

Global Green Building Trends

Market Growth and Perspectives from Around the World

connecting people_projects_products



Produced in partnership
with the World Green
Building Council



WORLD GREEN BUILDING COUNCIL

Sponsorship provided by

Forbo
FLOORING SYSTEMS

Introduction



Harvey M. Bernstein

Vice President

Industry Analytics, Alliances
& Strategic Initiatives
McGraw-Hill Construction



Andrew Bowerbank

Executive Director

World Green Building Council

We are very excited to introduce our first global-scale green building market research report. With the rapid pace at which green building practices and procedures are gaining traction in construction markets around the world, it is the optimal time to take a close look at how and where market growth is occurring. *Global Green Building Trends SmartMarket Report: Market Growth and Perspectives from Around the World* represents the tenth in McGraw-Hill Construction's thought leader SmartMarket Report series, and our second on the international construction industry, following *Key Trends in the U.S. and European Construction Marketplace* earlier this year.

Today's construction industry is facing unprecedented and growing pressures, originating from the lack of available resources, climate change, rising material costs and increasing instances of natural disasters. These trends have helped trigger widespread adoption of sustainable design and construction methods. Green building offers the opportunity to conserve energy and water, improve building operations and enhance the health and well-being of the global population. Further, green represents a tremendous market opportunity, as it grows rapidly to represent an increasing share of the global \$4.7 trillion construction industry output each year.

With this knowledge in mind, MHC partnered with the World Green Building Council (WorldGBC) to examine the level of industry awareness and the nature of market growth and activity around the world. The response to our study was tremendous—by reaching out to our collective global network of construction industry professionals, we received responses from more than 700 respondents from 45 countries in every region of the world. Our findings reveal that green building has truly become a global phenomenon, reaching every sector, stakeholder and region in the global construction industry.

Though it was not possible to obtain a representative sample of the entire global industry, the respondent represents the early market adopters in green building—those that are informed about and engaging in green building at some level.

By examining the pace and nature of market activity among this group, we can better understand how the green building movement will progress in the coming years.

We found that green is highly visible—**32% of responding construction industry professionals perceive that green already makes up over 10% of domestic construction output.** The level of firm involvement is expected to grow dramatically, with **94% of responding firms expecting to be significantly dedicated to green by 2013**, building green on at least 16% of their projects, and 53% expecting to build green at least 60% of the time.

Overall, the findings of our study demonstrate that this is a historical time for the global construction industry. Consumers, government stakeholders and market leaders are awakening to the importance and the benefits of creating a sustainable built environment. At MHC and WorldGBC, we are committed to providing the knowledge and intelligence needed to help carry the message to our colleagues around the world.

Harvey M. Bernstein, FASCE, has been a leader in the engineering and construction industry for over 30 years. He serves as Vice President of Industry Analytics, Alliances and Strategic Initiatives for MHC, where he has lead responsibility for MHC's green building initiatives, including the first-ever landmark studies on green construction and key market trends in the U.S. and Europe. Bernstein was also one of the team members involved in launching MHC's *Green-Source* magazine. Previously, Bernstein served as the President and CEO of the Civil Engineering Research Foundation. He has written numerous papers covering innovation and sustainability in the built environment, and currently serves as a member of the Princeton University Civil and Environmental Engineering Advisory Council, the Harvard Joint Center for Housing Studies Policy Advisory Board, and as a visiting Professor with the University of Reading's School of Construction Management and Engineering in England where he also serves on their Innovative Construction Research Centre Advisory Board.

Andrew Bowerbank B.Ed, OTC, D.Ind, NCCP, CCEP, LEED AP is the Executive Director of the WorldGBC, where he regularly draws from his diverse background to engage international leaders and encourage sustainable development strategies. Before his 2007 appointment to the WorldGBC, Bowerbank was the Manager for Sustainable Development for the Toronto and Region Conservation Authority and the Executive Director for the Greater Toronto Chapter of the Canada Green Building Council (CaGBC). He has been directly involved in the development of the CaGBC since 2003, and has acted as a green building consultant for a number of high-profile projects. He is a professor of design, certified by the Ontario Ministry of Education and a member of the Ontario College of Teachers. As a published author, Bowerbank has had two of his books on Canada's best-seller list. In 2007, he received the Leader of the Year award by Enerquality Corporation and the Ontario Home Builders Association for his contributions to sustainable community development and green home design.

Table of Contents

Introduction

Global Green Building Market Summary2

Global Construction and the Market Opportunity for Green.....4

The Green Transformation.....6

Regional Green Market Activity8

Europe.....9

North America10

South America11

Australia/New Zealand12

Asia13

Middle East/North Africa.....14

Sub-Saharan Africa15

Market Intelligence on Global Green Building16

Market Activity and Sector Growth.....16

Profitability, Planned Projects and Stakeholder Demand.....18

Motivations for Green Building20

Obstacles to Market Growth.....23

Green Building Practices and Renewable Energy.....24

Feature: Water Efficiency in the Desert.....25

Green Building Product Use and Identification.....26

International Partnerships and Access to Resources.....28

Global Perspectives30

Thought Leader Interviews30

Becoming Green in Asia.....30

Australia's Green Building Movement.....32

Corporate Green Building in South Africa.....34

Exemplary Green Buildings – Case Studies36

Groundbreaking LEED Projects in North and South America.....36

Green Buildings Across Europe.....38

The Middle East Region: Green Design Trends of the Future.....40

Evolution of Green Building.....42

Green Building Rating Systems44

Resources and References46



DIFC Lighthouse Tower, Dubai, UAE

Front cover image: courtesy of HOK
Architects and Adrian Wilson

Courtesy of Atkins

Global Green Building Market Summary

Global Green Building Market Opportunity

This study analyzed green building activity around the world from the perspective of early market adopters and construction industry professionals in 45 countries. According to the results, it is evident that **green building is achieving vast market adoption at dramatic rates in every region of the world.**

This momentum can be seen in the rate at which firms are increasing their green building activity, the growth in perceived green share of domestic construction output, and the rise in renewable energy, green product usage and the association of green with growing sales and profits.

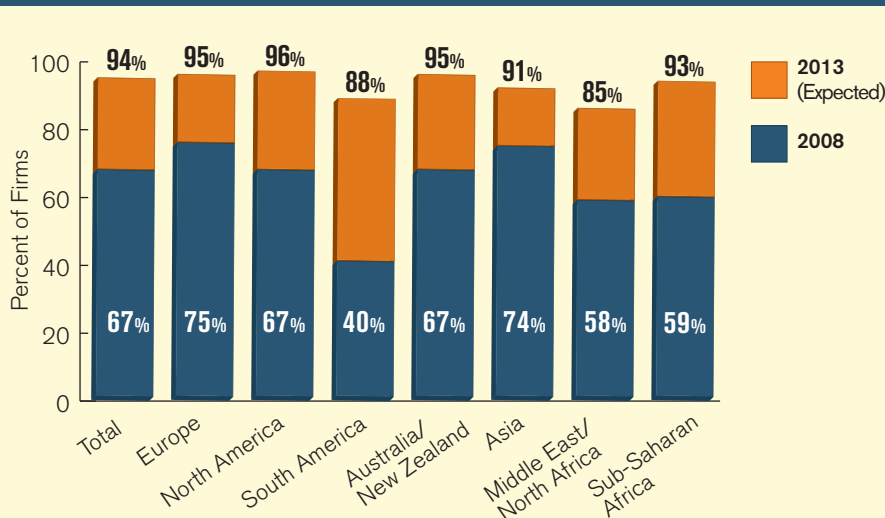
Market Activity Today

- Green is highly visible. Nearly one third (32%) of industry professionals **perceive that green already makes up more than 10% of domestic construction output.**
- Two-thirds (67%) of responding firms are currently dedicated to green** on at least 16% of their projects (see chart at right).
- Europe currently has the highest level of market activity**, with 44% of responding firms building green on over 60% of projects.

Market Growth

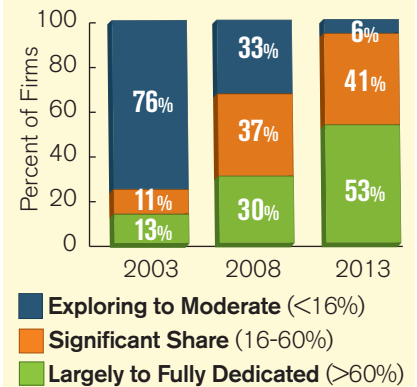
- By 2013, 94% of responding firms will be building green** on at least 16% of projects. More than half (53%) will be largely dedicated, building green on more than 60% of projects (see chart at right).
- The fastest-growing green building market is in Asia**, where the population of firms largely dedicated to green will nearly triple between 2008 and 2013 (from 26% to 73%).
- North America has the largest expected total market involvement**, with 96% of responding firms dedicated to green on at least 16% of projects by 2013 (see chart below).

Percentage of Firms Dedicated to Green Building on at least 16% of Projects, by Region—2008 and Expected 2013



Source: McGraw-Hill Construction, 2008

Global Level of Firm Involvement Over Time



Source: McGraw-Hill Construction, 2008

Research Parameters

The results reported in this report are a combination of MHC's proprietary data, analytics and content expertise, as well as information gathered by MHC Research & Analytics Market Research Group with the support of WorldGBC's Projects and Research Department. This research was conducted from April to May 2008 and reflects input from more than 700 construction industry professionals in 45 countries.

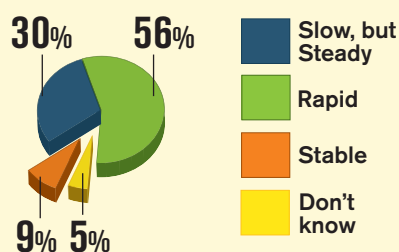
While it was not possible to obtain a true representative sample of the global construction industry, this study investigates market growth by evaluating the activities and perspectives of the early market adopters from each region. This study represents a first attempt in a series of global green building reports that will track the changes and growth in market trends.

For further details on the sample and methodology, see page 29.

Profitability of Green Building

Green building is widely associated with growing profits. Over half (56%) of industry firms foresee rapid sales and profit growth related to green projects over the next five years.

Sales Growth and Profit Levels Associated with Green - Global



Market Triggers and Obstacles

There is a strong consensus among global industry practitioners about the top motivators driving green building.

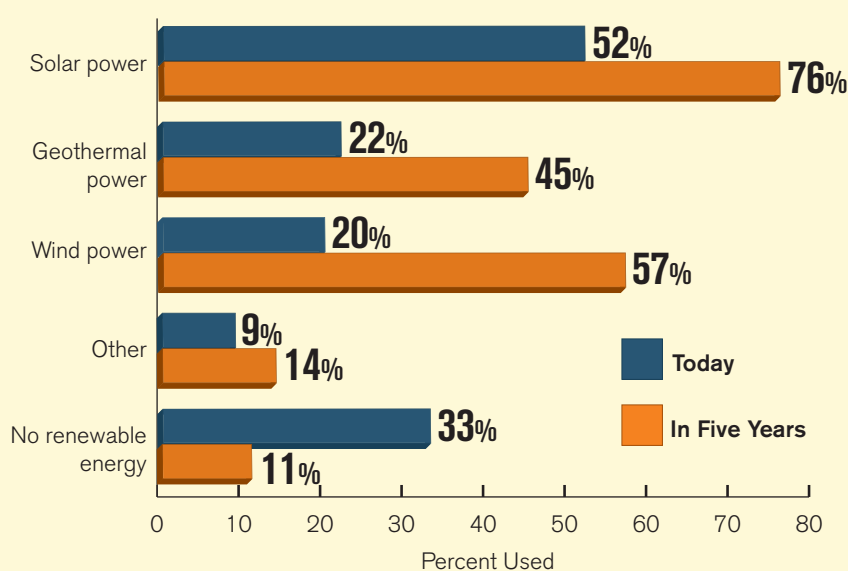
Top Reasons for Green Building

- **Doing the right thing** is cited by 42% of respondents as the **top business reason**.
- **Encouraging sustainable business practices** is cited by 90% as the **top social reason**.
- **Reducing energy consumption** is cited by 89% of respondents as the **top environmental reason**.

Top Obstacles Facing Green Building

- **Higher first costs** (perceived or actual), cited by 80% of respondents.
- **Different budget accounting**, cited by 49% of respondents.
- **Lack of public awareness**, cited by 48%.

Top Forms of Renewable Energy Used—2008 and 2013



Renewable Energy and Green Building Products

Energy efficiency is emphasized in 92% of green building projects.

As a result, practitioners in every region around the world demonstrate growing use of renewable energy sources (as seen in the chart above).

- **Europe has the highest current use of solar power** (used by 72% of respondents) and geothermal power (used by 43%).

Growth in Alternative Energy Use

- **By 2013, 78% of all respondents will be using solar power.**
- **Sub-Saharan Africa** will see the largest growth in solar power usage, up from 45% of respondents in 2008 to 84% in 2013.
- **North America** has the highest level of future wind power use, with expected use by 62% of respondents by 2013.

Green Product Use

- Today, 88% of respondents are installing and specifying green products.
- By 2013, an even larger majority (91%) will be using green products.

Recommendations

With rapid growth in green building market activity expected in every region, global industry leaders should take strategic steps to capture emerging market opportunities and support global green building market expansion.

- **Designers and Builders:** Stay informed and educate local industry stakeholders about the positive impacts of green buildings on society, business and the environment.
- **Building Product Manufacturers:** Recognize the gap in green building product availability around the world. There is a significant market opportunity to be captured, particularly in developing regions and emerging markets.
- **Information Providers:** Help create and provide more green building resources to industry professionals around the world, particularly region-specific knowledge. More project- and firm-level intelligence is needed to help foster market growth.

Global Construction and the Market Opportunity for Green

The Global Economy and Construction Output

At \$4.7 trillion, the construction industry contributes 8–10% of the global gross domestic product (GDP).¹

In a tenuous international economy, this output represents significant market opportunities spread throughout every region of the world.

Economic fluctuations in 2008, spurred by a significant weakening of the U.S. dollar, have dampened the growth of the worldwide economy. According to the International Monetary Fund (IMF), world GDP growth was at 4.9% in 2007, but financial market fluctuations related to the U.S. sub-prime mortgage crisis have pushed expected growth down to 4.1% for 2008.²

Overall construction industry growth has also slowed, from nearly 5% in 2006 to only 3% in 2007. However, output has been buoyed by high demand and continued growth in emerging markets.³

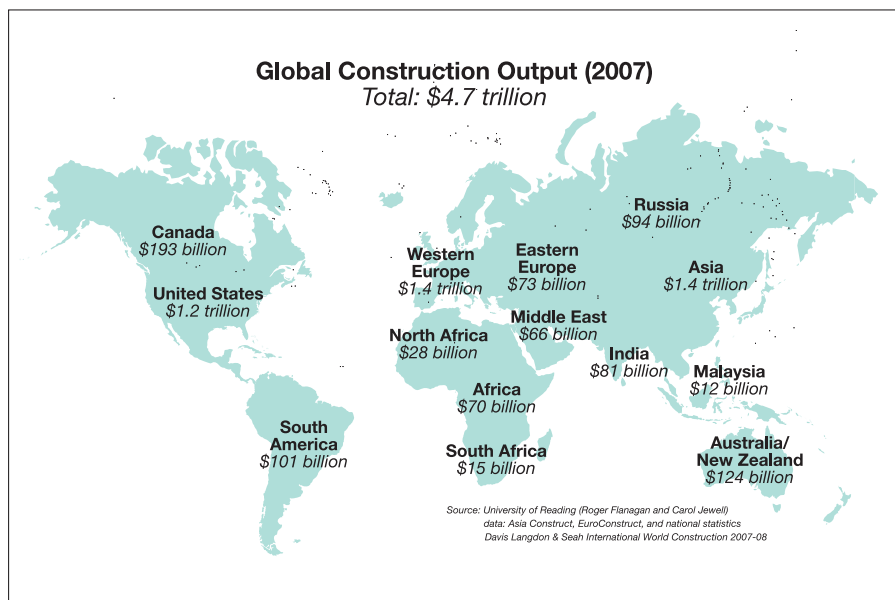
Regional Construction Output

The U.S. represents the largest single-country construction market in the world, at \$1.2 trillion annually. Asia and Europe have the strongest regionwide outputs, each with a \$1.4 trillion market per year.

Asia is the fastest-growing regional construction market, with China expected to expand at more than 9% per year until 2010. Similar growth is expected in other emerging economies in the region, such as Vietnam (9%) and India (8%).

Rapid growth is also occurring in emerging markets in Eastern Europe and the Middle East.

Korea, Brazil, Mexico and Germany are also expected to achieve high levels of construction growth in the coming years.⁴



New Opportunities in Emerging Markets

These trends in market growth are transforming the landscape of the global construction industry, as historic powerhouses such as Japan (currently the second-strongest domestic market), Germany and Italy all prepare to be overshadowed by China by 2009.⁵

These shifts are creating vast new opportunities in global construction. Recent research demonstrates that China and India are expected to spend up to \$1.5 trillion on infrastructure investments alone by the year 2012.⁶

Infrastructure represents one of the largest and fastest-growing sectors in construction activity. However, this sector is currently not viewed as a big opportunity for green construction.

Early green building market adopters, particularly in the China and India markets, could stand to gain significant market advantage in this sector as green grows quickly across the rest of the construction industry.

The Globalization of Construction Activity

As construction activity expands in new and nontraditional markets, the industry is becoming more global and firms are reaching across national boundaries to capture opportunities.

In addition to architecture and engineering firms, product manufacturers are growing their involvement in non-domestic markets. According to recent research by MHC investigating global business trends among building product manufacturers, these firms have taken on a larger role in the global marketplace over the years.

Among this segment, China is considered to be the most strategically important country to international expansion. High growth in market activity is also expected in Argentina, Brazil, India, the U.S. Gulf states and China.⁷

Green Represents an Increasing Share of the Global Marketplace

In the expansive global construction marketplace, green building represents a growing share of total output.

As demonstrated by research conducted for this study, a majority (63%) of industry professionals perceive that green contributes at least 5% of their domestic output (see chart at right). Further, 32% perceive that green makes up over 10% of domestic construction activity.

Though this figure represents opinion—without the use of statistical forecasting models—it demonstrates that green is becoming widely visible in the marketplace and is gaining prominence around the world.

Defining Green Building

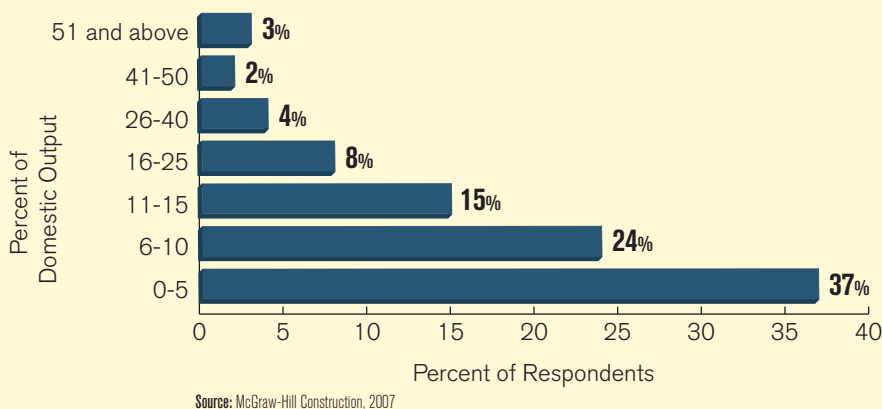
Green building refers to the careful design, construction, operation and reuse or removal of the built environment in an environmentally conscious, energy efficient and sustainable manner.

For the purpose of this report, the term green building is used interchangeably with sustainability. The key characteristics associated with green building practices include:

- Energy efficiency
- Indoor environmental quality
- Water efficiency
- Resource efficiency
- Construction process

It is important to note that green building is continuously evolving. As market activity increases, green building practices will evolve to become greener and more sustainable.

Perceived Green Share of Construction in Home Country



Green Market Activity Is Growing Exponentially

Sustainable design and construction is permeating every region of the world. Though overall levels of involvement vary, this research demonstrates that green building is now a multinational, global-level phenomenon.

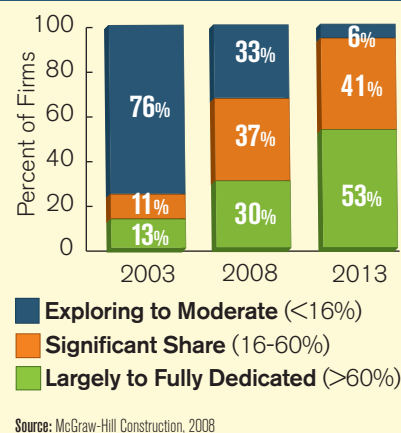
The depth of industry firm involvement in green building has transformed over the last five years and will continue to grow:

- **Past:** 24% were building green on at least 16% of projects.
- **Today:** This population has nearly tripled, to 67%.
- **Future Growth (2013):**
 - Ninety-four percent of these firms will be dedicated to green on at least 16% of projects.
 - More than half (53%) will be building green 60% of the time.

These trends indicate tremendous market transformation. As the early-adopting firms transition to this level of involvement, it is likely that green will reach the mainstream of the global marketplace and achieve critical mass.

Green building market growth is visible at the global and regional level, due to growing support from government

Global Level of Firm Involvement Over Time



legislation, consumer awareness and the pressure to conserve diminishing resources.

The nature of this market activity can be better understood by examining the impact of climate change and the global market shift toward green (see pages 6 and 7).

The Green Transformation

The Rise of Green

The global marketplace is undergoing a broad transformation to green. The growing green building movement is bolstered by a broader global shift toward sustainability and a cultural green consciousness.

The green transformation can be attributed to a series of global pressures and trends, ranging from natural disasters to the rise of the green consumer.

