HOLISTIC RESOURCE SYSTEMS

A framework approach for improving the management of waste and taking action against climate change.

TOMRA

EXECUTIVE SUMMARY

Over the next decade, it is widely accepted that carbon emissions need to fall to around half of the current levels to avert the worst impacts of climate change. As the population rises and middle-class growth further propels consumption, the sheer amount of mismanaged waste poses massive threats to ecosystems and humanity. The greenhouse gases (GHG) associated with producing what ultimately becomes municipal waste will grow by up to two-thirds by 2030, far outweighing the reduction in emissions happening today.

Bold action is needed now to overcome the threats of global mismanaged waste. Stronger recycling and emissions-reduction targets are achievable and necessary to offset rapidly growing resource consumption, prevent excessive waste and reduce our dependency on primary resources. Recycling is an essential part of a circular economy and a vital solution in transforming the current take-make-waste systems of today. When products or components eventually reach the end of their life, these valuable resources risk being permanently lost if they are not recycled.

Ambitious emissions-reduction targets like those of the European Union and the UK, and most recently the United States, demonstrate the urgent need to step up and resolute action. Adopting more assertive GHG performance standards, especially for carbon-intensive materials like plastics and metal, supports more scalable climate management solutions. Policymakers should not waste their chance of expanding actions rapidly; researchers and environmental groups indicate that a green recovery is possible with existing technologies.

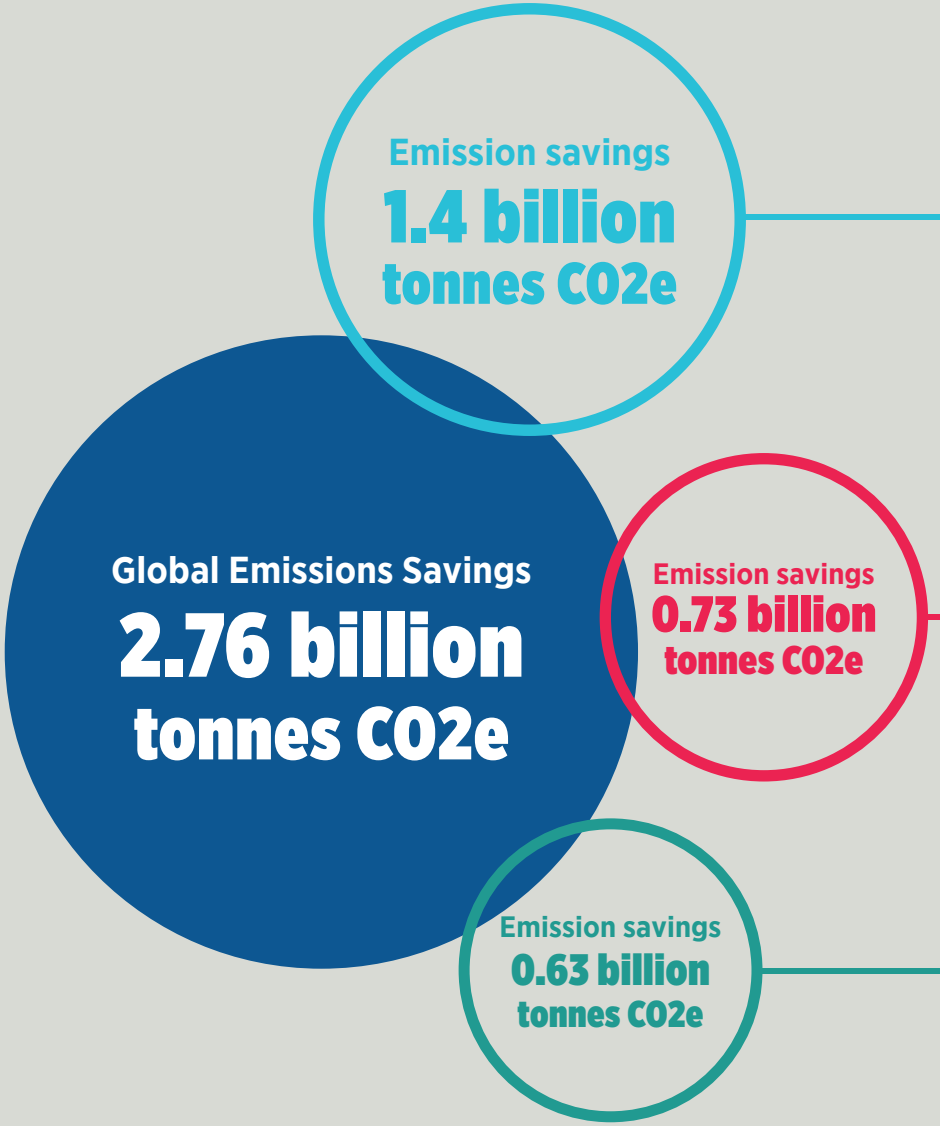
We also need policies that look beyond one's backyard to ensure responsible handling of resources worldwide. By significantly increasing recycling captures and improving resource management practices globally, GHG emissions can be reduced by 2.76 billion tonnes CO_2 equivalent per year compared to current waste disposal methods – the equivalent of removing more than 600 million passenger vehicles from the road annually.

As a global frontrunner in empowering the circularity of resources, TOMRA continues to analyze and optimize methods that achieve the highest recycling rate and reduction in GHG emissions possible. This white paper provides evidence that supports the efficiencies of Holistic Resource Systems – a combination of well-established waste management techniques using both national and regional level approaches. The framework integrates deposit return schemes (DRS), the separate collection of specific material types and mixed waste sorting (MWS) to maximize recycling and its associated carbon benefits.

TOMRA is committed to taking post-consumer plastic packaging waste management to a new level worldwide. The company pledged to enable 40% of all post-consumer plastic packaging produced globally each year to be collected for recycling by 2030. Taking it even a step further, TOMRA also intends to enable 30% of all post-consumer plastic packaging to be recycled in a closed-loop system, which is critical to reducing the world reliance on fossil fuels. These ambitious goals are, in part, based on the expert research and analysis presented in this document. And this is only the starting point. To rise to the challenge of climate change, we are accelerating the path towards a circular economy through collaborative efforts to build effective systems where recyclable materials are recovered, recycled, and reused cannot be hyphenated, over and over again.

HOLISTIC RESOURCE SYSTEMS' POTENTIAL

Reduction of CO_2 equivalent per year compared to current methods of waste disposal.



Circular recycling practices

Effectively increase the collection and sorting of recyclable materials and organic waste in both informal and formal waste sectors.

Mixed waste sorting

Enable high sorting efficiencies of recyclable materials from residual waste before incineration/landfill to avoid primary production emissions.

Global residual waste treatment

Eliminate open burning and dumping with minimum standard waste treatment options that contribute to human health and the environment.

Waste

[weɪst] *noun*

Unwanted or unusable material, substances, or by-products.

THE MAGNITUDE OF WASTE:

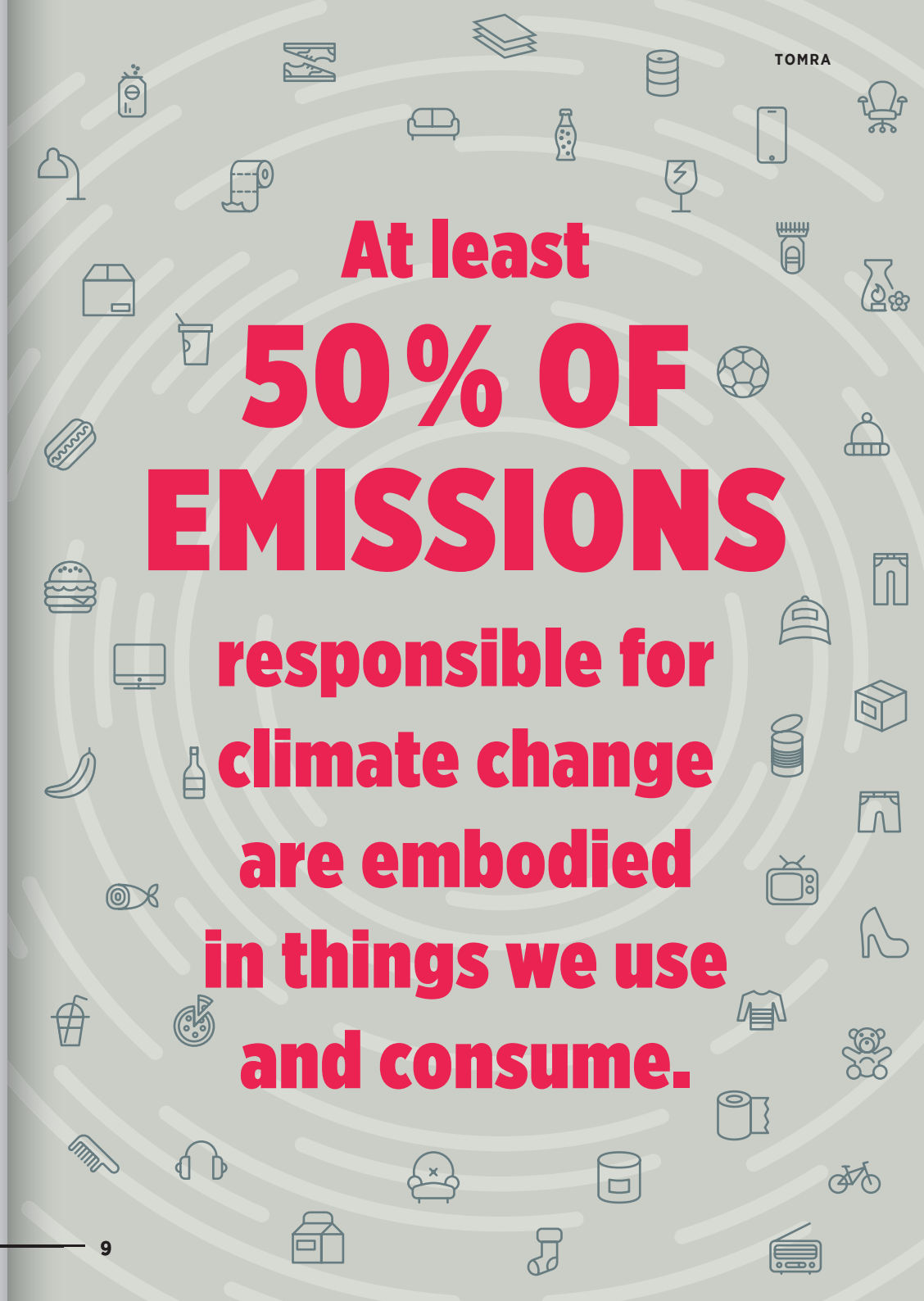
AN UNDERESTIMATED GLOBAL THREAT

According to the World Bank, the quantity of municipal waste generated globally in 2016 was estimated to be just over 2 billion tons. The volume occupied by this waste might be of the order 10 billion m^3, equivalent to filling up 10,000 Empire State buildings with waste. Waste production is also strongly coupled with economic development across the globe. In fact, as societal wealth grows, the World Bank also projects that the amount of waste produced will increase by a further 500 million tons by 2030.

The magnitude of the challenge is greater still when considering that everything we use or consume requires energy from the start. From the energy used in extracting natural resources, to the manufacturing and transportation – the "embodied energy" in the things we use and consume is responsible for at least 50% of climate change emissions. Thus, there has been a notable shift in how waste is perceived in recent years, and the concept of a circular economy has gained prominence. Now is the time to focus on how we keep material in the system rather than it being prematurely discarded.

DOING NOTHING MULTIPLIES OUR RISK

The sheer amount of waste and its mismanagement pose the twin threats of direct pollution and loss of resources, which increase as populations and the middle-class continue to grow. By 2030, the energy embodied in items that get thrown away will represent up to 15 % of our current CO_2 emissions. Between now and then, carbon emissions associated with the production of what eventually becomes municipal waste will grow by up to two-thirds, undermining efforts in other areas of the economy that are getting the most attention, such as energy and transport systems.



WASTE-TO-ENERGY IS NOT ENOUGH TO GO WASTE-FREE

In many developing countries, waste collection services are either absent or very limited in scope. As consumption patterns become increasingly globalized, waste in those areas without such collection infrastructure is often either burned, buried or discarded into the environment, sometimes directly into rivers or seas. While more waste is collected in countries with developed infrastructure, even in middle- and high-income countries the majority is still either burned or buried. Regulated incineration and landfilling of waste maintain emissions at what is deemed permissible levels. Burning and burying, however, remain significant sources of GHGs, and although some air pollutants from burning waste are controlled, those that are still emitted are concentrated in point sources.

The rise of on-the-go consumption and the associated increase in waste have given rise to littering, which persists even when comprehensive waste collection services are available. The casual discarding of rubbish into the environment significantly contributes to the plastic pollution found in our rivers and seas. Additionally, products and packaging have increased in complexity. As well as making the waste stream less valuable in many cases (e.g., flexible packaging), material compositions undermine the economics of good waste management and contribute to the sector's failure to address the problem.

The Double Threat of Waste Volume and its Mismanagement

 Direct Pollution	 Resource Loss
Unnecessary pollution of air, water and soil	Excessive carbon emissions
Negative impact on human health and livelihood	Destruction of ecosystems and loss of biodiversity
Disproportionate effect on the most vulnerable members of society	Raw material depletion with primary production

WASTE MANAGEMENT FACILITATES THE ENJOYMENT OF BASIC HUMAN RIGHTS

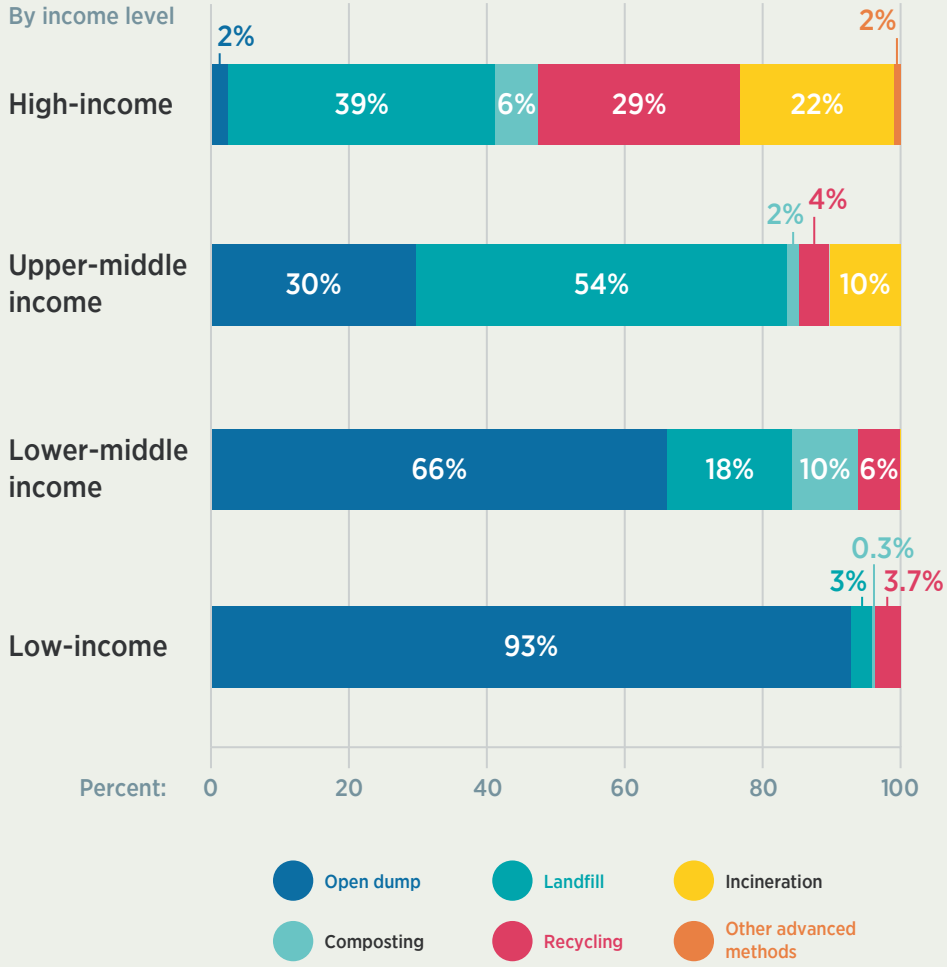
In 2019, the UN's Special Rapporteur on Human Rights and the Environment called on countries to take urgent action to improve air quality to fulfill their human rights obligations. Basic waste management is a global concern, as many countries still continue to battle uncontrolled dumping, open burning and lack of access to waste services. Globally, two out of five people lack access to controlled waste disposal facilities.[1]

There is an urgent need to implement formal waste management worldwide to meet the UN's Sustainable Development Goals (SDGs) by 2030. Waste dumped on land or in rivers can increase the prevalence of vector-borne diseases among the general population. Waste pickers, who derive income from sorting through discarded materials, are particularly exposed to the increased incidence of diseases, notably dengue fever, malaria and typhoid. Using a holistic approach in developing countries offers promising economic benefits and enables waste pickers to work in facilities with safer conditions.

Despite the world waking up to the impacts of inadequate waste management on society's poorest citizens, the right to a healthy environment has not yet been recognized at the global level. Formal waste management must play a crucial role in tackling air, soil and water quality problems to enable everyone to access a healthy environment.

