附　件　六

新加坡 ISWA 年會講者簡報

一
全球垃圾場封場倡議報告：每人替無人化垃圾場支付多少金額？ **(Global Closing Dumpsites Initiative Report: What will be the Price Everyone Pays for Unmanaged Dumpsites)**
講述無人管理的垃圾場的風險性和其對生態系統的影響，以及靠近河流和海洋的廢棄物處理設施對於海洋廢棄物的處理狀況。強調幫助那些希望過渡到更好、更安全的衛生垃圾掩埋場運營的垃圾場，並對減少溫室氣體排放以及提高周圍社區宜居性能有所貢獻。

Global Closing Dumpsites Initiative Report: What will be the price everyone pays for unmanaged dumpsites?

James Law, Chair of ISWA Working Group on Landfill & VP of SCS Engineers

Why closing dumpsites is a GLOBAL priority and what would be the price to pay if we don't act now?

What is an Open Dumpsite?

- Wastes widely spread, uncovered & no daily cover
- Open fires, waste periodically on fire
- Vectors (dogs, birds, other animals) often present; animals seeking food at open dumps
- Lack of security measures, access by waste pickers
- No liner system or CLAY soil liner
- No or limited compaction
- Leachate and landfill gas not managed
- Slope failure and instability issues

Unmanaged piling of waste

Courtesy: Ciclus, 2014

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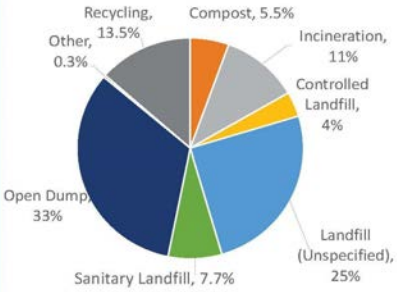
Why Closing Dumpsites A Global Priority?

- 70% of global waste goes to dumpsites, controlled or sanitary landfills
- 33% (per TWB) or 40% (per ISWA) is openly dumped with over 90% in low-income countries
- Issue with dump slope stability, fires, odors etc…



Past Dumpsite Slope Failures

2000 – Payatas Dumpsite, Manilla, Philippines; 278 killed; 300 missing

2005 – Leuwigajah Dumpsite, Bandung, Indonesia; 143 killed, buried 71 houses

2015 – Hongao C&D Landfill, Shenzen, China; 73 killed; 4 missing

2016 - Hrybovychi Landfill, Lviv, Ukraine; 3 firemen & 1 ecologist buried under 20m of waste

2017 - Koshe Dump, Addis Ababa, Ethiopia; 113 killed; 80 missing

2017 – Meethotamulla Garbage Dump, Sri Lanka; 19 killed

2017 – East Delhi Landfill, India; 2 motorists drown and dozens injured

2020 – Ermua Landfill, Zaldibar in Basque region of Spain; 2 dead

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Payatas Dumpsite, Manila, Philippines (2000)

Ref. Stark, 2008

- Unlined, operated since 1973
- Waste was pushed over the brink of landfill to create more space for landfilling but also ended up with very steep slope – 1:1.5
- 30 m waste height prior to failure
- Heavy rain from two typhoons – 68 cm
- Failure in July 10, 2000; 1.2M m^3 slide
- over 250 fatalities

Ghazapur Landfill, East Delhi, India (1 Sep 2017)

Total waste in East Delhi is 2200 tonnes per day

Dumpsite receives 1100 tonnes per day

- Started 1984, covers 30 ha or 74 ac.
- Very steep slope – 1:1.5
- 45-50 m waste height prior to failure
- Frequent fires
- Slide in 2017 that drowned 2 motorists drown and dozen injured
- It is one of the 50 largest and dangerous dumps in the world

What would be the best solution to solve this problem?

2019, Ghazipur Landfill

Fire Hazard on Dumpsite – 30 march 2022

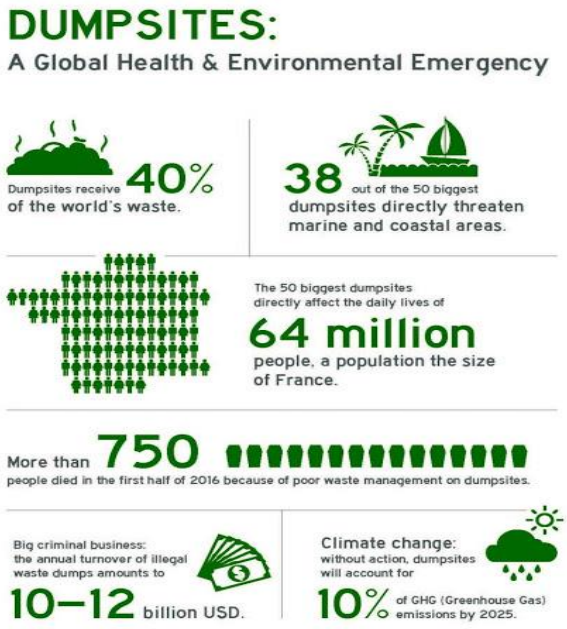
Firefighters struggled to contain the blaze at the Ghazipur landfill in New Delhi, India.

By Esha Mitra and Rhea Mogul, CNN

Updated 2:51 AM EDT, Wed March 30, 2022

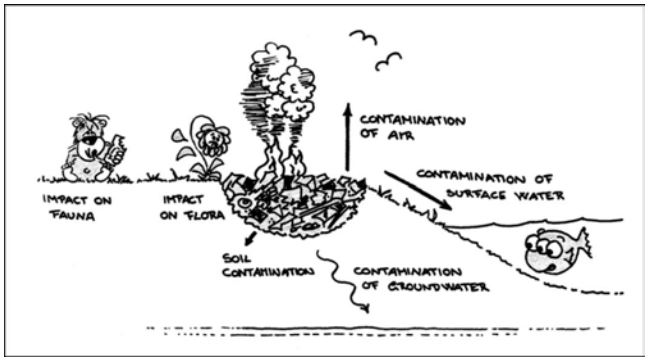
What prices we Pay if no actions to current practice?

- A global health and environmental emergency to people living around and on dumpsites, including waste pickers
- Issues with air & plastic pollution, and marine litter
- Climate change



Issues with Open Dumps - Environment

- Soil, ground & surface water contamination
- Impact on Fauna and Flora
- Uncontrolled fires and air pollution, black carbon from burning
- Climate impacts from black smoke and methane



Impacts of Open Dumps - Public Health

- Contamination of drinking water
- Pests and spread of disease
- Health & safety issues of waste pickers at the site
- ISWA videos on dumpsites:
  - https://vimeo.com/183801563
  - https://www.facebook.com/watch/?v=465687350650537
  - https://www.iswa.org/closing-the-worlds-biggest-dumpsites-task-force/?v=7516fd43adaa

50 Largest and Dangerous Dumpsites

Open Dumpsites: A Global Problem

Globally, >50,000 dumpsites, over 2 million people working on dumpsites,
750 people killed in first half of 2016

ISWA WGL - Task Force on Closing Dumpsites

- Our Vision - To Close All Dumpsites and Promote Engineered/Scientific/Sanitary Landfills or Other Practical & Affordable Waste Management Systems Worldwide

- Our Goals - To persuade international stakeholders and decision makers to increase their investments in waste management, especially in low- and middle-income economies, and to set up partnerships with NGOs, financial institution, governments and municipalities

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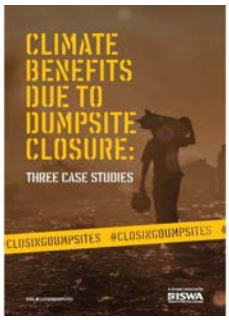
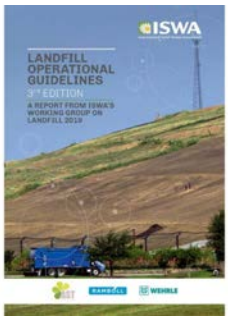
ISWA's Closing Dumpsite Publications

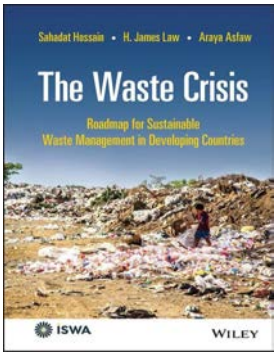
- 2014 - we mapped the 50 biggest dumpsites.
- 2015 - we released the "Wasted Health" report and the Global Waste Management Outlook –
  - First was dedicated to health impacts that are created by dumpsites;
  - Second was focusing on how developing countries can advance their systems and close their dumpsites.
- 2016 - we released the Roadmap for Closing the World's Biggest Dumpsites."
- 2018 - Task Force on Closing Dumpsites (TFCD) campaign was launched. Needs everyone involvement!
  - Find out more at:
    www.ClosingDumpsites.iswa.org

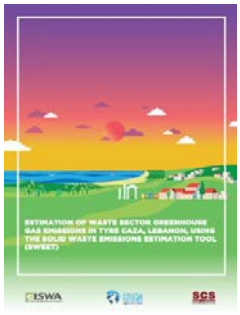
WGL TFCD 2019 Publications

- 2019 - we released two reports:
  1) Climate Benefits Due to Dumpsite Closure: Three Case Studies
  2) Landfill Operational Guidelines 3rd Edition
- 2021 – Estimation of Waste Sector Greenhouse Gas Emissions in Tyre Caza, Lebanon
- 2022 – ISWA-Wiley Book Series, "The Waste Crisis: Roadmap for Sustainable Waste Management in Developing Countries"









TFCD Project Example – ISWA Partnered with UN-CCAC

- First project was at a selected site: Ras El Ain Dumpsite in Tyre, Lebanon
- It is a city with strong support from the local government
- We engaged in the following deliverables:
  - Site selection and assessment
  - Emissions quantification modeling, analysis & report
  - Communication package and dissemination of results
  - Capacity building and training workshop

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ISWA-CCAC Closing Dumpsite Project

- Gas emissions estimation was done using a model called Solid Waste Emissions Estimation Tool (SWEET)
- SWEET v3.1 (2020) was developed by US EPA for UN-CCAC Waste Initiative. Free download at:
  - http://www.waste.ccacoalition.org/document/solid-waste-emissions-estimation-tool-sweet
- SWEET v4.0 (2021) – latest model at US EPA GMI site:
  - www.globalmethane.org/sweet
- This project showcases gas emissions quantification of a baseline + four alternative waste management systems for climate benefits comparison, leading to a decision on how to implement current Integrated WM Plan

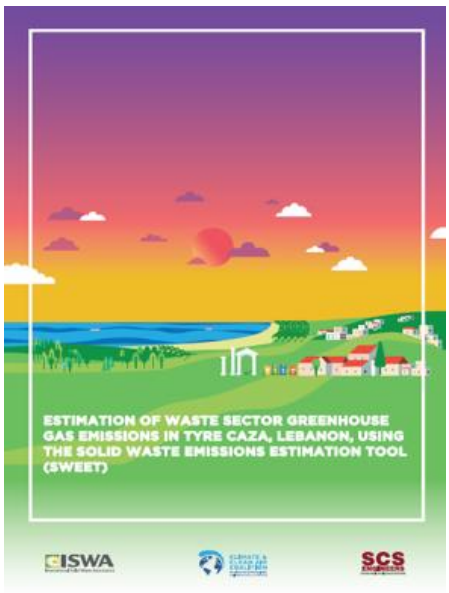
Closed Ras El-Ain Dumpsite near Tyre, Lebanon

Photo: Karim Hashash, Office of the Minister of State for Administrative Reform (OMSAR) in Lebanon

ISWA-CCAC Closing Dumpsite Project

Five Scenarios in Gas Emissions Estimation:

1. BAU: Baseline Scenario, Business as Usual
2. Alt S1: Remediate Dumpsite (2022-2025)
3. Alt S2: Remediate Dumpsite and Develop new Landfill (2023)
4. Alt S3: Remediate Dumpsite, Develop new Landfill, and Implement Phase 1 Diversion to 40%, involving local government actions & policies to revise and improve current collection, recycling, & operation systems (2023-2025)
5. Alt S4: Remediate Dumpsite, Develop new Landfill, and Implement Phase 2 Diversion to 52%, involving national policies on utilization of RDF (2023-2025)



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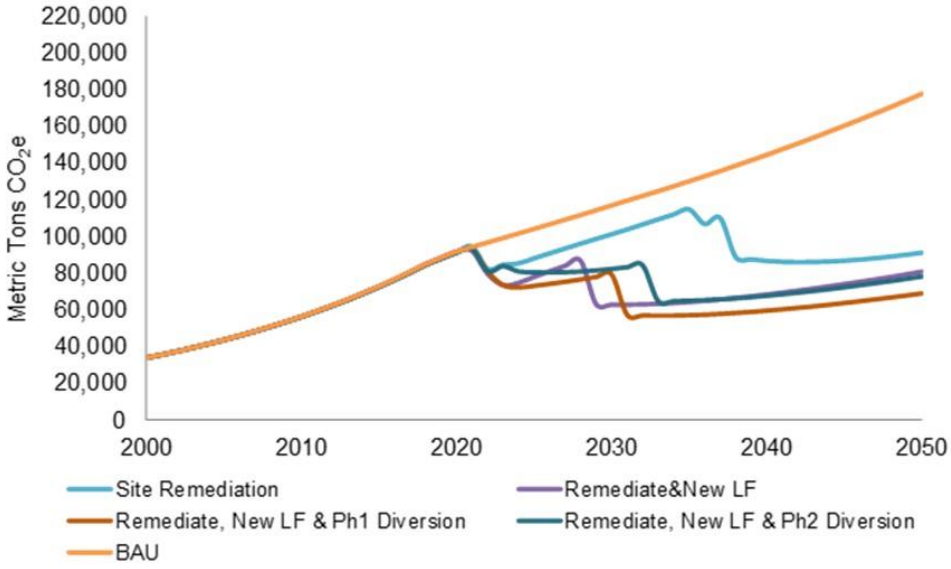
Total GHG and Black Carbon (SLCPs) Emissions



Total Emissions Reduction in Percent, %

(% of Baseline Scenario Emissions)

Year	Alternative Scenario 1	Alternative Scenario 2	Alternative Scenario 3	Alternative Scenario 4
2025	15%	25%	30%	22%
2030	13%	46%	32%	29%
2035	11%	51%	56%	50%
2040	40%	53%	59%	53%
2045	46%	54%	60%	55%
2050	48%	55%	61%	56%

Alt. S3 diversion scenario yields most emissions reduction, from 30% in 2025 to 61% in 2050

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Climatic Benefits at Lebanon Site

- In addition to a cleaner environment and better health for the people, a large GHG emissions reduction is achievable in realizing climatic benefits, by simply closing the dumpsite along with mitigating with landfill gas collection system
- Additional GHG emissions reduction can be realized by improving recycling and compositing rates in alternative waste management systems

Trash fills the riverbanks of Beirut, Lebanon during the waste disposal crisis in 2015

Photo from Antonis Mavropoulos, "Lebanon Waste Crisis: how it all started?" Wasteless Future. 12 January 2017

Task Force on Closing Dumpsites – next 4 years

- Use our reports as the basis for fundraising with international stakeholders and promoting best SWM practices in developing countries
- Provide technical guidance in transitioning from dumpsites to controlled or sanitary landfills or other long-term sustainable alternatives as part of an integrated waste management system
- Require partnerships with our NMs and networks for recognition and awareness in supporting the activities of TFCD
- Do one project at a time to tell a success story!

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In closing remarks, closing dumpsites is all about protecting….

Environment	Health	Climate
		

Thank You

Getting involved with TFCD, contact:

James Law, PE, BCEE, IWM, LEED AP

Chair of ISWA's WGL & TFCD

Vice President, SCS Engineers, USA

jlaw@scsengineers.com

+1 (919) 604-6102

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二
全垃圾掩埋的開採技術及其永續金融 **(Landfill Mining Technologies and its Financial Sustainability)**
介紹垃圾掩埋場和循環經濟如何齊頭並進；垃圾掩埋場不僅可作為回收或焚燒材料的最終場所，另外還可以使在垃圾掩埋場過渡到衛生掩埋場的運營過程中，將垃圾掩埋場作為一種潛在的資源回收及開採技術應用的寶庫，並將其對環境風險降至最低。

Landfill Mining contribution to a Circular Economy

RENÉ M. ROSENDAL

SENIOR PROJECT MANAGER AV MILJØ AND PARTNER DANISH WASTE SOLUTIONS APS

Dumpsites: A Global Waste Emergency

- Dumpsites are a global health and environmental emergency.
- Open dumpsites can have large negative impacts on the local economics and society as well as the health and safety of the people living around them
- Dumpsites receive roughly 40% of the world's waste and serve 3-4 billion people.
- As urbanization and population growth continue, several hundreds of millions more people will be served by dumpsites, mainly in developing countries.

ISWA Roadmap - Closing dumpsites (I)

ISWA has presented a roadmap for closing the world's biggest waste dumpsites (2016). In order to protect the environment and to assure better public health and safety, open dumps have not been permitted in developed countries since more than 30 years. However, in many countries waste still ends up on dumpsites.

#CLOSINGDUMPSITES

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ISWA Roadmap - Closing dumpsites (II)

- The first immediate steps to closing down dumpsites can have quick positive effects on the environment by reducing contamination and improving health and safety for those that live near them.
- The proper management of dumpsites can easily be linked to and contribute significantly to sustainable development goals both directly and indirectly.

Dumpsite closure means either:

a) A specific dumsite is shut down and substituted with a sanitary landfill site (maybe with source separation and/or pre-treatment of solid waste) or

b) A dumpsite is upgraded and becomes controllable and less risky for human health and the environment as a first step towards an integrated solid waste management system – Landfill Mining is an option

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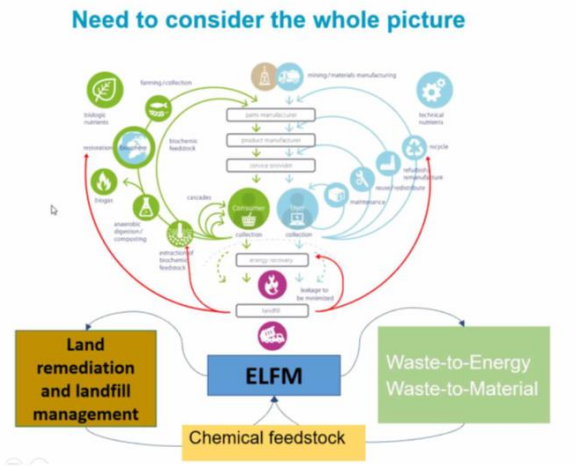
Definition: Enhanced Landfill Mining

Enhanced landfill mining [ELFM]:

*'the **safe conditioning, excavation and integrated valorisation** of (historic and/or future) landfilled waste streams as both **materials** (Waste-to-Material, WtM) ~~and~~* **or** ***energy** (Waste-to-Energy, WtE), using innovative transformation technologies and respecting the most stringent social and ecological criteria.' **(Jones et al. 2013)***

Landfill Mining in the Circular Economy



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Motivation and potential benefits of Landfill Mining

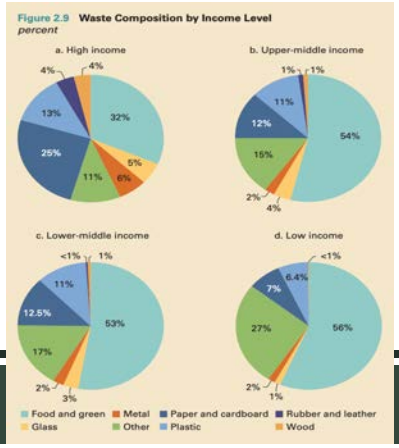
- Probably not feasible but a necessity
- Prevent contamination problems from old landfills or dumps
- Upgrade dumpsites to sanitary landfills
- Reduce closure and aftercare costs
- Recover of recyclable
- Recover material to produce RDF (energy)
- Conservation of landfill space
- Reclaim land

Developed vs. decevloping countries

- Landfill Mining of waste is the same concept whether you are mining a landfill in a developed or a developing country – but should be adjusted and adopted the specific case
- Differences can be found in the aim, background and the local conditions
- Methods and technology for mining the waste

Huge differences in:

- Income, wages, living conditions
- Market conditions
- Regulation (environmental + health/safety)
- Infrastructure
- Scavengers
- Political will



Developed vs. developing countries

- The consumption per capita is highest in developed countries, large stocks of secondary metals are located in developing countries due to high population density (UNEP, 2010).
- Open dumping instead of modern sanitary landfilling remains the disposal practice of choice in most economically developing countries - in some countries > 90%.
- Even today, many economically developed countries, including many EU, North America and Australia, still rely on landfilling as a part of solid waste management infrastructure, despite a loss of valuable resources when landfill (consider it a resource bank for now)
- (Hopefully) over time, open dumps will gradually be upgraded to well designed and managed landfills for MSW disposal as economies improve and environmental protection measures are adopted

Conclusions

- The rationale for landfill mining is huge (many years to come)
- With LFM its possible to eliminate the bad waste management choices from the past (not cheap, at least for now – will improve)
- Landfill Mining can´t stand alone and better waste management system need to be applied (etc. source separation and/or pre-treatment of solid waste) – dont continue the same mistakes and this will benefit the environment and the circular economy in the right direction
- Landfilling has been, and likely will continue for a long time to be, the most widespread disposal technology for MSW – but it can be done right and with a good management of landfill gas and leachate
- LFM can always be applied at a later stage

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Thanks for the attention

Danish Waste Solutions ApS
Agern Allé 3
2970 Hørsholm
Denmark

Phone: (+45) 22 51 66 64
Email: rmr@danws.dk
Web: www.danws.dk

AV Miljø
Avedøreholmen 97
2650 Hvidovre
Denmark

Phone: (+45) 22 51 66 64
Email: rero@av.dk
Web: www.av.dk

三
首屆塑膠信用標準要點：塑膠污染減排標準 **(Salient Points of the First Plastic Credit Standards: Plastic Pollution Reduction Standard)**
在這場全球污染危機中，塑膠信用交易所(PCX)於2020年3 月發布首個塑膠信用管理標準，現已演變成塑膠污染減少標準(PPRS)。塑膠信貸系統的構思和開發旨在為企業提供解決方案，以便與社區、機構和地方政府合作，阻止塑膠流入自然界，並介紹世界上第一個塑膠信用標準的要點和指導原則，以及它如何解決該機制面臨的問題。

