

Role of EPR in Waste Management and Circular Economy



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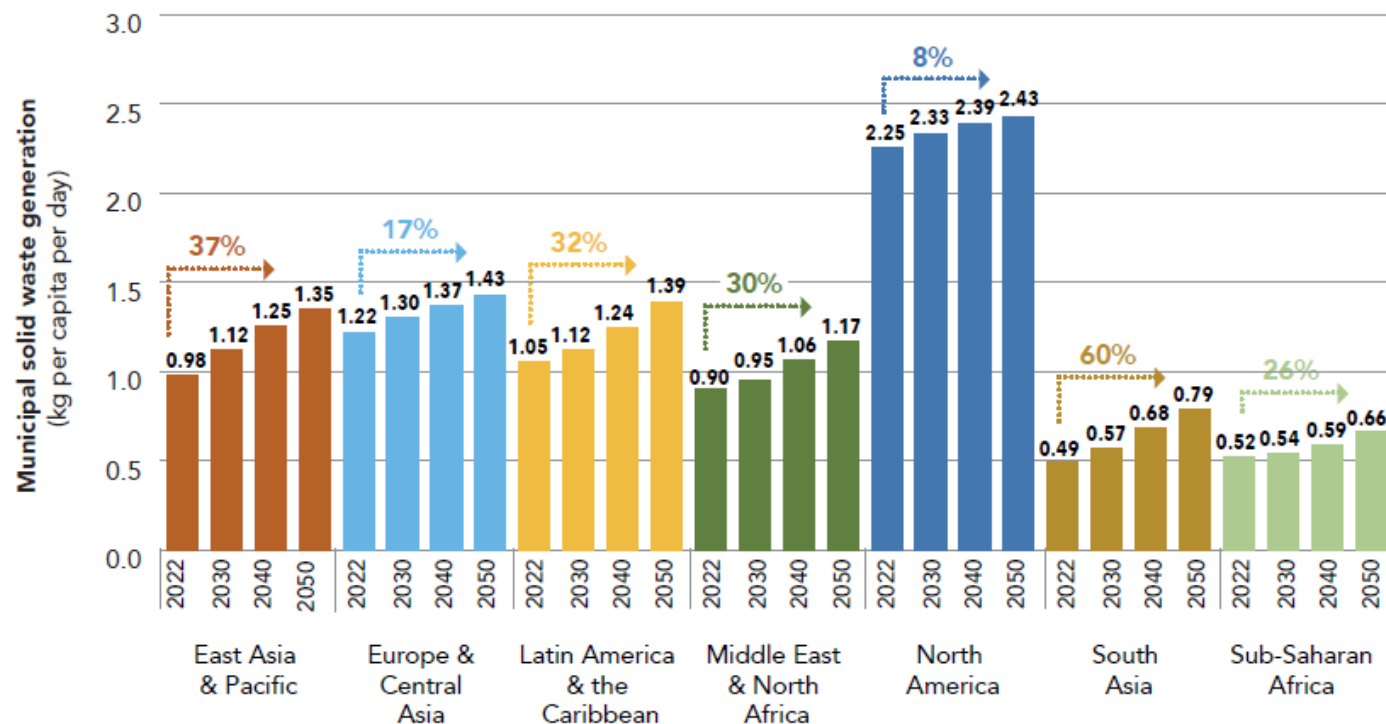
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This lecture explores the role of Extended Producer Responsibility (EPR) as a policy tool for sustainable waste management and the circular economy, covering:

- Global waste and plastic pollution challenges
- Introduction to EPR
- Linear versus circular economy
- How EPR works
- Core EPR mechanisms
- Industry case studies
- EPR and circular economy outcomes

Global Context of Municipal Solid Waste



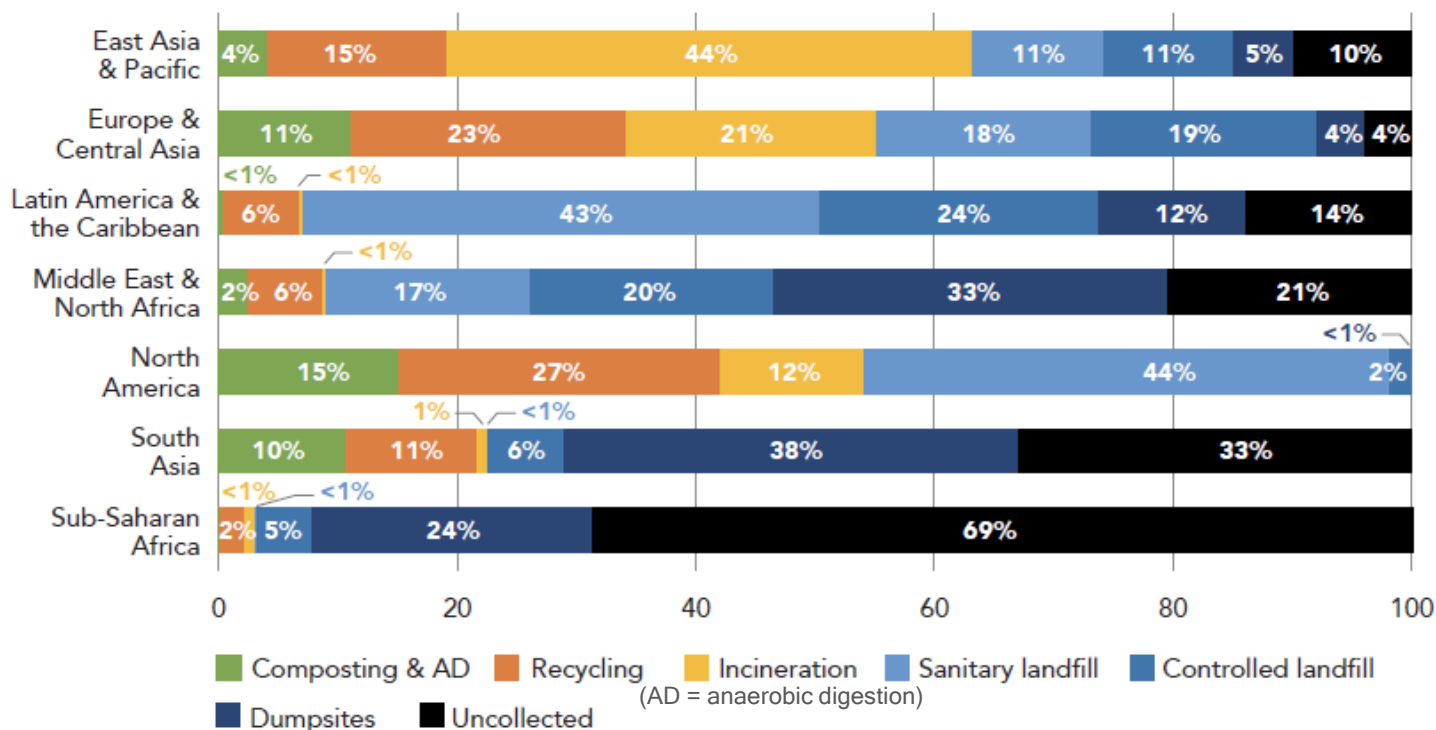
Projections of global municipal solid waste generation per year in 2030, 2040 and 2050 if urgent action is not taken !!!



- Global waste generation is expected to grow significantly in the coming decades.
- Growth is mainly driven by rapid population increase.
- Rapid urbanization and economic growth contribute to rising waste volumes.
- Increasing waste generation creates major challenges for waste management systems.

