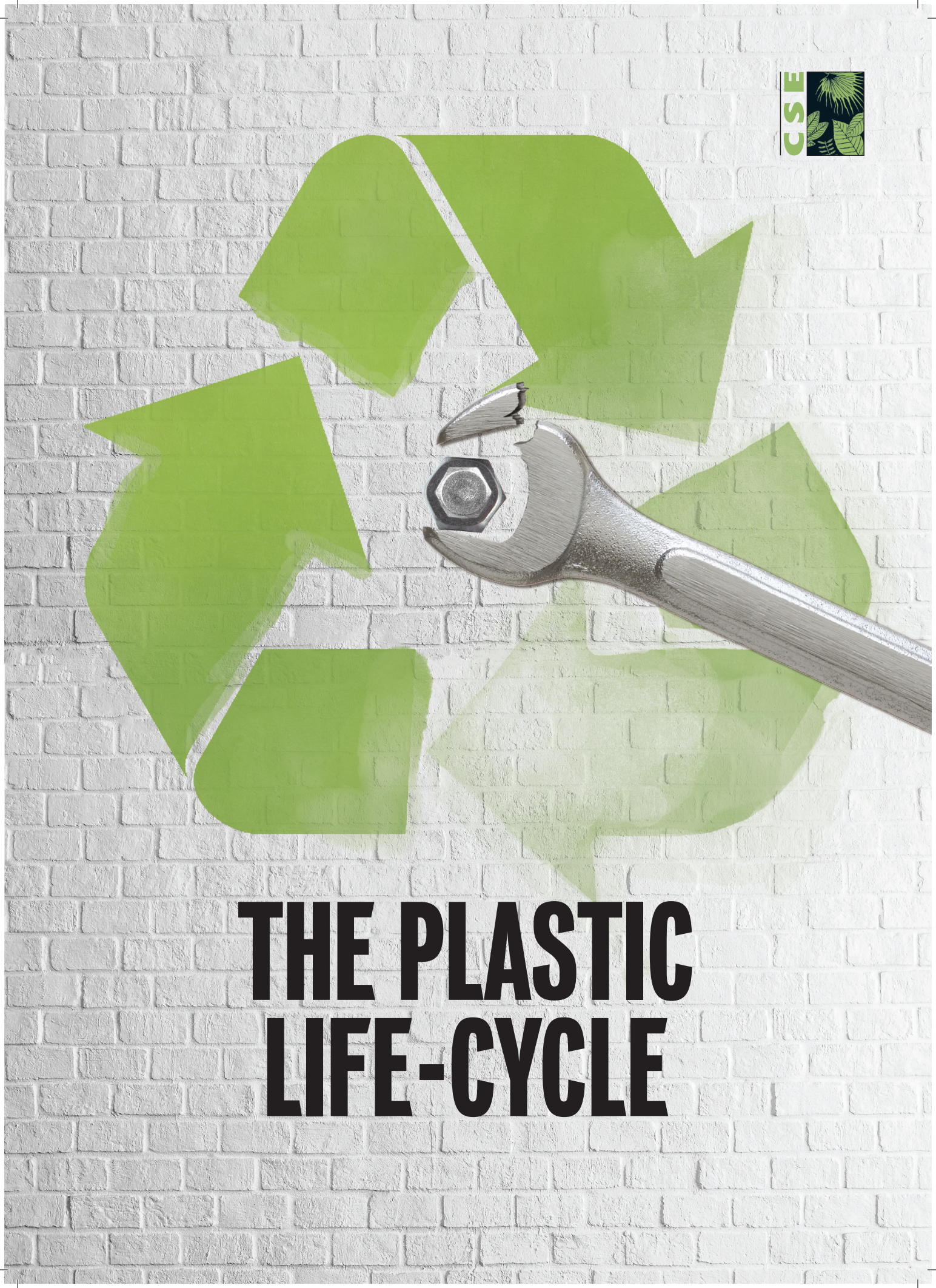

THE PLASTIC LIFE-CYCLE

THE PLASTIC LIFE-CYCLE

Research direction: Atin Biswas

Author: Siddharth Ghanshyam Singh

Research support: Minakshi Solanki

Editor: Souparno Banerjee

Design and cover: Ajit Bajaj

Layout: Kirpal Singh

Graphics: Sanjit Kumar

Production: Rakesh Shrivastava and Gundhar Das

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41, Tughlakabad Institutional Area
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Phones: 91-11-40616000
Fax: 91-11-29955879
Website: www.cseindia.org

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1. Introduction

Plastic is ubiquitous and omnipresent in our world. Plastic pollution is one of the greatest threats our planet faces today – despite a recognition and appreciation of this fact globally, plastic use continues unabated and in fact, might be growing. What is of concern is that plastic is now being increasingly found in every compartment of the environment.

We are given to understand that the problem of plastic is a waste management issue and not a material production issue because we can recycle it, burn and bury it, or ship it to other countries where it can be handled. But it is not that simple. Experts believe we have crossed the last frontier on plastic with our current production and consumption patterns.

A recent study by the Stockholm Resilience Centre states that global production of plastic increased by 79 per cent within a decade and a half (between 2000 and 2015).[1] The same study also says that the total mass of plastics on our planet is now twice the mass of all living mammals. Roughly 80 per cent of all the plastics ever produced continues to remain in the environment.

Another research paper published in *Nature Climate Change* says "plastic production has quadrupled over the last four decades and if this trend were to continue, the greenhouse gas (GHG) emissions from plastics alone would reach 15 per cent of the global carbon budget by 2050". If the plastic industry were a country, it would be the fifth largest greenhouse gas emitter on Earth.[2]

About this report

The landscape of the plastic industry in India (or any country) begins with the extraction of fossil fuel (oil, gas and coal), followed by refining these fuels to make intermediate chemicals. These intermediate chemicals are further refined and processed into different forms of plastic (polymers). The polymers are then sold by petrochemical companies to producers who work with end users like brand owners to design the type of the plastic, keeping in mind the desired properties that the brand needs, on the basis of their application.

Following this, the plastic reaches our homes as a plastic product through the complex logistics system; more often than not, it comes to us as packaging

material for products. This plastic leaves cities and human settlements as plastic waste and ends up in the municipal solid waste stream. Of this, whatever has value is collected by the informal sector and diverted to formal and informal recycling facilities through a series of aggregators to be given a second life (recycled). A lot of what remains – mostly what is non-recyclable – is channelised for burning, or dumping.

Despite an estimated informal workforce of over 2.2 million[3] in India, at least 25,940 tonne[4] of plastic waste eventually finds its way every day to the country's 3,159[5] dumpsites. Once dumped, and mixed with other forms of solid waste, more of the tax-payers' money is spent on bio-mining and recovering the plastic waste from the mountains of garbage and transporting it a few hundred kilometres away from the dumpsite to be co-incinerated (burnt) in specialised facilities.

This report is an effort to understand the plastic life-cycle and the plastic pollution challenge from the perspective of the different stakeholders who are integral to the landscape – from extraction of fossil fuels to end-of-life approaches such as co-incineration. The following stakeholders have been considered in the report:

- Petroleum, petrochemical and plastic industry
- Biodegradable and compostable plastic industry
- Producers and brand owners
- Retailers and consumers
- Informal sector, recyclers and aggregators
- Formal sector recyclers
- End-of-life solution providers

2. The petroleum, petrochemical and plastic industry

The petrochemical industry's role is usually overlooked when we talk about plastic pollution in the environment. Almost all the plastic that we consume in our daily lives is derived from the petroleum and petrochemical industry – with zero accountability: 99 per cent of the plastics we use today are sourced from chemicals that come from fossil fuels.[6]

Petrochemicals and plastics: The invisible link

The petroleum industry is the feeding source for the petrochemical sector, where polymers (plastic) are manufactured. This means that plastic is a petrochemical made from fossil fuels.

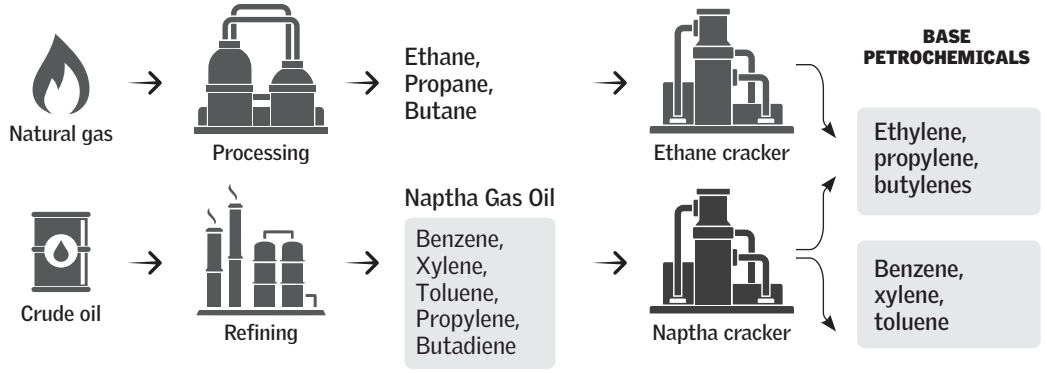
In 2020-21, over 84 per cent of India's petroleum (crude oil) demand was met through imports.[7] This crude oil is refined to get naphtha, which is then subjected to a process of 'cracking' to get building blocks (monomers like ethylene, propylene, styrene etc). These building blocks are processed with intermediate chemicals to make the basic petrochemical, which is then converted into the final product – this final product can range from plastics to detergents to chemical fertilisers.

A similar process is adopted when we manufacture basic petrochemicals using natural gas as the energy source (*see Figure 1: How building blocks are made from fossil fuels*).

Major petrochemical manufacturers in India

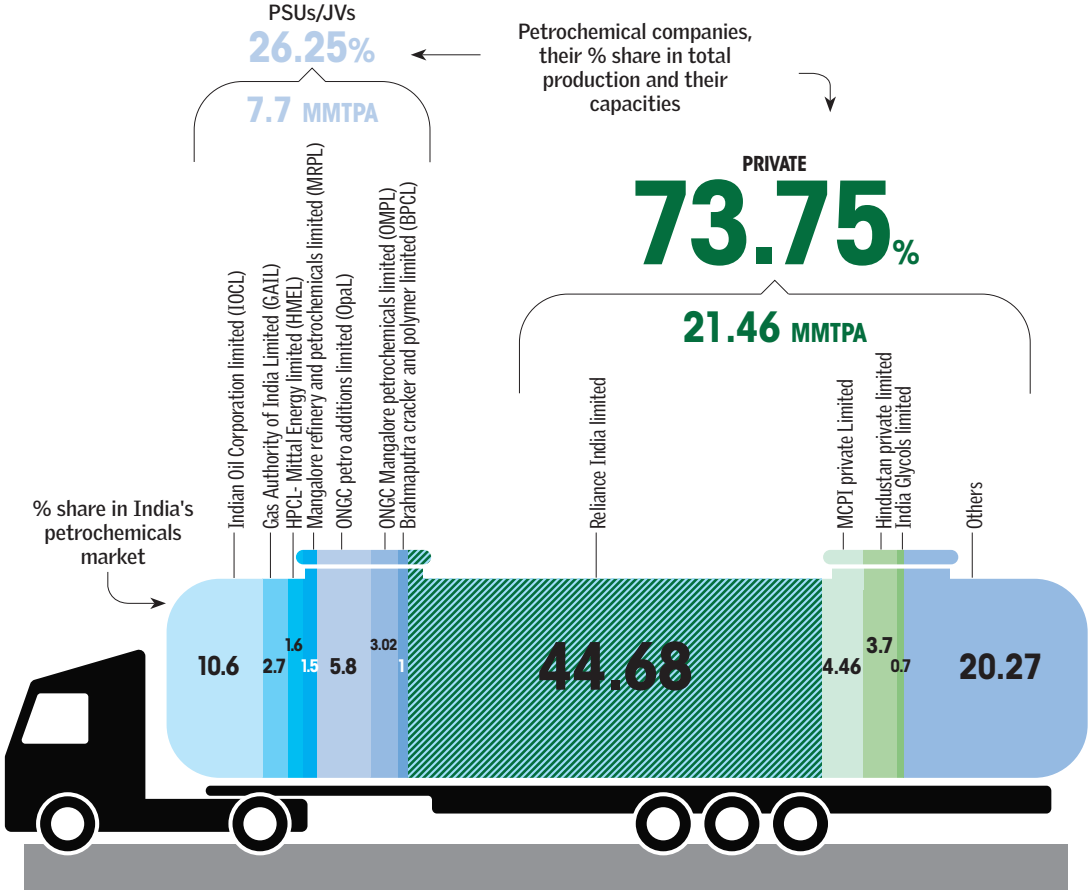
India's cumulative production capacity for petrochemicals is 29.10 million metric tonne per annum (MMTPA). There are seven public sector undertakings (PSUs) or joint ventures (JVs) and five private players in India who qualify as petrochemical manufacturers (*see Figure 2: Companies involved in petrochemical production*). It is noteworthy that the private players have almost thrice the capacity compared to the PSUs and JVs.

Figure 1: From fossil fuels to building blocks of plastic



Source: https://empower.afpm.org/products/what-are-petrochemicals, as viewed on June 5, 2022

Figure 2: Companies involved in petrochemical production



Source: 2021, 16th Standing Committee Report on Chemicals and Fertilizers, Union Ministry of Chemicals and Fertilizers, Government of India

The 29.10 MMTPA of total petrochemicals produced (*see Figure 2*) can be broken up into five key groups: synthetic fibres (polyester, nylon), polymers (plastics), elastomers (synthetic rubber), synthetic detergent intermediates and performance plastics. Apart from these, there are also some intermediates and other petro-based chemicals that are derived from petroleum.

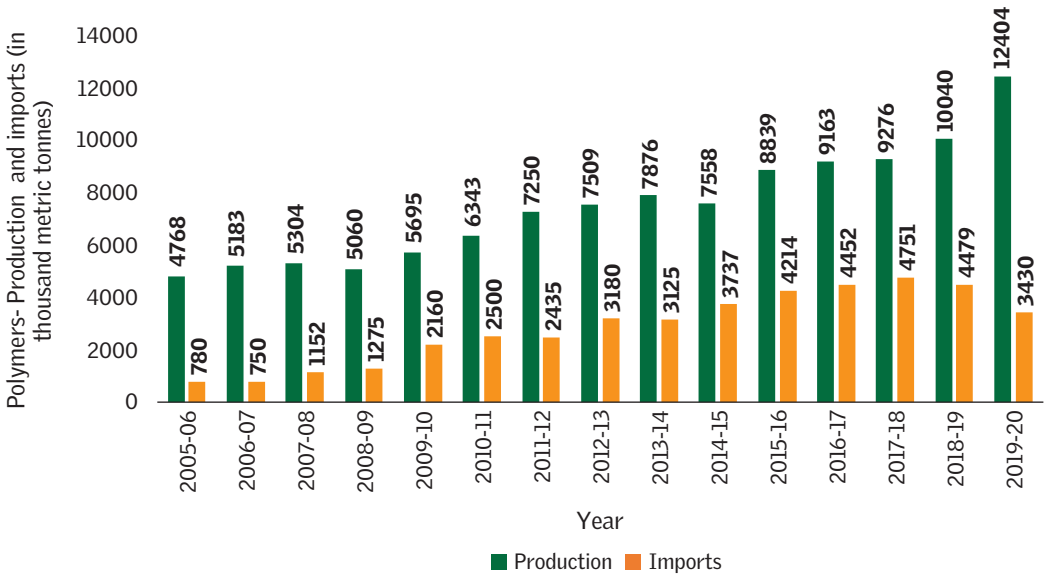
In 2020-21, of the 17.93 MMTPA, 12.14 million[8] metric tonne was used to manufacture polymers (plastic). This means that plastics accounted for more than 67 per cent of the total petrochemicals produced. The production of polymers has been constantly increasing over the last decade and a half (*see Graph 1: Production and import of polymers from 2005 to 2019*) – production in India has gone up by 2.6 times, while the import of polymers has witnessed a four-fold rise between 2005 and 2020.

Consumption of polymers has been a higher compared to production over the last decade and a half (*see Graphs 2-6: Production and consumption of specific polymers*). This can be explained by the fact that a lot of plastic and its products are imported in the form of pellets, which are then turned into usable products and sold to consumers.

The production of polystyrene (PS) has decreased by 6 per cent over the last 15 years, while its consumption has gone up by 45 per cent. Linear low density polyethylene (LLDPE) has recorded the highest increase in production percentage at 334.5 per cent, while the highest increase in consumption has been recorded by polypropylene (PP) at 276 per cent (*see Table 1: Increase in production and consumption of polymers*). The average increase in polymer production between 2005-06 and 2019-20 has been recorded at 160 per cent – shows an analysis by CSE – while the average increase in polymer consumption in the same period has been recorded at 196 per cent.[9]

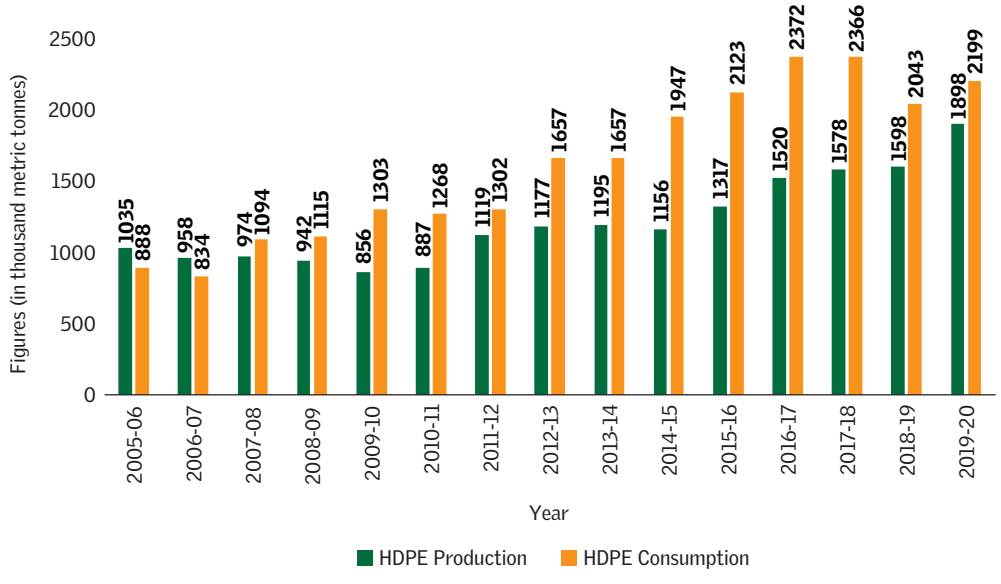
CSE researchers could not find data on polyethylene terephthalate (PET) in the specific polymers, because unlike what the name suggests, PET does not contain polyethylene. The majority of the world's PET production (60 per cent) is meant for synthetic fibres. According to the Chemicals and Petrochemicals Manufacturers Association of India, bottle production from PET accounts for 30 per cent of the global demand.[10]

Graph 1: India: Production and import of polymers from 2005 to 2019



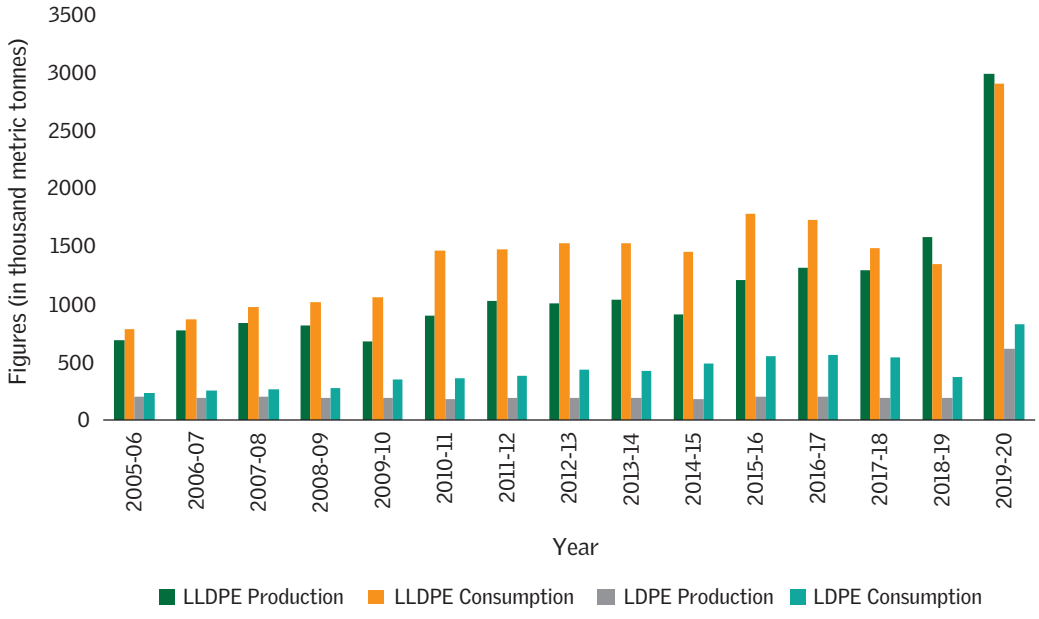
Source: Compiled by CSE from Statistics at a glance, 2013-2019, Department of Chemicals and Petrochemicals (DCPC)

Graph 2: Production and consumption profile of high density polyethylene (HDPE)



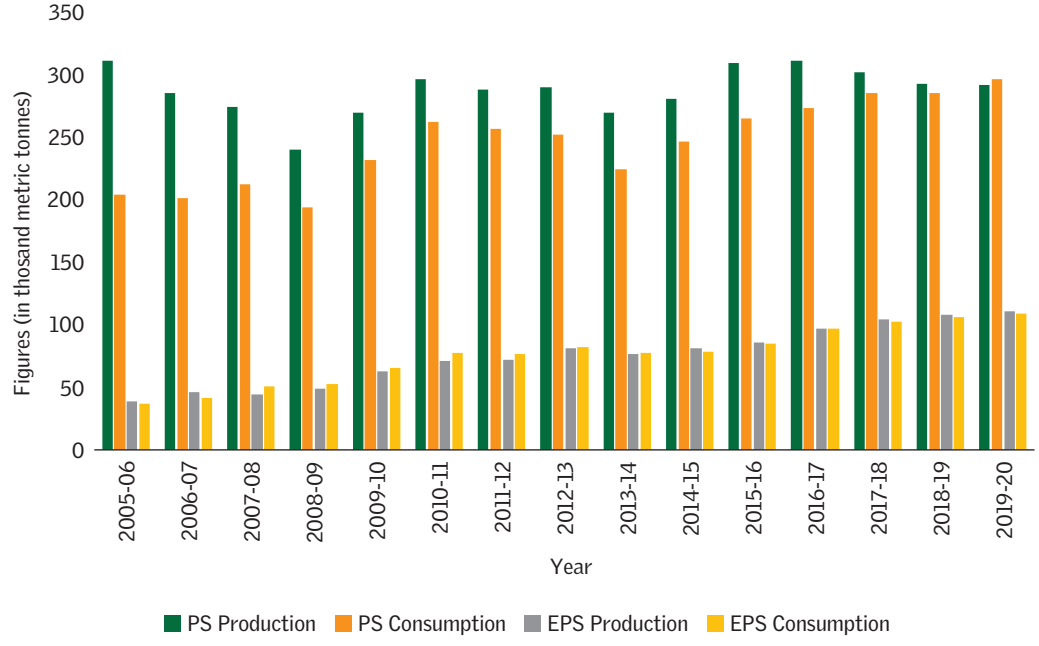
Source: Compiled by CSE from Statistics at a Glance, 2013-2019, Department of Chemicals and Petrochemicals (DCPC)

Graph 3: Production and consumption profile of linear low density polyethylene (LLDPE) and low density polyethylene (LDPE)



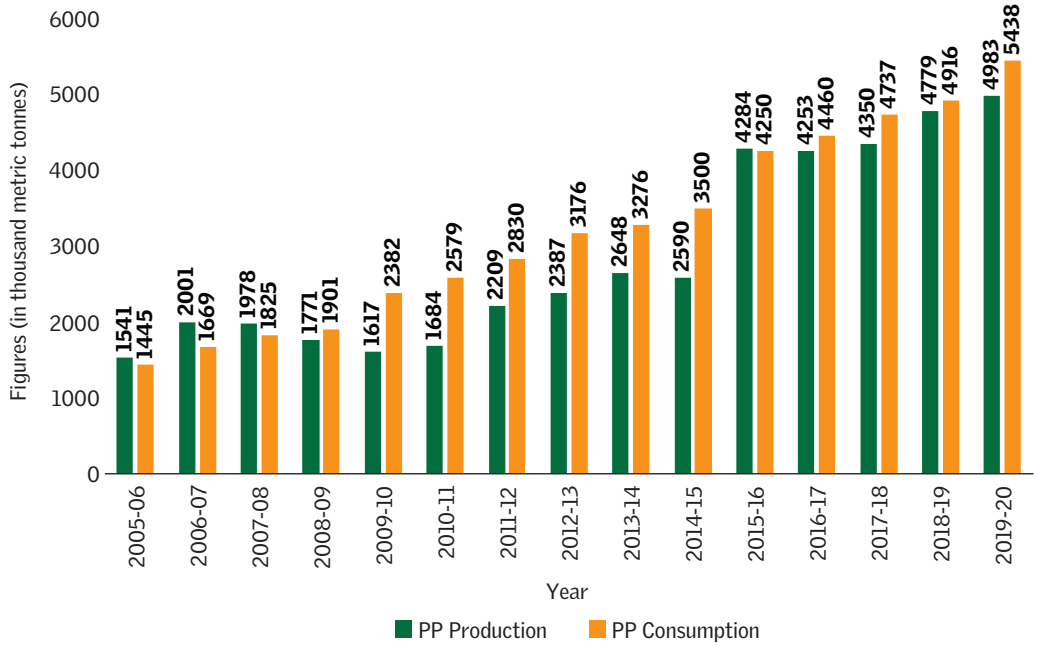
Source: Compiled by CSE from Statistics at a Glance, 2013-2019, Department of Chemicals and Petrochemicals (DCPC)

Graph 4: Production and consumption profile of polystyrene (PS) and extended polystyrene (EPS)



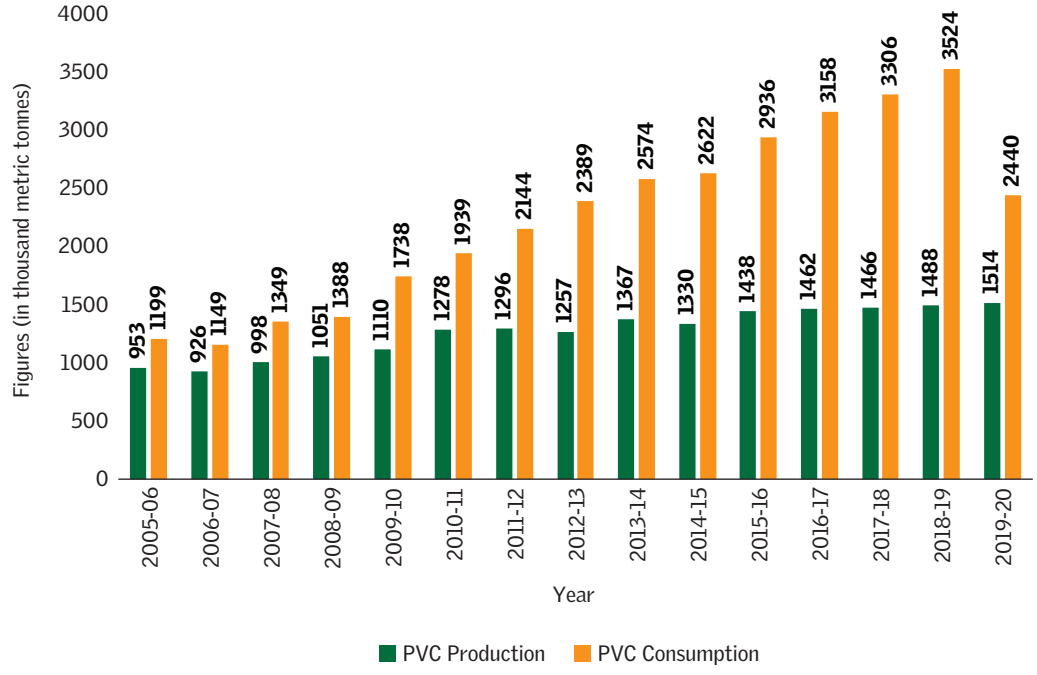
Source: Compiled by CSE from Statistics at a Glance, 2013-2019, Department of Chemicals and Petrochemicals (DCPC)

Graph 5: Production and consumption profile of polypropylene (PP)



Source: Compiled by CSE from Statistics at a Glance, 2013-2019, Department of Chemicals and Petrochemicals (DCPC)

Graph 6: Production and consumption profile of polyvinyl chloride (PVC)



Source: Compiled by CSE from Statistics at a Glance, 2013-2019, Department of Chemicals and Petrochemicals (DCPC)

Table 1: Increase in production and consumption of polymers

Polymer type	Increase recorded between fiscal year 2005-06 (base year) and 2019-20	
	Increase in production (%)	Increase in consumption (%)
LLDPE	334.54	268.35
HDPE	83.38	147.64
LDPE	204.98	256.03
PS	-6.11	45.10
PP	223.36	276.33
PVC	58.87	103.50
EPS	184.62	194.59

Source: 2022, analysis done by CSE

How do polymers reach the plastic industry?

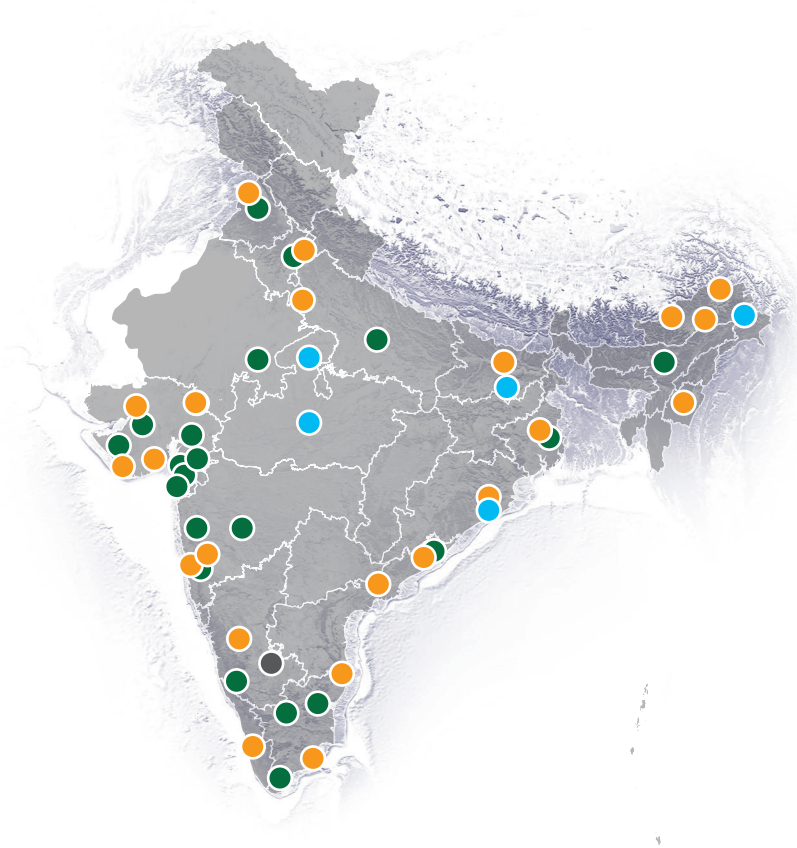
The petrochemical industry (polymer manufacturers) sells plastics in the form of pellets to the plastic industry (plastic product manufacturers). The plastic industry, which mostly comprises of micro, small, and medium enterprises (MSMEs), processes the pellets to convert them into plastic products, which are then sold to multinational conglomerates and local companies. According to a report – *Making plastics in India: Trends in the industry* – by the New Delhi-based Centre for Financial Accountability: "The structure of the Indian plastics industry includes 15 polymer manufacturers and 200 equipment manufacturers dominating production, while the plastic processing sector comprises of 30,000 units."[11]

The Government of India is promoting a 'cluster approach' for developing plastic parks across the country – a total of 10 such parks have been proposed. However, no plastic park was fully functional yet at the time of writing this report. The plastic industry is apprehensive about some of the drawbacks associated with this approach – such as non-strategic locations of the proposed plastic parks; inflated cost of transportation; and a possibility of raw material flow disruption.

The other approach has been the introduction in 2007 of the Petroleum, Chemicals and Petrochemical Investment Region (PCPIR). This was revised in 2020 for the period of 2020-35. The PCPIR is equipped with an anchor tenant who ensures the availability of raw materials by importing the crude oil, refining it and passing on the processed building blocks for further processing. The final product in the form of pellets is transported to the plastic industry.

In the plastic industry, these pellets are melted, moulded and remoulded into a variety of plastic objects for end use. The plastic industry benefits from the proximity and availability of the raw materials, which results in decreased transportation cost and an assured flow of raw material (*see Map 1:* Petrochemical companies, plastic industry and proposed plastic parks in India).

Map 1: Petrochemical companies, plastic industry and proposed plastic parks in India



Plastic industries
Bhatinda
Panipat
Pata
Kota
Lapetkata
HAldia
Jamnagar
Hazira
Sarigam
Dahej
Vadodara
Bharuch
Pune

Nagothane
Ratnagiri
Vishakapatnam
Mangaluru
Mettur
Cuddalore
Sahupuram

Refineries
Bhatinda
Panipat
Mathura
Vadinar
Jamnagar

Koyali
Mumbai
Mangaluru
Kochi
Narimanam
Cuddalore
Chennai
Tatipaka
Vishakapatnam
Paradeep
Haldia
Barauni
Bongaigaon
Guwahati

Numaligarh
Digboi

Plastic parks
Tamot
Billaua
Tinsukia
Siju village
Sarora
Thivallur
Sitarganj
Paradeep

Source: 2022, based on analysis done by CSE

The way ahead

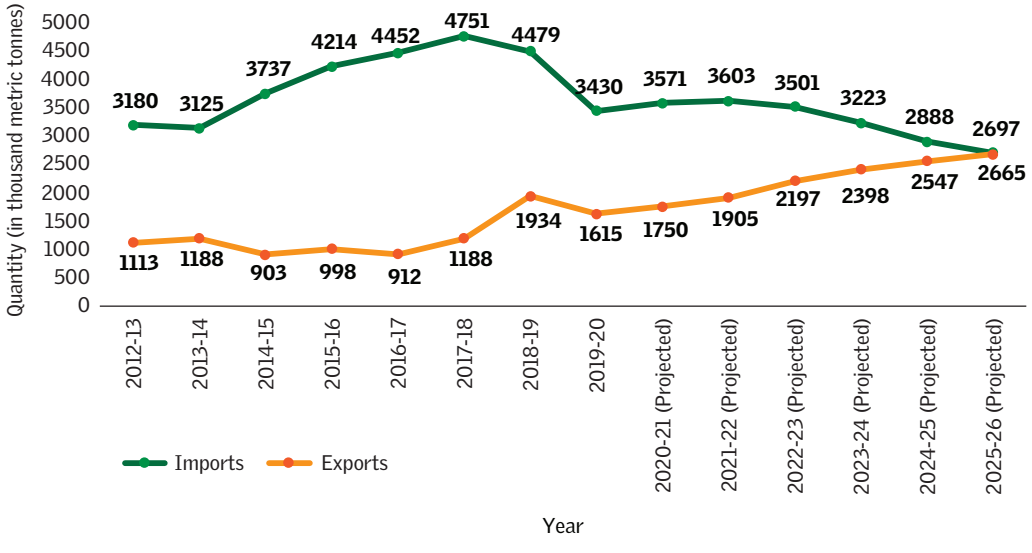
With the impetus to renewable energy in a world where climate change concerns are gaining more momentum, one might be forced to think that there is a lower demand for crude oil. Unfortunately, that is not the case. Crude oil production is set to witness an increase – not to produce fossil fuels, but to manufacture more polymers.

The United Nations Environment Assembly (UNEA) gave a go-ahead in March 2022 for a global instrument on plastic pollution with an open mandate, one that is legally binding and covers the entire life cycle of plastic – from extraction to end-of-life disposal. However, India has retained its bargaining power under the future instrument by inserting language on 'common but differentiated responsibility (CBDR)', borrowing its position from climate negotiations.

This implies that India will reserve the right to decide a timeline for reducing its petrochemical and plastic footprints: until then, the focus will continue to be on downstream issues related to collection, management, diversion and disposal of plastic waste – and not on addressing the problem at source.

This also hints at India's plan to position itself as a major exporter of basic petrochemicals, especially for polymers. The plan is to cut down on imports of finished plastic products, while increasing exports by over 100 per cent (*see Graph 7: Imports and exports of polymers in India – actual and projected*)

Graph 7: Imports and exports of polymers in India – actual and projected



Source: Statistics at a glance, 2013-2019, Department of Chemicals and Petrochemicals (DCPC)

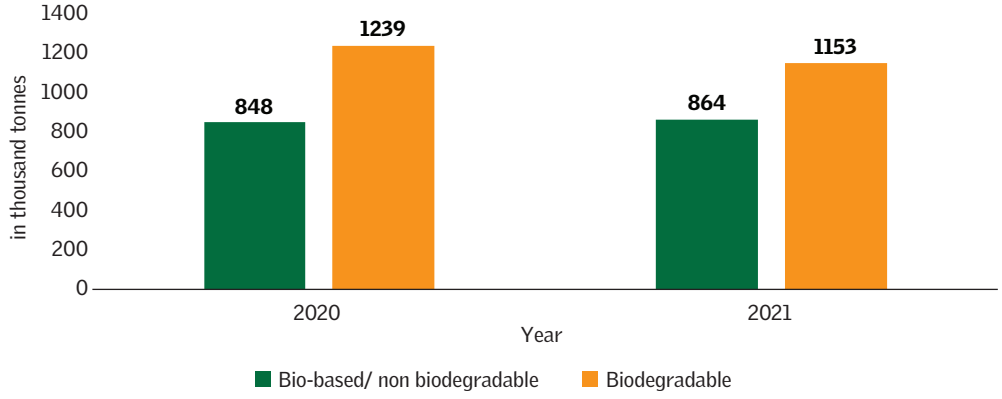
3. The Biodegradable and Compostable Plastic Industry in India

Less than 1 per cent of the plastics produced globally comes from bio-based sources. Bio-based plastics are fully or partially made from biological resources, rather than just fossil raw materials. They are not necessarily compostable or biodegradable.

Ideally, plastics should be labelled as compostable or biodegradable depending on their ability to disintegrate into simpler molecules without having an adverse effect on the environment (*see Box: What are bio-based, compostable and biodegradable plastics?*). Unfortunately, there is a deliberate confusion created among consumers about the nature, sustainability and environmental impacts of different kinds of plastics. The umbrella term "bioplastic" can be misleading, as it is often used to describe materials that have different properties, thus combining the terms bio-based, biodegradable and compostable.

The global production capacity for bioplastics reached 2.08 million tonne (MMT) in 2020, of which 40 per cent (approximately 0.84 MMT) is non-biodegradable[12] (see *Graph 8: Global production of bioplastics*). The global biodegradable plastic market is dominated by three different groups of polymers: polyesters (fossil-sourced and non-biodegradable), poly-lactic acid (bio-based), and starch blends (bio-based). These polymers hold 27 per cent, 24 per cent, and 42 per cent of the market, respectively.[13]

Graph 8: Global production of bioplastics



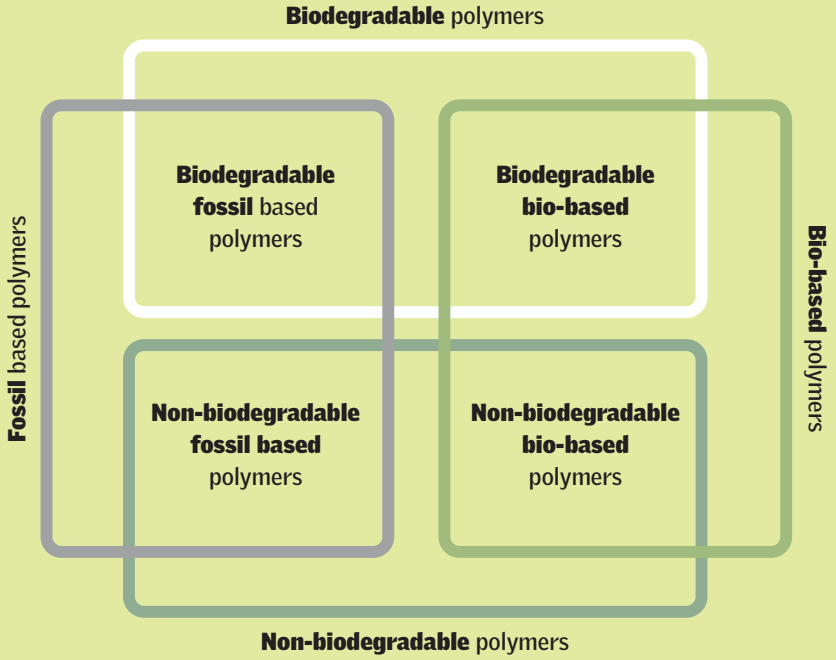
WHAT ARE BIO-BASED, BIODEGRADABLE AND COMPOSTABLE PLASTICS?

- Bio-based plastics are made fully or partially from biological resources, and may not necessarily be biodegradable.
- Biodegradable plastics degenerate and degrade in certain conditions only (for example, in soil or in marine environment).
- Compostable plastics are a subset of biodegradable plastics that only biodegrade in perfectly controlled conditions – for instance, in industrial composting facilities with temperatures above 60°C and humidity of over 20 per cent.

This means that every compostable plastic is biodegradable, but every biodegradable plastic is not compostable.

There are examples of biodegradable plastics being manufactured using fossil resources, as also non-biodegradable plastics being sourced from a bio-based source (*see Figure: Inter-relations between biodegradable plastics, their sources and biodegradability*).

Figure: Inter-relations between biodegradable plastics, their sources and biodegradability



Source: 2020, Biodegradability of Plastics in the Open Environment, European Commission

It is worth noting that the global non-biodegradable plastic share has increased by close to 2 per cent in a span of one year, whereas the global share of biodegradable plastic has declined by 7 per cent over the same period.

Biodegradable and compostable plastics in India

The Union Ministry of Environment, Forest and Climate Change is looking at compostable and biodegradable plastics as an alternative to single-use plastic and other conventional plastics. As a result, the bioplastic segment appears to be growing at a rapid pace in India: there is an increasing trend of claims that a plastic material is 'bio-based', 'compostable', or 'biodegradable' in nature.

A 2009 Central Pollution Control Board (CPCB) report had estimated the production of biodegradable plastics in the country in 2007-08 to be 98,000 tonne.[14] As per a website update in December 2021, 167 manufacturers/sellers of 'compostable' plastic have been authorised by the CPCB, and another 31 manufacturers' and sellers' applications are pending or are in process[15]. The CPCB's *2019-20 Plastic Waste Annual Report* says that there are 47 manufacturers of compostable plastic in India, as per data received from states and Union territories. However, the cumulative production capacity of compostable plastics in India has not been shared by the Board.

In the case of biodegradable and compostable plastics, what is of prime importance is the method and scale of confirming biodegradability and compostability; the medium in which the plastic will start disintegrating into simpler molecules like carbon dioxide and water molecules; and the time taken to fully disintegrate or decompose. Schedule I of the Plastic Waste Management (PWM) Rules, 2016 has listed nine Indian and international standards that can help determine the biodegradability and compost-ability of a plastic (see *Table 2: Standards and*

EPR: A NO-SHOW FOR BIODEGRADABLE PLASTICS

The extended producer responsibility (EPR) notification issued by the Union Ministry of Environment, Forest and Climate Change in 2022 has left out biodegradable plastics from the EPR mandate – which means producers and brand owners placing their products on the market in biodegradable packaging will not have any collection and recycling obligations.

Compostable plastics, which had also been left out of the EPR's scope, have now been included following intervention and advice from CSE and other civil society organisations, which have emphasised on why compostable plastics need to get collected and channelised into 'industrial composting' facilities. There are now collection, and recycling targets under EPR for compostable plastics, starting from the fiscal years 2021-22, and 2024-25, respectively.

protocols prescribed for compostable plastics in PWM Rules, 2016). The latest standard – ISO:17088:2021 – has not yet been added to Schedule I despite three amendments made to the Rules in 2021 and 2022.

Evidently, the biodegradable and compostable plastic market in the country and the world is at a nascent stage. There is an urgent need to demystify the concept of 'biodegradable' and 'compostable' plastics. Currently, 83 per cent of the compostable plastic used for packaging is industrially compostable[16] – however, this is not mentioned explicitly on the packaging, leaving room for assumptions around the scale, medium or the time taken for composting.

In fact, ISO standard ISO:17088: 2021 explicitly mentions that to eliminate the risk of misunderstanding by consumers, compostable plastic manufacturers should explicitly issue a warning stating "not suitable for composting in small installations by householders" or "not suitable for home composting". This labelling mechanism has not been adopted by Indian compostable plastic manufacturers.

Table 2: Standards and protocols prescribed for compostable plastics in the PWM Rules, 2016

Standard (IS/ISO)	What the standard determines?	Which medium/ conditions is the standard prescribed for?	Method
IS/ISO 14851:1991	Ultimate aerobic biodegradability of plastic materials	Aqueous medium	Measuring oxygen demand in a closed respirometer
IS/ISO 14852:1999	Ultimate aerobic biodegradability of plastic materials	Aqueous medium	Analysis of evolved carbon dioxide
IS/ISO 14853:2005	Ultimate anaerobic biodegradation of plastic materials	Aqueous system	Measurement of biogas production
IS/ISO 14855-1:2005	Ultimate aerobic biodegradability of plastic materials	Controlled composting conditions	Analysis of evolved carbon dioxide
IS/ISO 14855-2:2007	Ultimate aerobic biodegradability of plastic materials	Controlled composting conditions	Analysis of evolved carbon dioxide (lab-scale test)
IS/ISO 15985: 2004-Plastics	Ultimate anaerobic biodegradation and disintegration	High solids anaerobic digestion conditions	Analysis of released biogas
IS/ISO 16929: 2002-Plastics	Degree of disintegration of plastic materials	Defined composting conditions	Method not mentioned (pilot-scale test)
IS/ISO 17556: 2003-Plastics	Ultimate aerobic biodegradability	Soil	Measuring oxygen demand in the respirometer or the amount of carbon dioxide evolved
IS/ISO 20200:2004-Plastics	Degree of disintegration of plastic materials	Simulated composting conditions	Not mentioned (lab-scale test)

Source: Schedule I, Plastic Waste Management Rules, 2016

SIDDHARTH G SINGH

Compostable plastic packaging used by Indian e-commerce platforms

Offering solutions or creating more problems?

A closer look indicates that this segment of plastics – instead of offering a holistic solution to the problem of plastic pollution – might give rise to a new set of irritants. To begin with, compostable plastics have been reported to contaminate the conventional plastic recycling stream. This renders the entire batch of conventional plastic, which could be recycled, useless. During their visits to conventional plastic recycling facilities, the CSE research team was told that operators had been forced to throw away several batches due to contamination from compostable or other kinds of bio-based, non-conventional plastics.

Similar concerns have been observed at material composting facilities (MCCs) where the time taken for compostable plastic to degrade has been found to be much higher than the six- twelve week period required for organic waste to degrade. This eventually increases costs due to additional human-hours, time and unit operations. According to a waste management agency in Mumbai, most of the compostable plastic has been found to emerge from the compost pile without any degradation even after a period of 30 weeks.

In a country where the basic solid waste management mechanism is weak and there is little segregation of waste into the wet and dry streams, introducing compostable and biodegradable plastics in the conventional plastic waste stream means an additional stream of waste that needs to be segregated and channelised separately. This increases the burden on the consumer, waste collector and the existing transportation system.

What also needs to be taken into consideration is the fact that compostable or biodegradable plastic is heavily modified by addition of numerous additives. This is done for the plastic to have properties such as strength etc. This means that channelising compostable plastic for composting with other food waste may affect the quality of the compost generated due to the chemical additives, thus influencing the soil fertility and yield.

RECYCLE TRACK SYSTEMS

Industrial composting facility

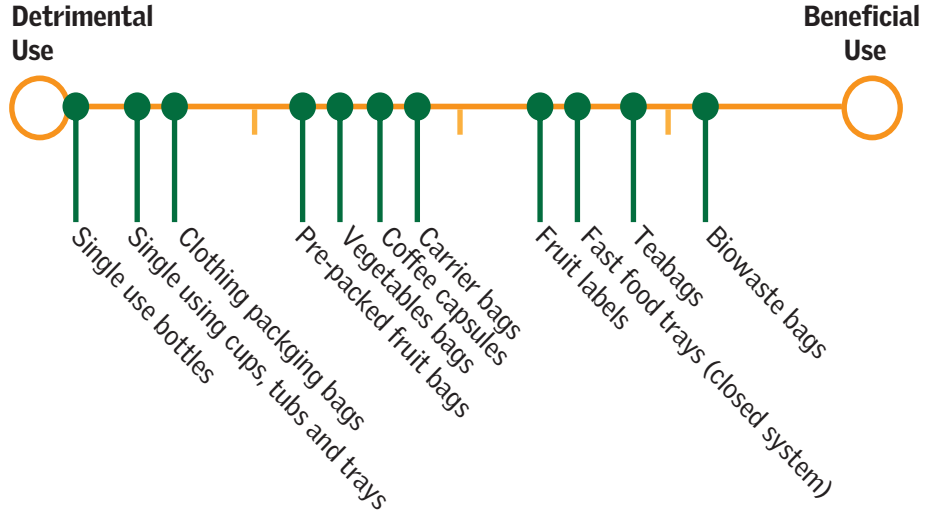
According to a 2020 report by Greenpeace on *Biodegradable plastics: Breaking down the facts*: "Consumers generally do not know the difference between the terminologies used to promote alternative plastic, thus creating confusion and increased littering. On the other hand, the corporates involved in production of such plastics exaggerate their benefits and provide limited information on how the products should be disposed of after use."

The way ahead

Notwithstanding the opportunities that the alternative plastic market seems to offer, it is a path that should be tread carefully. The European Commission has been deliberating on the issue of using bio-based, biodegradable and compostable plastics since December 2019; only in March 2022 did it begin the process of conducting intensive public consultations through surveys and in-person and online meetings for developing a policy framework on the subject. India, on the other hand, has allowed the use of biodegradable and compostable plastic without a strong regulatory, monitoring or evaluation mechanism.

Since biodegradable plastics have been left out of the EPR regime, the decision to adopt them should be supported with standards for 'open environment' degradation, which ensures that the plastic disintegrates into simpler molecules in ambient environment. It should be obligatory to 'NOT' consider biodegradable and compostable plastic as a solution for inadequate and inappropriate waste management practices. The use of compostable plastic should be limited – or

Figure 3: Compostable plastics – beneficial and detrimental uses



Source: Relevance of Biodegradable and compostable consumer plastic products and packaging in a circular economy, Eunomia, 2020

even better – mandated for specific applications only where the probability of conventional plastic recycling is negligible or low (*see Figure 3: Compostable plastic – beneficial and detrimental uses*). Also, it must be ensured that the compostable plastic does not affect the final quality and the cost of the resulting compost, and does not exert a negative impact on the soil eco-system.

To conclude, prevention, regulation and reduction of problematic/non-recyclable plastics should be the first priority. This should be followed by manufacturing only those plastics that can be collected and recycled cheaply and at scale. The biodegradable and compostable market has immense potential; but a lot more research needs to be done before ramping up production and distribution, more so due to the unregulated policy mechanism for use of alternative forms of plastics.

4. Producers, Importers and Brand Owners (PIBOs)

The plastics value chain begins from the petroleum refineries (*see Figure 4: The plastics value chain – production to disposal*). The polymer is procured by producers who are typically referred to as 'convertors' by the industry: they are by far the most complex ecosystem in the entire value chain.

Convertors are dominated by micro, small and medium enterprises (MSMEs). For instance, if a brand owner needs a multi-layered plastic packaging (MLP), multiple convertors come together to manufacture a single MLP which is basically a sandwich of different kinds of plastics – in such a scenario, there would be three different convertors, each making a different type of plastic film. A fourth convertor will have the job of merging all the different films of plastic and/or non-plastic together. Yet another convertor would be dealing with the printing and aesthetics of the MLP.

Usually, brand owners buy ready-to-package plastic from producers/convertors. However, in some cases, the brand owner itself would be the producer of the plastic packaging. In such situations, the brand owner buys polymers directly from petrochemical companies and manufactures its own plastic packaging, by-passing the producer/convertor stage of the value chain. This model is common among the giant dairy brands in the country, as they put out a high quantum of plastic packaging in the market every day. Sometimes, while the bulk of plastic packaging is produced by the brand owners themselves, some of it is also outsourced for ancillary products.

The Plastic Waste Management Rules, 2016 and the Extended Producer Responsibility (EPR) Amendment, 2022 have divided the 'polluters' into three different categories – importers, producers and brand owners. Each of these categories has now been assigned a collection, recycling and use of recycled content in their plastic packaging through the EPR mechanism.

The CPCB website has a list of producers and brand owners (last updated on June 15, 2021). The list contains 310 brand owners and four producers.[17] It does not mention any importers that are registered with the CPCB (*see Table 3: List of producers and brand owners and their registration status as on June 15, 2021*).

Table 3: List of producers and brand owners and their registration status, as on June 15, 2021

Type of polluter	Registration granted	Renewal application under process	Show cause notice issued
Brand owners	237	55	18
Producers	0	3	1
Importers	No information		

Source: Central Pollution Control Board

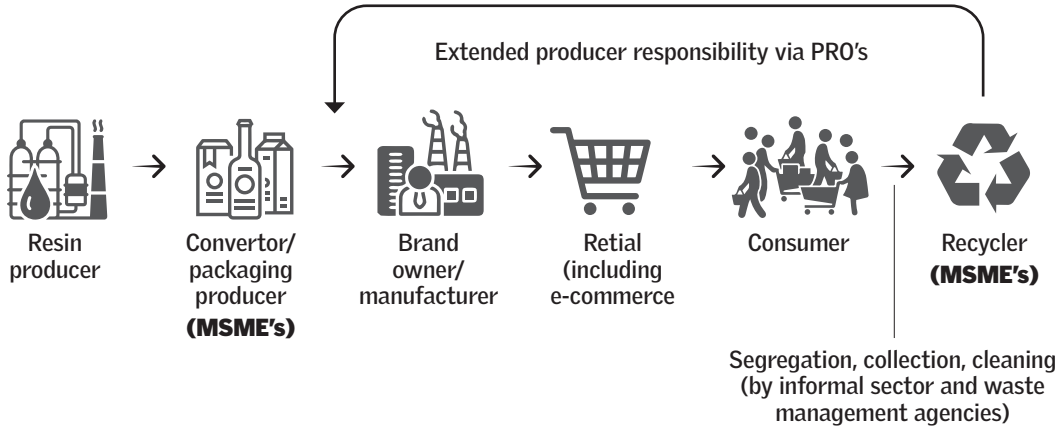
In March 2022, the centralised EPR portal for registration of PIBOs was activated. It was officially launched on April 5, 2022. As of September 2022, the numbers of brand owners, producers, and importers who have filed the application for registration under EPR stood at 869, 1157 and 1514, respectively. However, registration has been granted to 705 brand owners, 676 producers and 994 importers. Applications of 36 brand owners, 83 producers and 221 importers have been rejected by the CPCB, while the remaining are under consideration.[18]

Brand owners and their plastic footprints – India and the world

Most of the plastics that we see in the market is put there by brand owners. As per the Plastic Waste Management Rules, 2016, brands are supposed to disclose (to the CPCB) the amount of plastic that they put out on the market.

Some brands have voluntarily disclosed the amount of plastic that they have released in the market or collected back from the market (*see Table 4: Indian*

Figure 4: The plastic value chain – production to disposal



Source: India Plastics Pact, Confederation of Indian Industries-ITC-Centre of Excellence for Sustainable Development, 2022

Table 4: Indian brand owners that have disclosed their plastic footprints

Brand owner	Year	Plastic put out in the market (in tonne)
Hindustan Unilever*	2018	97000
	2019	96000
	2020	106000
ITC**	2020	35000
Dabur**	2021	22000

* https://www.hul.co.in/planet-and-society/waste-free-world/, as viewed in June 2022
** Based on press releases and verbal communication with company representatives

brands that have disclosed their plastic footprints). However, most brand owners do not disclose their plastic footprints due to fear of being singled out by conscious consumers, authorities and legislations.

India's plastic waste: The real picture

According to a 2019 report by Plastindia Foundation, a whopping 18.45 million metric tonne (MMT) of plastic was consumed in India in the year 2018-19; 59 per cent of this went into packaging.[19] This means that approximately 10.9 MMT of plastic was used just for packaging applications. This also means that of all the petrochemicals produced (29.1 MMT), more than 37 per cent was used to manufacture plastics for packaging applications *(see Figure 2)*. What is important to notice here is that most of the plastic used in the packaging sector is single-use.

According to a joint report – *Unwrapped: exposing India's top plastic producers* – by the global movement #breakfreefromplastic and the Pune-based body that works on reforming the informal sector, *Kagad Kach Patra Kashtakari Panchayat* (KKPKP), "Multi-layered plastics (which are non-recyclable at a commercial scale) made up 35 per cent of all plastic waste, and 40 per cent of all branded plastic waste[20] (*see Table 5: Brand audit results and the quantum of specific plastic types*). This indicates that nearly 3.8 MMT of multi-layered plastic packaging waste was generated in India. The report further states: "The reality is that the majority of multi-layered plastics that are collected under such extended producer responsibility and sustainability commitments today are sent to cement kilns for incineration, or to some form of waste-to-energy or pyrolysis plants, not for recycling."

Dalmia Polypro Industries Private Limited, a plastic recycler which has the highest recycling capacity in India – it is also the only Indian recycler on the New Plastics Economy (NPE) Initiative – has disclosed to NPE that it collected, sorted and

Table 5: Brand audit results and the quantum of specific plastic types

Plastic type	Percentage distribution of plastic type as per brand audit (%)	Computed quantity of plastic waste (million tonne per year)
Multi-layered packaging	35	3.815
PET	12	1.308
HDPE	7	0.763
LDPE	31	3.379
PP	14	1.526
PS	1	0.109

Source: 2020, Unwrapped: exposing India's top plastic producers, #breakfreefromplastic and Kagad Kach Patra Kashtakari Panchayat (KKPKP)

recycled 19,161 tonne of plastic waste. As per CSE's calculations, this accounts for 0.1 per cent of the plastic that was consumed in the Indian market in 2018-19.

Of the total plastic claimed to have been recycled, 40 per cent was recycled through mechanical recycling and 60 per cent through chemical recycling.[21] This highlights a very big pain point of the plastic recycling capacity and approach of the country, and also suggests that companies and recyclers are burning a major part of their plastic waste under the garb of recycling.

Plastic neutrality is a term catching up among Indian brand owners. For instance, Dabur, the consumer goods giant, declared itself plastic-neutral on February 14, 2022.[22] Plastic neutrality means that an entity will collect more or equal amount of plastics that it puts into the market – essentially, it would avoid adding more plastic waste into the environment. Another consumer goods company, Hindustan Unilever Limited (HUL), had announced that from 2021, it would collect and process more plastic packaging waste than the plastic in the packaging used by it.[23] However, plastic waste collection does not ensure recyclability. Moreover, plastic neutrality will only serve as a license to continue production of an unsustainable material.[24] Given the fact that 35 per cent of the plastic put out by brands are non-recyclable, ensuring collection of plastic waste alone does little to solve the plastic pollution problem. Promoting and accepting a brand as plastic-neutral gives it an opportunity to increase its plastic consumption for packaging and other applications and keep polluting in one way or the other.

The global scenario

The New Plastics Economy (NPE) initiative is an effort spearheaded by the Ellen MacArthur Foundation, with support from the United Nations Environment

Programme (UNEP), to reduce plastic pollution. In 2018, the NPE launched a global commitment initiative, and about 400 companies have signed on. Signatories include companies which are commonly referred to as the 'world's most polluting', such as Nestle, Coca-Cola, PepsiCo and Unilever, among others.

The signatories have pledged to disclose the amount of plastics that their businesses use annually, as well as how they are working towards the goals they have set for themselves. The goals vary, but all signatories have vowed to make their plastic packaging reusable, recyclable or compostable, and decrease the use of fossil-based raw materials (virgin plastic) by 2025. Consumer goods companies have also committed to an average of 25 per cent recycled content in their packaging. Some of the global plastic polluters have disclosed the amount of plastic that they put out on the market every year (*see Table 6: International brands which have disclosed their plastic footprints through NPE, 2020*)

But there are a few brands that – despite being a part of the NPE – have chosen not to disclose their plastic footprints. Companies like PepsiCo and Unilever have not revealed their plastic portfolio – meaning the amount of rigid, flexible and multi-layered plastic they put out on the market. This is important because flexible and multi-layered plastics are difficult to recycle at scale due to economic viability[25]; in most cases, they are shipped to developing countries that have inadequate waste management policies and poor enforcement and collection mechanisms.[26]

Table 6: International brands which have disclosed their plastic footprints through NPE, 2020

Brands	Plastic put out in the market (in tonne)	Source of the plastics#	
		Fossil-based (%)	Recycled plastic (%)
Unilever	690,000	89	11
Nestle	1267000	95.8	4.2
The Coca-Cola Company*	2961254	88.35	11.5
PepsiCo	2350000	95	5
Colgate-Palmolive Company*	288487	89.5	10
Johnson & Johnson Consumer Health*	150000	98	1
L'Oréal	137609	84.2	15.8
Mondelez International	189500	99.7	0.3

*#For companies marked with the 'asterisk', the numbers do not add up to 100 per cent. The rest of the plastic is sourced from pre-consumer waste (waste generated during industrial packaging) or renewable sources (like plant or bio-based plastics)

Source: https://ellenmacarthurfoundation.org/global-commitment/signatory-reports, as viewed in June 2022

The 2021 new plastics initiative progress report claims a reduction of 2 per cent in the use of fossil-based raw materials compared to the base year; it also says that there has been an increase in the number of brands publicly disclosing their plastic packaging weights as well as their plastic packaging portfolios.[27]

The way ahead

Initiatives like the India Plastic Pact and New Plastic Economy are a small step in the right direction – but the prime focus will have to be on the reduction of plastic production and use, especially that of non-recyclable plastics. Plastic packaging for consumer experience and satisfaction continues to be a common alibi for most of the brands to continue producing 'difficult to recycle' plastics like multi-layered packaging.

A systemic shift in the design of plastic products put out in the market by brands to ensure and enhance recyclability and re-usability is a way forward.

- Recyclability is a challenge for flexible plastics due to the low weight, high volume and low market value. However, recyclability can be achieved by avoiding composite and complex packaging (more than one type of plastics/ materials merged together) and using plastic (polymers) from the same family to design a packaging. This can help in achieving recyclability at scale, which would also be economically viable.
- Reusability is possible in case of rigid plastics (PET, HDPE). The packaging has to be designed to be refillable and should be collected back by brands through a reverse logistic mechanism, re-filled and put back on the market with the product (*see Figure 5: The refill and re-use model*).

THE INDIA PLASTIC PACT

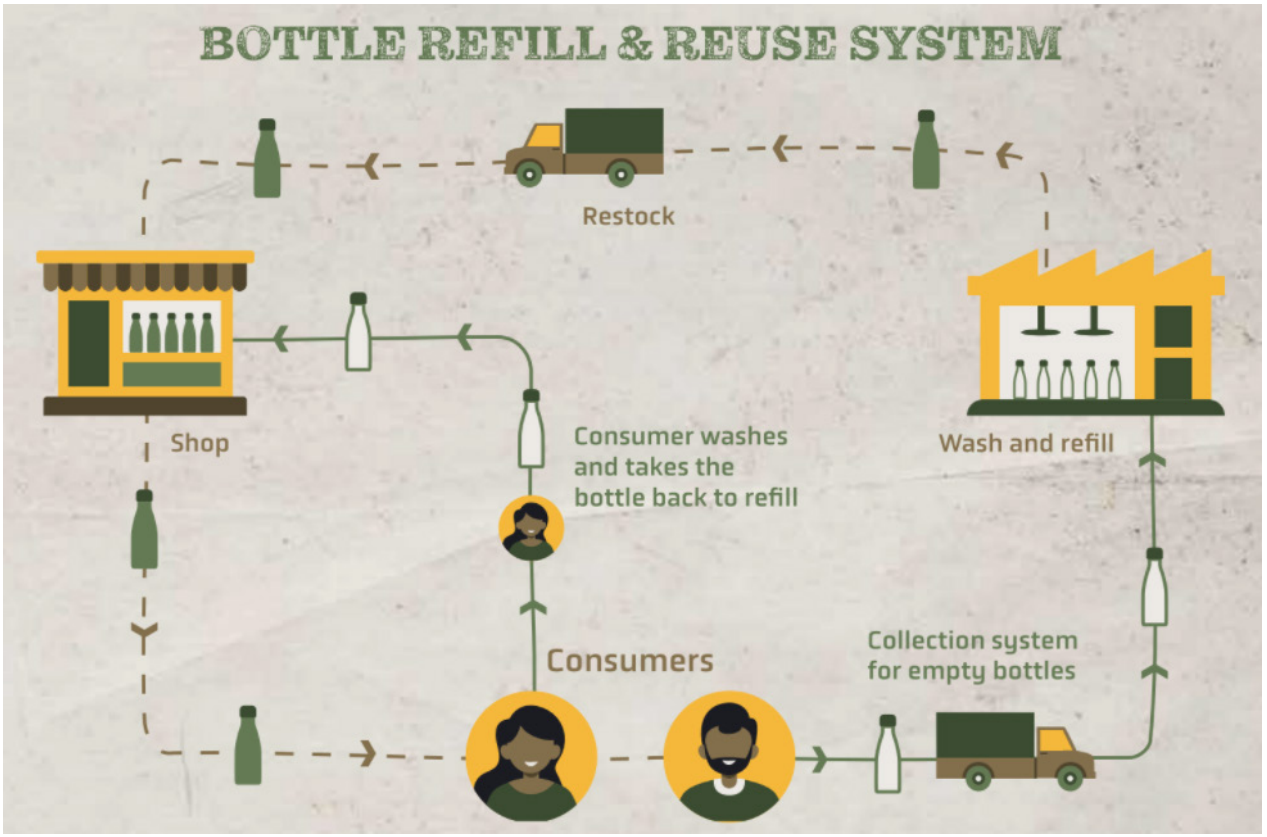
Stakeholders across the Indian plastic ecosystem are working towards developing an initiative that is similar to the New Plastic Economy. India is the first country in Asia to have a 'Plastic Pact' of its own. Launched in September 2021, the Pact has been spearheaded by the Confederation of Indian Industries (CII) and the Worldwide Fund for Nature (WWF). It is bring businesses, governments, civil society and other stakeholders on one platform to take the conversation on the plastic issue ahead. Till March 2022, the pact had close to 30 members and over 10 supporters.

The Pact has the following targets:

- To define a list of unnecessary or problematic plastic packaging and items and take measures to address them through re-design and innovation
- To ensure 100 per cent reusable or recyclable plastic packaging
- To ensure 50 per cent of the plastic packaging is effectively recycled
- To ensure a 25 per cent average recycled content across all plastic packaging

The India Plastic Pact will, however, not share individual plastic footprints of its members – instead, it will put out a cumulative figure of the plastics that the members will be releasing into Indian markets.

Figure 5: The refill and re-use model



Source: 2020, Unwrapped: exposing India's top plastic producers, #breakfreefromplastic and Kagad Kach Patra Kashtakari Panchayat (KKPKP)

Finally, as we move ahead, policies will have to be driven by data, and this is possible only when policymakers and environmental think tanks are equipped with authentic, standardised, disaggregated and comparable data on plastic production and consumption by the entities that put out the plastic in the market.

EXTENDED PRODUCER RESPONSIBILITY (EPR) FOR PIBOS IN INDIA

EPR was 'loosely' introduced in the Plastic Waste Management Rules, 2016 in India as there were no targets assigned for collection or recycling. Most of the brands were voluntarily collecting back plastic waste from communities, mixing their EPR mandate with their corporate social responsibility (CSR) mandate. Claims made for collection of hundreds of tonne of plastic could not be verified.

In February 2022, the Plastic Waste Management Amendment Rules were notified. They broaden the scope of the EPR with specific targets on collection, recycling and use of recycled content. While this latest notification leapfrogs from where we started, there still exist some loopholes which will need to be carefully plugged as we move ahead.

WHAT DOES EPR MEAN?

EPR is a policy tool that helps promote the principle of 'polluter pays' and places the liability of collection, recycling, and re-use of plastic waste on entities that are responsible for introducing plastic packaging.

HOW DOES EPR WORK?

The liability of extended producer responsibility gets passed on from the seller of a commodity to its purchaser – in this case, plastic packaging – to avoid duplication in accounting. It means that when a producer buys plastic from an importer, and then directly places the product on the market, the liability to collect back and recycle falls on the producer.

Similarly, if a brand owner buys plastic from a producer or an importer and uses it to place its products on the market, the brand owner becomes liable for end-of-life management of that amount of plastic waste.

The collection target (also known as EPR target) is arrived at by calculating the average of the amount of the plastic that a polluter has placed on the market in the last two consecutive years. EPR is 'brand neutral' – this means that a polluter does not necessarily limit itself to its own plastic packaging while collecting back; it can collect and recycle plastics put on the market by any other brand to fulfil its EPR targets.

However, the 2022 EPR notification binds the polluter to the plastic category. This means the EPR targets for every polluter will have to be fulfilled only for the category of plastic that they release into the market. For instance, if a polluter does not use multi-layered plastic (MLP-category IV as per the EPR policy) for packaging any of its products, it does not have the liability to collect MLP.

The new EPR policy also introduces a plastic credit system. This implies that if a polluter manages to recycle more plastic waste than it had put into the market, it can either carry it forward for consideration in the following fiscal year or sell it off to another polluter who has a mandate to recycle the same category of plastic.

The EPR certificates can only be issued to the 'polluters' by authorised plastic waste processors/recyclers.

WHAT ARE THE CATEGORIES OF PLASTICS AS PER THE EPR POLICY?

The EPR policy has divided plastics into four broad categories:

- Rigid plastics- Category I
- Flexible plastics (made up of more than one layer of plastic and may contain different types of plastic material)- Category II
- Multi-layered plastics (at least one layer of plastic along with a layer of non-plastic material)- Category III
- Compostable plastics- Category IV

This is the first time that such a categorisation has been done on the basis of properties of plastics. The 2016 Plastic Waste Management Rules did not specify any such categorisation.

There is also an inclusion of 'pre-consumer plastic waste' apart from the 'post-consumer plastic waste' for which EPR needs to be fulfilled. Pre-consumer plastic waste is the plastic packaging waste generated in the form of rejects or discards at the stage of manufacturing, before it reaches the end-use consumer. Post-consumer plastic waste is plastic packaging waste generated by the end-use consumer after the intended use of packaging is completed.

WHAT TARGETS AND TIMELINES ARE EXPECTED TO BE FOLLOWED?

The PIBOs have been assigned collection, recycling and use of recycled content targets.

- Collection target (calculated on the basis of the preceding two year average of the plastic put out on the market)

Year	Collection targets
2021-22	25%
2022-23	70%
2023-24	100%

- Recycling targets (calculated on the basis of collection/EPR targets)

Plastic category	2024-25	2025-26	2026-27	2027-28
I-Rigid	50%	60%	70%	80%
II-Flexible	30%	40%	50%	60%
III-Multi-layered	30%	40%	50%	60%
IV-Compostable	50%	60%	70%	80%

- Use of recycled content (calculated on the basis of the amount of plastic manufactured in a year)

Plastic category	2025-26	2026-27	2027-28	2028-29
I-Rigid	30%	40%	50%	60%
II-Flexible	10%	10%	20%	20%
III-Multi-layered	5%	5%	10%	10%

- End-of-life disposal limit (calculated on the basis of the difference between total plastic put out on the market and recycling targets)

Plastic category	2024-25	2025-26	2026-27	2027-28
I-Rigid	50%	40%	30%	20%
II-Flexible	70%	60%	50%	40%
III-Multi-layered	70%	60%	50%	40%
IV-Compostable	50%	40%	30%	20%

- Re-use targets (only for brand owners; limited to rigid plastics, calculated on the basis of products sold annually)

More than 0.9 l/kg but less than 4.9 l/kg

Year	Target
2025-26	10%
2026-27	15%
2027-28	20%
2028-29 and onwards	25%

More than 4.9 l/kg

Year	Target
2025-26	70%
2026-27	75%
2027-28	80%
2028-29 and onwards	85%

Recycling can be done by channelising the plastic waste to plastic waste processors. Different methods of processing have been assigned codes depending on the type of facility owned by the processor.

Waste into pellets/chips

R1 - Recycling of rigid plastic I R2 - Recycling of flexible plastic I R3 - Recycling of multilayered plastic

Waste to products

R4- Recycling of Rigid plastic I R5- Recycling of flexible plastic I R6- Recycling of multilayer plastic

Waste for industrial composting

C1 - Processing compostable plastic

Waste to energy

E1/E2 – End-of-life disposal through co-processing in cement/steel plants

E3- End of life disposal through waste to energy plants

E4- End of life disposal through waste to oil units

5. Retailers and street vendors

Modern retailers charge the consumer for plastic carry bags at a rate of Rs 5-10 per unit. The source of this malpractice lies in the Plastic Waste Management Rules, 2011. The Rules aimed at providing a regulatory framework for the management of plastic waste in the country, and directed that "No carry bags shall be made available free of cost by retailers to consumers".

There are two conditions pre-requisite to the sale of such a plastic bag:

- Charges could only be levied for a plastic bag, and not for cloth or paper bags. However, retailers began to take undue advantage of the Rules and charge for paper and cloth bags as well (which was not mandated).
- Every urban local body (ULB) was expected to work out a fee to determine the minimum price of a carry bag, taking into account the material cost and the cost of waste management.

Since the 2011 Rules did not mention how the money collected by retailers from the consumers would reach the ULBs, the 2016 Rules – through its Section 15 (Explicit pricing of carry bags) – introduced a mechanism wherein shopkeepers (retailers) and street vendors were mandated to register with the local body to be eligible to provide plastic carry bags for dispensing commodities at a fee of Rs 48,000 per annum. ULBs were directed to introduce state statutes or byelaws for facilitating registration of shopkeepers and street vendors. The ULBs, through their byelaws, could also propose a higher fee for this. Shopkeepers and street vendors were expected recover this cost by charging a minimum fee for every carry bag to the consumers depending on their quantum of sale every month. It was mandatory for every shopkeeper or street vendor to display at a 'prominent place' that 'carry bags will only be provided on payment of a minimum fee per carry bag'. The fees collected by the ULB through this mechanism was supposed to be used for sustainable waste management practices in the ULBs jurisdiction.

This mechanism, however, did not work. This was mainly due to resistance from retailers and street vendors to the high minimum charges that they were asked to pay to the ULBs. Consumers also complained of being charged haphazardly by retailers.

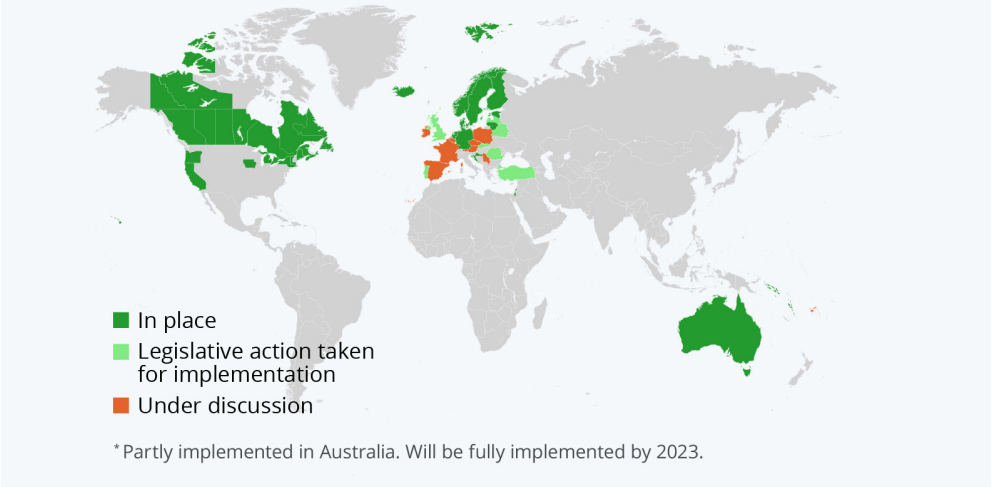
As a result of this, Section (15) was removed from the Plastic Waste Management Amendment Rules, 2018. While the arrangement stands discontinued, large retailers continue to charge consumers for carry bags.

The significance of retailers and street vendors

The National Hawker's Federation (NHF), an association of street vendors across 28 states in the country, says there are more than 40 million[28] street vendors in India. There are at least 12 million retail grocery outlets in India[29], including the traditional and modern retailers. The cumulative scale at which the distribution of plastic carry bags and other packaging material is done from this section of stakeholders offers an opportunity to actively involve them in the management of plastic waste.

Retailers and street vendors can play a very important role when it comes to setting up a reverse logistic system like a deposit refund scheme (DRS). Studies have confirmed that a deposit refund system can complement EPR very effectively.[30] While EPR places the burden of plastic pollution on the producer, DRS incentivises the consumer to create and continually feed the reverse logistic mechanism. Deposit refund schemes are already functional in at least 40 countries (*see Map 2: Countries that have a DRS in place or under consideration*) across the world, focussing specifically on beverage containers.

Map 2: Countries that have a DRS in place or under consideration



Source: Bottle deposit systems, Niall McCarthy, Statista and The Changing Markets Foundation, 2020

How does DRS work?

A deposit refund system – also known as a deposit return system, advance deposit fee, or deposit return scheme – is the surcharge on the price of potentially polluting products. When pollution is avoided by returning the products or their residuals, a refund of the surcharge is granted.[31] Although there is no limitation on the kind of material the system can collect back, its application has widely been limited to

glass bottles, aluminium cans – more recently, it is also being used for single-use plastic beverages.

However, flexible packaging has never been a part of DRS in any part of the world. This may be related to the limitation in recycling, reusability, economic value and post recycling application of flexible packaging formats. DRS promotes efficient collection, thus reducing littering and leakages into the environment, to enable recycling and re-use of material, ensuring better quality of the feed (and hence, the finished plastic products).

Should India have a DRS mechanism?

With the 2022 EPR guidelines introducing targets for collection, recycling, re-use and use of recycled content, having a DRS system makes sense. This will ensure high quality of feed to recyclers, which becomes essential in the current policy context and remains a big hurdle in the process of recycling. It will also incentivise the consumer while placing the burden on the polluter. Moreover, the DRS mechanism perfectly complements the EPR scheme if rolled out and implemented in the right manner.

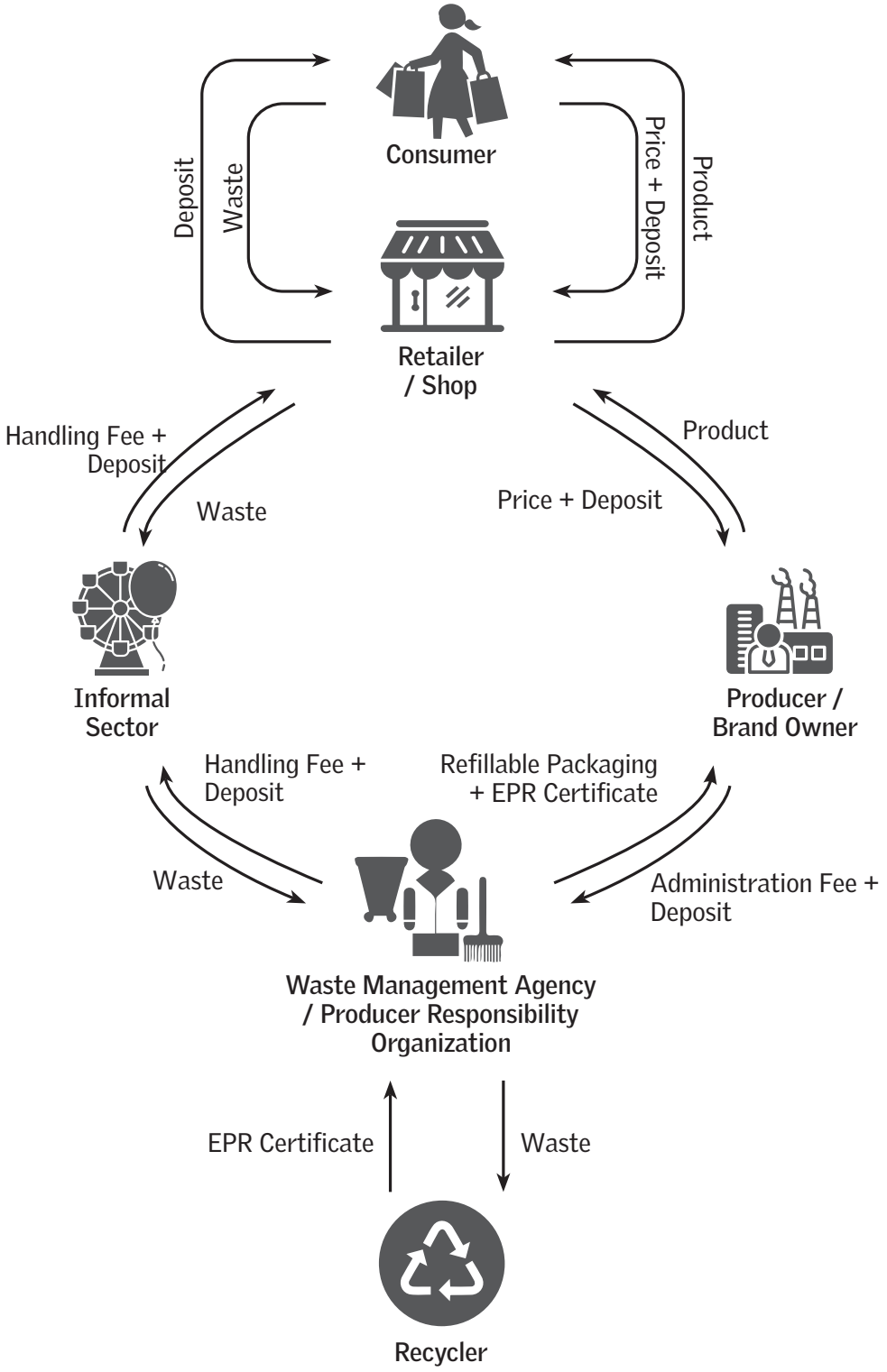
However, there are a handful of challenges that will need to be addressed before moving ahead.

The challenge with respect to a retailer is the increased humanpower requirement (in the case of a manual DRS) for this system to work effectively, and the space requirement for storing products received back from consumers.

Another huge challenge is with respect to waste-pickers, who are responsible for channelising waste to recyclers. The waste entering the DRS value chain will belong to the entity responsible for managing it, thereby restricting access to it for waste-pickers. In fact, waste-pickers across the country as well as globally – threatened by the privatisation of waste management activities – have been demanding a "right to waste".

Policymakers will have to focus on developing an optimal DRS mechanism that is adapted to local conditions. A DRS mechanism which involves waste-pickers across the country, and supports and incentivises them for the waste collected and diverted to the recyclers could be a feasible model *(see Figure 6: Proposed DRS for India)*.

Figure 6: Proposed DRS for India



Source: CSE 2022

DRS: A CASE STUDY FROM NORWAY

The most comprehensive and effective DRS in the world – operational since the early 2000s – can be found in Norway. The system ensures that 97 per cent of all plastic drink bottles are returned and less than 1 per cent of all plastic bottles sold in the country ends up in the environment. Most impressively, it is estimated that 92 per cent of all plastic bottles returned are recycled back into plastic bottles through Infinitum (a private not-for-profit operator of DRS owned by retailers and producers). Infinitum estimates that some bottles have already been recycled more than 50 times (see Figure: *Snapshot of the DRS system in Norway*).

Infinitum, which is an industry-owned body, is entrusted with the task of deciding how best to operate the DRS. It is incentivised to make the scheme as efficient as possible through an environmental tax placed on all producers of plastic bottles, which is lifted if 95 per cent of all single-use containers are returned.

The Norwegian scheme accepts all polyethylene terephthalate (PET) and aluminium containers if packaging has been designed in line with Infinitum's guidelines, which ensures that all containers entering the scheme can be easily recycled. These guidelines are fundamental to ensure the circular nature of the scheme. For example, it is critical that labels attached to bottles are easily removed without leaving any residue which could inhibit their ability to be recycled.

The level of deposit charged varies, with all aluminium and small PET containers set at 2kr (US $0.23) and large (500 ml+) PET containers at 3kr (US $0.35). All retailers that sell beverages eligible for the scheme are required to act as a collection point, either via reverse vending machines or as a manual collection point. Additionally, it is also possible for schools/charities to act as manual collection points, which enables them to garner additional revenues. Reverse vending machines also feature an option for the deposit to be donated to the Norwegian Red Cross.

Figure: A snapshot of the DRS system in Norway

Implementation of the system: 1999

Packaging for: Water, carbonated beverages, non-carbonated beverages, fruit and vegetable juices, alcoholic beverages

Packaging materials: PET, HDPE, alluminium, steel

Deposit amount: 2 NOK, <0.5L ; 3 NOK > 0.5L

Market size (2019): 1.3 billion cans and bottles with a population of 5.4 million

Collection rate (2019): cans 89.5 % (98.5% including other collection methods); bottles 89.4% (95.7% including other collection methods)

Number of collection points per 1000 inhabitants: approximately 2.8

Scale of recycling (2019): Plastics 20,219 tons; Alluminium: 9,025 tons

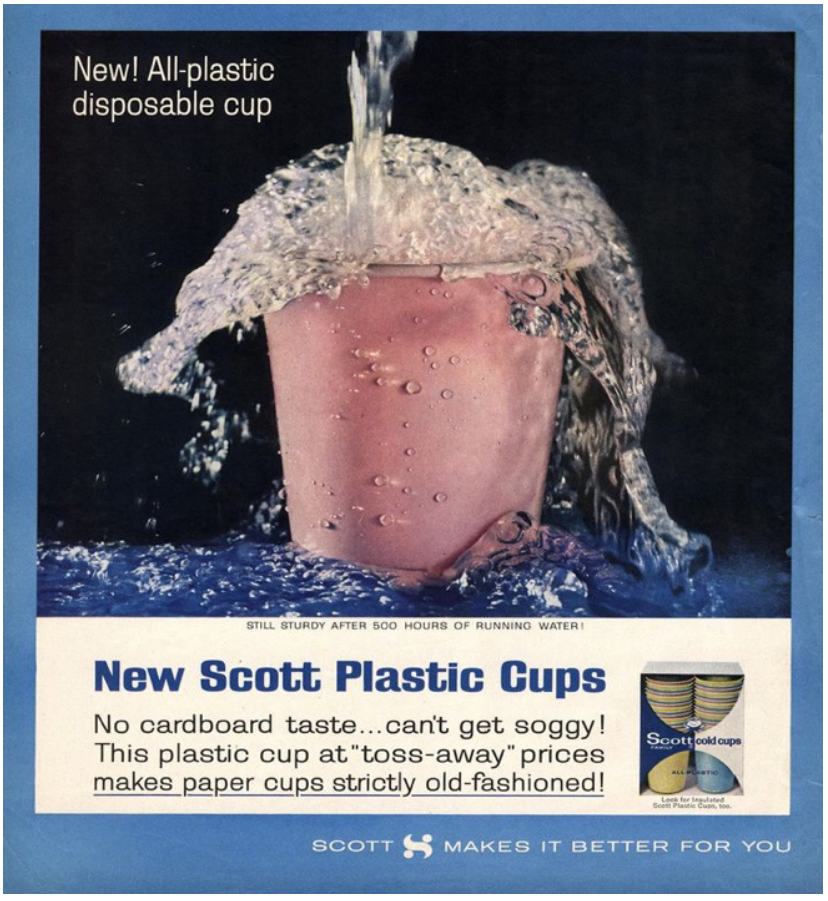
Source: 2020, How do effective deposit refund systems work? *Innowo (Institute of Innovation and Responsible Development)*

In short, the design of the Norwegian DRS has largely been left in the hands of the industry itself, which is incentivised to ensure it operates effectively in order to receive a tax reduction. This has enabled the creation of a truly circular system where everything from the design of the packaging itself to how containers are collected has been meticulously planned.

6. Consumers

In the 1950-70 period, extensive advertising campaigns in the West promoted plastics in a big way. Once the Western consumer got hooked to it, it was much easier for the industry to penetrate into other parts of the world, including India. Consumers were lured by companies into using plastic products, which were promoted for their convenience, making 'use and throw' culture a part of our lifestyle.

Consumers often find themselves being blamed for the mismanagement of plastic waste, but the typical consumer does not have the freedom of choice to buy a product in different packaging formats – s/he is forced to buy products packaged only in plastics. This is because all companies package most of their products in



CREDIT: HUFFPOST.COM

Magazine ad of disposable plastic cups, from the 1960s

CSE'S SURVEY ON CONSUMER PERCEPTIONS

In early 2022, Centre for Science and Environment (CSE) rolled out a survey to understand the perception of plastic amongst Indian consumers. This survey did not collect data of the respondents: it was anonymous and conducted digitally. The respondents were required to respond to a questionnaire (*see Annexure*). The survey focussed only on plastic packaging, since this sector contributes to roughly 60 per cent of the plastic consumption in the country. The questions in the survey can be classified into three distinct segments: perception, practices and awareness levels. A total of 219 responses were received, and some interesting conclusions can be drawn by compiling them.

KEY FINDINGS

Perception of consumers

- 73 per cent of the respondents were not happy with the kind of plastic packaging that comes with their online and offline shopping orders; 16 per cent were satisfied.
- 67 per cent of the respondents felt that these plastics are difficult to recycle; close to 20 per cent felt that all plastics are recyclable.
- 79 per cent of the respondents thought it was high time we stopped using plastic packaging; 13.7 per cent said there was no alternative.
- 97 per cent of the respondents indicated they were willing to buy products in alternative packaging, if made available; only 76.3 per cent indicated a willingness to pay extra for an alternative form of packaging.
- More than 50 per cent of the respondents believed that they were forced to buy products in plastic even when they did not intend to use plastic; only 36.5 per cent believed that it was easy to shop free of plastics.

a similar format, citing issues like prevention of environmental damage to the product, increasing shelf life, and retention of nutritional values. Plastics are also lightweight and facilitate transport of more product and less packaging material (which is designed to be thrown away) in a single trip.

Over the last few decades, giant companies have moved away from different formats of packaging like metal, paper and glass; the consumer, on the other hand, has been forced to continue to embrace plastic as the only option. According to an industry estimate, the global flexible packaging market was worth roughly US $93 billion in 2019. Plastic-based flexible packaging accounts for approximately 93 per cent of the total consumption, whereas paper-based flexible packaging accounts for just about 5 per cent of the market.[32] Consumers have off late started exploring alternative packaging.

Practices of consumers

- 65 per cent of the respondents said they always carried a reusable bag when they stepped out to shop; 30 per cent said they carried a reusable bag sometimes and demanded a plastic bag when they forget to carry a reusable bag.
- More than 80 per cent of the respondents shared that they reused the plastic bags received with their online orders in some way; 19 per cent suggested they threw the plastic packaging into the mixed waste bin right away.
- 47 per cent of the respondents said that they did not segregate plastic waste at source.

Awareness levels

- 85 per cent of the respondents indicated that they had noticed the recycling symbol imprinted on plastic products; almost 55 per cent wrongly believed that the number within the recycling symbol indicated the strength of the plastic material or number of times the plastic can be recycled.

INTERPRETATION OF THE FINDINGS

While a lot of respondents perceived plastic as a threat to the environment, they were forced to buy products packaged in it. Although alternative packaging options do exist, they come along with an added cost– almost one-fourth of the respondents were not willing to spend more for an alternative form of packaging.

Packaging options do not depend on consumer perception and demand, but are driven by economic interests of companies. While a majority of the respondents claimed that they reused plastic packaging in some way, plastic waste management practices followed by them need to be upgraded and upscaled.

The labelling mechanism on plastic packaging depicting recycling (three chasing arrows) is misleading and often misused by brands to instil faith in consumers, who are led to believe – falsely – that the plastic that is thus labelled can be recycled.

7. The informal sector

There are an estimated 2.2 million waste-pickers in India, as per a 2018-19 study by Women in Informal Employment: Globalizing and Organizing (WIEGO), a waste picker global network.[33] According to a 2018 report by the Union Ministry of Environment, Forest and Climate Change (MoEFCC), about 60 per cent of the plastic waste generated in India is recycled, mostly by the informal sector.[34] This group plays an important and critical role in diverting the waste from households, dumpsites and other vulnerable points to recycling/composting and other treatment and processing facilities.

CSE's researchers did an on-site assessment of two waste-pickers' cooperatives in Maharashtra: the Mumbai-based Stree Mukti Sangathan (SMS) and the Pune-based SWaCH.

Stree Mukti Sangathan (SMS), Mumbai

SMS is operational in seven wards of the Municipal Corporation of Greater Mumbai (MCGM) and three wards of Thane and Navi Mumbai. SMS works with 3,500 waste-pickers, of which 1,500 have been trained to handle organic waste in decentralised systems. Decentralised systems encourage capturing and treating organic waste as close to the source as possible, thus reducing the cost of collection and transportation.

All the waste-pickers of SMS also offer housekeeping services to residential societies in the catchment area. SMS manages the organic waste in decentralised systems at the source, conducts waste audits to arrive at waste compositions, and diverts the dry waste to their sorting sheds. From the sorting sheds, the dry waste is channelised to material recovery facilities (MRFs) owned and operated by Parisar Bhagini Vikas Sangh (PBVS), a subsidiary of SMS.