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SALIENT POINTS OF THE FIRST PLASTIC CREDIT STANDARDS: PCX'S PPRS

R. DE GUZMAN, V. KNEEFEL AND N. MEDVED-PO
PLASTIC CREDIT EXCHANGE
21 SEPTEMBER 2022

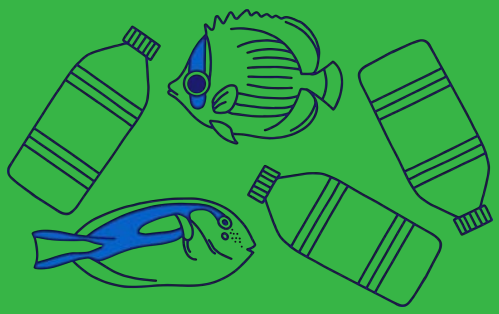
PCX

PLASTIC CREDIT EXCHANGE

ISWA
International Solid Waste Association

SILVER Member

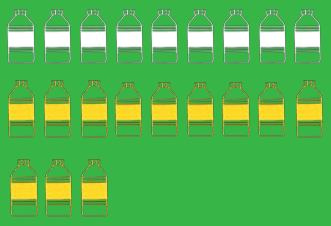
THE GLOBAL PLASTIC DEBT IS 8,706,836,932 TONNES… AND COUNTING



This means that by 2050, there could be more plastic by weight than fish in the ocean

OF ALL PLASTIC WASTE[1] EVER PRODUCED:

9% RECYCLED
12% INCINERATED



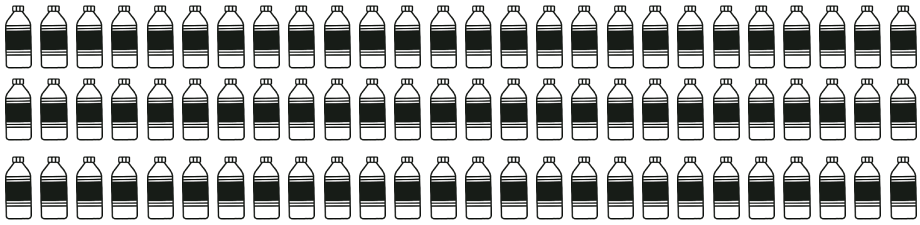
75%+ IN LANDFILLS AND THE NATURAL ENVIRONMENT, LEADING TO:

ECOSYSTEM DAMAGE
Microplastics found in water and marine organism samples globally

BIODIVERSITY LOSS
Thousands of animals killed annually by ingesting plastic or getting entangled

HUMAN HEALTH IMPACTS
Plastic exposure linked to a wide range of cancers and disorders

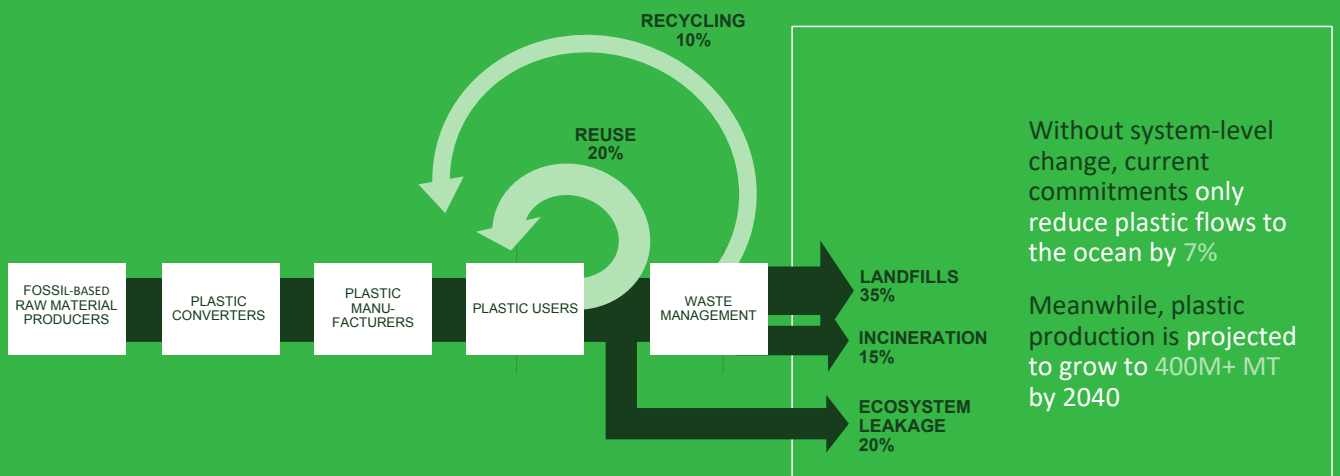
AND $100B+ IN FINANCIAL RISK[2]



1. Approx. 70% of all plastic produced; 2. 2021 UNEP report, "From Pollution to Solution"

PCX

DESPITE VERBAL COMMITMENTS, MORE CHANGE IS NEEDED



Without system-level change, current commitments only reduce plastic flows to the ocean by 7%

Meanwhile, plastic production is projected to grow to 400M+ MT by 2040

PCX

MOMENTUM TOWARDS A CIRCULAR ECONOMY FOR PLASTIC

CONSUMER DEMANDS

Consumers are shifting purchasing behavior:

- PwC's 2021 Global Consumer Insights Survey reported 50-60% respondents buy items with eco-friendly or less packaging – compared to 37% in 2019

MAINSTREAMING ESG

Corporations are increasingly expected by shareholders to measure and take responsibility for their impact on society

- 6 of top 10 FMCG companies have made commitments to reduce plastic packaging

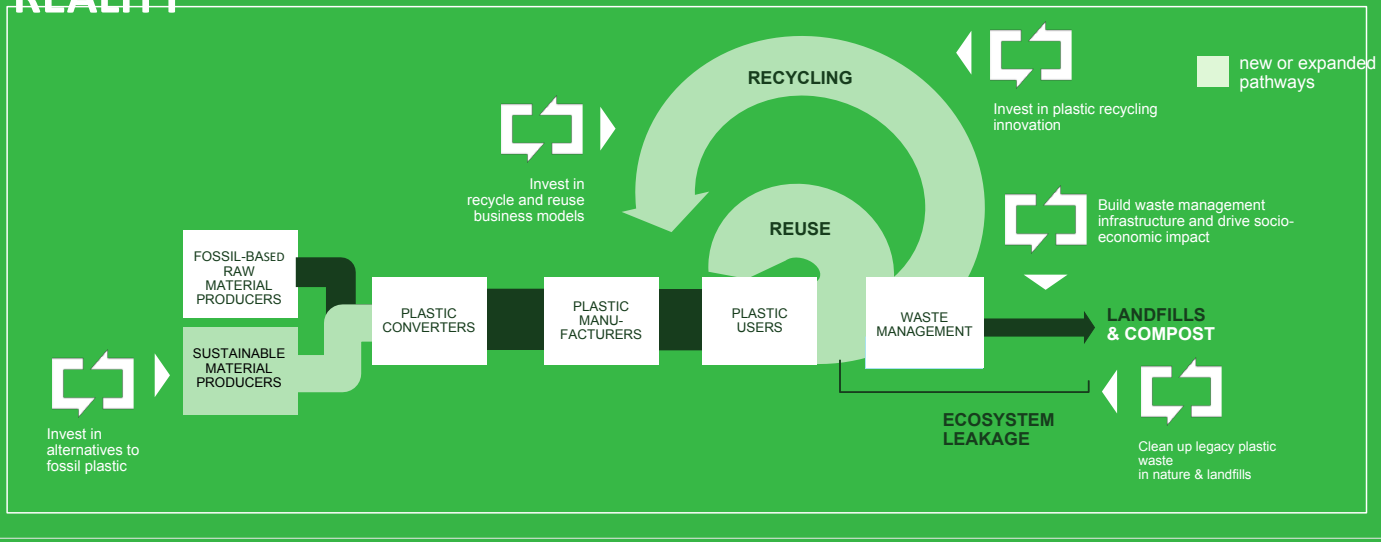
> "It's been two years since I wrote that climate risk is investment risk. And in that short period, we have seen a tectonic shift of capital.
>
> – Larry Fink, BlackRock CEO, 2022 Letter

REGULATORY TAILWINDS

- 35+ countries have introduced Extended Producer Responsibility schemes, holding producers responsible for collection and recycling of plastic they produce
- On March 2, 2022, representatives from 175 nations endorsed a UNEA resolution to end plastic pollution – with the ambition of a binding agreement by 2024

WHERE WE COME IN:

PCX MAKES PLASTIC CIRCULARITY AND NET-ZERO LEAKAGE A REALITY



PLASTIC CREDITS CAN ACTIVATE ECOSYSTEM TO ACCELERATE IMPACT AT SCALE

COMPANIES PURCHASE CREDITS

- Meet stakeholder & regulatory commitments
- Communicate impact to consumers and wider audience

CREDITS ACCELERATE PACE OF ACTIVITY AND ENABLE IMPACT TO SCALE

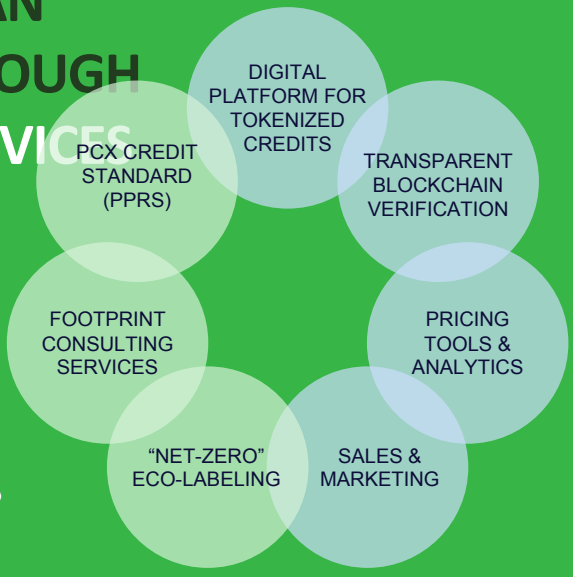
- Enhanced efficiency and transparency through a plastic credit marketplace

MORE PROJECTS GENERATE CREDITS

- More funding increases diversity of economically viable/impactful projects

PCX

PCX ACTIVATES AN ECOSYSTEM THROUGH INTEGRATED SERVICES



MARKETS

SOLUTIONS

PCX

THE ROAD TO CIRCULARITY: HOW PCX WORKS

STEP 1

AUDIT PLASTIC FOOTPRINT

PCX, together with an accredited 3rd party auditor, will map your plastic footprint using PCX's Plastic Footprint Calculator to determine a baseline and understand the use cases to solve for.

STEP 2

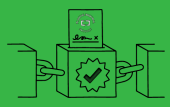
GOAL SETTING & MAPPING

Once footprint is analyzed and challenges are considered, goals are mapped for short, medium and long-term execution and solutions are canvassed .

STEP 3

ACTIVATE ECOSYSTEM

Once goals have been identified, PCX activates its ecosystem to execute on the plan.



STEP 4

VERIFY & REPORT IMPACT

PCX provides end-to-end tracking through M&E systems which provide proofs of origin and environmental compliance certifications on our blockchain-protected online public registry ensuring transparency across the entire process.

STEP 5

NET ZERO PLASTIC ECO LABELING

Accounts that comply with the requirements of Net Zero under PPRS can be certified and use our eco-labeling on pack to communicate to consumers that they are part of the responsible consumption movement.

100

PURCHASED CREDITS

COLLECT

Broad collection incentivized by funding from private sector credits

TRANSPORT

RECYCLE

Recyclable plastics are sent to facilities where they are converted to reusable plastic material.

UPCYCLE

Plastics which cannot be recycled due to limited infrastructure are sent to facilities that transform waste materials to more useful or valuable products.

CO-PROCESS

End-of-life plastics are sent to partners who use plastics as an alternative fuel to coal in waste-to-energy operations.

=

100

TONNES OF DIVERTED WASTE

PCX SOLUTIONS AIMS TO SUPPORT BRANDS IN THEIR JOURNEY TOWARDS A CIRCULAR ECONOMY

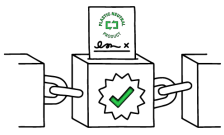
1

INDEPENDENT STANDARD SETTING

Plastic Pollution Reduction Standard

2

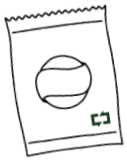
PROJECT CERTIFICATION & CREDIT ISSUANCE



Blockchain and Third-Party Verification

3

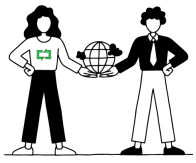
ECO-LABELING



Net Zero Plastic Waste

4

CONSULTING



Footprint, Strategy & Roadmap, Intelligence

SETTING THE STANDARD

PCX was the first in the world to publish a Standard in March of 2020. The Plastic Pollution Reduction Standard provides a framework for the implementation of a credible and verifiable plastic offsetting program. Our comprehensive approach to solution sets means our network of partners provides a safe and transparent system of physically collecting, transporting, and processing plastic waste to prevent leakage into nature.

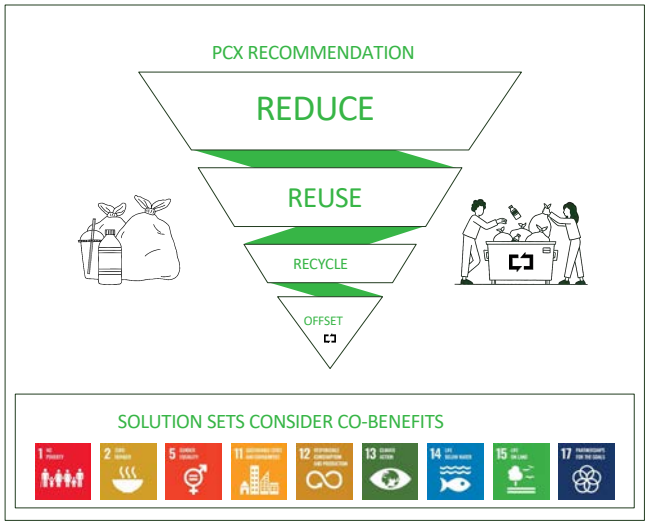
The PPRS, along with our processes, constantly evolves to reflect the latest environmentally responsible solutions, government policies, and industry best practices in all the markets we operate in.

PLASTIC CREDITS ARE NOT AND WILL NOT BE AN
AN EXCUSE TO POLLUTE

PCX believes the war on plastic waste requires comprehensive SOLUTION SETS. Any plastic that can be safely removed from the supply chain should be removed. Any plastic that can be reused or recycled should be labeled and directed to those use cases. And any plastics that can not yet be removed from the supply chain should be offset to ensure that it does not pollute the planet and wind up in nature.

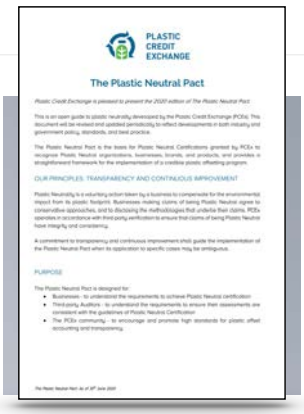
SOLUTION SETS CONSIDER THE CIRCULAR ECONOMY

PCX doesn't just look at the cleaning up and removal of plastic from the environment, we also consider the socio-economic benefits in all the communities that we work with. Tracking impact is a big part of making sure offsets are working for all stakeholders.



PLASTIC CREDIT STANDARDS OVER THE PAST YEARS FOCUS ON CONTINUOUS IMPROVEMENTS

V1.0
March 2020

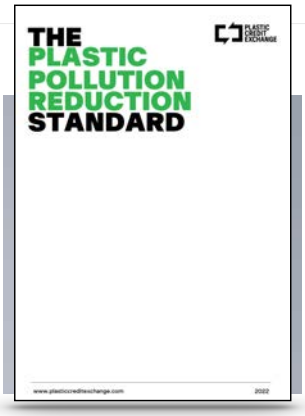


INTRODUCED PLASTIC CREDITS AND PLASTIC NEUTRAL CERTIFICATIONS

V3.0
Aug 2020

INCLUDED SAFEGUARDS REQUIREMENTS

V6.0
Jan 2022



FOCUS ON ADDITIONALITY AND SDG ALIGNMENTS

SCOPE OF PLASTIC CREDITS

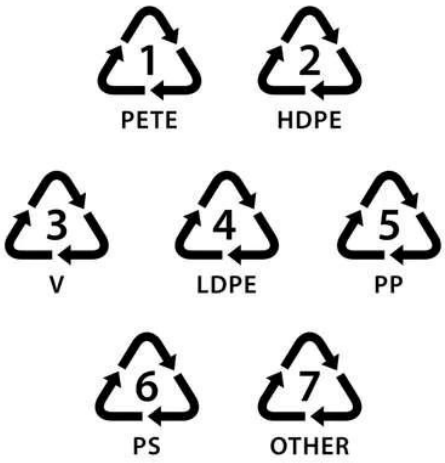
Post-consumer Plastic

Materials:

(i) all seven plastic types, (ii) any group of synthetic or natural organic materials including acrylic or poly methyl methacrylate, polyamide (nylon) and polycarbonate and (iii) composite materials containing plastics such as multilayer boards

Processing:

includes (i) material recovery (mechanical recycling, chemical recycling); (ii) energy recovery in the form of heat or electricity generation using plastic waste as substitute and (iii) other emerging technologies



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Accreditation Requirement:

Projects need to be accredited by independent party auditor prior being able to offer plastic credits to PCX. The accreditation includes the review of process, the environmental impact and social safeguards and the documentation / monitoring to verify succeeding credits.

FEEDBACK FROM VARIOUS STAKEHOLDERS LED TO DEVELOPMENTS IN THE PPRS

FEEDBACK FROM VARIOUS STAKEHOLDERS LED TO DEVELOPMENTS IN THE PPRS


WWF

Position Paper

NO PLASTIC IN NATURE • JANUARY 2021

WWF POSITION: PLASTIC CREDITING AND PLASTIC NEUTRALITY

Summary of Position

Plastic does not belong in nature.

In order to achieve No Plastic in Nature by 2030, a combination of various coordinated strategies must be pursued. Strategies driver sustainable inputs for nec and extended producer re action including internati

WWF is cautious in regar

PLASTIC CREDIT EXCHANGE

INTRODUCING 'NET ZERO PLASTIC WASTE' TO REPLACE 'PLASTIC NEUTRAL'

Guidance Note 03

June 2022

Plastic Credit Exchange's (PCX's) Plastic Pollution Reduction Standard or PPRS is among the world's leading references in the conduct of a plastic credit system and certifications. In the standards' infancy, it was referred to as the Plastic Neutral Pact but was later updated to its current name to reflect the organization's goal to enjoin our network and partners to reduce the plastic pollution through comprehensive solution sets and instead re-introduce these post-consumer plastic waste into a circular economy or an environmentally friendly destination and ensure that these materials do not end up in nature.

In addition to organization's internal reviews and assessment from brand partners, PCX


TIRES ARE ACTUALLY AMONG THE MOST COMMON PLASTIC POLLUTERS ON EARTH

International Journal of Environmental Research an estimated that tires account for as much as 10% of waste in the world's oceans. A 2017 report by the Conservation of Nature put that number at 28%. "Fu 2024" report a market size of over 2.36 billion units compound annual rate with an estimated micro pla least 1.8 million tons. The tire market in the Philippi surpass $ 900 million by 2021 on account of expandi fleets, continuing infrastructure growth and large sc activities being undertaken in the country. Tires are

NATIONAL GEOGRAPHIC

Tires: The plastic polluter you never thought about

PLASTIC CREDIT EXCHANGE

PLASTIC CREDITS FROM USED TIRES

Guidance Note 01

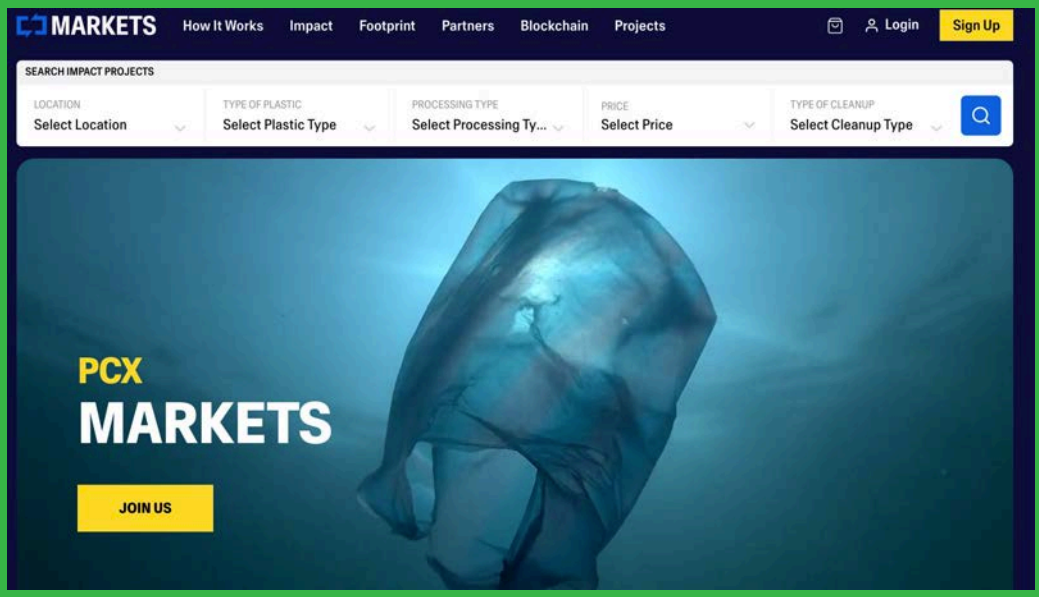
One of the aspects that makes the Plastic Credit Exchange (PCX) distinct is that it provides an integrated platform that directly works with brands, operators, regulators and communities. This first-hand experience helps PCX develop and refine the Plastic Pollution Reduction Standards (PPRS) in a way that better represents the unique requirements that we see on the ground – from the collection of post-consumer plastic all the way to the processing and the treatment of plastic credits as a sustainability instrument. In this Guidance Note, PCX shares the observation of high collection rates for used tires in our community collection network, the *Aling Tindera Waste-to-Cash Program*. In this initiative, PCX partners with women microentrepreneurs in *barangays* who buy back from the communities clean, empty, and dry plastic waste. During the pilot year of operations, PCX noted significant volumes of used tires collected - approximately 24% of which is classified as plastic* – which did not decrease as expected in volume over the project's initial phase.

