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?

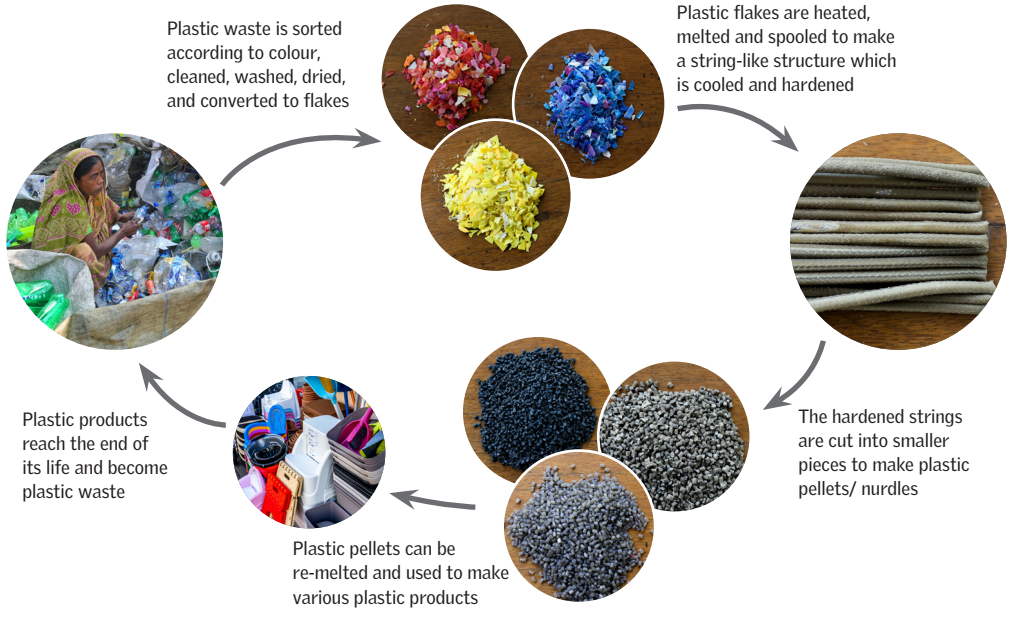
Plastic recycling is a process through which pre- and post-consumer plastic waste is passed through a number of unit operations like de-dusting, cleaning, washing, drying, shredding, melting, spooling, before being finally converted into pellets or products *(see Figure 7: Schematic of mechanical recycling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

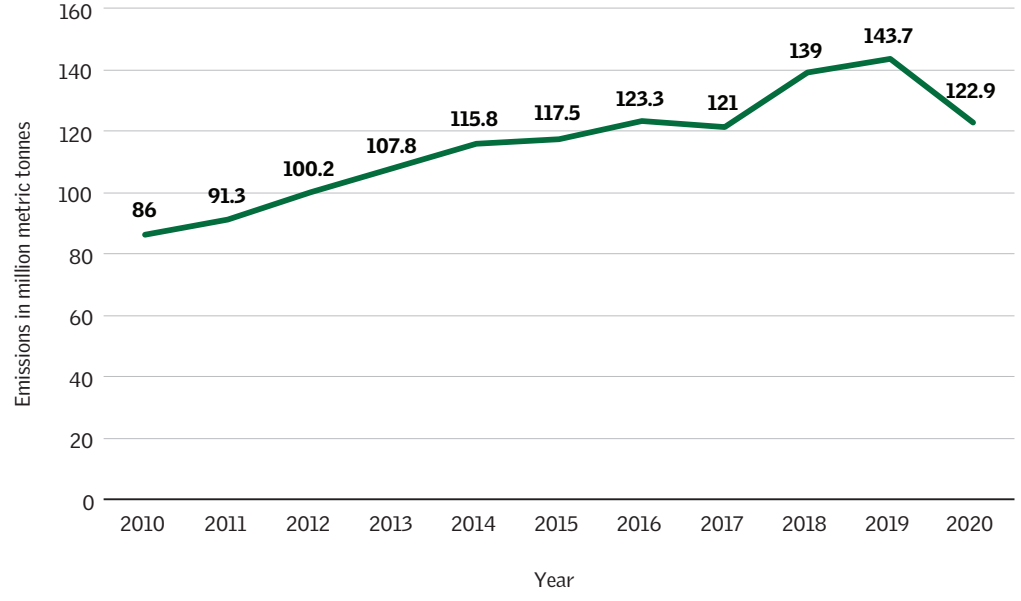
The quantum of alternative fuel needed is calculated on the basis of the thermal substitution rate (TSR), which refers to the quantity of alternative fuel required (as a substitution for conventional fuel) to generate a proportionate heat. The TSR for utilisation of plastic waste in 2016 was 4 per cent (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.