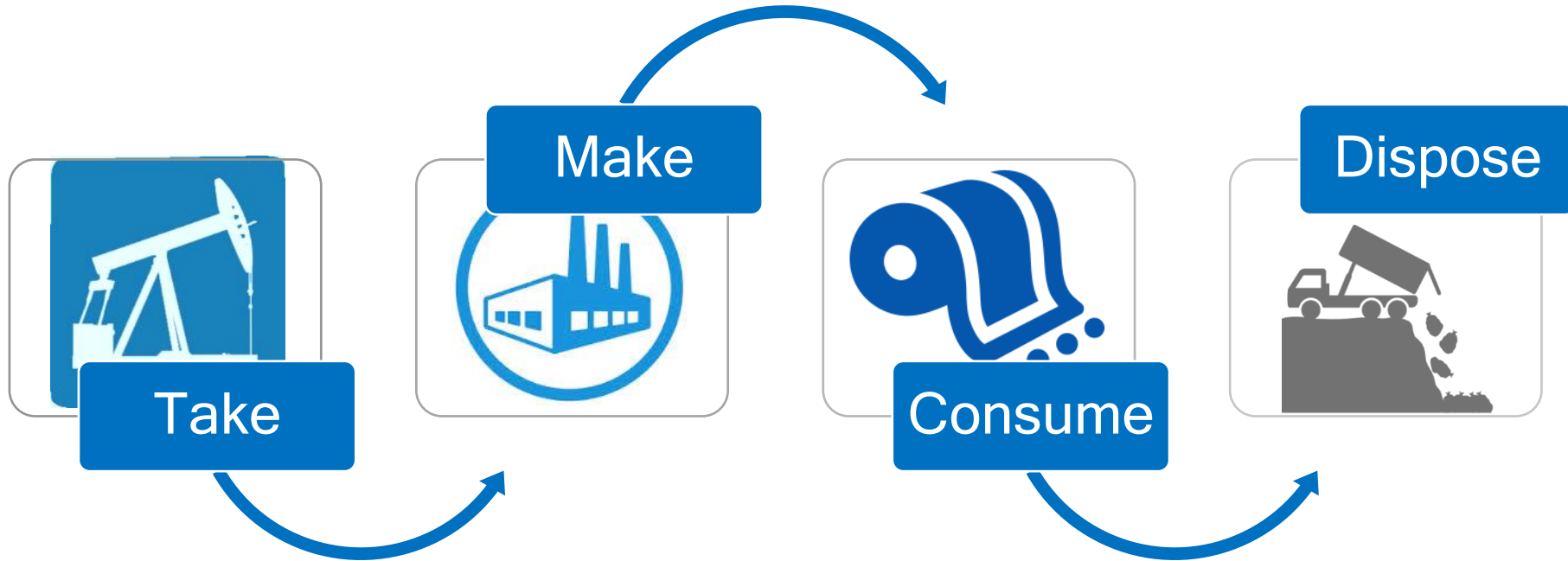
Global Context of Municipal Solid Waste

- Waste management practices vary significantly across regions worldwide.
- Many developing regions still rely heavily on open dumping and uncontrolled disposal.
- A large proportion of waste remains uncollected, especially in Sub-Saharan Africa.
- Recycling and composting rates are still relatively low in many regions.
- Current waste management systems are struggling to cope with increasing waste generation, highlighting the need for more sustainable approaches such as EPR and circular economy policies.



Proportion of uncollected and treated waste multiplied by the weight of waste generated in 2022

Conventional Use of Resources: Linear Approach?



- Conventional linear economy approach
- Why should there be an end to the use of resources?



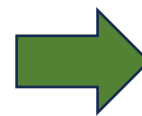
Can we decouple economic growth from the resource consumption?



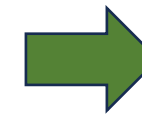
What Happens to Waste After Consumption?

Who responsible????
Who pays for this???

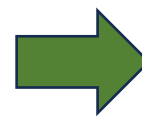
Government? Municipality?
Individual? Producer? Consumer?



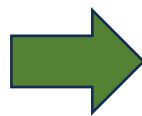
Open Burning



Dumpsite



Landfill



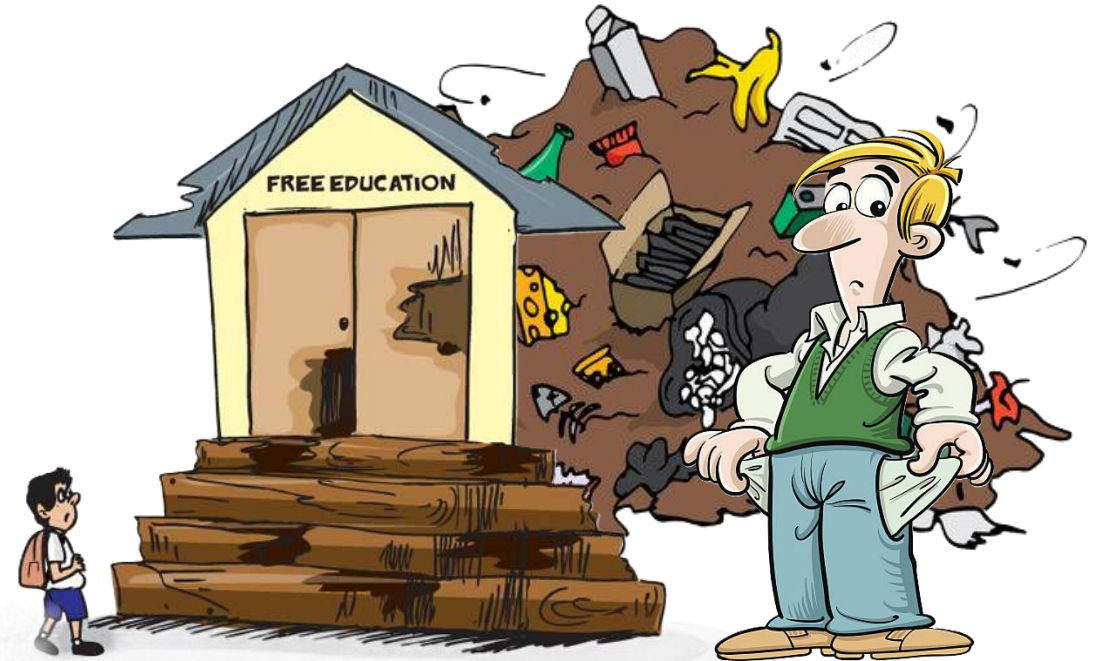
Collect

Rising Government Costs for Waste Management

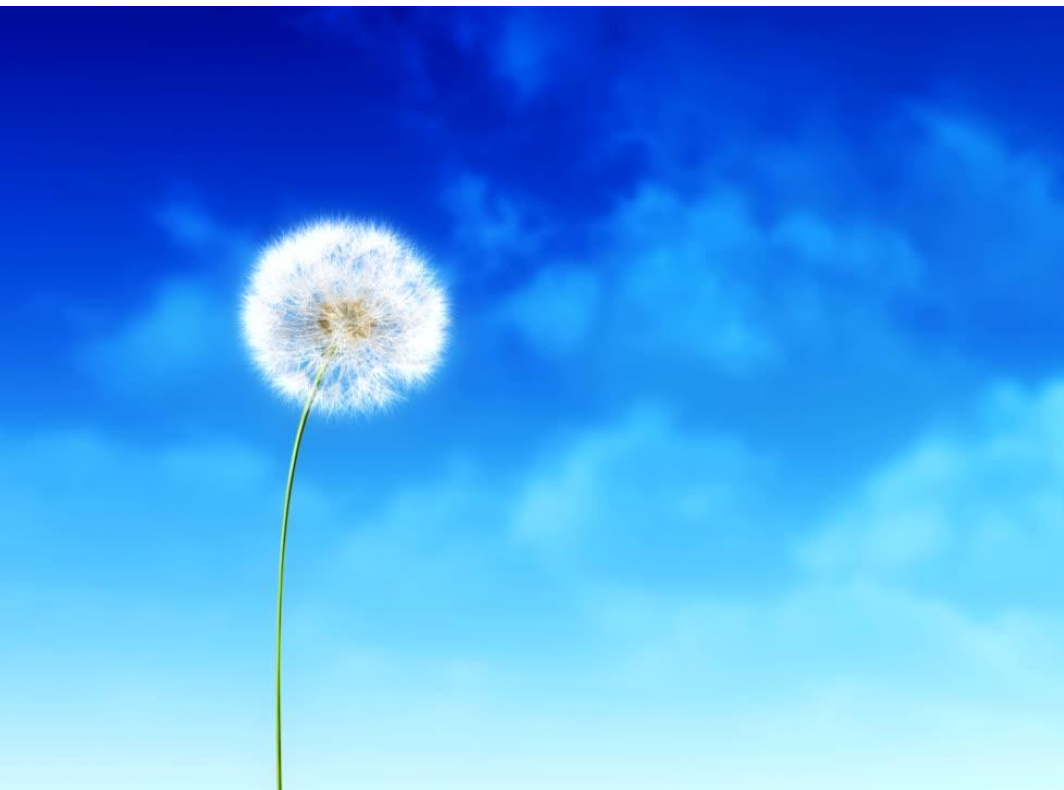
In most southeast Asian countries, the government is a primary funder for waste management.