PCX'S PPRS REMAINS INSPIRED BY ON-THE-GROUND EXPERIENCES BUT MORE NEEDS TO BE DONE

PCX will soon release revisions into the PPRS bringing full experiences in the implementation in the Philippines and drive towards:

- Global expansion and adoption
- Harmonization with different standards developers and implementers and with multilateral organizations (UNEA)
- Increased attention and criticisms from the market
- Developing interest from global brands
- Addressing the issues flagged by different stakeholders (e.g. ISWA)
- Developments in the EPR space

PPRS credits and other credits certified under globally recognized standards are made available through PCX MARKETS



PCX

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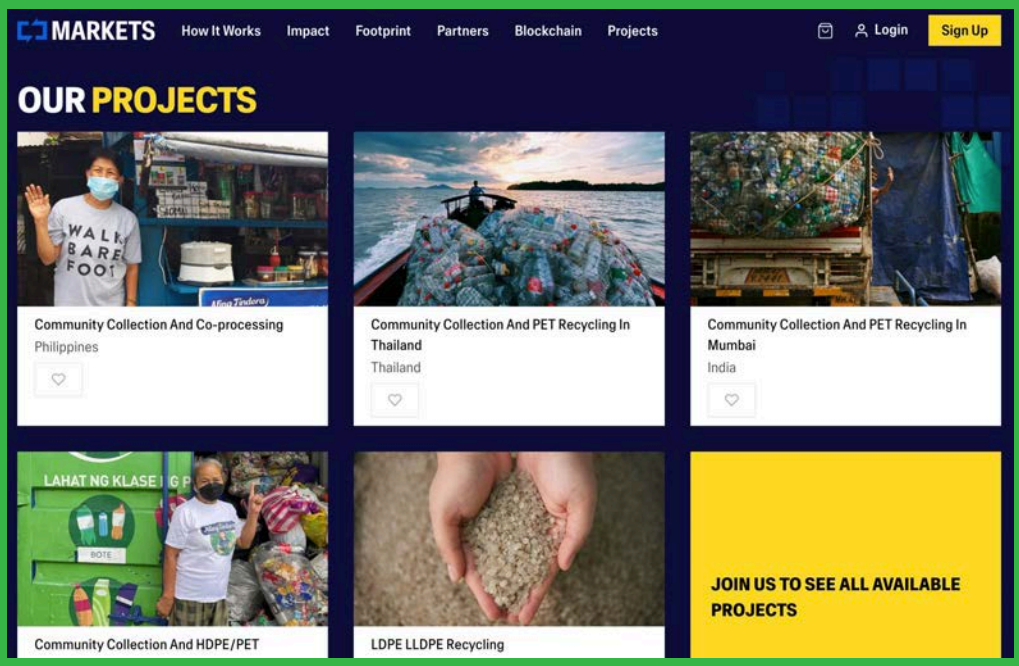


PCX

JOIN THE MOVEMENT.
IT'S YOUR TURN.

RICHARD DE GUZMAN

STANDARDS AND COMPLIANCE MANAGER
richard.deguzman@plasticcreditexchange.com
info@plasticcreditexchange.com

www.plasticcreditexchange.com
@plasticcreditexchange
@theplasticcreditexchange

PLASTIC CREDIT EXCHANGE

APPENDIX

PLASTIC CREDIT EXCHANGE

WHO WE ARE

THE ROAD TO CIRCULARITY: HOW PCX WORKS

STEP 1

AUDIT PLASTIC FOOTPRINT

PCX, together with an accredited 3rd party auditor, will map the accounts plastic footprint using PCX's Plastic Footprint Calculator to determine a baseline and understand the use cases to solve for.

STEP 2

GOAL SETTING & MAPPING

Once footprint is analyzed and challenges are considered, goals are mapped for short, medium and long-term execution and solutions are canvassed .

STEP 3

ACTIVATE ECOSYSTEM

Once goals have been identified, PCX activates its ecosystem to execute on the plan.

STEP 4

VERIFY & REPORT IMPACT

PCX provides end-to-end tracking through M&E systems which provide proofs of origin and environmental compliance certifications. For Credit accounts, our blockchain-protected online public registry ensures transparency across the entire process.

STEP 5

NET ZERO PLASTIC WASTE ECO LABELING

Accounts that comply with the requirements of Plastic Neutrality under the PPRS can be certified and use our eco-labeling on pack to communicate to their consumers that they are part of the responsible consumption movement.

CERTIFICATION FOR NET ZERO PLASTIC WASTE IS A BOLD STEP WE HOPE BRANDS WOULD ACHIEVE.

HOW TO ACHIEVE NET ZERO PLASTIC WASTE

Net Zero Plastic Waste Certification is a global standard for brands that have made a commitment to take 100% responsibility for the post consumer plastic footprint.

MEASURE YOUR FOOTPRINT
Our calculator will aid in determining your plastic footprint.

ACTIVATE SOLUTION SETS
Take 100% responsibility for your plastic footprint through solution sets.

VERIFY YOUR IMPACT
Our audit partners will help verify your net footprint.

WEAR YOUR BADGE WITH PRIDE
Proudly display your certification and the PCX badge for all to see.

PPRS ADDRESSES CHALLENGES FACED IN THE CARBON CREDIT EXPERIENCE

CONCERNS	PCX APPROACH
GREENWASHING	Work closely with ecosystem stakeholders - NGOs, governments, and auditors - to assess standards and impact
ENABLING "BUSINESS AS USUAL"	Invest in capital needed to transform the plastic economy and leverage dynamic pricing model to incentivize demand
DOUBLE-COUNTING IMPACT	Allow each credit to be only used once against one end buyer's footprint
LACK OF TRACEABILITY & TRANSPARENCY	Utilize proprietary blockchain network and provide common platform for pricing and transacting plastic credits
LACK OF ADDITIONALITY	Clearly define impact of each credit, fund collection efforts that would not occur otherwise, and transact credits compliant with industry-leading protocols
LACK OF SOCIO-ECONOMIC DEVELOPMENT	Work with credit providers who invest in on-the-ground communities and operations to realize co-benefits

WE PUT YOUR CREDITS TO WORK.

Your commitment is carefully stored on our blockchain ledger, ensuring traceability and transparency, with no double-counting, ever. We've included a breakdown of how your credits are spent across PCX's operations, from collection to processing.

100
PURCHASED CREDITS

COLLECT
Local communities and agencies aid in the collection of plastic waste through collection points.

TRANSPORT
Once collection points are filled, partners transport the plastic waste to processing facilities.

RECYCLE
Recyclable plastics are sent to facilities where they are converted to reusable plastic material.

UPCYCLE
Plastics which cannot be recycled due to limited infrastructure are sent to facilities that transform waste materials to more useful or valuable products.

CO-PROCESS
End-of-life plastics are sent to partners who use plastics as an alternative fuel to coal in waste-to-energy operations.

=

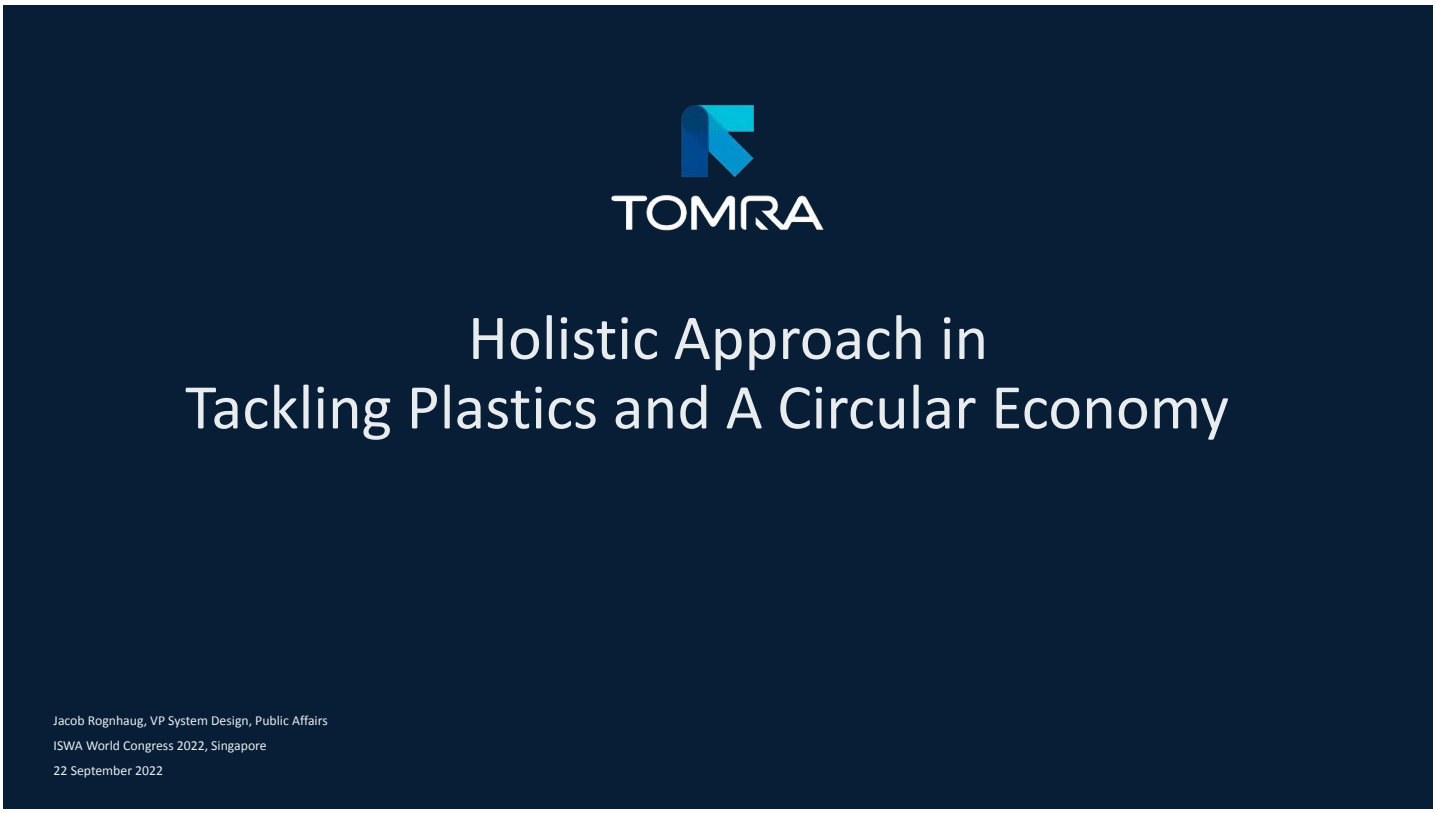
100
TONNES OF DIVERTED WASTE

MONITORING & EVALUATION
Expenses including Blockchain Technology and IT, Monitoring and Evaluation, Legal, Communication, and Salaries.

SDG INVESTMENTS
Waste Management Fund, Education Fund, Negative Tonnage Fund.

PCX

四
塑料處理和循環經濟的整體方法 **(Holistic Approach in Tackling Plastics and A Circular Economy)**
TOMRA成立於1972年，其創新始於設計、製造和銷售用於自動收集用過的飲料容器的反向自動售貨機(RVM)，提供以技術為主導的解決方案，通過先進的收集和分類系統實現循環經濟，優化資源回收並最大限度地減少浪費，以應對廢棄物管理不善的挑戰。根據既定的回收方式，包括押金回收系統(DRS)、分類收集和混合廢棄物分類(MWS)，採用整體方法進行廢棄物管理。HRS有能力提高回收率、優化資源回收並加速過渡到循環經濟。這種轉變將確保有價值的材料持續在閉環中以不同的形式被使用和再利用。



TOMRA

2

4600+
EMPLOYEES GLOBALLY

Publicly listed on Oslo Stock Exchange (OSEBX: TOM)

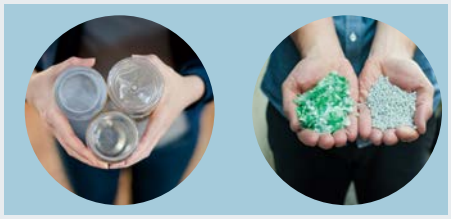
TOMRA

10.9
BILLION NOK REVENUES IN 2021

TOMRA COLLECTION

TOMRA RECYCLING MINING

TOMRA FOOD



REVERSE VENDING

MATERIAL RECOVERY

RECYCLING

MINING

PROCESSED FOOD

FRESH FOOD

TOMRA

3

Our Commitment by 2030

40%

of post-consumer plastic packaging collected for recycling

30%

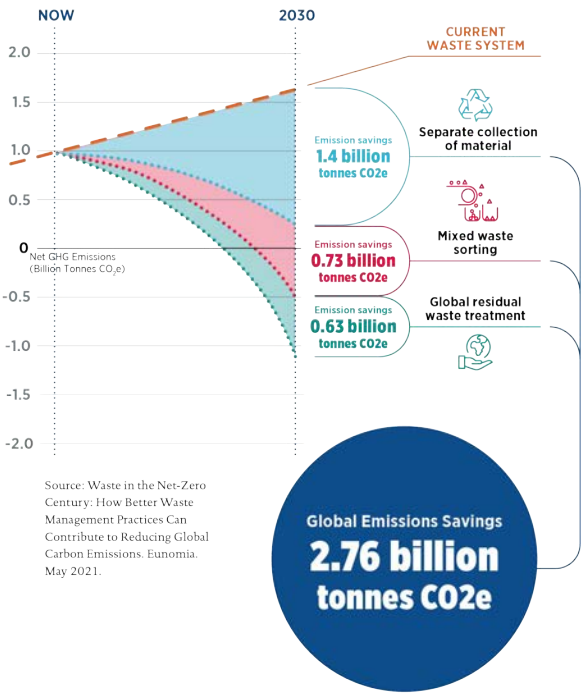
of post-consumer plastic packaging is recycled in a closed-loop

TOMRA

The Holistic Resource System

Integration of existing waste management practices and designed to respond to regional challenges

TOMRA



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.

Holistic Resource Systems

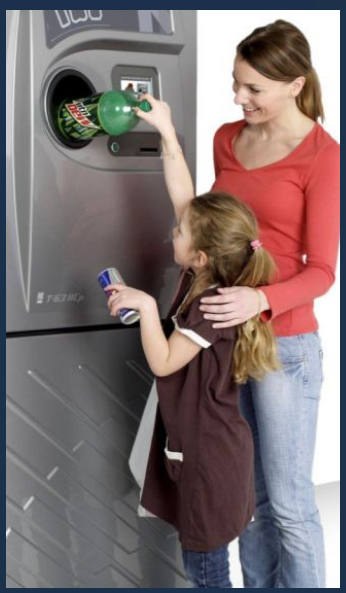
Extended Producer Responsibility

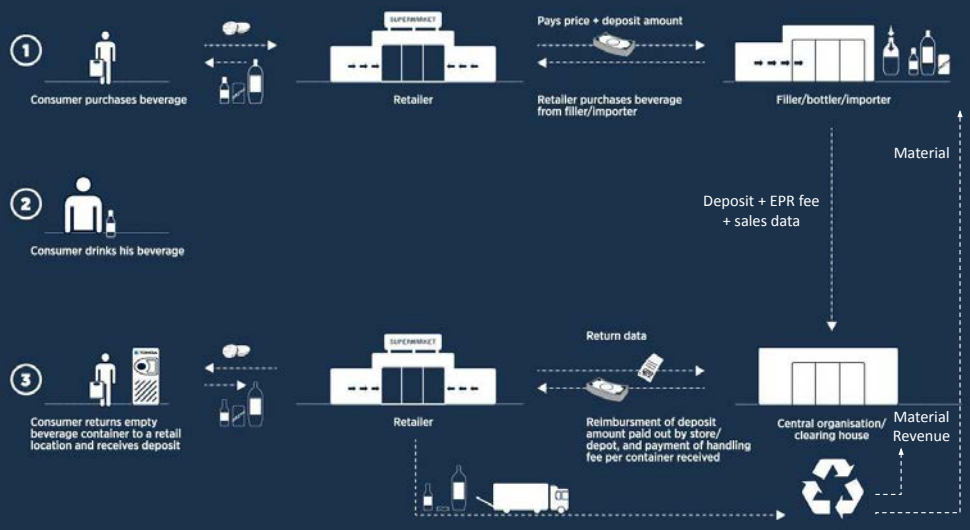
Deposit Return System

Separate Collection Systems

Mixed Waste Collection/Sorting

Deposit Return System





For: Beverage Containers - plastic, metal and glass

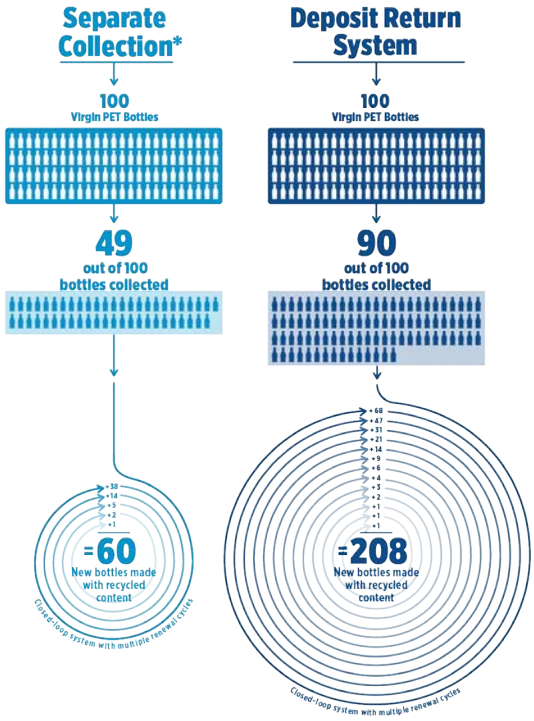
Deposit Return System

Delivers: average of **90%** collection rates and highest recycling content possible

Significantly Reduces Litter
Drives Circular Economy

Norway:
92% collection of PET bottles
Ready to provide the market with **80% recycled content**

TOMRA



* 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.

8

Separate Collections

Materials separated from residual waste at source and collected in single stream

ORGANIC
Food and garden waste

PAPER
Graphic, de-ink and packaging paper

TEXTILES
Post-consumer apparel and industry scrap

E-WASTE
Electrical and electronic equipment, household batteries

GLASS
Glass packaging, cullet

Separate Collection of
PLASTICS
is not necessary

ORGANIC
Food and garden waste

PAPER
Graphic, de-ink and packaging paper

TEXTILES
Post-consumer apparel and industry scrap

E-WASTE
Electrical and electronic equipment, household batteries

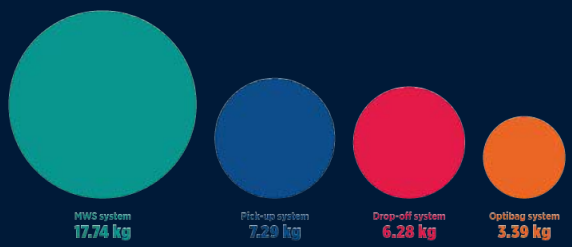
GLASS
Glass packaging, cullet

Circularity is in the Mix

Mixed waste sorting can capture

MORE THAN DOUBLE

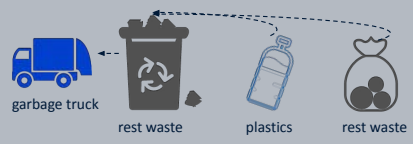
the amount of plastic packaging for recycling.



(Study "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.)

IVAR, NORWAY

AN EXAMPLE



TOMRA

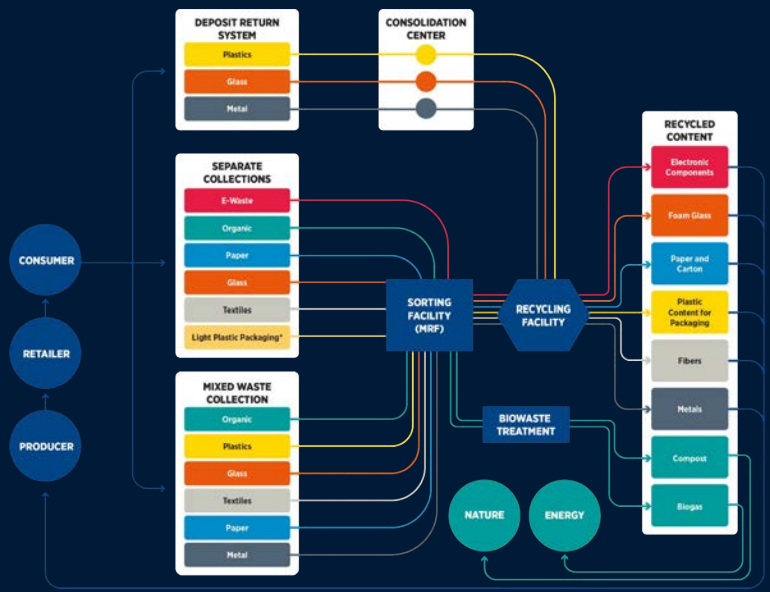
"We've invested in waste sorting plant. As a result, our region has made a big step towards a ***resource-efficient and climate-friendly circular economy****."*

Rudolf Meissner
Chief advisor, IVAR IKS

Image Source: SUTCO

The Holistic Recource System

Deposit Return Systems, Separate Collection Systems and Mixed Waste Systems triples its impact on GHG recycling rates.



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* Depending on circumstances for a given location.

13

Closed Loop for Virgin-Like Material

Home care, personal care, automotive interior, etc.

TOMRA

ADVANCED MECHANICAL RECYCLING DEMONSTRATION PLANT

TOMRA & Borealis to generate material for brand owners and converters to qualify, validate and prove fit for use in their applications

Why a Holistic Resource System?

Maximum recovery of all materials through implementation of
deposit return systems, separate source collections and mixed waste sorting

Increased resource efficiency

CO_2 footprint

Meet quotas

Higher efficiency of disposal capacity

Key Driving Policy Elements:
90% separate collection of plastic beverage containers
55% recycling of plastic packaging
Recycled content targets
65% target MSW utilization
Incentivize sorting before incineration and landfill

THANK YOU!

