GE Appliances Recycling Initiative

- EPA RAD Announcement
- Recycling Roadmap
- Recycling Models
- Environmental Considerations
- Business Considerations
- RAD Partnership Benefits

imagination at work

Energy Star Conference / 11/18/2011
GE Appliances First Appliance Manufacturer to Partner on EPA RAD Program

On February 8th GE announced a partnership with EPA on the Responsible Appliance Disposal (RAD) Program based on Philadelphia Regional Recycling Facility

- Center specializes in appliance recycling, shredding & automated foam management
- GE launched March 2010
- Serves a 12 state area in Northeast & Mid-Atlantic regions
- RAD compliant foam processing
  - First URT system in North America
  - Proven and innovative technology
- 750,000 unit capacity
Recycling Roadmap

**GE Baseline:**
- Over 1MM appliances requiring proper disposal annually
- Local solutions with process variation
- Compliance model focused end of life management
- Regulatory – get ahead of trends

**EPA Responsible Appliance Disposal (RAD):**
- Refrigerant product focus
- Annual reporting on appliance end of life
- Foam management required
- EPA seeking partners (Manufacturers, Retailers, Utilities)

**Network Improvement Opportunities:**
- Reduce greenhouse gas emissions
- Develop & deploy solutions to environmental challenges

**Market Dynamics:**
- Record scrap values – 1H’08
- Recycling industry – entrance of new players

**GE Path Forward:**
- EPA RAD partnership
- More detailed & centralized reporting
- Consider additional opportunities/jurisdictions

**Customer Inquiries:**
- Disposal practices

---

*Energy Star Conference / 11/18/2011*
Recycling Models

**Typical Scenarios**

- Landfilling shredded foam following the commercial shredding of appliances in a shredder

- Incinerating foam pieces at a waste to energy facility following manual foam removal from appliances in an appliance recycling facility

- Recovering foam and blowing agent in a dedicated appliance recycling facility employing a fully automated, fully enclosed appliance dismantling and foam degassing machine and preparing the blowing agent for reclamation or destruction…

**ARCA Approach**

No One Size Fits All Approach

Environmental, Cost, Logistics Considerations Critical to Determine Right Approach
Environmental Considerations

Key Factors
• Blowing Agent Considerations… GHG and ODS Emissions
• Energy Consumption… shredding appliances or processing units in dedicated facilities
• Refrigerant/Foam emissions
• Transport
• Landfilling Volume
• Potential future availability of carbon credits
Life Cycle Assessment
Understanding the impacts

Life cycle assessment (LCA) is a quantitative methodology that looks at comprehensive environmental impacts across the life cycle of a product system.

GE’s ecoassessment center of excellence applied LCA to compare the new recycling approach (URT) vs. traditional recycling (Hammermill).

• Primary focus on global warming potential and cumulative energy demand

System boundary included pick-up and distribution, pre-processing, shredding, separation, materials recycling, landfill

Impacts were grouped into three categories:

• Transport
• Shredding
• Landfill / avoidance
Impact on Global Warming Potential
IPCC 2007 GWP 20a V1.02

Shredding exhibits dominant GWP impact relative to transport and landfill disposal.

URT exhibits significantly lower GWP during shredding (and overall).

The contribution from regional transportation is larger for the URT, but the impacts from the lost blowing agent from the Hammermill system overwhelm this difference.

<table>
<thead>
<tr>
<th></th>
<th>Hammermill</th>
<th>URT</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfill</td>
<td>4.7%</td>
<td>1.8%</td>
<td>-43.8%</td>
</tr>
<tr>
<td>Shredding Systems</td>
<td>100.0%</td>
<td>22.2%</td>
<td>-63.7%</td>
</tr>
<tr>
<td>Transport</td>
<td>0.3%</td>
<td>0.8%</td>
<td>41.8%</td>
</tr>
</tbody>
</table>

All results were subjected to extensive sensitivity and uncertainty analyses, but have not been peer.
The URT system has a larger overall cumulative energy demand (CED) than the Hammermill process, primarily due to higher use energy.

The URT system exhibits higher CED relative to shredding and transport, but lower CED relative to landfill.

All results were subjected to extensive sensitivity and uncertainty analyses, but have not been peer-reviewed.
Business Considerations

Key Factors
• Population Density to Support Aggregation… Northeast/Mid-Atlantic Volume
• Logistics / collection points… transportation cost considerations
• Third party recycling expertise – ARCA Incorporated
• Scale for foam management - Automated foam processing/ URT technology
• Coordinated EHS management
• Payback analysis… raw material recapture rate and aggregation of volume & products key

Population, Logistics and Expertise Aligned to Support Philadelphia Center
RAD Partnership Benefits

Dedicated Framework for Reporting

EPA Support and Partnership on Initiative

Framework for Encouraging/Incentivizing Responsible Appliance Disposal

Brand Differentiation

Ecomagination
Backup
UNTHA Recycling Technologies

A leading European manufacturer of technologically advanced refrigerator recycling systems and waste recycling facilities for electrical household appliances and electronic scrap.

- UNTHA GmbH was founded in 1995
- Set up by managing directors in Karlstadt, Germany
- The Company offers recycling plants and systems with the emphasis on sophisticated shredding technology
- The basic assemblies are produced at the headquarters of UNTHA in Kuchl, Austria
- URT provides equipment including conveyors, separation technology, packing systems, sound insulation, and more
- Systems allow recovery of all propellants from isolation foam (R11, R12, pentane)
- Systems optimize fraction output - separating refrigerator materials (metals, plastic, and degassed polyurethane foam insulation) into streams of fine and uniformly sized granules
- Numerous URT systems are operational throughout Europe
- URT and ARCA are members of the Quality Association for the Recycling of Refrigerator and Electrical/Electronic Equipment (QVKE), a European organization of 35 recycling companies that works in partnership with the UBA (Germany’s EPA), public waste management agencies, manufacturers and retailers.

imagination at work