UNIVERSITY OF CALIFORNIA
Santa Barbara

Sustainable Property Rewards Initiative

A Corporate Strategy for Greening Commercial Property Management

A Group Project submitted in partial satisfaction of the requirements for the degree of Master's in Environmental Science and Management for the Donald Bren School of Environmental Science & Management

by

Christian Del Maestro
Jesse Fulton
Bob Jalalpour
Lindsay Lane
Jordan Sager
Brandon Willer

Committee in charge:
Sarah Anderson

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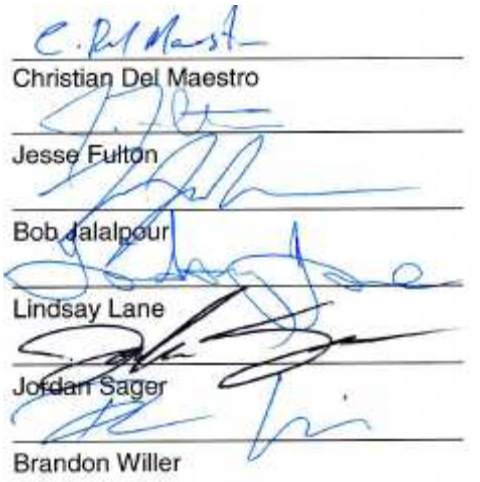

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Jordan Sager

Brandon Willer

The mission of the Bren School of Environmental Science & Management is to produce professionals with unrivaled training in environmental science and management who will devote their unique skills to the diagnosis, assessment, mitigation, prevention, and remedy of the environmental problems of today and the future. A guiding principal of the School is that the analysis of environmental problems requires quantitative training in more than one discipline and an awareness of the physical, biological, social, political, and economic consequences that arise from scientific or technological decisions.

The Group Project is required of all students in the Master's of Environmental Science and Management (MESM) Program. It is a four-quarter activity in which small groups of students conduct focused, interdisciplinary research on the scientific, management, and policy dimensions of a specific environmental issue. This Final Group Project Report is authored by MESM students and has been reviewed and approved by:

Sarah Anderson, Advisor

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Abstract

Despite the economic and technical feasibility of green building improvements, many existing commercial buildings do not utilize best management practices. The Sustainable Property Rewards Initiative (SPRI) seeks to leverage the market share of Yardi Systems, a leading property management software firm, to improve the performance of the domestic commercial building stock. In order to provide our property management audience with the information and tools necessary for the implementation of green building improvements and sustainable management practices, SPRI has developed an Interactive Resource Manual (IRM) which integrates the knowledge and experience gained from extensive background research, a series of local building audits and a nationwide survey of Yardi Systems' commercial clients. Our corporate strategy maximizes the effectiveness of the IRM through the design of three deployment programs, which include audit support, software integration and co-marketing. Together, these components of SPRI can achieve measured reduction of the environmental impacts associated with the U.S. commercial building sector.

Executive Summary

The environmental impacts created by the buildings we live and work in are becoming the subject of increasing focus. Energy consumption, water usage, and materials procurement in the United States commercial building sector result in significant environmental impact, much of which can be avoided through cost-effective green building upgrades. The U.S. Department of Energy reported in 2006 that this sector of the built environment consumed 18 percent of national end use energy. Furthermore, commercial buildings use approximately 12 billion gallons of water per day in the U.S. (USGS 2000) and adversely impact ecosystem and human health as a result of the materials and chemicals they consume as part of their everyday operations. A considerable share of the environmental impact resulting from these metrics can be avoided through the implementation of efficiency upgrades and sustainable purchasing policies, many of which make economic and business sense. Yet, informational barriers to these upgrades remain for many property managers.

Yardi Systems is a technical services firm providing property and asset management software to the managers of approximately 7 billion square feet of commercial space throughout the U.S. As a result of their wide market reach, Yardi Systems has the ability to strategically promote building performance improvements on a powerful scale. By developing the Sustainable Property Rewards Initiative (SPRI), this Bren School Group Project provides the information and tools necessary to improve building performance, reduce energy and water consumption, and implement sustainable materials purchasing policies throughout Yardi Systems' client base and beyond.

In developing SPRI, the project team took both a local and a national approach; detailed environmental audits were conducted among a subset of Yardi Systems' Santa Barbara, California clients, and a survey was distributed among the firm's U.S. client base. The execution of general audits of four commercial properties measured the environmental impacts associated with energy and water consumption, as well as materials used in the daily operations of the buildings. These audits yielded recommendations for increasing efficiency and sustainability at each of the properties and provided specific examples of improvements that will result in decreased environmental impacts as well as financial savings if implemented. Self-audit tools, financial calculators and case studies demonstrating the processes by which savings can be achieved were developed with data gathered during the property audits. The intent in creating these resources is to equip property

managers with the information necessary to benchmark their buildings performance and justify green improvement decisions economically.

SPRI also designed and analyzed a national survey to collect feedback from a national sample of property managers. The nationwide survey was distributed to Yardi Systems' entire commercial client base, and solicited data from property managers controlling approximately 730 million square feet of commercial space. This data served to establish the current level of commercial building performance on a national level, as well as highlight areas where property managers need more information and assistance to increase the likelihood of green upgrade implementation.

The data and insights acquired through the audit process and nationwide survey analysis were aggregated into the Interactive Resource Manual (IRM). The IRM is a web-based resource that provides financial and technical information on a range of green upgrades. The IRM includes step-by-step instructions for conducting self-audits and guidance on using this data to assess building performance. Additionally, financial calculators were developed for specific efficiency upgrades, and best practices are included for energy and water usage as well as materials procurement. SPRI property audits in the form of case studies serve as examples for property managers to reference when evaluating upgrade potentials at specific properties.