Collection and transport are usually the cost pressure point.



High waste costs reduce investment in education and development.!!!!



Imagine a dandelion blowing in the wind!

Similarly, products diffuse and disperse!

So, what's next?



Plastic Diffusion at the Consumption Stage



*Difficult to collect such
diffused plastic! Why?*

Policies and Regulations for Waste Diffusion at the Consumption Stage

Plastic Bans and Restrictions

- Many countries and regions have implemented bans or restrictions on **single-use plastics** such as plastic bags, straws, and utensils.
- These policies aim to reduce the **consumption of disposable plastics** and encourage the use of **reusable alternatives**.

Rwanda

European Union

Deposit-Refund Systems

- Deposit-refund systems **incentivize** consumers to **return** beverage containers for recycling by offering a **refundable deposit**.
- These systems **promote recycling** and **reduce littering** by providing a financial incentive for consumers to return their containers.

Germany

Norway

Extended Producer Responsibility (EPR)

- EPR policies hold **producers** responsible for the **end-of-life management** of their products, including plastic packaging.
- By **shifting the burden** of waste management to **producers**, EPR encourages **product redesign**, **recycling**, and **sustainable packaging practices**.

Germany

Canada

Packaging Regulations

- Some countries have implemented regulations and standards for packaging to **promote eco-design**, **reduce unnecessary packaging**, and encourage the use of **recyclable materials**.

Japan

Australia

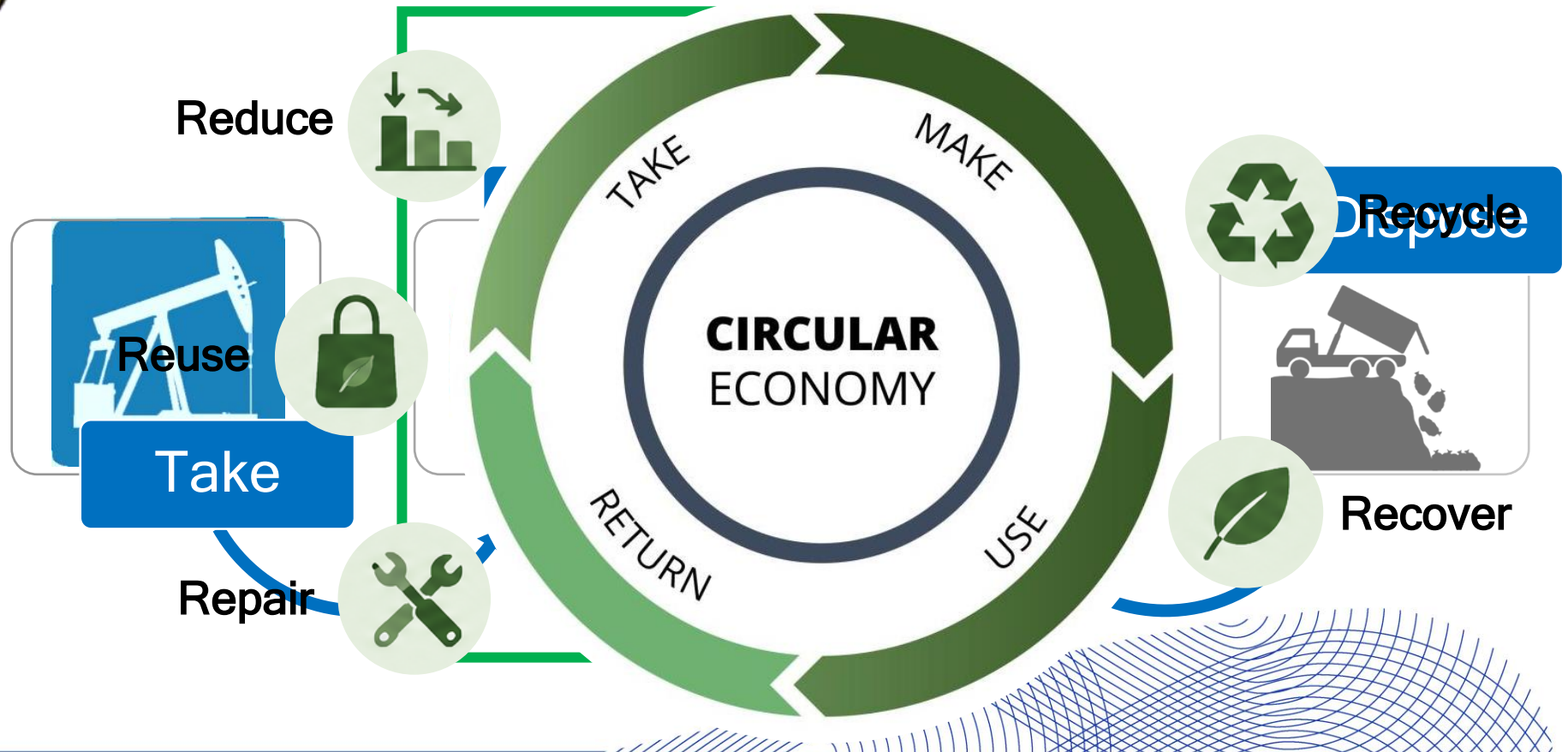
Strong political will, effective governance structures, public support, and robust enforcement mechanisms are essential!

Think Back...

