

MCG Reports

LCD Brightness Enhancement Films in an Era of Backlight Technology Turbulence: *Light management films (BEF, DBEF, and Reverse Prism film) forecast and product strategies as LED, HCFL, and FFL compete with CCFL for LCD backlighting.*

Principal Researcher and Analysts: Steve Marsland

246 pages

October 2006

BACKGROUND

3M Under Siege in BEF Film

With the expiration of 3M's key BEF patent last year, a group of competitors have now entered the market and are beginning to take share from 3M in BEF film. While Kodak and GE have entered the market, smaller and more aggressive Asian competitors appear to be establishing leadership positions in challenging 3M.

Competitive suppliers are forecasted to enjoy annual growth of nearly 100% per year in BEF based on aggressive pricing vs. 3M. Challenges are also forecast to emerge in polarization recycling film (DBEF) for 3M.

While use of reverse prism film will continue to grow, enthusiasm for this approach has been tempered somewhat by the difficulties of making the prism light guides required to deliver the overall level of performance required.

Backlight and panel makers have also forecast strong challenges to CCFL backlighting, not only from EEFL and flat fluorescent approaches championed by Korean makers, but also from LED backlights and HCFL. The forecast shifts in demand for backlight illumination will have a strong impact on the demand for brightness enhancement films. Meanwhile, CCFL prices are plunging and this is making it easier to design out brightness films.

The study is based on an industry survey of brands, panel, and backlight makers and industry experts from Japan, Korea, Taiwan and the USA. The survey specifically addressed product concerns and requirements for BEF and DBEF.

WHO SHOULD BUY AND WHY

The report is a comprehensive tool for marketing and supply chain professionals to understand the timing and scope of emerging opportunities and develop their company's response to those opportunities:

- LCD Panel and Backlight Makers – Understand price and performance trends through 2010 for BEF and DBEF, competitive positioning of suppliers

- Illumination source makers – Understand the interaction between illumination sources and brightness enhancement films as they both change and improve, leverage the forecast from the industry about emerging demand for new illumination sources LED and HCFL.
- Optical Film Makers – Anticipate the emerging demand trends and position for success in BEF and DBEF with an understanding of key technology, performance and cost trends

SCOPE AND QUESTIONS ADDRESSED

The study covers all sales of BEF, BEF equivalents such as reverse prism film, and DBEF sales globally through 2010. The report also shows forecast demand for LEDs, CCFL (and related EEFL and flat fluorescent light sources), and HCFL lamps. The study also provides clear feedback from the LCD industry about the desired improvements and product requirements for BEF and DBEF. The study addresses questions such as:

- How will prices trend over time on BEF, BEF equivalents and DBEF?
- What is the price trend for CCFL?
- What share will LED and HCFL backlights take, and how will this affect demand for brightness enhancement films?
- How fast will market share shift to new competitors and technologies and why?
- How will competition enter by market segment – handhelds, notebooks, monitors and TVs?
- What optical film configurations and combinations are being used in each market segment?
- How will optical film configurations shift over time by market segment?
- What key factors will affect the success of new competitive entrants?
- How will 3M react to the emerging competition?

Product Scope. The following optical films and brightness enhancement equivalents are included:

- BEF (Brightness Enhancement Film), 3M vs. competitors
- Reverse prism film and equivalents
- DBEF (Polarization Recycling Film)
- Combination films such as BEF/DBEF and polarizer/DBEF
- CCFL (including EEFL and flat fluorescent) backlights
- LED backlights
- HCFL backlights

Market Scope. For all products, demand by application:

- Handhelds
- Notebooks
- Monitors
- TVs

Company Scope, for BEF, reverse prism and DBEF, comments and evaluation by survey respondents of the following companies:

- 3M
- GE
- Kodak
- Mitsubishi Rayon
- E Fun
- Chia Wei
- LGS
- LG Chem
- SKC
- Enplas
- Kuraray

