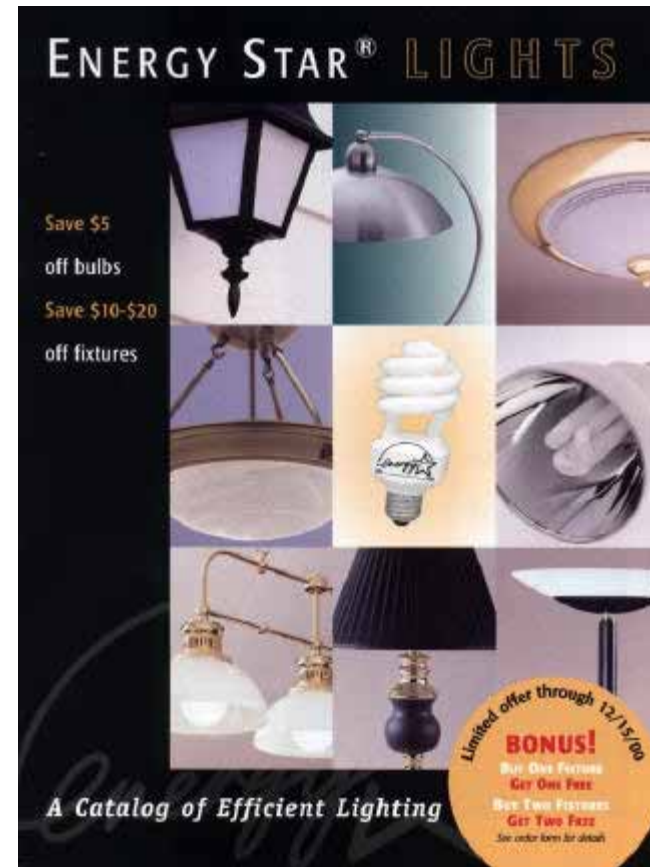


The Performance and Acceptance of Compact Fluorescent Lighting Products in the Residential Market

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Source of Data: Sales>Returns of CF Lighting Products through Utility/System Benefit Charges Funded Programs – 1994-2001



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.'

