Global Gateway

Solid Waste Management Training for private sector and government representatives in Zambia.

Material Recovery
Management and recovery of organic waste and key materials

Training Programme

11 September – Training plenary

Welcome remarks. European Union Delegation to Zambia.

- **Morning session :** SWM Introduction and Focus on **organic waste management and recovery**.

Q&A.

- **Afternoon session :** Focus on **materials recovery and recycling**. And Waste Policies and Future Developments.

Q&A.

12 September – One-to-one private Ask the Expert Sessions.

Sign-up at the registration desk.

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).)

Topics Overview

1. Overview of Solid Waste Management in S-S Africa.
2. Recovery Context.
3. Deep Dive: Focus on Organic Waste.

Q&A

LUNCH BREAK

4. Deep dive: Focus on Recycling.
5. Waste Policies and Future Developments.
6. Practical Application Examples.

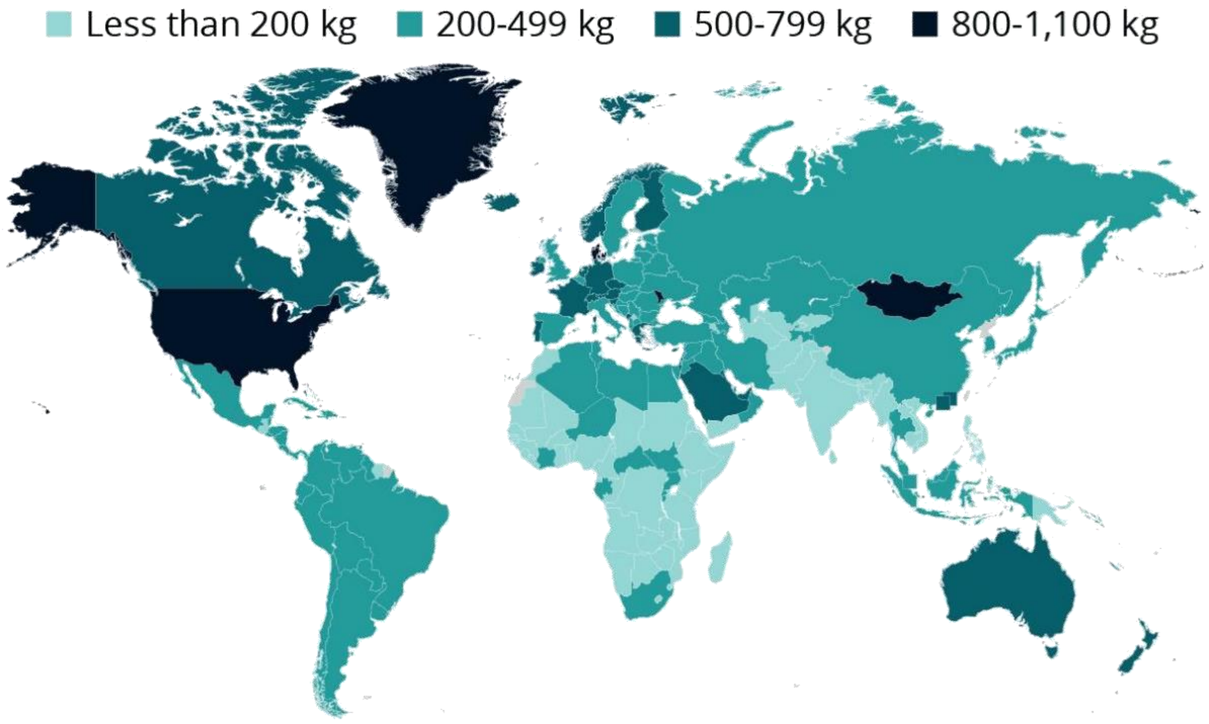
Q&A

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).)

Waste Generation by region

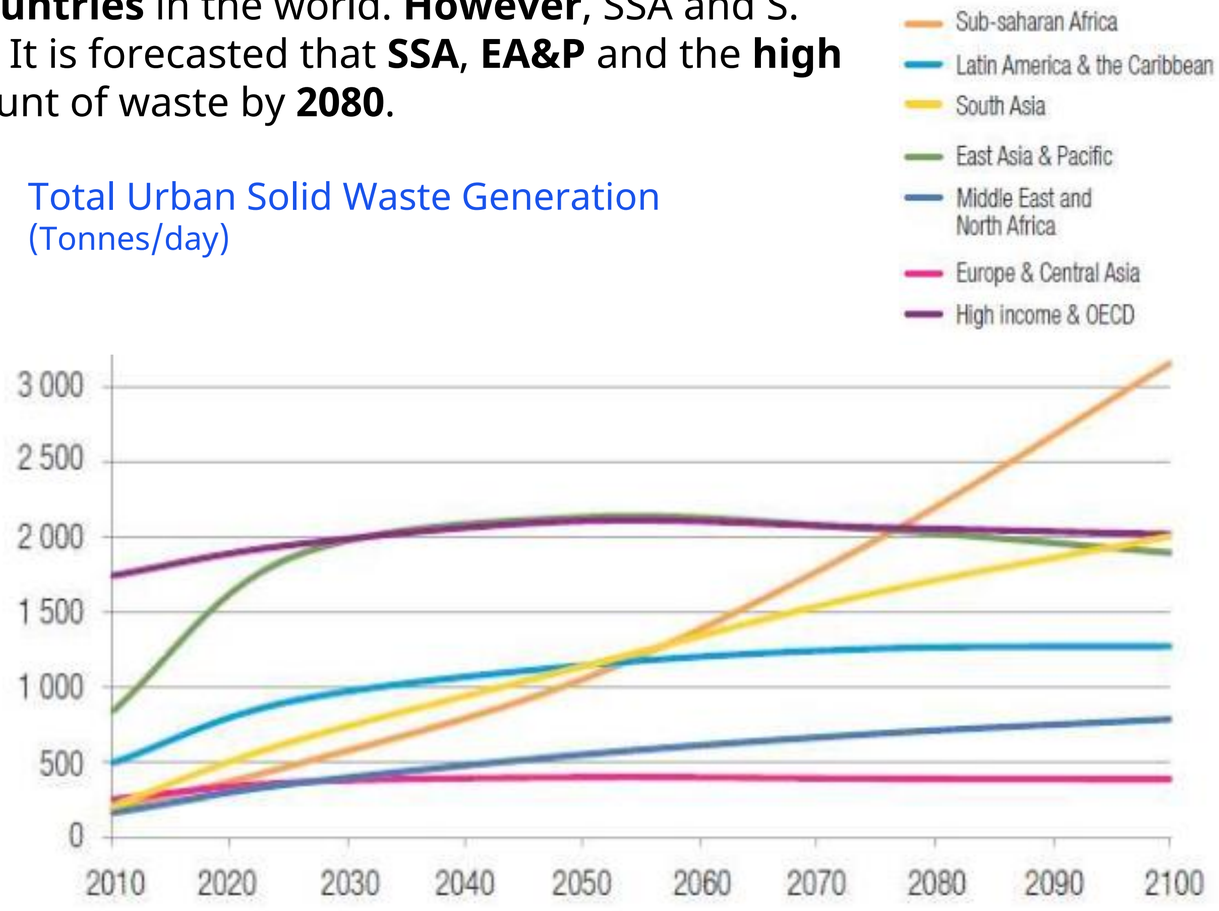
Today, most countries in **SSA generate less waste than most countries** in the world. **However**, SSA and S. Asia **will experience** the **fastest growth** in the decades to come. It is forecasted that **SSA**, **EA&P** and the **high income** and **OECD** countries will **generate about the same**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

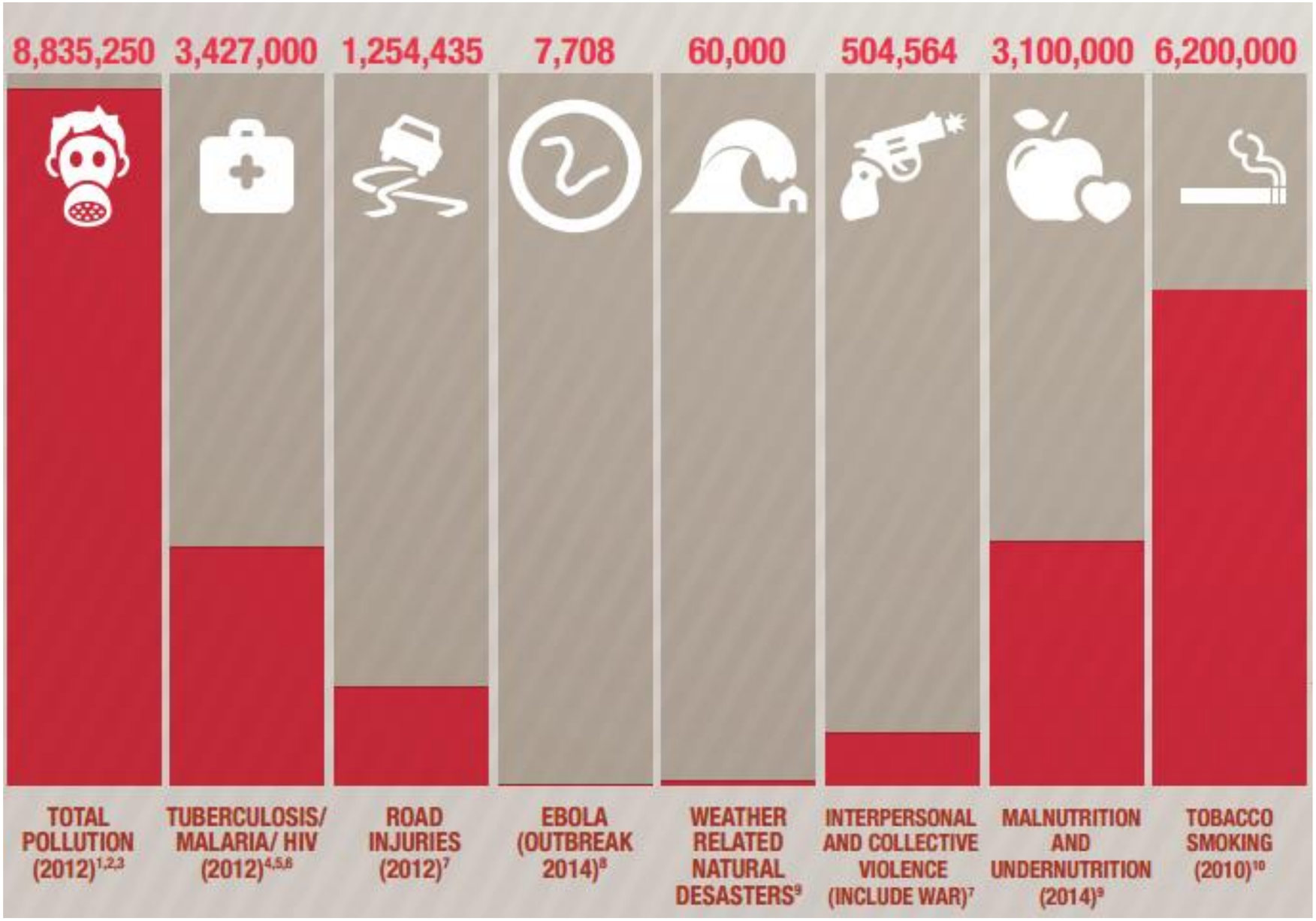
Waste Everywhere

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

Pollution

- Open burning releases a wide range of harmful chemicals, including dioxins, furans, mercury, and benzene.
- Particulate Matter: The burning process generates fine particulate matter (PM2.5), which is small enough to penetrate deep into the lungs, causing respiratory issues and increasing the risk of heart disease, asthma, and lung cancer.
- People living near areas where waste is openly burned are at a much higher risk of developing respiratory illnesses like bronchitis, asthma, and even lung cancer. Vulnerable populations, such as children and the elderly, are particularly at risk.
- Toxic Exposure: Hazardous materials like plastics, rubber, and electronics release carcinogenic chemicals when burned. Long-term exposure to these pollutants can lead to cancers, neurological problems, and reproductive issues.

Pollution


8,835,250
3,427,000
1,254,435
7,708
60,000
504,564
3,100,000
6,200,000
TOTAL POLLUTION (2012)[1,2,3]
TUBERCULOSIS/ MALARIA/ HIV (2012)[4,5,6]
ROAD INJURIES (2012)[7]
EBOLA (OUTBREAK 2014)[8]
WEATHER RELATED NATURAL DESASTERS[9]
INTERPERSONAL AND COLLECTIVE VIOLENCE (INCLUDE WAR)[7]
MALNUTRITION AND UNDERNUTRITION (2014)[9]
TOBACCO SMOKING (2010)[10]

Waste in S-S Africa

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Current Situation Dumpsites

Landfills poorly built and managed in Africa

Uncontrolled landfill fires

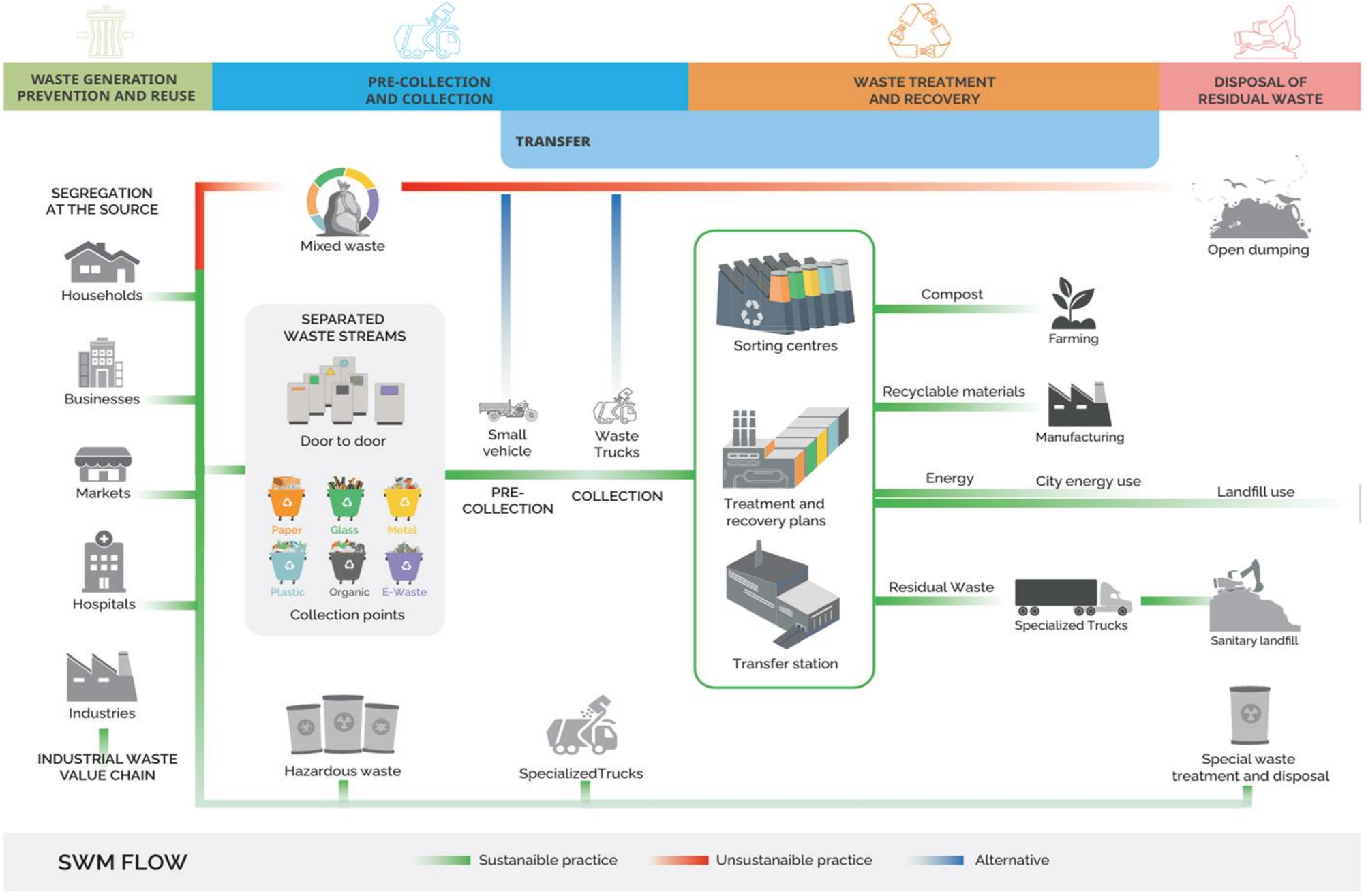
Dangerous leachate leakage

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



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.

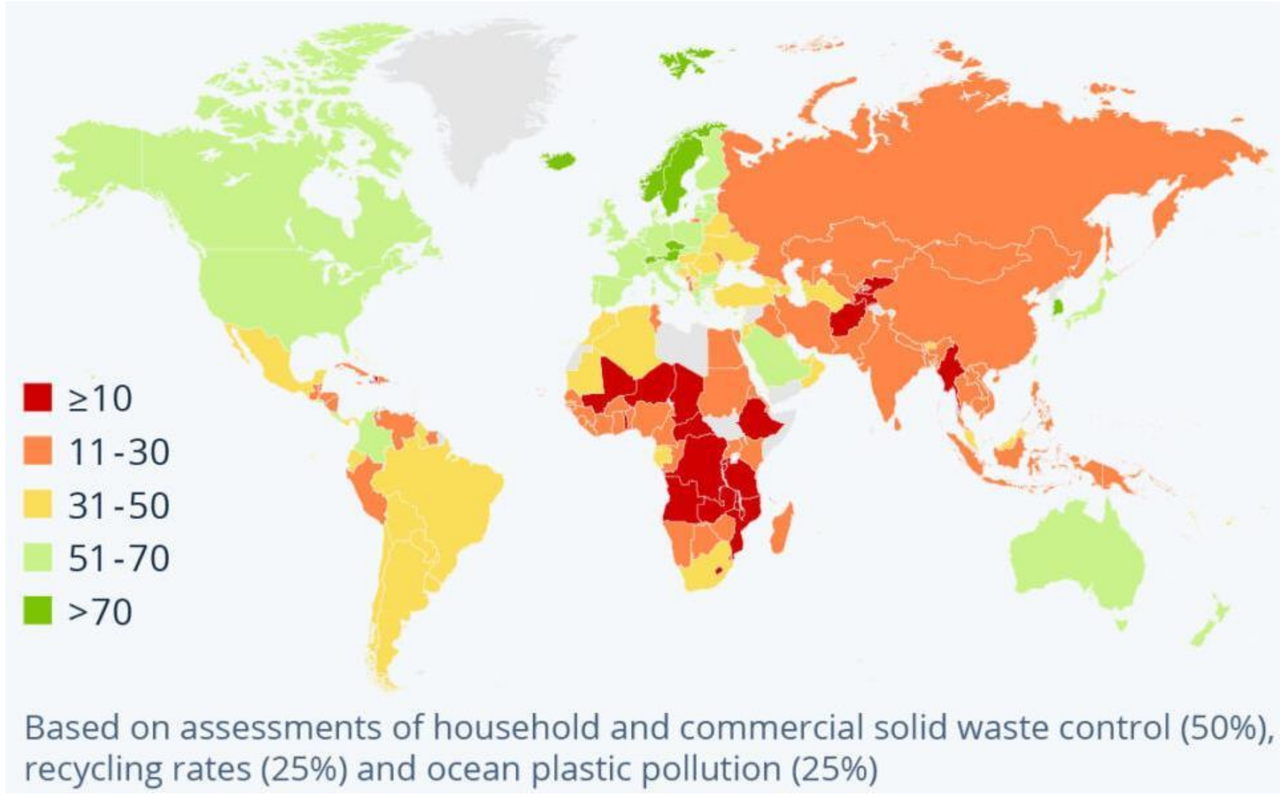
Waste Management Challenges

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.