Climate Change and Increasing Natural Pressures

Climate change is contributing to a dramatic rise in natural disasters and new pressures for the construction industry (see box at right). These growing trends have placed a new emphasis on the global dialogue about climate change, environmental pressures and the decreasing availability of natural resources.

As the cost of resources such as oil reach historic highs, the construction industry has been forced to seek alternatives to traditional methods of design, energy use and resource-heavy activities.

The Evolution of Green Building

These pressures, combined with a series of historic events, have led to the rise of green building (see Timeline on pages 42–43).

Some of the most significant events include:

- The creation of the first green building rating system (BREEAM) in the UK in 1990 (see page 44).
- The formation of the first national green building council—the U.S. Green Building Council (USGBC)—in 1993.
- The formation of the World Green Building Council (WorldGBC) in 1999, incorporated in 2002.

Today, the WorldGBC is active in nearly 50 countries. For more details, see page 46.

The Role of Climate Change in the Green Transformation

Recent research demonstrates the direct relationship between human-induced emissions of greenhouse gasses (GHG) and the increases in temperature, extreme weather and natural disasters that have occurred over the last 50 years.

GHG have also been linked to increased water vapor in the atmosphere, heavier levels of precipitation and the potential cause of the increase in sea surface temperatures in regions where hurricanes tend to form.⁸

Projections for the Future

The rise of GHG emissions and climate change will lead to further pressures in the future:

- Frequent heat waves and hot temperatures.
- Increase in evaporation and droughts.
- Less frequent, but more intense, precipitation.
- Increased instances of hurricanes, typhoons and associated core rainfall rates.

For each 1°C increase in temperatures of tropical sea surfaces, the speed of hurricane winds will increase by 1% to 8%, and core rainfall rates will increase by 6% to 18%.⁹

Green Consumers in Emerging Markets

Though much of today's green consumer research is focused on economies in the U.S. and Western Europe, the momentum of the ethics shift is beginning to influence the developing world.

The trend is consistent with challenges in these regions. Economies in Africa, Asia, Latin America and Eastern Europe have long been focusing on diminishing resources, the need for lower-cost energy, community-based development and sustainable farming.

Emerging economies arguably represent the next frontier of green consumers.

As multinational firms shift their operations and products to focus increasingly on green, these changes are likely to cascade down to the consumer practices of the growing middle classes in countries such as China, Russia and India.^{10,11}

The green trend has already taken hold in some areas such as China, where the value of the domestic organic food market is expected to grow by 30% in the next five years.¹²

Sustainability in the Built Environment

In today's resource-dependent world, buildings provide a tremendous opportunity to mitigate the impact of the built environment on water, energy and carbon emissions.

As the world's heaviest consumers of natural resources, **buildings account for the following environmental impacts:**

- Forty percent of total global CO₂ emissions¹³
- Forty-five percent of CO₂ emissions in the European Union, and 50% in the UK¹⁴
- Thirty percent of global raw materials consumption and solid waste output¹⁵

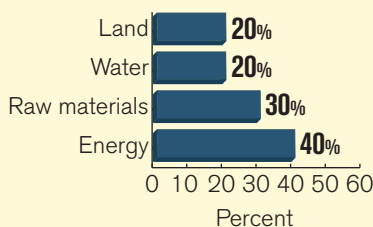
Residential and commercial buildings also consume a significant share of total energy use, though the proportion varies by region (see chart below).

Green building offers the opportunity to **reduce this negative impact:**

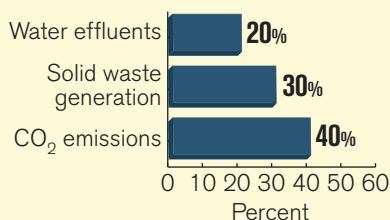
- Reduce energy use by 30–50%
- Reduce CO₂ emissions by 35%
- Reduce waste output by 70%
- Reduce water usage by 40%¹⁶

Share of the Built Environment

Global Resource Use

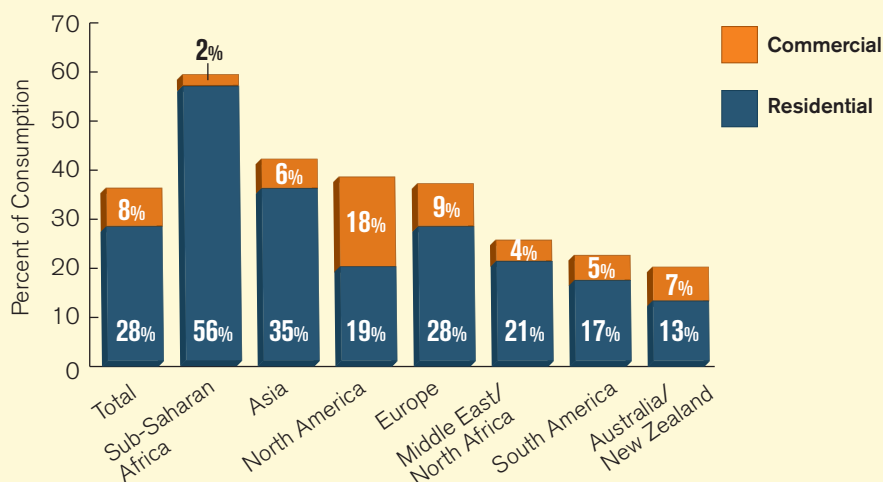


Global Waste



Source: UNEP Sustainable Buildings and Construction Initiative, 2006

Building Sector Share of Total Energy Use Around the World



Source: Earth Trends 2005

The Benefits

As demonstrated by results from a growing number of MHC studies, green building offers significant business, social and environmental benefits.

Business Benefits

According to an MHC study of commercial owners in the U.S., green building improves overall business performance in the following ways:

- Operating cost decreases **8–9%**.
- Building value increases **7.5%**.
- Return on investment up **6.6%**.
- Occupancy ratio up **3.5%**.
- Rent ratio increases **3%**.¹⁷

Corporate leaders also credit green building with leading to improved competitive positioning and market differentiation.¹⁸

Health and Well-Being Benefits

Several studies, as cited in the Education Green Building SmartMarket Report and the Health Care Green Building SmartMarket Report, have demonstrated a wide range of positive impacts on the health and well-being of green building occupants:

- Natural light increases worker productivity.¹⁹
- Reduced noise can decrease medication dispensing errors by half in hospitals.²⁰
- Savings in schools of up to 20 times costs—enough to hire a full-time teacher.²¹
- Improved test scores among students by 7% to 18%.²²
- Reduced absenteeism, improved concentration and increased annual body growth among students in schools.²³

Regional Green Market Activity

Green Building Regional Market Growth

To date, there is little region-specific green building market data available. This study represents a first effort to understand the scope, nature and pace of market activity across every region of the world.

The research presented in the following sections reflects the opinions, experiences and perceptions of more than 700 construction industry leaders in 45 countries. The survey was disseminated through a global network of green building leaders. Though active involvement in green building was not a prerequisite for completing the survey, many of the respondents had some knowledge of the trend. The results may therefore tend toward an optimistic view of market growth.

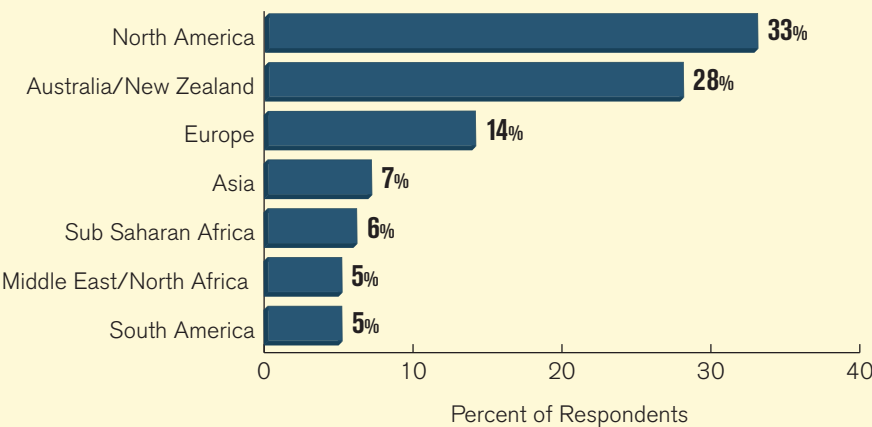
Regardless, the data provides the very first look at where, when and how market growth is occurring among the early market adopters in every region. Viewed in light of the massive scope of global construction output (see pages 4–5), these trends point toward a unified, global phenomenon that is rapidly gaining momentum throughout today's construction industry.

Regional Markets

For the purpose of this report, the 45 countries represented in this research will be categorized into seven regions. It should be noted that the sample size varies by region, which affects the nature of the results obtained. The countries represented in each region are listed below. The distribution of respondents by region is noted in the chart below.

- **North America:** Canada, United States (including Puerto Rico), Mexico, Costa Rica
- **South America:** Argentina, Brazil, Chile, Colombia, Venezuela
- **Europe:** Czech Republic, Finland, France, Germany, Greece, Hungary, Netherlands, Norway, Poland, Spain, Switzerland, United Kingdom
- **Middle East/North Africa:** Bahrain, Israel, Jordan, Qatar, United Arab Emirates, Egypt
- **Sub-Saharan Africa:** Botswana, Ghana, Nigeria, South Africa
- **Australia/New Zealand:** Australia, New Zealand
- **Asia:** China, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, Pakistan, Singapore, Taiwan, Thailand, Vietnam

Breakdown of Survey Respondents by Region



EUROPE

With 2007 output over \$1.4 trillion, Europe is one of the top regional construction markets.²⁴ Though growth is expected to be relatively slow over the next few years, Europe represents a consistently stable economy with strong prospects for fostering a growing green building marketplace.²⁵

Green represents a growing share of European construction.

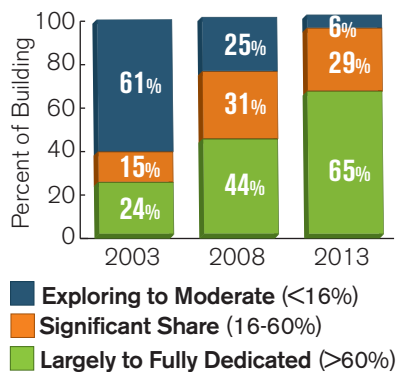
As can be seen in the chart at far right:

- Currently, green is perceived by 20% of respondents to make up 6%–10% of domestic construction output.
- While only 2% perceive that green represents 26%–40% of output, a larger share (7%) estimate that green makes up more than 41% of domestic construction activity.

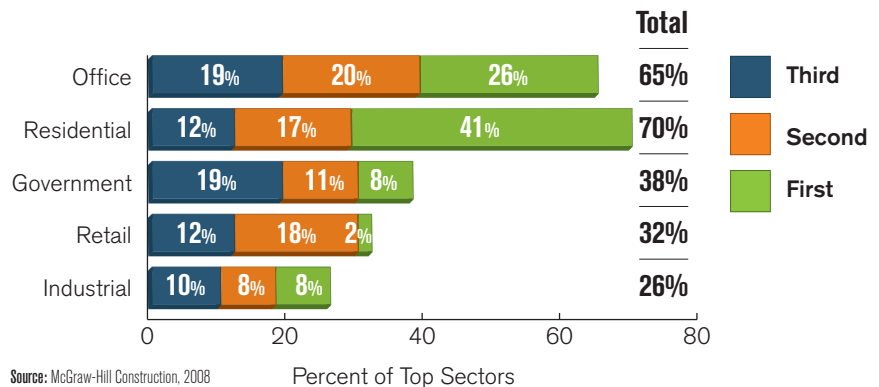
Green market activity is strong and continues to expand (see chart below).

- Today, 44% of responding firms are engaged in green on at least 60% of their projects.
- By 2013, this population will grow to 65% of firms.
- In the next five years, nearly all firms (94%) will be building green on at least 16% of their projects.

Level of Green Building Over Time—Europe



Top Sectors for Growth by 2013—Europe



Residential construction leads green building sector growth.

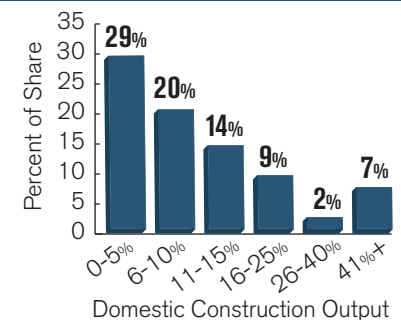
According to the chart above:

- By 2013, 70% expect residential to be the top green building sector.
- Office sector has the second highest expectation of growth (65%).
- Government will drop to third, but many (38%) expect it to be strong.

These market trends indicate continued growth in the green share of European construction output.

Averaging approximately 20% growth every five years among responding firms, the research points to a vast increase in green building market opportunity in Europe. With an annual output of nearly \$1.5 trillion, this could be one of the strongest green building markets in the world.

Perceived Green Share of Domestic Construction—Europe



Other Regional Indicators

- Expecting rapid sales and profit growth from green:** 59% of respondents.
- Top planned green building projects:** Nonresidential new construction (51%), existing building/retrofit and community projects (50%).
- Top business reason for green building:** Market demand—cited by 48%.
- Top social reason for green building:** Create a sense of community—cited by 32%.
- Top obstacle to green building growth:** Higher first costs (perceived or actual)—cited by 77%.

NORTH AMERICA

North America represents one of the largest regional construction markets, buoyed by the strongest national market in the world (the U.S. at \$1.2 trillion) and one of the fastest growing (Mexico, expected to grow by 4% annually).²⁶

Despite the downturn in the housing market due in part to the sub-prime mortgage crisis, nonresidential construction remains strong in the region.

Green is a significant share of regional output.

As can be seen in the chart at far right:

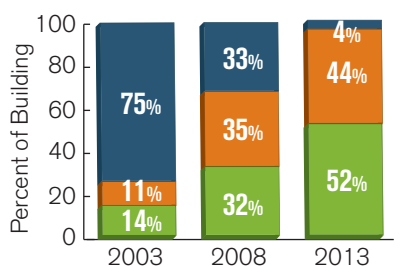
- Green is perceived by 28% of respondents to make up 6%–10% of domestic construction output.
- Moreover, 31% estimate that green comprises 11–25% of domestic output.

Market activity is growing dramatically.

Firms are rapidly adopting green building at a very strong level:

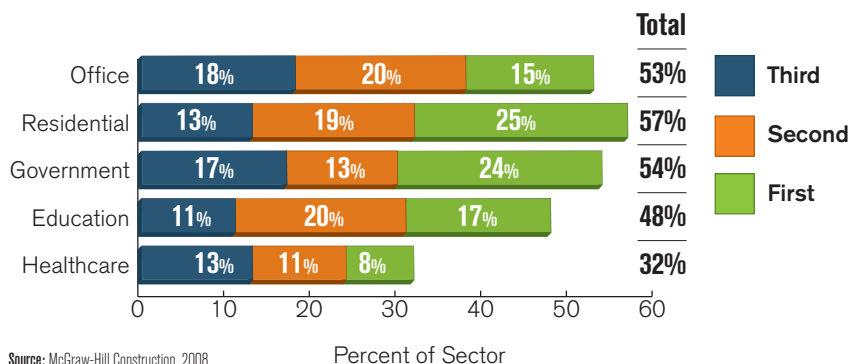
- Today, 67% of responding firms are building green on at least 16% of their projects.
- By 2013, this portion will reach 96% of firms. Only 4% think they will be at the “exploring” stage.

Level of Green Building Over Time—North America



Source: McGraw-Hill Construction, 2008

Top Sectors for Growth by 2013—North America



- More than half of all firms will be largely dedicated to green in five years, with green making up over 60% of all projects.

These trends indicate a tremendous market opportunity for green building.

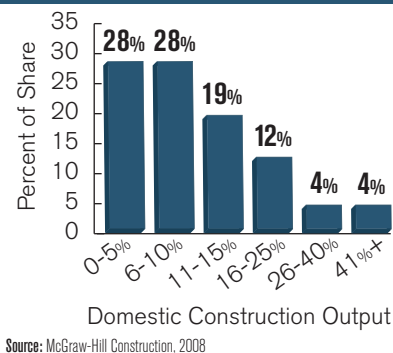
Based on the rapid pace at which respondents expect green to grow over the next five years, the green share of regional construction output is likely to grow dramatically.

Office and residential construction lead green building market growth.

Despite financial concerns and some construction market downturn, green building is expected to expand across several sectors (see chart above):

- Government and office construction are the most active green sectors today.
- Residential is expected to have the most growth, replacing both office and government to become the top green building sector by 2013.
- Education is also expected to grow, with nearly half of respondents citing this as a top green building sector in 2013.

Perceived Green Share of Domestic Construction—North America



Other Regional Indicators

- Expecting rapid sales and profit growth from green:** 62% of respondents.
- Top planned green building projects:** Nonresidential new construction (54%) and existing building/retrofit (53%).
- Top business reason for green building:** The right thing to do—cited by 53%.
- Top social reason for green building:** Encouraging sustainable business practices—cited by 48%.
- Top obstacle to green building growth:** Higher first costs (perceived or actual)—cited by 83%.

SOUTH AMERICA

Overall, growth in South American construction output has slowed considerably. This is likely related to the region's proximity to North America and the fallout of the sub-prime mortgage crisis and financial turbulence of early 2008.²⁷

Despite this slowing, South American construction growth rates remain higher than those in other regions. Infrastructure spending is strong and rising in emerging economies such as Venezuela, Peru and Colombia.²⁸

Green represents a small, but growing, share of construction.

As can be seen in the chart at far right:

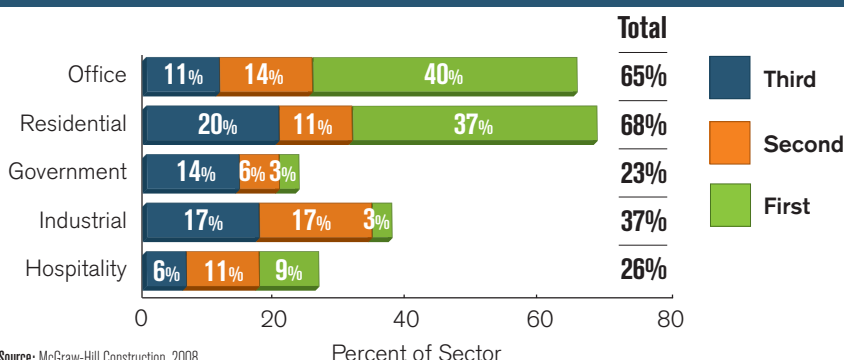
- Green is estimated to contribute less than 5% of domestic construction output by 76% of respondents.
- A much smaller population (8%) perceives that green makes up 6%–10% of construction activity.

Green will take hold over the next five years.

Though green currently represents a small share of regional construction output, this is expected to shift dramatically (see chart below right):

- By 2013, over one third (34%) of responding firms will be dedicated to green on more than 60% of their projects.
- Another 54% expect to be engaged in green for at least 16% of projects.
- The percentage of firms at the exploring stage of green building will drop dramatically from 93% in 2003 to 11% by 2013.

Top Sectors for Growth by 2013—South America

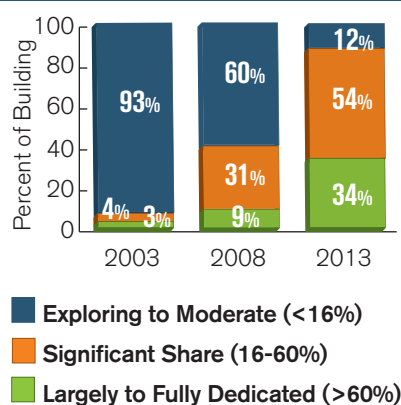


Residential, office and industrial are the strongest sectors for growth in green in South America.

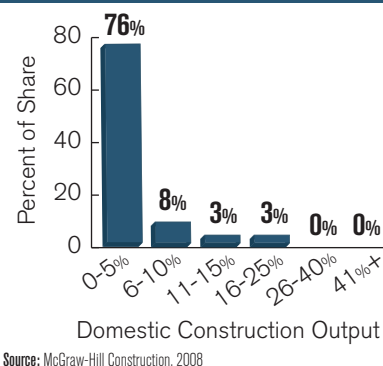
- By 2013, 68% of respondents expect residential to become the most active green building sector.
- Growth is also expected in industrial and hospitality, by 37% and 26% of respondents respectively.

Despite slowing construction output, these trends show that **the market opportunity for green is growing in South America**. With the region showing above-average growth rates and firms becoming deeply involved in green, the green building market will represent a growing share of the \$101 billion market opportunity in South America.

Level of Green Building Over Time—South America



Perceived Green Share of Domestic Construction—South America



Other Regional Indicators

- **Expecting rapid sales and profit growth from green:** 50% of respondents.
- **Top planned green building projects:** Nonresidential new construction (37%), low-rise residential and existing building/retrofit (both 29%).
- **Top business reason for green building:** Market transformation—cited by 51%.
- **Top social reason for green building:** Increasing worker productivity—cited by 37%.
- **Top obstacle to green building growth:** Lack of political support and higher first costs (perceived or actual)—cited by 63%.

AUSTRALIA/NEW ZEALAND

Construction activity in Australia and New Zealand is robust, with nearly 10% growth expected in Australia in 2008.

The market is carried by strong non-residential and infrastructure activity, while the residential sector is comparatively weak. Some slowing is expected in 2009 when these projects are completed.²⁹

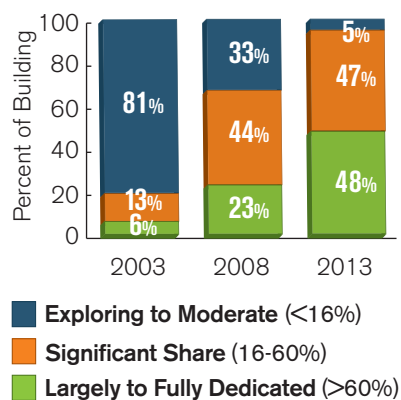
Green represents a growing share of regional construction output.

