Global Gateway

SWM Webinar Series

Plastic Waste

INTPA F4 - Urban Development Technical Facility (UDTF)

Topics Overview

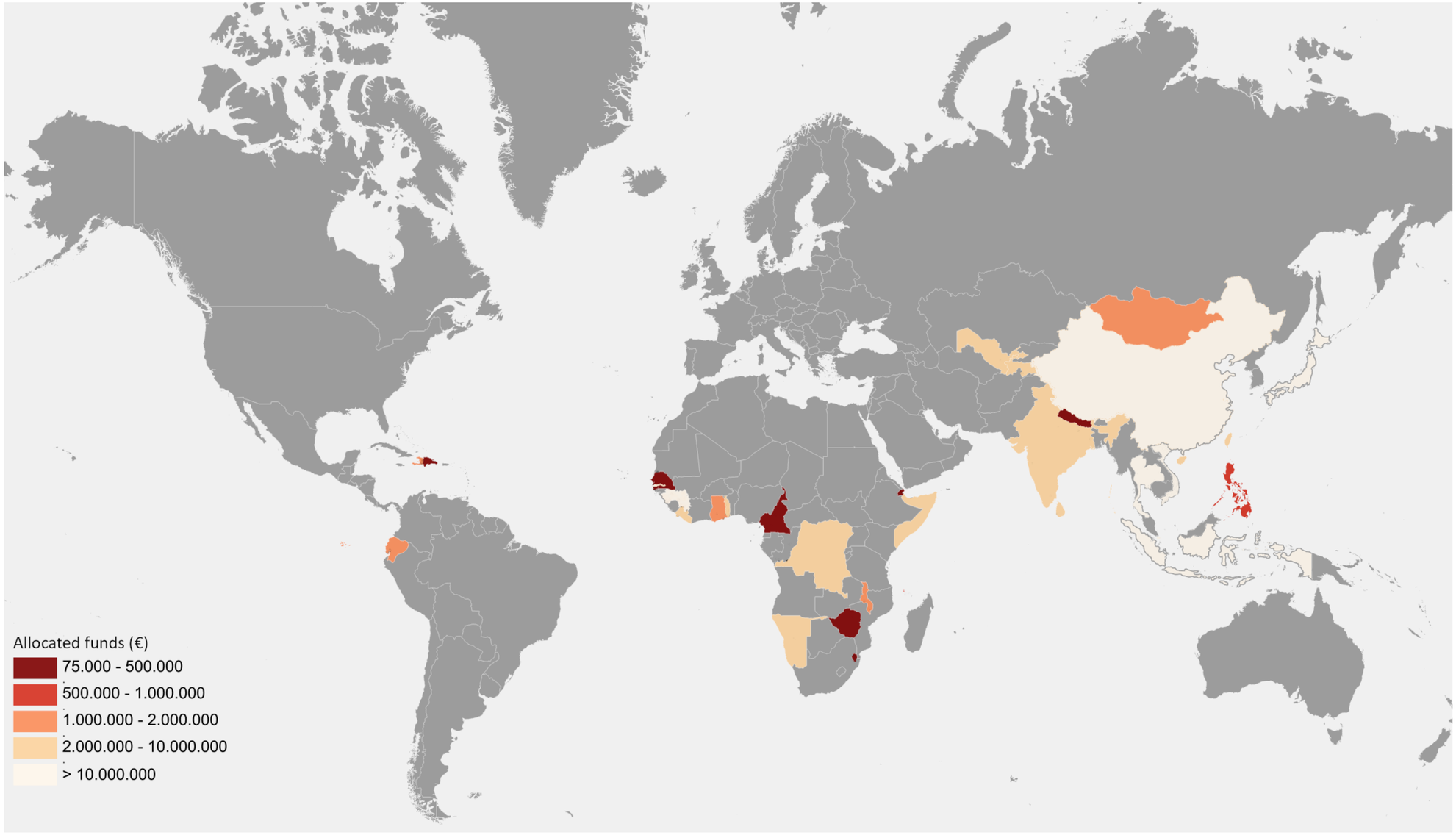
Welcoming remarks.

1. **Conceptual Introduction.**
   - Basic Concepts and Overview of SWM in Sub-Saharan Africa.
   - Waste Recovery Context.
2. **Deep dive: Focus on Plastics.**
   - Plastic Waste.
   - Collection and Recycling.
   - Business Models and Market Situations.
   - Plastic Waste Policies and Future Developments.
   - Practical Application Examples.
3. **Ask the Expert Session.**

Recycling of organic matter into compost, 2021, Sonfonia/ratoma composter, Conakry, Guinea. Sanita villes propres, a European Union project implemented by Enabel (Belgian development agency).)

Overview of INTPA SWM projects

Cameroon
China
Comoros
Congo D.R.
Djibouti
Dominican Rep.
Ecuador
Eswatini
Gambia
Ghana
Guinea, Rep.
Haiti
India
Indonesia
Japan



Liberia
Malawi
Mongolia
Namibia
Nepal
Philippines
Senegal
Singapore
Somalia
Sri Lanka
Tajikistan
Thailand
Togo
Vietnam
Zimbabwe

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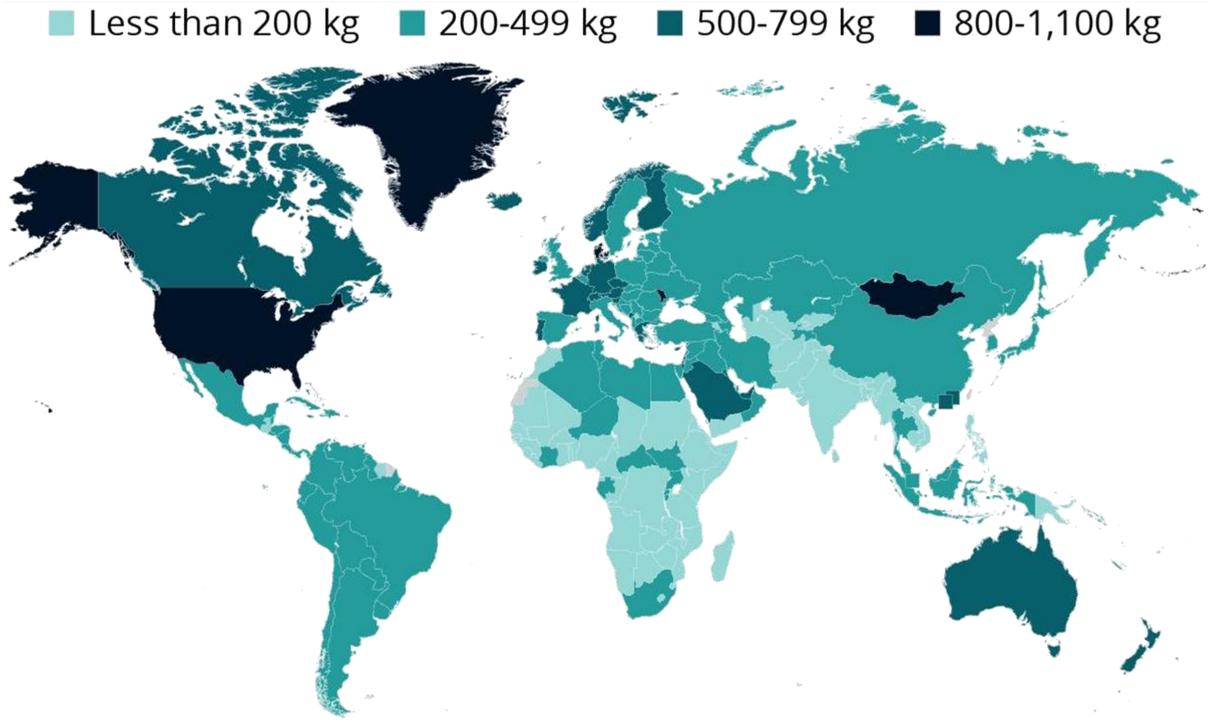
50Kg compost sacs, 2021, Conakry, Guinea. Sanita villes propres, a European Union project implemented by Enabel (Belgian development agency).

Waste Generation by region

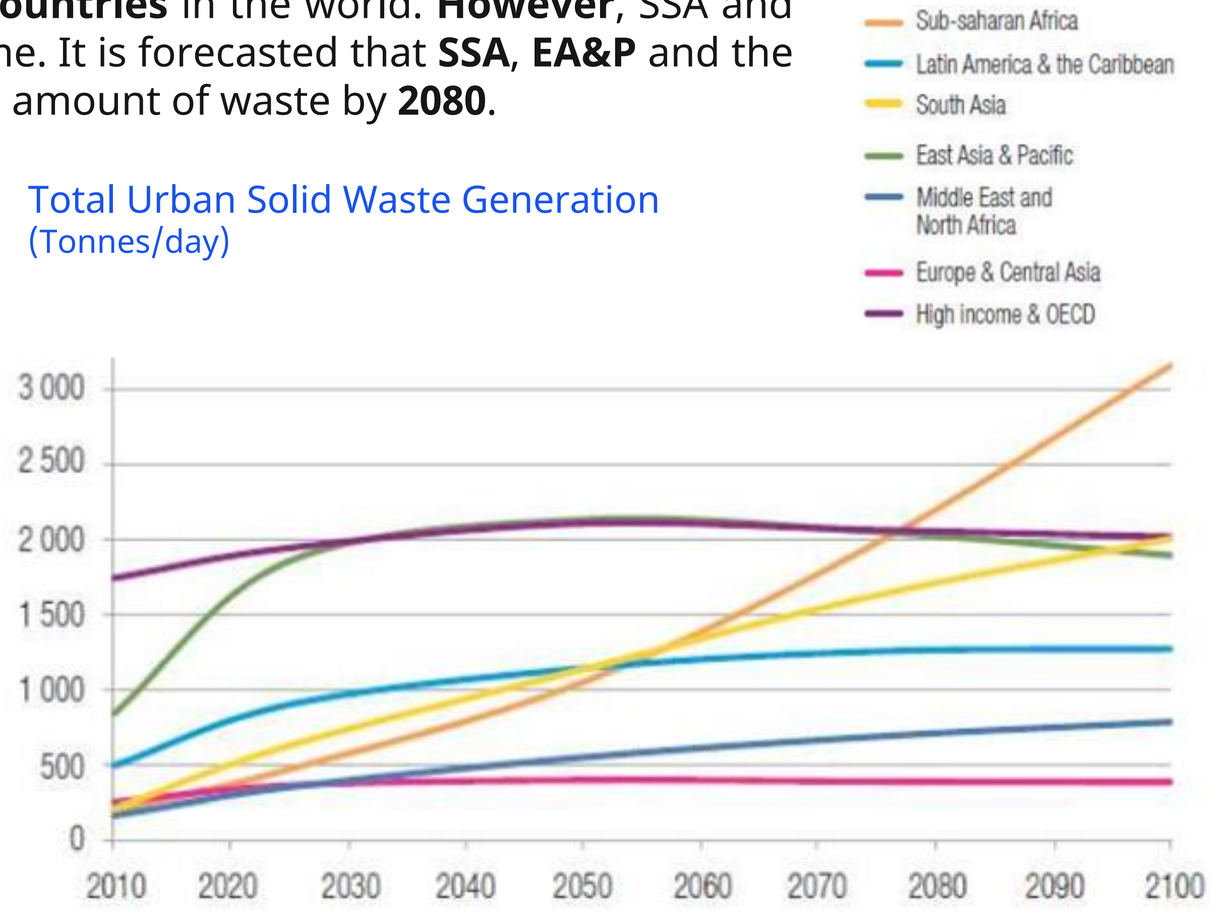
Today, most countries in **SSA generate less waste than most countries** in the world. **However**, SSA and S. Asia **will experience** the **fastest growth** in the decades to come. It is forecasted that **SSA**, **EA&P** and the **high income** and **OECD** countries will **generate about the same** amount of waste by **2080**.

Municipal solid waste generated per year
(Kg/capita)



Source: World Bank What a Waste Database, 2018 or latest available.

Total Urban Solid Waste Generation
(Tonnes/day)



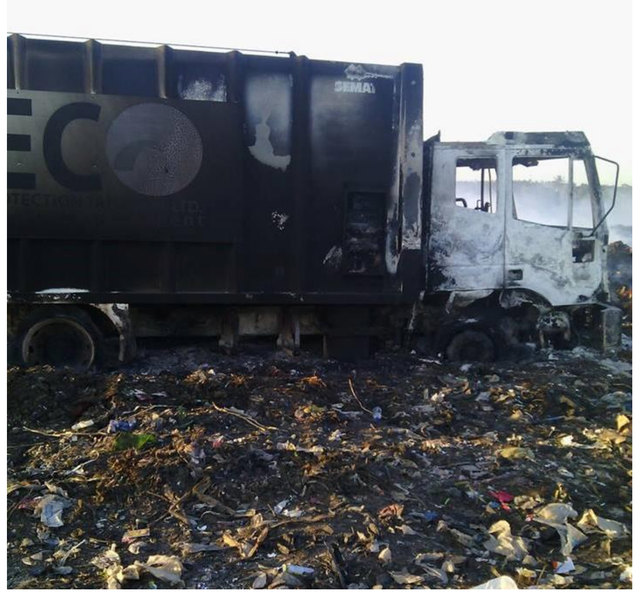
Source: UNEP, 2015 – “World's Cities Produce up to 10 Billion Tonnes of Waste

Waste in S-S Africa

- **Urban population** in Africa is **increasing at a faster rate** than any other continent (3.5 % per annum).
- **Sub-Saharan Africa is forecasted** to become the world’s largest **waste generator** (tonnes/day), if **current generation trends** persist.
- **19 of** the world's **50 biggest dumpsites** are located in Sub-Saharan Africa.
- More than **90% of waste** generated in Africa is **disposed at uncontrolled dumpsites,** leaks into the environment or is openly burned.
- In Africa, **64% of** the **plastic** material ends up **mismanaged** and **uncollected**.

Waste Everywhere

- Openly burnt producing harmful air pollution.
- Polluting water bodies and the oceans, and ecosystems. Increasing flooding.
- Negative impact in livelihoods and economic development.