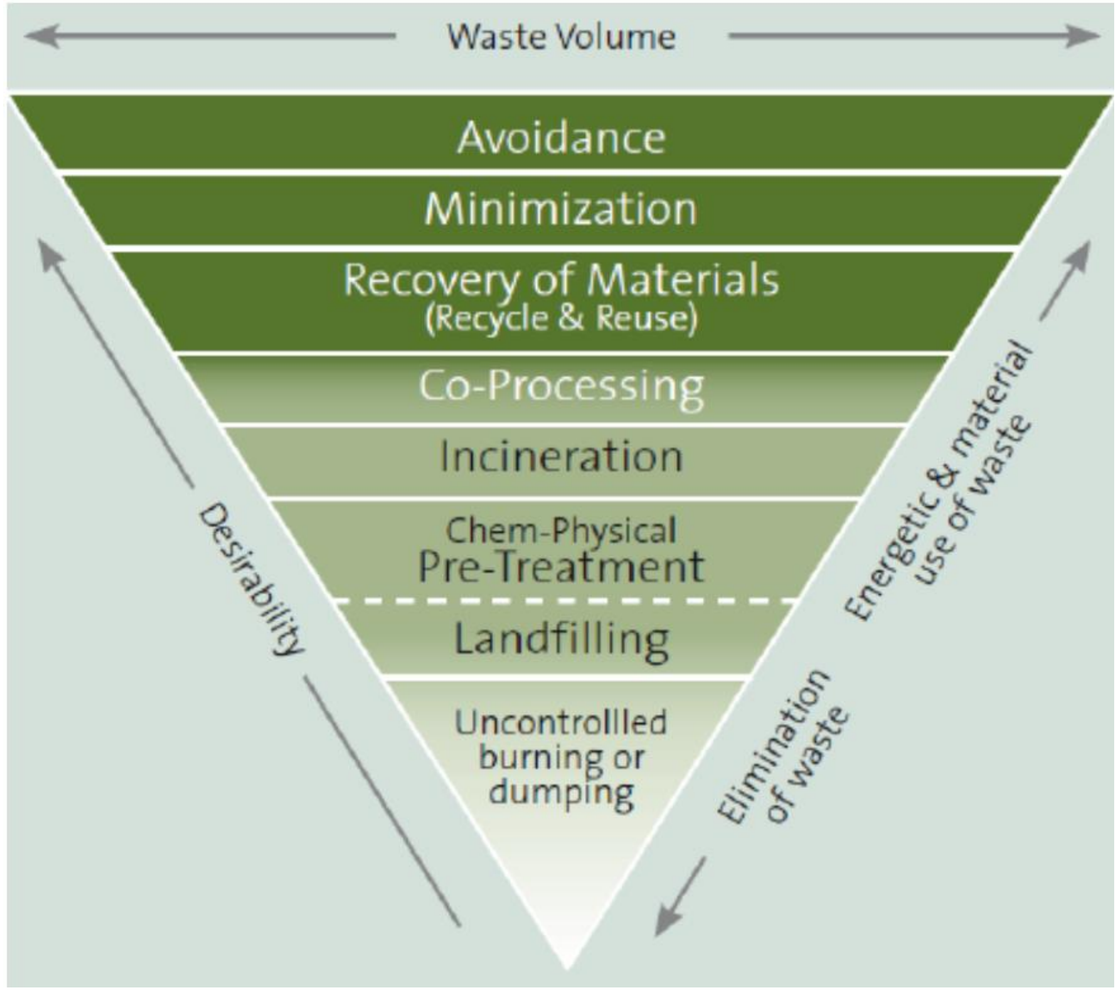
The Global State of Waste Management

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 in Zambia

- Zambia has experienced rapid urbanization, leading to increased waste generation.
- Lusaka, the capital city, produces the highest amount of waste, approximately 1,000 tons per day, according to the Lusaka City Council.
- An estimated 45% of waste generated in Zambia is formally collected – the rest is dumped in the environment or burned.
- Waste collection services are often inadequate in many parts of Zambia, particularly in low-income and peri-urban areas. The national waste collection rate is less than 40%, with much of the waste ending up in illegal dumpsites or being burned.
- The Chunga landfill in Lusaka is one of the few operational landfills, though it faces issues like poor waste management practices and insufficient capacity, but the landfill gate / tipping fees is low

Waste Composition Quiz

High-income vs Low-income countries.

Please rank this materials

Metal

Plastics

Paper

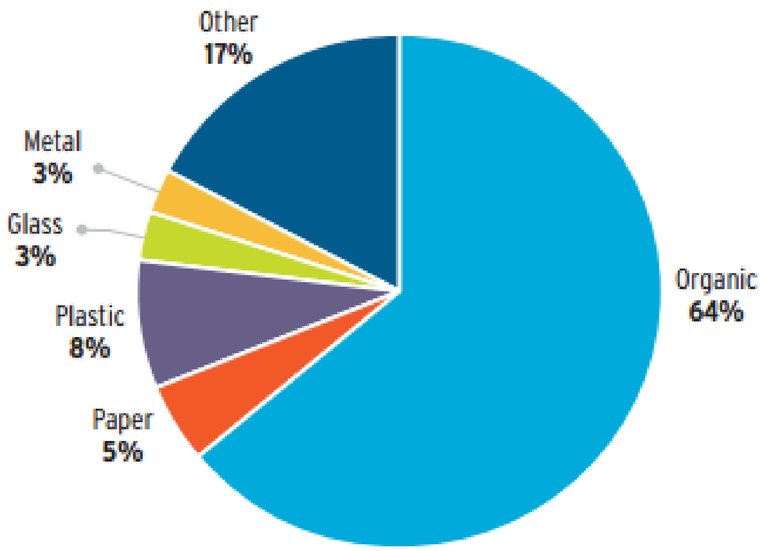
Organic Waste

Glass

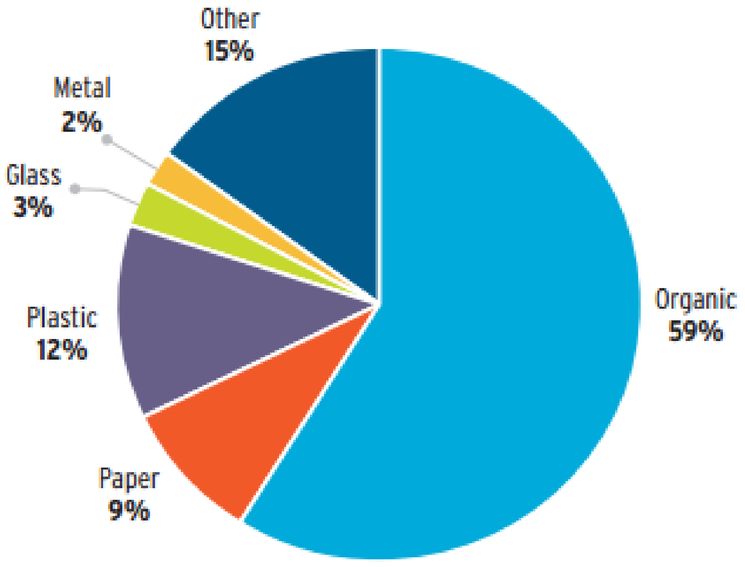
Waste Composition Quiz

High-income vs Low-income

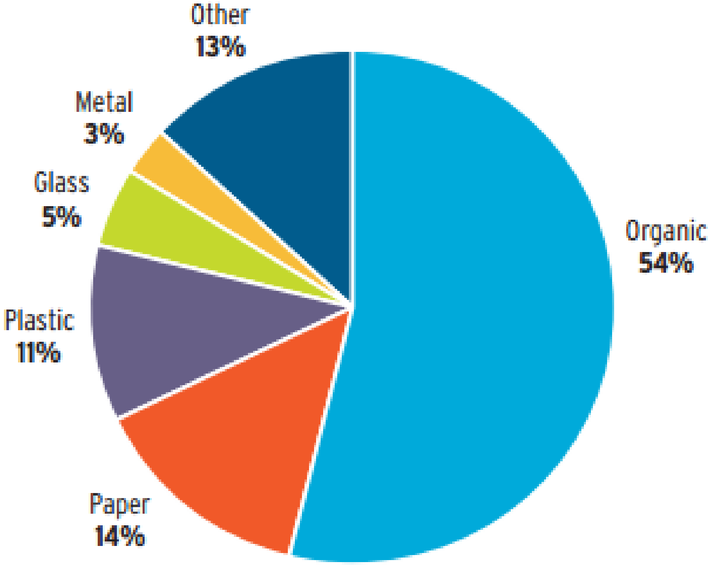
a. Waste Composition in Low-Income Countries



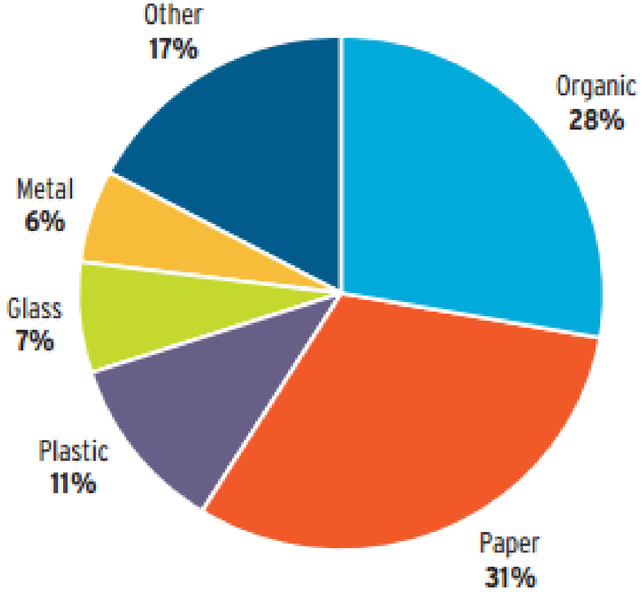
b. Waste Composition in Lower Middle-Income Countries



c. Waste Composition in Upper Middle-Income Countries



d. Waste Composition in High-Income Countries



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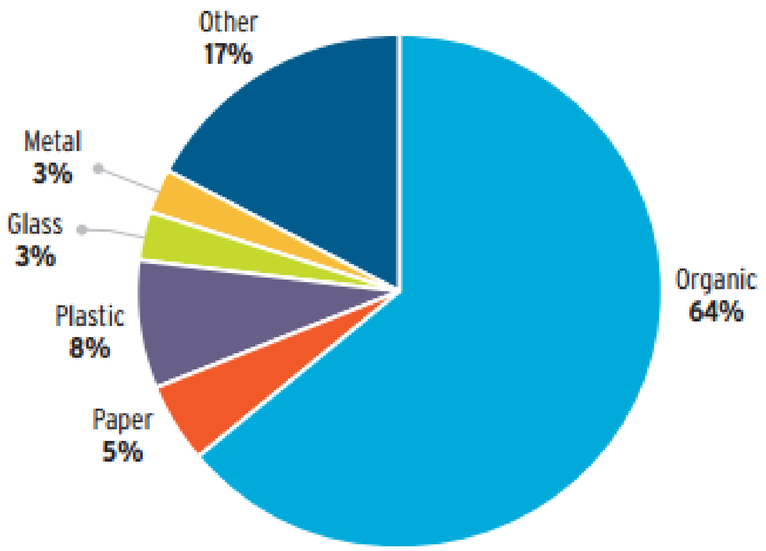
Waste Composition Quiz

High-income vs Low-income

a. Waste Composition in Low-Income Countries



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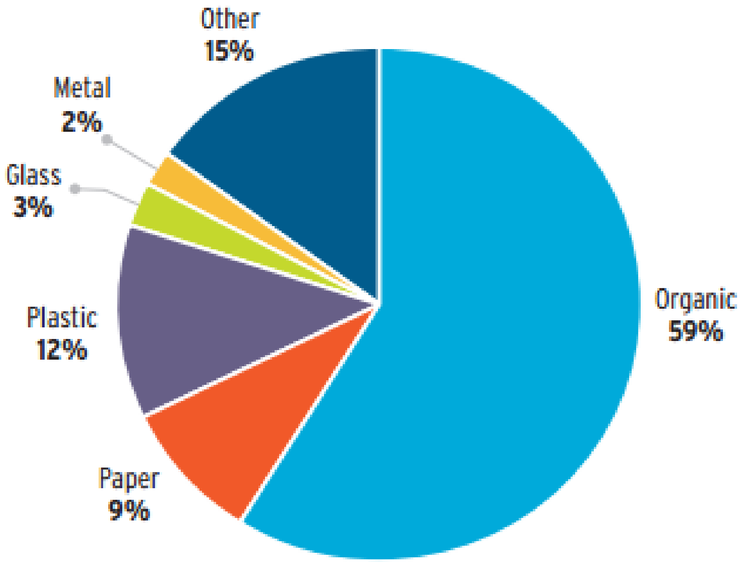

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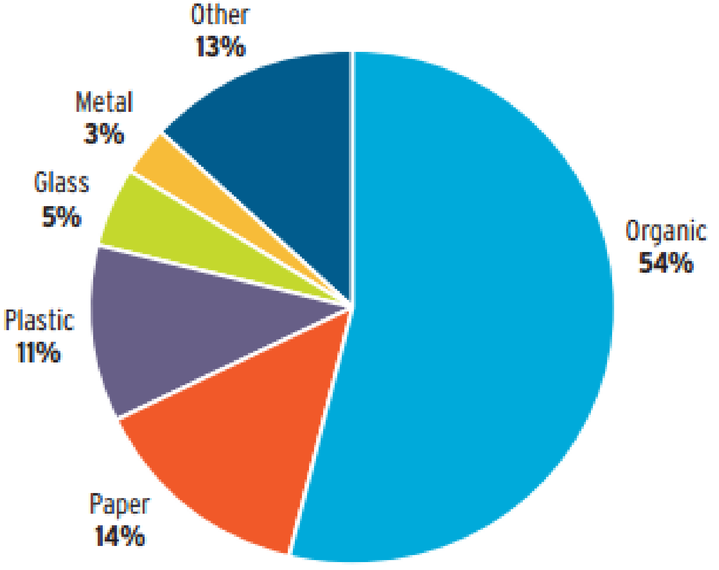

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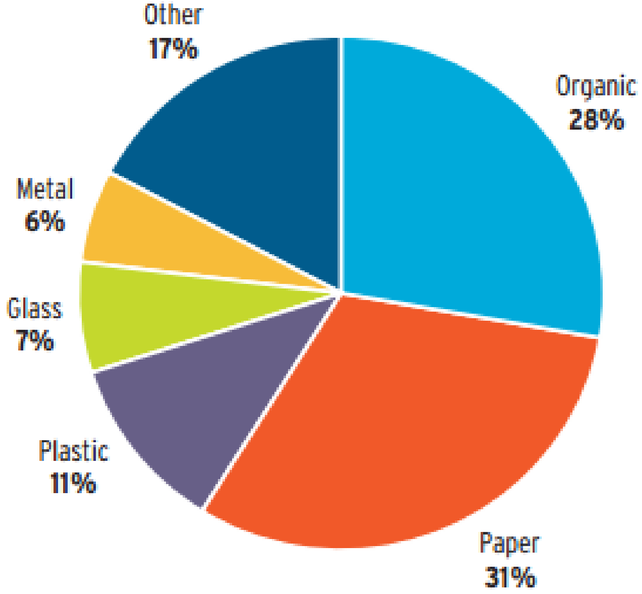
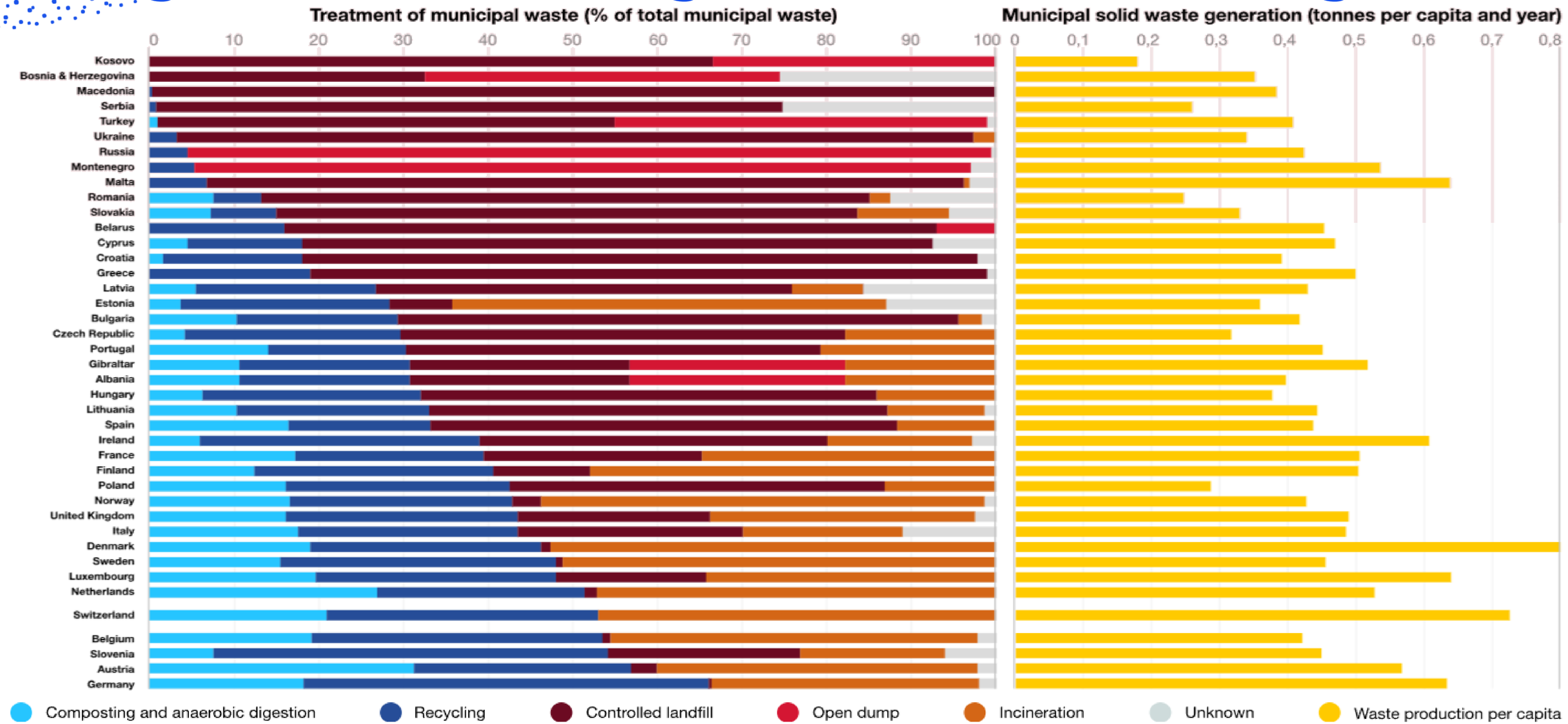


Organic Waste Management is Waste Management

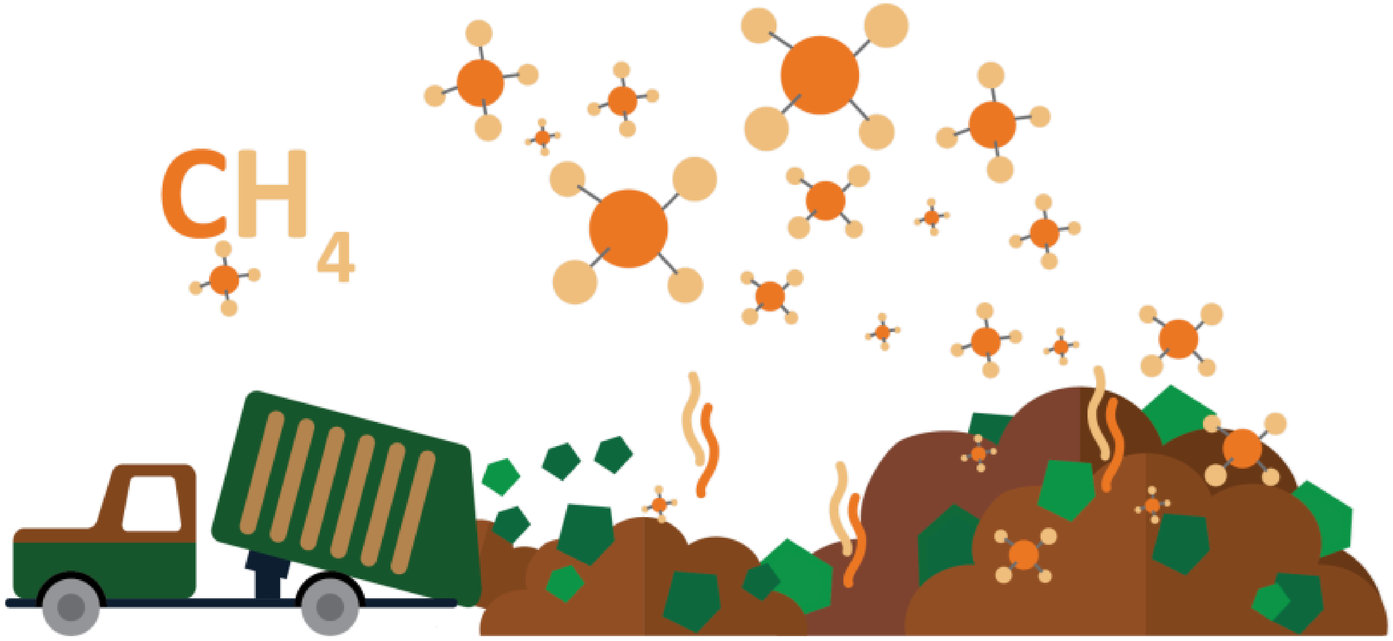


Source: Data prepared in Pollak (2019) on the basis of data from Kaza et al (2018)

Methane Release from Organic Waste if there is no air

Methane has **80x the warming power of Carbon Dioxide** over the first 20 years.

