Credits:

Indore:
Biomethane plant at Chhoitram Mandi along with another plant process 35 tonne wet waste daily and produce over 1000 kg bio-CNG

by Indore Smart City Limited

7

Waste Management

Waste Management

Significant increase in Municipal Solid Waste (MSW) generation has been recorded world wide due to rapid population growth accompanied with industrialization, urbanization, and economic growth. Globally, the average waste generated per capita per day is around 0.74 kilogram but ranges widely, from 0.11 to 4.54 kgs per capita per day[1]. Global municipal solid waste is expected to grow to 3.40 billion tonnes by 2050 from the current 2.01 billion tonnes annually, with doubled population growth over the same period.[1] The statistical data of waste production around the world is concerning. Waste accumulation and improper disposal severely affects the environment causing air, water and soil pollution which affects public health and causes ecological damage.

In India, waste management is one of the major environmental concerns, especially in metropolitan cities due to high amount of waste generation in comparision to the capacity of landfill availability. According to the "Swachhata Sandesh Newsletter" by the MoHUA, as of January 2020, 147,613 metric tonnes (MT) of solid waste is being generated per day, from 84,475 urban wards. The amount of waste generation in these wards ranges from 32 MT to 22,080 MT per day. The smaller towns and cities face challenges in managing the waste effectively and are usually disposed in low-lying areas without taking necessary precautions or operational controls. Hence, adopting government policies at national, state, and local level is required especially in the context of rapid urbanization of peri-urban areas. That said, India has shown progressive waste management approaches in recent years with the introduction Swachh Bharat Mission (SBM) and Swachh Survekshan (SS) in 2014 and 2016 respectively.

The waste management theme of CSCAF 2.0 is aligned with the SS 2020 and the same has been referred for this assessment. The 6 indicators in this theme include waste minimization initiatives, extent of dry waste recovered, extend to wet waste processed, construction and demolition (C&D) waste management, scientific land availability and landfill/dumpsite scientific remediation. These 6 indicators are mapped with 11 relevant service level indicators of SS 2020. The total SS score of these 11 indicators across one quarter was 620 and the same has been normalized to 600 in CSCAF 2.0.

"With launch of the ClimateSmart Cities Assessment Framework, an attempt is made to look into waste management practices in cities with a climate lens and adopt an outcome-oriented approach for implementation and monitoring."

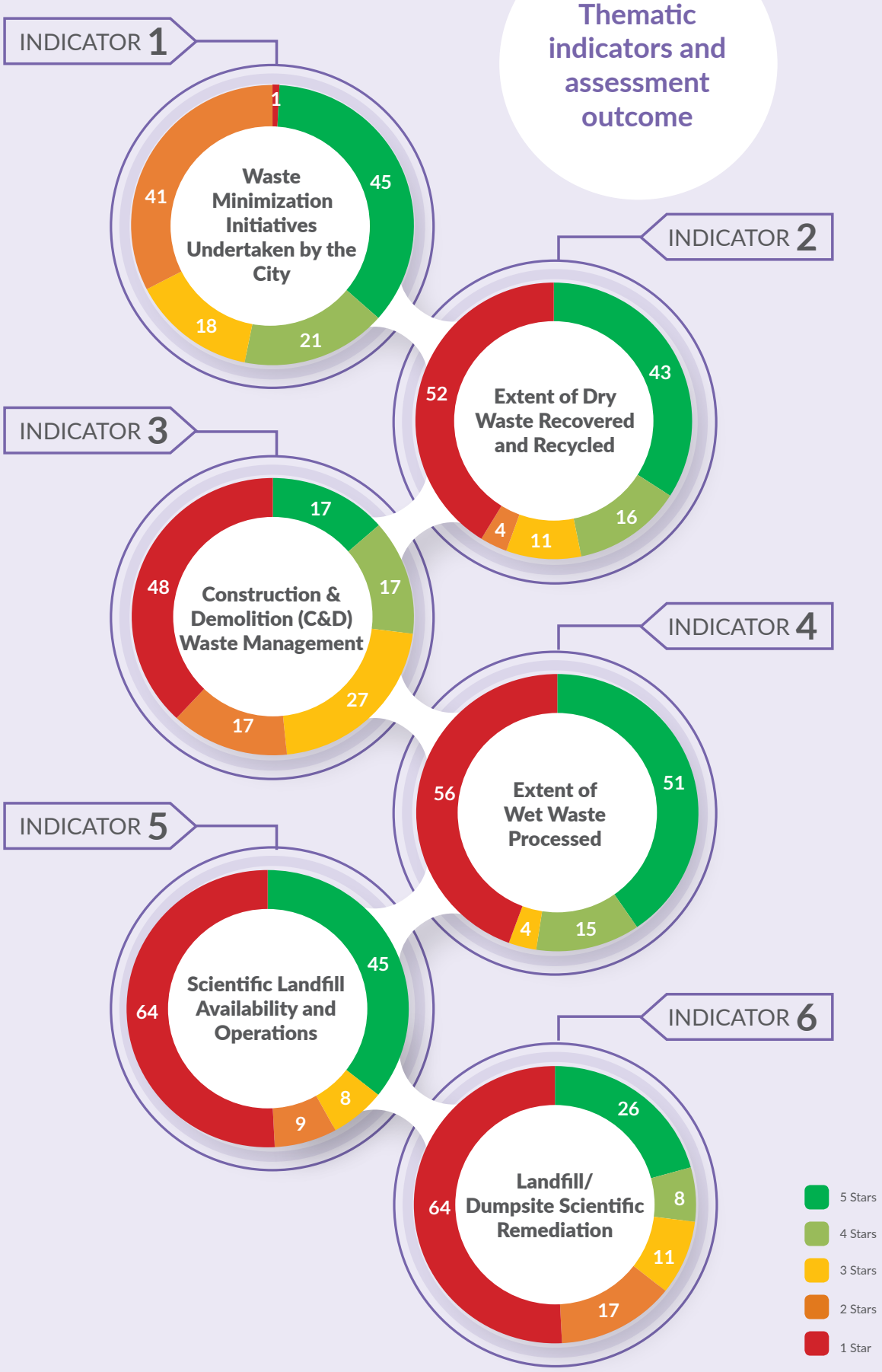
Mr. Vibhor Sood
Technical Expert
Climate Smart Cities Project, GIZ and
SWM Expert PMU Member, CSCAF 2.0

