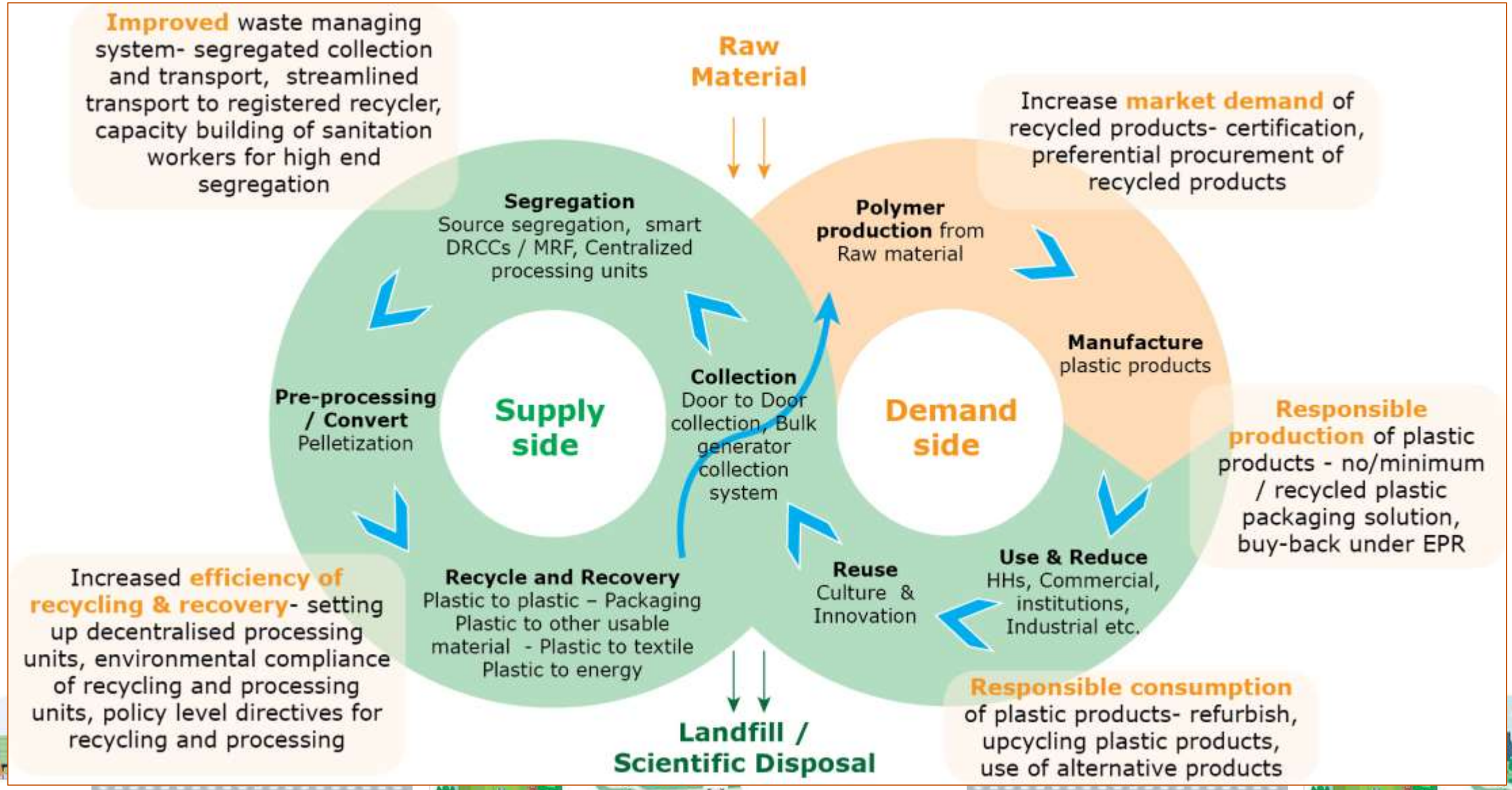
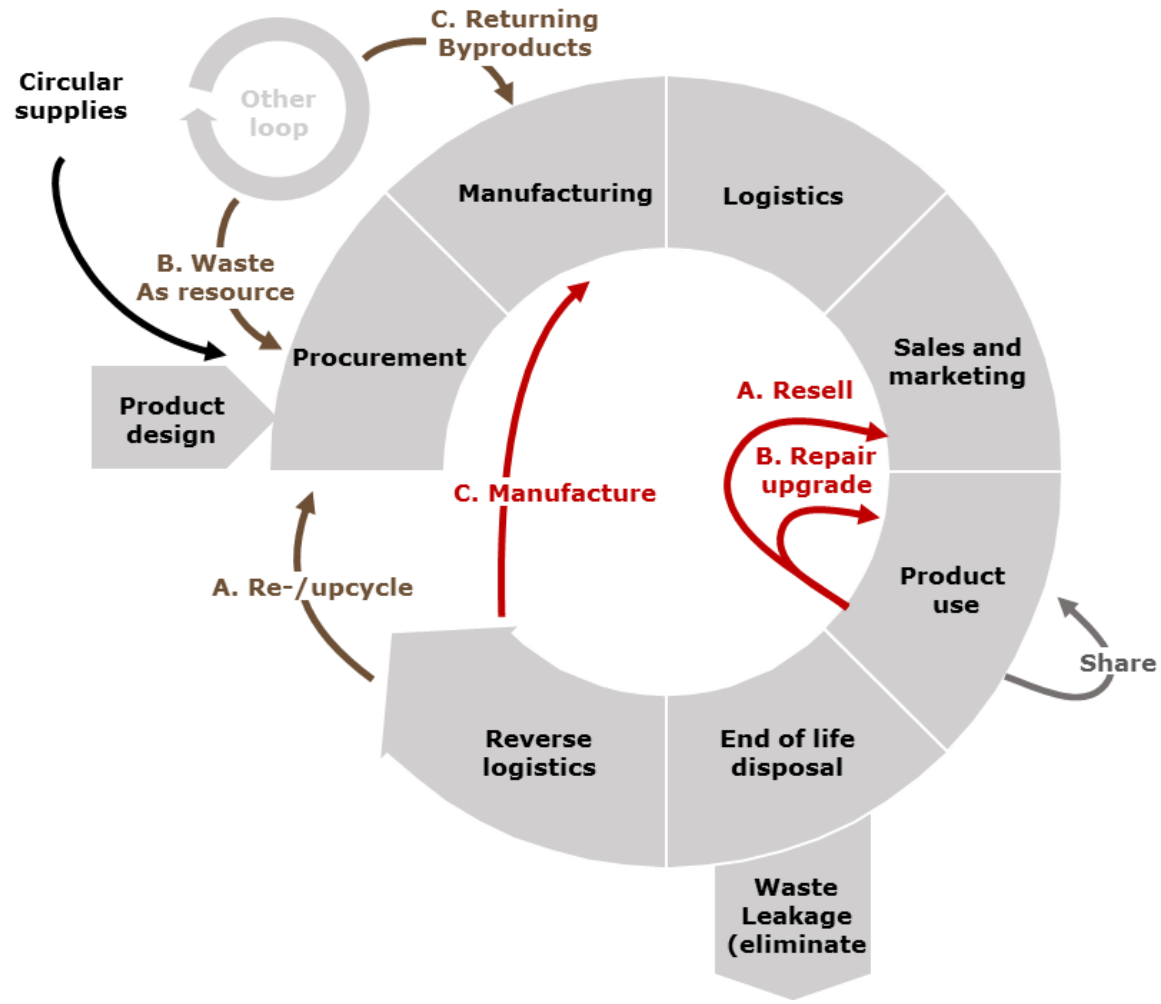
Compendium of Plastic Waste Management Strategies and Actions

Module VI

Circular economy in plastic waste management



Business models enhancing circular economy



- Circular supplies
- Resource Recovery
- Product life extension
- Sharing platform
- Product as a service

Bottle necks

- Citizen approach
- Infrastructure
- Regulations

(Source: Innovative Business Models and Technologies to Create Value in a World without Limits to Growth, Accenture strategy document)

Business models enhancing circular economy (Contd.)

