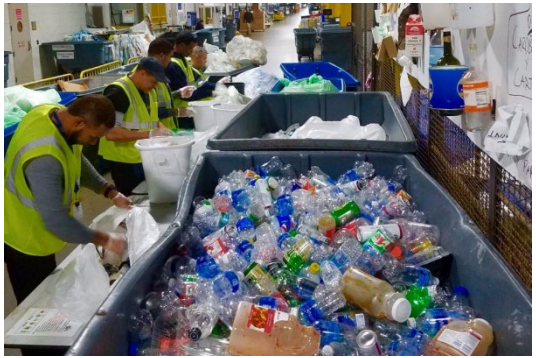
DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS

UNOSD
UNITED NATIONS OFFICE FOR SUSTAINABLE DEVELOPMENT

Brief Overview of Waste Management: Life-cycle Approach Towards the Circularity

Chun Kyoo Park, UNOSD



Introduction to UNOSD

- **Project Office under the UN DESA**
- **Located in Songdo Incheon, Republic of Korea**

Overarching Objective

- **Strengthen the capacity of UN Member** States to plan and undertake **integrated sustainability transformation,** particularly in the context of **the Agenda 2030 and the Sustainable Development Goals (SDGs)**

Main focused area: Environmental SDGs

UNOSD & MoE of Korea

UNOSD
UNITED NATIONS OFFICE FOR SUSTAINABLE DEVELOPMENT

Ministry of Environment
Republic of Korea

- **UNOSD and MoE of Korea have closely collaborated under partnership in** the environmental field.
- **UNOSD plays a bridging role** between Korea and Member States to convey the best practices in environmental domain of Korea.

Contents

I. Characteristics of Waste Management

1

Characteristics of Waste Management

Waste management: Context-based approach

- **Every country has its own *definition*** on waste in national legislation
- ***Classifications*** **on waste also varies** across the countries
- There is **a large variation of the waste *composition*** country by country

Context-based approach in waste management is significantly important

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Characteristics of Waste Management

Difference in Waste *Definitions*

Madagascar	Republic of Korea	Morocco	Cambodia
... toute matière qui n`a plus aucune utilité pour son propriétaire ou producteur et qui est mise au rebut ou abandonnée.	**Garbage, burnt refuse, sludge, waste oil, waste acid, waste alkali, and animal carcasses**, etc., which have become **no longer useful for human life or business activities**	Tous résidus résultant d'un processus d'extraction, exploitation,transformation, production, consommation... tout objet et matière abandonnés ou que le détenteur doit éliminer pour **ne pas porter atteinte à la santé, à la salubrité publique et à l'environnement**	...objects and products remaining or generated from human daily activities and livelihood which **do not consist of toxic substances or hazardous wastes**
Defines waste through functional and economic value	**Specific examples of waste defined within the context of functional and economic value**	**Definition includes public** health, hygiene and the environment **(Implies the inclusion of hazardous substances)**	**Definition refers specifically to "Solid Waste" and** excludes hazardous waste

1

Characteristics of Waste Management

Korea Case with PKS (Palm Kernel Shells): Waste vs Bio-fuel

2010

2014

- PKS was highlighted as an emerging bio energy source.
- **But in Korea, PKS was not possible to import. It was categorized as "Waste" according to the 'Waste Control Act'.**

Ministry of Environment (MoE)
"PKS is Waste"

VS

Ministry of Trade, Industry and Energy
"PKS is a renewable energy source"

- **MoE amended the related law to admit the import of *Solid Refuse Fuel (SRF),* made from PKS.**
- Waste-to-energy industry began to grow and became promoted.

1 Characteristics of Waste Management

Difference in Waste *Classification*

Madagascar	Republic of Korea	Morocco	Cambodia
• **Hazardous Waste (DECRET N° 2012-754)**	• Household Waste • Industrial Waste ➢ General Waste ➢ Designated Waste (Hazardous waste including Medical Waste) ➢ Construction Waste *** Household waste: any wastes <u>other than industrial wastes</u>**	• Household Waste • Household-like Waste • Industrial Waste • Medical and pharmaceutical waste • Hazardous Waste • Inert Waste • Agricultural Waste • End-of-life waste • Biodegradable waste *** Household waste: any waste <u>resulting from household activities</u>**	• Household Solid Waste • Industrial Solid Waste • Hazardous Waste *** Household (solid) waste: solid waste <u>remained or generated from business activities or services</u> which do not consist of *toxic substances or hazardous*.**

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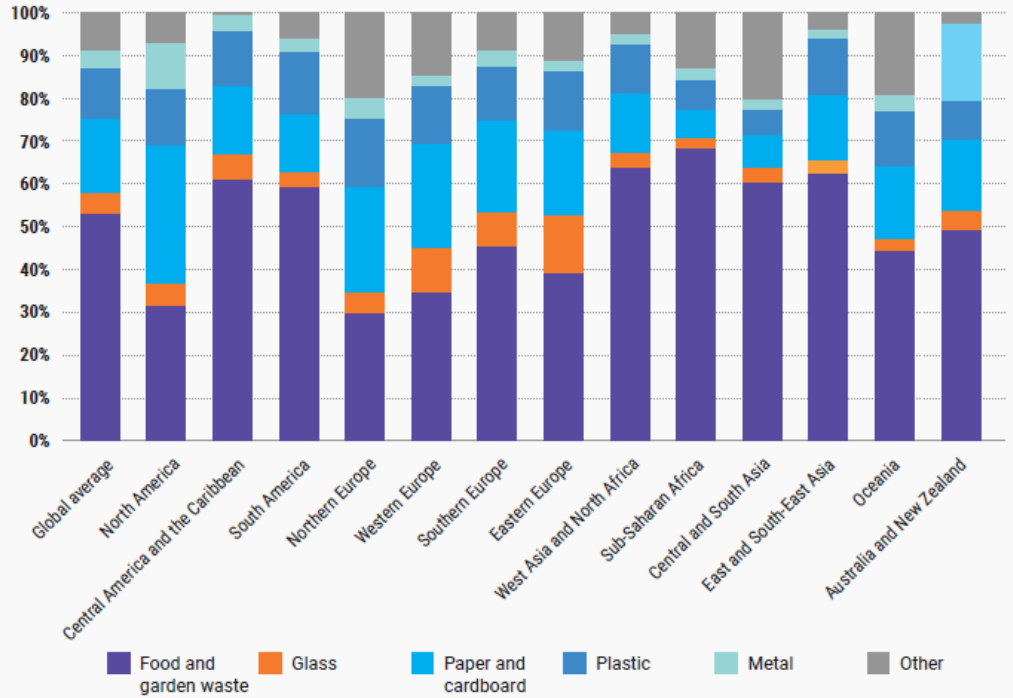
Characteristics of Waste Management

Waste *Composition* Across Countries

Figure 6: Global average and regional breakdown of municipal solid waste composition.
"Other" includes items such as textiles, wood, rubber, leather and household and personal hygiene products.

