The Performance and Acceptance of Compact Fluorescent Lighting Products in the Residential Market

Presented by: Bradley Steele (bsteele@efi.org)
Energy Federation, Inc.
States in which Programs were Operated

• Vermont
• New Hampshire
• Rhode Island
• Massachusetts
• Connecticut
• New York
• New Jersey
• Wisconsin
• Minnesota
• Illinois
• Georgia
• California
Sales and Returns ‘Sample’ Size
504,000 unique transactions

• Sales
  – 1.81 million CFLs (18 manufacturers)
  – 186,500 hardwire CF fixtures (20 manufacturers)
  – 116,170 plug-in CF fixtures (14 manufacturers)

• Returns
  – 27,900 CFLs
  – 13,500 hardwire CF fixtures
  – 5,770 plug-in fixtures
Factors Analyzed

• Who manufactured the products?
• What were the wattages of the products?
• What were the styles of the products (e.g., bare glass, encapsulated, horizontal, etc., for bulbs...off-ceiling, flush-mount, recessed, etc., for fixtures)?
• Were fixtures hardwire or plug-in, interior or exterior (and, if exterior, with or without photocell)?
• Did products offer a single light level, or variable light level?
• Were (fixtures) using electronic or magnetic ballasts?
Caveats

• Effect of price points on return rates is not entirely understood;

• Customers’ stated reasons for returning products – when they offer them – often are unclear, and on occasion, inaccurate;

• For products promoted in the first year or two of the study range, and subsequently dropped, and for products added in the last year of the study range, sales and return cycles might be ‘imbalanced.'
CFL Hypotheses Examined

• Is there a correlation between
  – product brands and customer satisfaction with the appearance, performance and reliability of the products?
  – the wattages of products and customer satisfaction with the appearance, performance and reliability of the products?
  – the style of products (e.g., bare glass, encapsulated, reflector) and customer satisfaction with the appearance, performance and reliability of the products?
Sales & Returns of Big and Little Brand CFLs

• BBrand Manufacturers
  – GE
  – Philips
  – OSI
  – Panasonic
• Sales - 909,036
• Returns - 12,612
• % Returns - 1.39%

• LBrand Manufacturers
  – TCP
  – LOA
  – Maxlite
  – Harmony
• Sales – 832,787
• Returns - 12,860
• % Returns - 1.54%
Comparison of Return Rates for Big Brand and Little Brand CFL Products
## Comparison of Sales & Returns of CFLs by Wattage Range

<table>
<thead>
<tr>
<th>CFL Wattage Range</th>
<th>Products Sold</th>
<th>Products Returned</th>
<th>Percentage Returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 15 watts</td>
<td>40,418</td>
<td>1,416</td>
<td>3.5%</td>
</tr>
<tr>
<td>15 watts – 17 watts</td>
<td>588,976</td>
<td>8,748</td>
<td>1.5%</td>
</tr>
<tr>
<td>18 watts – 21 watts</td>
<td>550,472</td>
<td>6,916</td>
<td>1.3%</td>
</tr>
<tr>
<td>22 watts – 25 watts</td>
<td>504,472</td>
<td>7,330</td>
<td>1.5%</td>
</tr>
<tr>
<td>26 watts – 29 watts</td>
<td>39,363</td>
<td>982</td>
<td>2.5%</td>
</tr>
<tr>
<td>&gt; 30 watts</td>
<td>86,493</td>
<td>2,500</td>
<td>2.9%</td>
</tr>
<tr>
<td>Average % returns</td>
<td></td>
<td></td>
<td>1.5%/bulb 2.6%/category</td>
</tr>
</tbody>
</table>
CFL ‘Family’ Categories

- Bare glass/upright
- Encapsulated
- Controlled
- Horizontal
- Reflectors
## Comparison of Sales & Returns of Different Style CFLs

<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Bare Glass, Upright</td>
<td>1,348,541</td>
<td>13,894</td>
<td>1.0%</td>
</tr>
<tr>
<td>Horizontal</td>
<td>575,892</td>
<td>1,487</td>
<td>2.6%</td>
</tr>
<tr>
<td>Encapsulated</td>
<td>232,254</td>
<td>6,408</td>
<td>2.8%</td>
</tr>
<tr>
<td>Controlled</td>
<td>120,156</td>
<td>3,967</td>
<td>3.3%</td>
</tr>
<tr>
<td>Reflectors</td>
<td>51,825</td>
<td>2,136</td>
<td>4.1%</td>
</tr>
<tr>
<td><strong>Average Percentage Returns</strong></td>
<td></td>
<td></td>
<td><strong>1.5% / bulbs 2.8% / category</strong></td>
</tr>
</tbody>
</table>
Factors Influencing CFL Return Rates

