Responsible Real Estate:

The Case for Retrofitting

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1 Overview

Despite the current economic crisis, the real estate industry is experiencing a rising movement to retrofit existing properties. Retrofitting is the addition of new technology or equipment to an existing property in order to reduce operational costs, improve occupant health and productivity, and reduce adverse effects on the environment. Commercial property owners are pursuing green retrofitting projects to reduce utility costs and differentiate themselves in order to fulfill increasing tenant demands for sustainable properties. In addition to operational efficiency and environmental concerns, government officials are supporting retrofitting programs to create jobs and restore economic growth. The current momentum in green building and retrofitting, however, took a very long time to develop, evolving over nearly 40 years to what it is today.

This paper will trace the evolution of the green retrofitting industry in the United States and will assess the direct impact of the current financial crisis. In parallel, we will examine Harvard University and Harvard Business School to understand these specific cases and the general lessons that can be applied going forward. Lastly, we will assess the future market opportunities for green retrofitting and propose certain key elements that will ensure its success.

2 The Development of Green Retrofitting in the United States

Early Beginnings

The green building and retrofitting industries both owe their beginnings to a major shift in the American way of thinking during the 1960s. The 1960s was an era that questioned many of the trends in American society including materialism, imperialism, racism, and violence.[1] These ideals continued to develop in the 1970s, influencing increasing concerns for the environment.

The United States celebrated its first Earth Day on April 22, 1970. Nearly 20 million Americans participated with the common goal of increasing awareness for a sustainable environment. The growing environmental movement was further fueled by the energy crisis of the 1970s. Two major energy crises occurred in 1973 and 1979. These events jump-started the ongoing environmental movement. With gas lines stretching for blocks, some Americans began to question the conventional wisdom that we should be so independently reliant upon fossil fuels for our energy.[2]

Speed Bump: Formalizing the Industry

The momentum of the environmental movement slowed down as record-level energy prices subsided. Reduced demand and overproduction caused a six-year-long decline in energy prices during the 1980s. During this time, however, public interest in energy conservation in buildings grew significantly. Buildings have historically been major contributors to greenhouse gas (GHG) emissions. According to a U.S. Department of Energy survey, buildings were (and still are) responsible for at least 39% of total energy use, 12% of total water consumption, 68% of total electricity consumption, and 38% of carbon dioxide emissions. This led to much research from the late seventies to the early nineties on energy efficiency in buildings. This research resulted in more effective solar panels, efficient wall systems, water reclamation systems, and direct usage of natural light in order to decrease daytime energy consumption.[3] Professional organizations began to formally develop green building technologies and position themselves

as advocates for sustainability. One example is the American Institute of Architects (AIA).

The AIA Committee on the Environment (COTE) was founded in 1990. This committee stemmed from the AIA Energy Committee founded in 1973. The committee's mission is to lead and coordinate the profession's involvement in environmental and energy-related issues and to promote the role of the architect as a leader in preserving and protecting the planet and its living systems. COTE serves as the voice for AIA architects regarding sustainable design and building science and performance.[4]

Government Involvement

Federal and State governments have also created formal departments that serve as stewards for the environment. The U.S. Environmental Protection Agency (EPA) was founded in 1970 with the mission to protect human health and the environment. In 1992, the EPA funded the development of the first Environmental Resource Guide (EPG). The ERG, published by the AIA, is a leading resource on the environmental impacts of building materials. Also in 1992, the EPA and the U.S. Department of Energy launched the Energy Star Program. Energy Star is an international standard for energy efficient consumer products. Devices carrying the Energy Star logo, such as computer products and peripherals, kitchen appliances, and buildings generally use 20% to 30% less energy than required by federal standards.[5] In addition to policy making, the federal government practiced what it preached by having the White House undergo a successful retrofitting program that saved nearly $300,000 annually in energy and water costs and eliminated 845 metric tons of carbon emissions per year.

More recently, the Federal government has continued its support of green building initiatives in the 2000s. The Energy Policy Act of 2005 included federal building sustainable performance standards. At a White House Summit in 2006, 19 federal agencies signed the Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding (MOU). These agencies committed to the implementation of common strategies for planning, acquiring,

designing, building, operating, and maintaining high performance and sustainable buildings.[6] Moreover, in 2007, former President Bush signed Executive Order 13423, which included federal goals for sustainable design and high performance buildings. The Energy Independence and Security Act of 2007 also included requirements for high performance green federal buildings.[7]

Local municipalities have also initiated green building programs. In 1992, the City of Austin, Texas created the first local green building program in the U.S. The Austin Energy Green Building Program was the first system that rated the sustainability of a home or building. More recently and specifically applicable to retrofitting, the City of Berkeley, California's Financing Initiative for Renewable and Solar Technology (FIRST) program offers property owners an opportunity to borrow money from the City to install solar photovoltaic electric systems and allow the cost to be repaid over 20 years through an annual special tax on their property tax bill.[8] In New York, the Community Preservation Corporation (CPC), a non-profit affordable housing lender, announced a new public-private partnership to provide $1 billion in construction and mortgage loans to multifamily housing owners for energy efficient upgrades and property retrofits. The $1 billion program is expected to retrofit approximately 15,000 housing units over the next 3 years in low, moderate, and middle-income properties.[9]

Influence of USGBC's LEED Rating System

Arguably the most influential organization in the green building movement is the U.S. Green Building Council (USGBC). The USGBC's Leadership in Energy and Environmental Design (LEED) rating system provides property owners with a major incentive to retrofit existing properties. Along with enjoying increased energy efficiency and lower utility bills, property owners benefit from increased marketing for their properties through the LEED branding. This often leads to greater demand from tenants who are looking to occupy LEED certified properties.