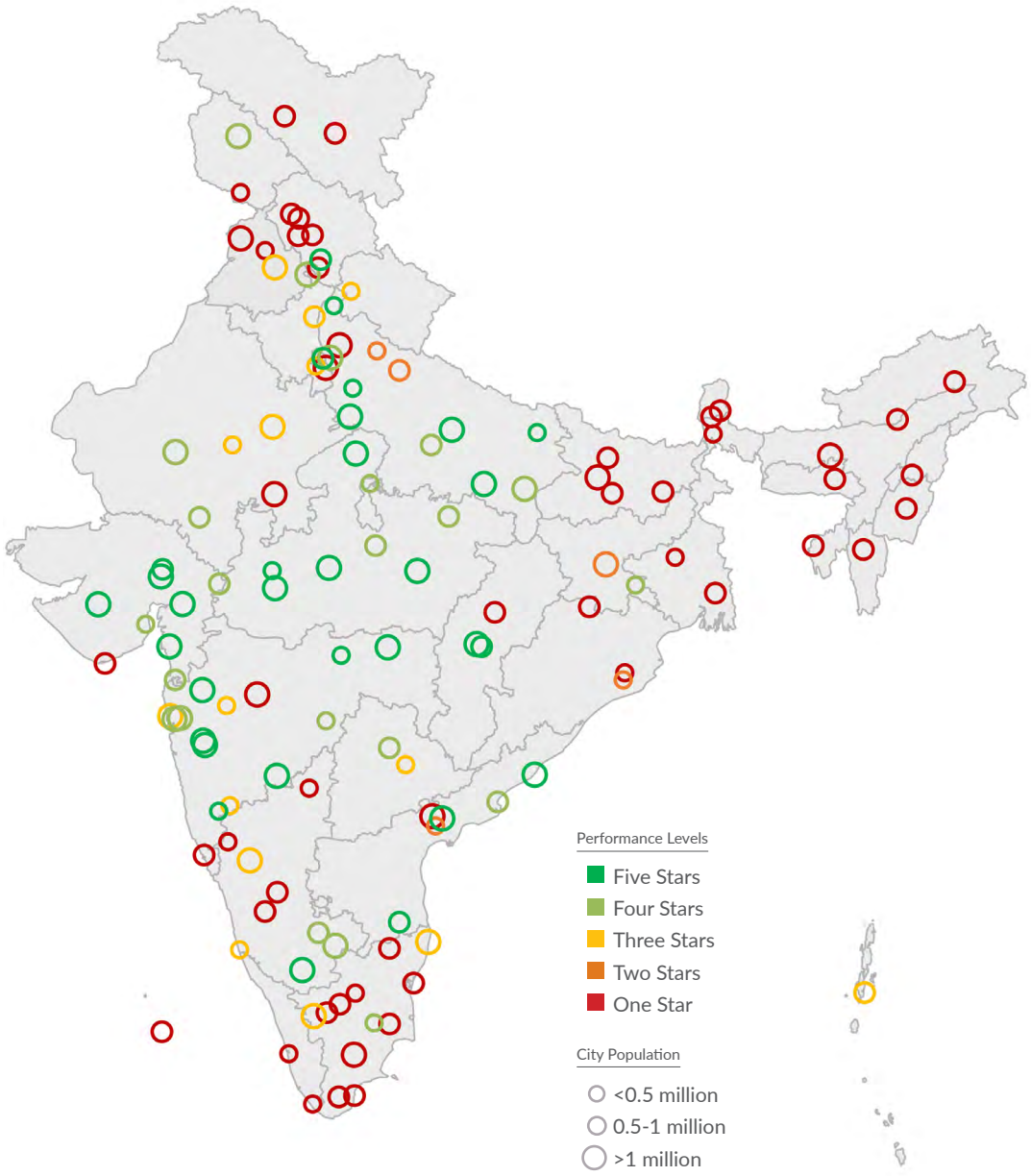
Ms. Paramita Datta Dey
Team Lead (SCIAP)
National Institute of Urban Affairs

"The scientific management of solid waste can substantially reduce the GHGs arising out of the waste sector. This will require more aggressive management of waste at source (source segregation) at the upstream, more recycling and reuse, at midstream and safer disposal, at the downstream. A great impetus to this has been the Swachh Bharat Mission and the competitive process of the Swachh Survekshan. The CSCAF framework will further strengthen and motivate more cities leapfrog to achieve its cleanliness targets, thereby making them more climate resilient."

1. The World Bank. Trends in Solid Waste Management. [Online]Available at: https://datatopics.worldbank.org/what-a-waste/trends_in_solid_waste_management.html#:~:text=The%20world%20generates%202.01%20billion,from%200.11%20to%204.54%20kilograms. [Accessed April 2021]

Thematic indicators and assessment outcome





Performance of 126 Cities

In this thematic area, 31 cities have progressed to the level of *Five Stars* cities. 21 out of the 31 *Five Stars* cities are metropolitan cities from Andhra Pradesh, Chattisgarh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, and Uttar Pradesh. These cities have managed to showcase evidences of practice and performance in the areas of plastic waste management, 3R principles, treatment of domestic hazardous waste, on-site processing of wet-waste by bulk waste generators, household/ community level wet waste processing, landfill availability and scientific remediation.

Half of the 53 *One Star* cities are medium size cities from the eastern, north-eastern and southern region (except Jamshedpur). All hilly cities (with an exception of Shimla) are at early stages of improving their waste management. Waste management requires adequate road infrastructure and the terrain in hilly areas may posecomplex challenges in transportation and management of waste. Even the small-town cities lack most aspects of waste management. This can be due to lower generation of waste owning to relatively low population or lack of resources to contextualize solutions and implement them.

9 out of the 15 participating coastal cities are not performing well. These cities face a risk of improper waste dumping in the sea, estuaries and creeks leading to negative impacts on coastal ecology.

31
5 Stars

22
4 Stars

15
3 Stars

5
2 Stars

53
1 Star

★★★★★

- **Agra**
- **Ahmedabad**
- Aligarh
- Amravati
- **Bhopal**
- Delhi
- Gandhinagar
- Gorakhpur
- **Gwalior**
- **Indore**
- **Jabalpur**
- Kolhapur
- **Lucknow**
- Mysore
- **Nagpur**
- **Nashik**
- Naya Raipur
- **Pimpri Chinchwad**
- **Prayagraj**
- **Pune**
- **Raipur**
- **Rajkot**
- Saharanpur
- Shimla
- Solapur
- **Surat**
- Tirupati
- **Ujjain**
- **Vadodara**
- **Vijayawada**
- **Visakhapatnam**

★★★★

- **Bengaluru**
- Bhavnagar
- Chandigarh
- Dahod
- **Ghaziabad**
- Jamshedpur
- Jhansi
- **Jodhpur**
- Kakinada
- **Kalyan Dombivali**
- **Kanpur**
- Karimnagar
- Nanded
- **Sagar**
- **Satna**
- Silvassa
- **Srinagar**
- **Thane**
- Tiruchirapalli
- Tumakuru
- Udaipur
- **Varanasi**

★★★

- Ajmer
- **Chennai**
- **Coimbatore**
- Dehradun
- Gurugram
- Hubli Dharwad
- **Jaipur**
- Karnal
- Loni
- **Ludhiana**
- Mangalore
- Mira Bhayandar
- Port Blair
- Sangli Miraj & Kupwad
- Warangal

