

Enhancing Circular Economy Perspectives - Plastic Waste Management Strategy and Action Plan for Greater Hyderabad Municipal Corporation



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This publication 'Enhancing Circular Economy Perspectives - Plastic Waste Management Strategy and Action Plan for Greater Hyderabad Municipal Corporation' is made under the Project 'Development of Holistic Strategy and Action Plan for Plastic Waste Management in Greater Hyderabad Municipal Corporation,' supported by the IGES Centre Collaborating with UNEP on Environmental Technologies (CCET) with ICLEI – Local Governments for Sustainability, South Asia as technical implementation partner. The strategy and action plan has been formulated based on data and information collected from the Greater Hyderabad Municipal Corporation and the recommendations received during multi-stakeholder interactions. The views expressed in this document do not necessarily represent the official decision or stated policy of the Greater Hyderabad Municipal Corporation, Government of Telangana, Government of India or the United Nations Environment Programme. The citing of trade names in this document do not constitute endorsement.

**Enhancing Circular
Economy Perspectives -
Plastic Waste
Management Strategy
and Action Plan
for
Greater Hyderabad
Municipal
Corporation**



Foreword

Plastics are an integral part of our daily life. Today, the linear model of “make, use, and dispose” plastic materials poses a serious threat to the public health and environment. Though there are a large number of interventions made across the country, the impact is not yet visible. It is realised that challenges with plastic waste are so prevalent that no single approach can address the problem successfully. Therefore, a cohesive strategy for the holistic management of plastic waste city wise/town wise is essential as per local conditions and life style of people.

Given the context, this project on ‘Enhancing Circular Economy - Plastic Waste Management Strategy and Action Plan for Greater Hyderabad Municipal Corporation (GHMC)’ supported by the IGES Centre Collaborating with UNEP on Environmental Technologies (CCET), the United Nations Environment Programme - International Environmental Technology Centre (UNEP-IETC), Japan and ICLEI Local Governments for Sustainability, South Asia (ICLEI South Asia) has come at a very opportune time. This strategy document will act as a guiding document for GHMC to ensure holistic management of plastic waste in the city of Hyderabad. The strategy is designed with a holistic approach, to improve the existing plastic waste management system, which is environmentally sustainable, socially inclusive and contributes to an improved quality of life. Five strategies, with a multi-pronged approach are identified, enabling the adoption of circular economy either through recycling, reducing and reusing plastics for new products, influencing consumer behaviour and developing better waste management practices at the community level. Uptake and adoption of these strategies will help to manage plastic-use and waste generation more efficiently while retaining its value as a material.

These recommendations, which were arrived based on the analysis of good practices and discussions with all major stakeholders, will give solutions to reduce the inflow of plastic waste by users and this reduction in the quantities of plastic waste inflow will benefit in saving the costs in collection, sorting, processing, recycling and landfill siting by the city administration.

We would like to take this opportunity to thank the the CCET, UNEP-IETC, Japan and ICLEI South Asia for this critical strategy document. We are affirmative that the efforts and contributions made by the team will pave way for the much-needed transformation and impact at scale in the coming years, towards sustainable plastic waste management at the city level.

Lokesh Kumar D. S., IAS
Municipal Commissioner
GHMC

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Principal Secretary, Municipal Administration and Urban Development, Government of Telangana and Special Chief Secretary (Energy, Environment, Forests, Science and Technology) encouraged and supported the development of the strategy and action plan for effectively and scientifically tackling plastic waste generated within Hyderabad city focusing on quick action and end-to-end solutions.

The Municipal Commissioner of GHMC encouraged the development of innovative solutions for waste management in Hyderabad, focusing on involving the informal sector as well as the maximum community involvement and ownership. The Additional Commissioner (Sanitation, Construction & Demolition Waste Management, Entomology & Veterinary Services) and Joint Commissioner (Solid Waste Management), guided the team in developing the strategy and action plan in line with the objectives of the Swachh Bharat Mission and adhering to the principles of circular economy.

The project team is grateful to the Zonal Commissioners of GHMC, the Superintendent Engineer, the Executive Engineer and the Project Manager (Swachh Bharat Mission), the Swachh Bharat team and the Sanitation team of the GHMC for their ongoing support to enable collection of baseline information on plastic waste in the city, development of the strategy and the implementation of pilot projects.

We are also grateful to the Assistant Commissioner (Urban Community Development), Project Director (UCD), Deputy Commissioner Central Zone & Corporator Gun Foundry Division for supporting us in the capacity development of Self Help Groups as part of the pilot interventions.

We express our appreciation and gratitude to all other organisations and individuals associated with the GHMC for extending their valuable support and guidance in preparing the action plan.

We also acknowledge various organisations including Telangana State Pollution Control Board (TSPCB), Telangana and Andhra Pradesh Plastic Manufacturers Association (TAAPMA), Central Institute of Plastic Engineering and Technology (CIPET), National Institute of Rural Development & Panchayati Raj (NIRD & PR), Indian Institute of Packaging (IIP), Modern Architects of Rural India (MARI), RAMKY Enviro Engineers Limited (REEL), Mission for Elimination of Poverty in Municipal Areas – Commissionerate of District & Municipal Administration (MEPMA-CDMA), Environment Protection Training and Research Institute (EPTRI) and District Industries Centre (DIC) Telangana besides including individuals representing various stakeholders for their valuable time, information and suggestions that greatly helped in developing the strategy and action plan.

Last but not least, the project team would like to acknowledge the United Nations Environment Programme – International Environmental Technology Centre (UNEP-IETC) and the Ministry of Environment, Japan (MOEJ) for their technical and financial support to make this project a reality.

ICLEI-South Asia team

Abbreviations

AIPMA	All India Plastics Manufacturers' Association
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
BIS	Bureau of Indian Standards
CBWTF	Common Bio-medical Waste Treatment and Disposal Facility
CCC	Control Command Centre
CDMA	Commissioner and Director of Municipal Administration
CFE	Consent For Establishment
CFO	Consent For Operation
CIPET	Central Institute of Petrochemicals Engineering & Technology (erstwhile Central Institute of Plastics Engineering & Technology)
CPCB	Central Pollution Control Board
CPHEEO	Central Public Health and Environmental Engineering Organisation
CSR	Corporate Social Responsibility
DBOT	Design-Build-Operate-Transfer
DIC	District Industries Centre
DRCC	Dry Resource Collection Centre
EPR	Extended Producer Responsibility
EU	European Union
FRP	Fibre Reinforced Plastic
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GHMC	Greater Hyderabad Municipal Corporation
GOI	Government of India
GO	Government Order
GOT	Government of Telangana
GST	Goods and Services Tax
HCU	Hyderabad Central University
HDPE	High Density Polyethylene
HIG	High Income Group
HiMSWM	Hyderabad Integrated Municipal Solid Waste Management
HMRL	Hyderabad Metro Rail Limited
HMWSSB	Hyderabad Metropolitan Water Supply and Sewerage Board
HPWMSAP	Holistic Plastic Waste Management Strategy and Action Plan
ICTD	International Centre for Tax and Development
IEC	Information, Education and Communication
IGES	Institute for Global Environmental Strategies
IIP	Indian Institute of Packaging
IIT	Indian Institute of Technology
IPC	Inter Personal Communication
IS	Indian Standards
ISWM	Integrated Solid Waste Management
JNTU	Jawaharlal Nehru Technological University
KT	Kilo Tons
KTA	Kilo Tons per Annum
LDPE	Low Density Polyethylene
LEV	Local Exhaust Ventilation
LIG	Low Income Group

LSP	Logistics Service Provider
MEPMA	Mission for Elimination of Poverty in Municipal Areas
MIG	Middle Income Group
MLP	Multi Layered Plastic
MOEF&CC	Ministry of Environment, Forest and Climate Change
MOHUA	Ministry of Housing and Urban Affairs
MoU	Memorandum of Understanding
MRF	Material Recovery Facility
MSW	Municipal Solid Waste
MUDRA	Micro Units Development and Refinance Agency Ltd.
MWCD	Ministry of Women and Child Development
NABL	National Accreditation Board for Testing and Calibration Laboratories
NCGTC	National Credit Guarantee Trustee Company Limited
NGO	Non-Governmental Organisation
PAH	Polycyclic Aromatic Hydrocarbons
PET	Polyethylene Terephthalate
PLA	Polylactic Acid
POP	Persistent Organic Pollutants
PP	Polypropylene
PRO	Producer Responsibility Organisation
PS	Polystyrene
PVC	Polyvinyl Chloride
PW	Plastic Waste
PWD	Public Works Department
PWM	Plastic Waste Management
RDF	Refuse Derived Fuel
REEL	Ramky Enviro Engineers Limited
SAT	Sanitary Autoriksha Tipper
SBM	Swachh Bharat Mission
SFA	Sanitary Field Assistant
SHG	Self Help Group
SI	Sanitary Inspector
SJ	Sanitary Jawan
SLABs	State Level Advisory Boards
SLMC	State Level Monitoring Committee
SMC	Sheet Moulding Compounds
SPV	Special Purpose Vehicle
SS	Sanitary Supervisor
SUPs	Single Use Plastics
TAAPMA	Telangana and Andhra Plastics Manufacturers Association
T-Fund	Telangana Innovation Fund
TPD	Tons per Day
TSGWD	Telangana State Ground Water Department
TS-iPASS	Telangana State Industrial Project Approval and Self-Certification System
TSPCB	Telangana State Pollution Control Board
TSRTC	Telangana State Road Transport Corporation
ULB	Urban Local Body
UN	United Nations
USD	United States Dollar
VOC	Volatile Organic Compound
WE-Hub	Women Entrepreneur's Hub

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1. Executive Summary

1.1. Urgency in Plastic Waste Management Strategy and Action Plan

Plastics are an important and ubiquitous material in our economy and daily lives. However, the way plastics are currently produced, used and discarded has failed to capture the economic benefits of a more 'circular' approach and threatens public health and environment. Plastic pollution is one of the fastest growing threats in the world (earth.com news, 2019), and has even been defined as a pandemic (UN Environment, 2019). India generates 26,000 Tonnes per Day (TPD) of plastic waste, amounting to 9.4 million Tonnes Per Annum (TPA) (MOHUA, 2019). Despite 60% of the plastic produced in the country being recycled through the informal sector, 9,400 TPD of plastic waste is left unattended, causing a growing public concern. Moreover, it has been found that the slow breakdown of plastic through mechanical forces and ultraviolet (UV) radiation creates micro-plastics, the presence of which has been detected even in drinking water supplies (WHO, 2019).

Considering the important role plastics play in our lives, imposing a blanket ban on plastic products would not be a viable solution in the absence of suitable alternatives. Instead, rolling out an efficient and sustainable method of plastic waste management is required to curb the growing menace. For a plastic waste management scheme to be successful and effective it needs to be designed based on a holistic approach led by the government, in which all the components of the waste management value chain are integrated, with a gradual progression from focusing on the front end of the value chain (sanitary workers, waste pickers, etc.) to the final management and processing (plastic manufacturers, administrative bodies such as GHMC). Greater Hyderabad Municipal Corporation (GHMC) has focused on improving its Solid Waste Management (SWM) services over the last decade. This effort has gained significant momentum since 2014, with the state government's active involvement in ensuring effective and sustainable waste management practices in the city. To ensure a systematic change towards implementing sustainable practices in plastic waste management, a practical action plan is required as part of this effort.

Aiming to assist the efforts of GHMC, ICLEI South Asia (ICLEI-SA) and the IGES Centre Collaborating with UNEP on Environmental Technologies (CCET) developed a Plastic Waste Management Strategy and Action Plan for GHMC, with support from the Government of Telangana (GOT), United Nations Environment Programme – International Environmental Technology Centre (UNEP IETC) and the Ministry of Environment, Japan (MOEJ).

1.2. Holistic and Consultative Approach Adopted for Developing the Plastic Waste Management Strategy and Action Plan

This strategy and action plan is based on information from a year-long baseline assessment of the existing plastic waste management system and scenario in Hyderabad, and recommendations identified through a consultative process with key stakeholders for efficient management of plastic waste in the city. Figure 1 shows the key process followed for developing the plastic waste management strategy and action plan. The baseline assessment includes primary data collected from elaborate field surveys, closed group discussions and laboratory assessments, in addition to the secondary data collected from GHMC and other major stakeholders, such as Telangana State Pollution Control Board (TSPCB), Telangana and Andhra Plastics Manufacturers Association (TAAPMA), Indian Institute of Packaging (IIP) and Central Institute of Plastics Engineering & Technology (CIPET).

According to the official GHMC data, the plastic waste collected from Hyderabad city is 325 TPD, corresponding to a collection efficiency of 98% (GHMC, 2019). However, as per the assessment conducted by ICLEI-SA, residential areas alone generate 365 TPD of plastic waste. Future waste projections included in this document are based on this data, which was generated during the assessment by ICLEI-SA. For the purpose of developing this strategy, to the extent possible, data from the GHMC that has been duly corroborated with officials has been used. In the absence of official data, the assessed/projected data generated during the baseline assessment by ICLEI-SA is considered.

The recommendations and suggestions made are mainly aimed at GHMC, but also addresses the GOT, TSPCB and private stakeholders, among others. They are also based on an analysis of best practices from around the

world and key discussions with all major stakeholders in the plastic industry and the plastic waste management sector in Telangana as well as across the country.

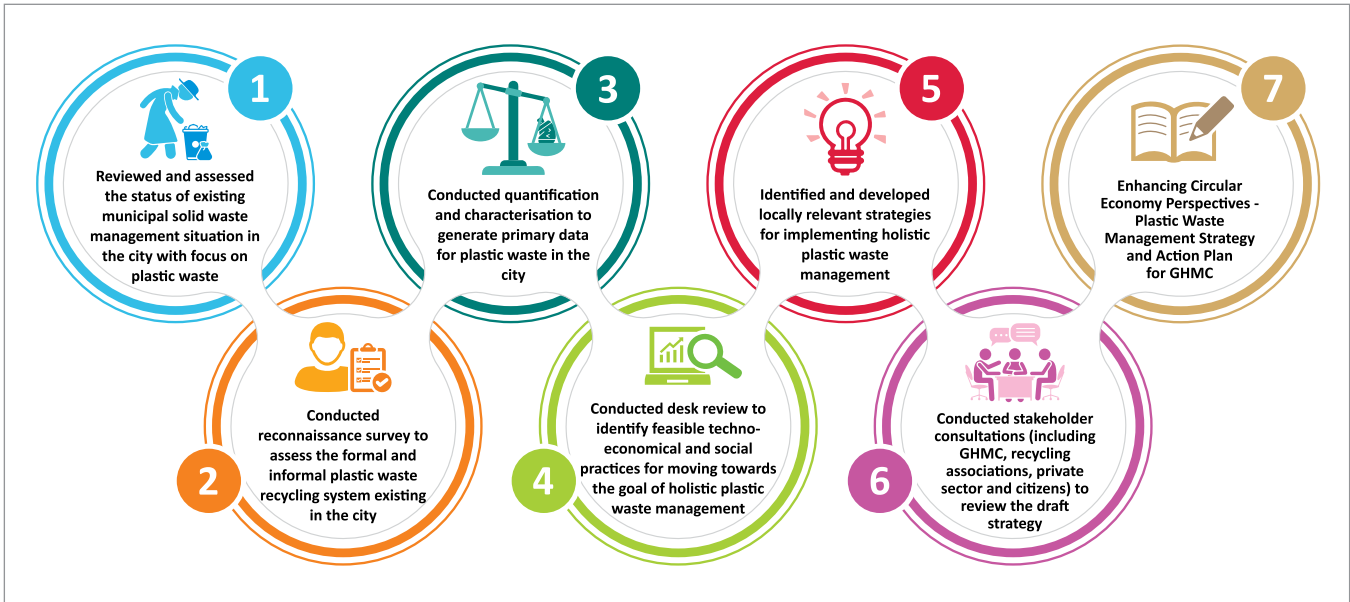


Figure 1: Methodology adopted for preparation of PWM Strategy and Action Plan

Source: ICLEI-SA

The suggested strategies are also in line with national regulations, including Solid Waste Management Rules 2016, Plastic Waste Management Rules 2016 and the guidelines on solid waste management developed by the Central Public Health and Environmental Engineering Organisation (CPHEEO) for the Ministry of Housing and Urban Affairs (MOHUA). Each suggestion was duly arrived at through allotting the utmost consideration, in terms of waste management hierarchy, where maximum importance is given to the reduction of waste generation at source, while the disposal of plastic waste is rendered as the least preferred option. The strategy focuses on municipal plastic waste and not on industrial plastic waste. However, the roles and responsibilities of industries in contributing to the generation of Municipal Solid Waste (MSW) were taken into account in drawing up recommendations for the best practices to be adopted by the sector.

The strategy, with a 10-year timeline, adopts a holistic approach, wherein different aspects of plastic waste including generation, storage, collection and transportation, as well as processing and disposal are addressed. Developing the capacity of all major stakeholder involved in each stage of the process was considered critical to realising a flawless, fool-proof system for plastic waste management. The targets to be

achieved laid out in the strategy were arrived at by taking into account the complexity of the current management and administrative structure. The strategy includes viable and cost-efficient actions that are predominantly technology-based. It also includes systemic/operational approaches where required; which are designed to be inclusive and have no negative impact on the socially and economically vulnerable sections of the society.

1.3. Key Findings

- As per the survey by ICLEI-SA, the plastic waste generated in residential areas alone is estimated to be 365 TPD. This figure is expected to increase to 495 TPD by 2025 considering the business as usual scenario.
- As per the data shared by GHMC, roughly 325 TPD of plastic waste is collected of which 13 TPD (4%) is recycled, 135 TPD (42%) is converted to Refuse Derived Fuel (RDF) and 176 TPD (54%) is sent to a sanitary landfill.
- Almost 23 TPD of the collected recyclable waste (such as plastic, glass, metal, wood and paper) is recovered by SAT operators by manual segregation and taken to authorised Dry Resource Collection Centres (a portion of the collected recyclables are also sold to the informal sector).

- Of the waste recovered at Dry Resource Collection Centres (DRCCs), 44% (10 TPD of 23 TPD) is plastic waste.
- Only 47% of all transfer stations (8 out of 17) have DRCCs onsite.
- The plastic waste recovered at DRCCs is used for pelletisation and plastic-to-plastic recycling. While plastic recovered at Integrated Solid Waste Management (ISWM) facility is used for plastic-to-plastic recycling as well as for energy recovery.
- Large number of plastic pelletisation and recycling units are operating in Hyderabad city without following any government regulations.
- Community awareness and access to information on alternates to Single Use Plastics (SUPs) is limited despite their market availability.
- Even with the resolution by GHMC and recommendation from GOT on ban of SUPs, it was observed that SUPs are still widely available in the local market.

1.4. Enhancing Circular Economy Perspectives-Plastic Waste Management Strategy and Action Plan

The primary objective of developing a Plastic Waste Management Strategy and Action Plan (PWMSAP) is to create an improved plastic waste management system that is financially and environmentally sustainable, socially inclusive and contributes to improved quality of life. Following a multi-pronged approach, five strategies have been identified to achieve the vision of a society free from the harmful impacts of plastic waste (Table 1). Considering the existing scenario of plastic waste management in the city, diligent implementation of the strategy, over a 10 year time period, is required for ensuring a sustainable plastic waste management system.

Table 1: Summary of Plastic Waste Management Strategy and Action Plan

Strategies	Target	Action plan
Strategy 1: Reduce generation of plastic waste at source	• Zero Single Use Plastics (SUPs) waste generation by 2025	• Ban on SUPs
		• Policies to restrict use of SUPs through preferential procurement, buy-back programmes under Extended Producer Responsibility (EPR), green protocol and taxation mechanism.
		• Enhance availability and access to existing alternatives to SUPs by marketing and promotion of products made from starch-based biopolymers and encourage establishing small-scale cottage industries for alternative materials.
		• Promote research & development for finding new and viable alternatives through direct funding, awards and recognitions for innovations and leveraging government programmes like WE-Hub, T-Hub, T-Fund and T-SEED to attract more investment for innovation.
		• Promote innovative designs- substitution and enhancement in packaging design, promote product designs that do not require additional packaging and enables easy recycling

Strategies	Target	Action plan
Strategy 2: Ensure segregated collection and transport of plastic waste to registered waste processing facilities	100% source segregated waste collection and transport system to facilitate scientific processing, by year 2030	Segregated waste storage through infrastructure development, awareness generation and also defaulter penalties
		Strengthening primary collection and transport of segregated plastic waste to registered recycling and processing units
		Strengthening secondary collection and transport of segregated plastic waste for enhanced recycling and resource recovery through up-gradation of transfer stations, secondary transport vehicles and control command centre, development of database on informal waste collection system and movement of recyclables to regulate informal waste management system along with IEC to enhance efficiency of segregated collection and transport.
Strategy 3: Promote maximum recycling and explore opportunities for co-processing of plastic waste	100% processing of non-hazardous plastic waste through recycling, reuse, reprocessing and co-processing by 2035	Improving the efficiency of existing recycling industries through provision of better segregated raw material and enforced process control through ensuring distinct coding of plastic products and that all plastic product manufacturers and recycling industries comply with the environmental standards
		A Multi-layered Plastic (MLP) recycling facility to be installed at the ISWM facility.
		GHMC to promote decentralised pre-processing and pelletisation units on a Public Private Partnership (PPP) basis with Self Help Groups (SHGs) and Community-based Organisations (CBOs).
		Reprocessing of non-recyclable plastics into fuel to be ensured
		Plastic-to-fuel processing facilities to be regulated through TS-iPASS certification, waste audits, certification process for end-products to be institutionalised by TSPCB and set industry specific emission standards.
		Only non-recyclable plastic to be converted to energy
		Reuse of plastics as a construction material to be promoted by facilitating availability of shredded plastics for public and private road construction and ensuring its utilisation through regulatory measures and promoting research and development. Ensure PVC plastic waste is not used for construction of roads by managing it separately at secondary collection points.

Strategies	Target	Action plan
		Increased market demand for recycled plastic through green certification system, preferential procurement of recycled plastic products and promote research on plastic recycling technologies.
Strategy 4: Create awareness among all stakeholder groups through Information, Education and Communication (IEC) activities	All major stakeholders are aware of harmful impacts of plastic waste and have adopted necessary measures by 2027	IEC activities for waste generators
		IEC activities for municipal sanitary workers and informal waste pickers
		IEC activities for DRCCs and processing units
Strategy 5: Strengthen governance and implement a Monitoring and Evaluation Framework	Creating an efficient institutional structure for holistic management of plastic waste by 2025	Strengthening governance and coordinating mechanisms across GHMC and TSPCB
		Enhancing the role of supporting/allied institutions like Indian Institute of Packaging
		Data management-integration of plastic data

2. Overview of Municipal Solid Waste Management in Hyderabad



Figure 2: Plastic waste in Hyderabad

2.1. Waste Generation

As of 2019, approximately 5,300 TPD of Municipal Solid Waste (MSW) reaches the Integrated Solid Waste Management (ISWM) facility maintained by GHMC at Jawahar Nagar (average per capita generation of 0.71 kg/day for a population of 7.64 million). The MSW is collected by about 2,500 Sanitary Auto Tipper (SAT) vehicles from source and transported to the 17 transfer stations located around the city. The SAT vehicles, which provide door-to-door collection of waste in all 150 wards, were introduced in 2015 by GHMC to replace tricycles for more efficient door-to-door waste collection. With this initiative, about 5,000 informal waste pickers (one driver and one helper per vehicle) were formally integrated into the solid waste collection system. GHMC transports the waste from transfer stations to the ISWM facility at Jawahar Nagar, where it is processed for resource and energy recovery, with the rejects sent to the landfill. Resource recovery is also practiced at transfer stations by formal Dry Resource Collection Centres (DRCCs). In addition to the formal system of waste management comprising of SAT operators, DRCCs, ISWM facility of GHMC and recycling facilities approved by TS-iPASS, there is also a large informal system, that include waste pickers, scrap dealers and unregistered recyclers. Each

step of the city's formal waste management system is briefly explained in this chapter below.

2.2. Waste Storage at Source

In the residential and commercial sectors predominantly, unsegregated waste is usually stored in dustbins or polythene covers in individual premises and is handed over to the waste collectors (SAT operators) at the doorstep on alternate days. Bulk generators such as institutions and hotels usually store mixed waste at source. However, a few bulk generators (hotels and corporate buildings) segregate recyclables and kitchen waste (wet waste) in accordance with government regulations and GHMC notification GO No.253/EE(SWM)/AC(H&S)/GHMC/2016 (GHMC, 2016). A few exceptions exist, where other residential and commercial waste generators also segregate waste at source and sell recyclables like cardboards, glass, plastics, paper to *Kabadiwalas*. Burning of waste and littering on the streets are also common occurrences in some parts of the city.

2.3. Primary Waste Collection

Primary waste collection in GHMC is carried out by the SAT vehicles, which are partitioned to collect segregated

waste (dry and wet) from the generators. Each SAT vehicle is operated by a driver and a helper. While waste is collected from residential and commercial entities on alternate days, it is collected daily from bulk generators. These SAT operators are not paid staff by the GHMC. They earn their own revenue by collecting service charges from waste generators and by selling recyclable materials. In general, they charge a minimum of 50 Indian Rupees (INR) per household per month for the service provided. Some high-rise buildings are charged more depending on the extra effort required to collect waste. Slums are only charged 25 INR per household/month. Waste collection charges are comparatively higher for bulk waste generators (institutions, hotels, etc.) and goes up to 3,000 INR per month, based on the quantum of waste generated by each unit.

According to the Solid Waste Management Rules, 2016, “bulk waste generator” means and includes buildings occupied by central government departments or undertakings, state government departments or

undertakings, local bodies, public sector undertakings or private companies, hospitals, nursing homes, schools, colleges, universities, other educational institutions, hostels, hotels, commercial establishments, markets, places of worship, stadiums and sports complexes having an average waste generation rate exceeding 100 kg per day.

Bulk waste generators need to ensure segregation of waste at source, facilitate collection of segregated waste in separate streams, and hand over recyclable material to either the authorised waste pickers or recyclers. The biodegradable waste is to be processed, treated and disposed of through composting or bio-methanation within the premises as far as possible. The residual waste is transferred to the waste collectors or agency, as directed by the local body as per SWM Rules 2016.

According to the Plastic Waste Management Rules, 2016, all institutional generators of plastic waste are to segregate and store waste they generate and hand it over to authorised waste processing, disposal facilities,



Figure 3: Primary collection by SAT operators

or deposition centres, either on their own or through the authorised waste collection agency.

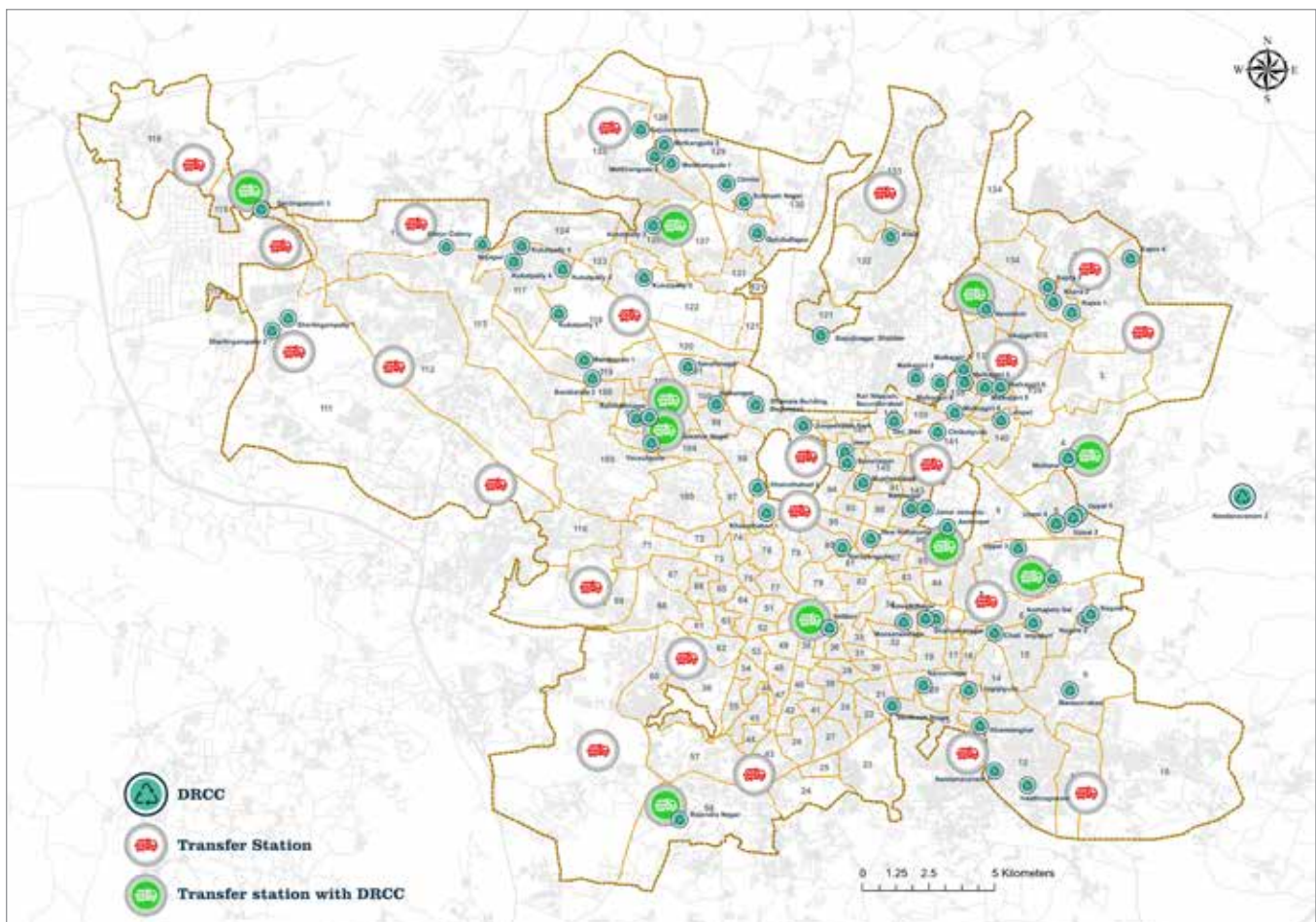
The recyclables with market value are sold to DRCC facilities or to scrap dealers by the SAT vehicle operators. Since most of the waste collected is unsegregated, the SAT vehicle operators manually segregate easy-to-sort recyclable waste in their vehicles. Other waste, including wet waste, non-recyclables and low-value recyclable materials are disposed of at transfer stations.

However, due to the irregular waste collection (days and timings), some waste generators resort to littering along streets, dumping in open spaces and burning of waste. The GHMC employs street sweepers to cover all major areas of the city, and on average each worker covers about 300 meters (m) per day (GHMC, 2019). Bicycle carts and pushcarts are used for street sweeping and roadside waste collection. A sanitary worker usually manages one trolley or bicycle cart and is supported by two sweepers who are allotted a stretch of about 600 m. Additional sanitary workers serve streets having more litter points. The waste collected in pushcarts is emptied into SAT vehicles and, in some cases, directly at

the transfer stations depending on the distance from the transfer station to the service area.

2.4. Secondary Storage and Collection

Community waste collection bins for secondary storage are made available in locations where there is significant floating population movement. There are about 1,663 dumper bins, 1,372 compactor bins and twin litter-bins in the city (GHMC, 2019), which are emptied by dumper placers and compactor trucks daily, with the waste taken to transfer stations. SAT vehicles also transport waste to transfer stations from individual premises. There are 17 transfer stations for segregating plastic and other recyclable waste in the city, some of which have set up DRCCs in collaboration with private entities like ITC & Godrej (Figure 4). There are about 78 DRCCs approved by the GHMC and operating in the city, of which eight are located inside transfer stations while others are located nearby (GHMC, 2019). The paper recovered at DRCCs is sent to ITC paper recycling facilities, whereas other recyclables including plastic waste is sold to scrap dealers.



Source: ICLEI-SA

Figure 4: Map showing spatial distribution of transfer stations and DRCCs

2.5. Secondary Transportation



Figure 5: Secondary transportation from transfer station to ISWM facility

Secondary transportation includes waste transport from transfer stations to the final treatment or processing facility. In GHMC, waste from transfer stations is transported to the ISWM facility at Jawahar Nagar

using vehicles either owned by the GHMC or hired from external agencies (see Table 2). On an average, 5,300 TPD of waste is transported daily to the ISWM facility at present (GHMC, 2019).