As can be seen in the chart at far right:

- Green is perceived by 29% of respondents to contribute 6%–10% of construction output.
- A slightly larger share (31%) see green building contributing less than 5% of domestic output.
- Interestingly, 9% of respondents are on the high end of the spectrum, estimating that green makes up over 26% of output.

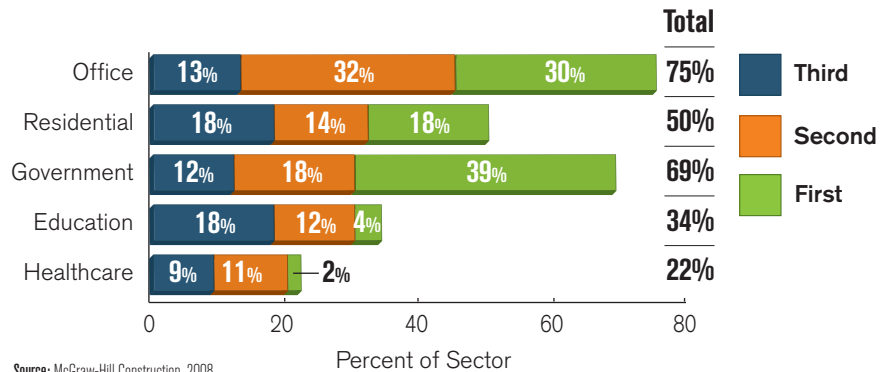
These trends point to a strong market for growth.

Level of Green Building Over Time—Australia/New Zealand



Source: McGraw-Hill Construction, 2008

Top Sectors for Growth by 2013—Australia/New Zealand



Source: McGraw-Hill Construction, 2008

Firm dedication to green is growing rapidly.

As can be seen in the chart below left:

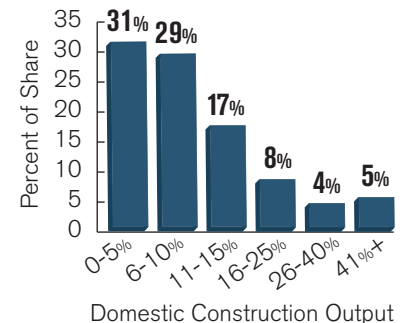
- The number of firms involved in green in at least 16% of their work has more than tripled in the last five years, from 19% to 67%.
- In 2013, this population will grow to 95%.
- Firms largely dedicated to green (on more than 60% of projects) will double by 2013, from 23% to 48%.

Office sector will remain strong for green building.

- The office sector is expected by 75% of respondents to remain the most active green building sector in the next five years.
- The government sector is expected to have the largest growth, becoming the second most active sector (69%) in 2013.

These trends indicate the emergence of a significant market opportunity for green. The Australia/New Zealand construction industry presents a strong and growing marketplace for green building. If market involvement continues to grow at the rates demonstrated by this research, green building may become mainstream in the near future.

Perceived Green Share of Domestic Construction—Australia/New Zealand



Source: McGraw-Hill Construction, 2008

Other Regional Indicators

- **Expecting rapid sales and profit growth from green:** 46% of respondents.
- **Top planned green building projects:** Nonresidential new construction and existing building/retrofit (both 44%).
- **Top business reason for green building:** Market demand—cited by 48%.
- **Top social reason for green building:** Encouraging sustainable business practices—cited by 34%.
- **Top obstacle to green building growth:** Higher first costs (perceived or actual)—cited by 86%.

ASIA

Home to some of the most dramatic GDP and construction-sector growth in the world, Asia has become one of the top three regional construction markets, with a \$1.4 trillion output in 2007.³⁰

Rapid development in countries such as China, India, Malaysia and North and South Korea is expected, leading to increased project starts in the non-residential and infrastructure sectors.

Growth is also visible in Laos (with 37% growth in 2007), Cambodia and Vietnam. Construction investment in Japan remains strong.³¹

Green is a relatively small share of the growing construction output.

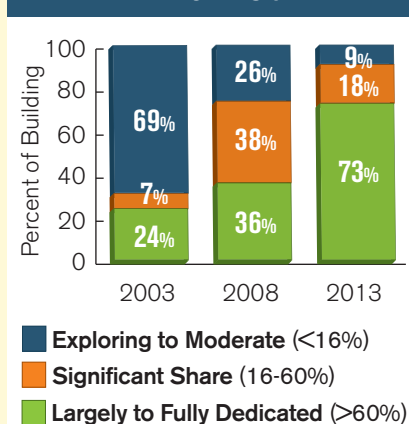
As can be seen in the chart at far right:

- Nearly half (49%) perceive that green makes up less than 5% of domestic construction activity.
- Only 22% foresee green comprising more than 10% of construction output.

Green market activity is growing rapidly.

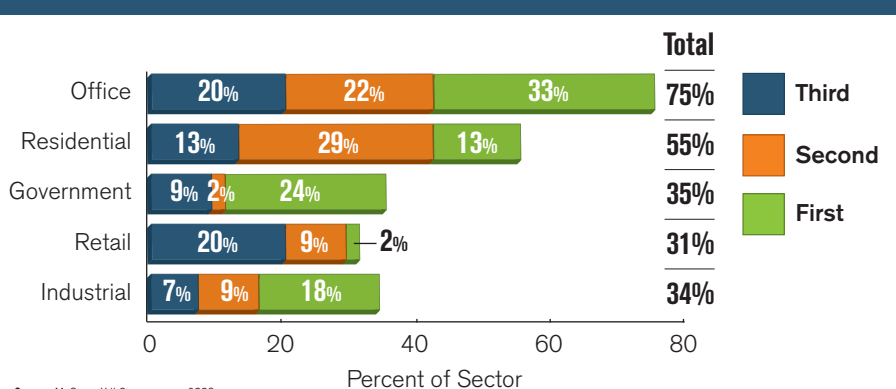
Though green activity makes up a small share of today's output, firm activity is growing at historic rates. As can be seen in the chart below:

Level of Green Building Over Time—Asia



Source: McGraw-Hill Construction, 2008

Top Sectors for Growth by 2013—Asia



Source: McGraw-Hill Construction, 2008

- The population of firms dedicated to green on at least 16% of projects is expected to nearly triple from 31% in 2003 to 91% in 2013.
- By 2013, firms largely dedicated to green (over 60% of projects) will double from 36% in 2008 to 73%.

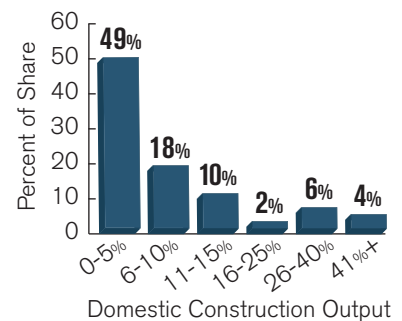
Office sector leads green building growth over the next five years.

- The office sector is expected by 75% of respondents to have the most growth by 2013.
- Residential will come in second—cited by 55%.

Asia represents a rapidly growing green building market opportunity.

Asia boasts a regional output of \$1.4 trillion and many of the fastest-growing construction markets in the world. It also demonstrates a very rapidly growing green movement. In these conditions, Asia may quickly become home to the world's largest green building marketplace.

Perceived Green Share of Domestic Construction—Asia



Source: McGraw-Hill Construction, 2008

Other Regional Indicators

- **Expecting rapid sales and profit growth from green:** 64% of respondents.
- **Top planned green building projects:** Nonresidential new construction (52%).
- **Top business reason for green building:** Internal corporate commitment—cited by 41%.
- **Top social reason for green building:** Increasing worker productivity—cited by 34%.
- **Top obstacle to green building growth:** Higher first costs (perceived or actual)—cited by 83%.

MIDDLE EAST/NORTH AFRICA

Bolstered by historically high oil prices and regional development, construction in the Middle East/North Africa region remains strong, at \$66 billion in 2007.³²

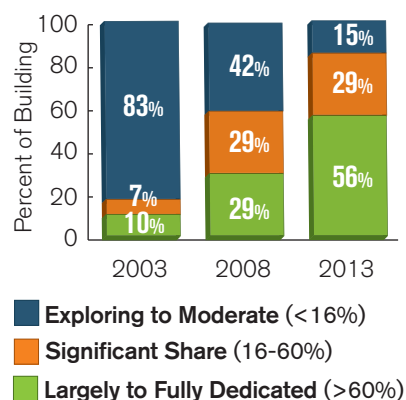
Following several years of 10% annual growth, regional construction is slowing slightly, with 7% growth expected over the next few years.³³ However, large-scale projects and high levels of investment will continue to make this region a major contributor to global construction output.

Green represents a small share of the regional construction activity.

As can be seen in the chart at far right:

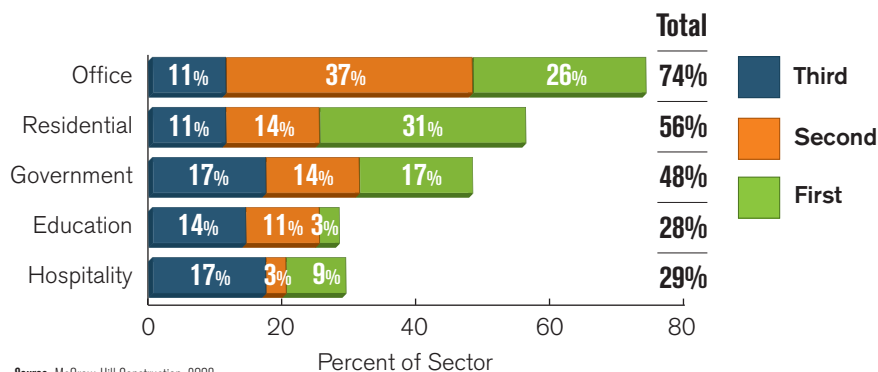
- Over half (55%) of respondents estimate that green makes up less than 5% of their domestic construction market.
- 13% perceive stronger green activity, estimating a share of 6%-10%.

Level of Green Building Over Time—Middle East/ North Africa



Source: McGraw-Hill Construction, 2008

Top Sectors for Growth by 2013—Middle East/North Africa



Source: McGraw-Hill Construction, 2008

The construction market is rapidly shifting toward green.

As can be seen in the chart below left:

- Since 2003, the population of firms significantly involved in green (at least 16% of projects) has nearly tripled, from 17% to 58%.
- By 2013, this population is expected to jump from 58% to 85%.
- The percentage of firms building green at least 60% of the time will nearly double over the next five years, from 29% to 56%.

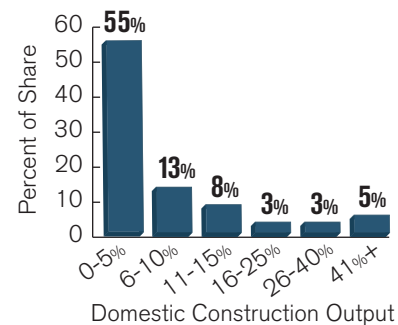
Office and residential are the fastest growing sectors.

- The office sector is expected by 74% of respondents to show the strongest growth by 2013.
- More than half (56%) also expect residential to be prominent by 2013.
- Government is also viewed as an active sector.

These trends represent a vast new market opportunity for green.

Rapid development of the regional construction industry and this dramatic growth in green building activity create an attractive new marketplace for green.

Perceived Green Share of Domestic Construction—Middle East/North Africa



Source: McGraw-Hill Construction, 2008

Other Regional Indicators

- Expecting rapid sales and profit growth from green:** 59% of respondents.
- Top planned green building projects:** Communities (50%).
- Top business reason for green building:** Right thing to do—cited by 51%.
- Top social reason for green building:** Supporting the domestic economy—cited by 29%.
- Top obstacle to green building growth:** Lack of trained/educated green building professionals—cited by 72%.

SUB-SAHARAN AFRICA

Sub-Saharan Africa has struggled with fluctuating political and economic conditions, which have deterred construction activity and much-needed foreign investment.

However, recent investment activity from China has helped to shed light on the emerging opportunities in this region.³⁴ In addition, South Africa's construction market is very strong (\$15 billion) thanks to improving economic development conditions and a growing middle class.³⁵ This activity may help drive investment in other Southern African countries.

Green building makes up a small share of domestic output in the region.

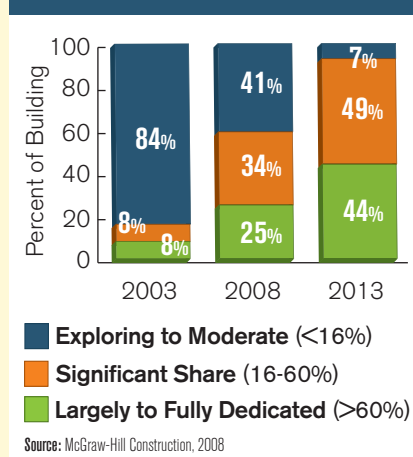
As can be seen in the chart at far right:

- Green is estimated by 69% of respondents to comprise less than 5% of domestic construction.
- A much smaller population (16%) estimates that green comprises 6%-10%.

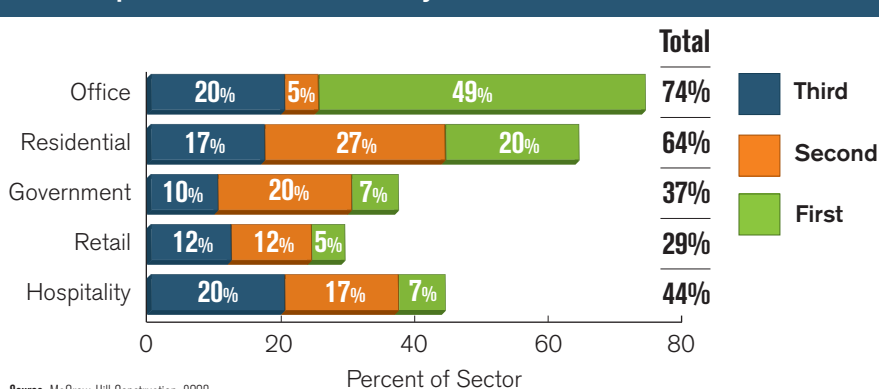
Green building is gaining rapid adoption among industry firms.

Though green currently represents a small share of regional construction output, this is expected to shift dramatically (see chart below):

Level of Green Building Over Time—Sub-Saharan Africa



Top Sectors for Growth by 2013—Sub-Saharan Africa



- More than half (59%) of responding firms are currently building green on at least 16% of their projects.
- This population will grow drastically from 16% in 2003 to 93% in 2013.
- By 2013, 44% of firms will be largely dedicated to green before on at least 60% of projects).

Office and residential will lead green building sector growth.

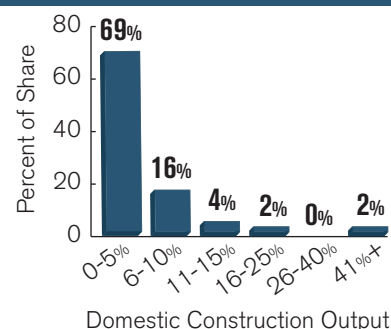
As can be seen in the chart above:

- Office construction is expected by 74% of respondents to show the most growth in green building over the next five years.
- Residential growth is close behind—cited by 64% as having high growth.

In a sluggish marketplace, these trends indicate that **green building will represent an important area for market growth in the coming years.**

Firms in Sub-Saharan Africa are rapidly adopting green building. As this trend becomes increasingly pervasive, it has the potential to help spur future industry growth throughout the region.

Perceived Green Share of Domestic Construction—Sub-Saharan Africa



Other Regional Indicators

- Expecting rapid sales and profit growth from green:** 49% of respondents.
- Top planned green building projects:** Low-rise residential (47%).
- Top business reason for green building:** Right thing to do—cited by 51%.
- Top social reason for green building:** Supporting the domestic economy—cited by 47%.
- Top obstacle to green building growth:** Higher first costs (perceived or actual)—cited by 74%.

Market Intelligence on Global Green Building

Comparing Market Activity Across Regions

Firm-level dedication to green is growing dramatically in every region. Across the board, responding firms expect to see significant increases in their level of green building activity.

As more firms adopt standard green practices, the nature of green building will continue to evolve to greener, more sustainable levels in the future.

Highest Levels of Market Activity

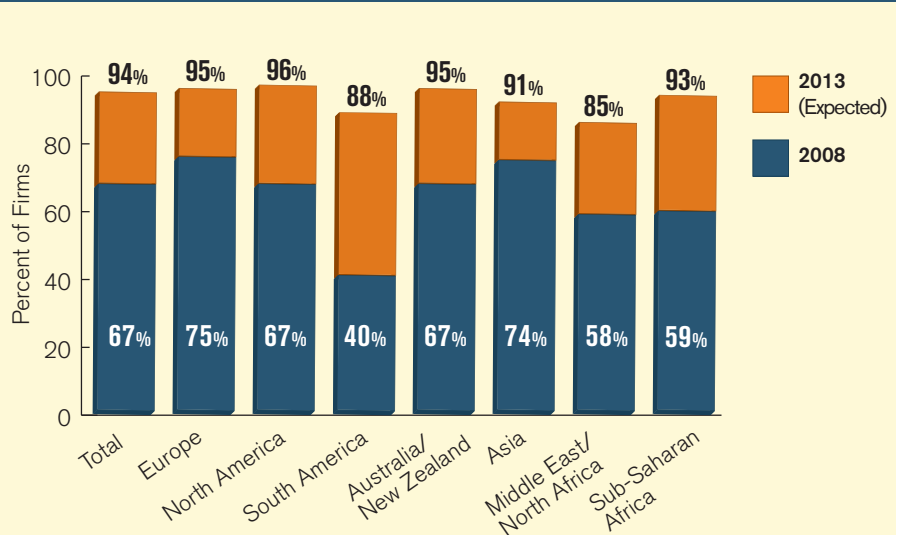
- **The highest level of market activity is in Europe**, with 44% of responding firms building green on more than 60% of their projects.
- **The fastest-growing market is in Asia**, where the population of firms largely dedicated to green is expected to nearly triple between 2008 and 2013, from 26% to 73%.
- **North America has the largest expected total market involvement**, with 96% of responding firms dedicated to green on at least 16% of projects by 2013.

Lowest Levels of Market Activity

- **The lowest current activity is in South America**, with only 40% of responding firms dedicated to green on at least 16% of projects.
- **The lowest level of expected future market activity is in the Middle East/North Africa**, where only 85% of firms will be heavily dedicated to green in 2013—far less than the global average of 94%.

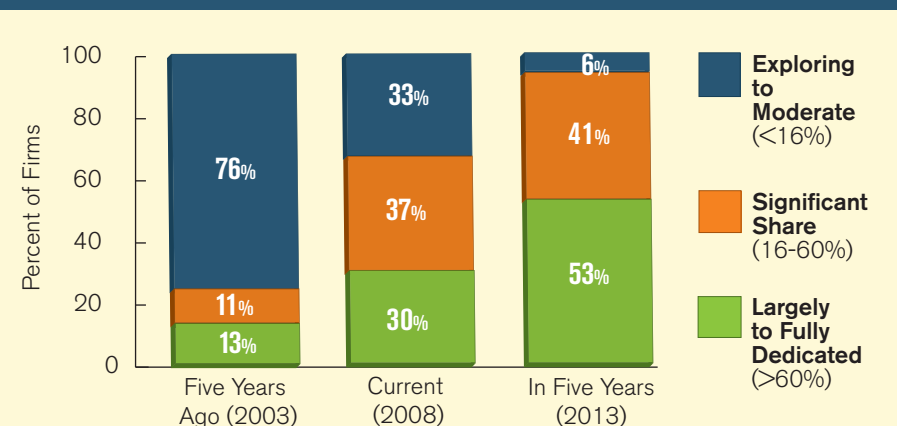
However, it is important to note that the share of firms at the lowest level of market involvement is dropping in every region.

Percentage of Firms Dedicated to Green Building on at least 16% of Projects, by Region—2008 and Expected 2013



Source: McGraw-Hill Construction, 2008

Global Level of Firm Involvement Over Time



Source: McGraw-Hill Construction, 2008

Global Construction Sector Activity and Growth

All regions demonstrate the highest levels of green building activity in office sector projects.

Significant Trends in Global Sector Activity (as seen in the charts below):

Office Sector Activity

It will remain strong, but less dominant in 2013 due to growth in other sectors.

- Today: 75%
- 2013: 66%

Government Sector

It is expected to decrease, dropping from the second to the third most active sector.

- Today: 64%
- 2013: 51%

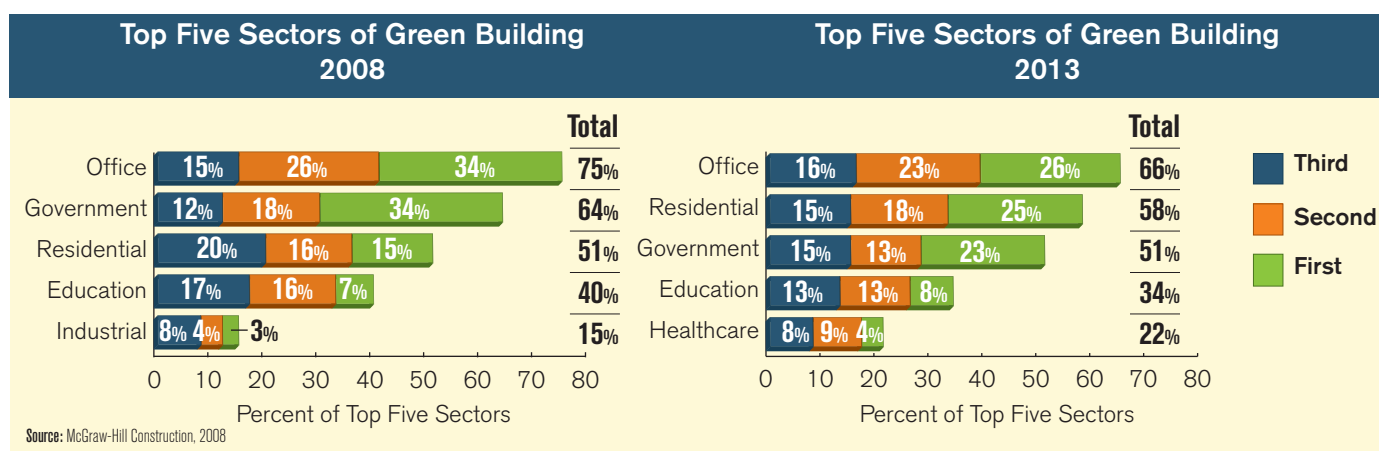
Residential

It is expected to surpass government.