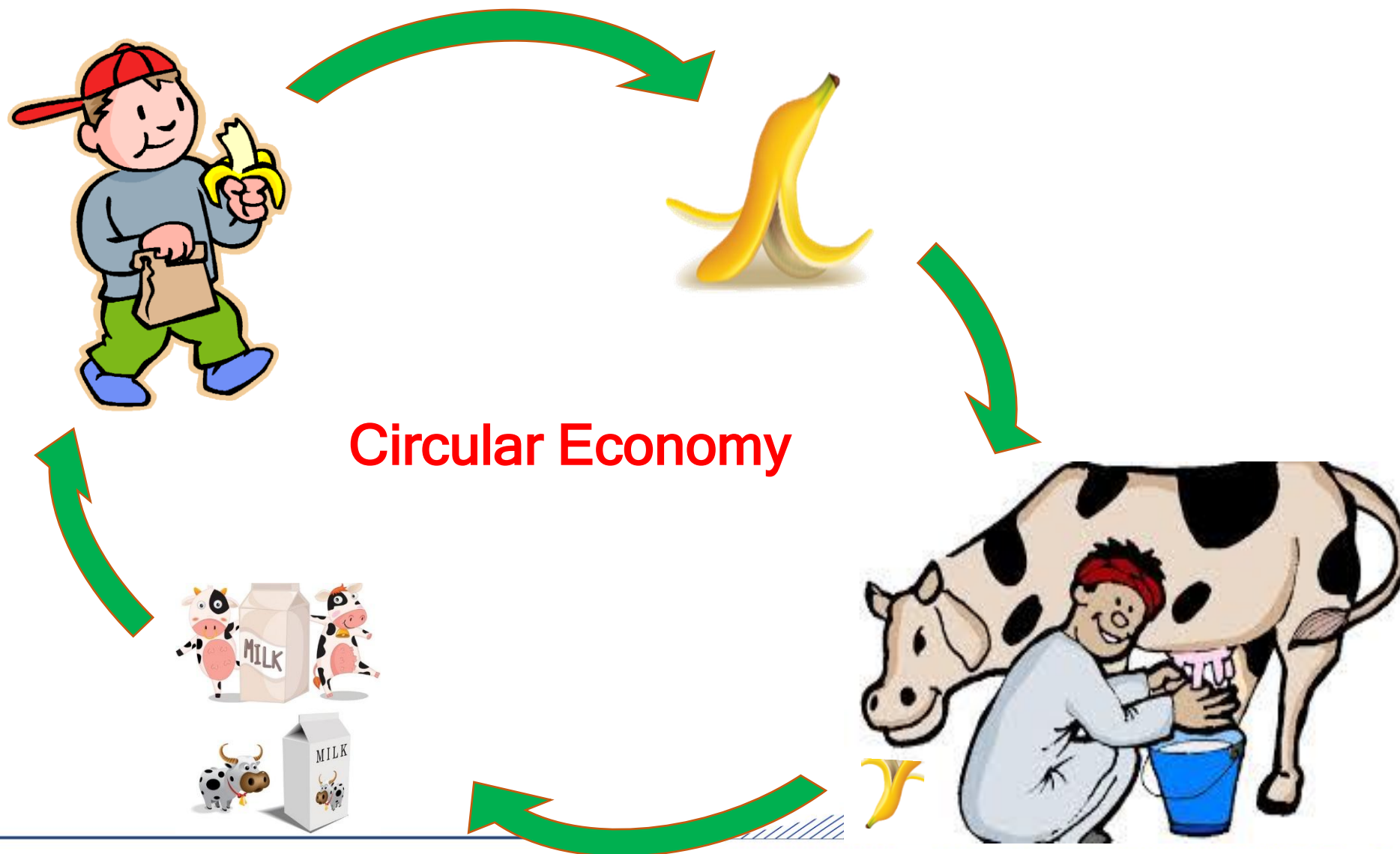
What if we could share responsibility with producers?

It's called "Extended Producer Responsibility or EPR"

Starting with the transition from a linear to a circular economy



Linear to Circular!