SMS is currently working with the United Nations Development Programme (UNDP) and is funded by Hindustan Coca-Cola Beverages Private Limited (HCCBPL). All the plastic that is collected by the SMS waste-pickers is credited as EPR target for the company's EPR mandate.

How much plastic waste does SMS collect?

SMS – along with PBVS – is responsible for the operations of the MRFs. The MRFs

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The SMS material recovery facility at Mumbai (T-ward, MCGM)

buy dry waste including plastics from waste-pickers who are called *safai saathis*. Other sources of the dry waste received at the MRFs are urban local body vehicles and citizens willing to sell their dry waste.

As per data from the first week of January 2022 (*see Table 7: Dry waste brought to MRF (T-ward) by waste-pickers over a period of one week*), on an average, waste-

Table 7: Dry waste brought to SMS MRF (T-ward) by waste-pickers over a period of one week

Date	Waste-pickers' contribution			Total dry waste received at MRF		
	Glass (kg)	Plastic (kg)	Cardboard (kg)	Glass (kg)	Plastic (kg)	Cardboard (kg)
02-01-2022	65	122	92	559	203.2	395
03-01-2022	43	81	46	210	105	435
04-01-2022	55	90.5	47	162	182	621
05-01-2022	0	23.5	18	210	244	762
06-01-2022	No data			121	252	658
07-01-2022	138	148	96	430	205	720
08-01-2022	75	223	136	306	259	641
09-01-2022	139	190	161	209	365	632
10-01-2022	88	95	83	109	224	520

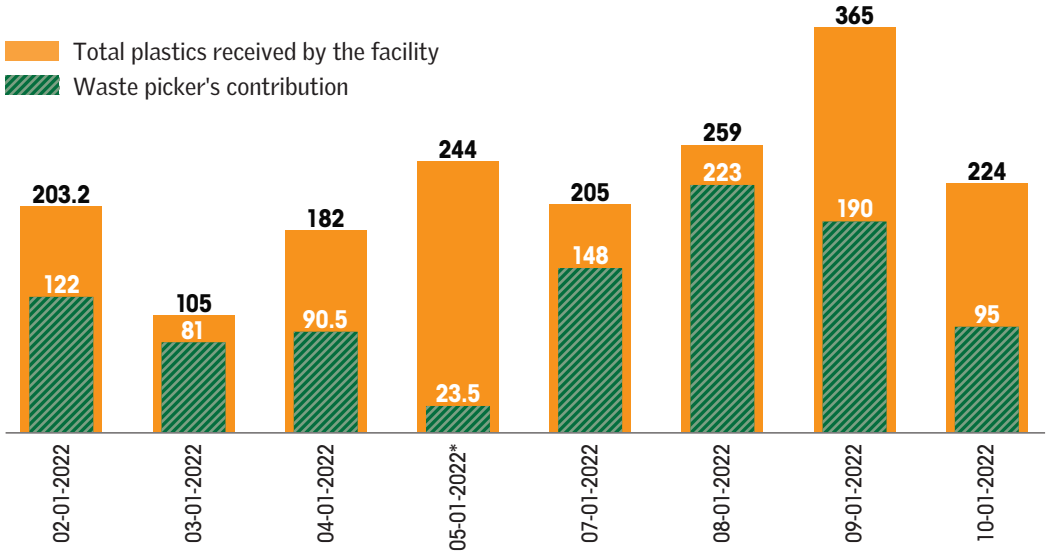
Sources: Parisar Bhagini Vikas Sangh and Stree Mukti Sangathan

pickers brought in 67 kg of glass, 75 kg of paper and cardboard, and 108 kg of plastics on a daily basis. The flow of waste-pickers coming in to sell the collected waste shows a lot of variation – this is probably because of the non-supervised/independent nature of the work of waste-pickers or their capacity to store the waste that they collect before bringing it to the MRF. Bifurcated data on waste brought in by waste-pickers suggests that some of them may either be storing or buying from other waste-pickers at a cheaper rate to earn some profits.

According to the PBVS team, in January 2022, the T-ward MRF received a total of close to 299 tonne of dry waste. Of this, about 201 tonne was channelised into relevant treatment, processing and recycling facilities, and more than 98 tonne (approximately 33 per cent) was accounted for as 'systems rejects' that had to be sent to the nearest dumping site. Most of the waste classified as rejects was brought in by the municipal vans and trucks: this affected the efficiency of the MRF negatively.

A weekly analysis of the receipt of waste at the facility from waste-pickers shows that on a good business day, a minimum of 12 per cent of the glass waste was sourced from the informal sector; this went up to a maximum of 81 per cent on certain days. In the case of plastics, the contribution of waste-pickers was a minimum of 42 per cent and a maximum of 86 per cent (*see Graph 9: Percentage contribution of plastic waste diverted to MRF by waste-pickers)*. In the case of cardboard, the figures were a minimum of 8 per cent and a maximum of 25 per cent.

Graph 9: Percentage contribution of plastic waste diverted to MRF by waste-pickers



Source: CSE research, 2022

*Data not considered for analysis as suggested by MRF operator

The UNDP has provided a mandate to SMS to sell all the recyclable plastic to Maharashtra Pollution Control Board (MPCB)-registered recyclers because of the EPR mandate as per the Plastic Waste Management Rules, 2016. However, only 30-40 per cent of the recyclables is channelised to six registered recyclers in the city. But these recyclers are mostly interested in buying PET products which have established forward linkages in the Indian market and can generate some profits for them.

The remaining 60-70 per cent of the recyclable material is sent to non-registered (informal) recyclers. The multi-layered plastic packaging that is received in considerable quantities is pre-processed by SMS. Pre-processing involves segregating, cleaning and making bales for promoting efficient transportation of material. However, SMS representatives say they are operating at a loss in the pre-processing of MLP: the demand for pre-processed MLP is compromised, forcing SMS to allot storage space for it, which has a direct impact on the revenues.

CSE researchers identified a major problem in the value chain of recyclers. Authorised recyclers are liable to provide an 'EPR certificate' to agencies that divert plastic waste to them. These recyclers offer a lower price (compared to the market

price) for the plastic waste when an MRF facility demands an EPR certificate. This is because the recyclers understand that the agency that is diverting the plastic waste to them is earning through the EPR model. While the benefit of EPR model is passed on to the recycler in the form of increased raw material flow for recycling, they want to extract more money out of it. This is the reason they resort to unethical practices. Agencies like SMS are forced to comply due to mandates from donors like UNDP and end up selling plastic waste at lower cost.

SWaCH, Pune

SWaCH is India's first wholly owned cooperative of self-employed waste collectors. It is an autonomous enterprise that provides front-end waste management services to the citizens of Pune. SWaCH's waste management operations cover over 70 per cent of the city's population.[35] In 2021, SWaCH, with the help of 3,500 waste-pickers, serviced 800,000 households daily in Pune, diverting 70,000 tonne per day of waste to recycling facilities and saving Rs 100 crore for the Pune Municipal Corporation (PMC).[36]

CSE's researchers visited the Katraj waste transfer station, one of the three co-operative scrap shops operated by SWaCH and interacted with four waste-pickers who had been in the business for the last 10-15 years. These waste-pickers helped us understand the SWaCH model, the trends in waste generation in the city, and the shift in valuable (dry) waste composition that they have witnessed over the last decade and a half.

The cooperative workers of SWaCH go from door to door for collecting waste. Having served over the years in the same catchment areas, they proudly say that they have formed a bond with the beneficiaries to whom they provide their services. An offshoot of their continued service has been the level of segregation that is practised in the city. Solid waste is collected in four different fractions – wet, dry, sanitary and domestic hazardous (as per the Solid Waste Management Rules, 2016).

The resalable items are recovered from the dry waste fraction by the workers and brought to the nearest scrap shop operated by the cooperative. The rest of the waste is given away to the municipal garbage van in a segregated manner; these vans meet the workers daily at a 'feeder point' at the designated time. The dry waste brought at the scrap shop is then sorted and sold to aggregators, who deal in very specific types of waste. For instance, an aggregator collecting PET bottles might not be interested in paper, cardboard or any other type of plastic.

Every worker covers a cluster of 200-250 households. Workers are assigned a mix of catchment areas depending on the waste generation potential of the area. For instance, a team of two people who service roughly 600 households will have a mix of 250 high income households and 350 slum dwellers. This ensures that service is not limited to affluent communities who can afford to pay the user charges and give away much more valuable waste owing to their lifestyle and consumption patterns. Some residents who have now understood the value of waste do not hand over the valuable dry waste to the workers; instead, they sell it to a *kabbadiwallah*.

A cooperative worker who services the affluent communities collects roughly 20 kg of dry waste; one who services slum areas manages to collect 10-15 kg on an average (*see Table 8: Dry waste collection potential of a single cooperative worker*).

It is interesting to note (*Table 8*) that some of the highest quantities visible like '*mix main*' and *'RS'* have no value in the recycling market; the workers struggle to sell such items due to limitations in forward linkages. Hence, most of the times, these are sent for burning at cement factories.

Both SMS and SWaCH confirmed that certain types of plastic wastes have no buyers; but despite that, they are being circulated in the market both by FMCG companies as well as local players. Most of this plastic packaging is made up of PET and poly-styrene (PS). The cooperative workers were unable to explain or understand themselves why such plastic packaging (despite being made up of polymers like PET, having a good recycling market) is not bought by aggregators.

Table 8: Dry waste collection potential of a single cooperative worker

Dry waste type	Dry waste name	Local name	Daily minimum quantity (kg)	Percentage (based on minimum collection)	Daily maximum quantity (kg)	Percentage (based on maximum collection)
Plastic	PET	*Kadak*	2	12.5	2.5	10.87
	Rigid	*Phugga*	3	18.75	4	17.4
	Rigid	*Kala phugga*	0.5	3.125	1	4.35
	Flexible (transparent)	*Main*	0.5	3.125	1	4.35
	Flexible (coloured)	*Mix main*	3	18.75	4	17.4
Paper	Cardboard	*RS*	3	18.75	5	21.73
	Cardboard	*Puttha*	3	18.75	4	17.4
	Paper	*Kagad*	1	6.25	1.5	6.5

Source: CSE research, 2022

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Plastic waste with no market linkage

Going by the current market value of dry waste, it was estimated that a cooperative worker can earn anywhere between Rs 200 to Rs 300 every day by selling the dry waste that is collected. This is in addition to the user fee taken from the beneficiaries to whom the service is offered, thus ensuring a decent income for the cooperative workers. More than 60 per cent of the income of a waste-picker through 'recovered' recyclables is contributed by plastics. However, almost half the dry waste that is sorted by the workers individually or at the scrap shop fetches a very poor value and takes up a lot of their time, energy and resources.

The MLP project at SWaCH

SWaCH has been working with ITC Private Limited to collect back multi-layered plastics (MLP) with the help of waste-pickers. Each waste-picker is offered by ITC a price point of Rs 4 for every kilogram of MLP that they collect and channelise to the scrap shop. Even after these subsidised efforts, the operations have not been able to generate enough profits for the waste-pickers, according to SWaCH and *Kagad Kach Patra Kashtakari Panchayat* (KKPKP) representatives.

According to a KKPKP representative, the MLP that is collected at the SWaCH scrap shop can have three fates:

- Pyrolysis (which means to burn the MLP in controlled conditions to derive a fuel out of it)
- Permissible additive (it is melted and used as an additive with another plastic product to impart some desired properties)
- Pallette board (Various types of MLPs are fused together through a physico-chemical process to make a board)

The problem, however, lies in the 'forward linkages' – this means that once the MLP has been processed using one of the three methods mentioned above, there are limited applications and even limited buyers for the final product. Moreover, the time dedicated by waste-pickers to recover and sort the MLP could be utilised better to recover some other material which would have fetched them a higher value.

In March 2020 when the pandemic hit the country, SWaCH was collecting 120 tonne of MLP per month under this initiative. This was roughly 10 per cent of the entire MLP waste that the city of Pune was generating, according to the KKPKP. Post-pandemic, the collection efficiency has been affected and has still not reached the pre-pandemic levels. In January 2022, SWaCH managed to collect only 70 tonne of MLP waste.

The major challenges of dealing with MLP are:

1. The time that a waste-picker has to dedicate to collect a considerable quantity, owing to the low weight
2. Storage of MLP in a facility takes up a lot of space owing to the high volumes
3. Contamination – food contamination, inherent oil contamination etc; often, the MLP is contaminated by the oil in the edible product or by some edible product itself. This affects the recycling and increases time and costs.

Informal sector: At the mercy of big brands?

The two models we discussed above are exactly how giant corporations are trying to fulfil their EPR targets in coming years – by engaging the informal sector for collecting back what the industry is putting out in the market. This is a classic case of 'externalising the internalities': a strategy used by big industry to pass on the cost and accountability of their liabilities to a vulnerable third party (like citizens/consumers or waste-pickers in this case).

Forcing a forged value for a type of plastics for which forward linkages do not exist, undermines the efforts of the informal sector and affects their income levels either directly or indirectly. Moreover, these kinds of plastics have been designed without considering their end-of-life environmental impacts. The effort is to glorify down-cycling and end-of-life disposal like burning plastic in cement plants or road making as the ultimate solutions. It is due to the intense lobbying and representation from the plastic industry and FMCG giants that such solutions are promoted in our legislations for plastic waste.

The question is, are these companies bearing the 'real cost' of EPR? This real cost will include things like the long working hours of a waste-picker trying to collect a kilogram of MLP for Rs 4/kg; the occupational hazard that waste-pickers are subjected to; the minimum wages that they deserve when working for a giant FMCG company; the health insurance and benefits that all multinational company employees are entitled to; the provident fund that the company is liable to pay to its employees; and the leaves that the waste-pickers should be entitled to or the extra working hours that they should be compensated for.

While there are challenges, there are ample opportunities as well. If the real cost of EPR is computed, and the giant corporations are mandated to account for all the internalities, they will be forced to diversify their packaging formats which is heavily inclined toward plastic in the current scenario. Even if companies decide to stick to plastics, we can expect them working towards having a robust reverse logistic mechanism – if they are held accountable for what they put out on the market.

Accountability is much more than collecting back, it is about designing packaging not just for profits but also for the people and the planet. The primary objective of the FMCG companies is to increase their profits while reducing their costs and that is exactly what current plastic packaging formats offer to them. However, in the process it is very important to integrate, involve and rightfully compensate the informal sector and not exploit them.

8. Plastic recyclers

An owner of a recycling facility in Vapi, a small city at the south west tip in the state of Gujarat, told a CSE researcher that every kind of plastic is recyclable, in theory and in practice. According to him: "Granules can be made from every kind of plastic." The problem, however, he points out, is the forward linkages and the non-existent buyers for the recycled plastic. Since a considerable variety of post-consumer recycled plastics do not have buyers, markets or gainful applications, they are not recycled by mainstream recyclers. This has a domino effect on the value chain. The recyclers do not recycle because there are no buyers for the recycled materials. The informal sector does not pick these plastics up because the recyclers do not buy it. This is how a lot of our plastic waste ends up uncollected, and can be found in various compartments of the environment and in dumpsites across the country.

A consultant with an organisation working in plastic waste management, when asked about the 60 per cent plastic recycling efficiency claimed in India, said: "Most of our numbers with respect to plastic recycling are limited to PET bottles. We fail to ask relevant questions like what is the polymer, how is it being recycled, and into what kind of products."

Let us consider a couple of India's biggest and most visible plastic recycling companies: Dalmia Polypro Industries Private Limited and Shakti Plastic Industries. Both have operations in Mumbai. Dalmia Polypro recycled 19,161 tonne of plastic waste in 2020, of which 40 per cent was mechanically recycled (primary and secondary recycling) while 60 per cent was "recycled" by burning in various facilities (tertiary and quaternary recycling).[37]

Similarly, Shakti Plastic Industries collected 1,00,000 tonne of plastic waste, as per its latest website update.[38] Of the plastic waste collected, only 30,000 tonne (30 per cent) was processed at the company's Palghar facility in Maharashtra through mechanical recycling, while 70,000 tonne was sent to cement plants for co-processing. All this, despite the claim by Shakti Plastic Industries to have come up with a technology for recycling non-recyclable multi-layered plastic (MLP) packaging.[39]

What is plastic recycling?

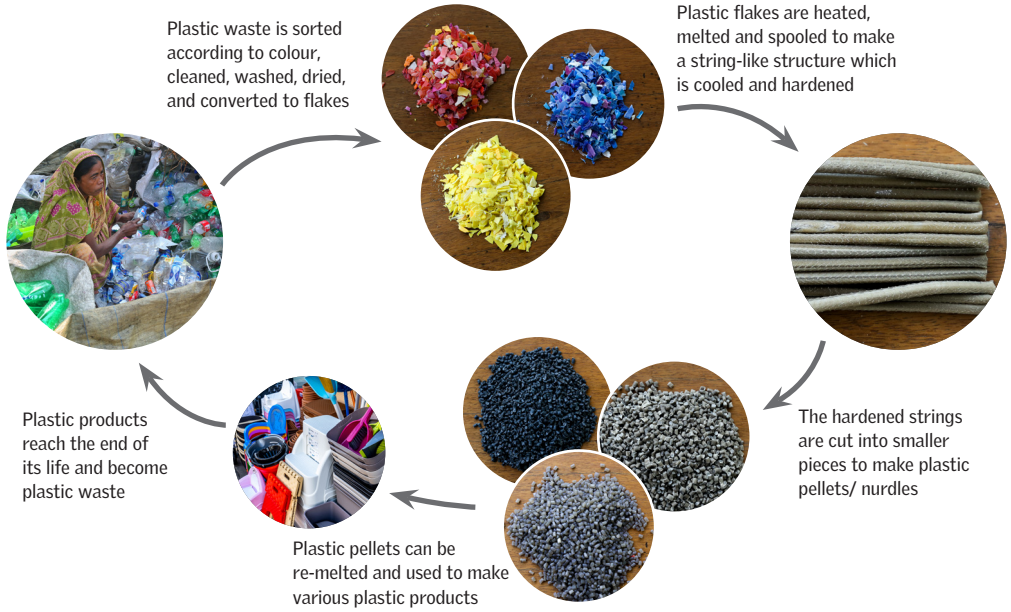
Plastic recycling is a process through which pre- and post-consumer plastic waste is passed through a number of unit operations like de-dusting, cleaning, washing, drying, shredding, melting, spooling, before being finally converted into pellets or products *(see Figure 7: Schematic of mechanical recycling of plastic waste)*.

In another approach, the inherent properties of plastic waste like high calorific value (embedded energy) or plasticity is utilised to be used as an alternative fuel or application as a replacement for natural resources such as fossil-based fuels.