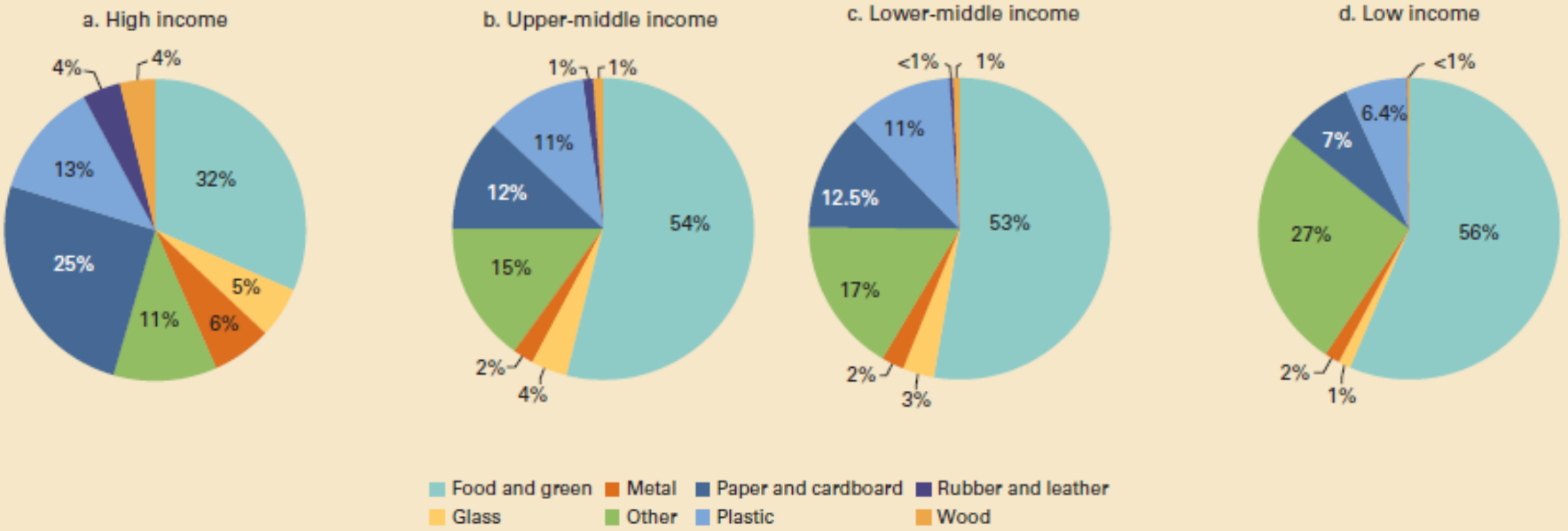


Source: UNEP, Global Waste Management Outlook 2024

1 Characteristics of Waste Management

Waste *Composition* Across Countries

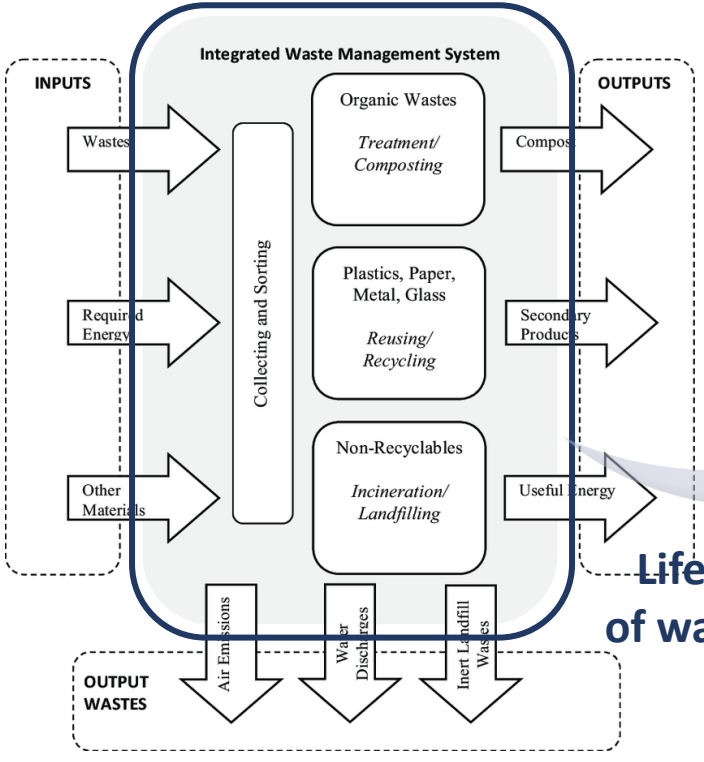
Figure 2.9 Waste Composition by Income Level
percent



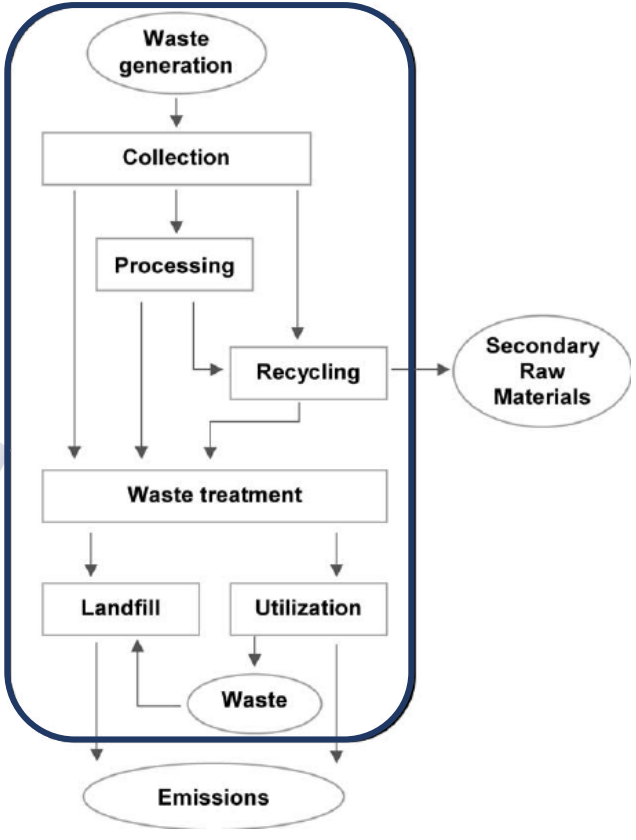
Source: World bank, What a Waste 2.0, 2018