The USGBC's LEED rating system provides credence to the vast complexities with rapidly

developing green technologies. Property owners that invest in retrofitting projects have to be knowledgeable on the latest technologies in the various systems of a building, including HVAC, energy, and water systems. Before the establishment of LEED, upon completion of a retrofit project, there was no indication of the project's success to the outside world. Essentially, owners were paying for property improvements that others didn't see. Thus, they did not receive much of a rent premium from tenants. Now, the USGBC's LEED rating system provides a common framework for all stakeholders to ascertain energy efficiency levels in a property. It has added credibility to energy efficient buildings, inherently putting a spotlight on the tenants that occupy them. To outsiders, this highlights companies that support environmental causes overall. Many major corporations have now made it a priority to house their headquarters in energy efficient buildings that are often LEED certified. Moreover, property owners will be incentivized to invest in retrofit projects as technologies continue to advance and returns for green investments increase. Exhibit 1 shows a history of the milestones achieved in sustainability.

3 Harvard's Retrofitting Strategy

Green Campus Sustainability Initiative

Many academic institutions, like Harvard, have had interest in green building and retrofitting that parallels or even exceeds society. In 1999, a concerned group of Harvard University faculty, staff and students formed a committee to discuss sustainability on the Harvard campus. Out of that group, the Harvard Green Campus Initiative (HGCI) was formed in 2000 to address these issues from a coordinated, University-wide perspective. HGCI developed a strategic plan to make the campus greener and received five years of funding from the Office of the President as a sign of the University's commitment[10]. HGCI was not intended to lead Harvard's effort by imposing command and control styled regulations and policies. Instead, each school and department was responsible for addressing sustainability issues themselves. HGCI's role was to raise awareness across the campus, provide thought leadership, facilitate best practice sharing and create the necessary support and infrastructure so that individual departments and schools were best positioned to enhance their sustainability. Very quickly, the HGCI's popularity expanded as faculty members and students gravitated to the cause. "In its short life, literally hundreds of faculty, students and staff have contributed their time and energy," said the HGCI in its newsletter. "By most standards, HGCI is now an inter-faculty movement powered by the individual environmental, economic and social convictions of many members of the Harvard community."[11]

Green Campus Loan Fund Launches

HGCI's initiatives were extensive, but one of the most powerful and tangible was the creation of the Green Campus Loan Fund (GCLF), intended to support and incentivize "environmentally and economically beneficial projects."[12] In its initial stage, GCLF was a $3 million revolving loan fund, which provided interest free capital to Harvard departments. To support the fund, HGCI also developed technical assistance expertise to help facility and operations managers identify and manage building upgrade projects.[13] To be eligible for HGCI support, projects had to reduce

the University's environmental impact and have a payback period of less than five years. The Fund's creation served four key purposes:

- **Bridge Financing**: allowed departments who were capital constrained to borrow money to make the upfront investments. Annual cost savings were then used to pay back the loan.
- **Zero Cost Capital**: incentivized departments to consider environmentally beneficial investments by providing "free" capital.
- **Project Identification and Risk Mitigation:** helped departments who were not familiar with green building upgrades by helping to identify and manage projects, thereby reducing the risks. In the early years of the fund, HGCI assisted 60% of the funded projects with its technical assistance services.[14]
- **Signal of University's Commitment:** re-enforced the University's commitment to HGCI and sustainability. The Offices of the President and Provost of Harvard University endowed the Fund.

Since its launch in 2002, the GCLF has been a tremendous success. The size of the Fund has doubled twice so it is now a $12 million fund. It has loaned out $11.5 million for 153 projects. These projects together have yielded about $4 million in cost savings and the median project level return on investment is 27%.[15] As a recent example, GCLF helped to fund the retrofit of 10 university garages with efficient lighting fixtures and sensors, resulting in the expected reduction in energy consumption of over 50% and expected annual cost savings of $400,000.[16]

Harvard Business School's Movement towards Sustainability

The biggest beneficiary of the GCLF in its early years was the Harvard Business School. In the Fund's first thirty months of operation, HBS accessed over $1.1 million in capital for 10 projects, which included the installation of a 75kW cogeneration unit in the Shad Hall gymnasium. The next largest amount accessed by any other department was less than $500,000. During that 30-month period, HBS reduced its utility costs by $215,000 annually (5.5% of total utility costs) and reduced CO_2 emissions by 2.7 million pounds.[17] According to HBS Director of Operations, Andy

O'Brien,[18] HBS really began to focus on energy retrofits in the early-to-mid-2000s, primarily in response to rising commodity prices and soaring energy costs. For HBS, energy retrofits were a cost reduction strategy and a strategic diversification of its energy inputs. Mr. O'Brien continued that administrators were responsive to the Department of Operations' retrofitting proposals primarily because they were able to clearly show expected cost savings for its investments. The availability of free capital through the GCLF and through government and utility administered grants and rebate programs helped make the economics of the deal workable in some cases and even more attractive in others.[19] Since the early 2000's, Mr. O'Brien estimates that HBS has spent $3 million in retrofitting improvements, which have yielded $900,000 in annual operating savings.[20]