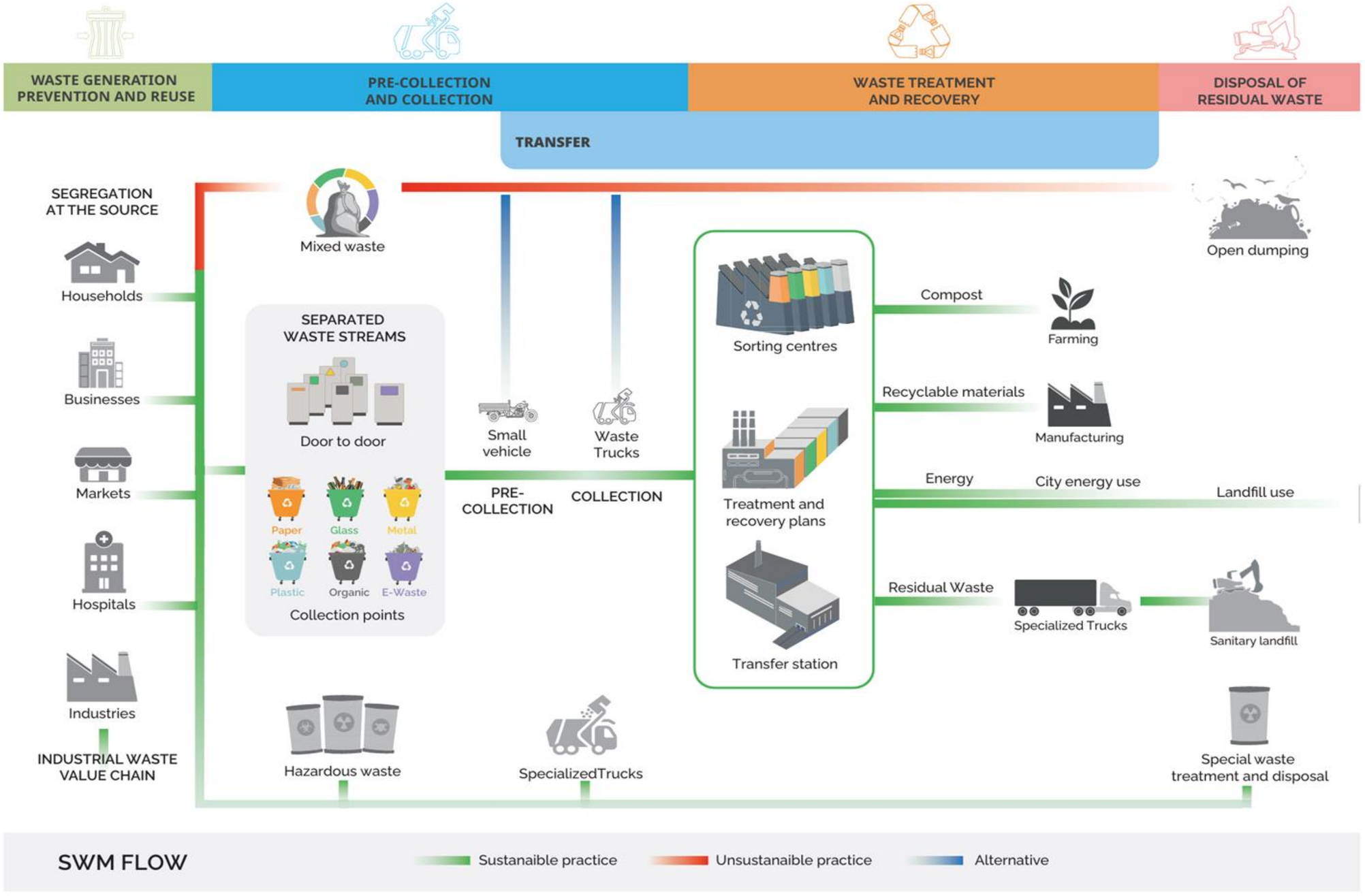
Current Situation Dumpsites

- Landfills poorly built and managed in Africa
- Uncontrolled landfill fires
- Dangerous leachate leakage
- Heavy CO^2 footprint

Waste Management Challenges in Cities

- Solid waste management (**SWM**) **to be addressed** in **urban contexts**.
  - Most waste **generated in cities**.
- SWM **responsibility of local governments** but SWM systems, or parts or it, are **often operated by** the **private sector** formally, or informally.
- **Urban shapes, densities, distances** and **road conditions affect SWM** planning, costs, and the system's feasibility.
  - **Optimisation** of technical aspects, cost, and coverage by **SWM** and **urban planning**.
  - **Concentration** is key **to tackle** negative **impacts**.
  - Economies of scale, resources efficiency and extended coverage by **metropolitan** and **regional agreements**.
- **Cities** can take **advantage** of material **recovery**.
  - **Agglomeration** is **key** to take advantage of economies of scale and to **maximize** the **profitability** of recycling and composting

Overview of Urban SWM value chain and flows



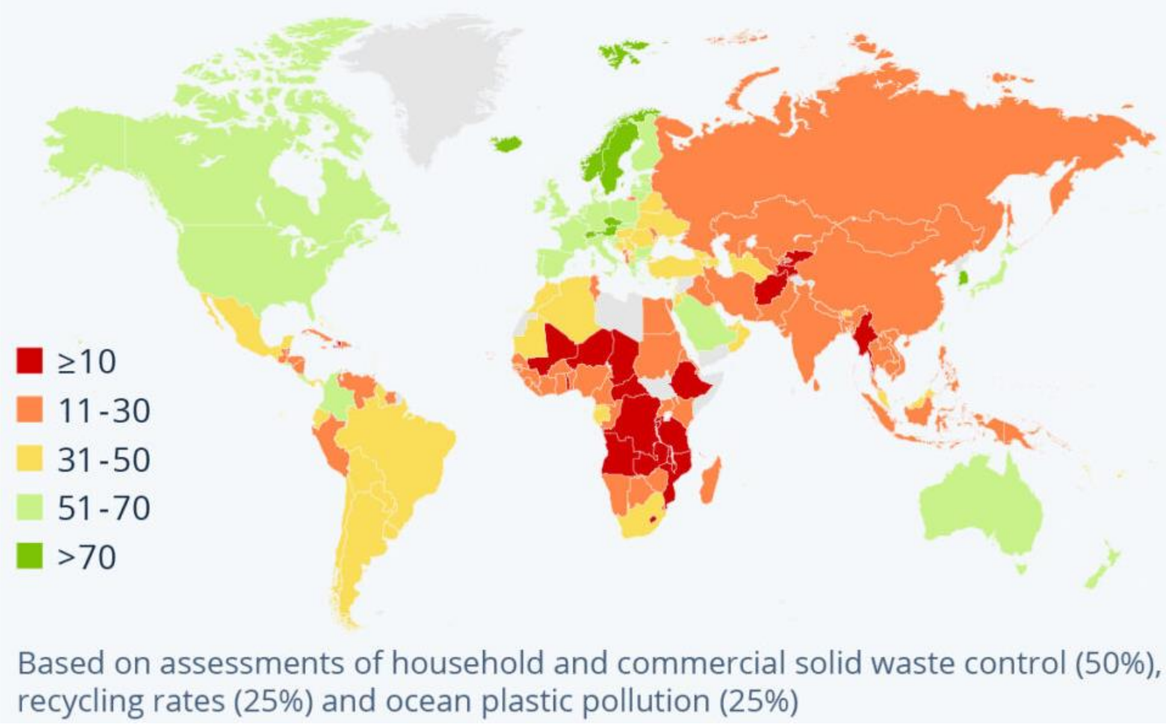
Waste Management Challenges

Management and operation of SWM services

- **Public sector not used to manage SWM professionally** - do not give SWM the needed priority in terms of funds, staff and equipment.
- The private sector is **less restricted by bureaucracy** and has slightly more freedom from political influence – though **corruption is prevalent in the private sector.**
- SWM services are usually not well financed as **costs are not known** and municipal budget does not provide the necessary funds.
- **User fee systems** are either not in place or do not reflect the financial needs – **can only cover costs in high-income countries**
- Potential for cost savings by **improving service efficiency** only possible if proper costs/revenues accounting is established.

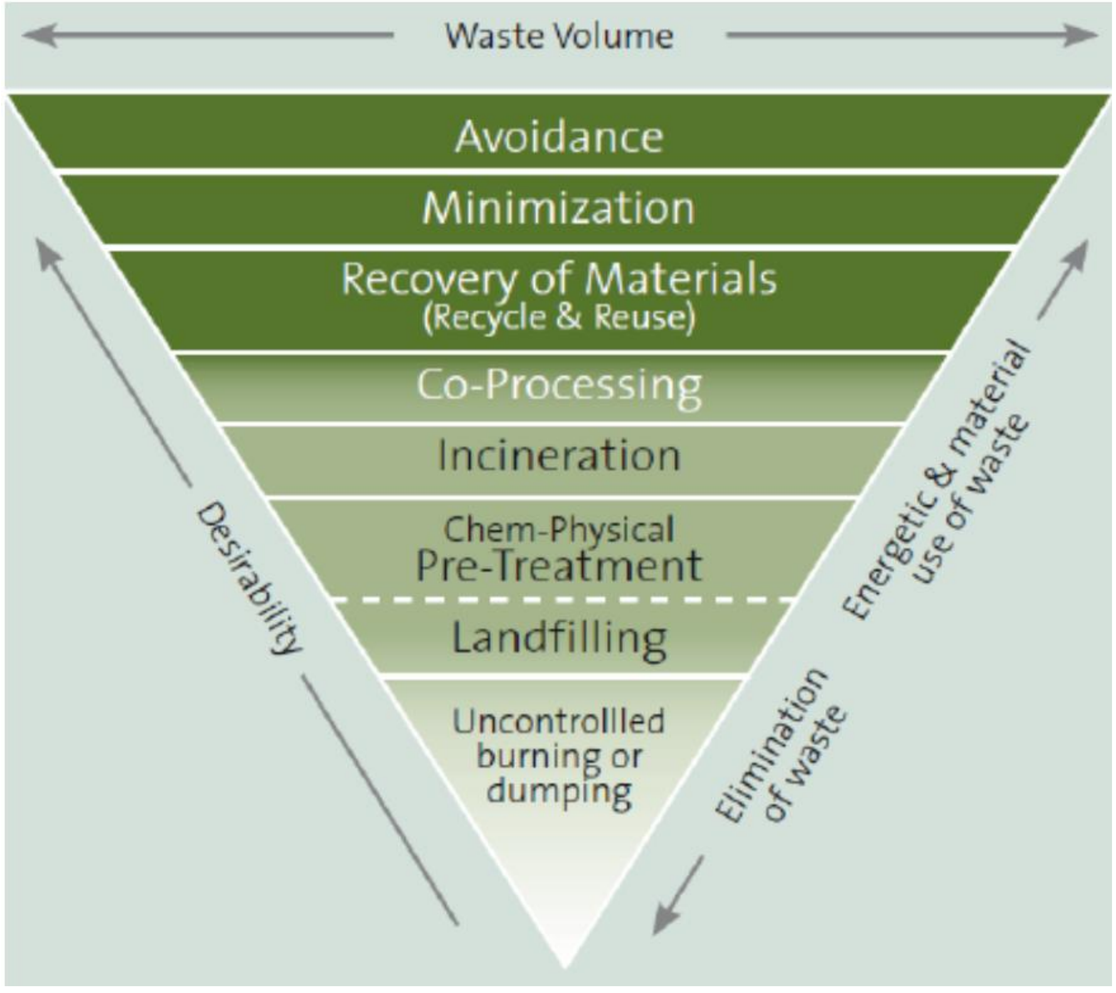
The Global State of Waste Management

Countries' waste management score based on assessments of household and commercial solid waste control (50%) recycling rates (25%) and ocean plastic pollution (25%). 100 = Best managed



Source: Yale Environmental Performance Index. (2022)

Waste Management Hierarchy and Conditions



- **Prevention** of waste generation should be implemented as **policy**, e.g., a ban of single use plastic bags.
- **Sorting** at **source** or in **collection points**: base for any kind of proper later treatment with clean segregated material.
- **Hazardous waste** to be collected and stored **separately** for proper treatment.
- **Collection** and **transport** systems need to be **adjusted to local conditions** and separate waste streams.
- **Consider private** waste **operators** through proper **contracting models**.
- **Long distance transport** needs special transfer sites and trucks.
- Adequate **treatment solutions** need to be developed and implemented **for each** waste/material **stream**.
- **Landfilling only** for stabilized **non usable** material.

Waste Composition Quiz

High-income vs Low-income countries.

Please rank this materials **here**. (See the link on Webex's chat box).

Metal

Plastics

Paper

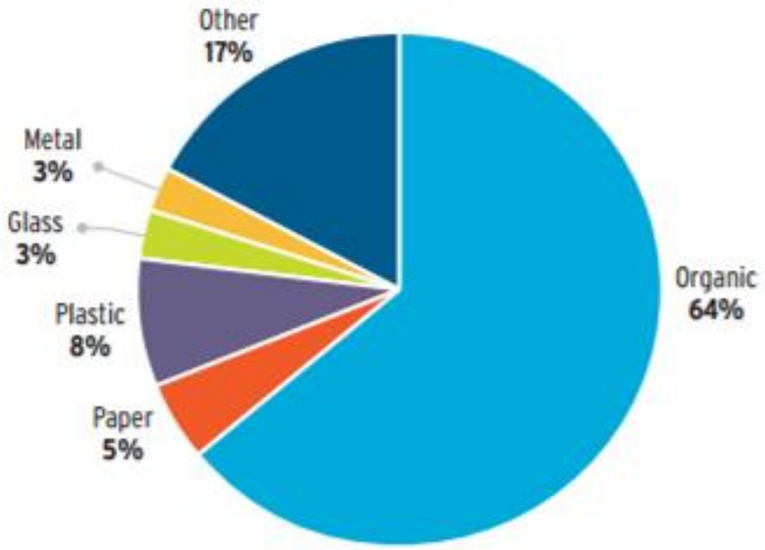
Organic Waste

Glass

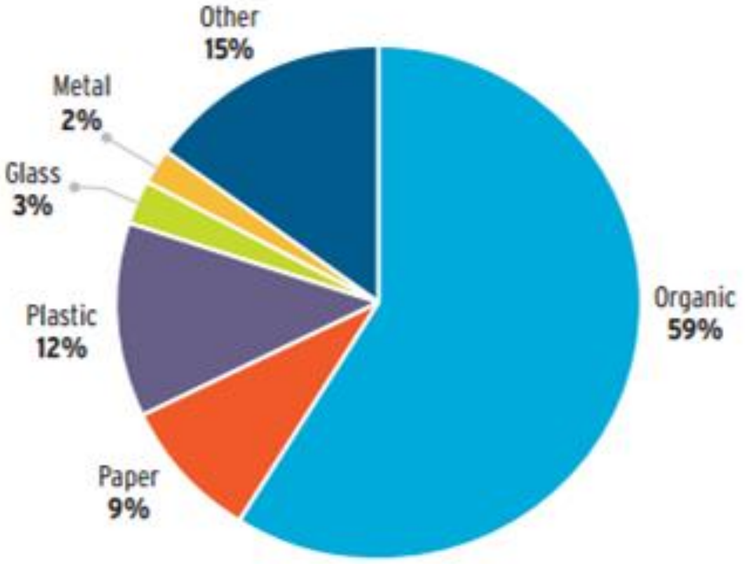
Waste Composition Quiz

High-income vs Low-income

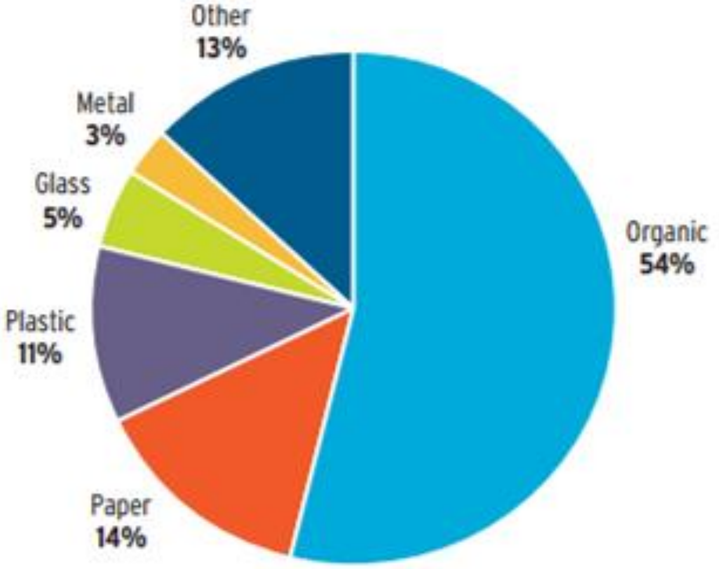
a. Waste Composition in Low-Income Countries