Table 2: Types and number of vehicles for secondary collection and transportation

Zone	Secondary transportation													Other vehicles							
	10 Tonne Truck	6 Tonne Tipper		Tractor		Autorickshaw	Skip steer loader		6 Tonne Truck	Compactor	Dumper placer		Refuse Compactor bins	25 Tonne Truck	Bucket Loader	Front End Loader		Excavator (Hitachi)			
			O	P	O	P	O	O	P	O	O	O	P	O	O	P	O	P	O	P	
F	0	9	5	2	6	0	0	2	3	0	9	2	0	0	13	1	5	1	0		
E	0	6	18	0	0	4	2	5	0	2	18	17	10	10	18	1	6	0	0		
D	0	1	23	0	0	0	2	3	0	3	23	6	17	12	15	2	3	3	1		
C	1	3	4	3	0	0	1	0	0	0	8	2	2	4	8	1	3	1	0		
B	4	13	10	0	0	0	1	1	0	1	16	3	0	0	16	1	6	0	0		
A	2	8	21	1	4	0	1	3	0	2	15	0	8	14	12	2	5	3	1		
Total	7	40	81	6	10	4	7	14	3	8	89	30	37	40	82	8	28	8	2		

(A=Secunderabad; B=Kukatpally; C=Serilingampally; D=Khairatabad; E=Charminar; F=L B Nagar; O=GHMC Owned; P= Private Contract with GHMC)

Source: GHMC 2019

2.6. Centralised Processing and Disposal

The Integrated Solid Waste Management (ISWM) facility in Jawahar Nagar, which is operated by Hyderabad Integrated Municipal Solid Waste Limited (HiMSW Limited), is an entity under Ramky Enviro Engineers Limited (REEL). It is one of the largest processing facilities in the country established under a concession agreement that was signed in February 2009 between GHMC and the Ramky Group. While the concession period is 25 years, REEL is also responsible for post-closure maintenance of the landfill facility for an additional 15 years. The facility includes (i) a windrow composting unit (ii) a biomethanation facility (iii) a Refuse-Derived Fuel (RDF) facility (iv) a Material Recovery Facility (MRF) (v) a plastic recycling unit with a capacity of 250 kg per day, (vi) a sanitary landfill, (vii) a leachate treatment plant and (viii) a 19.8 MW waste to energy plant (under construction). As per the data shared by GHMC, of the total waste received at ISWM 5% is converted into compost, 36% is converted into RDF and 16% is disposed into the landfill. Almost 42% of the incoming material is lost through fermentation, moisture loss and leachate. Roughly 1% of

the total incoming waste is recovered and recycled in to plastic products.

As of 2018–2019 the facility received 5,300 TPD of waste on average (GHMC, 2019). The process of treatment and disposal of waste at the facility is shown in Figure 6. First, the mixed waste received at the tipping floor of the facility is sieved through a 70 mm trommel. Approximately 55% of the waste passes through the sieve and is sent to the compost yard for making compost. The rejected material is mostly dry waste and is converted into Refuse-Derived Fuel (RDF) and stored to be used in the upcoming Waste-To-Energy (WTE) facility. After curing in the compost yard, the material's weight is reduced from 70% to only 30%. It is then sieved through a 20 mm and a 4 mm sieve, after which roughly 8% is recovered as compost and the rest is rejected to be sent to the sanitary landfill facility. On average, about 250 TPD of compost is manufactured by this process for an input waste quantum of 3,500 tonnes. In addition, the dry waste and plastic waste is manually separated on the tipping floor by about 40 waste pickers working in the facility, with the dry waste fraction stored as RDF and the plastic recovered sent to the plastic recycling facility for further processing.

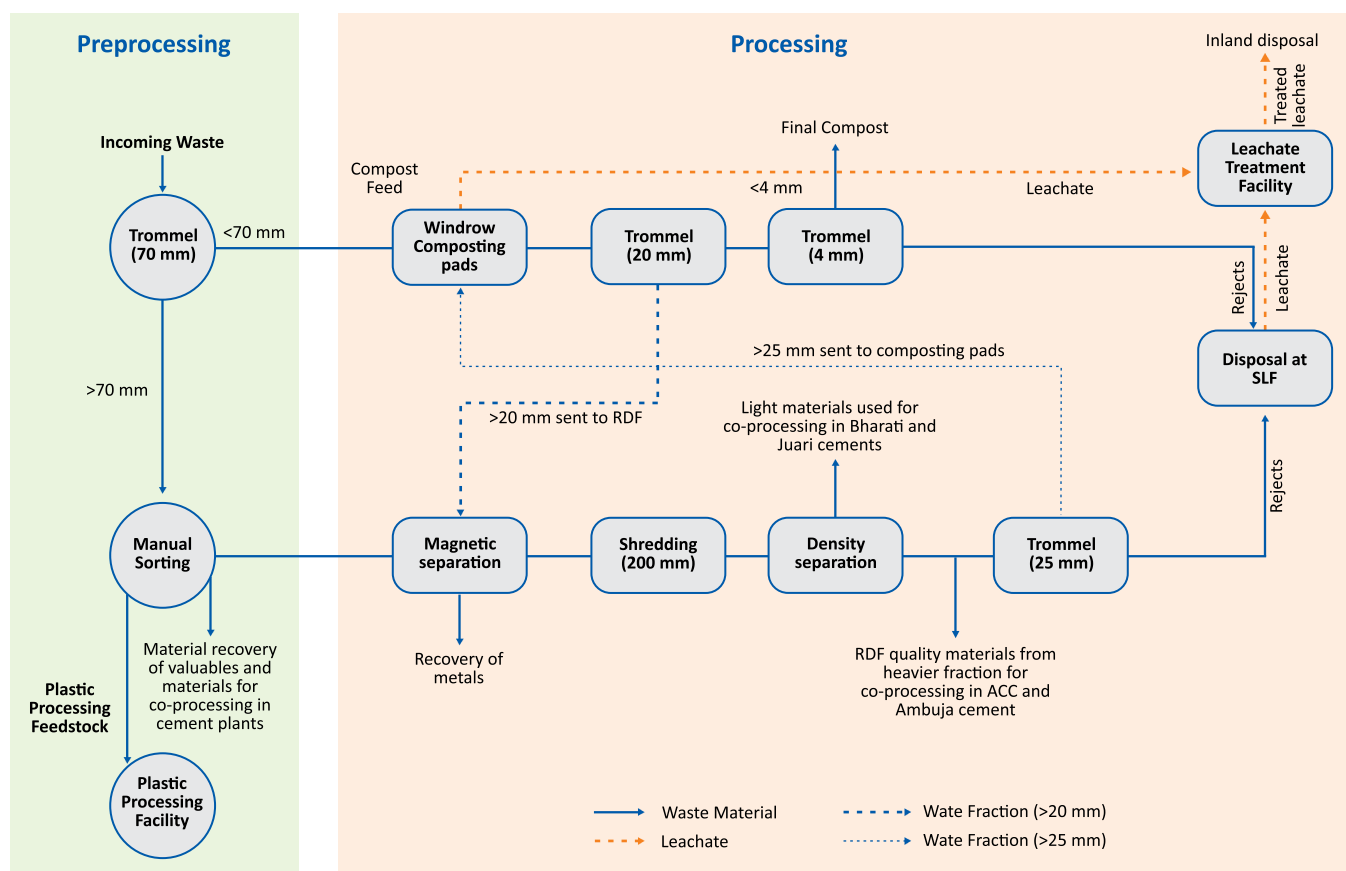
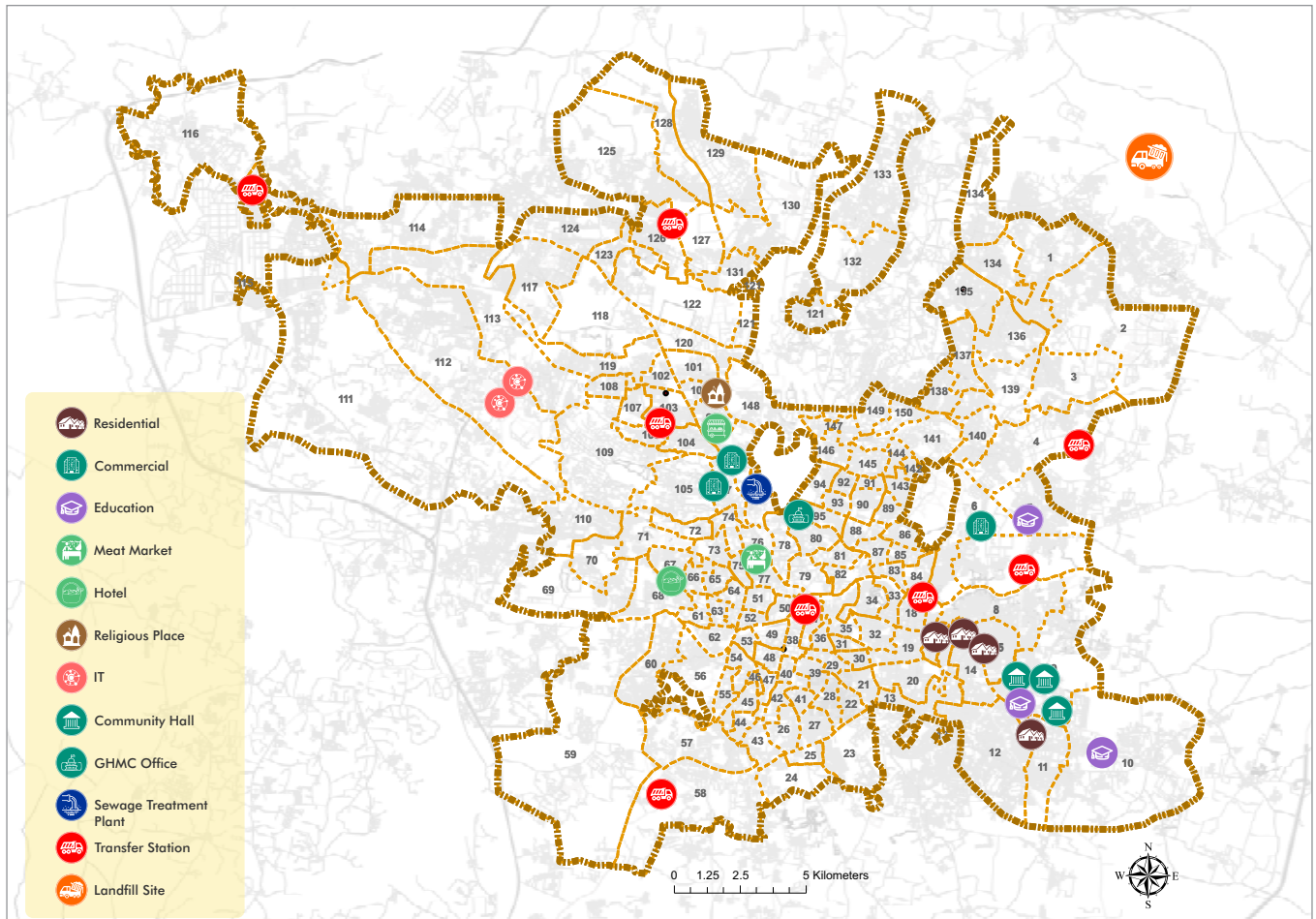


Figure 6: Overall flow of processing and disposal of waste at ISWM Facility, Jawahar Nagar

Source: ICLEI-SA

3. Review of Plastic Waste Management in GHMC

3.1. Plastic Waste Generation



Source: ICLEI-SA

Figure 7: Sampling locations for Plastic Waste Characterisation Study

3.1.1. Residential areas

An extensive study was carried out under this project to quantify and characterise MSW generated in Hyderabad, with a specific focus on plastic waste. Considering the unique characteristics of Hyderabad City, representative areas were selected for a detailed study. Samples from low-income neighbourhoods or slum settlements and

other residential areas (middle-income and high-income areas) were collected, after discussions with GHMC officials. Based on the waste samples, per capita waste generation (grams per capita per day; gm/c/day) and the quantification of waste generated from residential areas (TPD) were calculated, the results of which are presented in Table 3.

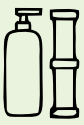
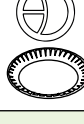
Table 3: Quantification and characterisation of MSW in residential areas of GHMC

Type of generator	Waste generation rate (gm/c/day)	Biodegradables (%)	Plastic (%)	Total population	Total Waste per day (TPD)	Total biodegradable waste per day (TPD)	Total plastic waste per day (TPD)
Lower income group/slum	297	70	10	1,805,716	536	377	54
Other residential areas (middle & higher income group)	345	68	14	5,835,598	2,013	1,358	274

Source: ICLEI-SA

As shown in Table 4, plastic waste found in MSW is basically categorised into seven types: Polyethylene Terephthalate (PET), High Density Polyethylene (HDPE), Polypropylene (PP), Polystyrene (PS) and Others (CPCB, 2017).

Table 4: Main categories of plastic waste in MSW in GHMC

Symbol	Products	Scientific name	Used in materials (as per CPCB ¹)	Category
		Polyethylene Terephthalate (PET)	Water bottles, pet bottles, soft drink bottles, furniture, panelling	Recyclable/thermoplastics
		High Density Polyethylene (HDPE)	Milk packets, detergent bags, carry bags, plastic containers, bottles, milk pouches, agricultural pipes, base cups, playground equipment	Recyclable/thermoplastics
		Polyvinyl Chloride (PVC)	Cables, pipes, flooring, window frames, fencing, flooring, shower curtains, lawn chairs, non-food bottles, toys	Recyclable/thermoplastics
		Low Density Polyethylene (LDPE)	Carry bags and films, plastic bags, containers, dispensing bottles, wash bottles, tubes	Recyclable/thermoplastics
		Polypropylene (PP)	Medical bottles, cereal liners, packaging films, auto parts, industrial fibre, food containers, dishware	Recyclable/thermoplastics
		Polystyrene (PS)	Foam packaging, tea cups, ice cream cups, cafeteria trays, plastic utensils, toys, clamshell containers, insulation board	Recyclable/thermoplastics
		Others (O)	Thermoset plastics, multi-layered and laminated plastics (MLPs), Polyurethane foam (PUF), bakelite, polycarbonate, melamine, nylon, etc. including resins and materials including Acrylonitrile Butadiene Styrene (ABS), Sheet Moulding Compounds (SMC), Fibre Reinforced Plastic (FRP)	Non-recyclable / Thermosets

Source: CPCB, 2017

1 CPCB, 2017, Consolidated Guidelines for Segregation, Collection and Disposal of Plastic Waste

Table 5 summarises the quantities of plastic waste generated in residential areas, including waste from both the lower income group (LIG) and the other households (middle and higher income groups (MIG, HIG)), based on the field surveys. The data shows that almost 35% of the plastic waste is not recycled (PVC, PS and others), whereas roughly another 45% of the plastic is LDPE, which is mostly low-value plastic including plastic covers, wrappers and films. Only around 20% (HDPE, PET, some PP and LDPE milk packets) of the waste is taken up for plastic-to-plastic recycling, as mentioned in detail in the chapter, 'Plastic Waste Recycling Industries in Hyderabad'.

3.1.2. Projection of plastic waste generation

Future projections of plastic waste generation in residential areas were made up to 2025 based on the Business As Usual (BAU) scenario, as presented in Table 6 below². Certain assumptions were made to arrive at the projected quantum of plastic waste generated, including (i) population growth of Hyderabad (an average of geometric and incremental increase in population is considered) added with the floating population data to arrive at a realistic figure, (ii) use of 2011 as the base year for population projection, (iii) waste generation at a rate of 1.3%³ annually attributed to lifestyle changes, and (iv) consideration of the waste characterisation data for 2019 from the baseline assessed in this project.

Table 5: Characterisation of plastic waste in MSW from residential areas of GHMC

Types of Plastics	LIG		Other residential areas (MIG+HIG)		Average
	(%)	TPD	(%)	TPD	(%)
PET	7	4	7	20	7
HDPE	14	7	9	26	12
PVC	<1	<1	4	10	2
LDPE	46	25	42	115	44
PP	4	2	4	10	4
PS	7	4	4	12	6
Others	22	12	30	82	26

Source: ICLEI-SA

Table 6: Existing and projected waste generation from residential areas of GHMC

Year	Population	Waste generation (gm/day)	MSW produced (TPD)	Categories of waste produced (TPD)								
				Biodegradable waste	Plastic waste	PET	HDPE	PVC	LDPE	PP	PS	Other
2019	8,612,484	329	2,832	1,928	365	26	36	11	155	13	17	104
2020	9,146,894	338	3,087	2,102	397	28	39	12	169	14	19	113
2022	9,722,716	346	3,367	2,293	434	31	43	13	184	16	20	123
2024	10,343,135	355	3,676	2,503	473	34	47	15	201	17	22	135
2025	10,671,139	360	3,842	2,616	495	35	49	15	210	18	23	141

Source: ICLEI-SA

² Per capita waste generation rate is based on baseline assessment by ICLEI South Asia in selected representative locations in 2019.

³ Ref: *<http://cpheeo.gov.in/upload/uploadfiles/files/Part2.pdf>

Table 7: Characterisation of MSW collected from generators other than residential in GHMC

Type of generator	Waste generation (Kg/day)	Biodegradables (%)	Plastic waste (%)	Type of generator
Commercial area: Saroor Nagar	Per shop per day	1	6	30
Commercial area: Habsiguda		1	20	25
Charminar market		1	2	41
Fruit, veg and meat market	Per shop per day	59	79	8
	Per shop per day	12		
	Per shop per day	11		
Community Hall	Per capita per day	<1	86	14
Large retail shop	Per shop per day	65	49	23
Hotel	NA	NA	48	22
Restaurant	NA	NA	86	8
Street vendor	Per shop per day	5	56	21
IT office building	Per person per day	<1	45	21
Educational institution	Per student per day	<1	16	35
Office institution (GHMC)	Per employee per day	1	Office building- 18	Office building - 27
			Canteen -79	Canteen-16
Religious building	NA*	NA*	61	13
Park	Per day	1265	55	13
NA	Quantification was beyond scope			
NA*	Significant amount of waste was obtained from one religious establishment only			

Source: ICLEI-SA

3.1.3. Other waste generators

The per-capita (or per entity) plastic waste generation from other waste generators, including commercial establishments, markets, hotels, institutions, and street vendors, etc., is summarised in Table 7. Even though plastic waste has a much lower density than wet waste and other recyclables like glass and metal, it contributes to almost a quarter of the total waste generated by weight in commercial market areas and institutions. Except in samples collected from bulk food waste generators like hotels and vegetable markets, **most other waste samples collected from different generators predominantly contain more than 10% of plastic waste.** Table 7 shows a characterisation and quantification analysis of waste samples collected from generators other than households.

3.1.4. Plastic waste at Hyderabad Integrated Solid Waste Management Facility

The waste quantification and characterisation study at the ISWM facility at Jawahar Nagar, Hyderabad shows that only 6%⁴ or approximately 314 TPD (GHMC, 2019) of the incoming waste is plastic. Table 6 and 7 shows that while almost an equal amount of plastic waste (328 TPD) is generated by households alone, a larger quantum of the plastic waste is generated by other bulk generators in commercial areas and markets and by educational institutes. Hence, it is evident that a large share of the plastic waste is recovered in the informal waste processing sector. Based on the characterisation study, the plastic fraction of the waste received at the facility primarily consists of 194 TPD (62% by weight of total 314 TPD) of LDPE and 31 TPD (10%) of HDPE. PP and PS account for an average of 6 TPD (2%) each, while thermosetting plastic and multilayer plastic together account for 75 TPD (24%) of the total plastic weight received.

4 Based on the characterisation study performed by ICLEI during February 2019 and field assessment conducted on incoming waste received at the tipping floor of the facility. Assessments do not include characterisation study of loads of Construction and Demolition waste received at facility.

Of the plastic waste received at the ISWM facility, based on the characterisation of waste in different stages of processing, almost 3 TPD of plastic is recovered along with other material for recycling at the material recovery platform⁵. Another 135 TPD is converted into RDF and the rest of the plastic, roughly 176 TPD, is contaminated with other material and non-recoverable (including process rejects) and hence sent to the sanitary landfill.

The composition of plastic in the waste recovered/processed at the ISWM facility is shown in Table 8 below

Some of the key findings from the study on plastic waste generation and characterisation in GHMC are given below:

- The waste generation rate in residential areas varies from 296.93 g/c/d in LIG areas to 345 g/c/d in other residential areas (an average of MIGs and HIGs)

Table 8: Characterisation of plastic in MSW collected at ISWM facility

Sl. No.	 Stages of plastic waste processing at ISWM facility	 MSW (TPD)	 Percentage of plastic waste	 Plastic waste (TPD)
A	Received	5,300	6%	314
B	Recovered for recycling	NA ⁵	NA	3
C	Recovered as RDF	1,935	7%	135
D	Disposed in sanitary landfill	848	20%	176

Source: ICLEI-SA

Table 9: Characterisation of plastic waste generated in GHMC

Type of plastic (%)	Commercial 1: Saroor Nagar	Commercial 2: Habsiguda	Commercial 3: Charminar Market	Vegetable & Fruit Market	Community Halls	Large Retailers (Malls)	Hotels	Restaurants	Street Food Vendors	IT Hubs	Educational Institutes	Office Institutions: GHMC Office	Canteen Waste: GHMC Canteen	Religious Places	Public Parks
PET	3	16	-	-	51	5	26	-	<1	6	23	22	7	4	13
HDPE	8	41	5	-	3	4	11	-	4	5	28	3	15	3	21
PVC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LDPE	58	15	37	40	7	31	44	80	53	18	25	21	41	16	21
PP	3	5	34	13	3	4	-	-	10	15	3	7	12	5	-
PS	13	8	15	10	33	16	-	-	9	28	4	16	8	6	16
Others	16	15	10	36	3	41	19	20	25	29	17	30	17	66	29

Source: ICLEI-SA

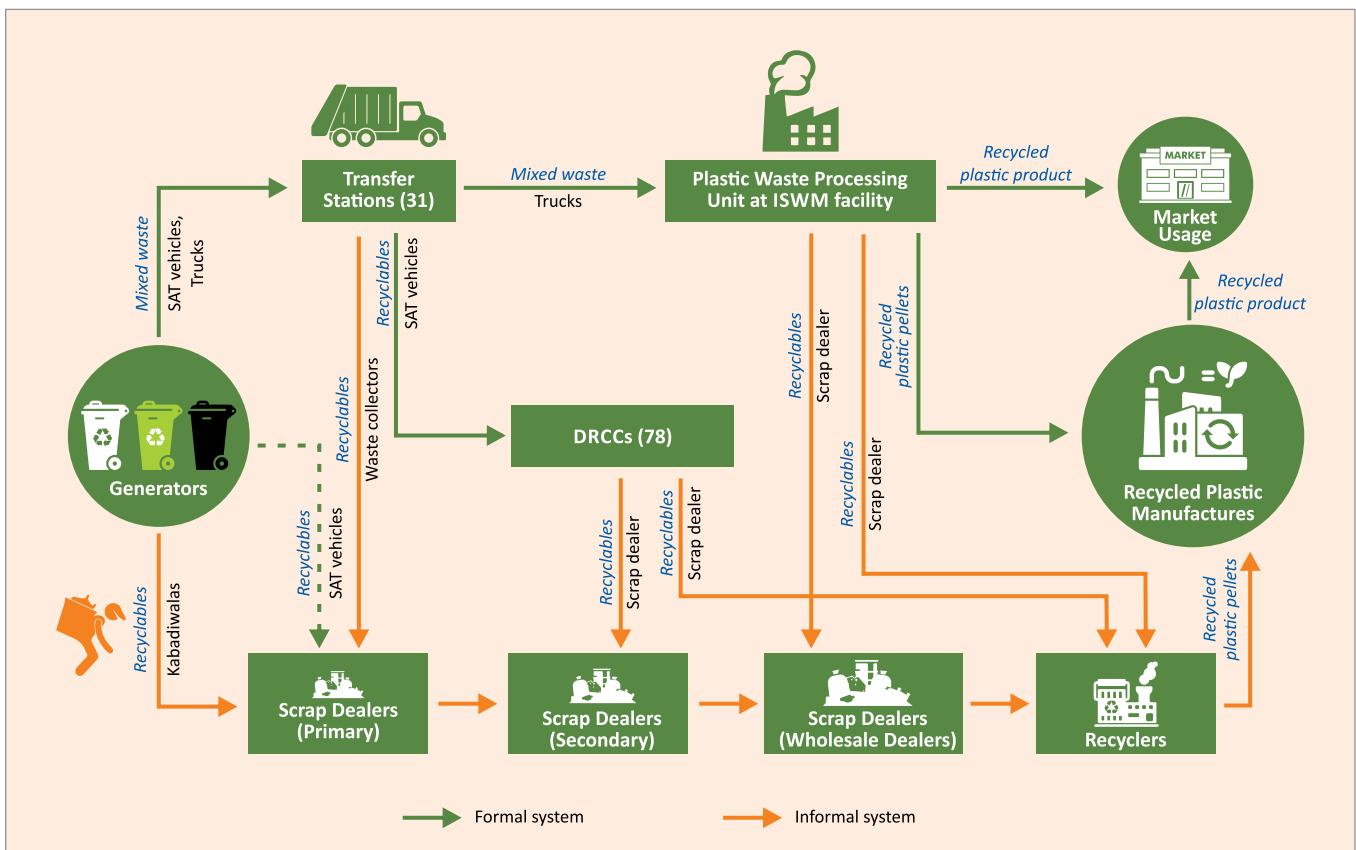
⁵ Recyclables including PET plastic, paper, metal, wood, glass etc. is recovered by waste pickers at the ISWM facility and hence not accounted for by ISWM facility authorities.

- Roughly 325 TPD of plastic waste is collected by GHMC
- 13 TPD (4%) of plastic waste collected is recovered for recycling; 10 TPD at DRCCs and 3 TPD at ISWM facility
- Roughly 135 TPD of plastic waste collected is recovered as RDF fuel
- Almost 176 TPD of plastic waste is sent to sanitary landfill
- LDPE is the largest constituent of plastic waste in residential areas at 46.34% in LIGs and 41.81% in other residential areas.
- HDPE is the second-highest category of plastic waste generated in residential areas.
- PVC is the least generated category of plastic waste in residential areas.
- It is estimated that by 2025, almost 500 TPD of plastic waste will be generated in residential areas alone.
- Plastics account for 41% of the total waste generated in Charminar area, with LDPE comprising almost 37% of the total plastic waste.

- LDPE constituted 40% of plastic waste generated in vegetable markets.
- Almost 80% of plastic waste from restaurants consists of LDPE.
- LDPE constituted the largest fraction of plastic waste at the Jawahar Nagar processing site, at 62%.
- Non-recyclable waste and low-value plastics constituted the majority fraction of most waste samples, except for community halls (51% PET), hotels (28% PET), educational institutes (28% HDPE), office institutes (22% PET) and public parks (21% HDPE), where a large number of food packages (box containers) and water bottles are generated.

3.2. Plastic Waste Management in Hyderabad

As seen in the figure 8 below, the flow of plastic waste in the city forms a closed loop, however, there are many leakages existing in the system. At present, plastic waste, along with the other dry waste fractions, is mostly collected by SAT operators. Waste generators do not usually segregate plastic waste, but sometimes directly sell recyclable materials including plastics to



Source: ICLEI-SA

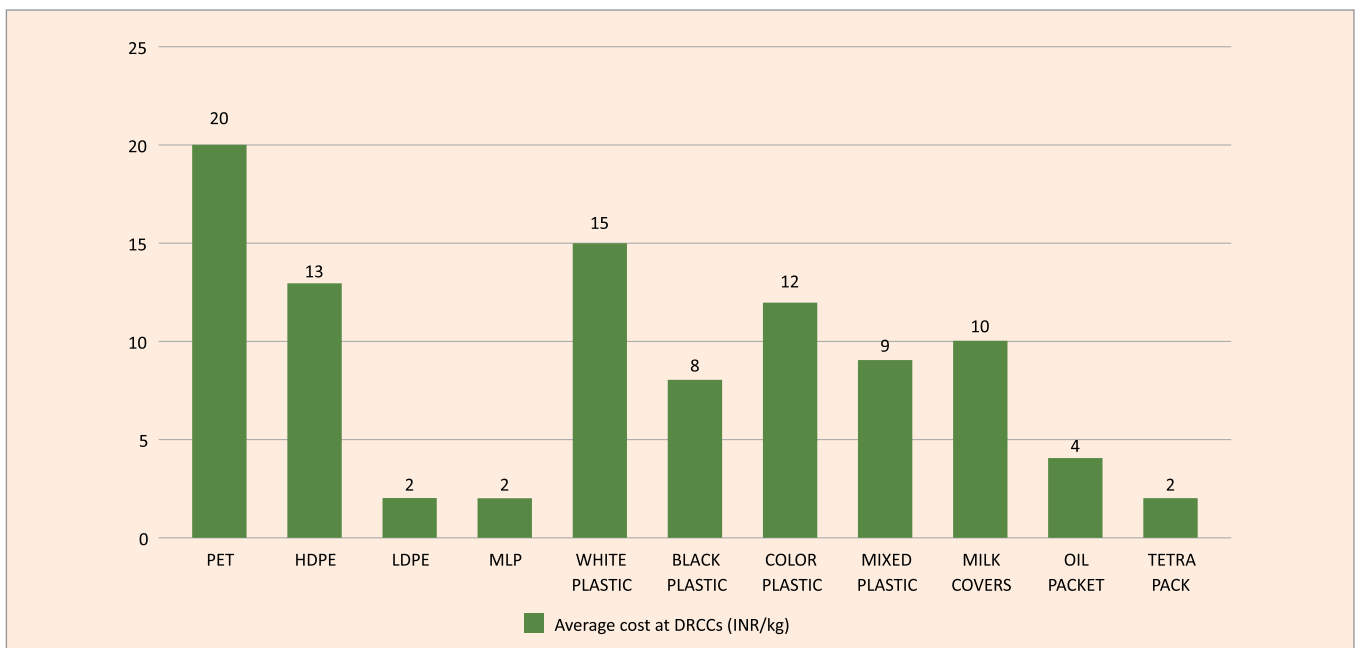
Figure 8: Process flow diagram of movement of plastic waste in GHMC

scrap dealers. The inadequate primary waste collection, as indicated in the previous section, results in much littering in public places, open drains, lakes or other water bodies or in burning of plastic waste along with other waste in several parts of the city. Littered waste is collected during sweeping of streets and transported to transfer stations and eventually the ISWM facility. Waste litter in drains and water bodies ends up clogging the natural drainage systems.

In general, the primary waste collected by SAT operators in the city is segregated and sold to DRCCs or scrap dealers. However, SAT operators segregate and sell only high value plastics, with the remaining plastic waste dumped in transfer stations. Later, waste pickers sort through the waste at transfer stations and litter points and collect recyclable materials, which are sold to DRCCs and local scrap dealers. The larger and



Figure 9: DRCCs at Rajendranagar (top) & Kapra (bottom left)



Source: ICLEI-SA⁶

Figure 10: Buying price of recovered plastic at DRCCs

6 Large cost fluctuations were found for LDPE, rising to Rs. 9/kg in Rajendra Nagar DRCC and Rs 2/kg in lower Tank Bund DRCC

heavier plastics like PET, HDPE, and PP are mostly segregated at this stage. A few of the DRCCs also buy the mixed non-recyclable, multi-layer and PS plastics at a lower price. The scrap dealers and DRCCs then send the collected materials to the plastic processing units directly or through secondary dealers. However, the purchase price for plastic waste at the DRCCs is not consistent and varies from unit to unit. Figure 10 shows the average rates for purchase of different plastic waste at the Lower Tank Bunk DRCC, as of September 2019.

The plastic waste collected at DRCCs is then sold to scrap dealers, who in turn sell it to wholesale dealers. The wholesale dealers segregate the waste according to the market demand and sell it for further processing, where it is turned into granules. The recycled plastic granules are used by the plastic recycling and product manufacturing companies to produce various plastic products, completing the cycle of plastic to plastic recycling. The plastic waste that is not collected by SAT operators and waste pickers is mixed with other waste and transported to the integrated processing facility. Waste pickers at the processing facility also scavenge the mixed waste for recyclables. A portion of the low value and soiled plastics that were intentionally not picked up in the previous stages and the valuable plastics that were not picked by waste pickers in previous stages is collected at this stage for recycling. PP and PE are recycled within the facility into plastic granules and sold in the market, whereas PET bottles are baled and sold to large waste dealers and recyclers outside the facility. Plastic pellets are utilised by registered/unregistered local recyclers in the city to be utilised as raw material for plastic product manufacturing thereby conforming to the circularity of life of plastics. The pellets are sold off pan country as well as exported to retail and wholesale dealers.