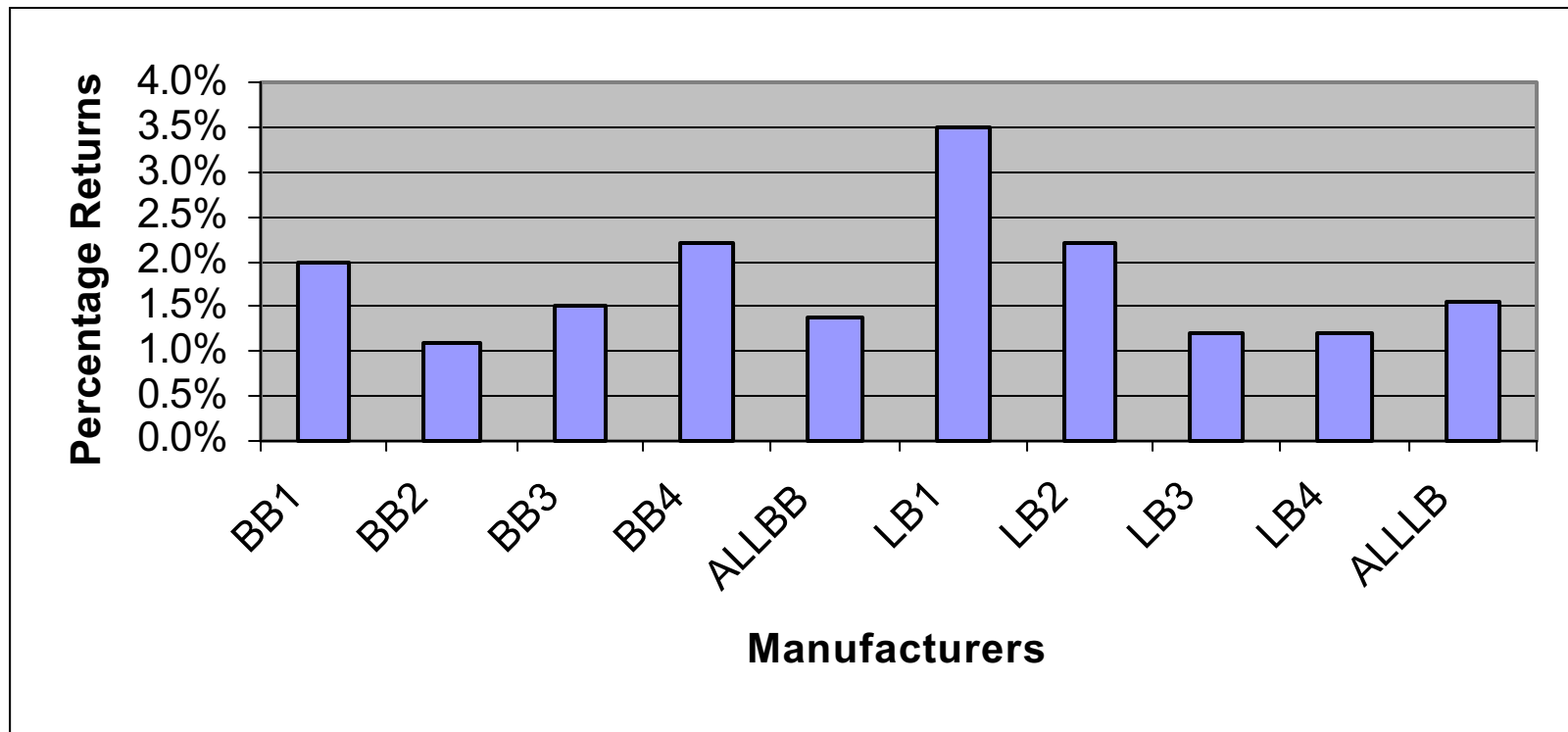
CFL Hypotheses Examined

- 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

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

CFL 'Family' Categories

- Bare glass/upright



- Horizontal



- Encapsulated



- Reflectors



- Controlled

Comparison of Sales & Returns of Different Style CFLs

Category of Style	Sales 1994-2001	Returns 1994-2001	Percentage Returns
Bare Glass, Upright	1,348,541	13,894	1.0%
Horizontal	575,892	1,487	2.6%
Encapsulated	232,254	6,408	2.8%
Controlled	120,156	3,967	3.3%
Reflectors	51,825	2,136	4.1%
Average Percentage Returns			1.5% / bulbs 2.8% / category