1 Characteristics of Waste Management

Integrated Waste Management System: *Life-cycle Approach*



Life-cycle approach of waste management process



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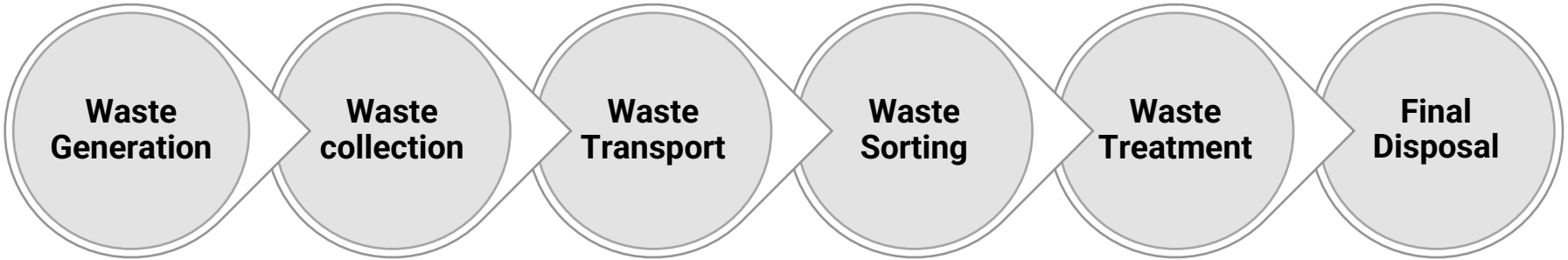
Characteristics of Waste Management

Why is the Life-cycle Approach Important: *Interlinkage*

Lifecycle approach 'from cradle to grave'



- Source Segregation

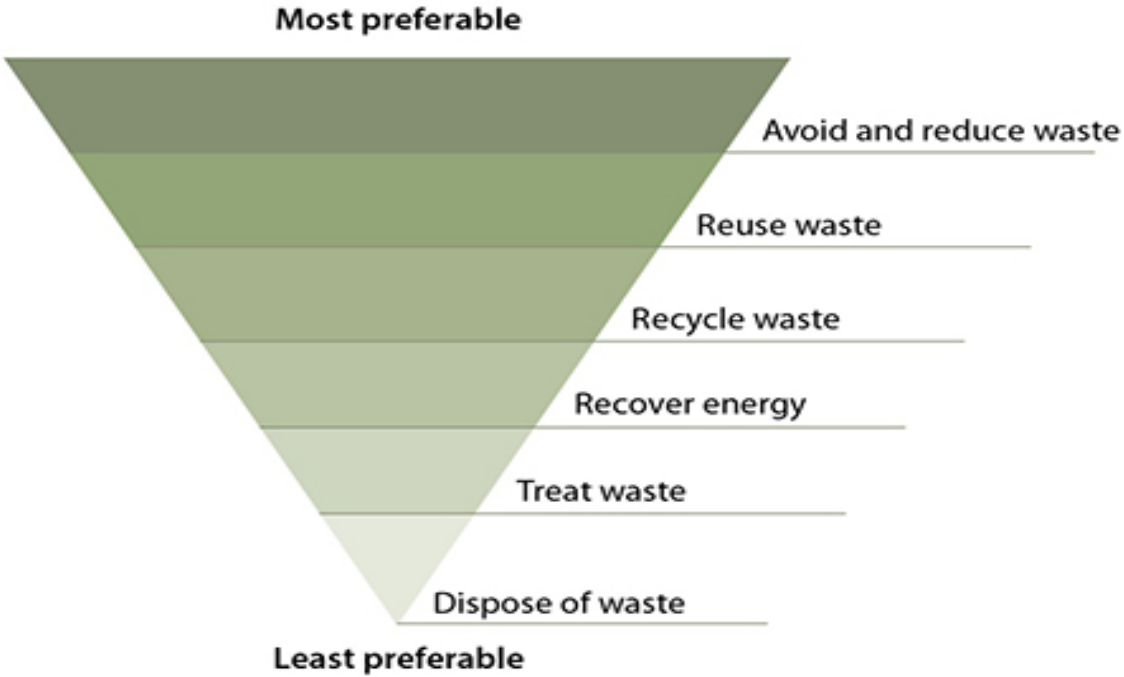
- Recycling
- Composting
- Incineration

- Landfilling

- **Each stage is closely interlinked with the others.**
- **Life-cycle approaches enable waste management to be implemented in a holistic and effective manner.**

II. Waste Management Policy & Measures

Waste Management Hierachy



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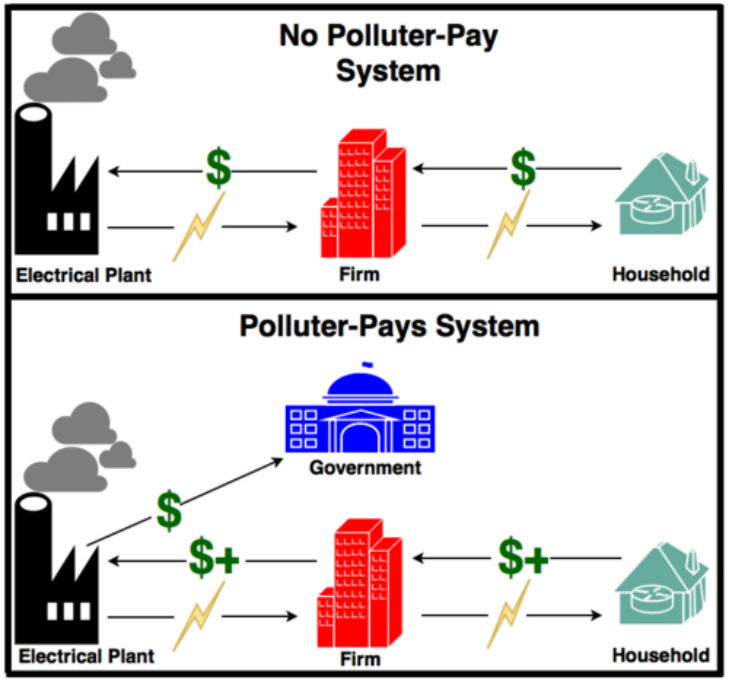
Waste Management Policy & Measures

Key Element for Waste Management Regulations

Polluter Pays Principle (PPP)



- **Waste producers (industry, households…) should pay for the collection, treatment, and disposal of the waste they produce.**

- Expected outcome:
  1) **Reduce waste pollution**
  2) **Minimize social cost**
  3) **Partially compensate for managing the waste pollution**

2

Waste Management Policy & Measures

Key Element for Waste Management Regulations

Instruments for implementing the Polluter Pays Principle (PPP)

Command and control law

- Licensing procedures
- Bans
- Emission limit values
- Administrative orders & sanctions

Market-based instruments

- Subsidies/feed-in tariffs
- Taxes, charges, fees
- Tradable permits and quotas
- Liability rules

Voluntary approaches

- Voluntary agreements
- Environmental management systems (e.g. ISO 14001)
- Labelling (e.g. eco-label, energy label)

- **Aim to cut pollution at source**
  - ➢ Set environmental standards
  - ➢ Mandate pollution control
  - ➢ Monitor systems to reduce risks
  - ➢ Prohibit certain activities
  - ➢ Cap the emissions of certain pollutants

- **Financial incentives or disincentives are used to influence polluters'** behavior by incorporating environmental costs and benefits into the budgets of households and enterprises.

