# WASTE SEGREGATION

## INSPIRATIONAL GUIDE FOR SOURCE SEGREGATED WASTE STREAMS

An initiative supported by Norad managed by IUCN and co-implemented by Searious Business

# ACKNOWLEDGMENTS

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# AUTHORSHIP

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# GOAL

WASTE MANAGEMENT SOLUTIONS FOR SIDS

## Purpose of this inspiration guide

- Show innovative, low tech recycling examples for source segregated waste streams that are well suited for island economies:
  - Organics
  - Sanitation and hygienic items;
  - Tyres (rubber)
- Focus on circular solutions
- Focus on unlocking the value of waste

## Why?

- Source segregated waste streams are easier to recycle
- Achieve a cleaner plastic waste stream for more efficient processing
- Optimising waste management creates economic opportunities on SIDS

Don’t mix what you can’t fix

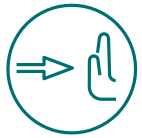
# SUCCESS FACTORS & CONSIDERATIONS

FOR PROCESSING WASTE STREAMS ON SIDS

- Circular solution
- Turns trash into cash: creates a product with an existing local market
- Enables island self reliance/autonomy
- Creates island employment opportunity
- Scalable/replicable
- Behavioural changes
- Speed of processing waste
- Space needed
- Costs and Return on investment

# KEEP MATERIALS IN THE LOOP

## HIERARCHY OF ACTIONS



### Refuse
- Ban/say no to unnecessary items, and hazardous/toxic materials
- Eliminate non-renewable/recyclable materials without a market value

### Reduce
- Minimise the quantity
- Use renewable (within 1 year), and recycled content

### Reuse
- Clean, reuse, repair, refurbish, remanufacture, repurpose products

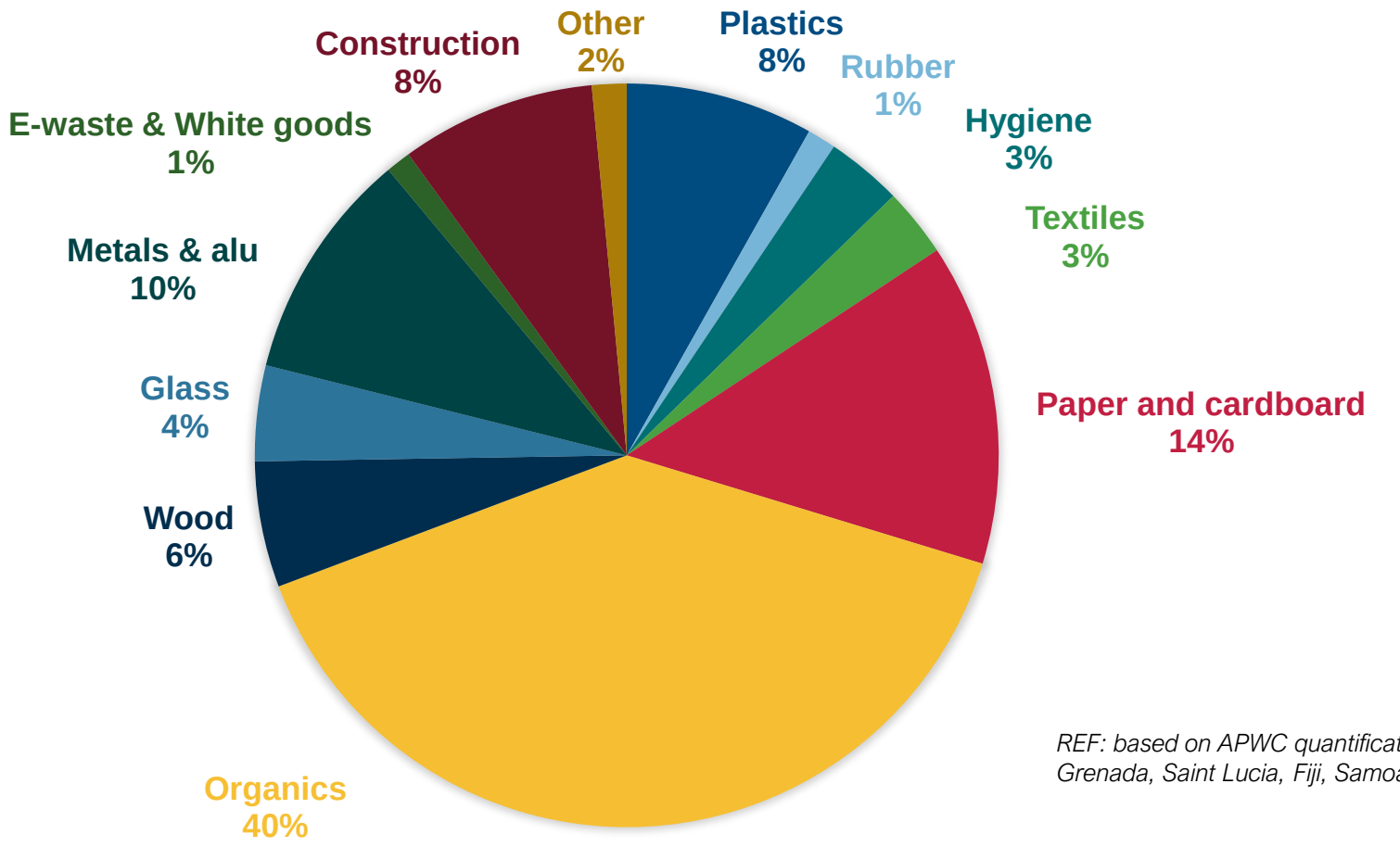
### Recycle
- Collect waste streams separately and recover high quality material e.g. plastics with a positive market value
- Includes mechanical and bio/chemical recycling. Mechanical recycling is priority