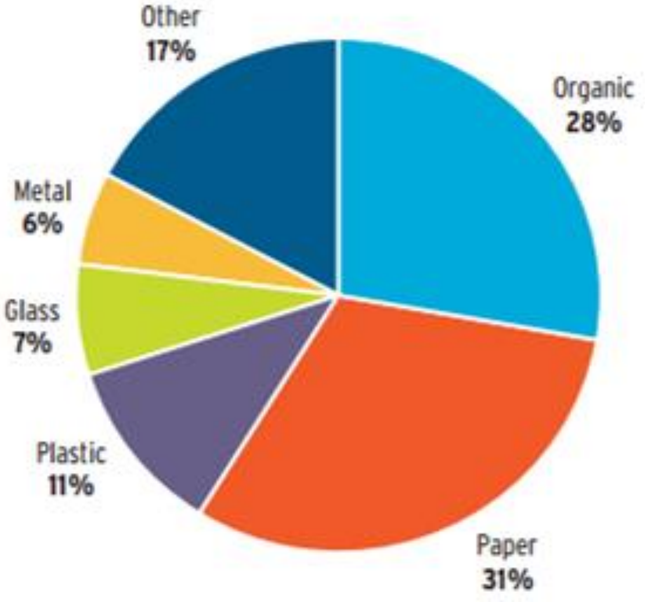
b. Waste Composition in Lower Middle-Income Countries



c. Waste Composition in Upper Middle-Income Countries



d. Waste Composition in High-Income Countries



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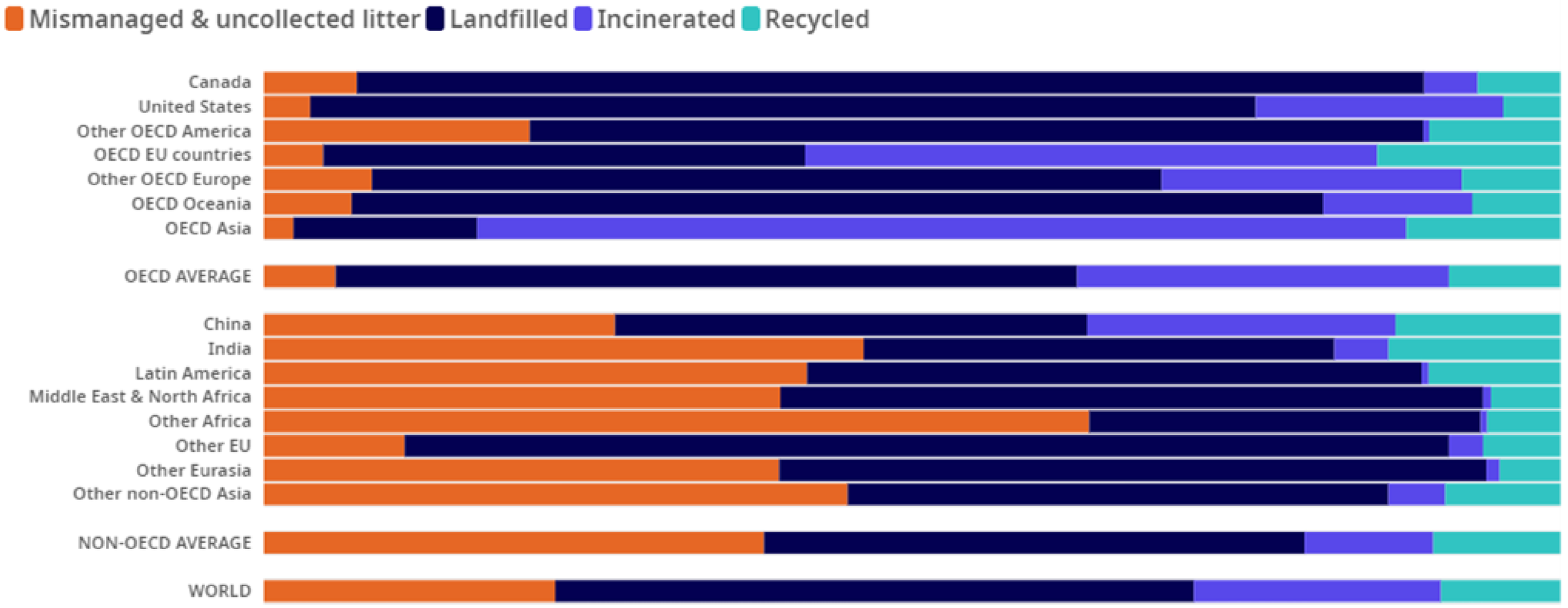
Plastic collection. 2021. Conakry, Guinea. Sanita villes propres, a European Union project implemented by Enabel (Belgian development agency).

Plastic Waste Treated by Region

Globally, only 9% of plastic waste is recycled while 22% is mismanaged.



Source: OECD Global Plastics Outlook Database. Share of plastics treated by waste management category after disposal or recycling residues and collected letter, 2019.

Opportunities and challenges

- High portions of **plastic** waste are **burned or dumped** in uncontrolled landfills and plastic contributes to air pollution – one of the leading causes of death in the developing world.

- **Negative Impacts on economic activities:**

Tourism: plastic choked beaches and environment.

Fisheries: through ingestion and entanglement leading to **reduced fish stocks** and impacting livelihoods of fishers.

Agriculture: plastic pollution can **degrade soil quality** and affect crop growth by **hindering water infiltration** and **root development**.

- **Health impacts** with microplastics in humans.

- **Negative effect** on **urban infrastructure** – clogging drainage systems leading to flooding and increased maintenance.

Opportunities and challenges

- **Millions** of the poorest urban dwellers **make their living collecting recyclable plastics** in cities.
- Plastic **recycling can provide raw materials** and processing to contribute to further **industrialization**.
- **Business opportunities** for private sector to reuse plastic such as PET, PE and others, under certain conditions. Hundreds of tons of **plastic waste** are **exported for recycling** across Africa, generating foreign exchange.
- Private **companies can support urban waste management** by taking up this service and relieving cities from part of the SWM system.
- **Financing mechanisms needed** to involve the producers and retail to cover cost and reduce burden for population.

- Technologies **must be adapted to local conditions**, providing job opportunities and being less mechanized and less costly.

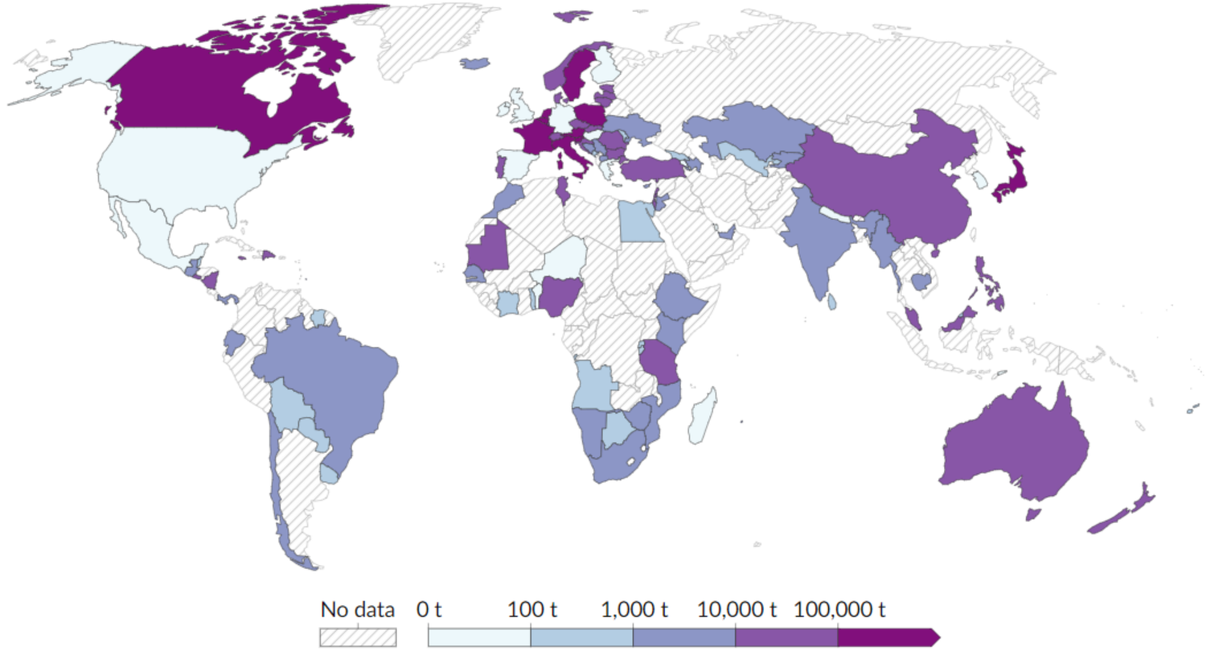
Opportunities and challenges

Plastic waste exports from Africa are increasing – and **imports to Europe are increasing**.

Policy based: Europe **R-pet regulations require 25% recycled PET**. China “National Sword” policy.

Plastic waste exports

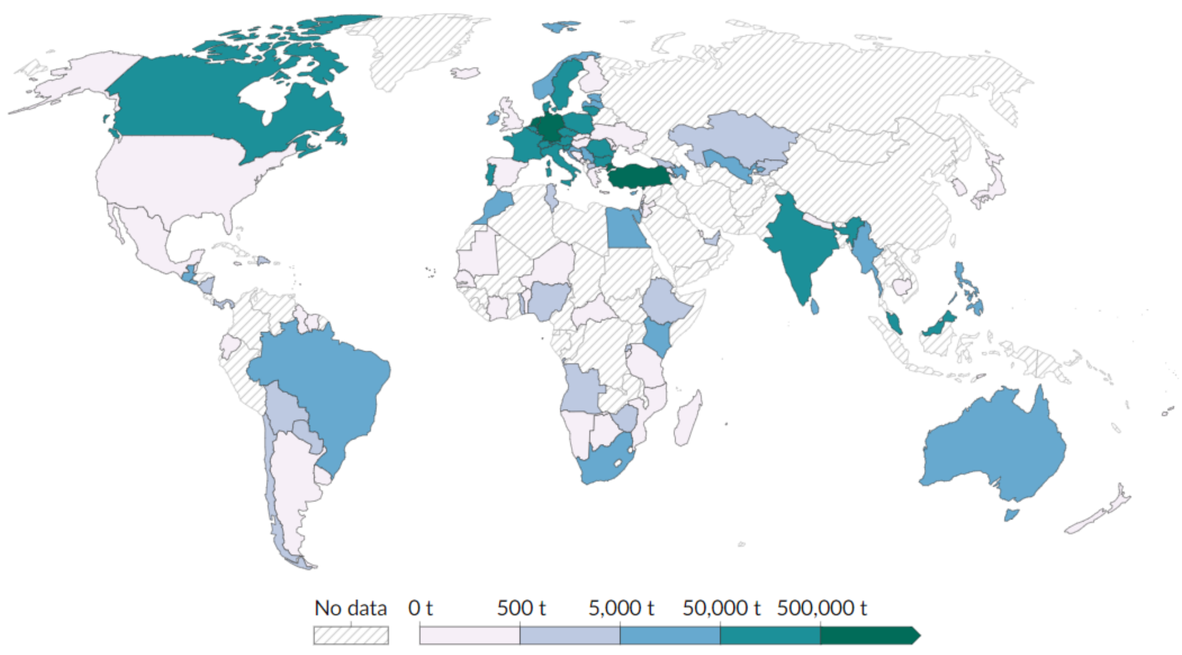
Plastic waste exported by all modes of transports in a year



Source: United Nations Comtrade database (2023).

Plastic waste imports

Plastic waste imported by all modes of transports in a year



Source: United Nations Comtrade database (2023).

Opportunities and challenges

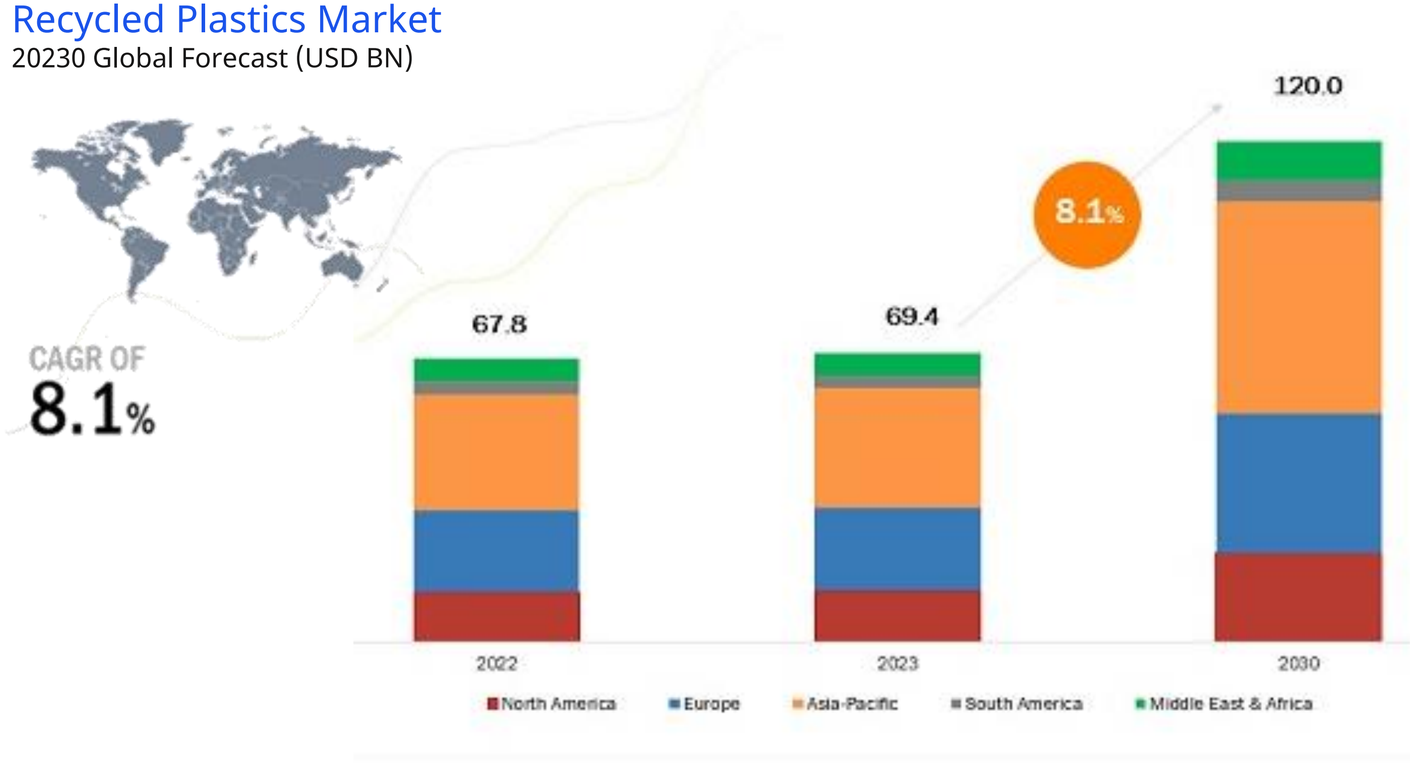
Positive

Global demand for recycled plastics is growing – mostly policy based.

