

# Advancing Waste Management and Circular Economy

Uttar Pradesh's Strategic Initiatives Addressing Food Waste in India

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# About The Energy and Resources Institute



TERI is an independent, not-for-profit organization, with expertise in research, policy, consultancy and implementation.



**Mission:** Serve as innovators and agents of change to enable policies and practices for an equitable and sustainable future through conservation and efficient use of energy and other resources.



Aims to incorporate circular economy (CE) and resource efficiency (RE) principals in all the projects through a full value chain assessment and understanding of key stakeholders involved

## Programmes



CLIMATE AND AIR



ENERGY



INDUSTRIAL  
BIOTECHNOLOGY



GREEN PORTS  
AND SHIPPING



SUSTAINABLE  
AGRICULTURE



SUSTAINABLE  
INFRASTRUCTURE



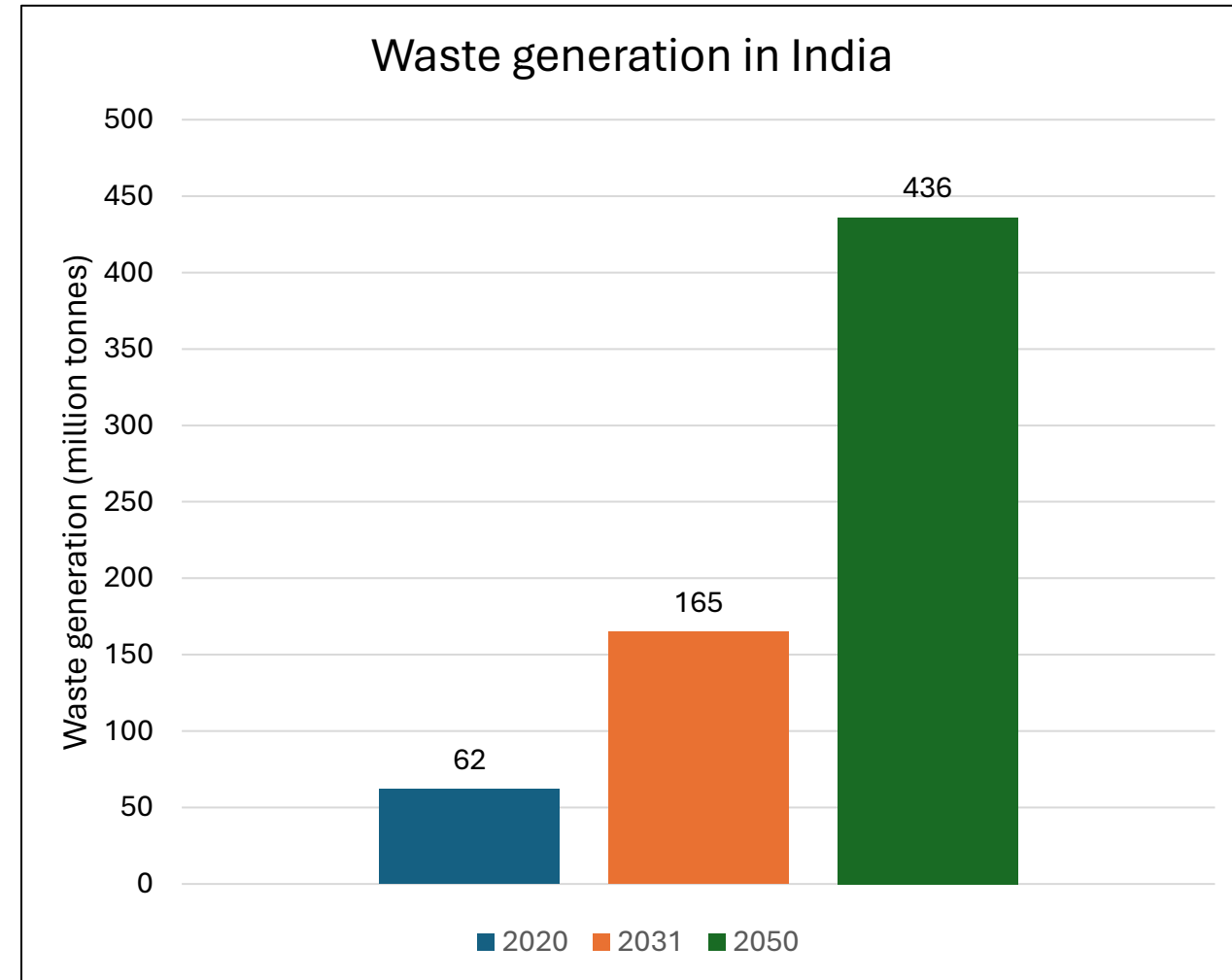
WASTE, WATER, AND  
NATURAL RESOURCES

# Overview of the waste scenario in India

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# Context

- Population: 1.43 billion, the largest globally
- India is presently ranked as the world's fifth-largest economy and is forecasted to achieve the third position by 2030.
- India ranks among the top 10 countries for municipal solid waste (MSW) generation
- Economic boom leading to a rise in annual material consumption
- Current per capita daily generation stands at 0.34 kg, with an anticipated rise in municipal solid waste (MSW) production to 0.7 kg per capita per day by 2025.