In addition to the Interactive Resource Manual, SPRI provides recommendations to Yardi Systems regarding implementation strategies to best encourage the use of the IRM amongst their commercial clients. SPRI demonstrates not only the environmental benefits associated with these upgrades, but the economic rewards as well. We show that the application of the SPRI across the client network of Yardi Systems as well as property managers nationwide can produce measurable improvement in resource efficiency and sustainable management practices in the U.S. commercial building sector.

1 Introduction

The Sustainable Property Rewards Initiative (SPRI) was developed through collaboration between the Bren School of Environmental Science & Management and Yardi Systems Incorporated. This unique opportunity to achieve significant environmental improvement within commercial building operations was created by combining the Bren School's multi-disciplinary approach to environmental problem solving and Yardi Systems' market influence among its commercial property management clients.

Yardi Systems has become a leading provider of investment, asset, and property management software enabling property managers worldwide to efficiently manage their real estate portfolios. Yardi Systems' software serves over 20,000 businesses, corporations and government agencies representing more than 7 billion square feet of domestic commercial space.

The building sector is currently the number one source of greenhouse gas emissions in the U.S. and a major consumer of water resources. The materials used in the daily operations of these buildings also result in significant environmental damage. SPRI focuses on these impact areas through the development of two crucial components; an Interactive Resource Manual (IRM), and a corporate strategy recommending the most valuable way in which Yardi Systems can deliver this resource to property managers.

Although there are various online sources for green building improvements, SPRI takes a targeted approach with our Interactive Resource Manual (IRM) designed specifically for *property managers* to utilize in the implementation of green building upgrades and sustainable management practices to improve *existing* buildings in the commercial sector. SPRI's corporate strategy maximizes the effectiveness of the IRM through the design of three deployment programs, which include audit support, software integration and co-marketing.

SPRI can take advantage of the substantial market share of Yardi Systems to reach a large proportion of commercial property management firms and provide feasible options to assist in the reduction of the environmental impact of the U.S. commercial building stock. Together with Yardi Systems, SPRI can achieve measured reduction of the environmental impacts associated with the U.S. commercial building sector

The following document details the Sustainable Property Rewards Initiative and its components, and makes clear its great potential to affect environmental change.

2 Background

Commercial and residential buildings account for a substantial share of energy use, water use, carbon emissions, waste and environmental toxicity throughout the United States. Of the estimated 4.5 million commercial buildings in the U.S., new construction represents only a small fraction of the existing building stock (Allen 2008). By focusing exclusively on opportunities for improvement in the existing commercial building stock, this project seeks to achieve the maximum return both financially and environmentally.

Further, heightened property values of Energy Star- and LEED-certified buildings will continue to fuel interest in green construction and retrofitting (Miller and Spivey 2008). In the most recent revision of LEED (publication expected in 2009), a new focus is placed on operating and managing existing buildings more efficiently (Allen 2008). Firms are realizing fiscal rewards from their sustainable building initiatives, and this is fueling demand in the green construction industry. Non-residential green building accounts for 2 percent of new development, and this market is expected to grow to between 5 and 10 percent of new projects by 2010 (Commission for Environmental Cooperation 2008). Over the course of a decade, the size of this industry has grown to an estimated $12 billion (Commission for Environmental Cooperation 2008).

The benefits of greener commercial buildings can include lower insurance costs, higher employee productivity resulting from improved natural lighting and indoor air quality, government incentives and rebates, and public relations value (Goforth 2008, Marlaire 2008, Mulkern 2008). Additionally, building tenants can potentially benefit from lower utility bills. These reduced expenses free operating capital that can be utilized for alternate and more productive business expenditures. Investors are not oblivious to such a shift in profit margins for property managers and factor it into their evaluations of potential projects and ventures (Kostigen 2008).

Traditionally, case study approaches have been used to support evidence of cost reductions through sustainable building techniques. A significant effort occurred when Adobe implemented major renovations and green retrofits in their buildings and received a return on investment of 121 percent (Egan 2007). The U.S. Green Building Council cites a variety of green building case studies focused on both new buildings and performance upgrades, but the diversity of infrastructure (building sizes, uses, age) and tenant structure within the commercial building industry makes a definitive and overarching study challenging. SPRI's audit process yielded case studies that provide property managers the guidance to implement low capital improvements that

can reach the maximum level of fiscal savings. This is unique, as a majority of case studies focus on building overhauls with significant capital investment.

The increased demand for green buildings not only stems from strategic efforts to reduce costs but is also being augmented by current and future government building regulations. In accordance with California's legislative mandate to reduce energy consumption, Title 24, Part 6 was established in 1978 and details the Energy Efficiency Standards for Residential and Nonresidential Buildings (CA DOE 2008). In order to allow for the consideration and possible inclusion of the latest energy efficiency technologies and methods, these standards are updated routinely. The need for increased energy efficiency standards has become more apparent in recent years.

Collectively, the buildings wherein Americans spend the vast majority of their time represent a major energy consumer. In 2007, buildings accounted for 37 percent of all end-use energy consumption, with 48 percent of that measure attributed to the commercial sector (CEC 2007). Consequently, commercial building efficiency standards can be expected to become more rigorous under future revisions for both new buildings and facilities renovations (Flex Your Power 2008). In 2004, commercial buildings consumed 17,400 trillion British Thermal Units (BTUs) of energy, representing a 64 percent increase compared to 1980 levels. As a result of the tremendous energy demand created by this sector, it is responsible for a substantial share of nationwide greenhouse gas emissions. By using 35 percent of California's electricity in 2005, commercial buildings in that state emitted roughly 17 percent of statewide carbon emissions (EPA 2007). The latest report from the IPCC states that without decisive action, "anthropogenic warming and sea level rise would continue for centuries due to the time scales associated with climate processes and feedbacks" (IPCC 12 2008).

This study quantifies environmental benefits achievable by leveraging Yardi's market reach to promote specific upgrades across their client base. For example, if a subset of Yardi's clients were to reduce lighting energy intensity by 10 percent, over 700,000 MWh of electricity would be saved. This equates to over one million tons of carbon dioxide avoided annually through implementation of just one such upgrade.