Methane is **28x more powerful at warming the planet than CO2** over 100 years.



Large Scale Windrow Composting

- Windrow Composting is one of the easiest interventions for large amounts of organic waste.
- Waste is organized in long rows called “Windrows”

- It is important to start with locations that already have high concentrations of organic waste like Fruit and Veg markets, Agro processors, Large Factories – where implementing systems of separation are easy.


CASE
521F

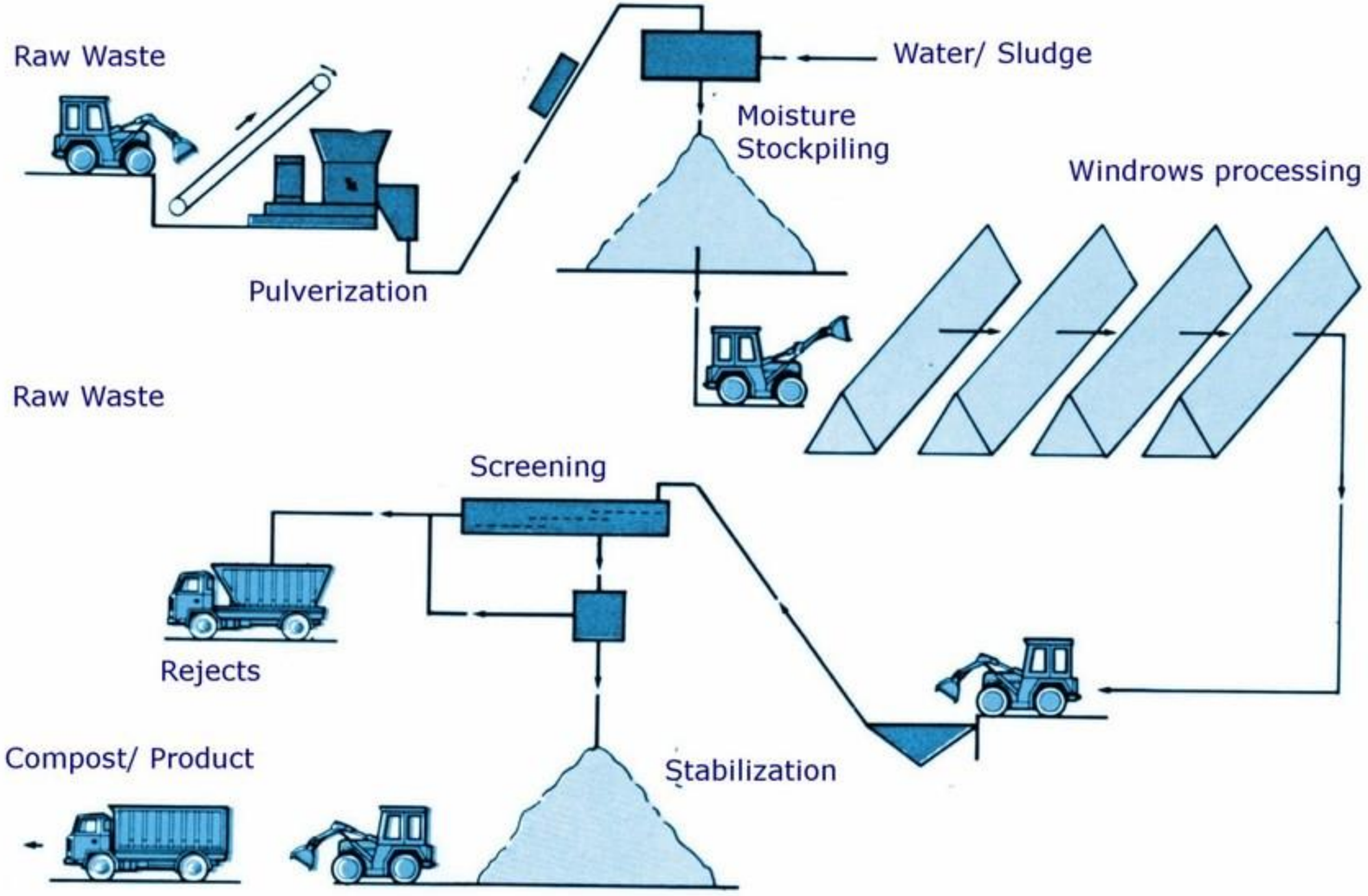

BACKHUS


CASE
521F


Mabwepande
Compost
Mbolea asilia
100% Organic Material Origin
Ingredient: Bio compost with nitrogen phosphorus, potassium, calcium and magnesium
Application: Natural organic fertiliser for your farm
Benefits: Improves soil structure Adds nutrients to the soil Retains moisture
Mauzo: 0764 966 317
Hamburg

Windrows last between 6 – 12 weeks in Rotting Stage then 6-12 weeks in maturation stage

- This give you and idea of the flow and process – including pulverization and water/sludge
- Pulverization can assist composting but is a heavy extra cost.
- It is important that there is proper draining and collection of leakage and this is then used to re-spray on the material.
- Covers are also a good option to protect against too much rain or too little.



- **Capex:** depends on size – but can be as low as $300,000 – can be covered by carbon credit financing.
- **Running costs** – not including transport $2,500 per month for a 25 ton a day facility.
- **Revenue** – Carbon credits at around $10 per 2 tons of waste in, compost is around 10% of waste in. Can also find cement companies to purchase residual waste for $10-$50 per ton. Compost makes up between 5% – 30% of waste in. Price per ton of compost – $30 – $100.

Black Soldier Fly Larvae

- 40 - 60% of waste in developing countries is organic.
- Chicken/Fish Feed – very expensive and connected to deforestation/overfishing
- Black Soldier Fly – Native to Zambia
- Consume their body weight per day
- Do not carry diseases.

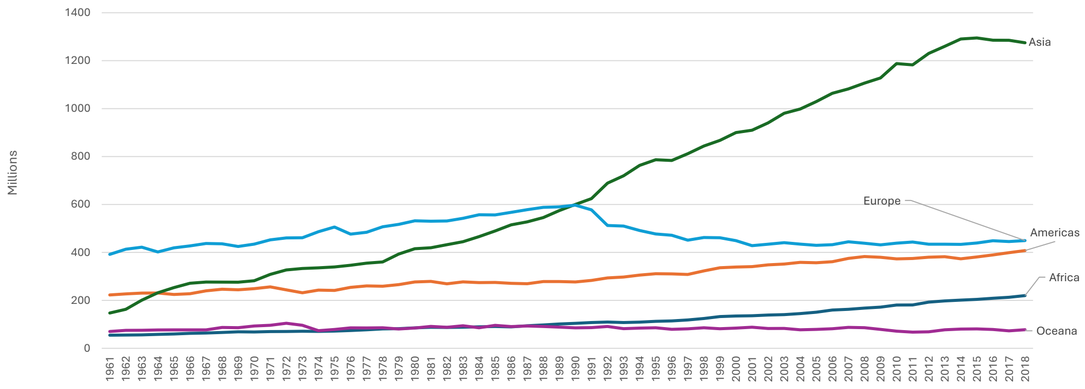
Black Soldier Fly

or

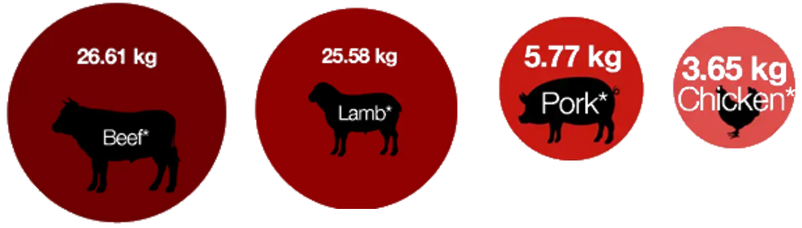
House Fly

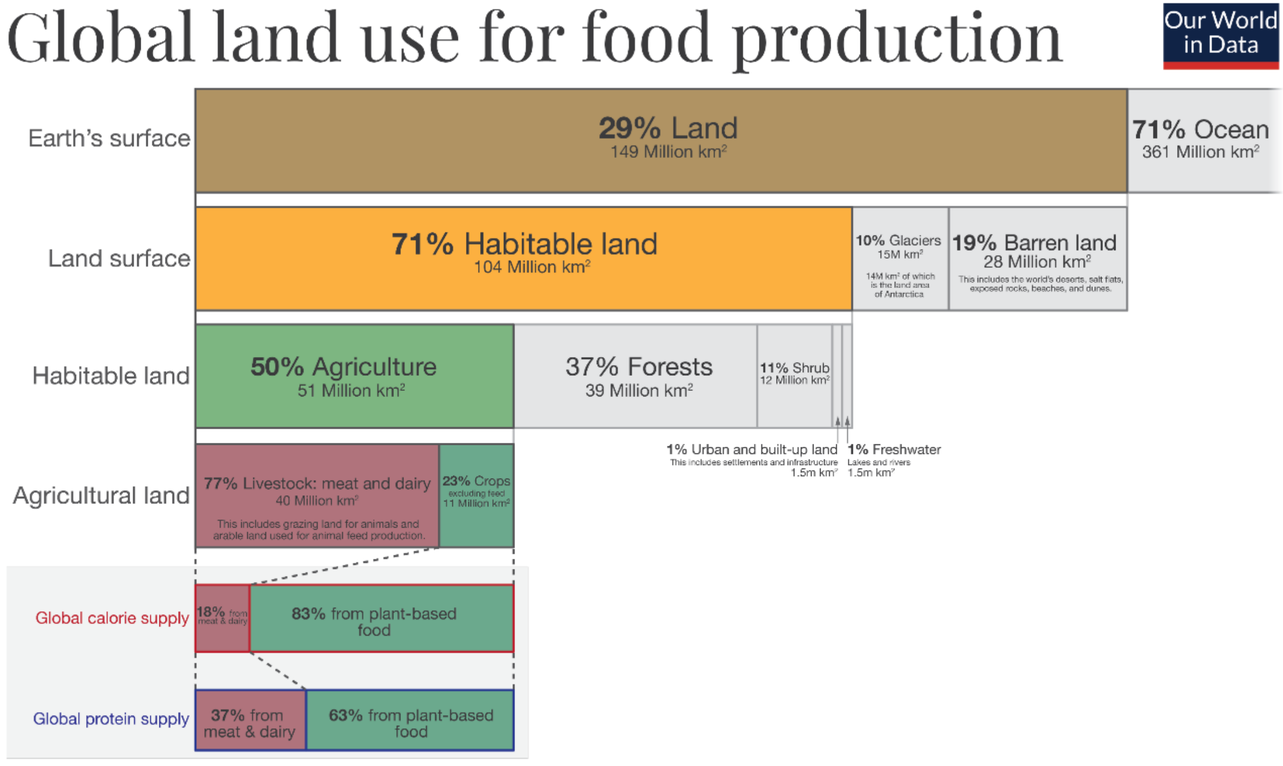
High Carbon and Land Cost of Livestock

Meat consumption continuing to grow[7]



Carbon Footprint per kg of meat (in kg CO2 eq/kg)[5]





- BSFL also assists with livestock feed issues, not just with methane reduction

BSFL facilities need large indoor space and equipment for breeding, feeding, processing. These upfront Capex costs can make the process challenging.

Black Soldier Fly Larvae

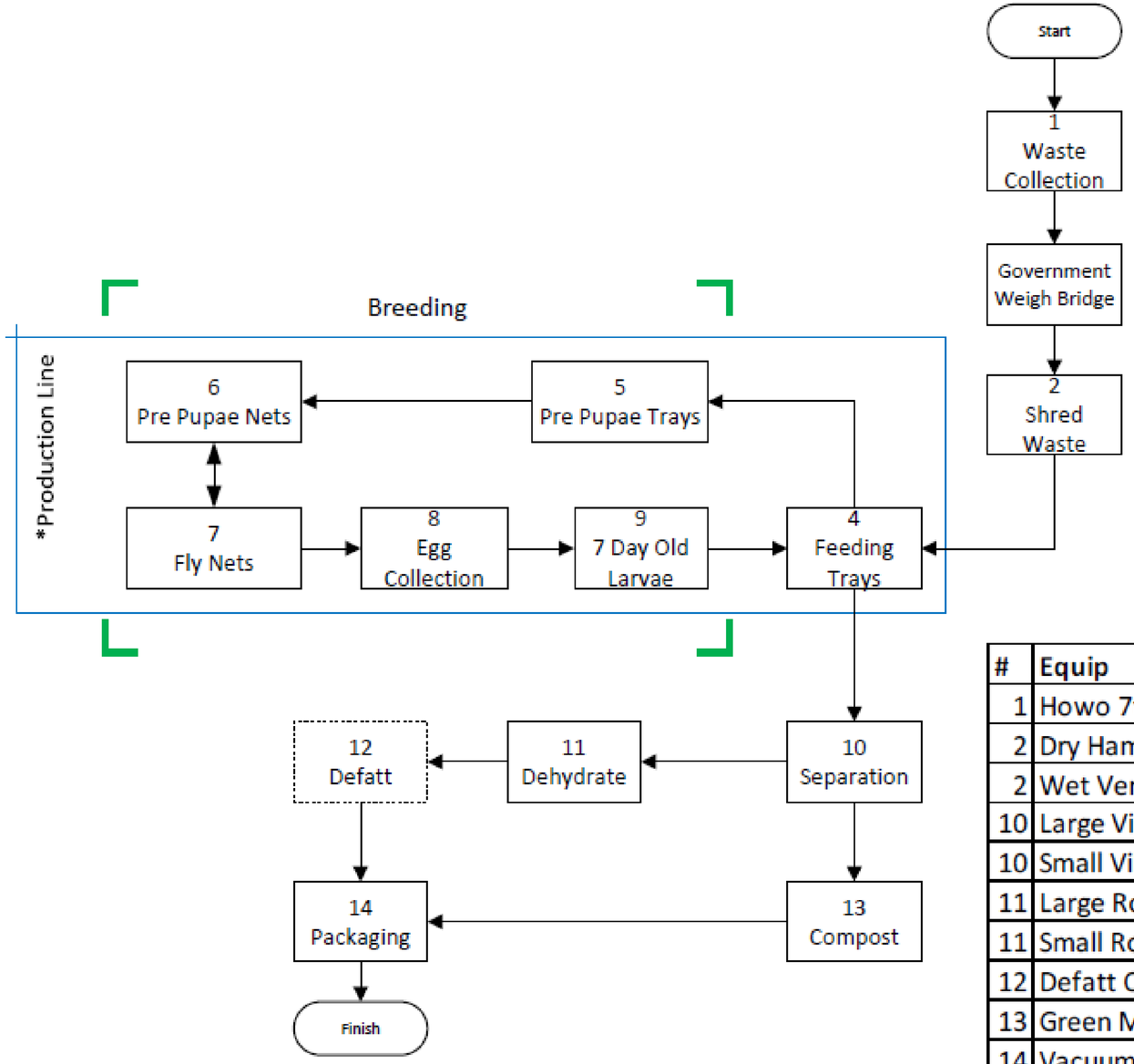

QUT
BioBug

Dried Insect Protein and Compost

- The main byproducts are dried insect protein and compost.
- The compost is than compost from a windrow compost due to exoskeleton shell can be used as a natural pesticide.

Work Flow and Machines

- **Capex:** depends on size – but can be as low as $150,000, as high as 10 million
- **Running costs** – not including transport $1,500 per month for a 3 ton a month facility
- **Revenue** – Carbon credits - $10 per 2 tons of waste in, compost is around 10% of waste in. Compost makes up between 5% – 30% of waste in. Price per ton of compost – $30 – $100.
- **BSF Revenue** - Live BSF is around 10% of waste in. Dried Larvae is around 2% of waste in. Around $600 – $1,000 per ton for dried pressed larvae locally. Up to $3,000 in Europe.

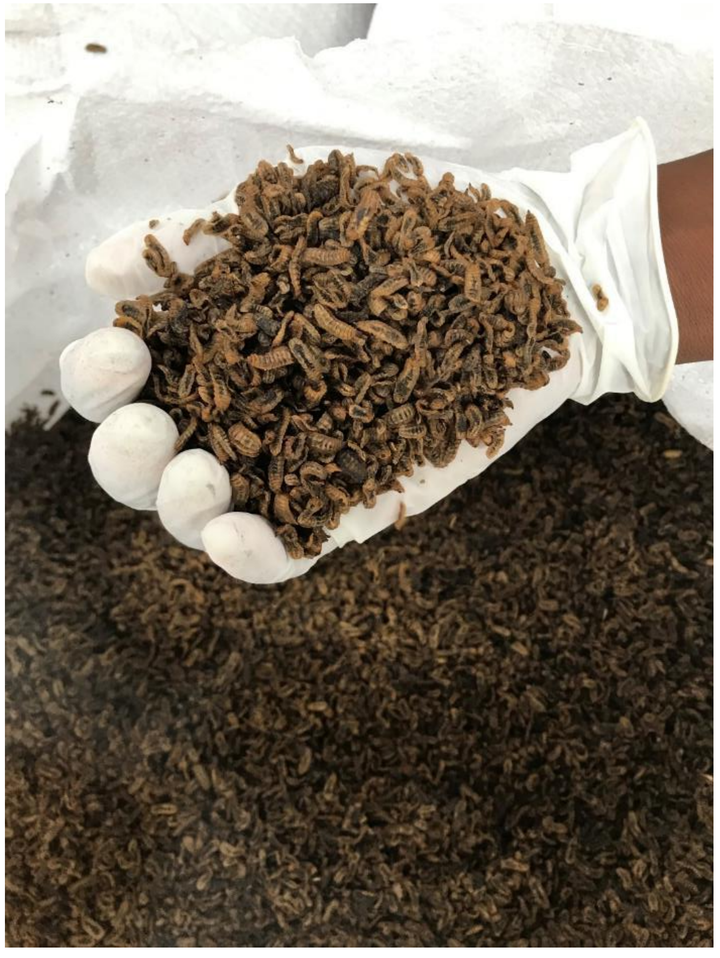


#	Equip	Capacity
1	Howo 7ton RORO	7 ton/trip
2	Dry Hammer Mill	5 ton/hr
2	Wet Vertical Shredder	10 ton/hr
10	Large Vibrating Separator	500kg/hr
10	Small Vibrating Separator	300kg/hr
11	Large Rotary Drier	500kg
11	Small Rotary Drier	300kg
12	Defatt Oil Press	70kg/hr
13	Green Material Shredder*	4cbm/hr
14	Vacuum Press	50kg/hr

Source: xx (YEAR).