- Projected waste generation: 165 million tonnes by 2031, and 436 million tonnes by 2050



Source: [MoHUA, 2021](#)

# Challenges



## Waste Segregation and Processing

Poor segregation of waste at source reduces processing efficiency.  
Inadequate infrastructure for transporting segregated wet waste to processing facilities.



## Compliance Issues and Regulatory

Bulk waste generators' non-compliance with SWM Rules 2016.  
Lack of SWM Rules 2016 provisions for compost testing.



## Data and Designing

Lack of data on waste generation hampers facility design.



## Financial Feasibility and Quality Concerns

Financial feasibility issues with wet waste processing models.  
Quality challenges in compost from mixed waste.



## Infrastructure and Awareness Issues

Insufficient testing labs and monitoring protocols for compost.  
Inadequate awareness of compost policy and Market Development Assistance among ULBs and compost producers.

# Swachh Bharat Mission

- 96% wards have adopted door to door collection of municipal solid waste

Door to door collection



Negligible

2014

2021-2022

92,707 wards

- 90% of wards segregated municipal solid waste

Source segregation



Negligible

2014

2021-2022

86,405 wards

- 78% waste being processed

Waste Processing



16%

2014

2021-2022

78%

# **Closing the Loop: Why a Circular Economy is Essential for Organic Waste Management**





Material consumption at the urban level alone is expected to climb from current 7 billion tonnes to 25 billion tonnes by 2050