The commercial building sector also uses a substantial and increasing share of water resources. In 1995, the commercial building sector used an average of 9.6 billion gallons of water per day, an increase of almost 15 percent from 1990 levels (USGS 1995). This represents about 12 percent of the total end water use by sector. While the population and demand for water continue to rise in most regions of the nation, supplies are limited, and scarcity will

inevitably become more common. Water conservation is one of the three primary areas of emphasis under SPRI, and projections based on the national survey indicate that implementation of water fixture upgrade improvements would save nearly 9 billion gallons of water per year among commercial clients of Yardi Systems.

The procurement of ongoing consumables and cleaning materials in the commercial building operations also creates considerable environmental impact. The Green Purchasing Program of California's Green Building Initiative reports that each year about 6 out of every 100 professional janitors are injured by the chemicals in the products that they use (Dept. of General Services 2008). According to the Office of the Federal Environmental Executive, the average American spends 90 percent of their day indoors (OFEE 2008). Poor indoor air quality can result in serious health conditions, including headaches, nausea, dizziness and fatigue. The EPA has indicated that the indoor air quality of commercial buildings has the potential to be 2 to 5 times more harmful than outdoor air quality (OFEE 2008). By substituting materials with preferable sustainability attributes, property managers can improve the indoor air quality of buildings and reduce the indirect impact associated with materials procurement.

Despite potential direct and indirect incentives available to property managers for improving the environmental performance of existing commercial buildings, barriers to implementing improvements remain. Commonly cited examples of barriers that property managers face include financial, managerial, regulatory, and informational obstacles. Financial barriers typically include the lack of a business case or justification for intensive first costs. Split incentives between property managers, owners, investors and tenants can present issues regarding managerial decisions. Regulatory barriers may consist of building code obstacles and inconsistencies within and across states (Davis 2001). Among these, first cost is often identified as the principal barrier to implementing sustainable building upgrades to existing buildings (Castillano et al. 2000). However, the *initial* barrier that property managers face when making investment decisions is the informational barrier associated with sustainable building improvements (de Groot et al. 2001).

Bridging the informational gap is a prerequisite to assessing other barriers to building improvements. Property managers must initially acquire adequate information regarding the range of available technologies and potential modifications they can make to their buildings. A sustainable development research project called Sustainable Demand Project interviewed key decision makers in the Seattle, Washington development community. This project found that the major issue facing improved building performance was the "need for effective communication" regarding sustainable building methods

(Castillano et al. 2000). Once the information barrier is overcome, property managers are better able to understand the associated costs, risks, and potential benefits before making optimal business decisions regarding resource efficiency and materials procurement strategies (de Groot et al. 2001). For example, to justify a high first cost of investing in an alternate lighting system for an existing building, a property manager must first determine the financial rewards associated with this energy-saving method over time.

Improved information will not automatically lead to decisions by property managers to perform sustainable upgrades to their existing commercial buildings (Kollmuss and Agyeman 2002). Rather, superior information will lead to an increased ability for property managers to make educated and rational decisions regarding their buildings. Tools such as energy and water usage cost calculators can assist property managers in conducting comparisons of initial costs with financial benefits and savings (Castillano et al. 2000). Property managers can use this data to compare investment in building upgrades to alternate investments and determine whether they have a business case for sustainable property improvements. Additionally, improved communication regarding building codes can minimize the regulatory risk associated with alterations to existing buildings (Davis 2001). Furthermore, improved communication between property managers, owners, investors and tenants regarding the potential incentives and options associated with green building may facilitate the decision-making process if split incentives are an issue (Davis 2001).

Another major finding of the Sustainable Demand Project in Seattle was the need for examples of sustainable building success. According to the study, “Examples are the best means to lend credibility to the values of high performance building techniques and to reduce fears about costs.” (Castillano et al. 2000) Case studies may lend credibility to these projects for commercial buildings and clarify circumstances of success for property managers evaluating sustainable building improvements (Davis 2001). SPRI delivers four case studies detailing potential improvements and their costs and benefits. Further, the IRM encourages property manager investments in building improvements and their specific cases can be used as examples of success. Such case studies can enrich the IRM and serve to overcome the informational barrier encountered by property managers.

The existing building sector in the United States is in an opportune position because it faces lower marginal costs associated with carbon abatement than other sectors. According to McKinsey & Company, investment in the reduction of carbon emissions throughout the United States will be highly concentrated in the power and transportation sectors. The transportation

sector will require significant capital investment by automakers and thus higher vehicle costs for consumers. Heavy industry will also have a difficult time abating carbon emissions due to lack of monetary incentives. However, it is estimated that the commercial building sector's 2020 projected demand for energy could be cut by 20 percent if available energy efficiency opportunities were to be captured (McKinsey 2007). Commercial buildings do not face the same degree of difficulty with modifying economies of scale. A company's improvement of their buildings will not be passed onto the consumer to the same extent as the manufacturing sector or the transportation sector. Opportunities for reduced environmental impact in the commercial building sector include negative-cost options and are often associated with lower societal costs than improvement in the aforementioned sectors (McKinsey 2007). Negative-cost options such as lighting and appliance upgrades and automation of electrical and HVAC systems have been proven economical and can potentially make large impacts in terms of GHG emissions reduction.

Yardi Systems' core property management software is used in the management of 40 percent of commercial buildings in the United States (Fickes 1998). Given this substantial market share and the availability of negative and low cost options to building improvements, Yardi is in a position to implement a program that not only reaches a large proportion of commercial buildings, but also provides a relatively feasible option to reduce the environmental impact of the sector. To capitalize on Yardi Systems' significant market share, the group developed the Interactive Resource Manual. This resource was developed from two processes, a localized set of commercial building audits and a national survey.