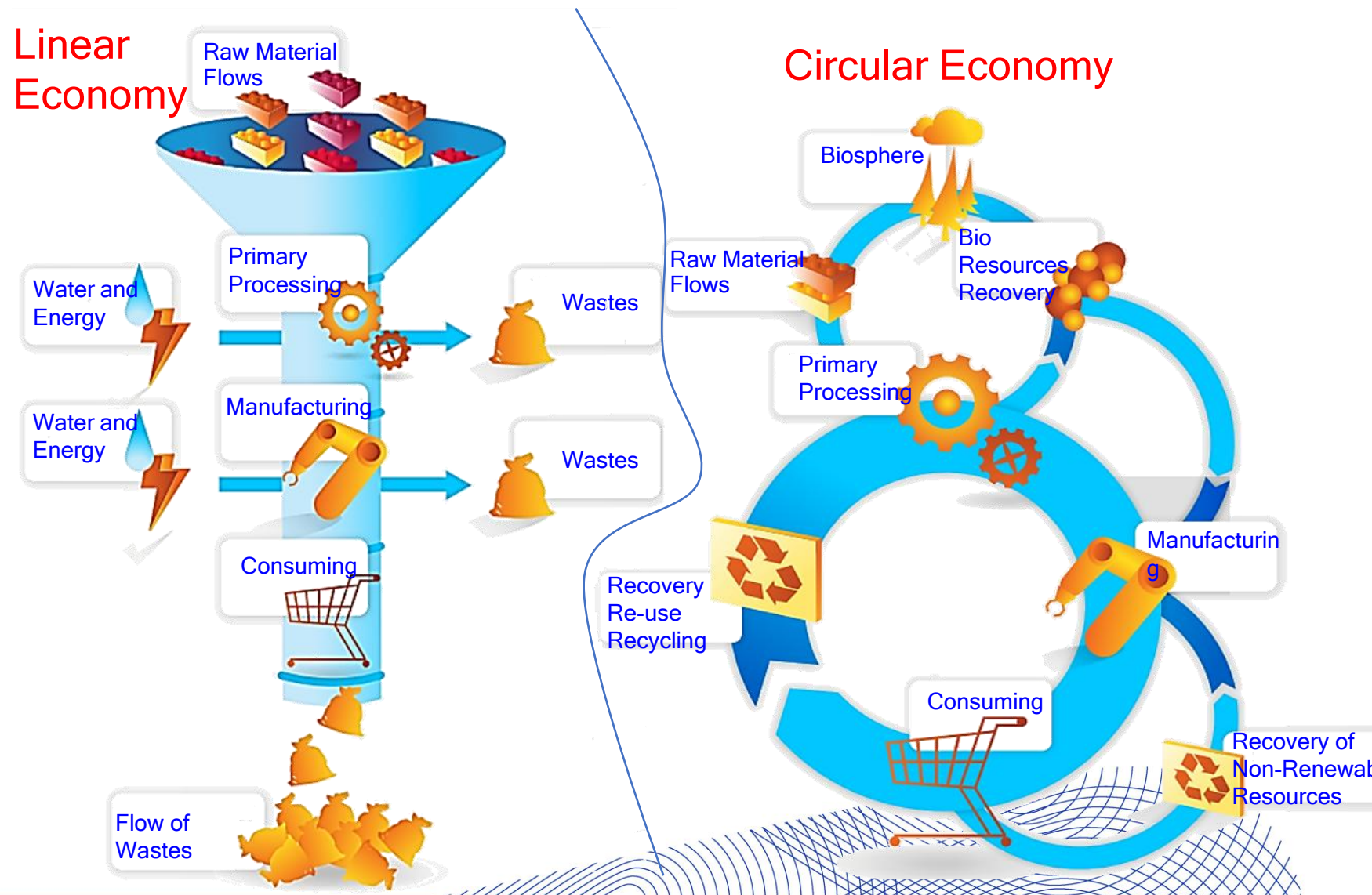


Drivers to Circular Economy

Technological Innovation/Green Technologies/Eco design

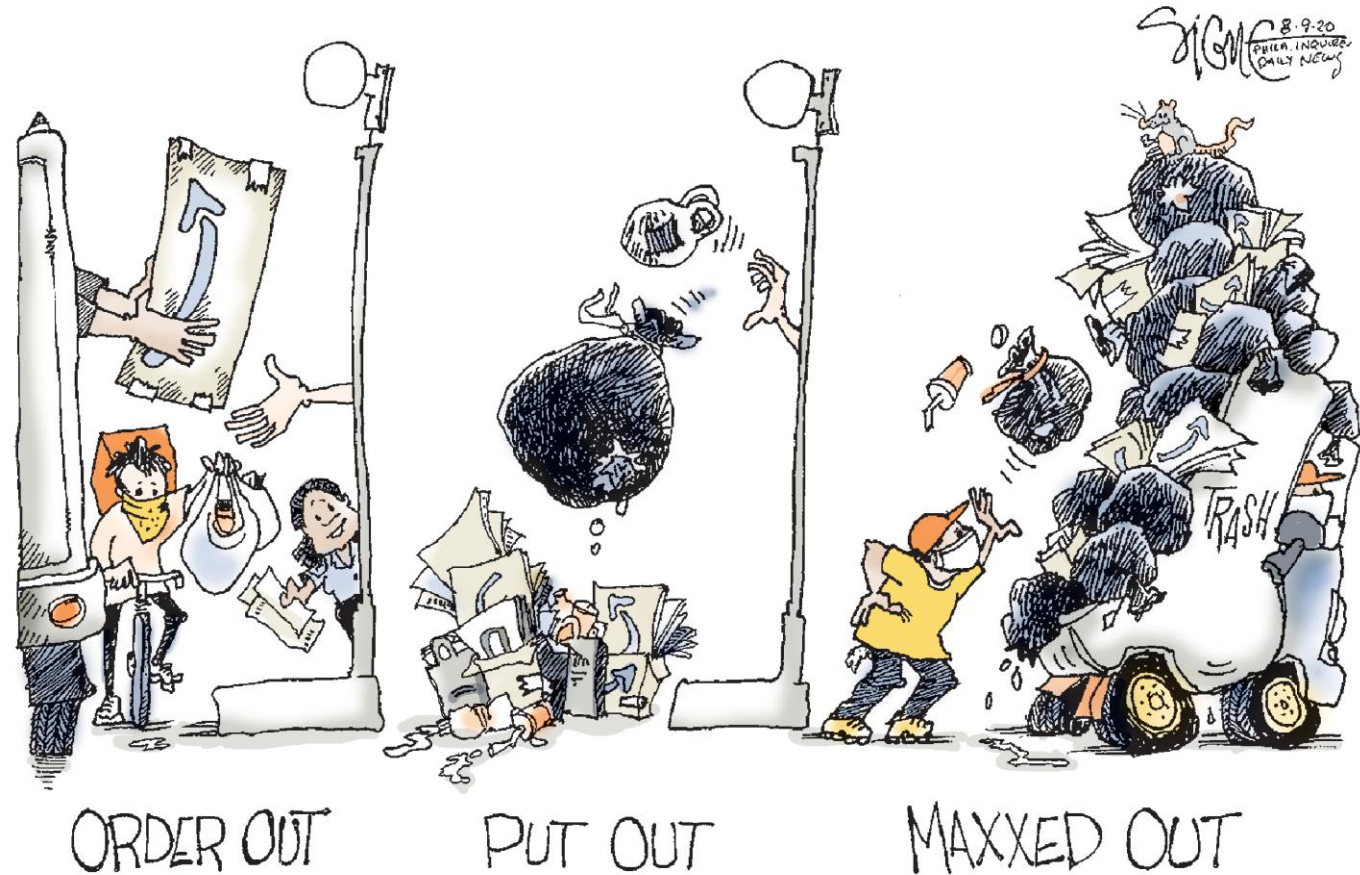
- Circular economy opens a wide array of new innovative technologies to close the loop.
- The role of technology has been mainly to:
 - Improve the efficiency of the production processes, significantly increasing the unit of output by unit of input, like for better combustion engine or faster transistors;
 - Reintroduce the “waste” into the production chain.

3R or CE



Why was EPR developed?

- Governments and municipalities cannot manage growing waste streams alone.
- Producers have little incentive to reduce waste after products are sold.
- Waste management costs are largely borne by taxpayers.
- Collection and recycling systems are often inefficient.
- Valuable materials are lost instead of being recovered and reused.



How EPR Works for Circular Economy

The Crisis of the Linear Economy and the Turning Point

Current Problem (Take-Make-Dispose)

Global material consumption is expected to more than double in the next 40 years. Without financial mechanisms, waste management will become a heavy burden for the state and local governments.



The Solution (Circular Economy)

Must keep materials in the economy for as long as possible. Reduce reliance on virgin resources.

The Missing Puzzle Piece (The Missing Engine)

Voluntary recycling or relying on government budgets is often insufficient. EPR is the 'tool' that forces the linear line to bend into a cycle.

Problem:

- Products are not designed for recycling.
- No incentive to collect waste.
- Recycling systems lack funding.
- Valuable materials are lost.
- Responsibility is unclear.



EPR provides:

- Collection systems
- Responsibility
- Financing
- Eco-design incentives

*"Circular Economy is the destination.
EPR is one of the mechanisms to get there."*

EPR IN ACTION

Producer Responsibility for Post-Consumer Waste

Under Extended Producer Responsibility (EPR), producers are responsible for the **end-of-life management** of the products they place on the market.



KEY RESPONSIBILITIES UNDER EPR



Collection

Establish and support systems to collect used products and packaging from consumers.



Recycling & Recovery

Ensure materials are recycled or recovered and returned to the production cycle.



Financing

Provide financial support for collection, treatment, recycling, and recovery systems.



Eco-design

Design products and packaging that use fewer resources, are reusable, and recyclable.



Producers play a key role in building a circular economy and reducing environmental impact.

- EPR policies hold producers responsible for the **end-of-life management** of their products packaging.
- By **shifting the burden** of waste management to **producers**, EPR encourages **product redesign**, **recycling**, and **sustainable packaging practices**.

How Does EPR Work?



- **Collection Systems** ensure post-consumer products and packaging are returned into formal waste management systems.
- **Recycling & Recovery** transform collected waste into valuable secondary materials and resources.
- **Financing Mechanisms** shift waste management costs from taxpayers to producers, supporting sustainable collection and recycling.
- **Eco-design** encourages products that are durable, reusable, repairable, and easier to recycle.
- Together, these mechanisms help keep materials in circulation and support the transition to a **Circular Economy**.

Case Study of Panasonic Battery Collection Program (Thailand)

• Overview

- Panasonic launched a used battery collection program through 7-Eleven stores.
- Collection points expanded from 31 pilot locations to 1,000 stores nationwide.

• Role in EPR

- Provides a convenient take-back system for consumers.
- Demonstrates producer responsibility for post-consumer battery waste.

• Benefits

- Increases battery collection and recycling.
- Reduces improper disposal and environmental impacts.
- Supports resource recovery and circularity.

• Key Takeaway

- EPR helps create collection systems that return end-of-life products back into the circular economy.



Case Study of AIS “Thailand without E-Waste” Initiative

• Overview

- AIS launched a nationwide e-waste collection program in partnership with Central Group.
- Collection points were installed at Central department stores to encourage proper disposal of electronic waste.

• Role in EPR

- Provides accessible collection channels for end-of-life electronics.
- Encourages consumer participation in responsible e-waste management.
- Supports take-back and recycling systems for post-consumer products.

• Benefits

- Increases e-waste collection and recovery.
- Reduces environmental impacts from improper disposal.
- Supports zero-landfill and circular economy objectives.

• Key Takeaway

- Effective EPR requires convenient collection systems that enable consumers to return end-of-life products for proper treatment and recycling.



Recycling & Recovery Role of EPR

- EPR increases the collection and recycling of post-consumer products and packaging.
- Well-designed EPR schemes improve material recovery rates and reduce waste sent to landfills.
- Recovered materials can be reintroduced into production processes, reducing the demand for virgin resources.
- Recycling and recovery are essential mechanisms for advancing resource efficiency and circular economy objectives.



Comparison of the collection for recycling rate for plastic packaging without EPR, with limited or voluntary EPR, and with mandatory EPR (UNIDO, 2023).

Case Study of RE.UNIQLO (Japan)

• Overview

- UNIQLO collects used down jackets from consumers through its RE.UNIQLO take-back program.
- Recovered down feathers are processed and reused in the production of new down jackets.

• Role in EPR

- Establishes a producer-led collection and recovery system.
- Recovers valuable materials from end-of-life products.
- Supports product-to-product recycling through closed-loop material use.

• Benefits

- Reduces textile waste sent to disposal.
- Decreases reliance on virgin down materials.
- Promotes resource efficiency and material circularity.

• Key Takeaway

- EPR can enable producers to recover materials from used products and transform them into new products, supporting a circular economy.



Financing Role of EPR

- Extended Producer Responsibility (EPR) is an important policy tool supporting **waste management financing**.
- It helps shift financial responsibility from municipalities to **producers of products**.
- In practice, EPR schemes can generate **substantial financial contributions** to waste systems.
- Examples from Europe show **large-scale funding support** in real implementation cases.
- Beyond financing, EPR is expanding in scope to address:
 - new product types (e.g., textiles, pharmaceuticals)
 - emerging environmental issues (e.g., littering, microplastics)
 - modern market systems such as online sales.
- At the global level, EPR supports **SDG 12: Sustainable Consumption and Production**.
- It is also recognized in **UNEA circular economy and plastic pollution resolutions** as a key policy instrument.