While HBS continued to identify and realize cost savings from energy retrofits, Mr. O'Brien notes that by 2005 the Operations Department was also seeing an increased interest in environmental issues by students, administrators, Harvard University and the press. For example, 2005 marked the first time that HBS celebrated Green Week.[21] Seeing a need for a more permanent focus on sustainability within his office, Mr. O'Brien created a new position to lead the School's energy and sustainability efforts. The Operations Department also launched a sustainability initiative that focused on energy conservation, waste management, best practices and peer-to-peer education. As the issue of sustainability rose in prominence on the campus, HBS also embarked on its first LEED certified building, Hamilton Hall, which received LEED gold certification. Hamilton, a 48,000 square foot facility that holds 72 dorm rooms, required a gut renovation. Some of the key green features of Hamilton Hall are occupancy sensor controlled thermostats, bamboo furniture, dual-flush toilets and low-flow sinks and showers.[22] Hamilton was the second residence hall at Harvard University to achieve LEED certification. Today HBS has five LEED certified buildings, with two more pending approval.

Formally Embracing LEED

LEED certification has become a key and widely referenced component of Harvard's sustainability strategy. From the outset, the HGCI and the University had encouraged departments to include sustainability considerations in their capital project decision making, however did not provide any specific requirements. To that end, HGCI helped to introduce the Harvard campus to LEED certification that serves as an independent verification and brand for sustainable buildings. As it did to support the Green Campus Loan Fund, HGCI developed LEED expertise and an advisory service, now called Green Building Services, to help departments better understand LEED guidelines with respect to individual projects. In 2007, Harvard established its Green Building Guidelines to codify its commitment to sustainable real estate and to identify specific goals that all capital projects must meet. Most importantly, the guideline requires all new construction and renovation exceeding $5 million to seek LEED Silver certification, and further specifies certain LEED credits that each building must achieve.[23] In reality, several Harvard University buildings were LEED certified before the guidelines were adopted and some leaders question the environmental value of the LEED certification. Jim Gray, from Harvard Real Estate Services (HRES), indicated that, by virtue of being on a campus in an urban city, and the quality and planning that go into Harvard University's construction plans, LEED Silver is not a difficult goal to achieve.[24] Doug Scatterday from HBS Operations agreed that LEED certification is more of a brand and symbol of leadership in sustainability than it is anything else.[25] For example, Aldrich Hall on the HBS campus is certified as a LEED Silver facility. When the renovation began in 2004, LEED certification was not an initial goal; however the project team was targeting sustainability goals such as energy efficiency measures and environmentally friendly product selection. In 2006, the team first considered LEED certification and even at that late point in the renovation cycle, was still able to achieve LEED Silver.[26]

Formal Commitment to Greenhouse Gas Reduction

Another key component of the University's sustainability strategy is the very public commitment to reduce GHG emissions by 30% below 2006 levels by 2016. This ambitious goal

has served as a rallying cry to motivate the University and garner the full strength of its resources. As part of the announcement, President Drew Faust created the Office for Sustainability to replace and build on the success of the HGCI. This new Office expands on HGCI's initiatives and provides vision and oversight for the University's GHG reduction goals. For the first time, Harvard University and its departments and schools have a quantitative energy reduction goal for which they are accountable. One of the key strategies for reducing the University's GHG emissions is through continued retrofitting of buildings.

Investment Criteria for Harvard Projects

Understanding the underlying motivations for retrofitting on the Harvard campus is important, but the interesting question is, given a world of limited resources, how to decide what to do. There are countless projects that could be undertaken, but not all are. Unfortunately, there is no easy answer. Generally, projects are considered across three key criteria:[27]

- **Financial:** Assess the financial implications of the proposed investment. Some of the key criteria include IRRs and payback periods. The decision maker also needs to understand the source of funds and the cost of funds (e.g. GCLF, grants, operating budget, capital budget) to help them understand their budgeting requirements and the opportunity cost of capital.
- **Environmental**: Assess what the environmental benefits are going to be. The most typical metrics in this category include the reduction in GHG emissions or energy waste.
- **Social:** Understand the social benefits of the project. Social benefits are harder to quantify but could include the contribution to the vitality and pride of the community at large or some sort of public declaration of leadership or innovation that the project might represent. It also represents the quality of the tenant's experience in the building.

While the framework is easy to understand, it is extremely difficult to identify a standard weighting system for each component. How much is each unit of reduction in greenhouse gas worth? How much value does the campus pride associated with a new green feature carry?

The decision is easy when the project is attractive across all three lenses. But what happens when a project is attractive financially, yields a small environmental benefit, and no social benefit? Is that a good allocation of capital? What if the project has a negative financial return, but yields huge environmental savings and social benefit?