The rare fractions of PVC received are stored separately and sold to large waste dealers who sell the plastic to waste processing facilities outside the city. Multi-layer plastic (MLP) and LDPE are also sorted and sold in bulk to cement factories for co-processing. The leftover plastic in the mixed dry waste is stored for use at the proposed Waste-To-Energy (WTE) facility. Rejects from the composting and plastic recycling processes at ISWM also contain fractions of plastic waste that are usually sent to the sanitary landfill.

3.3. Plastic Waste Recycling in Hyderabad

3.3.1. Types of plastic waste recycling

According to the field survey, the most common form of plastic recycling in Hyderabad is Material Recycling (plastic-to-plastic recycling). A brief description of the plastic recycling industry in the city is given in the sections below. It should be noted that while these recycling units, enterprises and entities are categorised based on their activities, many of them are involved in more than one activity.

Plastic segregation units: Some units are only involved in segregating plastics into categories based on colour, size, material and storage. These industries sell the required type of plastics to enterprises with shredding facilities for further processing.

Plastic shredding units: Some units shred plastic waste into flakes of feedable size for the process of extrusion. The flakes are then washed to remove impurities such as adhesives and organic waste. The shredded and washed flakes are sold to plastic pelletisation units or are used for in-house pelletisation. Lighter and less dense plastic waste such as LDPE and plastic films are first converted into lumps or cakes (ghattas) and then shredded.

Plastic extrusion and pelletisation units: Pelletisers are units that are involved in the process of extrusion of raw plastic flakes to pellets. Pelletisers are either involved in the process of extrusion (pelletisation) alone or in segregation, shredding, washing and then pelletisation.

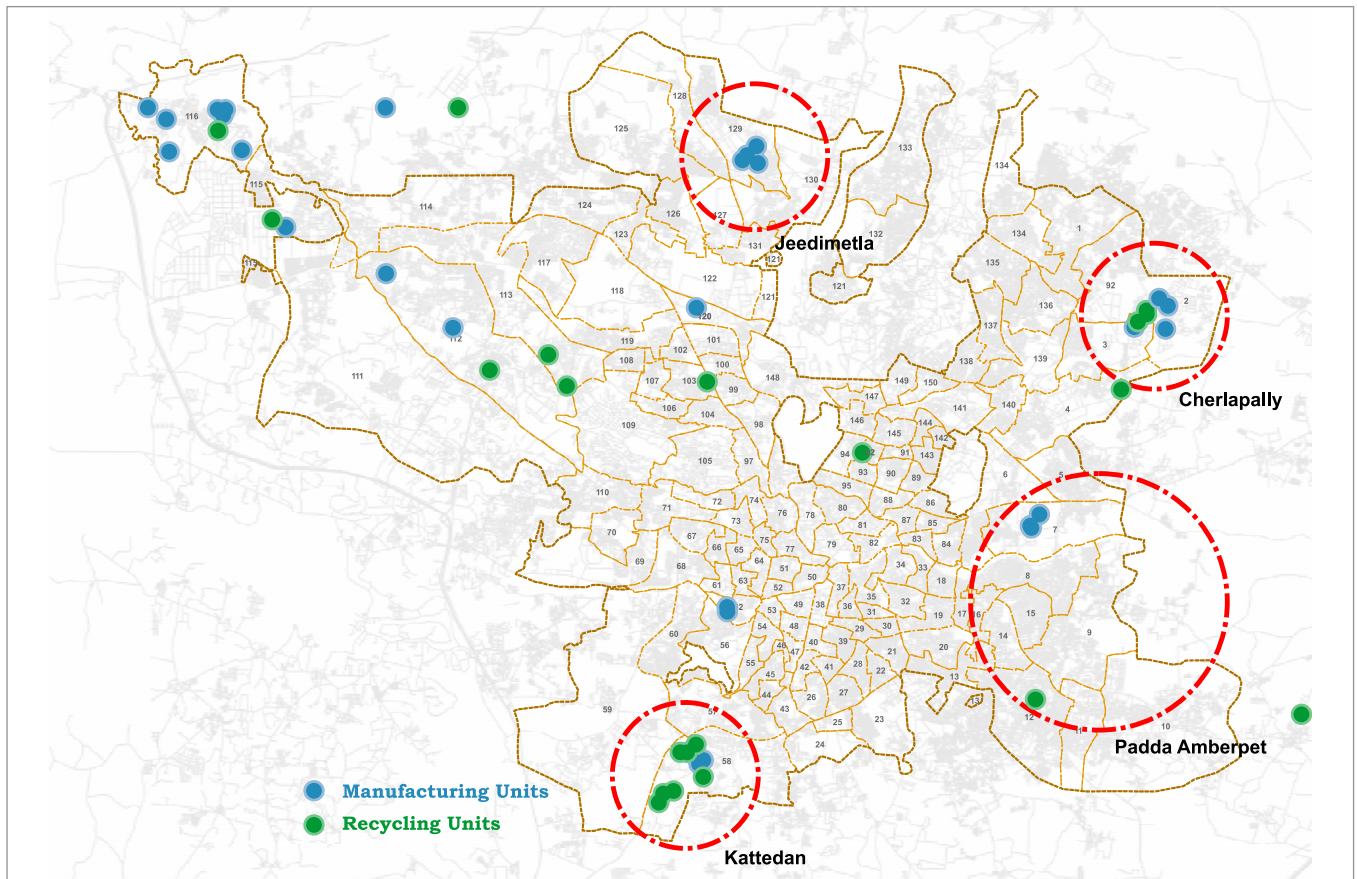
Plastic recycling units: Units that use recycled plastic pellets to manufacture plastic products are termed as plastic recyclers. They mix different proportions of recycled plastic with virgin plastic pellets (or even 100% recycled plastic) to manufacture recycled plastic products.

As can be seen in Figure 11, the plastic recycling units in the city are mostly located in Kattedan, Jeedimetla, Cherlapally and Pedda-Amberpet. In Telangana state, it is mandated that every industrial unit obtain clearances (depending on type of industry) for operation from the respective competent authorities through the 'Telangana State Industrial Project Approval and Self-Certification System (TS-iPASS)', which is a single point clearance system developed by the GOT. The clearances include No Objection Certificates (NOCs), consents, approvals, permissions, registrations, enrolments and licenses for establishing and operating an industry. These clearances are categorised into two stages: Consent for

Establishment (CFE) and Consent for Operation (CFO). Prior to the TS-iPASS, all industrial units had to get CFEs and CFOs separately from 27 departments, which were subsequently consolidated into the TS-iPASS in 2014.

According to the data received from TS-iPASS (from 2014 to June 2019) and TSPCB (till 2014), there are 541 industrial units in the plastic sector in Hyderabad, of which

99% are plastic manufacturing units and 1% are pelletisers. From the primary survey conducted by the ICLEI-SA team, it is observed that except the food grade plastic production units, all other plastic manufacturing units incorporate recycled granules as raw materials in their production processes. The portion of recycled granules used along with virgin plastic granules varies from 30% to 70% depending on the product quality required.



Source: ICLEI-SA

Figure 11: Location of recycling and manufacturing units in Hyderabad



Figure 12: Informal pelletisation facility in Hyderabad

In addition to the 541 certified plastic-based industrial units, there are 451 other plastic industrial units, which are members of the Telangana and Andhra Plastic Manufacturing Association (TAAPMA). Of these 451 units, 78% are manufacturers, 19% are pelletisers and 3% perform both pelletisation and manufacturing. A comparison of the data obtained from TS-iPASS, TSPCB and TAAPMA shows, that only 5% of the members (i.e., 24 industrial units) from TAAPMA have clearances from TS-iPASS or TSPCB accordingly (i.e., tally with TS-iPASS or TSPCB data), indicating that a large proportion of industrial units are operating illegally or informally. A total of about 960 plastic based industrial units are documented in the city, according to TS-iPASS, TSPCB and TAAPMA data. Table 10 below gives an overview of the data captured on plastic-based industrial units in Hyderabad, though several other units exist outside of these records.

Table 10: Types of plastic recycling units in Hyderabad City

Sl. No.	Sources	Pelletisers	Manufacturers	Both	Total
1	TAAPMA	86	350	15	509
2	TSPCB and TSiPASS	3	538		541(mostly manufacturers, as per TSPCB)

Source: ICLEI-SA

3.3.2. Process of pelletisation

The plastic pelletisation process usually followed in the units surveyed in the city involves several steps: (i) segregation, (ii) shredding, (iii) washing, (iv) drying, (v) granulation, and (vi) manufacturing of the final product. However, not all units follow all these stages, thus to determine any differences, ICLEI-SA surveyed and obtained information from 34 pelletisation plants. Details of the processes employed in these units are given in the section below.

Segregation: Plastic material is segregated based on its brand (like Parachute oil bottles, Pepsi PET bottles, Vijaya milk packets), type of material (mostly PET, PE & PP) and colour (mostly white, green, yellow, pink, red and mixed). Materials of the same brand, colour and make are



Source: ICLEI-SA

Figure 13: Number of surveyed recyclers involved in different stages of recycling

processed together to maintain uniformity in the quality of pellets being manufactured. The segregated materials are stacked and stored until used in further processes. Some of the most common plastic types collected for pelletisation are listed in Table 11⁷.

Table 11: Common materials collected for pelletisation

Type of plastic	Most common materials that are pelletised
PET	Water, juice and soda bottles of transparent/white, green, brown colour
HDPE	Packaging material, bags, containers, shampoo bottles, plastic jars
LDPE	Milk packets, water packets
PP	Large storage sacks (e.g., storage bags for rice, cement), water glasses, saline bottles

Source: ICLEI-SA

Shredding, washing and drying: The segregated plastic is shredded into flakes of average size of 1cm in a mechanical shredding machine and washed with detergent in a wash tank to remove oil, dirt, adhesives and other impurities. The washed material is then taken out and sun-dried. While hard plastic like HDPE boxes and PP bottles can be directly shredded using a mechanical shredder, more flexible plastic like carry bags, packaging/wrapping paper, and HDPE plastic sheeting needs to be converted into plastic lumps (ghattas) for shredding and further processing. Flexible plastic is converted into lumps using the extrusion method, explained in the sections below. During the survey, it was observed that the pellets were not washed efficiently by most of the units, leading to an impure raw material feed for recycling, resulting in low quality finished products. Figure 14 shows the equipment used for washing shredded plastic in these units.

Pelletisation: Most pellet manufacturers use a screw-type extruder for pelletisation. The shredded and washed plastic is fed into the extruder to make plastic pellets. Uniform plastic flakes segregated in the previous stage are fed for extrusion in order to ensure quality consistency of the plastic pellets produced. A similar extrusion technology is used to make plastic lumps

from raw flexible plastic, to make the feed suitable for shredding. The survey by ICLEI-SA shows that HDPE is the key plastic waste recycled, whereas LDPE and PP are in low demand. Though literature studies show that PET is one of the most recycled plastic categories, none of the units surveyed were using PET for extrusion.



Source: ICLEI-SA

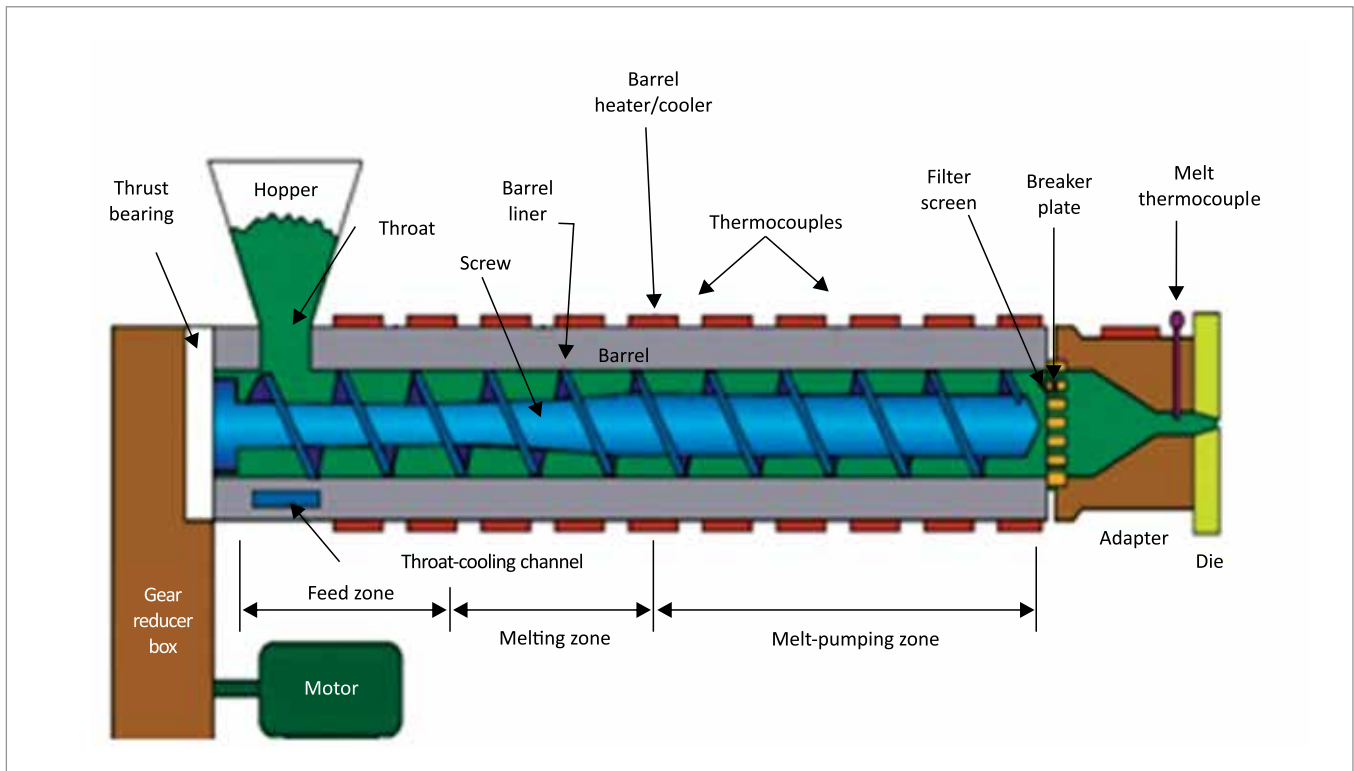
Figure 14: Semi-automated washing of shredded plastic

Process of Pelletisation Using a Screw Extruder

The shredded plastic material or granules are fed into the extruder (or “central body”) through the hopper. The screw barrel performs the functions of pumping, heating, mixing and pressurising. The screw, divided into three zones – Feed zone, Melt zone and Metering zone –has an increasing root diameter as material moves through it from the Feed zone to the Melt zone.

The Feed zone located at the hopper end collects the granules from the hopper and transports them to the screw chamber. During this process the granules heat up and become more compact, which builds up pressure as the bulk moves towards the screw tip. To ensure efficient pumping, the granules should not be allowed to remain in the screw channel. It is around the ‘Melt zone’ that the granules start melting. The correct consistency and pressure of the polymer melt is achieved in the Melt zone before it is pumped to the die at a constant rate, consistency and pressure. A smooth extrudate is achieved only when high pressure in the Metering zone provides constant properties. The high pressure is obtained by restricting the flow in the Melt zone and in the die head, and increasing the melt viscosity.

The extruder, by means of friction of its interior shaft or application of external heat from heaters placed around the barrel, enables the feedstock to be plasticised, resulting in uniform mass. The temperature of the extruder is controlled according to the respective melt temperatures of different plastics, thereby maintaining consistency and keeping the extrusion rate constant. This is done to avoid decomposition and degradation due to high temperatures and insufficient plasticisation due to lower temperatures. Overheating of the barrel can be avoided by circulating cooling water or forced air cooling. A breaker plate is fixed at the end of the Melt zone, between the barrel and die adapter, and holds back impurities and unplastified material. Then the melted plastic is cooled in a water bath and later converted to pellets.



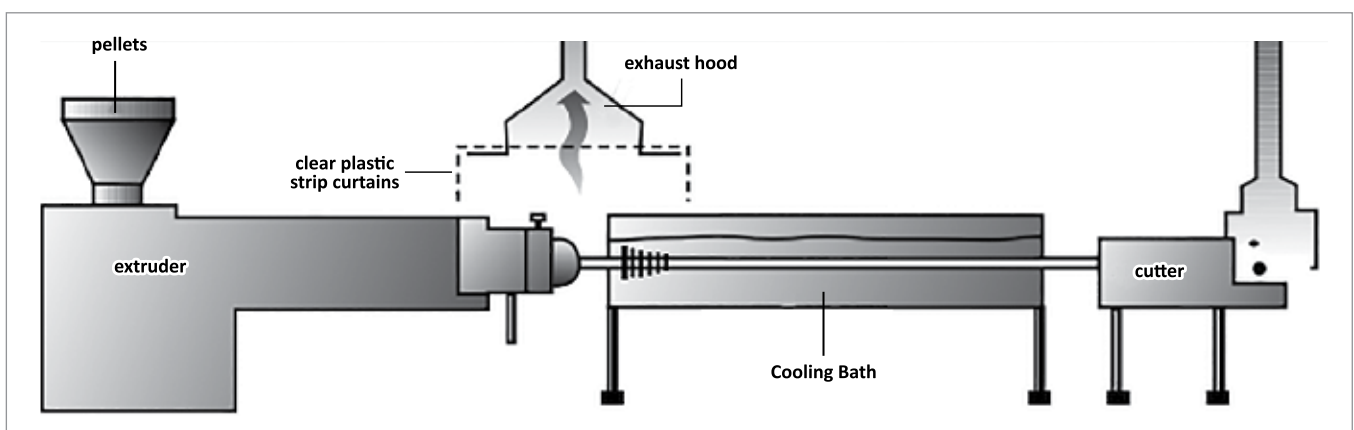
Source: (Natti S. Rao and Nick R. Schott, 2012)

Figure 15: Extruder

The extrusion process of plastic releases vapours or fumes of undesirable odour and possible risk to health. Such vapours could also contain volatile materials such as devolatilising printed films and resins that are highly hygroscopic. The vapours exit through the vent sections in the central body of the extruder, and need to be captured at the point of release (vent openings) and removed through exhaust ventilation before they disperse inside the processing facility and create a potential health hazard to workers. Providing Local Exhaust Ventilation (LEV) at the vent sections is the most effective method of capturing vapours, as it pulls them from the source and

ventilates them out of the building (DuPont Engineering Polymers). LEV consists of a clear plastic strip curtain, hood, exhaust duct system and exhaust fan, as shown in Figure 16 below.

Amongst the surveyed units, LEV systems were only seen on the extruder in the REEL plastic waste recycling unit. Different stages of pelletisation generate wastage in the form of impurities, rejected materials and low-quality products. While some of the plastic wastage is fed back into the hopper of the extrusion system, most of it is either discarded or burnt.



Source: DUPont Engineering Polymers

Figure 16: LEV system for plastic extrusion process

The extrusion process is performed within specific temperature ranges between the melting points and ignition temperatures for each type of plastic. Any deviation will result in deterioration of pellet quality or even hinder pellet formation. It was also observed that plastic materials of similar temperature ranges (like PP & PE) were mixed together to make pellets. The temperature ranges being used for pelletisation of most common types of plastics are shown in Table 12.

Manufacturers – Pellets to product: The recycled plastic granules are bought by the plastic recycling or product manufacturing units to produce various products through injection or blow moulding, which is the final step in completing the plastic-to-plastic recycling cycle. The fraction of recycled plastic granules used as a

substitute for virgin plastic differs according to material. According to the Indian Standards (IS), recycled products need to be clearly labelled to indicate the percentage of recycled material used in the product, as shown in Table 13.

According to the primary survey, the recyclers in GHMC are involved in the manufacture of a number of products including HDPE pipes, dustbin bags, water tanks, mirror frames, plastic chairs, flowerpots, twine, cement bags, water packets and other household and kitchen items. Table 14 shows the percentage of recycled plastic used in some of the products that are manufactured in the GHMC area⁸.

Table 12: Temperature ranges for pelletisation of common plastics

Sl. No	Type	Temperature used for extrusion (°C)	Melting point (°C)	Ignition temperature (burning temperature in °C)
1	HDPE	130 to 200	130	349
2	Mixture of LDPE & HDPE	50 to 100	107 to 130	349
3	LDPE	130-160	107 to 124	349
4	PET	ND	260	
5	PP	200-230	165-170	570

Source: CIPET

Table 13: Symbol of recycled products based on percentage of recycled content in product

Symbol	Abbreviation
R0	No recycling/reprocessing
R1	Less than 10%
R2	11-20%
R3	21-30%
R4	31-40%
R5	41-50%
R6	51-60%
R7	61-70%
R8	71-80%
R9	81-90%
R10	Over 90%

Source: CIPET

Table 14: Percentage of recycled plastic in products manufactured in Hyderabad

Product manufactured	Type of plastic	% of recycled plastic
Water pipes	HDPE	40
Water tanks	HDPE	30
Chairs	PP	20-40
Carry bags	LDPE	40
Mirror frames	PP	30
Flower pots	PP	40
Twine	PP, PE	40

Source: ICLEI-SA

Plastic recycling unit at ISWM facility: The plastic recycling unit inside the ISWM facility, Jawahar Nagar, is an example of a well-organised plastic waste recycling facility in GHMC. REEL receives almost 5,300 TPD (GHMC, 2019) of MSW, of which only 6% or approximately 314 TPD, as per ICLEI-SA survey, is plastic waste (data from the receiving tipping floor). Of the approximately 314 TPD of plastic waste received, 31 tonnes (10%) is HDPE, 6 tonnes (2%) is PP, and 194 tonnes is LDPE (62%), which is mostly contaminated and not recoverable from the mixed waste (Srinivasan, 2019)⁹. While the recyclables are recovered for processing in the recycling facility, the non-recyclables (including low-value recyclables) are dried and stored as RDF along with other dry waste as feed for the upcoming waste-to-energy plant. The plastic waste recovered is stockpiled at the recycling facility, processed into pellets and used for the manufacture of recycled plastic products.

The plastic recycling unit is an integrated facility with a 250 Kg/hour¹⁰ processing capacity and includes washing, drying, pelletising and product manufacturing units. The processing facility processes almost 3 TPD of plastic on average. Figure 18 shows the process of recycling at the facility, which is briefly described below.

Manual cleaning: Any macro-size impurities and other types of plastic are manually removed from the plastic waste by sanitary workers, who then feed it onto the conveyer belt. A minimum of 70% sorted plastic of specific types and colours is required to maintain the quality of the recycled product.

Shredding and grinding with water: The raw plastic at the end of conveyer belt is fed into a mechanical shredder via a hopper, and is shredded into small flux or chips for further processing. The chips fall into the grinding unit, where the plastic is mixed with water and is broken, crushed and ground, using baffles.

Washing: The shredded plastic from the grinding chamber falls into the pre-washer, where the plastic material is washed with flowing water to remove impurities that separate out during grinding. After the prewash, the plastic is sent to the centrifugal friction washer, in which the plastic is washed using the centrifuge effect created in the rotary drum of the washing machine. The water bath removes impurities like dirt, organic matter and adhesives. The necessary amounts of chemicals are also mixed in the tank to promote coagulation and sedimentation of impurities.

Floating: The material cleaned in the centrifugal washing machine is sent to the floating tank, where the plastic material floats in water while any heavy impurities settle at the bottom. This process is improved by adding chemical agents to the washing tank.

Drying and density separation: The cleaned plastic from the floating tank is skimmed into a centrifuge drier which separates the water from the plastic using centrifugal force, leaving the resultant product with an average 7% moisture. From the centrifugal drier, the plastic is channelled down into the thermal drier where it is passed through hot air tubes, further reducing moisture content to 3%. The plastic is then dropped into a cyclone separator, where it is again channelled downwards by gravity, with any remaining moisture evaporated off into the air, which reduces the water content of the plastic to under 0.5%.

Compactor: The plastic from the cyclone separator is collected in large bags and fed into a compactor, where it is made into cakes to be fed for extrusion. If required, colour is added to the final product during this process. Colour additives can constitute upto 10% of the input material only, to ensure compaction.

Pelletisation: The compacted plastic chips or flux are directly fed into the extruder, where they melt and the semi-solid material is extruded to form threads that are cooled using a cold water bath and cut into pellets by the cutting plate of the extruder. Any further impurities in the plastic are trapped in the cutting plate filter of the extruder device.

Gas venting: All gases formed inside the extruder device as well as any Volatile Organic Compounds (VOCs) formed by ignition of adhesives inside the device are sucked out through the LEV attached to the extruder unit, mixed with water and sent to the cooling tower.

Wastewater treatment: Wastewater from the washing of the plastic and fumes extracted by the LEV system are piped into the cooling tower, where the water undergoes filtration to remove all impurities from the washing process. The treated water is recirculated in the process for a period of two weeks to one month. Later, the water in the system is replaced and the wastewater is collected in a tanker and taken to the ion exchange wastewater treatment system within the ISWM facility.

⁹ ICLEI-SA Survey 2019

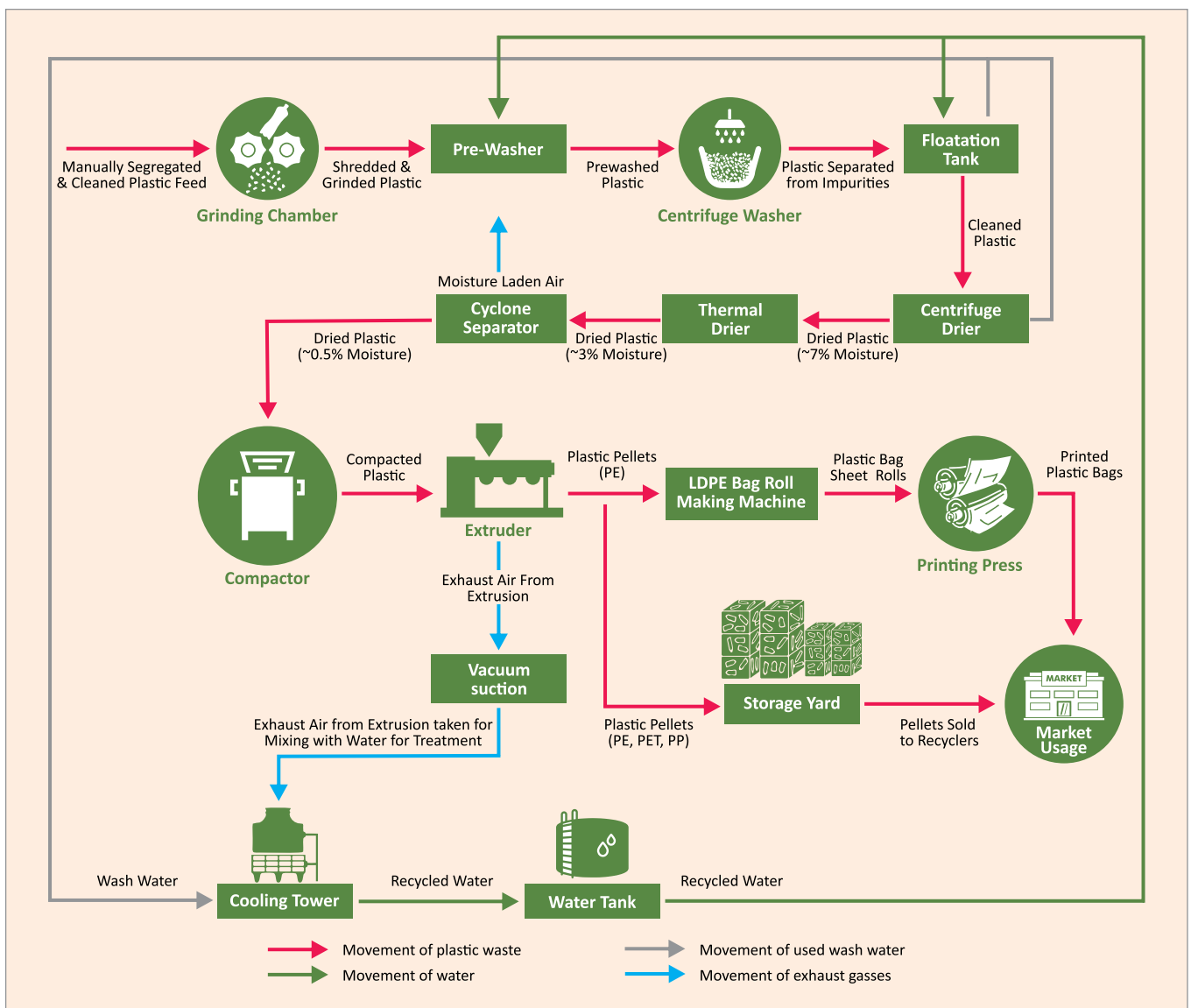
¹⁰ 250 Kg/hour for hard plastic and 80 Kg/hour for soft plastic

Manufacture of end product: The PE pellets are used for manufacturing HDPE bags of R9¹¹ quality. PET, PP pellets and additional PE pellets are sold to recyclers

outside the REEL facility. The figure below shows the process of plastic recycling at the REEL plastic recycling facility.



Figure 17: Washing plant (left), extrusion plant (center) and recycled plastic product manufacturing (right) at plastic recycling unit inside ISWM facility



Source: ICLEI-SA

Figure 18: Process of extrusion at ISWM facility

4. Existing Institutional Framework for Managing Plastic Waste

This chapter details the regulations, programmes and institutional arrangements currently in place at different levels of governance, from the national to local level i.e. GHMC, for managing plastic waste. An assessment of existing gaps and suggestions to improve implementation of the regulations are included in the following sections.

4.1. Regulations for Plastic Waste Management

4.1.1. At the national level

SWM Rules 2016: SWM Rules 2016 were framed under the Environment (Protection) Act, 1986, and govern the duties of all major stakeholders including MOEFCC, MOHUA and all other concerned departments, District Collectors, Secretary in charge of Urban Development in State, Pollution Control Boards, Urban Local Bodies, waste generators, waste processing facilities and processed waste utilising facilities (like cement plants using RDF) in the management of MSW. The rules also define timelines within which prescribed infrastructure are to be created. The detailed document also includes a performance evaluation system, including the formation of a state-level advisory body, for review of annual performance. The requisite information to support this evaluation is to be provided by the concerned authorities, according to the prescribed reporting structure. The rules go as far as elucidating the technical specifications for the construction and operation of sanitary landfills, and for processing and treatment facilities that are to be

adopted by local bodies and other concerned authorities. The rules specify that every Urban Local Body (ULB) should set up material recovery facilities and that each plastic product manufacturer, importer and brand owner should define, notify and implement an EPR policy. The SWM rules also authorise ULBs to prepare and notify byelaws to prevent plastic littering and ensure efficient management of plastic waste.

PWM Rules 2016 (Amendment 2018): The PWM Rules 2016 were introduced by the MOEFCC to boost plastic waste minimisation, source segregation, recycling and reprocessing, as well as to address the issues of waste pickers, recyclers of plastic waste and adoption of the 'polluter pays' principle for sustainable waste management practices. The rules included the aspect of explicit pricing¹² for single-use plastic as a deterrent for plastic waste generation, but this was removed in the 2018 amended version. The rules specify the following:

- Manufacturing, marking, labelling and disposal conditions for plastic products
- Responsibility of ULBs, waste generators including brand owners, importers and also street vendors in Plastic Waste Management (PWM)
- Protocols for manufacture and use of compostable bags as an alternative to plastic
- Monitoring system of PWM and annual reporting structure for different levels of government

Extended Producer Responsibility in India

The MOEFCC released the guideline document on 'Uniform Framework for Extended Producers Responsibility' (EPR) in June 2020 (MOEFCC, GOI, 2020). The document defines EPR as 'a policy principle to promote total life cycle environmental improvements of product systems by extending the responsibilities of the manufacturer of the product to various parts of the entire life cycle of the product, and especially the take-back, recycling and final disposal of the product'. The guidelines are based on the Plastic Waste Management Rules 2016 which further extends the mandatory responsibilities not only to manufacturers but also to brand owners and importers who introduce the products in Indian markets. The guideline proposed three different strategies for EPR implementation from which plastic producers need to mandatorily choose one.

¹² Explicit pricing is a provision where shopkeepers who are registered with the local governing body can provide plastic carry bags to customers on a payment basis. These registered shopkeepers need to pay the local body a minimum plastic waste management fee of Rs. 4000/month (or higher as decided by local body based on sales capacity), which will be used by the local body for sustainable waste management in its jurisdiction. Unregistered shopkeepers will be prohibited from selling or providing free plastic covers to customers.