- Local demand in S-S Africa is also growing – mostly demographic based.

Negative

- Oil and gas companies pushing plastic as their new growth areas as countries switch to renewables.

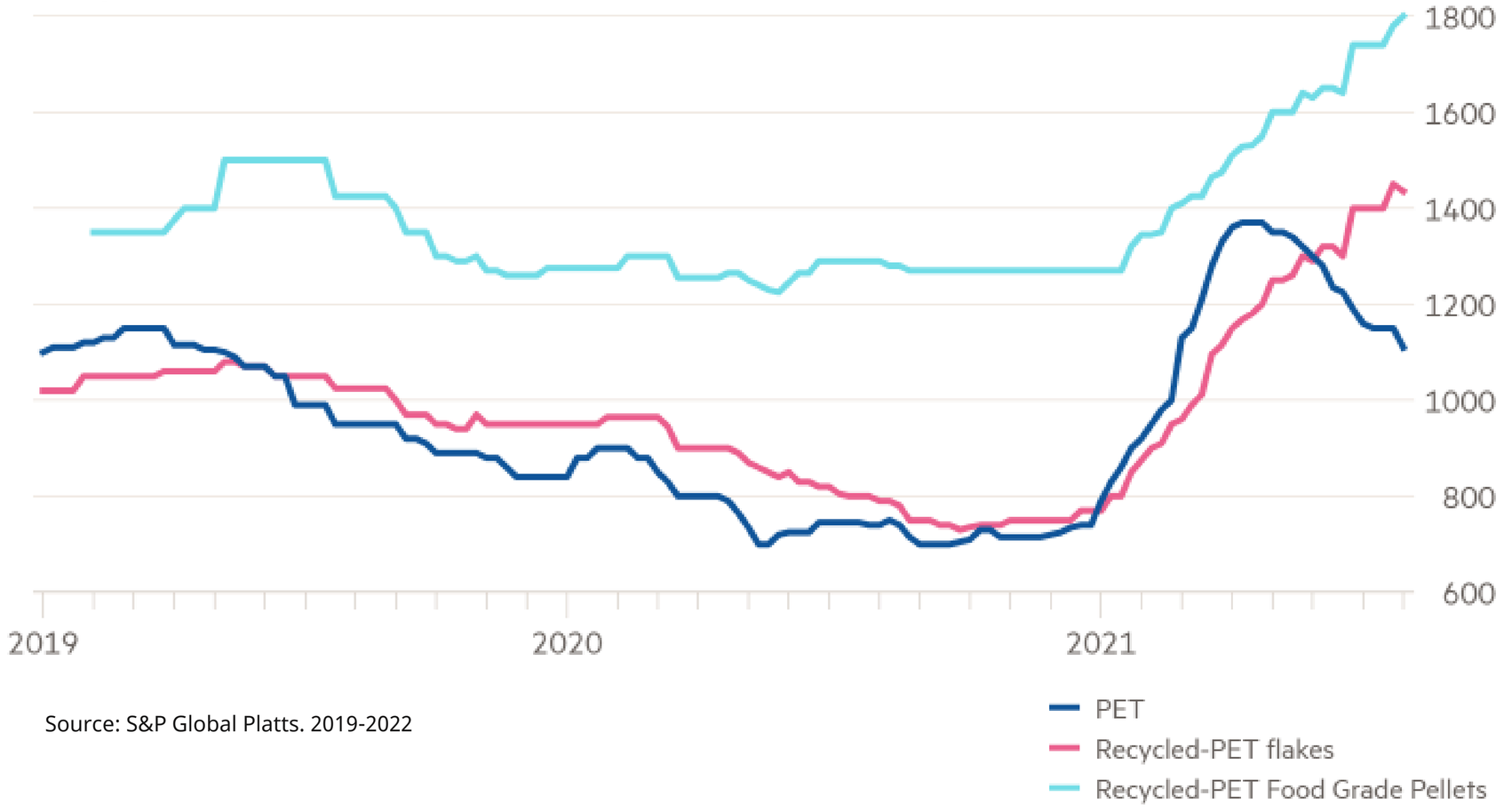


The global recycled plastics market is expected to be worth USD 120 Billon by 2023, growing a CAGR of 8.1% during the forecast period.

Opportunities and challenges

- **Recyclable Plastic** is now fetching a **better price than virgin** material
- This is due to **regulation**
- No longer needs to **compete** on an even playing field with **virgin material**

Recycled plastic prices overtake ‘virgin’ material (€/tonne)



Source: S&P Global Platts. 2019-2022

Types of Plastic

What are those numbers?

The resin codes on packaging tell you what kind of plastic it is. You still need to check your local recycling rules to see which types can go in your bin. Here are some examples!

1	2	3	4	5	6	7
PET	HDPE	PVC	LDPE	PP	PS/EPS	Other

What they recycle into:

PET	HDPE	PVC	LDPE	PP	PS/EPS	Other
New bottles, clothing, carpet	New bottles, lumber, furniture	Pipes, flooring, siding, binders	New bags, mailers, decking	New jars, bins, buckets, car parts	Picture frames, crown molding	Electronic housing, lumber

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Waste pre-collection in small vehicles, 2021, Conakry, Guinea. Sanita villes propres, a European Union project implemented by Enabel (Belgian development agency).)

Recycling Quiz

Recycling Value

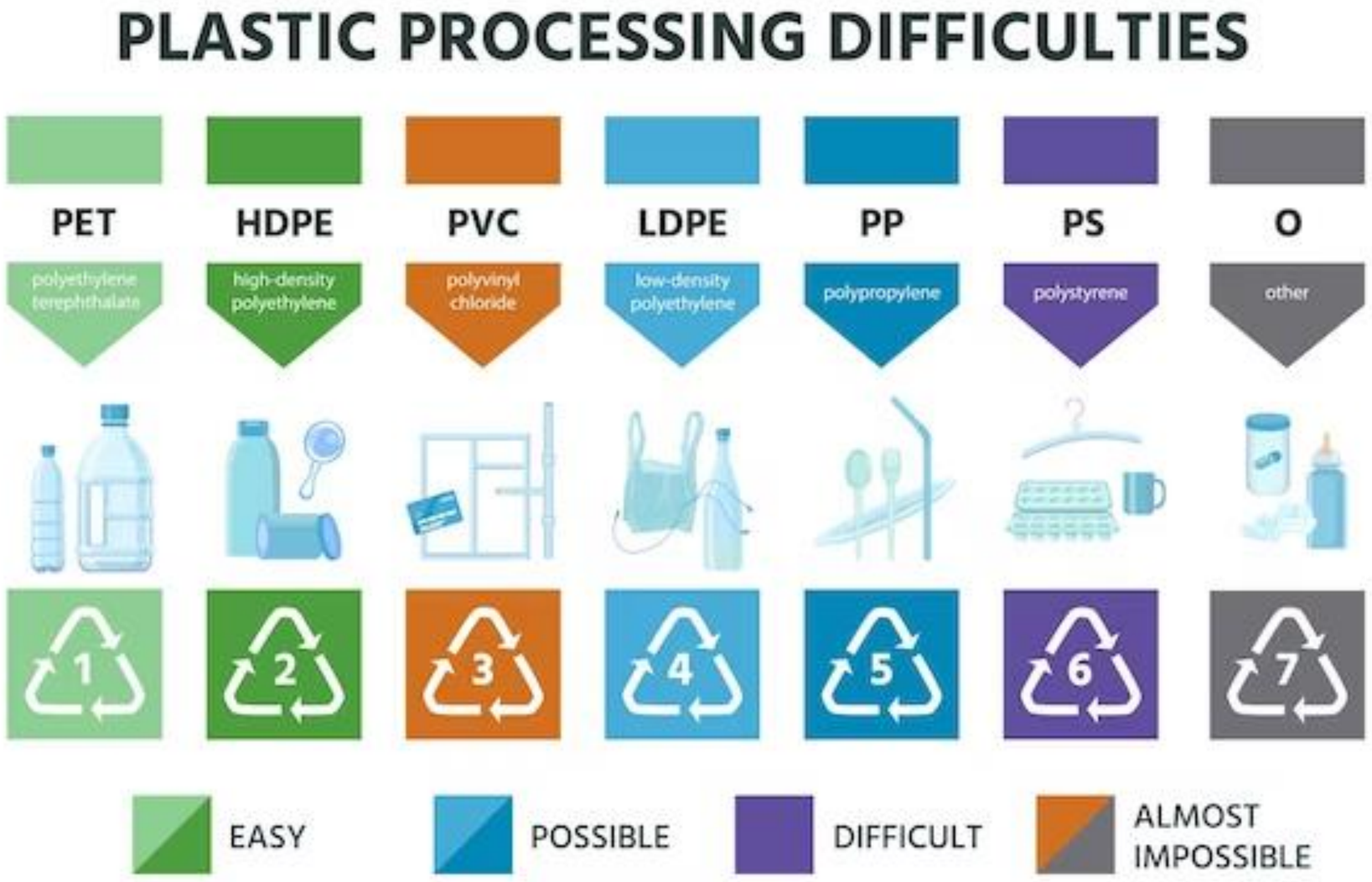
Please rank the type of recycling material from highest value to lowest here. (Please see the link on Webex's chat box).

Answers in terms of most valuable

Recyclable Waste Typologies and Economic Values

Typology	Price (Euros /Ton)	Prices (USD/Ton)
Copper	3,640 - 8,190	4,000 – 9,000
Aluminum (Used Beverage Cans)	1,260.35	1,385
PET flakes (Clear) (plastic bottles)	819	900
PET flakes (Green)	637	700
PET flakes (Brown)	491.40	540
HDPE / PP flakes (Shampoo bottles, oil bottles)	650.65	715
LDPE pellets (Bubble wrap, stretchy plastic covering)	486.85	535
White Paper	364	400
Corrugated cardboard paper	291.20	320
Newsprint paper	136.50 - 182	150 – 200
Glass cullet (Clear)	40.95	45
Glass cullet (Green/Brown)	18.20	20

Recyclable Plastic



Recyclable Plastic – Rigid vs Flexible

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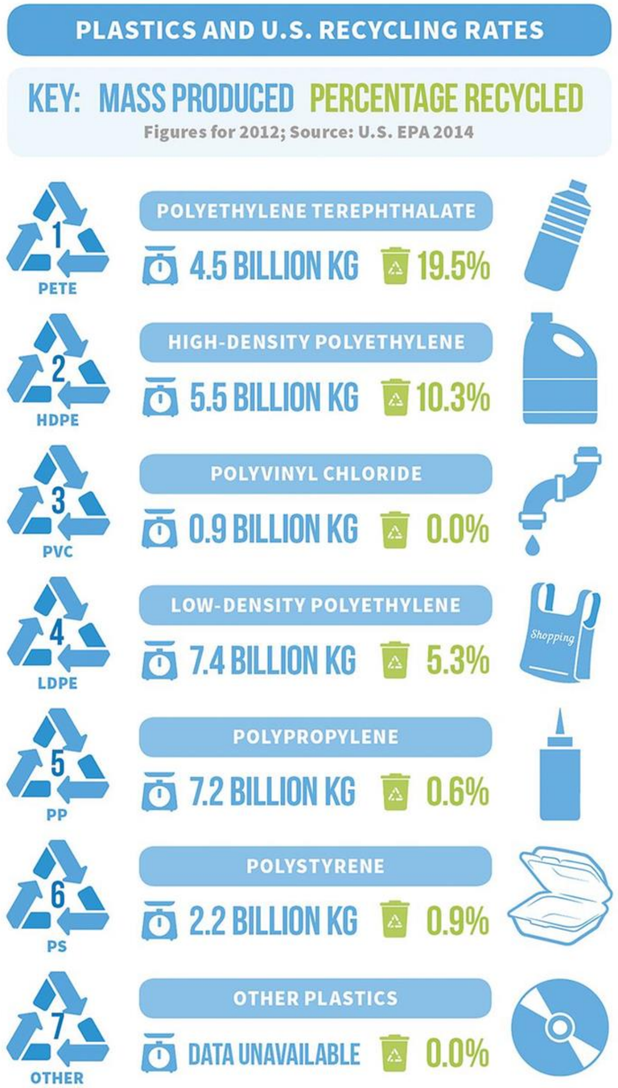
Recycling

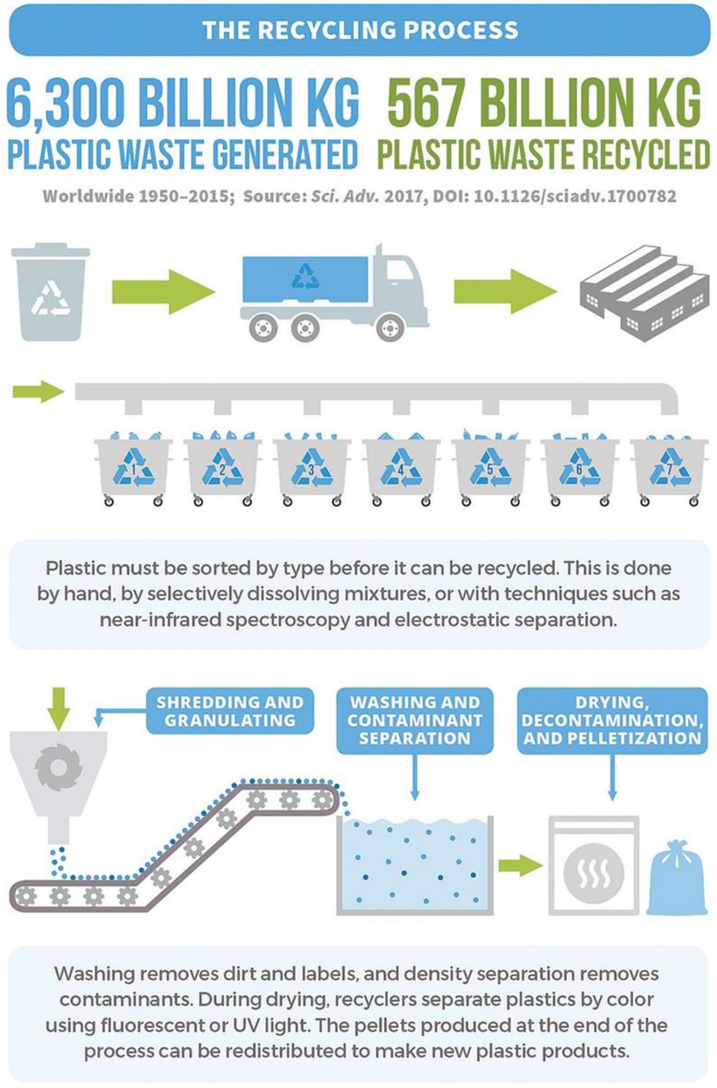

RECYCLED POLYESTER - HOW IT'S MADE
2
3
4
5
Step 1:
Plastic PET containers are picked up at community recycling centers, then sorted by type and color.
Step 2:
The are stripped of their labels and caps, washed and crushed, then chopped into flake.
Step 3:
The flakes undergo a second melting and are made into consistently shaped pellets.
Step 4:
The pellets are melted and extruded to make fiber. The fiber is crimped, cut, drawn and stretched, then baled.
Step 5:
The baled fiber can be processed into fabric for a variety of textile product end uses.