Dried Insect Protein and Finished Products

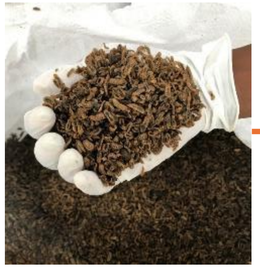
Additional processing of the insect protein is necessary including removing the oil and mixing with other ingredients.



Food Waste

Input: Waste in - to Insect Protein - 5%
Input: Waste in – to compost out Ratio – 10%

Insect Processing



Insect Protein

Press

Insect Protein Powder

Insect Protein incorporation to feed

Dog Food
30%

Final Products

Fish Feed
20%

Samaki Bonge

Chicken Feed
1% – 4%

Kuku Bonge

Biowaste

Brown Waste

Input: Waste in - to Compost out - 10%

Windrow Composting

Compost

Compost Packaging

Black Soldier Fly Larvae – Small Scale

- BSFL has also been used a community or smaller level in countries like Zambia
- The larvae are native to tropical areas like Zambia
- These models are interesting cause they are community composting that provide BSFL larvae.

Black Soldier Fly Larvae – Small Scale

The community can put their waste in these bins and the insect naturally comes in, lays eggs and eats the waste.

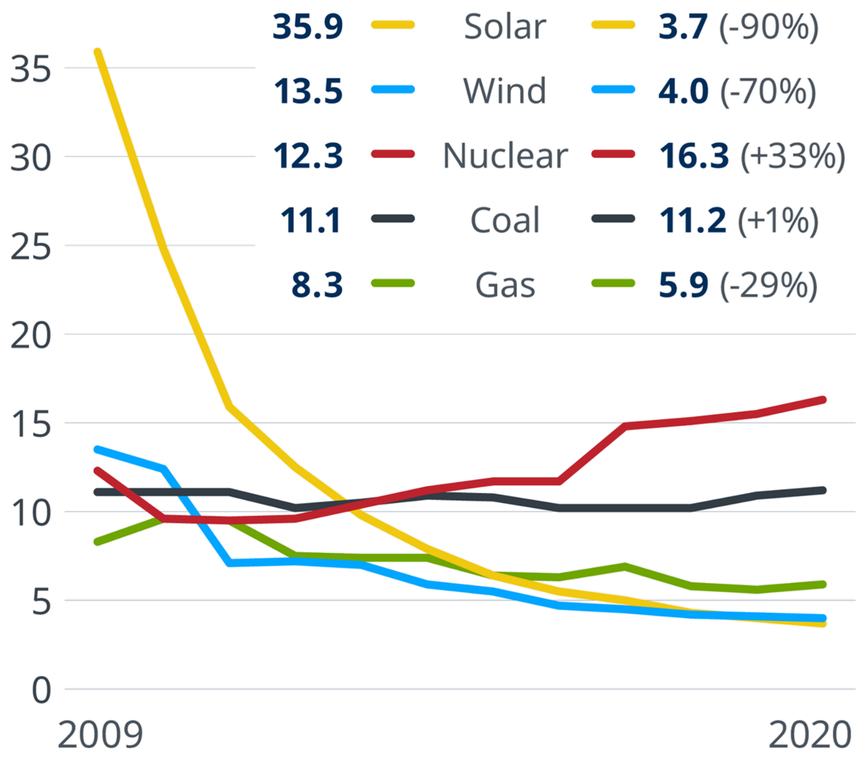
Black Soldier Fly Larvae – Small Scale

The larvae then self-harvest – as they are looking for dry locations to become flies. Then fed directly to chickens

Biogas

Biogas

Worldwide energy prices over the last decade
Generation costs in cents



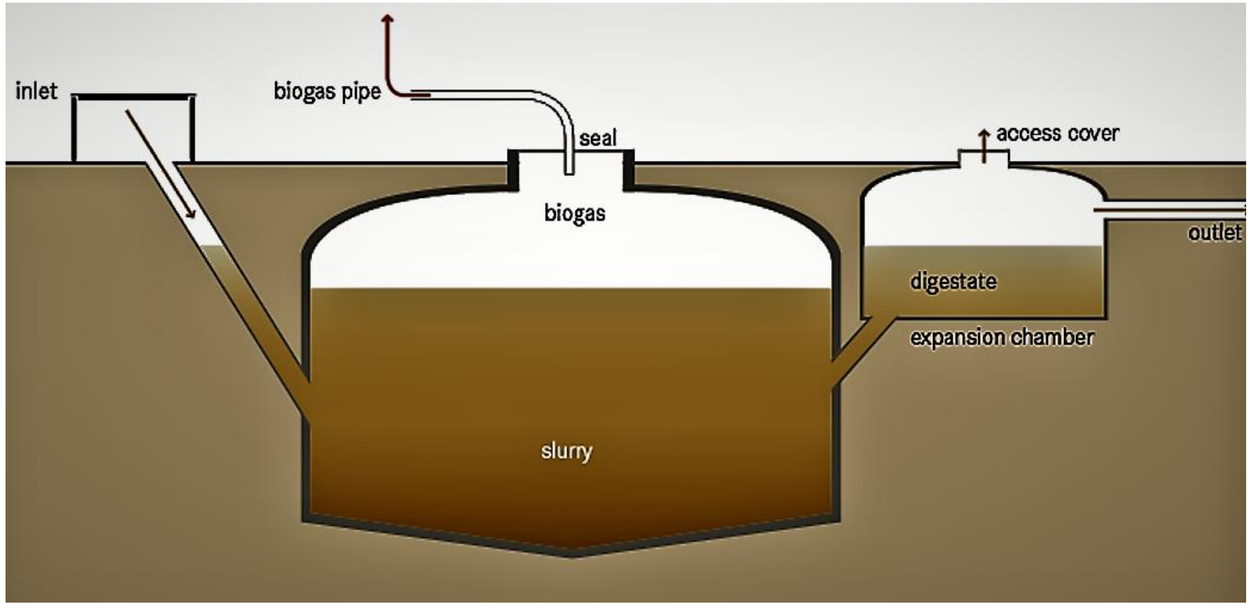
Source: WNISR, Lazard (2020)

- **CAPEX:** for a 1 MW biogas plant typically ranges from $1.75 million to $4.45 million, depending on the specific project requirements and conditions. 10,000 tons of waste annually is 1MW.
- **Income:** At $0.05 per kWh, 1 MW would generate $438,000 per year (8,760 MWh × $0.05/kWh) at $0.10 per kWh, 1 MW would generate. At $0.20 per kWh, 1 MW would generate $1,752,000 per year (8,760 MWh × $0.20/kWh).
- **Challenges:** Need to sign a power purchasing agreement with offtaker.
- **Solar and Wind Costs are continually going down** – 90% in a decade. Biogas will struggle to compete.
- Clean organic waste from easy source.
- Ideally you would get paid a gate fee to receive the waste and not have to pay for the collection and transport.
- Work better for livestock and crop waste rather than municipal solid waste.

Small Scale Biogas

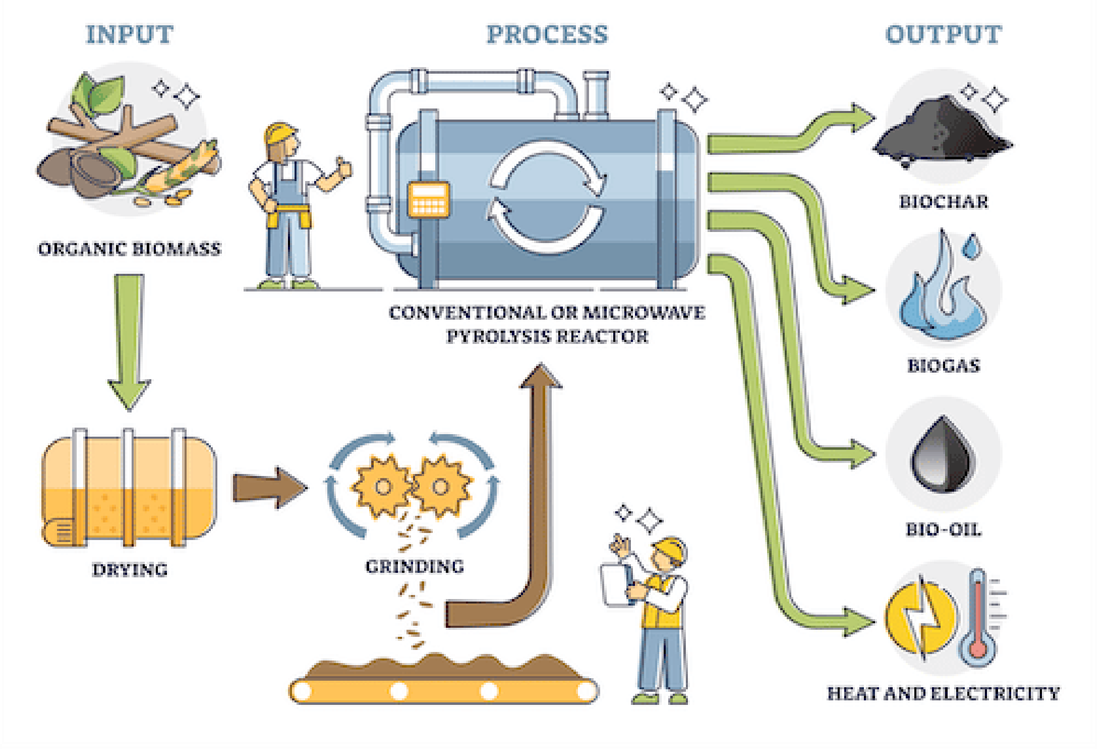
Low Cost
Household / Small farm-scale: $300 - $2,000
Community / Medium-scale: $2,000 - $10,000

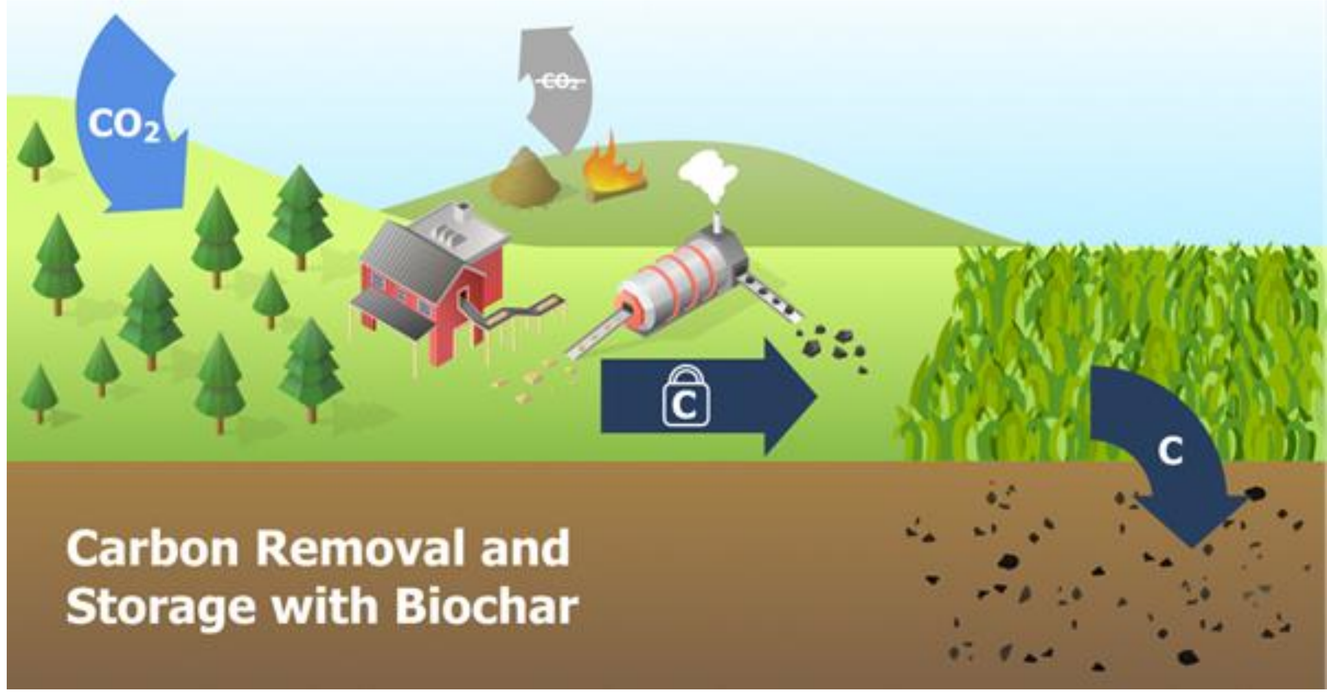
Best for agricultural waste and local use of cooking
Reduces demand for firewood and ambient particulate air pollution.
Household / Small farm scale - $120 - $500 savings per year
Community or Medium-scale – $1,000 - $2,000



Biochar

Biochar is a relatively new process for woody biomass organic waste that can be funded through carbon credits.





Source: WNISR, Lazard (2020)

Biochar

- **CAPEX:** 10,000 tons input capacity - $1,000,000
- **Income:** 3 – 5 tons of biomass input to make 1 tons of biochar. 1 ton of biochar is equal to 2.5 – 3.5 tons of CO2eq. In terms of Carbon Credits 1 ton of CO2eq is $100 per offset
- **Challenges:** Woody material only. Costs for transporting waste, sometimes needed to purchase. Cost for then planting biochar into soil.

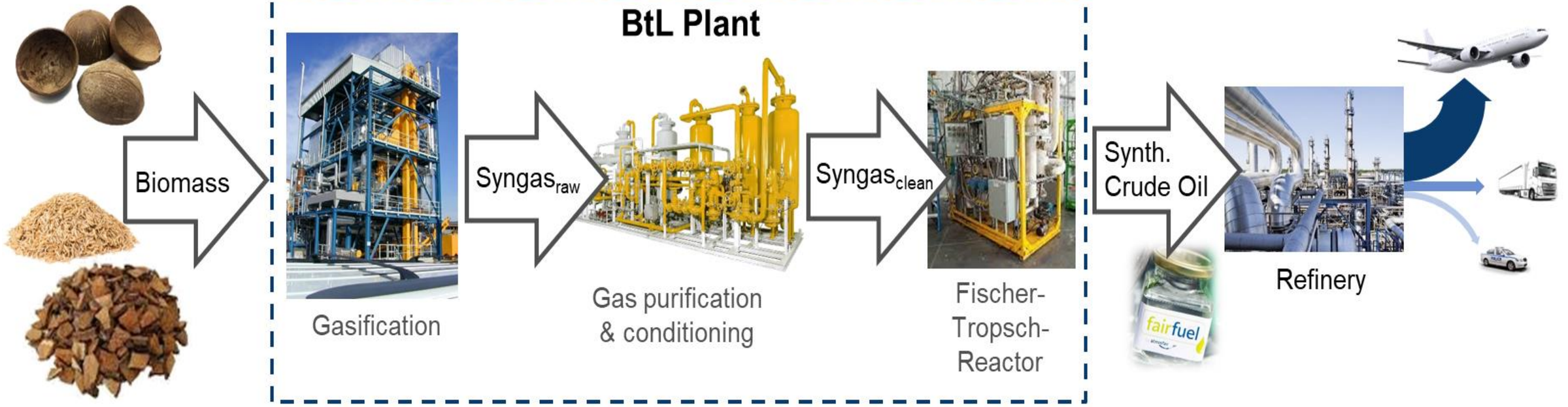
Green Jet Fuel

- Proposed Biomass-to-Liquid Pathway (BtL) for Sustainable Aviation Fuels (SAF).

- Main components of the BtL-Plant.
  - Dual fluidized bed gasifier.
  - Gas cleaning.
  - Fischer-Tropsch reactor.

- Main feedstock: sustainable biomass.
  (almost) no additional power needed.

- Main product: synthetic crude oil.
  Basis for sustainable aviation fuel.



Green Jet Fuel?

- Takes woody waste, seeds, agriculture byproduct
- Very high capex – $11 million min for 10,000 tons of material
- Potential for high revenue – $7 million annual including fuel and fair fuel certificates

Global Gateway

Q & A Session

Management and recovery of organics.

Dear Participants

- Please present yourself, the company or institution where you work.
- Ask your question to the experts.

Raise your hand, introduce yourself and ask your question if you are participating in person.

Introduce yourself and ask your question in the chat if you are participating on-line.

Topics Overview

1. Overview of Solid Waste Management in S-S Africa.
2. Recovery Context.
3. Deep Dive: Focus on Organic Waste.

Q&A

LUNCH BREAK

4. **Deep dive: Focus on Recycling.**
5. Waste Policies and Future Developments.
6. Practical Application Examples.

Q&A

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).)

Recycling Value Quiz

Recycling Value

Please rank the type of recycling material from highest value to lowest

Answers in terms of most valuable

Highest value

Lowest value

Recyclable Waste Typologies and Economic Values

Typology	Price (Euros /Ton)
Copper	3,640 - 8,190
Aluminum (Used Beverage Cans)	1,260.35
PET flakes (Clear) (plastic bottles)	819
PET flakes (Green)	637
PET flakes (Brown)	491.40
HDPE / PP flakes (Shampoo bottles, oil bottles)	650.65
LDPE pellets (Bubble wrap, stretchy plastic covering)	486.85
White Paper	364
Corrugated cardboard paper	291.20
Newsprint paper	136.50 - 182
Glass cullet (Clear)	40.95
Glass cullet (Green/Brown)	18.20

How long does it take to decompose in a landfill if not recycled?