Five underlying business models encompassing circular economy

- **Circular supplies** – Based on supplying fully renewable, recyclable, or biodegradable resource inputs. Example – compostable carry bags production units
- **Resource Recovery** - Closed loops recycling and Cradle-to-Cradle procedures. Example – PET bottle recycled to textile fibres
- **Product life extension** – Refers to extend lifecycle of products and assets by repairing, upgrading, remanufacturing or remarketing products. Example – waste to interior designing products
- **Sharing platform** – Promotes a platform for collaboration among product users, either individuals or organizations. Example - Cutlery banks etc.
- **Product as a service** - Products are used by one or many customers through a lease or pay-for-use arrangement. Example –refill services of daily use products like shampoos creams, etc.

Design solutions to reduce plastic packaging and enable easy recycling

Change in plastic design

No or very less addition of dark colour and additives

Packaging substitute

- Mushroom packaging by IKEA & Paper cushioning by Amazon

(Source: https://news.yahoo.com/ikea-commits-biodegradable-mushroom-packaging)

Design solutions to reduce plastic packaging and enable easy recycling

Tide Ecobox

- Made with 30% less water, its re-engineered formula gives you 30% more cleaning power per drop than Tide Original liquid detergent in three 46-ounce bottles
- Bag-in-box packaging for liquid detergents uses 60% less plastic than the comparable bottle version

Reduced plastic packaging by Danish Crown

(Source: https://english.fleischwirtschaft.de/economy/news/Sustainability-Danish-Crown-introduces-new-climate-friendly-packaging-40700 http://www.myreplenish.com, https://tide.com/en-us/shop/type/liquid/tide-original-eco-box)

Design solutions to reduce plastic packaging and enable easy recycling (Contd.)

Replenish

- Replenish, Los Angeles, US (2010)
- Customizable packing platform for liquid concentrates
  - Circular design for detergent bottle, that is durable
  - It reduces energy, plastic waste and carbon dioxide emission 80-90% compared to one-use bottles and avoids the illogical need to transport water over great distances

(Source: http://www.myreplenish.com)

EPR initiatives by FMCG brands

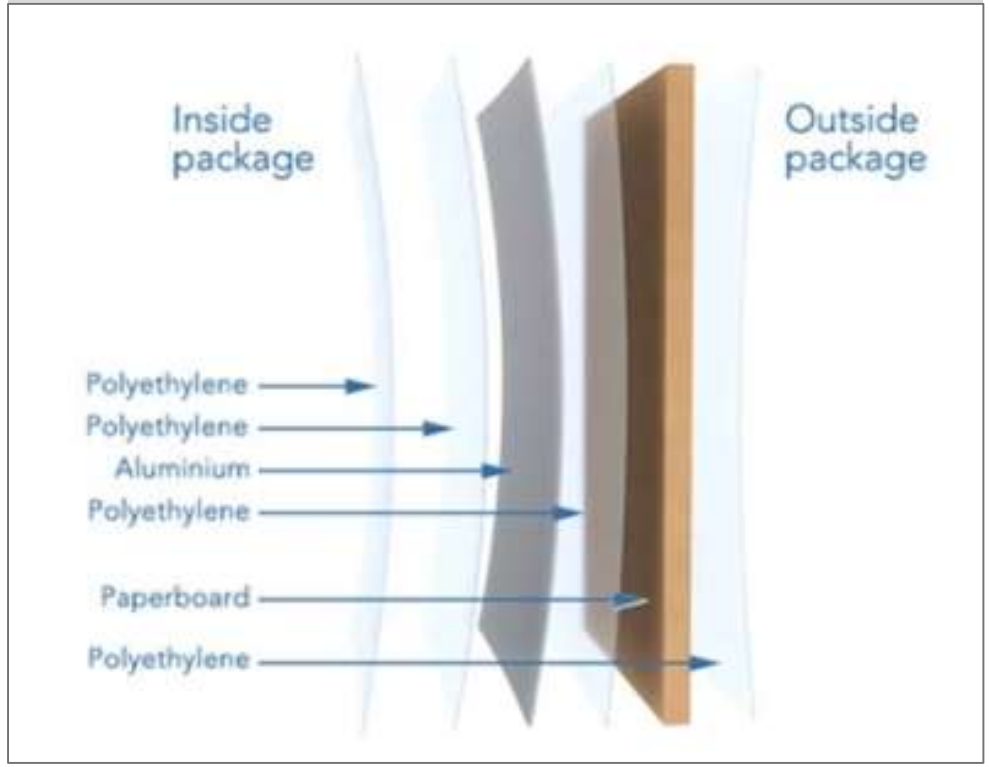
Tetra Pak collaborated with 'Sahakari Bhandar' and 'Reliance Fresh' to

- Collect cartons from designated collection centres
- Shred them into smaller pieces
- Compact them under high temperature and pressure to recycle into composite sheets for making furniture

Impact

- 45 lakh tetra pack cartons recycled in 10 years
- 300 school desks donated
- 170 garden benches donated

Tetra Pak Layers of Packaging



(Source: https://rur.co.in/services/epr/epr-tetra-pak/)

EPR initiatives by FMCG brands

Tetra Pak Collection Centres

(Source: https://thelogicalindian.com/story-feed/awareness/recycled-tetra-pak-cartons-difference; https://packagingsouthasia.com/type-of-article/industry-news/go-green-tetra-pak/)

Benches Made of Recycled Carton

Upcycling of plastic products

Ban on Single Use Plastics (SUPs)

Partial Ban- Pan India ban on less than 50 micron plastic carry bag

Complete Ban on sale, storage and use of SUPs in few states

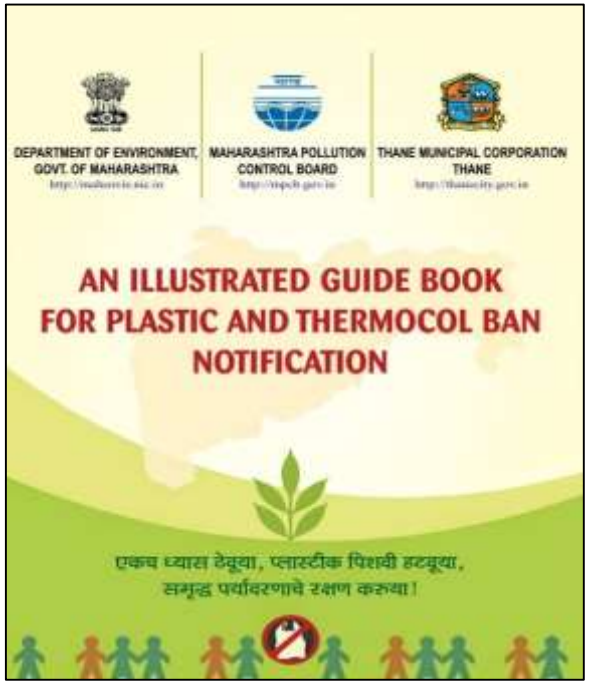
South & Central Asia

India's Sikkim State Leads Country's Plastic Ban with Bar on Bags

By Anjana Pasricha
September 29, 2019 11:46 AM

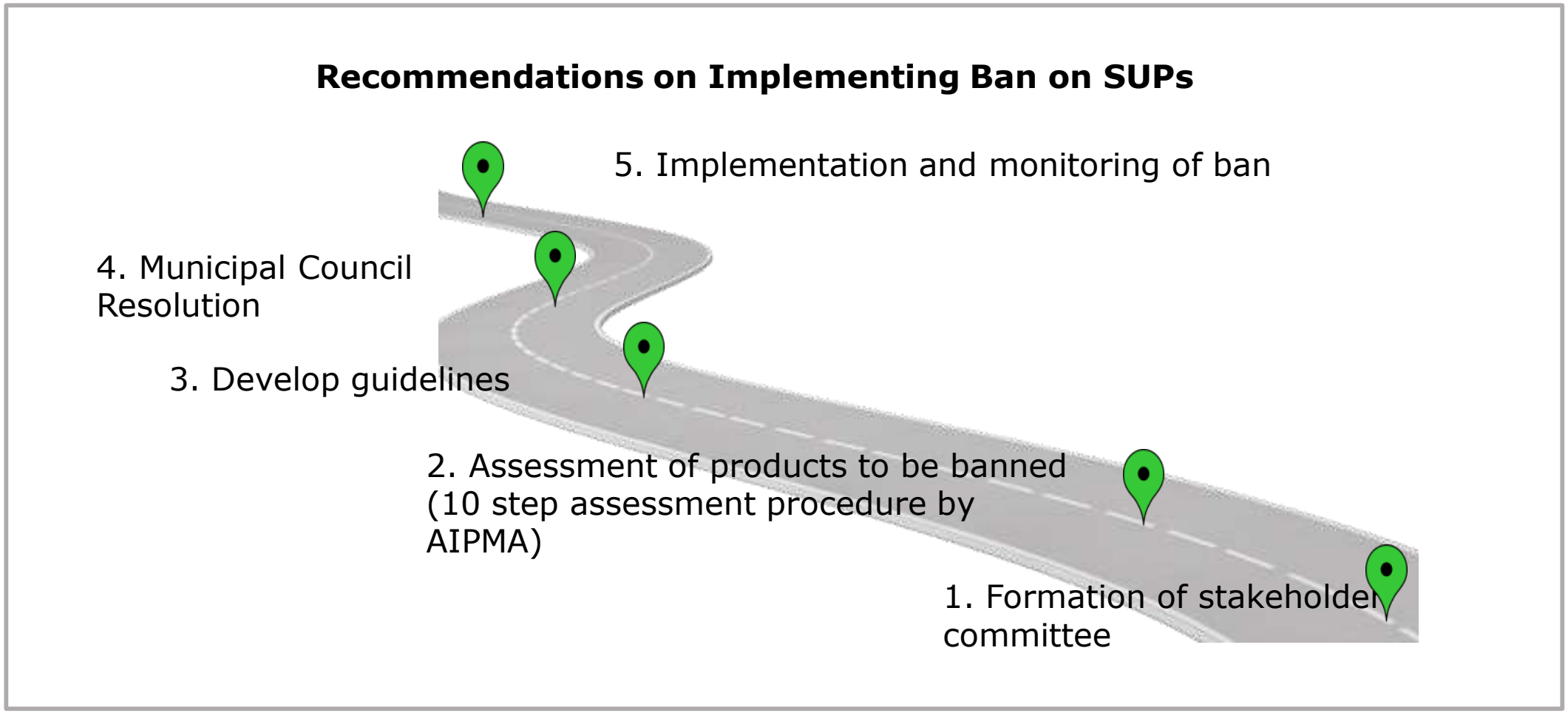
A stall owner in a market in Gangtok city in India's northeast wraps fermented soya beans in a leaf, one of the alternates used in place of plastic for packaging. (A. Pasricha/VOA)

GANGTOK, INDIA – At a grocery store here in the capital of Sikkim state, in India's northeast, a shop assistant tears a sheet from a stack of old newspapers on the



(Source: https://www.voanews.com/south-central-asia/indias-sikkim-state-leads-countrys-plastic-ban-bar-bags; https://sujal-swachhsangraha.gov.in/sites/default/files/5%20x%207%20inch%20Brochure.pdf)

Ban on Single Use Plastics (SUPs)



Ban on Single Use Plastics (SUPs)

Impact of plastics ban in India

State	Year	Ban on Plastic products	Impact
Himachal Pradesh	2011	Disposable plastic products, Non-biodegradable plastics bags	Significant decrease in plastic pollution
Karnataka	2016	Plastic bags	Plastic bags still available and used
Punjab	2016	Single use plastic carry bags and containers	No data
Haryana	2018	Plastic carry bags	Limited impact because of poor enforcement
Kerala	2020	Plastic bags <50 microns and SUPs	No data
West Bengal	2004	Plastic bags <40 microns	

Ban on Single Use Plastics (SUPs) (Contd.)

Impact of plastics ban in India

State	Year	Ban on Plastic products	Impact
Sikkim	1998	Disposable plastic bags, is also among the first to target SUP bottles	Although plastic bags are still common, 66% of population shifted to paper bags and newspapers.
Delhi	2017	Ban on all kind of disposable plastics	Limited impact; poor enforcement
Maharashtra	2018	Plastic carry bags, PET bottles(below 200 ml), disposable items, decoration items	No data
Telangana	2019	Plastic bags <50 microns	Limited impact because of poor enforcement

(Source: Developed based on the presentation by All India Plastic Manufacturers Association)

Sustainable public procurement

Sustainable Public Procurement (SPP) - "A process whereby organizations meet their needs for goods, services, works and utilities in a way that **achieves value for money** on a **whole life basis** in terms of generating **benefits not only to the organization, but also to society** and the economy, whilst **minimizing damage to the environment**."

- UNEP Marrakech Task Force

European Commission's main guidance document to help public authorities to buy goods and services with a lower environmental impact. It is also a reference for policy makers, and companies responding to green tenders. Available at: https://ec.europa.eu/environment/gpp/pdf/Buying-Green-Handbook-3rd-Edition.pdf

Sustainable public procurement (Contd.)

- Procurement of bio-degradable alternatives - part of organisation policy or procurement policy

Preferential Procurement by Large Generators

- Ghent Sustainable Public Procurement Strategy
- City of Malmo Furniture Framework
- Green procurement policy in TCS
- Green Public Procurement Manual on Plastic Waste Prevention in 2015 by city of Copenhagen

- Procurement of **reparable, reusable, recyclable** plastic products without composite or harmful material

Green protocol

Green Protocol is a set of guidelines to organise festivals or mass gathering events in a way to minimise waste generation. Kerala Green Protocol is one of the best examples

- Welcoming guests with water in steel tumbler
- Disposal bins for recyclables at the checkpoints
- Security deposit to carry plastic items inside the demarcated green zone
- Blanket ban on disposable serveware being used by caterers
- Use of bamboo and cloth for banner, gazebo, signage etc.

Eco-friendly Container

Cloth banner 'Welcome'

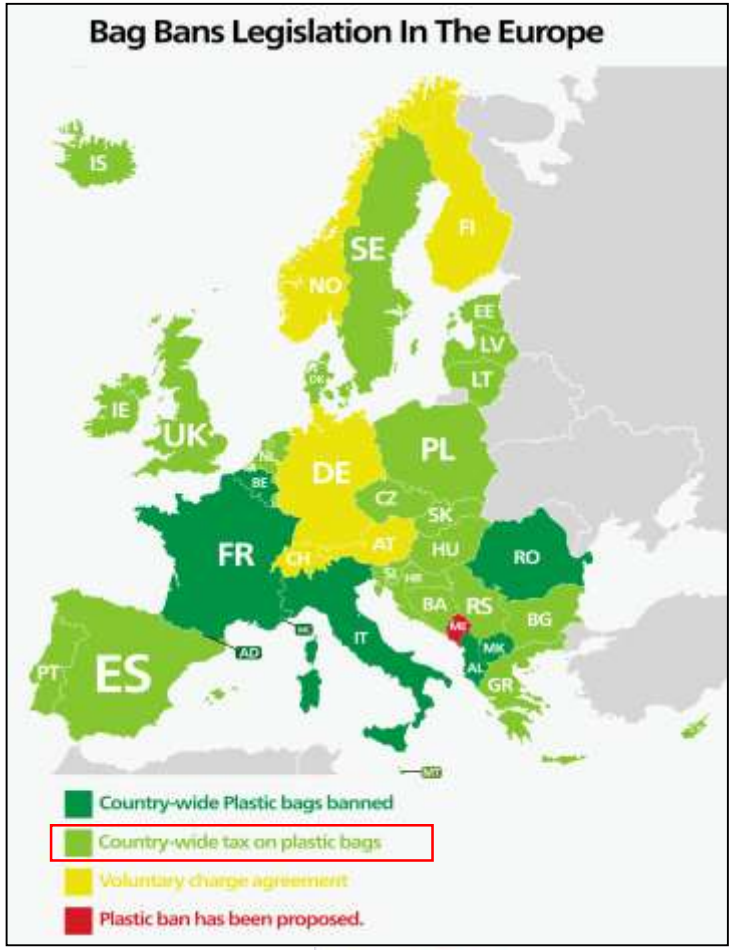
Steel Container for Buying Perishable Goods

Financial instruments to reduce consumption of SUPs

Plastic Packaging Tax	Tax on production and import of plastic packaging with less than specific percentage of recycled content, subject to consultation
Deposit and Refund Systems	Promote brand owners using plastic packaging to invest in deposit and refund systems for their products
Extended Producer Responsibility (EPR)	Systems with modulated fees to steer product design towards reuse and cost-effective recycling, and to establish joint value-chain responsibility
Green Bonds	Possibility for state governments/ULBs to develop a special purpose vehicle to promote investment by plastic brand owners (among others) to invest in green bonds. Funds to be used for plastic waste processing initiatives

Financial instruments to reduce consumption of SUPs

- England's plastic bag usage dropped 85% since the 5 penny charge introduced
- Ireland reduced plastic bag consumption by 90% (over 1 billion bags) between 2001 and 2011 by imposing a plastic bag tax of 37 cents
- Washington DC and Dallas charge for plastic bags and incentives for stores and consumers have dropped bag usage by some 50%



(Source: https://homesgu.com/where-are-plastic-bags-banned-or-taxed-around-the-world/)

Enhancing availability and accessibility of alternative products

Sal and Areca Nut Leaf Plate and Serve ware

'Rent a Cutlery' Facility

Sanitary napkin of Banana and Bamboo Fibre

Admaya Chetna's Plate Bank

Distribution of Tapioca Bags to Shopkeepers

Food Wrap from Honeybee Wax

(Source: https://iknowwaste.com/list-of-cutlery-banks-rentals-in-india, www.amazon.in/)

IEC to prevent littering, open burning and promote use of alternatives

- Information about health and environmental threats of littering & burning of plastics
- Capacity building of targeted specific groups
- Capacity building to adopt the practice of plastic specific source separation
- Sensitisation to reduce usage of SUPs

Wall Painting / Public participation events

Mass awareness programmes

Posters

Collection and Transport - Improved waste management system

Waste Segregation into 5 components in Panaji

(Source: MoHUA (2018). Transforming Urban Landscapes of India. Success Stories in Solid Waste Management. http://164.100.228.143:8080/sbm/content/writereaddata/SBM%20Coffee%20Table%20Book_Final.pdf)

Waste in Ambikapur is collected and transported in segregated e-rickshaws

Collection and Transport - Improved waste management system

D2D collection of segregated waste in slums by SWaCH (members of waste-pickers co-operative society)

Nets to Capture Plastic Waste at Drain Outlet

(Source: MoHUA (2018). Transforming Urban Landscapes of India. Success Stories in Solid Waste Management. http://164.100.228.143:8080/sbm/content/writereaddata/SBM%20Coffee%20Table%20Book_Final.pdf; http://www.chinadaily.com.cn/a/201906/14/WS5d02facba3103dbf143282c4.html)

Collection and Transport - Improved waste management system

Material Recovery facility (MRF) or Dry waste Resource Collection center (DRCC)

- Weighing – Weigh machine
- Sorting in compartments as defined by city – Space for manual sorting space/ conveyor belt and air classification.
- Shredding / baling – Shredder or bailing machine
- Washing (optional) – Wash line
- Drying – Hot air dryer
- Store - Storage space
- Transport to formal recycling units

Collection of crushed bottles from RVM at Charminar

(Source: MoHUA (2018). Transforming Urban Landscapes of India. Success Stories in Solid Waste Management. http://164.100.228.143:8080/sbm/content/writereaddata/SBM%20Coffee%20Table%20Book_Final.pdf)

MRF in Ambikapur

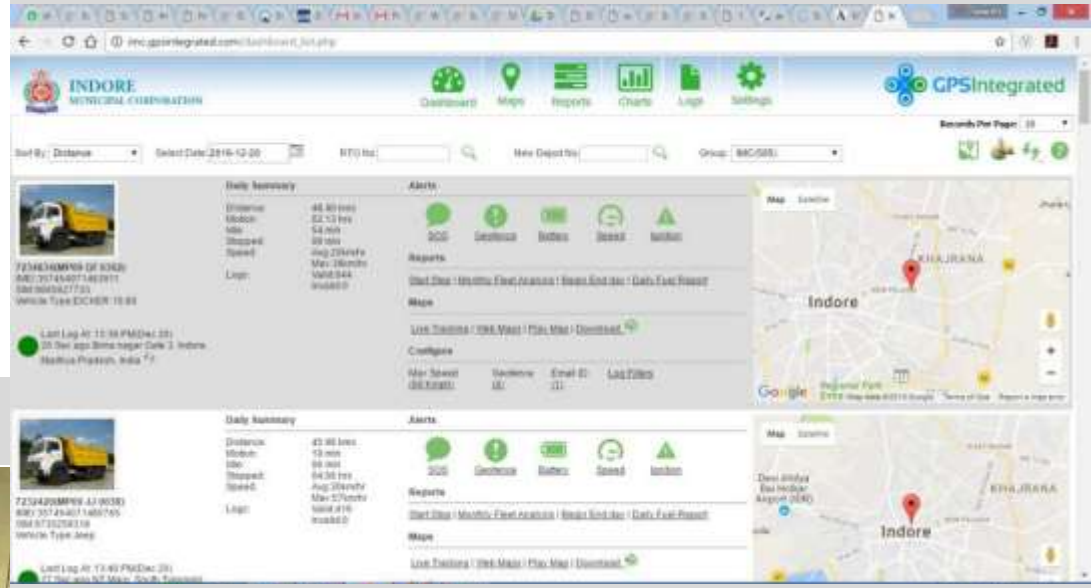
Portable workspace for waste pickers in Pune

Supply Side of Circular Economy – IT/IETC Enabling

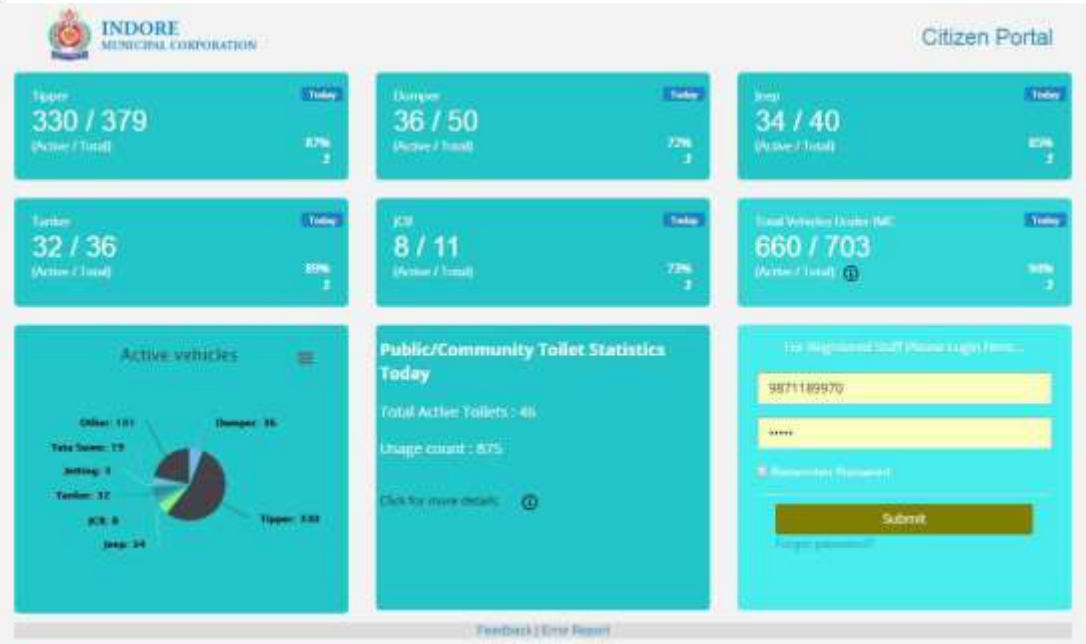
Collection and Transport - Improved waste management system

Biometric Attendance System for Sanitary Staff in Indore

GPS Based Monitoring of Garbage Vehicles



Real Time Monitoring of Waste Management through Command Control Centre



Collection and Transport - Improved waste management system

Saahas: a community zero waste pioneer

- Since 2001, 2,00,000+ beneficiaries, handling and diverting ~2,000 kgs of waste daily
- 170 people in Bangalore, Mumbai, Ballari, Gurgaon, Bharuch, Chennai, Noida, Mysore
- Partners: 50+ foundations and corporates including: JSW, ITC, Coke, Bosch, Tetra Pak, GIZ

Kabadiwalla Connect: A start-up per excellence

- Started in 2014 in Chennai
- Using ICT and IoT based technologies to track and manage city waste
- 500 metric tons of PET bottles collected in 3 years
- 2,000 kabadiwallas listed with the company

Banyan Nation

- Plastic cleaning technology
- High quality granules
- Works with informal recyclers to manage waste

Innovation in enabling services for formal recycling industry

Collection and Transport - Improved waste managing system to enforce Extended Producers Responsibility (EPR)

United Nations Development Programme (UNDP) India, in partnership with Hindustan Coca-Cola Beverages Private Limited (HCCBPL), Hindustan Unilever Limited (HUL), HDFC Bank & Coca Cola India Foundation (CCIF) is **setting up Material recovery facility (Swaccha Kendra) in 36 cities in India**

(Source: https://wastewarriors.org/what-we-do//)

Collection and Transport - Improved waste managing system to enforce Extended Producers Responsibility (EPR)

- The project is currently operational in 36 cities, with **22 Material Recovery Centres (Swachhta Kendras)**
- More than **66,000 metric tonnes of plastic waste** collected and processed
- The project has reached out to **5500 Safai Sathis**, in an effort to institutionalize workers from the informal sector
- UNDP was felicitated as a key partner by the MoHUA at the Swachh Survekshan Awards 2020 under the Swachh Bharat Mission

(Source: https://www.in.undp.org/content/india/en/home/projects/plastic-waste-management.html)

Collection and Transport- Improved waste managing system

SUNYA Model of Segregated Waste Collection for SAT Operators in Coimbatore

SAT Operator Selling Waste to Designated DRCC in Hyderabad

Collection and Transport- Improved waste managing system

E-Training of ULB Sanitation Staff in Indore

Handheld Training Session for SAT Workers on Safe Waste Collection Practices in Hyderabad

Recycling and Recovery - Increased efficiency

Advanced extruder technology for MLP waste

- UFLEX Limited developed an advanced version of the extruder called UFLEX RE Lam- 250 to recycle MLP
- Conversion of industrial waste into pellets
- Recycling of both single layered and multi-layered plastic waste
- Operates on double extruder technology
- Temperature ranges 150°C to 225 °C
- Equipped with air suction pump to captures the fumes generated during the melting of the inks and adhesive
- Ensures no discharge of harmful gases into the environment

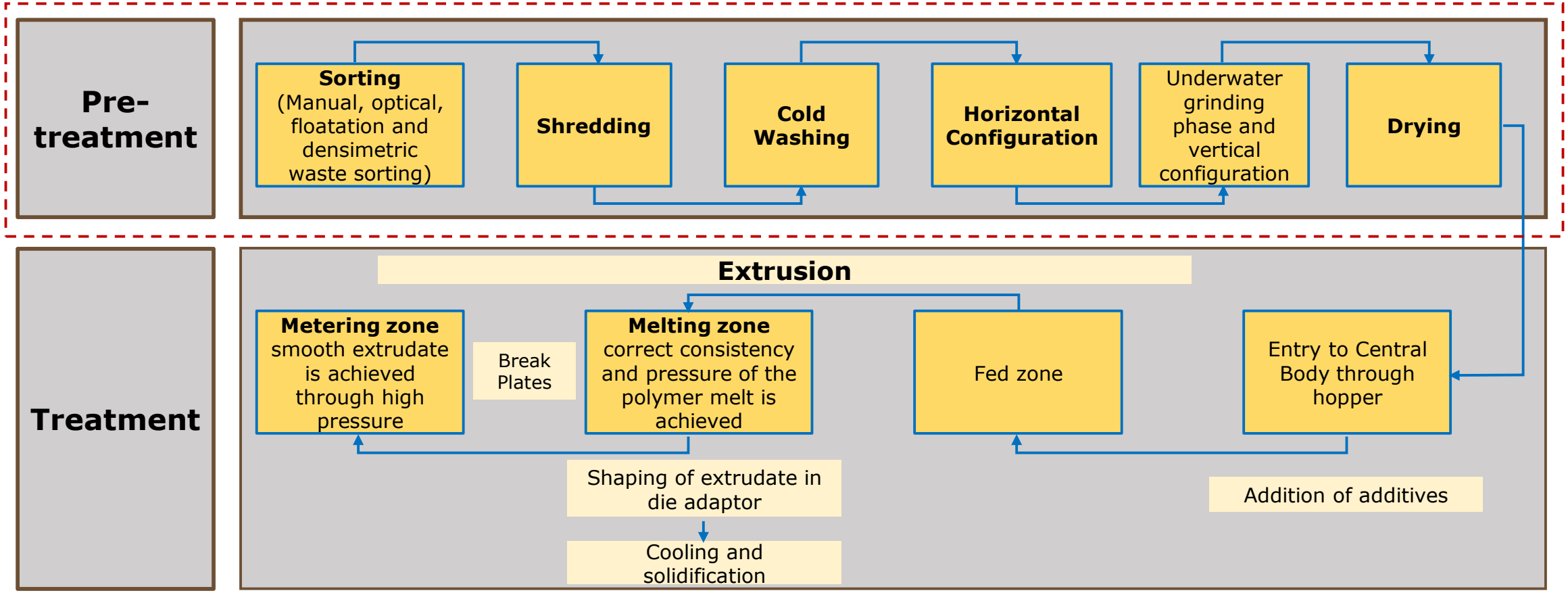
This technology is still at a nascent stage, need further research and development.