- Today: 51%
- 2013: 58%

Other

Education and healthcare are also expected to grow, while industrial sector green building is on the decline.



Sector Activity by Region

Regionally, sector activity shows similarities across the more developed economies (North America, Europe and Australia/ New Zealand), and the developing world (Sub-Saharan Africa, Middle East/North Africa and South America). Falling somewhere in between is Asia.

Overarching Sector Trends

Differences in the opinions of firms vary from more developed economic regions versus the developing world.

Government

- Low in Sub-Saharan Africa and South America.
- Top three in all other regions

Hospitality

- Low in developed regions
- Top five in developing world (including Asia)

Education

- In top four in most regions
- Exceptions are Sub-Saharan Africa and Middle East/North Africa.

Infrastructure and Industrial

- Very little activity in North America and Australia/New Zealand.

Top Construction Sectors for Growth by Region

Anticipated sector growth varies across the board, with the broadest diversity showing in the top fourth and fifth sectors in each region, including:

- **Highest global growth:** Office and residential construction.
- **Government** will remain in top three in every region except for South America and Sub-Saharan Africa.
- **Industrial** will only be in top three in South America.
- **Hospitality** will only be in top three in Sub-Saharan Africa.

Market Intelligence on Global Green Building

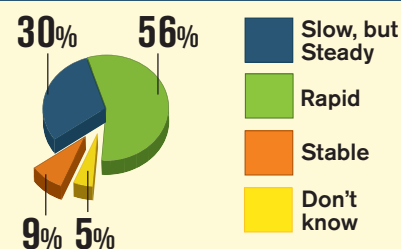
Profitability of Green Building

Green building is widely associated with growing profits. **More than half (56%) of industry firms foresee rapid sales and profit growth related to green projects over the next five years.**

Regional Differences

- Expectations of profit and sales growth are relatively similar across regions.
- Only differences are in Sub-Saharan Africa (49%) and Australia/ New Zealand (46%), lower than the global average of 56%.

Sales Growth and Profit Levels Associated with Green—Global



Source: McGraw-Hill Construction, 2008

Types of Planned Green Projects

As firms see increased profits associated with sustainable design and construction, the **volume of planned green projects is also growing.**

- 17% of respondents have over one million sq. ft. in green projects planned for the next three years.
- 46% have at least 100,000 sq. ft. planned.

Top Planned Project Types

Non-residential New Construction

It makes up nearly half (48%) of planned projects.

Existing Buildings

These projects are common in Europe, North America, Australia/New Zealand and Sub-Saharan Africa.

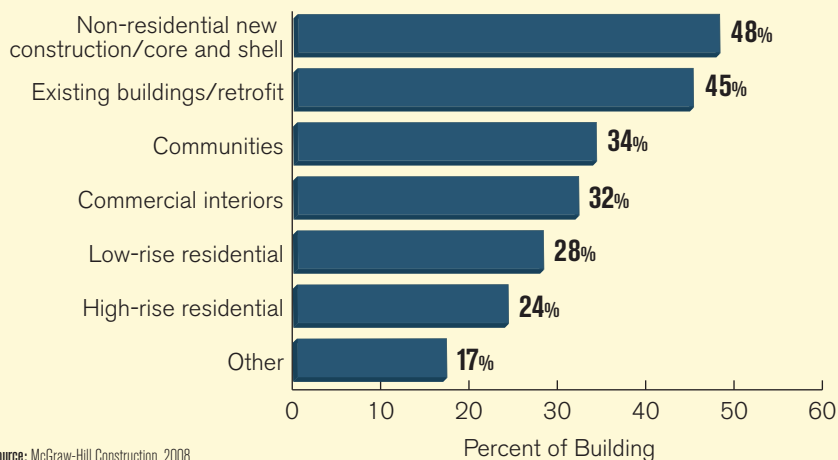
Community Projects

Most common in Middle East/North Africa and Europe.

Residential

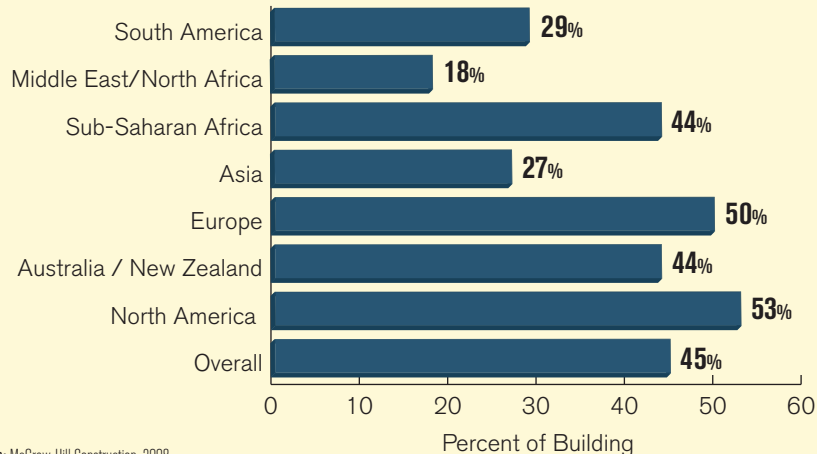
- High-rise significant in Europe and Middle East/North Africa.
- Low-rise is the top overall project type in Sub-Saharan Africa (47%).

Planned Green Building Project Types—Global



Source: McGraw-Hill Construction, 2008

Planned Existing Building/Retrofit Projects—by Region



Source: McGraw-Hill Construction, 2008

Stakeholder Demand

As the industry expands in new regions and sectors, more industry stakeholders are recognizing the importance of green. As this trend grows, green will be seen as increasingly critical to previously nontraditional industry groups.

Demand

Highest Demand (critical or often demanded)

Other than architects, the highest is in the public sector:

- National government: 55%
- Local/regional government: 49%
- International governing bodies: 40%
- Public owners: 37%

Slower Growth

There are slower levels of growth in the private sector:

- Financial institutions: 19%
- Owners and developers: 22%

Lowest Level

- Labor organizations: 5%
- Realtors and tenants: 16%

This trend reflects the need for more awareness among these groups of the benefits of green buildings on occupant health, well-being and productivity.

Regional Stakeholder Trends

These stakeholder trends are similar across regions. The only major exception is the high level of variety in government support.

High National Government Support

- Australia/New Zealand: 78%
- North America: 59%

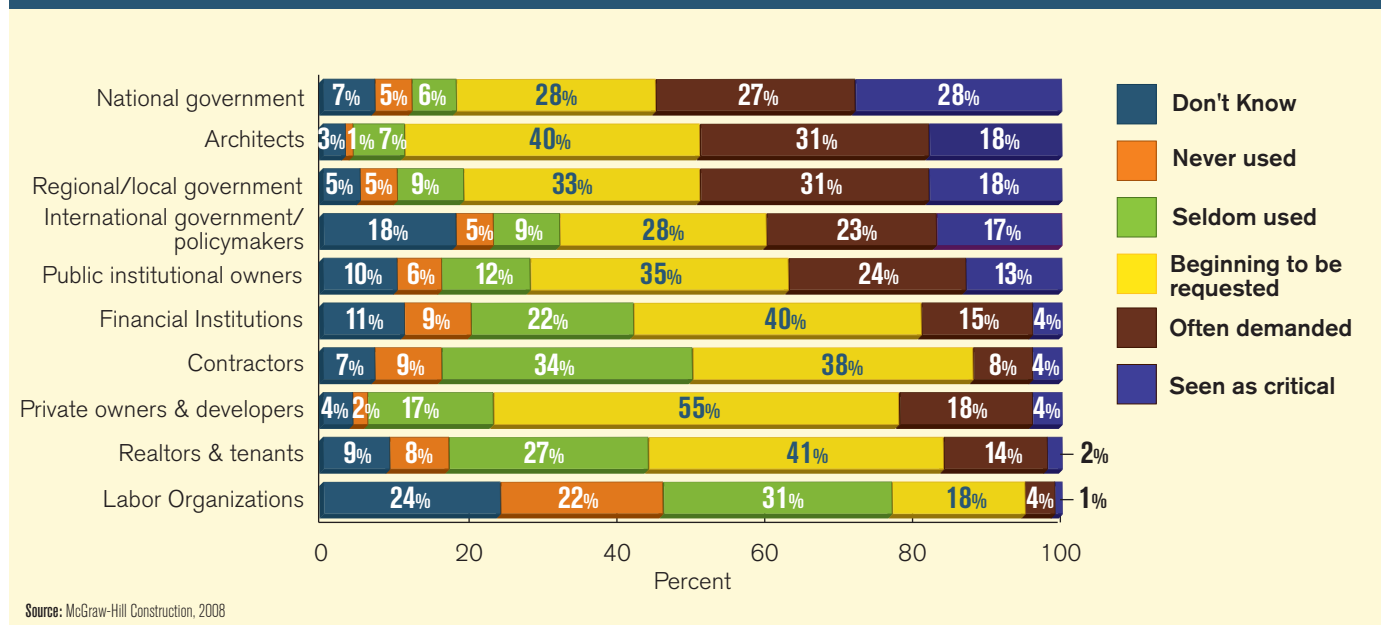
Low National Government Support

- South America: 3%
- Sub-Saharan Africa: 10%

These trends highlight the need for enhanced commitment and action among public-sector groups in developing economies.

Increased levels of government support could greatly help to generate higher levels of market demand for green building products, practices and knowledge throughout industry sectors. This activity would bolster the further expansion of the green building movement in these and other regions.

Importance of Green Building to Stakeholders—Global



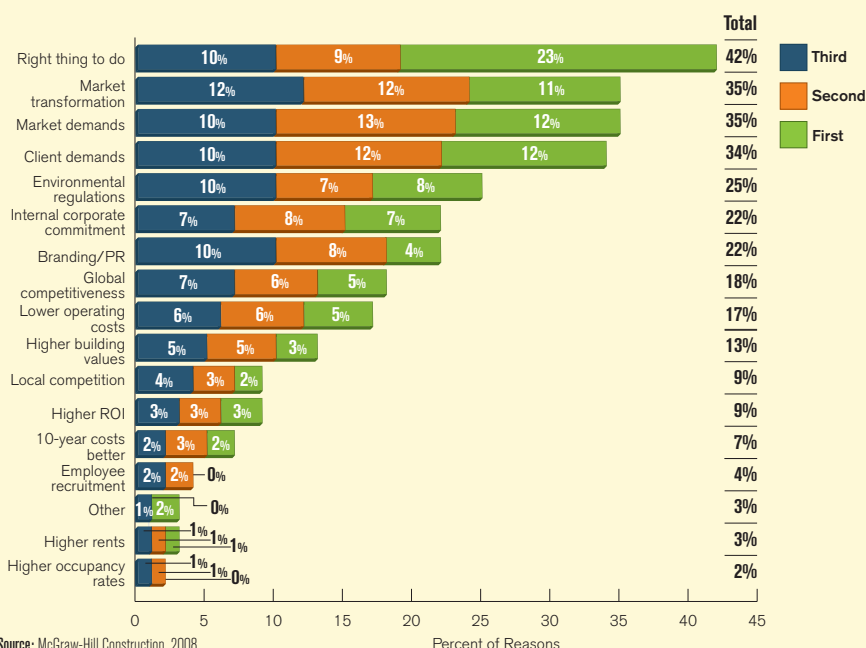
Market Intelligence on Global Green Building

Motivation for Green Building

Globally, practitioners agree on the most important motivators for green building:

- **Top Business Reason:** The right thing to do—cited by 42%.
- **Top Social Reason:** Encourage sustainable business practices—cited by 90%.
- **Top Environmental Reason:** Reduce energy consumption—cited by 89%.

Business Reasons for Green Building—Global



Source: McGraw-Hill Construction, 2008

Business Reasons

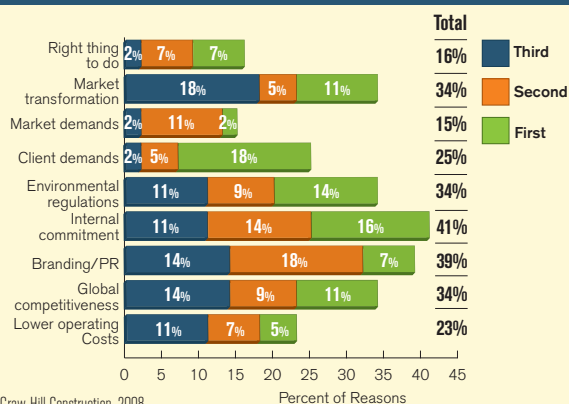
The difference in business reasons leading to green building activity reflects the diversity of regional market conditions and drivers.

- **The right thing to do** is a top concern in every region except Asia.

- **Internal corporate commitment** and **branding/PR** rank higher in Asia (see chart below left).
- **Market and client demands** are the top business motivators in Australia/New Zealand

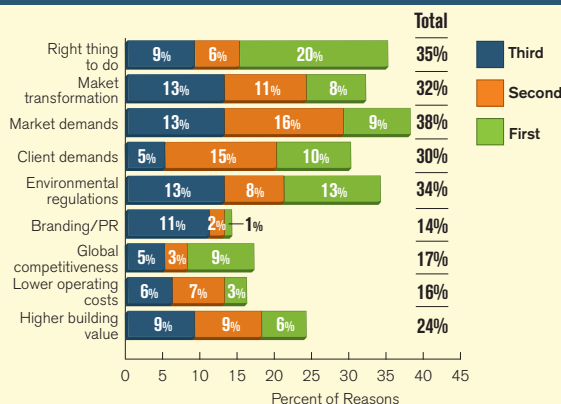
- **Environmental regulations** provide more of a push in regions such as the Middle East/North Africa and Asia.
- **Environmental regulations** and **market demand** are significant factors in driving green building in Europe (see chart below right).

Top Business Reasons for Green Building in Asia



Source: McGraw-Hill Construction, 2008

Top Business Reasons for Green Building in Europe



Social Reasons

There is a general consensus about the top social reasons for green building:

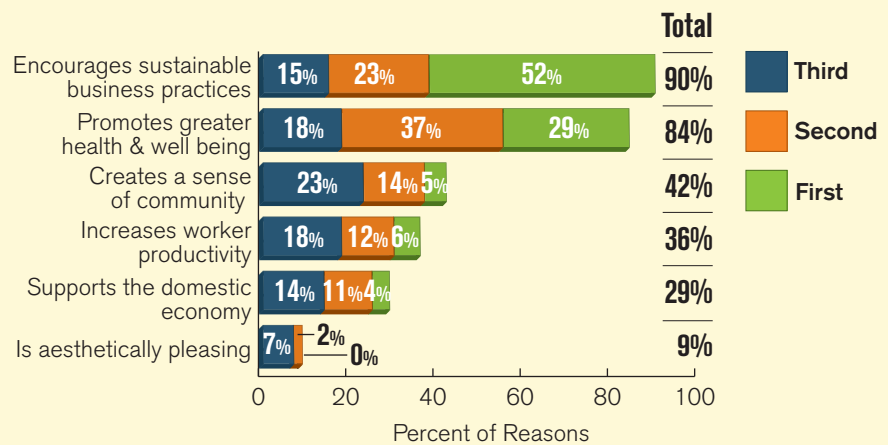
- Encourages sustainable business practices.
- Promotes greater health and well-being.

North America and Australia/New Zealand align closely with these overall trends. Sub-Saharan Africa is the only area that shows marked differences from the overall trends. (see chart below right).

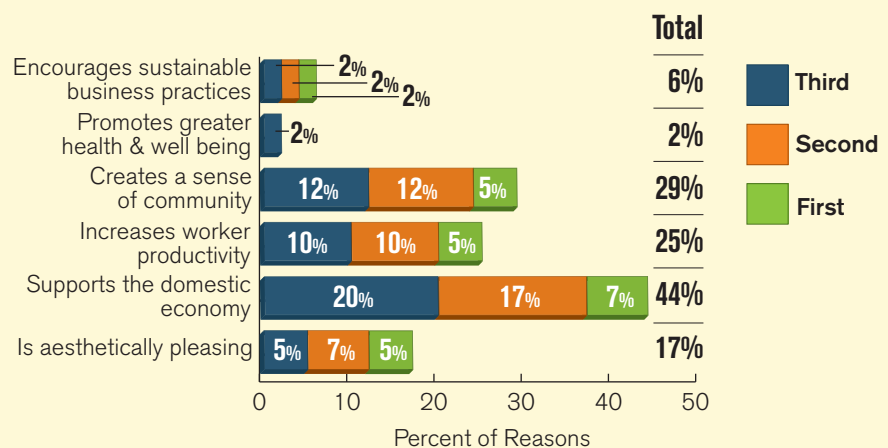
Other Regional Differences

- **Supporting the domestic economy is the top concern in Sub-Saharan Africa**, but it is the least cited concern in Europe, cited by only 11%.
- **Promotes greater health and well-being** is only cited by 2% of respondents in Sub-Saharan Africa and 6% in South America.
- **Increases worker productivity is the top concern in Asia**—cited by 34% of respondents—but ranks lowest in North America, cited by only 10%.
- **Creates a sense of community ranks first only in Europe**, cited by 32% of respondents.

Top Global Social Reasons for Green Building



Top Social Reasons for Green Building in Sub-Saharan Africa



Market Intelligence on Global Green Building

Environmental Reasons

There is a strong global consensus about environmental reasons to build green.

As can be seen in the chart at right:

- **Reduce energy consumption:** Listed as the top reason—cited by 88% of respondents.
- **Lower greenhouse gasses:** It is the next most cited at 65%.
- **Indoor air quality:** Cited by the least respondents at 36%.

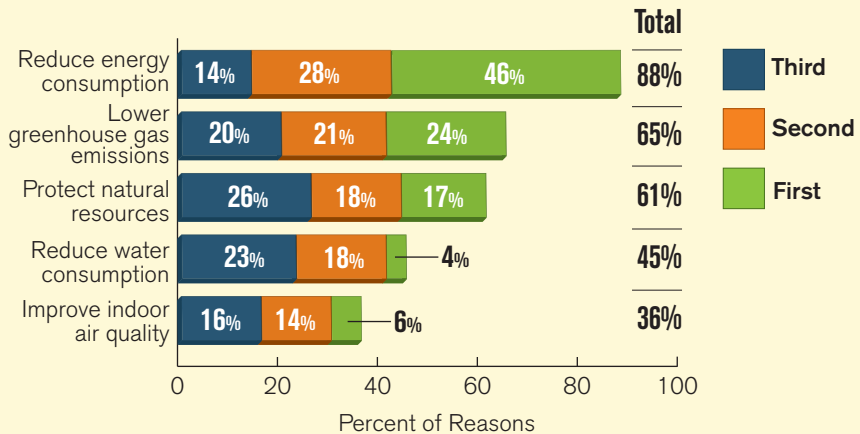
Regional Differences

The largest differences occur in South America, which shows the following reasons:

- **Three-way tie:** Reduce energy consumption, protect natural resources and reduce water consumption, all at 72%.
- **Two-way tie at second:** Lower greenhouse gas emissions and indoor air quality both at 38%.

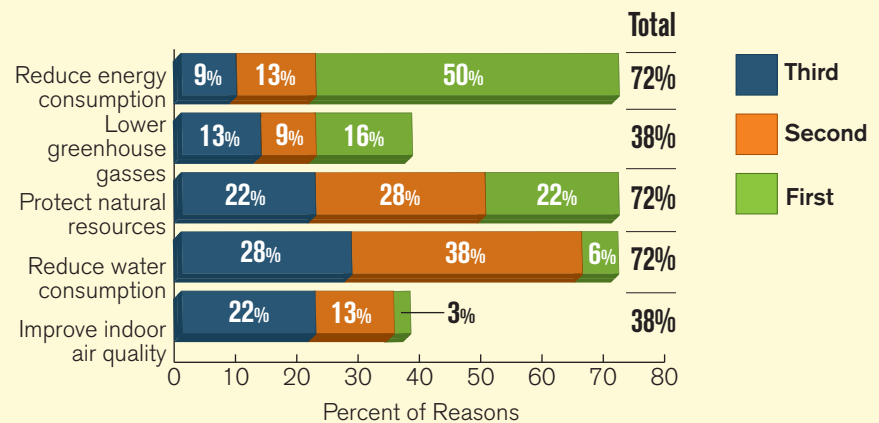
These trends show a lack of clear consensus among early adopters in South America. As the market matures, these reasons may shift more toward the global consensus cited above.

Top Environmental Reasons for Green Building—Global



Source: McGraw-Hill Construction, 2008

Top Environmental Reasons for Green Building—South America



Source: McGraw-Hill Construction, 2008

Overall Obstacles to Market Growth

Green building professionals face a range of obstacles to continued market growth, with the largest focus on costs, accounting and the need for education.

Top Obstacles

- Biggest obstacle is higher first costs (perceived and actual)—cited by 80% of respondents.