1) UNEP 2019

Treatment of Municipal Waste by Income Grouping, 2016



Source: Silpa Kaza, Lisa Yao, Perinaz Bhada-Tata, and Frank Van Woerden (2018) **What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050.** Urban Development Series. Washington, DC: World Bank

ECONOMIC GROWTH SHOULD CREATE VALUE, NOT WASTE

As prosperity increases worldwide, waste management is a crucial enabler for sustainable growth. The Circularity Gap Report 2021 states that the circular economy has the power to shrink global GHG emissions by 39 % and cut virgin resource use by 28 % by implementing smart strategies and reduced material consumption.[2]

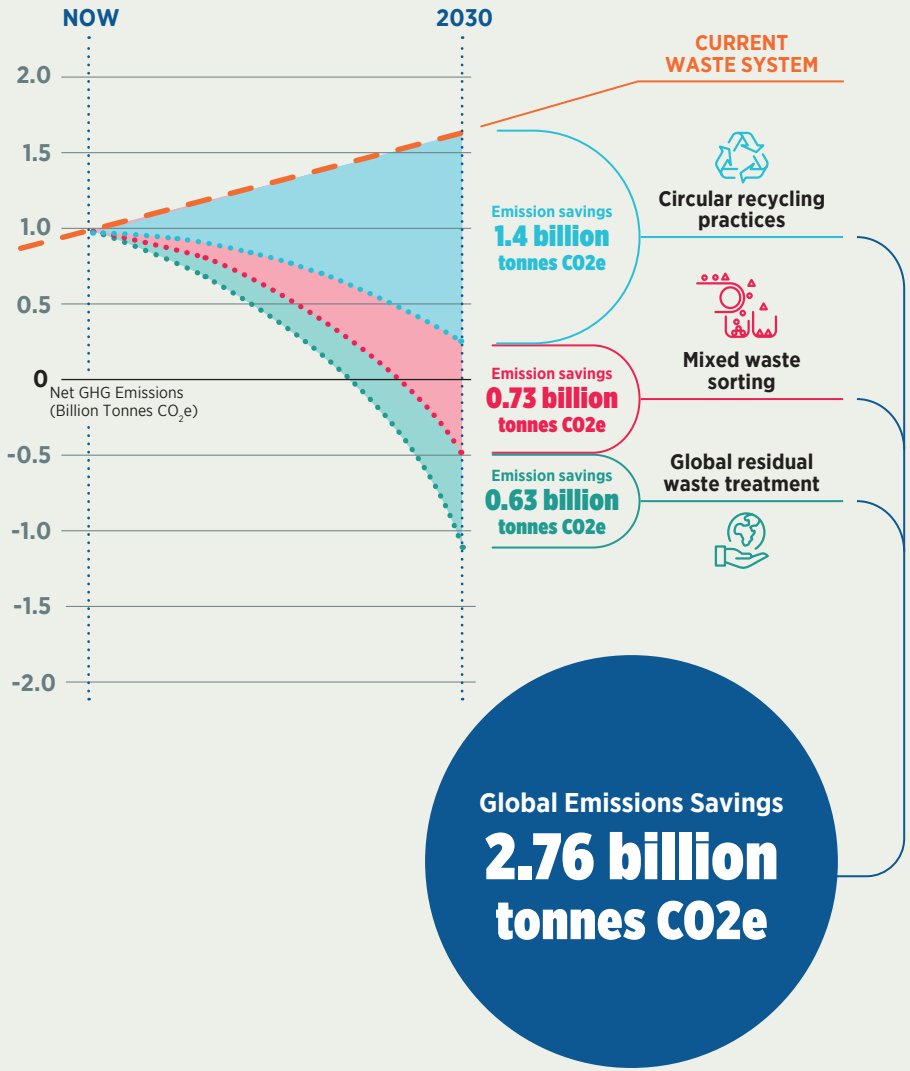
Analysis conducted by Eunomia, commissioned by TOMRA, indicates a significant underestimate in the World Bank's figures for municipal solid waste generated across the world. The findings modelled an adjusted baseline in which the municipal waste arisings are increased by 30 % and projected the magnitude of carbon emissions savings resulting from implementing improved waste management practices worldwide.

Significantly improving recycling captures and the way in which the remaining waste is managed can reduce GHG emissions by 2.76 billion tonnes CO_2 per year. If we incorporate the emissions of biogenic origin, by introducing for example anaerobic digestion practices, the impact is even greater with up to 3 billion tonnes CO_2 equivalent. Failure to act swiftly will lead to the accumulation of greater damage and an even bigger hurdle to overcome than if action is taken now, using tried and tested approaches across the globe.

2) The Circularity Gap Report 2021. https://www.circularity-gap.world/2021

2030 Scenario for Municipal Waste GHG Emissions

30 % Increase on World Bank projections (excluding biogenic CO_2)



Source: Waste in the Net-Zero Century: How Better Waste Management Practices Can Contribute to Reducing Global Carbon Emissions. Eunomia. May 2021.

PROSPERITY REQUIRES PLANNING

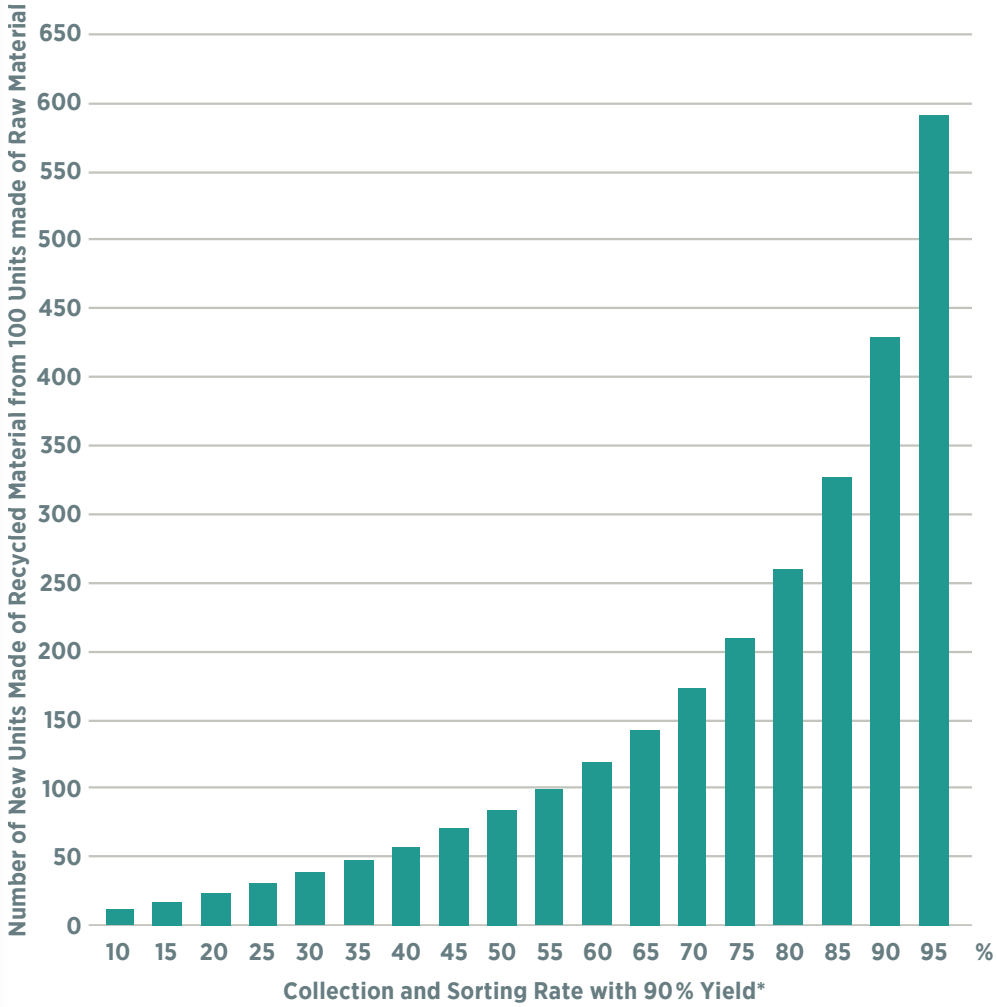
Any system that assumes waste is inevitable is incompatible with the challenges humanity must confront collectively, let alone the 21st century. Designing infrastructure as though there is no waste, however, risks downplaying the immense challenges that show no signs of disappearing in the short- or even medium-term.

While there is a need for rapid reduction of consumption and preventing waste where possible, recycling is also a significant part of the solution. What is not collected and recycled is lost – a waste of valuable resources. In a circular economy, very high recycling rates deliver exponential benefits by repeatedly returning material to the system, therefore avoiding primary production emissions. While one might argue that waste-to-energy is a transition technology, recycling is a long-lasting and fundamental component. Waste management is a basic requisite for humanity to thrive and works most efficiently when appropriated, organized and managed. Therefore, the only viable solution is to optimize how we manage waste – the will to do so is the only requirement to implement these readily available solutions.

Holistic Resource Systems exponentially increase circularity with a multi-method approach that produces very high collection and sorting rates of targeted materials. While 60% collection and sorting rates are considered 'respectable' today, Holistic Resource Systems can deliver over 500% more new products made of recycled content.

How Collection and Sorting Rates Impact Circularity

Holistic Resource Systems with collection and sorting rates as high as 95% can deliver over 500% more new products made of recycled content.



*Yield rates vary widely based on materials and infrastructure.

Resource

[rɪˈzɔːs] *noun*

A source or supply from which a benefit is produced and that has some utility.

