Role of Informal Sector for Effective EPR

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## Present Scenario of E-waste Recycling in India

### Non-formal sector
- 90-95% e-waste recycling in non-formal sector
- PCBs are treated in primitive methods to remove components & value metals
- Burning cables to recover copper & unwanted materials in open air
- Leaching of heavy metals/chemicals into landfills and incinerator hazardous
- Recovery yield is poor (~10-20%) - loosing precious metals

### Formal sector
- 5-10% e-waste is recycled in formal sector
- Segregating, disassembling to recover: structural metal parts, cables, Printed Circuit Board (PCB), glass components etc.
- Limited PCB treatment or Exported them for further process to recover precious metals
## Potential Materials Recovered from E-waste

<table>
<thead>
<tr>
<th>Recovered Items</th>
<th>Recycling Option</th>
<th>Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Small &amp; large structural metal parts, heat sinks, Ferrous metal,</td>
<td>Smelting</td>
<td>secondary raw material</td>
</tr>
<tr>
<td>2. Ferrite and ceramic components Non ferrous metal scrap mainly Cu &amp; Al</td>
<td>Striping + Smelting</td>
<td></td>
</tr>
<tr>
<td>3. Cables and wires</td>
<td></td>
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<tr>
<td>4. Precious metal scrap, PCBs with IC Chips, electronic components and connectors</td>
<td>Smelting, Hydro-metallurgy, Electro-chemical, Mechanical shredding etc.</td>
<td>secondary raw material: Cu, Ag, Au, palladium etc.</td>
</tr>
<tr>
<td>5. Small &amp; large structural plastic parts</td>
<td>Chemical, Materials Energy Recovery</td>
<td></td>
</tr>
<tr>
<td>6. Glass components</td>
<td>Smelting</td>
<td>secondary raw material</td>
</tr>
<tr>
<td>7. Hazardous wastes like CFC, Mercury (Hg) Switches, CRT, batteries and capacitor, flame retardants plastic</td>
<td>Recycling is possible with due environmental care</td>
<td>secondary raw material</td>
</tr>
</tbody>
</table>
### PCB Recycling Practiced Globally

**Mechanical shredding + Physical separation + hydrometallurgical**

- **Pretreatment**: to disassemble reusable & toxic parts and to segregate PCBs
- **Physical recycling of** PCBs by (separators- magnetic, eddy current, electrostatic etc),
- **Chemical recycling** (pyrolysis process and gasification process)
- **Pyrometallurgical, Hydrometallurgical or Biotechnological process** to treat metal fraction

**Smelting + Hydrometallurgy + electrolysis**

- **Smelting**: PCBs, ICs, processors, connectors are treated in integrated copper & precious metal smelter-refinery operations, without reduction size
- **Pyrometallurgy, Hydrometallurgy and electrometallurgy** to recover precious metals
DeitY’s Initiatives on E-waste Recycling

- To develop cost effective processing technology of electronic waste recycling and scale up PCB process
- To promote research on recovery of RE from CFL, Indium from LCD screen, Li-on battery etc.
- Awareness programme to sensitize about ill-effect of the unscientific recycling practices
Technology Developed for Extraction of Metals

- Processing technology successfully developed for recycling and reuse of electronic waste
  - Pulverization, physical separation, chemical leaching etc.
  - Pilot Plant level demonstration done to recover precious metal from 1 Metric Tonnes of e-waste with a recovery rate of 95%. Commercialization:
    - NML, Jamshedpur

- Printed circuit boards processing technology was successfully developed & demonstrated
  - Depopulation, pyrolysis, calciner, chemical leaching etc.
    - CMET, Hyderabad & E-parisara, Bangalore.
Dismantling and Segregation

Initial Process

Electronic Products  Segregated Components  Printed Circuit Boards
PCB Recycling

- Physical Separation (Magnetic, Gravity, Electrical)
- Pulverized PCB
- Chemical Leaching
- Cu, Au Ag Pd metals fractions
- Metal Rich Powder
- NML, Jamshedpur - process
PCB Recycling

- Populated PCB
- Depopulator
- Depopulated PCB
- Pyrolysis
  - Oil
  - Gas
  - Solid
- Chemical Leaching & Electrolysis
- Calcinations & Smelting
- Materials
- Metal Recovery

CMET, Hyderabad & E-Parisara, B’lr- process
Demonstration Plant: Metal Extraction from PCB Recycling at Bangalore

Major Targeted Deliverables

- Metals recovery demonstration from PCB: Cu, Au, Ag and Pd of from PCB (30mT per annum).

