

Formaldehyde-Free Building Materials

WHAT?

Industry Profile

The relevant industries include large and small contractors, architectural firms and material manufacturers (of varying specialty and industry concentration). Information transfer occurs through industry magazines, trade associations, and word-of-mouth. Product purchases are based on familiarity and availability, design specifications, price, effectiveness and sometimes environmental and health factors. US construction industry spending on research and development (R&D) in 2003 was equal to 0.2-0.5% of annual sales (US industry average is 3.0%).

	Building Construction		Building Material Manufacturing		Adhesive Manufacturing	
	USA	MA	USA	MA	USA	MA
# of Establishments	761,330	19,827	24,787	395	676	32
Industry Employment	6,023,710	124,880	591,646	4,343	23,621	1,476
% Total Employment	4.7%	4.0%	0.46%	0.14%	0.02%	0.05%
% of Total Wages Employment Coefficient	4.7%	4.1%	0.38%	0.11%	0.03%	0.07%

WHY?

Needs and Driver

Sick building syndrome caused by poor air circulation, poor lighting, volatile organic compounds (VOCs) and mold was recognized as an issue in the 1970s. Public outcry led to basic improvements, but publicized problems (like the EPA's sick building in 1987) and lawsuits by occupants still occurred.

Formaldehyde is a known human carcinogen, irritant, asthmagen, etc. with many applications in the building trades. Formaldehyde is recognized as a significant indoor air quality (IAQ) problem and has been regulated by the EPA, FDA, and OSHA, but not with regard to building products. Various product-level regulations on Formaldehyde exist internationally.

Green building in general has been driven by energy and sustainability concerns as well as the potential for operational savings. Studies and anecdotal evidence have indicated a high potential for savings from reduced health costs, employee turnover and absenteeism and from increased worker productivity and occupancy rates. However the real estate community is slow to be convinced of these harder to measure benefits.

Expectations for green buildings from McGraw Hill Construction Survey of Architect, Engineer, Contractor (AEC) and building owner communities:

- Operating costs - 8-9%
- Building value +7.5%
- ROI + 6.6%
- Occupancy Ratio +3.5%



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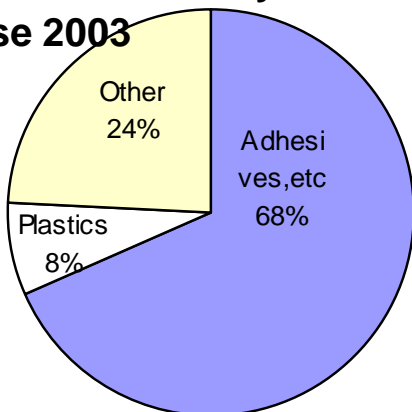
HOW?

Technology History

Formaldehyde was discovered in 1867. It is a widely used basic building block chemical that is now in a plethora of products and processes including adhesives, hard surface building materials, insulation, floor finish, and composites. In 2003, 4 million metric tons (MMT) of 37% Formaldehyde was used in the US and 24 MMT was used worldwide. Formaldehyde-free products have slowly become more available. Initially imported from specialty manufacturers to meet niche consumer demand by chemical sensitive individuals and green-motivated builders, such products are increasingly developed by domestic and larger companies as demand increases.

The U.S. Green Building Council (USGBC), founded in 1993, publicly launched the Leadership in Energy and Environment (LEED) certification in 2000. In 1997 the American Institute of Architects (AIA) Energy committee expanded to become the Committee on the Environment. Many other green building groups have emerged. LEED in particular has advanced green building, creating “bragging rights” for green firms and owners. *Green-building cost premium estimates have reduced from +20% to +2-5% in up front cost (that pays for itself) . This change is attributed to greater availability of green technology and building materials¹.*

USA Formaldehyde Use 2003



- Wood adhesives, binders, laminants, insulation, molding compound
- High performance plastics (auto, building products, consumer goods)
- Other (fertilizer, chelating agent, explosives, etc.)

Average green cost premium for LEED buildings

LEED RATING (# of projects)	Green Cost Premium
Certified (8).....	0.66%
Silver (16).....	2.11%
Gold (6).....	1.82%
Platinum (1).....	6.50%
Average (33).....	1.84%

Source: USGBC, Capitol E analysis, in *The Costs and Financial Benefits of Green Building.*
Greg Kate et al., October 2003.

Analysis of 33 LEED- registered projects (25 office buildings and 8 schools) shows an average first-cost “green premium” of less than 2%. The projects were chosen because cost data for both actual green design and convention design was available.