### Recover Energy
- Incinerate non-recyclable waste for energy production e.g. bio-gas converter

### Responsible Disposal
- Waste which can’t be processed is collected for disposal in a managed landfill

# PRIORITY WASTE STREAMS

AVERAGE WASTE COMPOSITION IN % ACROSS PLASTIC WASTE FREE ISLANDS' SIDS, T/YR




*REF: based on APWC quantification data Antigua & Barbuda, Grenada, Saint Lucia, Fiji, Samoa, Vanuatu, 2021*

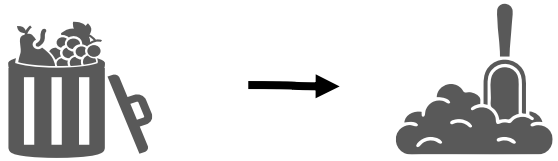
# ORGANIC WASTE (1)

BEST PRACTICES

Up to 40% of waste on SIDS is organic waste. 88% is household waste, remainder is market waste, agricultural waste, food waste from restaurants

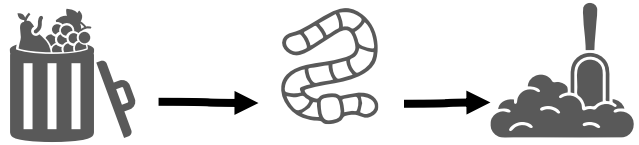
## Compost heap

Kitchen and garden waste biodegrades naturally in a compost heap. Needs a mix of soft green and hard woody material to work effectively. Not suitable for meat, fish, bones or fat.



## Vermiculture

Worms convert organic waste to rich compost. Worms can also be used as high quality animal feed. Suitable for kitchen and soft garden waste. Not suitable for meat, fish, bones, fats, citrus fruit, raw garlic and raw onions.