★★

- Barielly
- Bhubaneshwar
- Guntur
- Moradabad
- **Ranchi**

★

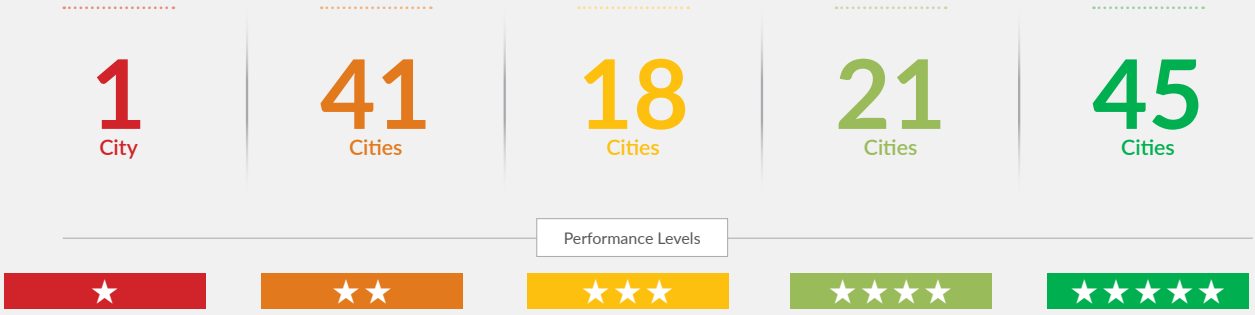
- Agartala
- Aizawl
- Amravathi
- **Amritsar**
- **Aurangabad**
- Belagavi
- Bhagalpur
- Bihar Sharif
- Bilaspur
- Cuttack
- Davangere
- Dharamshala
- Diu
- Durgapur
- Erode
- **Faridabad**
- Gangtok
- Gulbarga
- Guwahati
- Hamirpur
- Imphal
- Itanagar
- Jalandhar
- Jammu
- Kargil
- Kavaratti
- Kochi
- Kohima
- **Kota**
- Leh
- **Madurai**
- Mandi
- **Meerut**
- Muzaffarpur
- Namchi
- New Town Kolkata
- Palampur
- Panaji
- Pasighat
- **Patna**
- Puducherry
- Rourkela
- Salem
- Shillong
- Shivamogga
- Siliguri
- Solan
- Thanjavur
- Tirunelveli
- Tiruppur
- Tiruvanantapuram
- Toothukudi
- Vellore

● Smart and AMRUT cities ◈ Smart cities ◆ AMRUT cities ○ Other cities *Million + population cities

INDICATOR 1

Waste Minimization Initiatives Undertaken by the City

This indicator is mapped with the marks of 5 service level indicators of Swachh Survekshan 2019. They are plastic waste management (1.8), 3R principles of dry and wet waste (1.9), domestic hazardous waste collected and processed (2.5), management of bulk waste generators (2.9) and wet waste processing at household or community level (2.11). The performance levels are categorized based on resulting CSCAF 2.0 score.



Performance of 126 cities

- ✓ Among the 126 cities, only Amravati (A.P) is in *One Star* category, since it is a new and developing city and is yet to inititate necessary steps for efficient waste management.
- ✓ Cities from the northern and western region are performing better than the cities from north-eastern and southern region. Half of the *Five Stars* cities are from the northern and western regions. Half of the cities in the *Two Stars* category are from the north-eastern and southern regions.
- ✓ 45 cities managed to showcase their efforts in minimizing waste generation through various methods. 29 out of these 45 cities are from the northern and western regions. Innovative ways for reduction of waste generation at a household/ community level, hazardous waste treatment and other technological interventions to strengthen existing waste management practices have been explored by these 29 cities. Among the 45 cities, 24 are metropolitan cities where infrastructure and technology available for waste management are good.
- ✓ 41 *Two Stars* cities have initiated comprehensive actions adopting waste reduction practices and are in process to develop further. Among the *Two Stars* cities, 21 are medium sized cities where their waste management practices and especially the 3R principles, plastic waste, and domestic hazardous waste management can be improved.
- ✓ 98 out of 126 cities have already banned single use plastic including plastic with <50 micron during all festivals/social gatherings/events.
- ✓ With respect to 3R Principles, measures are being taken by cities to reduce generation of Dry/Wet Waste. These include, 5 initiatives undertaken across 40 cities, 4 initiatives in 1 city, 3 initiatives across 19 cities, 2 initiatives across 11 cities, 1 initiative across 13 cities. Currently, no initiatives are being taken across 42 cities.
- ✓ 44 cities have more than 95% of their collected domestic hazardous waste are being treated either by decentralized or centralized processing techniques. Also, only 35% of participating cities are scientifically collecting and processing their hazardous waste.
- ✓ 25% of participating cities are successfully managing their waste at household level, thereby supporting the waste management ecosystem. In 31 cities, more than 5% of their households process wet waste at home or community level.
- ✓ All the participating cities (except Shimla) from hilly regions are under *Two Stars* category. Shimla has performed well and is among *Five Stars* category and can act as an exemplar for other hilly cities .

Actions

JABALPUR

The city was awarded the title of "Best Big City in Innovation and Best Practices" in the SwachhSurvekshan 2019. With 100% segregation at source, most of the city's waste is transported to waste to energy plant at Kathonda, where the Municipal Corporation and Essel Infra projects Ltd. has set up 600 TPD processing plant.

Around the world, with the growing population, waste generation is rising rapidly. With rapid population growth and urbanization, annual waste generation is expected to increase by 70% from 2016 levels to 3.40 billion tonnes in 2050.[3] India is among the highest generators of waste globally, as per The World Bank report. Delhi, Greater Mumbai and Chennai top the list of Indian cities with maximum waste generation. Goa and Delhi produce as much as 60 grams and 37 grams per capita per day respectively, whereas the national average as per SBM is 11 grams per capita per day[4]. The current practice of waste management in India involves collecting waste from sources through a collective community bin system followed by intermediate processing before transported to a landfill. The major challenges experienced by Indian cities include open dumping leading to various problems such as contamination[5], lack of scientific treatment, inadequate waste collection and increased generation of plastic waste.[6]

During the recent past, the management of solid waste has received considerable attention from the Central, State and local governments in India. Swachh Bharat Mission (SBM), an initiative by the Government of India, was launched in 2014 with the vision of enhancing sanitation and hygiene in cities. In 2016, the MoHUA has also introduced a new scheme known as Swachh Survekshan to assess the progress made. Important guidelines published by MOHUA through Central Public Health and Environmental Engineering Organisation (CPHEEO) in the year 2016 provide implementation guidelines for all the aspects of Municipal Solid Waste Management (MSWM) especially for segregation, collection, transportation, treatment and disposal.

Many cities are innovating around waste minimization initiatives through public-private, community-public and private-private partnerships. This indicator focuses on capturing the impacts of interventions made to manage waste generation. Aligning to the Swachh Survekshan, this indicator focuses on capturing the measures adopted by cities in implementing Plastic Waste Management Rules 2016 and initiatives undertaken to reduce dry/ wet waste, treatment of domestic hazard waste, onsite waste processing by non-bulk waste generators, measures taken by bulk waste generators to treat dry and process wet wastes and processing of wet waste at household/ community level.

3. TNN, 2020. In 30 years, India tipped to double the amount of waste it generates. [Online]
Available at: https://timesofindia.indiatimes.com/india/in-30-years-india-tipped-to-double-the-amount-of-waste-it-generates/articleshow/74454382.cms [Accessed March 2021].
4. Nair, S., 2020. Plastic waste is India's and the world's most formidable environmental challenge today, and the COVID-19 pandemic has made matters worse: CSE. [Online]
Available at: https://www.cseindia.org/plastic-waste-is-india-s-and-the-world-s-most-formidable-environmental-challenge-10375#:~:text=A%20Central%20Pollution%20Control%20Board%20%28CPCB%29%20report%20%282018-19%29,frightening%20as%20it%20is%2C%20might%20be%20an%20under
[Accessed March 2021].
5. Reddy, K. V. R. & Ram, A. S., 2019. Waste Management Initiatives And Activities In India For Society's Welfare. International Journal of Scientific & Technology Research, DECEMBER, 8(12), pp. 2995-2998.
6. BBanerjee, A., 2019. India Is Generating Much More Plastic Waste Than It Reports. Here's Why. [Online]
Available at: https://www.indiaspend.com/india-is-generating-much-more-plastic-waste-than-it-reports-heres-why/ [Accessed March 2021].