Based on the end product, plastic recycling can be broadly classified into four types[40]:

1. Mechanical recycling
    - Primary recycling (e.g. bottle to bottle)
    - Secondary recycling (e.g. bottle to t-shirt)
2. End-of-life disposal
    - Tertiary/chemical recycling (e.g. bottle/plastic to fuel)
    - Quaternary recycling (e.g. bottle/plastic to energy by burning)

Figure 7: Schematic of mechanical recycling of plastic waste



Source: CSE 2022

End-of-life disposal solutions

Technically, end-of-life disposal of plastic waste in cement plants, road making and plastic-to-fuel applications cannot be termed as recycling. However, policies in India have been promoting use of plastic waste in these applications.

Plastic 'processing' and plastic 'recycling' are terms that are often used interchangeably by stakeholders across the plastic value chain. The definition of 'plastic waste processing' was added to the Plastic Waste Management Rules only in March 2021. Unfortunately, it labels all the end-of-life disposal arrangements as 'processing', under the garb of burning plastic waste.

Clause 18 of the Solid Waste Management Rules, 2016 states: "All industrial units using fuel and located within 100 kilometres from a solid waste based refuse derived fuel plant shall make arrangements within six months from the date of notification of these rules to replace at least 5 per cent of their fuel requirement by refuse derived fuel so produced."

Clause 5 (b) of the Plastic Waste Management Rules, 2016 states that "local bodies shall encourage the use of plastic waste (preferably the plastic waste which cannot be further recycled) for road construction as per the Indian Road Congress guidelines or energy recovery or waste to oil etc".

But the fundamental question to be answered by the plastic industry and regulatory bodies is why do we manufacture plastics that cannot be recycled? Why don't we encourage companies to make design changes in packaging products to ensure minimal or zero environmental impacts? Why do we create products deemed to become waste in the bat of an eyelid and then try to find false solutions to deal with the problem?

We discuss some of the so-called 'solutions' here.

Co-processing in cement plants

India is the second largest producer of cement in the world. In 2020, the country produced 329 million metric tonne of cement.[41] According to Ulhas Parlikar, an independent global consultant, in the cement industry, "12-15 per cent of the clinker (intermediary stage of cement) production can be attributed to coal – this means that at least 40 million tonne of coal was burnt to support cement production in India in 2020".

Over the years, to reduce costs and to adhere to compliance directives, the cement industry has started replacing coal with alternative fuels and raw materials (AFRs). AFRs include different kinds of hazardous and non-hazardous waste, such as pre-processed plastic waste (refuse-derived fuel) apart from fly ash and slag: these can be 'co-incinerated' without the need for companies to undertake trials.

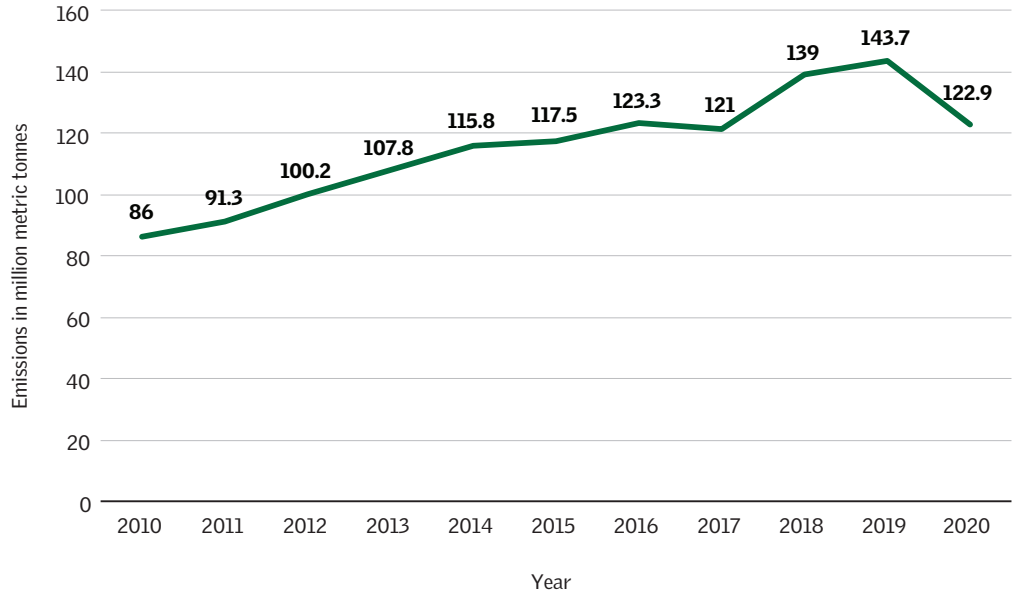
The quantum of alternative fuel needed is calculated on the basis of the thermal substitution rate (TSR), which refers to the quantity of alternative fuel required (as a substitution for conventional fuel) to generate a proportionate heat. The TSR for utilisation of plastic waste in 2016 was 4 per cent (this means 4 per cent of the total fuel consumption was replaced with alternative fuels like plastic waste): 1.6 million tonne of plastic waste was utilised as alternative fuel.[42]

Cement companies want to drive the TSR upward to 25 per cent by the year 2050.[43] While this would save costs for them, they will end up burning a lot more alternative fuel to generate the same amount of energy than they would burn if they used coal. To extract the same amount of energy from plastic (compared to coal), almost twice the amount of plastic waste will need to be burnt. The emissions from burning the same quantity of plastic as coal would be more than double. This is because, unlike as envisaged, the plastic waste is not necessarily received by cement industries in the form of refuse derived fuel (RDF). Instead, in a lot of cases, it comes in the form of bales directly from the bio-mining operations at the dumpsite, thus reducing the calorific value (CV) when compared to RDF.

The cement industry mainly uses non-coking bituminous coal[44] as a fuel, says the Cement Manufacturers Association (CMA) in India. Burning one kg of bituminous coal will produce 2.42 kg of carbon dioxide.[45] On the other hand, burning one kg of plastic emits 2.7 kg of carbon dioxide equivalent.[46] One of the limitations of this comparison could be that CO_2 equivalent accounts for other gases like methane, nitrous oxide etc as well. However, plastics – unlike coal – do not emit just carbon and hydrogen because of the additives that are present in them.

The cement industry alone is responsible for 8 per cent of global GHG emissions.[47] India being the second largest cement producing country in the world, has a considerable carbon footprint from cement production – the carbon dioxide emission intensity of the Indian cement industry in 2018 was 576 kg CO_2 per tonne of cement produced.[48] On the contrary, the average carbon dioxide emission intensity from total global cement production is 222 kg CO_2 per tonne of cement produced.[49] The emissions from the industry had spiked in 2018, as the use of refuse-derived fuel (RDF) received an approval from the CPCB (*see Graph 10:*

Graph 10: Emissions by the cement industry in India from 2010 to 2020



Source: CO_2 emissions from manufacture of cement in India, energy and environment, Statista 2022

Emissions by the cement industry in India from 2010 to 2020). The year 2020 saw a decline in the emissions owing to the impacts of the COVID-19 pandemic.

It is, therefore, imperative to understand the ill effects of burning plastic waste, even in sophisticated facilities like cement plants. We have to push for a systemic change upstream in the plastic value chain instead of opting for 'band-aid solutions'. We must move away from manufacturing plastics that are non-recyclable and have to be burnt in specialised facilities.

Using plastic waste in making roads

Another such practice fiercely promoted by the MoEFCC is the use of plastic waste in building roads. A 2004 report by the CPCB – *Dioxins (PCCDs and Furan (PCDFs) – Critical persistent organic pollutants (POPs)* – says: "During melting and mixing of asphalt, PCCDs and PCDFs are formed and emitted to the environment. The road construction activities are contributing extensive dioxin emissions through hot mix plants." This report also states that in the US, municipal waste incineration accounts for the highest levels of mean dioxin and furan emissions.[50]

Officials from ULBs point out that to build a one kilometre stretch of road having a width of 3.5 metres, one tonne of plastic waste can be used up. It has been found that modification of bitumen with shredded waste plastic marginally increases the cost by about Rs 2,500 per tonne, which can be attributed to the transportation

and the human-power requirement for handling the waste – while saving almost Rs 30,000 per kilometre of road (if conventional materials are used).
However, CSE's research revealed that a higher labour requirement mars the economic benefits, as labour availability and compensation are dynamic in nature. It was found that road contractors often pay for plastic waste as mandated by the Indian Road Congress (IRC) and get the "*challan*" for procurement, but do not use the waste in their road making activities because of the high labour count and cost.

In a written reply in the Lok Sabha, Nitin Gadkari, the Union Minister for Road Transport and Highways shared that as of July 2021, 703 km length of national highways had been constructed using plastic waste.[51] The ministry has issued guidelines for mandatory use of waste plastic in periodic renewal of roads with hot mixes, and in the weaning coat of service roads on national highways within a 50-km periphery of urban areas having a population of over 0.5 million.

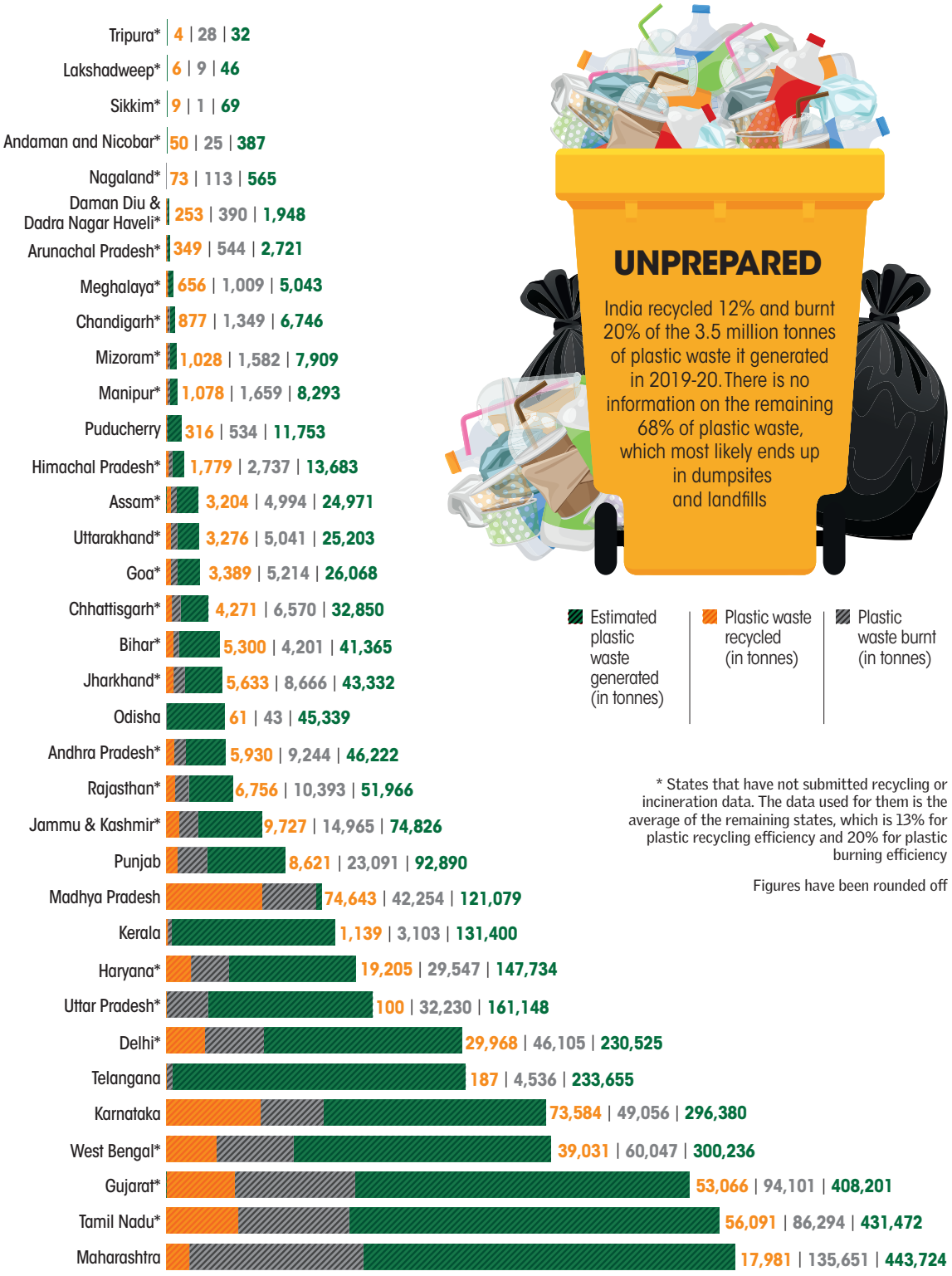
The road network in India grows at a rate of 10,000 km per year.[52] Assuming these roads to be four or six lane roads, a maximum of 40,000-60,000 tonne of plastic waste can be utilised for road making – this works out to be less than 2 per cent of the total plastic waste generated in the country (considering the latest plastic waste generation figure of 3.5 million metric tonne as per the CPCB's 2019-20 annual report for plastic waste management).

Making roads using plastics should, therefore, not be seen as a silver bullet for our mammoth problem. In the long run, such half-solutions may add to a bigger problem of micro-plastic in various compartments of the environment. There is enough evidence, globally as well as in India, to nudge policymakers to move away from false and interim solutions which do not tackle the problem of plastic at the source. Promoting such false narratives encourages companies to continue the production and use of non-recyclable plastics like multi-layered plastics, and encourages local governments to move away from actual solutions like mechanical recycling.

How much do we recycle and burn as a country?

In accordance with the provision 17(2) of the Plastic Waste Management Rules, 2016: "Every local body shall prepare and submit annual report in Form-V to the concerned secretary in charge of the Urban Development Department under intimation to the concerned State Pollution Control Board (SPCB) or Pollution Control Committee (PCC) by 30th June, every year." As per CPCB's Annual Report of 2019-20, all ULBs in 23 states and Union territories have submitted their annual reports to the concerned SPCB/PCC. However, none of the village panchayats (VPs) in any of the states and UTs have complied.

Figure 8: Plastic waste recycling efficiency in India



* States that have not submitted recycling or incineration data. The data used for them is the average of the remaining states, which is 13% for plastic recycling efficiency and 20% for plastic burning efficiency

Figures have been rounded off

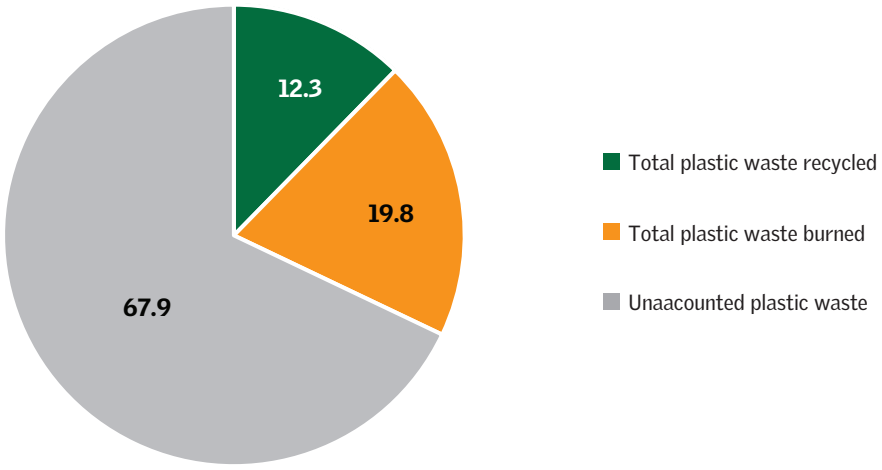
Source: CSE analysis based on the Annual Report on Plastic waste management, 2019-20, released by the Central Pollution Control Board

In five states/UTs – Andhra Pradesh, Chandigarh, Goa, Haryana and Jammu and Kashmir – none of the ULBs have submitted their annual reports. In seven states, only some of the ULBs have submitted the reports. The CPCB says there are 896 plastic recyclers in 30 states and UTs of the country – but the country's plastic recycling capacity is nowhere to be found in the Board's annual report.

Based on the limited data that the CPCB has released (of 23 states and UTs), CSE researchers have tried to compute the recycling efficiency of the country. Only 10 of the 23 states/UTs have submitted in their annual report the details of the plastic waste recycled through primary and secondary recycling (*see Figure 8: Plastic waste recycling efficiency in India*). Thirteen of the 23 have submitted data for tertiary and quaternary recycling, which involves burning of plastic waste in one form or the other.

The plastic recycling and burning efficiencies of the states were computed and the average was applied to all the states which have submitted incomplete data, and those that have not submitted anything. This was done to arrive at the total amount of plastic that could possibly be getting recycled or burned across the country, as well the amount of unaccounted plastic waste (*see Graph 11: Percentage of management and mismanagement of plastic waste in India*).

Graph 11: Percentage of management and mismanagement of plastic waste in India



Source: CSE analysis, 2022

This analysis reveals that India is recycling a meagre 12 per cent of its plastic waste, while it is burning – through end-of-life approaches – close to 20 per cent; a whopping 68 per cent of its plastic waste is unaccounted for, most of it probably lying in the environment and on dumpsites.

FOOD FOR THOUGHT

The Union Ministry of Housing and Urban Affairs claims that India recycles 60 per cent of its plastic waste. This could be true – but only for PET bottles that are collected in the country. This figure does not necessarily include other polymers like LDPE, PP, PS etc.

Moreover, almost 97 per cent of the collected PET bottles are channelised for making fabric, and all the bottles converted to fabric are then claimed to have been recycled as per the existing policies in the country.

There are, however, problems associated with terming this approach of making fabrics or textiles from plastic as 'recycling'. For starters, when textile is made from PET bottles, it is further blended with other materials to make the final product. This affects the recyclability of the final product.

The biggest loophole in this approach is that when the fabric reaches the end of its life after serving its mean service period, it is not considered as plastic waste despite having a considerable amount of plastic in it. For instance, polyester, nylon, acrylic and other synthetic fibres – all of which are forms of plastic – make up 60 per cent of our clothes worldwide.

CPCB's report also captures the best practices in plastic waste management. Of the 25 states/UTs that have been listed for best practices, 19 have mentioned extensive use of end-of-life approaches to deal with plastic waste generated in their jurisdictions. This points to the inclination of the ULBs and states governments towards opting for false and interim solutions of managing plastic waste since the National Plastic Waste policy fails to address the root cause.

9. Key findings and the way forward

Key findings of the report

On the petroleum, petrochemical, and plastic industry

- The petrochemical sector is the feeding source of the plastic industry. The sector is dominated by private players, whose production capacity is roughly thrice as much compared to public sector undertakings and joint ventures.
- Sixty-seven per cent of the basic petrochemicals produced in India are used to manufacture polymers (plastics).
- Average polymer production has increased by 160 per cent, and average polymer consumption has gone up by 196 per cent between 2005-06 and 2019-20.
- Linear low density polyethylene (LLDPE, used to make films and packaging) production increased by 334 per cent, highest for any polymer between 2005-06 and 2019-20.
- Polypropylene (PP, used mostly for packaging applications) consumption increased by 276 per cent, highest for any polymer between 2005-06 and 2019-20.