HOLISTIC RESOURCE SYSTEMS

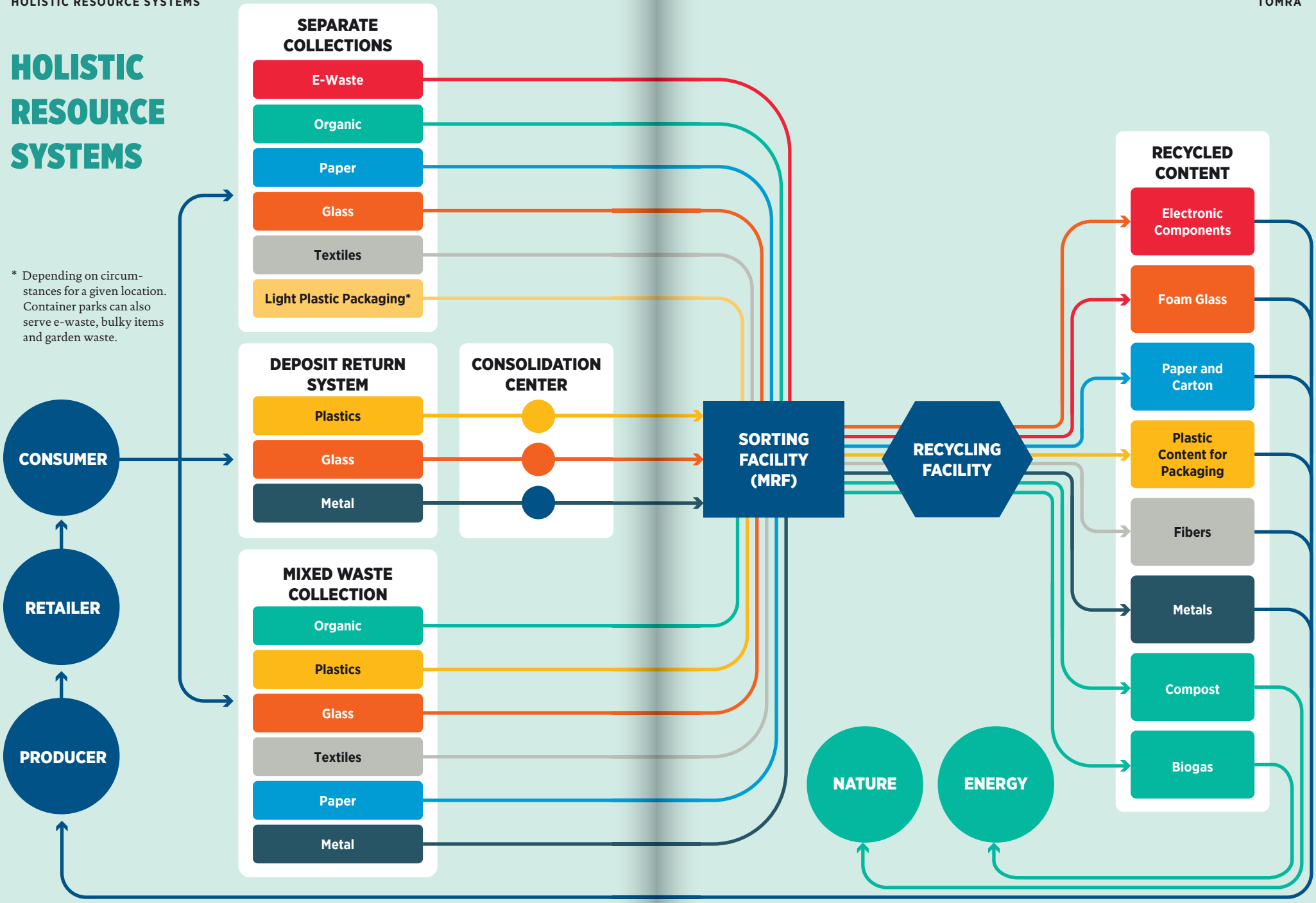
A WORTHY OPPORTUNITY

In a study commissioned by TOMRA, Eunomia examined which combination of waste management practices deliver maximum recycling rates and the most significant associated reduction in CO_2 emissions. Given the advanced regulatory framework and access to detailed data, the analysis started by examining several European case studies. Further work and best practices from across the globe will follow in due course.

Holistic Resource Systems integrate waste management techniques designed to respond to regional challenges of managing resources and minimizing their impact on the planet. They are based on current policies and approaches on both national and regional levels that deal with existing products, materials, and waste flows. The composition of materials will inevitably alter over time, with systems being adapted incrementally to adjust to these changes. The unique advantage of using a Holistic Resource Systems approach is its capability to adapt to location requirements and future needs.

HOLISTIC RESOURCE SYSTEMS

* Depending on circumstances for a given location. Container parks can also serve e-waste, bulky items and garden waste.



DEPOSIT RETURN SCHEMES

Deposit return schemes (DRS) for beverage containers generate much higher collection rates when compared to other separate collections of the same materials. They are an ideal solution for policies such as, or similar to, the Single Use Plastics (SUP) Directive in Europe, which includes a target collection rate of 90% for plastic beverage containers.

DRS are an intrinsic part of Holistic Resource Systems and should always include polyethylene terephthalate (PET) and metal beverage containers. DRS are capable of high return rates for glass packaging, which in many cases may be appropriate to include within the scope, but should be determined on a case-by-case basis. Some countries are considering including other recyclable waste materials in the future. The principle of deposit redemption ensures high collection rates and therefore low losses to the environment.

Recycling rates for PET vary considerably in Europe. The countries that have implemented high-performing deposit return schemes have proven their feasibility and benefitted from reduced amounts of litter. Germany currently leads recycling efforts, with 97.9% PET bottles sold with a deposit on them being returned to its legislated deposit return system.

Numerous studies on litter show that beverage containers contribute to waste found in the terrestrial and marine environment and underpin the rationale for the collection rate target of 90% for single-use plastic bottles in the EU's SUP Directive. In its annual report, Ocean Conservancy's International Coastal Cleanup found that two of the top five most common items of litter were related to beverage containers, in the form of the containers themselves and the caps.[3]

3) https://oceanconservancy.org/wp-content/uploads/2020/10/FINAL_2020ICC_Report.pdf

COLLECTION: THE CRUCIAL FACTOR IN CIRCULARITY

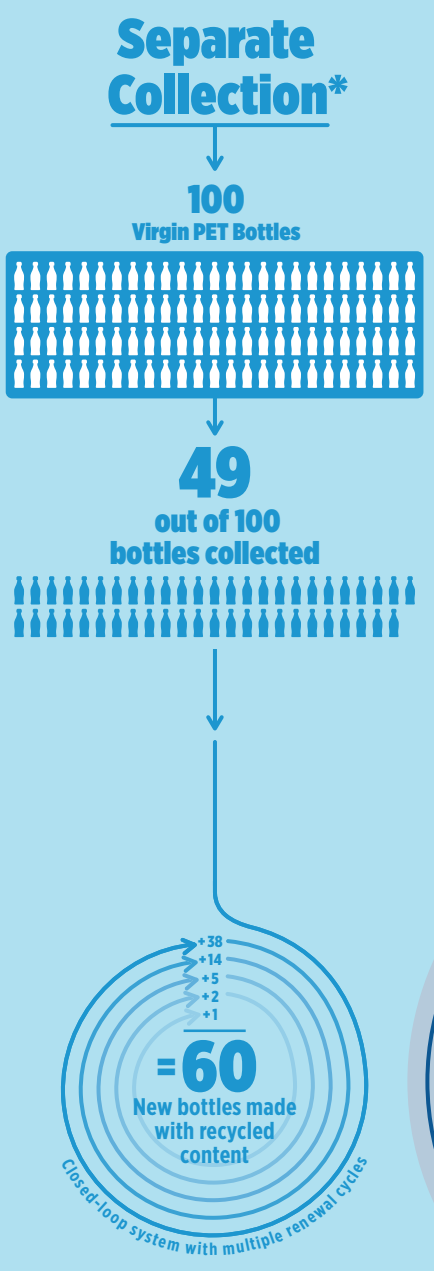
Cumulative Comparison, PET Beverage Containers

