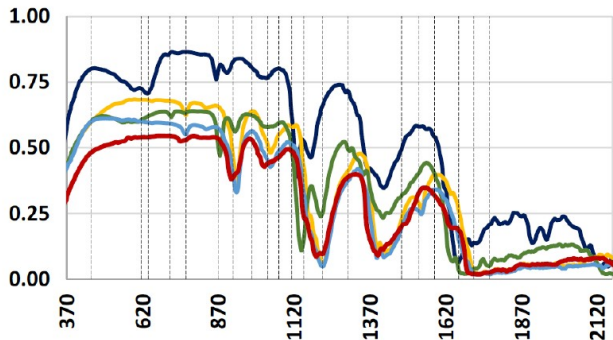
Manufacturer

Reuse

Collection

Smart bin

Reflectance



Wavelength (nm)

- PETE
- HDPE
- PP
- PS
- OTHER

How AI, DNA are unlocking the mysteries of global supply chains

Firms using them to trace raw materials as concern grows over opacity, abuses

NEW YORK—At a cotton gin in San Joaquin Valley, California, a busy machine helps to spray a fine mist containing billions of molecules of DNA onto freshly cleaned Pima cotton.

The DNA will act as a kind of miniature barcode, nesting amid the fluffy fibres as they are shunted to factories in India. There, the cotton will be spun into yarn and woven into bedsheet, before landing on the shelves of Costco stores in the United States.

At any time, Costco can test for the DNA's presence to ensure that its American-grown cotton has not been replaced with cheaper materials—like cotton from the Xinjiang region of China, which is banned in the US because of its ties to forced labour.

Amid growing concern about opacity and abuses in global supply chains, firms and government officials are increasingly turning to technologies like DNA tracing, artificial intelligence (AI) and blockchain to try to trace raw materials from the source to the store.

US companies are now subject to new rules that require firms to prove their goods are made with out forced labour, or face having their orders at the border. US Customs officials said in March they had already seized nearly US\$1 billion (S\$1.3 billion) worth of incoming shipments that were suspected of having some ties to Xinjiang.

Customers are also demanding proof that expensive, high-end products—like coffee-free decaffeinated organic cotton, high-grade tuna or manuka honey—are genuine and produced in ethically and environmentally sustainable ways.

This has forced a new reality on companies that have long relied on a tangle of global factories to



to make its products—and so on, for many levels up the supply chain.

Given these challenges, some companies are turning to alternative methods, not all proven, to try to inspect their supply chains.

Some companies—like the one that sprays the DNA mist onto cotton, Applied DNA Sciences—are using scientific processes to tag or test a physical attribute of the good itself to figure out where it has travelled, or to analyse its isotopes, which are variations in the carbon, oxygen and hydrogen atoms in the cotton. Differences in rainfall, latitude, temperature and soil conditions mean these atoms vary slightly across regions of the world, allowing researchers to pinpoint where the cotton in a pair of socks or both levels has come from.

Other companies are turning to digital technology to map supply chains by creating and analysing complex databases of corporate

A technician at Applied DNA Sciences testing samples of raw materials to trace their source. US firms are now subject to new rules that require them to prove their goods are made without forced labour, or face having them seized at the border. PHOTO: GETTY IMAGES

term agents as well as private companies. Mr Jessica Abel, vice-president of solutions at Sparta, recently ran the supplier list of a major US retailer through the platform and watched as dozens of tiny red flags appeared next to the names of distant companies.

"We are flagging not only the Chinese companies that are in Xinjiang, but... also automatically exploring their commercial networks and flagging the companies that are directly connected to it," Mr Abel said. It is up to the companies to decide what, if anything, to do about their exposure.

Studies have found that most companies have surprisingly little visibility into the upper reaches of their supply chains because they lack either the resources or the incentives to investigate. In a 2022 survey by consultancy McKinsey & Co, 45 per cent of respondents said they had no visibility at all into their supply chain beyond their immediate suppliers.

Executives at these technology companies say they envision a future, perhaps within the next decade, where most supply chains are fully traceable—an outgrowth of both tougher government regulations and the wider adoption of technologies.

"It is extremely doable," said Mr Leonardo Bonanni, chief executive of Sotomayo, which has helped companies like chocolate-maker Mars map their supply chains. "If you want access to the US market for your goods, it is a small price to pay, frankly."

Others express scepticism over the limitations of these technologies, including their cost. While Applied DNA's technology, for example, adds only five to seven cents to the price of a finished piece of apparel, this may be significant for retailers competing on thin margins.

Some express concerns about accuracy, including, for example, databases that may flag companies (incorrectly). Investigators still need to be on the ground locally, they say, speaking to workers and remaining alert to signs of forced or child labour that may not show up in digital records.

Mr Justin Dillon, CEO of FRIDA, a software company that helps organisations map their supply chains, said there was "a lot of angst, a lot of confusion" among companies trying to satisfy the government's new requirements.