3 Building Audits

The first step toward improvement of a building's performance is conducting an environmental building audit. The goal of a building audit is to assess the efficiency of multiple technical and operational components of a property, and establish a performance baseline. The audit assessment data allows the auditor to analyze and address critical inefficiencies existing at the site, as well as benchmark building performance to similar type buildings. The establishment of a baseline of your building's current performance is a key component in reducing inefficiencies within operations.

3.1 Purpose

Given the need cited by Castillano et al. (2005) for more examples of sustainable building success, the SPRI team conducted four commercial property audits and developed case studies built on these audits. These case studies serve as models for property managers in the assessment and improvement of the environmental and financial performance of their own commercial properties. Property inefficiencies were identified, updated technologies were detailed and recommended, and amounts of environmental and financial savings potential were measured for each property. These case studies recommend specific upgrades and strategies and guide property managers through the audit process.

3.2 Audit Sheet Development

SPRI's development of a self-audit procedure allows Yardi Systems' property manager clients to perform their own audits to establish energy, water and material baselines. The SPRI audit sheets are user-friendly and were developed using a hybrid of a number of pre-established auditing guidelines. The audit sheets utilized elements from the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), the EPA's Energy Star program, and California's Flex Your Power campaign. The audit sheets were developed as Excel spreadsheets, with the worksheets entitled "Energy", "Water", and "Materials".

The "Energy" sheet is the most detailed and requires the greatest amount of time in the actual audit. To begin, the sheet has identifying characteristics, including *Building Name, Floor, Room Number, and Type of Room or Office*. These help to create an easy paper coding system, and to identify and locate those locations throughout the facility in the future. For each floor and room

number, the auditor is directed to identify the sources of electricity use; including *Light bulb Quantity, Type of Bulb, Room Regularly Occupied (Yes or No), Number of Workstations, Number of PC's, Task Lighting (Yes or No), Number of Light Switches, Heating/Cooling Automated Controls (Yes or No)*. The last two columns are dedicated to subjective comments by the auditor including *Recommend De-Lamp (Yes or No)* and *Additional Comments*. These columns and rows form the basis for energy management by identifying target areas and creating baselines upon which property managers can improve.

The "Water" section is focused on identifying all of the water fixtures throughout the facility and identifying areas for improvement. This sheet begins by directing the auditor to identify general property characteristics including *Building Name*, *Floor*, and *Room Number*. For each restroom, the auditor is directed to identify the water use and efficiency by populating the following columns; *Number of Low Flow Toilets*, *Toilet Info, Number of Old Urinals, Number of Low Flow Urinals, Urinal Info, Number of Old Sinks, Number of Low Flow Sinks*, and *Sink Info*. For each kitchen, the auditor is directed to identify, *Number of Old Sinks, Number of Low Flow Sinks*, and *Sink Info***.** The "info" columns allow the auditor to copy any identifying fixture characteristics such as serial number, brand name, gallons per flush (gpf) or gallons per minute (gpm).

The "Materials" section assists the auditor in indentifying the materials usage throughout the facilities. Materials in this reference are characterized as the goods used in the daily operation and maintenance of a commercial property. Examples of these types of materials include cleaning products and equipment, ongoing paper consumables, durable goods, and maintenance equipment. The *Type/Name* label directs the auditor to specify the type of material by the manufacturer brand name and is the identifying characteristic for its use in the facility. The auditor is then directed to identify the following attributes for each material, *Usage, Bathroom (√), Kitchen (√), Office (√), Eco Label (Yes or No), and Recycled Content (Yes or No)*. The Eco Label is only for cleaning supplies, and generally refers to a certification label such as Green Seal or EPA's Comprehensive Procurement Guide (CPG). The Recycled Content is meant for all paper supplies including printer paper and tissue paper used throughout the facility.

Please see **Appendix A** for the Audit Sheet and instructions for performing a self audit.

3.3 Audit Performance

Audits were performed on four facilities throughout the Santa Barbara area; three of which are managed by The Towbes Group, a local property management firm and the fourth building being Yardi Systems' corporate headquarters. The Towbes Group is a client of Yardi Systems, and the SPRI team employed both companies in order to gain access to the buildings and their utility data.

The first audit was performed on July 26th, 2008 at the Calle Real Shopping Center in Goleta, California. This shopping center is 125,041 square feet, with a large variety of different local, regional and national companies. With such massive size, and limited access to many of the businesses, the group decided to audit only a subset of the retail spaces. The businesses audited in these buildings were of a wide mix, including restaurants like Rudy's and Panino's, and retail businesses such as Surf Country, Goleta Sports, and Bob's Vaccuum, among others. Each business was sent a letter by The Towbes Group informing them that a team of students would arrive on a particular date and time to perform energy, water and materials audits.

The second audit was performed on August 4th, 2008 at the Riviera Park facility in Santa Barbara, California. This complex is 92,586 square feet, with a number of different commercial office buildings and tenants. The audit included such businesses as Bosch Automotive Parts, Vetronix, and Berkus Architectural Firm. This company was informed by The Towbes Group that an audit would be taking place. Some of the companies required further identification and employee accompaniment during the audit in order to lessen the exposure to sensitive company material.

The third audit was performed on September 3rd, 2008 at the 222 East Carrillo office building in Santa Barbara, California. The office facility is 48,880 square feet, with a total of four stories and a parking garage below. This office building houses a mix of government, banking, and commercial clients. The Social Security Administration and the United States Probation and Parole Office are both located in this facility, and prior notification was required in order to gain access to these facilities.

The fourth audit was performed on September 11th, 2008 at the Yardi Systems, Inc. office building in Goleta, California. This office facility is over 60,000 square feet, with a large data center housed in the middle. Yardi Systems' corporate headquarters is owner operated, employs over 350 people, contains over 400 computers, and has a separate cooling system for the data center. This particular audit was different from the other three audits

in that no notification was required to gain access to the building. The company is the client of this group project and requested the audit for energy and water improvement purposes.