In the early days of the HGCI, the University provided little formal guidance on how to answer those questions. Each individual department or school made their decisions based on their unique set of criteria. Mr. O'Brien was clear in saying that the biggest priority for HBS was financial cost savings. Mr. Gray on the other hand, indicated that in the early days of the HGCI, his impression was that, "the Cambridge side of the river was much more environmentally focused. We were more concerned with saving the world than money."[28] Luckily in the early days of HGCI, this tension did not surface in earnest since there were so many projects that met multiple criteria. In the first 30 months of the Green Campus Loan Fund, project ROI's were averaging 34% and annual GHG reduction was 2% of 2003 levels.[29]

As HGCI grew, sustainability issues gained support on campus and some of the low-hanging fruit projects were completed, many investment decisions have and will become more challenging. For example, ROI's from GCLF funded projects have been declining from the mid 30% range in 2005 to the mid-to-high 20% range today.[30] We expect ROI's to continue to compress as many of the most financially attractive projects have already been undertaken. At the same time, in the mid-to-late 2000's the University began to take a more controlling role in the investment decision criteria. The University began to layer on requirements such as LEED certification and GHG reductions which help to place a value and prioritization level on the social and environmental aspects of the decision making process. As such, projects like the recent installation of wind turbines on the Soldiers Field parking garage have been completed. The environmental savings are expected to be relatively small, about 5-10% of the garage's energy needs, but the social benefit appears to be the driving factor. Mr. Gray says it was important from a community and social perspective. The turbine, developed in partnership

with the State, serves as a very visible signal of the University's leadership and as a means to raise campus awareness and pride in sustainability initiatives.

In addition to making capital investments to drive more efficient real estate assets, Harvard and HBS are also actively engaged in zero-to-low cost behavior modification actions. The low cost of these actions help to bypass the tension between environmental, social and financial benefits of a project and produce a very attractive ROI.[31] Some recent examples on the HBS campus include changing building schedules so that buildings are now opened thirty minutes before their first use and closed thirty minutes after their last use. Previously, HBS Operations provided a two-hour period before and after building use. Behavior modification measures have proven to be a low cost and effective environmental strategy and should serve as an example to other building owners.

It is interesting to observe the short but rapid evolution of sustainability in real estate assets at Harvard and the Harvard Business School. We believe that this evolution represents many of the successes, trends, and underlying tensions that building owners across the country and across the world are facing. Harvard, in many respects, is an idealized example of the "eco-system" of commercial and residential real estate, with building owners, tenants, investors, and developers all struggling to achieve the best and most efficient use of their capital and real estate assets. The tension between the underlying rationales for sustainable real estate is real. Some groups are driven by the environmental benefits and others are driven by the financial. The trade-offs and prioritization calculations inherent in retrofitting decisions at Harvard are the same issues that plague developers, owners and tenants outside of Cambridge. But, in the case of Harvard, the key stakeholders are one in the same, all members of the larger Harvard University community with similar goals. When those stakeholders are different, the decision making process is much messier and can lead to inaction.

4 The impact of the economic crisis on the decision to retrofit

The 2008 Dilemma

With the decline of the US economy beginning in mid-2007 with the credit crisis and the plummeting of all types of assets, priorities for many stakeholders in the real estate industry have been reevaluated. The resulting state of the economy, marked by complete illiquidity in the credit markets and limited access to capital, has affected not only the housing sector, where the credit crunch began, but also the entire real estate market.[32] Furthermore, the soaring energy prices of the last few years had exerted ample pressure on the real estate market to embrace sustainable building and retrofitting by yielding increasingly attractive financial returns on green efforts. But the economic crisis affected energy prices as drastically as it did most other sectors, leading oil prices to plummet from a high of $140/barrel in July 2008 to $35/barrel by the end of December.[33]

The one-two punch of the virtual shutdown of credit markets and investor risk aversion and the precipitous decline in energy prices may not have given the green building and retrofitting market much of a fighting chance in the recession. Furthermore, tenant willingness-to-pay for green premiums can be expected to be much lower than in years past. However, some experts assert that statements heralding the decline of the green building market are premature and exaggerated. Instead, they aver that the current economic conditions will only slow, not stop nor reverse, the shift to green buildings.[34]

The evidence in support of this argument is varied. On a basic level, buildings that are “green” are still worth more than buildings that are not. An April 2008 study by the CoStar Group found that buildings that were LEED certified saw rent premiums of $11.24 per square foot over their conventional building competitors, and had a 3.8% higher occupancy rate. Some LEED certified buildings in the study also sold for an average of $171 more per square foot than their conventional competitors.[35]

It is true that property values are down significantly, leading to more vacancies and distressed owners. However, the steady demand for green buildings, buoyed by the marked outperformance of those buildings in energy efficiency compared to conventional versions, and the relative scarcity of the green buildings in the mix, mean that the value of green properties has not fallen as much as the market average suggests.[36]

Furthermore, there is evidence that shows that despite the harsh economic environment, construction activity has been picking up momentum. At year-end 2008, outstanding construction debt for commercial real estate projects, net of reported delinquencies, was up 14% over the previous year and was at 2.5x the mid-2006 level, when property values were at their peak. Even including possible unreported delinquencies, these numbers are large enough to indicate a clear amount of construction activity. It is no coincidence that the spurt in construction activity aligns with the commercial sector's more mainstream adoption of green building and retrofitting techniques (around 2005-2006). Therefore, it is fair to say that green building efforts are largely responsible for the construction activity that occurs throughout the economic crisis.