- **To encourage less polluting products or companies**

  (ex) consumers may favor products bearing "Ecolabel", which gives producers the incentive to manufacture fewer polluting products

Market-based Instrument at Waste Collection

Pay-as-you-own vs. Pay-as-you-throw

Bigger house, More charge:
Property tax-based

Waste Collection Charging Scheme

Behavior change intended

More waste, More charge:
Volume-based

2

Waste Management Policy & Measures

Market-based Instrument at Waste Generation

Waste Generator → Pay-as-you-throw

Pay-as-you-throw (PAYT) Garbage Systems

Here are various PAYT systems that charge based on garbage amount

1 Trash Bags

Trash collectors will only collect designated trash bags that can be bought at typical local supermarkets or convenience stores.

3 Wheelie Bins

Municipalities offer a few size options for wheelie bins, with smaller bins having a cheaper weekly collection cost.

2 Stickers

Trash can be put into any bag, but trash collectors will only collect bags with a designated sticker.

4 Weight-based

Collection trucks or smart garbage cans will weigh the garbage and charge based on the actual weight.

2

Waste Management Policy and Measures

Separate Discharge of Recyclables (Household)

Separate Collection Station
In Apartment

Paper and
Cardboard

Transparent
PET Bottle (2020~)

Other Plastics

Vinyl Bags

Styrofoam

Fluorescent lamp

Bottle

Can

Clothes

Battery

General waste

Food waste

Cooking oil

Furniture

2

Waste Management Policy & Measures

Market-based Instrument at Waste Generation

Waste Producer → Waste Charge

Charging to waste producers for Non-recyclables, such as:

Harmful substances
(e.g. pesticides)

Non-recyclables
(e.g. cigarette butt)

Products causing problems
in managing waste

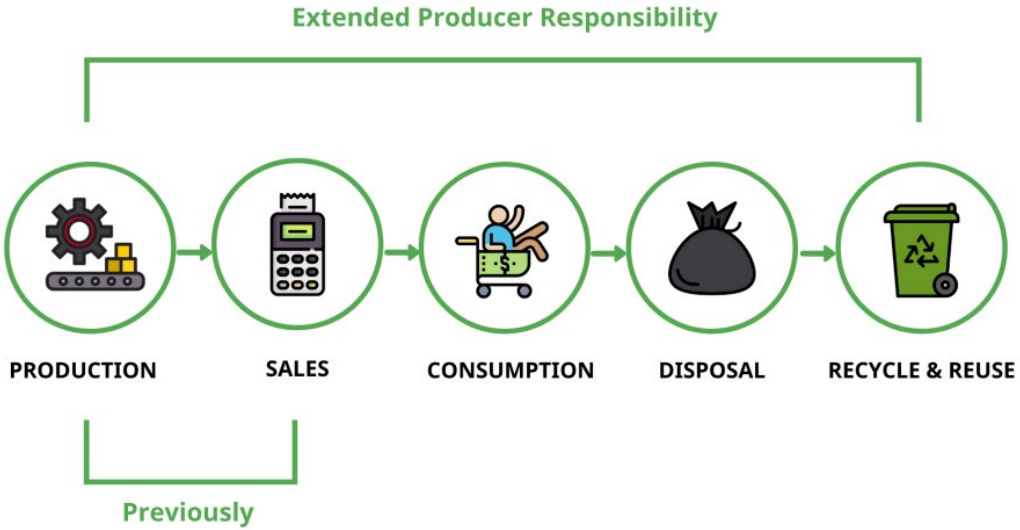
EU plastic packaging tax

2

Waste Management Policy & Measures

Market-based Instrument at Waste Treatment

Extended Producer Responsibility (EPR): Industry-funded approach



Extending producer responsibility to the <u>end of a product's life cycle</u>:

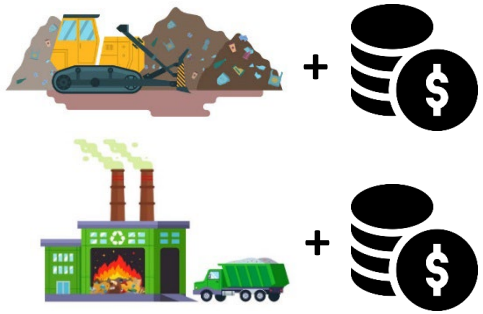
Responsibility? Physically and Economically!