On the biodegradable and compostable plastic industry

- All biodegradable plastics are not made from biodegradable sources and are not necessarily biodegradable.
- Compostable plastics cannot be handled and processed along with conventional fossil fuel-based plastics and hence, promoting them will require special attention to collection, channelisation and treatment streams.
- There is no inventory of companies in India manufacturing compostable plastics; neither is there a repository of industrial composting facilities (where compostable plastics can be processed).
- The labelling mechanism for compostable and biodegradable plastics – which are being looked up at and promoted as alternatives to conventional plastics by the Ministry of Environment, Forest and Climate Change – is very weak in the country and needs to be taken up on priority. The labelling requirements of the latest ISO standard are not met by most of the manufacturers who are putting compostable products on the Indian market, thus passing incomplete information to authorities and consumers regarding the disposal practices and management of compostable plastics.

On producers, brand owners and importers (PIBOs)

- In 2018-19, 10.9 million metric tonne (MMT) of plastic was used to manufacture packaging products: this translates into 37 per cent of the overall petrochemical production in the country. In the same year, 3.8 MMT of multi-layered plastic was released in the market.
- Brand owners are trying to greenwash their products through claims of 'plastic neutrality'. Plastic neutrality only guarantees collection of waste and not its recycling. Companies should be allowed to call themselves plastic neutral only when they are able to recycle 100 per cent of the plastic they put on the market.
- The extended producer's responsibility (EPR) policy, introduced for plastics in the Indian market, has serious limitations in clarity for implementation. For instance, there is no information on the quantity of plastic material or waste the company generates. Not only is it based on self-declaration, there is nothing available in the public domain to assess its accuracy. This means the target that has been set for each company is meaningless. There is no benchmark on which it can be said to be adequate.
- PIBOs were assigned a 25 per cent collection target for the plastic they put out on the market for the fiscal year 2021-22 – there has been no update on the performance of the companies by CPCB for 2021-22. In fiscal year 2022-23, the companies have an EPR target of 70 per cent. However, CPCB is struggling to even register all the PIBOs on its EPR portal.
- The recycling targets (under EPR) for PIBOs only start from the fiscal year 2024-25, which means that there is no mandate on recycling of the collected plastic waste till 2024-25. More clarity is needed on what will happen to the collected plastic waste – will it be stored, burnt or dumped?
- Post-fiscal year 2027-28, close to half of the flexible and multi-layered plastics manufactured could still be burnt in facilities like cement plants. The question here is, why should we continue to manufacture multi-layered plastic when we know that most of it cannot be recycled and will have to be transported hundreds of miles to be burnt?
- The technology to verify the use of recycled content in plastic products is non-existent. Thus any claim of use of recycled plastic cannot be verified. This means that we have no option but to rely on the integrity, honesty and credibility of the organisation's claim.
- The EPR notification gives a comfortable miss to biodegradable plastics; however, it has kept compostable plastic under its ambit. The policymakers need to get their basics right – every compostable plastic is biodegradable in nature, but every biodegradable bag may not be compostable. The ecosystem of biodegradable and compostable bags is not as easy as it has been envisaged

in our legislation. There needs to be much more deliberation before promoting and giving exemption to biodegradable plastics in the Indian market.

On retailers and street vendors

- Retailers and street vendors are a critical part of the plastic value chain.
- Retailers' involvement in plastic waste management was explored in the Plastic Waste Management Rules, 2016 but was withdrawn due to capacity and commitment issues of urban local governments and state officials.
- Deposit refund system (DRS) may complement extended producer responsibility (EPR) by incentivising consumers and making 'polluters' accountable.

On consumers

- Consumers are often blamed for the plastic problem that the country faces.
- Conscious consumers do not have affordable non-plastic options to choose from while buying products.
- A majority of consumers surveyed by CSE are aware of the issues and concerns related to plastic and plastic waste.
- Waste management practices adopted by consumers need to be upgraded and up-scaled.

On the informal sector

- As high as 42-86 per cent of the plastic waste flows through the informal sector to material recovery facilities operated by giant multinational corporations in partnership with local governments or otherwise.
- The informal sector is being imposed with the responsibility of collecting non-recyclable plastic waste released in the market by FMCG companies.
- Engaging with the informal sector is a strategy used by corporates to ensure the flow of materials to MRFs. This helps the brands build up an image of being environmentally responsible and socially inclusive.
- The industry is trying to 'externalise the internalities' by deciding for itself the collection price for every kilogram of non-recyclable plastic waste. The facilities that CSE interacted with claimed that they did not make any profits from such a collection mechanism; moreover, due to the high volumes, it also affects their income from other recyclable plastic wastes.

On plastic recyclers

- The Indian government's claim of the country recycling 60 per cent of its plastic waste is limited to specific types of polymers (plastics) like PET bottles.
- As per a statistical analysis done by CSE using CPCB's data, India is merely

recycling (through mechanical recycling) 12 per cent of its plastic waste. Close to 20 per cent of this waste is channelised for end-of-life solutions like co-incineration, plastic-to-fuel and road making, which means we are burning 20 per cent of our plastic waste and still calling it 'recycling'. Sixty-eight per cent of the plastic waste is unaccounted for.

- The major plastic recyclers who have submitted data to the CPCB send 60-70 per cent of the waste collected by them for end-of-life disposal like co-incineration.
- We are not 'closing the loop' with our approaches to plastic waste management – this is evident for both PET down-cycling, as well as for burning of non-recyclable plastics. In fact, we are bifurcating the loop, and such approaches cannot be termed circular, a buzz word often used by companies to show their commitment to the environment.

The way forward

Short term actions (one-two years)

- **Strengthen the inventories, collect credible data:** The plastic waste production, consumption and recycling inventory of the country needs to be strengthened. Simultaneously, we need to work on estimating/calculating the country's plastic recycling capacity, and create an inventory of all the plastic recycling processes used in the country. It is amusing to note that the industry and plastic research markets have already compiled this data and sell it for as high as Rs 300,000[53], but this data is not to be found in government records.
- **Build capacity of government functionaries**: There should be a focus on building capacities of Central, state and local government officials on the concept of extended producer responsibility, single use plastic ban enforcement and what exactly is meant by "closing the loop" – this will help them identify the false solutions and avoid including them in plastic waste management laws. Apart from this, the representation of industry in committees formed by the various ministries needs to be brought down; at the same time, representation from other stakeholders like recyclers, retailers, the informal sector and civil society organisations should be increased.
- **Monitor biodegradable and compostable plastics**: A stringent monitoring mechanism is needed for tracking the biodegradable and compostable plastics that are being released into the market. With the CPCB looking at them as potential alternatives, we should not lose sight of the challenges that come along with this special stream of plastic waste. A labelling mechanism needs to be enforced especially for compostable and biodegradable plastic to ensure that

such plastics are not designed and labelled to confuse consumers regarding their disposal practices.

- **Proactive disclosure policy for PIBOs:** A high degree of opacity lies in the systems that are currently in place as far as use of plastic by PIBOs is concerned. Brands should be mandated to have a proactive disclosure policy to continually report the amount of plastics put out by them in the market each year. The amount of plastic they collect back and send for recycling and burning should also be made available in the public domain. This will decrease the possibility of greenwashing of products by brand owners. Currently, the arrangement is that brands disclose data to the CPCB, which never reaches the public domain. On a global scale, the sustainability reporting matrix needs to be updated by Global Reporting Initiative (GRI) to ensure companies correctly and continuously report on the amount of plastic used and put on the regional and global market, along with the collection and recycling initiatives.
- **Ramp up communication campaigns**: Local and state governments should invest in behaviour change campaigns with appropriate communication strategy and products. It has been observed such campaigns, when done right, have always been pivotal to the success achieved by city governments. Behaviour change aimed at ensuring segregated streams of plastic waste, can create an enabling environment for efficient channelisation of plastic waste to relevant facilities. The Swachh Bharat Mission (SBM) 2.0, which has plastic waste management as one of its agendas, has earmarked Rs 3,763 crore for capacity building.
- **Ensure credible labelling**: Consumers should have the right to correct and relevant information through robust labelling mechanisms. For instance, use of the recycled symbol even on non-recyclable plastic packaging is equivalent to misleading consumers. Such plastics should explicitly mention that they are non-recyclable. Consumers should also be given the right to buy products in packaging formats that are not plastic-based. The packaging material should be diversified and include materials like glass, metal, paper, etc, depending on the application and utility. Brands should not be allowed to put out products in just one type of packaging material.
- **Involve the informal sector**: The informal sector needs to be included in the formal value chain of plastic waste management. It also need to be protected from the rapid privatisation of plastic waste management services. Trade unions should help organise waste-pickers and form cooperatives that provide front-end waste management services. Support organisations like civil society bodies, research institutions and non-governmental organisations can help waste-picker's cooperatives engage in the policy making process and

multi-stakeholder debates on waste management, particularly through data collection and knowledge generation on the role of waste-pickers. They can also support capacity building of members including on occupational health and safety, gender issues and policy advocacy.

- **Promote refillable/reusable models of packaging**: Refillable models for single use plastic packaging for FMCG products should be promoted by the government and explored by the brand owners. Refillable models promote the concept of reduce and reuse which takes us in the right direction towards solutions for the plastic problem. When packaging products are designed to serve a higher mean service life and will be taken back by manufacturers, the entire approach to product design will be different and sympathetic to environmental concerns.
- **Rationalise the EPR system:** Giant companies have devised a mechanism to involve waste-picker cooperatives to fulfil their (the companies') EPR liabilities. All this is being done without knowing the actual cost of EPR, which should account for the cost of minimum labour wages, occupational safety and the health benefits for the workers actually involved in making EPR targets a reality for big companies. The 'Code on Wages' notified in August 2019 by the Union Ministry of Law and Justice clearly states in Clause 5: "No employer shall pay to any employee wages less than the minimum rate of wages notified by the appropriate government." The cost of EPR should not be limited to collection services if the informal sector is involved – it should take into account the livelihood and human health aspects of the workers, and provide a fair compensation to them. A roadmap for a 'just transition' of the informal waste-picker groups needs to be developed.
- **Ban Multi-layered plastic (MLP):** The agenda of banning/phasing out MLP has time and again escaped lawmakers. We need to institute a systemic change in the way we are consuming. We cannot keep producing materials that cannot be dealt with once their end-of-life is reached. Collecting, transporting and burning of these material come with a cost which is paid from the taxpayer's money. It is high time that we work on a strategy to phase out MLP from the India market.
- **Enforce the laws:** Stricter enforcement mechanisms need to be developed for the state pollution control boards and urban local governments. Capacity of government officials needs to be upgraded on what to look for when they visit a certain type of facility. A checklist can be developed for SPCB/PCC officials (see Box: *A sample checklist*) for every kind of facility they are expected to inspect. Reporting should be facilitated (on the website of the government agency) on the scale at which inspections were done at various facilities.

A SAMPLE CHECKLIST

For SPCB officials inspecting plastic recyclers

1. Name of recycler
2. Authorisation/registration form
3. Action consent under Water Act,1974 and Air Act,1981
4. Proof of recycling capacity issued by the authorising agency (SPCB/PCC etc)
5. Is the official capacity being met through operations, or is the facility underutilised or over-utilised?
6. Consent to establish
7. Consent to operate
8. Most recent date of inspection and details thereof
9. Utilities (electricity and water) bill for the last one year
10. Types of plastic the recycling facility handles
11. Recycling process flow chart with mass/material balance sheet, comments on the process
12. List of companies: Source of raw materials (who supply to the recyclers), along with GST details
13. List of companies: Destinations of products (who buy from the recyclers) along with GST details
14. Destination of rejects of the recycling process along with GST details
15. Is data appropriately managed for incoming waste, stored waste and outgoing waste from the facility? Details thereof
16. What kind of additives are being used in the recycling process?
17. List of companies that supply additives with GST details
18. Measures taken for control of air pollution from the resulting activities
19. Measures taken for control of water pollution from the resulting activities
20. Are the measures taken enough? If not, elaborate what extra measures should be taken

For SPCB/PCC officials inspecting producer responsibility organisations (PROs)

1. Name of PRO and details thereof
2. List of clients with details thereof (including GST)
3. Cumulative collection targets as per client's requirements
4. Bifurcated collection targets as per client's requirements
5. Types of plastic being collected by the PRO
6. Total quantum of plastic waste (by type specified in EPR) collected by the PRO in the last fiscal year
7. List of organisations/agencies/ individuals who act as source of plastic waste collected by the PRO and details thereof
8. List of organisations/ agencies/individuals who act as destination for the plastic waste and details thereof
9. Is the PRO involved in any other activity like operating MRF or recycling – details thereof

Medium term actions (five-10 years)

- **Institute design changes in product packaging**: While it is important to focus on the downstream aspects of plastic pollution by promoting better waste management practices, equal importance and thought needs to be given

to upstream solutions such as design changes in product packaging. Product packaging priorities usually revolve around appeal to consumers, safety of the product, durability, shelf life, ability to communicate product and brand purpose etc. However, it is important to shift the conversation to designing with the 'end-of-life' in consideration. What happens to the product packaging once it serves its purpose should be clearly defined at the concept stage, and disposal methods communicated to consumers through labelling. It is a fact that the more composite the packaging, the costlier and more unfeasible is the recycling potential. Using polymers from the same family will increase the recyclability of the plastic packaging: this needs to be a way forward, simultaneously moving away from composite plastics.

- **Encourage R&D on plastic packaging:** The industry should earmark funds for research and development on plastic packaging which will help us transition from the problematic non-recyclable plastics to a market with higher recyclable materials. Recently, Colgate-Palmolive has developed a mono-material plastic packaging for toothpaste which reportedly increases the recyclability of the otherwise non-recyclable lami-tube used currently for paste or gel-based products. The company has also declared that it is inviting other stakeholders to use this packaging format without demanding royalty for the developer.

Long term actions (10-15 years)

- **Match environmental choices with economic choices:** India will need to put its environmental preferences at par with its economic preferences, if not above. This will need a lot of courage and some tough decisions.

» Petroleum and petrochemical companies should also be held accountable for the plastic waste that we have to deal with. While the existing legal arrangement gives this a comfortable miss, we need to understand that any number of midstream and downstream plastic waste management strategies like design changes, clean-up drives, and bio-remediation are responses to the pollution that we already have to deal with. Placing a considerable amount of responsibility (economic, social and environmental) on the very source of the plastic pollution, and regulating plastic production both quantitatively and qualitatively, will go a long way in nailing the problem.

» The ultimate solution is to target the 'source' of the problem by regulating the production of polymers, which has witnessed an exponential rise in the last few decades. For instance, the Organisation for Economic Co-operation and Development (OECD) has defined polymers of low concern (PLCs) as those deemed to have insignificant environmental and human health impacts. PLCs are proposed to have a reduced regulatory requirement as compared to polymers of high concern that have a low molecular weight.

» Europe, USA, Australia, China, Japan and South Korea have a dedicated authority to regulate the use of polymers that are being introduced in the market. The relevant authority in these countries needs to be notified before work begins on a new category of polymer. Such a mechanism needs to be developed in India as well, not only for qualitative purposes but also for quantitative reasons to keep a check on the polymer production in the country.

- **Introduce DRS**: Deposit refund schemes (DRS) that involve all stakeholders and strengthen existing legal tools like EPR should be introduced. Such schemes will incentivise the consumer while putting the responsibility on the right shoulders in the plastic value chain. This will ensure that bottles are recycled and converted back to bottles, and not to a product which takes the plastic waste generated at the end-of-life out of the plastic waste eco-system and accounting, leading to unaccounted composite/blended plastic waste which is much more difficult to recycle.

Annexure

CSE survey on consumer perceptions

Please note: Most of the questions are about plastic packaging and not about plastics used for other application like transport, healthcare etc. Please keep plastic packaging in mind when answering the questions.

1. Do you carry a reusable bag when you go out for shopping to buy your daily necessities?
   a. Yes
   b. No
   c. Sometimes

2. Are you happy with the kind of plastic packaging that comes with your online/ offline shopping order?
   a. Yes
   b. No
   c. I never really thought about it

3. Do you think the plastic packaging received with your online/offline orders can be recycled?
   a. Yes, all plastics are recyclable
   b. No, some plastics are difficult to recycle
   c. I am not sure

4. What do you do with the plastic bags that you receive with your online order?
   a. Throw them right away in the dustbin
   b. Re-use as bin liner for mixed/dry/ wet waste
   c. Re-use for some other purpose

5. What do you do with the milk (dairy products) packets and multi-layered packaging that you get with your products? *(A photo of Multi layered plastic is shown for your reference)*

a. Clean them and then dispose of in dry waste bin
b. Dispose without cleaning in mixed waste bin
c. Clean and re-use them for some other purpose

6. Do you think we should stop using plastic packaging for good?
   a. Yes absolutely, plastics are not good for the environment
   b. No, we cannot live without plastic packaging
   c. I think there is no alternative to plastic packaging

7. Do you get products packed handed over in plastics without asking for it?
   a. Yes, almost everything I buy comes packaged in plastic
   b. No, there are a lot of things which don't come in plastic packaging

8. Assume that you decide to go plastic free one day, but have to get your daily necessities from the market? Will it be an easy day for you?
   a. Yes, it is easy to shop free of plastics
   b. No, I will have a very difficult day

9. Would you buy something packaged in an alternative packaging (like paper, glass and, metal)
   a. Yes
   b. No

10. Would you pay extra for something that is packaged in an alternative packaging (like paper, glass and, metal)?
    a. Yes
    b. No

11. Have you noticed the three chasing arrows (recycling symbol) that is imprinted on plastic products? *(A picture of recycling symbols is attached for your reference)*

    a. Yes
    b. No

12. According to you what does the recycling symbol and the number inside/below it indicate?
    a. The number of times a plastic product can be recycled
    b. The type of plastic.
    c. The strength of plastic

13. Do you segregate your plastic waste at home?
    a. Yes
    b. No

14. On an average, what is the amount of plastic waste you generate as an individual every day?
    a. Up to 50 grams
    b. Up to 100 grams
    c. More than 100 grams
    d. Can't really say

15. Would you, as a consumer want to buy products packaged in material other than plastic?
    a. Yes
    b. No

16. What according to you to reduce plastic pollution?
    a. Answer in brief with word limit of 100 words
    b. Don't want to comment

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Plastics have become a part of our lives, lifestyles and our environment – omnipresent, undying, and threatening to swamp this world completely. A recent study says the global production of plastics increased by 79 per cent between the years 2000 and 2015, and that 80 per cent of all the plastics ever produced continues to remain in the environment.

How do we surmount this seemingly unsurmountable problem? To begin doing that, we need to clearly understand the life-cycle of plastic. We need to get a grip on the plastic pollution challenge from the perspective of the different stakeholders who are integral to the landscape – from the petroleum-petrochemical and plastic industry to the recycling sector. This report is an effort to do just that, and come up with a viable set of actions that might help in turning the tide.

Centre for Science and Environment
41, Tughlakabad Institutional Area, New Delhi 110 062
Phones: 91-11-40616000 Fax: 91-11-29955879
Website: www.cseindia.org