• Consumer purchases of CFLs are not strongly influenced by brand (price more critical); consumer satisfaction with major lighting brand CFLs is not *obviously* superior to consumer satisfaction levels with ‘minor’ brand CFLs.
• Return rates for CFLs in 15w to 25w range are lower than return rates for lower and higher wattage CFLs, suggesting ‘dimness’ (low wattage) and fit (high wattage) are issues.
• **Thermal sensitivity of critical components is the key technical challenge CFL manufacturers face.**
• ‘Controllable’ (dimming, multi-level switching) CFL technology may not have entirely arrived.
Experiences Selling
Compact Fluorescent Hardwire Fixtures
Return Percentages of Various Types of Hardwire CF Fixtures

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage Returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Ext. Fixtures</td>
<td>7.0%</td>
</tr>
<tr>
<td>Flush Ceiling (M)</td>
<td>5.0%</td>
</tr>
<tr>
<td>Wall</td>
<td>7.0%</td>
</tr>
<tr>
<td>Off Ceiling</td>
<td>9.0%</td>
</tr>
<tr>
<td>Vanity</td>
<td>8.0%</td>
</tr>
<tr>
<td>Flush Ceiling (E)</td>
<td>7.0%</td>
</tr>
<tr>
<td>Recessed/track</td>
<td>13.0%</td>
</tr>
</tbody>
</table>
Factors (Potentially) Influencing Hardwire Fixture Return Rates

• Prices are higher; greater incentive for a customer to return a product s/he is dissatisfied with in any respect;
• Consequences of a failed fixture are much more severe than the consequences of a failed bulb;
• Fixture manufacturers know relatively little about CF technology, and are not equipped to evaluate the quality of critical components such as ballasts and lamps;
• Many fixtures thermally stress components;
• Influence of Energy Star® requirement for exterior fixtures to have photocells. (14,216/664/4.7% vs. 12,556/1501/12.0% example)
• Electronically ballasted fixtures did experience higher return rates, particularly when not well ventilated, but differences were not as pronounced as predicted.
Plug-in Compact Fluorescent Fixtures
## Sales and Return Rates of Plug-in Compact Fluorescent Fixtures

<table>
<thead>
<tr>
<th>Plug-In Fixtures</th>
<th>Product Sales</th>
<th>Product Returns</th>
<th>Percent Returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desk Lamps</td>
<td>30,245</td>
<td>982</td>
<td>3.2%</td>
</tr>
<tr>
<td>Table Lamps</td>
<td>29,862</td>
<td>1,365</td>
<td>4.6%</td>
</tr>
<tr>
<td>Floor Lamps</td>
<td>5,312</td>
<td>219</td>
<td>4.1%</td>
</tr>
<tr>
<td>Torchieres</td>
<td>46,340</td>
<td>3,062</td>
<td>6.6%</td>
</tr>
<tr>
<td>Under-cabinet</td>
<td>4,411</td>
<td>139</td>
<td>3.2%</td>
</tr>
<tr>
<td><strong>Totals:</strong></td>
<td><strong>116,170</strong></td>
<td><strong>5,679</strong></td>
<td><strong>5.0%</strong></td>
</tr>
</tbody>
</table>
Factors (Potentially) Influencing Plug-in Fixture Return Rates

• For plug-in fixtures there does appear to be a significant variation in quality between manufacturers.
• Many plug-in fixtures use dimmable or three-way ballasts, which may be as problematic in fixtures as they appear to be when used in CFLs.
• Torchieres present assembly challenges to many consumers.
• Switch problems with torchieres account for close to 50% of ‘defective’ returns for some models.
• Plug-in fixtures are more susceptible to ‘transit’ damage than other lighting products
“Conclusions”

• Consumer acceptance of CFLs seems to be relatively high.
• Consumers experiences with compact fluorescent fixtures, particularly hardwire fixtures, are not as positive.
• Compact fluorescent products have difficulty addressing ‘complex’ applications – such as applications requiring interface with controls or variable current/voltage, or applications where products will deal with extreme ambient temperatures.
• Thermal related issues impact the reliability and performance of both CFLs and CF fixtures.
To Contact the Author

• Bradley Steele
• Energy Federation, Inc.
• 40 Washington St., Suite 3000
• Westborough, MA 01581
• Phone: 508-870-2277 x 430
• Fax: 508-870-9933
• E-mail: bsteele@efi.org