Sparta, a corporate risk intelligence provider that has developed a platform combining data from billions of public records issued globally, is one of those companies. The service is now used by US Cal-

AI & DNA Labelling in
Plastics Waste
Management



Fifty Shades of Greenwashing

By SEERAM RAMAKRISHNAN

Greenwashing, or the process of conveying a false impression by providing misleading information about how a company's products are more environmentally sound than they actually are, can be damaging to a company's reputation. How can businesses ensure they remain focused on sustainability and keep their messaging authentic and accurate?

How to Avoid Greenwashing?



1. Deepen sustainability, net zero carbon and ESG literacy to all stakeholders of the company.



2. Integrate sustainability, net zero carbon and ESG into the business strategy, risk management and operational processes. Set science-based ESG targets and goals and explain clearly to all stakeholders of the company.



3. Integrate sustainability, net zero carbon and ESG targets and goals with financial reporting.



4. Ensure adequate resources and skills are in place to achieve the set targets and goals. Also, put in place accountabilities and incentives to deliver on sustainability goals and targets.



5. Develop a more robust, transparent, and fact-based approach for measuring sustainability performance so as to enable all stakeholders to make more informed decisions.

renewable energy since 2015, which is less than one third of funds invested in the oil and gas businesses. In other words, their investment decisions are not yet fully embracing the spirit of ESG and sustainability.

ASEAN is making efforts to transition from its heavy reliance on “dirty” fuel energy sources, namely coal, oil and gas to renewable energies. But according to the ASEAN Center for Energy, the region is projected to miss its aspirational goal of greening its energy mix so that 23 per cent will be from renewables by 2025.

Cited reasons include skills and technology lag, lack of sustainability and climate change premiums, and smaller economies of scale, which contribute to higher costs of renewables in the region when compared to the global averages. This underscores the role of governments in upgrading the transmission grids and ensuring reliability and security.

By performing well in terms of ESG, businesses can build reputation and deliver value to shareholders against the backdrop of the net zero carbon and sustainability agenda being pursued by nations. Moreover, they can resonate with the minds and hearts of people who are increasingly sensitised to climate change issues and the need for a carbon neutral world.