	Mapped Swachh Survekshan 2019 Service Level Indicators Swachh Survekshan		Swachh Survekshan Total marks of Mapped indicators	CSCAF 2.0 Score
5 Service Level Indicators	1.8	Plastic Waste Management Rules: Whether the City has banned single use plastic including plastic with <50 micron during all festivals/social gatherings/events?	30	27.5
	1.9	3R Principles: Whether measures taken to reduce generation of Dry/Wet Waste? If yes, share details	50	45
	2.5	Percentage of total domestic hazardous waste collected is treated, either by decentralized or centralized processing	30	27.5
	2.9	Percentage of Bulk Waste Generators (BWG), including those generating more than 100 Kgs (or less as notified by the State/city) of waste per day, practicing on site processing of their wet waste or outsourced to private agency -processing not outsourced to ULB. However, cities with <1 Lakh population can outsource to ULB on a commercial rate.	50	45
	2.11	Percentage of households processing their wet waste at Home/ Community Level (Households under RWAs will qualify under the BWG definition)	50	45
		Total	210	190

Way forward to transition towards Waste Minimization Initiatives Undertaken by the City

- Cities can implement Plastic Waste Management Rules 2016 and enforce the Single Use Plastic Ban.
- Cities can encourage their citizens to reduce waste by practicing source segregation, recycling and reuse of dry waste at household level through citizen awareness programs and campaigns.
- Cities can promote segregation of Domestic Hazardous waste in accordance with Solid Waste Management Rules 2016. Recently, National Green Tribunal has also issued an order (order NGT OA 72/2020) regarding the same.
- Cities can monitor all the Bulk Waste Generators (BWGs) within their purview on a monthly basis and ensure the segregated wet waste including kitchen/ garden waste are being processed onsite or collected and processed by private parties authorized by ULB.

Ms. Shabnam Siddiqui
Executive Director
United Nations Global Compact Network India

> The private sector must be a primary catalyst in building a progressive business case for climate action, scaling-up private investment in climate-smart urban infrastructure and supporting innovative ecopreneurs in this decade of action. Collective action and ethical leadership will help strengthen mitigation and resilience strategies in the long run and provide a fillip to the commercial opportunities that sustainability presents.

Credits:

Udaipur:
Waste to energy biomethanation plant that is capable of scientifically disposing 730 tonnes of wet waste annually

by Udaipur Municipal Corporation

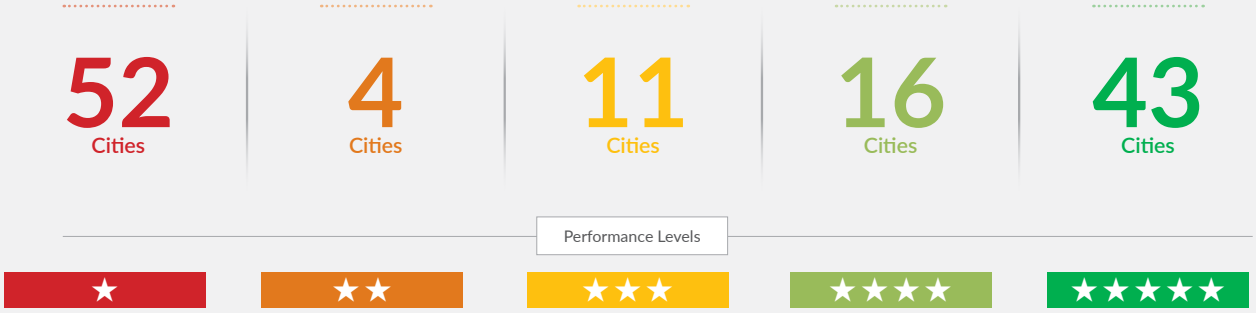
INDICATOR 2

Extent of Dry Waste Recovered & Recycled

In many developed and developing countries the collection, segregation and disposal of solid waste is a widespread problem.[7] Segregation, recycling and reusing of waste can be a viable and cost-effective solution to reduce waste. Recycling mostly involves recovering and reprocessing usable materials (predominantly dry waste) that generally might end up as waste such as plastic, paper, etc.[8] Presently, around 7 million tons of paper is being consumed in India for packaging, of which only 33% are being recycled.[9] Dry waste also contains several non-recyclable components, such as plastic bags, laminated metallized plastics or mylar, shredded paper and textiles. This makes dry waste recovery and recycling challenging. Furthermore, many Indian cities practice open dumping at sites which were originally allocated for developing sanitary landfills, leading to no further segregation to recover the usable waste.[8] In the last two decades, there has been a sharp increase in the use of plastics by citizens leading to increased plastic waste generation.

Aligning to the Swachh Survekshan, section 2.3 and 2.4; the focus of this indicator is on assessing the capacity of dry waste processing facilities and the quantity of dry waste processed MRF, RDF or Waste to Energy plants.

This indicator is mapped with the marks of 2 service level indicators of Swachh Survekshan 2019. They are dry waste collected and processed (2.1) and treatment/ recycle/ reuse of plastic waste collected (2.2). The performance levels are categorized based on resulting CSCAF 2.0 score.



Performance of 126 cities

- ✓ 23 metropolitan cities, 10 large cities and 10 medium sized cities are performing well in this indicator. This includes measures such as secondary and tertiary sorting, and processing facilities in their cities.
- ✓ 24 out of 43 *Five Stars* cities are able to process 100% of their collected dry waste. Majority of these cities are from the western, central and northern regions.
  - » Cities from Gujarat, Madhya Pradesh, Maharashtra, Chhattisgarh and Uttar Pradesh have performed relatively better.
  - » Shimla is the only hill city that has considered implementing waste management practices for recycle and reuse of dry waste.
  - » Among the coastal cities, Kakinada, Surat, and Visakhapatnam have been successful in managing their dry waste with initiatives like Refuse Derived Fuel (RDF) facility and decentralized dry-waste recycling centers.
- ✓ 16 cities in the *Four Stars* category are mostly metropolitan cities from the northern, southern and western regions. This includes 2 coastal cities, Chennai and Port Blair.
- ✓ 40 out of the 126 cities have more than 95% of their generated dry waste (excluding plastic and domestic hazardous waste) collected and processed (re-used or recycled), either by decentralized or centralized facilities. These cities are majorly from the states of Andhra Pradesh, Gujarat, Madhya Pradesh, Maharashtra, and Uttar Pradesh.
- ✓ 32 out of the 52 cities in *One Star* category are mostly from the southern (16), northern (14), eastern and north-eastern regions (9). These cities are mostly small and medium towns indicating inadequate infrastructure and institutional resources at local level to take actions.

This indicator assesses the efficiency of city's waste management systems based on the extent of recyclables recovered from the city's total dry waste and further processed by the authorized recycling units.

Actions

VARANASI

Scrapshala, Ravindrapuri – is a unique initiative that works toward creating decorative products from waste materials and discarded items. Non-degradable, dry trash/scrap is used to customized products and is being encouraged by the city.