# VERMICULTURE

## WHAT DO YOU NEED FOR A WORM FARM?

1. Bedding- various materials can be used including straw, newspaper, leaves, corn cobs and stalks
2. Food source: organic material
3. Moisture (50% by weight) – Worms need moisture to breathe so bedding must be able to hold sufficient moisture
4. Aeration choose bedding correctly so that it does not pack too densely. No need to turn the bedding.
5. Protection from extreme temperature worms can be grow outdoors all year round. Worms survive as low as 0ºC but thrive between 15ºC and 20ºC. Max temperature 35ºC
6. Space to build the vermicomposting system which can be windrows, beds, bins or flow-through reactors. The systems are either batch or continuous flow

100-1500kg per day

24hrs in machine

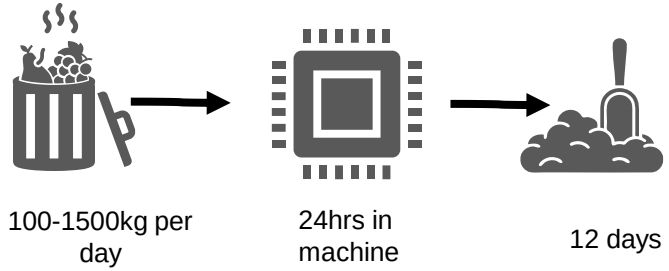
12 days

# ORGANIC WASTE (2)

## BEST PRACTICES

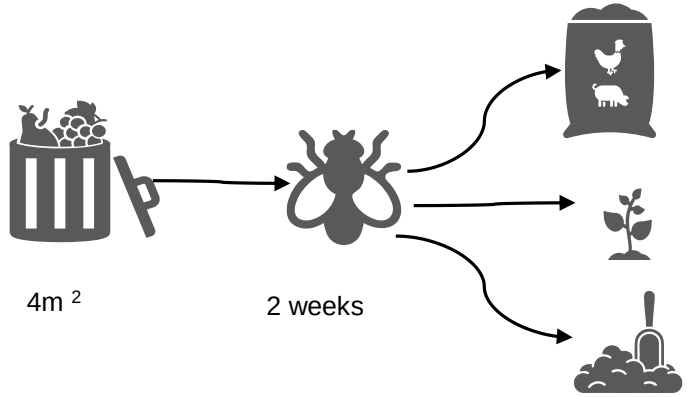
### Organic Waste Converter

Machine which converts organic waste to compost within 2 weeks. Specifically interesting for markets, community-level, hotels, canteens, restaurants, schools