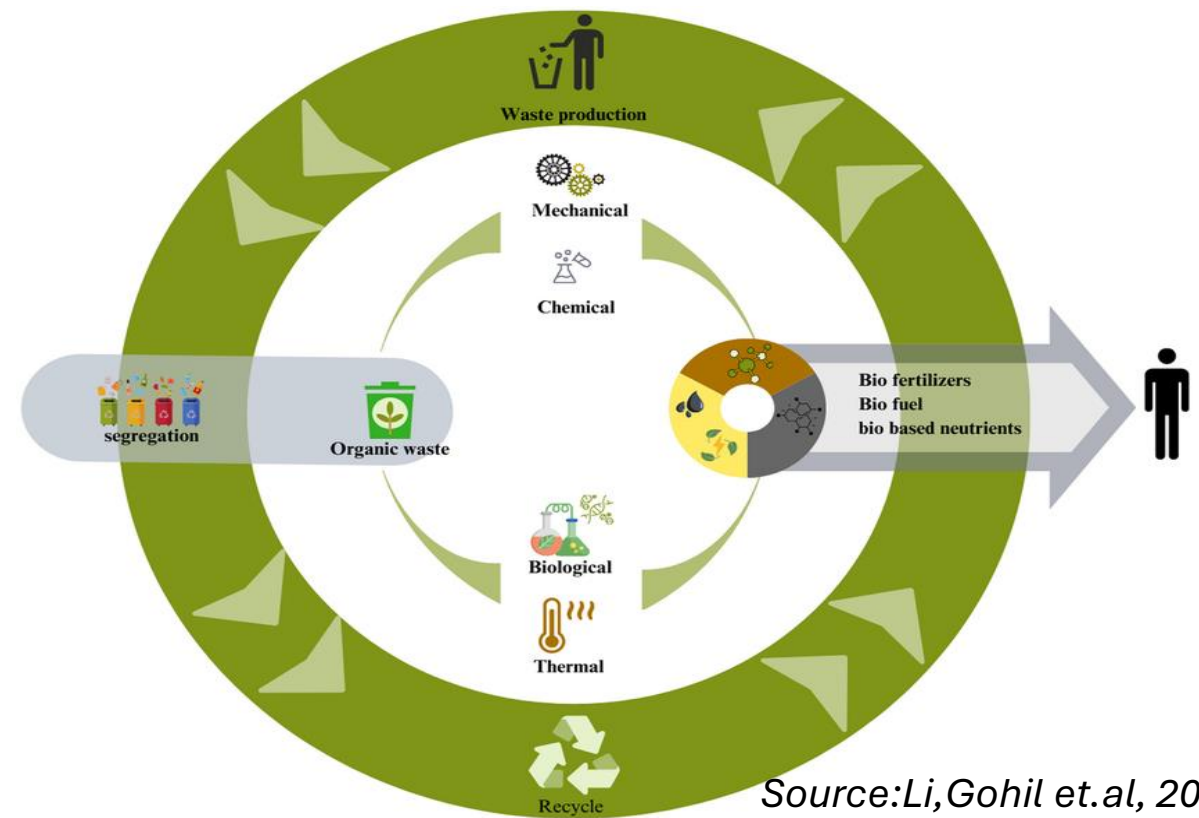


Compost and Bio- CNG from wet waste can generate revenues of nearly ` 365 crores and ` 1,679 crores per annum respectively



Reduction in GHG emissions by about 10.36 million tonnes CO2 equivalent

Source: [MoHUA, 2021](#)



Source: [Li, Gohil et.al, 2023](#)

Year	2021	2025
Wet waste generation (TPD)	72,500	1,02,500
Bio-methanation plants (TPD)	2,300	51,250
Development Target % (for CE)	3%	50%
Potential Gas Generation @3% CBG	69	1,538
Gas Generated, in MMTPA	0.025	0.561
Estimate Revenue Generation @ INR 46.00/kg (in crores)	115.85	2,581.46
Net contribution to the economy		INR 2,460 crores



**What are India's targets ?**



- Mandate segregation of waste at source, including organic waste.
- Promote composting or bio-methanation of organic waste.
- Aim to minimize landfilling of

Municipal Solid Waste Management Rules, 2016



- Ambitious targets for processing and disposal of organic waste.
- Promoting decentralized composting solutions at community and household levels.

Swachh Bharat Mission Urban 2.0 national strategies



- Reduce GHG emissions, including methane generated from decomposing organic waste in landfills.
- Diverting organic waste from landfills to achieve climate change mitigation goals.

Nationally Determined Contributions (NDCs) under the Paris Agreement



- Act as an enabler for mission acceleration in cities
- Encourage large scale participation to create awareness