		Mapped Swachh Survekshan 2019 Service Level Indicators	Swachh Survekshan Total marks of Mapped indicators	CSCAF 2.0 Score
2 Service Level Indicators	2.1	Percentage of generated dry waste (excluding plastic and domestic hazardous waste) collected that is actually processed/Re-used/recycled, either by decentralized or centralized facilities	60	60
	2.2	Percentage of total plastic waste collected is treated/ Re-used/recycled, either by decentralized or centralized processing	40	40
		Total of Indicator 2	100	100

Way forward to transition towards reducing the extent of dry waste recovered and recycled

- Cities can focus on promoting source segregation of dry waste through various awareness programs and rigorous campaigning to achieve 100% recycling and reuse of waste.
- Cities should maintain proper baseline data for assessing the quantity of waste recycled per year.
- Cities can announce incentives to encourage reuse and recycling of waste.
- Cities should maintain the monthly record of the quantity of recyclables, SCF/RDF generated in the waste stream for estimating the capacity of the treatment facility (Material Recovery Facility or Refused Derived Fuel).
- Cities can refer to the following advisory and guideline pertaining to Plastic waste management,
  - » Advisory on Material Recovery Facility
  - » Guidelines on Usage of Refuse Derived Fuel in Various Industries

7. Bhatia, A., 2017. 5 Cool Waste Management Ideas From The World That India Can Adopt. [Online] Available at: https://swachhindia.ndtv.com/5-cool-waste-management-ideas-world-india-can-adopt-6190/ [Accessed March 2021].
8. Patel, U., 2018. Solid Waste Management in India An Assessment of Resource Recovery and Environmental Impact. [Online] Available at: https://icrier.org/pdf/Working_Paper_356.pdf [Accessed March 2021].
9. Singh, S., 2020. Solid Waste Management in Urban India: Imperatives for Improvement. [Online] Available at: https://www.orfonline.org/research/solid-waste-management-in-urban-india-imperatives-for-improvement-77129/ [Accessed March 2021].

INDICATOR 3

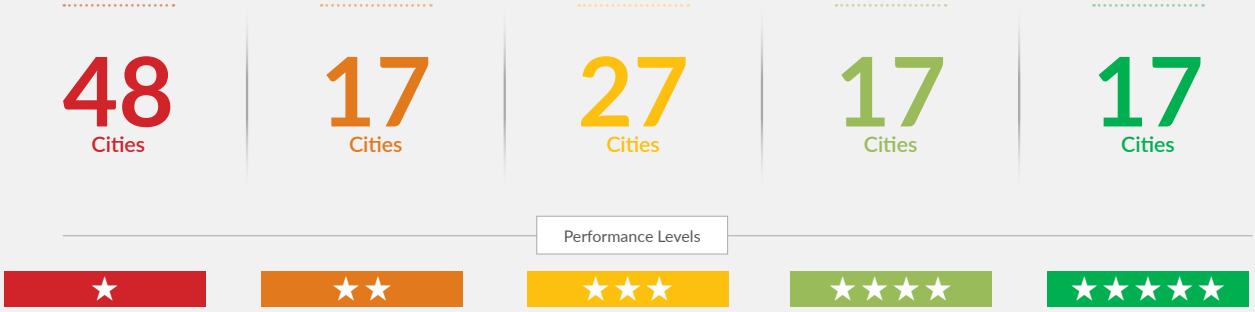
Construction & Demolition (C&D) Waste Management

Construction waste at global level accounts to 2-3 billion tonnes per year of which 30-40% is concrete.[10] Construction and Demolition (C&D) waste management is highly important especially for the developing countries, where much of their infrastructure requirements are mostly under development or expected to be implemented in the next two to three decades.

Water bodies, green areas and public spaces in Indian cities are severely getting affected by unsafe disposal of concrete, bricks, and metal waste from construction.[11] Toxic dust particles from the debris further impact the air quality, eventually increasing the pollutants level above the National Ambient Air Quality Standards (NAAQS). As India's construction sector is projected to grow at a rate of 7-8% over the next 10 years, it is likely to become the world's third largest country in the construction sector by mid next decade.[12]

According to the Building Material Promotion Council, India generates an estimated 150 million tonnes of C&D waste every year, although the official recycling capacity is a meagre 6,500 tonnes per day which accounts to a little over 1% of the total generation of C&D waste[11]. In the year

This indicator is mapped with the marks of 1 service level indicator of Swachh Survekshan 2019 - Mechanism in place for Construction and Demolition (C&D) waste as per C&D Waste Management Rule, 2016 (3.1). The performance levels are categorized based on resulting CSCAF 2.0 score.



Performance of 126 cities

- ✓ 17 cities in the *Five Stars* category are from Gujarat (4), Maharashtra (4), Uttar Pradesh (4), Andhra Pradesh (3), Madhya Pradesh (1) and Tamil Nadu (1). These cities have succeeded in implementing C&D Waste rules. 11 out of these 17 cities are metropolitan cities.
- ✓ 20 out of the 27 cities in the *Three Stars* category are metropolitan and large cities. As per C&D Waste Management Rules 2016 it is mandated for large cities to set up recycling plants within 18 months. 10 of the 31 large cities participating in the assessment have managed to set up such recycling plants.
- ✓ 32 of the 48 cities in the *One Star* category are medium sized cities and small towns. These cities have highlighted that they do not have formal C&D waste collection system or related infrastructure for treatment and management.
- ✓ All 10 participating cities from the north-eastern region and 15 of the 33 participating cities from the southern region are in the *One Star* category.
- ✓ 8 of the 15 participating coastal cities are also in the *One Star* category wherein the sensitive water ecosystem and other aquatic life may get severely impacted if safe practices of C&D waste management are not adopted.

Actions

CHANDIGARH

Chandigarh Municipal Corporation has set up the construction and demolition waste processing plant in its industrial area for stacking, crushing, processing and manufacturing of various C&D products. Till date 5000 MT C&D waste has been processed into recycled products saving natural resources, reducing the quantum of waste reaching landfills. Another major benefit has been the reduction in carbon footprints and hence yielding numerous environmental benefits.

2017, 53 cities committed to set up the recycling facilities to recover material from C&D waste, although only 13 cities were able to achieve the same by 2020[11].

Under Swachh Bharat Mission (SBM) and aligning to the Swachh Survekshan 2020, section 2.6; the focus of this indicator is to document the mechanisms which are currently in place to collect, process and reuse C&D waste. Through this indicator we have managed to capture the extent of decentralized management of C&D waste generated and its utilization.

		Construction & Demolition (C&D) waste management	SwachhSurvekshan Total marks of Mapped indicators
1 Service Level Indicator	3.1	Any mechanism in place to manage Construction & Demolition (C&D) waste as per C&D Waste Management Rule, 2016? Whether plans in place to initiate processing of C&D Waste?	50
		Total of Indicator 3	50

Way forward to transition towards improving C&D waste management

- Cities may prioritize setting up C&D Waste management system and maintain the inventories of construction activities in the city. To begin with, cities can notify dumping points and storage facilities for C&D waste.
- Cities are encouraged to form a collection mechanism using a helpline system. Cities can enforce user charges, penalty for non-compliance while implementing a robust C&D waste management system.
- Cities can set up facilities for processing of C&D waste in collaboration with private entities. If it is not financially viable to set up such a processing facility due to limited C&D waste generation, then cities can explore options for setting up such a facility in partnership with neighbouring towns or cities. The following documents can be referred for additional information:
  - » A Ready Reckoner for utilization of recycled produce of C&D waste.
  - » Guidelines on Environmental Management of Construction & Demolition Waste, CPCB, 2017.
  - » Coarse and Fine Aggregate for Concrete – Specification- IS 383: 2016.

10. Shrivastava, S. & Chini, A., 2016. Construction Materials and C&D Waste in India. [Online] Available at: https://www.irbnet.de/daten/iconda/CIB14286.pdf [Accessed March 2021].
11. DTE Staff, 2020. India recycles only 1% of its construction and demolition waste: CSE. [Online] Available at: https://www.downtoearth.org.in/news/waste/india-recycles-only-1-of-its-construction-and-demolition-waste-cse-73027#:~:text=India%20recycles%20just%20one%20per,25%2C%202020%2C%20has%20shown.&text=This%20demands%20a%20circular%20economy,C%26D%20waste%20into [Accessed March 2021].
12. Resource Efficiency & Circular Economy – Current Status and way forward, NITI Aayog: 2019, p16

INDICATOR 4

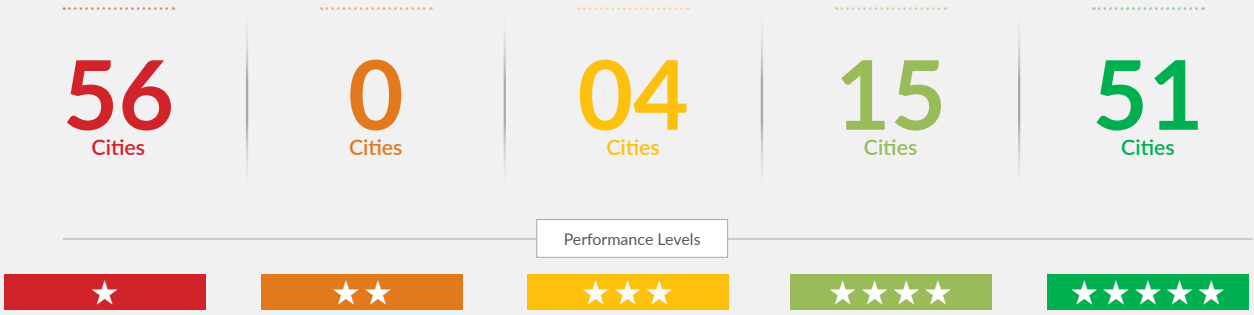
Extent of Wet Waste Processed

Human wellbeing is affected by inadequate wet waste management as it is a major cause of environmental and water pollution. Besides, burning of wet waste contributes to the depletion of ozone layer which accelerates climate change. Globally, in comparison to the amount of waste produced there are insufficient treatment plants for wet waste processing. Therefore, the global wet waste management industry is expected to expand in the future.

By 2022, the global wet waste management market is expected to be worth more than USD 130 billion, providing an economic potential for improved waste management[13]. India generates 62 million tonnes of waste per year (mixed waste containing both recyclable and non-recyclable waste), with an annual growth rate of 4%. Organic waste (all types of biodegradable waste), dry waste (or recyclable waste) and biomedical waste (or sanitary and hazardous waste) are the three major categories of waste produced in our country[13]. Appropriate management of organic waste is therefore essential as 50% of the waste generated in India is organic waste[14]. This will further substantially reduce the volume of pollution induced by improper waste management.

In order to mitigate climate change and improve quality of lives, it is important for cities to manage wet waste by

This indicator is mapped with the marks of 1 service level indicator of Swachh Survekshan 2019 - Processing of wet waste generated (4.1). The performance levels are categorized based on resulting CSCAF 2.0 score.



Performance of 126 cities

- ✓ The assessment of this indicator highlights that cities are either performing extremely well or poorly. Majority of cities (66) are in either *Five Stars* or *Four Stars* categories, or are in *One Star* category (56).
- ✓ Among the 51 *Five Stars* cities, 40 cities are able to process 100% of their collected wet waste.
- ✓ Metropolitan cities (26 cities) have performed well in this indicator, followed by large cities (14 cities) and 11 medium cities who have achieved wet waste handling, separation, storage and processing.
  - » Shimla is the only hill city, and Surat and Visakhapatnam are the only two coastal cities that have been successful in undertaking wet waste management initiatives such as enforcement of onsite wet waste processing units (bio methanation and vermicomposting plants) at various locations (industrial, restaurants, commercial).
  - » Port Blair and Kakinada are the only coastal cities in *Four Stars* category. These cities have managed to successfully implement decentralized compost yard plants and city-wide strict cleanliness initiatives, respectively. 11 of the 15 participating coastal cities are in the early stages of processing their wet waste.
- ✓ Majority of the participating medium sized cities (41) and all of the 10 participating small towns are in the *One Star* category. A large portion of waste in these cities are often dumped in open areas, water bodies and stormwater drains leading to water pollution and clogging of the drainage.
- ✓ 40 of the 56 *One Star* cities are part of both AMRUT and Smart Cities missions and can make use of the central government funding to prioritise and initiate measures for improving their wet waste management systems.

setting up appropriate processing facilities and scientifically operated systems.The focus of this indicator is on capturing actions initiated by cities in wet waste processing as per the Swachh Bharat Mission (SBM) and aligning to the section 2.2 of Swachh Survekshan.

Actions

NAGPUR

Nagpur has a centralized vermi-composting plant at Bhandewadi operational since 2008. Large quantities of the city's waste from vegetable market, fruit market and hotels are processed in this plant.

1 Service Level Indicators	Extent of Wet Waste Processed		SwachhSurvek-shan Total marks of Mapped indicators	CSCAF 2.0 Score
	4.1	Percentage of wet waste generated actually processed, either by decentralized or centralized facilities.	150	150
		Total of Indicator 4	150	150

Way forward to transition towards reducing the extent of wet waste processed

- Cities can treat their wet waste effectively by segregating and processing of the same through decentralised approaches such as composting and community level biomethanation plants.
- Cities can encourage citizens for home composting to reduce the overall generation of Municipal Solid Waste. To promote such endeavours, cities should implement incentive schemes and increase awareness generation.
- Cities can establish regulatory mechanisms by mainstreaming advisory on on-site and decentralized composting of municipal organic waste.

Ms. Aditi Garg, IAS
CEO of Indore Smart City
(during the implementation of CSCAF 2.0)

"CSCAF 2.0 has been a steep learning curve for Indore Smart City. It not only challenged us to deliver beyond the realm of a Smart City but also launched us into an arena of global best practices of building Climate resilient cities. Indore has aimed to think out of the box, while at the same time keep a local flavour to our solutions; and CSCAF2.0 has helped us do just that. It has enabled us to enhance our capabilities and skills sets internally, build bridges with the community in tackling the challenge of climate change, and at the same time devise ongoing cooperative mechanisms for inter-departmental coordination which is our greatest tool in designing a Climate Smart Framework for the city. CSCAF 2.0 has truly helped redefine and reinvigorate the role of a Smart City in the present context."

13 Press Information Bureau, 2018. Press Release Details. New Delhi. [Online] Available at: https://pib.gov.in/PressReleseDetail.aspx-?PRID=1532692 [Accessed 20 June 2020].

14 Ayilara, M., 2020. Waste Management through Composting: Challenges and Potentials. [Online] Available at: https://www.mdpi.com/2071-1050/12/11/4456/htm [Accessed March 2021]. [Accessed March 2021].