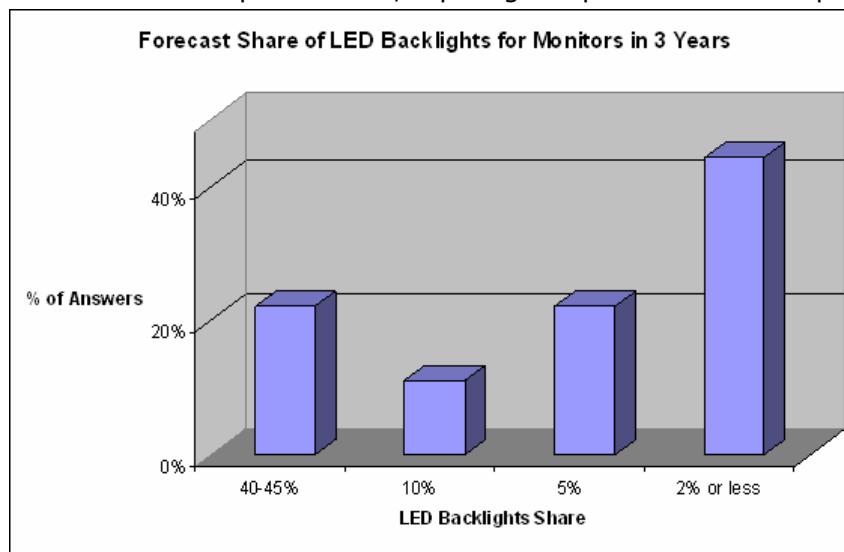
CONTENTS

The 246-page study consists of 196 pages of analysis including text, 136 color graphs and 125 tables, plus 50 pages of product specifications, and includes:

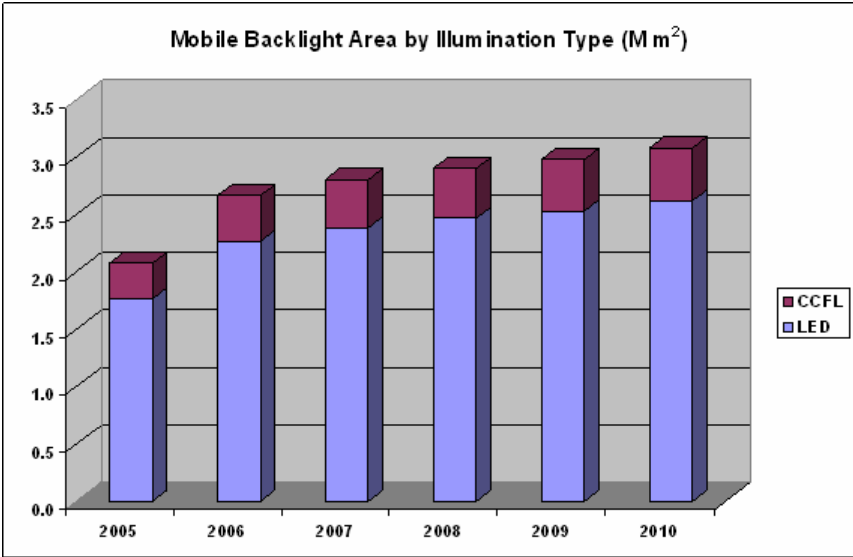
- Forecast through 2010 for LCD by handhelds, notebooks, monitors and TVs
- Forecast of film use configurations by market segment (handhelds, etc.)
- Forecast through 2010 for BEF, reverse prism film and DBEF
- Forecast pricing and market shares for 3M and 3M competitors over time
- Detailed analysis of pricing strategy of 3M with analysis of impact on 3M profitability
- Detailed film customer survey feedback about requirements for BEF and DBEF film and present quality and other issues that customers want to see addressed by new suppliers
- Respondent evaluation and impression of BEF and DBEF suppliers
- Relevant patents
- Product specifications

