PV End-of-Life Management

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August 2019
SEIA’s PV Recycling Initiative

- Member working group
- Working proactively to develop end-of-life solutions
- Collaborate early with stakeholders
- Build reuse and recycling resources
Where is the waste coming from?

- Manufacturing scrap
- Warranty-related
- Broken during logistics or handling
- Extreme weather events
- Technology upgrades
Products recycled

• PV Modules
  • Crystalline
  • Thin-film

• Inverters

• Mounting / racking systems
Why recycle PV modules?

Heath/Engel-Cox, SPI 2018

Relative material value of a c-Si Panel
Based on Raithel (2014)
Cooperation throughout the value chain

- **R&D Organisations**
  - Public and private institutions
  - Producers

- **Repair/Re-use services industry**
  - Producers
  - Independent services partners
  - Producer-dependent contract and service partners (e.g. installation and construction companies)
  - Waste collectors and companies
  - Pre-treatment companies

- **Recycling treatment industry**
  - Public waste utilities and regulators
  - Waste management companies
  - Pre-treatment companies
  - Producers

Source: IEA/IRENA, 2016
### SEIA’s PV Recycling Program

<table>
<thead>
<tr>
<th>Member-based program</th>
<th>Evaluate and develop recyclers</th>
<th>Collect data</th>
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</thead>
<tbody>
<tr>
<td>• Evaluate service capabilities</td>
<td>• Members help develop process</td>
<td>• Weight and volume (est. annually)</td>
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<tr>
<td>• Downstream capabilities</td>
<td>• Members help with technology</td>
<td>• Recovered materials (modeled)</td>
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<tr>
<td>• <strong>Anyone</strong> can use these recyclers</td>
<td>• Site visit, samples</td>
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# Challenges and Opportunities

<table>
<thead>
<tr>
<th>Manufacture</th>
<th>Reuse</th>
<th>Remanufacture or Refurbishment</th>
<th>Recycle</th>
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<tbody>
<tr>
<td>Solutions for manufacturing scrap</td>
<td>Create and prioritize reuse above other channels to ensure viable product is utilized</td>
<td>Identify treatments that don’t affect module certification</td>
<td>Develop collection in key markets</td>
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<tr>
<td>Design innovation for ease of reuse, refurbishment or recycling</td>
<td>Expand beyond off-grid or charitable / second-market solutions</td>
<td>Minimize / eliminate expensive retesting</td>
<td>Minimize costs to encourage recycling</td>
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<td>Work with suppliers, improve purity of recovered minerals</td>
<td>Potential conflicts with state waste regulations</td>
<td>Training, staffing</td>
<td>R&amp;D PV recycling equipment to maximize material recovery</td>
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<td></td>
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<td>Codes and standards</td>
<td>Maximize communication to minimize environmental impacts</td>
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</tbody>
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Thank you!

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