INDICATOR 5

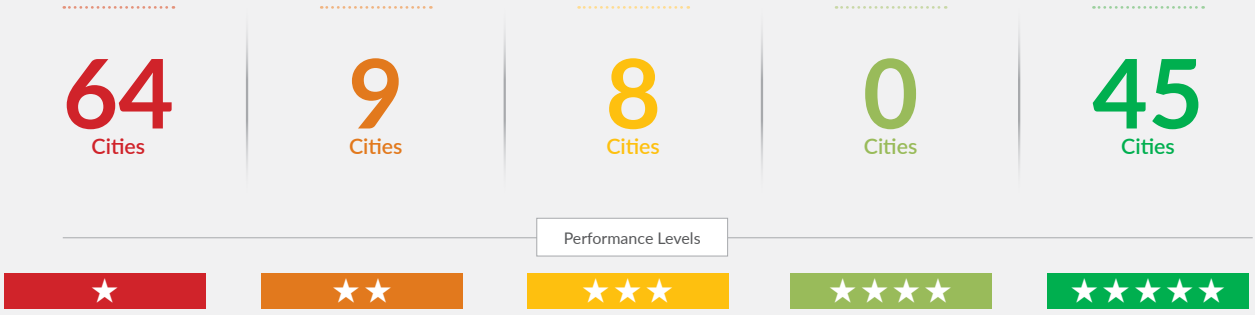
Scientific Landfill Availability & Operations

Since the last few decades, scientific landfill management has been implemented around the world to address site-specific issues and to enable the construction of bigger landfill sectors in the same region. Population expansion in urban areas over the years has resulted in landfills becoming dump yards, with little regard for their capacity or lifespan. Due to the difficulty in achieving economic viability of a sanitary landfill project, the application of landfill operations to other situations where the main motivation is the removal of a potential source of contamination or the recovery of resources has been limited to very few cases so far. Scalability of this operation can only be achieved by providing specific incentives or accessing public funding.

In India, landfills pose numerous threats due to their unscientific design and indiscriminate disposal of waste. One of the key threats is the emission of methane gas due to accumulation of waste, causing fires at landfills and hence resulting in garbage burning which causes severe air pollution. Landfills also pose tremendous health hazards as they are a storehouse of virus and bacteria, causing cardiovascular and lung diseases. Presently in India, only 5% of the total municipal waste collected, is processed. Untreated landfill sites account for approximately 20% of methane gas emissions in India[16]. With nearly 72% of India's garbage remaining untreated, scientific landfills are an option for urban India to ensure proper waste management[17].

This indicator assesses cities conformity to Solid Waste Management Rules, 2016 and guidance given in the Municipal Solid Waste Management (MSWM) Manual, 2016 (CPHEEO, 2016) along with any other updated criteria published by CPCB/ State PCB for Solid Waste Disposal Facilities.

This indicator is mapped with the marks of 1 service level indicator of Swachh Survekshan 2019 - Sanitary landfill or zero landfill city (5.1). The performance levels are categorized based on resulting CSCAF 2.0 score.



Performance of 126 cities

- ✓ The assessment indicates that majority of cities are either performing well and are in *Five Stars* category (45) or in *One Star* category (64) and are yet to adopt relevant measures.
- ✓ 27 out of the 45 cities in *Five Stars* category are metropolitan cities that have scientific landfills meeting the prescribed guidelines by the CPEEHO, Solid Waste Management Manual, 2016.
- ✓ A majority of the cities from north-eastern and eastern regions of the country are in the *One Star* category. 9 out of 10 small towns are also in the *One Star* category. The small towns generally produce relatively less waste, therefore, may have not prioritised construction and operation of their landfills in a scientific manner.
- ✓ 9 out of the 15 coastal cities are in the *One Star* category and this is concerning because lack of scientific landfill availability, besides polluting the groundwater, can severely impact the marine life.

The focus of this indicator is towards capturing the amount of collectable waste which is going to the landfill and whether the management and operations of landfills are according to the guidelines under the Swachh Bharat Mission (SBM) and aligning to the section 2.8 of Swachh Survekshan.

Actions

MYSURU

The Zero Waste Management Plant at Kumbarakoppal was started in 2005 and covers 5 wards of Mysuru Municipal Corporation. Wet and dry waste is segregated at two stages to ensure all parts are retrieved and sold or sent for composting. This ensures that zero waste is sent to landfill from these 5 wards.

			SwachhSurvek-shan Total marks of Mapped indicators	CSCAF 2.0 Score
1 Service Level Indicators	Scientific Landfill availability & operations			
	5.1	Is the landfill in the city a sanitary landfill? Or landfill not required/ Zero landfill city	50	50
		Total of Indicator 5	50	50

Way forward to transition towards improving scientific landfill operations

- Non-performing cities should initiate the process of setting up sanitary landfill and monitor the same. The construction, operation and maintenance of these facilities may be in accordance with the guidelines provided within Manual on Municipal Solid Waste Management, 2016, CPHEEO (Chapter IV on Technical Aspects of Municipal Sanitary Landfill).
- Non-performing cities should initiate construction of sanitary landfill. Focus on adopting sanitary measures for disposal and recycle of municipal solid waste and promoting waste to energy can be considered. Examples for sample contracts for Design Build Operate of sanitary landfill can be referred.

Mr. Emani Kumar
Deputy Secretary General, ICLEI Global and Executive Director ICLEI South Asia

> ICLEI South Asia witnessed the enthusiasm of fore-runner cities to showcase existing and ongoing climate actions, while responding to the CSCAF. The framework helped build capabilities of cities that are just embarking on their climate action journey by guiding them through a step-wise process of assessing the present status and laying out the next steps to deploy sustainable climate solutions.

16. Bhatia, A., 2017 . Waste Management: How India Is Drowning In Garbage. [Online] Available at: https://swachhindia.ndtv.com/waste-management-india-drowning-garbage-2147/ [Accessed March 2021].
17. Centre for Science and Environment, 2020. Clean It Right - Dumpsite Management in India. [Online] Available at: http___cdn.cseindia.org_attachments_0.75728500_1606740511_clean-it-right--dumpsite-management-in-india.pdf [Accessed March 2021].

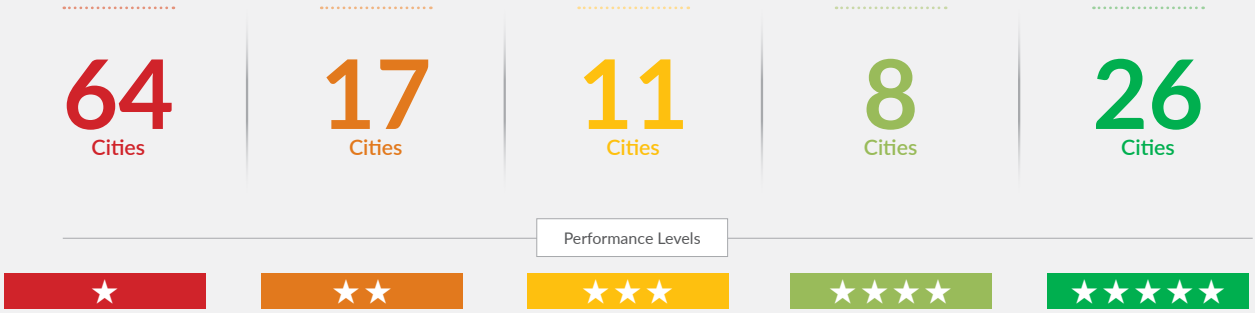
INDICATOR 6

Landfill/ Dumpsite Scientific Remediation

Dumpsite is defined as a dedicated land allocated for disposal of municipal solid waste. The deposited waste in these areas should be covered with soil in order to isolate it from the environment. Humans and animals are usually restricted from entering these areas. The waste deposited in these areas gradually decomposes through a combination of biological, chemical and physical processes. If not adequately managed, they are likely to cause concern with respect to two major emissions namely, leachate and landfill gas. These emissions can have severe impact on the environment during the decomposition process. According to the Waste Atlas report (2013), cases from 50 biggest dumpsites in the world revealed that together they affect the lives of almost 65 million people[18]. In 2015, the GWMO report estimated that at least 2 billion people do not have access to regular waste collection and they depend on unmanaged dumpsites[18].