Multilayered Plastic Extruder Machine

(Source: M/s Uflex Limited in July, 2019)

Recycling and Recovery - Increased Efficiency

Process Flow of Extrusion



- Pre-processing is crucial for efficient and environmentally sustainable extrusion process
- Cities can set up separate pre-processing units and integrated plastic pelletisation units in PPP model

Recycling and Recovery - Increased Efficiency

- Bamboo House India has constructed a parking office at parking lot of a metro station in Hyderabad.
- This house which costs INR 1.8 lakh is made of construction blocks comprising of **2,500 kg of plastic waste, which includes plastic covers, milk packets and caps of water bottles.**

Parking Kiosk made of recycled plastic in Hyderabad

Dustbins made from recycled plastic in Hyderabad

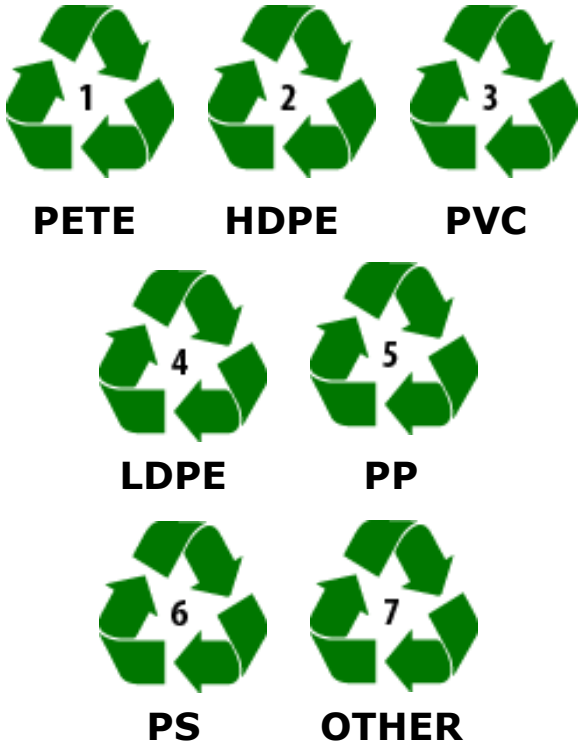
Recycling and Recovery - Increased Efficiency

Flue gas emission standards

Parameters	Emission standard
Particulates	50 mg/Nm^3
HCl	50 mg/Nm^3
SO_2	200 mg/Nm^3
CO	100 mg/Nm^3
Total Organic Carbon (TOC)	20 mg/Nm^3
HF	4 mg/Nm^3
NOx (NO and NO_2 expressed as NO_2)	400 mg/Nm^3
Total dioxins and furans	0.1 mg TEQ/Nm^3
Cd + Th + their compounds	0.05 mg/Nm^3
Hg and its compounds	0.05 mg/Nm^3
Sb + As + Pb + Cr + Co + Cu + Mn + Ni + V + their compounds	0.5 mg/Nm^3

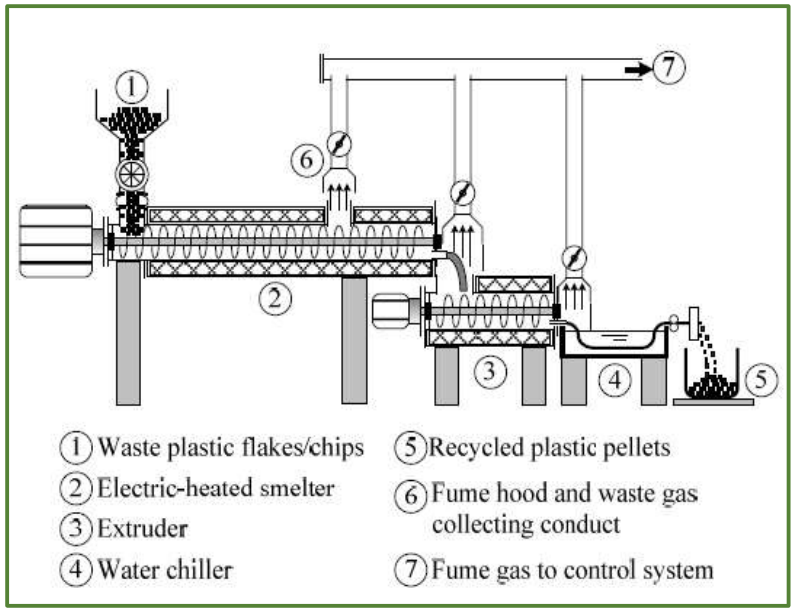
(Source: Solid Waste Management Rules, 2016)

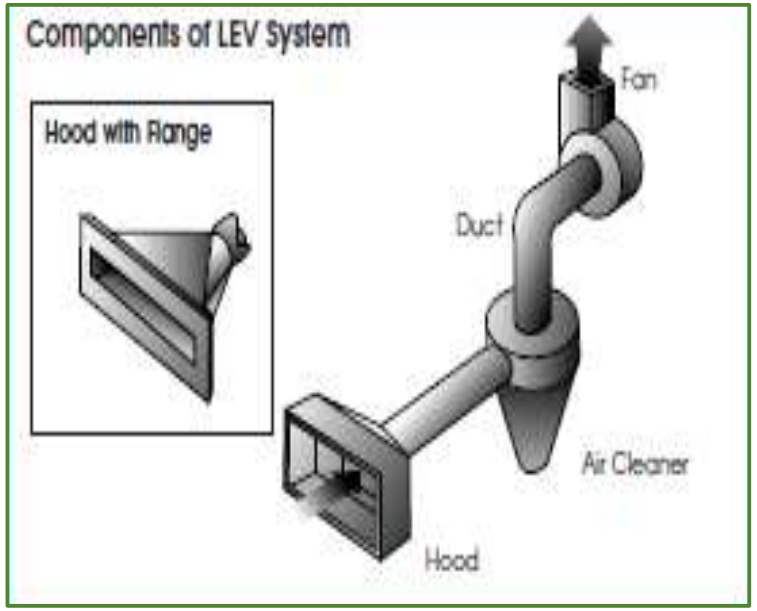
Marking of Society of Plastic Industry (SPI) Code



Recycling and Recovery - Increased Efficiency

Schematic of emission control in extrusion (left), Components of a Local Exhaust Ventilator (LEV) (right)