2

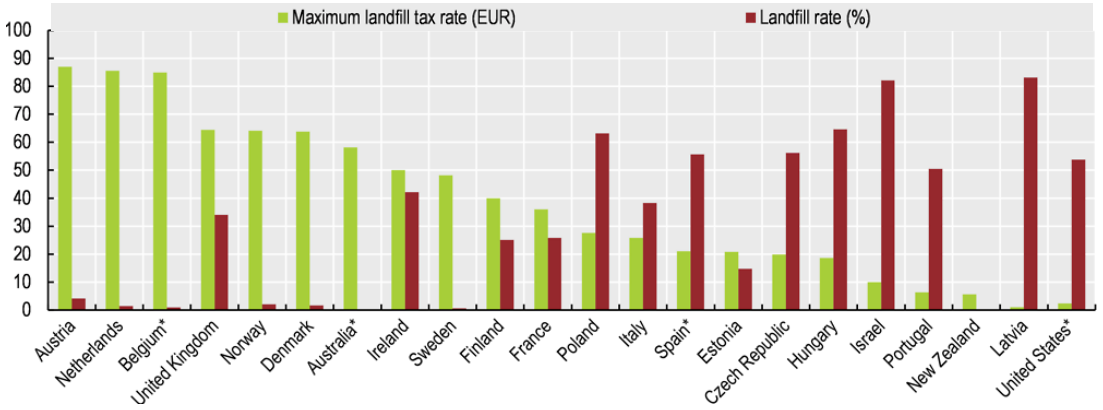
Waste Management Policy & Measures

Market-based Instrument at Waste Treatment

Waste Disposal Charge



Municipal waste *landfilling and tax rates*, 2013



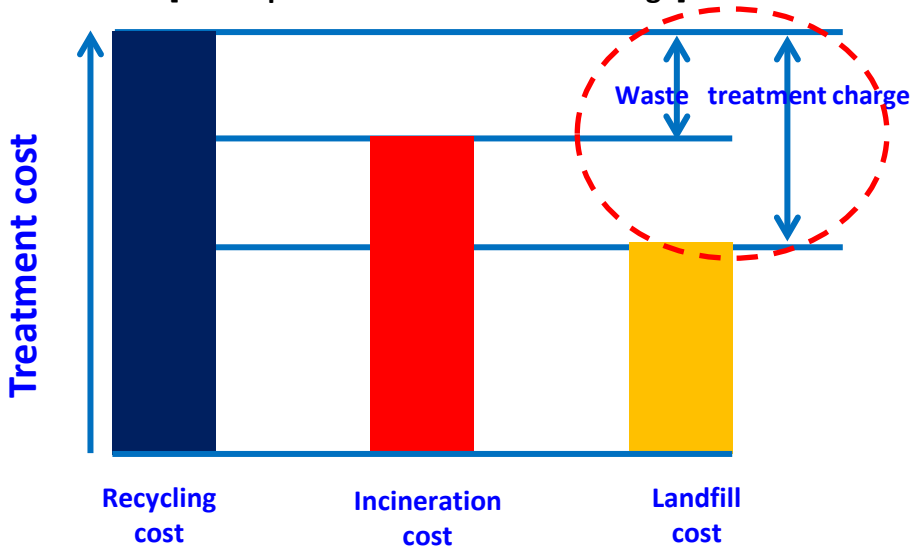
Countries with high landfill taxes tend to have low landfill rates

Key Policies on Waste Reduction and Recycling

Waste Disposal Charge

- Wastes treatment charges are imposed to fill the gap among treatment method.
- Economic inducements are introduced in order to reduce incineration and landfill and promote recycling.

[Concept of Wastes Treatment Charge]



Waste Type	Landfill	Incineration
MSW	**15 won/kg**	**10 won/kg**
Industrial waste (combustible)	**25 won/kg**	**10 won/kg**
Industrial waste (incombustible)	**10 won/kg**	**-**
Construction waste	**30 won/kg**	**10 won/kg**

2 Waste Management Policy and Measures

Key Policies on Waste Recovery

Waste-to-Energy (SRF)

Mixed Wastes

Sorting

Combustible (40%)

(Paper, Plastic, wood etc.)

SRF (Solid Refuse Fuel)

Organic(15%)

(Food waste etc.)

Non-combustible(10%)

(Steel, Glass etc.)

Water(35%)

Key Policies on Waste Recovery

Waste-to-Energy (*Incineration Facility*)

- Scale : 750 tons/day
- Power Gen. : 6.5MWh

Household Waste

Incineration Facility

Electricity Prod. & Supply

Steam Prod. & Supply

Integrated Bio-gasification Process

Mixed Input

Import/ pre-treatment

Anaerobic digester

Digestive waste fluid

Waste fluid treatment facility

Compost/dry fuels

Associated Treatment, Discharge

Biogas

Gas storage

Gas utilization facility

Biogas (Biomethane 99%)

Biogas utilization

Provide Urban Gas

Electricity Generation

Charging CNG Vehicles

Charging Hydrogen Vehicles

III. Enabling Environments for Successful Waste Management

3

Enabling Environments for Successful Waste Management

What Are the Enablers for Sound Waste Management?

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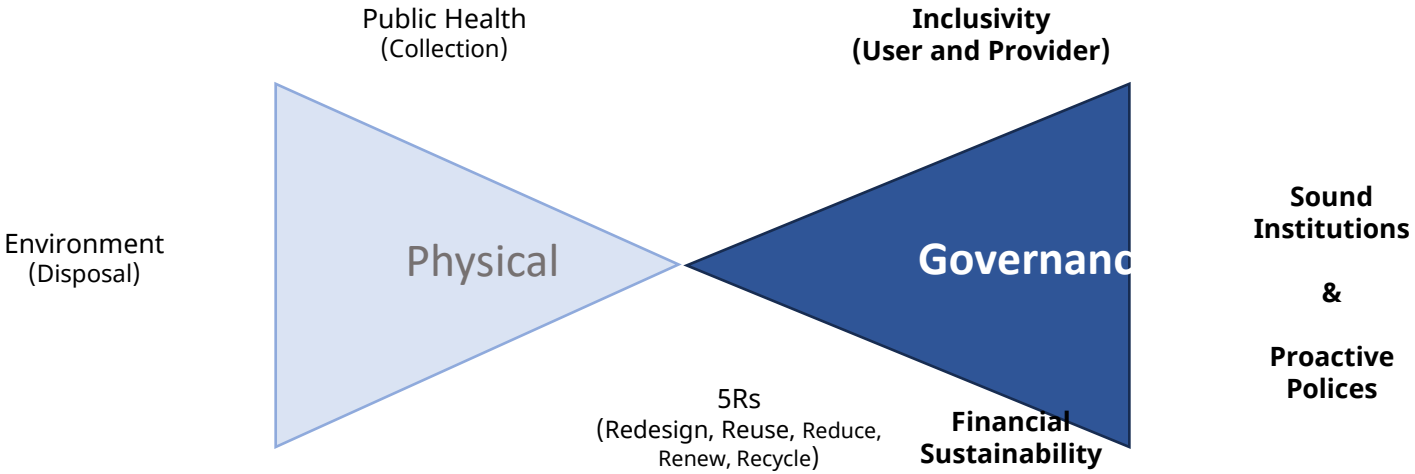
Enabling environments for Successful Waste Management

Enabler (1) Governance



"Two Triangle" Analytic Framework for Solid Waste Management

developed by UN-Habitat

3

Enabling environments for Successful Waste Management

Enabler (2) Legal Framework

- **Combination of command-and-control measures and market-based approach**
- **Clear depiction of roles and responsibilities** of different levels of government and different players
- **Laws in force** to enhance compliance rate
- Solid waste subject to **national or local laws**
- **Hazardous waste/non-hazardous waste streams** regulated

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Enabling environments for Successful Waste Management

Enabler (3) Long-term planning & Visioning

A roadmap for how waste will be managed in country over the next decades

Durham Long-term Waste Management Plan

Executive Summary

Final January 2022

Targets and Actions

The Waste Plan consists of:

- **Targets:** Developed to meet the objectives
- **Measurements:** To assess the progress of meeting the targets
- **Actions:** What the Region will do, with our community, to meet the targets

Timelines for actions:

- **Short-term:** First five years of Waste Plan (2022-2026)
- **Mid-term:** (2027-2033)
- **Long-term:** (2034-2040)

Objectives

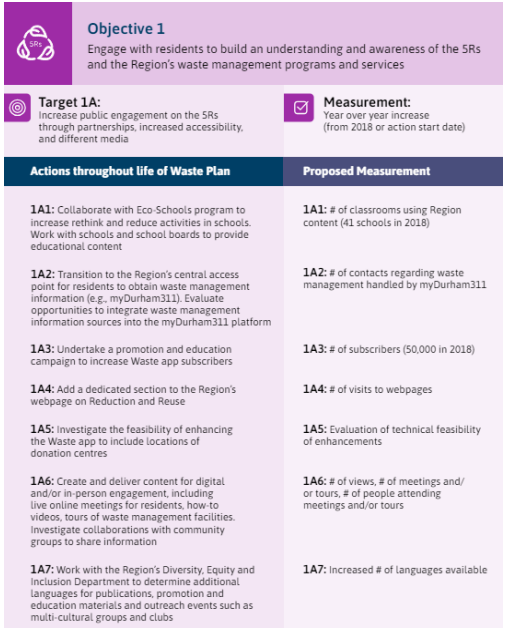
Objective 1
Engage with residents to build an understanding and awareness of the 5Rs (Rethink, Reduce, Reuse, Recycle, Recover) and the Region's waste management programs and services

Objective 2
Reduce the quantity of waste we create

Objective 3
Increase diversion of waste from disposal and support the circular economy

Objective 4
Support the Region's greenhouse gas reduction and climate change mitigation efforts

Objective 5
Protect or improve water, land, and air quality in Durham Region



Objective 1
Engage with residents to build an understanding and awareness of the 5Rs and the Region's waste management programs and services

Target 1A: Increase public engagement on the 5Rs through partnerships, increased accessibility, and different media

Measurement: Year over year increase (from 2018 or action start date)

Actions throughout life of Waste Plan	Proposed Measurement
1A1: Collaborate with Eco-Schools program to increase rethink and reduce activities in schools. Work with schools and school boards to provide educational content	**1A1:** # of classrooms using Region content (41 schools in 2018)
1A2: Transition to the Region's central access point for residents to obtain waste management information (e.g., myDurham311). Evaluate opportunities to integrate waste management information sources into the myDurham311 platform	**1A2:** # of contacts regarding waste management handled by myDurham311
1A3: Undertake a promotion and education campaign to increase Waste app subscribers	**1A3:** # of subscribers (50,000 in 2018)
1A4: Add a dedicated section to the Region's webpage on Reduction and Reuse	**1A4:** # of visits to webpages
1A5: Investigate the feasibility of enhancing the Waste app to include locations of donation centres	**1A5:** Evaluation of technical feasibility of enhancements
1A6: Create and deliver content for digital and/or in-person engagement, including live online meetings for residents, how-to videos, tours of waste management facilities. Investigate collaborations with community groups to share information	**1A6:** # of views, # of meetings and/or tours, # of people attending meetings and/or tours
1A7: Work with the Region's Diversity, Equity and Inclusion Department to determine additional languages for publications, promotion and education materials and outreach events such as multi-cultural groups and clubs	**1A7:** Increased # of languages available

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Enabling environments for Successful Waste Management

Enabler (4) Stakeholder Engagement

- National Government
- Regional and local governments
- Private sector
- Waste management service providers
- Waste management workers
- Informal sector
- Waste generators
- Members of the community
- Opinion leaders and decision-makers
- Non-government organizations (NGOs)
- Waste experts and academics
- Teachers and other educators

⋮

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Enabling environments for Successful Waste Management

Enabler (5) Public Campaign

School educational program

Public education

Eco-labelling

IV. International Trends toward a Zero Waste Society

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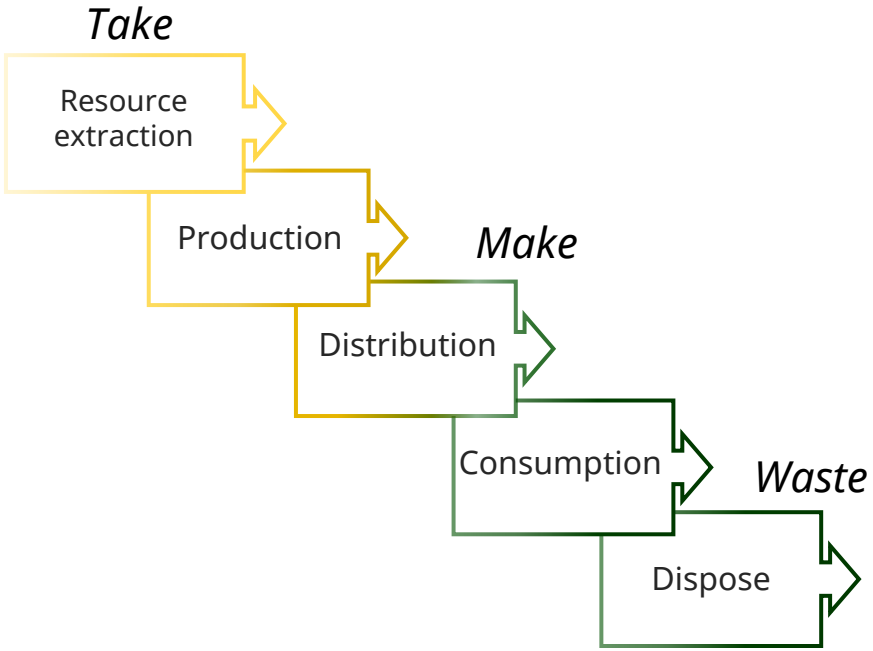
International Trends toward Zero Waste Society