In India, urban areas account for a third of India's population and generates 54.75 million tonnes of MSW annually[19]. The current estimate is that 22.5 million tonnes of waste dumped annually is unprocessed[20]. On the top of that, 77% of the waste generated in India is disposed of in open dumpsites as per The World Bank[18]. Unmanaged dumping of mixed municipal waste has created around 3,159 dumpsites across the country[20]. These dumpsites have led to environmental consequences, including contamination of the air, water (ground and surface), and soil.

This indicator is mapped with the marks of 1 service level indicator of Swachh Survekshan 2019 - Remediation of existing dumpsites (6.1). The performance levels are categorized based on resulting CSCAF 2.0 score.



Performance of 126 cities

- ✓ Around two third of the participating cities do not have their landfills scientifically remediated.
- ✓ 26 cities in the *Five Stars* category meet the prescribed norms by CPEEHO for scientific landfill remediation. 16 of these are metropolitan cities from the states of Andhra Pradesh, Madhya Pradesh, Uttar Pradesh, Maharashtra, Gujarat, Himachal Pradesh, Tamil Nadu, Jammu & Kashmir, Karnataka and Jharkhand.
- ✓ 7 out of the 8 participating hilly cities and 9 out of the 15 coastal cities are in the *One Star* category. The probability of surface water and groundwater pollution due to improper remediation is highly likely in these cities.
- ✓ Most of the cities in the eastern-northern, north-eastern and southern regions are also in the *One Star* category.
- ✓ 27 out of the 41 medium sized cities and all the 10 small towns participating in the assessment are also under the *One Star* category. These cities generally produce relatively less waste and therefore are yet to prioritise landfill remediation processes.

Actions

TIRUPATI

Tirupati is in the process of remediating the Rampuram dump site through bio-mining process. It will help in reduction of soil, air and water pollution in the area along with restoring the local flora and fauna. It will also be beneficial for residents' health living in close proximity the site.

The Swachh Bharat Mission has been emphasising on reclamation of landfill sites with an aim to recover over an estimated 10,000 hectares of urban land that is locked in these dumpsites in India. Innovative and sustainable landfill remediation methods like bio-mining and bio-remediation are promoted over the traditional 'capping' which means covering the landfill with a layer of soil.

The focus of this indicator was on evaluating the city's readiness to scientifically manage or efforts made to remediate landfills and dump sites.

			SwachhSurvekshan Total marks of Mapped indicators	CSCAF 2.0 Score
1 Service Level Indicators	Landfill/ dumpsite Scientific Remediation			
	6.1	Remediation of existing dumpsites undertaken and the stage of the same or no legacy waste (dumpsite)	60	60
		Total of Indicator 6	60	60

Way forward to transition towards landfill/dumpsite scientific remediation

- As a first step, cities can assess the baseline condition of existing dump sites in terms of quantification of legacy waste, topographical survey, geotechnical investigation, other environmental parameters such as water, air and leachate quality and characteristics of legacy waste etc.
- Non-performing cities need to refer to the document Model RFP for Closure and Capping of Existing Dumpsite.
- Cities can prepare a DPR of scientific landfill/ dumpsite closure and initiate the work of remediation once agreement of remediation is completed.
- Cities can explore options for converting landfills into conceptual landscape areas.

18. International Solid Waste Association, 2016. A Roadmap for closing Waste Dumpsites The World's most Polluted Places. [Online] Available at: https://www.iswa.org/fileadmin/galleries/About%20ISWA/ISWA_Roadmap_Report.pdf [Accessed 22 March 2021].
19. Advisory on Improving Municipal Solid Waste Management Services, 2013 (Ministry of Urban Development, CPHEEO). [Online] Available at: http://cpheeo.gov.in/upload/uploadfiles/files/Advisory%20on%20Improving%20Municipal%20Solid%20Waste%20Management%20Services.pdf [Accessed April 2021].
20. The Week, 2021. India's answer to the mounting landfill problem: Bio-mining and Bio-remediation [Online] Available at: https://www.theweek.in/news/biz-tech/2021/01/09/india_s-answer-to-the-mounting-landfill-problem--bio-mining-and-.html [Accessed April 2021]

Actions in the cities

Ujjain

Bio-methanation project

The city has adopted an integrated approach to strategically process and reduce the bio-degradable waste of the city to generate electricity by a bio-methanation plant. This plant is helping in the solid waste management of the city and is also a step towards reducing the burden on non-renewable resources by producing electricity used in the nearby street lights. The slurry generated from bio-methanation is utilized for landscaping, gardening and farming purposes. The project has reduced greenhouse emissions onto the environment by 12,176 Kg/month.

Ahmedabad

Material Recovery Facility

The Material Recovery Facility (MRF) at Ahmedabad runs on a public private partnership (PPP) model between Ahmedabad Municipal Corporation (AMC) and Nepra Resource Management Pvt. Ltd. The daily sorting capacity of dry waste of the MRF plant is around 100 MT. Dry Waste is collected with the help of waste pickers and through collection vehicles and brought to the material recovery facility (MRF) where it is manually segregated, checked and segregated waste is then sold to the authorized recyclers.

Delhi

Construction and Demolition Waste recycling facility at Burari

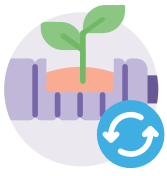
North Delhi Municipal Corporation has installed a recycling facility in Burari which is installed, operated and maintained on a Public Private Partnership (PPP) basis between the Corporation and Infrastructure Leasing and Financial Services Limited (IL&FS) Environment. There are 168 designated intermediate collection points across the city from which waste is transported to the processing facility.

98 cities

have banned single-use plastics including plastics <50 micron

40 cities

have instituted mechanisms for processing 100% of collected wet waste



40 cities

have more than 95% of generated dry waste (excluding plastic & domestic hazardous waste) collected that is actually processed/ recycled/reused

Coimbatore

Biogas plant and Vermicomposting plant in Coimbatore - Processing and treating wet waste

The Coimbatore city municipal corporation has installed a biogas plant at Amma Unavagam premises at Chitra Nagar. Vegetable waste, cooked and uncooked food waste from the hotels and restaurants in and around the are used to generate biogas through anaerobic digestion. At the vermicomposting plant, segregated waste is processed and converted into compost at this site.

Jabalpur

Zero landfill & bin free city

The city has adopted a robust solid waste management solution which aims to integrate Waste-to-Energy plant with the centralized monitoring system with a better governance on collection of daily garbage, monitoring of garbage collection, transportation system by the command control center, while ensuring cost reduction and resource optimization.

Indore

Bioremediation/ Bio-mining of legacy waste

Indore had taken considerable steps to tackle waste management in new and innovative ways. One such example is Indore's Devguradiya dumpsite where the dumping yard is saddled by heaps of garbage for decades. The project aims to clear legacy waste dumps and reclaim 100 acre land of worth Rs. 300 Cr. Due to adoption of scientific bio-remediation process the area inside the processing and disposal site is transformed into beautiful green-belt uplifting the environment, eliminating dump fires, reducing emissions, soil pollution and ground water contamination.

17 cities

have successfully implemented Construction & Demolition (C&D) Waste Rules

45 cities

are scientifically managing landfill sites, meeting CPEEHO, Solid Waste Management Rules, 2016

45 cities

Have implemented scientific remediation of their landfills