Advanced Recycling Issues

Macro Issues that will affect Post Consumer Carpet Recycling in North America
Macro Issues affecting Recycling

- New Technology Development
- Regional Processing Centers
- Economic Cycles
- Commercial Carpet
- End Market Outlets
- Long Term Carpet Trends
New Technology Development

Critical Issue for Robust Sustainable P.C. Carpet Recycling
Why we need it?

- Low Value P.C. Products are disappearing
  - Key in early stages of P.C. recycling: Produces Early stages products
  - Today: Raw materials Too expensive for low Tech applications
  - Cost of Carpet acquisition = value of many “low tech” products.

- Higher Value products are Natural progression
  - As we learn, we evolve; as we evolve, we learn, etc.
  - What makes a “High Value” Product?
  - Purity, Purity, Purity.
  - Nascent Higher Value Recycling P.C. Technologies are developing
  - New Technologies (Purities), increase viability of P.C. Industry
Available Recycling Technologies

- **Broad Recycling Systems:**
  - Chemical Recycling: Two types have been developed
  - Mechanical Recycling – Dry Systems
  - Mechanical Recycling – Wet/Dry Systems
  - Mechanical Recycling – Shearing Systems
Advanced issue:

Development of technically & Economically viable technologies for the production of purer and purer Post Consumer High Value carpet materials is the most crucial Key for a Sustainable Carpet Recycling Industry which will achieve CARE’s goals of high Levels of Recycling. Many new and innovative solutions are taking place in the P.C. Carpet recycling Industry.
Regional Recycling Centers

Why we need them?

- **Economics : Transportation Costs**
  - Ave. Sq. Yd. Residential Carpet: 1.8 lbs. of Calcium Carbonate
  - On average: 1 lb carpet contains 40% Limestone
  - Transport of “dirt” is expensive
    - Ave. 40K lb load contains 16K lbs dirt: 500 mile trip = 5 cents/Lb. Dirt.

- **Regional Collections/Recycling**
  - Single Regional Recycling Center supports dozens collection points
  - Smaller collection points must be the closest for cost control
  - Min. Collections for Profitable Single Center: **19-20 million Lbs.**
  - Process where the carpet is located. Choose market size wisely.
Regional Recycling Centers

Conclusions

Advanced issue:

The development and deployment of Regional Recycling Centers as the hub of dozens of Regional collection centers is a Critical component of Cost and Viability. It assures that every market nationally, is engaged in collections and Recycling so that CARE’s National goals are met and a robust Economic model can be formed.
Economic Cycles

Critical Issue for outlet Demand and Pricing Power
How do they affect Recycling?

- **Cycles Greatly Affect Recycling volume**
  - 2008 low point: reduced resin demand 75%
    - End Users & Outlets Disappeared
    - Recyclers had no outlets
  - 2010 Recovery Greatly Increased Recycling Demand
    - Volume due to pent up demand accelerated Rapidly: Demand outstripped Supply.
    - Affected entire recycling supply Chain: Equipment, collectors, Processors, End Users

- **Cycles Correspondingly affect Recycled Material Pricing**
  - Rapidly increasing demand creates shortages; Pricing increases
  - Falling Demand has the opposite effect. Costs = Selling prices
  - CARE numbers reflect both extremes.
Virgin vs. Recycled Price Trends

Virgin 6
Virgin 66
P.I. 6
P.I. 6.6
P.C 1
P.C. 2
P.C. 3
PA66 Prime Pricing – 30 years

Actual

Inflation Adjusted


Y-axis: 0.00 1.00 2.00 3.00 4.00 5.00 6.00

- Actual
- Inflation Adjusted
Economic Cycles Conclusions

Economic cycles are inevitable. A robust and sustainable Post Consumer Carpet Recycling Industry must be sufficiently cost effective vs. other competing materials in order to be able to whether severe Economic downturns. On way to ensure “sustainability” is the continued development of extremely “high Value” materials that have no substitutes.
Commercial Carpet Recycling

Critical Issue is Diversity of Product types and Chemistries
Commercial Carpet Recycling Issues

- **Commercial Carpet is difficult to recycle**
  - Multiple fibers in single carpet (N6 & N66)
  - Multiples chemistries in backings: (thermosets, thermoplastics, fiberglass, PET, etc).
  - No single Recycling system can process all the variations.
  - Lags behind in recycling

- **Emerging trends are more positive for recycling Commercial.**
  - Growth of Commercial tiles
    - 2010: 50% of Commercial Volume
    - 2015: Estimated at 65% of Commercial Volume
  - Types of Tiles
    - PVC
    - Extruded Thermoplastic tiles
  - PVC has mature recycling systems
  - Extruded tile Recycling systems are developing
Commercial Carpet Recycling
Conclusions

Recycling Issues will abate and recycling rates will grow as Commercial products trend toward tiles at an ever increasing rate. Two primary tile chemistries appear to dominate the space. Since PVC recycling is mature and robust, the concentration of recycling efforts should narrow to one additional chemistry.

Caution:
The commercial Manufacturers must stop mixing N6 & N66 in face fibers
Long Term Carpet Trends

Critical Issue: Affects the future of End Markets
# Long Term Carpet Trends

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
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<tr>
<td><strong>Production</strong></td>
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<tr>
<td>Residential Lbs.</td>
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<td>1528</td>
<td>1560</td>
<td>1590</td>
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<tr>
<td><strong>Total Nylon % (Of Total)</strong></td>
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<tr>
<td></td>
<td>64%</td>
<td>62%</td>
<td>60%</td>
<td>59%</td>
<td>54%</td>
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<td><strong>Total Nylon Lbs.</strong></td>
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<td>2178</td>
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<td>2022</td>
<td>2014</td>
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<tr>
<td><strong>6/66 Ratio</strong></td>
<td>60/40</td>
<td>63/37</td>
<td>65/35</td>
<td>67/33</td>
<td>70/30</td>
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<td>Nylon 6</td>
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<td>Nylon 6.6</td>
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<td>826</td>
<td>762</td>
<td>720</td>
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<td>544</td>
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<td><strong>Total PET/PTT %</strong></td>
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<td></td>
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<td><strong>Total PET/PTT Lbs.</strong></td>
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<tr>
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<tr>
<td></td>
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<td>2%</td>
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<tr>
<td><strong>Others Lbs.</strong></td>
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</table>
There are Issues, but

The future seems Bright
What is the Future Potential of Post Consumer Carpet

- Great source of Material for Plastics
- Great source for New carpet constituents
- Fills gap P. Industrial left behind. As P.I. disappears, P.C. fills the void
- More Dependable pricing: Somewhat insulated from wild fluctuations
- De-couples plastic materials from the Oil well: Multiple lives
- Low Environmental impact vs. Virgin Thermoplastics
- Relieves landfill burdens Nationally
- Develops an entire new industry with jobs
- Projects carpet Industry as Sustainable Industry
- Higher Value products are constantly being developed
- Extremely Large pool of material availability
Thank You