Swachh Survekshan

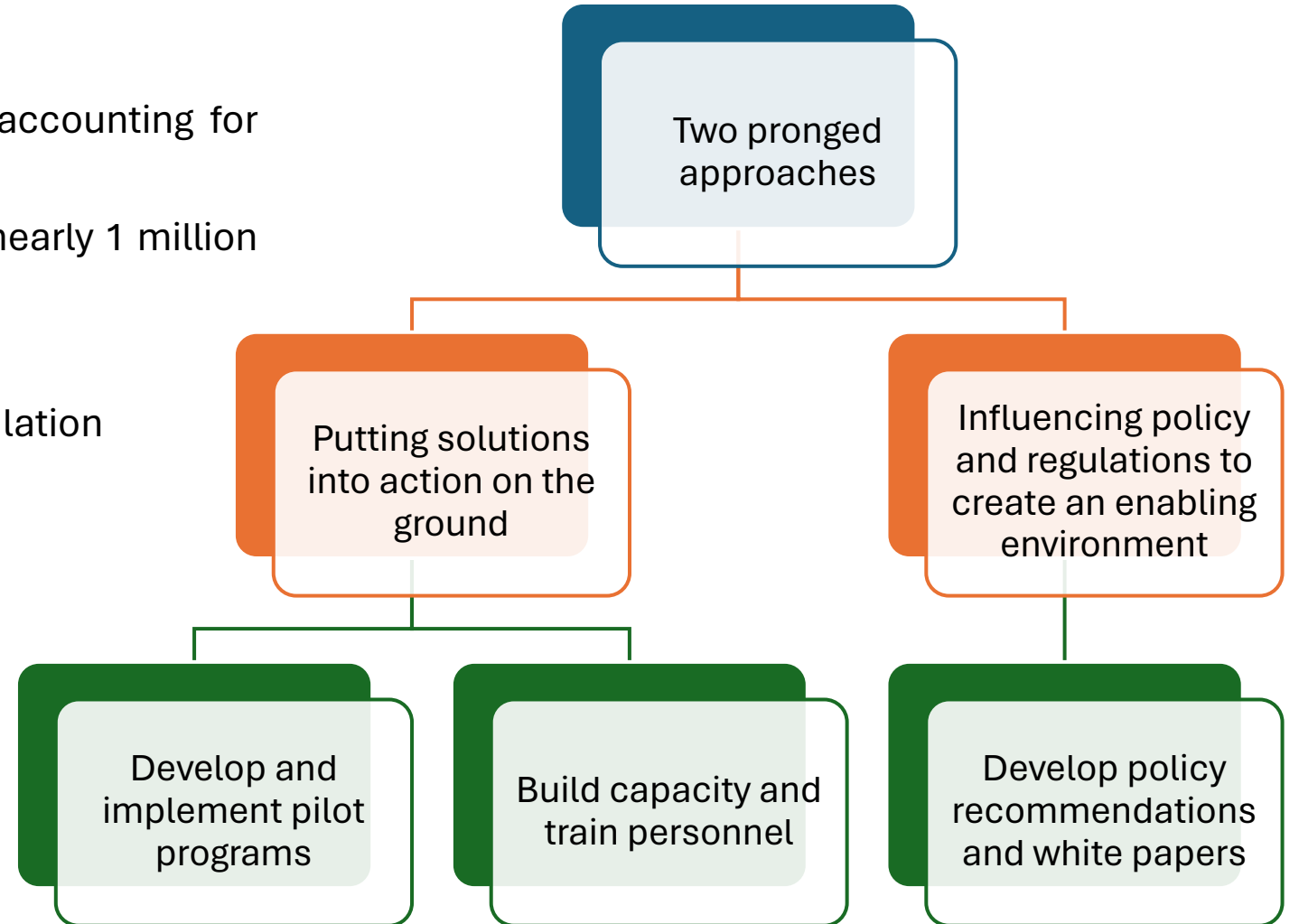


# **Uttar Pradesh's Strategic Initiatives Addressing Food Waste in India**

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# Context

- Population: 24.14 crores,
- Area: 243,286 sq.km.
- UP is the most populous state in India, accounting for 16.8% of the total population
- The top 10 largest cities in UP each have nearly 1 million residents or more
- Capital and largest city : Lucknow
- High waste generation driven by large population



Putting solutions into  
action on the ground