3.4 Audit Results and Recommendations

Once the audits were completed, the information was transferred to an electronic copy on an Excel spreadsheet. This information was distributed to The Towbes Group and Yardi Systems, Inc. as part of a three step recommendation package including:

1) Excel Spreadsheet of Audited Buildings
2) Building Recommendation
3) Energy Star benchmarking output

The Excel spreadsheet was delivered to both businesses for their records and will assist in the development of baselines for the energy, water and material usage for each property.

The Building Recommendations pinpointed different areas of energy, water, and material procurement issues along with cost-effective solutions. They were delivered be in the form of a newsletter, with intuitive recommendations that can be easily followed by any building manager.

The Energy Star rating was derived from the building audits as well as utility data provided by the clients. This rating is an effective means for property managers to benchmark their building(s) against similar buildings throughout the United States. Another function of the Energy Star rating shows how much energy usage needs to be reduced by the building in order to be certified as an Energy Star rated building. This is an important step in the auditing process, as it provides the property manager a metric for measuring the performance of their building as compared to a national database of buildings with similar features (i.e. size, climate, use).

Each of the buildings used in this study had this three-step recommendation package written up and delivered to The Towbes Group and Yardi Systems. Please see **Appendix B** for each of these case studies.

3.5 Building Audit Highlights and Generalizations

Although the sample of properties used in the study were fairly localized, they served to provide general highlights and lessons learned in conducting building audits and assessing the improvement potential of varying types of commercial buildings. These generalizations are further supported by data collected through the delivery of a national property management survey.

The first generalized finding from the audit process is that the age of the building is not necessarily indicative of the building's performance. For example, two of the properties audited were built within the past 20 years, but still showed significant potential for sustainable improvements. This finding demonstrates the ability of a physical building audit to indentify and address building inefficiencies that might have otherwise been overlooked in a general building profile review.

Second, each of the properties audited showed significant potential for improving the efficient use of artificial lighting sources. The audits generally indicated that lighting levels common areas were considerably higher than needed for occupant safety and comfort. In addition, many areas throughout the audited properties demonstrated the ineffective utilization of natural daylight – artificial lighting was used within proximity of a natural daylight source. In these cases, the implementation of creative low-cost delamping strategies showed potential for high-yield energy and financial savings.

Finally, a general finding of the water audit process for each of the properties was the savings potential that came from taking advantage of existing product rebates and incentives. Each of the water audits conducted indicated that the many of the flow and flush fixtures could be upgraded to high-efficiency, low-flow fixtures. It was found that local and state water efficiency programs and equipment manufactures provided various rebate incentives, which decreased the upfront cost of these upgrades and increased their potential return-on-investment.

4 National Survey

Because the physical building audits were only performed in the Santa Barbara area, the group recognized that the data would be limited. In order to gain a more thorough understanding of drivers for green building upgrades, a national survey was distributed to over 3,600 respondents. The survey is a vital part of the development of the Interactive Resource Manual (IRM) as it seeks to identify barriers and incentives faced by property managers, as well as to determine the current level of green building upgrades. The SPRI team has taken this information and used it to tailor the IRM. The survey can be viewed in **Appendix C** with results in **Appendix D.**

4.1 Survey Design

The group project had to meet the requirements of the University of California Santa Barbara's Office of Research regarding human subjects. Each group member obtained official certification required when conducting human subject research or analyzing data that includes identifiable private data. The scope of the project, methodology, draft survey and email materials had to be approved in accordance with the Human Subject guidelines by the Office of Research

As part of the literature review of this project, extensive research was completed on the financial and informational barriers that property managers face when improving the environmental performance of their buildings. Also, information was gathered on the various incentives that result from improving these buildings.

The survey was distributed through Yardi Systems, Inc's client list, called Corp Comm. The list was created by Antara Hunter, the group's liaison at Yardi Systems, with final approval from the COO, Gordon Morrell. A query was created to narrow down all clients who managed commercial space throughout the United States.

Participation of the survey was done on a voluntary basis, with assurance that all answered material would be fully confidential as well as completely anonymous. The time estimated to take the survey was between five and ten minutes. The email was sent out on December 4th, 2008 to 3,626 commercial clients through with a link to an online website service called Survey Monkey (www.surveymonkey.com). A reminder email was sent out again on January 12th, 2008. A total of 410 surveys were begun and 170 completed.

The order in which the questions appeared was changed on January 8th, as a result of a significant response drop-off in one of the early questions. The "Incentives" section was originally the fourth section, and a ranking matrix question caused many respondents to quit the survey prematurely. In order to increase the number of respondents who completed the survey, we moved "Incentives" to a later stage. In doing so, we noticed a larger percentage of survey completions after the follow-up email was sent on January 12th.

4.2 Sample Representation

Our survey found that the sample population was representative of the whole population in terms of three explanatory variables. The population term used hereafter refers to all of Yardi Systems commercial property management clients.

To test the relevance of our survey sample we compared the sample to our population based on the following three variables:

1. Square footage managed
2. Number of properties managed
3. Location Distribution (by region)

4.2.1 Total Square Feet Managed

We tested the null hypothesis that:

- H_0: There is a significant difference between the sample mean and the population mean in terms of amount of total square feet managed by a property manager.
- The sample mean is 2,316,304 square feet managed.
- The population mean is 2,000,000 square feet managed.

At a degree of freedom of 311, the p-value resulting from the two-sided t-test was 0.576. The test results indicate that we reject the null hypothesis. Thus, there is no statistically significant difference between the sample mean and the population mean in terms of the amount of square feet managed my property managers.

Since these results demonstrate that the sample is strongly representative of the population in terms of square footage managed by property managers, SPRI utilized square footage managed by property manager as the variable to base projections for potential adoption (see section X). Varying percentages of improved square footage were used to create extrapolations

of the square footage managed by respondents in the survey across the population of all of commercial property managers in Yardi's client base.