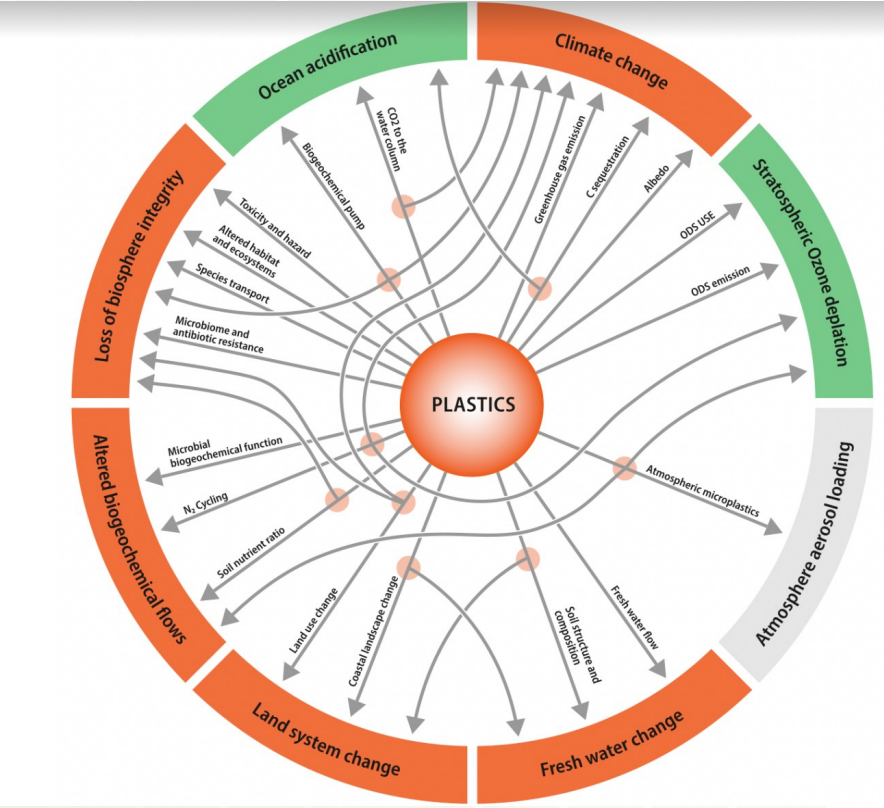
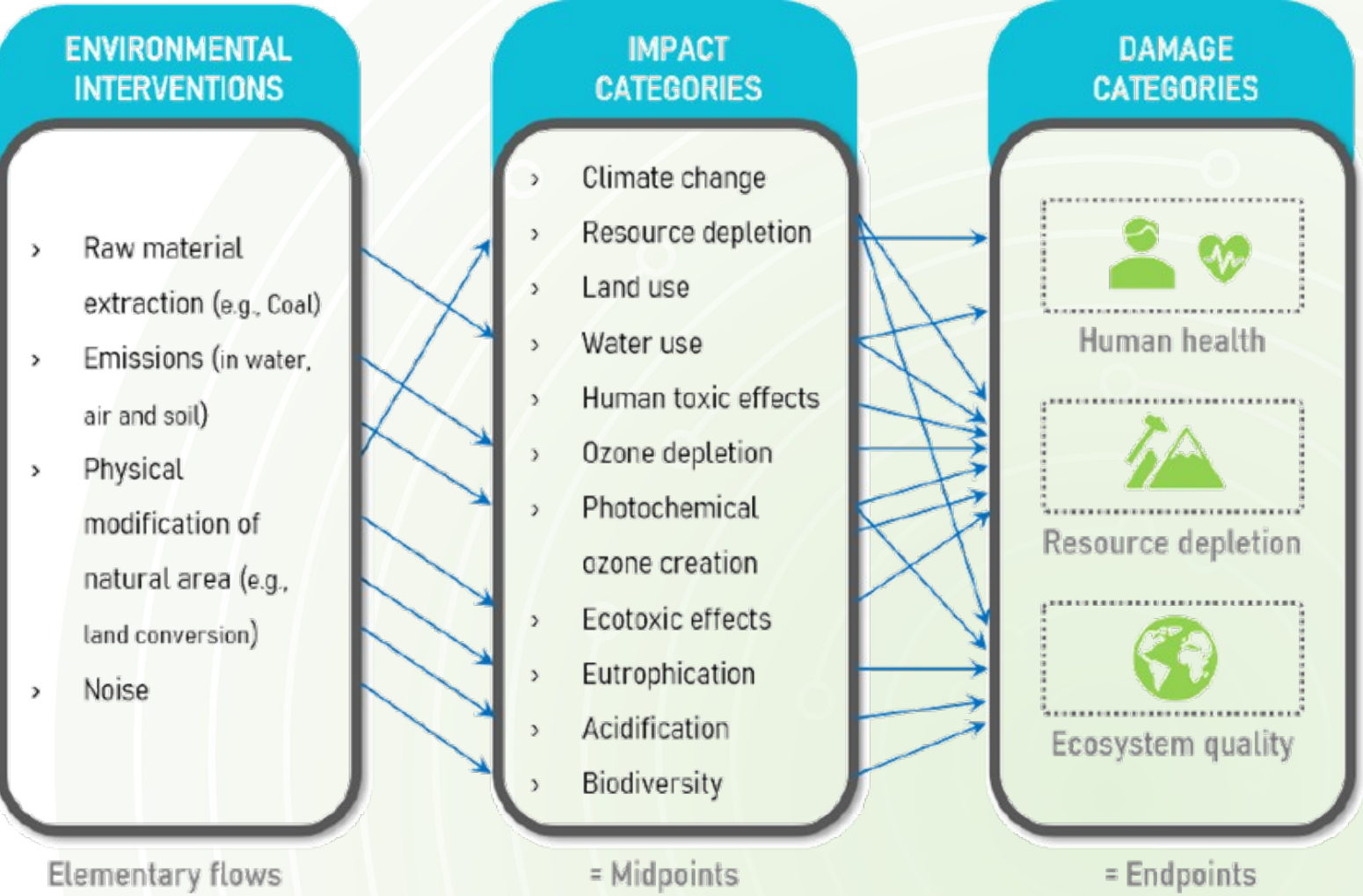
Carbon neutrality should be a core business principle alongside financial considerations and balance sheet, which has dominated the decision-making processes and strategies of corporate leaders for decades. Businesses must be encouraged to develop a thorough understanding of net zero carbon and sustainability, and to make deeper ESG commitments so as to unlock value for all stakeholders, including employees, customers and communities. ■

Seeram Ramakrishna is a professor at the National University of Singapore and a member of SID's ESG Committee.

Greenwashing

Greenwashing, or the process of conveying a false impression by providing misleading information about how a company's products are more environmentally sound than they actually are, can be damaging to a company's reputation. How can businesses ensure they remain focused on sustainability and keep their messaging authentic and accurate?