Two months

500 years

80 Years

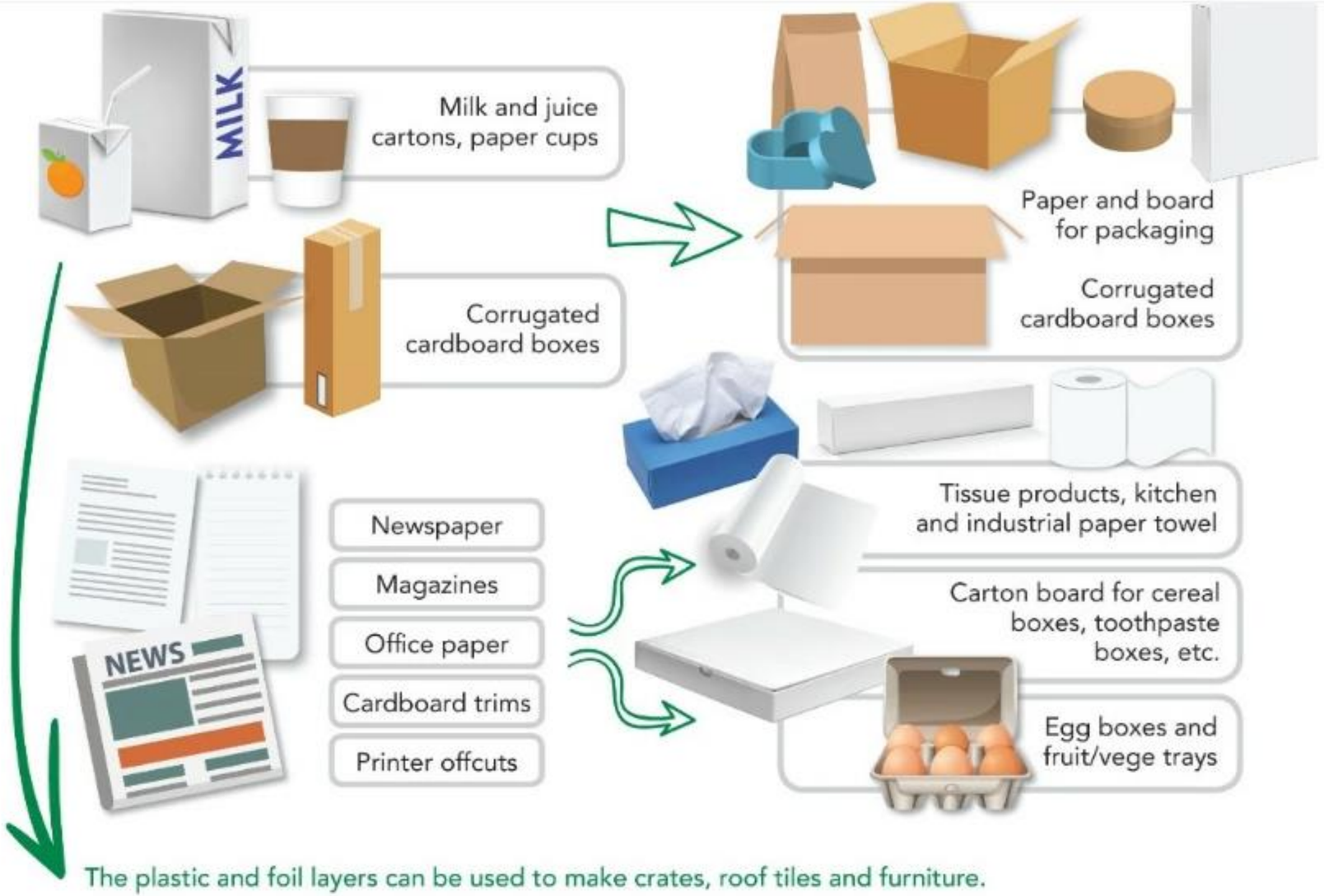
1 million years

Metals

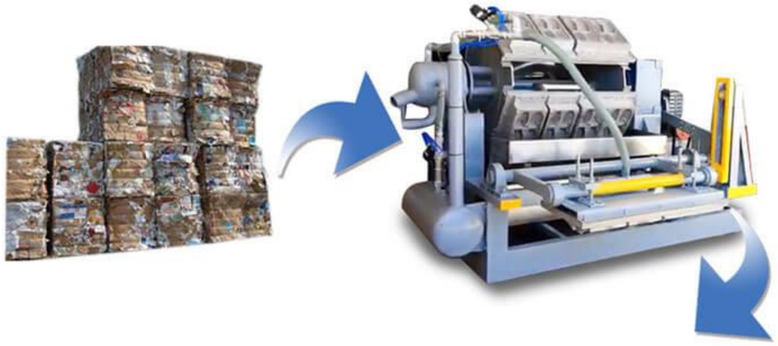
Metal Recycling continues to be the most lucrative and easiest recycling.
This industry will continue to grow with electronic waste and batteries and renewable energy.

Paper and Cardboard

- Paper - not as glamorous as plastic recycling
- Not as lucrative as metal recycling
- Remains one of the lowest cost recycling initiatives
- Makes economic sense almost everywhere either through export or through local paper mills or even egg cartons.



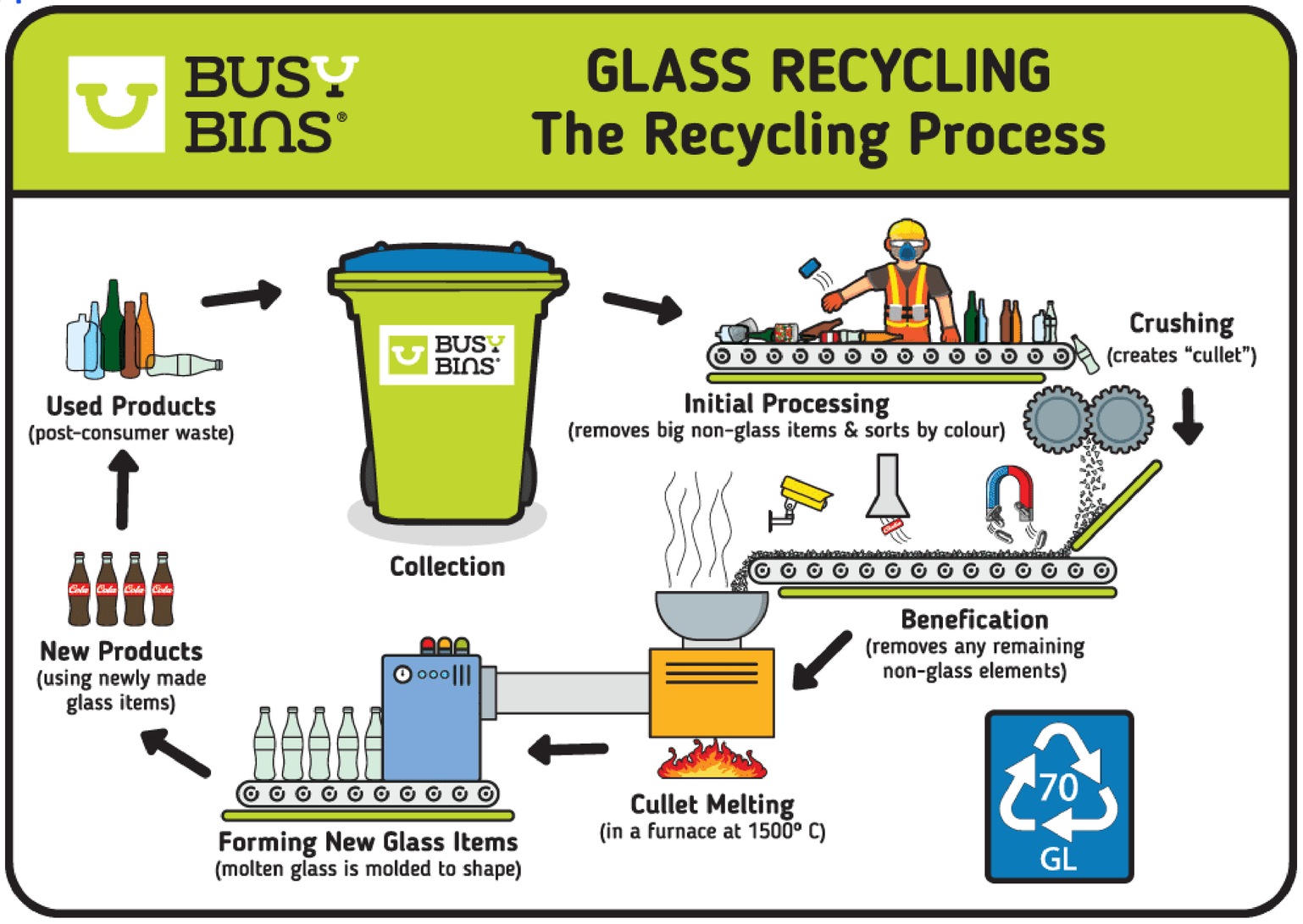
Paper and Cardboard



- Horizontal Baler – potential to export baled cardboard, white paper, newspaper, mixed paper. Need 200 tons per month to justify
  - Cost - 40,950 EUR (45,000 USD)
    - Good to also have weighbridge and money for material (13,000 EUR)

- Egg Carton Machine – potential for making local products with paper waste. Need 30 – 60 tons of waste per month to make sense.
  - Cost – 10,000 EUR plus civil works of around 5,000 EUR. (1,000 trays per hour and sun-drying)
    - Good to also have weighbridge and money for material (13,000 EUR)

Glass



Advantage

- Glass can be recycled over and over again.
- Less negative effects to wildlife compared with plastic.
- Saves lots of landfill space (glass takes 1 million years to breakdown)

Disadvantages

- High Capex and need for large buyers of products
- Big companies moving more into Plastic.
- Lowest value – competing with sand cost. 30 – 60 usd per ton. Cannot export or transport very far.
- High carbon footprint from transport.

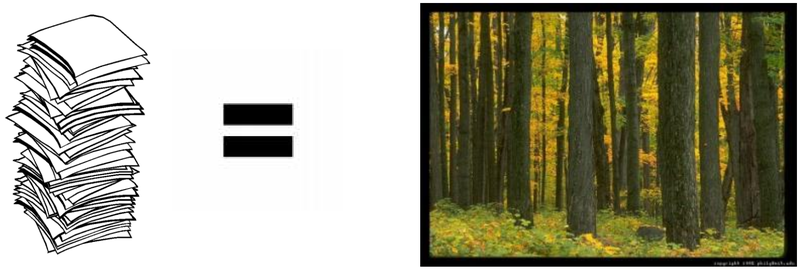
Glass

- Most sustainable is re-usable/washable glass that is used, returned and washed.
- Can be used over 10 times.
- Significantly smaller CO2 footprint than plastic or recycled glass.

Resource Recovery Saved by Recycling

Recycling just one plastic bottle saves enough energy to power a 60-watt light bulb for 3 hours, one can saves enough for 20 hours.

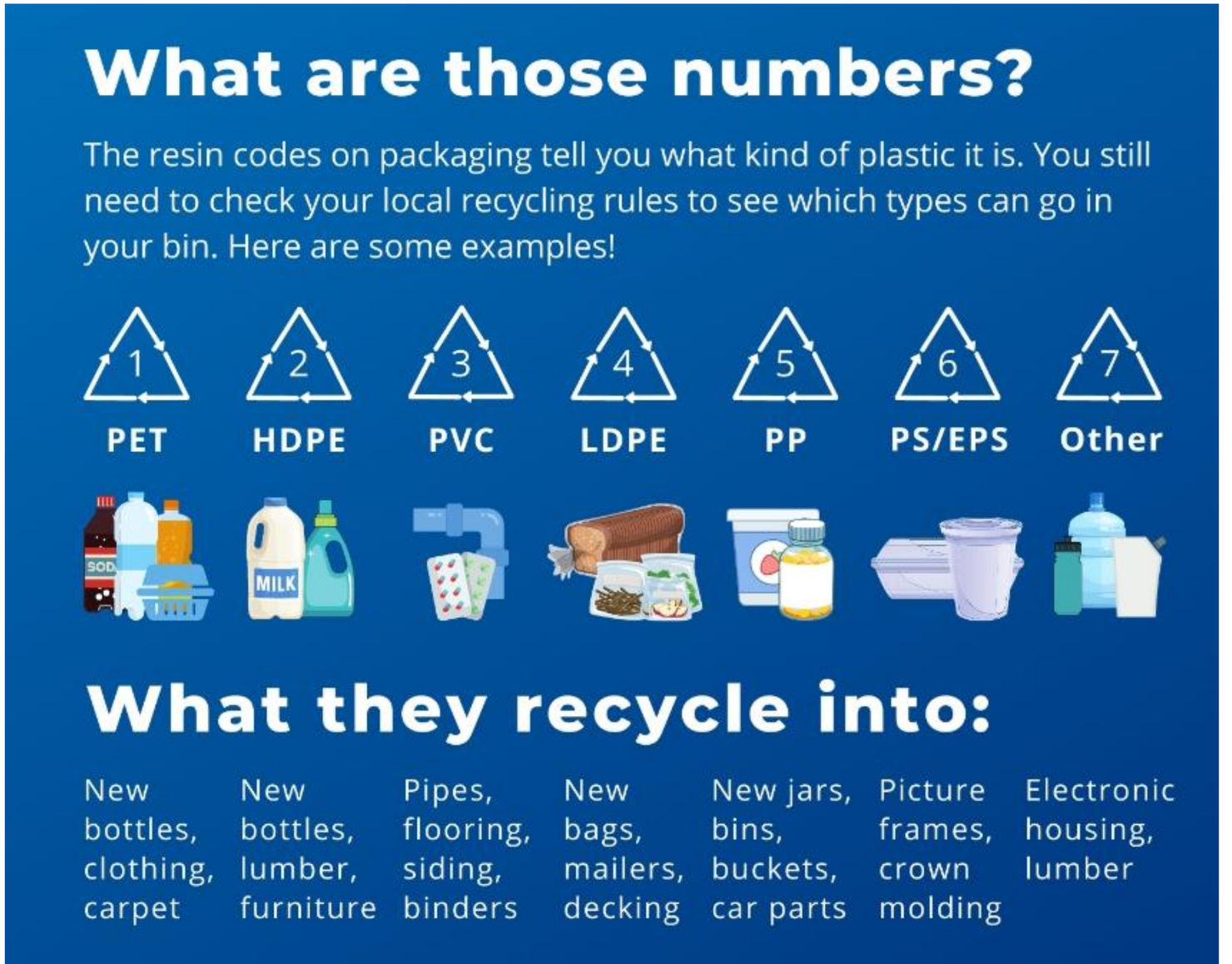
Recycling a ton of paper is equal to saving 17 trees



Recycling one bottle saves the equivalent amount of energy used to power a computer for 25 minutes

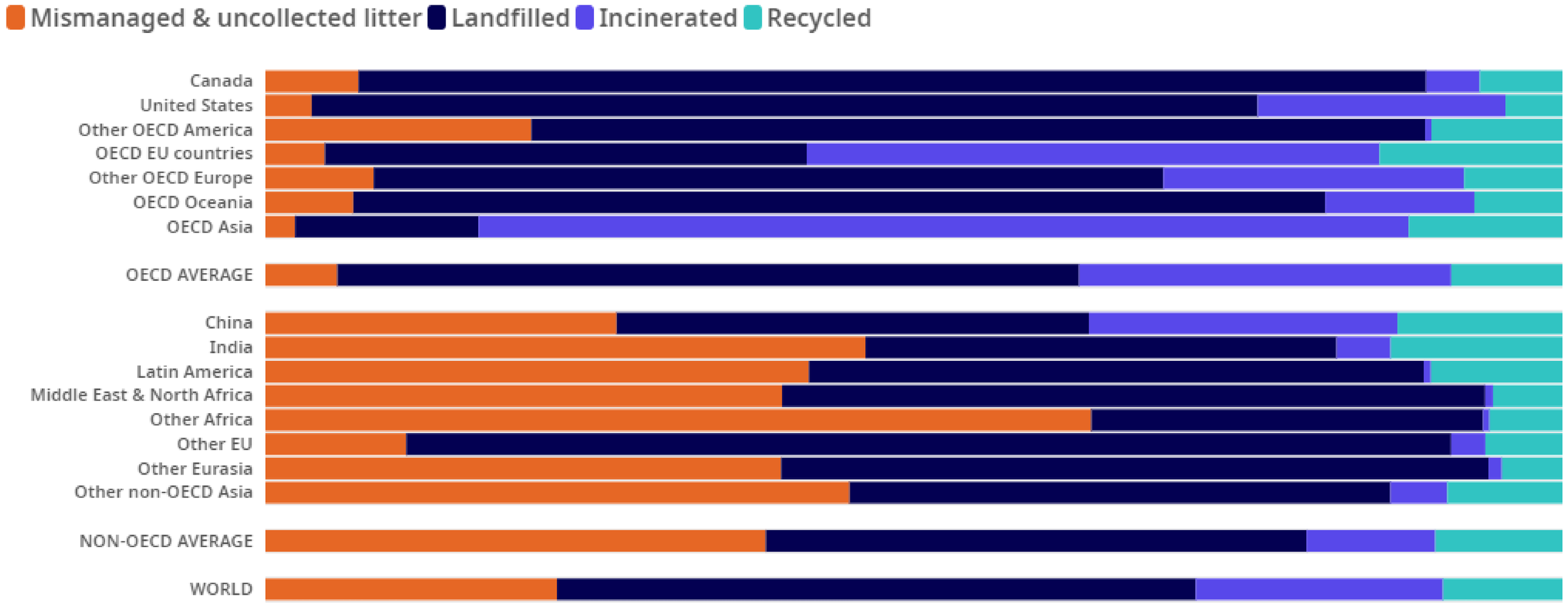
Plastic

- Plastic Recycling and the system is complex and misleading.
- Only a certain types of material are really recycled, even though the plastic industry claims otherwise.
- Plastic Recycling was created by oil and gas companies along with the carbon footprint to shift blame to the consumer



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.

- Technologies **must be adapted to local conditions**, providing job opportunities and being less mechanized and less costly.
- **Financing mechanisms needed** to involve the producers and retail to cover cost and reduce burden for population.