4.2.2 Number of properties managed

We tested the null hypothesis that:

- H_0: There is a significant difference between the sample mean and the population mean in terms of the number of buildings managed by a property manager.
- The sample mean is 48.885 buildings managed.
- The population mean is 30 buildings managed.

At a degree of freedom of 321, the p-value resulting from the two-sided t-test was 0.0366. The test results indicate that rejection of the null hypothesis depends on the confidence interval used to analyze the results. At a 99 percent confidence interval, we reject the null hypothesis and conclude that our sample mean is not statistically different from our sample population. However, at a 95 percent confidence interval, we fail to reject the null hypothesis.

From these tests we conclude that our sample is not as statistically representative of our population when evaluating the number of buildings managed as when evaluating in terms of the square footage managed by a property manager.

4.2.3 Location of Property Managers

To test the relevance of our sample in terms of location distribution, we conducted a χ^2 test on the frequency of respondents from every geographical region in our sample to the theoretical frequency of Yardi's commercial clients in every region based on their frequency of the population. Figure 1 shows the comparison:

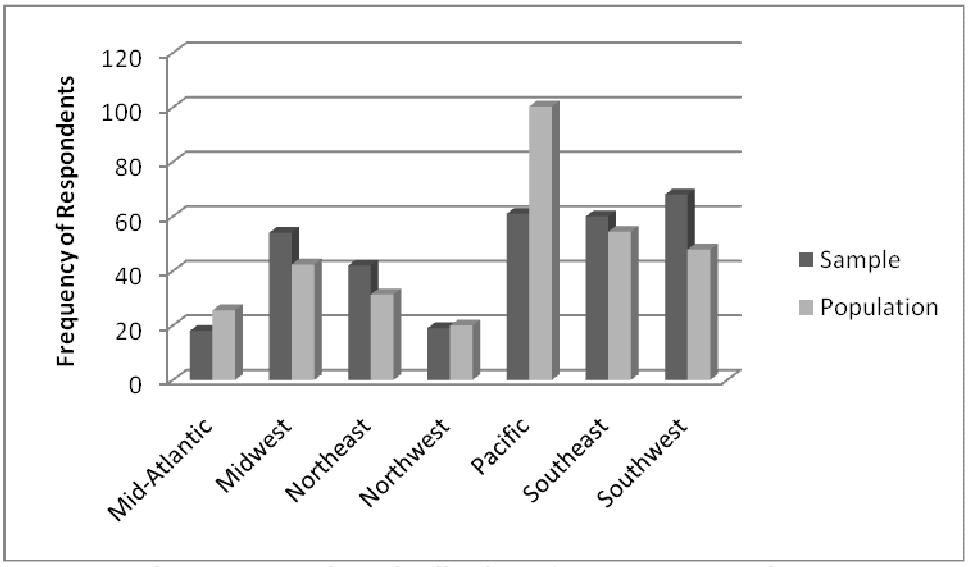

Figure 1: Location Distribution of Survey Respondents

The χ^2 test for this direct comparison resulted in a p value of 8.36 x 10-6. This demonstrates that there was a very significant difference between the regional distribution of our sample and the population.

Information for Yardi's client base was provided by state. This enabled grouping the Pacific and Southwest regions together and the Northeast and Mid-Atlantic regions together (Figure 2). These grouped regions additionally share similar climatic patterns. After this regrouping, the χ^2 test resulted in a p-value of 0.17. This demonstrates that when these groupings are utilized, there is no significant difference between the regional distribution of our survey sample and the population.

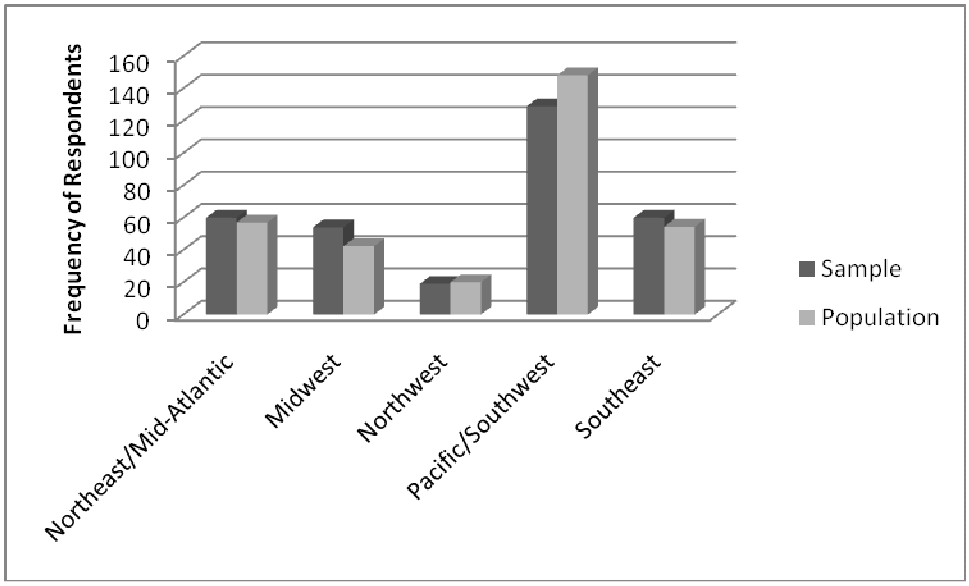

Figure 2: Grouped Location Distribution of Survey Respondents

4.2.4 Summary of Sample Representation

The sample is more representative of the population in terms of square footage than in terms of the number of properties. This is advantageous to SPRI, as the total square footage is a better indicator of the amount of energy, water, and materials used by a property manager than the number of buildings. Square footage is the most significant explanatory variable for SPRI's analysis of the survey results, and also utilized to make projections on proportions of unimproved space. The sample was representative of the population in terms of the location of property managers when grouped with the Pacific and Southwest together and the Northeast and Mid-Atlantic together. To conduct hypothesis testing on the sample data with location as an explanatory variable, these groupings would need to be utilized.