Recyclable Plastic

- Some **African cities** likely have **higher** PET, HDPE and LDPE **recycling rates** than high-income countries – due to **waste pickers**.
- US based, but this is a good representation of which material are actually recycled - mostly PET, HDPE and a little LDPE
- **Highest recycling rate PET** though one of the lower quantities produced.

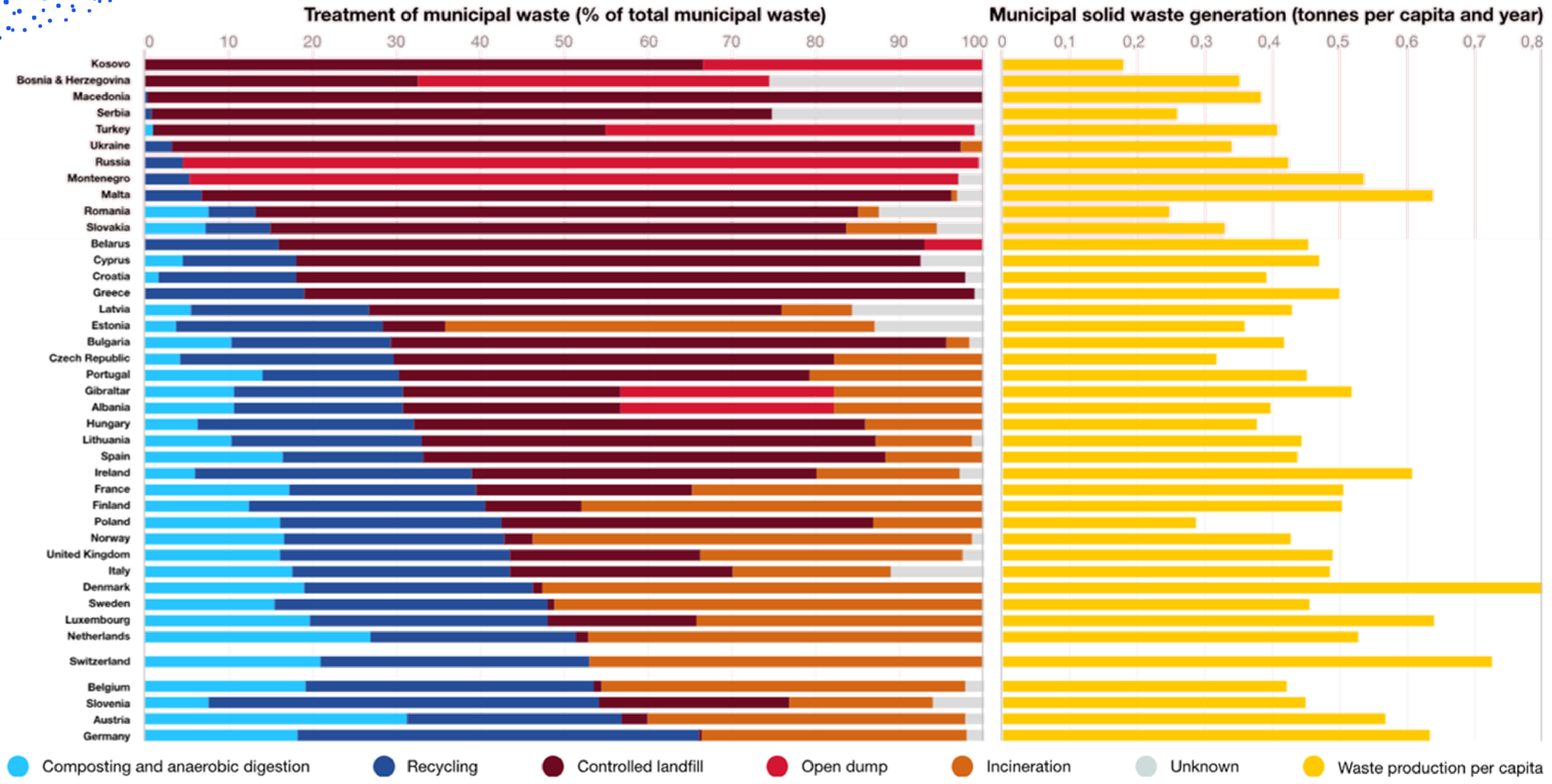
How is plastic Recycled





Source: C&EN 2018. Andy Burning for Chemical & Engineering News.

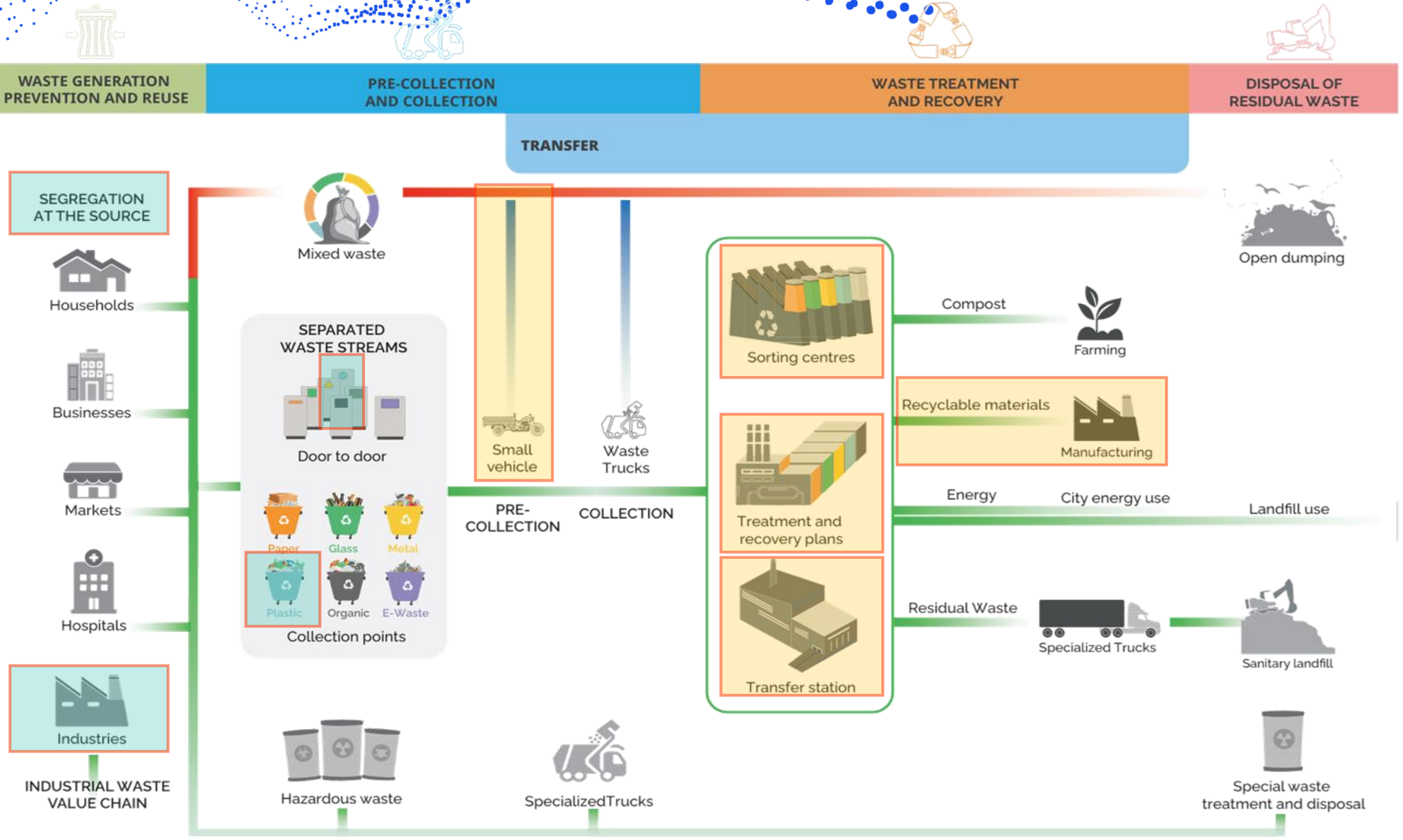
Collection and Recycling



Source: Data prepared in Pollak (2019) on the basis of data from Kaza et al (2018)

Sorting and segregation

- Plastic management starts with **materials** and **product design**.



Separate collection is key to obtain clean material. The **sooner** in the value chain, **the better**.

Plastic can get further sorted, treated or processed to be recovered.

Collection and Recycling

Challenges in Africa

- Agglomeration and concentration: **still less than 50% urban**.
- **Lack of Roads** – high proportion of people live in informal settlements.
- **Low income** – reduces ability to pay for service.
- **Lack of investment** in efficient collection equipment.
- **Poor Dumpsite Infrastructure** – vehicles get stuck.
- Low levels of enforcement.
- Corruption.

Collection and Recycling

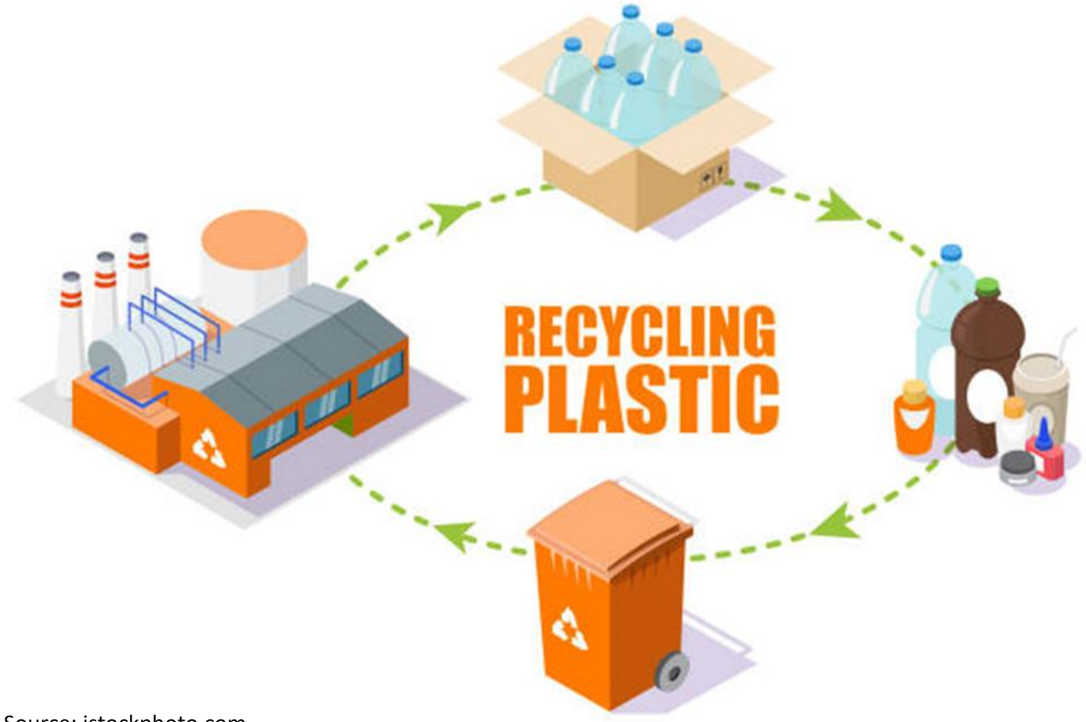
Types of Waste

Pre-Consumer

Waste from the factory that is generated in the process of making products. This material never reaches the consumer. This is the easiest to separate and the cleanest material to recycle

Post-Consumer:

Waste that has been used and discarded. This material is harder to collect and separate.



Source: istockphoto.com

Collection and Recycling

Informal Recyclers

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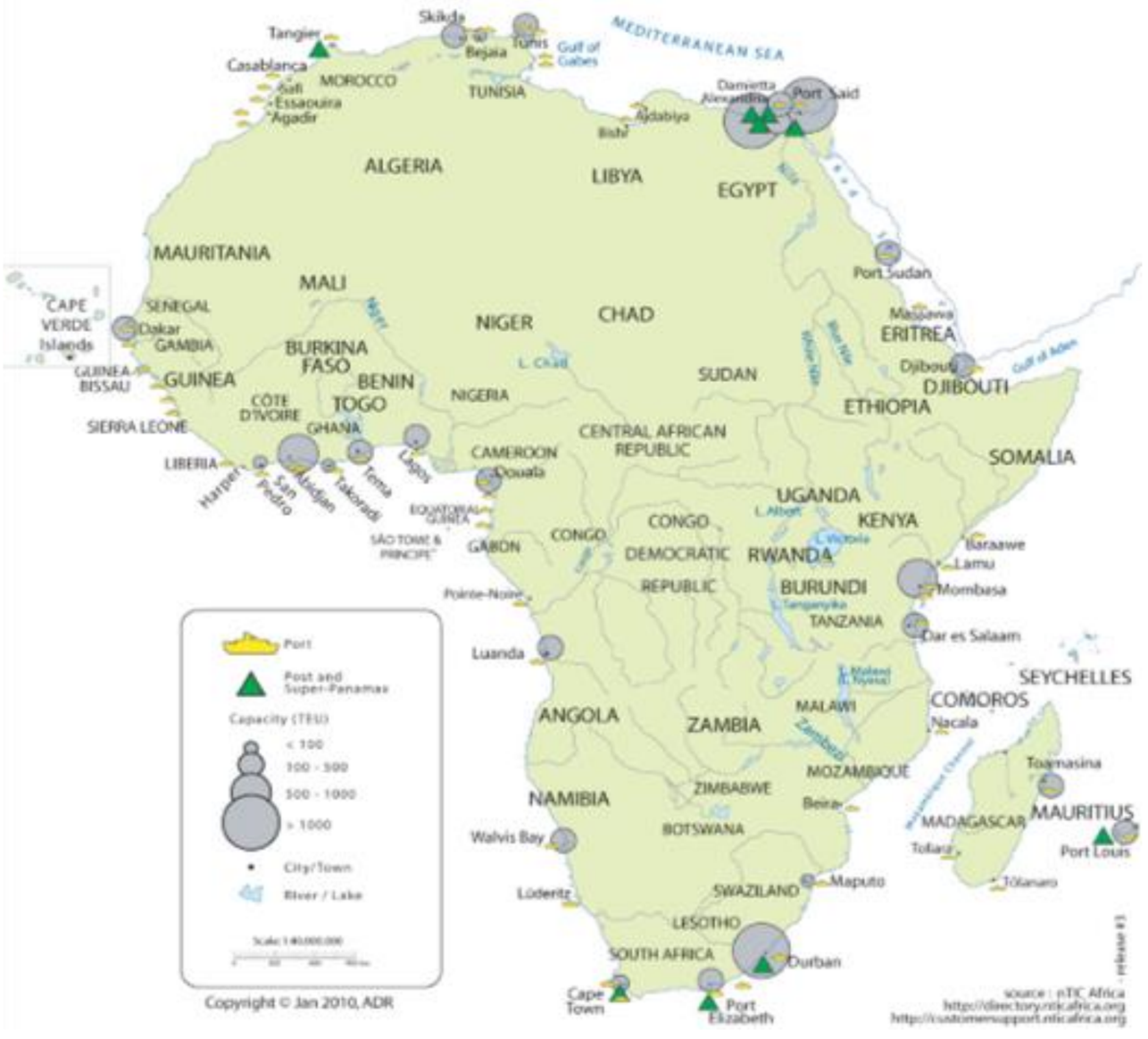
Business Models and Market Situations

Conditions for Plastic Recycling

- Transport Costs – Transporting air – need to be within **200 Km from a port or processor user**.
- Volume – Need a minimum of **200 tons a month** in a location to make economic sense.