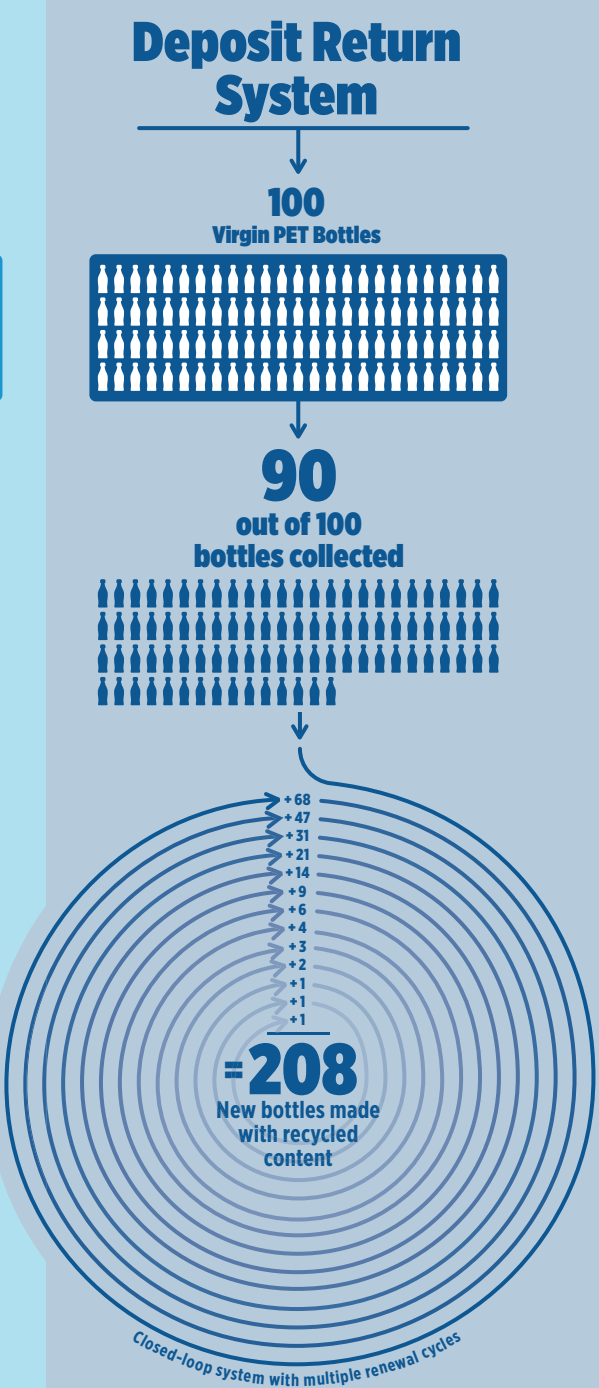
Deposit Return Systems enable bottle-to-bottle recycling in a circular economy. Assuming a recycling rate of 75% of all PET beverage containers in a closed-loop system, the original material is exhausted through cumulative process losses in each renewal cycle over time.

Collection rates exponentially influence the cumulative total of new bottles for every 100 virgin bottles produced – an excellent case for implementing deposit return systems that consistently achieve >90% collection rates. Holistic Resource Systems focus on how materials are collected and sorted to boost recycling rates and maximize circularity.

* Non-deposit containers. Collection rate based on 2017 European average.

New bottles made with recycled content are based on a 75% recycling rate for PET in a closed-loop system.





How a High-Performing Deposit Return System Works in Practice

STEP 1 PRODUCER

Producer pays deposit, extended producer fee (EPR) and sends data to central system administrator (CSA). Producers are aligned to design an effective system to reach the legislated return-rate target. They finance the net costs of the system through an eco-modulated EPR fee.

STEP 2 RETAILER

Producer charges retailer price and deposit for each container sold.

STEP 3 CONSUMER

Retailer recovers deposit paid to producer by charging consumer deposit upon sale. Consumers are incentivized to participate through a meaningful deposit value and broad scope of beverage containers.

STEP 4 RETAILER

Consumer returns empty beverage containers and redeems their deposit. Container redemption is easy due to a comprehensive return-to-retail obligation, which provides a convenient network of return locations.

STEP 5 LOGISTICS

Central system administrator arranges and pays for the transport of empty beverage containers and receives data.

STEP 6 CONSOLIDATION & COUNTING CENTER

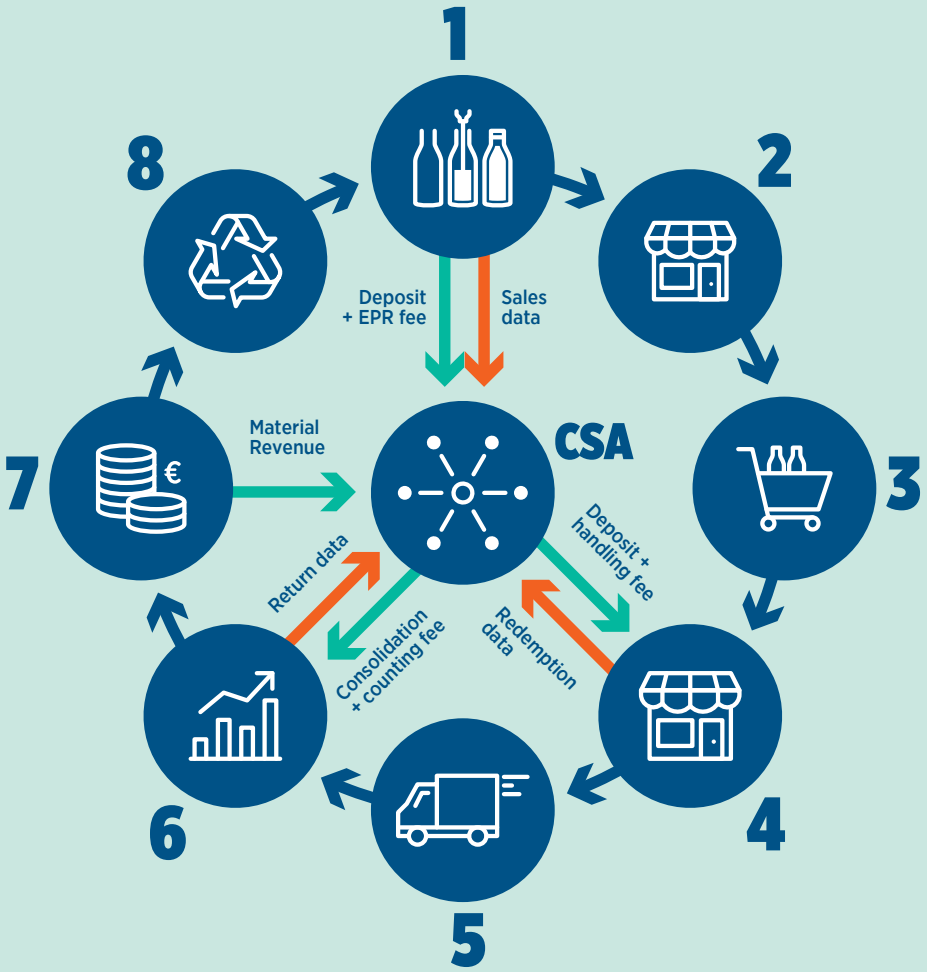
All manually returned containers are consolidated, counted and validated.

STEP 7 MATERIAL SALES

Central system administrator sells material as feedstock to recyclers.

STEP 8 RECYCLING

Material recycled and converted into new packaging for producers.



Source: Rewarding Recycling: Learnings from the World's Highest-Performing Deposit Return Systems. TOMRA. 2021.
(Link: https://www.tomra.com/en/collection/reverse-vending/deposit-return-schemes/white-paper)

SEPARATE COLLECTIONS

To ensure the maximum carbon benefit when recycling materials, the following should be separated from residual waste at source and collected in single streams:

ORGANIC

Food and Garden Waste

Offsets demand of fossil-derived fertilizer and improves soil carbon through compost and digestate from source-separated organic material suited for agricultural needs. Reduction of organics in residual waste also likely to enhance mixed waste sorting.

PAPER

Graphic, De-Ink and Packaging Paper

Maximizing the amount of reusable pulp for paper recycling requires dry and clean collection to avoid the structural degradation of material. Source-separated papers further reduce non-fiber contaminants resulting in the highest potential yields of pulp.

GLASS

Glass Packaging, Cullet

Greatly reduces energy demands in primary production and curtails contaminants in dry mixed recycling streams. Source separation, in some cases by color, heightens the quality and quantity needed to enable maximum recycling yields.

TEXTILES

Post-Consumer Apparel and Industry Scrap

Significant reduction of primary production impact on climate through reuse of textiles. Recycling pre- and post-consumer textiles requires clean and dry collection to effectively sort various types of fibers at scale for the garment industry.

E-WASTE

Electrical and Electronic Equipment, Household Batteries

Reduce demand for primary resources while protecting the environment from toxic substances by enabling the safe reuse and recovery of recyclable materials found in electrical and electronic equipment waste. Source-separated collection with possible integration into DRS in the future.