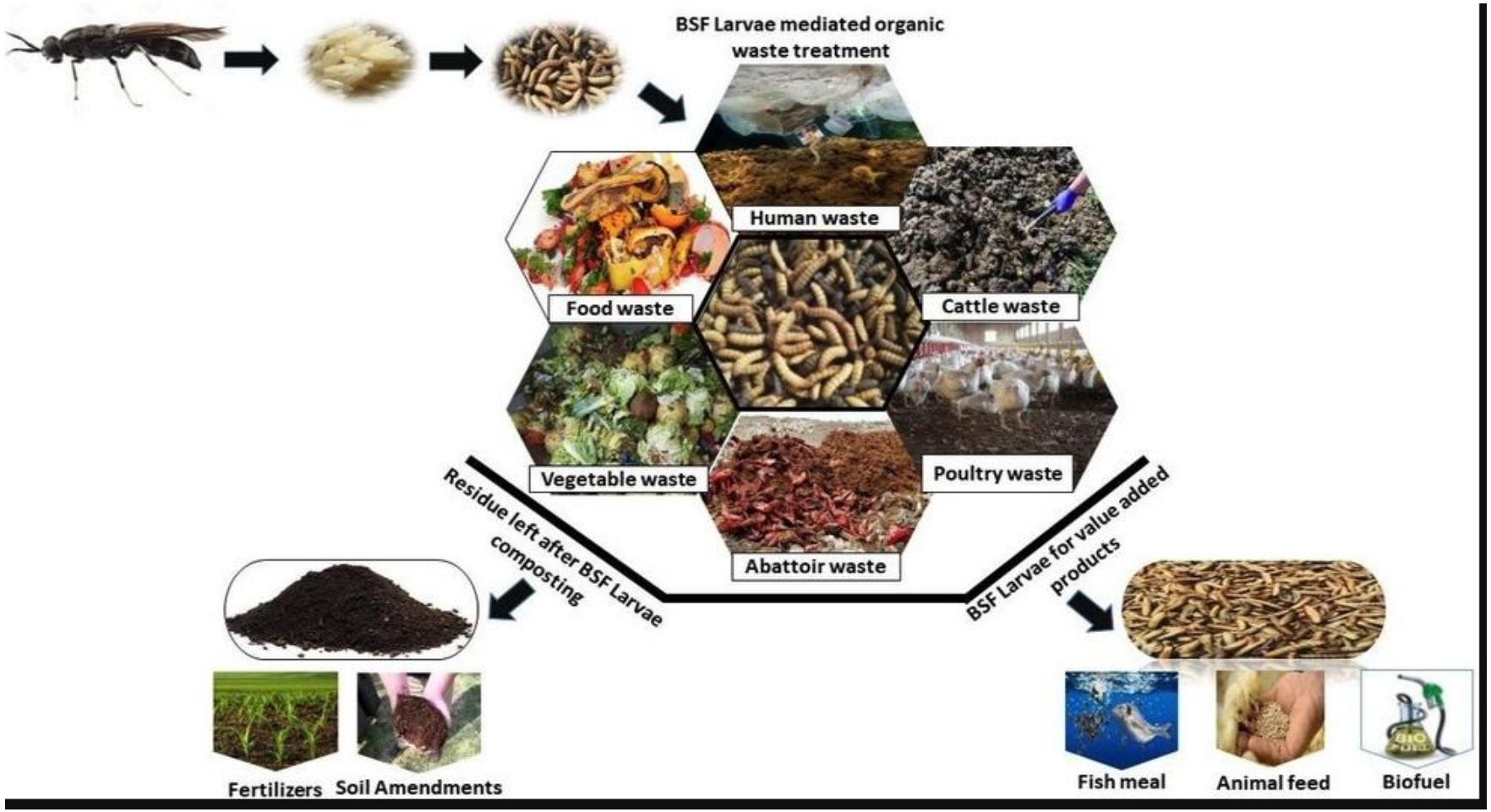



### Black Soldier Fly Larvae Farms

Low-tech DIY kit to farm black soldier fly larvae. The larvae eat all kinds of organic waste, and generate valuable compost



# BLACK SOLDIER FLY LARVAE FARM



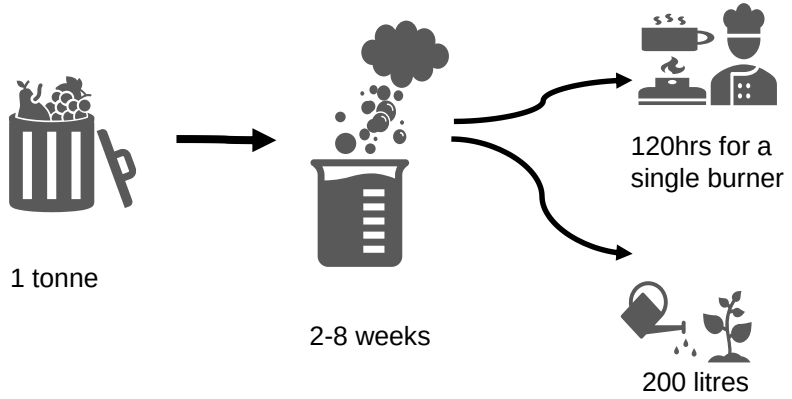

# ORGANIC WASTE (3)

## BEST PRACTICES

### Anaerobic digester

Organic waste biodegrades under anaerobic conditions using bacteria from manure. Produces biogas & liquid fertilizer. Not suitable for meat, fish, oil or fat.

NB!! Burning methane contributes to climate change but is less harmful than methane emitted from landfill. Ensure controlled conditions using a sealed, oxygen-free tank.