- i. **Fee based system:** It is proposed that the producers/importers/brand-owners who are using less quantity of plastic for packaging (cut-off quantity shall be decided by the government after the registration process) shall contribute to the EPR corpus fund at the central level. This may be an escrow account managed by a Special Purpose Vehicle (SPV) where private and other stakeholders can become members. Contributions by each producer will be decided based on normative cost and will be based on generation of plastic waste, efforts required and money spent by ULBs to handle plastic generated. The fund would be used for plastic waste handling, collection, segregation, treatment and processing. Funding will be provided to three entities- (i) ULB, (ii) assembler/recycler and (iii) IEC activities. A committee will be constituted at the central level for overall monitoring the implementation of EPR. The State Level Advisory Boards (SLABs) constituted under the Solid Waste Management Rules, 2016 may be engaged for recommending the disbursement of funds to the ULBs, recyclers and for IEC activity. Representative of producers can also become part of SLABs.
- ii. **Producer Responsibility Organisation model:** Producer Responsibility Organisation (PRO) provides opportunity to producers to execute their own project for managing plastic waste under EPR compliance. Producers individually or collectively as a consortium (legally agreed between producers) can form a PRO, to handle collection, arrange for recycling, and ensure that recycling targets are met either by themselves or engaging the waste management agencies. Local bodies and some states do not have the expertise or resources to design, implement and manage effective local plastic waste management programs. This can be addressed by having self-managed PRO take on responsibility for discharging producer's national and state legal obligations in a more efficient and cost effective manner. A producer/PRO with utilisation of such mechanism would nevertheless secure plastic credits upon recycling or recovery of the collected plastic through an accredited processor/exporter as well.
- iii. **Plastic credit based model:** In a plastic credit based model, the producer has to ensure that an equivalent amount of packaging waste has been recovered and recycled to meet their obligation. However, producers are mandated to acquire evidence of recycling or recovery (in form of plastic credit) from properly accredited processors (recyclers, WtE plant operators, cement co-processors, users utilising plastic in road) or exporters. Producers may exchange plastic credits for a financial transaction at a price and other terms as negotiated between them. The system is designed to ensure that funding may be directed to remove bottlenecks in the material recovery chain (like processing of low value plastics) through market corrections. To enable create a link between the PRO model and the credit model, it is also advised to create a tradable recycling credit scheme in India.

The guidelines require an online national registry to be developed by the MOEFCC and governed/operated by PCBs. All stakeholders including plastic product producers (manufacturers, importers and brand owners) recyclers (plastic pelletisers and plastic to plastic product manufacturers) and processors (plastic to other material and energy processing) need to register on web portal.

4.1.2. At Telangana State level

Solid Waste Management Policy and Strategy, 2018:

As with the national SWM rule, the SWM policy of Telangana is also based on the 5R principles (Reduce, Reuse, Recycle, Recover and Residual Management). The policy restricts the manufacture and use of plastic bags of <50 micron thickness. The policy recommends that a ULB like GHMC with a population exceeding 2 million or generation exceeding 500 TPD of waste should have an integrated waste processing facility with RDF facility and that the RDF should be utilised in the cement industry for co-processing. The policy also recommends that the ULB should explore opportunities for installing a waste to energy plant (gasification, pyrolysis, incineration or mass burning) for power generation or a plastic to fuel oil facility (GOT, 2018). The policy also mandates annual reporting by every city to the state office of Commissioner and Director of Municipal Administration (CDMA).

Single-Use Plastic ban in Telangana State: As per ROC.No.E.131083-2019-H2 in October 2019 the Government of Telangana issued certain instructions to implement a ban on Single-Use Plastics (SUPs), by which the following actions are mandatory:

- Prohibition of sale and use of SUPs within municipal limits
- Meeting to be conducted by Municipal Commissioner with all major stakeholders, including ULB officials, institutions, NGOs, commercial enterprise unions, etc., to provide capacity building on the ban of SUPs
- Special notice to be issued to all commercial units, restricting use of SUPs
- Information, Education and Communication (IEC), training and advertisements on the ban to be conducted, using social media, mass media and print media

- All stakeholders to store and hand over segregated dry and wet waste to ULBs and ULBs to impose strict penalties (up to three times higher than user charges) for non-compliance
- Special task force to be formed in every ULB to ensure regulation of ban through frequent inspection and penalising of defaulters
- Strict litter-free zones to be notified and enforced
- Dry waste collection centres to be established

Ban on <50 micron thickness plastic in Telangana: In addition, through Government Order (G.O.) Ms. No. 79 dated December, 2016 Environment, Forest, Science and Technology (EFS & T) Department of Government of Telangana issued a ban on plastic carry bags of less than 50 microns thickness. The notification focuses on the following:

- Restriction in the use of recycled plastic for storage and packaging of foodstuffs, pharmaceuticals and drinking water
- Restriction in the manufacture, storage and use of virgin plastic bags of less than 50 micron thickness
- Carry bags and plastic packaging shall either be in natural shade without any added pigments or made using only those pigments and colourants in conformity with Indian Standard : IS 9833:1981 "List of pigments and colourants for use in plastics in contact with foodstuffs, pharmaceuticals and drinking water"
- Process of recycling shall conform to Indian Standard: IS 14534:1998 titled as Guidelines for Recycling of Plastics
- Manufacturing of carry bags made from compostable plastics shall conform to the Indian Standard: IS 17088:2008 titled as Specifications for compostable Plastics

Resolution by GHMC to implement ban on plastic bags below and above 50 microns: As per resolution No.266 by GHMC dated on 23 May 2018, a ban is imposed on manufacture, supply, sale and use of all types of plastic bags including above 50 micron plastics within GHMC limits, except for the provided usages

- The plastic carry bags manufactured exclusively for export purpose against any export orders in a plastic industry located in Special Economic Zones (SEZ) and Export Oriented Units (EOU)

- The plastic bags which constitute or form an integral part of packaging in which goods are sealed prior to use at manufacturing /processing unit
- The plastic bags and sheets used in forestry and horticulture nurseries against the orders from the government departments or from the firms concerned
- The plastic used for packing of milk and milk products (dairy products)

The resolution also prescribes penalties for offence starting at 25,000 INR (first offence), 50,000 INR (second offence) and sealing of firm at the third time.

4.2. Specific Programmes for Plastic Waste Management

4.2.1. At the national level

Swachh Bharat Mission (SBM): SBM is a national programme launched by the Indian government on 2nd October, 2014 through the Ministry of Housing and Urban Affairs (MOHUA) as a centrally sponsored scheme envisioned to ensure hygiene, waste management and sanitation across the nation. One of its major objectives was to achieve 100% scientific management of MSW by 2019 through focusing on enabling modern and scientific MSWM and augmenting technical capacities of ULBs to create an enabling environment for private sector participation in waste management (MOHUA, 2017). Plastic waste management is also a focus area under SBM. Given below is a 10-step roadmap developed by the UNEP and suggested by the MOHUA under the SBM for governments to restrict the use of SUPs and reduce their various impacts (MOHUA, 2019):

- Target the most problematic SUPs
- Consider the best actions to tackle the problem
- Assess the potential social, economic and environmental impacts
- Identify and engage key stakeholder groups
- Raise public awareness about the harm caused by SUPs
- Promote alternatives
- Provide incentives to industry
- Use revenues collected from taxes or levies
- Effectively enforce the measures selected
- Monitor and adjust the chosen measure as needed

Swachh Survekshan: Swachh Survekshan (Cleanliness Survey), known as the world's largest cleanliness survey, was started in 2016 with the objective of establishing healthy competition among municipal corporations and ULBs in sanitation and cleanliness. In 2019 a total of 4,237 ULBs participated in the survey, with the focus on sustainability. The survey also helped in encouraging large-scale citizen participation in the Clean India movement and in creating cleaner cities (MOHUA, 2019). Most of the ULB-led and citizen-led initiatives submitted for review came under the solid waste management or sustainable solutions category and included plastic waste management, restriction in the use of SUPs and substitution of SUPs.

4.2.2. At local government level (GHMC)

Twin bin system for waste storage: GHMC provides households with two bins for storage of segregated waste, and to facilitate better waste processing including the recycling of plastic.

Swachh Auto Tippers for waste collection: In 2016, all cycle rickshaws used for primary collection of waste were replaced with 2,500 Swachh (cleanliness) Auto Tippers in all 150 wards with a target of segregating waste, reducing littering on streets and in open places, increasing the level of source collection of garbage, reducing the number of dustbins on main roads and ensuring direct transportation of waste to transfer stations.

Wealth Out of Waste (WOW): This is a Corporate Social Responsibility (CSR) program of the Indian Tobacco Company (ITC) Limited to collaborate with ULBs to

promote recycling. ITC in collaboration with GHMC is working towards encouraging people to inculcate the habit of source segregation and to recover and recycle dry recyclables, paper, plastic and metal. The recyclables collected through DRCCs were bought under the WOW programme and sent for recycling, as described in the previous chapter. While paper is recycled in-house by ITC, paper and other recyclables are sold to the contracted regional recyclers in the city itself.

GHMC periodically also undertakes campaigns to address several aspects of MSWM, some key ones of which are listed below:

Campaign against littering - Plogging: GHMC in coordination with several Resident Welfare Associations (RWAs) adopted the practice of plogging (jogging and picking up litter) as an awareness campaign on picking up litter from roads. The volunteers in this campaign were mostly morning joggers who pick up litter during their exercise routine and deposit it at designated locations.

Plastic ban campaign in meat shops: IEC was conducted with meat shop owners and their customers to reduce the use of plastic covers in meat shops. Customers were requested to carry tiffin (stainless steel) boxes instead of plastic covers. The programme also included awarding the 'Swachh Chicken and Mutton Shop' title and awarding customers (who carried tiffin boxes) through lucky draws as part of promoting eco-friendly packaging practices.

Black bag campaign: This was a social initiative by GHMC, conducted in co-ordination with RWAs, to



Figure 19: GHMC campaigns against SUPs

sensitize citizens on the generation of plastic waste. As part of this initiative, volunteers collected plastic waste and displayed it in black plastic bags for public viewing. About 492 kg of plastic waste was collected from Bagyalatha colony alone in the Hayath Nagar circle within one week. The total waste collected was packed into 82 black bags and displayed at a large rally.

4.3. Responsible Agencies, Roles and Responsibilities

There are several entities at the national, state and local levels responsible for implementing PWM Rules, 2016, the roles of which are briefly covered below:

Ministry of Environment, Forest and Climate Change (MOEFCC):

The MOEFCC is responsible for overall monitoring of plastic waste management and other streams of solid waste in India. It is responsible for forming the central monitoring committee for yearly review of SWM, as per the SWM Rules 2016 and ensuring implementation.

Ministry of Housing and Urban Affairs (MOHUA):

The MOHUA is responsible for co-coordinating with the state and the local governments and for implementing plastic waste management in the country according to the SWM Rules and PWM Rules. It is responsible for formulating strategies and policies, promoting research and development, providing capacity building and technical guidelines, conducting annual reviews and for suggesting corrective courses of action to the state governments. The MOHUA executes its responsibilities through institutions such as the CPHEEO, which developed the 'Municipal Solid Waste Management Manual'. The MOHUA also constitutes and implements programmes and missions that address waste management, including the SBM and Atal Mission for Rejuvenation and Urban Transformation (AMRUT).

Central Pollution Control Board (CPCB):

The CPCB is a statutory organisation formed under the Water (Prevention and Control of Pollution) Act, 1974. It is entrusted with powers and functions under the Environmental Protection Act. The TSPCB is entrusted with implementing Environmental Laws and Rules within the jurisdiction of GOT, India. It ensures proper implementation of the statutes, judicial and legislative pronouncements related to environmental protection within the State. The CPCB formulates standards for emissions from processing and disposal facilities, including those for plastic waste management, reviews the standards, and develops guideline documents for

the performance of plastic industries. Below are some example documents:

- Guidelines for Co-processing of Plastic Waste in Cement Kilns, 2017
- Guidelines for Segregation, Collection and Disposal of Plastic Waste, 2017
- Guidelines for Disposal of Thermoset Plastic Waste including Sheet Moulding Compound (SMC)/Fibre Reinforced Plastic (FRP), 2016

The CPCB is also responsible for coordinating and reviewing the activities of State PCBs, including TSPCB. The activities performed by TSPCB that are annually reviewed by the CPCB are listed below:

- Ensure adherence to the prescribed standards of SWM and PWM Rules 2016 by GHMC and other ULBs
- Compile data from industrial units and ULBs on implementation of environmental standards and review such data at least twice a year
- Prepare annual report on implementation of environmental rules in every ULB and the state as a whole
- Develop guidelines for maintaining buffer zones, restricting any residential, commercial or other construction activity from outer boundaries of waste processing and disposal facilities, for any facility handling more than five tonnes of solid waste per day
- Examine proposals for authorisation of processing facilities and industries with respect to their adherence to environmental standards; recommend authorisation only if they operate in accordance with the conditions stipulated
- Provide directions to local bodies for safe handling and disposal of hazardous domestic plastic waste
- Regulate interstate movement of plastic waste

Municipal Administration and Urban Development Department, Telangana:

The department is responsible for developing the strategy and action plan for plastic waste management for Telangana. It is also in charge of ensuring efficient plastic waste management, according to the SWM and PWM Rules in every ULB in the state, including GHMC. The responsibilities of the state department include: the development of plastic waste collection and processing facilities in cities, ensuring allotment of space for all required infrastructure, facilitating the establishment of sanitary landfills,

developing schemes for informal waste pickers and developing the capacity of GHMC and other ULBs in terms of plastic waste management along with other waste streams.

State Level Monitoring Committee (SLMC): The SLMC for effective monitoring of the implementation of PWM Rules in Telangana, under the chairmanship of Principal Secretary, Municipal Administration and Urban Development, is mandated to meet every six months to review the implementation of provisions of the PWM Rules 2016, and is convened by the CDMA Director.

Bureau of Indian Standards (BIS): The BIS is the national body of India for developing the activities related to standardisation, marking and quality certification of goods and so on. IS 14534:1988 – Guidelines for recycling of plastics were developed by BIS as a reference document for recycling activities of plastics, as referenced by PWM Rules for developing the recycling policy in India. The manufacture of compostable plastic is governed by the standard IS 17088:2008, entitled Specifications for Compostable Plastics. The BIS is also involved in the certification of recycled plastic products that are referred for product quality assessments.

Hyderabad District Administration: The district administration under the District Collector is responsible for quarterly (once every three months) reviews of the performance of GHMC, in accordance with PWM Rules 2016. All aspects, including collection, segregation, processing treatment and disposal, are covered and corrective actions are taken in consultation with the commissioner of GHMC. The Collector also closely coordinates with the activities of GOT and GHMC.

Greater Hyderabad Municipal Corporation (GHMC): GHMC is responsible for the development and setting up of infrastructure for segregation, collection, storage, transportation, processing and disposal of plastic waste.

These activities are implemented by engaging SAT vehicles for collection, and with REEL as the private partner for processing. Details of the process of plastic waste collection and management by GHMC are given in Chapter 3. Plastic waste management, as part of solid waste, is managed by the Health & Sanitation Department. Waste management on the ground is monitored by Sanitary Jawans (SJs) and Sanitary Field Assistants (SFAs) at the ward level. While the SJs are to monitor waste generators and penalise defaulters for activities such as littering and burning of plastic, the SFAs need to ensure the 2,500 SAT operators are segregating waste collected from all waste generators efficiently.

Both SFAs and SJs are monitored and coordinated at the zonal level by Sanitary Inspectors (SIs) and Sanitary Supervisors (SSs). SIs are responsible for managing municipal plastic waste at the zonal level. SIs from all six zones report to the Health Officer of GHMC, in charge of technical aspects of waste management in the city. The Sanitary Department is headed by the Deputy Commissioner with special charge over Solid Waste Management, who implements the PWM in GHMC in accordance with PWM Rules 2016. The Deputy Commissioner also reviews and approves all activities to be performed by the sanitary department under guidance from the Municipal Commissioner, the signatory authority for any operation, initiative or implementation of byelaws for plastic waste management in the city.

4.4. Gaps in Institutional Structure of Plastic Waste Management

Gaps in the existing institutional arrangements were identified during the baseline assessment conducted by ICLEI South Asia in the city, with the key gaps summarised in Table 15.

Table 15: Key gaps in institutional system

Institution	Existing Gap
GHMC	• Require additional sanitary staff (SI /SS/ SFA / SJ) for efficient monitoring considering the population of the city (with reference to CPHEEO manual)
	• Need for 2000 additional SAT vehicles.
	• Provision of requisite number of operators, two operators for each SAT vehicle should be ensured every where.
	• Need for capacity building of GHMC vigilance team to help them identify banned materials and penalise defaulters

Institution	Existing Gap
	• Specific work hours need to be allotted to vigilance team staff
	• Require more efficient monitoring capacity and infrastructure for movement of plastic waste in the city during collection, recovery at DRCCs, disposal at transfer stations, and secondary transport
	• Require a standardized rate chart and list of materials for DRCCs across GHMC¹³
	• Data on waste that is being recycled, reused and reprocessed by the private recycling industries needs to be collected and maintained regularly.
	• Optimal utilisation of grievance redressal system is essential. As of now most of the stakeholders are unaware of the system and there is absence of rapid response.
	• Need better integration of informal sector into the formalised waste management system
	• SAT operators' performance monitoring mechanism is to be strengthened
TSPCB	• Data and information on polluting industries in and around GHMC need to be updated regularly
	• Mechanisms to control industrial emissions from unlicensed and unregistered plastic recycling units, most of which work out of garages, should be strengthened
	• Ensure enforcement of plastic resin identification code on products
	• Ensure enforcement of recycling symbols on products
	• Ensure effective enforcement for controlling the use and sale of <50-micron thickness plastic in markets
	• Legal enforcement of SUPs ban should be ensured with detailed categorisation of type of SUPs.
	• Effective implementation of EPR related actions by major plastic waste generating brands should be enforced

Source: ICLEI-SA

13 For example: The Lower Tank Bund DRCC accepts PET and HDPE bottles at the same rate, whereas the Rajendra Nagar DRCC takes PET bottles separately at a higher price and HDPE bags and oil covers at a lower price range.

5. Plastic Waste Management Strategy and Action Plan

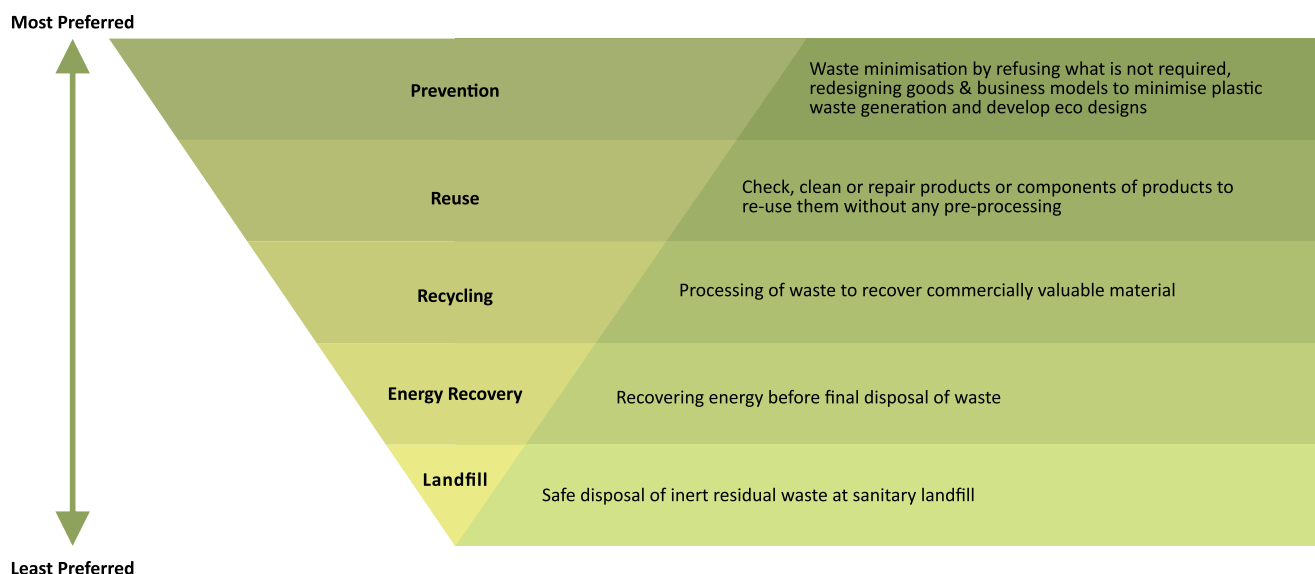


Figure 20: Integrated Solid Waste Management Hierarchy

The proposed strategy for plastic waste management and action plan for GHMC incorporates an integrated approach in accordance with the Solid Waste Management Rules 2016, Plastic Waste Management Rules 2016, and the Solid Waste Management Policy, 2018 of the Government of Telangana. It focuses on achieving the following targets for GHMC:

- Zero SUPs waste generation by 2025
- 100% segregated waste collection and transport by 2030
- 100% plastic waste processing by 2030

The action plan is also poised in view of achieving the targets of Swachh Survekshan, especially the seven star rating for MSWM. The strategy has been developed in accordance with the principles of integrated waste management hierarchy (Figure 20), where minimising plastic waste generation at source is considered the most important aspect, followed by ensuring segregated storage, streamlined collection and appropriate recycling and processing. The strategy focuses on implementing a multi-pronged approach of sustainable and scientific processing of plastic waste, starting with plastic-to-plastic recycling from a circular economy perspective

and lower priority allotted to plastic waste-to-energy conversion. The least preferred option is scientific landfilling of plastic waste, an approach only relevant for hazardous plastic waste and highly contaminated process rejects. The strategy also considers the following aspects:

- Accountability regarding legal measures
- Technology-based interventions
- Viable and cost-efficient alternatives
- Socially inclusive actions that do not negatively impact the weakest sections in society
- Collaborative action of all stakeholders
- Ambitious deadlines and targets

The recommended strategies and specific actions to achieve the targets and implement an efficient plastic waste management system in GHMC are discussed in further detail in subsequent sections. The successful implementation of the proposed strategy will require a comprehensive awareness strategy, multi-stakeholder consultations, policy initiatives including incentives and penalties, creation of market demand for alternatives and active community participation and interaction –

all aspects of which are incorporated in the strategies detailed below.

5.1. Strategy 1: Reduce Generation of Plastic Waste at Source



Figure 21: Cloth bag manufacturing supported by ICLEI-SA, CCET and UNEP-IETC

'An ounce of prevention is worth a pound of cure'; the most efficient way to manage plastic waste is by minimising its generation at source. At the United Nations Environmental Assembly (UNEA), Nairobi, Kenya in 2018, India proposed a commitment from world nations to "phase out the most problematic single-use plastics by 2025," which was agreed upon and backed by a majority of the 200 ministers present, including those from the European Union (UN Environment Programme, 2019). At the same event, India set a goal of phasing out SUPs by the year 2022 (UN Environment Programme, 2018). Beyond a blanket ban on SUPs, behavioural change to reduce the usage of common SUPs materials is now the focus of national policies and actions in India (DownToEarth, 2019).

The most preferred strategy for plastic waste management for GHMC is reduction at source, which focuses on minimal consumption of SUPs as being the most important factor. Minimising the consumption of SUPs commodities can be achieved via a multi-pronged approach – such as bringing about behavioural change among consumers through policies to reduce the availability of SUPs, penalties and fines for using them, making available alternative materials and promoting their use and IEC activities. To support the phase-out and reduced usage of SUPs by GHMC and GOT in line with the national commitments, the following actions are proposed.

5.1.1. Ban on Single-Use Plastics (SUPs)

As per ROC.No.E.131083-2019-H2 in October 2019 the Government of Telangana issued certain instructions to

implement a ban on Single-Use Plastics (SUPs). However, it did not define which materials were covered under the ban or how the ban will be implemented.

A ban can be imposed partially – for select items that are considered highly problematic in terms of their generation in large quantities, difficulty in handling and environmental threats, or completely – for all kinds of SUPs.

Partial ban: The PWM Rules 2016 direct that carry bags made of virgin or recycled plastic shall not be less than 50 microns in thickness. A pan-India ban on plastic packaging of <50 micron thickness has been notified, and 21 states and Union Territories (UTs) have separately notified more stringent norms by banning all plastic carry bags and other items (MOEFCC, GOI, 2016). GOT also announced a ban on the manufacture, stocking, sale and use of plastic carry bags of <50 micron thickness in December 2016 through the order G.O. Ms. No. 79 (Government of Telangana, 2016). As per Roc.No.3678O/2018-M3, dated June, 2018, GOT has also issued guidelines to reduce use of SUPs, urging ULBs to avoid the use of plastic water packets, tetra packs, single-use straws, plastic/styrofoam tea cups/containers, plastic less than 50 microns thick, plastic-coated items and any other form of SUPs. A ban has also been imposed on multilayer plastic sachets used for storing, packing or selling gutkha (chewable tobacco), tobacco and pan masala. Multilayer plastic has a lower value in the recycling sector due to the complex nature of the material. Further, while multilayer plastic sachets account for only about 5–10% of plastic waste, they are spread across mixed plastic and are difficult to segregate, which in turn impacts the efficiency of recycling of other kinds of plastic.

The GHMC's vigilance department needs to conduct routine flash inspections to ensure that single-use plastic products and banned products like tobacco packets are not sold in the city. If necessary, penalties should be levied on the defaulters to discourage the use and, therefore, generation of plastic waste.

Complete ban on SUPs: A complete ban on the sale, storage and use of SUPs has already been implemented in Sikkim (Government of Sikkim, 2019), New Delhi (Government of NCR of Delhi, 2011), Maharashtra (Government of Maharashtra, 2018), Karnataka (Government of Karnataka, 2016), Uttar Pradesh (Government of Uttar Pradesh, 2018), Tamil Nadu (Government of Tamil Nadu, 2018), Nagaland (Nagaland Government, 2019) and Jharkhand (Jharkhand, 2017). Each of these state governments has published lists of SUPs items covered by this restriction, as shown in Table 16.

Table 16: List of states and banned single use plastic products

State	Single-use plastic products banned
Sikkim	Water bottles, disposable items such as cups, plates, spoons, containers and similar items made from PS foam
Maharashtra	Drinking water PET bottles of below 200 ml, plastic mineral water pouches, plastic shopping bags with or without handles, single-use disposable items made of thermocol-like cups, plates, saucers, spoons and straws and single-use plastic decoration materials
Karnataka	Plastic covers, cups, spoons, plates, flags, banners, buntings, flex, cling films, items made of thermocol (PS), and non-woven PP bags
Uttar Pradesh	Plastic less than 50 microns thick, disposable cups, plates, spoons, forks and glasses
Tamil Nadu	Plastic sheet/film used for wrapping food, plastic sheet used as dining table cover, thermocol plates, plastic-coated paper plates, plastic-coated paper cups, plastic tea cups, plastic tumbler, thermocol cups, plastic carry bags of all sizes/thicknesses, plastic-coated carry bags, non-woven bags, water pouches/packets, plastic straws and plastic flags. The House Select Committee had also recommended restricted use of plastic for packaging items of daily-use such as like milk, curd, oil and medicines
Nagaland	Single-use plastic products such as plastic carry bags, plastic cutlery and decorative items made of Styrofoam (thermocol), polythene, nylon, poly-vinyl-carbohydrates, poly-propylene and polystyrene
Jharkhand	Manufacture, storage, import, sale or transport of plastic carry bags for supply of goods
New Delhi	Ban on plastic bags, cups, water bottles, wrappers, sachets and straws
Kerala	Plastic carry bags, non-woven carry bags, plastic flex banners, plastic buntings, plastic plates, plastic cups, plastic straws, plastic spoons, plastic bottles, plastic pouches, plastic flags, plastic sheets, plastic cling films, plastic beads and plastic decorations. The ban does not apply for milk pouches and food-grade plastic of more than 50 microns in thickness, agricultural product medical packets, rain coats, tarpaulin sheets and pens

(Compiled from different sources)



Source: pexels.com

Figure 22: Most commonly banned SUP products by states in India

Alternatively, it is proposed that a well-considered complete ban on single use plastics is implemented backed by appropriate policy measures, enhanced access to existing SUPs alternatives and promotion of R&D of new and more sustainable alternatives.

Recommendations on implementing ban on Single-Use Plastics

In order to restrict the use of single-use plastic products, it is critical to ensure that a systematic approach is adopted for the selection of materials to be banned. The following steps provide support in this respect and are based on the experiences of several Indian states and other countries.

- **Step 1:** ULBs form a core committee of stakeholders to identify single-use plastic products that need to be banned and to identify the anticipated impacts of the same. Core committee should include experts and representatives from the plastic industry, departments of environment, forest and science and technology, management and research institutes, TSPCB, specialists in waste management, civil society, consumers' forum and market associations.
- **Step 2:** Identify the categories of materials that are to be banned through a systematic process. The 10-step assessment procedure recommended by the All Indian Plastic Manufacturers Association (AIPMA) comprises: functionality of the product, convenience for user, safety (food safety and health safety), environmental impact, social impact, economic impact, resource efficiency provided by the product, consumer preference and affordability, significance and utility of the product for the economy, recyclability and reusability (AIPMA, 2019).
- **Step 3:** Develop guidelines for phased implementation.
- **Step 4:** Submit proposals in city council meetings, obtaining approval.
- **Step 5:** Implement ban and generate mass awareness among the public, while simultaneously provide access to and availability of alternatives and generate awareness about them.
- **Step 6:** Monitor enforcement of the ban. The ban should be accompanied by strict penalisation and vigilance to ensure proper enforcement. Penalising needs to be a constructive approach, starting with statutory warnings, followed by symbolic fines, and later heavier fines for repeated offences. In the Greater Chennai Corporation, for example, any retailer storing or supplying banned plastic items

would be penalised from 25,000–100,000 INR whereas multiple offences (e.g., fourth time) would lead to the sealing of the shop or impounding of the storage vehicles, as applicable (Daily Thanthi, 2020). Penalties need to be fixed by a team comprising of multiple stakeholders, including economists, industry representatives, waste management experts, the Additional Municipal Commissioner (head of SWM wing in GHMC) and vigilance department in order to ensure that penalty rates are acceptable to society. **A standing core committee needs to be formed to oversee the process of inspection and penalisation.**

A monitoring team needs to be formed within the GHMC, there is already a vigilance team, consisting of SIs and other officers. The team needs appropriate capacity building and should be empowered to identify offenders, communicate with them in a constructive manner, execute penalties and seize materials when required. The inspections and penalties need to be carried out in a time-bound manner, and the submission of monthly reports to the standing core committee by the vigilance team needs to be ensured.

A list of products that can be banned by GOT has been identified on the basis of a ground survey of waste generated in Hyderabad, the availability of alternatives and actions taken by other Indian states (Table 17). The notification of this list would provide much needed clarity and represent a first step in ensuring reduction in the consumption of SUPs and subsequent generation of SUPs waste in the city.

Table 17: Recommended list of products for ban



Figure 23 : Community initiative for refusing Single Use Plastic items supported by ICLEI-SA, CCET and UNEP-IETC

Tamil Nadu SUPs ban: Case study

The Government of Tamil Nadu notified the ban on the manufacture, storage, supply, transport, sale or distribution of 'use and throwaway plastics,' including plastic sheets used for wrapping food and as dining table covers, plastic plates, plastic-coated tea cups, plastic tumblers, water pouches/packets, plastic straws, plastic carry bags and plastic flags, irrespective of thickness, vide G.O. (Ms). No. 84, dated 25 June, 2018. This ban came into effect on 01.01.2019.

Prior to the implementation of the ban, several meetings were conducted with representatives of hotels, restaurants, function halls and other relevant generators, besides NGOs to spread awareness. District Environmental Committee meetings and large-scale awareness rallies chaired by the District Collectors were conducted in all districts of Tamil Nadu. Resolutions were passed to create a 'one-time use and throwaway plastic-free districts'. A dedicated website (www.plasticpollutionfreetn.org), logo, mobile app and awareness videos for the state-wide plastic ban have been developed by the Tamil Nadu Pollution Control Board (TNPCB) in coordination with regional coordinators. Additionally, an exhibit vehicle was also inaugurated. TNPCB directed all major industries in the state to comply with the government order banning the use of single-use and throwaway plastic items and to create awareness about it in the areas adjacent to their industrial units. Display boards showing the banned items were placed at 45 toll plazas, and 173 units that were manufacturing the banned items were directed to stop production from 1 Jan., 2019. Of these, 154 units are no longer in operation and the remaining 19 have halted manufacture of the banned items (TNPCB, 2019).