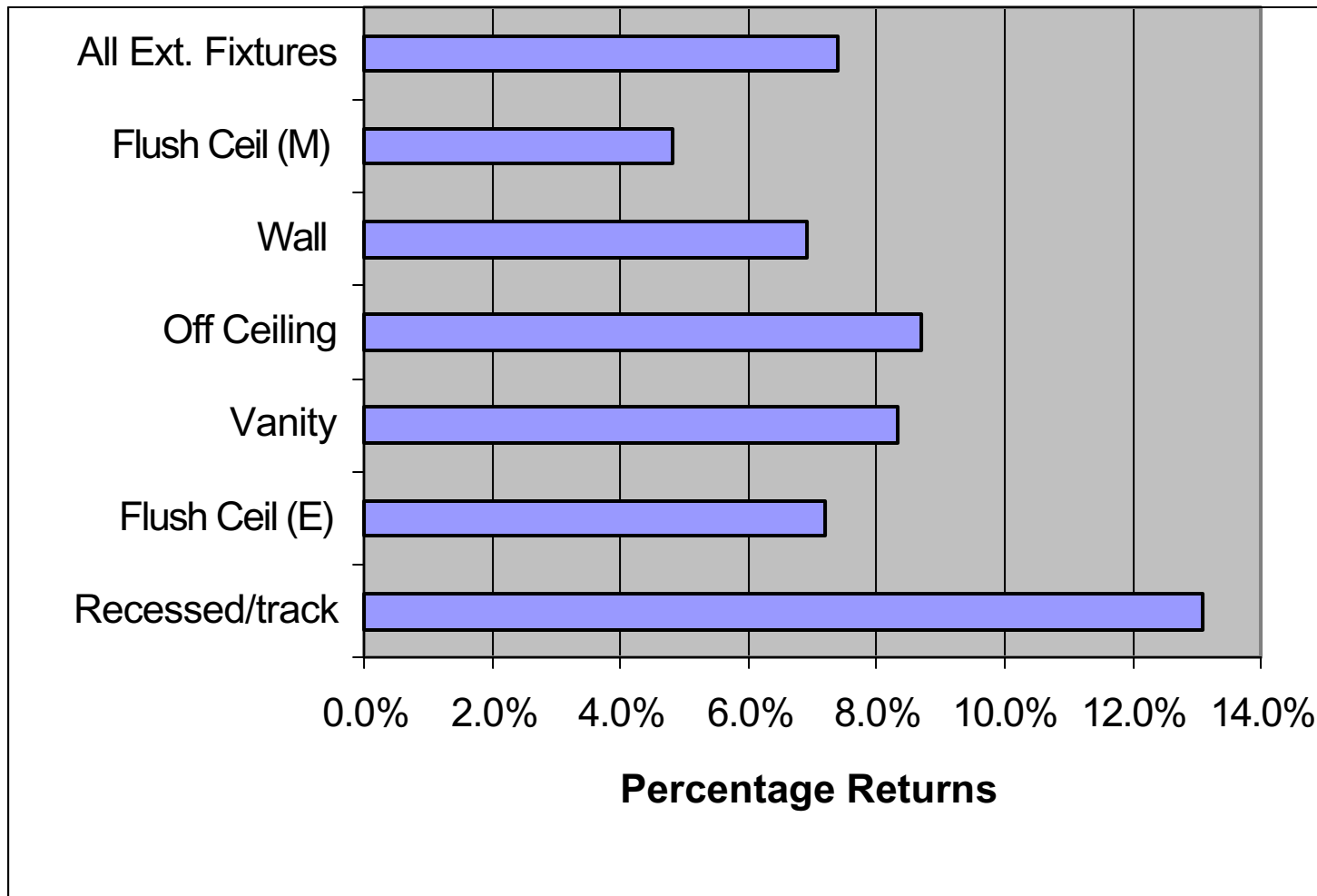
Factors Influencing CFL Return Rates

- 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



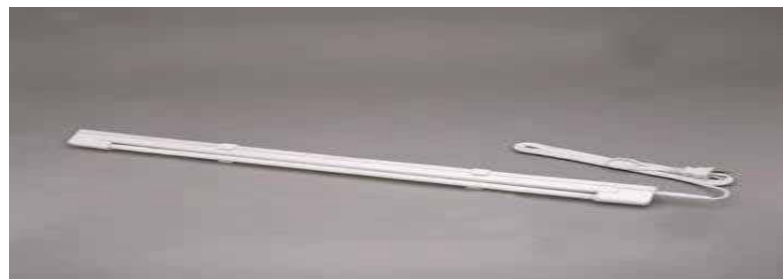
Return Percentages of Various Types of Hardwire CF Fixtures



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

Plug-In Fixtures	Product Sales	Product Returns	Percent Returns
Desk Lamps	30,245	982	3.2%
Table Lamps	29,862	1,365	4.6%
Floor Lamps	5,312	219	4.1%
Torchieres	46,340	3,062	6.6%
Under-cabinet	4,411	139	3.2%
Totals:	116,170	5,679	5.0%

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.

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