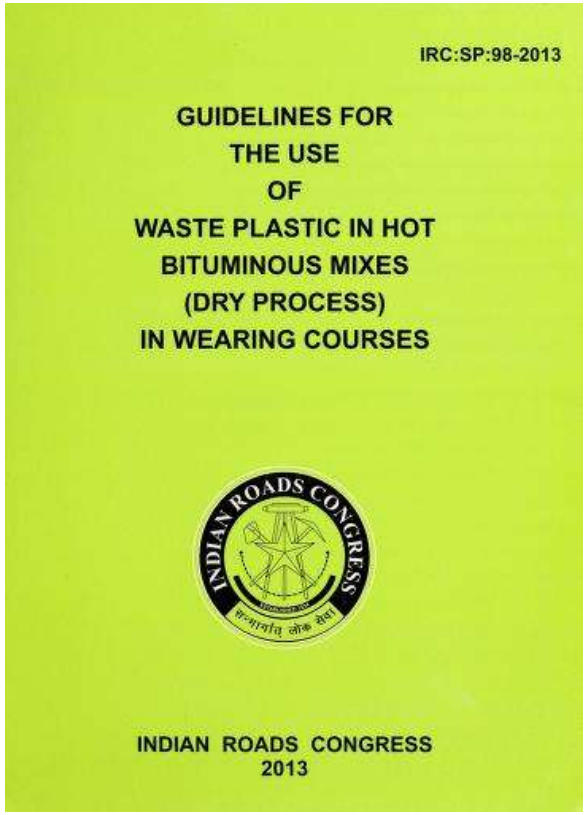
(Source: https://aaqr.org/articles/aaqr-13-01-tn-0014.pdf and https://www.dupont.com/content/dam/dupont/amer/us/en/transportation-industrial/public/documents/en/Ventilation_brochure_en_200108.pdf)

Recycling and Recovery- Increased Efficiency

Feedstock for Using Plastic in Road Construction

- Films (Carry Bags, Cups) thickness up to 60 micron (PE, PP and PS)
- Hard foams (PS) any thickness
- Soft foams (PE and PP) any thickness
- Laminated plastics thickness up to 60 micron (Aluminium coated also), packing materials used for biscuits, chocolates, etc.

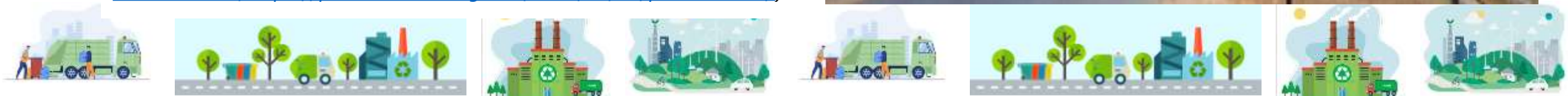
PVC and Black Plastic should not be used. Dust and impurities should not be more than 1 percent



Recycling and Recovery- Increased Efficiency

Plastic waste for road construction in Bengaluru and Jharkhand

(Source: http://www.inspiraction.news/en/2017/04/14/driving-on-plastic-roads-in-india/https://prasadmodakblog.com/2018/06/18/plastic-roads/)



Recycling and Recovery - Increase Market Demand of Recycled Products

Preferential Procurement of Recycled Products

Indicative process for developing preferential procurement policy adopted from The city of Pittsburgh, Pennsylvania,

- Gathering information about recycled products, vendors, etc.
- Formation of Recycled Products Committee to develop policy
- Evaluating usability of products
- Developing procurement policy and procurement guidelines

Recycled plastic procurement strategy of municipalities in Philippines

- Davao City and Candaleria Municipality have formed partnership with Enviro Tech Waste Recycling Inc.,
- Enviro Tech uses 90% hard-to-recycle (MLPs and plastic films) plastic in its furniture.
- Municipality provides the land and factory equipment and, in return, buys the furniture

(Source: Recycled Products Procurement Policy, 2007, URL: http://www.responsiblepurchasing.org/UserFiles/File/General/pittsburg.pdf
19 Plastics Policy Playbook: Strategies for a Plastic Free Ocean, URL: https://oceanconservancy.org/wpcontent/uploads/2019/10/Plastics-Policy-Playbook-10.17.19.pdf)

Recycling and Recovery- Increase Market Demand of Recycled Products

TUVRheinland Certified Green Product: A voluntary environmental labelling scheme based on product life cycle considerations and aims to communicate verifiable and accurate information on environmental aspects of products

3 pillars of Green Product mark certification criteria

- Prevention of pollution
- Sustainable use of resources
- Climate change mitigation

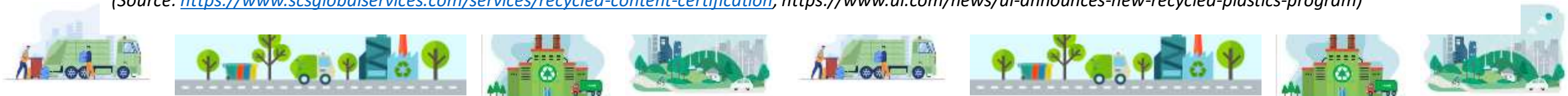
(Source: https://www.tuv.com/india/en/green-product-mark.html)

Recycling and Recovery- Increase Market Demand of Recycled Products

SCS Recycled Content Certification evaluates products made from pre-consumer or post-consumer material diverted from the waste stream. Certification measures the percentage of recycled content for the purpose of making an accurate claim in the marketplace.

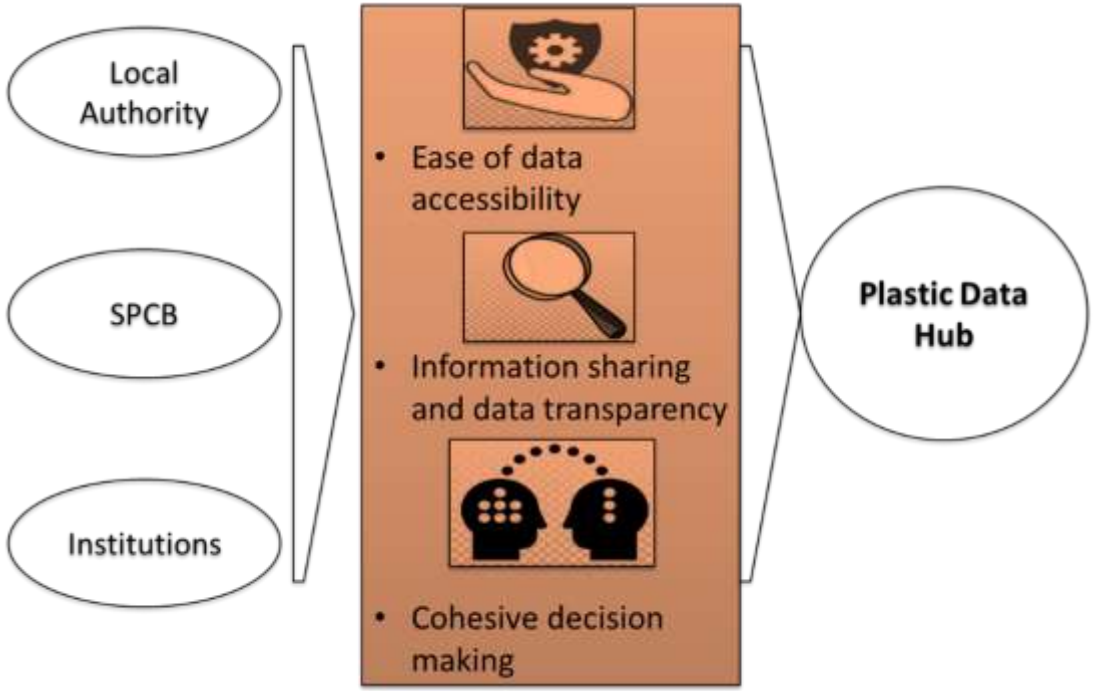
UL Recognition program for recycled plastics uses proven scientific analysis and testing to evaluate plastic compounds with post-consumer or post-industrial content for compliance to UL 746D (Standard for Safety for Polymeric Materials - Fabricated Parts).