Established Scale up operation:

- Physical Process (1T/day)
- Pyrolysis/ Calcinations (500Kg/day)
- Smelting (300Kg/day)
- Hydro-Metallurgy (300Kg/day)
Technology developed for E-waste Plastics

- 7 categories of plastics (ABS, HIPS, PC, PP, PVC, nylons, Epoxy, phenolic, Polyesters etc.) Segregated in 3 Types:
  - Homogenous type **Type 1** (76%): housing, mouse etc.. Processing technology developed to convert these plastic to Master batch for value added product, gained virgin properties, Process patented. TOT in progress
  - Hetero-genous type: **Type 2** (20.5%): connectors, catridge, etc., & **Type 3** (3.5%): Thermoset plastics containing BFR, fillers & heavy metals

CIPET, Bhubaneswar
E-waste Awareness Programme

Major Targeted Deliverables

a. **Creation of contents** for awareness programme: Training Material – Creation of training material for different stakeholder categories which include – Schools, Youth, Bulk Consumers, RWAs, Informal Sector, Collaterals – Shall cover both ATL/BTL Activities, Online/ Social Media Engagement, Adaptation of all material in Local Language
b. **Organization of Workshops**: 10 states, namely, Madhya Pradesh, Uttar Pradesh, Jharkhand, Orissa, Goa, Bihar, Pondicherry, West Bengal, Assam and Manipur
c. **Inventory study** of quantum of e-waste in 10 specific cities

Status of the Programme

a. Initiated project on Creation for content in Hindi/ English/ Regional languages- *To be completed by May 2016*
b. Initiated project on organizing Workshops various states- *Initiated by March 2016*
c. Initiated project on Inventory study of quantum of e-waste in few 4 states: WB, Odisha, MP, Chattisgarh- *Initiated on February 2016*
d. Initiated project on Awareness programme for Government officials for 10 States- *Initiated on April 2016*
Strength of Informal Sector

• Around 95% of generated e-waste is being processed
• ~2 Crore population engaged in waste management (~10Lacs in e-waste)
• Effective collections process: Highly sophisticated collection methods - reaching from bulk generators to households through a door-to-door collection network.
• Collection mode also involves auction from offices and companies, the drop-off of units at collection sites such as bins and collection centres
• Provides attractive compensation for products
• Historical role in waste management
• Collection from different channels
• Component and material recovery
• Widespread and active network
Key Challenges of Informal Sector

Key Challenges

• Inadequate facility: ventilation, exhaust pipes, working environment
• Employ crude method for extraction of the metal- Only 30% of the material embedded in a circuit board is recovered and losing major precious material
• Informal sector makes it difficult to channelize the waste into the formal sector
• Leaching of toxic materials in the environment causing pollution to air, water and soil leading to health effects
• No personal protection equipment
• Employed child labour
• Illegal set up
• Low income levels
• Unstable employment
• Operate in unsafe conditions
Proposed Steps to Improve Informal Sector

- National Environmental Policy (NEP) 2006 ensures to provide legal status to informal sector
- E-waste recycling is fast evolving sector. Formal sector is however not getting materials due to competition from informal collectors, scrap dealers and recyclers. **Formal sector can engage informal operators or their clusters**
- Collaboration between the informal sector and Producers with the formal recyclers
- An industrial park (Eco-park) can be established for provisions to house informal operators.
- Organize the informal sector units to main stream of e-waste recycling activities
- Provide adequate Skill Development and Awareness for the informal operators
Trainings and Awareness

• Increase knowledge and create awareness among the various levels of operators

• Provide soft skill training to informal sector

• Training for awareness creation on the environment and health implications of improper handling and processing of e-waste

• Trainings for the informal sector on using the indigenously developed technology
Role of Informal Sector

- Appropriate Training would facilitate informal operators to **Dismantle & Segregate the components**
- **Sale these spare parts and components as per market price and requirement**
Eco-Park

- Metal Extraction Unit
- PCB, IC, Components
- Dismantlers & Segregators
- Collector/s
- Metal & other scrap for normal processing
- e-waste
- Evaluators
- Payment based quality
- Plastics
- Effluent Treatment Unit
- Plastic Processing Unit

Some Examples

- Proposed Area Requirement: 5-10 Acre
- Area development cost:
- Metal Extraction Plant Cost: ~Rs. 10Cr. for 1MT PCB/day
- Plastic Processing Plant Cost: ~Rs. 5 Cr.
- Power requirement
- Water requirement
- Producers can link with formalized informal sector to use their network for collection of e-waste
- To meet up the set collection target of E-waste (management) Rules, 2016
- Greater market visibility & efficient e-waste collection to create a sustain business
- Establish new model for acquisition
Outcomes

• Associations of informal sector recyclers can be formed at the level of the Eco/industrial park

• To provide collection services to the producers and bulk consumers

• Segregation and channelization to dismantling or recycling units for environmentally sound technologies

• Significant gap in collection and channelization of e-waste to formal sector can be addressed.

• Illegal activity of informal sector can be regulated by linking them with producers and formal recyclers.