A nighttime photograph of Ayodhya, India, featuring illuminated buildings and a body of water reflecting the lights. The scene is dark, with warm orange and yellow lights from the buildings and cooler blue and purple lights from the water's reflection. The text is centered in a white box.

**Ayodhya Case Study:  
Climate-robust and -resilient  
waste policy in India**



Area: 2,522 Sq. Km.



Population : 6.7 lakhs (2022)



Waste generation: 300 tonnes per day



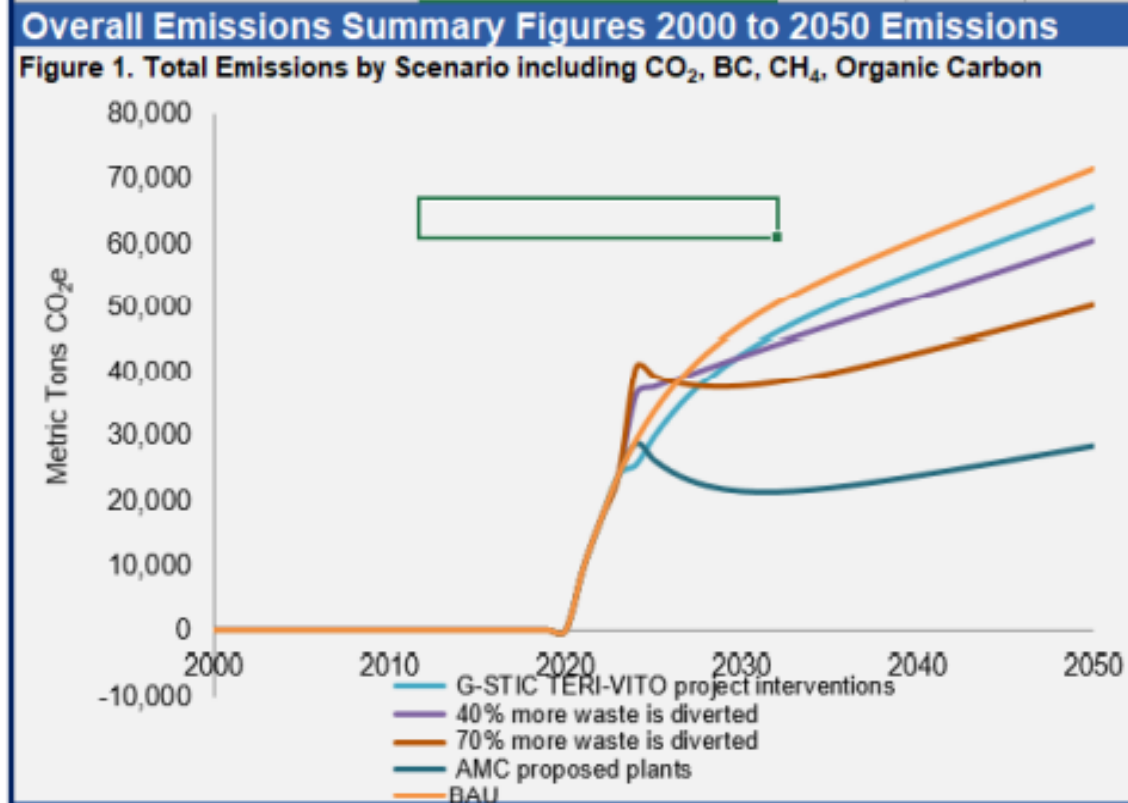
One of the most religious places in India