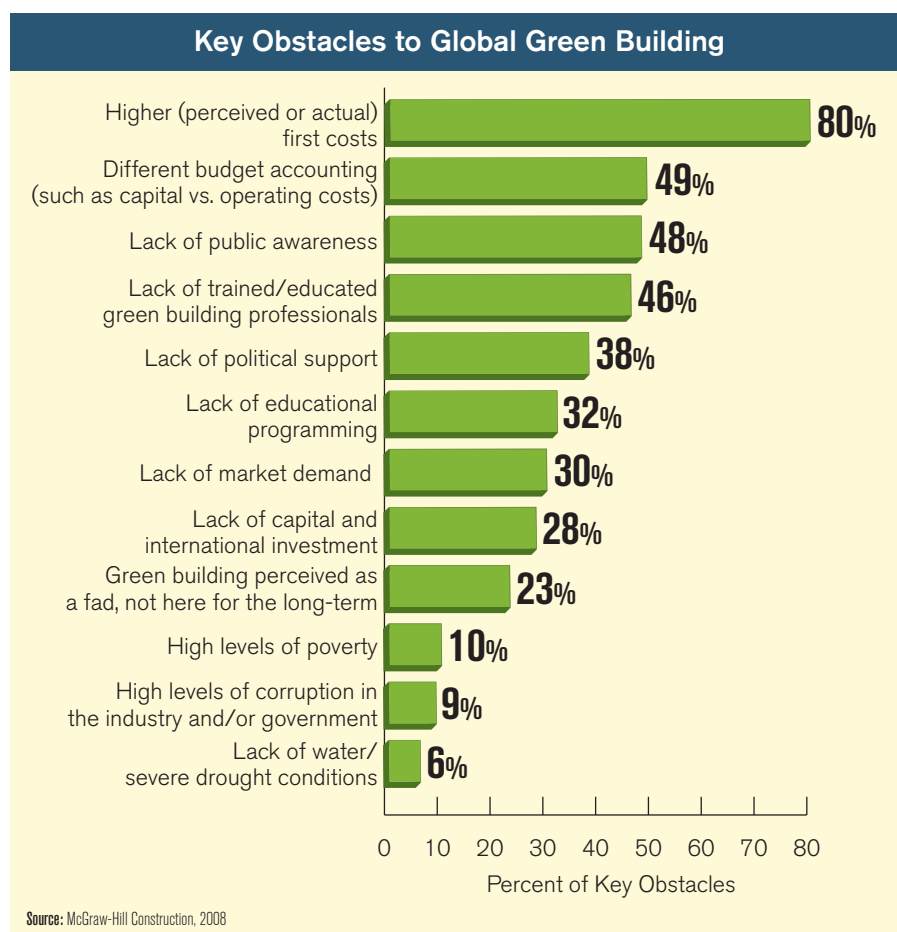
Other obstacles include the following:

- Different budget accounting (49%)
- Lack of public awareness (48%)
- Lack of trained/educated green building professionals (46%)

The industry needs to collaborate to identify solutions to these major areas.

As the market grows, increases in demand for sustainable materials and knowledge may help to lower the costs of these goods, and businesses will transition their operating procedures to accommodate green.

Further awareness will also help educate owners and practitioners about the lifecycle benefits of green building techniques. It will help lead to the increased use and development of green building techniques. This knowledge will help **reduce the perception that green is more expensive.**



Regional Obstacles

The regional differences in market obstacles reflect the broad diversity in economic development and market activity.

Region-Specific Concerns

- **Lack of public awareness** is strongest in Sub-Saharan Africa (62%) and Asia (60%).
- **Lack of trained/educated professionals** is acute in the Middle East/North Africa (72%) and Asia (69%).
- **High levels of poverty** are a concern in Sub-Saharan Africa (59%) and South America (47%).



Bahrain World Trade Center

Courtesy of Atkins

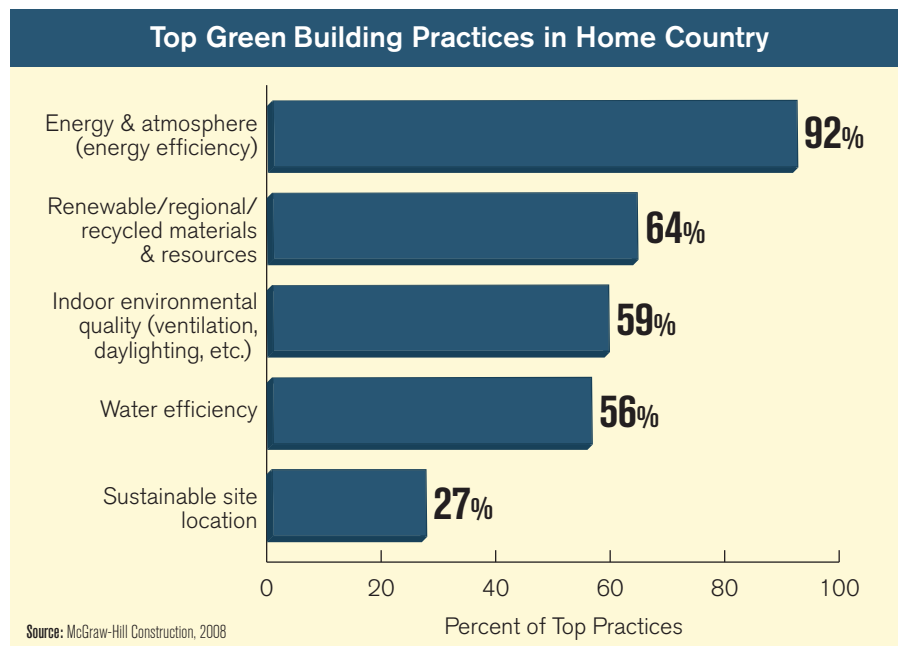
Green Building Practices and Renewable Energy

Most Emphasized Green Practices

Resource efficiency is a dominant theme in green building practices around the world.

Top Trends in Green Practices

- **Energy efficiency** is top in every region—cited by 92% of respondents.
- **Renewable resources** are prominent in Europe—cited by 82%.
- **Water efficiency** is common in Sub-Saharan Africa (74%), Middle East/North Africa (72%) and South America (75%).
- **Indoor environmental quality** ranks second in Australia/New Zealand (71%).
- **Sustainable sites** only prominent in South America (47%).



Renewable Energy

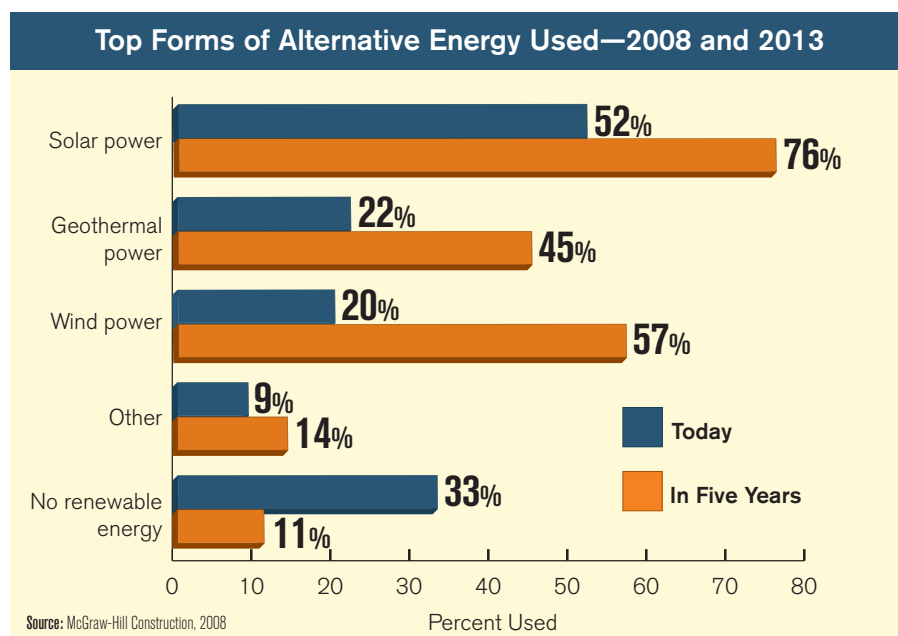
With the significant and widespread emphasis on energy efficiency, **industry professionals are increasingly turning to renewable sources of energy** that are transforming the traditional methods of providing energy for the world's buildings.

Every form of alternative energy is demonstrating growth over the next five years:

- **Solar power** is expected to grow from 52% to 76% in use by industry professionals from 2008 to 2013.
- **Geothermal power** will double in usage, from 22% to 45% in 2013.
- **Wind power** will nearly triple, from 20% use in 2008 to 57% in 2013.
- The percentage of **respondents not using any renewable energy** is expected to decrease from 33% in 2008 to 11% in 2013.

Regional Alternative Energy Growth Trends

All regions demonstrate growth in alternative energy use.



Regional Differences

- **Europe** has the highest current use of solar power (used by 72% of respondents) and geothermal power (used by 43%).
- **Sub-Saharan Africa** expected to see the largest growth in solar

power use—up from 45% use by respondents in 2008 to 84% in 2013.

- **North America** has the highest level of future wind power use, expected to be used by 62% of respondents by 2013.

Water Efficiency in the Desert:

Conserving a Non-Renewable Resource in the Middle East

by Bruce Buckley

The reduction of energy use has long been a central focus of sustainable design and construction. However, as the movement continues to evolve and gain momentum across varying climates and industries, the role of water efficiency has become increasingly important to owners, practitioners and occupants.

This growing trend is particularly important in arid regions and in the developing world, where water shortage is an acute and widespread concern. Below, Bruce Buckley investigates the ways in which the green building community is tackling the problem in one such region—the Middle East.

For many in the Middle East, the most precious resource is not oil—it's water. Rapid urban population growth in areas with limited water sources has spotlighted the urgent demand for water efficiency in the region.

The recent development boom in United Arab Emirates (UAE) is providing a testing ground for water conservation in arid climates that could serve as model in the region. The country averages nearly 5 inches of rainfall per year along its popular coastal areas, with up to 14 inches inland at the higher elevations. Since the 1960s, the country has relied almost entirely on desalinization plants to feed its demand for water.³⁶

Although desalinization can be costly, the Emirati are among the highest consumers of water in the world. The country's water resources are being further strained by the influx of new residents that have followed the massive urban growth in cities such as Dubai and Abu Dhabi. Between 2000 and 2005, UAE's urban areas experienced 6.3% annual growth.³⁷

Last year, UAE officials began to take action. In Abu Dhabi, the city's water agency announced its plans to cut water usage by 37%, with conservation emerging as a key component.³⁸



Masdar Headquarters, Abu Dhabi, UAE

These water efficiency efforts coincide with Dubai's new green building initiative, effective on January 1, 2008. The resolution—announced last year by Shaikh Mohammad Bin Rashid Al Maktoum, vice president and prime minister of the UAE—calls for all commercial and residential buildings to conform with internationally recognized standards. The initiative is the first of its kind in the Middle East. In June, Abu Dhabi's Urban Planning Council released its own set of sustainable design guidelines, called Estidama, which uses a point system to rate buildings.³⁹

Water-efficient elements are already emerging in many of UAE's recent developments. In October 2007, Pacific Controls opened its LEED Platinum headquarters building in Dubai. In addition to green features such as waterless urinals and efficient fixtures, all water in the building is recycled and used for landscaping. Metito, a designer of desalinization systems and water treatment facilities, also opened a LEED Gold headquarters in 2007.⁴⁰

The 1.6-million-square feet Masdar Headquarters building is expected to consume 70% less water than typical

mixed-use buildings of its size. The zero-waste, zero-carbon facility is part of the master-planned Masdar City project near Abu Dhabi, and is expected to be complete in 2010.⁴¹

While many forward-thinking water-efficient projects are located in the UAE, green activity is occurring throughout the entire region. For example, Saudi Arabia is raising the bar with the 5-million-square feet King Abdullah University of Science and Technology project, which will showcase emerging standards for water efficiency. The facilities will achieve a 30% reduction in water use from low-flow fixtures and waterless urinals. Water reuse will have a major impact as well. All condensate from the mechanical systems, all gray water from sinks and showers, all black water from toilets and urinals, and all stormwater on site will be piped to one place. The water will then be treated and piped back to the campus for irrigation purposes.⁴²

Water efficiency efforts will not end with the facilities' design. The university is planned as a major regional hub of research, studying such areas as water resources and conservation.

Image courtesy of MASDAR

Green Building Product Use and Identification

Green Product Installation and Specification

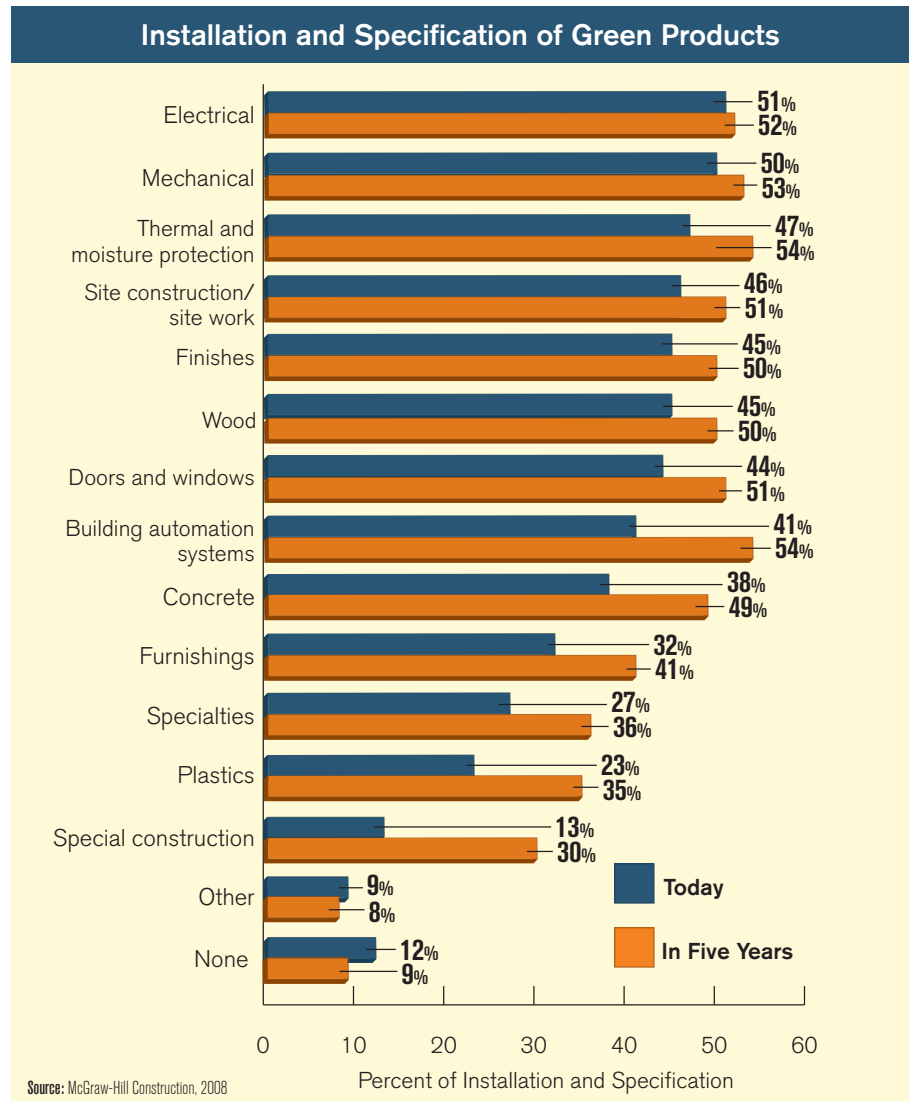
Globally, green building product use is high and growing in every major category, reflecting the expanding green building marketplace and growth of diverse project activity.

Increase in Green Product Use

- The most-used categories will remain strong; the lower six will increase by 25%.
- Overall use of green products is high and growing. By 2013, 91% of respondents expect to be using green products, up from 88% in 2008.

Most-Used Green Products

- **Mechanical and electrical** are the most frequently used products today, installed or specified by over half of respondents.
- **Thermal and moisture protection** products are expected to become the most used product category in 2013.
- **Building automation systems** will show the largest increase in use, jumping from 41% in 2008 to 54% in 2013.



Regional Product Trends

Product use and specification varies widely by region.

North America

It is the region with the highest overall green product use, likely due to comparatively higher access to certified green building products.

South America

It is the region with the lowest overall levels of green product use, with no product cited as used by more than

one third of respondents, and the highest regional ranking of "no green product use."

In five years, 45% of professionals expect to be using green concrete, and 42% will use green electrical products.

Europe

There are no prominent product usage trends, though doors and windows are expected to jump the most, from being installed and specified by 34% of

respondents in 2008 to 48% in 2013 (the most used category in that year).

Middle East/North Africa

Growth is in special construction products. Electrical and mechanical products are the most common today and will remain so in 2013. However, special construction products will see the highest increase, jumping from a low 6% to 36% in the next five years.

Identifying Green Products

In the absence of a widely recognized and reliable third-party certification for green building products, industry professionals are using a range of criteria to identify the best green products.

Most Common Methods of Identifying Green Products

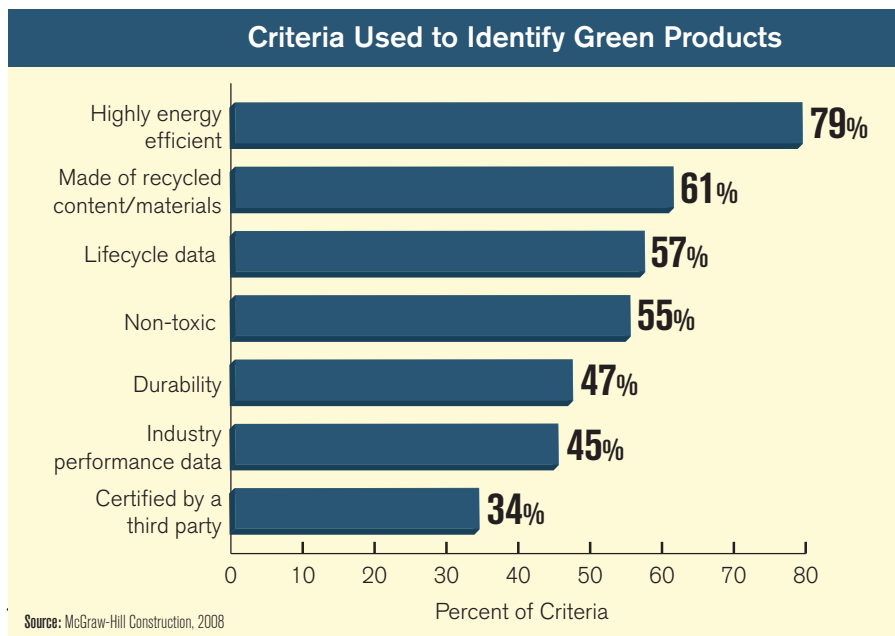
- **Energy efficiency:** Cited by 79% of respondents.
- **Recycled content:** Cited by 61%.

Trends in lifecycle data use and third-party certification are markedly lower in South America, Sub-Saharan Africa, Asia and the Middle East/North Africa. This is likely due to **a significant lack of available green product information in developing regions.**

Third-Party Certification

It is the least used criteria in every region:

- **Middle East/North Africa:** Lowest use at 15% of respondents.
- **South America:** Also low at 17%.
- **North America:** Highest use at 42%.



Third Party Certification

These trends highlight the **universal lack of, and need for, a widely utilized green building product certification program.** As green building continues to gain traction, so will the demand for reliable information about green products.

Increased access to certifiable green products in every region of the world is essential to the further expansion of the global green building movement, particularly in emerging economies and developing green building markets.



Northumbria University's City Campus East

Courtesy of Atkins

International Partnerships and Access to Resources

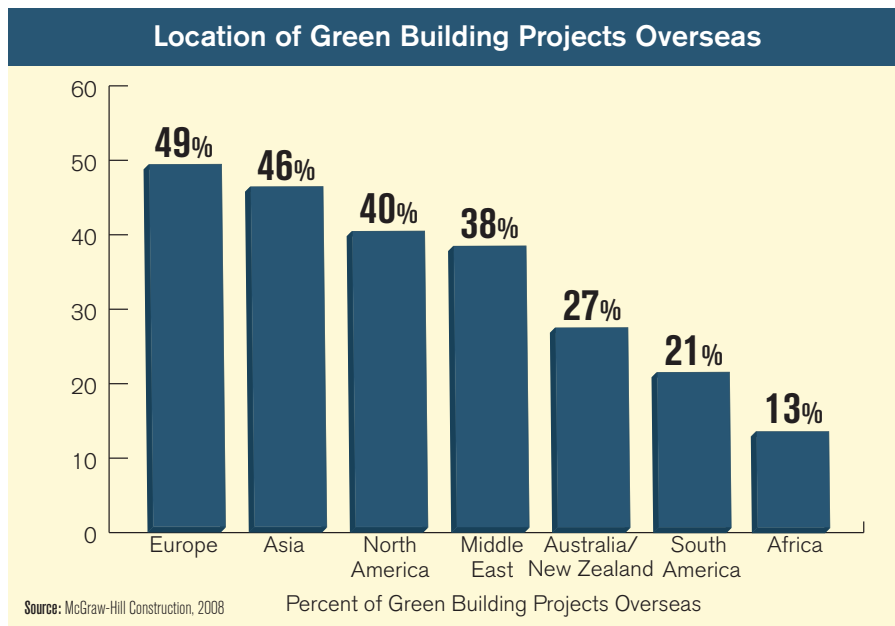
International Partnerships in Green Building

Green building is an international practice in today's global construction marketplace.

- **57% of green building firms are conducting some work overseas.** Of this population, 62% are engaged in **green projects** overseas.
- **Europe is the most common destination for overseas work**, with 49% of firms working internationally conducting some of their green work in Europe.
- **The region with the smallest population of firms conducting green work overseas is Sub-Saharan Africa (20%).**

Partnership Trends

When firms cross the border for projects, they are most likely to partner



with multinational or foreign architecture firms on their international work.

Engineering firms are also common partners, particularly among Asian and European firms working overseas.