Case Study of Norway's Deposit Return System

• Overview

- Consumers return beverage containers (PET bottles and cans) through Norway's deposit return system (DRS).
- Returns are made via reverse vending machines (RVMs) and retail collection points.
- Collected containers are processed and recycled into new packaging by Infinitem

• Role in EPR

- Establishes a nationwide return infrastructure linking consumers, retailers, and recyclers.
- Uses deposit incentives and EPR principles to drive high return rates.
- Shares financial responsibility between producers and system revenues (deposits, material value, fees).

• Benefits

- Achieves high return rates (approx. 92%+ for cans and bottles).
- Reduces littering and environmental leakage of packaging.
- Enables high-quality closed-loop recycling of PET and aluminum.

• Key Takeaway

- Norway demonstrates how EPR and deposit incentives can create a self-sustaining, high-efficiency circular packaging system.



Eco-design Role of EPR



- Eco-design aims to reduce environmental impact across the product lifecycle.



- Focus on reducing resource use through sustainable materials and efficient production.



- Improve product durability through long-lasting and repairable designs.



- Facilitate recycling by using recyclable materials and minimizing hazardous substances.



- Use Life Cycle Assessment (LCA) to identify environmental impacts at each stage



- Design products for disassembly to improve recycling and material recovery

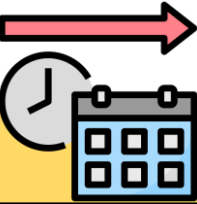


- Strengthen collaboration between producers, suppliers, regulators, and stakeholders



- Align product design with EPR requirements to support circular economy goals

Challenges & Future of EPR and Eco-Design

 Challenges	 Future Directions
High costs of implementing eco-design and EPR systems	Innovation in sustainable materials (bioplastics, recycled, renewable resources)
Lack of internal expertise and technical knowledge	Expansion of EPR regulations across more product types and countries
Resistance to organizational and production changes	Increasing consumer demand for sustainable products
Complexity in compliance with EPR requirements	Technological advancements in recycling, LCA tools, and smart manufacturing
Need for coordination with multiple stakeholders	Stronger integration of digital tools and lifecycle-based design

Case Study of Suntory PepsiCo Thailand – 100% rPET Bottles

SUNTORY
PEPSICO

“Bottle-to-Bottle Recycling” ขวด rPET สะอาด ปลอดภัย เป็นมิตรต่อสิ่งแวดล้อม



• Overview

- Suntory PepsiCo Thailand became the first beverage company in Thailand to introduce bottles made from **100% recycled PET (rPET)** in 2023.
- rPET bottles are produced through a **Bottle-to-Bottle recycling process**, where used PET bottles are collected, recycled, and transformed into new food-grade beverage bottles.

• Role in EPR

- Integrates **eco-design principles** by increasing recycled content in packaging.
- Supports a **closed-loop recycling system**, allowing used bottles to become new bottles.
- Reduces dependence on virgin plastic and promotes circular use of materials.

• Benefits

- Reduces plastic waste sent to landfill and leakage into the environment.
- Lowers demand for virgin fossil-based materials and greenhouse gas emissions.
- Demonstrates how producers can redesign packaging to improve resource circularity.

• Key Takeaway

- EPR is not only about collecting waste; it also encourages producers to redesign packaging and increase recycled content to support a circular economy.



Mapping Worldwide Current EPR Systems

Group	Country / Region	EPR Status	Key Regulations / Features
Advanced / Harmonised EPR Systems	European Union, United Kingdom	Strong mandatory EPR systems with circular economy integration	EU: recyclability by 2030, waste reduction targets (2030-2040), PPWR standardization UK: PackUK system, recyclability assessment (2025), eco-modulated fees (2026)
Decentralised / Sub-national EPR Systems	United States, Canada	No national EPR; implemented at state/province level	US: State-led (e.g. California), Circular Action Alliance reporting Canada: Provincial EPR, varying implementation
Emerging EPR Systems (Expanding Implementation)	Australia, New Zealand, South Africa, India, Chile	Developing or strengthening EPR frameworks	Australia: APCO-led, 2030 Strategy, eco-modulated fees New Zealand: Mandatory plastic packaging EPR, phase-out delays South Africa: EPR for packaging & e-waste (since 2021) India: Plastic Waste Rules (2016) Chile: Packaging recovery targets
Established Producer Responsibility System (Asia)	Japan	Mature recycling-based producer responsibility system	Mandatory recycling obligations via Containers & Packaging Recycling Association

Why EPR Matters in India

- India generates approximately **62 million tonnes of municipal solid waste** and **3.2 million tonnes of e-waste annually**.
- Significant gaps remain between waste generation, collection, and recycling.
- EPR regulations were introduced for **e-waste, plastic packaging, batteries, and tyres**.
- Producers are required to **collect and recycle a portion of end-of-life products placed on the market**.
- EPR has stimulated the development of collection systems, recycling infrastructure, and stakeholder collaboration.

Is EPR Authorization Mandatory in India



Yes, EPR (Extended Producer Responsibility) Authorization is mandatory in India for specific categories of businesses and products such as plastics, electronics, batteries, and other waste-generating goods.



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Key Lessons

- Strong collection systems are essential for circular economy success.
- Sustainable financing mechanisms are critical.
- Digital monitoring improves transparency and accountability.
- Integration of the informal sector strengthens collection and recycling performance.

Key Takeaway

- India demonstrates that EPR can serve as a key policy tool for building collection systems, improving recycling rates, and enabling a circular economy at scale.



Mapping ASEAN's Current EPR Systems

Country	Legislative Clarity	Industry-Led Compliance	Local Adaptation	Targets & Standards	Fee Coverage	Incentivizing Upstream Solutions
Philippines	Law for plastics since 2022	Credit-based, with optional PRO-based	Mention, but no formal integration of informal sector	Targets in place	No clear ringfencing	No eco-design or fee modulation
Vietnam	Law since 2022	Either PRO- or fee-based	No mention of informal sector	Targets in place	No clear ringfencing	No eco-design or fee modulation
Indonesia	Waste Reduction Roadmap - Ministerial Regulation since 2019, but not full EPR and not yet fully enforced	Voluntary PRO-based	Mention, but no formal integration of informal sector	Targets in place	No clear ringfencing	No eco-design or fee modulation
Singapore	Reporting & DRS only	DRS: industry-led, fee-based	Integrated into local waste system	Announced, not legally binding	DRS fee ringfencing in place	No eco-design or fee modulation
Thailand	Implementation aiming for 2027/2028	PRO-based	No mention of informal sector	Proposed	No clear ringfencing yet	Eco-design criteria mentioned
Malaysia	Implementation not before 2030	Fee-based	No mention of informal sector	No targets	No clear ringfencing	No eco-design or fee modulation
Cambodia	No EPR policy					
Myanmar	No EPR policy					
Brunei	No EPR plans					
Laos	No EPR plans					

What is PRO????

A **Producer Responsibility Organization (PRO)** is an entity that manages producers' responsibilities for end-of-life products.

Core Function	Responsibility of the PRO
Waste Logistics	Organizing collection, transport, and sorting networks.
Financial Management	Collecting producer fees and subsidizing recycling infrastructure.
Data & Compliance	Monitoring material flows and reporting to governments.
Public Awareness	Educating consumers on proper disposal and take-back channels.

PROs serve as the operational backbone of most ASEAN EPR systems.