# SPECIFIC ORGANIC WASTE TYPE SOLUTIONS (1)

## ALTERNATIVES TO PLASTIC

**Waste Banana trunks** can be turned into beautiful veneers for surfaces and walls

**Banana tree leaves** for reusable bags, customisable cups, takeaway containers, gift boxes etc

**Coconut husks** turned to coir fibre for ropes, doormats, mattresses, carpets, insulation, and cocopeat for growing plants

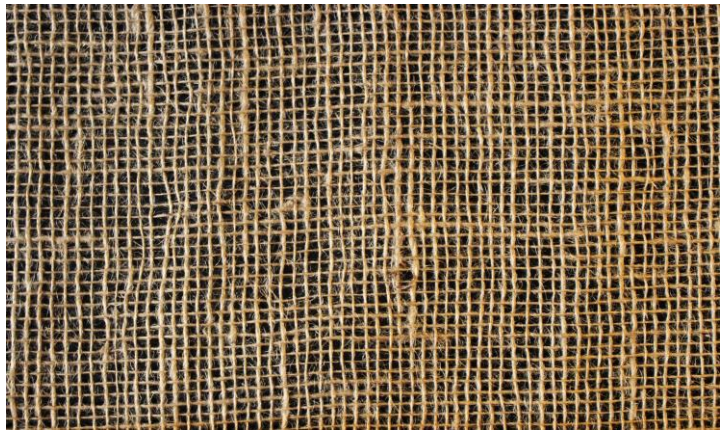
NB: Substitutes for plastic can be categorized into: A) Traditional materials are based on naturally occurring polymers of plant and animal origin as well as non-renewable mineral substances found in nature; B) bio-based polymers are derived from natural polymers, but undergo extensive physical, chemical and abiotic transformations. Many bio-based polymers are only compostable under specific industrial composting conditions and, for this reason, may not be a solution in places where such facilities are few or non-existent, particularly in developing countries. Read more: https://unctad.org/system/files/official-document/ditctedinf2021d5_en.pdf

# SPECIFIC ORGANIC WASTE TYPE SOLUTIONS (2)

ALTERNATIVES TO PLASTIC

**Waste Palm leaves** for weaved reusable bags (e.g. 300 coconut bag, Vanuatu) and Harakeke (Flax) woven casket

**Fish waste** for producing compostable packaging, i.e. MarinaTex. Related innovations include packaging made from seaweed, algae, agar-agar



**JACKS fibres,** any natural fibres and value-added plastic replacing products like bags, particularly jute, abaca, coir, kenaf and sisal (JACKS fibres) are produced and exported by several developing countries thereby benefiting smallholder farmers and reducing plastic waste

# DIAPER AND HYGIENIC WASTE (1)

## BEST PRACTICES

### Toilet / ‘potty’ training

Babies don’t wear nappies at all

- Clothing without a crotch can be considered, which is widely used in countries such as China
- In many countries, toilet training begins very early, sometimes within days of birth and usually no later than a month

### Reusable nappies, menstruation pads & cups

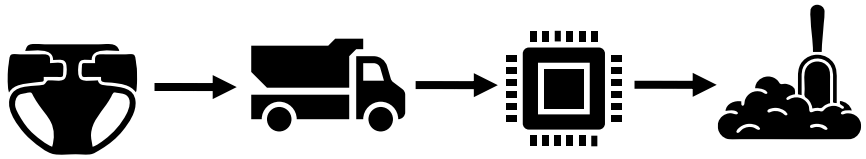
- Washable cloth nappies and pads
- Upfront costs replace ongoing costs
- Lots of YouTube videos available

# DIAPER AND HYGIENIC WASTE (2)

## BEST PRACTICES

Compostable nappies with a collection service

- Suitable for community which uses large volumes of compostable nappies and incontinence material
- Used compostable nappies are collected and commercially composted to certified standards in 72 hrs  (e.g. Little Brave company in New Zealand). Requires considerable investment, but has a significant landfill diversion impact