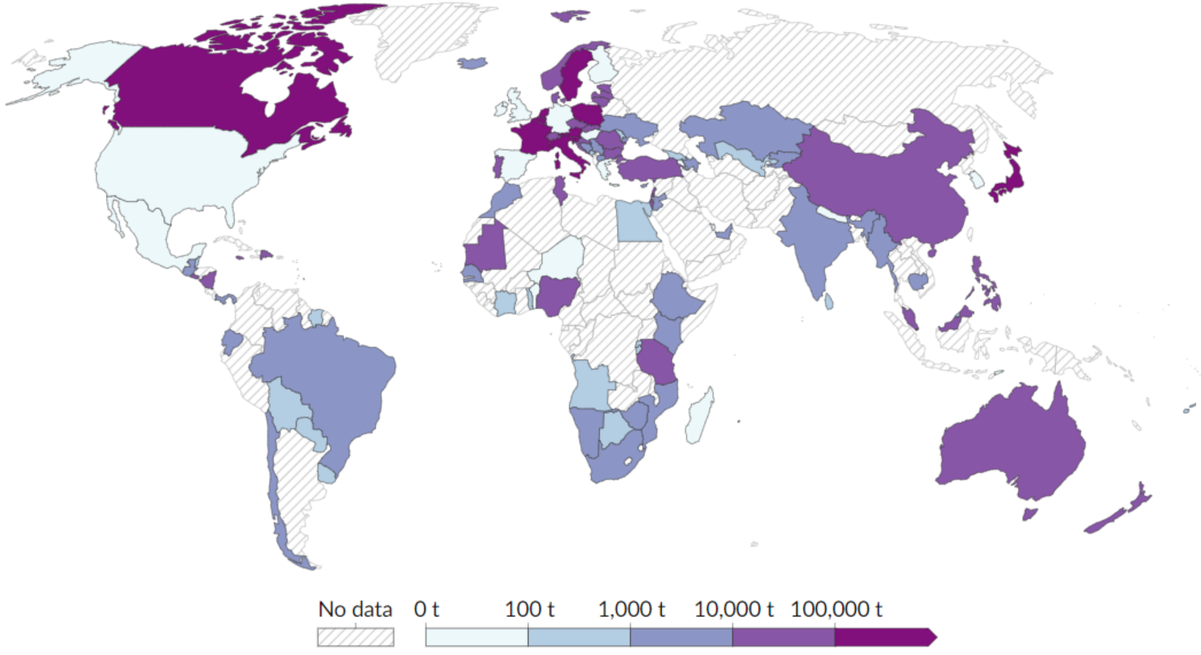
Opportunities and challenges

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

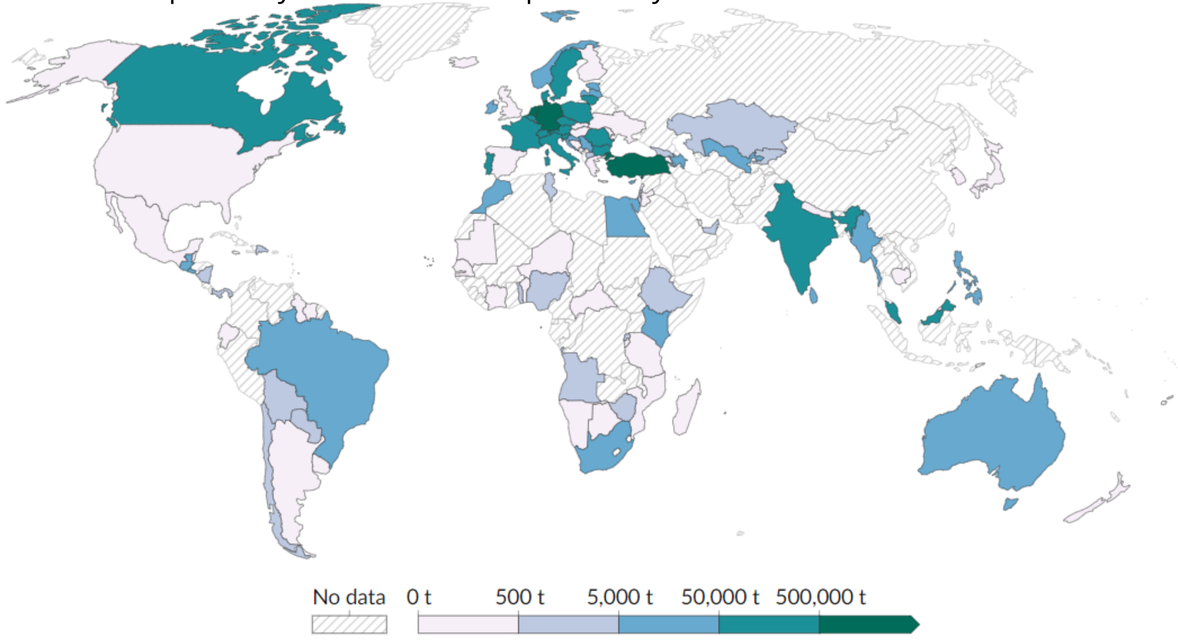
Plastic waste exported by all modes of transports in a year



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

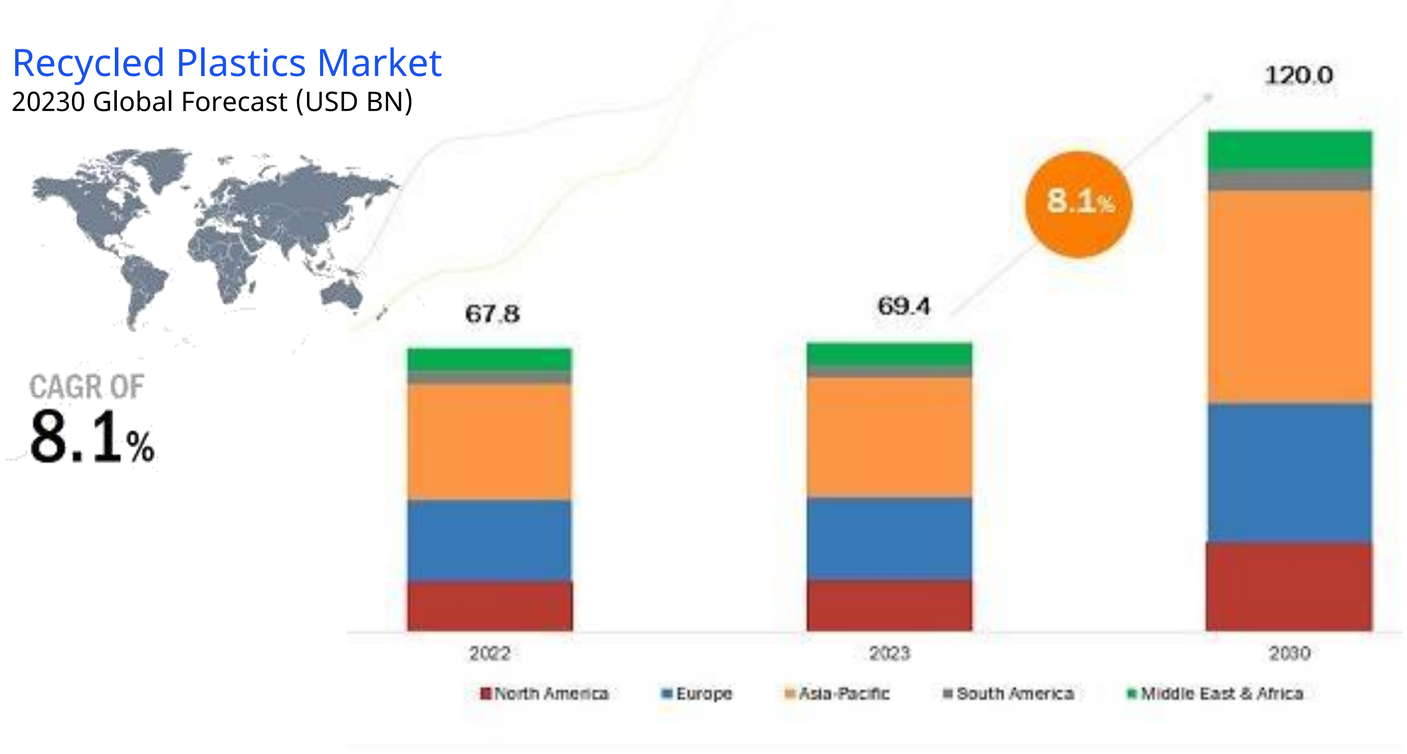
Positive

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.
- Plastic waste set to triple by 2060

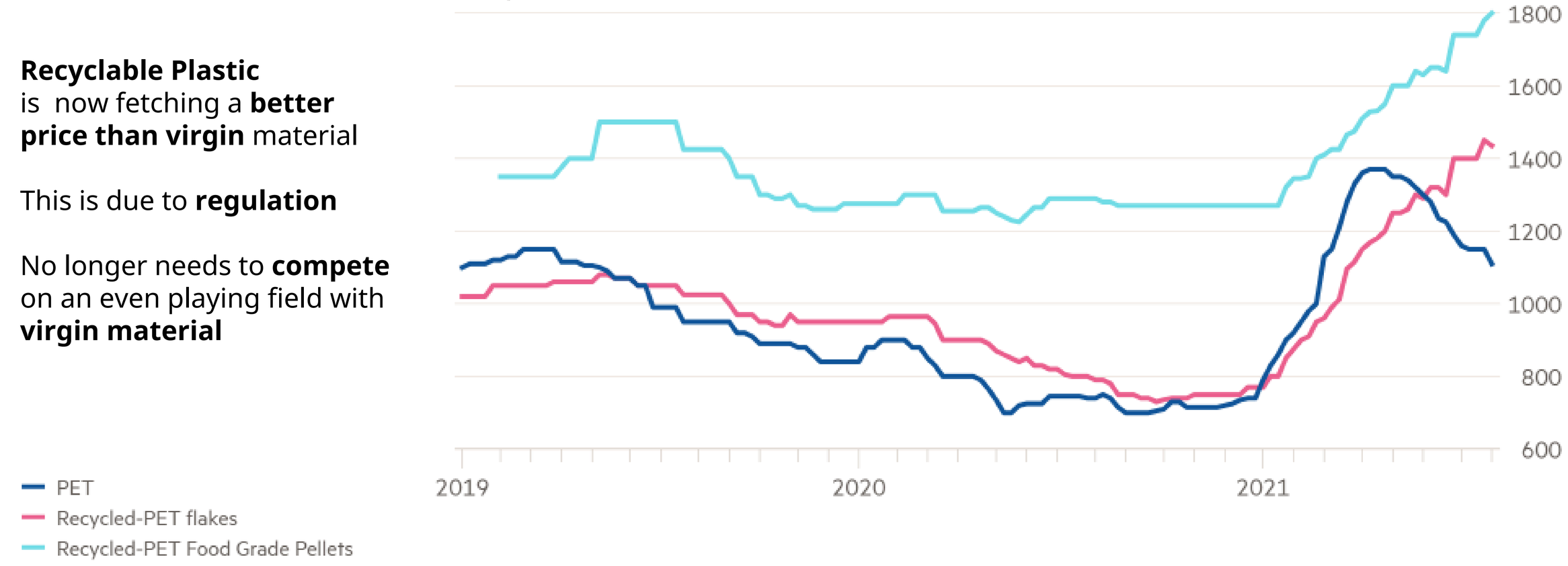


The global recycled plastics market is expected to be worth USD 120 Billon by 2023, growing a CAGR of 8.1% during the forecast period.

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**

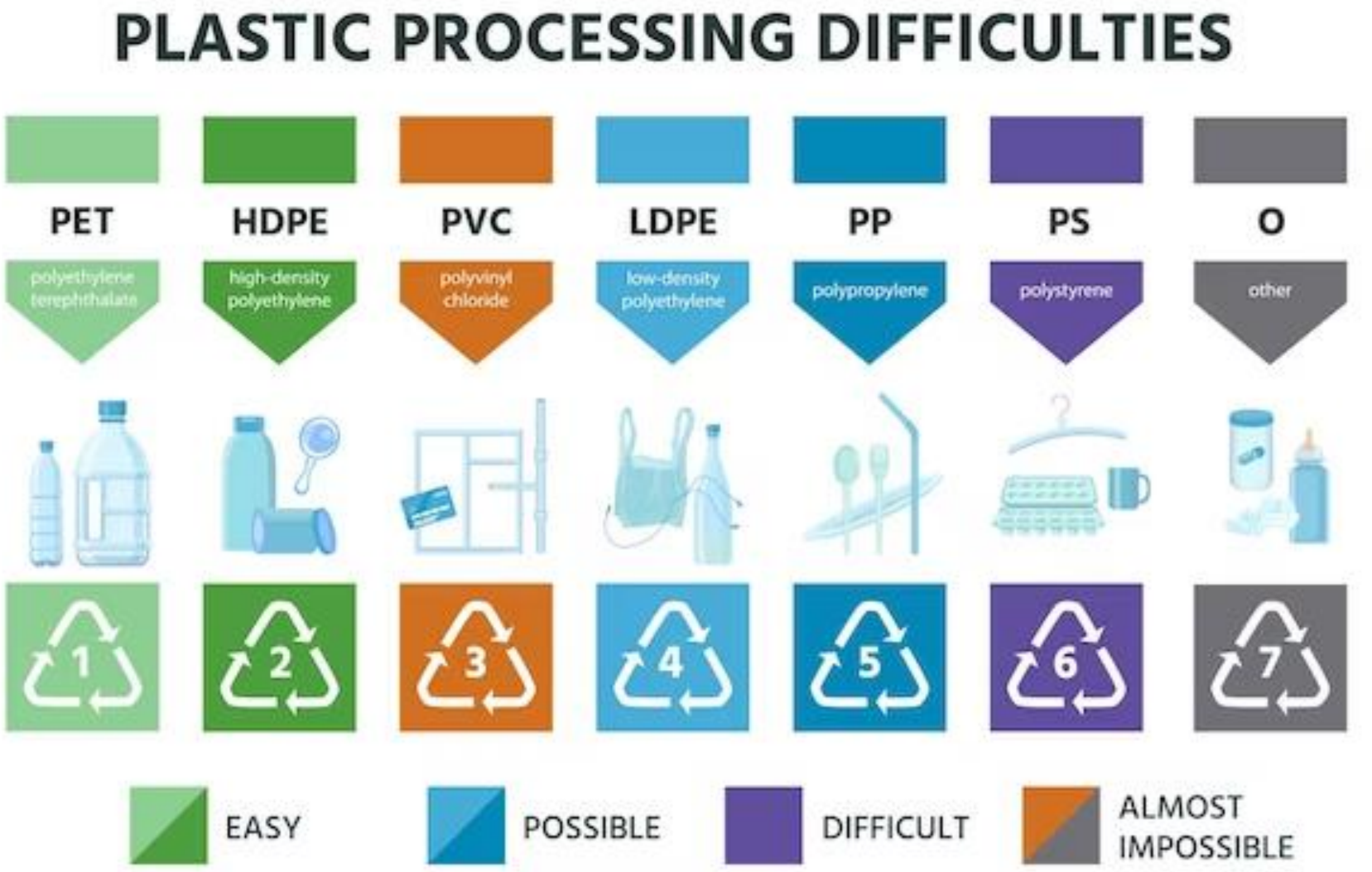
Recycled plastic prices overtake ‘virgin’ material
(€/tonne)



Source: S&P Global Platts. 2019-2022

Recyclable Plastic

- In terms of recycling some are easier than others – with some nearly impossible.
- Even if it is rated as PP or HDPE, it won't necessarily be recyclable.
- There is also material like chip bags that are plastic mixed with aluminum and are not recyclable.
- Only certain type of plastic should be recycled – as the effort and cost for others is too high.



Recyclable Plastic – Rigid vs Flexible

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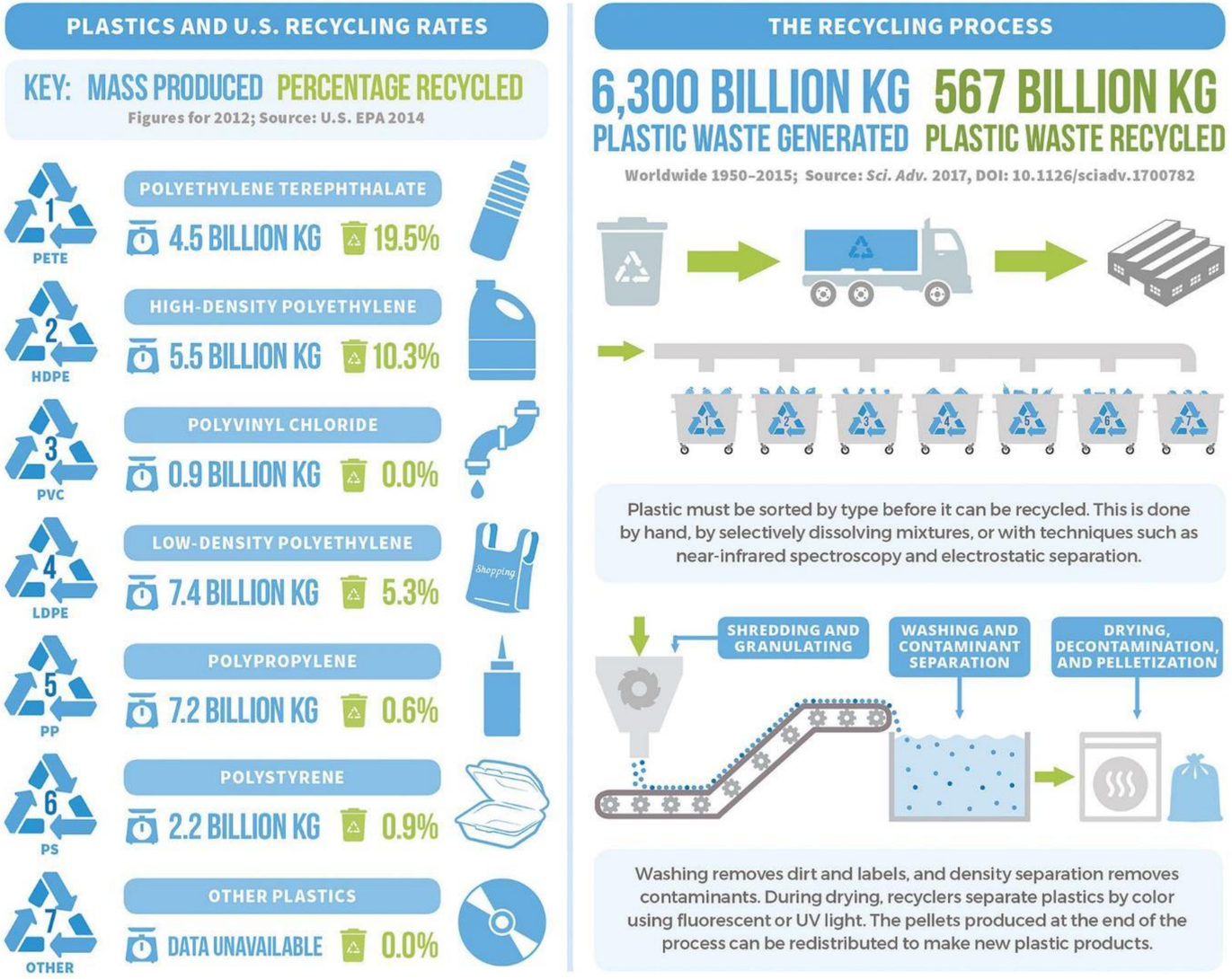
Recycling


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

Informal Recyclers

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 and transport cost reduction
  - Cost around 5,460 EUR (6,000 USD)

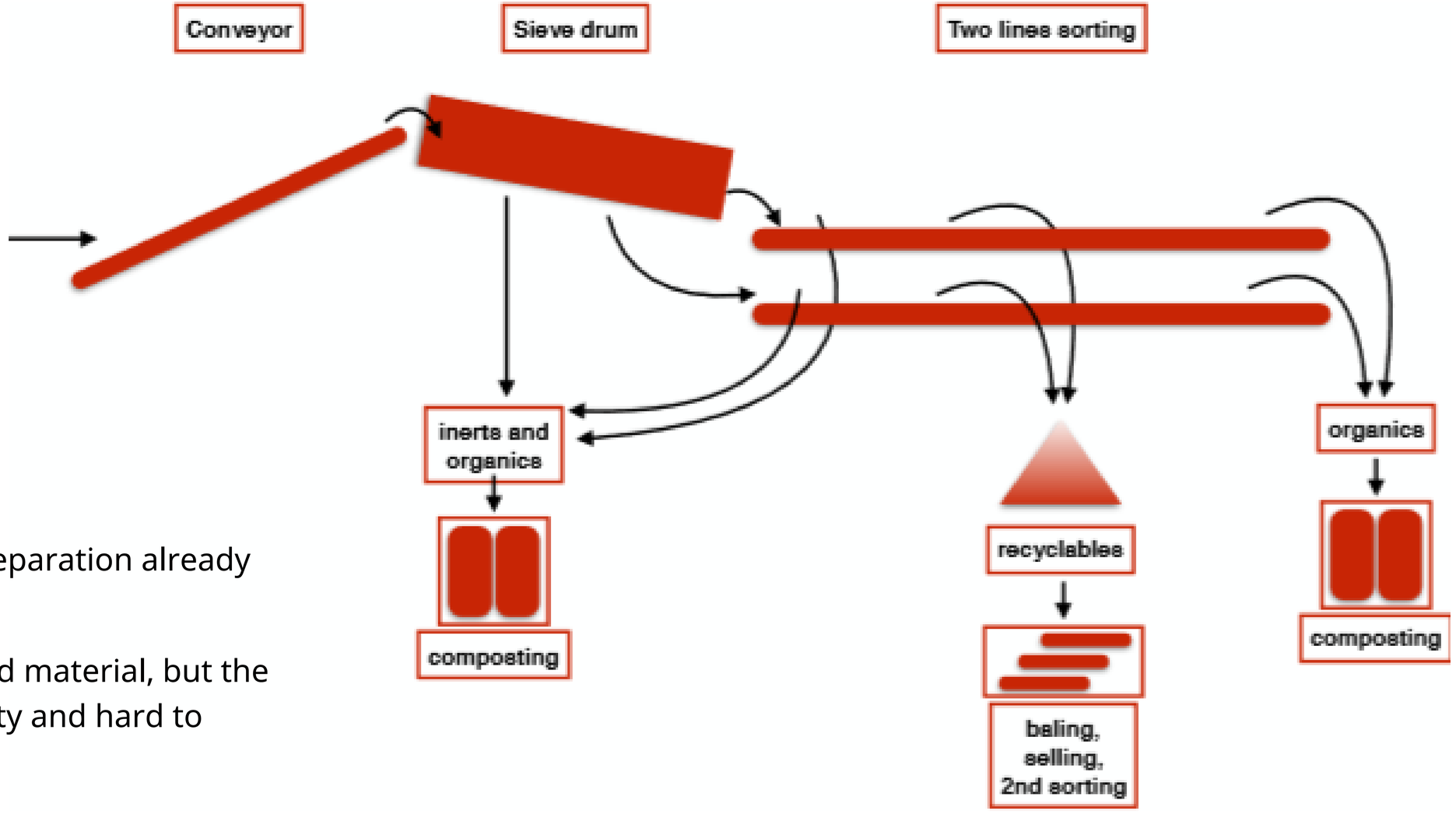
- Horizontal Baler – potential to export baled PET & LDPE
  - Cost - 40,950 EUR (45,000 USD)

Horizontal Baling Equipment

Vertical Baling Equipment

Plastic Crusher

Material Recovery Facility



- Dirty MRF vs MRF where separation already takes place
- You can receive dirty mixed material, but the recyclables will be very dirty and hard to recycle.