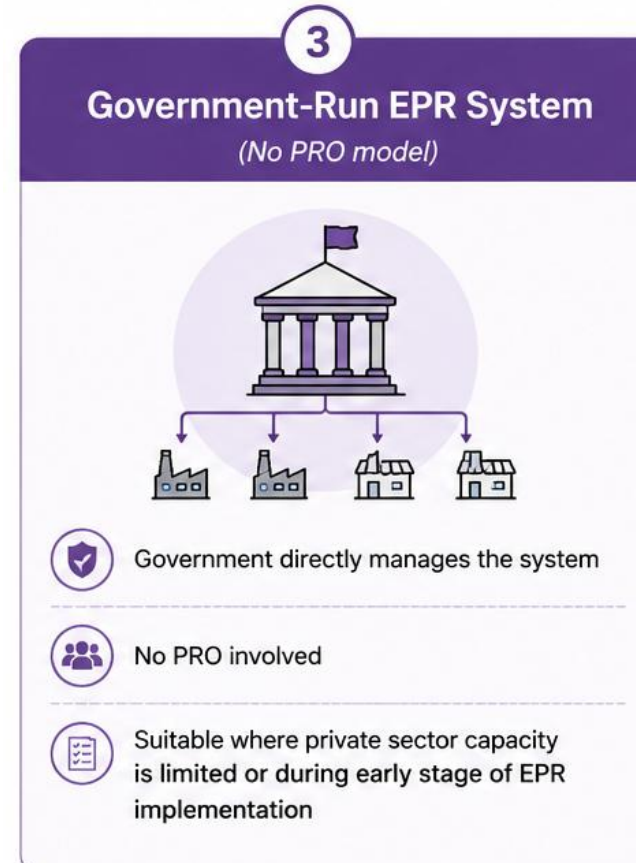
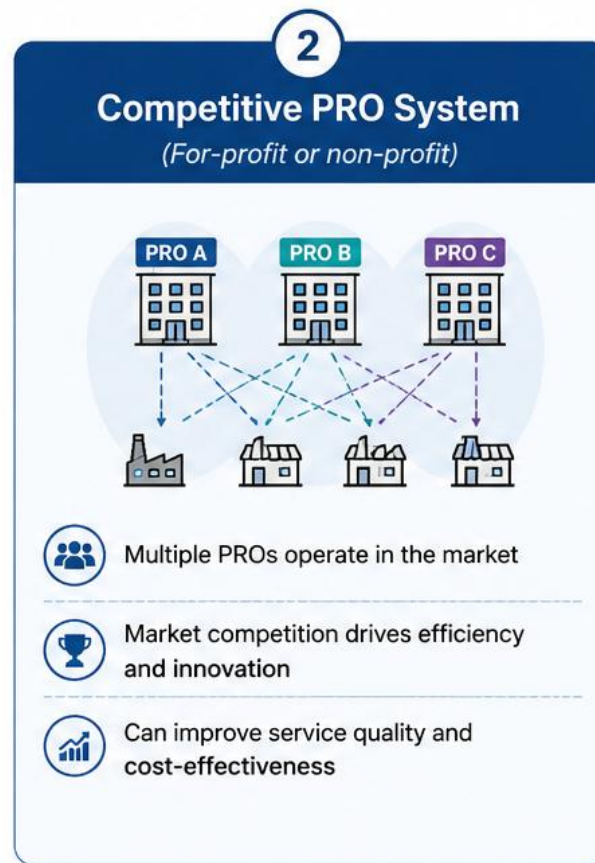
EPR = "who is responsible"

PRO = "who implements the responsibility"

Governance Models of PROs



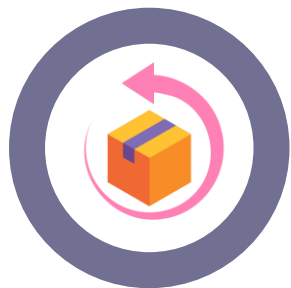
PRO (Producer Responsibility Organization) systems can be structured in different ways depending on market size, policy objectives, and regulatory capacity.



Suitable For:

- **Mono PRO** → Simple & controlled (start-up phase)
- **Competitive PRO** → Efficient & innovative (mature systems)
- **Government-run** → Strong control but less flexible (early/centralized systems)

Policy Instruments Supporting PRO



Take-back requirements

- Producers responsible for collection of end-of-life products.



Economic instruments

- Deposit-refund schemes
- Advance disposal fees
- Material taxes and upstream incentives



Regulatory instruments

- Recycling content standards
- Collection and performance targets



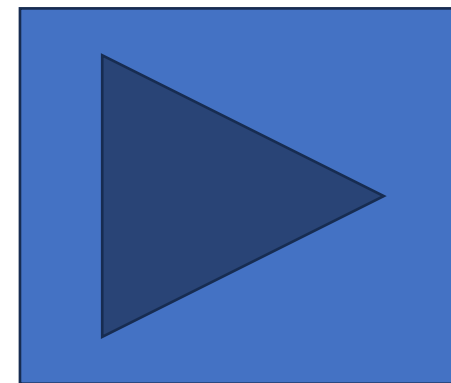
Information-based tools

- Product labeling
- Reporting requirements
- Digital product passports

These instruments strengthen the effectiveness of PRO systems and support a circular economy transition.



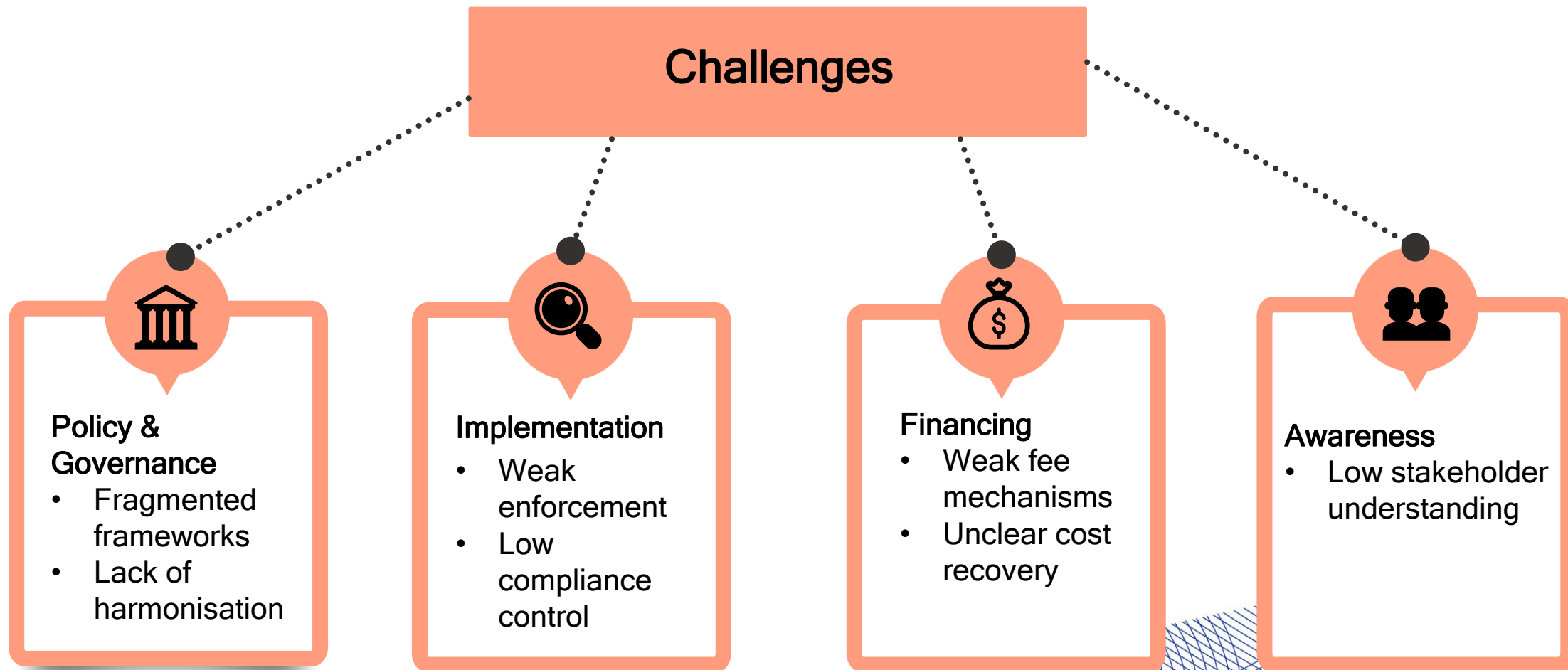
Understand EPR for packaging in 3 minutes!!!