Another argument in support of the relative strength of the green building and retrofitting market in these tough financial times is that because green building was just picking up momentum as the economy took a nosedive, there is a significant backlog of green projects. One reason for this is the learning/experience curve was slow to grow at first. New building techniques take time to master and the green certification process can be cumbersome to the uninitiated. However, research shows that as practitioners become proficient, development grows exponentially. This is certainly true of the LEED New Construction market (LEED-NC), but it appears to be true of more nascent LEED Existing Building (LEED-EB) market as well.[37] Exhibit 2 shows exponential growth of both LEED markets. Furthermore, there is a significant backlog of green projects just nearing completion and awaiting certification, which reinforces this

argument. In the LEED-EB market the ratio of projects in the pipeline (registered) to projects that are complete (certified) is nearly 20:1.[38]

A Shift in Focus for the Industry

It is clear that interest in pursuing green projects has not abated - only temporarily softened due to capital constrictions. Green retrofitting offers an enticing option to would-be green property investors and managers. Companies that cannot afford to construct a new green building due to the recession, or that cannot afford the disruption of moving to a green building or of undertaking a top-to-bottom renovation of their existing workplaces, may find that green retrofits are a reasonable way to reap the many benefits of green workplaces.[39]

Even for companies and organizations that were already choosing retrofit over new construction, the focus has shifted. The goal now seems to be more affordable repositioning and energy efficiency improvements instead of more costly complete building renovations.[40] Tweaks and capturing the low-hanging fruit are the first and most reasonable steps for most. Larger jobs may be forced to the back burner until capital becomes available.

The Impact of the Crisis on Harvard University

The financial crisis has impacted the various organizations within Harvard in myriad ways. However, the biggest considerations for all the organizations seems consistent, both with one another, and with those faced by private industry: the costs of energy, both the recent downturn in prices and the long-term bet on rising prices, and the costs of financing projects. One thing that all the sustainability experts at the University agree to is that the crisis has certainly affected the access to capital for sustainability projects. Interestingly, how they approach this constraint on capital varies from organization to organization. Mr. O'Brien and Mr. Scatterday believe that the reputation they have established and the past successes in cost savings have enabled them to continue to receive approval for most of their plans. Furthermore, as far as energy price consideration goes, as Mr. O'Brien said,

> "If you are going to hedge energy prices, they are only going up. This increases our argument that we need these energy efficiency projects *because* of the crisis, not *despite* it. Never let a good crisis go to waste."[41]

Mr. Gray feels a little differently than Mr. O'Brien and Mr. Scatterday when it comes to the impact of the financial crisis. While he does agree that in the long-term, energy prices are going to rise, the recent fall in energy prices has forced downward pressure on upcoming projects, as it makes the financials look less favorable. Also, for HRES, the pipeline of projects has slowed in light of the economic crisis because the University's capacity for debt has been significantly reduced. For the first time in recent history, Harvard is concerned with bond ratings, and therefore, even if an organization within the University can afford to finance a project, they might not qualify for it. However, there is still a lot of interest in low-hanging fruit that can garner returns in one to two years, but "there doesn't seem to be much of those left."[42]

Despite the crisis, Mr. Gray affirms that the University remains committed to achieving LEED Gold whenever possible, because the benefit of the positive public response and marketing still outweighs the incremental cost of certification, which is already relatively low for Harvard.[43]

Mr. O'Brien admits that the financial crisis has led HBS to become more selective about its future retrofit plans. In the summer of 2009, HBS Operations hired Aramark Corporation to conduct an energy audit of HBS facilities in order to identify which buildings were the worst offenders. "With the utility bill as the only metric, it is hard to tell which buildings waste the most energy," Mr. O'Brien says. The results of the audit proposed over 100 possible projects costing approximately $12 million. These projects are currently being analyzed across the spectrum of financial, environmental, and social metrics to determine the priority of the projects to be undertaken. However, in the long-term, there may be a conflict between which projects need the most attention because they are energy wasters and which projects can get the quickest, most effective returns. With this dilemma, Mr. O'Brien remains optimistic that

HBS will choose projects that benefit the school more directly, if not financially, then at least environmentally or socially.

> "If we renovate Kresge Hall, for example, it may have a 20-year payoff. If we send the money to Brazil, in carbon offsets for example, instead of renovating Kresge, we might have a much quicker payoff. But I think I will be more inclined to put that money into Kresge anyway."

The Harvard GHG reduction goal also raises the profile of the environmental benefits in this investment decision equation. Right now, the majority of retrofit projects at HBS are still attractive on a financial basis.[44] But some important questions remain. With HBS pushing to meet its goal for GHG reductions, will financial considerations continue to be the key driver? Would HBS ever consider losing money on a project that would yield significant GHG reductions to help achieve its GHG target? If so, how much? These are issues that HBS and Harvard administrators are grappling with today. Importantly, the use of carbon offsets is also currently under consideration. Harvard's stance on carbon offsets will clearly impact the priority level of environmental benefits in the retrofitting decision making model.