TOMRA

五
延伸生產者責任**(EPR)**介紹：通過國際合作解決東亞和東南亞的塑膠包裝廢棄物 **(The Introduction of EPR: Tackling Plastic Packaging Waste in East and Southeast Asia through International Cooperation)**
在這場全球污染危機中，塑膠信用交易所(PCX)於2020年3 月發布首個塑膠信用管理標準，現已演變成塑膠污染減少標準(PPRS)。塑膠信貸系統的構思和開發旨在為企業提供解決方案，以便與社區、機構和地方政府合作，阻止塑膠流入自然界，並介紹世界上第一個塑膠信用標準的要點和指導原則，以及它如何解決該機制面臨的問題。

Co-funded by the European Union

german cooperation
DEUTSCHE ZUSAMMENARBEIT

Implemented by giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

EXPERTISE FRANCE
GROUPE AFD

ISWA 2022
WORLD CONGRESS
21 - 23 SEPTEMBER, SINGAPORE

ISWA, 22 September 2022

The introduction of EPR: Tackling plastic packaging waste in East and Southeast Asia through international cooperation

The Rethinking Plastics project

Objectives:

- Support the international aspects of the **European Union's (EU) Plastics Strategy** in East and Southeast Asia by
- **strengthening EU cooperation** with the countries in the region on the topics of **circular economy, plastic waste and marine litter reduction**.
- **Transition to sustainable consumption and production of plastic** and thereby contribute to **significantly reduce marine litter** while including EU approaches, policies and business models.

The Rethinking Plastics project

General information:

- Funding: EU and German Federal Ministry for Economic Cooperation and Development (BMZ), 10 Mio. EUR
- Duration: May 2019 – October 2022
- Project countries: China, Indonesia, Japan, Philippines, Singapore, Thailand, Vietnam
- Implementation: GIZ and Expertise France

Areas of action

Policy dialogues between EU and partner countries

Improvement of plastic waste management

Sustainable consumption and production of plastic

Reducing litter from sea-based sources

Green public procurement (Japan and Singapore)

Awareness raising and communication

Improving waste management – our focus

- Contribute to the improvement of plastic waste management according to the waste hierarchy, mainly covering approaches for waste segregation at source, collection, sorting and recycling.

  - ➢ Fostering regional exchange and policy dialogues
  - ➢ Providing technical assistance at national and potentially local level through advisory services, through e.g. workshops, studies and/or policy briefs.
  - ➢ Implementing 8 pilot projects, with close link to ongoing policy dialogues and processes.

Extended Producer Responsibility (EPR) for packaging

Why EPR?

- EPR is a proven policy instrument to enhance the interaction between stakeholders along packaging value chains, including plastic packaging, and to contribute to higher collection and recycling rates. In practice, EPR involves producers to take responsibility for collecting end-of-life products and for sorting them before their final treatment – ideally – recycling.

➢ Knowledge and understanding of EPR as well as the political willingness diverged between the project countries but ongoing developments could be seen in all of them.

➢ The 'EU Directive 94/62/EC on packaging and packaging waste' and the 'EU Waste Framework Directive 2008/98/EC' serve as European policy examples.

Activities focussing on EPR for packaging

- Support of EPR establishment in the project countries by e.g. providing know-how, delivering studies and policy briefs, and facilitating exchange between policy and business stakeholders, incl. national and international experts.

- Support of the development of the 'EPR for Packaging Toolbox' of the PREVENT Waste Alliance and translation into Bahasa Indonesia, Chinese, Thai and Vietnamese, ensuring that concepts and information are fitting and understandable in the countries' contexts.

- Series of webinars and technical exchanges between the project countries to discuss relevant topics regarding their current steps towards the introduction of EPR in their respective countries, incl. EPR examples from the region and around the world.

- Pilot projects that revealed data and insights for the setup of EPR.

EPR and international cooperation (1)

- **Momentum:** in the context of an upcoming international legally binding agreement by 2024, EPR appears as an increasingly attractive instrument to avoid waste pollution and setup a circular economy.
- **Global transition**: Regulations are being developed on all continents and in countries with significant EPR experience, regulations are being refined and improved through the introduction of additional mechanisms, such as modulated fees, mandates to minimum recycled content, etc.
- **Acceleration:** Countries in the process of designing an EPR regulatory framework have the opportunity to leapfrog to a practical and effective design, leveraging over 30 years of experience of the pioneering countries.

EPR and international cooperation (2)

- **Options:** Countries can compare the merits of EPR to other financing options, which have been developed, e.g. plastic credits or environmental funds, considering them as an alternative, complement or precursor to EPR, or entirely dismissing them.
- **Exchange**: EPR is a complex concept that may raise many questions, doubts and even fears. Besides awareness raising and capacity building, a dialogue platform for stakeholders from the different sectors helps addressing issues and developing consensus. Regular communication between the East and Southeast Asian countries could be helpful.

Key learnings

Definitions

- Comprehensiveness and accuracy of definitions establish the basis for unequivocal assignment of roles & responsibilities.
- Definitions should seek to prevent confusion between participating stakeholders.

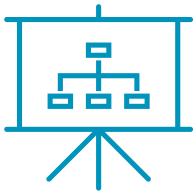
Key learnings

Roles and responsibi-lities

- Distinguishing collection, sorting, recycling, recovery and other end-of-life treatment would be relevant for calculating ‘recycling rates’. Assigning those roles to designated stakeholders will increase legibility and enforceability.
- Distinguishing producers, importers and brand owners (PIBO) is crucial to really cover everyone who is responsible for putting packaging on the market.

Key learnings

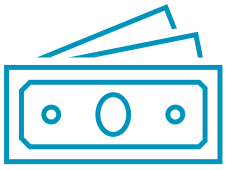
PRO set-up



- PRO can coexist with alternative compliance methods, offering compliance flexibility to producers. However, this requires more supervision from the enforcement authority as it might be less obvious to ensure that any given producer is fulfilling its obligations.
- A voluntary PRO can be a good precursor to mandatory EPR, as it allows to bring producers together, develop awareness and to conduct initial operations, generating results and building know-how.
- Competition can be considered as development accelerator and efficiency driver.
- National and international investment in PROs, e.g. by experienced international PRO operators, is recommended.

Key learnings

Design of financial flow, fees, payments



- Diversity of compliance methods may lead to producers opting to the most affordable one. In order to incentivise the creation of PROs and private initiative in countries allowing such diversity, the policy makers should make sure that joining a compliance scheme is not less attractive than having the compliance obligation fulfilled by the state-run body.
- Diverse membership tiers create a risk of unequitable contribution of producers, depending on the tier they opt for. While this is acceptable under a voluntary system, equitable contribution (i.e. in proportion of market share) should be achieved in a mandatory EPR system.
- If producers are not easy to identify in geographically limited deployment, retailers might be considered as a proxy.

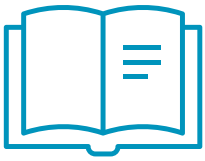
Key learnings

Establish-ment of register of obliged companies

- Registration is a cornerstone of an effective ERP system. All producers (admittedly over a certain sales threshold) should register and report their sales.
- Similarly, waste operators should also register and report, either directly or via the PRO they are contracted with. An EPR registry is the first step towards a successful implementation of EPR.
- The registry can be even implemented before the PRO(s) have started working efficiently. The data of this registry is a crucial input for creating the business models of the PROs.

Key learnings

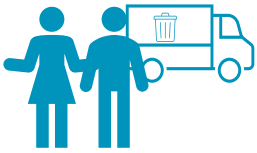
Design of regulatory framework



- It takes time to develop binding regulations and work should start early, even in the case there is a deliberate intention to operate initially on a voluntary basis.
- There is merit in establishing a common framework for several EPR product categories, as it increases legibility, facilitates supervision and reduces administrative burden for producers exposed to several product categories.

Key learnings

Collection of packaging waste



- Collection and recycling targets should be set at a sufficiently granular level to ensure that each plastic of concern will have its specific target. In other terms, it should not be allowed to fulfil a flexible plastics collection target with PET for instance.
- Additionally, incentive mechanisms should be considered to render the collection of low/no value waste by waste collectors, including the informal pickers.
- Leveraging pre-existing logistic networks such as waste banks in Indonesia, Salengs and junk shops in Thailand or distributors (like for mulch films in China) can help accelerating ramp-up.

Key learnings

Sorting and treatment of packaging waste

- A clear regulatory framework, combining clear assignment of roles and responsibilities and binding collection, recycling and recovery targets, will create the necessary visibility and legal security to investors, national and foreign alike.
- PRO may play a role in facilitating such investment, for instance via contracts long enough to give ROI confidence to investors.
- Recovery should be defined and admitted as an option for packaging for which there is no recycling solution
- Assessing the need of sorting guidelines for waste banks (in Indonesia) and Salengs and junk shops (in Thailand) should be considered.

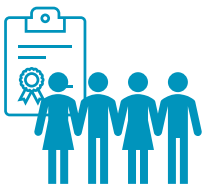
Key learnings

Incentivising waste separation at source

- Waste banks and junk shops may be considered to disseminate sorting guidelines to the population (awareness campaigns) and the informal pickers in their caption area.
- A Deposit Return System (DRS) is considered in China for mulch films, in order to incentivise farmers to bring back their waste to the distributor.
- Besides the segregated, recyclable plastic packaging, incentives should be set for the collection of multilayer packaging (MLP). This can be financed with EPR funds and/or with plastic credit schemes. However, source segregation is only effective if the required treatment capacities are available.

Key learnings

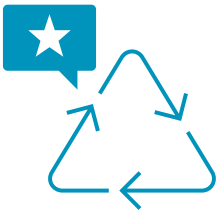
Involvement of informal sector



- PRO may play a role in the integration of the informal sector through enforcement of a remuneration based on work done (time-driven) rather than material (value-driven).
- PRO can also set incentives to the informal sector for collecting multilayer packaging (MLP) waste.

Key learnings

Ensuring high quality recycling and increasing recyclability



- Technical standards are needed for the development of quality recyclates that are expected to meet the market demand. Specific design requirements could be added in the regulations, such as for instance minimum recycled content, which would also boost the demand for recyclates. In the case of mulch films, a minimum thickness requirement would make the product more durable and facilitate recycling.
- Besides the required standards, the necessary recycling infrastructure is needed. National and international investors and operators should be incentivized to build the required recycling infrastructure. In all countries that were analysed a significant lack of treatment capacity has been identified. This lack of treatment capacity is a risk for any successful EPR implementation in Southeast Asia. This has been described in detail in the Recycling Handbook that was written for Vietnam.
- In addition, it should be considered to also set up the required capacity for non-recyclable plastic packaging waste (multilayer packaging, MLP). This can be pre-treatment facilities for co-processing or waste-to-energy facilities. Again, private national and international investors and operators can play a vital role here.

Key learnings

Ensuring private sector engagement

- Consider promoting the concept of nation-wide PRO and make alternative options financially less attractive in order to increase producer involvement in a PRO.
- Developing a voluntary PRO should be considered as an initial step when preparing for mandatory EPR. Encourage the private sector, nationally and internationally, to operate (and invest in) PROs.
- Whereas a monopoly of just one non-profit PRO can make sense, there is a good experience with privately operated PROs in competition with each other. Then the main requirement for a success is a transparent and efficient EPR registry, evenly enforced targets and standards, and the control by the authorities.

Key learnings

Strengthen collaboration

- A dialogue platform for stakeholders helps addressing issues and developing consensus. The platform should be comprised of policy makers, obligated (or to be obligated) companies, waste management operators, academia and NGOs. This dialogue platform or expert working group should be maintained in the long run. It might be useful to also have a direct communication between the East and Southeast Asian countries on a regular basis.

Key learnings

Capacity building

- EPR is a complex concept that may raise many questions, doubts and even fears. To address these issues, awareness needs to be built and developed. Raising awareness in public sector contributes to better policy drafting, whereas educating private stakeholders ensures better understanding of the roles, obligations and benefits of compliance.

Recommendations for EPR implementation (1)

- While EPR is most successful as a mandatory regulatory framework, voluntary collective initiatives such as a PRO creation by the private sector should be encouraged. Pilots could be considered for gaining knowledge over the waste flows and the operational processes.
- Meanwhile, work on the development of a binding framework should be developed early on, as it takes time.
- The PRO model has demonstrated its performance repeatedly. The co-existence of alternative compliance methods, like for instance contribution to a Environmental Protection Fund, should not “threaten by design” the development and success of PROs (but offering a more affordable but less operationally effective way of compliance).



Recommendations for EPR implementation (2)

- The informal sector is a key stakeholder in the project countries and practical inclusion of their legacy operation in the EPR system will reduce resistance and shorten the ramp-up phase. However, incentives have to be developed for the management of low or no value waste.
- Targets and pricing should be sufficiently granular to promote the collection and recycling of each material of concern and discouraging opportunistic collection of easy to collect or valuable waste at the detriment of other waste.
- Consideration should be given to data collection and management as it is necessary to successfully manage an EPR system.



If you would like to learn more and/or download our publications, please visit our website: https://rethinkingplastics.eu/

THANK YOU !

Contacts: Elena Rabbow, GIZ, elena.rabbow@giz.de
Christophe Pautrat, Landbell Group, c.pautrat@landbellgroup.com
Sebastian Frisch, BlackForest Solutions, s.frisch@bfgroup.org

六
全恢復一般包裝的逆向物流計劃 **(Recupera: Reverse Logistics Program for Packaging in General)**
恢復一般包裝的逆向物流計劃是一種用於消費後的逆向物流結構化程序，可確保實現企業的相關回收目標。在過去的 3 年，這項計劃與來自250個組織的5000名拾荒者合作，已將超過12萬噸的垃圾進行回收利用，並向這些合作夥伴投資了超過130萬美元，有助於擴大巴西的廢棄物回收能力，讓拾荒者融入社會，並有可能減少近8萬噸的二氧化碳當量排放，加入全球挑戰以拯救地球。

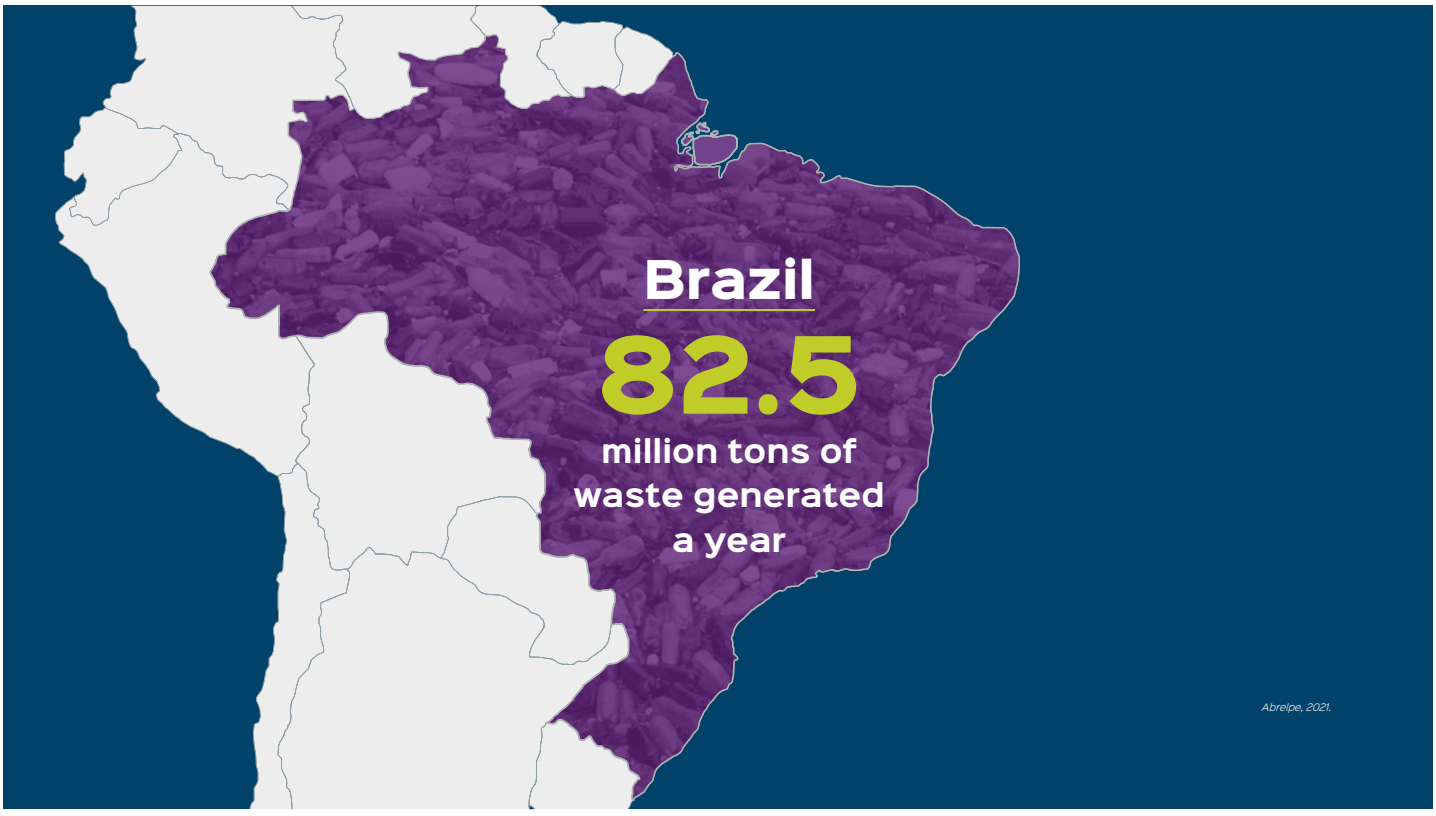
About us

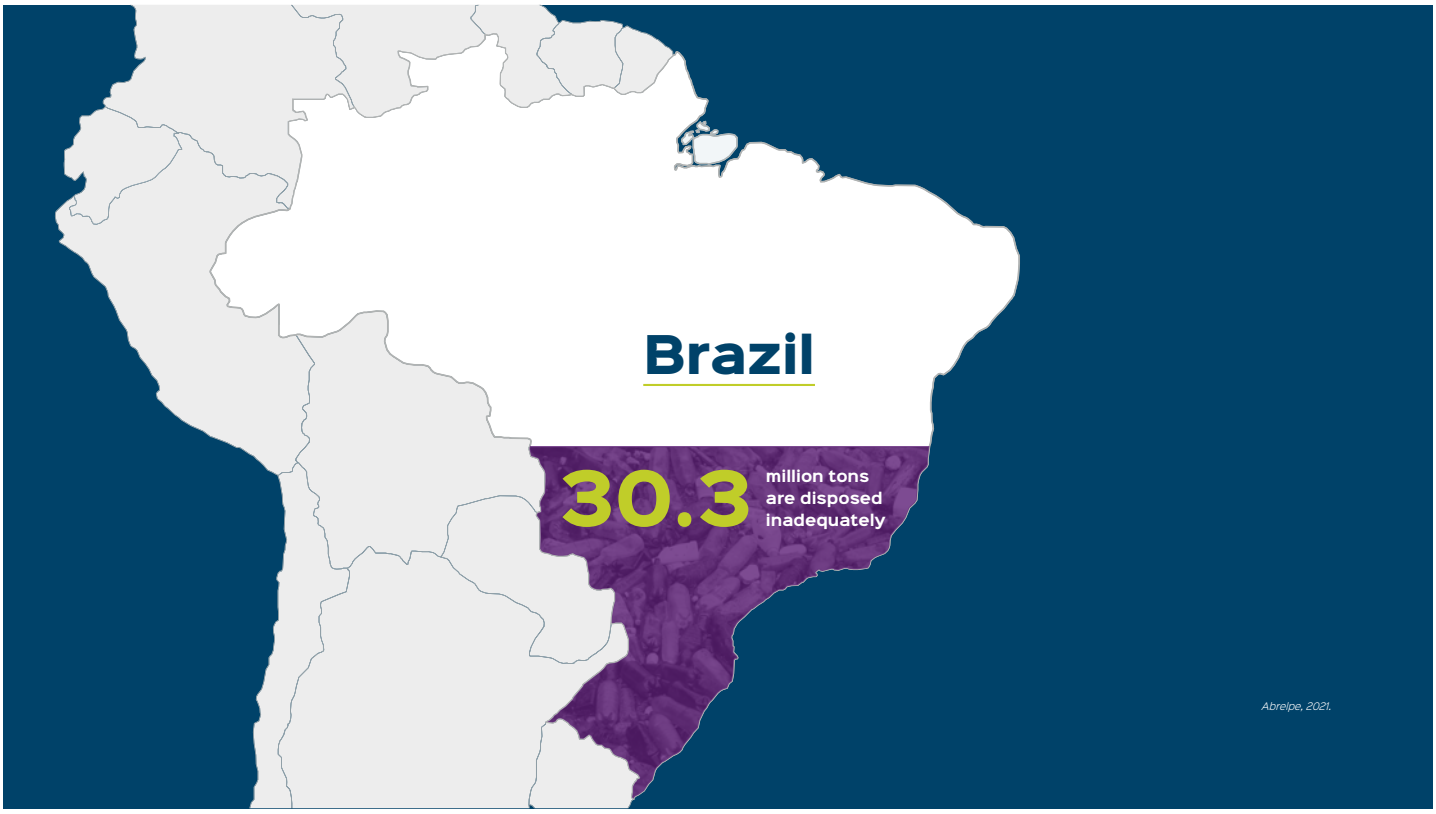
We are connected to the global challenges to face climate change.

We develop sustainable solutions for reverse logistics, circular economy and projects that generate a positive impact on society.

We participated intensively in the implementation of the National Solid Waste Policy (PNRS).

We work to engage society in reducing waste generation and recovering recyclable materials.




Brazil
30.3
million tons
are disposed
inadequately
Abrelpe, 2021.


