Decentralized Organic Waste Management with Small-scale Anaerobic Digesters – A Case Study of Pune, India

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Overview

• Background on solid waste management in Pune
• Pune’s approach to diverting waste
• Benefits and challenges of biodigesters
• Leveraging Pune’s experiences with biodigesters
Pune Context

• 8th largest city of India (2nd largest in the state of Maharashtra)

• Population
  o 6 million in 2018
  o Projected to increase to nearly 8 million by 2030
Solid Waste Management in Pune

• Generation: 2,100 metric tons of municipal solid waste daily
• Composition:
  o 45-50% organic
  o 35-40% recyclable
  o Remainder is inert
• Collection:
  o 55% - door to door
  o 12% - gate collection (directly in small truck)
  o 30% - community bins
  o 3% - unauthorized disposal locations
• Key sources:
  o Households (around 69%), hotels and restaurants (about 11%) and markets and commercial establishments (around 4%).
Solid Waste Management Challenges

- Limited disposal capacity
  - Community opposition
  - Most of Uruli Devachi landfill closed
    - Open portion receives 600 tonnes per day
- Excessive waste transportation costs
- Failure of privately operated material recovery, composting, and RDF facilities
Multiple Diversion Strategies

- Pune has adopted a suite of technologies and options in recent years to address emerging waste emergency
- Current organic waste treatment facilities
  - 3 segregation facilities (25 TPD, 50 TPD, and 50 TPD)
  - 1 centralized composting facility (200 TPD)
  - 13 decentralized composting facilities
  - 1 facility preprocessing organic waste for BioCNG (300 TPD)
  - 1 RDF and compost plant (300-350 TPD)
  - 26 decentralized biodigesters
Decentralized Biodigesters

- Network of 26 biodigesters
- Each processes approximately 5-10 tonnes of organic waste daily
- Technologies
  - Up-flow anaerobic sludge blanket technology
  - Conventional anaerobic digestion technology
- Some plants are operated by a private concessionaire that receives tipping fees paid by the municipality
- Contracts are for a period of five years for plants installed by the municipal corporation, and ten to fifteen years for plants installed by the private sector
Biodigester Benefits

• Reduced methane emissions (estimated by Pune Municipal Corporation as 180m³ of methane per day per 5 TPD plant)
• Biogas is used to generate electricity, which is used to power local street lighting
• Digestate is used as soil amendment to maintain local green spaces
• Reduced transportation costs by treating waste locally (estimated by PMC as Rs. 400 or about $6.00 per ton of waste)
• Reduced risk of unprocessed waste piling up due to a temporary failure of a single facility
Implementation Challenges

• Quality of the feedstock
  o Challenges with monitoring, reporting, and verification mechanisms to ensure high quality feedstock

• Operations
  o Dysfunctional scrubbers and inadequate maintenance

• Implications: frequent system down-time and low electricity output
  o E.g., electricity production at a five tpd plant using a 50 KVA generator operating less than 6 hours per day was 2.09 KWh on average - as observed in March 2018
Overcoming Challenges

• Focusing on improving operations and maintenance
• Developing an action plan for solid waste management under the Smart City initiative that employs integrated strategies to improve solid waste management in general
  o Promotes “smart” technologies to address urban challenges
  o Includes specific objectives and strategies for each aspect of the solid waste management cycle (e.g., using monitoring technologies for collection)
Sharing Pune’s Experiences

• Pune is participating in the Climate and Clean Air Coalition Municipal Solid Waste Initiative
• Waste Initiative working with regional implementer, TERI, to promote Pune’s achievements
• A number of other large and medium cities in India have conducted site visits to Pune and started to replicate its successful model
• TERI is identifying barriers and opportunities to extending the Pune model to other cities
Considerations for further research

• Is this a useful model?
• If so, what polices and practices were initial drivers for diversion technologies employed – and which have subsequently been successful?
• What are changes in waste flows since inception of program? Are there measureable changes in leachate and groundwater contamination?
• What information would be helpful to others in the network to replicate this approach?
Thank you! Questions?

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