5 The future of retrofitting

The Case for Retrofitting

Since the start of the environmental movement in the 1970s the U.S. has made significant progress, however, it still has a long way to go. Retrofitting existing buildings is the natural choice for making a big impact in a financially constrained world. Green property retrofits are critical to energy conservation and green design and technologies will utilize their full potential only when applied to the existing building stock. It is worth noting the conclusion of a McKinsey study on Energy Efficiency which makes a strong case for retrofitting the existing stock: "Energy Efficiency offers a vast low cost resource for the US economy but only if the nation can craft a comprehensive and innovative approach to unlock it. Significant and persistent barriers will need to be addressed at multiple levels to stimulate demand for energy efficiency and manage its delivery across more than 100 million buildings and literally billions of devices. If executed at scale, a holistic approach would yield gross energy savings worth more than $1.2 trillion, well above $520 billion needed through 2020 for upfront investment in efficiency measures (not including program costs). Such a program is expected to reduce end-use energy consumption in 2020 by 9.1 quadrillion BTU's, roughly 23% of projected demand, potentially abating 1.1 gigatons of green house gases annually." It will also generate 600,000 to 900,000 jobs in the process.[45]

Next Steps

Standardization and Measurement: The industry needs best practices and standards to not only rate buildings (as provided by LEED[46]) but also to utilize them to undertake retrofitting projects at a micro level for office, industrial, and residential space. The current work in benchmarking done by some states within the US is insufficient as it does not apply to all building types and secondly cannot be generalized due to variable local weather patterns. Measurement is also indispensable since building performance cannot be evaluated,

benchmarked, and improved without it. Measurement and verification by home/office-based and grid level devices is also critical for getting private investment into energy efficiency.

Regulation and Incentives: Why should an existing tenant or an existing building owner invest upfront for benefits that may not be realized at all or far into the future? The question is justified on the part of the investors and has been the biggest retrofitting roadblock. Pilot programs and innovation in green financing can provide a solution to such a hindrance. We have analyzed the situation in terms of alignment of interests for the various stakeholders involved:

- **Government**: If the federal government commits to GHG reductions then the pressure on the existing building stock will be immense. Regulation would not only cut GHG emission but would also create thousands of jobs in the process. A few state governments have started giving incentives to property owners in terms of tax credits for rated green buildings. We believe this trend will spread to more states and will also support green ratings, thus indirectly backing the retrofit movement. New York City's six-point Greener, Greater Buildings Plan, passed on December 9, 2009, provides a perfect example of future movement in the regulatory space. The plan, introduced on Earth Day and enacted as part of *PlaNYC* (a comprehensive sustainability plan for the City's future), includes four bills that will dramatically reduce the City's energy usage, saving consumers $700 million annually in energy costs, while creating 17,880 jobs and reducing New York City's carbon footprint.[47]

- **Tenants:** The upfront capital costs incurred for a retrofit project cannot be transferred to tenants immediately. Thus, green leases and performance-based contracts with utility companies will be the norm in the future. Moreover, tenants need to be educated about the benefits of making their occupied space energy efficient in order to encourage adoption. An innovative way to do this was demonstrated by Jonathan Rose Companies, a New York-based green real estate investment firm. For one of their

properties, the firm instituted an online web portal where tenants could view how energy efficient they were as compared to others. This pseudo competition lowered energy use by 10%.[48]

- **Energy Service Companies and Property Managers**: The property owners benefit as operating costs are reduced and they have a more satisfied tenant base. It is again imperative and justified that the owner cannot generally bear the entire capital costs upfront; this can be achieved by innovating on leasing terms and involving the utility provider. The utility provider, on the other hand, will only benefit if the system is controlled and monitored upon retrofitting. This therefore calls for a smart grid based system for monitoring and controlling consumption upon retrofitting. Again, it boils down to awareness and technology integration.

Technological Advancements

The future pace of retrofitting will be dependent on the implementation of regulation and the realistic distribution of costs and benefits among the various stakeholders, but also on the advancement of smart building technologies. We are surely at the tipping point in the realm of adaption of technology to manage and monitor building operations. With the advent of smarter buildings and the need for continual monitoring alongside advances in information technology, it is evident that technology will play a crucial role in the large-scale adaption and implementation of green retrofitting. With the development of innovations in building technology such as smart grids, efficient lighting, waste conservation, solar power, insulation, and building materials as well as the development of new approaches such as biomimicry, the stage is set for large-scale retrofitting of existing buildings.[49]

Harvard Campus Sustainability Initiative

Harvard's Campus Sustainability Initiative is clearly a step in the right direction. It can certainly do well by learning from best practices in retrofitting from around the world, especially to

achieve its ambitious goal of 30% GHG reduction. The program will do well by sharing its findings and results in an open web portal and also by forming alliances with other active campus sustainability initiatives in the near term. They could further build on this by working with the industry and developing creative adaption models in this growing space. Registering for LEED-EB under Version 3.0 is a great next step. It will test the current level of building efficiency and also set the stage for continuous monitoring of systems at regular intervals of time.

6 Continued Momentum

The green building and retrofitting industry has gained significant momentum in the last decade. Unlike the 1980s, where the environmental movement slowed down, there are numerous indications that the current movement will only increase in momentum. Record-level energy prices in 2008 and the recent economic recession have increased societal pressures to minimize the U.S.'s dependence on fossil fuels and foreign energy sources. Property owners are consistently looking to retrofit their properties to decrease utility costs and market their properties as efficient and sustainable buildings. They are also experiencing pressures from tenants, who are increasing their demands to occupy sustainable properties in order to reduce their utility expenses and increase employee productivity.