Material Recovery Facility

Household Segregation at Source

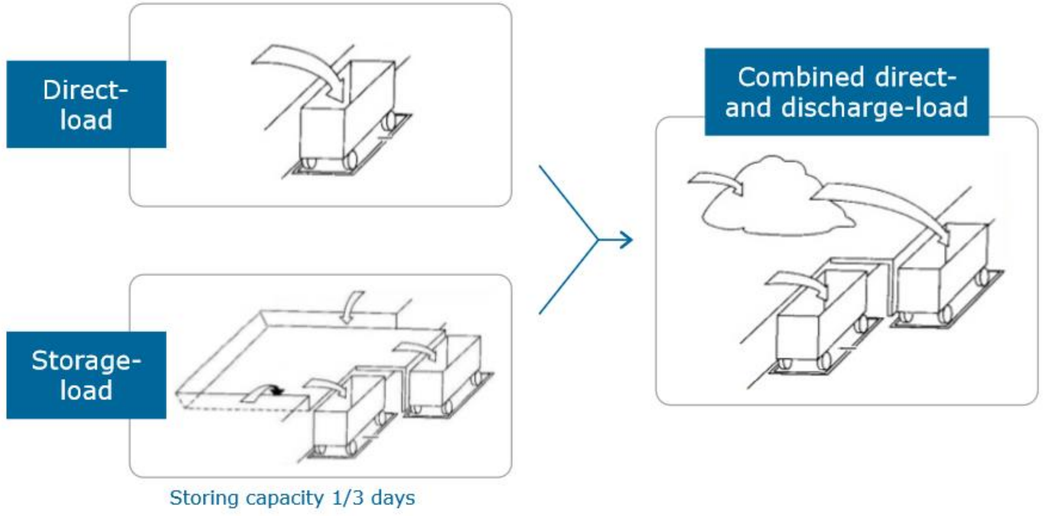
- Household segregation is incredibly challenging and expensive to implement.
- If you do, you need very good communication. It also costs extra to collect.

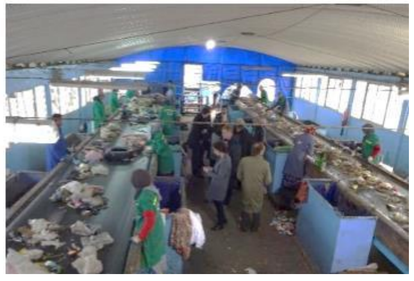
Household Segregation at Source

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

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

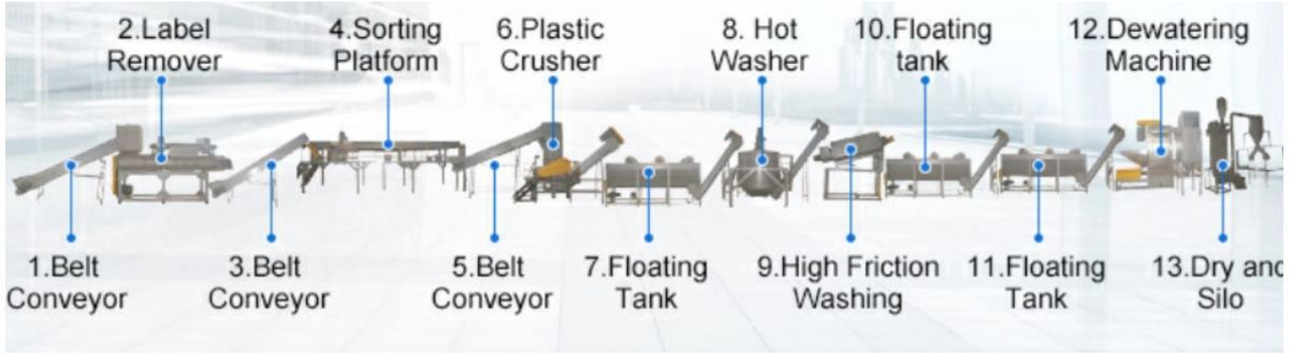
Faux Opportunities with Plastic

- 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 -



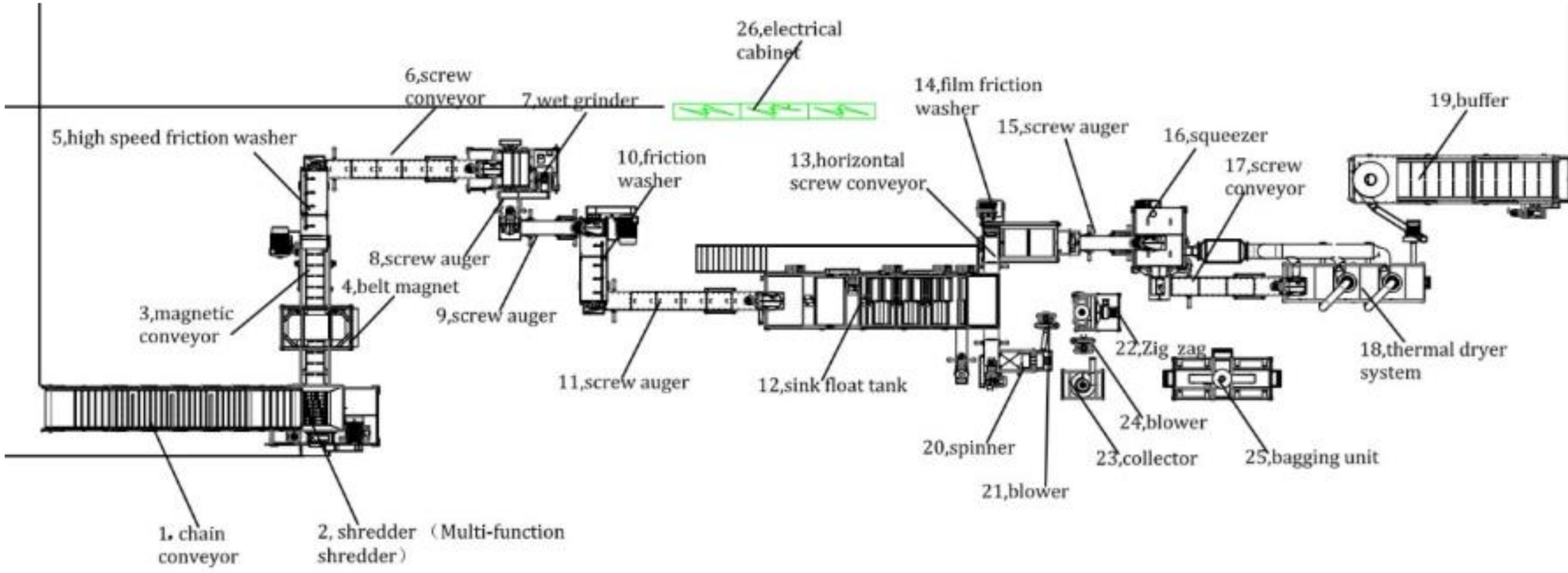
- CAPEX: €255,000 EUR
- OPEX: €38,250 EUR per month
- Cost of Material: €38,250 EUR
- Revenue: €93,500 EUR per month

- 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



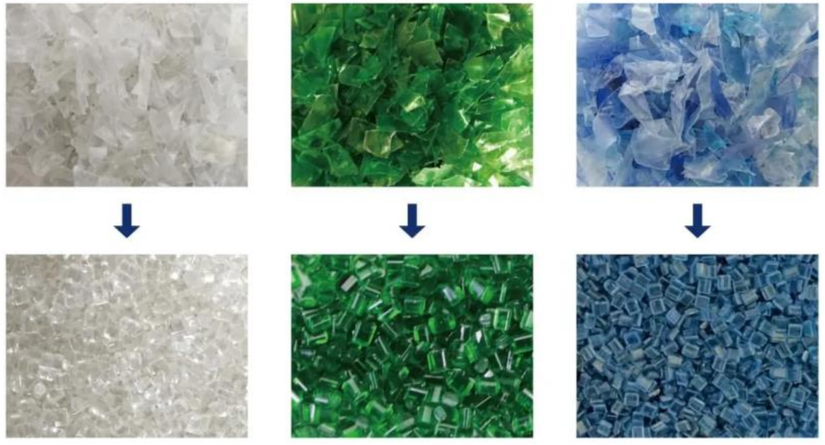
- CAPEX: €425,000 EUR
- OPEX: €34,000 EUR per month
- Cost of Material: €29,750 EUR
- Revenue: €85,000 EUR per month

- 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

- To make refuse derived fuel usually just need a crusher. This depends on the feeding mechanism of the cement kiln, but most cement kilns cannot take material bigger than 10cm.
- This is where most of the waste in Europe goes for “recycling”
- Cement companies are focusing on this more and more – to reduce cost and have ‘sustainable fuel’

Co-Processing / RDF – Cement Plants

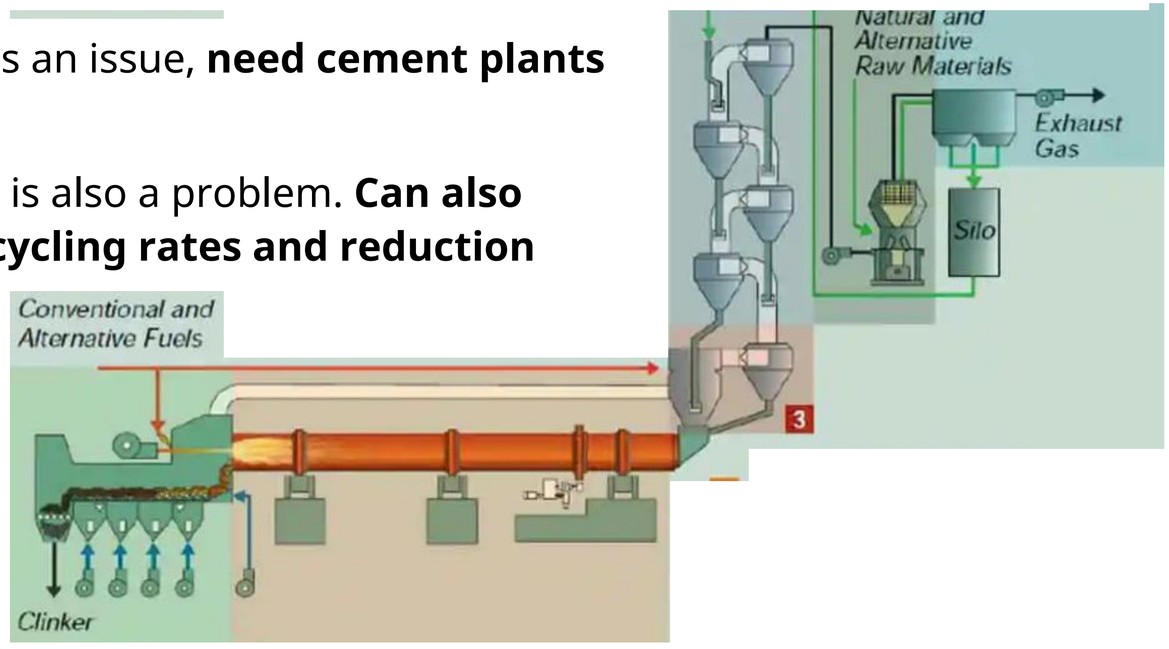
RDF: Refuse Derived Fuel

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.
- **Cement kilns operate at temperatures up to 1,450°C**, which is high enough to break down most hazardous compounds in waste, including organic pollutants. This ensures the complete destruction of harmful substances, such as dioxins and furans.

Negative

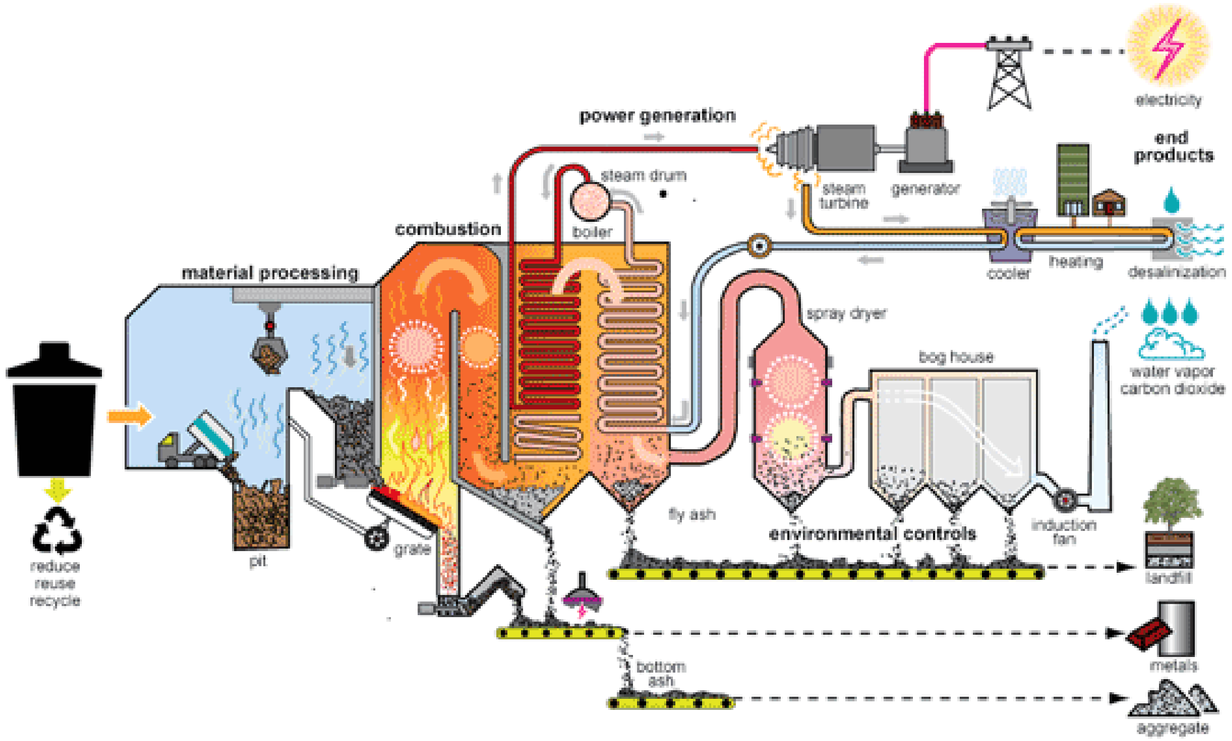
- **Waste to Fuel is not Recycling**.
- **Competing against Coal** – very cheap – can be even 30 – 50 USD per ton plus transport.
- **Material needs to be relatively dry** and often **shredded** depending on the feeding system.
- Transport is an issue, **need cement plants nearby**.
- PVC plastic is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



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

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Q&A

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).)

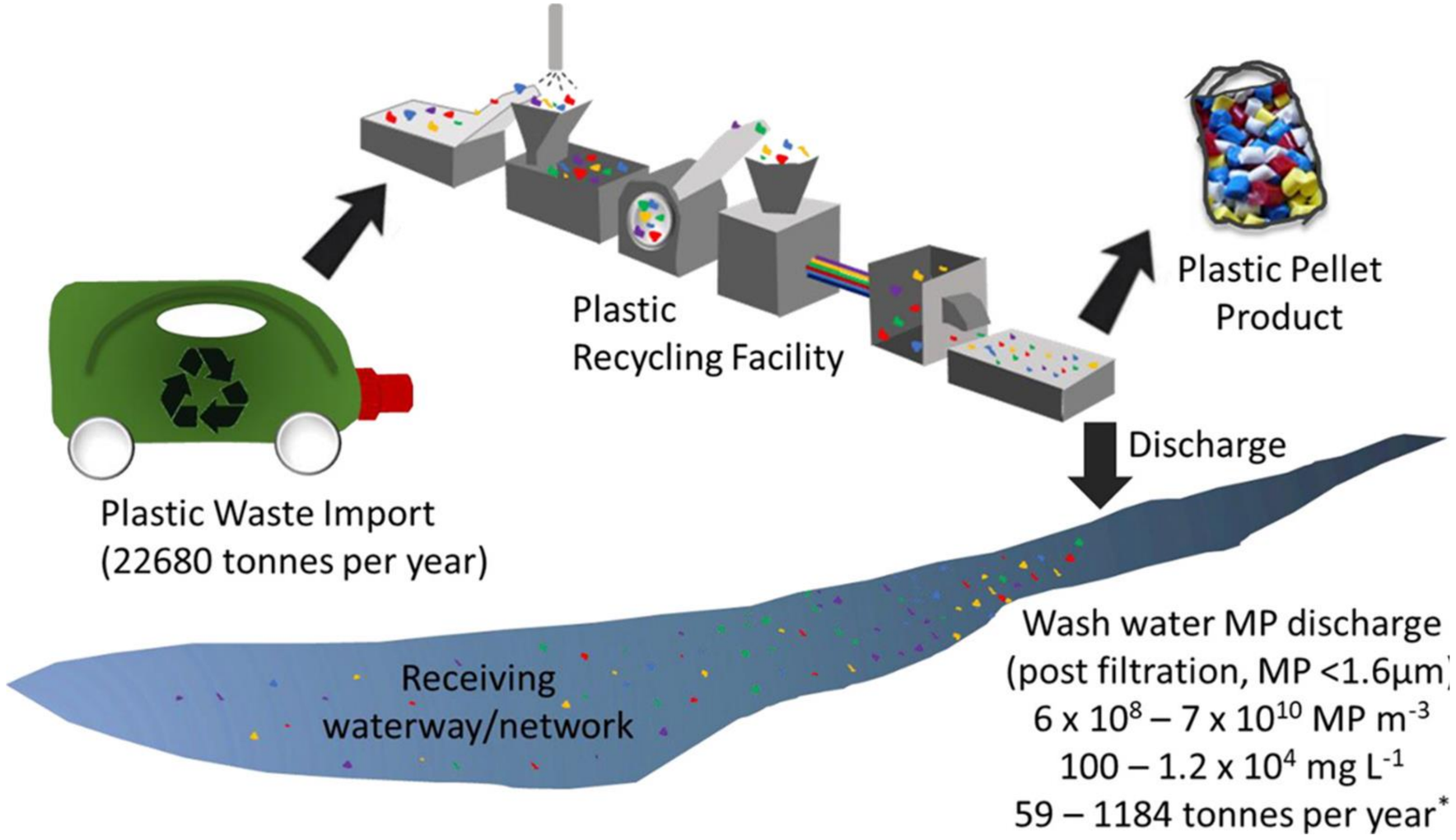
Plastic Waste Policies and Future Development