Report Highlights

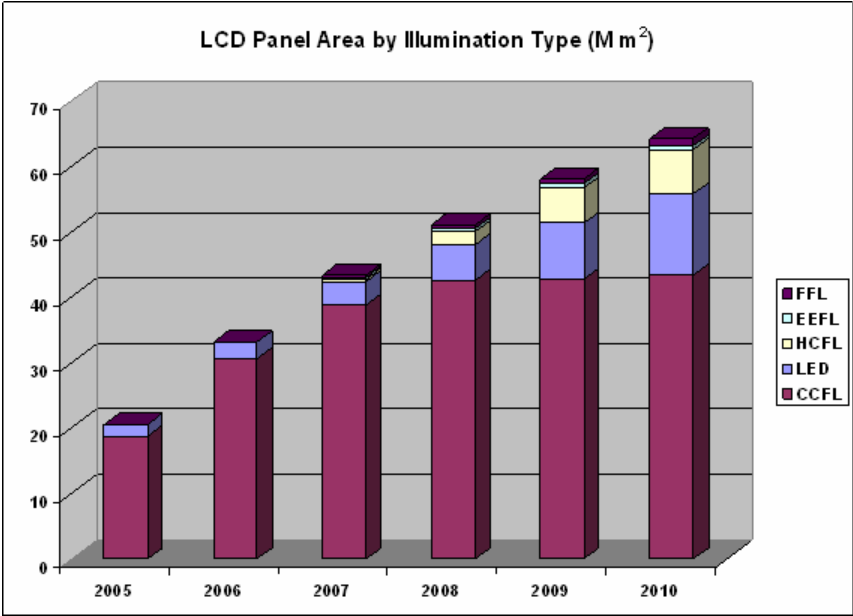
- Sample data for Monitor penetration, report gives penetration for laptops and TVs as well



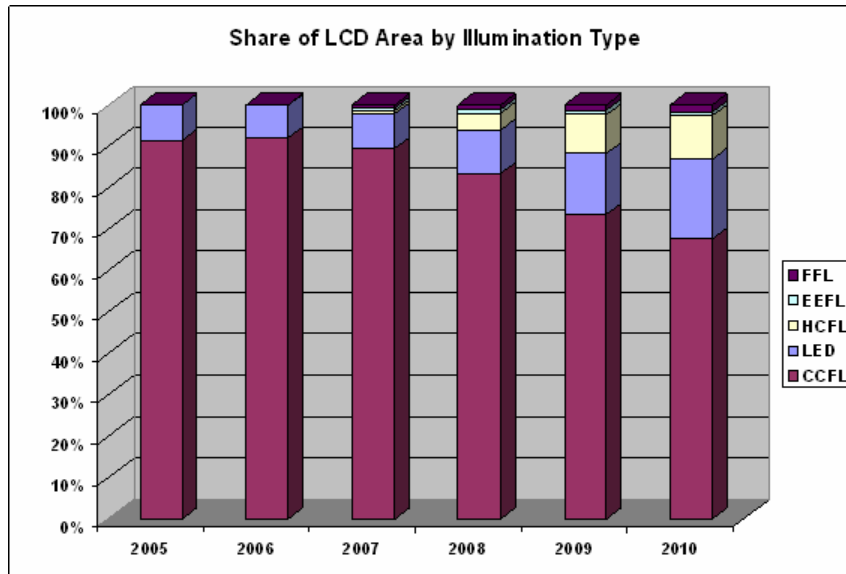
- Sample data for Mobile market, report gives data for laptops, monitors, and TVs as well



- Total demand for LEDs to grow rapidly, see report for forecast detail



- LED share of LCD backlights will grow, report shows full detail by market segment



METHODOLOGY

The MCG study is based on a combination of sources. Information was gathered via an in-depth survey of LCD panel and backlight makers as well as LCD branders, particularly regarding product performance requirements and desired improvements. Information from other industry sources was also incorporated. Careful evaluation of 3M's profitability and likely impact of BEF and DBEF pricing has been incorporated in the study. Recent industry, market and technology trends were also incorporated in the forecasts.

FORMAT

A printed hard copy plus 2 PDF files. The report (2MB) and the specs (5MB) files are sent as separate PDF files.

SUPPORT FOR PURCHASERS OF REPORT

Free phone consultation available from the study's principal researcher, Steve Marsland (contact info shown below) for 30 days after report purchase.

ABOUT THE AUTHORS

The report been developed with extensive technical and analytical support. [Steve Marsland](#) was the principal researcher and analyst. [Carl Cobb](#) was a supporting author and analyst in the study. [Charles McLaughlin](#) acted as senior author and final editor.

For more information contact: Bruce Kuhlmann bkuhlmann@mcgweb.com (707) 292-3693

SUBSCRIPTION

Subscription Type	Includes	Price
Multi-user, Single-site License	1 pdf file, site license	\$7,500
Color Hard Copy	Bound, double-sided includes shipping	\$250
Other	On-site presentation, consulting services	Ask for quote

ORDER INFORMATION

To order please download the PDF order form and e-mail to usdc@usdc.org or FAX the form to (408) 993-8121.