Life cycle assessment (LCA) is designed to estimate the effects of a product on the environment from creation to disposal



ISO 59 004 – Circular Economy – Terminology, principles and framework for implementation

ISO 59 010
**Circular Economy – Guidance
on business models and value
networks**

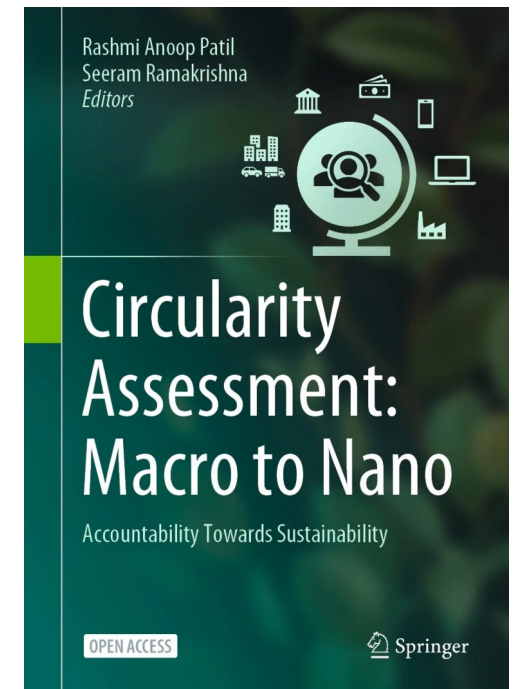
ISO 59 020
**Circular Economy – Measuring
and assessing circularity**

ISO 59 040
**Circular Economy – Product
Circularity Data Sheet**

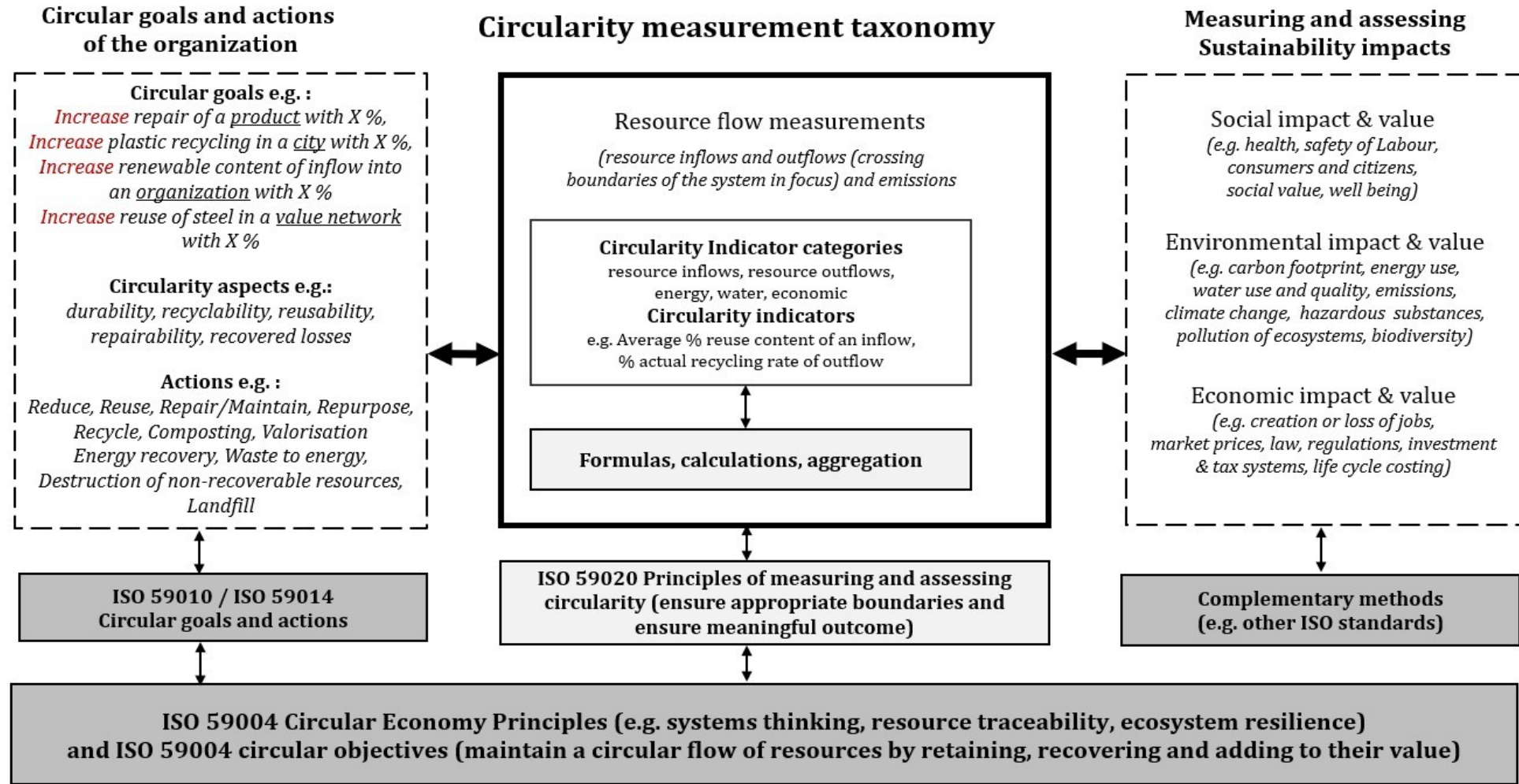
ISO 59 014
**Secondary materials –
Principles, sustainability
and traceability
requirements**