Unique challenges in waste management such as Garbage Vulnerable Points



Source: TERI



- Importance of sustainable waste management practices in preserving cultural and environmental heritage
- Strategies and initiatives implemented to address waste generation and disposal in the sacred city
- Collaboration with local communities, religious institutions, and government authorities for effective waste management
- Potential for innovative solutions and technologies tailored to the specific needs of the sacred city

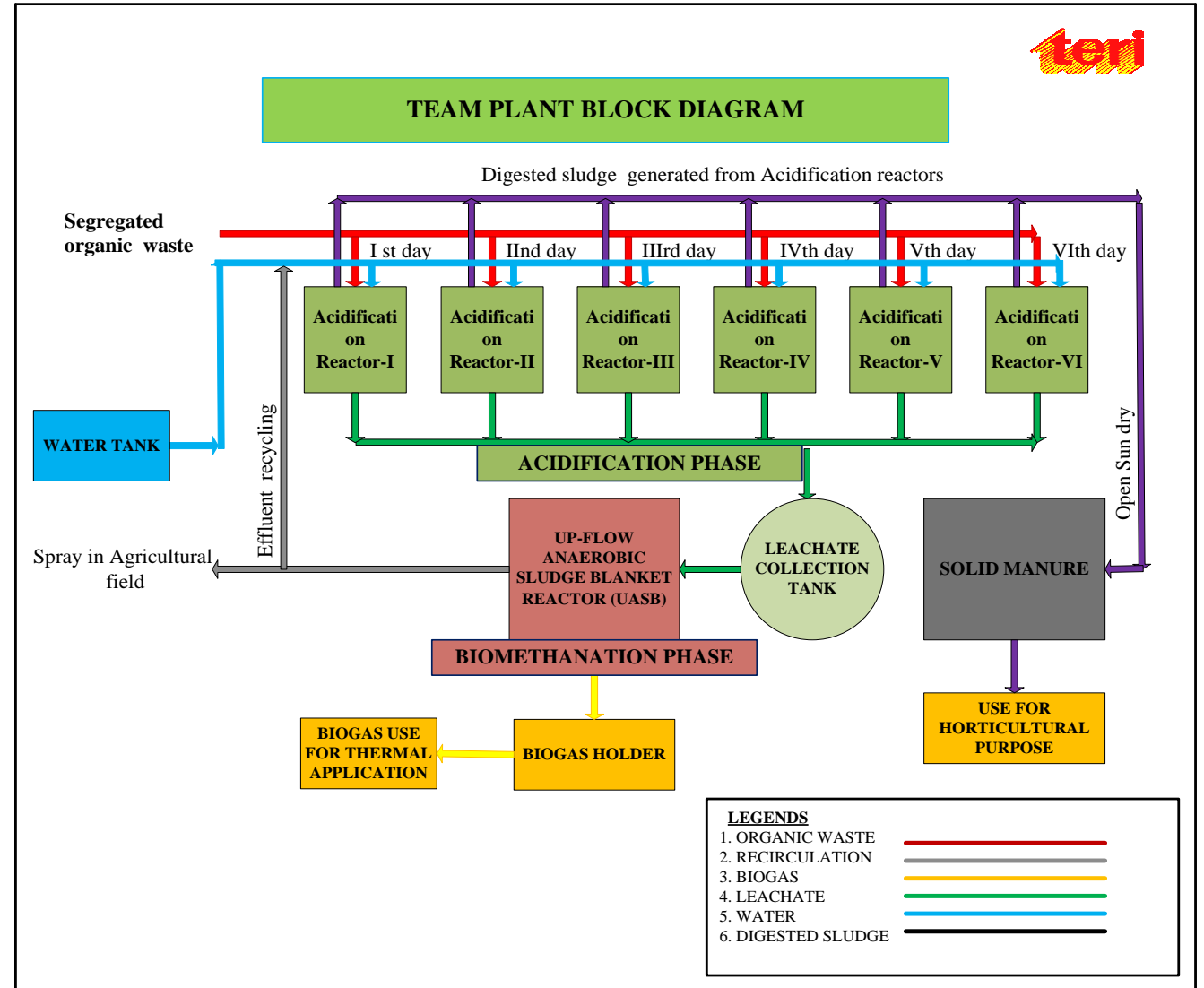


# TERI's Enhanced Acidification and Methanation Technology

- Unique design and biphasic in nature
- High biogas generation
- Low maintenance and ease of operation
- Low retention time

## Beneficiaries:

- Municipal Corporations, Bulk Waste Generators, Industries





Influencing policy and regulations to create an enabling environment





# Key strategies for managing organic waste in Lucknow

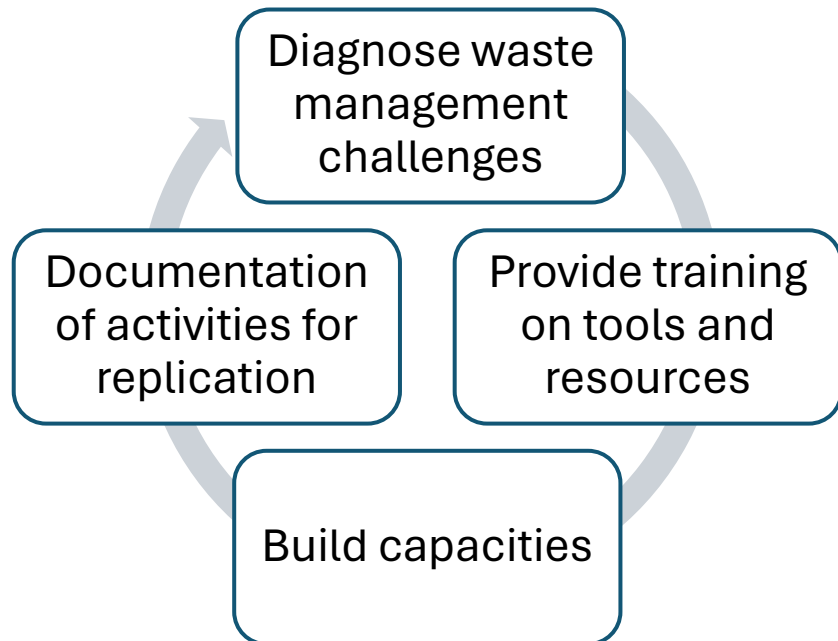
Area: 631 Sq. Km.