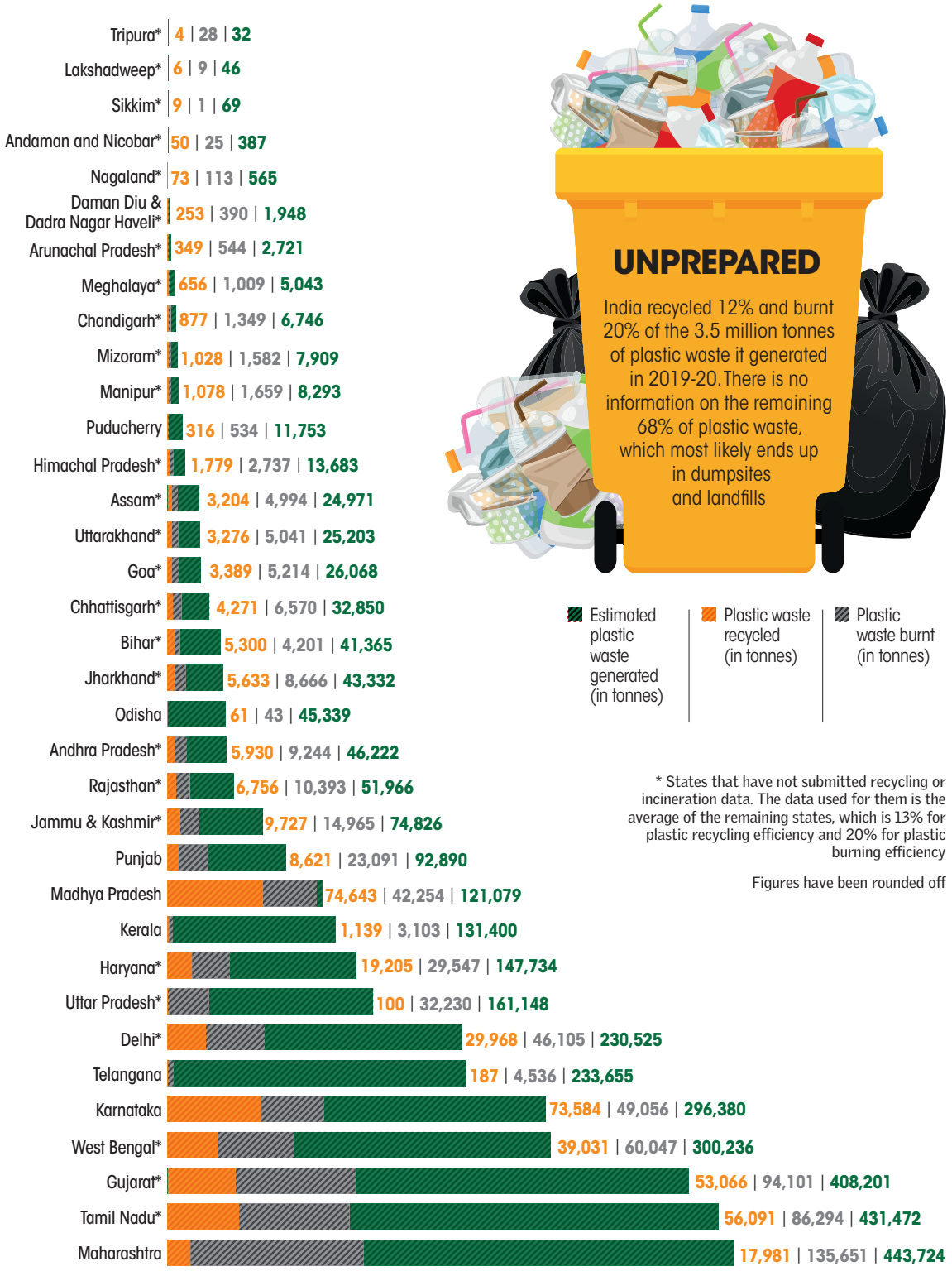
The road network in India grows at a rate of 10,000 km per year.[52] Assuming these roads to be four or six lane roads, a maximum of 40,000-60,000 tonne of plastic waste can be utilised for road making – this works out to be less than 2 per cent of the total plastic waste generated in the country (considering 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

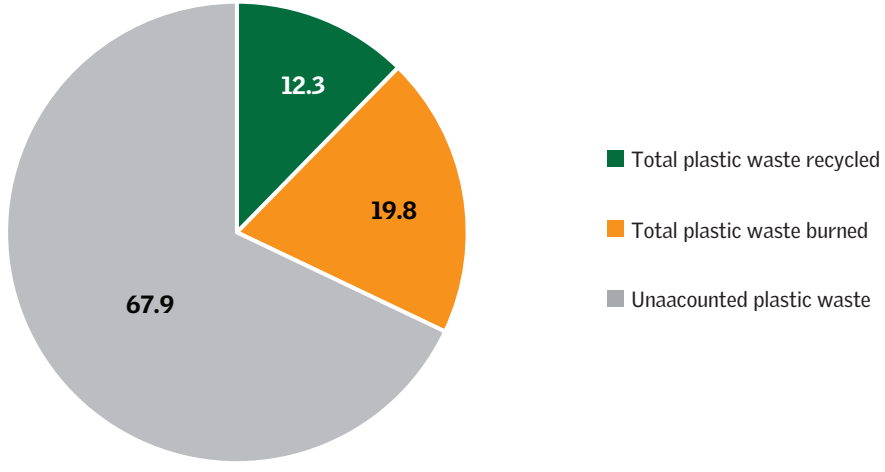
Source: CSE analysis based on the Annual Report on Plastic waste management, 2019-20, released by the Central Pollution Control Board

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.