TABLE OF CONTENTS

1. Executive Summary
2. Supply and Demand Trends for LCDs
 - a. Growth in Demand
 - b. Growth in size and applications, particularly large screen LCD-TV
 - c. Aggressive Investment in Supply Capacity
3. Competitive Picture for Large-Size LCDs
4. Demand Forecast for LCDs
5. Types of Backlights
 - a. CCFL (including EEFL and Flat Fluorescent)
 - b. LED – White
 - c. LED - RGB
 - d. HCFL
6. Trends in backlights
 - a. CCFL (EEFL, Flat Fluorescent)
 - i. Trade-off of lamps vs. films
 - b. LED
 - i. Inflection point for substituting LEDs for brightness enhancement films is when?
 - c. HCFL
7. Forecast for Future Use of Backlights by Application and illumination type
 - a. Mobile
 - b. Notebook
 - c. Monitors
 - d. TVs
 - e. Total overall
8. Brightness Enhancement Products (BEPs)
 - a. Prism Film and equivalents
 - i. 3M BEF
 - ii. BEF look-alikes
 - iii. Microstructure BEF
 - iv. Nanostructure BEF

- v. Reverse Prism Film
 - vi. Prism light guides
 - b. Polarization Recycling Film
 - i. 3M DBEF
 - ii. 3M APF (APCF)
 - iii. Cholesteric LC DBEF
 - iv. Nano-structure DBEF
 - c. Hybrid Film
 - i. Combination DBEF and BEF (3M)
 - ii. Nano-structure hybrid
 - d. Microlens Film for LEDs
- 9. LCD Product Configurations Using BEPs
 - a. No BEPs
 - b. Single BEF
 - c. Two BEF
 - d. Reverse Prism with Wedge Backlight
 - e. 1 DBEF (or APF)
 - f. 1 DBEF and 1 Reverse Prism
 - g. 1 DBEF and 1 BEF (or BEF/DBEF combination)
 - h. 1 DBEF and 2 BEF
 - i. Microlens film with RGB LEDs
 - j. Comparisons of different BEP configurations
 - i. Performance
 - ii. Price/performance
 - 1. trade-off of backlight cost determines price/performance optimum
- 10. Supply Chain
 - a. Supply Chain Map and key observations
- 11. Key Trends in Use of BEPs
 - a. Overall trends
 - i. Higher aperture ratios for panels
 - ii. Lowering specifications for brightness
 - iii. Willingness to sacrifice viewing angle
- 12. Sales Forecast for BEF and Reverse Prism Film
 - a. Product Configuration Trends
 - i. Mobile
 - ii. Notebooks
 - iii. Monitors
 - iv. TVs
 - b. Area Demand
 - c. Pricing
 - i. BEF pricing – 3M and competitors
 - d. Sales Forecast
 - i. Total
 - ii. 3M
 - iii. 3M competitors
- 13. Survey Responses by BEF Supplier

- a. 3M
 - b. E Fun
 - c. Reflexite
 - d. Kodak
 - e. GE
 - f. LG Chem
 - g. LGS
 - h. Chia Wei
14. Survey Respondents on BEF
15. Survey Responses by Reverse Prism Supplier
- a. Mitsubishi Rayon
 - b. Enplas
16. Survey Respondents on Reverse Prism Film
17. Sales Forecast for DBEF
- a. Product Configuration Trends
 - b. Area Demand
 - c. Pricing
 - d. Sales Forecast
 - i. Total
 - ii. 3M
 - iii. 3M competitors
18. Survey Respondents on DBEF
19. Pricing Strategy – 3M and New Entrants
- a. Volume sensitivity to pricing
 - i. BEF
 - ii. DBEF
 - iii. Interplay between BEF and DBEF pricing
 - b. Modeling of optimum scenario for 3M for profitability
20. 3M Sales Forecast
- a. Forecast Top-Level 3M Sales and Sales Mix
 - b. 3M Defensive measures
 - i. BEF/DBEF Hybrid
 - ii. APF
21. Survey Methodology and Respondents
22. Product Specifications