GOING FORWARD

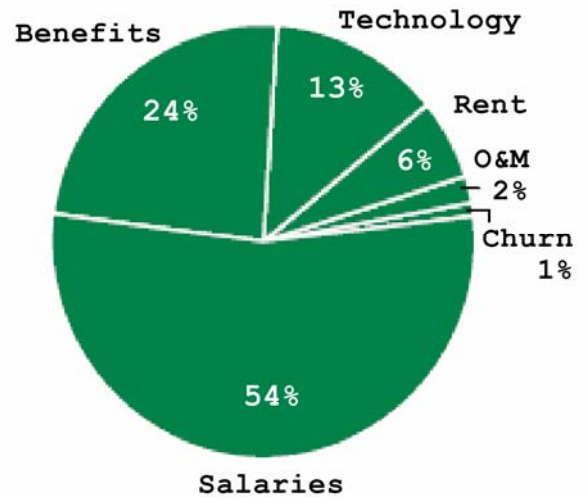
- Increasing customer demand for green products** caused by high profile green building projects and increased familiarity with and proof of operational benefits.

“Productivity gains, though far more difficult to quantify than energy savings, have substantially larger payback potential and may be the key to more widespread adoption of greenbuilding.”¹

Performance & Health Costs: An estimated \$29 –168 billion in national productivity losses per year are due to poor IAQ². Formaldehyde is one of a number of indoor air pollutants.

- Niche-market goes mainstream: increasing supply of lower cost green products.** After a time-lag (for the market need to reach the supply chain), there may be a continued trend toward increased supply of green building materials, followed by a move from ‘premium’ products to standard price products as competition increases and economies of scale are realized.

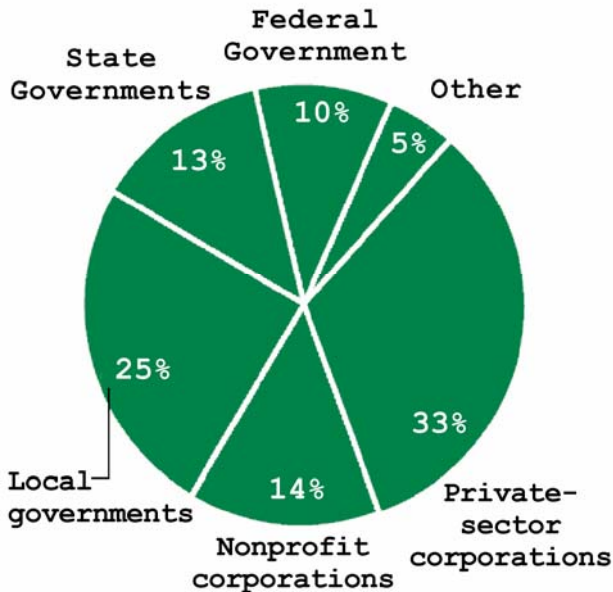
Building costs as a portion of business expenses



Source: Carnegie Mellon University, 1999

Who is doing LEED projects?

Registration of LEED projects by ownership category



Source: USGBC, October 2003.

(<http://greenguard.org/>)

- Market share gains to early-adopter leaders:** There may be loss of market share for non-innovating firms and gains for innovators (builders, architects, and manufacturers), who developed a green reputation, expertise, and brand image early on. *When asked to name green product manufacturers in various types of products, few respondents could name a green manufacturer. Over 300 brands were recalled, yet no brand emerged as a market leader... Learning about green products was listed as an important green building information need by 61% of respondents³.*
- Increased standard-setting and marketing for green building and green products:** The latent market need may be recognized and targeted with marketing on health, productivity, and efficiency. An increased need for certification may be recognized and provided. In 2001 *GREENGUARD* Environmental Institute was established to certify low-emitting products and materials and provide a guide for selection. This certification is used by LEED.

*“High performance green building is just a fancy description for good building.” –Mayor Menino*⁴