Green Building and Workforce

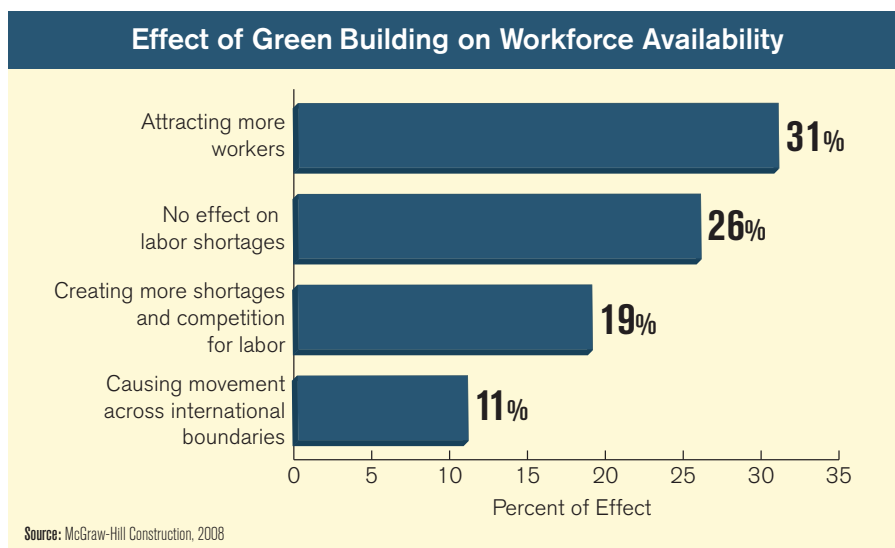
The global industry is split on how it views the connection between green building and labor.

Though 31% perceive that green is helping to attract more workers, 26% see no effect, and 19% find that green is exacerbating labor shortages and increasing competition.

Regional Differences

The lack of consensus is similar across every region, though there are some interesting differences in perspective:

- 46% of practitioners in **North America** see green having a positive impact on attracting more workers.
- The impact is relatively minor in **Australia/New Zealand** (38%).



- In **Europe**, 25% see green building causing increased movement across international boundaries.

This fluctuation in responses highlights the variation in labor concerns across regions, such as "green-collar workers" in North America and open labor borders in the European Union.

Access to Green Building Information

Globally, there is a significant lack of green building information. Among industry professionals, 38% feel that there is not enough information available on the topic. Of those resources that are available, 36% feel that there is not enough region-specific information. This sentiment is strongest in Sub-Saharan Africa, at 66%, followed closely by South America (59%) and Asia (57%).

The Internet serves as the resource used most often for finding information about green building, particularly among respondents in North America, Sub-Saharan Africa and Australia/New Zealand. These trends are indicative of the high level of knowledge sharing across national borders that occurs in the green building marketplace.

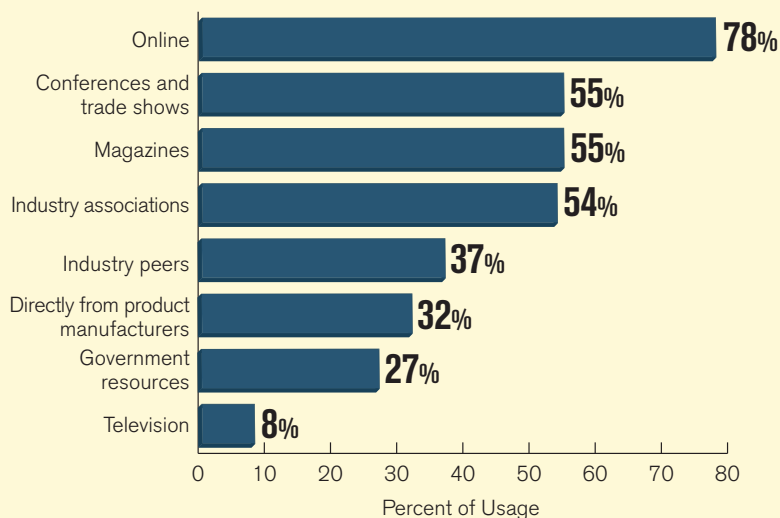
Professionals in the Middle East/North Africa and Australia/New Zealand also tend to rely heavily upon industry associations for information. Meanwhile, very few respondents turn to the government for resources, and hardly any rely upon knowledge gained from television.



Courtesy of Samuel Mupamunda, BP South Africa

Visitor Information Center—BP Headquarters Office Cape Town, South Africa

Most Used Resources for Green Building Information



Source: McGraw-Hill Construction, 2008

Research Methodology

The research in this report was conducted under the direction and management of John DiStefano, Director of MHC Research & Analytics. In this research, MHC sought to gain insight about the size and scope of the green building marketplace worldwide, looking in particular to examine the attitudes, motivations and challenges facing the green building movement in different countries and regions.

MHC used an online survey to conduct data collection between April and May 2008. Email invitations were sent out by WorldGBC and MHC to members of Green Building organizations and construction industry professionals worldwide.

From the sample provided by WorldGBC and MHC a total of 1,503 participants accessed the survey and a total of 703 completed it. The confidence interval was 95% with a margin of error in the range of +/- 5%.

The green building movement was defined as a trend in the construction industry to promote buildings that are environmentally responsible and provide healthy places to live and work. In the survey, the term *green building* was used interchangeably with *sustainable building*, *high performance building*, *environmentally sustainable building* and *whole building* within the construction industry.

Global Perspectives – Thought Leader Interviews

Becoming Green in Asia

In the growing global construction marketplace, the Asia region is demonstrating the fastest pace of market expansion. Over the next three years, China is expected to take the lead, at just over 9% annual growth through 2010. Vietnam is close behind, and India is anticipated to grow 8% per year. In these rapidly developing countries, the pressure and opportunity for conserving energy, water and other natural resources is at an all-time high. However, there are many obstacles facing the adoption of green design and construction in the Asia region. MHC and WorldGBC recently spoke with two Asian industry leaders who have overcome these challenges to lead their markets forward and demonstrate how sustainability can be manageable, marketable and good for the community.



K. B. Albert Chan

K. B. Albert Chan is the Director of Planning and Development at Shui On Land, a public company listed in Hong Kong and headquartered in Shanghai. Chan is currently responsible for the conceptualization and planning of developments by the company, which develops sustainable, community-level projects.

“We are students of sustainability. Every time we build something, we learn something new.”

In a recent interview with Catlin O'Shaughnessy of MHC, Chan shared his experiences in developing green projects in China's booming construction industry.

How did Shui On Land get involved in green building?

We develop whole communities that are always mixed-use and very walkable, and now very sustainable. We didn't [always] realize this kind of community is green. We just did it because it seemed the right thing to do. Then in 2003, we started a sustainable project in reality, and there was an architect friend of ours who introduced us to the idea of sustainability and LEED. So we actually tried and succeeded to get a pre-certification for LEED Platinum.

[After that], we have become interested at the corporate level in doing green projects. In 2005, our chairman and CEO told the company that all of our projects have to be sustainable. So it's part of our mission now.

How did you go about meeting this goal?

The first thing I would say is that we are students of sustainability. I don't think we as a company feel that we have already mastered the implementation or even the ideas of sustainability.

Through the development of projects we build up [our] capability. Every time we build something, whether it's interior or office building or retail building or resi-

dential building, we learn something new. And we try to share with other companies.

What kinds of challenges did you face as you became a green building company?

In China, it's really not that easy. The materials have to be in place, the methods have to be in place. Here, in this part of the world, we have very few sustainable consultants to help us. Also, with the building materials, there have been some materials that say “green” and all that, but it's not enough. It's quality that's quite difficult [to find].

Cost is also definitely a very basic challenge that has to be overcome. When you tell people to use only certain types of materials and these materials sometimes are not very available, it becomes more expensive. And it's a hard sell.

How has Shui On overcome these challenges?

We follow certain principles of sustainability—we try to get local materials, because local is always more sustainable. [Also], we used a sustainable development consultant to help us assess projects, set goals, give us ideas and actually apply for the LEED rating. It's a gradual process. It's not [a situation] where suddenly you learn everything.

What else needs to be done to foster the growth of China's green building market?

We need to set some standards that are understandable and implementable. [Also], if the government sets some standards, then there will be demand for [green] materials and construction methods, and then the prices will come down.

In China there's so much development that if everyone could try in their own little way, then it would really help a lot. I think the mentality is there; it just has to be shifted to some concrete direction.



Parasu Raman

Parasu Raman is the CEO of BMTC, a leading provider of electrical, water and lighting solutions to the construction sector. Raman is also the founder and immediate past chair of the India Green Building Council, as well as the founding vice chairman of the WorldGBC.

In a recent interview with Melissa Ferrato-Jacobs of the WorldGBC, Raman shared his perspectives on the challenges and direction of India's growing green building marketplace.

How did you first get involved in green building?

My business was very active within the Confederation of Indian Industry (CII). Since the liberalization in India, when India opened up its economy in the early 1990s, CII has played a major role in making India competitive globally. In the late 1990s, I was asked to head up the national committee on construction. Our mandate was to bring changes within the construction sector.

With this in mind, we created an organization called the CII Sohrabji Godrej Green Business Center in Hyderabad. This unit, the CII Green Business Centre, was driving corporations to shift their attitude towards energy conservation, renewable energy, water and waste management, and green buildings. So it was kind of a natural extension that I was chairman of the national

committee on construction, and I became the founding chairman of the India Green Building Council.

Did you find that industry firms were responsive to CII's efforts?

I think that the corporations that were more stock-market active were more willing to subscribe to the ideas of sustainability.

One of CII's responsibilities was to drive best global practices into Indian industry so that they could be globally competitive. I think that this had an effect, because when a business is global in terms of its management policies and in terms of its day-to-day practices, it will look at what it can do beyond the obvious; that is where people begin to subscribe to sustainability.

Did you come across any major obstacles in getting green building accepted?

The first few green building projects were truly corporate, like the ITC building and our own building. Therefore, our focus was really to drive home the fact that what you are doing is not only for charity or the social good, but also makes economic sense. One of our slogans was "green makes business sense."

We [wanted to] lead the way for industry, demonstrate the economic value and create an example of leadership—encouraging the rest of the country to follow. So we established the fact that corporations believe [green] makes good business sense. Very quickly, the developing community took it up.

What are the major challenges for green building firms in India?

[Today], the challenges are on the supply side. There is a wealth of support [for] green building, but we need more practitioners in terms of contractors, consultants and architects. But there is a belief by all of the stakeholders that it is the right thing to do and it makes business sense.

Where does India's green building market stand with regard to the global movement?

There is still [a lot of] learning to do in terms of tools. Best practices and execution are still coming from the West, particularly the U.S. But in terms of demand, it is growing exponentially. In order to accelerate the market transformation, we adopted LEED as LEED India, which we launched a couple of years back. All projects are now being certified as LEED India.

What will help the global green building movement continue to grow?

When analyzing all of the different models of green building councils around the world, you will see that in some places, governments play a bigger role than others. In the long run, it would be beneficial for governments to lay down minimum benchmarks of building performance for all sectors of buildings, and then the gap between that and excellence must be driven by the [national] Green Building Councils and supported by the WorldGBC. [We should] move the minimum standard of excellence through market-driven activity rather than through legislation.

"There is a wealth of support for green building, but we need more practitioners."

Global Perspectives – Thought Leader Interviews

Australia's Green Building Movement



Maria Atkinson

“Having world leaders and city mayors calling for green buildings has made [this] a real movement.”

Maria Atkinson is the global head of sustainability at Lend Lease. Based in the Sydney office, Atkinson leads the company's efforts toward becoming a sustainable organization.

Prior to her current appointment, Atkinson helped foster the growth of Australia's green building movement as the co-founder and founding CEO of Green Building Council Australia (GBCA) and as the manager of Bovis Lend Lease's Environment and Sustainable Development team. Atkinson is a Board member of the Australian Building Codes Board and the Banksia Environmental Foundation, and a member of the Barton Group.

Dominika Czerwinska of the WorldGBC spoke with Atkinson about her perspectives on the green building movement at Lend Lease, in Australia and on a global scale.

Where do you think Australia stands in the green building movement with regard to the international spectrum?

Australia is a global leader. I have recently realized how much the Australian market has really taken to green building. The Asia Pacific region has had growth in new property development [similar to] some countries in the EU where there is a high rate of new development.

In Australia, there are many buildings that have applied innovation and have gone beyond just the first shade of green. These buildings have gone to the [LEED] Platinum level, and the innovation that's been applied is easy, affordable, and it is being delivered.

Australia is leading because we have had the opportunity to apply innovation and recognize that [the green movement] is inevitable. We have developed the skills within the industry to apply it.

What regional or political factors do you see impacting the growth of green building in your region?

I think [the green building movement] is entirely about political factors. Having world leaders and city mayors calling for green buildings and celebrating green buildings has made it a real movement.

[This movement] is not separate from politics—it is politics. So while all the politicians and world leaders keep talking about the built environment, I think we have a real political impetus for the property sector to be responding to [climate change concerns]. It is critical that there is a political conversation and a call to action.

How did Lend Lease get involved with green building? What motivators and drivers spurred your involvement?

Well, [Lend Lease] is 50 years old, and it had been located in what used to be the tallest building [in Sydney]. So when the organization relocated, it needed to move to another iconic building. It just happened to be at a time, following the Sydney Olympics, when the trend was to build green. No one really knew how to do this in Australia, so the organization set out to effectively identify what was a green building and then developed these elements into our own new headquarters.

There was some anxiety that the employees wouldn't like the new location because it was [further away] and such a dramatic change, so the organization went about interviewing [staff] to identify what kinds of things they wanted to see in the new building.

It was remarkable because the majority of the people said they wanted a green building that was energy-efficient [and] that they wanted natural light and

100% fresh air. So it was actually the employees who wanted this in the new office space.

What are the major obstacles your firm has faced in growing your involvement in green building?

I think in construction the biggest challenge is a building cycle. To design a building, construct it and then go back and test it after it has been occupied for a year, is at least a three-year if not a five-year cycle. So there is a slow pace of learning, and our industry traditionally learns by applying. The learning is slow, and it takes time.

In 2005, we only had five people in the world out of our 11,000 employees that had green building certified training. Now we have 735. So we have been working at just getting people to take courses, getting them trained and aware, and getting people to experience innovation on real projects. All of that has taken time.

How has Lend Lease's involvement in green impacted your business?

I think we are in a movement now where people are trying to find us, and we are trying to find them. We have gone through a ten-year period of trying to sell green to clients, and it has been particularly difficult in the U.S. market because our construction business doesn't control design, whereas our UK and Australian business does a lot of the design control. When you are controlling design you can control the building easily, but if you are just the builder you are very limited to the outcomes and the influence in the food chain.

So for the U.S. market, it's been an interesting challenge. But the really interesting thing is the high projection on the rate of growth of green buildings in the U.S. Our market will diminish if we are not in green buildings. It's not a "nice to have" for new clients—for our U.S. market, if we aren't in green building, we aren't in business.

What is next for green building?

I think the biggest challenge at the moment for the green building movement is to be included in emissions trading schemes rather than to be ignored.

There is a strong legal and economic dialogue around emissions trading schemes and a significant opportunity for allowing energy efficiency within buildings to be recognized as a carbon credit. That would provide a financial incentive to overcome that split incentive barrier [between developers and owners].

Any predictions for the future?

I really think the international movement is the next big thing, where we can compare buildings in London, New York and Sydney. Although they will have different climatic obstacles and issues, they should still share the same kind of rating that we can recognize internationally.

I think that it's a wonderful movement to be associated with, and we will end up with a brand and a label that perhaps the average person on the street will recognize and seek out. You want to work in a green building, you want to live in a green building, you want to play in a green building.

“You want to work in a green building, you want to live in a green building, you want to play in a green building.”

Global Perspectives – Thought Leader Interviews

Corporate Green Building in South Africa



Interview with Eric Noir, BP Head Office in Cape Town, South Africa

Eric Noir is the Principal Architect and Director of Green by Design based in Johannesburg, South Africa. Noir specializes in sustainable built environment designs, urban development frameworks, development strategies and design. In 1999, he earned praise for his work designing sustainable public bathhouses in South Africa's townships.

Green by Design served as sustainable consultants to KrugerRoos Architects Urban Designers for the BP Head Office Building in Cape Town, South Africa.

Catlin O'Shaughnessy of MHC recently interviewed Noir about his experiences on the project and his perspectives on the growing green building movement in Southern Africa.

How did you become involved with green building?

It came really out of my own willingness to go into the sustainable field [about] five years ago when there was no information, no movement, no willingness from anywhere [to get involved in green building]. There was a little bit of what I call "environmental activism," but nothing of a more mainstream nature.

That's how Green by Design came about. I made it a commitment to go into that field and to consult to architects and professional teams on the field of sustainability in the built environment.

So where did your knowledge of green design come from?

The interesting part is that none of what I do in sustainability here comes from my background [growing up in] Geneva. It's purely grown [in South Africa]. I found myself working in a complete vacuum here. I couldn't find information [on sustainable practices]. There was nothing here—no interlocutor, no coursework, no books, no mentors, nothing.

South Africa was also grappling with far greater issues than the environment. I created Green by Design as a one-man-show practice, and have been consulting in sustainability ever since.

What has changed between then and now? How did green building take root in South Africa?

There are early examples of sustainable practices, which would kind of be dots on the historical radar. Dieter Holm, who taught at the University of Pretoria about sustainability and passive solar design for the last 30 years, is without a doubt the grandfather of sustainable architecture in South Africa.

And there is the Eastgate Building, designed in 1994 in Harare, Zimbabwe,

and BeauTech in Botswana. Then the BP building came about, and it's very interesting how things have changed rapidly over the last couple of years. The BP building has been certainly one of the catalyst buildings in showing what it is possible in an A-Grade office building.

How did the BP Head Office project develop? What was your role?

The BP building design came about in what was originally a competition. BP had asked Arup from the UK to write a RED brief—Resource Efficiency in Design—which was really a remarkable document in many respects.

I got involved at the competition stage with the architect, and we ended up winning the competition and developing the building. I was the environmental architect consulting to the professional team on sustainability.

What local concerns did you take into consideration for this building?

The key element was the recognition of the local climate. The Cape Town weather is interesting: It's dry in summer and wet in winter, which [poses complex challenges]. There is a cycle in that we can simply take air from outside, push it right through the building, and pump it right back into the outside air. Through this, we get fresh air for a substantial portion of the time in the year—I think it's a phenomenal benefit.

Did you come across any unexpected design challenges?

We had to build green within a conventional A-Grade office budget, which was non-negotiable, so the challenge was to try to fit as much as we could within the budget. That took its toll on many things.

Certain elements did cost more, but we managed to fit that within the budgetary envelope in the sense of having less expensive marble façade, for instance. There was also a tight time frame. Certainly, with a long time frame, we would have been in a position to deliver a more carefully researched building. Nevertheless, I think it's an excellent building.

What impact has the building had on local green building?

With BP, their drive came from abroad. The local components of BP were responding to concerns from elsewhere, so that was good in terms of helping drive this building to become a reality. Since then, we've found a lot of the local companies have started to catch up, and they need to do it for themselves, for their own good.

Although this building is not an "accredited building" we have made a broad-based claims, where a lot of the concerns were not just energy and water, but also local employment and those kind of things.

It really makes the BP building a benchmark—it is apparently *the* benchmark for South Africa. If you want to do anything in sustainability, look at what the BP building has done, and try to calibrate or rate yourself against that as a point of comparison.

Do you see green building in South Africa continuing to grow in the near future?

Oh, yeah. You can't build normally anymore. Everybody has to have some kind of [green] element in their building, and we've seen that. One bank comes to you, and the next thing you know, you've got three banks coming to you—and after the banks, the retailers, and then public corporations, and then the government.

What will it take to help the green building movement grow in South Africa?

It's very interesting to see—with regard to sustainability in Europe. Typically what is not legislated or subsidized doesn't happen. They have adopted this assisted mentality. **The beauty of South Africa is that [green building] is voluntary**—it's not legislated, so nothing forces you to do it.

There are no subsidies. We don't have to do it and it can cost more, but people are doing it because it's a good thing to do. And they're doing it because they're getting marketing mileage or other kinds of [benefits] out of it. But it's a very, very interesting market. It's completely voluntary, and it's entirely led by the private sector.



Entrance—BP Head Office, Cape Town, South Africa

“You can’t build normally anymore. Everybody has to have some kind of [green] element in their building.”

Project Overview

BP Head Office

V&A Waterfront, Cape Town
South Africa

Project Profile

Owner: BP South Africa

Developer: Victoria & Alfred Waterfront Company

Architects: KrugerRoos and JoshuaConrad

Environmental Consultant: GREEN by DESIGN

Start Date: September 2003

Completion: November 2004

Green Features:

- Solar thermal panels provide heated water for fixtures
- Roof lanterns for natural lighting and minimizing solar gains
- Natural ventilation units in each of the three building wings
- Grey water tank
- Stormwater recovery from the roof
- Photovoltaic panels providing more than 10% of required energy
- Recessed facades, shading and insulation to help minimize heat gains in summer and maximize winter sun contributions.⁴³



Lanterns and Photovoltaic Cells—BP Head Office, Cape Town, South Africa

Images this page courtesy of Samuel Mupanemunda, BP South Africa

Global Perspectives – Exemplary Green Buildings

Groundbreaking LEED Projects in North and South America

The HSBC headquarter building in Mexico City has gained global recognition for groundbreaking achievement as the first LEED Gold certified building in Mexico and Latin America. However, it is the social side of the experience that Cesar Trevino, the project's LEED Consultant, wants to talk about. **“The human part is as relevant as the technical element.”**

Trevino describes the challenge of bringing USGBC's LEED rating system to a building in Mexico: “We had a big learning process which required and demanded a lot of effort for individuals on our team.” Though the project team was made up of multinational companies such as HSBC Bank (the owner), AKF Engineering and HOK Architects, the majority of the on-site workers were Mexican nationals. “We had Spanish-speaking workers trying to build according to a rating system written in English.”