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



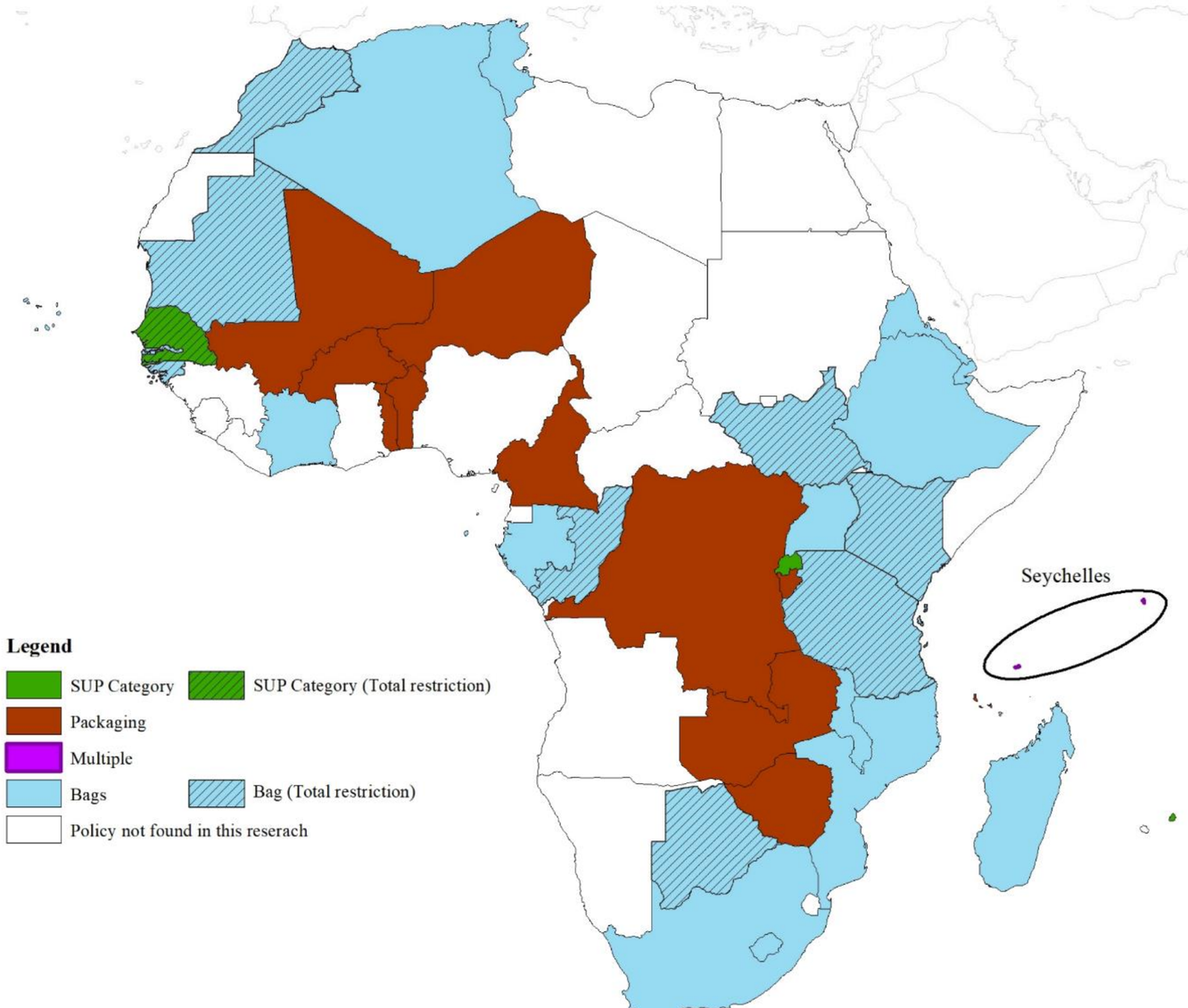
Plastic Waste Policies and Future Development

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

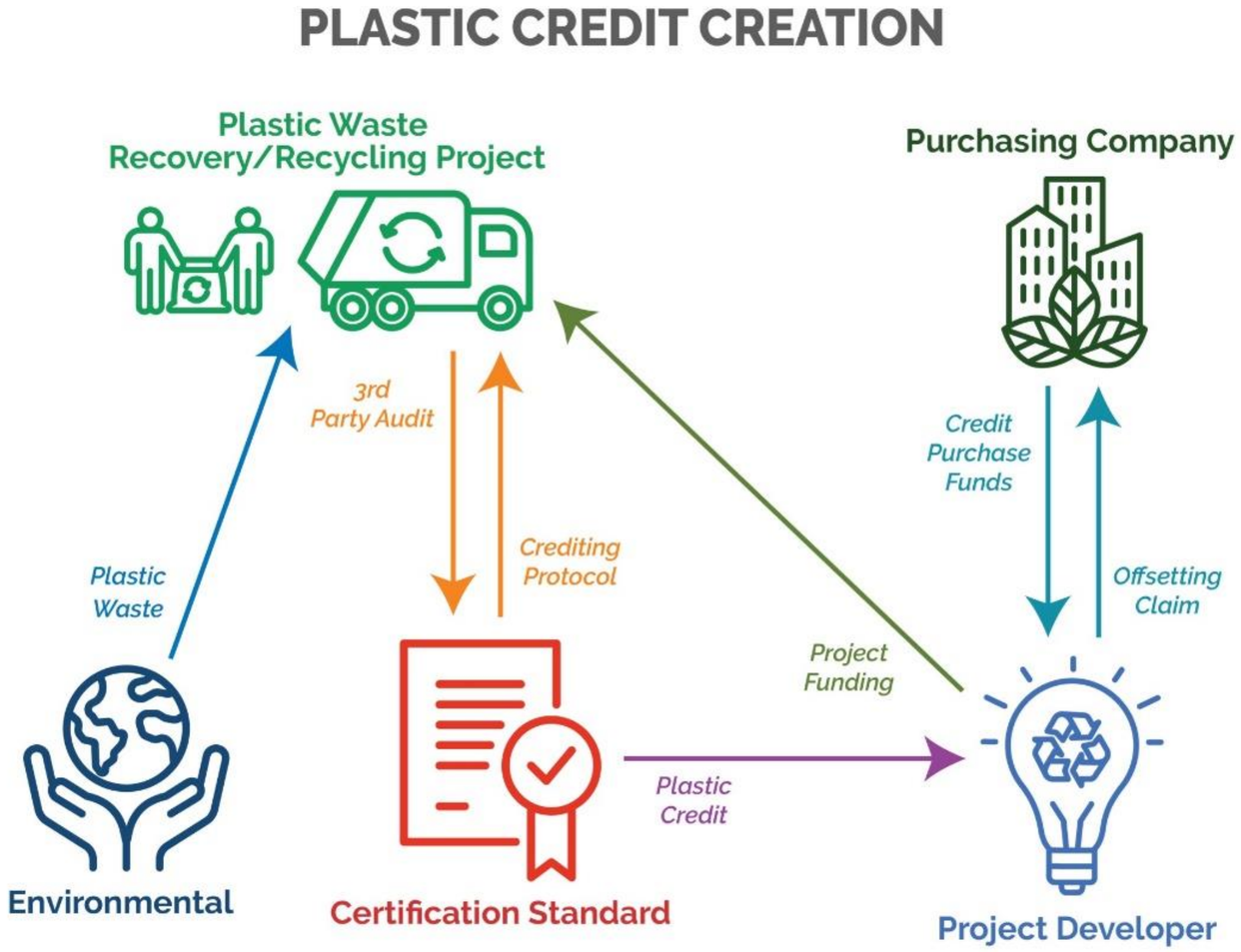
Policy: scale of bans, step by step

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

The Recycler
Waste Management and Recycling

Tanzania Breweries Limited
Recycling Report

Glass
= 5,000 bottles recycled

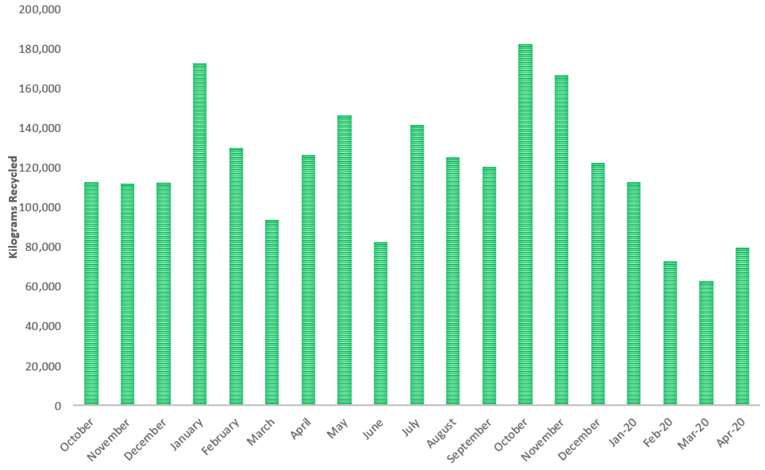
124,321 bottles
(69,620 kilograms)

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*

Recyclables – majority locally processed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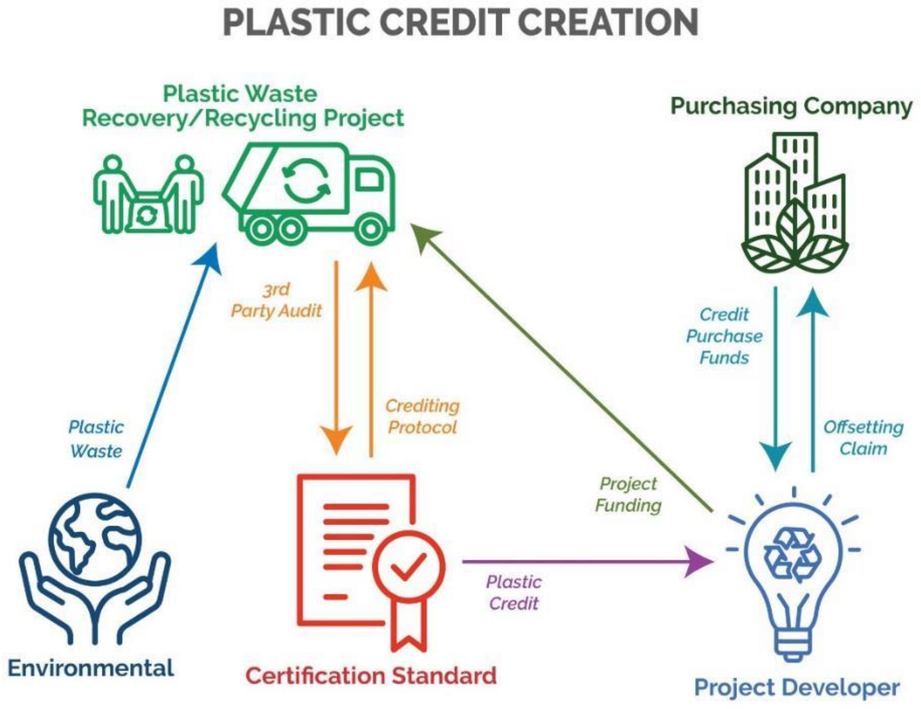
The Recycler – Plastic Credits

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

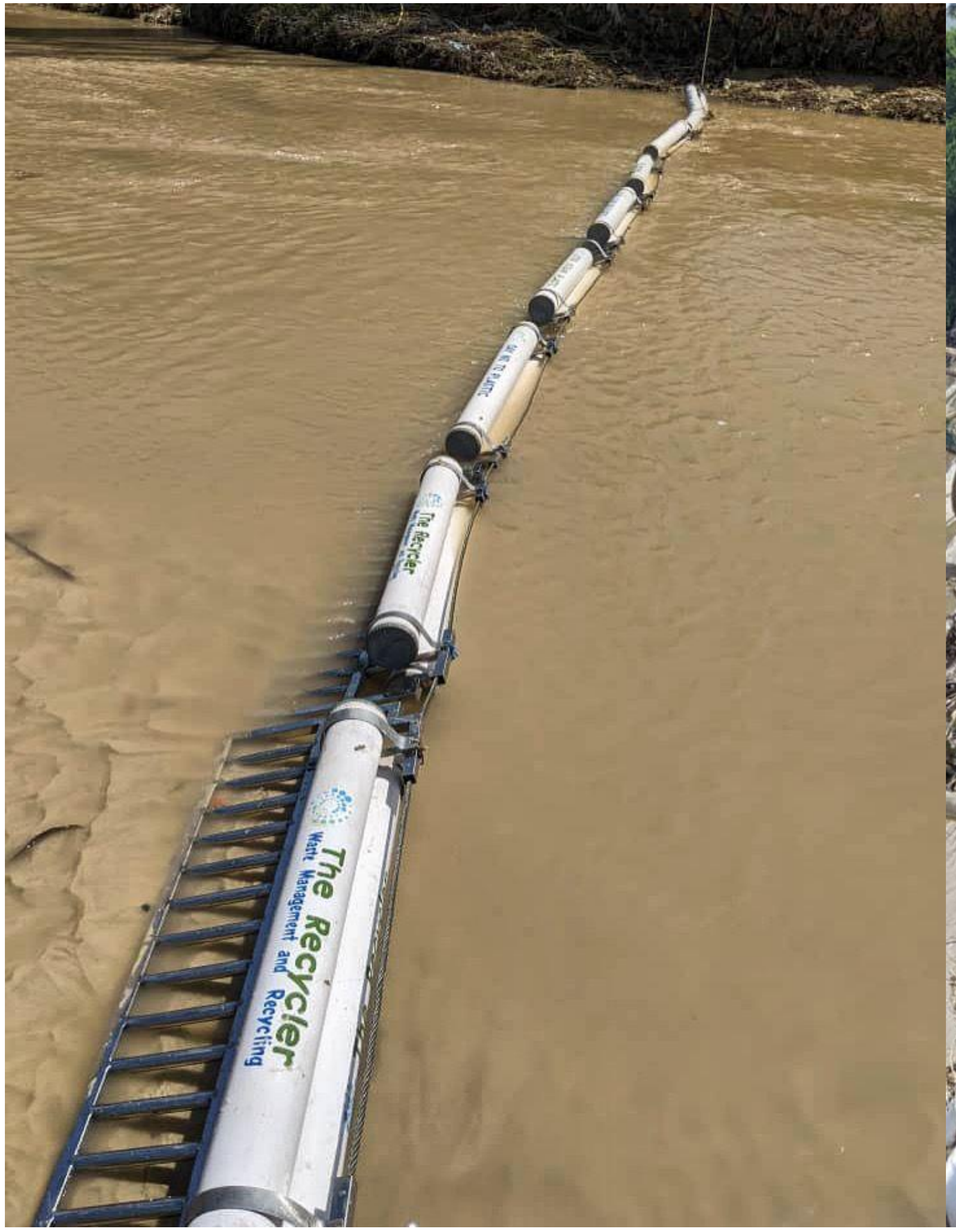


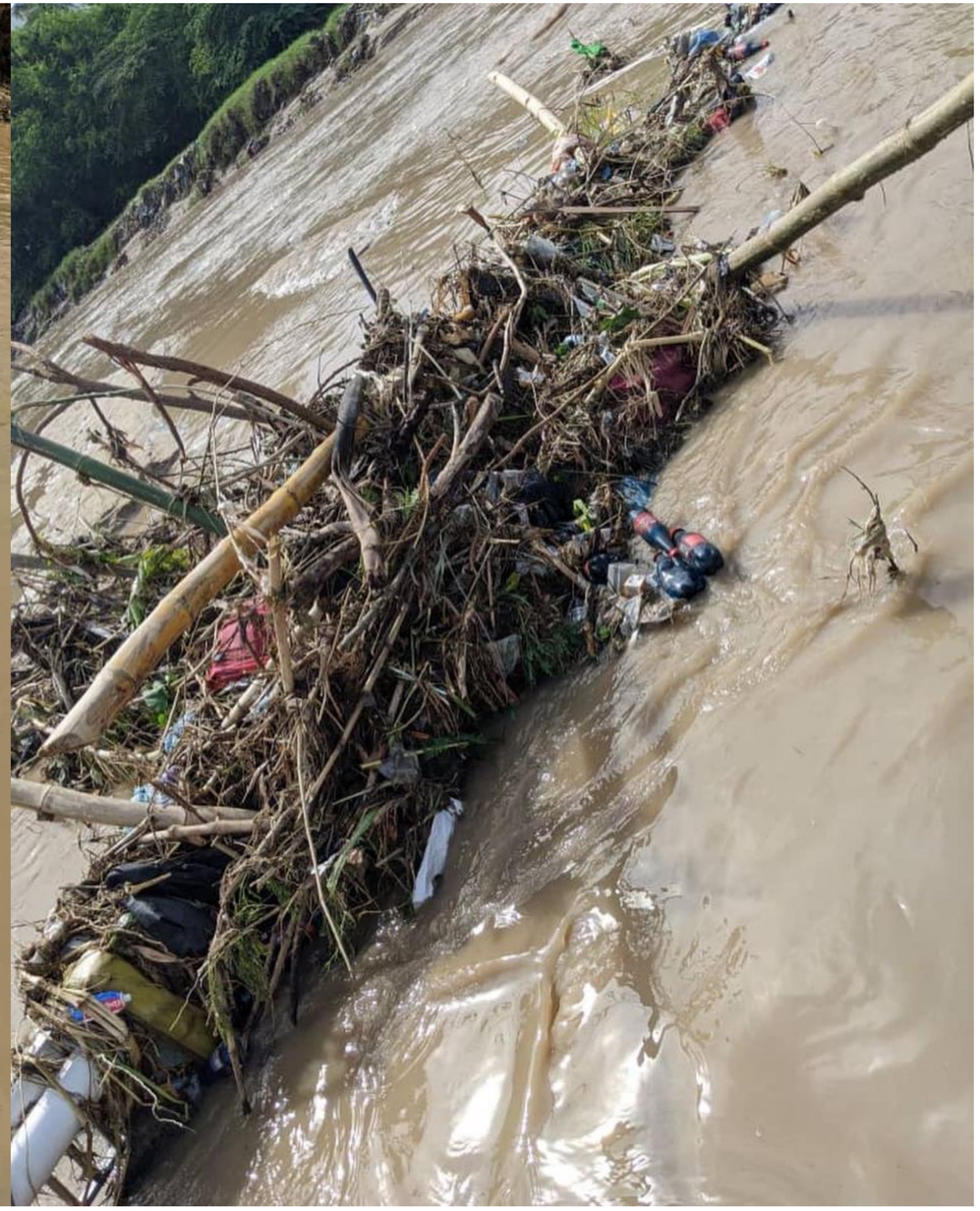
The Recycler
Waste Management and Recycling

Beaches

The Recycler
Waste Management and Recycling

Rivers Traps





Rivers Traps

BioBuu

- BioBuu has managed Mabwepande Compost Facility – built on carbon credits to offset the city of Hamburg
- BioBuu expanded to build second facility registering their own carbon credits and building out animal feed facility
- BioBuu’s facility in Kenya failed due to issues around pre-consumer waste availability which was needed for export.

Global Gateway

Q & A Session

Management and recovery of key materials.

Dear Participants

- Please present yourself, the company or institution where you work.
- Ask your question to the experts.

Raise your hand, introduce yourself and ask your question if you are participating in person.

Introduce yourself and ask your question in the chat if you are participating on-line.

Global Gateway

Thank you!

Please give us your opinion on the training
SWM in Zambia: Organics recovery, and key materials management and recycling.

Use the QR code or link: https://forms.office.com/r/hPaNk2S5jt

SWM Webinar in Zambia: Organics recovery, and key materials management and recycling.

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.
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