4.3 Survey Results

4.3.1 Survey Results Overview

Analysis of the survey was conducted with a focus on understanding how to most effectively frame the Interactive Resource Manual. This analysis allowed the group to market the IRM in a manner that appropriately reaches the target market and optimizes its effectiveness.

Findings from these analyses were used to craft the IRM in terms of designing both an overall approach and honing in on the best tools and

resources to link with specific upgrades. The following are the most prominent overarching approach-based findings with regards to performing upgrades, divided into two separate analysis mechanisms

A. Univariate Analysis
- Conducted to:
  - ⇒ Gauge property managers' current level of specific upgrades
  - ⇒ Understand property managers' responses to decision-making drivers such as barriers, incentives, types of information, etc.
- Major conclusions used to design the IRM:
  - **A.1.** Barriers, incentives, and information valued for performing upgrades focused consistently on financial obstacles and rewards.
  - **A.2.** Property Managers faced varying types of barriers depending on whether building improvements were related to energy, water, or materials procurement. Specifically, barriers were most financially focused for energy upgrades and least financially focused for materials procurement.

B. Hypothesis Testing
- Conducted to:
  - ⇒ Assess the effect of explanatory variables (such as square footage or number of properties managed, current level of upgrades, etc) on property managers' decision-making drivers.
- Major conclusions used to design the IRM:
  - **B.1.** The amount of property managed (both total square footage and number of properties) does not significantly affect decision-making drivers.
  - **B.2.** The type of information that property managers find most valuable is affected by their past level of green upgrades.

4.3.2 Univariate Analysis Conclusions

4.3.2.1 Barriers, incentives, and information valued for performing upgrades focused consistently on financial obstacles and rewards.

An essential function of the survey was to identify the reasons property managers perform or fail to perform green upgrades on their properties. To understand this, the survey set out to examine the barriers to performing

upgrades, as well as the incentives for performing them, and the type of information that would be most useful when evaluating whether to perform a particular upgrade or not.

Throughout the parts of the survey that sought to identify these drivers of property-manager decision-making, financially-focused barriers, incentives and information related to the decision were consistently the most prominent. SPRI assessed the relative focus on financial rewards and obstacles for various property manager actions and applied the survey results to the construction of the IRM. This involved anything from determining the prominence of links to financial resources, such as cost calculators and rebate information, to focusing on the financial rewards of the upgrade in the upgrade messaging itself. This section provides specific information on how property managers concentrated on financial concerns for the barriers, incentives, and type of information when considering green upgrades on their properties.

Barriers

Figure 3 shows that 62% of respondents ranked upfront cost as the highest barrier. The next most frequent barriers ranked as most significant were ranked that way by only 7% of respondents. This lopsided distribution is a key point of the survey. High upfront costs are the barrier we concentrated on addressing the most in the IRM, through such resources as cost calculators and rebate links.

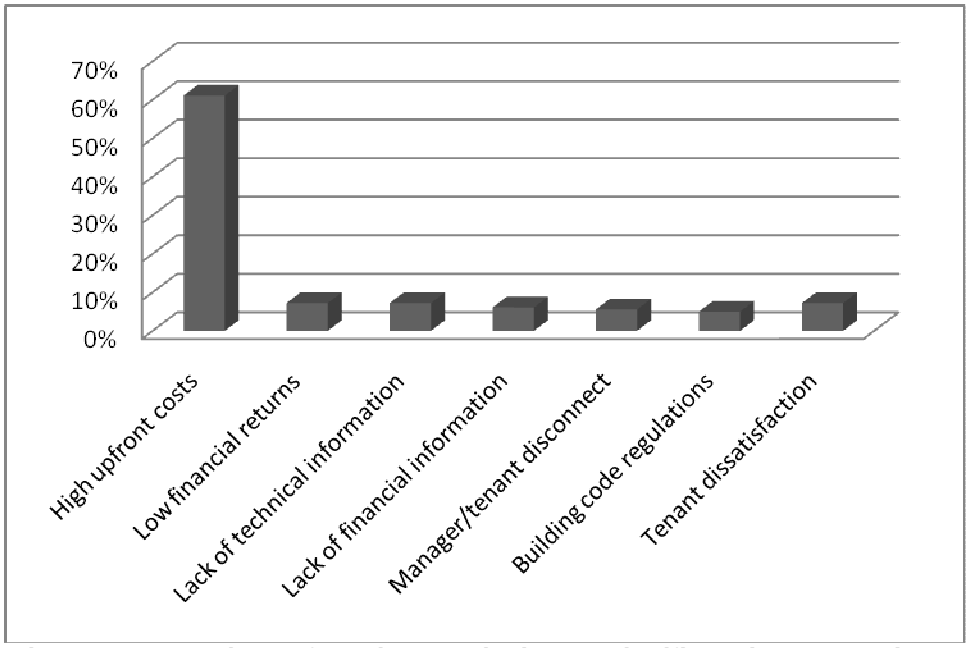

Figure 3: Proportions of Barriers Ranked Most Significant by Respondents

Figure 4 reinforces this focus on high upfront costs with an illustration of the average ranking of the seven barriers. Note how the average ranking for upfront costs was 2.04 and the average ranking for low financial returns was 3.28 (a difference larger than the standard deviation of the average rankings - .097).

