Topics Covered

- Waste Generation and Disposal
- Identification and Separation
- Down-Cycling
- Monomer Recovery
- Hydrogenation, Pyrolysis, and Gasification
- Incineration with Energy Recovery
- Degradable Polymers
- Prospects
### Municipal Solid Waste (MSW)

<table>
<thead>
<tr>
<th>Type of waste</th>
<th>Amount (millions of tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper</td>
<td>87.2</td>
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<tr>
<td>Ferrous metals</td>
<td>13.3</td>
</tr>
<tr>
<td>Glass</td>
<td>12.6</td>
</tr>
<tr>
<td>Plastics</td>
<td>24.2</td>
</tr>
<tr>
<td>Wood</td>
<td>12.2</td>
</tr>
<tr>
<td>Food waste</td>
<td>25.0</td>
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<tr>
<td>Yard waste</td>
<td>27.8</td>
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<tr>
<td>Total</td>
<td>230.0</td>
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</tbody>
</table>

### Method of Disposal

<table>
<thead>
<tr>
<th>Method of Disposal</th>
<th>Amount (millions of tons)</th>
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<tbody>
<tr>
<td>Landfill</td>
<td>131.9</td>
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<tr>
<td>Combustion with energy recovery</td>
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<td>Recovered materials</td>
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<td>Paper</td>
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<tr>
<td>Ferrous metals</td>
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<td>Glass</td>
<td>2.9</td>
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<tr>
<td>Plastic</td>
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Degradable Polymers

- Biodegradation
- Photodegradation
- Hydrolysis
Identification and Separation

- SPI Container Code
- Size Reduction
- Direct Flotation
- Froth Flotation
- Water, Paper, and Metal Removal
- Dissolution
Down-Cycling

- Example: Plastic Lumber
Monomer Recovery

- Depolymerization
- Repolymerization
Hydrogenation, Pyrolysis, and Gasification

- Hydrogenation
  Liquid Product

- Pyrolysis
  Gaseous Product

- Gasification
  Gaseous Product
Incineration with Energy Recovery

- Power Plants
- Incinerators
- Cement Kilns
Prospects

- Reduce manufacturing waste
- Reuse items
- Recycle without separation
- Recycle after separation
- Depolymerize
- Convert to liquid fuels
- Incinerate to recover energy
Polymer Life Cycle
Questions/Comments

Reference: