Semi-formal Recycling as a Viable Option for Methane Abatement in Developing Countries

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Discussion Points

- Methane generation
- Common methane mitigation options for the Municipal Solid Waste (MSW) Sector
  - Organic MSW
  - Inorganic MSW
- MSW management in developing countries
  - Formal
  - Informal
  - Semi-formal
- Case studies
- Estimate methane reductions
- NAMAs
### Organic Waste Generation

<table>
<thead>
<tr>
<th>Income Level</th>
<th>Waste generation (Kg/capita/year)</th>
<th>Organic fraction (%)</th>
<th>Organic waste generation (Kg/capita/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>550</td>
<td>29</td>
<td>160</td>
</tr>
<tr>
<td>Upper-middle</td>
<td>370</td>
<td>52</td>
<td>190</td>
</tr>
<tr>
<td>Lower-middle</td>
<td>300</td>
<td>67</td>
<td>200</td>
</tr>
<tr>
<td>Low</td>
<td>225</td>
<td>71</td>
<td>160</td>
</tr>
</tbody>
</table>

Solid Waste Management Hierarchy*

- Waste Reduction / Reuse
- Recycling / Composting / Anaerobic Digestion
- Waste-to-Energy / Landfilling with LFG Recovery
- Treatment and Disposal

* Source: www.epa.gov/osw/nonhaz/municipal/hierarchy.htm
Common Methane Mitigation Options for the MSW Sector

- Sanitary landfills
  - Passive venting
  - Landfill gas (LFG) projects
    - Flaring
    - Utilization: electricity generation or direct use

- Composting

- Anaerobic digestion

- Direct reuse
  - Food banks
  - Animal feeding
Challenges to the Customary Methane Mitigation Options

- Passive LFG venting
  - Direct emission to the atmosphere

- LFG projects
  - Feasibility dependent on volume, incentives, etc.

- Anaerobic digestion
  - Needs clean raw materials
  - Sensitive procedure

- Composting
  - Contamination
  - Market

- Direct reuse
Preferred Methane Abatement Options for Organics

<table>
<thead>
<tr>
<th>Materials</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food waste</td>
<td>Reuse</td>
</tr>
<tr>
<td>Yard waste</td>
<td>Composting</td>
</tr>
<tr>
<td>Wood</td>
<td>Recycling</td>
</tr>
<tr>
<td>Paper &amp; Cardboard</td>
<td>Anaerobic Digestion</td>
</tr>
<tr>
<td>Organic Textiles</td>
<td></td>
</tr>
</tbody>
</table>
Recycling of Non-Organics and Methane Abatement

• Virgin materials versus secondary materials
• Virgin materials require more fossils
  – Fuel energy
  – Petroleum: produce plastics
• Methane emissions from oil and natural gas systems primarily the result of normal operations and system disruptions
MSW Management in Developing Countries

• Stakeholders
  – Municipalities
  – Formal Sector
  – Informal Sector
  – “Semi-formal” Sector

• Arrangements
  – Public
  – Private
## Recovery Rates

### Formal vs. Informal

<table>
<thead>
<tr>
<th>Income Level</th>
<th>Average %</th>
<th>Formal %</th>
<th>Informal %</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>54</td>
<td>54</td>
<td>0</td>
</tr>
<tr>
<td>Upper-middle</td>
<td>15</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Lower-middle</td>
<td>27</td>
<td>11</td>
<td>16</td>
</tr>
<tr>
<td>Low</td>
<td>27</td>
<td>1</td>
<td>26</td>
</tr>
</tbody>
</table>

Informal Sector – Main Activities

• Recovery
  – Itinerant waste buyer
  – Door-to-door collector
  – Street pickers: bins, dumpsters and piles
  – Garbage trucks
  – Transfer station or landfill

• Processing

• Transporting

• Selling
  – Junk dealers
Informal Sector - Numbers

- 1988 - World Bank study estimated 1-2% of the world’s population ~ 15 million people
- In developing countries about 15% of waste is processed by the IS.
- Save the cities as much as 15-20% of waste management budget

<table>
<thead>
<tr>
<th>City</th>
<th>% of total population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bengaluru</td>
<td>0.5</td>
</tr>
<tr>
<td>Belo Horizonte</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Canete</td>
<td>0.4</td>
</tr>
<tr>
<td>Delhi</td>
<td>1.3</td>
</tr>
<tr>
<td>Dhaka</td>
<td>1.7</td>
</tr>
<tr>
<td>Ghorahi</td>
<td>0.1</td>
</tr>
<tr>
<td>Lusaka</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Managua</td>
<td>0.3</td>
</tr>
<tr>
<td>Quezon City</td>
<td>0.5</td>
</tr>
<tr>
<td>Sousse</td>
<td>0.1</td>
</tr>
<tr>
<td>Average</td>
<td>0.5</td>
</tr>
<tr>
<td>Total workers in 10 cities</td>
<td>350,000</td>
</tr>
</tbody>
</table>

Table source: 2010 - Scheinberg, A. et al. *Solid Waste Management in the World’s Cities*
Informal Sector – Main Characteristics

• Profile
  – Migrants
  – Specific ethnic or social groups
  – Have few or no alternative livelihood options

• Modus operandis
  – Work individually or with spouse and children
  – Ease of entry and exit
  – Sell to middle dealers – no legal bonds
  – Entirely private sector