ISO TR 59 031 – Circular Economy – Performance based approaches
**ISO TR 59 032 – Circular Economy – Review of business model
implementation**

Circularity Assessment

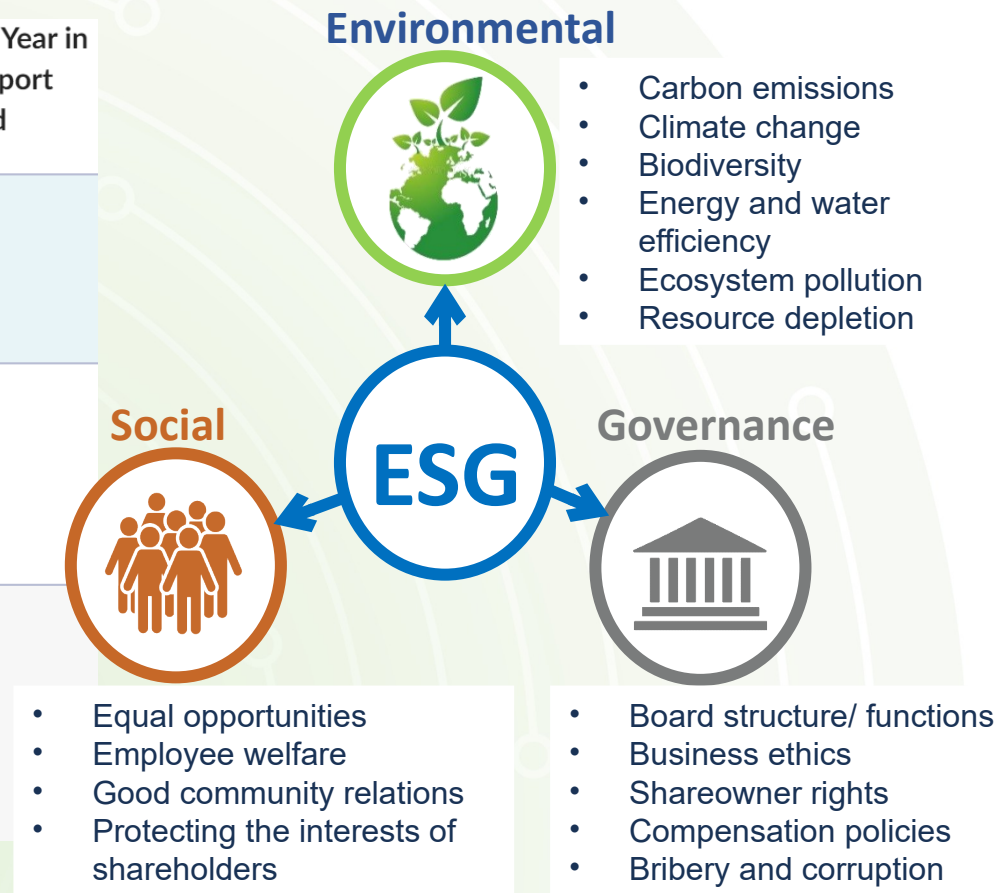


Circularity Measurement Taxonomy and Interactions



Singapore Exchange (SGX): With the effects of climate change becoming increasingly pronounced, the call globally for efforts to combat climate change has grown exponentially. SGX has therefore introduced a phased approach to **mandatory climate reporting | sustainability reporting | Environmental, Social and Governance (ESG) reporting.**

For Financial Year Commencing	Baseline Reporting Practice	Calendar Year in which Report Published
Between 1 January 2022 and 31 December 2022	Climate reporting is mandatory for all issuers on a 'comply or explain' basis.	2023
Between 1 January 2023 and 31 December 2023	Climate reporting is mandatory for issuers in (a) financial industry; (b) agriculture, food and forest products industry; and (c) energy industry. For other issuers, climate reporting on a 'comply or explain' basis.	2024
Between 1 January 2024 and 31 December 2024	Climate reporting is mandatory for issuers in (a) financial industry; (b) agriculture, food and forest products industry; (c) energy industry; (d) materials and buildings industry; and (e) transportation industry. For other issuers, climate reporting on a 'comply or explain' basis.	2025



Waste Management & ESG KPI's contributing to SDG's



Extended producer responsibility

Schemes to promote recycling, minimize environmental impact and Efficient collection Via DRS system

Green footprint management

Reduced carbon footprint with efficient waste supply chain management

Green procurement Polices

Environmental friendly procurement decisions and vendor selection criteria

Efficient Waste Management

Increase recycling rates of self generated & collected materials by Implementing 3R strategies

Ethical Business Practices

Promoting responsible, ethical, transparent, and accountable business practices among stakeholders

Zero Waste to Landfills Audit & Procedures

Fostering transparency, compliance, and sustainability, aligning waste management.



Diversity and inclusion

Increased customer engagement, talent attraction, community involvement in though waste management initiatives.