Price per Kg of PET in Tanzania paid to informal collectors

- Dar es Salaam (Port) – 400 TZS *(0,14 EUR)*
- Bagamoyo (70km away) – 250 TZS *(0,09 EUR)*
- Morogoro (200km) – 150 TZS *(0,05 EUR)*



Business Models and Market Situations

Opportunities with Plastic

- Small Scale Shredders and Small-Scale Baling for pre-processing ar transport cost reduction
  - Cost around 5,460 EUR (6,000 USD)

- Horizontal Baler – potential to export baled PET & LDPE
  - Cost - 40,950 EUR (45,000 USD

Horizontal Baling Equipment

Vertical Baling Equipment

Plastic Crusher

Business Models and Market Situations

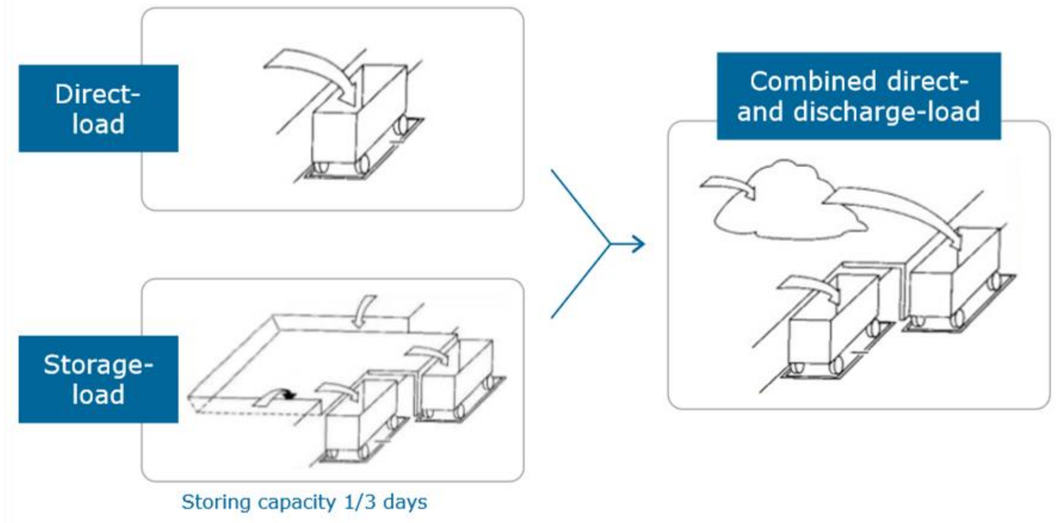
Opportunities with Plastic

Material	Price Euro/Ton
Baled Plastic Bottles	273
Baled Plastic LDPE	273
PET flakes (Clear)	819
PET flakes (Green)	637
PET flakes (Brown)	491
HDPE / PP flakes	650
LDPE pellets	486

Business Models and Market Situations

Opportunities with Plastic

Government contracts to collect waste, run transfer stations, material recovery facilities, do household recycling



Business Models and Market Situations

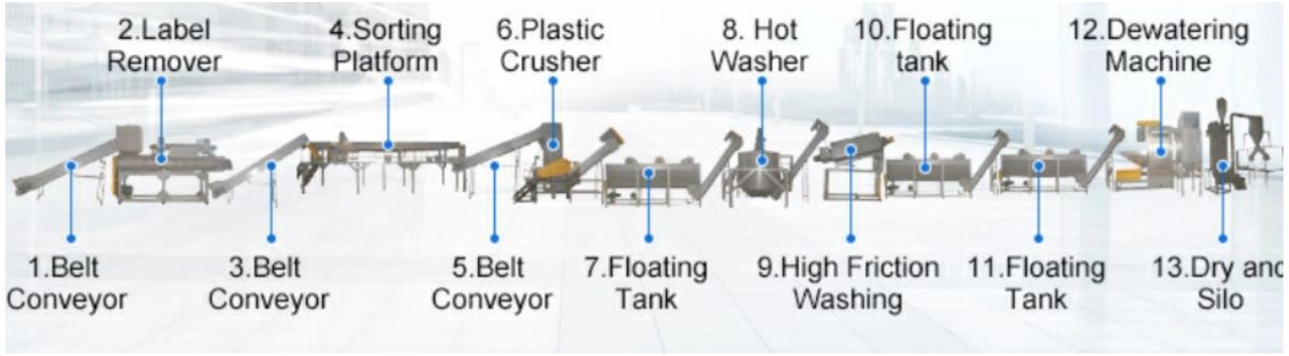
Faux Opportunities with Plastic

- Upcycling
- Construction Blocks
- Poles
- Pyrolysis

Business Models and Market Situations

Opportunities with Plastic

With cities of 200 tons of plastic/month and access to a port – PET shredding, washing lines.



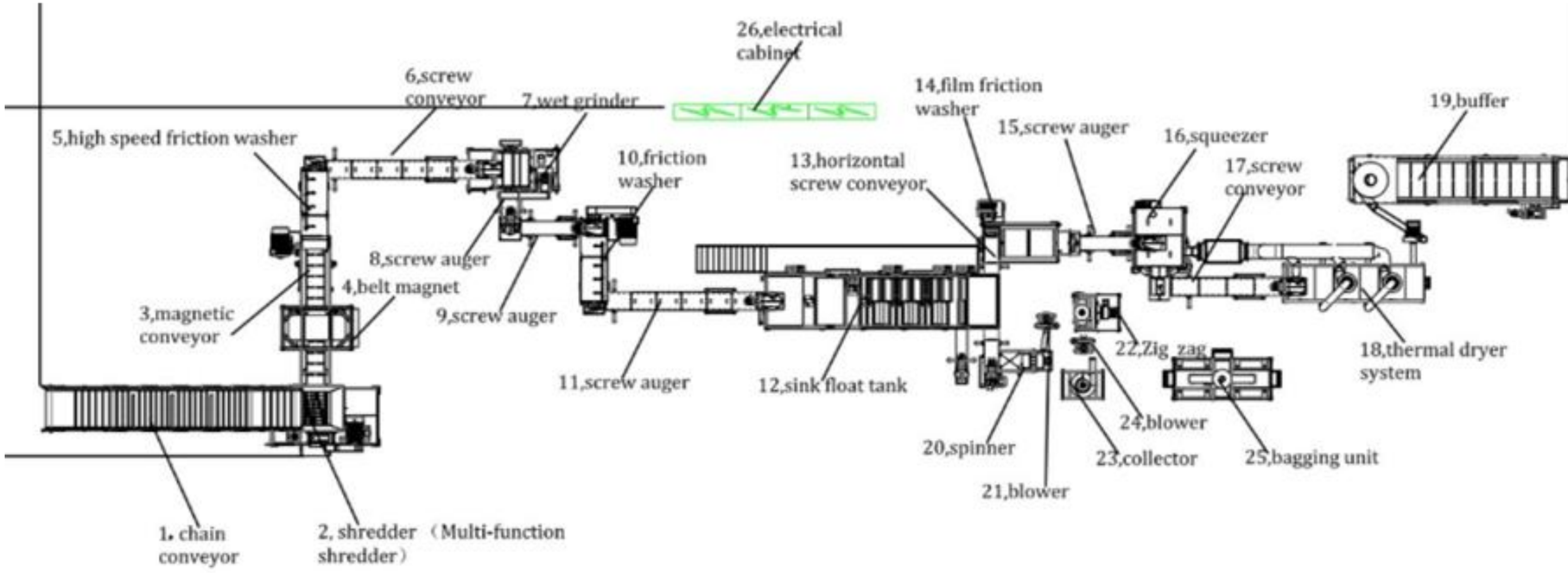
- CAPEX: €255,000 EUR
- OPEX: €38,250 EUR per month
- Cost of Material: €38,250 EUR
- Revenue: €93,500 EUR per month

- Factory Staff: 50 people
- Informal Collector supporting: 1,000 people

Business Models and Market Situations

Opportunities with Plastic

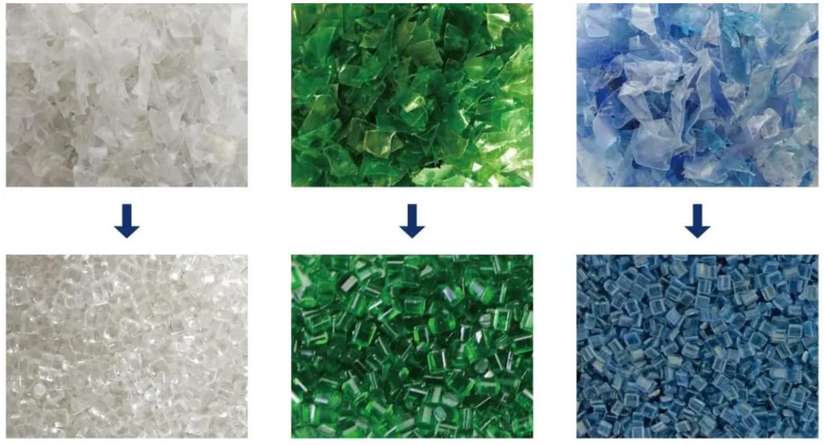
With cities of 200 tons of plastic/month and access to a port – HDPE / LDPE flexible shredding, washing lines.



- CAPEX: €425,000 EUR
- OPEX: €34,000 EUR per month
- Cost of Material: €29,750 EUR
- Revenue: €85,000 EUR per month

- Factory Staff: 50 people
- Informal Collector supporting: 1,000 people

Business Models and Market Situations



Opportunities with Plastic

PET, HDPE or LDPE Extrusion into pellets for cities with plastic manufactures willing to substitute virgin plastic for recycled pellets.

- CAPEX: €127,500 EUR
- OPEX: €25,500 EUR per month
- Price of Material: €59,500 EUR per month
- Revenue: €102,000 EUR per month
- Staff members – 20 people

Business Models and Market Situations

Co-Processing/Refuse Derived Fuel – Cement Plants

Sorting

Drying

Transporting

Waste to fuel

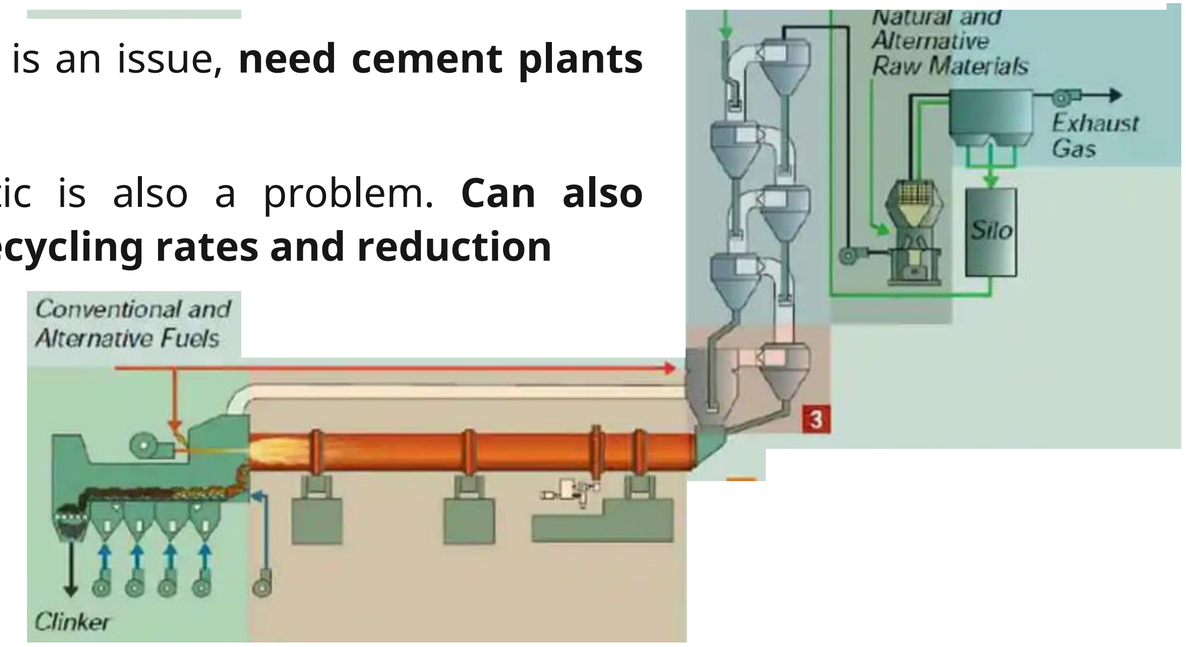
Co-Processing / RDF – Cement Plants

Positive

- There are **over 150 kilns in Europe that use waste to fuel** every day, with waste making up 40% of thermal energy used in the clinker-making process at EU-based cement factories.
- This **process** is accepted and **recommended by** both the **Basel Convention** and the **Montreal Protocol**.
- When Replacing Coal – has lower GHG, has **similar GHG as natural gas**.
- **No microplastics in water** from plastic recycling.
- There are already **over 100 kilns in S-S Africa**, do not need to build new plants like WtE plants.