(Source: https://www.scsglobalservices.com/services/recycled-content-certification; https://www.ul.com/news/ul-announces-new-recycled-plastics-program)



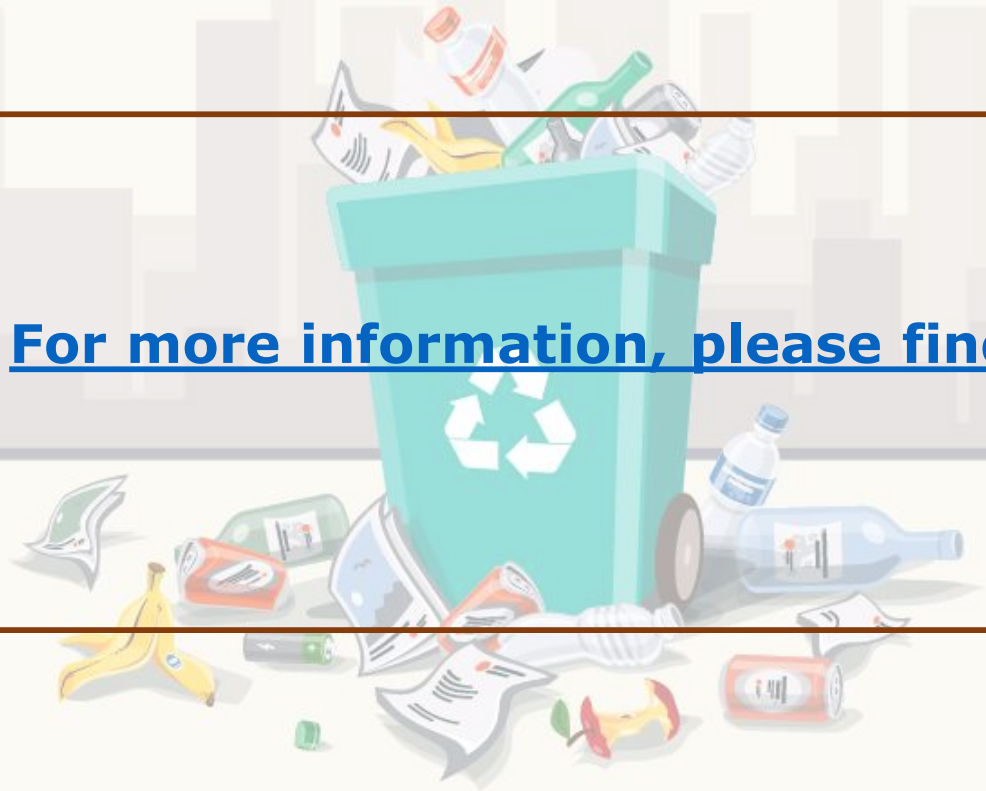
Institutional Strengthening

Integration of Plastic Data among Organisations



- Crucial to share information among local authority, pollution control board and R&D institutions for ease of planning and strategy development
- National tax and customs authorities having access to information on manufacturing and sale of plastics should be involved
- Need to ensure a transparent flow of information between all stakeholders and to raise awareness regarding alternatives, financial repercussions, regulatory measures etc.

An initiative needs to be taken by local authority and state government to encourage the convening of a plastic data hub for creating an updated, transparent and readily available data pool



[For more information, please find the link]





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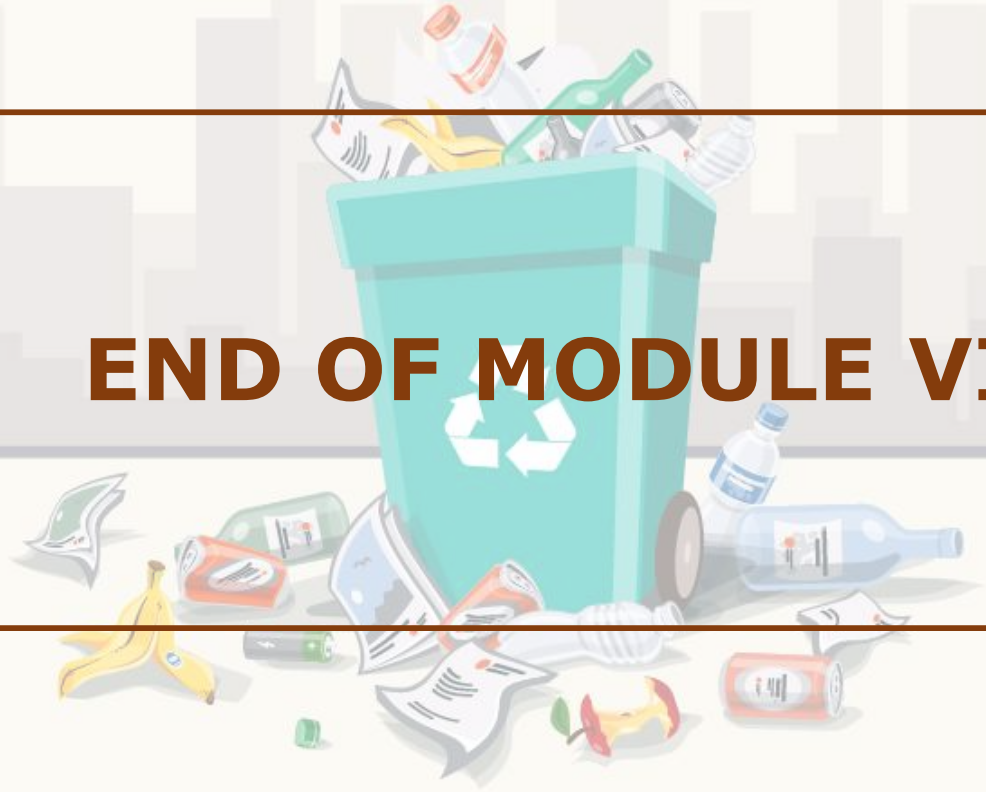

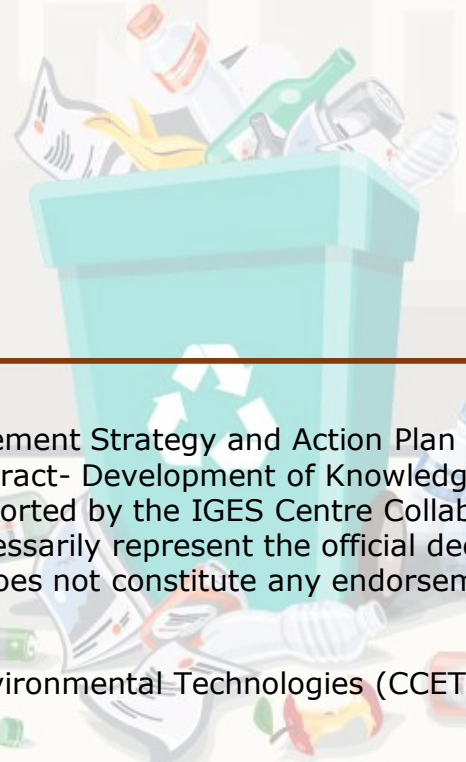

Disclaimer

The Training Modules on developing 'Plastic Waste Management Strategy and Action Plan for Urban Local Bodies(ULBs)' is prepared by ICLEI-Local Governments for Sustainability, South Asia under the contract- Development of Knowledge, Training and Capacity Building Materials on Plastic Waste Management based on the activities of GHMC, supported by the IGES Centre Collaborating with UNEP on Environmental Technologies (CCET). The views expressed in this document do not necessarily represent the official decision or stated policy of the United Nations Environment Programme. The citing of trade names in this document does not constitute any endorsement.