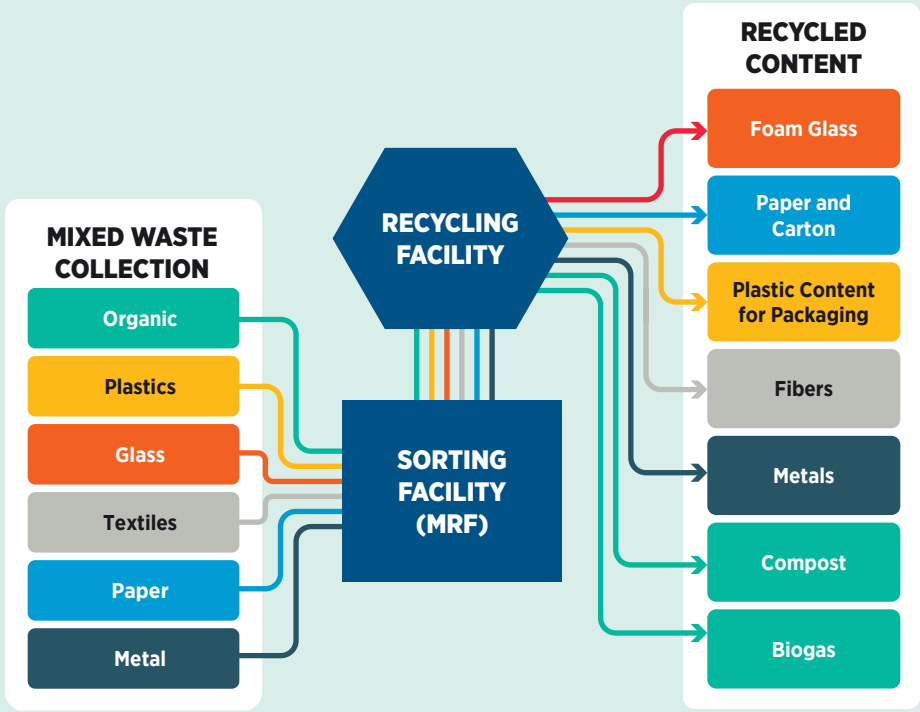
THE RECOVERY OF RESOURCES BEYOND SEPARATE COLLECTIONS

Given the capability to produce the highest capture rates and decrease contamination of recyclable materials, thus maximizing the reduction of GHG emissions, the separate collection of specific material streams is an intrinsic part of Holistic Resource Systems. Notably, the source separation of plastics may not always be necessary when all components of Holistic Resource Systems are in place, depending on the particular circumstances for a given location.

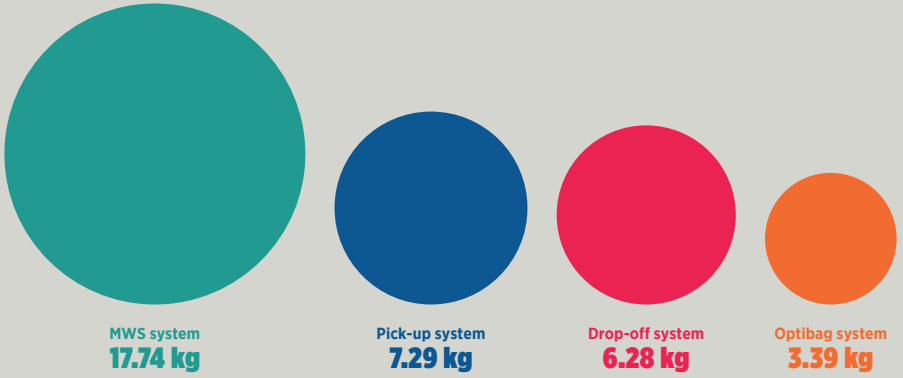
While separate collections offer value and play an essential part, their capture rates are insufficient, and further mixed waste sorting will always be necessary to meet climate mitigation demands.

MIXED WASTE SORTING

Holistic Resource Systems always include mixed waste sorting (MWS) as a fundamental pillar in maximizing recycling rates and GHG benefits. MWS powerfully enables the recycling of packaging not captured in DRS and separate collections effectively and with equal yield quality, assuming the post-collection processes are the same.



Mixed waste sorting can capture MORE THAN DOUBLE the amount of plastic packaging for recycling.



Source: "Sirkulær plastemballasje i Norge – kartlegging av verdikjeden for plastemballasje" [Circular plastic packaging in Norway – mapping of the value chain for plastic packaging], Report for Forum for Circular Plastic Packaging, Deloitte AS, April 2019.

CIRCULARITY IS IN THE MIX

Advanced MWS plants featuring mechanical sorting technology ensure such high efficiencies it can even eliminate the need for source-separated plastic and metal packaging. Studies in Norway show that plastic packaging recycling rates can more than double when the systems introduce MWS plants and no longer rely on residents to separate plastic packaging from household waste. After all, it's human nature: when source separation becomes inconvenient, complicated or confusing, post-consumer waste can quickly end up in the wrong bin.

Depending on local circumstances and where the resulting benefits outweigh the costs, MWS can also include target materials not captured by separate collections, such as paper, glass packaging and organic waste. In most cases, the overall system cost is reduced due to savings on residual treatment and substantial environmental benefits.

WIDER CONSIDERATIONS

Environmental Impact

Designed to maximize environmental benefits through recycling, Holistic Resource Systems offer significant potential in addressing the climate crisis. By applying Holistic Resource Systems across European cases studied, work to date indicates these methods would meet the EU's target to recycle 65% of municipal waste by 2035.

The MWS component is particularly important when considering the GHG benefit – a metric calculated by assigning a CO_2 emission equivalent in terms of net benefit to each compositional item that is or is likely to be recyclable. When combined with DRS and separate collections, MWS provides an increase in the recycling rate of around 5% and contributes about 15% in terms of the GHG benefit. DRS inclusive of PET and metal beverage containers adds about 2% to the overall recycling rate and contributes 9% GHG benefit. While the environmental impact varies considerably between the types of materials collected, recycling has a net benefit on climate change. The emissions associated with recycling a tonne of material are far less than producing a tonne of material from primary production.

EXISTING WASTE MANAGEMENT INFRASTRUCTURE

A significant number of developed economies already have a certain degree of separate collections, and several also have well developed DRS and MWS systems. In developing economies, the infrastructure relies heavily on the informal sector to pick and sort the waste. In both cases, alternative investments in waste management strategies would require a complete analysis of the existing system.

In regions with established separate collections that generate reasonable performance, MWS is a necessary next step to boost the overall GHG recycling rate. As a complementary solution to enhance region-specific waste flow, MWS also helps meet reprocessing requirements further along the value chain.

Where no separate collection currently exists for plastic and metal packaging, it is most cost-effective to implement a combination of DRS for beverage containers and MWS for the remaining plastics and metals, thus, generating a high performing GHG benefit across these materials. Depending on the circumstances for a given location, it may be worthwhile to also collect glass beverage containers in the DRS. If not, and for other glass containers, the most cost-effective collection method is likely to be through separate collection points, with the possibility of capturing any remaining glass in the system. Other materials, such as biowaste and paper, should still be collected separately to ensure sufficient quality to maximize the subsequent emissions mitigation benefit.

3×IMPACT

In combination with DRS and Separate Collections, MWS triples its impact on GHG benefit.

COMPLEMENTARY WASTE MANAGEMENT POLICY FEATURES

Extended Producer Responsibility (EPR) policies are fundamental in ensuring Holistic Resource Systems' success in increasing recycling rates and GHG benefit. An EPR's key principle is that the costs of end-of-life management of specific materials (e.g., packaging) should be recovered from producers. Thus, the policy encourages producers to create longer-lasting products designed for recycling. Deposit return schemes should be considered as part of a suite of policies used to implement EPR.

Proof of Concept

[pru:f əv ˈkɑ:nsept] *noun*

Evidence that shows a certain method has practical potential.

CASE STUDY

IVAR IKS
ROGALAND REGION, NORWAY

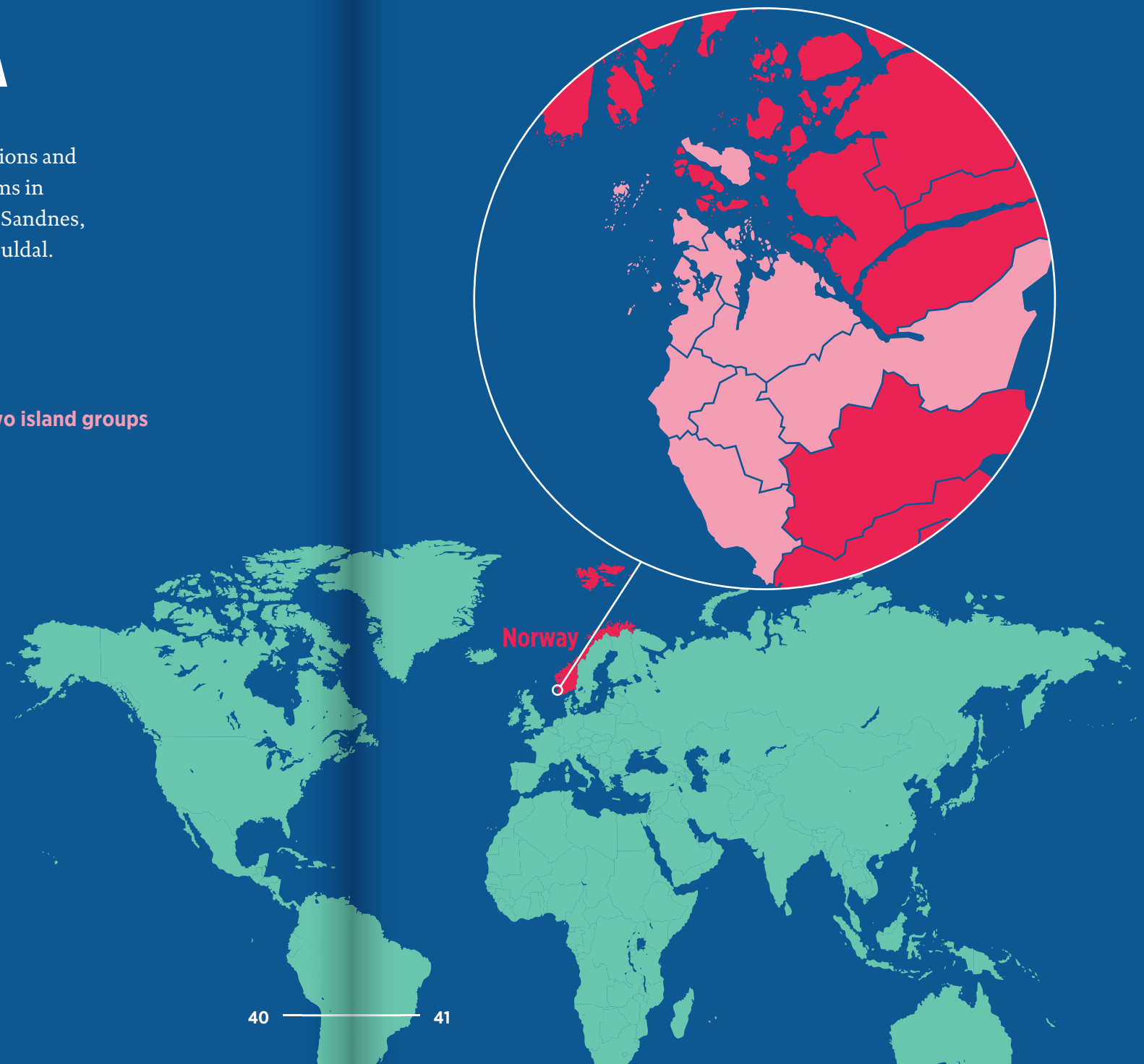
A representative model of the Holistic Resource Systems framework is in the region surrounding Stavanger, Norway. IVAR IKS is a municipality-owned company that recognized the need to improve its waste management methods to enhance environmental performance and boost recycling rates.