STRATEGIES

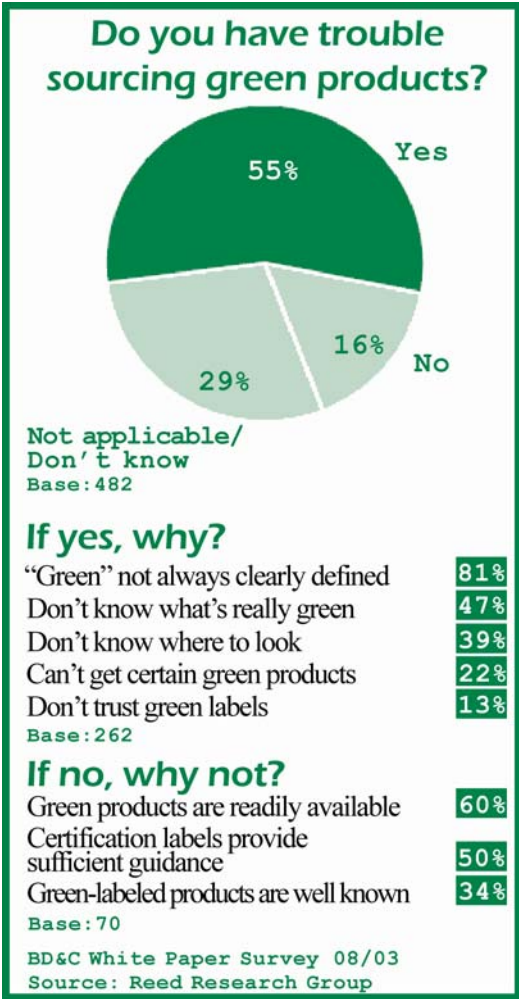
- Market Leader:** Has an R&D focus on green products and plans to meet the specialty market niche, educate consumers and grow the market.
 - **Rohm & Haas** (16,000+ employees) has created formaldehyde free resins “We see technology shifts as...an engine for growth... Whether we talk about solvent to water shift, formaldehyde free technology”ⁱⁱ
 - **John Manville** used Rohm & Haas resins to make formaldehyde free insulation and is significantly expanding capacity. “This expansion... reflects the construction industry's migration toward healthier buildings that are also environmentally smart and energy efficient.”ⁱⁱⁱ
 - **Hercules** has created a soy-based kymeme adhesive
 - **Columbia Forest Products** is converting all of it’s plywood production to produce LEEDS compliant, formaldehyde-free plywood and particleboard using the Hercules product. These products “...eliminate formaldehyde from both press and product emissions, which is good news for everyone, including our employees.”
- Early Adopter Consumer:** Sensitive individuals as well as proactive companies and governments:
 - **Conde Nast Tower in NYC:** used Low-emitting materials including carpet and office furniture making use of Washington State pollutant specifications for purchasing decisions.
 - **An Atlanta based** accounting firm hired a special design firm to help them decrease IAQ problems. The firm selected construction materials, furnishings and finishes with low, nontoxic emissions.VOC concentrations in the new office space were 50-70% lower than similar offices in another part of the building and individual absenteeism was 6-10% less than in the previous location.

Firm’s response to sustainable design market

Encouraged staff members to obtain expertise in sustainable design	57%
Made an effort to green-build at least one project	46%
Hired outside green-building experts as consultants	19%
Created new marketing materials	16%
Recruited professionals with green-building experience	9%
Created a new division or profit center	5%
Other/ no activity	10%

BD&C White Paper Survey 08/03
Source: Reed Research Group

Respondents reported that their firms were taking a wide variety of actions in sustainable building. Nearly half of those responding (49%) had tried at least one green project, and a clear majority (57%) had encouraged staff to learn more about sustainable design.



- Bandwagon:** Over 85% of the Architectural, Engineering and Construction community report participation in green building activities. 64% of architects and 53% of contractors have specified and/or installed green products in buildings.^{iv}
- Tax Credits:** In 2000 New York implemented a Green Building Tax Credit Law including a credit of 5% of the cost of a project for meeting requirements for energy efficiency and use of nontoxic materials.

All Charts¹⁰

¹ How green is your household? By Nancy D. Holt, Wall Street Journal, 1998

² McGraw Hill Construction (2006) “Green Building SmartMarket Report”

³ Fisk and Rosenfeld, (1998) “Improved Indoor Environment Could Save Billions of Dollars”

⁴ McGraw Hill Construction (2006) “Green Building SmartMarket Report”

ⁱⁱ Mayor Menino’s Green Building Task Force Report Executive Summary Fall 2004

⁶ Carson, D. (2005) Rohm and Haas Company at Merrill Lynch Chemicals Conference” FD (Fair Disclosure) Wire Mar.16

⁷ “PR Newswire (2005) “Johns Manville Announces Next Phase of Capacity Increase at Richmond, Ind. Manufacturing Plant. Oct.14

⁹ McGraw Hill Construction (2006) “Green Building SmartMarket Report”

¹⁰ Cassidy, R. ed. (2003) “White Paper on Sustainability: A report on the green building movement” Building Design & Construction

11,12&13 “Building Green Workplaces” Aerias IAQ Resource Center