800 thousand
waste pickers work
informally in Brazil

Our reverse logistic's solution

Recupera

Programa de
Logística Reversa

Permanent, structuring and compliance initiative

Destination of post-consumer packaging for recycling

Recupera

Permanent, structuring and compliance initiative

Destination of post-consumer packaging for recycling

Recupera

Efficient solution for companies to comply with PNRS

Permanent, structuring and compliance initiative

Destination of post-consumer packaging for recycling

Recupera

Efficient solution for companies to comply with PNRS

According to the current legislation

Permanent, structuring and compliance initiative

Destination of post-consumer packaging for recycling

Recupera

Efficient solution for companies to comply with PNRS

Priority partnership with waste pickers organization

According to the current legislation

Permanent, structuring and compliance initiative

Destination of post-consumer packaging for recycling

We invest directly in waste picker organizations, strengthening the base of the recycling chain

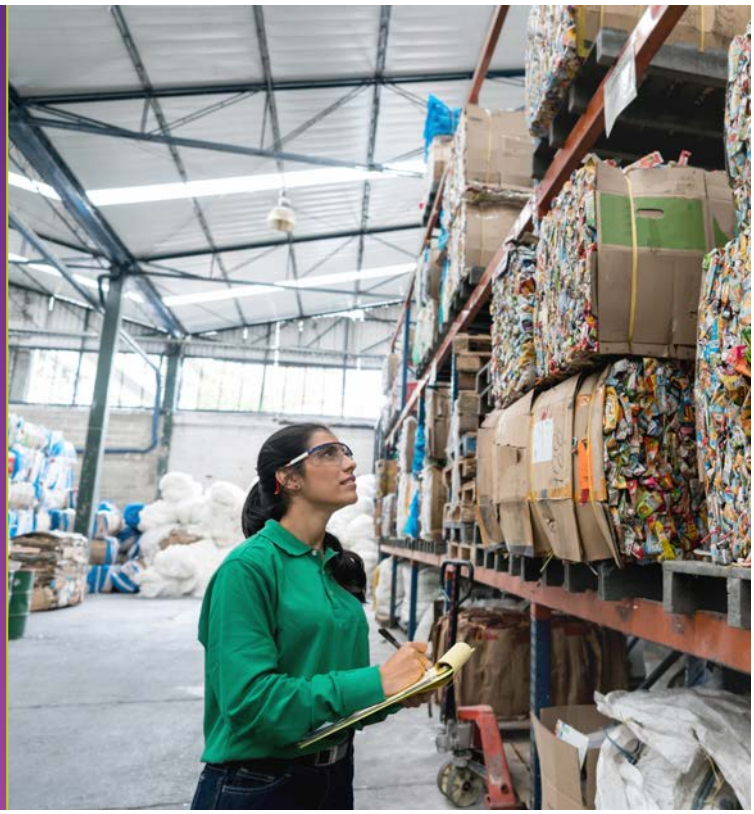
Recupera

Efficient solution for companies to comply with PNRS

Priority partnership with waste pickers organization

According to the current legislation

Our program contributes to increase the amount of waste that is destined for recycling in Brazil, facing climate change.



Some of our structuring investments

Forklift

Loading shovel

Truck

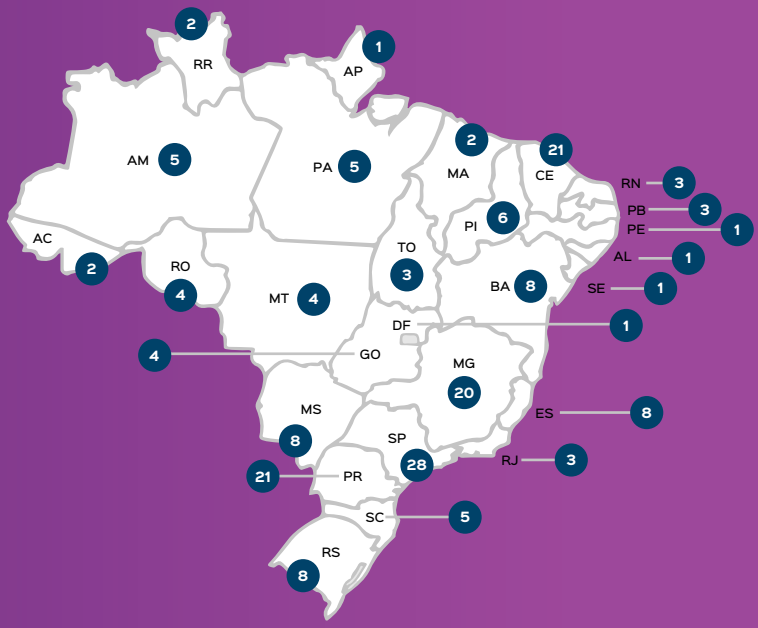
Motor tricycle

Hydraulic press machine

Conveyor belt

Our reach

- The Programa Recupera reach all states and the Federal District;
- The first reverse logistics structuring program to act in all Brazilian states;
- Today, 177 waste picker organizations are partners of Recupera.



Recupera's numbers

120 thousand
tons recovered

More than 600
costumers

100%
of the states in Brazil

150
municipalities

250
waste pickers' organizations

5 thousand
waste pickers

Pragma | Instituto Pragma

Recupera

Come and be part of this change!

Thank you

Pragma | Soluções Sustentáveis - pragma.eco.br

Dione Manetti - CEO
dione@pragma.eco.br
parcerias@pragma.eco.br

七
ISO/TC 297的目標是什麼及這些標準如何幫助提升垃圾車**(RCV)**的安全性及性能？ **(What are the Objectives of ISO/TC 297 and How Can Standards Help Improve RCV Safety and Performance?)**
廢棄物收集與運輸管理技術委員會ISO/TC 297從事廢棄物收集和運輸管理標準的工作只有幾年時間。然而，在垃圾收集車方面，垃圾收集車的安全使用、能源效率、氣味污染防治等多項標準已經成功制定。未來，數位化、自主操作或替代驅動等主題也將在新的工作項目中獲得解決，以使廢棄物收集和運輸更具永續性和使用者友善性。

What are the objectives of ISO/TC 297?

How can standards help improve waste collection and transportation management safety and performance?

Frank Diedrich, Managing Director of EUnited Municipal Equipment & Chair of ISO/TC297

ISWA Singapore, 2022-09-21

Presented by ISO/TC 297

About EUnited

EUnited Municipal Equipment

European Engineering Industries Association

ISO/TC 297 – Participants & Projects

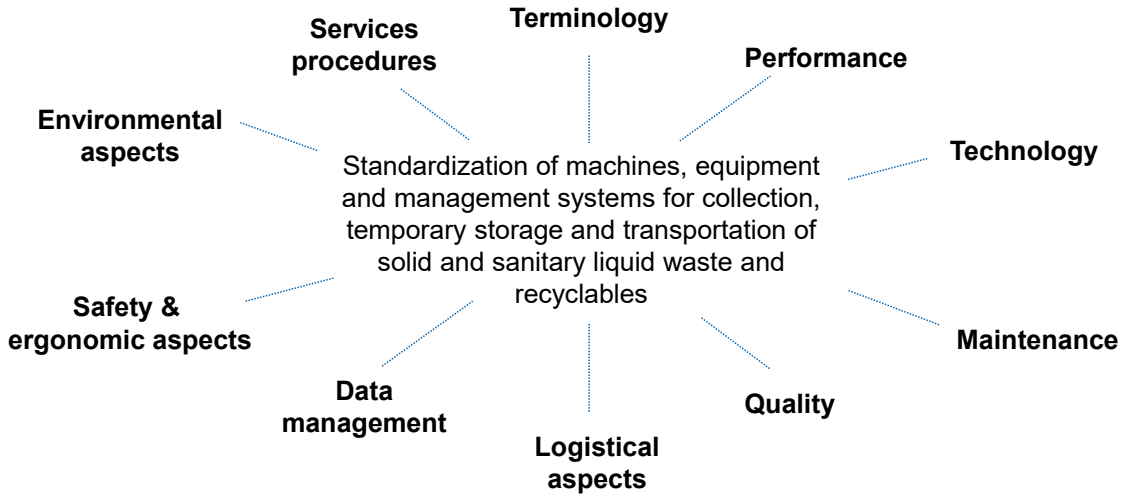
3 Standards published
2 Standards under development
1 Working Draft

PARTICIPATING MEMBERS(19)

OBSERVING MEMBERS(18)

ISO/TC 297 – Scope

Waste collection and transportation management



Do you know the difference between a rotating plate and a compression plate?

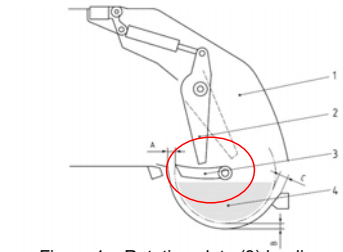


Figure 1 – Rotating plate (3) loading system

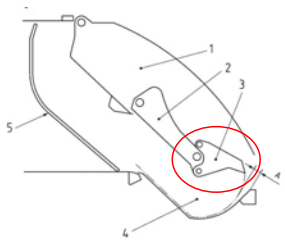
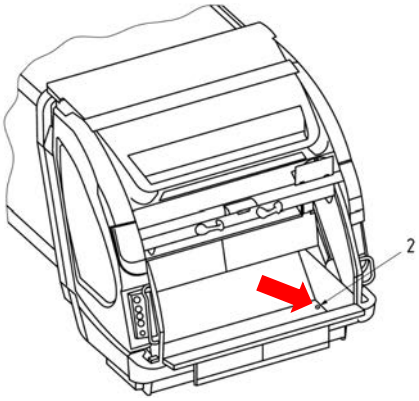


Figure 2 – Compression plate (3) loading system

ISO 24159, *Refuse collection vehicles – Safety of manual and rear-loaded refuse collection vehicles*

- … applies to manual and rear-loaded RCVs with rotating plate loading systems, compression plate loading systems and rotating drum loading systems
- … provides general requirements, recommendations and examples of safety methods to ensure the safety of operation of these vehicles
- … applies to the design and manufacture of manual and rear-loaded RCVs to ensure that they can be operated, adjusted and maintained such that they function properly.

Do you know what diameter the drainage hole to the leachate tank must have?



Key
1 leachate tank
2 drainage hole
3 leachate tank door installed on tailgate

Figure A.5 — Leachate tank (example)

ISO 24160, *Refuse collection vehicles – Waste odour and leachate prevention and control*

- … provides support, advice and guidance to the owners of RCVs, waste service providers, vehicle manufacturers, suppliers, maintenance providers, consultants, authorities and others.
- … specifies methods for preventing the spread of waste odour and the leakage of leachate during the collection and transportation of waste in refuse collection vehicles (RCVs),

Do you know how many waste categories are defined in ISO 24161?

municipal solid waste
bulky waste
industrial sludge
incinerable waste
glass waste
wood waste
manufacturing waste
pathogenic waste
paper waste
industrial waste
post-consumer waste
horticultural waste
organic waste
incineration bottom ash
litter
e-waste
packaging waste
biomass
non-ferrous metals
incineration fly ash
municipal solid waste
agricultural waste
refuse
hazardous waste
food waste
waste tyres
municipal sewage sludge
household waste
ferrous scrap metals
recyclable
general waste
construction and demolition waste

33

ISO 24161, *Waste collection and transportation management – Vocabulary*

… defines terms that are commonly used in the area of waste collection and transportation management.

Do you know what VECTO stands for?

VECTO means "**V**ehicle **E**nergy Consumption **C**alculation **To**ol" which is a simulation tool that has been developed by the European Commission for determination of CO_2 emissions and fuel consumption from heavy duty vehicles.

ISO 24162, *Test method for energy consumption of refuse collection vehicles*

- … specifies a uniform, reproducible test procedure for various drive units, chassis, superstructures and lifting devices for refuse collection vehicles, with which a comparison can be made for energy consumption.
- … defines criteria for a test track and it serves to define data for a software calculation tool, e.g. VECTO).

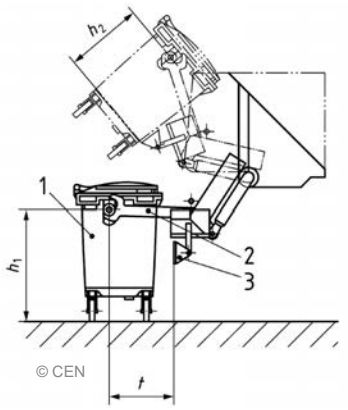
Do you know how many different types of waste container pick-up systems are used in the world?

Comb pick-up system

Trunnion pick-up system

Double trunnion pick-up system

Diamond pick-up system



Four chains skip pick-up system

two chains skip pick-up system

Skip pick-up system

Clamping system

Pocket pick-up system

BG pick-up system

Well, we don't know either!

That is why we start a new standardisation project ➡ **ISO/AWI 13155, *Refuse Collection Vehicles – Terminology of Main Functional Components & Performance Indicators***

9

ISO/TC 297 – What is the future?

Waste collection and transportation management

ISO/TC 297/WG 1
Terminology

ISO/TC 297/WG 2
Waste collection and transport vehicles

ISO/TC 297/WG 7
Sewage system cleaning and suction vehicles and mobile equipment

Active and planned working groups

ISO/TC 297/WG 3
Services

ISO/TC 297/WG 6
Data Management

ISO/TC 297/WG 5
Containers and bins

ISO/TC 297/WG 4
Suction systems

ISO/TC 297 – What will be the future topics?

Waste collection on demand

Alternative drives

Autonomous operation

New environmental aspects

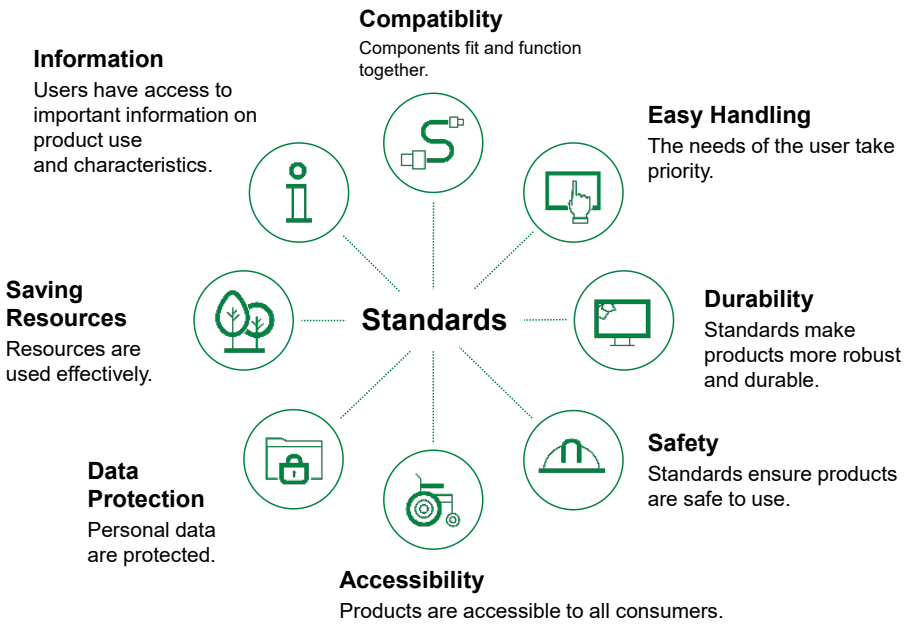
Virtual services

Artificial Intelligence

ISO/TC 297 – Standards help …

... in the procurement ...	**... to make waste collection and transport ...**	**... to make future technologies...**
… to be able to compare equipment with each other	… more efficient	… available
... to choose the right equipment	… more ergonomic	… acceptable
… to make the right decision	… more safe	… applicable

Benefits for customers/users



We are looking forward to your ideas...
…and invite you to join us

Thank you!

Frank Diedrich, Managing Director of EUnited Municipal Equipment & Chair of ISO/TC297

Presented by ISO/TC 297

八

為什麼調和廢棄物收集和運輸的術語和定義至關重要？

(Why is it Essential to Harmonize Terms & Definitions for Waste Collection and Transportation?)

國際標準化組織將推出廢棄物術語集，以統一術語和定義，為廢棄物收集和運輸管理方面的訊息交流提供基礎架構，例如與廢棄物、設施、車輛、設備、儲存和收集相關的術語。

Enterprise Singapore

Singapore Standards Council

Why is it essential to harmonise terms & definitions for waste collection and transportation?

Ms Melissa Tan
Convenor of ISO/TC 297 Working Group 1
Deputy Chair of Technical Committee for Circularity of Materials
Chief Executive Officer, Wah & Hua Pte Ltd

ISWA Congress
21 September 2022

SCIC SINGAPORE CHEMICAL INDUSTRY COUNCIL | Standards Development Organisation

What is a standard?

A document that provides requirements, specifications, guidelines etc that can be used consistently to ensure that products, processes & services are fit for purpose.

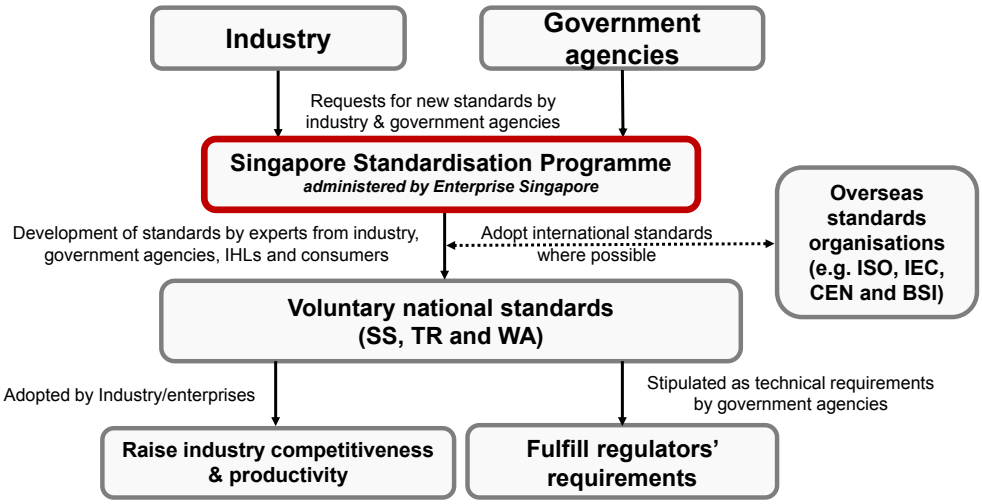
- An agreed way of doing something
- A tool that helps companies interact effectively with stakeholders
- Provides the means for market access
- The bridge between innovation and the market

This is why all your credit cards fit into foreign cash machines & ATMs when you shop…

…why you can print documents on your "Brand A" computer on a Brand D printer …

…and easily make international calls to different countries based on fixed country codes…

Singapore Standardisation Programme – A private & public partnership



National and international standards are developed based on the principles of ***transparency, openness, impartiality, consensus, market relevance and coherence***

Structure of Singapore Standards Council

Mr Robert Chew
SSC Council Chairman
Partner, iGlobe Partners

Mr Tay Jih-Hsin
SSC Council Deputy Chairman
Managing Director, Swee Hin Power Systems Pte Ltd

Singapore Standards Council

Coordinating Committees (CC)

Smart Nation | Cybersecurity | Silver Industry

Standards Promotion Committee

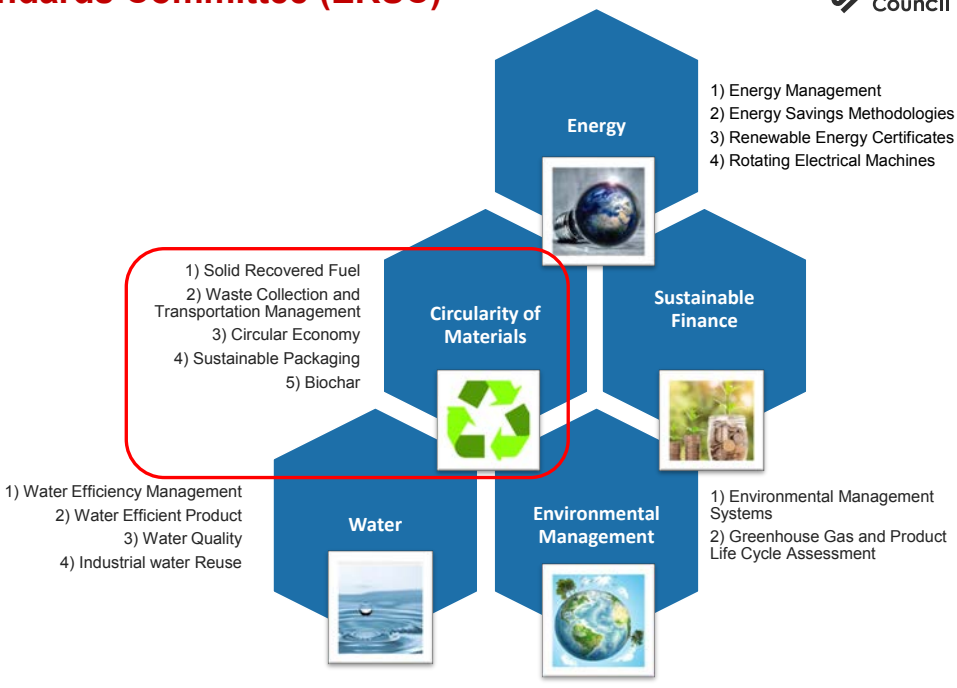
Standards Committees (SC)

Biomedical & Health | Building & Construction | Chemical | Electrical & Electronic | Environment & Resources | Food | Information Technology | Manufacturing | Quality & Safety | Services | Trade & Connectivity | Transportation

60 Technical Committees (TC)

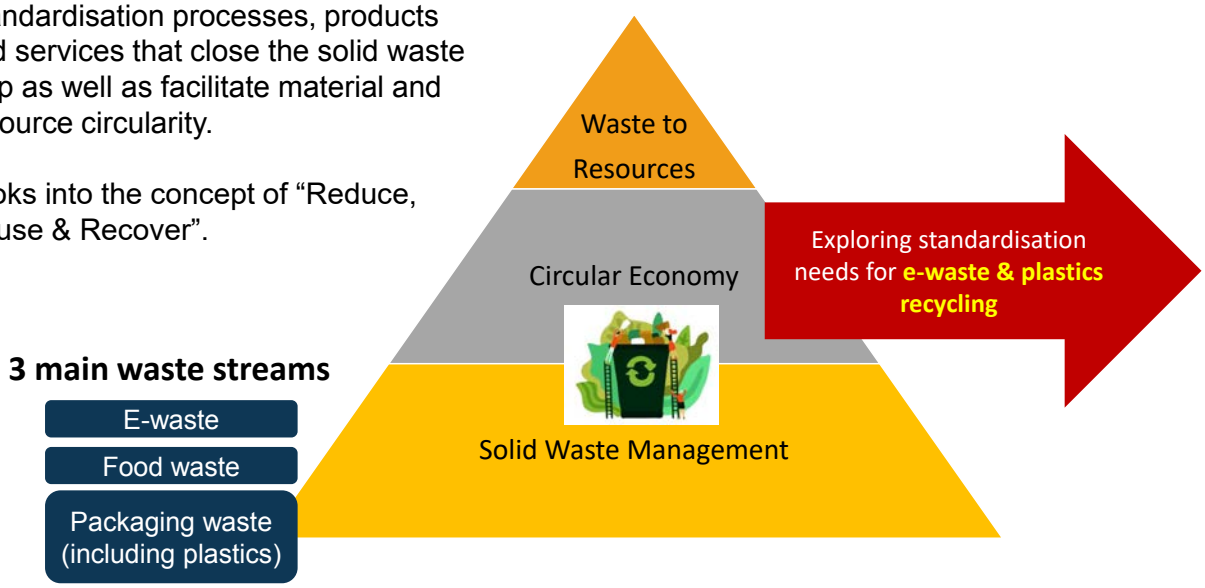
180 Working Groups (WG)