• Global recycling partner

• Opportunity and challenge
Semi-Formal Sector

- Organized group of informal sector agents
- Legal organizations: Cooperatives, associations, micro- and small enterprises (MSEs), etc.
- Clear and functional institutional framework
- Sustainable financial system
- Data collection and documentation
- Training
- Rules
- Accountability
- Higher standard of living for the members
Opportunities and Challenges

Opportunities
- Increase recycling rates
- Segregated green waste
- Reduce public sector costs
- More personnel
- Availability of secondary raw materials
- Increase lifetime of landfill and less leachate generation
- Sustain employment
- Improve working conditions

Challenges
- Contamination
- Heterogeneity of the pickers
- Vices/Criminality
- Logistics
- Quantity and quality of the materials
- Sustainability
Hierarchy of Recycling

Source: Wilson et al. (2006) Role of informal sector recycling in waste management in developing countries. *Habitat International*
Issues

• Modernization of the MSWM system
  – Formal participants gain privileged claims to materials
  – Waste pickers are denied access to materials
    • Streets
    • Commercial or industry
    • Transfer stations

• Heterogeneity of individual pickers

• Political time

• Inherent characteristics of organic material - rate of decomposition, heavier and denser
Improving the Position

• There is broad room for improvement, strengthening, and integration of the informal sector in solid waste, to improve working conditions and secure livelihoods.

• Areas of action
  – Economic
  – Social
  – Public policies
  – Private sector
Economic

• Professionalization: Training and capacity building
  – Costs
  – Technical skills
  – Occupational health and Safety
  – Marketing
  – Information and innovation
  – Business management
  – Legal issues

• Access to information and innovation
• Access to financing
• Legal counseling
Economic (cont.)

- Improve earnings
  - Access to better materials, i.e., source separation of organics and dry recyclables
  - Transfer stations and collection depots
  - Upgrade materials and meet user specifications

- Potential end users
  - Food banks
  - Animal feed
  - Energy generation
  - Use compost for city green areas, public and/or agriculture/remediation lands
Social

• Better access to basic services
• Changing public perception of the recyclers
• Capacity building of intermediaries and leaders in the community
  – Political and business leaders
  – Educators
  – Leaders of NGOs and CBOs
  – Media
• Promote environment of cooperation, not competition
Public Policies

• Source separation
• Regulatory framework
  – Conducive to prioritizing services from semi-formal recycling organizations
  – Encourage production systems that use recovered materials
• Formation of Public-Private Partnerships between public agencies and the semi-formal recycling sector for the provision of MSWM services
• Promote and support networks
Private Sector

- Source separation
- Buy products made from recovered/recycled materials
- Large consumer products companies: producer responsibility
- Industries: direct sale of secondary raw materials
- Solid waste management service providers
Case Studies
Iloilo City, Philippines

• 2009: USWAG Calahunan Livelihood Association Inc (UCLA) ~ 150 members
• 2 mechanical, in-house segregation units
• From September 2008 to mid-2010, 450 tons alternative fuels and raw materials (AFR) were recovered and send to a cement plant
• Efforts to recover organics (60% of the waste)
Case Study
Belo Horizonte, Brazil

- 1990 - Creation of ASMARE
- 1990 - City included clause in its Organic Law stating that the collection of recyclables would preferably be the work of the organized informal sector and that they should be the beneficiary of all collected recyclables
- 1993 - Municipality implemented separate collection
  - Drop-off system with recycling containers in public areas
  - Transported to warehouses: Associates are the managers of recycling depots
- Contracts with the commercial sector
- Association organized in committees: Infrastructure, health, religion, social communication, finances, environment, education/culture/entertainment and a Steering committee
Case Study
Phnom Penh, Cambodia

- Raw food market: organic waste is separated
- Windrow compost facility
  - Operated by former waste pickers
- Municipality: provides free space for the facility
- Compost user: farmer
- Waste is transported by the waste collection company
  - Landfill tipping fee is less
Estimating Methane Reductions

- SWM GHG Calculator – GIZ and KfW-Entwicklungsbank
- Waste Reduction Model (WARM) – US EPA
- CDM Methodologies Composting & Anaerobic Digestion: AM0025 (large scale) & AMS-IIIF (small scale) - IPCC
- Other:  
  - IWM
  - ORWARE
  - LCA - IWM
  - WASTED
  - EASEWASTE
  - WISARD
  - WRATE
  - MSW-DST

Source: California Integrated Waste Management Board: Evaluation of Existing MSW/Life Cycle Assessment Tools
National Appropriate Mitigation Actions (NAMAs) - MSW

• Conduct assessment to understand waste quantities generated and recovered, waste composition, and trends
• Conduct an analysis of current waste policies and regulations
• Evaluate existing informal waste recycling sector
• Create a Public Awareness Programme and provide awareness training to change behaviour
• Develop / modify national waste management and recycling strategy
• Establish plans to improve waste collection rates
• Define strategy to improve energy and material recovery
“...if problems in society are to get better it is not enough that a few experts discuss these things. Every individual has to change and the only way to do this is for ordinary people to have greater awareness of bigger problems, and understanding of what creates the problem and desire to change things person by person. So as a member of society you are as qualified as anyone else and the only way to change is through education.”- The Dalai Lama

Thanks

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