Plastic materials to be considered for ban		Remarks
Carry Bags	Plastic carry bags that are less than 50 microns thick (PE & PP)	As per PWM Rules 2016 recommendations
	Unnamed/untagged plastic carry bags	As per PWM Rules 2016 recommendations
	Uncertified compostable/starch-based carry bags	As per PWM Rules 2016 recommendations
Serve-ware	Non-woven PP bags	Sold in market as cloth bags, which create confusion among customers
	All kinds of PP and PS cups, glasses, plates, bowls and cutlery items	Comprise a major share of the plastic waste in GHMC. Sold by companies without any waste collection plan
	Plastic films used on steel plates used by street vendors	Comprise a major share of plastic waste in GHMC. Do not get recycled
	Plastic straws	Do not get recycled
	Cardboard/paper plates with plastic film/liner	Comprise a major share of plastic waste in GHMC. Sold by companies without any waste collection plan
	Paper cups with plastic liners	Comprise a major share of plastic waste in GHMC. Mostly littered and not recycled
Packaging	Drinking water pouches	Mostly littered and not recycled
	Plastic packaging without brand names and contact information (e.g., camphor, cotton, accessories and jewellery)	As per PWM Rules 2016 recommendations
Decorations & Advertisements	Single-use decorative items including thermocol decorations	Mostly littered and not recycled
	PVC flex and banners	No suitable waste recovery system exists

Source: ICLEI-SA

5.1.2. Policies to restrict use of SUPs

Green Public Procurement Policy - City of Ghent, Belgium

In 2008, the city of Ghent, as part of its sustainable development action plan, implemented the 'Ghent sustainable public procurement strategy,' focusing on achieving improved life-cycle, cost-efficient and sustainable supply chain management by 2020. As part of this policy, sustainability-related technical specifications were introduced in procurement criteria, such as exclusion of PVC material in self-adhesives and folders and giving preference to refillable office gadgets/products.

The sustainability aspects had an overall positive effect on the tendering process by creating awareness and setting a positive example. Up to 90% of the participating suppliers were able to provide products that met the tender requirements. As extra points were offered for 'green products', more sustainable goods were provided by suppliers (European Union, 2013).

In addition to ban, GOT and GHMC can restrict the use of SUPs by implementing efficient policy measures as have been practiced around the world. Policy measures that can be implemented are discussed below.

Preferential procurement: Preferential procurement of biodegradable alternatives instead of SUPs materials by large generators such as GHMC, PWD, TSPCB and technical institutes (for instance Osmania University), as part of an organisational policy, will help reduce the consumption of plastics. The procurement preferences can be made part of a general procurement policy or included as specific requirements in tenders or calls for proposal. Non-plastic alternatives should always be the preference. If plastic products cannot be avoided, the following attributes should be included in the procurement guidelines for such products:

- Have reparability, reusability and recyclability
- Made from recycled materials
- Avoid composite materials
- Avoid harmful plastic (e.g., chlorinated plastic)

Buy-back programmes under Extended Producer Responsibility (EPR): EPR reinforces the responsibility of manufacturers who place products in the market that usually end up in the waste stream, which GHMC has to deal with. Buy-back assurance of used or discarded plastic products by manufacturers is an EPR model that helps reduce the chances of the material ending up in unmanaged waste streams. Manufacturers can provide assurances that their products will be bought back with a specific return fee, if returned to stores or company specified collection centres. Alternatively, they can also collect a payback fee from customers at the point of sale of the product, which can be returned to the customer when the emptied packaging is returned. The buyback

schemes require efficient infrastructure and fool-proof collection procedures to ensure movement of plastic packaging material back to the retailer, wholesaler and then the manufacturer. This approach encourages customers to not throw away plastic packaging and other SUPs and creates value for low-value plastics, especially LDPE and Multi-Layer Plastics (MLPs).

The dairy industry, for example, has an established buyback scheme in multiple states in India. A major proportion of the milk packets from major distributors like Alwin and Warana are collected back at their authorised outlets at a buyback price and returned to the manufacturer for recycling. The customers are made aware of the buyback option. In Maharashtra, notification No.Plastic-2018/C.R. No.24/TC-4 requires that all manufacturers of plastic packaging materials print their buyback scheme on the packaging itself (except medicines, horticulture and agriculture products). The SWM Policy and Strategy by the Government of Telangana emphasises the promotion of CSR. **Telangana should, as a policy measure, ensure that buyback systems are developed by all identified manufacturers who use plastic packaging.**

Green protocol for events: As a policy initiative, a green protocol to be developed and implemented by GHMC, to be followed during festive events and other mass gatherings in the city such as sports competitions and college festivals, exhibitions, events in offices, hotels and institutions, as well as political, state and other community events. The green protocol will act as a guideline designed to restrict the use of SUPs during events and encourage the use of SUPs alternative materials.

Green Protocol by Kerala

Green Protocol initiatives of Suchitwa Mission were first implemented in Kerala during the National Games in November 2014 to promote responsible waste management strategies and practices during festivals and mega events in the city. The protocol was based on the first preferred approach in the waste management hierarchy, i.e., prevention of waste. The protocol is now being successfully adopted by local election bodies, educational institutes for events and institutions, including the Legislative Assembly Complex. Key activities as part of the green protocol agenda include welcoming guests by offering water in steel tumblers, placing disposal bins for recyclables at checkpoints, levying security deposits to allow carrying of plastic items inside the demarcated green zone, implementing a blanket ban on disposable serve-ware by caterers, and use of cloth banners, gazebo and signage. Following its successful implementation during the National Games, the Green Protocol was adopted in *Attakai Pongala* (religious festival), the State School Youth Festival, *Malayatoor Fete* (religious festival) and various mass-gatherings where disposable items were replaced with eco-friendly clay, steel, and coir products.

Policy to avoid single-use plastic by Taj group of hotels

The Taj Group of hotels run by the Indian Hotels Company Limited (IHCL) started reducing the use of plastic in its day-to-day operations from 2017. To eliminate the use of SUPs, several measures have been taken in all 100 IHCL-owned-and-operated hotels. All plastic wrappers for in-room dry amenities in 25 Taj hotels in the country have been replaced with oxo-biodegradable wrapping¹⁴. The hotels are switching over to this new packaging in a phased manner. In addition, IHCL is replacing single-use plastic items with biodegradable options, some of the initiatives include plastic sandwich trays being replaced with paper trays, plastic forks, knives and spoons being replaced with those made of corn starch or wood, and plastic straws being replaced with paper straws. The IHCL is also moving towards safe, reusable ceramic dispensers for all bathroom amenities. Jute bags, cotton laundry bags and non-plastic packaging are used for tea and coffee (The Hindu, 2018). Private bar amenities are packaged in glass and biodegradable bamboo straws and chopsticks are used as cutlery. Plastic garbage bags are replaced with oxo- biodegradable bags, plastic carry bags with paper carry bags, plastic wet umbrella bags with oxo- biodegradable bags and all plastic waste generated by the hotels is sent for recycling through scrap traders authorised by the Pollution Control Board. The Taj Exotica Resort & Spa in the Andaman Islands is the IHCL's first 'Zero Single-Use Plastic Hotel' with an in-house glass bottling unit to eliminate the use of SUPs (IHCL, 2018).

Taxation mechanism: Imposition of heavy taxes on the manufacture and sale of plastic products is another preferred method to restrict the production of SUPs waste at source as well as to encourage the use of recycled plastic in manufacturing. In the GST system, plastic products are taxed at 5%, reduced from an earlier rate of 18%. Taxes on plastic production overall affects the plastic recycling industry (ICTD, 2019), hence needs to be specific to the targeted type of plastic. For example, a tax on single-use virgin plastic products, or on products that contain less than a fixed percentages of recycled plastic would result in increased recycling rates and reduced use of virgin plastic products. Such taxes would raise the market demand for and value of recycled plastic.

The taxation policy, in accordance with the '2015 European Union Plastic Bags Directive' significantly reduced the use of plastic bags in many European countries (New Economics Foundation, 2018). It should be ensured that the taxes are visible on the purchase and not absorbed into the cost of production for the action to create a higher impact.

The revenue generated from the tax can also be earmarked for establishing better infrastructure and capacity development of institutions to enhance the efficiency of collection and recycling. The recommended steps for developing a taxation system for SUPs by the state government broadly include the following:

- Consultation with multiple stakeholders, including government and industry to identify suitable points of tax interventions targeting producer and consumer behaviours
- Detailed assessment of impact of taxation on the economy
- Design of tax system in alliance with major stakeholders to ensure its effective implementation
- The taxation process should also be accompanied by simultaneous increase in import duty on the product to prevent manufacturers from importing the material rather than manufacturing it in domestic markets.

¹⁴ The environmental viability of oxo-biodegradable products is a subject for debate by the science community and is [the use thereof is] not recommended by the ICLEI-SAs currently. The example is given to show the goodwill taken up by IHCL.

Table 18: Alternatives to SUPs available in Hyderabad

Single-use plastic product	Alternative product available in Hyderabad	Description of the product
 Plastic carry bag	Starch based bags	Biodegradable carry bags made from natural starch with no chemicals or preservatives; if required, food grade colouring is added
	Cloth tote bags	Bags made by small-scale industries, SHGs & CBOs
	Paper bags	
	Jute bags	
	Recycled cotton paper bags	Discarded cloth pieces are upcycled to create handmade paper and used in the manufacture of bags and folders
 Plastic water bottle, cups	Biodegradable water bottles, biodegradable cups, bio laminates	Made of natural products, free of plastic
 Plastic straw	Leafy straws	Biodegradable straws made from palm leaves
 Plastic garbage bag	Biodegradable garbage bags	Garbage liners made from newspaper
 Plastic cutlery	Edible cutlery	Edible cutlery can be eaten as a snack after use or can be disposed of as animal feed
 Plastic serve-wares	Biodegradable serve-ware	Biodegradable serve-ware: plates, bowls, spoons
	Biodegradable utensils	
 Plastic cling wrap	Beeswax wrap	Biodegradable cling wrap
 Diapers and sanitary items	Eco-friendly menstrual products	Biodegradable sanitary napkins, diapers, etc.

Source: ICLEI-SA

5.1.3. Enhance availability and access to existing alternatives to SUPs

Though feasible alternatives to single-use plastic items for consumers and retailers are available to a certain extent in the city, it is challenging to enhance their availability and affordability. **A thorough analysis of the alternatives based on their carbon footprint also needs to be conducted before promoting such products.** Providing robust infrastructures, strengthening markets, innovations, subsidies and incentives for consumers to use alternatives are some of the measures that could be taken. A list of alternative or market-ready materials available in Hyderabad for uptake and promotion is given in Table 18.

Marketing and promotion of products made from starch-based biopolymers: Starch or Polylactic Acid (PLA) based polymers made from renewable resources are alternatives that can reduce the dependence on petroleum-based plastic products and the quantity

of non-biodegradable plastic waste being generated while still yield products providing the same benefits as traditional plastics. Starch-based polymers have shown to be a viable alternative to fossil-fuel sources, besides offering environmental advantages such as decreasing toxic emissions. A life-cycle assessment of starch-based polymers has revealed that emissions of greenhouses gases during manufacture, transportation and disposal are very low and sometimes below the detection limits, and in particular have no alarming or significant impact on India's climatic conditions (CPCB, 2018). Target products for biodegradable polymers include packaging materials such as trash bags, film wrapping, laminated paper, egg cartons, toys and agricultural tools (e.g., mulch films and planters).

Encourage and establish small-scale cottage industries for manufacture of alternative materials: The landscape for women's empowerment has been evolving over the last few decades, with a paradigm shift from considering women as only recipients of welfare benefits to



Figure 24: SHG formed for manufacture of cloth bags in Hyderabad with support and handholding of ICLEI-SA, CCET and UNEP-IETC

mainstreaming gender concerns and engaging them in the development process of the country. This has brought several opportunities and possibilities for women's empowerment. Given the multiple roles that a woman is expected to play in her family and society, Micro and Small Enterprises do provide a critical opportunity for women empowerment. Presently, 9.46% of small scale enterprises are managed by women (MSME, GOI, 2020). The GHMC and the state government need to encourage the setting up of small, cottage-industry units with specific focus on women entrepreneurs for manufacturer of products as mentioned in the table above. Such initiatives can create a ripple effect among communities and generate employment opportunities for self-help groups and other community-based organisations, as well as promote a culture of sustainable living. GHMC can support such initiatives by adopting preferential procurement and providing incentives from the existing govt. programmes for setting up of such facilities. GHMC and the state government can also extend financial support for upscaling present units to large commercially viable industries. Schemes such as the following can

be tapped for this purpose: Support to Training and Employment Programme for Women (STEP) by the Ministry of Women and Child Development (MWCD) (WCD, GOI, 2019), Mahila E-Haat (online marketplace) (WCD, GOI, 2019), Pradhan Mantri Mudra Yojana under Micro Units Development and Refinance Agency (MUDRA) Ltd. (MUDRA, GOI, 2019), Stand Up India Scheme (Stand-Up India, GOI, 2015), Prime Minister's Employment Generation Programme (MSME, GOI, 2017), National Credit Guarantee Trustee Company (NCGTC) Ltd (NCGTC, 2014), Women Entrepreneurs Hub (WE-Hub, GOT, 2018), Mission for Elimination of Poverty in Municipal Areas MEPMA (MEPMA, GOT, 2017), Kishori Shakti Yojana (WCD, GOI, 2007), Telangana-Hub (T-Hub, GOT, 2015) and Telangana Innovation Fund (T-Fund) (GOT, 2015). GHMC needs to ensure SHGs and other Community Based Organisations (CBOs) have access to these schemes and funds. While GHMC can promote CSR initiatives to support small scale industries, a list of government schemes that can be utilised to promote enterprises for the manufacture of alternatives to SUPs is given below in Table 19.

Table 19: Government schemes with potential to support enterprises that manufacture alternatives to SUPs

Sl. No.	Scheme	Overview	Potential opportunity
National level programmes			
1	Support for Training and Employment Programme for Women (STEP)	Aims to provide skills to women to raise their employability and provide competencies and skills to enable them to become self-employed/entrepreneurs.	There is scope to incorporate and promote business in production of alternatives to SUPs as part of STEP.
2	Mahila E-Haat	This is a unique online marketing platform maintained by the Ministry of Women & Child Development, leveraging technology for supporting women entrepreneurs/SHGs/NGOs and for showcasing the products/services made/manufactured/undertaken by them.	Leverage online portal and facilitate marketing aspects for locally made SUPs alternatives to plastics produced by local SHG women, NGOs, CBOs, etc.
3	Pradhan Mantri Mudra Yojana	Access to loans up to 0.1 million INR (i.e. 10 lakhs INR) with the aim of boosting confidence in young, educated or skilled workers, for those with aspirations to become first generation entrepreneurs. Existing small businesses will also be able to expand their activities.	Access to financial support for existing and new entrepreneurs producing alternatives to plastic products. The scheme can also be leveraged for small-scale plastic recycling units.
4	Stand Up India Scheme	Government of India (GOI) launched the Stand Up India scheme on the 5 April, 2016. The Scheme facilitates bank loans between 1 million INR and 10 million INR (i.e. 10 lakh INR and 1 crore INR) to at least one Scheduled Caste (SC)/ Scheduled Tribe (ST) borrower and at least one woman borrower per bank branch for setting up greenfield enterprises.	Access to financial support for SC and ST population for manufacture of alternatives to plastic products. The scheme can also be leveraged for small-scale plastic recycling units.

5	Prime Minister's Employment Generation Programme (PMEGP)	Credit-linked subsidy for generation of employment opportunities through establishment of micro enterprises in rural and urban areas. The scheme is implemented by the Ministry of Micro, Small & Medium Enterprises as the single nodal agency at national and state levels, District Industry Centres (DICs) and banks in urban areas.	Access to financial support for existing and new entrepreneur's with respect to production of alternatives to plastic products. The scheme can also be leveraged for small-scale plastic recycling units.
6	National Credit Guarantee Trustee Company Ltd. (NCGTC)	Presently, there are five dedicated credit guarantee trusts under the Management of NCGTC: Credit Guarantee Fund Scheme for Educational Loans (CGFEL), Credit Guarantee Fund Scheme for Skill Development (CGFSD), Credit Guarantee Fund Scheme for Factoring (CGFF), Credit Guarantee Fund for Micro Units (CGFMU) and Credit Guarantee Fund for Stand Up India (CGFSI). Cumulatively, these five trusts have a committed credit guarantee corpus of 130 billion INR (i.e 13,000 crore INR)	Access to financial support for existing and new entrepreneurs with respect to production of alternatives to plastic products. The scheme can also be leveraged for small-scale plastic recycling units.
State Level			
1	WE Hub	Start-up incubator exclusively for women entrepreneurs, aiming to support women entrepreneurs with innovative ideas, solutions and entities focusing on emerging areas in technology. WE Hub will also support under-explored/unexplored sectors along with the service sector.	Incubation support for existing and new women entrepreneurs with respect to recycling, refurbishing, up-cycling and manufacture of alternatives to plastic product businesses.
2	Mission for Elimination of Poverty in Municipal Areas (MEPMA)	Forming urban women into Self Help Groups (SHGs) and encouraging internal savings and internal lending Capacity building of Community Based Organisations: - Creating access to credit by providing bank linkage - Loans with subsidies for self-employment units - Placement linked skill trainings - Market linkages to SHG entrepreneurs and their products - Community Resources Centres (CRCs) & Mahila Swasakthi Bhavans (MSBs) - Stree Nidhi (State Level Women Credit Cooperative Society)	Holistic support for women groups to help them to develop into entrepreneurs producing alternatives to plastic.
3	Kishori Shakti Yojana	Enables self-development and empowerment of adolescent girls by imparting training on home-based skills, life skills and vocational skills.	Creating skilled manpower that can support small-scale/cottage industries for production of alternatives to plastic.

4	T-Hub	Concept of nurturing and creating proper eco-systems for technology relevant start-ups through mentoring, networking, workshops, etc.	Holistic support for existing and new SHGs to help them develop into entrepreneurs producing alternatives to plastic or into scientific plastic recycling units.
5	T-Fund	A fund provided by the Government of Telangana to invest in start-ups for initial support.	Access to financial support for existing and new entrepreneurs with respect to recycling, refurbishing, up-cycling and producing alternatives to plastic products.

Case study of ban on plastic and promotion of cloth bag units by the cantonment board

Director General Defence Estate (DGDE), working under the Ministry of Defence (MOD), issued a specific order for the Secunderabad Cantonment Board (SCB) for a single-use plastic ban, which came into effect on 2 October, 2019 and affected 3,500 commercial establishments and 500 eateries located in the cantonment area (The Times of India, 2019). Plastic bags, plastic water pouches, disposable cutlery and food containers come under the blanket ban. The penalties applicable on first, second and third-time offenders are 5,000, 10,000, and 25,000 INR and three months' imprisonment, respectively. Health and sanitation officials of the cantonment board are observing a well-coordinated instructive and monitoring drive in the area. The uniqueness of this initiative lies in the fact that to ensure sustained implementation of the ban, 200 women SHGs are trained to manufacture and sell jute, paper and cloth bags in the commercial establishments. Awareness generation activities are also conducted through street plays and vehicle announcements. These activities are carried out as part of the 'Swachhta Hi Seva' campaign being undertaken by all 62 cantonment boards in the country.

5.1.4. Promote research and development for finding new and viable alternatives

Innovations have the capacity to rapidly change the way businesses and societies work, hence research and development (R&D) of alternatives to plastics is crucial in helping to reduce plastic consumption. Government policies have a huge impact on innovation and acceptance of innovative ideas within society, thus central and state governments can promote R&D of alternatives to plastics by supporting research in this sector through multiple methods, as follows:

Direct funding: The central and state governments can directly fund institutes for advanced research on the development of alternatives to SUPs. Generally, intellectual property rights for privately funded R&D results in the development of products that are strictly controlled by private industry, resulting in higher costs, limited production and limited further development. However, development of technologies and products using public funding and sharing of R&D advancements will ensure a larger uptake and promote further advancements (Ben S. Bernake, 2011).

The state government can collaborate with nationally recognised institutes on R&D by funding projects

directly. Two types of recommended funding mechanisms are proposed:

- Institutional funding: Continuous funding of a particular institution for R&D
- Fixed term project funding: Funding of an institution or group of institutions involved in a particular project with targeted outcome over a fixed period.

A number of nationally recognised institutes can be funded for R&D work by state governments. The Indian Science Technology and Engineering facilities Map (I-STEM) is a national portal developed by the GOI to promote R&D and connect researchers to the government and other resources, including funding opportunities and infrastructure such as laboratories (Office of Principle Scientific Advisor to the GOI, 2019). About 14 institutes in Telangana have already been registered with I-STEM. The state government can focus on developing 'Centres of Excellence and Technology Hubs' to promote R&D of alternatives to SUPs by engaging with these institutes. Other institutions such as the National Institute of Micro, Small & Medium Enterprises (ni-msme), National Institute of Smart Governance, Telangana State Industrial Infrastructure Corporation, Tata Institute of Fundamental Research – Centre for

Interdisciplinary Sciences (TCIS), Central Institute of Petrochemicals Engineering & Technology (erstwhile Central Institute of Plastics Engineering & Technology), IIT-Hyderabad, Hyderabad Central University (HCU) and Jawaharlal Nehru Technological University (JNTU), which are already involved in similar R&D programmes can be supported by the government. Funding for R&D in areas such as novel polymers including bio-plastics resin-infused paper and natural fibre-based packaging material needs to be secured. **It is recommended that GOT should allocate specific funds in the annual budget for R&D of eco-friendly alternatives to support the cause of phasing out SUPs. GHMC can also explore the possibility to promote CSR funds for R&D activities.**

Awards & recognitions for innovations: To promote excellence in R&D, the Telangana State Government can announce 'Phase Out Plastic Awards' for innovative designs and eco-friendly products that can be used as alternatives to plastic in the manufacturing or packaging industry. Appropriate innovations could be supported through cash awards and by enabling market scale production by providing access to finance, in collaboration with other government institutions.

Leveraging government programmes: Number of

government programmes such as WE-Hub, T-Hub, T-Fund and T-SEED (GOT, 2015) are supporting incubation of innovative projects along with R&D in businesses. GOT should utilise such programmes to attract more investment in innovation that support availability of alternative to SUPs, and hence reduction in generation of plastic waste by the society.

5.1.5. Promote innovative designs - substitution & enhancement

Design optimisation is an efficient method to reduce plastic waste generation, especially in the plastic packaging industry. Besides providing protection to packaged products, attractive and efficient packaging is a critical component of product branding and hence manufacturers tend to use more packaging than required. Plastic packaging alone accounts for more than 43% of the post-consumer plastic waste in India (CII, 2019), thus new and innovative packaging designs can ensure optimal packaging of products and reduce the plastic waste generation from this sector. **Three kinds of innovations need to be promoted: (i) substitution of plastic components in packaging design, (ii) product designs that do not require additional packaging and (iii) packaging that is designed to enable easy recycling.**

Table 20: Government schemes with potential to support R&D for alternatives to SUPs

Sl. no.	Scheme	Overview	Potential opportunity
State Level			
1	WE Hub	Start-up incubator exclusively for women entrepreneurs. WE-Hub aims to support women entrepreneurs with innovative ideas and solutions focusing on emerging technologies. WE-Hub also supports under-explored/unexplored sectors along with the service sector.	Support for start-up organisations to develop alternatives to SUPs
2	T-Hub	Concept of nurturing and creating an appropriate eco-system for start-ups through mentoring, networking, workshops, etc.	Support for start-up organisations to develop alternatives to SUPs
3	T-Fund	A fund which operates as a master fund for investment in sector-specific and general risk capital funds.	Access to financial support for existing and new entrepreneurs with respect to recycling, refurbishing, up-cycling and producing alternatives to plastic products
4	T-SEED	T-SEED funds are used to encourage innovators who want early-stage funding to materialise accidental discoveries and school project concepts into real-time projects.	Support for incubation of innovative ideas by students, researchers and start-ups to make alternatives to SUPs.

Substitution of plastic components in packaging design:

Partial or complete substitution of plastic packaging can be achieved for many products, such as the e-commerce sector. Here, the substitution of plastic boxes and bubble wrap with alternative materials such as bagasse (sugar cane) boxes, natural fibre-based packaging, and resin-infused paper and cardboard paper can reduce the use of plastic in packaging. Packaging designs with minimal amount of materials help reduce the use of plastic or other materials from a resource efficiency perspective, such as below:

- **Compact packaging:** The fit of the product inside the packaging is optimised, by reducing empty spaces, thus minimising the size of the box. Packaging

of disassembled components can reduce space requirement and hence minimise waste generation further.

- **Reusable packaging designs:** Packaging designs are mostly of the 'tear open and throw away' type and, hence, are meant for one-time use only. However, they can be designed to be more robust, reusable and to withstand washing and sterilisation. Packaging materials can also be designed to serve multiple purposes. For example, a takeout container that can be folded into a plate or serving bowl will extend the life of the product as well as reduce the need for disposable plates or bowls.

Efforts by e-commerce ventures to reduce use of single-use plastic for packaging

E-commerce venture Flipkart reduced the use of SUPs by 25% through various initiatives across its packaging value chain. It also claimed that it was working on long-term initiatives such as eco-friendly paper shreds, replacing bubble wraps and airbags with carton waste-shredded material and two-ply roll (Flipkart, 2019). Amazon India announced that it was committed to eliminating single-use plastics from its packaging by June 2020, and plans to substitute plastic packaging like air pillows and bubble wrap with paper cushions across all its centres in India (Amazon India, 2019).

PepsiCo, in partnership with Danimer Scientific, designed industrially compostable bio-plastic packaging for chips and started using the same on a pilot basis in selected areas in the USA, Chile and India in November 2018. The packets are made of plant-based materials and can be disposed of with regular food waste; it is claimed that this packaging will take only 12 weeks to decompose under industrial composting conditions (Pepsico, 2020).



Figure 25: Amazon introduced paper cushion instead of plastic bubble wrapping in 2019

Product designs that do not require additional packaging: The product or packaging design can be changed to obviate the need for additional plastic packaging; e.g., adding the tote facility to a product or cardboard box containers can avoid the need for a carry bag. Food processing company 'Danish Crown' reduced its plastic consumption by 85% through a packaging design change adopted through innovative packing of their minced meat (Danish Crown, 2019).

Packaging that is designed to enable easy recycling: Many multi-layered plastics are made from a range of polymers with specific additives to meet market requirements. This complicates the recycling process, makes it more costly, and affects the quality and value of the recycled plastic. In addition, specific design choices, some of which are driven by market considerations such as the use of dark colours also negatively affect the recyclability of the product. Product design is one of the keys to improving recycling levels, thus changes in production and design practices can enhance plastic recycling rates by ensuring greater durability, reuse and high-quality recycling. It is estimated that design improvements can halve the cost of recycling packaging waste (European Commission, 2019).

Since recyclers tend to avoid multilayered plastic packets, a shift to mono-materials that ensure the same packaging quality is preferable for improving recyclability. Retrieving, recycling and reuse of waste packaging materials is another way of reducing the use of virgin plastic materials in packaging and ensuring the recovery of waste materials. Recycling can also be improved by design changes that enable ease of disassembly and removal of labels. The Government of Telangana can promote sustainable packaging of materials through eco-labelling and green public procurement criteria that allot preference to products with sustainable packaging options, have minimum plastic packaging, use alternative materials, and have better reusability and recyclability of packaging.

5.2. Strategy 2: Ensure Segregated Collection and Transport of Plastic Waste to Registered Waste Processing Facilities

The ISWM hierarchy prioritises the maximum recovery of resources from waste before its disposal. One of the major constraints in plastic resource recovery in Hyderabad is the insufficient quantity and quality of the collected and segregated plastic waste in the formal collection system. Segregated collection of dry and wet

waste is a prerequisite for developing an efficient plastic waste management system, and the plastic waste needs to be decontaminated and segregated for recycling and resource recovery. Based on the recommendations in the CPHEEO manual, this strategy proposes developing a system that achieves 100% source-segregated waste collection and transportation to facilitate complete scientific processing of plastic waste by the year 2030.

5.2.1. Segregated waste storage

In accordance with the Solid Waste Management Rules 2016, waste should be segregated at source into three fractions: wet, dry and domestic hazardous. Segregated waste storage at source is partially implemented in Hyderabad city.



Figure 26: Recommended system of segregated storage of waste at source

100% segregated storage of dry, wet & domestic hazardous waste should be implemented by GHMC through the following measures:

- Providing two bins to each household/commercial entity for segregated waste storage
- Providing a separate waste collection system for domestic hazardous waste
- Ensuring segregated waste storage by bulk waste generators
- Ensuring 100% door-to-door waste collection
- Ensuring daily collection of wet waste and collection of dry waste on alternate days
- Organising mass awareness campaigns to ensure segregated storage of waste by waste generators
- Promoting in-situ wet waste processing (composting, bio-methanation, etc.)
- Penalising for littering

In addition to having a segregated stream of dry waste, the plastic waste in it needs to be recoverable for recycling and processing. **Strong IEC activities thus need to be implemented to ensure that clean plastic waste is stored and handed over to SAT operators.**

IEC for cleaning of plastic waste: As observed in the baseline assessment, plastic waste in waste streams mostly consists of packaging waste and is usually contaminated with biodegradable waste, lubricants and powdered leftovers. The higher the volume of impurities,

the more complex the processing of plastic waste is due to the need for more manual pre-sorting and thorough washing during pre-processing. The IEC activities designed to promote segregated storage of waste need to include various components: cleaning of the plastic before disposal; how plastic waste needs to be emptied of its contents and cleaned; why plastic waste needs to be cleaned for efficient processing; and the kind of plastics that are classified as domestic hazardous waste. Table 21 summarises the proposed IEC strategies for improving mass awareness on cleaning of plastic waste for storage.

Table 21: Proposed IEC strategies for raising awareness

 Category of waste generator	 IEC to be performed by GHMC
 Households / commercial entities / gated communities / street vendors	Door-to-door campaigns
	Illustrative campaigns using pamphlets
 Educational institutions	Awareness-raising programmes through interactive sessions with students
	Develop model DRCCs in institutes
	Notifications to be circulated to administrative units (public/individual) on segregated and cleaned waste storage and handover
 Hotels / Institutes/ Other bulk generators	One-to-one meetings to be held with administrative body
	Notifications to be circulated to administrative units (public/individual) on segregated and cleaned waste storage and handover
	Regular inspections and corrective measures to be implemented
	Technical support in constructing in-campus dry waste collection centres
	Decentralised waste management to be promoted through an annual award system
 General public	Advertisements through mass media (internet, visual media, radio, print media)
	Awareness generation through advertisements regarding disposal of specific products, in accordance with the manufacturer specifications in the pouch provided or the instructions (to be supported by manufacturer)
 Tourists	IEC through advertisements specifically designed for tourists and floating populations in tourist locations, bus stands, railway stations and airports

Source: ICLEI-SA

IEC to prevent public littering and open burning:

Littering of waste and burning of plastic is a common occurrence in few parts of Hyderabad. GHMC needs to implement sustained IEC activities to prevent them and to improve public awareness about the health and environmental impacts of such practices. Promotion of activities such as waste storage at source, handing over segregated waste to SAT operators and other agencies appointed by GHMC or registered waste pickers, recyclers and waste collection agencies needs to be undertaken. Mass awareness-raising activities using social media, regional cultural programmes such as folk dances (*Dappu Nirthyam*) and focused group discussions with communities need to be implemented to create awareness.

Policy amendment on waste storage by bulk generators

(bye-law): PWM Rules 2016 authorise ULBs to make bye-laws to facilitate efficient plastic waste management. Policy amendments in the form of bye-laws need to

be developed by GHMC making it mandatory for bulk waste generators to store, clean and sort plastic waste and other recyclables. Such bye-laws need to give authority to GHMC, such as to enter sites and weigh the waste of bulk waste generators submitting suspicious declarations on waste generation and to impose penalties for non-cooperation in providing segregated and cleaned waste.

Institutionalisation of bulk waste generator monitoring

cell: GHMC, under the Additional Commissioner in charge of MSW management, should form a monitoring cell and set up a specific team to conduct inspections, especially of bulk waste generators. According to the recommendations of the Bulk Waste Generator Management Manual 2019 by CPHEEO, the monitoring cell needs to conduct inspections at least every six months to identify bulk waste generators and determine if regulations are being followed in accordance with the city bye-laws, and waste management responsibilities



Figure 27: Community level awareness generation meeting conducted by ICLEI-SA, CCET and UNEP-IETC

as per PWM Rules 2016. An inventory of the list of bulk waste generators in the city should be prepared and updated regularly. The defaulters should be penalised based on the guidelines by state government (GOT, 2018). IEC activities to be conducted and annual awards system for the best performing bulk waste generators to be introduced. In GHMC, the existing vigilance team can also assume the role of the monitoring cell as well as meet the training needs of all members of the committee.

Property tax rebate for onsite management of waste: The SWM Policy and Strategy, 2018 by Government of Telangana suggest CDMA to develop policy amendments enabling property tax rebates for bulk generators who have made provisions for complete onsite waste management and provided documentation to TSPCB authorised recycler for recycling. Monitoring team from GHMC to conduct regular visits and certify the bulk waste generators to make them eligible for such tax rebate.

5.2.2. Strengthening primary collection and transport of segregated plastic waste to registered recycling and processing facilities

The proposed strategy addresses both primary and secondary collection and transport of plastic waste.

Strengthening primary collection

SAT operators, who segregate the valuables and transport the remaining mixed waste to transfer stations, perform the primary collection from the doorstep.

The major gaps identified in the waste collection and transport include the following:

- Irregular intervals of primary collection of waste
- Absence of segregation of plastic waste
- Absence of recovery of low- value plastics for recycling
- Sale of recyclables to untracked/unchecked informal markets
- Inefficient monitoring and documentation system of primary and secondary transport of waste
- Inefficient monitoring and documentation of plastic waste recovered and recycled from DRCCs
- Mixing of unrecovered plastic waste (LDPE, PS, MLP and thermosetting plastics) with organic waste, resulting in lower quality RDF and compost made at ISWM facility

This strategy thus suggests the following actions to close the above-mentioned gaps and to improve the separated waste collection and transportation in the city.

Training of SAT operators on segregated waste collection: SAT operators segregate waste according to their convenience and knowledge of value of materials in the market, which is usually inefficient as it does not meet the requirements of DRCCs. Providing formal capacity development to SAT operators on the actual value of



Figure 28: Training of SAT operators on segregated waste collection by ICLEI-SA, CCET and UNEP-IETC

recyclable materials in the secondary market as well as better means of waste segregation, i.e., as per DRCC requirements, can enhance the segregated collection and transport of plastic waste to DRCCs. A SUNYA (zero) model of waste collection can be used for this purpose. A 'SAT operator training module' can be developed, with training (once every four months) conducted for SAT

operators to ensure capacity building. Regular training is critical considering the high staff turnover rate¹⁵.

Daily wet waste collection; twice a week dry waste collection: The daily collection of wet waste will ensure better segregation of wet and dry waste during transportation. GHMC, over time, can streamline the

SUNYA model of segregated waste collection for SAT operators

The SUNYA (Zero) strategy of waste collection is a model aimed to maximise segregated waste collection through community engagement, enhanced recycling of dry waste by engaging existing recyclers in the city, as well as finding more recycling opportunities. The model has seen success in cities such as Coimbatore, Siliguri, Varanasi, Udaipur and Rajkot, and resulted in reducing the waste reaching the landfills.

SAT operators can be trained in the SUNYA model of waste collection, wherein in addition to wet and dry waste, hazardous household waste can also be collected separately. During the collection process, the dry waste needs to be segregated into four-five categories stipulated by DRCCs. While one SAT worker collects the waste, another SAT worker can engage in waste segregation in SAT vehicle itself. SAT vehicle can be retrofitted for further sorting inside the vehicles, with separate drums or jumbo bags for collection of segregated streams of plastic waste (PET, hard plastic, soft plastic, others) and other recyclables as required by DRCCs.

Implementation of the SUNYA model involves providing training to SAT operators in efficient segregation of waste and finding better revenue opportunities for dry waste resources collected. Hand-holding support needs to be provided to the SAT operator until he/she can efficiently segregate the collected plastic waste in a time-bound manner.



Figure 29: Inauguration of SUNYA model waste collection system in Coimbatore, Tamil Nadu

waste collection by collecting dry waste only twice a week, while collecting wet waste on a daily basis. Since wet waste starts to decompose after 24 hours and is lower in volume as compared to dry waste, it is recommended to be collected every day. Thus, dry waste can be accumulated over the week and collected twice a week. The absence of wet waste contamination will make it easier to segregate dry waste into recyclable components. The large quantity of waste collected enables the SAT operators to sell the recyclables as they receive it, rather than storing it inside the SAT vehicles or at their homes over the week to amount to a saleable quantity.

Digital mapping and route rationalisation of SAT vehicles: Routes of SAT operators, the number of buildings to be serviced and collection timings are presently not fixed by GHMC. This leads to miscommunication and lack of clarity about the primary collection system among all stakeholders. Several areas still lack primary collection services, whereas multiple SAT vehicles cater only to certain areas. Charting the collection routes and documenting the numbers of buildings to be served, along with specific collection timings for each SAT operator will help develop a systematic primary waste collection that can be monitored. This will also help in identifying areas that are not served and help in arrangements for providing alternative services in the area. Digital route maps of SAT vehicles can be developed by GHMC through extensive ground exercises, which will help rationalise routes and therefore optimise the collection system.

Institutional strengthening: Vigil monitoring, regulation and documentation of waste collection by SAT operators: In the existing system, SJs are responsible for monitoring public littering and penalising offenders, while the SFAs are responsible for monitoring primary waste collection checking on the management at the ward level. There is no proper documentation of the waste collected or monitoring of waste segregation. To ensure vigilant monitoring of segregated waste collection it is critical to empower GHMC field staff with the necessary authority to make on-ground decisions. Monitoring should be strengthened by implementing a systematic monitoring and centralised documentation system. SAT operators must be enabled to provide the right service at the right time; an MoU between SAT operators and GHMC, delineating the roles and responsibilities of both parties, will help to streamline this service. The following measures, if implemented, will

result in a strategic monitoring system for primary waste collection being developed:

- **Attendance system**

- The existing attendance system needs to be improved for effective control on SAT operators.
- Attendance needs to be submitted to the SS or SI in-charge of the ward at the end of every month; upon non-performance (non-compliance with collection in accordance with the agreement with GHMC), the SAT operator should be adequately warned and subsequent repetitions need to be penalised.
- The SS need to verify the system and maintain proper documentation of performance in their respective wards.
- The system needs to be digitalised and made available online for review by senior officials.

- **Waste segregation monitoring system**

- Segregated collection of dry and wet waste in different compartments of SAT vehicles needs to be strictly monitored by SFAs.
- It should be ensured by SFAs that the plastic waste is not mixed with wet waste (even plastic waste with no market value) in any batch of waste collected by SAT operators.
- Checking of waste collected in SAT vehicles by SFAs is necessary to ensure efficient operations.
- Any irregularities in collection or mixing of waste need to be documented and duly reported to the Health and Sanitation Department in GHMC by the SJs, and SIs should be authorised by the Medical Health Officer to penalise SAT operators for such irregularities.
- SFAs and SJs should ensure that waste generators hand over segregated waste to SAT operators.
- SAT operators should report non-complying households

- **Waste disposal monitoring system¹⁶**

- Each SAT operator should collect receipts from DRCC and transfer station when disposing

¹⁶ Not required if a Central Command Centre for MSW management is developed

waste and recyclables. The receipt needs to be presented to sanitary officer on a weekly basis.

- o Every SAT operator needs to be allocated to a specific DRCC in order to maintain a data set, ensure regular monitoring and address leakage to informal market.
- o The receipts should be documented to monitor the waste disposed of at the transfer stations and the recyclables recovered from the collected waste.
- o SAT operators should be penalised for non-compliance.
- **Penalisation for non-compliance by waste generators**
 - o SFAs to ensure that all waste generators pay user charges as decided by GHMC
 - o In case of non-compliance, SFAs to penalise the defaulter as advised by the GOT
 - o The Telangana state policy (GOT, 2018) requires penalisation of 'environmental compensation' on defaulters engaged in burning of waste or littering
 - o SFAs within their jurisdiction, to penalise whoever that fails to intimate about organising an event or gathering of more than 100 persons or fails to segregate the waste at source and hand over to SAT operators as specified by the Telangana state policy (GOT, 2018)
- **Grievance Redressal System**
 - o There is a mobile application 'My GHMC' for registering grievances from citizens about unsegregated and irregular waste collection. The grievances need to be regularly monitored; and need to be directly communicated by the grievance redressal cell to the concerned SFAs within eight hours of the complaint being made.

Linking of segregated plastic waste: As observed in the baseline assessment of plastic waste management in the city, the infrastructure in the city is inadequate for handling 100% primary collection and transport of plastic waste to the formal processing facilities. Hence, multipronged strategies need to be adopted to connect SAT operators and other waste collectors with scientific

waste processing facilities in a streamlined manner, as given below.

Ensure transport of segregated plastic recyclables to certified recycling facilities through DRCCs: In order to ensure plastic recyclables collected at DRCCs are sold only to scientific recycling facilities, a Memorandum of Understanding (MoU) or an agreement should be signed between the DRCC operators (ITC and Godrej, in the case of GHMC) and the GHMC. It should be mandated for DRCCs to sell recyclables only to PCB-certified recycling units, preferably those that implement all the steps of recycling, including segregation, shredding, washing, pelletising and manufacture of finished products.

To ensure SAT operators deliver recyclables to DRCCs, innovative financing models like competitive rates, as compared to secondary market rates, should be introduced. Producers, importers and brand owners of plastic products, according to the PWM Rules 2016, are mandated to develop models for collecting the plastic waste generated through use of their products. TSPCB with the support of GHMC can draw up a list of organisations based on plastic waste characterisation in the city and notify such organisations that generate the maximum waste. The identified organisations can be asked to buy back their plastic products from the DRCCs at a fixed price, according to the EPR policy. The DRCCs can also segregate incoming plastic waste in accordance with the list of the available companies. **Alternatively, the development of an EPR corpus fund to provide the minimum guaranteed price for recyclables could be explored by the central government based on uniform framework for EPR by the MOEFCC. The rates could be changed to match current market prices, which fluctuate.**

Install Reverse Vending Machines in GHMC: GHMC should introduce innovative collection mechanisms, including installation of Reverse Vending Machines (RVMs) for PET bottles and other recyclables like glass bottles and aluminium cans at strategic locations to promote segregated collection of recyclables. RVM accepts the material desired to be recycled and gives rewards such as cash, electronic cash, redeemable coupons or toffees in return as a token of appreciation. Modern RVMs can be designed and customised to accept recyclable materials of choice and reject other materials.

The use of RVMs for collecting recyclables creates a win-win situation for the waste generator and the ULB. The



Figure 30: Reverse Vending Machines installed in Mumbai, India

waste generator receives a small reward for disposing of post-consumer waste products in the machine rather than littering and GHMC receives segregated, uncontaminated and compacted valuables that can be directly handed over to authorised recyclers for processing. Multiple advantages of RVMs include:

- o With the installation of RVMs, collected plastic waste can be sent to authorised recyclers
- o Collects specific grade i.e PET which is uncontaminated and has better market value
- o In addition to material recovery, RVMs can also be used for IEC and awareness generation

Installation of such RVMs at strategic locations, including shopping malls, food courts, bus terminals, monuments and other tourist locations will help reduce littering as well as improve authorised collection and processing of PET. GHMC needs to carry out an extensive assessment for identifying feasible locations to install RVMs and the kind of recyclables generated in each of these locations so as to design and programme the RVMs accordingly. RVMs can be installed at these locations using EPR corporate funds or in a Public Private Partnership (PPP) model where private contractors can operate and maintain them in exchange for advertisement rights. It should also be ensured by GHMC that contractors hand over recyclables to either the manufacturers or dealers as part of a buy-back plan or to registered recyclers only.

GHMC to promote CSR programs to install and operate RVMs in the city. Waste pickers can be trained and capacitated to operate the machines thereby creating livelihood opportunities. It can help in diverting large portion of PET to the formal recycling system.

Create market linkage through private logistics service providers: In the existing system, SAT operators sell

recyclables to informal scrap dealers due to the attractive market prices. If the recyclables are sold directly to the pelletisers and recyclers certified by the TSPCB, bypassing the intermediaries and informal scrap dealers, it will ensure better revenues for the SAT operators. **This strategy is most suitable for locations in the GHMC where the DRCCs are absent or non-operational.**

- SAT operators can be connected to certified recyclers through GHMC-approved Logistic Service Providers (LSPs).
- LSPs can purchase segregated plastics and other recyclables from SAT operators at higher rates than those of informal scrap dealers.
- The LSPs will transport the recyclables to TSPCB-certified recyclers and sell them for higher margins of profit.
- The collection and disposal of recyclables can also be tracked through a mobile-based cloud platform. The information can be mandatorily made available to GHMC or any other major stakeholder by enacting a byelaw in the city.
- The process of tracking will ensure transparency to the recycling practices and provide information on waste recycled in the city. It will also help to ensure that segregated waste is recycled only by scientific means.

Multiple LSPs are already registered and active in Hyderabad city (e.g., ScrapTap, Crapbin, Waste Ventures). **GHMC can facilitate MoUs between selected LSPs and the certified recyclers to ensure plastic waste transportation is formalised.** In addition, a registration process for LSPs can be developed in discussion with GHMC to formalise the entire value chain. Similarly, LSPs can also be linked to cement plants or plastic-to-

fuel facilities in Hyderabad to enable them to sell the non-recyclable plastic waste directly. The figures below depict the difference in the flow of plastic waste between

the existing system (Figure 31) and the proposed system (Figure 32).

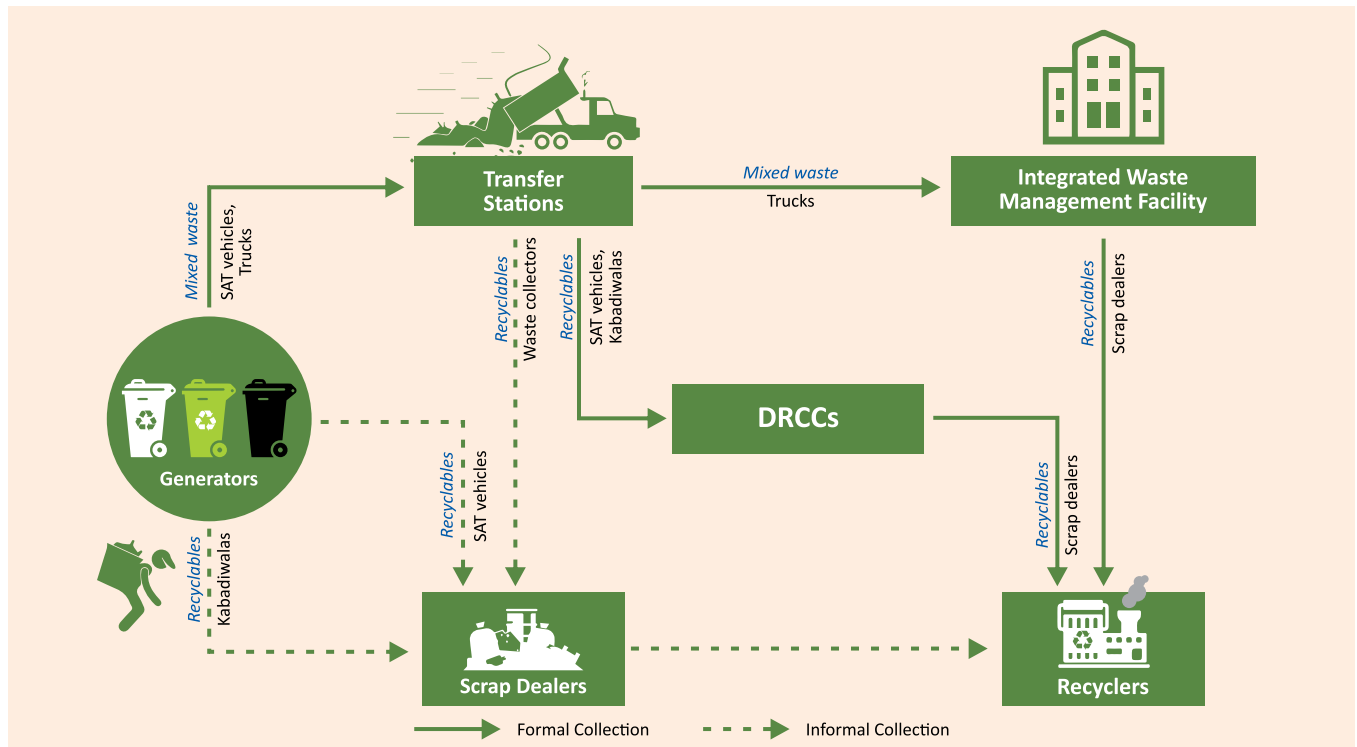


Figure 31: Existing system of transportation of recyclables in GHMC

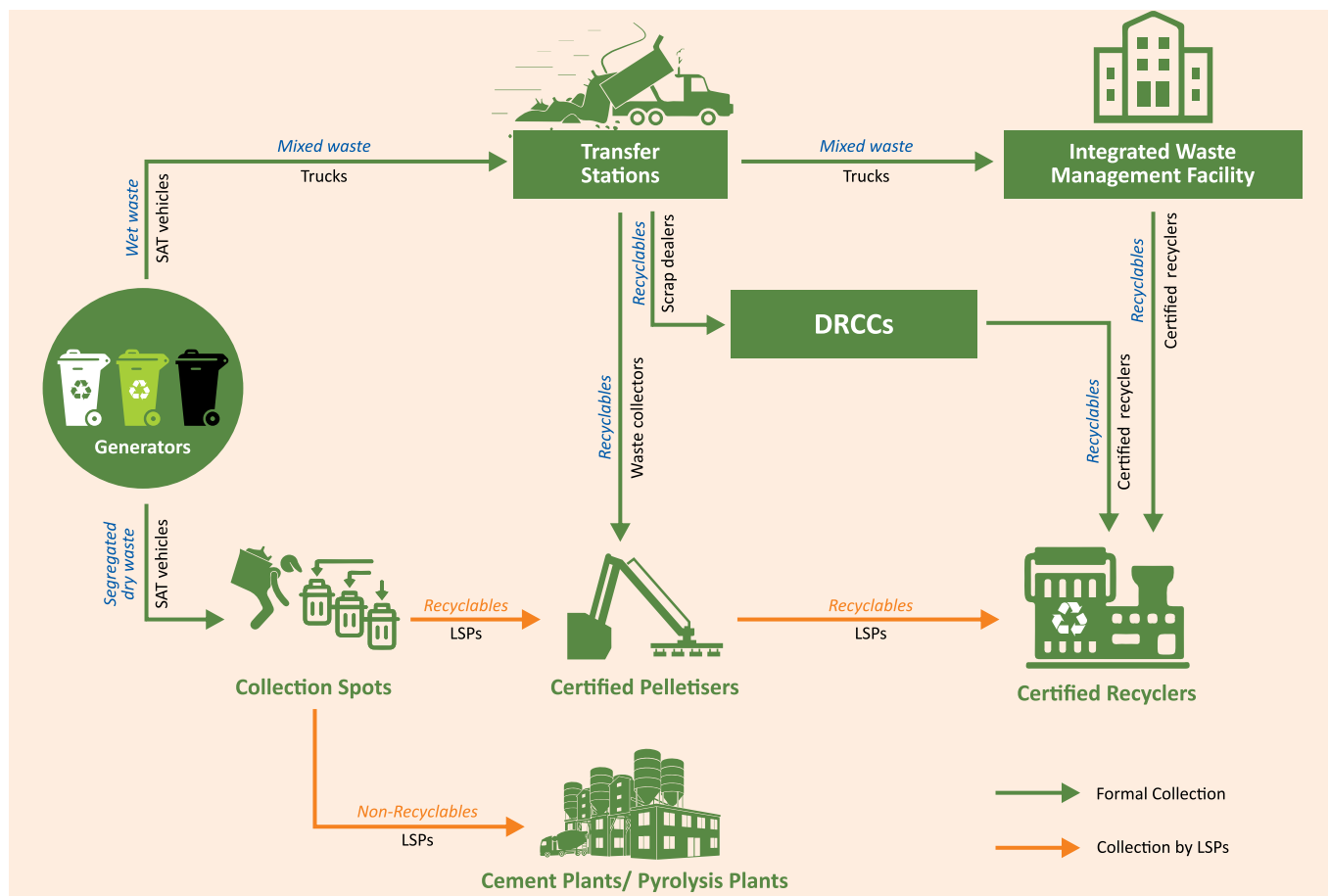


Figure 32: Proposed system of transportation of recyclables through LSPs

Upgrading DRCCs: There are 78 DRCCs in GHMC, and more facilities are being approved and designated as waste recovery centres for recyclables. Most DRCCs within transfer stations have inadequate facilities for the storage of collected materials, hence recovered materials end up being mixed with wet waste in transfer stations and are transported to the ISWM facility. Facilities outside the transfer stations face operational issues such as local resistance, pilfering of the recovered materials and lease issues. DRCCs need to be efficiently maintained to ensure segregated secondary storage of resources. The following infrastructural changes are required as part of the strategy for upgrading DRCCs:

- Land allocated to DRCCs needs to be government property and should be specifically demarcated for DRCC, as opposed to land allocated for transfer stations
- Provision of separate storage yards/spaces for each category of recovered recyclables/resources (for storage up to 10 days)
- Provision of space for SAT operators to segregate collected dry waste
- Provision of permanent sheds with facilities for storage of recovered material and record keeping
- Equipping DRCCs with decentralised plastic waste cleaning and shredding units to facilitate efficient material recovery and to promote recycling

Standardised prices and sorting types at DRCCs: Standard practices for sorting of plastics and other recyclables are not followed in all DRCCs, which makes documentation and fixing of costs for recyclables a challenge. As explained in Section 4.4, DRCCs set differing sorting requirements and costs for recyclables, which creates confusion among SAT operators and reduces the efficiency of segregated collection. The types of waste to be segregated need to be standardised across GHMC, in synchrony with the needs of the recycling industry and SAT operators should receive capacity development training accordingly. The pricing of the recovered plastic materials can also be standardised in each area based on distances from recycling units.

5.2.3 Strengthening secondary collection and transport of segregated plastic waste for enhanced recycling and resource recovery

After primary collection by SAT operators, the collected waste is disposed of at transfer stations in a mixed

manner (after manual recovery of recyclables and handing over at the DRCCs) due to limited efficiency and lack of infrastructure. The mixed waste dumped at transfer stations is also transported to the ISWM facility in a mixed form by GHMC as explained in Section 2. Once mixed, it is difficult to recover plastic and other recyclables from the waste heaps.

While developing a primary waste collection system for segregated waste as recommended in this document, secondary collection and transport also need to be conducted in a segregated manner to create a holistic impact on the waste collection process and ensure maximum recovery of plastic waste. The following strategic actions are proposed to ensure segregated collection and transport of plastic waste, among other goals.

Upgradation of transfer stations and secondary transport:

With a segregated primary collection system in place, the transfer stations should also be upgraded to handle incoming segregated wet and dry waste. Below are the infrastructure upgrade actions required at transfer stations to handle segregated storage of waste:

- Separate tipping platforms for both wet and dry waste
- Separate platforms for receiving mixed waste, including waste collected from sweeping of streets, litter points, dumper placer bins and drains.
- Separate waste storage space for domestic hazardous waste
- Fencing of all transfer stations with gated and guarded entry points to prevent unauthorised entry and removal of waste
- All transfer stations to be equipped with a weighbridge and data entry system on dry, wet and mixed waste received.
- Data entry system to log the entry of registered waste pickers and quantities of recyclables collected by waste pickers
- Demarcation of separate locations for dry, wet and street sweeping waste disposal

In addition, **separate log data needs to be maintained for the dry, wet and street sweeping waste¹⁷ brought into and taken out of the transfer stations.** Incoming waste can be left at respective tipping stations where

17 Street sweeping waste includes litter point waste and drain silt waste which is usually taken to the ISWM facility without segregation.

waste pickers can recover any leftover recyclables. The availability of segregated waste on the tipping floor will make it easier for waste pickers to recover recyclables. Once registered, only waste pickers with proper ID cards should be allowed to enter the transfer stations, to make monitoring feasible.

Upgradation of secondary transport vehicles: At present, the mixed waste is transported to the ISWM facility using trucks. With segregated waste being collected at transfer stations, the secondary collection and transport also need to incorporate segregation for ease of processing. To optimise the secondary transportation from transfer stations to the ISWM facility, the following strategic actions are recommended:

- Wet waste needs to be transported daily
- Dry waste and street sweeping waste needs to be transported on alternate days
- Waste needs to be transported only in properly covered vehicles, with monitoring thereof being conducted at the exits of transfer stations

Upgradation of Control Command Centre: The existing CCC needs to be upgraded, in phases, for live coordination, regulation and remote monitoring of the collection and transport of MSW, with the following prerequisites:

- Geo-tagging of all primary and secondary collection vehicles (including SAT vehicles)
- Geo-mapping of all transfer stations and DRCCs
- Geo-mapping of all GHMC-registered scrap dealers and recycling facilities
- Geo-tagging (digital door numbering) of all waste generators to ensure monitoring of regular waste collection.
- Cloud linking of transfer Stations, ISWM facility and DRCCs data on the GHMC web platform
- Linkage of the grievance redressal system to CCC

With the above-mentioned pre-requisites in place, daily waste collection activities can be monitored in real time and regulated. Any irregularities in waste collection, segregation and disposal can be immediately identified and attended to. The CCC can also track the movements of plastics and other recyclables sold to the informal market and received at the ISWM facility.

Development of a database on informal waste collection system: Since a large portion of plastic waste collection, recovery and recycling is handled by the informal sector,

GHMC needs to develop a database of all waste pickers, scrap dealers, waste collection agencies and informal waste recyclers in order to integrate them into the formal system of waste processing and to monitor their activities.

At the ward level, SFAs need to develop a database of waste pickers and scrap dealers and provide them with registration numbers and identity (ID) cards, irrespective of their scale of operation. Information including name, mode of business, location and valid national ID card details need to be collected and documented. At the zonal level, the SIs need to review the database to avoid multiple entries, and data errors need to be identified and corrected. GHMC can then build a database based on the information collected at the ward and zone levels. The database needs to be updated annually to keep track of fluctuating markets and provide visibility to the informal waste management sector.

A database on movement of recyclables: Once a database on the informal sector is created, the data needs to be collected from the GHMC-registered waste pickers, scrap dealers, recyclers (pelletiser for plastic waste) and recycled product manufacturers. GHMC can develop a data collection format to be used by SFAs to collect information on the management of recyclables, including plastics. The data needs to be collected twice a year to understand the nature of plastic recyclables that are recovered and processed. The data, when analysed, will provide information on major recycling hubs and the quantum of plastic waste recycled by informal recyclers. Should the existing manpower be insufficient to carry out such an exercise, CBOs can be engaged to conduct assessment twice a year. This database should be shared with the TSPCB to facilitate enforcement of regulations.

Regulation of informal waste management system: Once the baseline data is collected and the existing informal sector is mapped, registration with GHMC can be made mandatory for all new waste pickers, scrap dealers and recyclers. The registered stakeholders, over a period of time, will need to adopt the mandatory requirements, as per the national rules and guidelines by the CPCB.

IEC to enhance efficiency of segregated collection and transport

Extensive and ongoing IEC activities are essential for capacity building of multiple stakeholders who support segregated collection and transport of plastic waste. Stakeholder specific IEC interventions are suggested below.

Plastic waste management during natural disasters and epidemics

Waste management activities during natural disasters, major epidemics/pandemics, war and other un-foreseeable situations will be impacted. Therefore, according to the prevailing situation, availability of resources, GHMC should develop an ad-hoc action plan as required for plastic and other waste management. The SWM cell of GHMC to make the action plan and implement it as per the state, national or international guidelines available (as available/applicable) for waste management. Following are recommended to be made available to face such emergency situations:

- o Maintain a separate budget head for 'Contingency expenses' in SWM fund of GHMC
- o Service and maintain reserve waste collection equipment (tools, trolleys, PPE kits etc.) for emergency requirement
- o Identify and earmark space for temporary storage of waste for a situation when waste cannot be transported to ISWM facility or cannot be processed
- o Maintain an updated list of voluntary organisations/NGOs that can support waste management in case of human resource shortage

Managing waste during Covid -19

'The Guidelines for Handling, Treatment and Disposal of Waste Generated during Treatment/Diagnosis/ Quarantine of COVID-19 Patients' by CPCB, 2020 delineates management of waste from quarantine centres/homes. The guidelines specifies syringes, date expired or discarded medicines, used masks/gloves of patients and suspected people in observation to be considered as biomedical waste and managed by Common Bio-Medical Waste Treatment Facility (CBWTF). The guidelines engage ULBs responsible for ensuring safe collection and disposal of bio-medical waste, if, any generated from quarantine camps/homes and include:

- Information on each quarantine camp/ quarantine home to be made available to local administration and updated list to be provided to SPCBs/PCCs
- Ensure that general solid waste and biomedical waste generated is not mixed and collected separately
- ULBs to engage CBWTF operator for ultimate disposal of biomedical waste collected from quarantine homes/ home care or waste deposition centres or from door steps as may be required
- Engage authorised waste collectors for door-step collection of biomedical waste and transfer to collection points for further pick-up by CBWTF
- In case number of quarantined homes/home-care units are less, ULBs may engage services of CBWTFs to collect the waste directly from door-steps
- ULBs shall create a separate team of workers for door-step waste collection at waste deposition centres or at quarantine homes or home care
- The staff involved in handling and collection of general solid waste and biomedical waste from quarantine homes/home care centres shall be provided with adequate PPEs such as three layer masks, splash proof aprons/gowns, heavy-duty gloves, gum boots and safety goggles. These PPEs are required to be worn all the time while collecting waste from quarantine centres/quarantine homes/home care/waste deposition centres
- Use dedicated carts / trolleys / vehicles for transport of biomedical waste. Ensure sanitisation of vehicles with 1% sodium hypochlorite after each trip
- Bags containing general waste may be sprayed with disinfectant solution (1% sodium hypochlorite solution) prior to disposal
- Establish common waste deposition centres (as stipulated under SWM Rules, 2016) for receiving / collection of biomedical waste. For this purpose, existing *Dhalaos* if any may be converted suitably
- The general solid waste collected from quarantine homes or home care shall be disposed off as per SWM Rules, 2016
- ULBs shall designate a nodal person for waste management of specific quarantine centre of an area and for maintenance of its record

- Designated nodal person to download and use biomedical waste Tracking App 'COVID19BWM' developed by the CPCB to feed daily data on quantity of biomedical waste collected from home-cares or home quarantines.
- Waste handlers must be given basic/elementary training by ULBs/SPCBs/PCCs with help from NGOs on SWM, hand hygiene, respiratory etiquettes, social distancing, use of PPEs and its disposal, and screening clinics via videos and practical demonstrations in local language
- In case ULBs are unable to manage solid waste with their existing staff, professional solid waste management agencies may be engaged/authorised during COVID-19 situation for timely collection of solid waste and biomedical wastes separately from quarantine centers, home-care, COVID-19 isolation wards and quarantine homes.



Figure 33: Collection of MSW from quarantined homes during COVID pandemic

IEC for civil societies: Many gated communities and other civil societies have appointed private waste collection agencies for waste collection and disposal at transfer stations. In most cases, the private agencies are not registered with GHMC and there is no guarantee of disposal of collected waste at transfer stations. GHMC therefore needs to hold meetings with gated communities and raise awareness about the need for engaging GHMC-approved SAT operators to ensure segregated collection and scientific management. GHMC also needs to provide training to civil society to establish in-house DRCCs from where SAT operators can collect waste from society at large.

IEC to waste pickers/scrap dealers on registration with TSPCB and GHMC: A series of IEC activities, including one-to-one consultations, classroom sessions and trainings need to be provided to the identified informal waste pickers and scrap dealers to develop their capacity in segregated collection of plastic waste, as required by DRCCs. Training, awareness raising and hand-holding support should also be provided to ensure plastic



Figure 34: IEC leaflets distributed to civil societies by GHMC, ICLEI-SA, CCET and UNEP-IETC

waste collected by waste pickers and scrap dealers is transported only to the DRCCs and recyclers registered with TSPCB and not the informal market. A 'waste picker training module' needs to be developed by GHMC for this purpose.

IEC for plastic waste management in large-scale events:

Awareness raising activities need to focus on the general public and prospective organisers of large-scale events regarding plastic waste management during public events. According to the PWM Rules 2016, everyone responsible for organising events in open spaces that involve catering of food in plastic or multi-layered

packaging need to segregate and manage the waste generated during such events. Information concerning responsibilities of organisers, implementation and the consequences of not following rules (penalties, for example) need to be addressed through mass media by the GHMC and specifically communicated to the RWAs.

Green protocol: As mentioned in the Strategy 1, the green protocol can be implemented in GHMC including guidelines for segregated collection of plastic waste from bulk generators as well as after large gatherings such as sports matches and cultural events.