Key priorities of Environment and Resources Standards Committee (ERSC)

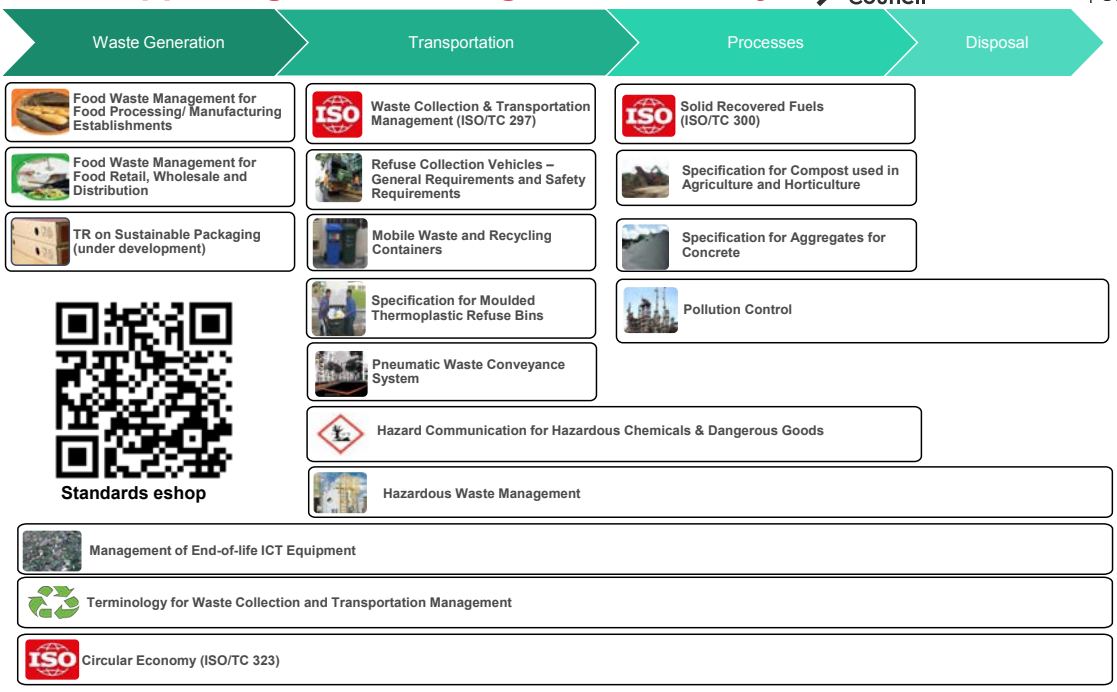


Technical Committee for Circularity of Materials

- Standardisation processes, products and services that close the solid waste loop as well as facilitate material and resource circularity.
- Looks into the concept of “Reduce, Reuse & Recover”.



Standards supporting waste management industry



Singapore Standards Council

Upcoming ISO 24161

Waste collection and transportation management - Vocabulary

SCIC SINGAPORE CHEMICAL INDUSTRY COUNCIL | Standards Development Organisation

Purpose of ISO 24161 Waste collection and transportation management - Vocabulary

Singapore Standards Council | SCIC SINGAPORE CHEMICAL INDUSTRY COUNCIL | Standards Development Organisation

01 Enable user to understand the scope of work of ISO/TC 297 and is the source document for the terms and definition of ISO/TC 297

02 Harmonised terms and definitions will serve as a basis for a common language for regulations, standards, academia, research and training in the waste management industry

Multi-country experts participating in development of ISO 24161

ISO/TC 297/WG 1

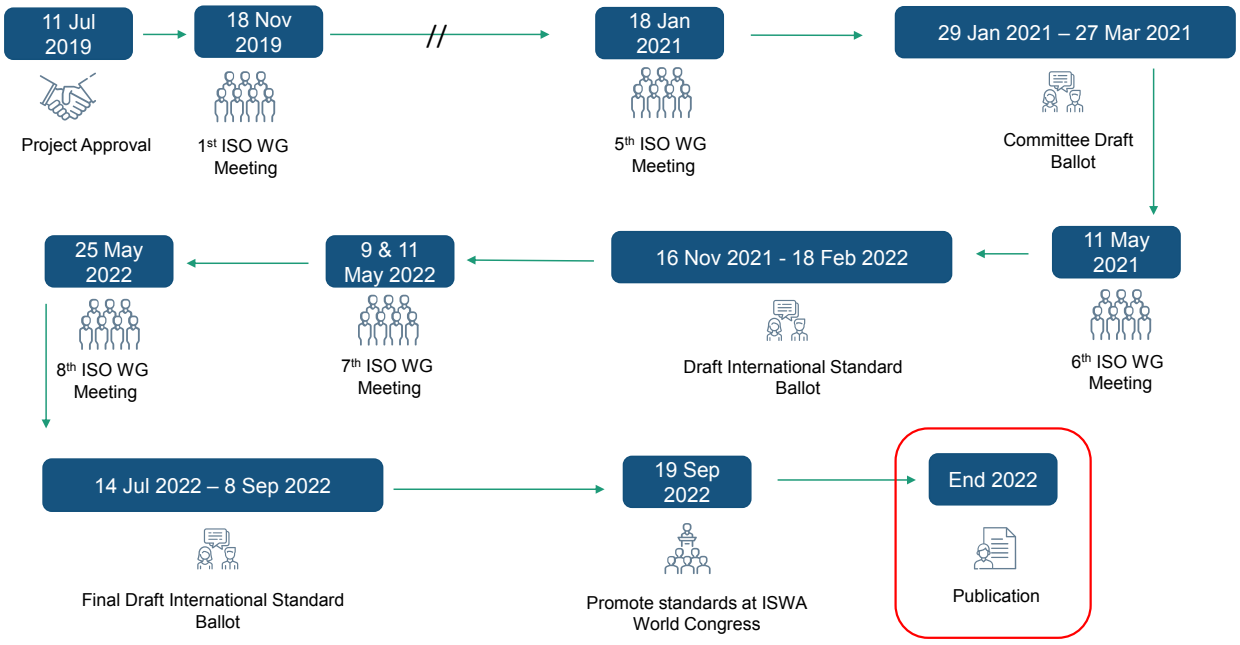
Participating Members

Belgium
China
Germany
Japan
Republic of Korea
Singapore
Sweden

ISO/TC 297 Working Group 1, Nov 2019, Tokyo

10

Timeline for development of ISO 24161



11

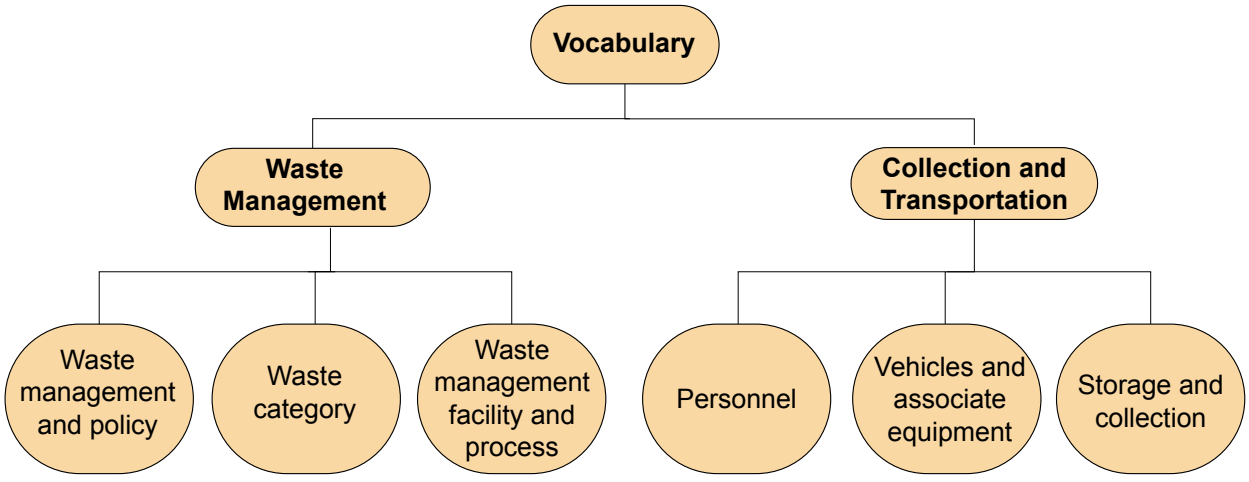
Scope of upcoming ISO 24161

Defines terms that are commonly used in the area of waste collection and transportation

Aims to align terminologies used internationally

12

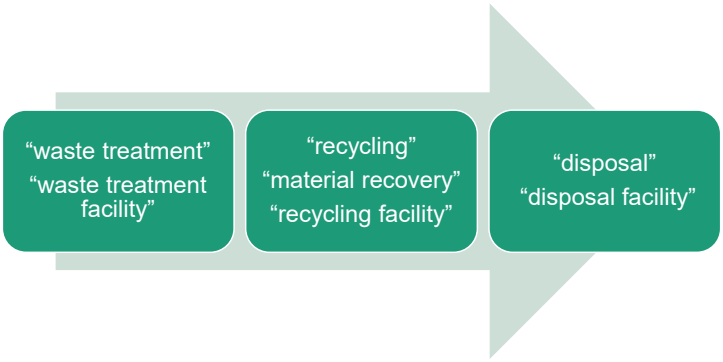
Vocabulary structure of upcoming ISO 24161



13

Examples of key vocabularies

- ISO 24161 took into account the 3R concept (reduce, reuse recycle)
- Examples of terms and definitions for “Waste management” include:



14

Examples of key vocabularies

- Includes vocabularies complementary to standards under ISO/TC 297/WG 2 Waste collection and transport vehicles
- Examples of terms and definitions for “Collection and transportation” include:
  - ✓ Refuse collection vehicle
  - ✓ Direct refuse collection
  - ✓ Indirect refuse collection
  - ✓ Hooklift loader, front loader, top loader

15

Benefits of upcoming ISO 24161

- Minimise ambiguity
- Minimise confusion
- Minimise misunderstanding of terms used in the waste management industry

16

九

收集有機物—聰明的垃圾桶和愚蠢的人類？

(Collecting Organics – Smart Bins and Stupid People?)

介紹數位化應用的MSW收集，以便於收費並改變家庭行為，實現更多的廢棄物收集和更少的殘餘廢棄物產生。義大利將數位化和 IT 解決方案應用於MSW收集的三個實踐經驗。每個方案都會導致用戶／廢棄物生產者的習慣和行為發生變化。對於每一次體驗，解決方案給予用戶／廢棄物生產者的習慣和行為帶來的變化，體現於包括顯示城市對固體廢棄物生產、回收和資源回收以及廢棄物增加的積極和消極影響的數據和訊息。

Practical experiences in changing social behaviour by applying digitalisation to MSW collection

Session Theme: Session 2: Making Waste Management Sexy & Intelligent through Robotics and Digitalisation

Collecting Organics – Smart Bins and Stupid People?

ISWA 2022 - Singapore
Dott. Marco Ricci - Jürgensen
Altereko sas

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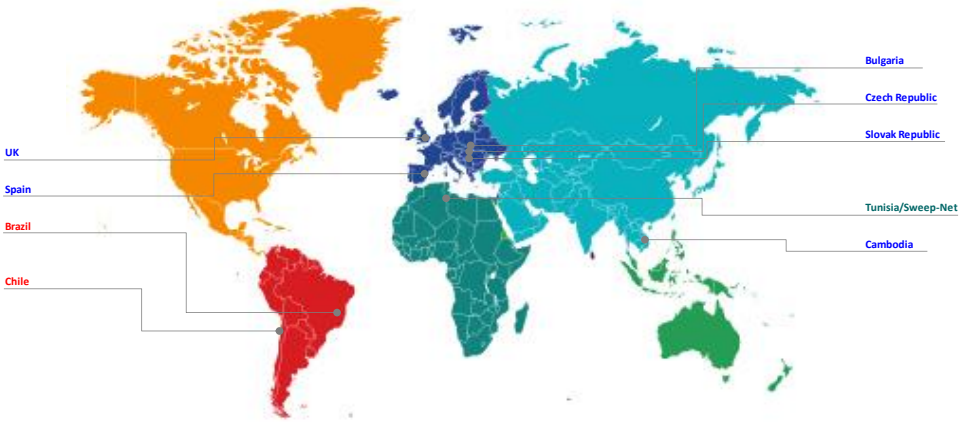
environment, consulting and planning

About Altereko…

- **25 years of experience in planning MSW management**, designing and up¬grading of collection and transport schemes, assessing recycling facilities (focus on composting), planning comunication and participation initiatives, chairing multi-linguistic, multi-tasking working groups or projects.
- **18 year foreign working experience** as consulting expert focusing on issues related to solid waste management. Extensive consultancy experience in the Solid Waste Sector – on Strategy and Policy, Fees&Taxes, Separate collection schemes - , both in ´advanced´ and ´low to middle income' countries in Europe, Latin America and Asia.
- **15 years experience cooperating with international organisation/agencies** (as ECN-European Compost Network, ACRR, EEA-European Environment Agency, Sweepnet-GIZ, SCOW).

CV

Activities (outside Italy)



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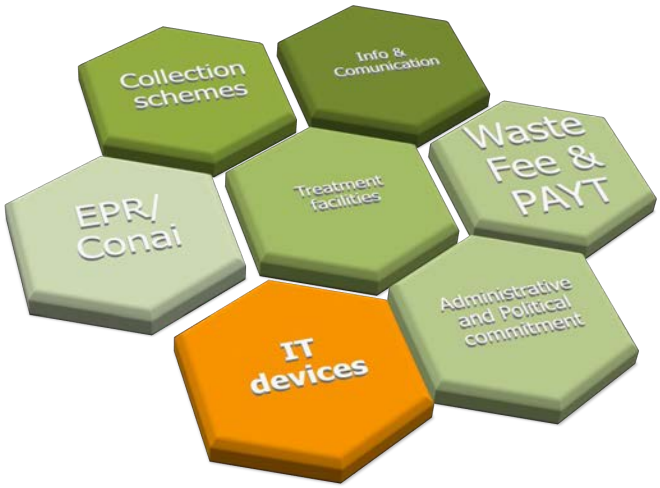
Modern MSW management in Italy



5

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Why digitalisation and IT solution for MSW collection?

- Optimise **distribution** of collection tools to households and other waste producers
- To track and **locate** collection tools on the territory
- To track and **monitor users behaviour** and commitment towards separate collection and recycling
- To **monitor collection services** and optimise collection routes

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6

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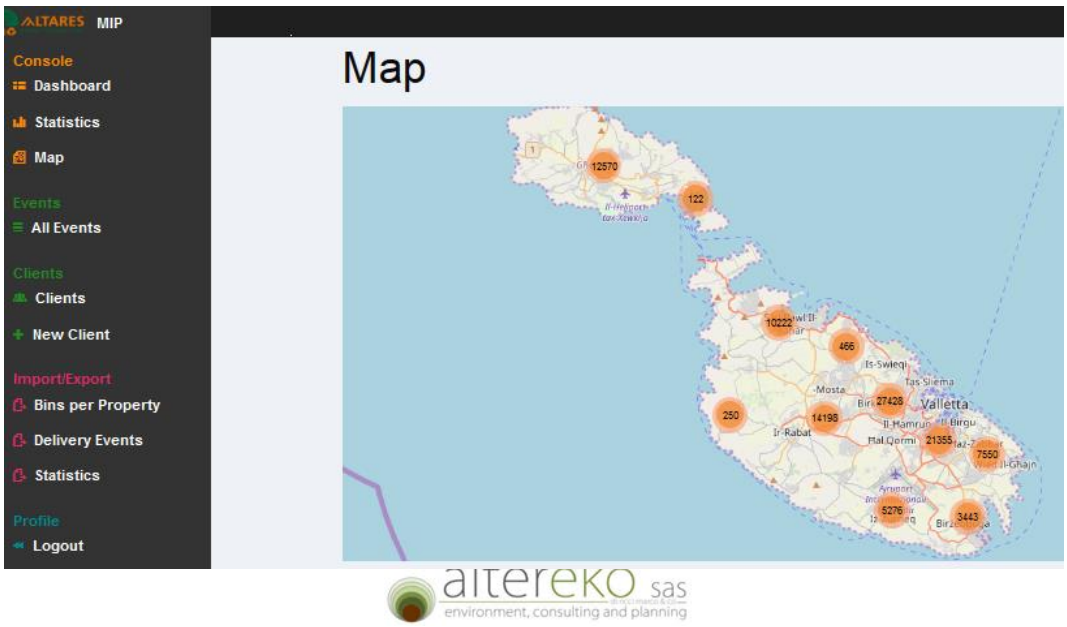
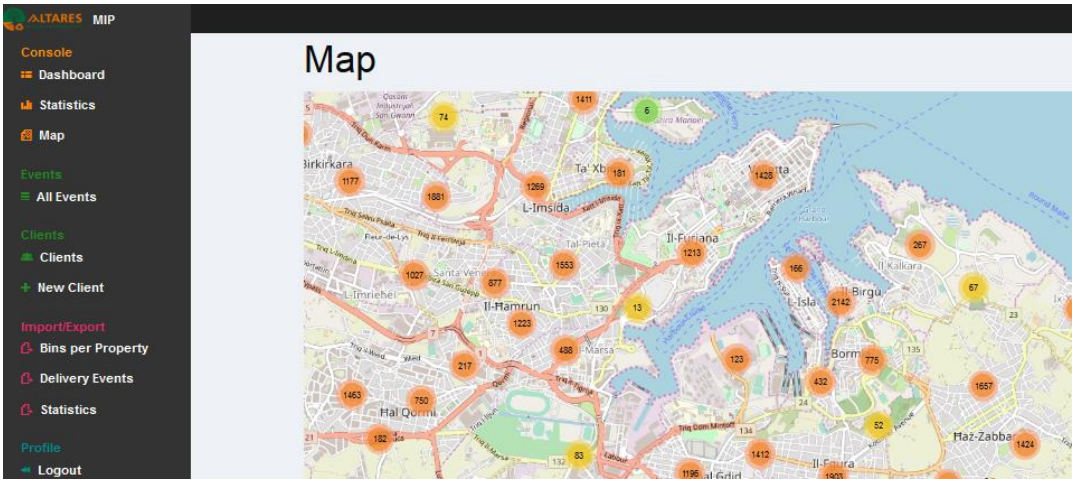
Optimse distribution of collection tools to households and other waste producers

8

4th IR in Malta



4th IR in Malta



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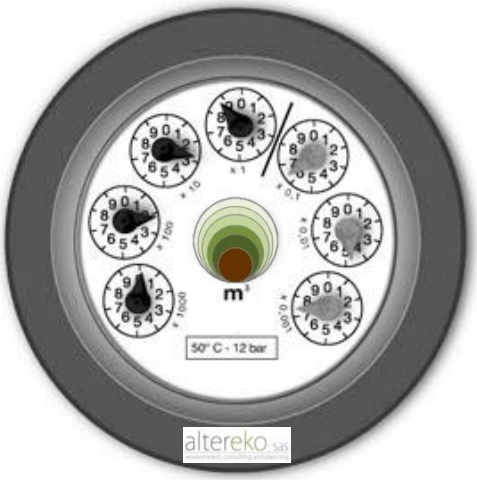
Why digitalisation and IT solution for MSW collection?