In response to growing concerns and public interest, federal, state and local governments are further fueling the ongoing environmental movement. The Recovery Act's Green Retrofit Program offers $250 million in grants and loans to improve housing unit energy efficiency, incorporate Energy Star appliances, enact recycling programs, and take other steps that make properties more energy efficient and create green collar jobs.[50]

As governments become more active in this space, we believe that retrofit loan funds like Harvard's GCLF are a key component to success. Such funds have sprung up across the country to help building owners access capital to make these environmentally and economically beneficial investments. Banks, community development financial institutions and governments are trying to offer these types of loan funds. Unfortunately, these loan funds are much more difficult to implement outside of the Harvard community since capital-constrained building owners run a much higher risk of default than a department at Harvard University and zero-interest loans are nearly impossible to come by outside the University or without government intervention. Additionally, many of the existing loan funds do not provide the technical assistance that was needed at Harvard to help drive adoption.

Much like at Harvard, we are seeing more private corporations and government entities set emissions reductions goals. We believe that the introduction of tangible reduction goals and other legislative measures are an effective strategy to drive innovation and compliance. It will cause building owners and municipalities to think harder and more creatively about how to make strategic investments in energy efficiency just as Harvard has been doing. Harvard has developed a strong infrastructure and support system to help its efforts. The launch of HGCI and then the Office for Sustainability raised the level of awareness on campus. The introduction of the Green Campus Loan Fund, best practice exchanges and countless other initiatives provided the University with capital, experience and ideas to address sustainability. HGCI's technical support, in helping to develop projects and manage them, has made these projects less risky and more realizable. It is important to remember that while Harvard has realized great success, many more opportunities lie ahead. Harvard's success was achieved under very positive conditions. Stakeholders were relatively well aligned and the University invested considerable resources and expertise. Harvard can be looked at as a model as long as it goes with the caveat that it usually isn't so easy outside of Cambridge.

Recent economic events have slowed the momentum of this green movement, but the dynamics signal that the retrofitting industry will continue to expand and grow. According to a new study by Pike Research, the total potential market for major green renovations in the commercial building sector is approximately $400 billion. Market conditions, governmental regulations, and societal pressures are forcing owners and investors to embrace energy efficient properties. Therefore, we remain optimistic that the economic effects are short-term and that the long-term business, environmental, and social opportunities for green retrofits are significant. We believe that tenant demand, regulation, and incentives will drive this industry and that the pace of awareness and technological improvements will fuel its large-scale adoption going forward.