Economic Paradigm Shift : Linear Economy → Circular Economy



Linear: "Take-Make–Waste" model

Circular: "Make-Use-Recycle" model

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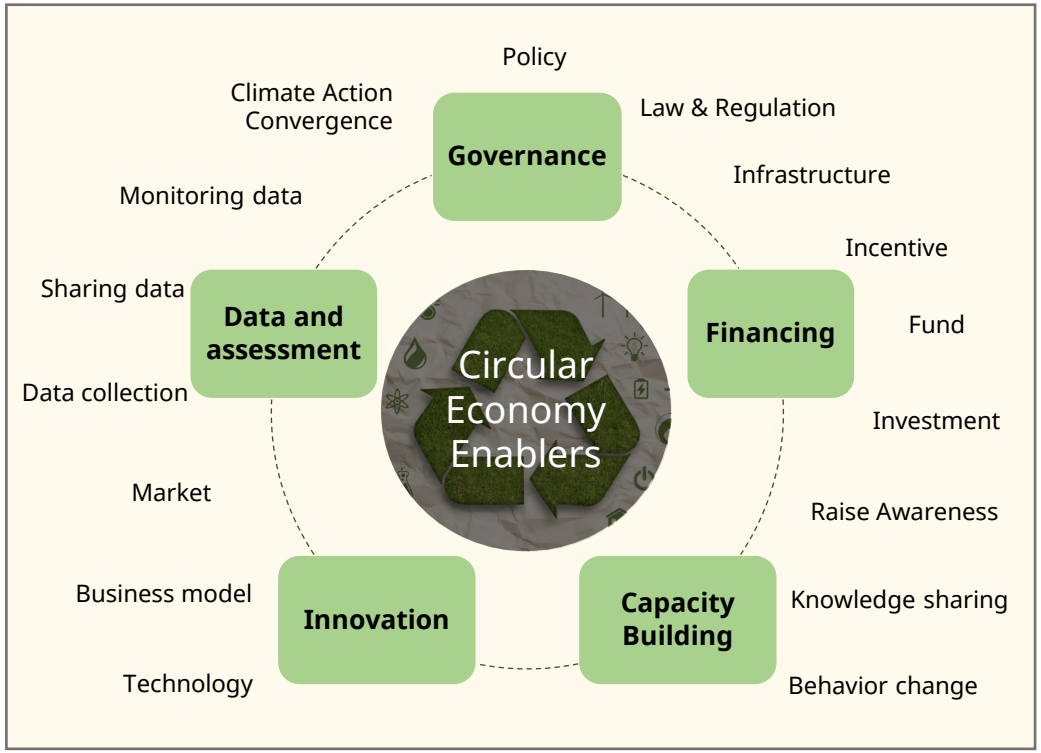
International Trends toward Zero Waste Society

Circular “Economy” = Just “Economy” Paradigm?



The broad definition of “Circular Economy” entails *not only economic shift, but societal transition*.

▶ **Implies an integrative framework Embedding socio-economic transformation**

▶ **Emphasizes the need for engaging all relevant stakeholders not only industries**

Source: OECD i-library

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International Trends toward Zero Waste Society

National Policy Shift towards Zero-Waste Paradigm

- **European Green Deal** aims to promote growth by **transitioning to a modern, resource-efficient and competitive economy.**
- **The Waste Framework Directive** is the EU's legal framework for treating and managing waste in the EU.

- **"K-Circular Economy Action Plan"** to reduce waste and enhance circularity (disposable cup deposit scheme etc.)
- **"Plan for lifecycle zero-plastic"** to reduce plastic pollution

- **The Zero Waste project was established in Türkiye** by the country's first lady in 2017.
  - A Zero Waste education program in Türkiye schools
  - Success in waste reduction and recycling program

- **Local Zero Waste Model in Dar es Salaam, Tanzania**
  - Community-based model embedded into national conversation
  - Material Recovery Facility (MRF) run by a cooperative of waste pickers and community members

4

International Trends toward Zero Waste Society

Circularity into Business Models

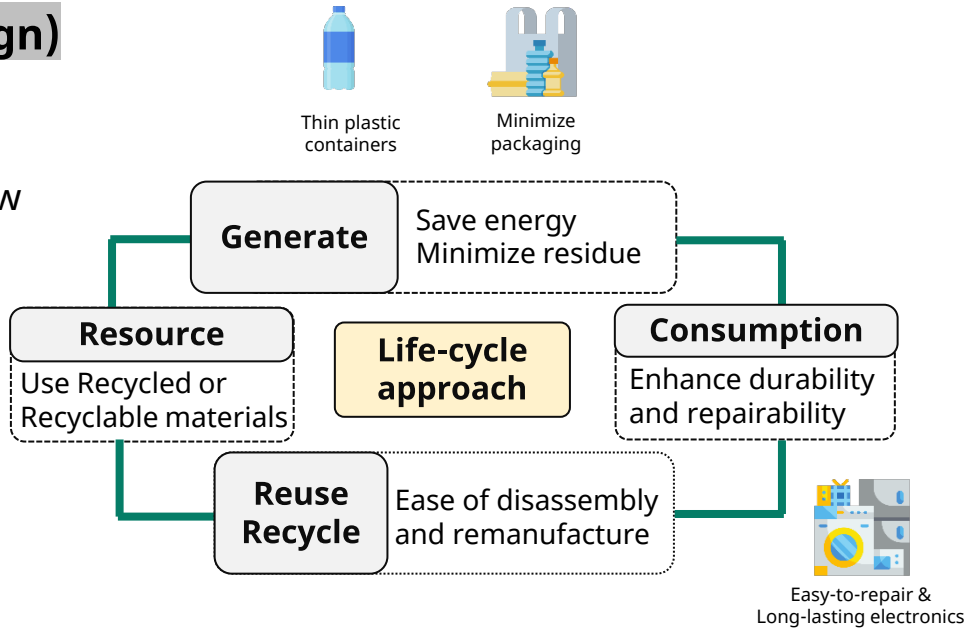
Adidas now uses **96% recycled polyester** in products with an aim to replace virgin polyester with recycled wherever possible by end of 2024.

H&M-owned brand COS is launching **its own resale business**, a move that will allow customers to buy and sell used COS clothing as a circular and renewable solution.

Zero Waste Action: Sustainable Product Design (Eco-design)

Sustainable Product Design (Eco-design)

- Enhance the guideline of Eco-Design for manufacturer and importer to follow the below criteria:
  - **Usage of Recycled materials**
  - **Ease of Reuse and Remanufacturing**
  - **Durability and Repairability**
  - **Restriction on Hazardous Materials**
  - **Carbon Emission etc.**