The team experienced other challenges in the process as well, including initial skepticism and concern over how certification might impact project budgets and timing. However, the group was able to pull together and focus on the ultimate goal of providing a superior workplace for HSBC and a beacon of hope to Mexico's fledgling green building industry.

“The key to success was having a client who was well informed about the benefits of green building. Eventually, our team gained confidence as they saw results, and we gained momentum as a group. We all evolved personally and professionally,” said Trevino.

The team worked vigorously to achieve project certification, holding more than 200 weekly meetings throughout the building process to document LEED requirements.

Project Overview

HSBC Headquarters Building

Mexico City, Mexico

Project Profile

Project Owner: HSBC Bank

Architect: HOK

Project Type: Commercial Office

Total Area: 855,000 square feet

Height: 32 Story
(includes 12 parking levels)

Rating: LEED Gold Certification
(first in Mexico)



Green Features:

- 4,000 square foot green roof
- Highly reflective surfaces
- Grey water treatment plant and stormwater tank
- Waterless urinals and low-flow fixtures
- 95% of solid waste diverted from landfill during construction
- Low partitions and clear walls to enhance daylighting for all occupants
- Controllable lighting and thermal comfort controls
- CFC- and Halon-free HVAC and appliances



Trevino has seen the benefits of this commitment unfold in the form of business opportunities for the groups involved as well as an impetus to further growth among the local green building community. “The ripple effect is very amazing. These kinds of projects are really pushing the envelope, creating a general motivation. **We are making a real breakthrough in the marketplace.**”⁴⁴

Images courtesy of HOK Architects and Adrian Wilson

Project Overview

Toronto and Region Conservation Authority (TRCA)'s Restoration Services Center

Living City Campus, Vaughan, Ontario

Project Profile

Client: Toronto and Region Conservation Authority

Architect: Montgomery Sisam Architects Inc.

Principal Contractor: Percon Construction Inc.

Start Date: April 2006

Completion Date: April 2007

Awards: Ontario's first LEED Platinum Building, Recipient of 2007 Green Design Award from Ontario Wood Works (Canadian Wood Council)

For more than forty years, the Toronto and Region Conservation Authority (TRCA) has been protecting the renewable resources within its watersheds. Developing a "Living City" where TRCA can provide harmony between the region's nine watersheds and three million residents, is a key initiative in the growing area.

In 2007, TRCA opened a new green facility to reflect their commitment to a sustainable environment. Construction on the new Restoration Services Center broke ground in 2006, and the recent completion of the green building is a ground-breaking example of hopes for the Living City.

The new office space uses a variety of recycled materials expected to save 57% annually on energy. These green materials include reclaimed brick, crushed concrete instead of asphalt, FSC-certified wood and abundant natural light.⁴⁵

The ventilation of the center is provided by a combination of a ground source heat pump (GSHP) and radiant slab heating with ventilators.

The office has also pledged to buy electrical power for two years from a local supplier of renewable power. The center's irrigation system works to



maintain the same protection of its own water as the local rivers. Indoor water use is decreased by 89% with waterless urinals, low-flow lavatories and composting toilets. Rainwater is contracted from the roof of the facility and transported to a pond, which then redirects it to plants on the thriving landscape.⁴⁶

As the first LEED Platinum building in Ontario, the Restoration Services Center serves as a beacon for the Living City and for future buildings planned in the region.



Global Perspectives – Exemplary Green Buildings

Green Buildings Across Europe

A Green Building Heritage

Historically, European sustainability initiatives have raised the bar for the global effort. Given their higher energy bills and cooler climates, Scandinavia, Germany, Austria and Britain have been the source of many cutting-edge ideas.

Europe is responsible for several key contributions to the global green building movement, including the Passivhaus Concept (see page 43). According to Frank Faraday at the European Construction Industry Federation (FIEC), “The Passivehaus model is very much the starting point for the sustainable building movement in Europe and is the model in vogue in many EU states.”⁴⁷

Another leading player has been British-based design firm Arup, which has incorporated a number of sustainable measures in a series of corporate headquarters buildings. By working directly with willing owners, rather than speculative developers, Arup used a holistic design approach. According to director Chris Twinn, “[Arup’s] low-energy, customized approach enabled us to shift money around in the capital budget, and take money out of the HVAC/mechanical system and devote it to a wider arc of design and greater floor area.”⁴⁸

Innovation from designers, contractors and engineers across Eastern and Western Europe has provided leadership for green building around the world. This is evident in the array of sustainable projects around the region, ranging from first-class green public buildings to sustainable corporate headquarters and highly efficient homes.

Project Overview

Umweltbundesamt (Federal Environment Agency Building)

Dessau, Germany

Sauerbruch Hutton Architects

The Office for the Ministry of the Environment (UBA) in Dessau, Germany, is an exemplary case of European environmental design. The building, started in 2001 and completed in 2005, was designed by Sauerbruch Hutton Architects and is a pilot project for the new German certification system. The owners have contracted a local group to oversee the sustainability of materials and construction for the lifecycle assessment of the building and for monitoring of the indoor air quality and indoor climate conditions.⁴⁹

One of the key green features of the building was the site selection. The building was constructed in Dessau’s former “Gas Quarter” in order to demonstrate the possibilities and challenges of working with a brown-field site. The surrounding contaminated area has been treated, and the existing Worlitzer railway station, as well as parts of a former gas appliances factory, will eventually be incorporated into the complex.⁵⁰

The building has been designed to be accessible to the public, featuring amenities such as a library, information center and convention hall. These features have transformed the whole

area into a public park for the city. The UBA Forum, a crescent-shaped space which acts to draw the park into the building where visitors enter, links the public areas to the offices themselves. A landscaped atrium, which opens to the various departments of the Ministry, leads to the offices for the Ministry of the Environment.⁵¹

The compact volume of the building combines with thermal insulation and renewable energy resources to reduce energy consumption. The Umweltbundesamt also contains low-VOC materials to enhance indoor air quality for inhabitants.⁵²



Image courtesy of Bitterbrecht.de

Project Overview

Jubilee Library

Brighton, England

Following its opening in 2005, the Jubilee Library in Brighton has been praised for green design and efficient performance. However, the most interesting feature is the relatively low price tag. At £9 million (\$17.6 million), the library is a stylish, affordable example of sustainable design for public space.

Jubilee Library received a BREEAM excellent rating for a design that features a wind-assisted passive ventilation system, top quality local material and toilets that flush with recycled rainwater.

The building is part of a larger-scale city square redevelopment plan aimed at reinstating the original public square and street pattern. The plan exemplifies the kind of holistic, multi-scaled approach associated with the integrated design process.⁵³



Project Profile

Client: Brighton & Hove City Council

Developer: NUPPP Fund (Mill Group/Norwich Union joint venture)

Architect: Bennetts Associates/Lomax Cassidy Edwards

Principal Contractor: Rok

Start Date: 1999

Completion Date: 2005



Awards: South East England RIBA Award 2005, Operational project with the best design—2005 PFI Awards, BSJ/CIBSE Major Project of the Year.⁵⁴

Images courtesy of Peter Cook/View

Project Overview

Sustainable House

Poland

2007 marked the completion of an innovative sustainable house (Dom Ekologiczny) designed by Polish architect Piotr Kuczia. The house offers several elements of green design, including:

- Green roof
- Raw, untreated wood
- Dark-colored surfaces to absorb heat
- Lower level built from cement bricks and durable wood
- Outer envelope covered by eight inches of thermo-insulating material, allowing for zero heat escape
- Open concept, bottom level 574 square feet, narrow stairways and few hallways to maximize space
- Clay wall installation to regulate humidity and heat and to facilitate natural air flow



- Water heated via solar panels
- Washrooms with white glass on walls and exposed concrete floors
- Advanced ventilation and heat exchange system

The building will be used as a case study, with progress tracked by the Slask and Wroclaw Schools of Engineering.⁵⁵



Images Courtesy of Piotr Kuczia

Global Perspectives – Exemplary Green Buildings

The Middle East Region: Green Design Trends of the Future

Project Overview

The 2030 Plan and the Masdar City Initiative

Abu Dhabi, United Arab Emirates

Abu Dhabi's population is expected to triple to 3.1 million by the year 2030. In anticipation of this growth, the Emirate has established a long-range 2030 development plan, which incorporates elements to ensure that the development of the state stays environmentally and culturally appropriate.

The Masdar Initiative was first developed separately from the 2030 plan, but the two have become intertwined and mutually reinforcing. The initiative is a \$22 billion investment financed in part by private partners and the government. The prize element of the initiative is Masdar City, a zero-carbon, six-square-km “carbon-free city within a city.”⁵⁶

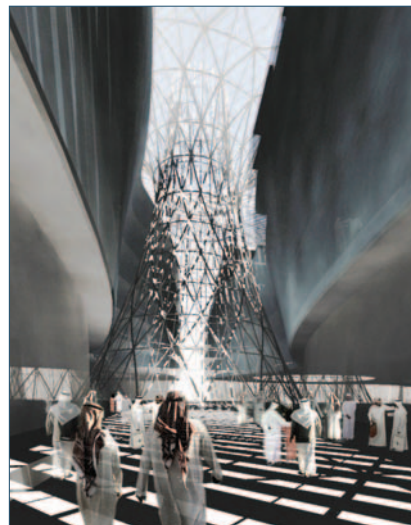
Key Features

- Self-sustaining community with 1,500 businesses
- Completely car-free
- Emphasis on cultural diversity, with 80% of the 50,000 eventual inhabitants expected to be ex-patriates from outside the UAE
- Expected completion date of 2016
- No financial carbon offsets⁵⁷

Designed by Norman Foster, Masdar City will be located near Abu Dhabi. Some of the challenges facing the construction of the city include how to design a layout and structures that are architecturally congruent with both a modern feel, and the historical structures of the Middle East.



The model also needs to be flexible and adaptive to new and future technologies that may arise between now and the opening in 2016, as well as to new innovations that may arise beyond that. One of the project's major challenges was obtaining buy-ins for renewable energy due to the cheap cost of power in the region. The government has worked around this by incrementally raising the cost of energy in order to encourage the use of alternative energy sources.⁵⁸



Images this page courtesy of MASDAR

Project Overview

The Central Bank of Kuwait

Sharq, Kuwait City, Kuwait

Project Profile

Construction Started: 2005

Location: Sharq, Kuwait City, Kuwait

Estimated Investment: \$230 million

Height to Rooftop: 240 meters

Floors: 40

Office Area: 130,000 square meters

Sponsors: Central Bank of Kuwait, Project Management and Control (Kuwait), DMJM (USA)

Architects, Designers, Contractors:

HOK UK, Roberts and Partners, Pan Arab Consulting Engineers, Davis Langdon Schumann Smith, Hyder, TPS Consult, Jeremy Gardner Associates, Hilson Moran Partnership, Ltd.

In June 2003, HOK of London won the design, construction and supervision contract to oversee the expansion of the Central Bank of Kuwait (CBK) to its new headquarters on a site adjacent to the Al-Babtain Central Library of Arabic Poetry and the Office of the State Minister for Parliamentary Affairs. Founded in 1968, the CBK replaced the Kuwait Monetary Council and has since rapidly developed into a organization dedicated to the expansion of domestic and international economic development.⁵⁹

The 40-story tower of the CBK will stand 240 meters tall, topped with a glass pyramid and equipped with the latest high-tech tools and building technologies. In a city that continues to produce some of the world's most sophisticated architectural designs, the triangular-shaped tower is expected to dominate the Kuwait City skyline as a geometric complement to the nearby Ben Khamis Mosque.

Design and construction of the CBK tower involves importing stone for the city-facing south walls, which will absorb the desert sun during the day and later harness that stored heat during the evening. In addition, the tower's north-facing walls will have solar-controlled, double-glazed glass that will offer

expansive views of the Gulf and allow for energy conservation.

With excavation, shoring, dewatering and construction of a new electrical substation and site offices already completed, 1,600 workers from the China State Construction Engineering Corporation will begin site logistics to construct the main building structure, electromechanical services and finishes that include hard and soft landscaping and external fencing. The tower is expected to be completed in 2010.⁶⁰



Images this page courtesy of HOK International

Evolution of Green Building

The Founding Actions of the Green Building Movement

The current level of global environmental consciousness was not formed gently or gradually. Instead, it was jolted into being by a series of forces: revelation, agitation and legislation.

Revelation: Rachel Carson's book *Silent Spring*, published in 1962, warned of the dangers to wildlife—and possibly to humans—posed by DDT, a commonly used pesticide. Meanwhile, the tanker Torrey Canyon ran aground off Britain, spilling more than 500,000 barrels of oil on the coast of Cornwall.

Agitation: In 1965, the Sierra Club sued a utility to stop a proposed pumped-storage hydropower project at Storm King Mountain in New York's Hudson Valley on environmental grounds. This case represented the first time that a court recognized the right to sue over non-economic interests. The following year, the Sierra Club rallied the public to stop a proposed dam on the Colorado River in Arizona that would have flooded an area near the Grand Canyon.

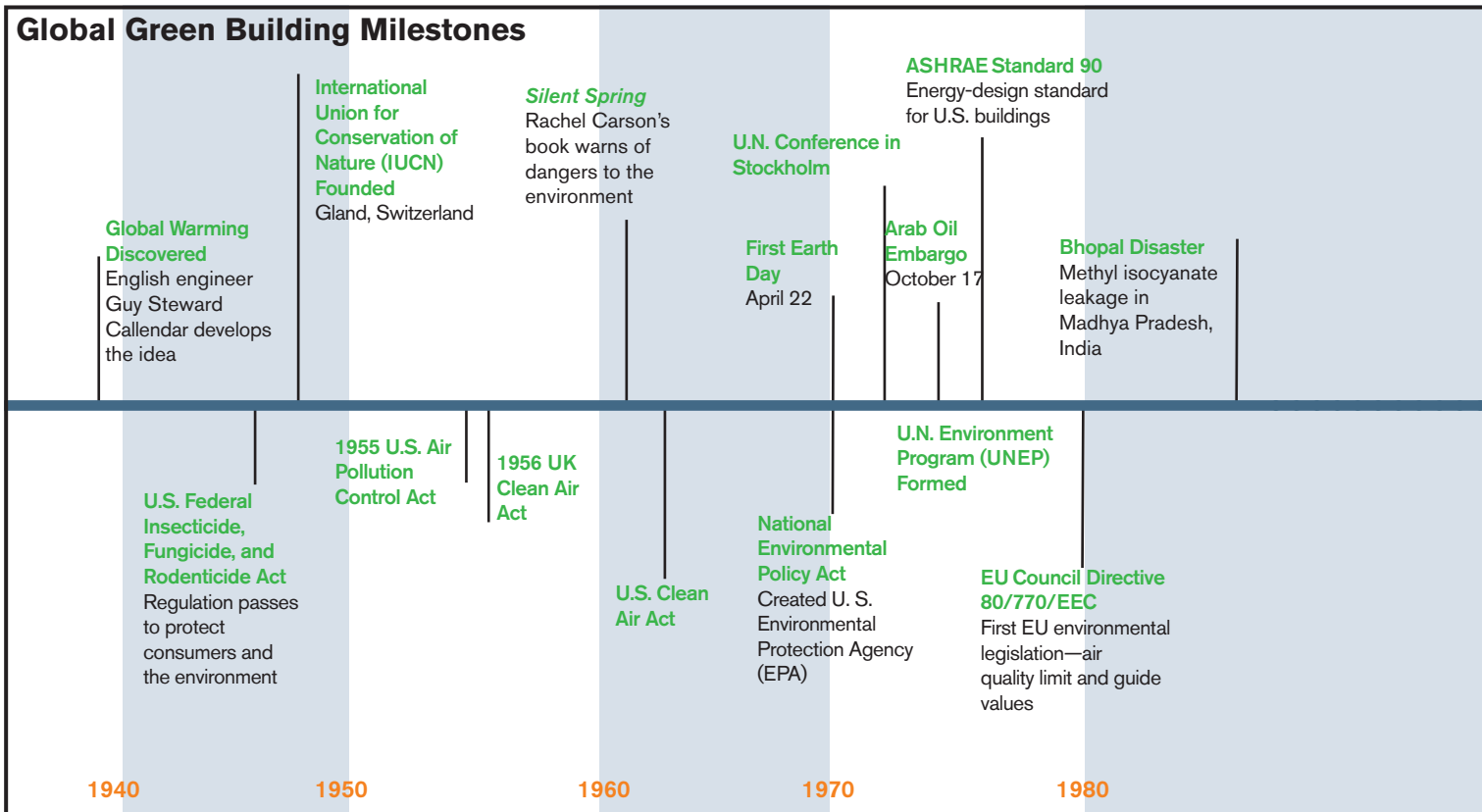
Legislation: In 1970 the U.S. Environmental Protection Agency (EPA) was established, and federal agencies were required to produce environmental impact statements outlining ways in which they would avoid or minimize the environmental impact of projects such as buildings, airports or military bases. The Clean Water Act, passed two years later, tasked the EPA with issuing permits for most industrial and municipal facilities discharging effluent into waterways—a major step in reducing pollution levels.

The 1970s: Green Activities in the U.S.

The early activities and commitments in green building occurred in the United States. In the 1960s and 1970s, a number of architects began paying more explicit attention to ecological implications of their work. In 1979, the nation's first standards for energy-efficient state office buildings were developed in California.⁶¹

Other significant events included the Arab oil embargo in 1973 and the creation of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90 in 1975. This prescriptive energy-design standard has become a benchmark for energy codes.⁶²

In 1978–80, the dialogue around mandatory performance standards grew in response to new research funded by the U.S. Department of Energy and intensive debates coordinated by the National Institute of Building Sciences.⁶³



The 1980s: Achievements in Europe

In the 1980s, green building activities in Europe helped raise the movement to a new level. In 1988, the Passivhaus Concept was designed by Professors Bo Adamson (Sweden) and Wolfgang Feist (Germany). To date, this voluntary low-energy building design standard has been used for more than 6,000 buildings (commercial and residential), and it has also spurred the development of a range of energy-saving building products.⁶⁴

Frank Faraday of the European Construction Industry Federation (FIEC) has called Passivhaus, “very much the starting point for the sustainable building movement in Europe and the model in vogue in many EU States.”⁶⁵

Other significant contributions came from Arup, the British-based design firm, which worked with building owners instead of developers to incorporate a number of sustainable measures in a series of corporate headquarters buildings.⁶⁶

The 1990s: Consortium and Network Building

The 1990s were characterized by the establishment of industry associations, consortiums and green building resources. The American Institute of Architects (AIA) set an example by creating their Committee on the Environment in 1990. AIA worked to bring this resource to the global level at its 1993 convention, held with the International Union of Architects world congress, where more than 3,000 architects signed a “Declaration of Interdependence for a Sustainable Future.”⁶⁷

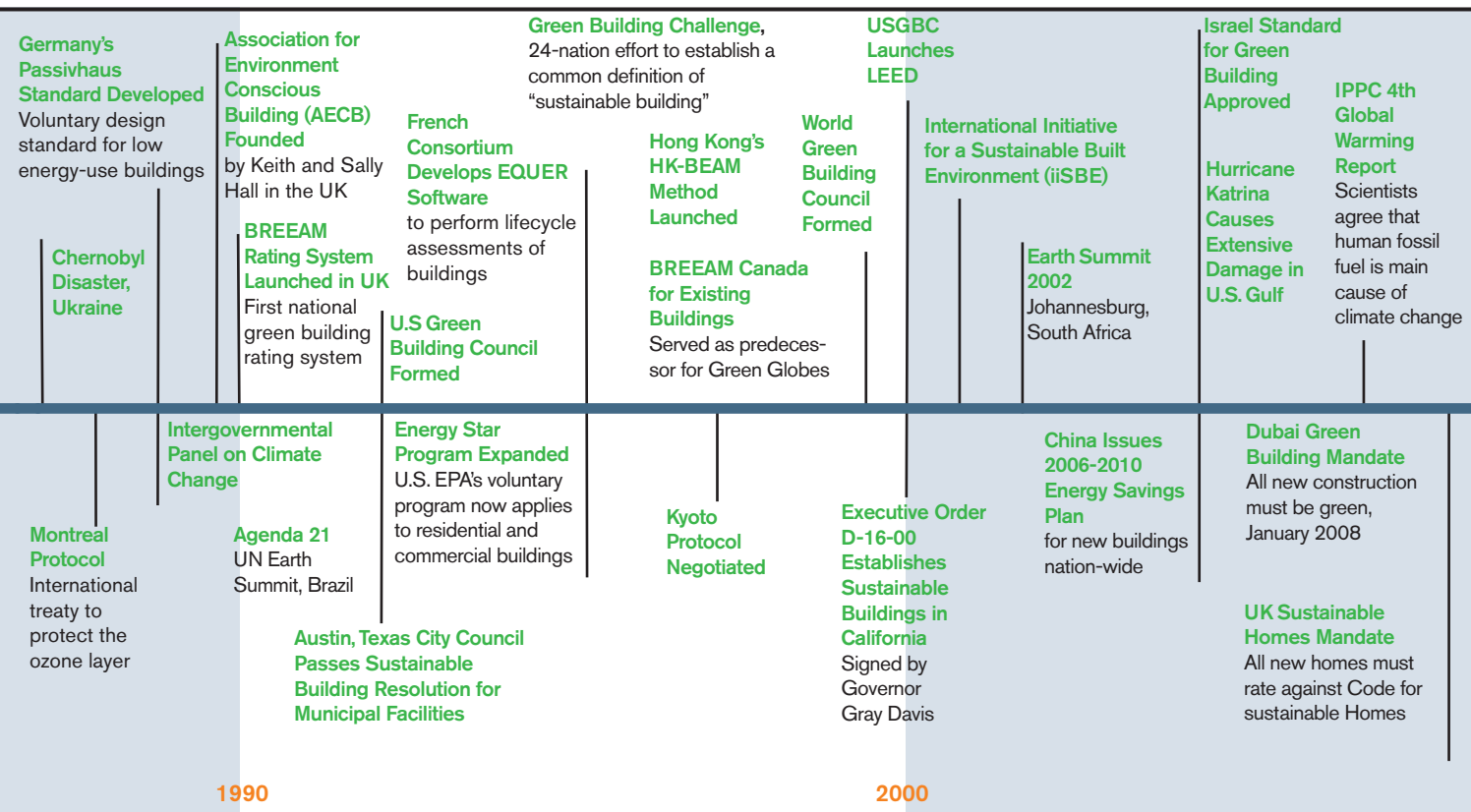
1990 also saw the launching of the Building Research Establishment Environmental Assessment Method (BREEAM) in the UK (see page 44). In 1993, the U.S. Green Building Council was launched—the first professional network of its kind for all professions in the green building field.⁶⁸ The creation of green building tools such as GBTool and EQUER also helped propel the global movement forward.⁶⁹

2000 and Beyond: Global Consensus Building

The international awareness of climate change and the need for action have grown dramatically. Consequently, this decade has seen increased collaboration and green building initiatives among intergovernmental and global nongovernmental organizations (NGOs).

