Role of Technology in ELV Management – Process and Challenges

Presented by:
Dr Bharat Bhushan Nagar,
Garbologist and Material Circularity Expert
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- Shredder Residues Management
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Present ELV Scrapping in India

- India Steel Scrap Policy, 2019
- India Vehicle Scrapping Policy 2021
- National Urban Air Quality Campaign 2019
- National Resource Efficiency Policy 2019 with Steel as Focus Area
- India National Emission Reduction Target submitted to Paris Climate Agreement
- Extended Producer Responsibility guidelines 2020 (Under Consideration)

In 2014, 50 lac vehicles achieved ELV, but only 4.1 lacs were dismantled.
Rest dumped at garbage yards, resulting in dumping of 0.3 Mn tons of Steel and 0.4 Nm tons of Al.
Interesting fact is the maximum ELV status car will be ALTO and vehicles of Maruti.
By 2021 90 lac vehicles will achieve ELV, which is expected to increase to 140 lacs.

<table>
<thead>
<tr>
<th>Type of vehicle</th>
<th>Total ELV count in 2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two Wheelers</td>
<td>1,77,23,951</td>
</tr>
<tr>
<td>Three Wheelers</td>
<td>7,57,932</td>
</tr>
<tr>
<td>Private Cars/SUVs</td>
<td>28,09,966</td>
</tr>
<tr>
<td>Commercial passenger Vehicles</td>
<td>94,757</td>
</tr>
<tr>
<td>Commercial goods vehicles</td>
<td>11,88,833</td>
</tr>
<tr>
<td><strong>Total vehicle count likely to be ELV in 2025</strong></td>
<td><strong>2,18,95,439</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>City</th>
<th>Survey Area</th>
<th>Number of Units Operating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delhi</td>
<td>Mayapuri</td>
<td>3000</td>
</tr>
<tr>
<td></td>
<td>Gokul Puri</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>Jama Masjid</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>Abul Fazal</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Karam Pura</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Karol Bagh</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Gehvra Mor</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Merut</td>
<td>Chatriwala Peer</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Soti Ganj</td>
<td>55</td>
</tr>
<tr>
<td>Kolkata</td>
<td>Phool Bagan</td>
<td>1000</td>
</tr>
<tr>
<td>Nazibabad</td>
<td>Kabari Bazaar</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>Langdey ki puliya</td>
<td>100</td>
</tr>
<tr>
<td>Moradabad</td>
<td>Nawabpura</td>
<td>Only informal discussion</td>
</tr>
<tr>
<td></td>
<td>Karaula</td>
<td>Only informal discussion</td>
</tr>
<tr>
<td></td>
<td>Transport Nagar</td>
<td>Only informal discussion</td>
</tr>
</tbody>
</table>
Standard ELV Management Process

1. End-of-life vehicles
   - CO2 collection
   - Airbag collection and recycling

2. Removal of parts in good condition
   - Reuse as used parts, and as ferrous and non-ferrous metals

3. Press

4. Shredder company
   - Sort into three
     - Ferrous
     - Nonferrous metals
     - Shredder residue (ASr)

5. Recycling company
   - Reuse as materials
   - Reuse as energy

6. Dismantling company
   - Bumper
   - Battery
   - Engine, transmission
   - Catalyst
   - Power steering, etc.
Indian ELV Standards & Difference with EU standards


- ISO 11469: Generic identification and marking of plastic products.

- Considering the significant population of two wheelers in India, it was decided to cover the 2-wheelers along with the M1 category vehicles in the scope. On the other hand, the European directive covers M1 and N1 category in the scope.

- The inclusion of N1 category in India was debated at length. Based on the experience with implementation of M1 category, a decision will be taken for inclusion of N1 category vehicles.

- The marking of the parts is limited to only plastic components unlike Europe where rubber components are also required to be marked.