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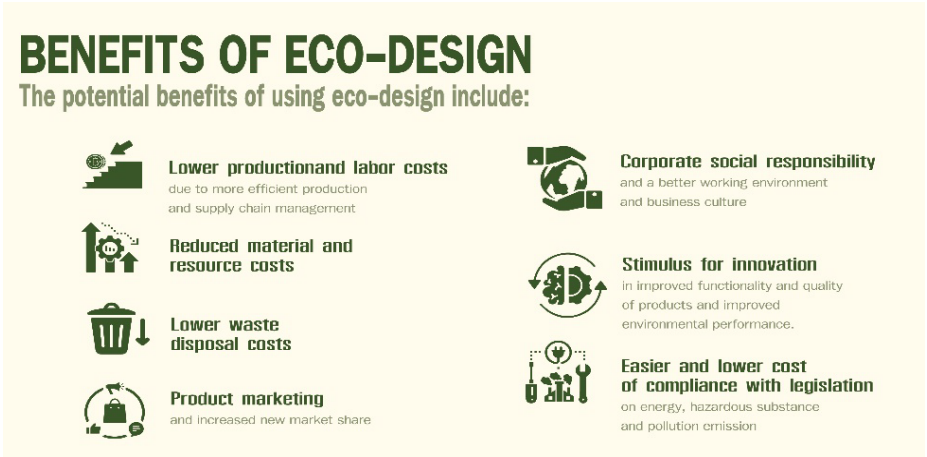
International Trends toward Zero Waste Society

Eco-Design: Key to Zero Waste & Circular Economy Society

- **Eco-design is**

  'a proactive approach in designing products and services that use **minimum resources and energy** and **have minimum negative environmental and social impacts** throughout **their life cycle** while meeting the users' need of functionality and quality.



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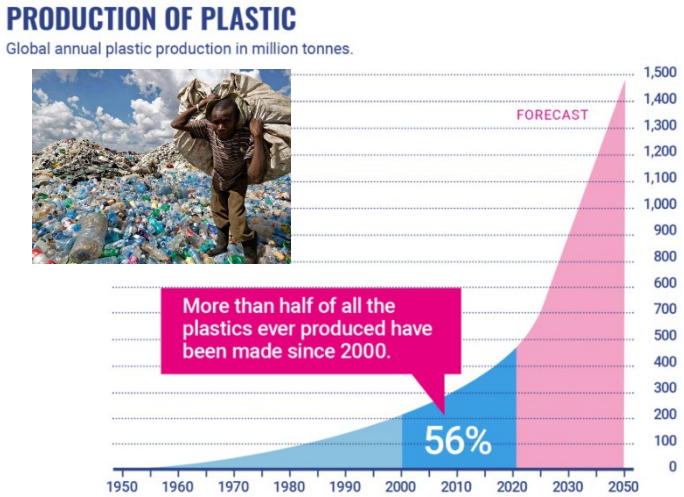
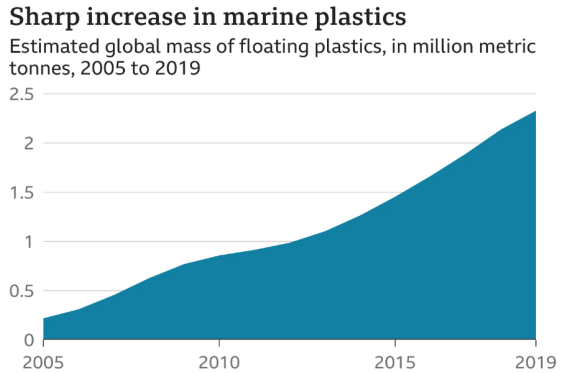
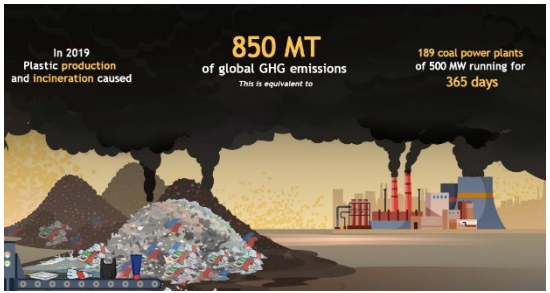
International Trends toward Zero Waste Society

Plastic crisis: From Ocean Pollution to GHG Emission







✓ Global plastic production (ton):

2 million (1950) → 358 million (2017)

- 11 million tons of plastic waste flow annually into oceans. ***This may triple by 2040.***

- GHG emission associated with plastic: ***15% of allowed emissions by 2050***

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International Trends toward Zero Waste Society

Global Plastic Treaty

✓ **Legally binding agreement** to end the plastic pollution by 175 countries (UNEA-5)

End Plastic Pollution: Looking forward

2022

UNEA-5.2
28 Feb – 2 Mar | Nairobi, Kenya
Adoption resolution 5/14 End Plastic Pollution: Towards an International Legally Binding Instrument

OEWG
30 May - 1 Jun | Dakar, Senegal

2023

INC-1
28 Nov - 2 Dec | Punta del Este, Uruguay
Preceeded by a multi-stakeholder forum

INC-2
29 May - 2 June | Paris, France

INC-3
13 - 19 Nov | Nairobi, Kenya

2024

INC-4
21-29 April | Ottawa,Canada

UNEA-6
26 Feb - 1 Mar | Nairobi, Kenya
Report progress of the INC

2025

INC-5
25 Nov - 1 Dec | Busan, Republic of Korea

Diplomatic Conference of Plenipotentiaries
Mid 2025 | For the purpose of adoption and opening for signature the new instrument

UNEA-5 resolution sets the ambition of completing the INC work by the end of 2024

4 International Trends toward Zero Waste Society

Plastic Management through the Product Life-Cyle

- Mainstream **"Reduction of Plastic Use"** and **"Waste as Resources"** throughout the whole life-cycle of the plastic product **(Generation – Distribution – Consumption – Reuse/Recycle);**
  - **(Generation)**
    - **Waste Disposal Charge on Plastic** (a.k.a Plastic Tax)
    - Induce manufacturers to use a single material for the ease of recycling
  - **(Distribution & Consumption)**
    - Expand of scope to ***ban and restrict using single-use plastic*** products
    - Mandatory purchase of recycled plastic products from the public sector
  - **(Reuse/Recycle)**
    - Improve and **expand the sorting facility**
    - **Chemical Recycling** of plastic waste through pyrolysis etc.
    - R&D for developing **bioplastic**

Key Takeaways

Characteristics of Waste Management

- **Waste management: Context-based approach**
  - Different definitions on waste
  - Different classifications on waste
  - Different waste composition across countries

Waste Management Policy & Measures

- **Polluter Pays Principle (PPP) + Hierachy**
  - **Market-based instruments**
    - **Waste generation:**
      Waste Generator → Pay-as-you-throw
      Waste Producer → Waste Charge
    - **Waste Collection:**
      Pay-as-you-own vs. Pay-as-you-throw
    - **Waste Treatment:**
      Extended Producer Responsibility (EPR)
      Waste Disposal Charge

Enabling Environments for Successful Waste Management

International Trends toward Zero Waste Society

- Plastic crisis from ocean pollution to GHG emission
- **Global Plastic Treaty (agreed in 2022): legally binding agreement by 2024**
- Global paradigm shift towards Zero Waste and Circular Economy → **The key is the eco-design**

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