Human Rights

Ensuring compliance to labor laws and requirements during waste managements activities

Stakeholder Engagement

Collaborative efforts promoting responsible and sustainable waste management practices across all stakeholders involved.

Capacity Building and awareness program

Efficient waste management Training programs, Capacity building and awareness program & initiatives.

Health and Safety

Commitment to workers & employees wellbeing and the broader community

Transparent Governance

Effective policies for waste management through traceable, transparency and robust external and internal engagement.

Environmental compliance management policies

Enhanced accountability, transparency, and ecological risk mitigation.



UNEP
United Nations
Environment Programme

In March 2022, at the resumed fifth session of the UN Environment Assembly (UNEA-5.2), a historic resolution was adopted to develop an **international legally binding instrument on plastic pollution, including in the marine environment.**

The resolution (5/14) requested the Executive Director of the UN Environment Programme (UNEP) to convene an Intergovernmental Negotiating Committee (INC) to develop "the instrument," which is to be based on a comprehensive approach that addresses the full life cycle of plastic, including its production, design and disposal.

The INC began its work during the second half of 2022, with the ambition to complete the negotiations by the end of 2024. The **first session** of the INC (INC-1) took place in Punta del Este, Uruguay from 28 November to 2 December 2022, followed by a **second session** (INC-2) in Paris, France from 29 May to 2 June 2023. The **third session** (INC-3) is now scheduled from 13 to 19 November 2023 at the UNEP Headquarters in Nairobi, Kenya.



Around the world and within Asean, waste disposal rates are rising while materials and resource recovery lags targets. PHOTO: AFP



ASEAN Framework on Sustainability and Circular Economy

Trash to treasure: A vision of no waste in South-east Asia

A crucial pathway to achieving the circular economy in the region is collaboration across supply chains.

Kris Hartley

Erratic weather and extreme climate events gripped the world this summer, from wildfires in Canada to floods in Greece and Hong Kong. The human and economic loss, along with the increasing costs of recovery, has led to consternation among many, with unsustainable human behaviour largely blamed for the worsening situation.

Conferences and summits concerning sustainability are proliferating, with attention focused on the need for broad change in industrial production and the potential role of technology to achieve this.

But technology – while a crucial part of sustainability efforts – cannot by itself plug large and impending gaps in meeting the United Nations' Sustainable Development Goals (SDG) by 2030. Last Monday, UN Secretary-General Antonio Guterres disclosed that only 15 per cent of SDG targets are on track and that many are, in fact, going in reverse. Committing to ever more sophisticated technological solutions can address some problems, but the sustainability crisis is bigger than what technology alone can solve. A broader perspective is needed.

This broader perspective should include transformational thinking about the economy. Decades of industrialisation and economic growth generated employment opportunities for millions in low-income countries, while flooding wealthier countries with ever-cheaper consumer goods. Globalisation of supply and delivery chains and trends like fast fashion have exacerbated the situation over the past 10 years – a golden era for industrial production.

But it has been anything but a golden era for the natural environment. Unbridled manufacturing and consumption are degrading the environment in manifold ways, through resource extraction, energy consumption, production by-products, and end-of-life disposal.

GROWTH OF THE CIRCULAR ECONOMY

Circular thinking can help foster a more holistic perspective on sustainability. Ideas about circularity have existed in various forms going back decades, but the concept itself has come into its own only in the past 10 years.

In a recent article analysing more than 200 definitions of the concept, Dr Julian Kirchherr, other colleagues and I defined the circular economy as "a regenerative economic system which necessitates a paradigm shift to replace the 'end of life' concept with reducing, alternatively reusing, recycling and recovering materials throughout the supply chain".

Our definition also maintains that the aim of the circular economy is to promote value maintenance and sustainable development, creating environmental quality, economic development and social equity, to the benefit of current and future generations.

This broad definition highlights numerous pathways to implementation – including in South-east Asia, as much of the region continues to industrialise.

Consider the textile sector, which is responsible for a significant amount of waste across various production stages, including water used to farm cotton. On top of this, consumption preferences often result in material being discarded rather than reused – particularly

clothes.

Adopting circular thinking can help address such challenges by recognising how waste can be reduced not only through recycling and materials recovery but also through reuse, remanufacturing and refurbishing. The goal is to treat production processes like cycles that require fewer external inputs and generate fewer external by-products.

Circularity currently shows up in many ways, including through novel use of waste materials. For example, discarded polyethylene terephthalate (PET) bottles, more commonly recognised as the ubiquitous plastic water bottle, can be reprocessed to produce polyester fibre for use in clothing and other textiles – an imperfect but still useful substitute for virgin materials.

Japanese clothier Uniqlo has made polo shirts using polyester obtained from PET bottles. Swedish furniture retail giant Ikea likewise uses recycled materials in polyester products, having reached a threshold of 90 per cent usage in 2020. The company also pursues circularity through product design, maximising the interchangeability of parts to facilitate repair and remanufacturing for novel reuse.