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The municipality of Sommacampagna (VR)

- 15’000 inhabitants
- MSW collection service by a Private contractor
- Municipalty controlls the service-provider
- Pioneer municipality in separate collection since the ‘90
- PAYT: yes

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- MSW collection service by a Private contractor
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DA 20 ANNI FACCIAMO LA DIFFERENZA
1998
2018

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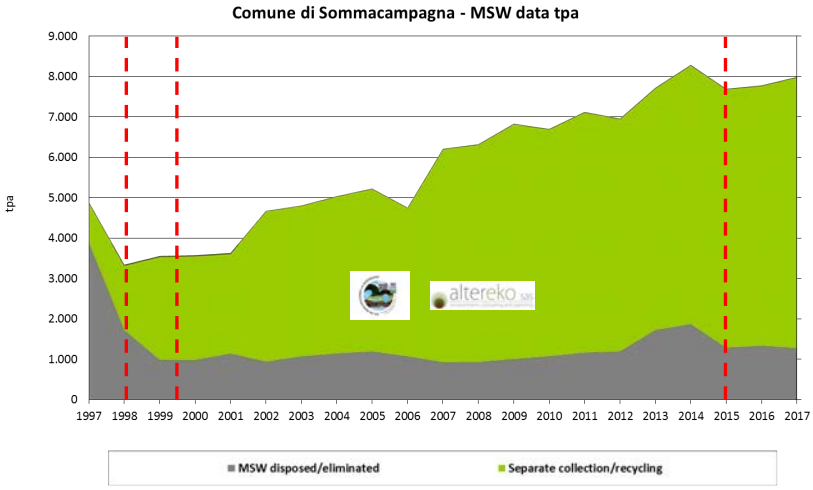
20 years of MSW management



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The 4th industrial revolution applied in 2015

Expectations

- Increase separate collection & drop residual waste
- Trace/Verify collection routes
- Feedback on the amounts of residual waste delivered by each waste-producer (households)
- Survey of the use of the collection of food-waste
- Set up a “buffer/emergency” option for residual waste

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Summer 2015: new collection tools for residual waste

- 1 x 40 liter per family
- TAG RFID
- Collection services are traced
- Collection frequencies are reduced to 1/2weeks

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Hardware on board during collection service

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Tracking of collection services

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Collection services and frequencies

	Collection scheme	Years 2000→2014		Year 2015 →	
Residual	Kerbside & Coll.Center	bags	1/week	Buckets with RFID Coll.center	1/2weeks
Food waste	kerbside	Buckets	2/week	Buckets with RFID	2/week
Paper & Card	Kerbside & Coll.Center	Lose/cardboard boxes	1/week	Buckets	1/month
Plastics	Kerbside & Coll.Center	Transparent bags	1/ week	Transparent bags	1/2weeks
Glass	Kerbside & Coll.Center	Buckets	1/month	Buckets	1/month

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The change in the behavior of households

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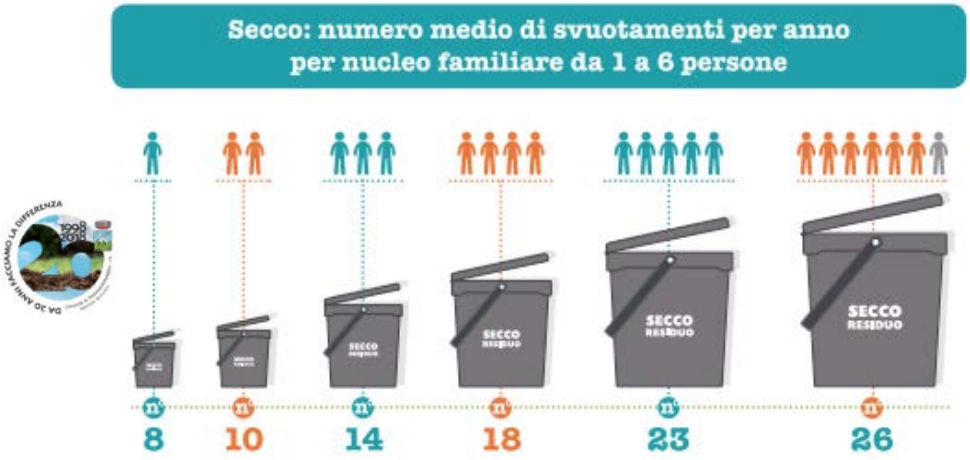
The change in the behavior of households



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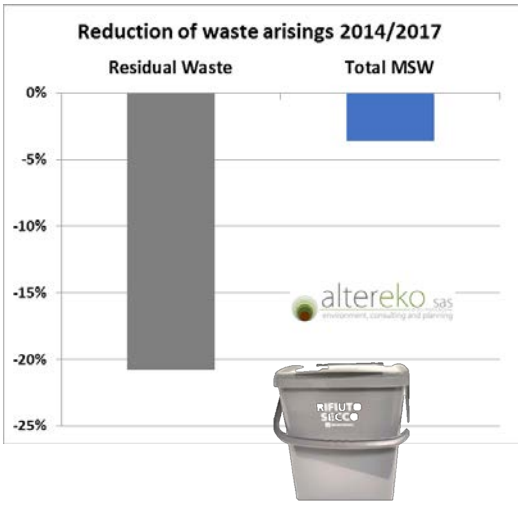
The change in the behavior of households



- Residual waste dropped by -21%
- Residual waste drops to 0.95kg/p/week

- Total MSW reduced by 4%
- Separate collection boost from 77% to 84%

- No contamination of recyclable waste
- PAYT scheme fully implemented and accepted by population

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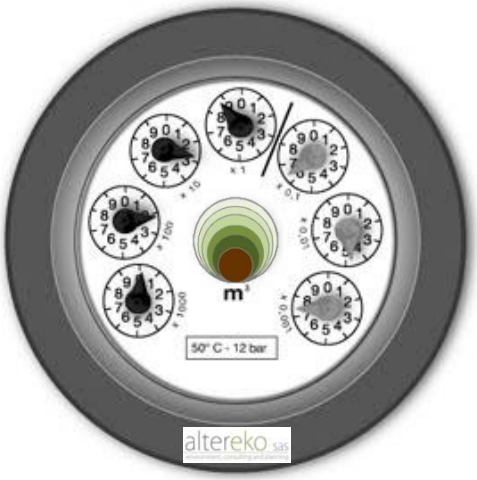
Why digitalisation and IT solution for MSW collection?



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Upgrading road container collection

- A smart approach to apply used identification and PAYT with road container collection (s)
- But…..

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The change in the behavior of households

- WYGINWYE
- Increase of waste littering around the containers
- Need for frequent clean up
- Risk to contaminate separate collection (if bins still open-access)

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The lack of feedback to households

- What you loose?

- Waste check
- User feedback
- Operator ←→ user contact

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Compare two approaches

Parma (DtD & PAYT)

Brescia (RC & ID systems)

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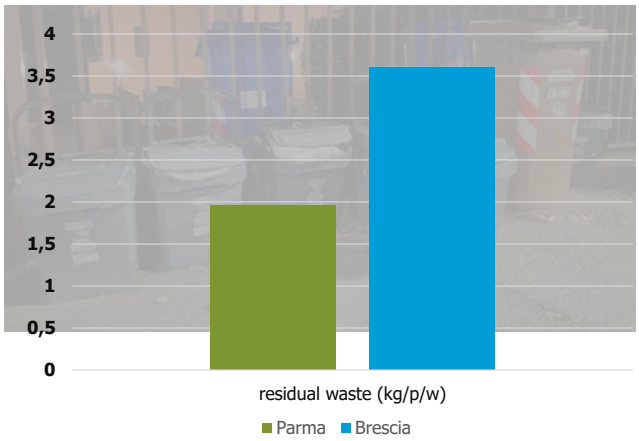
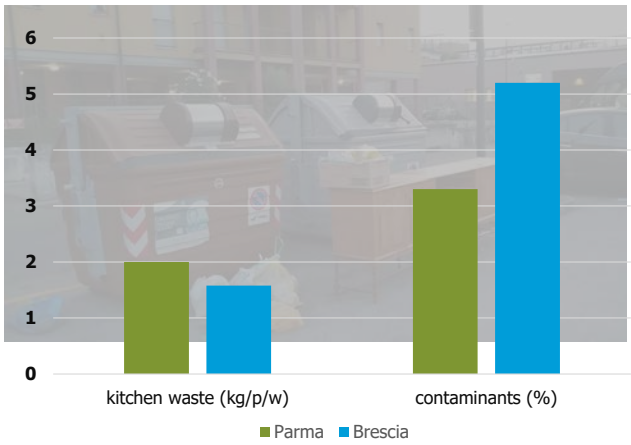
41

Compare two approaches

Parma (DtD & PAYT)



Brescia (RC & ID systems)



Waste quantities , year 2017

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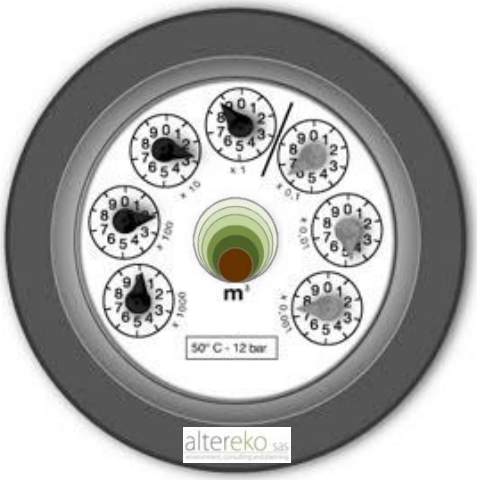
Why digitalisation and IT solution for MSW collection?



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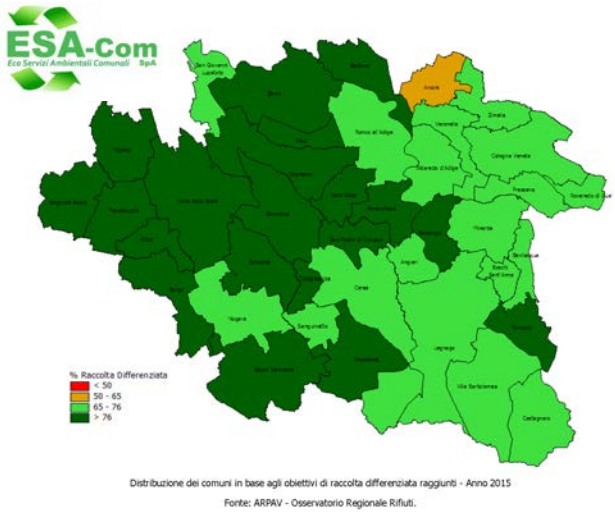
ESA-Com District (IT) - 90.000 p, 19 Municip.



- Door to door collection
- High sep. Collection and recycling (82% in 2015)
- PAYT applied in all (but 2) municipalities
- Monitoring of the separate collection scheme for food waste

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ESA-Com District (IT) - 90.000 p, 19 Municip.

2015/2016

- hh equipped with a new 20 lt caddy with UHF Tag RFID
- Vehicles equipped with Controllers (i.e. Read Tags and register GPS position)
- For monitoring only: wheight of each bucket assessed

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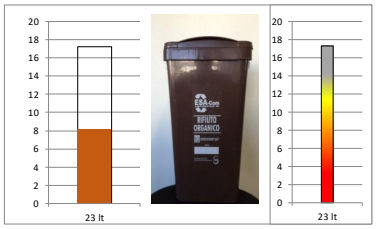
A dashboard on collection

- Measure food waste delivered per type of bin
- Measure frequency of food waste delivered per size of household



Source: Esacom 11-2016, Ecomondo

The change in the behavior of households

2016/2017

- Collection frequencies (buckets placed on the curbside by HH) reduced by 1/3
- Collection routes optimised at about 5 min/1000 inhab (or 4-500 HH)
- Start-up of the separate collection of used diapers with about 12 kg/HH send to recycling

2018

PAYT applied to both residual waste and FW collection

Costo a svuotamento aggiuntivo servizio Secco Indifferenziato	Bidone da 40 Lt	Carrellato da 120 Lt	Carrellato da 240 Lt	Cassonetto da 1080 Lt
	1,37 €	4,12 €	8,24 €	37,07 €

	Bidone da 20 Lt	Carrellato da 120 Lt	Carrellato da 240 Lt
Costo a svuotamento aggiuntivo servizio Organico	1,32 €	7,92 €	15,84 €

The change in the behavior of households

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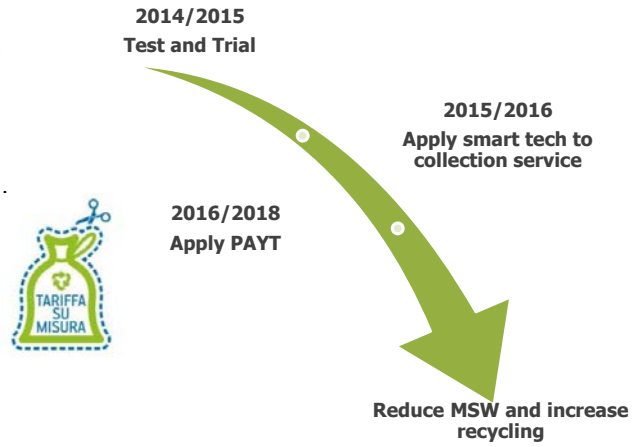


Conclusions

- Smart bins enhance collection performances….
- ….provided consistent feedback to users…..
- Achieve positive change in user behavior (less residual waste, more recyclables, better recycling)

- Smart tools alone do not increase consciousness in waste producers…..
- and effects can worsen the situation (littering, contamination of open bins)

- Waste and recycling is about people, not about waste, nor about IT tools

Grazie !

Thank you

Marco Ricci-Juergensen
Altereko sas\Verona\Italy
it.linkedin.com/in/riccieco

十

側向裝載城市固體廢棄物收集系統的優點及優勢

(Benefits and Advantages of the Side Loading Municipal Solid Waste Collection System)

廢棄物收集已成為一項代價高昂的工作，許多廢棄物收集者在執行相關的工作時遇到問題。為了提高服務水平和緩解些許結構性問題，側向裝載的廢棄物收集系統已被全球一些主要城市採用，該系統包括一台側向裝載的壓實車和大容量側向裝載集裝箱，可在32秒內完成清理，使其成為市場上收集城市固體廢棄物達到最快、最高效、最安全的效果。此外，它還提升了廢棄物收集者的工作尊嚴，使其更具永續性，對今世後代更具吸引力。

WHO IS CONTENUR?

THE COMPANY

- ESTABLISHED IN 1984, is one of the three major MSW containers manufacturers by turnover in Europe, and absolute leader in side loading containers (+300,000 units sold with quality claims ratio close to zero).
- 120M€ TURNOVER, 4 FACTORIES (Spain, Poland, United Kingdom and Brazil), +800 employees, delegations in 14 countries, sales in +50 countries.
- PRODUCTS: side loader containers, rear loading bins, hook lift igloos, underground containers, litter bins.
- SERVICES: cleaning, repairing and maintenance of our products (including children playground areas).

CONTENUR

WHAT IS SIDE LOADING WASTE COLLECTION?

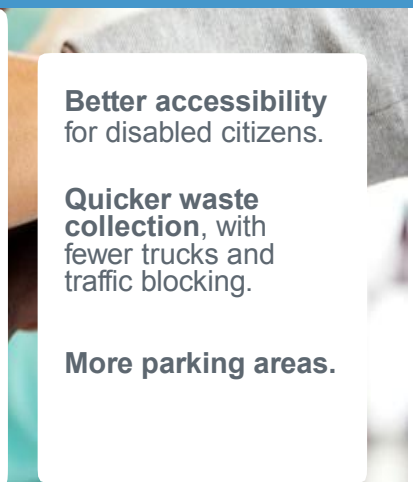
Introducing a new way of waste collection that is quickly replacing the old rear loading system in many countries of Europe (and beyond) due to its multiple qualitative and quantitative advantages

Advantages for the citizens

Easier to use (different apertures).

Cleaner (pedal – no need to touch).

Less noisy (use and discharge).

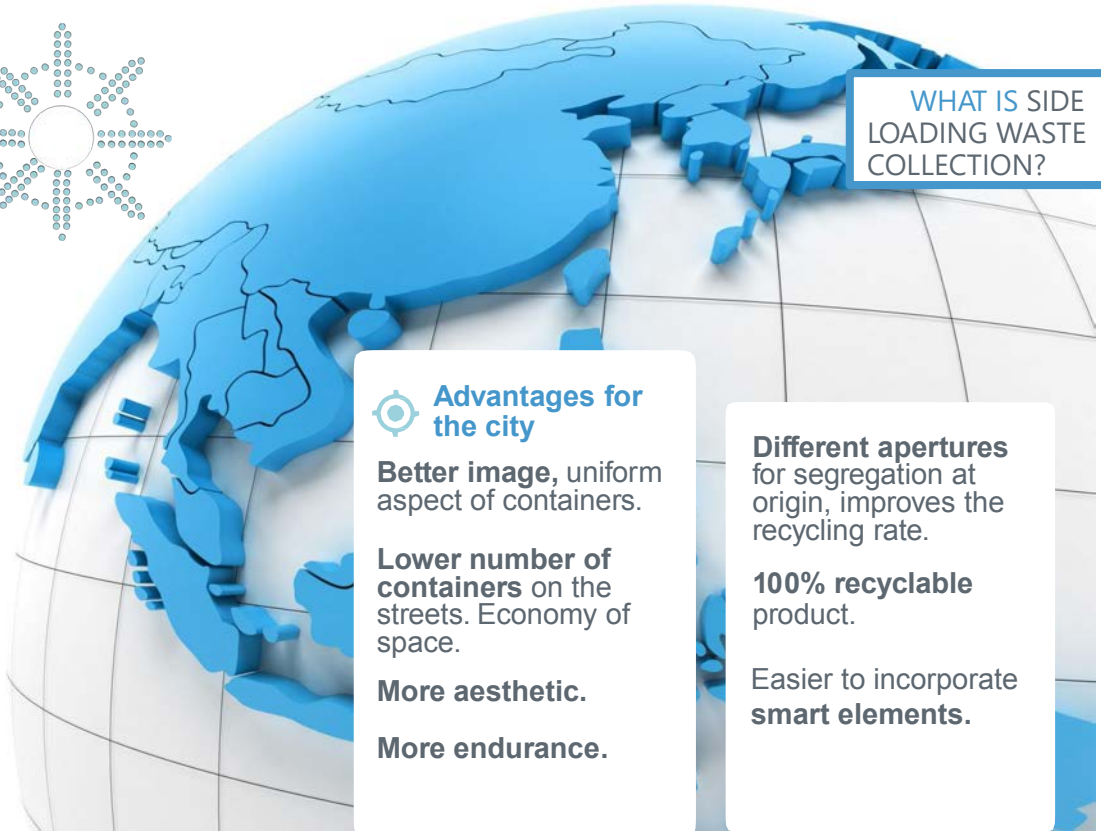


Better accessibility for disabled citizens.

Quicker waste collection, with fewer trucks and traffic blocking.

More parking areas.

CONTENUR



WHAT IS SIDE LOADING WASTE COLLECTION?

Advantages for the city

Better image, uniform aspect of containers.

Lower number of containers on the streets. Economy of space.

More aesthetic.

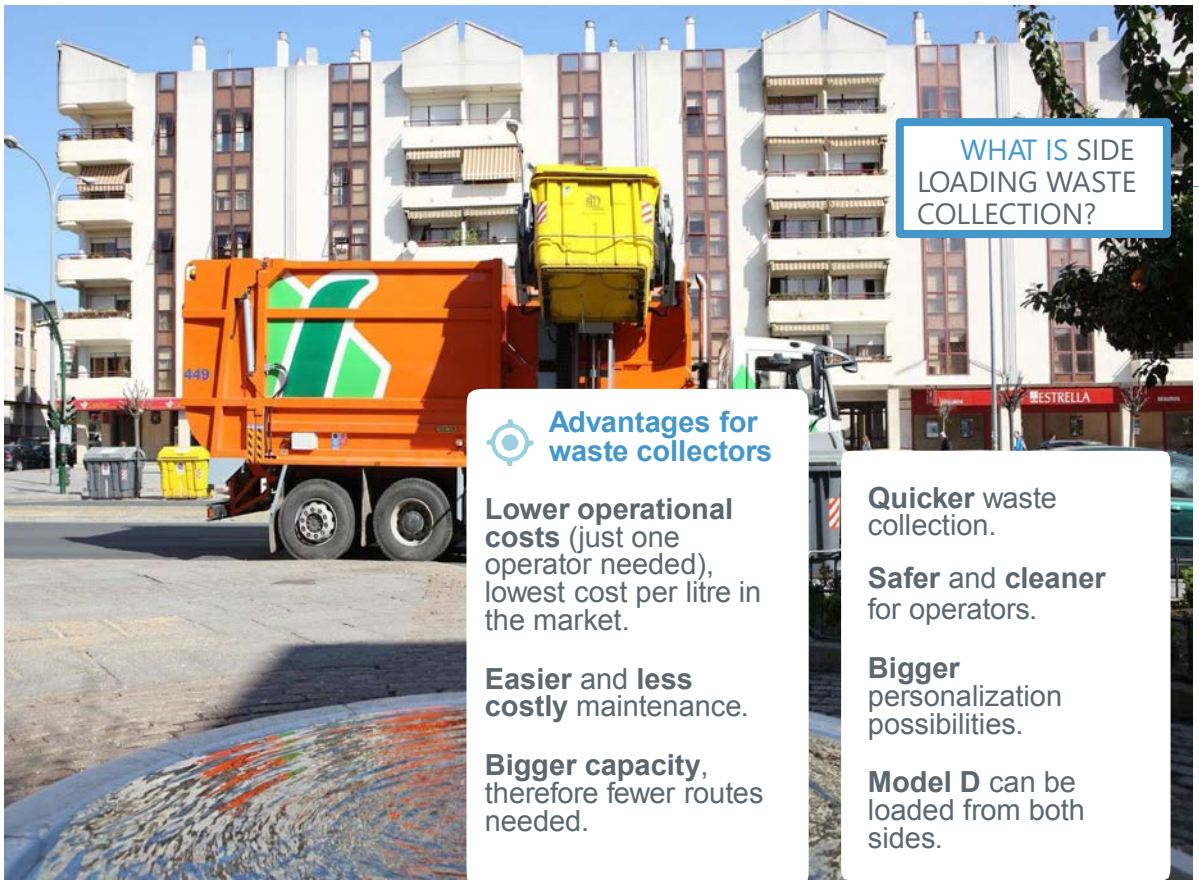
More endurance.

Different apertures for segregation at origin, improves the recycling rate.

100% recyclable product.

Easier to incorporate **smart elements.**

CONTENUR



WHAT IS SIDE LOADING WASTE COLLECTION?

Advantages for waste collectors

Lower operational costs (just one operator needed), lowest cost per litre in the market.

Easier and **less costly** maintenance.

Bigger capacity, therefore fewer routes needed.

Quicker waste collection.

Safer and **cleaner** for operators.

Bigger personalization possibilities.

Model D can be loaded from both sides.

CONTENUR

Cost efficiency due to higher productivity and automation

Efficiency comparative table for one route	Side load	Rear load
Containers per route and fraction	120-150	200-250
Collection per route and fraction	480 m3	165 m3
Time of collection of 3.2 m3	32″	220″
No. of operators	1	9
No. of containers	150	750
No. of trucks	1	3

One route equivalent to 480 m3

CONTENUR

SUCCESS STORIES
CONTENUR

- Mallorca (Spain)
- Sharjah (United Arab Emirates)
- Singapore

CONTENUR

SUCCESS
STORIES

Mallorca (Spain)

Improvement of recycling rate and citizenship awareness, harmony of containers design with the city.

CONTENUR

SUCCESS STORIES

Sharjah (United Arab Emirates)
Integration of side loading containers in a vertical city.

CONTENUR

SUCCESS STORIES

Singapore
Improving the efficiency and sustainability of public services.