Exhibits

Exhibit 1: Milestones in Sustainability

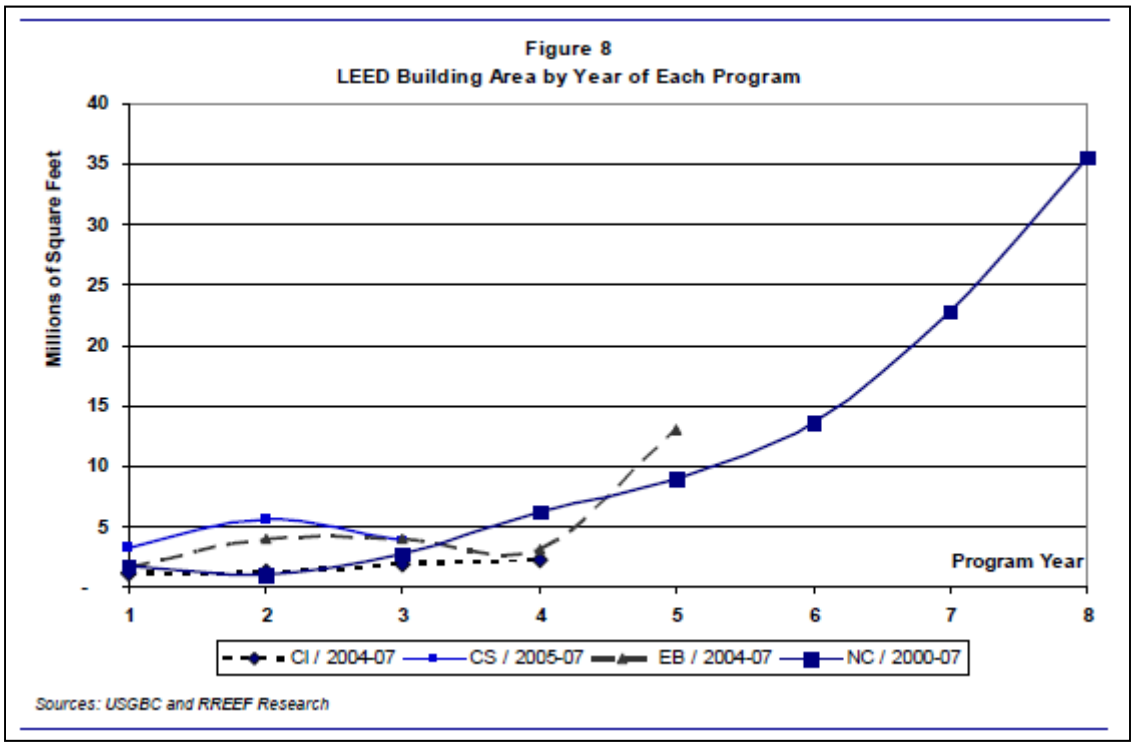
Milestones in Sustainability

- 1851 — Crystal Palace (Joseph Paxton), London
- 1877 — Galleria Vittorio Emanuele II (Giuseppe Mengoni), Milan
- 1903 — Flatiron Building (D.H. Burnham & Co.), New York
- 1905 — New York Times Building (Eidlitz & McKenzie), New York
- 1932 — Rockefeller Center (Hood and Corbett), New York
- 1962 — *Silent Spring* (Rachel Carson)
- 1963 — *Design with Climate* (Victor Olgyay, with Aladar Olgyay)
- 1967 — *Sun; Wind; Water* (Ralph Knowles)
- 1968 — *Form and Stability* (Ralph Knowles)
- 1 April 1970 — First Earth Day
- 1972 — The Limits to Growth (Club of Rome Report)
- 1972 — UN Conference on the Human Environment, Stockholm
- 17 October 1973 — OPEC oil embargo
- 1973 — AIA Energy Conservation Task Force established
- 13 November 1973 — Trans Alaska Pipeline approved
- 4 December 1973 — Federal Energy Office established (E.O. 11748)
- 1973 — Federal Energy Management Program chartered
- 7 May 1974 — Federal Energy Administration Act signed
- 1975 — AIA Committee on Energy established
- 1 October 1977 — Department of Energy commissioned
- 1977 — USDOE Solar Energy Research Institute (SERI) established (later renamed National Renewable Energy Lab)
- 1977 — Willis Faber and Dumas Headquarters (Foster and Partners), Ipswich, England
- 1978 — Gregory Bateson Building (Sim van der Ryn), Sacramento, Calif.
- 1985 — Environmental Defense Fund offices (William McDonough + Partners), New York
- 1987 — Bruntland Report, UN World Commission on Environment and Development
- 1989 — AIA Committee on the Environment (COTE)
- 24 March 1989 — Exxon Valdez runs aground
- 1989 — NRDC Headquarters (Croxton Collaborative), New York
- 1990 — Building Research Establishment Environmental Assessment Method (UK)
- 1991 — Residential Green Building Program initiated, Austin, Texas
- 1992 — Audubon House (Croxton Collaborative, Architects), New York
- 3-14 June 1992 — 'Earth Summit,' UN Conference on Environment and Development, Rio de Janeiro
- 1992 — Energy Policy Act of 1992
- 1992 — Menara Mesiniaga (T.R. Hamzah and Yeang), Selangor, Malaysia
- 1992 — Executive Order 13123
- June 1992 — EPA introduces ENERGY STAR labeling program
- 1993 — Navy launches green pilot project with eight buildings

- 6 April 1993
  USGBC founded
- 21 April 1993
  Greening of the White House
- 18-21 June 1993
  UIA/AIA World Congress of Architects, Chicago
- 29 June 1993
  President's Council on Sustainable Development established by Executive Order 12852
- 1994
  Greening of Grand Canyon National Park
- 1994
  Building Environmental Performance Assessment Criteria (BEPAC), Canada
- 1995
  Greening of the Presidio
- 1995
  Commercial Green Building Program, Austin, Texas
- 3-14 June 1996
  Habitat II, UN Conference on Human Settlements, Istanbul
- 1996
  Greening of the USDOE Headquarters
- 1996
  Greening of Yellowstone National Park
- 1996
  The Sustainable Building Technical Manual (Public Technology, Inc.)
- 1997
  Whole Building Design Guide (WBDG) created
- 1997
  Minnesota Sustainable Design Guide established by Hennepin County, Minn.
- Earth Day 1998
  Top 10 Green Projects launched by AIA/COTE (as Earth Day Top 10)
- 14 September 1998
  Executive Order 13101
- 1998
  Green Building Challenge, Vancouver, B.C.
- 1998
  Federal Interagency Committee on IAQ established by EPA
- 1998-9
  LEED Version 1.0 pilot program
- 27 April 1999
  "Green Energy Parks" inaugurated by National Park Service
- 3 June 1999
  Executive Order 13123
- 1999
  Pennsylvania and New York issue guidelines for high-performance buildings
- 12 November 1999
  World Green Building Council founded, San Francisco
- March 2000
  LEED 2.0 adopted
- 15 April 2000
  DOE Order 430.2A, directing application of sustainable design to new DOE buildings
- 21 April 2000
  Executive Order 13148
- 2000
  The HOK Guidebook to Sustainable Design (Mendler and Odell)
- 2000
  Seattle Sustainable Building Program approved
- 2000
  National Institute of Building Sciences undertakes management of *WBDG*
- 2000
  Green Building Tax Credit approved for New York State
- 2000
  AIA Sustainable Design Guidelines adopted
- 2001
  Interagency Working Group on Sustainability established by Federal Energy Management Program
- 1 May 2001
  U.S. Army Technical Letter introduces SPiRiT program
- 21 May 2001
  Life Cycle Inventory meeting, Dearborn, Mich.
- 9 June 2001
  UN Declaration on Cities and Other Human Settlements in the New Millennium
- 19 December 2001
  Sustainable Design and Development Policy adopted by USAF

Source: Building Design and Construction, "White Paper on Sustainability," November 2003

Exhibit 2: LEED Building Area by Year of Each Program



Source: Andrew J Nelson, "How Green a Recession?—Sustainability Prospects in the US Real Estate Industry," RREEF (Deutsche Bank), February 2009, p. 7, https://www.rreef.com/cps/rde/xchg/ai_en/hs.xsl/3157.html, accessed October 2009.

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