Circularity is achievable in other ways. American computer manufacturer HP uses recovered ocean plastics as material in new computers, and Dutch phone manufacturer Fairphone sources materials from fair-trade certified and "conflict-free" mines focused on sustainable extraction and humane conditions for workers.

CIRCULARITY PROSPECTS IN SOUTH-EAST ASIA

Individual efforts are important, but a collective approach to circularity is also needed. A crucial pathway to achieving this in Asean is collaboration across supply chains.

The feasibility of such collaboration depends on partner-to-partner interoperability, including roughly

equivalent technical capabilities such as digitisation and information sharing. Closing the gaps in technology access and infrastructure among Asean countries can also help ensure more seamless interactions among supply chain collaborators.

Broadly, there are four challenges to overcome to achieve circularity in production, according to research conducted by me and European Union-based researchers.

Cultural barriers include low awareness and interest among customers and producers, hesitant company culture, myopic business models and the dominance of linear thinking including the entrenchment of the "take-make-dispose" model of production. Such factors are particularly salient in newly industrialising countries, where fast-growing domestic firms or foreign investors primarily chase quick financial wins under lax regulatory regimes.

Market barriers include the low cost of raw or newly extracted materials relative to reused materials, an issue that has universal dimensions given the globalisation of factor markets.

Technical barriers include lack of technology to incorporate reused or refurbished components into production systems and absence of product design traits like modularity that enable such reuse and refurbishment.

Finally, regulatory barriers include policies that inadvertently obstruct circular activities, such as restrictions on the use of scrap material for novel purposes and the failure of policy interventions to treat waste management as an integrated, multi-stage process with inter-firm and cross-sector collaboration.

BETTER POLICY CAN LEAD THE WAY

The time for action is now. A 2023 study indicates that global production is less than 10 per cent circular. Around the world and within Asean, waste disposal rates are rising while materials and resource recovery lags targets.

The notion of the circular economy is realisable now and in small ways, as illustrated by examples of companies.

One important development is the effort to develop an agreed approach to carbon neutrality in the region which is expected to look at a number of issues. They include:

Establishing an emissions inventory to provide better awareness on emission reduction opportunities and monitoring the progress of the region's transition towards a low carbon economy.

Developing nature-based solutions and an ecosystem-based approach. The abundance of natural resources in the region provides significant opportunities in generating carbon removals for offset that can be sold into regional and global carbon markets.

Developing market-based solutions to stimulate economically efficient emission reductions, manage carbon pricing risks, and maximise the potential for the region to export mitigation outcomes to other countries.

Investing in emission reduction technologies as well as transition and energy storage technologies, which will be essential in supporting the region's transition, and

Ensuring inclusive and sustainable infrastructure so as to not overlook other important socio-economic considerations that fuel economic growth, such as women's empowerment and gender equality, among others.

The Phnom Penh summit will overlap with the UN Climate Change Conference (COP27) in the Egyptian city of Sharm El-Sheikh from Nov 6 to 18, so expect media attention on Asean's commitment to reducing carbon emissions. This week, the Asean leaders could take the lead by recognising the need for a decarbonised future.

While Asean economies have grown by over 5 per cent over the past decade, electricity demand has increased by 6 per cent, primarily generated by fossil fuels. As they continue to grow over the next decade, standards of living will rise in member countries, the pace of urbanisation and industrialisation will increase and the consumption of fossil fuels for electricity will expand rapidly. According to the climate risk index, Germany faces three Asean member states – Myanmar,

the Philippines and Thailand – were among the top 10 countries in the world affected by climate risks between 2000 and 2020.

Asean leaders could commit to faster reduction in carbon emissions through sharply increased investment in renewable resources, greater use of gas for electricity and the cutting down of coal usage. With the war in Ukraine and the decision of Opec+ to support deep oil production cuts, the decline in the currently high fuel prices is unlikely in the immediate future. The leaders could show the way by supporting measures aimed at transitioning to alternative technologies such as solar panels, wind turbines, hydrogen and electric vehicles.

The development of the region as a manufacturing hub for these alternative technologies could be enhanced by individual Asean members specialising in the manufacture of specialised parts and components of these alternative technologies, taking advantage of Asean's economic integration arrangements. It is worth remembering that the East Asian region became a global hub for electronics manufacturing through the development of distributed manufacturing, with Singapore, Hanoi, Bangkok, Taipei and Shanghai specialising in the manufacture of different components, with final assembly often taking place in China.

A vision for region-wide circularity would go hand in hand with the Asean Economic Community's promotion of regional value chains, worker upskilling and technology transfer.

The 2023 release of the Asean Circular Economy Stakeholder Platform holds potential in encouraging knowledge sharing and promotion of facilitative policies.