Optimizing waste and resource management systems requires a collaborative, in-depth assessment of the waste streams and the options available to improve environmental performance. TOMRA provided IVAR IKS advice based on their extensive expertise in advanced material flows for sorting residential mixed waste.

IVAR IKS SERVICE AREA

IVAR IKS operates several recycling stations and receives waste from the collection systems in Gjesdal, Hå, Klepp, Kvitsøy, Randaberg, Sandnes, Sola, Stavanger, Hjelmeland, Time and Suldal.

- **Urban and rural area mix, including two island groups**
- **Total population served: 322,000**



IDENTIFYING OPPORTUNITY

At the start of the collaboration, the region's waste management system already featured two of the three fundamental methods defined in TOMRA Holistic Resource Systems: deposit return scheme (DRS) and separate collections. To identify the opportunities of introducing mixed waste sorting technology, IVAR IKS sent municipal solid waste samples from the region to TOMRA testing facilities in Germany to determine its performance potential.

After meticulously examining the quantities and quality of post-sorted fractions, the performance analysis of municipal solid waste testing identified several additional opportunities to enhance recycling rates further and reduce the overall environmental impact.

Well-running systems have room to improve, too

Introduced in 1999 and based on a tax reduction model for producers, the Norwegian DRS is a leading model in circularity worldwide. While the system has always captured large quantities of target plastics and metals (PET and aluminum beverage containers), the analysis performed by TOMRA identified that significant amounts of other plastics and metals still ended up in the municipal solid waste stream.

Before the analysis, the region offered a comprehensive system of separate collections for organic (food and garden) waste, paper, plastic packaging, glass, and textiles. The mixed waste sorting analysis results identified that that paper was being recovered from source separation reasonably well. However, organic waste streams required optimization and significant amounts of plastic packaging not being source-separated ended up in household mixed waste.

MIXED WASTE SORTING

The Missing Link for Evolutionary Transformation

Mixed waste sorting (MWS) of residual waste before incineration ensures high recycling rates of materials that strongly influence Waste-to-Energy (WtE) emissions. IVAR IKS recognized MWS as an essential component in making their business equipped for the future and potential new regulation and therefore developed a business case. The result: a newly constructed, fully automated mixed waste sorting plant, including brand new facilities for plastics reprocessing and paper sorting.

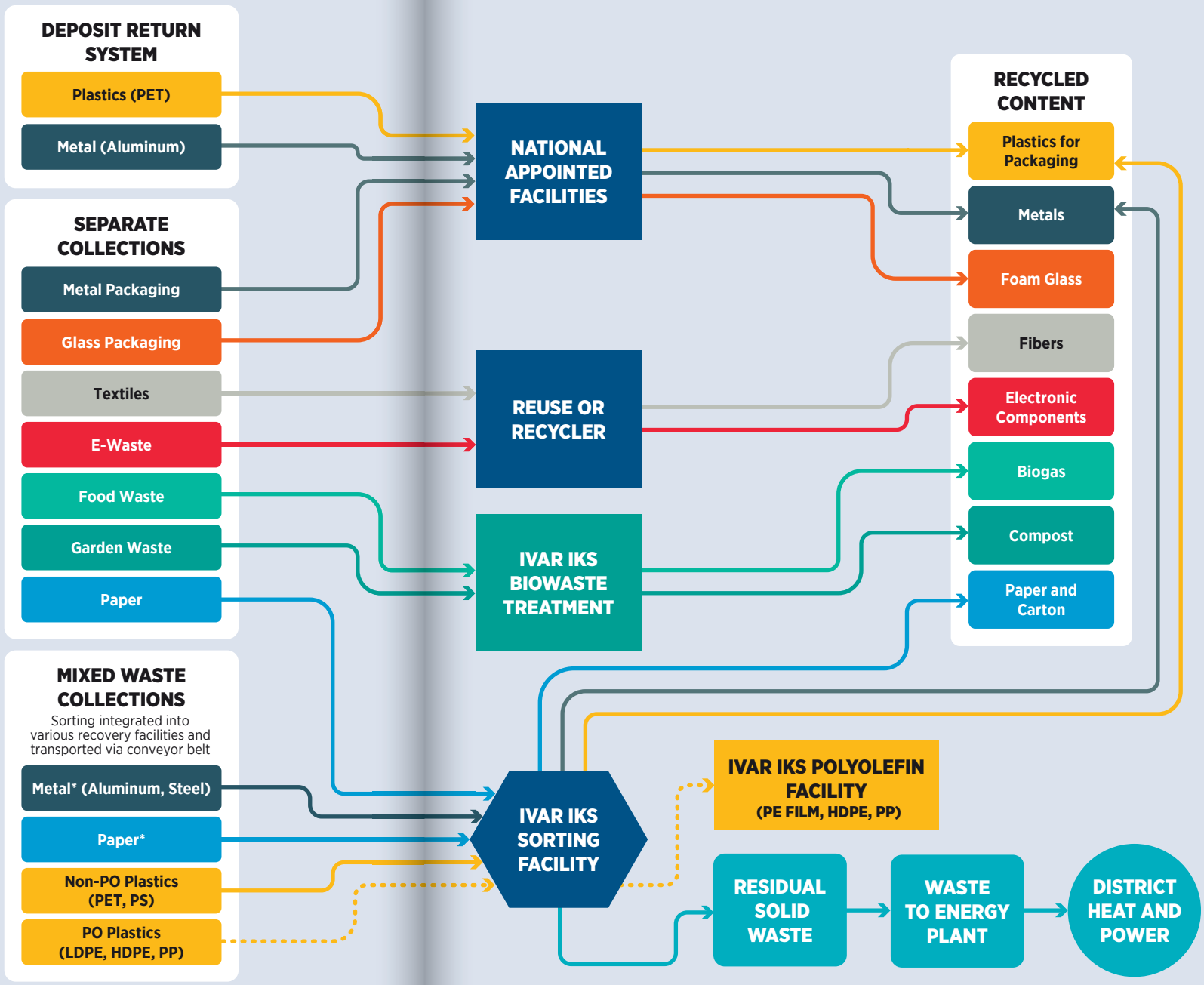
The IVAR IKS system now processes all its residual municipal solid waste in one of the most advanced MSW plants in Europe. Processing 40 tonnes throughput of mixed waste per hour, the plant efficiently and effectively sorts plastics (PET, PS, LDPE, HDPE, PP), paper (mixed paper, cardboard, beverage cartons) and metals (aluminum, steel). Installed adjacent to the waste-to-energy plant, the MWS facilities transport residual waste automatically via conveyor belts. In combination with its paper sorting facility, the fully automated plant features 22 sensor-based sorting units.

Notably, adding mixed waste sorting enabled IVAR IKS to eliminate the separate collection of plastic packaging and its associated costs. Mixed waste sorting technologies deliver significantly higher sorting efficiencies of plastic and metals than the previous separate collections systems – resulting in a more simplified process for residents, too. Furthermore, once the polyolefin plastics are sorted, they are then washed and reprocessed at the same location, which also reduces transport-related emissions. Thanks to its new plastics reprocessing facility, IVAR IKS provides ready-for-market recycled content for new products and packaging.