# TYRE WASTE

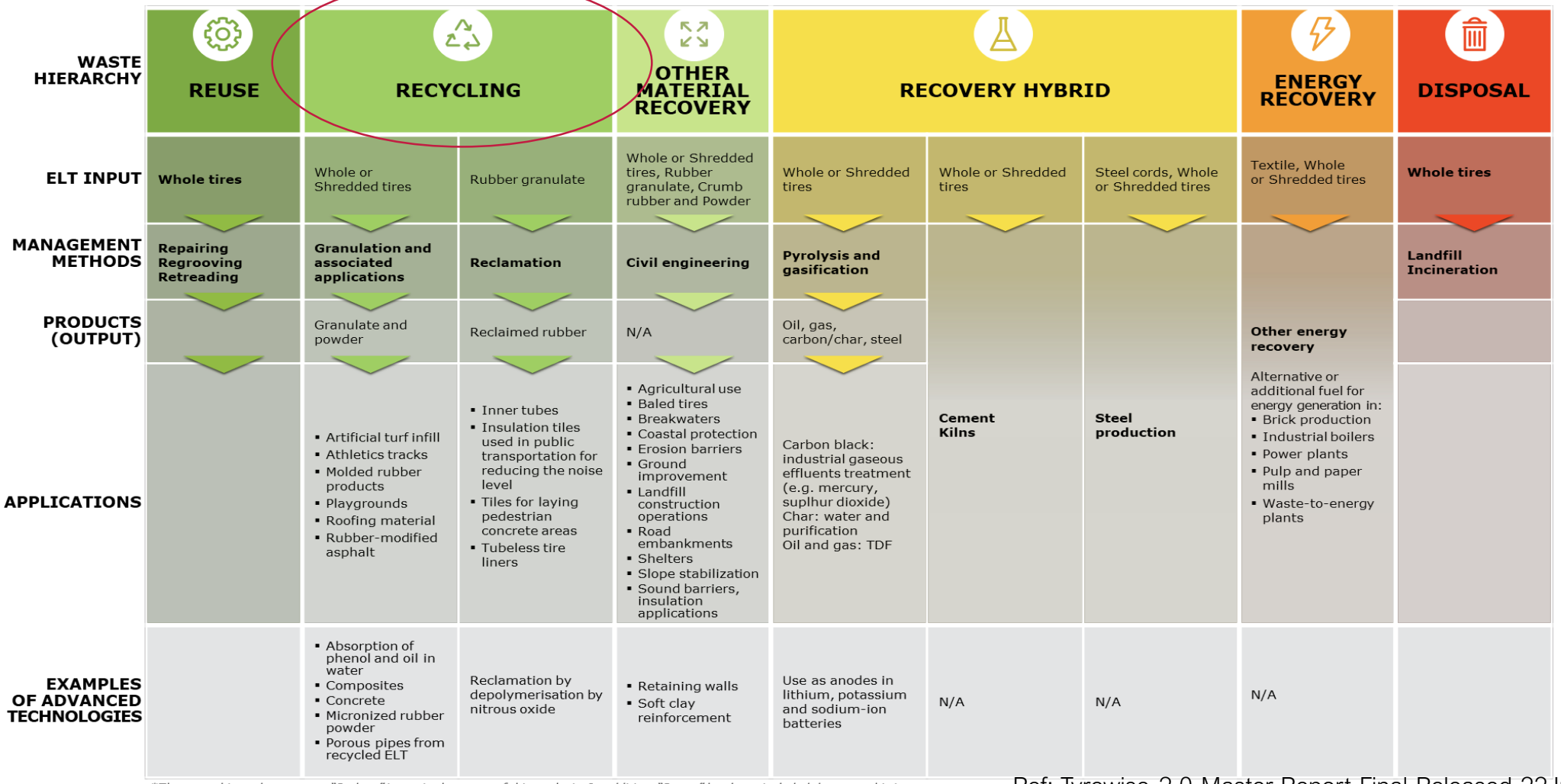
## CHALLENGES AND OPPORTUNITIES

- Tyres cause 28% of primary microplastics in the ocean
- On average a tyre loses 10% of its weight in 4 years in the form of microplastics
- Solutions include i.e. circular design & business models, reuse and recycling

For SIDS, tyre recycling could contribute significantly to reduce plastic leakage and landfill pressures

NB: !!! Prioritise applications where there is limited wear & tear, and water/food contact, to prevent negative impacts from micro-plastics during the use phase