Kerala green protocol: Rapid plastic waste collection and transport for events

According to the green protocol followed in Kerala, organisers of any mass-scale event identified by the state government or ULBs will be asked to form a green protocol committee to ensure its implementation during the event. Specific areas will be identified for the collection of waste and storage of segregated waste. During the event, ULB volunteers and sanitary staff are pooled to enable rapid segregation and packing of waste. The segregated plastic waste is to be transported by the ULB within 24 hours of generation to the registered processing facility with reports submitted to the Suchitwa Mission (Clean Kerala Mission) department. The entire process is monitored by the green protocol committee that consists of organisers, Suchitwa Mission staff and local political representatives. The protocol has been successfully implemented in multiple events, including schools' youth festivals, international cricket matches and annual film festivals.

5.3. Strategy 3: Promote Maximum Recycling and Explore Opportunities for Co-processing of Plastic Waste

Not all forms of recyclable plastic waste (PET, PP, PE, PS & PVC) in MSW has market value due to factors such as difficulties in recovery, cleaning, and recycling. In Hyderabad, only PET, PP, HDPE and a small fraction of LDPE have recycling market value at present. As seen in Figure 35, the waste received at transfer stations predominantly consists of 62% LDPE, 21% of multi-layered packaging and non-recyclable plastic/thermosetting plastic, 2% PS and 1% PVC, accounting to over 85% unrecycled plastic which ends up in landfills. The plastic waste found in transfer stations is dominated by low-value plastics, as all recyclables of value are mostly picked up and separated for recycling by SAT operators and waste pickers during the primary collection stage. On an average the remainder consists of 9% HDPE, 2% PET and 3% PP, adding up to less than 15%, which is mostly left behind mainly due to contamination. A major portion of the recyclable plastic waste left behind will be re-segregated at the ISWM facility in Jawahar Nagar, to be

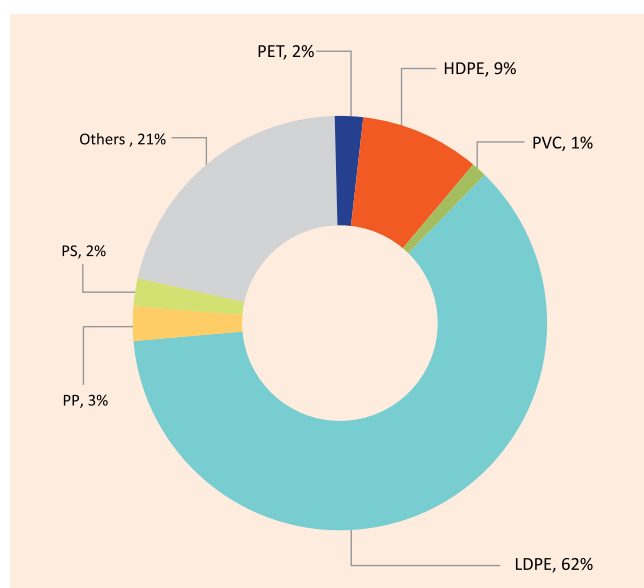


Figure 35: Characterisation of plastic in MSW collected at transfer Stations

processed at the recycling unit that has pre-processing washing and drying facilities to treat it.

Plastic waste recovery and recycling are hindered by two factors – inefficient management of low value plastic waste and unscientific processing of plastic waste of higher value in the recycling market. The proposed strategy focuses on increasing process efficiencies to achieve 100% processing of non-hazardous waste through recycling, reuse, reprocessing and co-processing by 2035. The following strategic actions are proposed for improving the recovery and recycling of plastic waste in GHMC:

- Improving the efficiency of existing recycling industries through provision of better segregated raw material and enforced process control
- Reprocessing of non-recycled plastic into fuel is to be ensured
- Plastic-to-fuel processing facilities are to be regulated
- Only non-recyclable plastic is to be converted to energy
- Promoting reuse of plastics as a construction material
- Increase market demand for recycled plastic

5.3.1. Improving the efficiency of existing recycling industries through provision of better segregated raw material and enforced process control

As detailed in the previous sections, the plastic recycling industry is mostly managed by the private sector with minimal government interventions, such as by regulations or enforcement to ensure optimal processing efficiencies, environmental pollution control and quality of end product. The actions proposed to be taken by the state government and GHMC with support from the TSPCB to facilitate recycling and improving its efficiency are as follows:

Ensuring distinct coding of plastic products, in accordance with the Plastic Resin Code: Effective enforcement and monitoring by the TSPCB is required to ensure all plastic products are marked clearly with a plastic resin or Society of Plastic Industry (SPI) code (ranging from 1 to 7) according to IS 14534: 1998, to eliminate any confusion during the sorting procedure. The temperature range for processing and other factors differ for each resin, and a heterogeneous mixture of plastic fed into a plastic pelletisation device or a recycling unit results in lower quality material, which results in down-cycling of the product rather than recycling. Plastic waste sorted homogeneously according to the reference resin or SPI codes will enhance the recycling efficiency as the technology is highly efficient when used for homogenous waste.



Figure 36: Informal recycling facilities without any environmental compliance

Ensuring environmental compliance by all plastic products manufacturer and recycling industries: Only a fraction of the plastic recyclers registered with the Confederation of Indian Industry (CII) and TAAPMA have the TSPCB clearance. Scientific recycling of plastic waste in an environmentally safe manner is critical for developing a sustainable waste processing system in the city. Hence, it is critical that all plastic product manufacturers and pellet manufacturers conform to IS 14534: 1998 (entitled Guidelines for Recycling of Plastics), and obtain clearance from the TSPCB.

The TSPCB should ensure that the recycling units comply with the permitted concentration levels of additives and contaminants in the fumes they emit. The industrial units need to comply with the technical specifications specified by the TSPCB; for example, recycling units should be equipped with suction pumps or Local Exhaust Ventilation (LEV) to capture and filter the fumes generated during the processing of plastic waste. Exhaust stacks must be placed at a minimum distance of 15 m from the sources of air intake to prevent the fumes from re-entering the workspace. Along with the clearance from the TSPCB, pelletising units should maintain a temperature range up to 20% above the melting temperature, as recommended by CIPET to ensure the extrusion process is sustainable. Strict monitoring and vigilance by the TSPCB on an annual basis are critical, even in the registered processing units, to ensure the plastic recycling process complies with all environmental standards.

A Multi-Layered Plastic (MLP) recycling facility is to be installed at the ISWM facility: Multi-layered Plastic (MLP) accounts for 21% of all plastic waste collected at transfer stations in the city. The recycled plastic granule-manufacturing units in Hyderabad use extrusion technology and mainly process PE, PET and PP. MLPs are not processed by any of these processing units because they contain adhesives that degrade the quality of granules manufactured, and multiple layers of plastic have multiple melting temperature ranges which also degrade the quality of the granules being manufactured.

Although the focus should be on phasing out of MLP packaging, as specified in the Strategy 1, until this is completely achieved the processing of MLP waste in MSW needs to be secured in the first instance. Specific MLP recycling plants with multiple extrusion systems are already used for industrial MLP waste recycling on a commercial scale in India. Segregated and pre-processed (washed and dried) MLPs from the MSW stream can also be recycled using the same technology. **After performing**

a feasibility analysis, an MLP recycling unit can be installed at the ISWM facility where the segregated and transported MLP can be processed into granules using advanced multiple extrusion technologies (Sabharwal, 2019). Until such time MLP can be utilised as a material feed for waste to energy plant.

Decentralised pre-processing and pelletisation units are to be promoted by GHMC on a PPP basis: Recyclable plastics collected at DRCCs and transfer stations should be transported to the plastic pelletisation units. However, even at the recycling facility, the municipal plastic waste stream is considered secondary to the industrial plastic waste due to the presence of impurities and the need for thorough washing of MSW plastic with detergents. There are 17 transfer stations and even more DRCCs in GHMC, where segregated recyclable waste will be received with the proposed collection strategy. This is an opportunity for GHMC to utilise the segregated plastic resources.

PPP model-based decentralised plastic pre-processing and pelletisation units can be developed by GHMC in partnership with SHGs and other CBOs around the city limits. Since plastic processing is an 'Orange' category industry, the units can be established only in demarcated industrial zones by GOT, away from residential areas. Such locations can be identified in coordination with and support from the Hyderabad Metropolitan Development Authority (HMDA). The facility should be installed under the guidance of the TSPCB and the pellets should be sold to plastic recycling industrial units with TS-iPASS certification, with the support of TAAPMA. Such an initiative can assure the following:

Quality assurance of processed plastic: Chemical washing and drying of plastic waste would ensure the quality of segregated waste plastic, since the process will be governed by the contract terms of the GHMC.

Environmental assurance: Pelletisation facilities would conform to the IS 14534: 1998, entitled Guidelines for Recycling of Plastics, thus obtain TSPCB clearance, ensuring environmental compliance.

Formalised recycling: Recycled pellets would be sold to only TSPCB-approved plastic manufacturers, ensuring scientific recycling of plastic and manufacturing of finished products in accordance with IS standards, resulting in a sustainable formal plastic recycling value chain.

Healthier working conditions: It would be ensured that Local Exhaust Ventilation (LEV) systems are provided

to capture the fumes formed from extrusion processes. Any polluting emissions would be removed through the suction process before dispersal in the atmosphere, ensuring better working conditions for plant operators.

Ensure better recycling rate: Unlike in other recycling units, LDPE would also be recycled in the unit ensuring better plastic recycling rates. In addition, no recyclable plastic waste is lost during transport from the transfer stations or DRCCs to the pelletisation units.

5.3.2. Reprocessing of non-recyclable plastic into fuel is to be ensured

More than 70% of the plastic waste is not recycled in Hyderabad due to its non-recyclable property (thermosetting plastic), low market value (LDPE & PS) or need for complex technologies for recycling (multi-layered plastic). At the ISWM facility this plastic waste is used as RDF for co-incineration.

With a segregated plastic waste collection system in place, the collected non-recyclable plastic fraction in MSW can be used as input feed for plastic to fuel processing facilities based on plasma-pyrolysis, through pyrolytic conversion technologies (Ocean Recovery Alliance, 2015). It should be noted that the carbon emissions from using plastic processed fuel are much lower than from petroleum fuels (Ocean Recovery Alliance, 2015). GHMC has already constructed a centralised waste to energy plant of 19.8 MW (using Stocker technology), where plastic along with other combustibles will be utilised for energy generation. Therefore, it is not recommendable to develop a plastic to fuel facility at ISWM, but GHMC can promote private investments in the city for establishing plasma-pyrolysis facilities and other technologies as well that could convert plastic waste into different forms of commercially valuable fuel. A portion of segregated non-recyclable plastic waste from transfer stations/DRCCs/ISWM facility could be transported to such facilities where plastic can be converted into crude petroleum

fuel. Two types of business opportunities result from crude petroleum fuel:

- Crude petroleum fuel: can be sold to industries in and around GHMC, which can use the fuel as a substitute fuel in boilers
- Refined fuel from crude petroleum fuel: can be further distilled into refined petroleum products for sales to the large suppliers for further blending with other grades of fuel.

5.3.3. Plastic-to-fuel processing facilities are to be regulated

It should be ensured that plastic to fuel processing facilities obtain TS-iPASS certification. TSPCB needs to conduct strict annual inspections to ensure facilities are not violating the Environment Act. Plastic-to-fuel facilities also generate industrial-grade process rejects. The state pollution control boards should notify of regulations specifically applicable to such industries.

Waste audits: The GHMC should ensure that plastic waste recycling units (including private facilities) have established waste collection, transport and disposal systems to deliver the residual wastes from manufacturing processes to the industrial hazardous waste management facility operated by REEL in Hyderabad. GHMC should ensure that 'management of waste' audits are performed by the processing facilities and duly submitted to GHMC, which will provide information on the waste received, processed and rejected at the facility.

Certifications for end-product: Since the end product of processing is a petroleum-grade fuel, the TSPCB has to ensure the facility receives approval certification, in accordance with the BIS Specification for Petroleum Products (ONGC-MRPL, 2019). The certification process needs to be a prerequisite for the Consent for Establishment certificate issued by the TSPCB and the

New Source Emission Standards – United States Environmental Protection Agency

Any new technology/industry in the USA comes under the purview of the 'New Source Performance Standards' and the standards for industries involved in the manufacture, processing, or recycling of polymers (mostly plastic polymers) is specifically classified under 'Polymer Manufacturing Industry: Standards of Performance for VOC Emissions' (EPA, 2020). The standards limit VOC emissions from certain process sources in new, modified or reconstructed facilities within polymer manufacturing plants as well as also polymer manufacturing plants that produce copolymers that contain by weight at least 50% specific plastic polymers. The standards also include VOC emission limits due to equipment leaks in processing plants (EPA, 2020).

sanctions issued by the Commissionerate of Industries, Telangana. This would require significant coordination between the GHMC and the TSPCB.

Industry specific emission standards to be set by PCBs: Plastic to fuel is a developing technology in India, with regular up-gradation of the processing methods. Anticipating changes in technologies, and considering it could be a new source of pollution, annual updates of the regulations of plastic to fuel units need to be incorporated into the 'Industry-Specific Emission Standards in India' by CPCB (CPCB, 2000).

5.3.4. Only non-recyclable plastic is to be converted to energy

The non-recyclable plastic waste fraction in GHMC is currently used as RDF feed along with other dry waste fractions for co-incineration. Plastic waste is the most preferred fraction of waste suitable for RDF feedstock. According to the proposed strategy, with segregated plastic waste collection and the availability of segregated non-recyclable plastic waste fraction at the ISWM facility, the efficiency of converting plastic to energy should be enhanced as described below:

- Segregated plastic contains fewer impurities of organic matter and hence will be a more efficient feed.
- The pre-segregated plastic feed will ensure PVC plastic is not mixed with the fuel feed; PVC plastic in the waste feed can release potentially hazardous toxic gases during gasification or incineration, thus pre-segregation also ensures the chloride content is within the permissible limit of <1.5% in the feedstock.
- Pre-sorting ensures all plastic is processed and only the inert char is disposed of in the scientific landfill.

Regulation of usage of plastic waste in co-incineration:

Generally, any kind of contaminated or uncontaminated plastic waste is suitable for use as Waste to Energy (WTE) feedstock due to its high calorific value. Hence, there is a tendency for waste management contractors to divert all streams of plastic waste to WTE. Since GHMC is already transporting a part of the combustible MSW for co-incineration to cement plants, **proper regulation, monitoring and documentation are critical to ensuring only non-recyclable and non-reusable plastic waste is used for co-incineration.** It is important

to ensure only documented quantities of non-recyclable plastic waste are used for co-incineration in cement plants. Annual waste material audits by HiMSW Limited and cement plants need to be conducted to ensure only non-recyclable, plastic and process-rejected plastic waste fractions are utilised for co-incineration in cement plants.

5.3.5. Promoting reuse of plastic as a construction material

The Indian Road Congress (IRC) has approved the application of plastic waste in hot bituminous mix (dry mixing) in wearing courses (IRC, 2013). Approximately one tonne of plastic can be used for tarring 1 km of road, which allows savings of approximately 35,000–40,000 INR per km (MOHUA, 2019). GHMC, on a pilot basis, has laid 100 meters of road using non-recyclable plastic and has also used plastic waste for making building materials, including paver blocks and tiles. GHMC should ensure plastic waste is systematically used in the construction sector in compliance with IRC SP 098 and the 'Manual for Construction and Supervision of Bituminous Work' by the Ministry of Road Transport and Highway'. Use of plastic in road construction should be encouraged, as such roads are more durable and have no potholes, can withstand climate extremes, temperatures above 50°C, and can last up to 10 years as compared with conventional roads that only last up to five years. **The following strategic actions need to be adopted by GHMC to ensure plastic waste is reused for road construction.**



Figure 37: Road resurfaced using plastic waste bituminous mix



Figure 38: Recycled plastic paver blocks used for making pavements, Dogpark, GHMC

Facilitate availability of shredded plastic for road construction: Once there is availability of segregated non-recyclable plastic waste at transfer stations and the ISWM facility, the waste should be washed, shredded and the feedstock should be made available at these facilities for purchase by interested parties – both governmental and non-governmental for road construction. The Ministry of Road Transport and Highways, GOI has already notified all ULBs to provide plastic waste for use in bituminous mixes in the construction of National Highways (MORTH, GOI, 2015). The pre-processing facilities for transfer stations, proposed in the previous sections, if implemented would ensure availability of such waste for road construction.

Ensure utilisation of plastic waste through regulatory measures: GOI has made it mandatory for road developers to use plastic waste in bituminous mixes

in road construction. For example, the Maharashtra state government has made it compulsory from 2018 for the Public Works Department (PWD) to use plastic waste in the construction and repair of bituminous (or asphalt) roads (The Better India, 2018). The Ministry of Municipal Administration and Urban Development (MAUD), Telangana and the GHMC should notify that any government project (new or retrofitting) for laying hot bituminous mix (dry mixing) in wearing courses (up to 50 kms outside GHMC limits) should replace at least 10% of the tar with plastic waste. The plastic waste should be sourced from DRCCs, transfer stations or stockpiled plastic waste from the ISWM facility (TCE, 2014).

Promoting utilisation of plastic waste in the construction of private roads: GOT should promote the utilisation of plastic waste in the construction of private roads by private developers and institutes. GHMC also needs to design and execute activities like mass media advertisements to ensure private contractors, builders, gated communities, institutes and other stakeholders engaged in construction of private roads are aware of the benefits of utilising plastic for road construction and are informed about the availability of cleaned and shredded plastic from GHMC for said purpose.

Promote research and development: Roads and Building Department (R&B dept.), GOT along with GHMC should ensure the quality and durability of roads made by mixing plastic with hot bitumen. GOT should also promote research and scientific verification of the use of plastic waste as filler material in other construction materials.



Figure 39: Security staff kiosk made using recycled plastic (left), dust bins made of recycled plastic (right)

International Recycled Product Certification Schemes

Multiple Recycled Product Certification Schemes already exist at the international level that can be adopted for the Indian International Recycled Product Certification Scheme. The TUV Rheinland Green Product Mark for recycled products (TUV Rheinland, 2020), the UL Component Recognition programme for recycled plastic (UL, 2020) and the SCS Recycled Content Certification (UL, 2020) are some of the most popular and widely accepted programmes, and include complex assessments of material use, onsite audits and annual verification tests.



Figure 40: Examples of recycled product certification systems

For this purpose, research and development in this sector should be supported by involving institutions in Hyderabad such as the National Council for Cement and Building Materials, National Academy of Construction and National Institute of Construction Management and Research.

Management of PVC plastic: PVC, when melted, generates hydrochloric acid and other toxic gasses like dioxins hence should be processed separately. One per cent of the plastic fraction in GHMC is PVC, thus PVC must be segregated from other non-recyclable plastic fractions before utilising it for waste-to-fuel technology or plastic road laying. Since the quantum of PVC plastic in GHMC is comparatively low, the PVC waste received from MSW can be segregated and transported under due care to the scientific landfill for disposal. The TSPCB should also ensure PVC is not recycled by the plastic pelletisation units.

5.3.6. Increase market demand for recycled plastic

“For a circular economy to become a reality, end markets must be available for the recycled materials that the recycling and reprocessing sector produce, reducing the economy’s dependency on natural resources” (Imperial College London, 2018). Increasing market demand for recycled plastic products is thus critical for promoting recycling industries and recycling in Hyderabad. Developing strong market demand for recycled plastic will ensure competitive prices for finished products, thus resulting in development of a sustainable plastic recycling industry in the city. Following are some of the initiatives to be implemented to raise market demand for recycled plastics.

Develop green certifications for recycled plastic: A national-level green certification programme can be developed to certify recycled plastic products. The

certification of products and brands based on the recycled material content can increase their product value as green products, which would make it easier for environmentally aware organisations and individuals to choose such products in procurement. Such programmes can also help maintain recycling product quality control, management and traceability, if such parameters are included as certification parameters. The certification programme once developed needs to be promoted in the market with strong IEC activities and through adaptation by the Government of Telangana, GHMC and other government institutions.

Some of the major components recommended for inclusion in the certification process are:

- No mutagenic or toxic substances to be used in the production process
- Availability of proof of traceability of the materials used
- Certification by TSPCB
- Minimum 30% of recycled plastic composition by mass

Research and Development on plastic recycling technologies: GOT should support and encourage research and development of technologies and policy measures for plastic waste recycling. The state departments need to support technologies enabling identification of contaminants and contamination of recycled plastics (granules and products) and policy initiatives, including better certification processes, by involving organisations like CIPET, JNTU and Hyderabad Central University (HCU).

Preferential procurement of recycled plastic products: Adoption of preferential procurement of

plastic products with a guaranteed minimum recycled plastic content of, e.g., 20-30% will promote the plastic recycling industry. Procurement preferences to be institutionalised including such preferences in the general procurement policy or specific tender requirements. Such actions by influential organisations will create much needed awareness and steer the

market in a more desirable direction. Large government institutes like GHMC, TSPCB and PWD can spearhead such a preferential procurement initiative. As explained in the Strategy 1, preferential procurement of alternatives to plastic should be prioritised and the preference for recycled plastic should be considered only when there are no practically implementable alternatives.

Recycled products procurement policy: City of Pittsburgh, Pennsylvania

The city of Pittsburgh, Pennsylvania, developed a procurement policy focused on procuring recycled products as an approach towards circular economy¹⁸. The major steps taken by the local administration for developing this policy briefly included the following:

- Gathering information about recycled products, vendors, etc., and communicating such to departments
- Establishing a Recycled Products Committee comprising volunteer staff from various departments to develop the policy
- Evaluating the extent to which recycled products can be used by different departments with reference to the parameters and guidelines for recycled products
- Developing procurement policy and procurement guidelines based on the baseline information collected, including provisions for individual departments to procure products according to their requirements, with a condition that all contractual procurement needs to abide by the guidelines for procuring recycled products

Recycled plastic procurement strategy of municipalities in Philippines

Davao City and Candalaria Municipality have formed partnership with Enviro Tech Waste Recycling Inc., a furniture manufacturer that uses 90% hard-to-recycle (MLPs and plastic films) plastic in its products. The municipality provides the land and the factory equipment and, in return, buys the furniture for office administration requirements¹⁹.



Figure 41 : Crockery bank to reduce usage of single use servewares in events initiative by GHMC

18 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>

5.4. Strategy 4: Create Awareness among All Stakeholder Groups through IEC Activities



Figure 42: Sensitisation and awareness generation through Dappu Nirthyam facilitated by ICLEI-SA, CCET and UNEP-IETC

To raise awareness and ensure support and participation of all stakeholders across the entire value chain of plastic waste management, different public campaigns and awareness generation activities should be undertaken by the GHMC and civil societies. GHMC to promote and partner with other private and public entities on PPP basis to utilise CSR funds for IEC activities in the city. Considering the impacts SUPs have on people's lives, the reduction of its waste will require extensive and intensive sensitisation programmes targeted at generators. Streamlined collection, transportation and scientific processing depends upon strong attitudinal and behavioural changes among GHMC sanitation staff, DRCC operators and recycling and processing unit operators; hence programmes need to be designed for capacity development, training and raising awareness of the opportunities and threats. Sensitisation at multiple levels is proposed, targeting the following components:

- Informing stakeholders about the health and environmental threats of littering and burning of plastics
- Capacity building to target specific groups and sectors to encourage them to reduce the use of SUPs and adopt sustainable lifestyles
- Capacity building for GHMC sanitary staff, SAT operators and other waste management contractors to adopt source segregation and to ensure segregated collection and transportation, thereby increasing the recycling potential
- Educating scrap dealers, waste pickers and informal waste recyclers on the importance of joining the formal sector and channelising recyclables to registered recycling and processing units, as well as capacity building to earn better revenue from the above
- Capacity building of recycling and manufacturing units to ensure scientific processing of waste and their compliance with environmental control measures for unit operations

The sensitisation activities aim at ensuring access for the population at large to essential plastic waste management information. **Information and public awareness campaigns should be part of ongoing programmes like the Swachh Bharat Mission, implemented both at national and local levels, targeting appropriate groups, and disseminating key messages through direct communication channels and mass media campaigns.**

Include all target groups: The IEC campaign in Hyderabad should include not only households, shops, gated communities, commercial and institutional premises, but also all the other stakeholders such as municipal officials, elected representatives, NGOs, social welfare organisations, the informal sector involved in plastic recycling and the media to ensure their participation in managing plastic waste by discharging their duties effectively. The IEC campaigns to be adopted and key messages to be shared with each group are given in Table 22.

Table 22: Recommended IEC activities by GHMC for capacity building of stakeholders

 Target Groups	 Category	 Key Messages	 IEC Methods
 - Residential colonies (HIG/ MIG/LIG) - Slums - Commercial stretches - Schools, colleges and other institutions	Plastic Waste Generation	- Minimising use of SUPs - Build awareness about alternative materials - Reiterate importance of maximum possible reuse and recycle - Stop open dumping, littering and burning of waste - Awareness about harmful impacts of plastic waste - Awareness on requirement for segregated waste storage at point of generation - Awareness on specifications of recycled products, their characteristics, content and restrictions of use.	- Door-to-door campaigns - Mass awareness activities - Dissemination via brand-ambassadors - Cultural events - Sensitisation workshops - Series of competitions - Community participation programmes
	Plastic Waste Collection	- Sensitisation towards waste collectors - Education on regular payment of user charges	
	Plastic Waste Processing	Education on how collected plastic waste is processed and/or disposed	
 - Sanitary staff and SAT workers - Informal sector (Kabadiwalas and scrap dealers)	Plastic Waste Collection	- Capacity building for 100% daily door-to-door collection of segregated waste only - Capacity building for transportation of waste in segregated manner - Capacity building for daily clearance of community bins - Capacity building on dumping of waste at designated bins/sites - Education about sale of recyclables to only registered scrap dealers, DRCCs or registered recyclers - Capacity building on reporting of defaulters and collection of user charges according to requirements - Capacity building of higher-level officials for daily reporting and monitoring of SAT workers - Education on real value of waste - Education on impact of waste segregation on processing systems	- Inter-Personal Communication (IPC) - Training sessions - Exposure visits
 - DRCCs - Recyclers and Manufacturers	Plastic Waste Processing	- Education on transportation of waste only to registered processing facilities or ISWM facility - Disseminating information on all possible processing facilities, i.e., decentralised and centralised - Education on what should be sent to landfills - Awareness on registration process with the TSPCB - Education on adhering to the recommended melting temperatures for various kinds of recyclables - Education on strict application of environmental control mechanisms while recycling - Awareness on health and environmental impacts of unscientific recycling processes	- IPC - Training sessions - Exposure visits

Source: ICLEI-SA

IEC needs to be a continuous process until the requisite behaviour change is effected among stakeholders. The frequency of implementation is to be defined by the type of IEC activity. For example, mass awareness campaigns, including advertisements and street shows, need to be continuously implemented over several years, whereas door-to-door awareness activities need to be more intense and conducted over shorter durations of 1–2 months. Similarly, different time periods are required for capacity building of different stakeholders. For example, intense training sessions could be held for SAT operators over a few weeks, whereas capacity building for the general public and

households on segregated waste generation needs to be ongoing, spanning years, for visible behavioural changes to take effect. Table 23 presents tentative frequencies recommended for different IEC activities for capacity building.

Table 23: Recommended frequency of IEC activities

IEC method	IEC tool	Recommended annual frequency of implementation by GHMC
Door-to-door campaign	Distributing pamphlets to residential units	Quarterly
	Distributing pamphlets to other generators	Once every 2 months
	Pledge for 'No Single-Use Plastic'	Annual
	One-to-one meetings and discussions with bulk generators	Quarterly
Mass awareness activity	Circulation of notifications on social media (WhatsApp, Facebook, Twitter) by GHMC Information Technology (IT) wing	Weekly
	Advertisements in mass-media/print media by GHMC IT wing (Newspaper, Television, etc.)	Daily
	Audio-visual clips to be screened before shows in movie theatres	Selected shows throughout the year
	Advertisements on public transport, on blank side of tickets, etc.	Throughout the year
Promotion using brand ambassador for plastic waste	Community involvement exercises: mass clean-up drives, marathons, cyclothons, etc.	Monthly
Cultural event	Mass awareness generation using traditional art forms in local dialects	Monthly
Workshops and lecture	Lectures, workshops and seminars in association with educational institutes and NGOs	Throughout the year
Competitive event	Competitive events focused on students and youth – essay writing competitions, painting and poetry competitions, Hackathons, etc.	Quarterly
	Competitive events for social groups – awards for civil society groups, gated communities, bulk waste generators, institutes, etc. for best practices in plastic waste management	
	Awarding local champions among sanitary workers, SAT operators, NGOs, etc. in plastic waste management initiatives	

Source: ICLEI-SA



Figure 43 : Cloth banners in the Birla temple area to promote reduction in SUPs facilitated by ICLEI-SA, CCET and UNEP-IETC



Figure 44: Wall paintings by college students to promote reduction in plastic waste facilitated by ICLEI-SA, CCET and UNEP-IETC

5.4.1. IEC activities for waste generators

Some key IEC activities that should be actively pursued by GHMC for capacity building of waste generators in Hyderabad are proposed here:

Door-to-door campaigns: These should comprise distribution of pamphlets and brochures across all generators on the topics indicated in the table above. Area-specific NGOs/SHGs/CSOs/CBOs should be engaged for this activity on basis of familiarity with the stakeholders and ease of access through personal interaction. All generators should be encouraged to take a pledge of 'No Single-Use Plastic' and specific properties/households should display dedicated stickers such as 'No Single-Use Plastic User'.

Mass awareness activities: Mass awareness activities should include frequent circulation of information on social media (WhatsApp, Facebook, Twitter and Instagram hashtags, etc.) and advertisements on mass media (newspaper, TV and FM jingles etc.). Hoardings made of eco-friendly materials like cloth should be placed in strategic locations such as major junctions and landmarks, and should be custom-designed for RWAs, community parks, main commercial stretches and major educational and religious institutions. Movie theatres can play 30-second audio-visual clips before each show. Ticket counters of major tourist spots can play the same clips. GHMC in association with the Telangana State Road Transport Corporation (TSRTC) and Hyderabad Metro Rail Limited (HMRL), can display slogans on public transport for high visibility.

Spread message through brand ambassadors:

Prominent celebrities should be engaged as brand ambassadors for promoting the use of alternative materials and reduction in the use of single-use plastics.

Cultural events: Using vernaculars, events based on traditional art forms should be organised in each residential colony and commercial stretch, to enhance the impact on local citizens.

Sensitisation workshops, lectures and seminars:

Sensitisation workshops, lectures and seminars should be conducted in educational institutions. Students can be involved in setting up artistic structures made of plastic waste in community parks and institution premises.



Figure 45 : ICLEI-SA, CCET and UNEP-IETC conducted sensitisation meeting with shop keepers in Birla mandir area to reduce usage of SUPs

Competitions: Essay writing, wall painting and poetry writing competitions, among others, need to be organised in schools and colleges, with themes around issues of plastic waste and use. Schools should introduce supplementary internal credit systems to encourage students to adopt sustainable lifestyles. They can also distribute stationery and basic groceries to students who collect segregated plastic waste. GHMC should organise ward-level competitions to award 'Clean and Green Wards' in terms of large generators practicing waste segregation at source.

Community participation programmes: Walkathons, rallies and mass clean-up drives need to be conducted with the help of proactive NGOs in every ward. RWA

representatives should be convened periodically for group discussions on specific topics.

5.4.2. IEC activities for municipal sanitation workers and informal waste pickers

Proper mechanisms need to be developed for building capacities of SAT operators, GHMC sanitation workers and informal waste pickers on segregated collection of plastic waste and on maximising profit from the recovery of recyclables by educating them on the hidden potential, especially of low-value plastics. Awareness also needs to be raised for the safe handling of plastic waste and health hazards in the waste management sector. Table 24 proposes some suggestions for IEC activities.

Table 24: IEC activities for GHMC sanitation workers and informal sector staff

IEC activity	IEC tool	Recommended frequency
Inter-personal communication (IPC)	IPC with SAT workers	Once every 2 months
	IPC with SFAs	Once every 2 months
	IPC with other sanitation workers	Bi-annual
Training programme	Classroom training sessions	One time
	On-ground demonstration	Once every 2 months
	Handbook/manual distribution	One time
	Sensitisation at dumpsites for waste pickers	Bi-annual
Exposure visit	Visits to recycling and manufacturing units	Annual

Source: ICLEI-SA

Inter-personal communication: Inter-personal communication with every on-ground sanitation worker at the ward level should be conducted in smaller gatherings at ward offices. Similarly, ward-level scrap dealers should be invited to small group discussions. Advertisements should be stuck on SAT vehicles, communicating the importance of segregation of plastic waste. Inter-personal communication also needs to be done with SIs, SFAs and SJs.