Negative

- **Waste to Fuel is not Recycling**.
- **Competing against Coal** – very cheap – can be even 30 – 50 USD per ton plus transport.
- **Material needs to be relatively dry** and often **shredded** depending on the feeding system.
- Transport is an issue, **need cement plants nearby**.
- PVC plastic is also a problem. **Can also impact recycling rates and reduction**

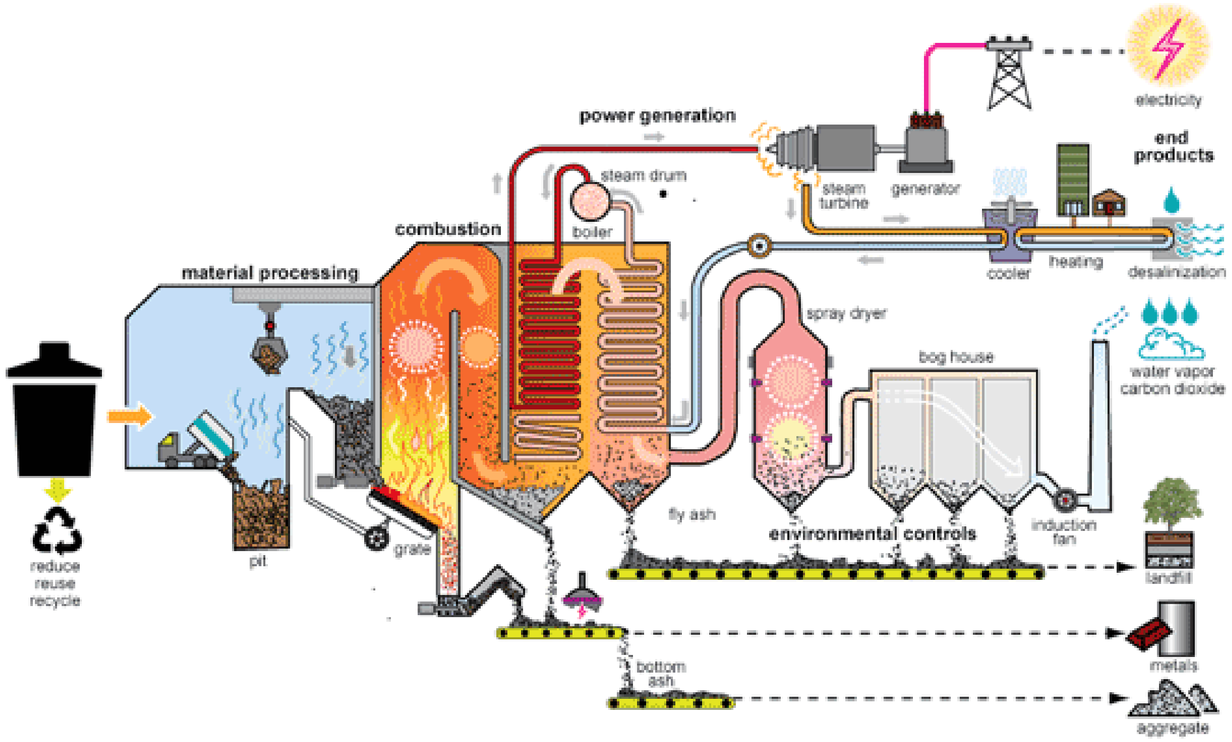


RDF: Refuse Derived Fuel

Waste to Energy: Plants

Positives

- Used in Europe and North America.
- **No microplastics** in water from plastic recycling.
- Efficient way to **reduce waste** quantities by around 80%
- Still recommended as one element of the **chain for Megacities** where more than 10,000 tons of waste come up every day.



Negatives

- Waste to Energy is **not Recycling**.
- Most **expensive** way to **get rid of waste**, and most expensive way **to generate energy**.
- **Does not work** as well in S-S Africa due to **high moisture** content of waste and lack of segregation.
- Many **projects fail** and **does not send the right messaging** around reduction.

Business Models and Market Situations

How to Identify Projects - Checklist

- Go to the dumpsite/landfill and see **what material is being collected already**.
- Go to Coca-Cola or Pepsi and see **where** they **sell their different scrap material** from the factory.
- **Trace** this **material to** the buyer and **final user** – there will be more than one.
- Find **manufacturers of** different **plastics –** look at the furniture, buckets, etc. and meet with the manufacturers to see if they are willing to use recyclable material.
- Meet with **local cement plants** and ask about what fuel they use and how do they load it.
- Meet with **informal recyclers** and middle people that are collecting material.

Recap of Businesses that Work

- If a location has over 200 tons per month of PET, HDPE, or LDPE then a recycling business can work.
- Easiest is setting up a horizontal baler system, then when volumes established chose which processing machinery depending on local manufactures available and port access
- Co-processing will likely be the future for plastic waste in Africa, especially as cement companies set alternative fuel targets, and Plastic Credits develop
- Caution on developing WtE or even large-scale Material Recovery Facilities as they often fail due to access to waste, high organic waste composition and equipment failures

- Important to look for additionality – what is already being done, how will your work affect waste pickers.
- Large million-dollar investments to develop bottle to bottle or fiber need to secure supply of material first

Topics Overview

Welcoming remarks.

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   - Practical Application Examples.
3. **Ask the Expert Session.**

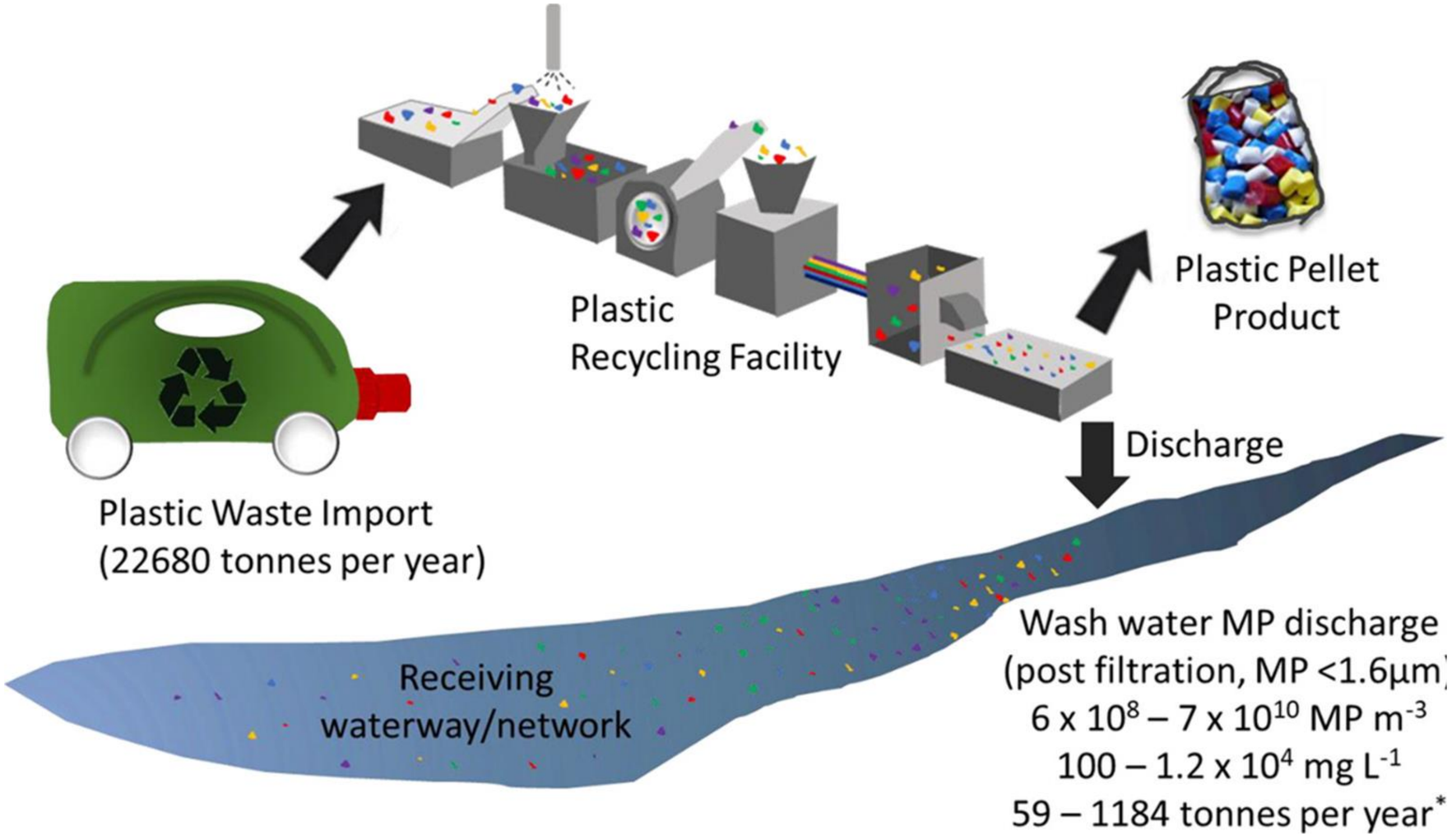
Plastic Waste Policies and Future Development

Problems with Recycling Plastic

- We are losing too much plastic generated to recycle.
- Different colors, smaller sizes, sachets, mixed material, plastic seal.
- Dumping by high-income countries – especially in terms of textiles.

Plastic Waste Policies and Future Development

Problems with Recyclable Plastic



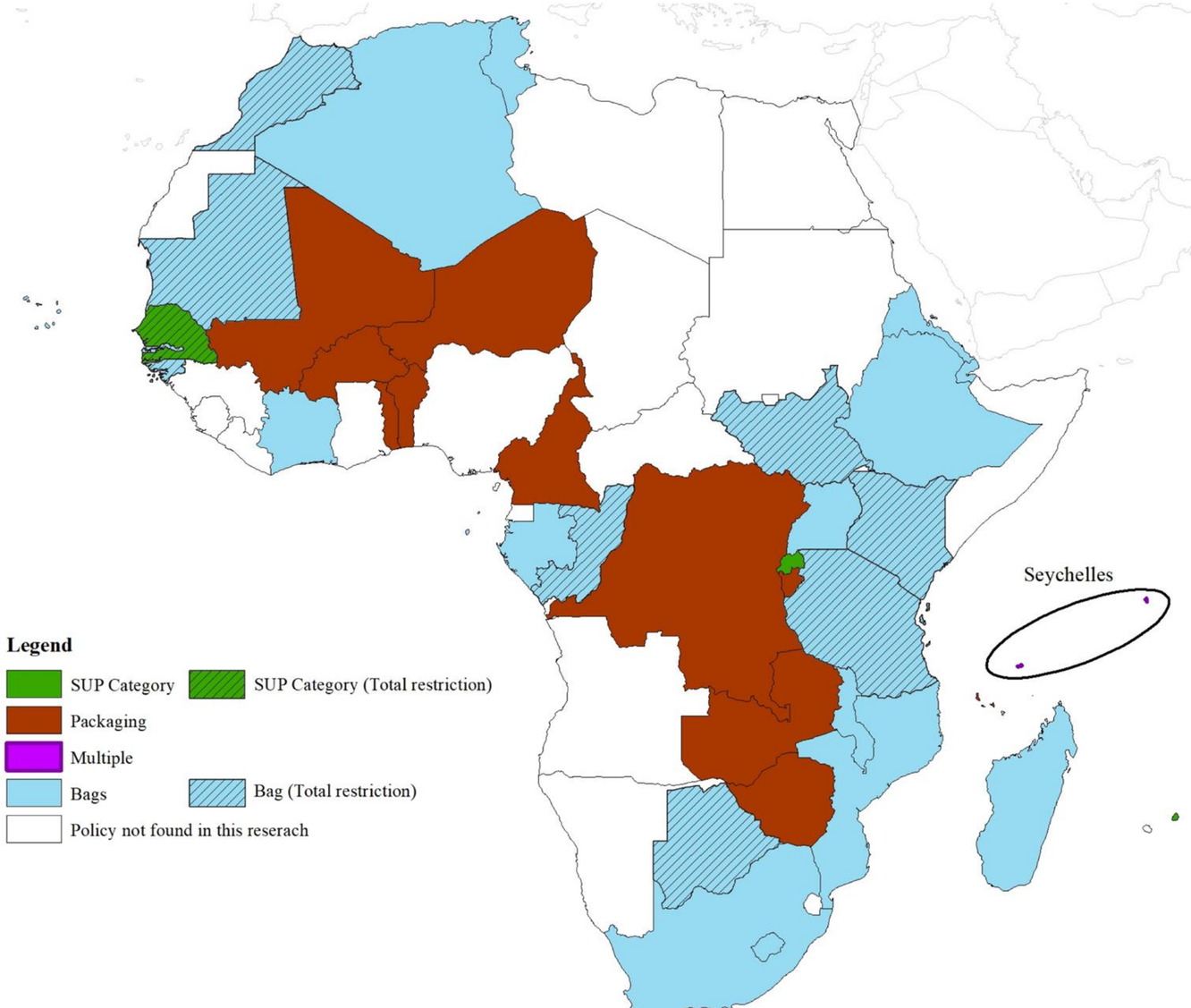
Plastic Waste Policies and Future Development

Policy

Plastic Waste Policies and Future Development

Policies in Africa have been mixed

- Kenya’s plastic ban was mostly successful.
- Tanzania banned water sachets and alcohol sachets successfully – plastic bags mostly successful.
- Rwanda banned many different SUPs successfully.
- Ivory Coast ban a failure.



Plastic Waste Policies and Future Development

Policy: thoughts to consider

- There are a lot of easy wins – water sachets, plastic carrier bags.
- Requires long term planning and speaking with manufacturers and port administrators, giving over 1-year timelines for the ban and then having heavy fines for manufactures and users.
- Must be clear what is allowed – suggestion for plastic carrier bags is ban on all bags that are not large bin liners – Tanzania allowed small bin liners that people used as plastic bags.
- Must be constant enforcement and fines.