# TYRE WASTE MANAGEMENT HIERARCHY



| WASTE HIERARCHY | REUSE | RECYCLING | | OTHER MATERIAL RECOVERY | RECOVERY HYBRID | | | ENERGY RECOVERY | DISPOSAL |
|---|---|---|---|---|---|---|---|---|---|
| ELT INPUT | **Whole tires** | Whole or Shredded tires | Rubber granulate | Whole or Shredded tires, Rubber granulate, Crumb rubber and Powder | Whole or Shredded tires | Whole or Shredded tires | Steel cords, Whole or Shredded tires | Textile, Whole or Shredded tires | **Whole tires** |
| MANAGEMENT METHODS | **Repairing Regrooving Retreading** | **Granulation and associated applications** | **Reclamation** | **Civil engineering** | **Pyrolysis and gasification** | | | | **Landfill Incineration** |
| PRODUCTS (OUTPUT) | | Granulate and powder | Reclaimed rubber | N/A | Oil, gas, carbon/char, steel | | | **Other energy recovery** | |
| APPLICATIONS | | ▪ Artificial turf infill<br>▪ Athletics tracks<br>▪ Molded rubber products<br>▪ Playgrounds<br>▪ Roofing material<br>▪ Rubber-modified asphalt | ▪ Inner tubes<br>▪ Insulation tiles used in public transportation for reducing the noise level<br>▪ Tiles for laying pedestrian concrete areas<br>▪ Tubeless tire liners | ▪ Agricultural use<br>▪ Baled tires<br>▪ Breakwaters<br>▪ Coastal protection<br>▪ Erosion barriers<br>▪ Ground improvement<br>▪ Landfill construction operations<br>▪ Road embankments<br>▪ Shelters<br>▪ Slope stabilization<br>▪ Sound barriers, insulation applications | Carbon black: industrial gaseous effluents treatment (e.g. mercury, suplhur dioxide)<br>Char: water and purification<br>Oil and gas: TDF | **Cement Kilns** | **Steel production** | Alternative or additional fuel for energy generation in:<br>▪ Brick production<br>▪ Industrial boilers<br>▪ Power plants<br>▪ Pulp and paper mills<br>▪ Waste-to-energy plants | |
| EXAMPLES OF ADVANCED TECHNOLOGIES | | ▪ Absorption of phenol and oil in water<br>▪ Composites<br>▪ Concrete<br>▪ Micronized rubber powder<br>▪ Porous pipes from recycled ELT | Reclamation by depolymerisation by nitrous oxide | ▪ Retaining walls<br>▪ Soft clay reinforcement | Use as anodes in lithium, potassium and sodium-ion batteries | N/A | N/A | N/A | |

**The waste hierarchy category "Reduce" is not in the scope of this analysis. In addition, "Reuse" has been included, however this is not applicable to all tires and would depend on the condition of the product in relation to the appropriate safety standards.*

Ref: Tyrewise-2.0-Master-Report-Final-Released-22July2020-with-disclaimer.pdf

# TYRE RECYCLING (2)

## BEST PRACTICES

For example: Xtyre recycling

- Using low-tech recycling technology
- Low start-up costs
- Manufacturing recycled rubber products from waste tyres such as: reusable pallets, matting, sports materials, architecture materials, and safety & construction materials
- The steel tyre wiring can also be retrieved for recycling
- Scalable business model via a licensed manufacturing agreement with technology transfers
- Principle: Same products, same moulds and same formulations in all manufacturing entities and markets
- The recycling line/machinery can be dual purposed to recycling/granulating both used tyre and plastic waste
- Government could support business development in the form of regulation/mechanisms to obtain waste recycling licenses, and taxing for example the tyre suppliers per kg of tyres sold into this market. Then using this tax to pay/substitute the cost for the collection, storage and recycling of these waste tyres

# RUBBER TYRE RECYCLING

BEST PRACTICES

**Want to learn more about the benefits of source segregation and integrated waste management systems:**

- Community level waste management, see: Waste Aid - Making Waste Work toolkit: https://wasteaid.org/toolkit/

- General Solid Waste Management suggestions for SIDS:
  - UNEP - SIDS Waste Management Outlook: https://www.unep.org/ietc/node/44
  - IUCN's Plastic Waste Free Islands quantification and qualification reports. Contact IUCN at plastics@iucn.org

# FOR MORE INFORMATION

## IUCN

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https://www.iucn.org/theme/marine-and-polar/our-work/close-plastic-tap-programme

#ClosethePlasticTap

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