The next step should be an institutionalised and systematised monitoring mechanism to track progress, much in the same manner as the SDG tracker and the EU's circular economy monitoring framework. The EU framework's indicators for materials consumption and productivity, waste generation and management, trade in recycled materials, and softer factors like innovation and contribution to global sustainability can be a model for how Asean policymakers can target action.

Better flow of information through a material flow accounting database can also help producers identify potential partners and available streams of reusable scrap. This effort, as do many others, requires resource support, industry coordination and participation, and cross-jurisdiction regulatory consistency to track, analyse and circulate data.

The regionalisation and integration of the circular economy is an important and exciting moment for Asean. Home to numerous thriving industries but also vulnerable to the impacts of climate change, South-east Asia has an excellent opportunity to be a leader in sustainability thinking in the 21st century.

in economic regionalism for Asean

Third, sustainability as a theme has recently emerged on Asean's economic agenda through overarching initiatives such as the Asean Comprehensive Recovery Framework (ACRF), the AEC Blueprint 2025, and the Asian Framework on Circular Economy. Significantly, the bloc is developing an implementation plan for its framework on the circular economy.

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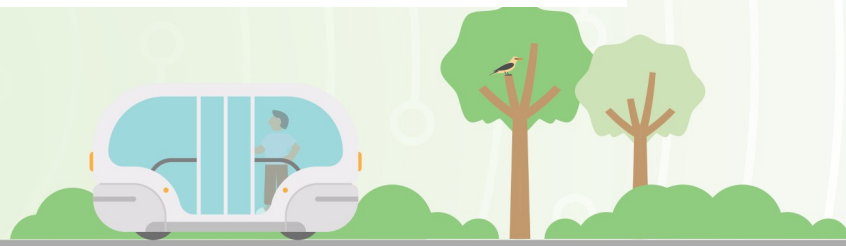
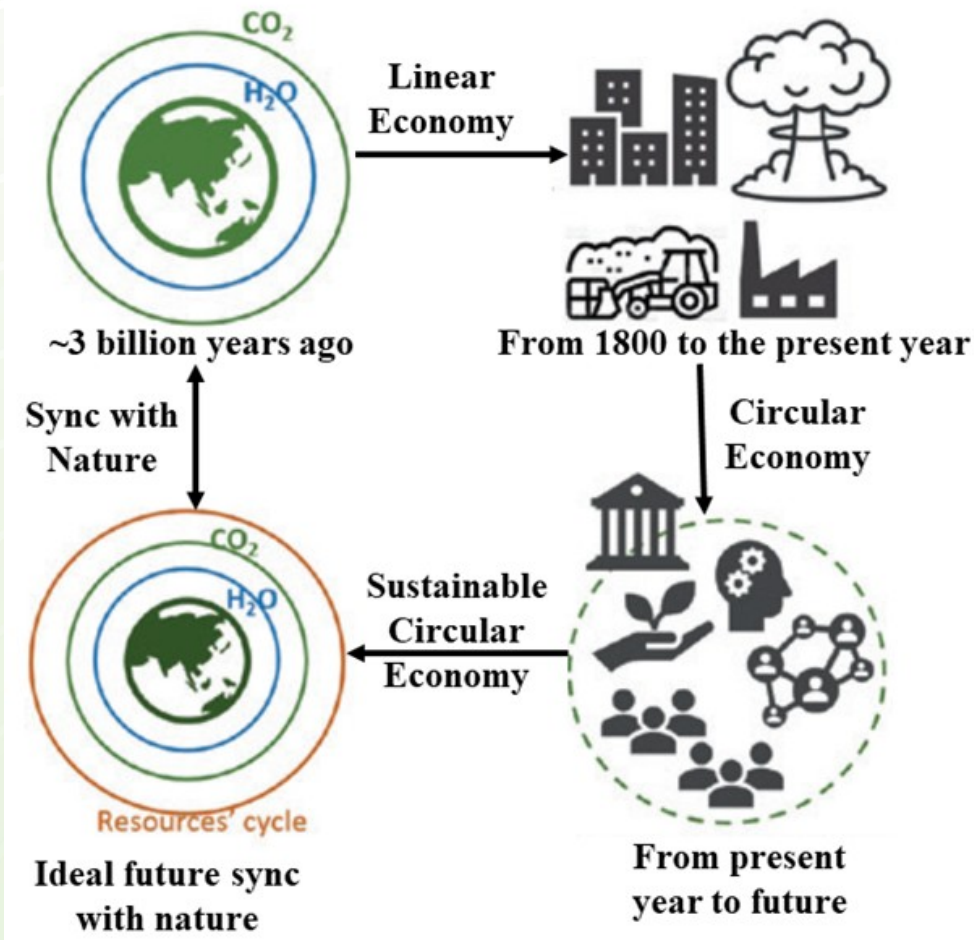
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• Kris Hartley is assistant professor of public policy in the Department of Public and International Affairs at City University of Hong Kong.





Thank You