Plastic Waste Policies and Future Development

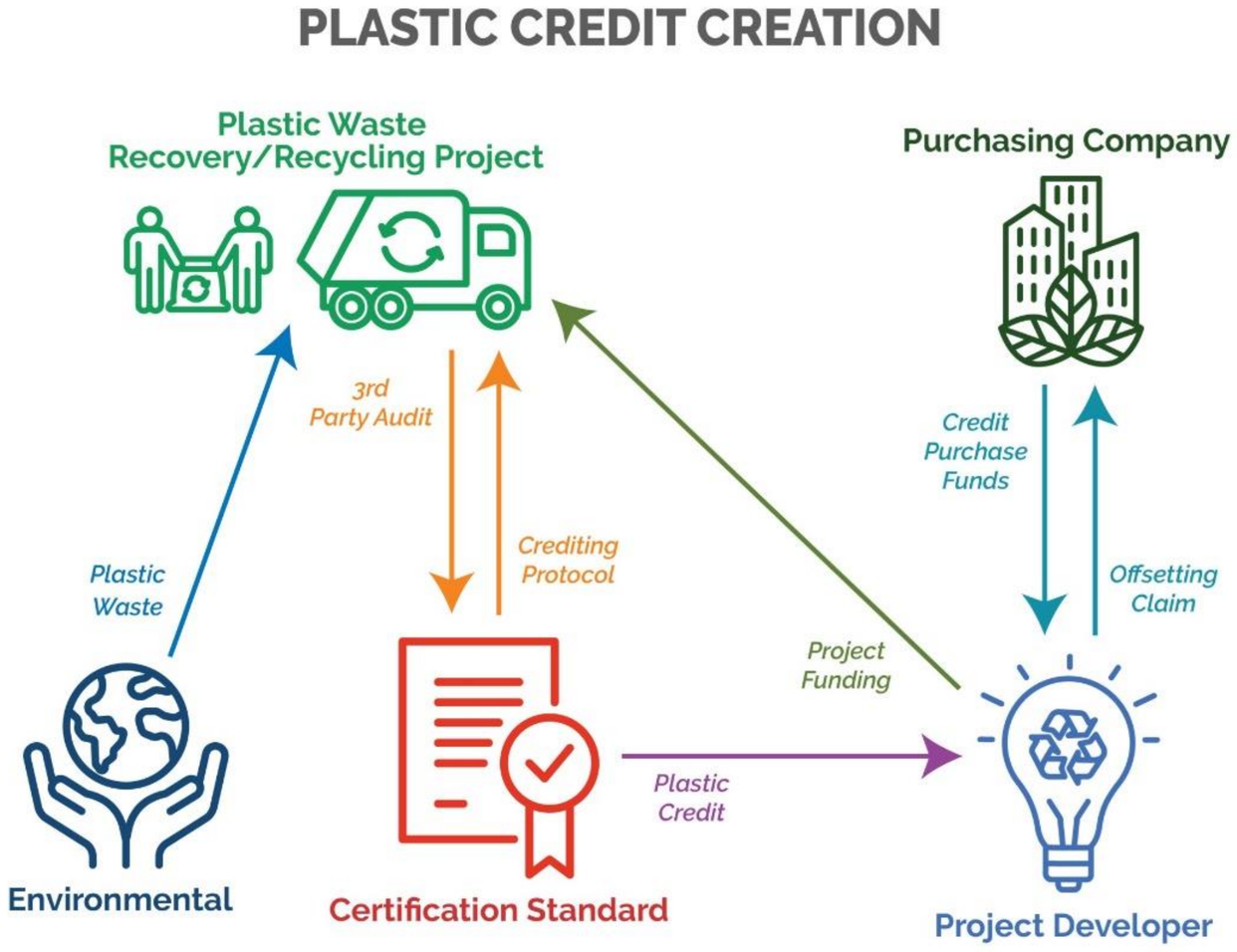
Policy: scale of bans, step by step

1. Ban water and alcohol sachets.
2. Ban plastic carrier bags.
3. Ban straws, cutlery, plates, cups.
4. Ban smaller than 1 liter plastic bottles and non-clear color water bottles.
5. Ban polystyrene (Styrofoam) and single use toiletries in hotels.
6. Ban non-returnable plastic bottles.
7. Ban Plastic Packaging for Food and Retail Items.

Plastic Waste Policies and Future Development

Plastic Credits & Extended Producer Responsibility (EPR)

- Pushed by industries like Coca-Cola who already have to report on their plastic due to corporate governance.
- Can be helpful in some cases, if implemented appropriately – distinguishments between rigid and flexible and organizing extra costs for plastics out of main urban centers.
- Plastic credits are a way to do this globally.



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Waste to Fuel with Plastic Credits in Tanzania

The Recycler
Waste Management and Recycling

CleanHub

- The Recycler – signed deal with European Company CleanHub to collect non-recyclable waste.
- Buys non-recyclable plastic waste from informal collects, beach clean ups, river traps at a price per kg like other recyclable material.
- Uploads the material into an app managed by CleanHub with weight and photos.
- The Recycler shreds the material and then delivers it to a local cement company where it is weighed again and used as waste to fuel.
- The Recycler receives 150 euros per ton (cost for material, collection and processing with small margin) and transport costs by the cement plant to deliver to cement plant, this is paid by brands who want to remove plastic from the environment as a voluntary Plastic Credit Payment.

Solution - Waste Management

Services for commercial/industrial clients:

- On-site sorting and cleaning.
- Waste reduction and Recycling.
- Zero Waste to Landfill.
- Reporting.

Recycling Collections

The Recycler
Waste Management and Recycling

Electronic Reporting

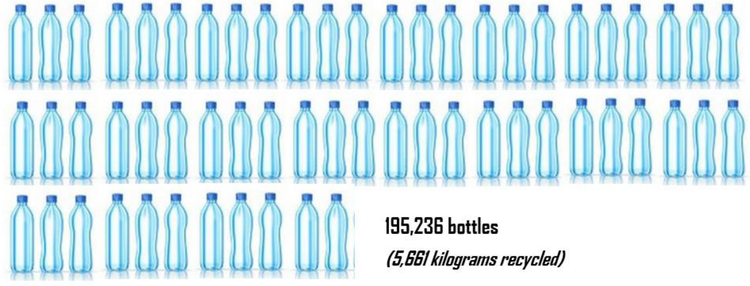
Tanzania Breweries Limited
Recycling Report

Glass
= 5,000 bottles recycled

124,321 bottles
(69,620 kilograms)

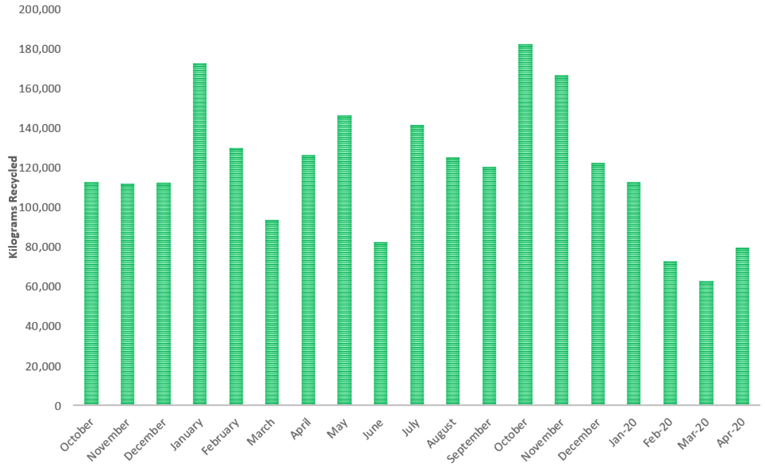
Tanzania Breweries Limited
Recycling Report
April 2020

Plastic Bottles
= 10,000 bottles recycled



195,236 bottles
(5,661 kilograms recycled)

Tanzania Breweries Limited
Recycling Comparison



Monthly
(Kilograms Recycled)

Month	Cardboard	Plastic Bottles	Cans	Glass	Nylon	Scrap Metal	Wood / Ceiling	PP Bags	Total (in Kilograms)
JUNE	853	3,627.31	2,460	72,800	0	0	1,844	960	82,544
JULY	200	2,600	0	134,720	0	48	1,768	1,993	141,329
AUG	0	3,074	660	109,740	0	740	8,283	3,440	125,325
SEPT	2060	1,959	1,330	110,220	0	64	3,088	1,500	120,221
OCT	3,325	1,365	230	170,200	0	0	4,464	2,536	182,120
NOV	0	1,589	0	146,400	0	3,824	8,817	2,798	20,447
DEC	0	4,786	0	106,080	0	0	9,344	2,088	122,298
JAN 2020	0	5,091	200	97,980	0	0	8,207	1,240	112,718
FEB 2020	0	2,763	300	65,940	0	0	3,945	0	72,949
MAR	0	4,179	380	55,600	0	0	2,352	400	62,911
APR	820	5,661	500	69,620	0	0	1,944	1,200	79,746
*Grand Total	266,567	92,875	52,918	4,322,160	27,185	14,009	345,871	100,543	5,231,473

** Total since beginning of collections*

The Recycler
Waste Management and Recycling

Recyclables – majority locally processed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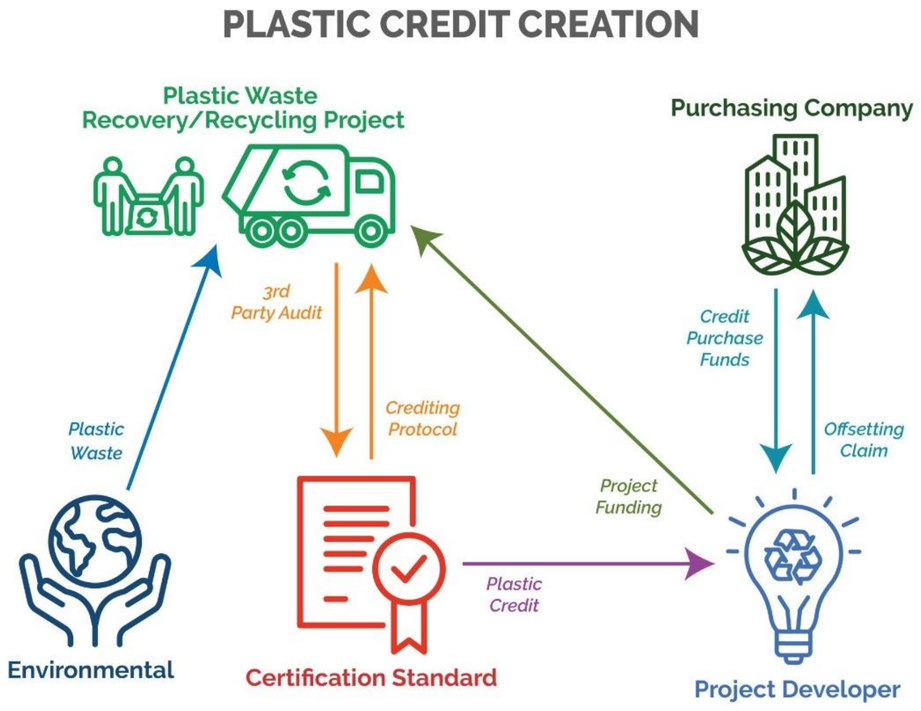
Other Projects: Large Scale Composting

The Recycler – Plastic Credits

- Non-Recyclable Plastic – 9% of plastic worldwide is recycled – most not made to be recycled

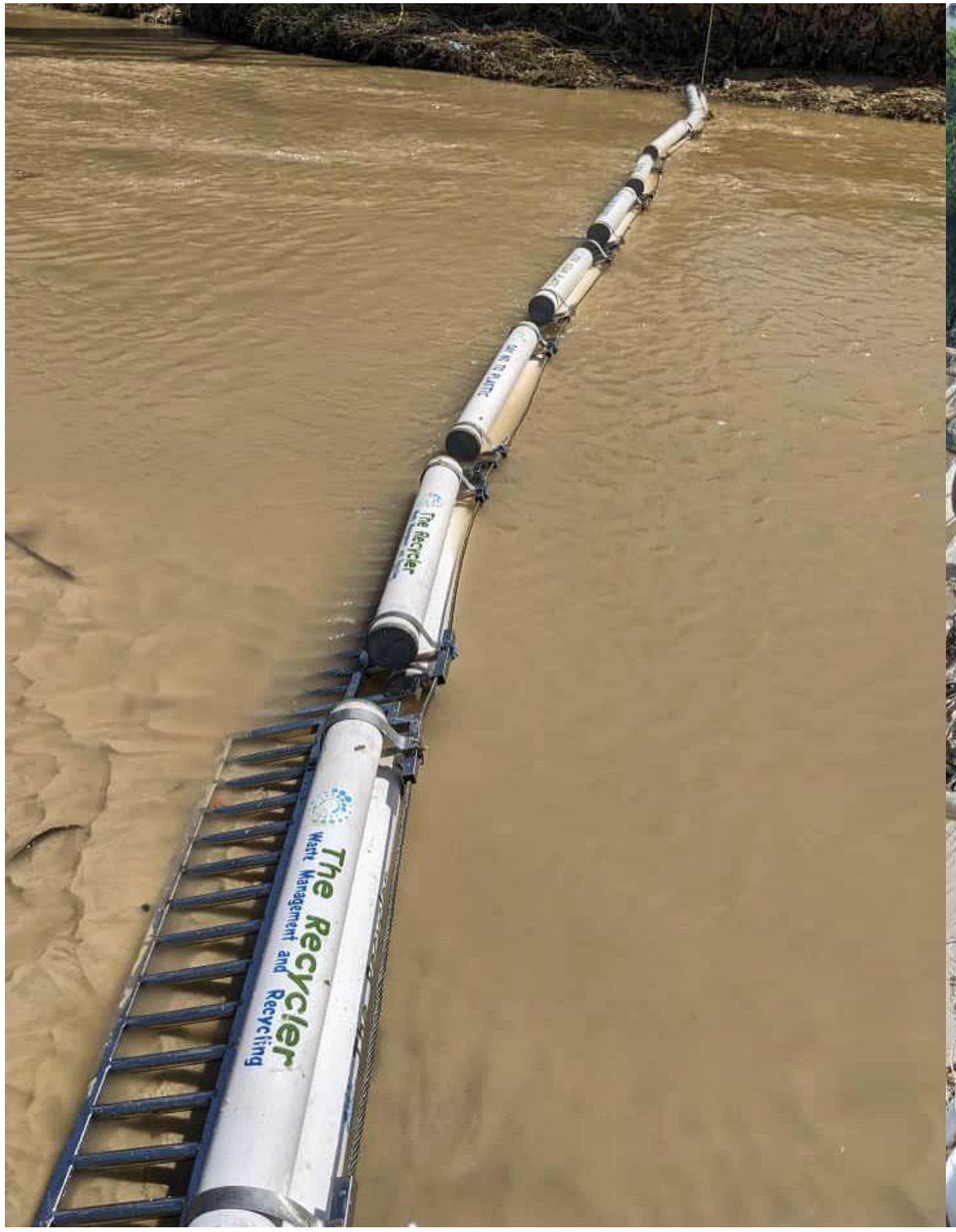


The Recycler
Waste Management and Recycling

Beaches

The Recycler
Waste Management and Recycling

Rivers Traps



Rivers Traps

Bottle to Bottle Recycling in Tanzania

- Largest Plastic Soda Bottle Producer in Tanzania – Azam purchased a full PET washing, shredding and pelletizing line when they purchased the bottling line.
- They ran the line for 2 years setting the price for plastic bottles in Dar es Salaam and using 25% recycled plastic to make bottles.
- The cost of virgin plastic dropped along with the price of oil in 2016.
- Azam decided to shut down the facility and just import virgin plastic due to small returns on running such a huge plant and the difficulty in importing in chemicals to make the recycled plastic food grade.
- Price of plastic bottles dropped by 40% in Dar es Salaam overnight and equipment has remained unused for 8 years.
- Second largest soda maker has now spent 11 million on a new bottle to bottle facility that opens in 2024.

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Ask the expert session

Matthew Haden
Plastic Waste Management
and Ocean Plastics Specialist

Bernhard Schenk
Solid Waste Management Expert

- Please present yourself, the country or region you are currently working in and your unit.
- Formulate your question to the experts.

Global Gateway

Thank you!

INTPA F4 - Urban Development Technical Facility UDTF.

The UDTF focuses on supporting partner countries in their urban development challenges. It delivers technical assistance and policy advice to improve the quality and impact of the EU's interventions in urban development at all levels - local, regional and global - with a focus on Africa, Asia, the Caribbean, and Latin America.