The most widespread achievement came in 2005, when the Kyoto Protocol went into effect. The Protocol, which has been ratified by 182 parties, requires developed countries to reduce their carbon emissions by 2012 and establishes monitoring and reporting of emissions among developing nations.

Other significant global achievements include the formation of the International Initiative for a Sustainable Built Environment (iiSBE) in 2001 and the Sustainable Buildings and Construction Initiative partnership between the United Nations and industry stakeholders in 2006.



The Development of Green Building Rating Systems

The First System: The History of BREEAM

In 1980, British engineer-architect John Doggart, head of the energy consultancy unit at Milton Keynes Development Corporation (MKDC), began to set standards incorporating various elements of green design, such as south-facing positioning, improved insulation and energy-saving boilers, into his designs. Inspired by the results of his experiment, Doggart left MKDC to establish Energy Conscious Design with two partners. Working with three forward-thinking developers, who shared Doggart's vision that buildings should be rated on environmental issues beyond just energy consumption, Doggart developed a new building rating methodology.

The team brought in the British Research Establishment (BRE), a government agency, to help write a new building code based on these principles—the Building Research Establishment Environmental Assessment Method (BREEAM). The method was used immediately among developers, and because of the close contact among many of the real estate development firms in Britain and the usability of the methodology, the standards gained rapid momentum and widespread adoption.⁷⁰

Rating Systems Around the World

As Doggart's story illustrates, the availability of accessible, user-friendly green building rating systems has been instrumental to the widespread growth of green building practices. Since the creation of BREEAM, several other methods have developed across the world that provide more targeted guidelines that apply to region-specific building practices and conditions.

Below are highlights of some of the major existing rating systems:

BREEAM

(Building Research Establishment Environmental Assessment Method): www.breeam.org

- Created in the UK in 1990 with two versions, one for offices and one for homes.
- Weighting scale: pass, good, very good, excellent.
- Now offers an entire family of methods and tools, including systems for health care, retail, schools, homes, offices, prisons, multifamily residential and industrial, among others.

LEED

(Leadership in Energy and Environmental Design): www.usgbc.org/leed

- Developed by the U.S. Green Building Council in 1998.
- Rating scale: certified, silver, gold, platinum.
- Offers tailored rating systems including health care, schools, homes, neighborhood development and retail (in pilot phase).

GREEN STAR

www.gbcaus.org.au/green-star/

- Created by Green Building Council Australia in 2003.
- Rating scale: one to six stars; four through six obtain official certification.
- Current tools include office design, office interiors and office as built.
- Pilot programs include shopping center design, health care, education, office existing building.

CASBEE

(Comprehensive Assessment System for Building Environmental Efficiency):

www.ibec.or.jp/CASBEE/english

- Program of Japan Sustainable Building Consortium.
- Started in 2002.
- Rating scale: C (poor), B-, B+, A and S (excellent).
- Areas for evaluation: predesign, new construction, existing building, renovation.

What's Next for Rating Systems

As the green building movement grows, many green councils and organizations are working to establish rating systems that meet the specific needs of the local construction industry. In some locations, these efforts are taking the shape of adapting existing systems to reflect local guidelines, such as South Africa's plans to launch a national version of Green Star, UAE's adoption of BREEAM and LEED for Canada and India.

To assist local and national groups looking to design their own system, the International Initiative for a Sustainable Built Environment has created the

SBTool, a tool kit to aid in the development of a new rating system. Additionally, established systems like LEED, BREEAM and Green Star are making their systems, training and expertise available on a global scale.

In October 2008, many of these international rating systems will be evaluated and compared in the new report *Building Environmental Assessment Methods: A Critical Review of International Developments*, by Dr. Raymond Cole. For more information, visit www.worldgbc.org.

Hotel Planned in Songjiang, China



Image courtesy of Atkins

Biowall in GreenWorks, Ontario, Canada



Image courtesy of TRCA

Light Shelves, BP Headquarter office, Cape Town, South Africa



Image courtesy of BP South Africa

Resources and References

Resources that can help you get smarter about green building trends, products and practices around the world

McGraw-Hill Construction

- Main Website: www.construction.com
- Research and Analytics: www.analytics.construction.com
- Architectural Record: www.archrecord.construction.com

- GreenSource magazine www.greensourcemag.com
- Engineering News-Record: www.enr.com

- Green Smart Market Reports: www.greensource.construction.com/resources/smartMarket.asp
- Sweets Network for Products Green Community: www.products.construction.com

World Green Building Council

- Main Website: www.worldgbc.org

Mission and Objectives

WorldGBC provides the global green building movement with leadership and a global forum to accelerate market transformation from traditional, inefficient building practices to new-generation, high-performance buildings.

WorldGBC is composed of national Green Building Councils that represent over 50 percent of global construction activity, and touch more than 10,000 companies and organizations worldwide.

Working as consensus-based, not-for-profit organizations, these GBCs work on a national scale to engage leaders across sectors to transform the built environment.

Supporters of WorldGBC include:

- Province of Ontario www.gov.on.ca
- Toronto and Region Conservation Authority www.trca.on.ca
- Colliers International www.colliers.com

Global Green Building Councils

- Green Building Council Australia www.gbcaus.org
- Green Building Council of Brasil www.gbcbrazil.org.br
- Canada Green Building Council www.cagbc.org
- Germany Sustainable Building Council www.gesbc.org
- India Green Building Council www.igbc.in
- Japan Sustainable Building Consortium www.jgbc.com
- Mexico Green Building Council www.mexicogbc.org
- New Zealand Green Building Council www.nzgbc.org.nz
- Taiwan Green Building Council taiwangbc.org.tw/
- Emirates Green Building Council www.emiratesgbc.org
- United Kingdom Green Building Council www.ukgbc.org
- United States Green Building Council www.usgbc.org

Emerging Green Building Councils

- Argentina Green Building Council www.argentinagbc.com.ar
- Colombia Green Building Council <http://www.cccs.org.co>
- Green Building Council of South Africa www.gbcsa.org.za
- Viet Nam Green Building Council www.vsgbc.org
- Poland Green Building Council

Forbo

- Main Website: www.forbo.com

Mission and Values

With a strong focus on innovation, Forbo Flooring inspires customers to create better interior environments. Forbo has been recognized as the leader in providing color and design options with its Marmoleum products. Naturally occurring anti-static properties make Marmoleum easy to clean, while naturally occurring antimicrobial properties stop the breeding of many micro-organisms such as allergen producing dust mites, and the MRSA strains of bacteria.

These features, combined with simple, low cost maintenance and unmatched durability make Marmoleum ideal choices for the indoor environment.

References

- ¹Flanagan, Roger and Carol Jewell, University of Reading, 2008. Data: Asia Construct, Euro Construct and National Statistics, 2007 with data from David Crosthwaite and John Connaughton, *World Construction 2007-2008*, Davis Langdon and Seah International, 2008.
- ²International Monetary Fund (IMF), "IMF Sees World Growth Slowing, With U.S. Marked Down," *IMF Survey Magazine: IMF Research*, 29 January 2008. Accessed 25 June 2008 at <<http://www.imf.org/external/pubs/ft/survey/so/2008/RES012908A.htm>>
- ³Crosthwaite, David and John Connaughton, *World Construction 2007-2008*, Davis Langdon and Seah International, 2008.
- ⁴Crosthwaite and Connaughton, 2008.
- ⁵Crosthwaite and Connaughton, 2008.
- ⁶"China and India Set to Spend \$1.5 trillion on Infrastructure Needs," *Civil Engineering*, July 2008.
- ⁷McGraw-Hill Construction Research & Analytics, 2008.
- ⁸Gutowski, William J. Jr., "Causes of Observed Changes in Extremes and Projections of Future Changes," *Weather and Climate Extremes in a Changing Climate*, U.S. Climate Change Science Program and the Subcommittee on Global Change Research. Washington, D.C.: U.S. Department of Commerce, NOAA's National Climatic Data Center, 19 June 2008. Accessed 20 June 2008 at <<http://www.climate-science.gov/Library/sap/sap3-3/final-report/default.htm>>
- ⁹Gutowski, 2008.
- ¹⁰Kasriel, Daphne. "Are Emerging Market Consumers Engaging with the Green Bandwagon?" *Euromonitor International* 2008, 4 October 2007. Accessed 9 June 2008 at <http://www.euromonitor.com/Articles.aspx?folder=Are_emerging_market_consumers_engaging_with_the_green_bandwagon&print=true>
- ¹¹Prahalad, C.K. *The Fortune at the Bottom of the Pyramid: Eradicating Poverty Through Profits*. Philadelphia: Wharton School Publishing, 2006.
- ¹²Kasriel, 2008.
- ¹³United Nations Environment Program (UNEP) Sustainable Buildings and Construction Initiative (SBCI), *Buildings and Climate Change*, 2007. Accessed 9 June 2008 at <http://www.unep-sbc.org/docs/938539C9CB94EC18/Buildings_and_climate_change_new.pdf>
- ¹⁴World Business Council for Sustainable Development (WBCSD), *Energy Efficiency in Buildings: Business Realities and Opportunities Summary Report*, 2007. Accessed 9 June 2008 at <http://www.wbcsd.org/DocRoot/kPUZwapTJKNBf9UJaG7D/EEB_Facts_Trends.pdf>
- ¹⁵UNEP SBCI, 2007.
- ¹⁶U.S. Energy Information Administration (EIA), *EIA Annual Energy Review 2005*. U.S. Department of Energy, 2005. Accessed 13 December 2007 at <[http://www.fypower.org/pdf/EIA_IntlEnergyOutlook\(2006\).pdf](http://www.fypower.org/pdf/EIA_IntlEnergyOutlook(2006).pdf)>
- ¹⁷McGraw-Hill Construction, *Greening of Corporate America SmartMarket Report*, 2007.
- ¹⁸*Greening of Corporate America*, 2007.
- ¹⁹Bierma, Paige. "Hospitals: Green Revelation," *Health Leaders*, 1 January 2005.
- ²⁰Joseph, Anjali, and Roger Ulrich. "Sound Control for Improved Outcomes in Healthcare Settings," *Center for Health Design Issue Paper #4*, January 2007.
- ²¹Kats, Gregory. *Greening America's Schools: Costs and Benefits*, Capital E, October 2006.
- ²²Heschong Mahone Group, *Daylighting in Schools: An Investigation into the Relationships Between Daylighting and Human Performance*, Pacific Gas and Electric Company, 1999.
- ²³Hathaway, W.E., "Effects of School Lighting on Physical Development and School Performance," *The Journal of Environmental Psychology*, vol. 12, pp.301-305, 1992.
- ²⁴Flanagan, et al., 2008
- ²⁵DLSI, 2008
- ²⁶DLSI, 2008
- ²⁷DLSI, 2008
- ²⁸DLSI, 2008
- ²⁹DLSI, 2008
- ³⁰Flanagan, et al., 2008.
- ³¹DLSI, 2008
- ³²Flanagan et. al, 2008
- ³³DLSI, 2008
- ³⁴DLSI, 2008
- ³⁵Flanagan et. al, 2008
- ³⁶CIA, "United Arab Emirates," *CIA World Factbook*, 2008.
- ³⁷United Nations, "United Arab Emirates," UNData, 2008.
- ³⁸Todorova, Vesela, "Abu Dhabi's Water Conservation Plan," *The National*, 15 June 2008.
- ³⁹Landais, Emmanuelle, "Dubai to Turn Green in 2008," *Gulf News*, 24 October 2007.
- ⁴⁰Australian Government, "Green Building to the United Arab Emirates," Austrade, 10 June 2008. Accessed at <www.austrade.gov.au>
- ⁴¹Masdar Headquarters to be Located in World's First 'Positive Energy' Mixed-Use Building," *PRNewswire*, 22 February 2008.
- ⁴²King Abdullah University of Science and Technology (KAUST) Global Research Partnership, *Introduction to KAUST*, King Fahd University of Petroleum and Minerals. Accessed 15 June 2008 at <<http://www.kfupm.edu.sa/dsr/research/manual/Intro-KAUST.pdf>>
- ⁴³Noir, Eric. "The New Head Office for BP in Africa at the V&A Waterfront, Cape Town," *Building Performance Congress*, 2004.
- ⁴⁴McGraw-Hill Construction interview with Cesar Trevino, 28 May 2008.
- ⁴⁵TRCA, "Toronto and Region Conservation's new Restoration Services Centre Awarded LEED Canada-NC 1.0 Platinum Rating," *TRCA Website*, 2008. Accessed 16 July 2008 at <<http://www.trca.on.ca/Website/TRCA/website.nsf>>
- ⁴⁶Canada Green Building Council (CaGBC), "Toronto and Region Conservation - Restoration Services Centre," *Canada Green building Council Website*, 2008. Accessed 16 July 2008 at <http://mycagbc.org/green_building_projects/leed_certified_buildings>
- ⁴⁷McGraw-Hill Construction correspondence with Frank Faraday of the European Construction Industry Federation (FIEC), 15 June 2008.
- ⁴⁸McGraw-Hill Construction correspondence with Chris Twin of Arup, 15 June 2008.
- ⁴⁹WorldGBC correspondence with Alexander Rudolphi of the company Gesellschaft für ökologische Bautechnik Berlin mbH (GfÖB) and Chair of the Board of Directors of the GeSBC, 9 June 2008.
- ⁵⁰Sauerbruch Hutton Architects, "Federal Agency for the Environment, Dessau," *Sauerbruch Hutton Architects Website*. Accessed 9 June 2008 at <http://www.sauerbruchhutton.de/portfolio/portfolio_e.html>
- ⁵¹Umweltbundesamt Dessau-Roblau, "Umwelt-Bundesamt Für Mensch Umwelt," Umweltbundesamt website. Accessed 10 June 2008 at <<http://www.umweltbundesamt.de/building-products/index.htm>>
- ⁵²Sauerbruch Hutton Architects, 2008.
- ⁵³Bennetts Associates, "Central Library and Jubilee Street Development," *Bennetts Associates Architects Website*. Accessed 9 June 2008 at <<http://www.bennettsassociates.com>>
- ⁵⁴Concrete Centre, "Jubilee Library, Brighton," *The Concrete Centre Website*, 2008. Accessed 9 June 2008 at <<http://www.concretecentre.com/main.asp?page=1207>>

References, continued

⁵⁵CO₂ Saver, "Sustainable House at Lake Laka in Poland," *CO₂ Saver Website*. Accessed 9 June 2008 at <http://www.uebersetzung-polnisch.de/Oeko_Haus/english.htm>

⁵⁶"Masdar headquarters will be the greenest building in the world," *Mad Architect*, 13 March 2008. Accessed at <<http://www.madarchitect.org/tag/masdar-city/>>

⁵⁷"The Masdar Initiative," *Masdar Website*, 2008. Accessed at <<http://www.masdaruae.com/>>

⁵⁸"Masdar Development," *Foster + Partners Website*, 2008. Accessed at <<http://www.fosterandpartners.com/Projects/1515/Default.aspx>>

⁵⁹Design-Build Network, "Central Bank of Kuwait Headquarters, Kuwait City, Kuwait," *Design-Build Network.com*, 2008 Accessed at <<http://www.designbuildnetwork.com/projects/cbk/>>

⁶⁰Central Bank of Kuwait (CBK), "New CBK Building," *CBK Website*, 2008. Accessed at <<http://www.cbk.gov.kw/WWW/index.html>>

⁶¹*AIA Architect magazine*, April 2006

⁶²*Engineering News-Record*, Feb. 12, 2007.

⁶³*Engineering News-Record*, March 26, 1981.

⁶⁴"Overview of PassivHaus Dwellings," *Passiv-HausUK*, 2008. Accessed at <<http://www.passivhaus.org.uk/index.jsp?id=66>>

⁶⁵E-mail from Frank Faraday to Scott Lewis, June 16, 2008

⁶⁶Interview with Chris Twinn, Director, Ove Arup & Partners, June 16, 2008

⁶⁷"AIA/COTE: A History Within a Movement," *AIA Website*, January 2007. Accessed at <http://www.aia.org/cote_history>

⁶⁸*Engineering News-Record*, Feb. 12, 2007.

⁶⁹"iisBE Overview," *iisBE Website*, 2008. Accessed at <<http://www.iisbe.org/iisbe/start/iisbe.htm>>

⁷⁰McGraw-Hill Construction correspondence with John Doggart of the Milton Keynes Development Corporation (MKDC), 15 June 2008.





SmartMarket Report

Design & Construction Intelligence

McGraw-Hill Construction

President: Norbert W. Young, Jr., FAIA

McGraw-Hill Research & Analytics/Alliances

Vice President, Industry Analytics, Alliances & Strategic Initiatives: Harvey M. Bernstein, FASCE

Senior Director, Research & Analytics: Burleigh Morton

Director, Green Content & Research Communications: Michele A. Russo, LEED® AP

Director, Market Research: John DiStefano, MRA, PRC

Director, Industry Alliances: John Gudel

Global Green SmartMarket Report

Editor-In-Chief, Research & Marketing Specialist: Catlin O'Shaughnessy, LEED® AP

World Green Building Council Contributors

Executive Director: Andrew Bowerbank, B.Ed, OTC, D.Ind, NCCP, CCEP, LEED® AP

Contributing Researcher and Editor: Melissa Ferrato-Jacobs

Reproduction or dissemination of any information contained herein is granted only by contract or prior written permission from McGraw-Hill Construction.

For further information on this *SmartMarket Report* or for any in the series, please contact McGraw-Hill Construction Research and Analytics.

1-800-591-4462, 34 Crosby Drive, Suite 201, Bedford, MA 01730

www.analytics.construction.com

MHC_Analytics@mcgraw-hill.com

Copyright © 2008, McGraw-Hill Construction, ALL RIGHTS RESERVED

Acknowledgements: The authors wish to gratefully thank our partners at the World Green Building Council (WorldGBC), specifically Melissa Ferrato-Jacobs, Kevin Hydes, Jennifer Semple and Dominika Czerwinska. We would also like to thank Albert Chan, ShuiOn Land; Parasu Raman, BMTC; Maria Atkinson, LendLease; Eric Noir, GREEN by DESIGN; and Cesar Trevino, Mexico GBC for talking about their personal and professional experiences in green building. Thanks also Tom Hicks and Sabrina Morelli of the U.S. Green Building Council (USGBC) and to the MHC staff who contributed to the report, including Scott Lewis, Nina DeJesus, Richard Goodier, Susan Barnett and Valerie Beard.

We would also like to thank the following organizations and individuals for their generosity in securing and allowing the use of their photos and graphics: Samuel Mupanemunda and Nino Calvert, BP South Africa; Helen Dixon, Donna Boyd and Marina Beloni, Atkins; Mike Plotnik, Shashi Narayan and Colin Rohlfing, HOK; Alan Issler, Brighton & Hove City Libraries; Jenny Sheerin, The Concrete Centre; Jan Bitter, Bitter Bredt and Amy Cassara, World Resources Institute; Toronto and Region Conservation Authority.

Global Green Building Trends SmartMarket Report

www.greensource.construction.com/resources/smartMarket.asp

Executive Offices

McGraw-Hill Construction
2 Penn Plaza
New York, NY 10121-2298

McGraw-Hill Construction—One Name for Industry-Leading Information and Intelligence

McGraw-Hill Construction, North America's leading provider of information and intelligence solutions to the \$4.6 trillion global construction industry, makes it easy for design and construction professionals to cut through the clutter, make better decisions and grow their business.

A **trusted source** for more than a century, McGraw-Hill Construction continues to transform the global construction industry by setting new standards through connecting people, projects and products.

McGraw-Hill Construction drives industry growth with critical sales and marketing solutions:

- **McGraw-Hill Construction Network®**: Online, integrated information solutions to find work, do work and manage opportunities
- **McGraw-Hill Construction Network for products**: Online, integrated solution to find building products, specs and more
- **McGraw-Hill Construction Media/Marketplace**: Connecting buyers and sellers through the McGraw-Hill Construction magazines—*GreenSource*, *Architectural Record*, *ENR* and the Regional Publications – and online resources
- **McGraw-Hill Construction Research and Analytics**: Gaining Insight and Intelligence

This report is printed using soy-based inks on New Leaf Reincarnation Matte, made with 100% recycled fiber, 50% post-consumer waste, processes chlorine-free with a cover on New Leaf Primavera Gloss, made with 80% recycled fiber, 40% post-consumer waste, processed chlorine free. By using this environmental paper, McGraw-Hill Construction saved the following resources (calculations provided by New Leaf Paper, based on research conducted by Environmental Defense and other members of the Paper Task Force):

- 32 fully grown trees
- 14,691 gallons of water
- 21 million BTUs of energy
- 1,579 pounds of solid waste
- 3,507 pounds of green-house gases

\$149

ISBN: 978-1-934926-16-1



9 781934 926161



30% Pre-Consumer Fiber

smartmarket.construction.com

©McGraw-Hill 2008

The McGraw-Hill Companies