Training sessions: Training should be conducted on the technicalities of PWM in an easily explainable manner (using local language, figures and diagrams, simple economics, etc.) along with on-ground demonstrations of collection and segregation of various kinds of plastic. Illustrated handbooks and manuals should be provided to higher level sanitation staff for monitoring and implementation of best practices. Special training sessions should be conducted to explain the usage of technology for app-based systems. While the rest of the

IEC activities are focused on GHMC sanitary staff and SAT operators, the sensitisation at dumpsites (including transfer stations) should be focused on waste pickers in the informal sector.

Exposure visits: Exposure visits should be organised for SAT operators and other stakeholders to registered recycling units to provide them with a better understanding of the requirements of segregation for the recycling industry.

5.4.3. IEC activities for DRCCs and processing units

The capacities of DRCC operators and operators of plastic processing units need to be enhanced to create awareness on occupational health hazards and environmental impacts of unscientific recycling mechanisms and other subjects, including registering with the TSPCB and obtaining the TS-iPASS.

Table 25: IEC activities for DRCCs and processing units

IEC activity	IEC tool	Recommended frequency
Inter-Personal Communication (IPC)	IPC with DRCC operators and workers	Once every 2 months
	IPC with recycling and manufacturing unit operators and workers	Bi-annual
	Classroom training session	One time
Training programme	On-ground demonstration	Once every 2 months
	Handbook/manual distribution	One time
Exposure visit	Visits to recycling and manufacturing units	Annual

Source: ICLEI-SA

Inter-personal communication: Inter-personal communication should be organised with specific recyclers and DRCCs, to create awareness on health and environmental impacts of unscientific recycling mechanisms and other subjects, including registering with TSPCB.

Training sessions: Training sessions, both classroom-based and practical demonstrations should be provided for respective target groups on how the model DRCCs function and on scientific recycling and manufacturing

units. Handbooks and manuals should be designed, developed and provided to recycling and manufacturing unit operators for implementing scientific processing.

Exposure visits: Exposure visits to integrated plastic waste processing facilities operating to CPCB standards should also be conducted for plastic pelletisation entrepreneurs, in order to provide an understanding of the upgradation required in their own processing facilities for sustainable production and processing.



Figure 46 : Sensitisation and awareness generation through Dappu Nirthyam facilitated by ICLEI-SA, CCET and UNEP-IETC

5.5. Strategy 5: Strengthen Governance and Implement a Monitoring and Evaluation Framework

5.5.1. Strengthening governance and coordinating mechanisms across GHMC, TSPCB and other allied institutions



Figure 47: Stakeholder workshop conducted by ICLEI-SA, CCET and UNEP-IETC

Different institutions, are involved directly and indirectly throughout the plastics waste value chain and play various roles in reducing use of single-use plastics and efficiently managing municipal plastic waste. It is important to ensure that an efficient institutional structure is in place and the capacity exists for regulating and monitoring the management of plastic waste at different levels of government (national, state and municipal) and in other allied institutions. Strategic actions for improving institutional processes to ensure efficient plastic waste management in Hyderabad city include the following, as summarised in Table 26:

- Addressing human resource gaps in relevant institutions
- Technical capacity building for GHMC staff in plastic waste management
- Establishing coordinating mechanisms between GHMC and TSPCB
- Establishing monitoring mechanisms for end-to-end management of plastic waste
- Institutional development to promote R&D
- Institutional financial capacity strengthening through EPR system

Table 26: Identified institutional strengthening mechanisms

Institution: GHMC		
Targeted for institutional strengthening	Performance indicator	Recommended action
Sufficient sanitary staff for GHMC to ensure efficient plastic waste collection	• 30 - Number of SIs • 30 - Number of SSs • 150 - Number of SJs • 150 - Number of SFAs	• Recruitment for all vacant positions by government order

Sufficient number of SAT vehicles to ensure 100% doorstep waste collection on daily basis	• 100% doorstep waste collection daily from every waste generator • 2,500+ vehicles being operated, according to requirement	• Map and rationalise SAT routes • Identify required number of additional SAT vehicles to provide doorstep collection service to every waste generator every day • Identify localities not served by SAT operators • New contracts with required number of SAT vehicles to fill gaps and ensure 100% coverage of waste collection • Maintain backup systems when SAT vehicles undergo service or repair
Capacity development and empowerment of vigilance team of GHMC	• Strict vigilance on manufacture, storage, sale & usage of SUPs and <50 micron plastic (Telangana State Circular on Ban on usage of SUPs No. Roc. No. E-13108, dated 16 October, 2019) • Strict vigilance of informal/unregistered plastic waste recycling facilities • Strict vigilance of 100% segregated waste collection and transport • Strict vigilance of collection of user charges from waste generators (GHMC notification no. 253 issued on 8 September, 2016)	• Train vigilance team members in identifying banned items and respective action to be undertaken on ground • Assign specific job responsibilities and targets as part of job profile • Provide all required tools including weighing machines, callipers, etc. • Assign specific targets to all SFAs to monitor segregated waste collection, identify defaulters and penalise them as defined in the Strategy 2 • SFAs should monitor collection of user charges on designated day of the month • Provide weekly report on vigilance activity to Commissioner-in-Charge
Immediate response to grievances	• Action within 24 hours to be ensured regarding grievances filed on plastic waste management	• All stakeholders to be made aware of the grievance redressal system available at GHMC • All grievances to be redirected immediately to regional vigilance officers and SFAs for action • Status of grievance redressal to be submitted by SIs within 24 hours. • SIs to submit report on all grievances to Commissioner-in-Charge every week
SAT operator management	• Efficient monitoring and regulation of waste management activities of SAT operators in waste management (collection and disposal) • 100% daily attendance of SAT workers	• SFAs should monitor daily biometric attendance of SAT workers • SFAs and other members of vigilance team to ensure waste collected is segregated and taken to only authorised collection centres

Bulk waste management	• Management cell formed • Timely inspections and documentation made • Defaulters penalised as per model criteria of SWM Policy and Strategy of Government of Telangana, 2018 • Best practices awarded on annual basis	• Bulk waste management cell should be formed with GHMC • Monthly inspections should be made and documented • Defaulters to be penalised and documented evidence to be included in the annual report sent to CDMA. In case of further non-compliance by defaulters, environmental compensation shall be recovered as arrears of land revenue by GHMC • An annual award system to incentivise bulk waste generators performing best practices for onsite waste management
Ensure designated user charges are paid by generators to SAT workers	• User charges being paid by 100% generators • No complaints from SAT workers regarding user charge collection mechanism	• SFAs to collect user charges from waste generators, failing of which should lead to fines and further administrative actions • SFAs should levy penalties on defaulters accordingly
Ensure spot fines and environmental compensations are collected from defaulters	• Spot fines collected from defaulters for littering or failing to comply to provisions of SWM Rules • Environmental compensations levied on defaulters for open burning of waste • Spot fines levied on organisers of mass participation events without prior intimation or who have not made provisions for waste management	• GHMC to notify and release press note declaring prohibition of open burning of waste including penalty chart sheet for non-compliance • GHMC to declare environmental compensation for burning of waste as recommended in SWM Policy and Strategy of Government of Telangana, 2018 • GHMC to notify and release press note declaring format for obtaining prior permission for organising events with more than 100 people including penalty chart sheet for non-compliance • Monitoring cell should levy spot fines on organisers of large participation (more than 100 people) events without prior permission or without waste management provisions
Ensure scheme is in place to register waste dealers (as per the SWM Policy and Strategy of Government of Telangana, 2018)	• Maintaining database on scrap dealers • Geo-tagging of all scrap dealers in the city • Capturing the route map of recyclables to and from scrap dealers through a GPS enabled system	• SFAs should update ward-specific information on scrap dealers on quarterly basis • SIs should monitor locations and transportation of plastic waste across scrap dealers through CCC

Ensure no environmental damage while undertaking PWM activities (PWM Rules, 2016)	Regular testing of groundwater and air quality in and around areas of transfer stations and major processing facilities should be conducted and ensured that its within permissible limits	- SFAs should visit transfer stations and areas with processing units to conduct visual inspection of environmental situation once a month - Telangana State Ground Water Department (TSGWD) with support of Hyderabad Metropolitan Water Supply and Sewerage Board (HMWSSB) should assess ground water quality samples at designated locations on regular basis. - TSPCB should conduct air quality testing at designated locations on regular basis.
Encourage use of plastic waste for road construction (PWM Rules, 2016)	- Replace 10% bitumen with plastic for road construction or retrofitting projects - Quantify amount of plastic waste sold for road construction by DRCCs/ transfer stations	- Chief Engineer of GHMC should closely investigate the material mix of all new road construction/ renovation projects - GHMC to provide road contractors with shredded plastic waste - SlIs should continuously monitor flow of plastic waste from DRCCs to road construction companies
Waste audit	Waste audit conducted in GHMC on annual basis	- Capacity building of GHMC to prepare for waste audits and to develop all required documents - Engage third party waste audit experts - Municipal council to take corrective action based on waste audit data (mismanaged plastic and other waste data) - Individual data of bulk generators, transfer stations, processing facilities and landfills should be available to calculate the mass balance of waste generated
Centralised facility for monitoring and regulation of management of plastic and other waste in the city	Upgraded CCC facility for efficient waste management system	- GPS tagging of all vehicles involved in waste collection - GPS tagging of all mapped stakeholders - Route mapping of all vehicles - Recruitment of agency for establishing facility on Design-Build-Operate-Transfer (DBOT) model with GHMC - Training of all stakeholders to report to CCC facility
Promote CSR Programs	CSR programs leveraged to support GHMC in managing multiple challenges of plastic waste management	- Develop programs based on PPP model to attract CSR investments - Encourage corporates, brand-owners, importers and distributors to implement their EPR through CSR activities - Provide advisory and guidelines to brand owners to invest in CSR projects in line with plastic waste management strategy of GHMC and the GOT

Form committee to coordinate activities between GHMC, Telangana Industrial Department and TSPCB regarding plastic and other waste management	• Joint annual review of implementation of PWM Rules in GHMC conducted • GHMC prepare and submit annual report as per format of Form IV of SWM Policy and Strategy of Government of Telangana before 30 April of the subsequent year • Bye-laws developed and reviewed for PWM in GHMC • Registrations of enterprises for recycling or processing waste renewed jointly based on compliance to MSW norms of State government • Coordination of inspection of vigilance team of GHMC/state departments and inspection activities of TSPCB • Future city development plans and city sanitation plans developed that facilitate municipal plastic waste management.	• Form committee for coordination of activities between GHMC, Telangana Industrial Department and TSPCB • Organise quarterly meetings and review implementation of PWM Rules • Jointly develop and review byelaws for sustainable plastic waste management practices in GHMC • Coordinate and conduct inspections of manufacturers, wholesalers and retailers by every department (under their own jurisdiction) simultaneously in order to ensure complete compliance from all illegal manufacturers/processors • Technical review of all waste processing facilities • Review and ensure that Form IV of SWM Policy and Strategy of Government of Telangana, 2018 is filled and sent to CDMA before 30 April of the subsequent year • Develop future city development plans and city sanitation plans for GHMC, incorporating aspects of holistic plastic waste management
Institution: TSPCB		
Ensure registration of all processing units (manufacturing and recycling of plastic waste) (PWM Rules, 2016)	• All industrial units comply with Water (Prevention and Control of Pollution) Act, 1974 (6 of 1974) and the Air (Prevention and Control of Pollution) Act, 1981 (14 of 1981) and the emissions or effluents from the units are within prescribed limits • All industrial units procure certificates of registration issued by the District Industries Centre or any other government agency authorised in this regard • All industrial units procure Consent to Establish/Operate/Renewal certificates • All industrial units adhere to IS 14534: 1998 'Guidelines for Recycling of Plastics'	• TSPCB should have routine inspections in all industrial areas to identify defaulters (informal industries, unregistered industrial units and units without required environmental approvals) • TSPCB should collect air and water quality testing reports from the processing units once every 3 months • TSPCB should check required certificates twice a year so that they are renewed within the stipulated timeframes

Ensure manufacture and distribution of plastic products utilise proper identification code (IS 14534: 1998 guidelines)	All plastic items marked with resin code as required by IS 14534: 1998 guidelines	TSPCB should inspect various plastic manufacturing units, wholesale distribution units and retail distribution units every 3 months and submit reports to CPCB every 3 months
Ensure manufacturing of recycled products follow IS 14534: 1998 guidelines (PWM Rules, 2016)	- All recycled products display the amount of recycled plastic as specified in IS 14534: 1998 guidelines - No food-grade plastic is made of recycled plastics	TSPCB should inspect various manufacturing units, wholesale distribution units and retail distribution units every 3 months and submit reports to CPCB every 3 months
Ensure plastic used for co-processing is pre-processed, in accordance with guidelines of co-processing of plastic waste in cement kilns	- All plastic used for co-processing is subjected to pre-processing, as approved and monitored by TSPCB in accordance with Rule '5(b)' of Plastic Waste Management Rules, 2016 (CPCB, 2017) - No recyclables are used for co-processing - All cement plants using co-processing have operational Continuous Emissions Monitoring System (CEMS) unit installed by TSPCB - All cement plants maintain records of amounts of plastic received and processed	- TSPCB to conduct quarterly inspections of ISWM facility to validate pre-sorting facilities - TSPCB to validate pre-processing of plastic waste from sources other than HiMSW for cement plants - TSPCB to monitor process of feeding mechanism using calciner in cement plants to ensure plastic is used in co-processing in a scientific manner - Ensure all cement plants are connected to a Continuous Emission Monitoring System (CEMS) - Collect data from cement plant and ISWM and other sources on plastic waste utilised for co-processing and establish mass balance
Ensure recovery and recycling of plastic and other valuables from municipal waste by Special Economic Zones (SEZs), Industrial Estates & Industrial Parks (SWM Policy and Strategy of Government of Telangana, 2018)	Special Economic Zones (SEZs), Industrial Estates & Industrial Parks have earmarked at least 5% space for recovery and recycling of plastic and other recyclables	- Ensure compliance of mandatory requirement of Special Economic Zones (SEZs), Industrial Estates & Industrial Parks to allot 5% of total area to facilitate recycling - Ensure recovery and recycling of valuable dry waste resources by regular monitoring - Conduct feasibility of incorporating requirements by existing Special Economic Zones (SEZs), Industrial Estates & Industrial Parks and provide guidance as required for implementation

Promote best practices of plastic recycling and sustainable alternatives for single-use plastics	- A list of best practices developed and published by TSPCB - A list of sustainable alternatives analysed and declared by TSPCB	- TSPCB to assess existing technologies and identify their advantages, disadvantages and gaps - Identify the best technologies and practices in the state/nation and recommend the most suitable ones/acceptable technologies for plastic waste management in Telangana for publication - Analyse energy consumption and life cycle assessment of all available alternatives to SUPs and provide a list thereof in a publication - Update the list of best practices and best alternatives from time to time
Emission control of recycling industries	Emission control systems exist in all plastic processing and waste recycling industries as part of the requirement of CFO from TSPCB	TSPCB to make amendments in its system of valuation of emission standards of plastic recycling/processing industries to include emission reduction/capture mechanisms as a part of necessities/requirements for attaining CFO certificate
Ensure brand owners establish a system to collect used plastic sachets/pouches or packaging under the Extended Producer Responsibility	Annual action plan of EPR submitted by brand owners and producers	- TSPCB should monitor the implementation in accordance with the action plan submitted by companies - TSPCB should take into account all brand owners/producers dealing with MLPs, following a specific reporting template twice a year - Send notice to companies that are identified as major plastic waste generators who have not yet submitted EPR plans
Institution: Indian Institute of Packaging (IIP and other similar institutes)		
Efficient infrastructure for certification of biodegradable plastics in Telangana	Laboratory in Hyderabad, accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL) to certify biodegradable plastic	- IIP to speed up the process of establishing laboratory facilities in Hyderabad to simplify licensing of biodegradable plastic manufacturers - IIP to conduct widespread IEC activities to improve its visibility in Hyderabad
'Green Certification' for recycled plastic products	- Green certification for recycled plastic products available with IIP - Recycled products are attracting added value resulting from green certification	- IIP to develop a process of green certification for plastic products based on environmental safety standards - IIP to conduct widespread IEC activities regarding the importance of green certification

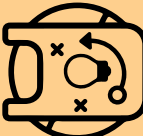
Source: ICLEI-SA

5.5.2. Data management - Integration of plastic data

The availability of actual, consistent and up-to-date data from various stakeholders is critical for assessments, strategy development and monitoring of implementation by institutions like GHMC and TSPCB. It is crucial for GHMC and TSPCB to share information. Relevant information can also be shared among these institutions, TAAPMA, IID, IIP, CII and research institutions. Critical information can be shared among the institutions for ease of planning and strategy development. National tax and customs authorities, which have access to information on the manufacture and sale of plastic by individual companies and other items, should be involved in the data-sharing mechanism.

There is a need to ensure a more transparent flow of information between all stakeholders and to raise awareness about the sustainability of existing and emerging alternatives to plastics. This may help incentivise design changes and ensure new solutions are firmly established. This in turn depends on further improving our understanding of the impacts of plastics on human health and the environment (including plastic additives, other chemical components and marine litter), giving academia and research institutions an important role to play going forward. An initiative needs to be taken by the GOT/GHMC to encourage the convening of a plastic data hub by involving multiple institutions, in order to share data and create a data pool that is updated, transparent and available to all concerned stakeholders for analysis.

6. Roadmap for Holistic PW M Strategy and Action Plan

	Action plan	Phase 1 (2020-2025)					Phase 2 (2025-2030)					Outcome
		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
 Strategy 1: Reduce generation of plastic waste at source	Ban on Single Use Plastics (SUPs)											
	Ban on SUPs – Implementation & penalisation											No banned plastic available in the market
	Policies to restrict use of SUPs											
	Implementation of preferential procurement by government institutions											Preferential procurement included as a policy measure in government institutions
	Enforce buy-back programmes under EPR											All major waste generator brands identified and mandated for EPR
	Enforce green protocol for events											Green protocol designed and implemented in city
	Enforce stringent taxation											Increased state and central government taxation on SUPs products made of virgin plastic
	Enhance availability and access to existing alternatives to SUPs											
	IEC on starch-based biopolymers											Biopolymer goods replace multiple SUPs in markets
	Establishing small-scale cottage industries for manufacture of alternative materials											Small-scale industries established in city for manufacture of alternatives to products for SUPs

	 Action plan	 Phase 1 (2020-2025)					 Phase 2 (2025-2030)					 Outcome	
		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030		
	Promote R&D for finding new and viable alternatives												
	Direct funding, various programmes and award and recognitions from central and state government for advanced research on the development of alternatives to SUPs											All major research institutions have capacity and are engaged in development of alternative materials Multiple alternative materials introduced in local markets as a result of R&D activities	
	Substitution of plastic components in packaging design												
	Promote innovative designs: Substitution and enhancement											Manufacturers and brand owners reduced plastic consumption by substitution in design, change in design, etc.	
	Design packaging to enable easy recycling											Non-recyclable plastic packaging removed from markets	
 Strategy 2: Ensure segregated collection and transport of plastic waste to registered waste processing facilities	Segregated waste storage												
	IEC for cleaning of plastic waste											Cleaned plastic waste handed over by waste generators to SAT operators	
	IEC to prevent public littering and open burning of waste											100% waste generators hand over waste to SAT operators	
	Policy amendment on waste storage by bulk generators (bye-law)											Byelaw passed for storage of cleaned plastic waste by bulk waste generators	
	Setting up of cell to monitor bulk waste generators											Cell to monitor bulk waste generators established	

	 Action plan	 Phase 1 (2020-2025)						 Phase 2 (2025-2030)				 Outcome
		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
	Strengthening primary collection and transport of segregated plastic waste to registered recycling and processing facilities											
	Training of SAT operators on segregated waste collection											Segregated collection of plastic waste executed by SAT operators
	Daily wet waste collection. Twice in a week dry waste collection											Wet waste collected daily Dry waste collected twice in a week
	Digital mapping and route rationalisation of SAT vehicles											Digital map of SAT vehicle collection routes developed SAT vehicle routes reorganised and rationalised for better efficiency and coverage
	Institutional strengthening: Vigil monitoring, regulation and documentation of waste collection by SAT operators											Documentation and monitoring of plastic waste collection and disposal in place Documentation and regular monitoring system for DRCCs in place Digital attendance system for SAT operators in place Efficient use of grievance redressal system
	Development of a database of informal waste collection system											Database developed for all informal waste collectors
	IEC to enhance efficiency of segregated collection and transport											Voluntary segregation of plastic waste at source taking place Segregated plastic waste transported to DRCCs by SAT operators
	Linking of segregated plastic waste to TSPCB certified recycling facilities											Plastic collected in GHMC, transferred to TSPCB certified recyclers only

	Action plan	Phase 1 (2020-2025)					Phase 2 (2025-2030)					Outcome
		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
	Promoting private investment to set up plasma pyrolysis facilities and transport of non-recyclable plastic to such facilities for conversion into commercially viable fuel											Plastic-to-fuel processing facilities installed in GHMC area
	Plastic-to-fuel processing facilities are to be regulated											
	Regulation of plastic to fuel processing facilities											Plastic-to-fuel processing standards and guidelines to be developed by TSPCB Waste audits made mandatory and implemented in ISWM facility and other processing units Certifications for end product made mandatory
	Industry specific emission standards to be set by BIS											
	Only non-recyclable plastic to be converted to energy											
	Regulation of use of plastic waste in co-incineration											Plastic material audit made mandatory and implemented by CPCB at ISWM facility and cement plants
	Promoting reuse of plastic as a construction material											
	Facilitate availability of shredded plastic for road construction											Cleaned and shredded plastic made available by ULB to all road contractors
	Ensure utilisation of plastic waste through regulatory measures											Plastic waste (minimum 5% of bitumen) to be mandatorily used in construction of all municipal roads to be built by GHMC (including under contracts) by 2022 Plastic waste (minimum 5% of bitumen) to be mandatorily used in construction of all PWD roads/state highway roads by 2030

	Action plan	Phase 1 (2020-2025)					Phase 2 (2025-2030)					Outcome
		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
 Strategy 4: Create awareness among all stakeholder groups through Information, Education and Communication (IEC) activities	Promoting utilisation of plastic waste in the construction of private roads											GHMC conducted IEC activities to build capacity of all major builders and other stakeholders in using plastic waste as filler in construction materials
	Increase market demand for recycled plastic											
	Develop green certifications for recycled plastic											Green certification programme developed by IIP, Hyderabad GHMC includes green certification as part of procurement policy
	Preferential procurement of recycled plastic products											GHMC to include preferential procurement policy for recycled plastic products included in budget by 2022 Preferential procurement policy for recycled plastic products included in budget by 2027 (by GOT and other institutions)
	Door-to-door campaign											Door-to-door campaigns to create awareness in households, commercial units about segregated storage of cleaned recyclables Meetings conducted with all major bulk waste generators for capacity building on segregated waste storage
	Mass awareness activity											Multiple mass awareness activities conducted by and in partnership with GHMC including cultural events, competitions, mass media advertisements, etc.
	Promotion using brand ambassadors											Advertisement and awareness campaigns conducted using selected brand ambassadors
	Training sessions											Capacity building training sessions conducted for all GHMC sanitary staff including SAT operators for efficient management of plastic waste

	 Action plan	 Phase 1 (2020-2025)					 Phase 2 (2025-2030)				 Outcome		
		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030		
 Strategy 5: Strengthen governance and implement a Monitoring and Evaluation framework	Strengthening governance and coordinating mechanisms of GHMC												
	Collation and integration of plastic data available with various governing and certification institutions												Integrated and updated data available with GHMC and other institutions
	Form committee for co-ordination of activities between GHMC, Telangana Industrial Department and TSPCB regarding plastic and other waste management												Joint committee formed by representatives from GHMC, TSPCB and Telangana State Industrial Development Department for ensuring enforcement of PWM Rules 2016.
	Recruitment of sufficient sanitary staff in GHMC to ensure efficient plastic waste collection												All available vacancies in GHMC filled
	Sufficient number of SAT vehicles to ensure 100% doorstep waste collection on a daily basis												Appropriate number of SAT vehicles deployed
	Capacity development and empowerment of vigilance team of GHMC												Vigilance team members are trained
	System for immediate response to grievances												Grievance cell complaints immediately communicated to local SIs, SJs & SFAs Centralised monitoring by updated CCC All corrective actions reported by ground staff to grievance cell and response sent to customer within 8 hours

	 Action plan	 Phase 1 (2020-2025)					 Phase 2 (2025-2030)					 Outcome
		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
	Efficient SAT operator management system											Performance monitoring of SAT operators institutionalised by SSs, SIs, SFAs & SJs Regular collection of segregated waste by SAT operators
	Ensure user charges are being paid by generators to SAT workers											User charges collected from all waste generators
	Ensure a scheme is in place for registration of informal waste dealers											Data collection of all formal and informal waste pickers/scrap dealers by GHMC to be completed by 2022 Annual updation of information and digital mapping of stakeholders to be conducted and regularised by 2025
	Waste audit by GHMC											Annual waste audits conducted by GHMC
	Central facility for monitoring and regulation of plastic and other waste in the city											Centralised CCC developed by GHMC for waste management
	Strengthening governance and coordinating mechanisms of TSPCB											
	Ensure registration of all processing units											All plastic waste recycling units in GHMC registered with Commissionerate of Industries along with approval of TSPCB
	Ensure manufacture and distribution of plastic products that have proper resin identification code											Strict monitoring of vigilance team ensured that no plastic product is sold in GHMC without proper resin identification code

	Action plan	Phase 1 (2020-2025)						Phase 2 (2025-2030)				Outcome
		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
	Ensure manufacture of recycled products are in compliance with IS 14534: 1998 guidelines											All plastic recycled in GHMC comply with IS 14534: 1998 guidelines and are monitored by TSPCB twice per annum
	Ensure the plastic used for co-processing is pre-processed in compliance with guidelines on co-processing of plastic waste in cement kilns											TSPCB ensures pre-processing of plastic waste before it is used for co-processing at cement plants
	Promote best practices of plastic recycling and sustainable alternatives to SUPs											GHMC opens web portal/directory with list of SUPs alternatives and their availability in Hyderabad GHMC creates directory of plastic recyclers
	Emission control of recycling industries											TSPCB ensures emission control systems installed and operational in all registered recycling industrial units
	Ensure brand owners establish a system for collection of used plastic sachets/pouches or packaging under the Extended Producers Responsibility											List of all major brand owners contributing to plastic waste developed on annual basis through survey All brand owners/importers/distributors submit annual EPR plans to TSPCB TSPCB ensures and verifies all submitted EPR plans are implemented
	Strengthening governance and coordinating mechanisms of other allied institutions											
	Efficient infrastructure for certification of biodegradable plastics in Telangana											IIP has established a biodegradable plastic certification facility in Hyderabad
	'Green Certification' for recycled plastic products											Green certificate programme developed and implemented by GHMC and other institutions for preferential procurement of plastic goods

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Annexure

Green Protocol For Zero Single Use Plastic Waste Generation In GHMC

The green protocol guidelines for institutions and mass-events in GHMC are listed in the table below. GHMC should ensure that the green protocol is followed in its jurisdiction as part of its plastic waste management strategy.

Table: Green protocol recommendations

Establishments, Events & Festivals	
Regular events/ meetings	All events to be conducted as green events
	Ban usage of single use plastics at the event
	Use steel/glass cutlery (including water bottles). Strict no to plastic straws, glasses, plates and other cutlery
	All materials used for administrative purpose to be ecofriendly. No throw away pens to be used
	Water kiosks to be provided at events
	No to plastic lined paper cups. Many paper cups in the market contain a thin layer of plastic lining inside, and hence need to be avoided as per the green protocol
Institutions (Educational and Offices)	Plastic waste recovery centers in every school and government office with more than 50 students/20 staff
	Innovative ideas to be tried out in schools & colleges to recover plastic waste in a participatory approach (Eg: plastic disposal structures). Arrangements to be made for delivering the recovered material to SAT operators or DRCCs in segregated manner in definite time intervals
	Green volunteers to be formed in all institutions (1 volunteer for every 50 students/20 staff) to ensure green protocol is implemented on a daily basis. In educational institutions, the volunteers should be a mix of teachers and students
	All events to follow green protocol. The green volunteers along with event organising committee to ensure that all arrangements are made in advance to facilitate green protocol
	SUPs to be banned in institute campuses. List of banned single use plastic products to be advertised in institute notice boards and circulars. Timely IEC activities to be undertaken by green volunteers
	Institutes to ban use of plastic bottles, flex prints, single use pens inside campus
	Use reusable ID card designs
	Institutes to have in-situ waste composting facilities
Monument structures	Promotion of steel containers for food, water and beverages to be implemented by green volunteers. Programs to be designed as required
	Campus of all monument structures to be marked single use plastic free and green protocol to be implemented
	No plastic banners to be used inside the monument structures.
Religious places	Appropriate water kiosks and water ATMs to be provided in all monuments to make sure water bottles need not be carried by visitors
	Token system to deposit single use plastics should be adopted for religious places.
	Steel or leaf or organic plates and cutlery during sevas (Separate fund to be maintained for the purpose)
	Discourage use of worship/pooja items sold in plastic packets
	Vigilance department of GHMC to make sure worship/pooja items are not sold in plastic carry bags/covers

Events	
Any mass public events	Green decorations with only natural materials to be promoted
	Do not provide free water bottles – provide clean water only in tumblers and steel glasses
	Token system for depositing single use plastics should be adopted (explained in detail in the document)
	Ban on plastic disposable cutlery
	Cloth banners to be used instead of plastic flex banners
	The vigilance team in GHMC to get specific training for monitoring of green protocol in events
	Social media campaign/mass communication media campaign to be implemented by GHMC one month prior to every large scale mass event to sensitise the public on single use plastic reduction, not to bring single use plastic into the venues and alternates available. (Use mediums including FM radios, TV advertisements, internet advertisements, railway announcements etc)
Event in stadiums/ large exhibitions	Token system for depositing single use plastics: Before allowing entry into any event venue, the volunteers will check belongings of guests for single use plastic materials. Each material will be marked with a sticker and charged a fixed rate (Eg. 10 INR per item). The amount collected is refunded by the volunteers while returning back from the venue, if they still carry the plastic products with the stickers. Dustbins to be provided near check points if guests need to dump any plastic waste. This ensures that single use plastic is not littered by guests at the venue and is carried back by them out of the venue
Temple events	Food, water and beverages to be distributed to devotees by voluntary organisations in reusable cutleries only
	Reusable plates, Areca palm plates and wax coated paper plates to be distributed rather than plastic products
	Temple trusts and festival organisation committees to support volunteer organisations in supplying steel plates and glasses in control of GHMC
	Allow usage of cloth banners only
Festivals & Celebrations	
Holi	Plastic packaging (single use plastic covers and tins) of colors to be banned
	Natural colors to be used
	Packaging of colors in paper bags to be used
	No Use of plastic in bon fire
Ganesh Chaturthi	Eco friendly décor to be used
	Encourage clay idols
	Plastic packaging or wrappers to be stopped
	Provide water kiosks instead of free water bottles
	Eco friendly cutlery should be used during the distribution of prasad
	Devotees should not be bringing plastic bags and the pooja thalis should not use plastic packaging
Dussehra	No making of <i>Ravan</i> using plastic materials
	Eco friendly cutlery should be used during the distribution of prasad during Durga pooja
	Eco friendly décor to be used
Durga Puja	Durga idols not to be immersed in Hussain sagar lake or any lakes
	Artificial ponds to be made in city and idols to be directed for immersion in those only
	Promote creation of Durga idols made of natural materials
	Make screens in major lakes during festive season to prevent people from throwing small idols and pooja items into the water body

Diwali	The crackers should be wrapped/packed in paper/cardboard boxes instead of plastic packaging. To be ensured by vigilance department of GHMC
Ramzan & Bakra Eid	Green Iftar by mosques and voluntary organisations to be implemented and follow green protocol guidelines for mass gatherings
Religious processions and rallies	Use of natural flowers and color paper to decorate vehicles, plots and pandals
	Ban on plastic decorations including plastic flags, ribbons etc
	No supply of refreshments by volunteer groups in plastic cups and bottles. Steel cups to be used
	Cloth banners to be used instead of plastic banners
Wedding celebrations	GHMC to encourage 'Green wedding concept'
	Do not use plastic decorations and banners
	Do not use disposable cutlery
	Awareness drive to be conducted with GHMC with support of event organising groups and venue owners
	Green theme option to be provided by event organisers and venue owners
	Penalties for non-cooperation
	Green marriages can be informed to GHMC in advance and upon verification will be awarded certificate and gift by GHMC during the marriage

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