- The concept of an assessment to be carried out by appropriate agency before type approval certificate is issued to the manufacturer has been capture.
# International ELV Standards Comparison

<table>
<thead>
<tr>
<th></th>
<th>EU</th>
<th>Japan</th>
<th>Korea</th>
<th>China</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ELV management system</strong></td>
<td>Law</td>
<td>Law</td>
<td>Law</td>
<td>Law</td>
<td>Related law [5]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Automotive Products Recycling Technology Policy (declared in February 2006) [35]</td>
<td>Clean Air Act, etc.</td>
</tr>
<tr>
<td></td>
<td>Measures for abandoned automobiles</td>
<td>Illegal dumping of ASR [29]</td>
<td>Effective use of resources</td>
<td>Effective use of resources</td>
<td>Environmental conservation measures associated with ELV recycling</td>
</tr>
<tr>
<td></td>
<td>Environmental measures of dismantling sites</td>
<td>Effective use of resources [29]</td>
<td>Management of information on ELVs</td>
<td>Measures for recycling economy</td>
<td></td>
</tr>
<tr>
<td><strong>Parties responsible for recycling costs</strong></td>
<td>Automobile manufacturers and importers (if the recycling incurs cost), finally users</td>
<td>Users</td>
<td>Automobile manufacturers and importer (if the recycling incurs cost), finally users</td>
<td>No regulation (traded as a valuable secondary resource)</td>
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</tbody>
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International ELV Standards Comparison

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<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recycle target</td>
<td>[26] Until 2006: Reuse + Recovery: 85%</td>
<td>[24] Airbag: 85% ASR: 70% (from 2015 onwards)</td>
<td>[15] Material + energy recovery: 85%  (of which energy recovery rate is within 5%)</td>
<td>[35] Possibility of recycling: 2010: about 85% (material recycling of 80% or more) 2012: about 90% (material recycling of 80% or more) 2017: about 95% (material recycling of 85% or more)</td>
<td>[36] No specific goals (95 % of ELVs enter the recycling route, of which 80 % of the materials are recycled)</td>
</tr>
<tr>
<td></td>
<td>Reuse + Recycle: 80%</td>
<td>50% (2010 to 2014)</td>
<td>30% (2005–2009)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reuse + Recovery: 95%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reuse + Recycle: 85%</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Information management</td>
<td>Issuance of Certificate of Destruction (CoD), monitoring of target values by the government</td>
<td>Electronic manifest system</td>
<td>Intensified collection of information on deregistration and recycling</td>
<td>Issuance of ELV collection certificate [34]</td>
<td>Information collection management by recycling industry groups</td>
</tr>
<tr>
<td>Characteristic of the system</td>
<td>Based on the subsidiarity principle and the principle of Extended Producer Responsibility [27]</td>
<td>Automobile manufacturers and importers take responsibility for the recycling</td>
<td>No target for the recycle rate/recovery rate regarding the total automobile weight</td>
<td>Based on the Extended Producer Responsibility (EPR) [32]</td>
<td>There is no regulative system that directly manages ELV on the national level [5]</td>
</tr>
<tr>
<td></td>
<td>Regulation to prohibit inclusion of heavy metals (mercury, cadmium, hexavalent chromium, lead)</td>
<td>No target for the recycle rate/recovery rate regarding the total automobile weight</td>
<td>System planning adjusted to fluctuations in ELV price is being done.</td>
<td>System planning adjusted to fluctuations in ELV price is being done.</td>
<td>Under the Anti-Car Theft Act (1992), information on vehicles collected by recyclers is managed by the National Motor Vehicle Titling Information System.</td>
</tr>
<tr>
<td></td>
<td>Domestic laws are being enforced but the manner of operation varies with country.</td>
<td>Thermal recovery is recognized in ASR recycling.</td>
<td>Operated under the Eco-assurance system [32, 33]</td>
<td>Operated under the Eco-assurance system [32, 33]</td>
<td>The Automotive Recycling Association of the ELV recycling industry operates an information website for related regulations to attain stricter compliance. [37]</td>
</tr>
</tbody>
</table>

M1, 4-wheeled vehicles with seating capacity of nine or less, including passenger vehicles; M2, seating capacity of nine or more, vehicle weight under 5,000 kg; M3, vehicle with seating capacity of nine or more, vehicle weight over 5,000 kg; N1, freight vehicle with maximum load capacity under 3,500 kg; N2, maximum load capacity of 3,500 kg or more, freight vehicle weight under 12,000 kg; N3, freight vehicle with maximum load capacity of 12,000 kg or more
ELV Recycling Flow in EU & Japan

In the EU

- ELV (premature or natural) 100%
- Depollution
- Dismantling
  - Car hulk 60-90%
  - Shredder (hammer mill)
- Air classifier
  - Magnetic drum
  - Non-ferrous metal separator
    - Heavy ASR 2-8%
    - Light ASR 10-24%
  - Ferrous metal fraction 35-65%
  - Non-ferrous metal fraction 1-5%
- Landfilling

In Japan

- ELV 100%
- Fluorocarbon collection
- Depollution
- Dismantling
  - Car hulk 55-60%
- Shredder (hammer mill)
- Air classifier
  - Magnetic drum
  - Non-ferrous metal separator
    - Heavy ASR 17%
    - Light ASR 50-55%
  - Ferrous metal fraction 5-35%

Material and thermal recovery (legality) 15-16%
Auto Shredder Residues Management

There are two basic approaches to ASR post treatment.

1. Mechanical processes which use systems of magnetic separation, eddy current separation and high speed air and water streams for mechanically segregating different materials by density

2. Pyrolytic/chemical processes for recovering materials and producing energy.
## Exploring Circularity with ELV Management

![Diagram: Automotive and ELV value chain]

![Table: Material / Components]

<table>
<thead>
<tr>
<th>Material / Components</th>
<th>% by weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ferrous metal</td>
<td>68%</td>
</tr>
<tr>
<td>Non Ferrous Metal</td>
<td>8%</td>
</tr>
<tr>
<td>Plastics &amp; Process Polymers</td>
<td>10%</td>
</tr>
<tr>
<td>Tires</td>
<td>3%</td>
</tr>
<tr>
<td>Glass</td>
<td>3%</td>
</tr>
<tr>
<td>Batteries</td>
<td>1%</td>
</tr>
<tr>
<td>Fluids</td>
<td>2%</td>
</tr>
<tr>
<td>Textiles</td>
<td>1%</td>
</tr>
<tr>
<td>Rubber</td>
<td>2%</td>
</tr>
<tr>
<td>Others</td>
<td>2%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Figure 3: Automotive and ELV value chain
MoEFCC has released National Resource Efficiency Policy for reducing extermination of natural resources through maximizing waste recycling through circular economy and optimizing resource consumption.

MoEFCC has identified C&D Waste recycling among national priority areas.

- Economic
  - Rs. 60.8 billion in material savings in manufacturing sector alone
  - Reduce import dependence for critical minerals to improve the country’s trade balance
  - In Steel sector, save material cost from 21 MT iron ore, 8.25 MT coking coal and 3.75 MT limestone by 2025
  - In Aluminium sector, save cost from 36 million barrels of crude oil eq. energy by 2025
  - Improve resource availability that is critical to the growth of industries

- Social
  - Reduce conflict and displacement in mining areas, as well as improve health and welfare of local communities due to reduced extraction pressures
  - Improve affordability of and access to resources critical for poverty reduction eg. recycled aggregates and other secondary raw materials
  - Job creation in recycling sectors, innovative design and manufacturing
  - Contribute towards preserving resources for future generations

- Environmental
  - Reduce ecological degradation and pollution associated with mining due to reduced extraction pressures
  - Reduction in GHG emissions from extraction, manufacturing and use phase
  - Avoid 31.5 MT of CO₂ emissions in steel sector and 13.5 MT of CO₂ emissions in aluminium sector
  - Avoid industrial wastes and landfill of solid wastes
  - Provide opportunities for restoration of landscape and water bodies

Benefits of resource efficiency to India (NITI Aayog, 2017; TERI, 2019)
Proposed Process for Battery Recycling in ELV Management

Battery Material Recycling Business Structure

A. Dismantlers and Dealers
- Removal and recovery of batteries

B. Toyota Chemical Engineering
- Recycled materials
- Reduction processing
- Crushing and sorting

C. Sumitomo Metal Mining
- Refining process
- Nickel hydroxide processing

D. PEVE
- New battery manufacture

Customers

Dealers

Toyota
Technology for Multiple Residues Waste Management in ELV Recycling
Conclusion

- India need to explore optimized technology approach, as far as electro-mechanical options are concerned.
- There is a lot of spade work required to define a minimum set of commercially available technologies, which may be made accessible to local entrepreneurs.
- None of companies in India produce auto–grade shredders, which might pose a challenge for setting new facilities.
- Since the facilities might involve an in-depth component related to hazardous waste generation and EHS aspects, it would be a challenge for first take-off facilities to optimize the related performance.
- These ELV recycling facilities have potential to disrupt the existing dry waste and other hazardous waste markets, hence it may attract a lot of commercial realization with passage of time.
- Challenge does exist to link and define legal compliances will be a great challenge, due to complicated mixture of materials emanating at these facilities.