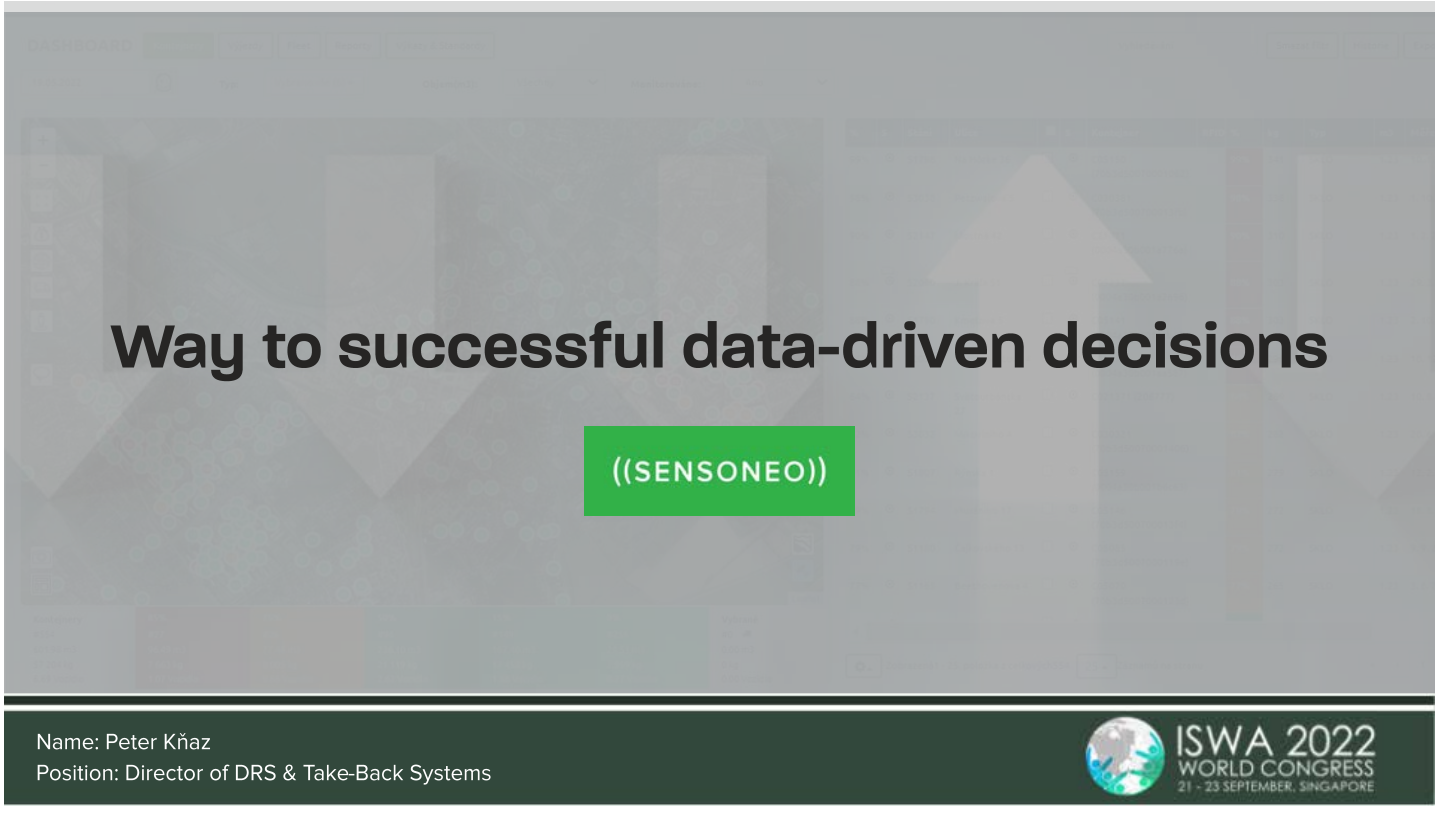
CONTENUR

十一

數據驅動的廢棄物管理。結果就在這裡！

(Data-Driven Waste Management. The Results Are Already Here!)

儘管不同行業的數位化轉型蓬勃發展，但廢棄物管理中數據驅動的管理方法仍然很少見。廢棄物數據管理意味著如何影響效率、透明度和可追溯性，藉此了解數位化轉型如何改變特定利益相關者、組織和公司的運營方式，展示準確的數據如何幫助廢棄物管理行業轉型以實現效率和永續性。



Sensoneo making digital transformation happen

#1	SW + HW partner Top-notch quality and reliability	**>400**	On-going projects Businesses, municipalities, countries
70+	Countries Using Sensoneo sensor units and SW	**EUR 4m**	Revenues 2022
40+	Certified partners Supporting our deployments worldwide	**>150%**	CAGR 2017-2021

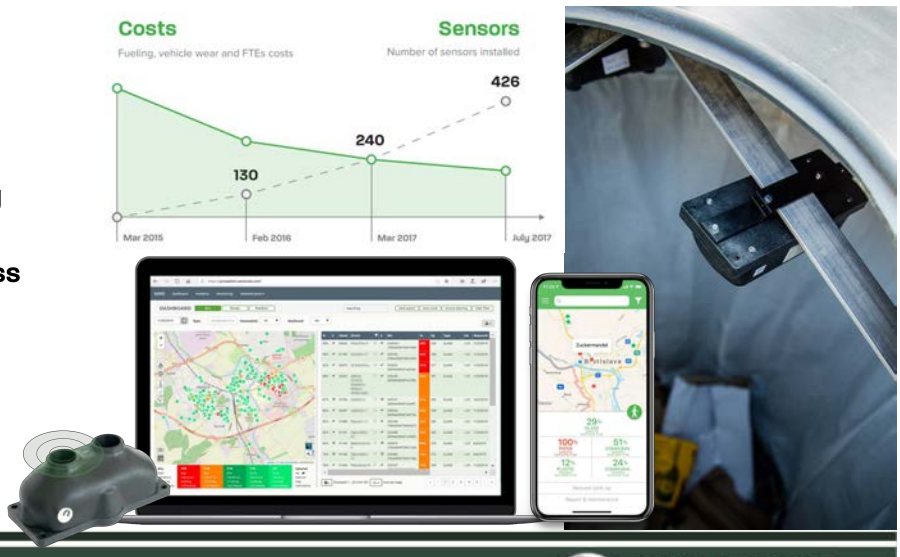
> Good decisions are data-driven decisions.
> Sensoneo enables you to make truly good decisions.

ISWA 2022 WORLD CONGRESS 21 - 23 SEPTEMBER, SINGAPORE

Sensoneo - Data Revolution in Waste Management

Waste collection management

- 30% of operation costs reduction from system implementation
- Bringing reduced pick-up frequency
- Waste tourism revealed – Bin Access Management



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Waste Monitoring Use Case

1300 bins for textile waste

600 sensors monitoring 8x a day

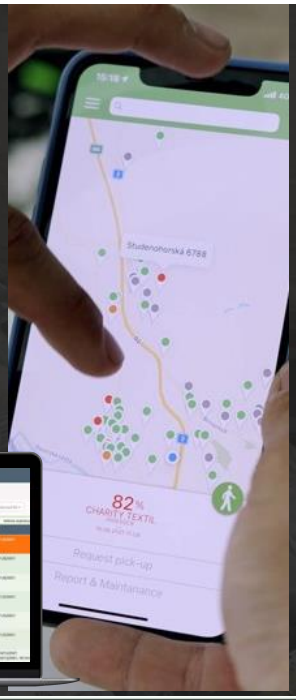
3000 tons collected annualy

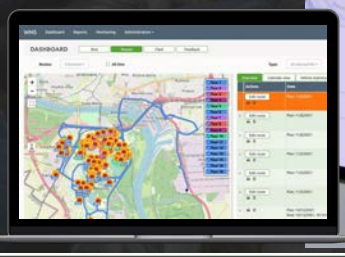
20% reduction of collection costs

30% reduction of time required for the collection of 1 ton of material

7 months Return On Investment

EKOCHARITA,
Textile Waste Collector





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"Digitalization not only helped our operations – but it also opened a brand new customer segment for us."

Juraj Kunak
CEO of EKOCHARITA

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International large-scale deployments

BUENOS AIRES
3.500 SENSORS

CITY OF PRAGUE
420 SENSORS

CITY OF BRATISLAVA
1.750 SENSORS

CITY OF TRIESTE
640 SENSORS

CITY OF AL-ULA
1500 SENSORS

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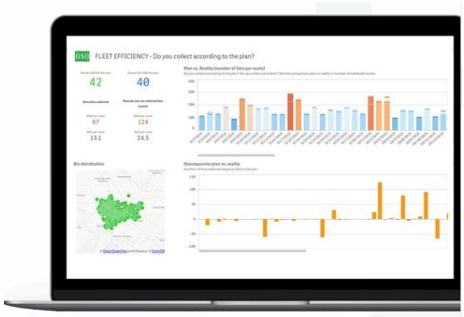
Sensoneo - Data Revolution in Waste Management

((S))

Embracing operational efficiency through waste collection and fleet data

4-6 months of collection data to face the real efficiency KPIs of waste collection:

- Fleet utilization
- Overall operational efficiency
- Healthy and unhealthy patterns reveal
- Data economy (operational costs per ton of material)
- Average bin fill level evaluation



Saving opportunities evaluation:

- Route planning cost simulation
- Waste monitoring & schedule amendment

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Collection Efficiency Analysis Use Case

46% average fill-level in bins

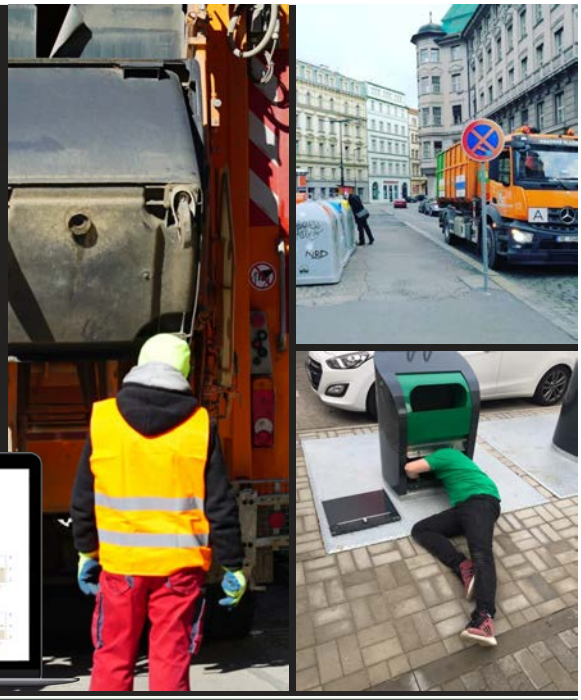
43% used time of fleet capacity

25% missing data from Prague

46% cost savings from new collection routes & schedules

PRAHA PRAGUE PRAGA PRAG

City of Prague, Czechia



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"This tool should provide the city with new information which will be used for the optimization of waste collection routes, creation of predictive models for the planning of collection routes and the placement of new waste containers."

Michal Fiser

CEO of municipal enterprise Operator ICT

PRAHA PRAGUE PRAGA PRAG

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Take-Back System Use Case

asekol

Nationwide WEEE collector in Czechia

25K	collection points
4K	collection street bin
78K	km2 (country-wide system)
47	regional logistic subcontractors
7	processing & recycling facilities

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"Sensoneo tools enable us to set the right pickup frequency, optimize bin distribution, manage costs, and receive service verification without unnecessary fieldwork. Digital tools from Sensoneo make everyday management easier and records transparent."

asekol

Sarka Kohakova
Logistics Manager at Asekol CZ

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Sensoneo - Data Revolution in Waste Management

((s))

Make your complete operation data-driven

asekol

Data-driven Take-Back system for EPR organization:

- Dynamic planning by data
- Transparent waste and financial streams
- Simple marketplace for solving demand and supply of transport
- Reaching operational efficiency by empowering collection points and logistic operators
- Minimizing CO2 emissions and cost efficiency through powerful route planning algorithms

In 16 months

10.036
collection routes executed

42.953
orders processed

78.339 tons
WEEE amount transported

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Sensoneo - Data Revolution in Waste Management

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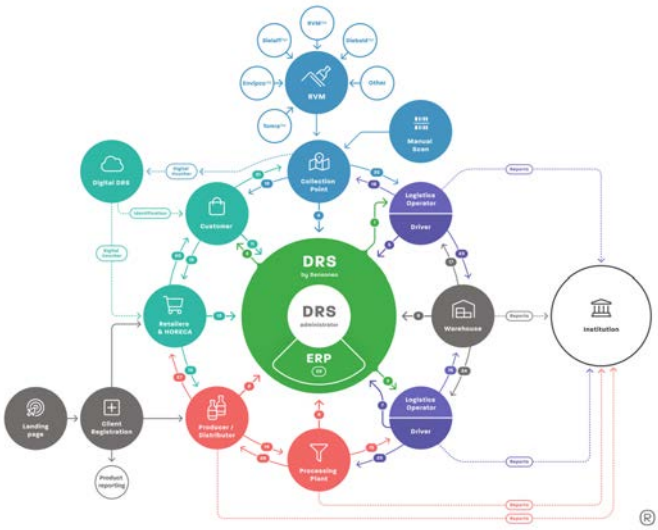
Make the national-level system work efficiently - Deposit Return System



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Deposit Return System Use Case

2900+ collection points registered in the system

3600+ EANs in the system

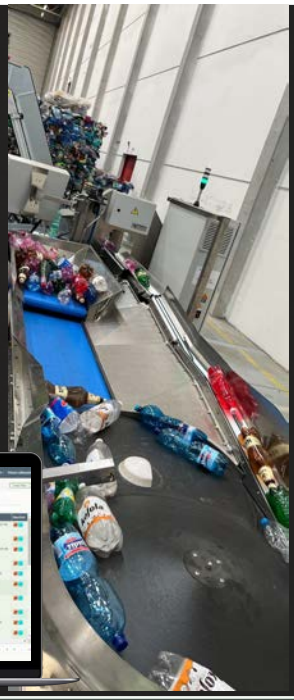
>580m bottles and cans collected since January to September 2022

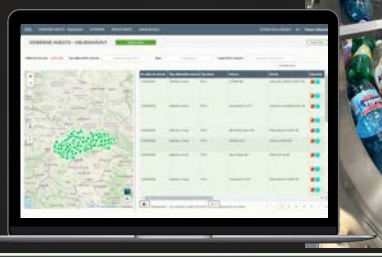
3,5+ m returns in a day on average

10 months for complete implementation of the system

SPRÁVCA ZÁLOHOVÉHO SYSTÉMU

DRS Administrator in Slovakia





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Sensoneo - Data Revolution in Waste Management

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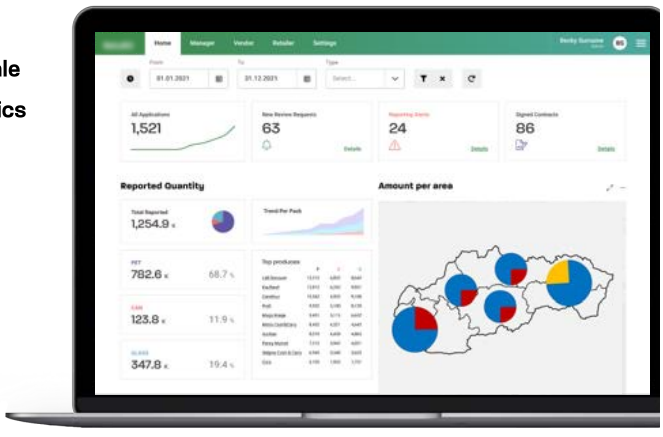
Start from accurate data collection prior to DRS implementation

System based automated market research tool to calibrate your operation and conduct effective planning:

- Market placement reports of producers to evaluate economy of scale
- Sales reports of retailers & HoReCa to evaluate the scaling of logistics
- Estimate recollection quantities by % targets and calibrate your processing capacities and operational resources needed
- Seamless digital contracting



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Go full scope with data – understand the impact and tune the system

- Understand stronger and weaker regions
- Focus more resources on biggest hotspots (logistics, operational resources)
- Listen to market and conduct data analysis to firm the decisions

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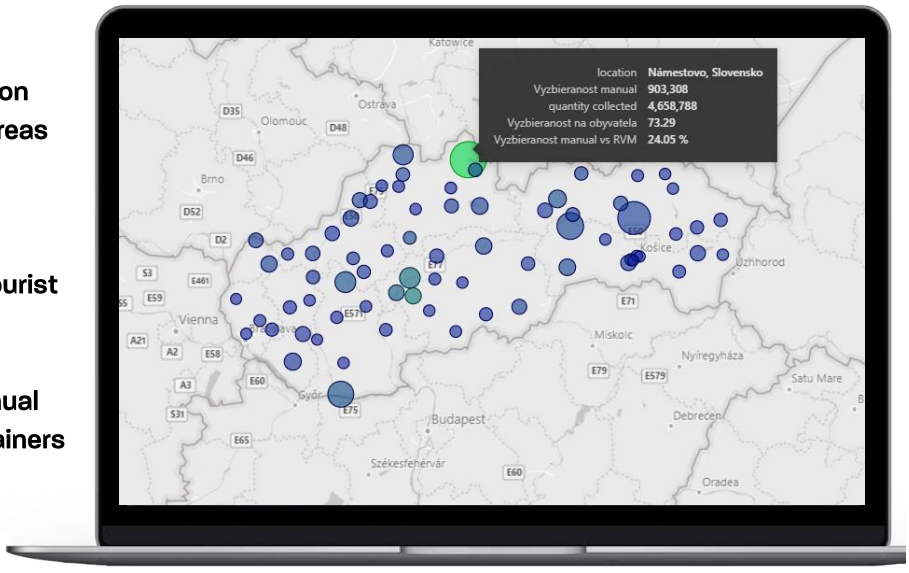
Methods of collection

- Adhere to regional network distribution
- Do not underestimate more remote areas and power of local economy

example: Námestovo county

- Mountainous area with significant tourist inflow, low density of big chain supermarkets
- 24% of containers collected by manual collection method means 903k containers (~36tons)



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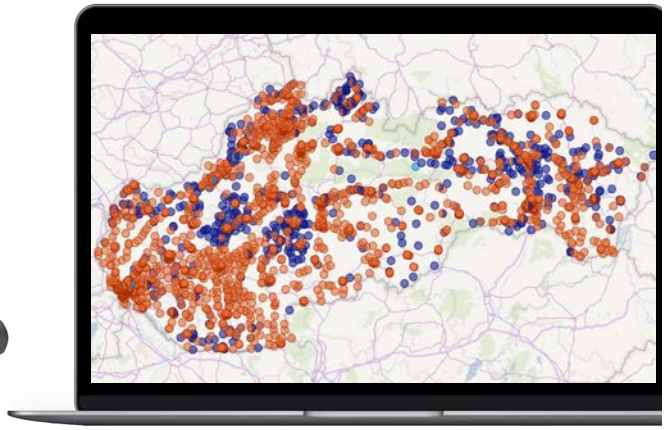
Expand the scope

Include HoReCa and small retailers:

- **Bring DRS closer to people, amend to local culture**
- **Choose right tools and technology to enable the expansion**
- **Provide convenience and motivate**



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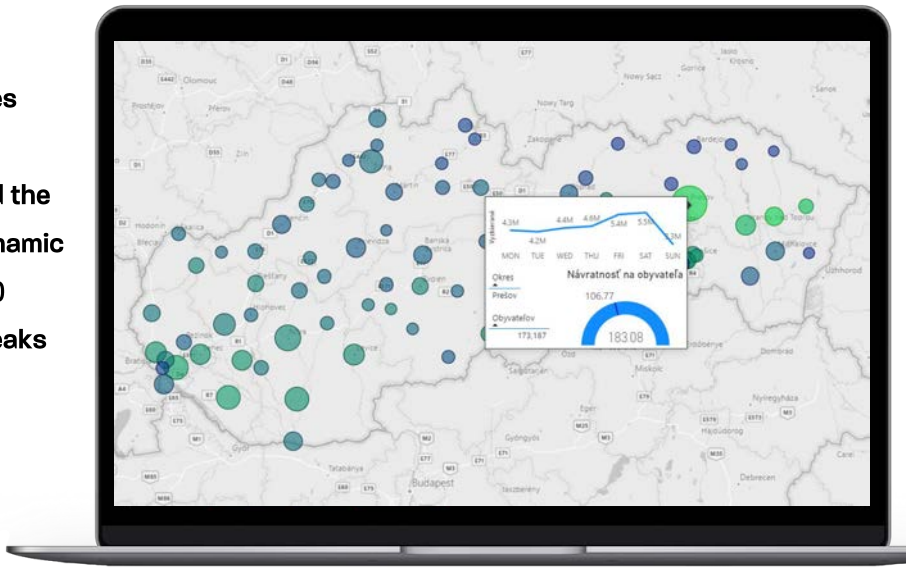
Optimize your operation

- **Tune the regional operation capacities ready (warehouses, sorting plants)**
- **Adjust your logistics schedule based the market need (combine static and dynamic routes, adjust for weekend schedule)**
- **Count with seasonality drops and peaks**



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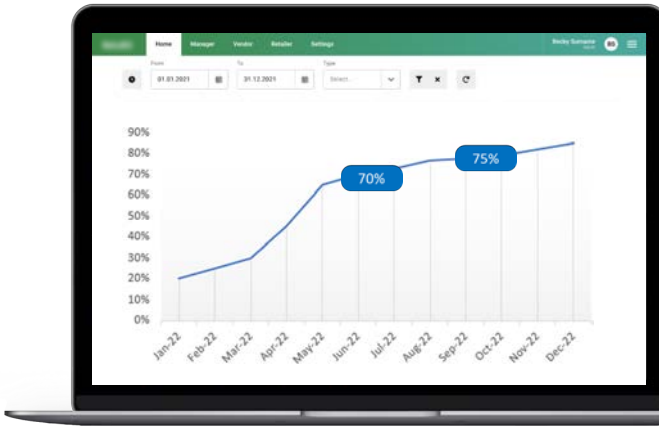
Align with targets

Keep your KPI targets to satisfy all parties

Recollection rate is one of the most important parameters on which validates the purpose of DRS system:

- **Report on overall market targets fulfillment**
- **Report to producers on individual product returns**
- **Monitor and solve potential fraud cases**



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Data-driven decisions are the right decisions

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Contact

Peter Kňaz
DRS & Take-Back Systems
Division Director
peter.knaz@sensoneo.com
linkedin.com/in/peterknaz

Questions?