By sorting recyclable materials before incineration, IVAR IKS reduces its WtE emissions and lessens global demand for primary resources.

OPTIMIZED WASTE FLOW

Holistic Resources Systems in Action

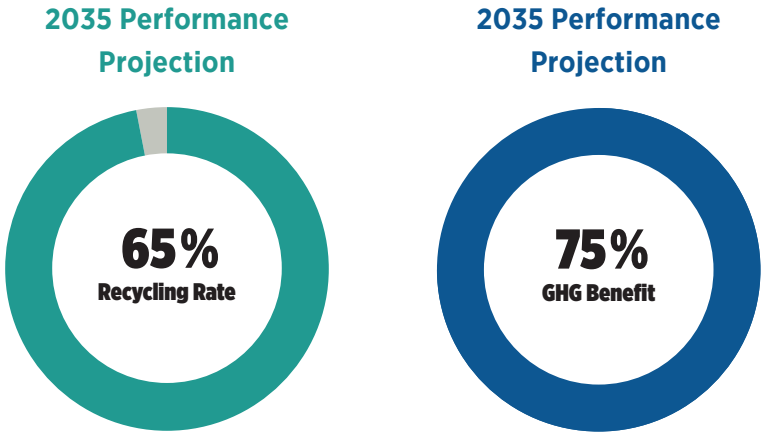


* Improperly disposed of in municipal solid waste

CONTINUOUS IMPROVEMENTS

Implementing additional methods to further enhance performance

As recycling rate and greenhouse gas (GHG) targets gradually increase to fight climate change, IVAR IKS performs continual analysis of the system in collaboration with various experts, including TOMRA. To meet future European Union waste and pollution targets of 65% recycling rates and 75% GHG benefit in 2035, IVAR IKS is focused on improving organic waste collections by separating streams for food and garden waste and the subsequent sorting of organic material before treatment. Modelling likely changes to these systems, based on proven methods in other parts of Europe, projects the system is already close to achieving its 2035 objectives.



FROM OPPORTUNITY TO FIELD-PROVEN RESULTS

IVAR IKS achieved significant improvements in the overall recycling rates, with plastics and metals recovery being most notable in reducing climate change emissions. The implemented system changes including mixed waste sorting have resulted in class leading recycling rates. As of 2021, IVAR IKS ranks 1st in Norway in post-consumer plastic packaging collection rates.

With this approach, IVAR IKS and TOMRA laid the necessary groundwork to offer waste management services that meet the needs of the community, the environment and economic efficiencies. With the approaches recommended by the Holistic Resource Systems framework and supporting technologies, the facility is well on its way to meeting future recycling rates and GHG targets under the European Union Waste Package requirements.

Solution

[səˈluːʃən] *noun*

A means of solving a problem or dealing with a difficult situation.

SUMMARY AND CONCLUSIONS

The threat of global mismanaged waste is getting notably worse. The Circularity Gap Report 2020 revealed that the global economy was only 8.6% circular, down from 9.1% just two years earlier. There is an urgent need to reduce consumption, prevent waste where possible, and invest in a green recovery.

At least 50% of emissions responsible for climate change are embodied in things we use and consume – from the energy used in extracting natural resources to manufacturing and transportation. When these products or components reach the end of life, we risk losing valuable resources if they are not recycled. Optimized management of waste delivers very high recycling rates with exponential benefits for the environment and humanity. The solutions are readily available – failure to act swiftly will lead to greater damage and even bigger hurdles to overcome.

Holistic Resource Systems that bring together an integrated package of waste management techniques to deliver maximum recycling and the highest reduction in CO_2 emissions is the best way forward, here and now. It is comprised of:

- Deposit return schemes for PET and metal beverage containers – maximizing captures of high-quality, high carbon-intensity material while reducing litter. DRS may also include glass containers.

- Separate collections of organic waste, paper, glass packaging, textiles and e-waste – ensuring the maximum carbon benefit when recycling materials. Although separate collections are an intrinsic part of Holistic Resource Systems, the capture rates in even best practices are not good enough. Mechanical sorting to complement separate collections will always be necessary to achieve targets. Select materials may continue to be targeted via separate collections depending on the approach or cost-effectiveness.

- Mixed waste sorting – generates additional recycling above and beyond what the other elements can deliver. The incineration or burying of plastics and other high carbon materials unnecessarily generate GHG emissions. MWS reduces those emissions and puts the material back into the system for incorporation into new products.

- EPR policies to underpin the system are vital to its success.

Significantly reducing GHG emissions requires the implementation of Holistic Resource Systems worldwide. To achieve the highest recycling rate and maximum environmental benefits, every part of the system is vital to its overall success. MWS needs to be considered an investment priority now, as it is a required backstop to ensure we are capturing all the resources we can.

Now is the time for bold action. TOMRA is committed to taking post-consumer plastic packaging waste management to a new level worldwide. Having pledged to enable 40 % of all post-consumer plastic packaging produced globally each year to be collected for recycling by 2030, the company takes its commitment even further. TOMRA also intends to enable 30 % of all post-consumer plastic packaging to be recycled in a closed-loop system in the same timeframe. Additional analysis and case studies on Holistic Resource Systems will be made available in due time, and we invite interested parties to engage with us actively.

We look forward to rapidly transforming the ways in which we collect, manage and sort our Earth's most valuable resources together with you.

ABOUT US

TOMRA

TOMRA is a global impact leader in the resource revolution, creating and providing sensor-based solutions for optimal resource productivity. Founded in 1972 on an innovation that began with the design, manufacture and sale of reverse vending machines (RVMs) for automated collection of used beverage containers. Today, TOMRA provides technology-led solutions that enable the growth of the circular economy with advanced collection and sorting systems that optimize resource recovery and minimize waste in the food, recycling and mining industries.

www.tomra.com

ReSociety

ReSociety is a global collaborative platform initiated by TOMRA's Circular Economy Division. With passion for sustainability and expertise in circular waste management, ReSociety brings people and organizations together to address the holistic management of resources. Leveraging the skills and expertise of the collective for climate action, we aim to implement Holistic Resource Systems throughout the world.

Join us today to network, exchange ideas and establish a more sustainable future!

www.resociety.net

OUR PARTNERS

WORKING TOGETHER TOWARDS A CIRCULAR FUTURE

TOMRA works with many global brands, plastic producers, converters and recyclers, enabling organizations to improve sustainability and reduce environmental impact through our solutions and knowledge.

"With the new 'Greiner Blue Plan' sustainability strategy, we have set ourselves ambitious goals. Blue Plan focuses on climate change, circular economy and people. But we cannot master the major challenges alone. This requires alliances, and we are happy to be in exchange with numerous companies and organizations and to drive forward great projects together."

Tobias Strasser
Managing Director
Greiner Packaging AG

"Today's consumers want sustainable packaging. Henkel is committed to drive progress towards a circular economy. Creating truly circular packaging requires much more than a design – it demands collection, sorting, and recycling systems in place. We are excited about the progress made in the necessary technologies, because it creates a path to a better, more sustainable world."

Dannielle Borger

Head of Packaging Sustainability Laundry & Home Care

Henkel AG

"We can now deliver advanced recycled products for use in high-demanding plastic applications, including automotive and consumer products industries with our state-of-the-art plant for post-consumer plastic waste. Our joint enterprise with TOMRA demonstrates that, true to our EverMinds™ ambitions, collaboration is essential in accelerating action in plastics circularity to re-invent for a more sustainable living."

Christopher McArdle

Vice President Polyolefins Strategy & New Business Development

Borealis

"PreZero is proud to be pioneering circular economy solutions in the US, Germany and beyond. It's our work with TOMRA that has truly enabled these solutions to be scaled for worldwide growth."

Philipp Gatzen

Project Leader

PreZero International

"With TOMRA on the steering committee for action towards a circular economy, CEFLEX benefited from their expertise in recycling flexible packaging. Together, we drive towards the development of fully recyclable flexible packaging – making a positive impact on climate change."

Dana Mosora

Lead Consultant

CEFLEX

"Half our carbon emissions come from our materials and food systems, with their attendant pollution and habitat destruction impacts. A circular economy that minimises resource use while driving equality in global standards of living is fundamental to a socially just net zero."

Joe Papineschi
Chairperson
Eunomia Research & Consulting

"Waste levels are growing everywhere in the world and magnified as three billion people still have limited or no access to waste management systems. Infrastructure and solutions are much needed to stop the leakage of plastic waste into our environment. Tomra's paper highlights why the full plastic value chain has to work together so there can be maximum impact in preserving resources, improving the lives of people in the most vulnerable regions and creating new economically viable business models that support integrated waste management systems."

Jacob Duer
President and CEO
Alliance to End Plastic Waste

"We've invested in 22 NIR sorting machines in our waste sorting plant. Collaborating with TOMRA is essential to achieve our ambitious environmental goals. As a result, our region has made a big step towards a resource-efficient and climate-friendly circular economy."

Rudolf Meissner
Chief advisor
IVAR IKS

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www.tomra.com