<https://www.youtube.com/watch?v=N21izp8Tw70>

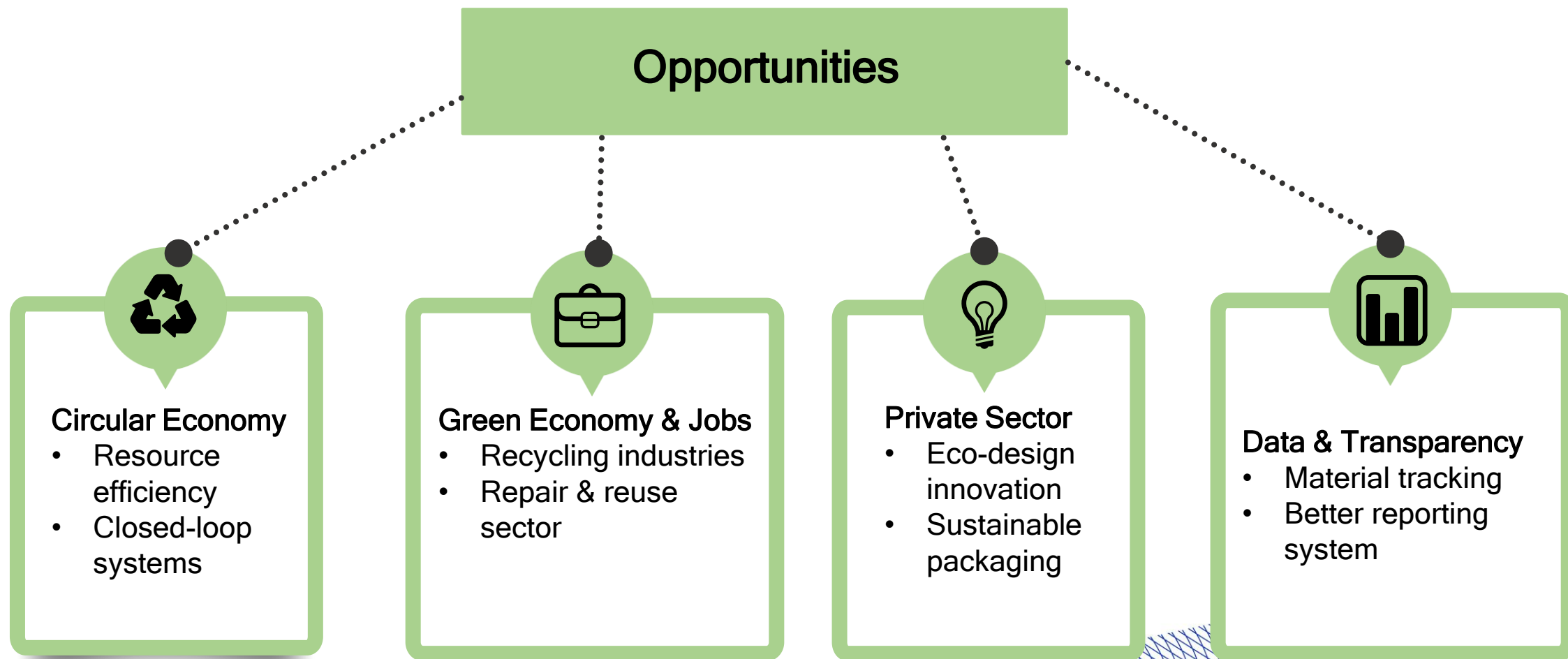
Challenges of EPR

EPR implementation still faces fragmented **policy frameworks**, **weak enforcement**, and **limited system readiness** that hinder effective producer responsibility across value chains.

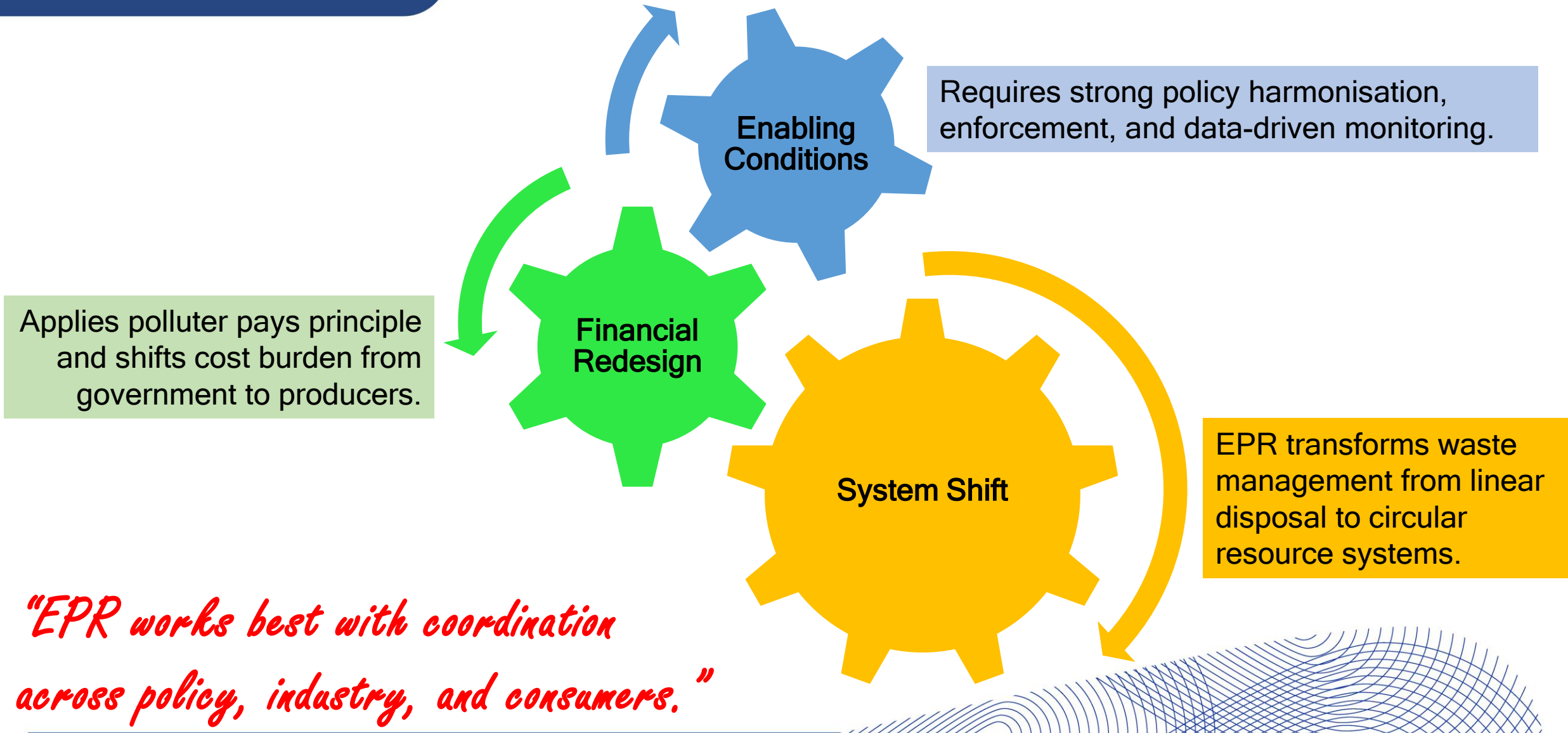


Opportunities of EPR

EPR offers a powerful lever to accelerate **circular economy** transition through stronger **producer accountability**, improved **recycling systems**, and new **green economic opportunities**.



Key Takeaways



Discussion Points



- What kinds of waste problems exist in your country?
- Could Extended Producer Responsibility (EPR) help address these problems?



Thank You!