Population : 24 lakhs

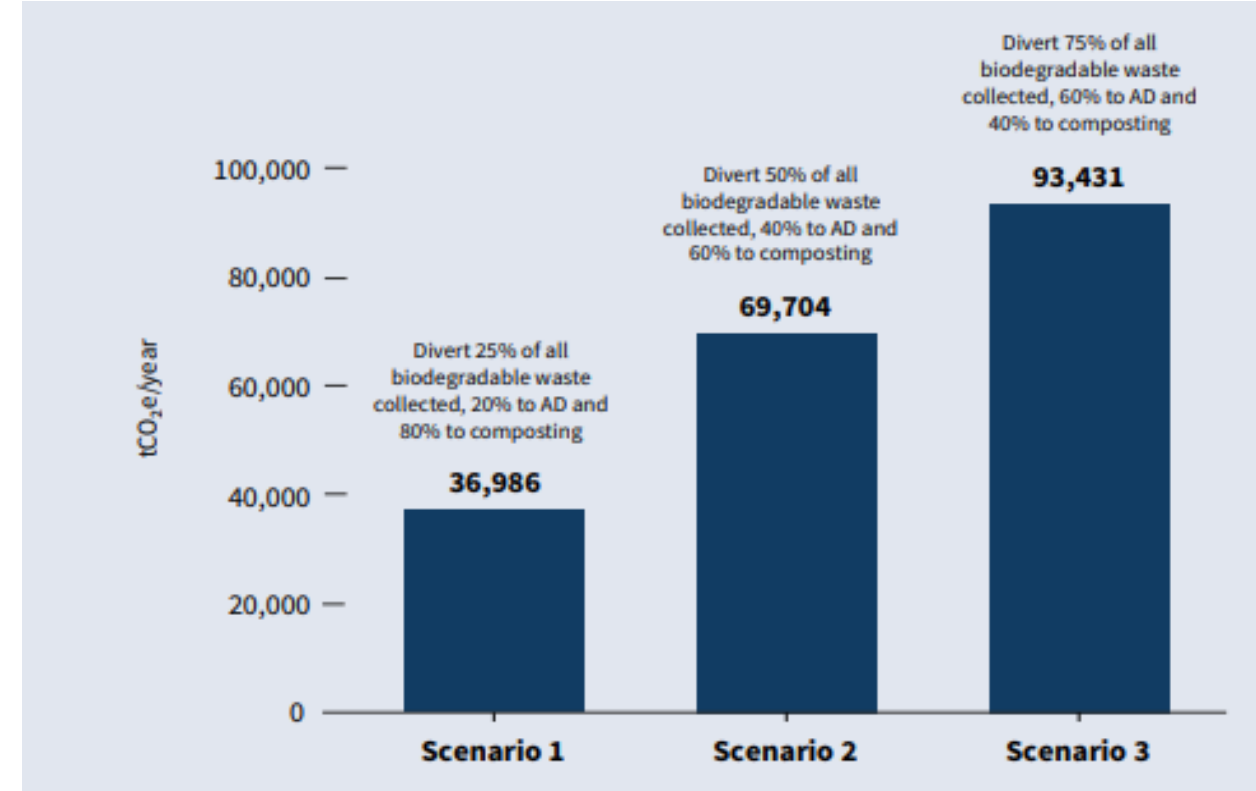
Waste generation: 2000 tonnes per day

Capital city of Uttar Pradesh

High population, rapid urbanization and tourist inflow



## Greenhouse gas emissions reduction potential for modelled alternative scenarios



Source: TERI

- Rapid urbanization: Increased population density generates more waste, straining existing infrastructure.
- Limited waste segregation: Mixed waste streams make processing less efficient and resource recovery difficult.
- Inadequate processing facilities: Lack of composting plants and recycling facilities leads to reliance on landfills.
- Public awareness gap: Limited understanding waste management practices like reduction, reuse, and segregation

# Key strategies for managing organic waste across value chain



## Waste generation

Implement the SSP organics



## Waste collection and transportation

Expand infrastructure  
Optimize collection frequency  
Route optimization



## Waste recovery

Develop centralized and decentralized facilities  
Support end markets for OW derived product



## Waste Disposal

Install landfill covers  
Install gas collection and control system  
Use biocovers to oxidise methane products



# A Model city for waste management: Indore

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# A Model City for Waste Management: Indore, MP

- Located in Madhya Pradesh, Indore is a leader in sustainable waste management practices.
- Recognized for national cleanliness in Swachh Survekshan rankings.
- Population: 32 lakhs
- Daily waste generation: 1,100 metric tons



- **100% Waste Segregation at Source:** Households separate waste into categories for efficient processing and resource recovery.
- **100% Daily Door-to-Door Collection:** Waste is collected conveniently and consistently
- **100% Daily Processing:**
  - Organic waste converted to compost or biogas.
  - Recyclables processed for reuse.
  - Residual waste minimized and responsibly disposed of.
- **13 Lakhs Metric Tons of Legacy Waste Cleared**
- **Bio-remediation/Bio-mining Process**
- **100 Acres Recovered**
- **Wet Waste to Clean Energy**
- **Bio-methanation Plants**
- **City Buses Powered by Bio-CNG**



*A 20 TPD Bio-methanation Unit at Choithram Mandi*

Thank you!