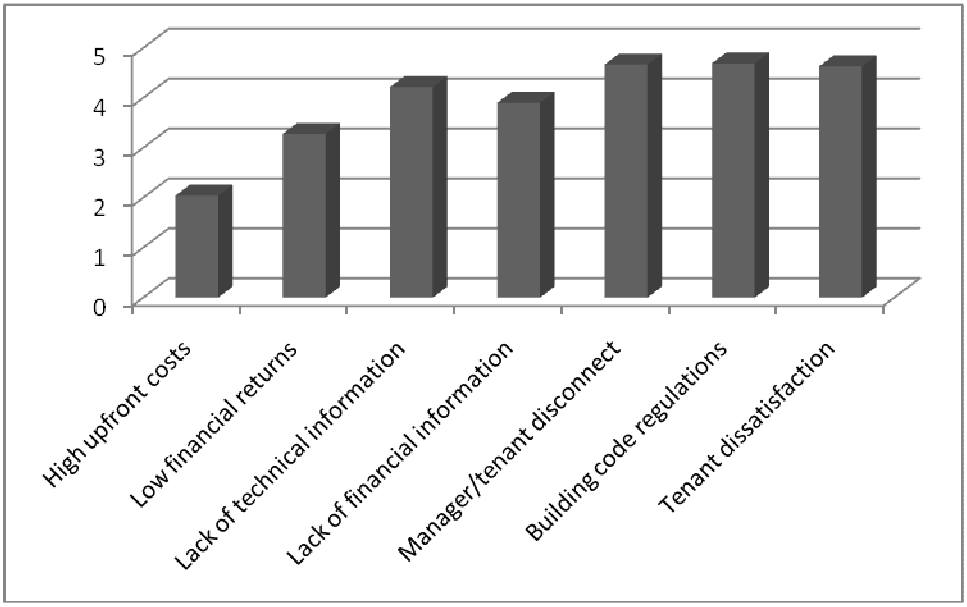

Figure 4: Average Ranking of Each Barrier (1= highest)

When grouping barriers into three types (financial, informational, and building/tenant issues), financial barriers were ranked as most significant 69% of the time. Building/tenant issues were ranked as least significant 67% of the time.

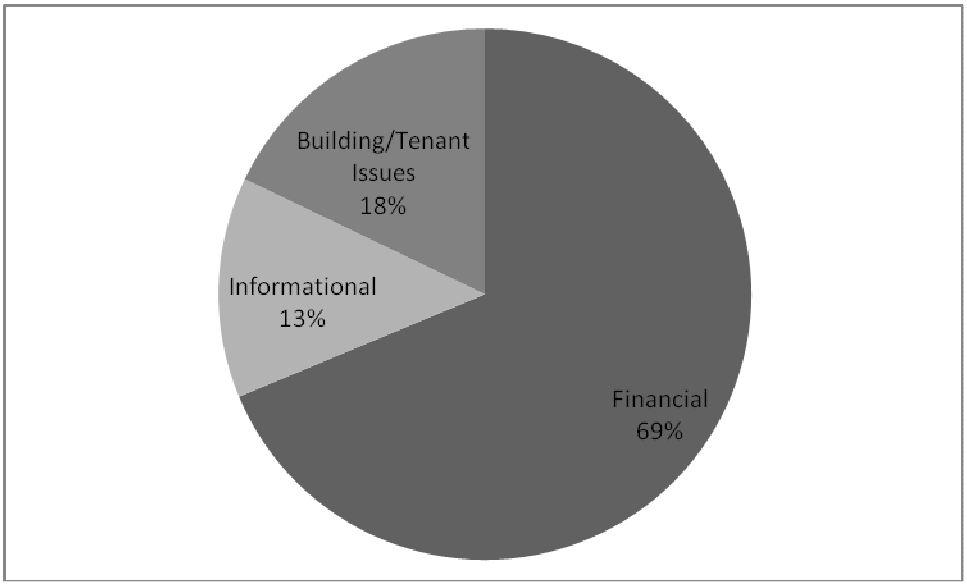

Figure 5: Proportions of Barrier Type Ranked Most Significant by Respondents

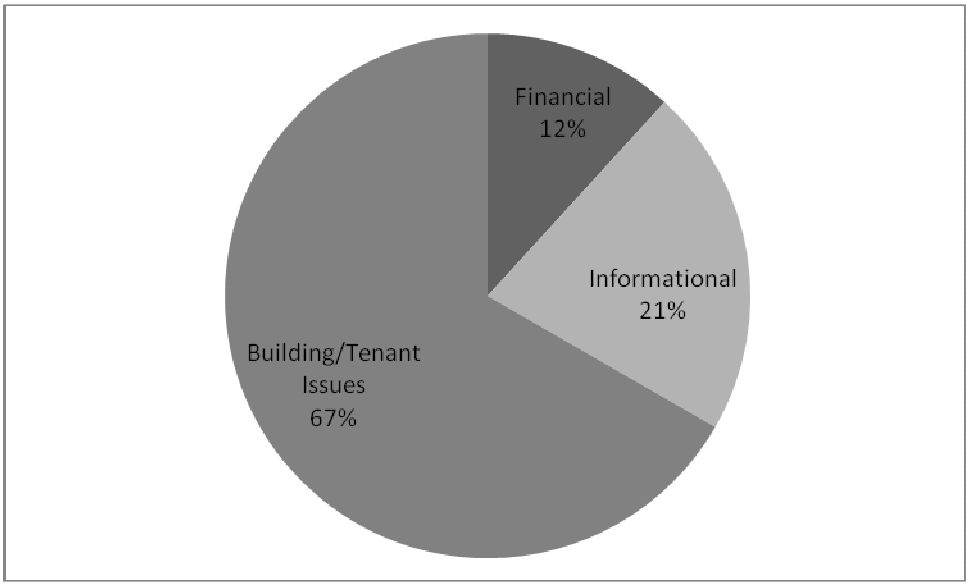

Figure 6: Proportions of Barrier Type Ranked Least Significant by Respondents

Incentives

Grouping incentives into three separate categories illustrates that 75% of respondents ranked an incentive related to ROI as the most important. 41% of respondents ranked ROI from decreased utility bills and 18 % ranked ROI through increased occupancy and rental rates as the most important incentive. Only a quarter of the respondents ranked other incentives, such as

brand recognition, anticipation of future regulation, or corporate social responsibility as the most important incentive.

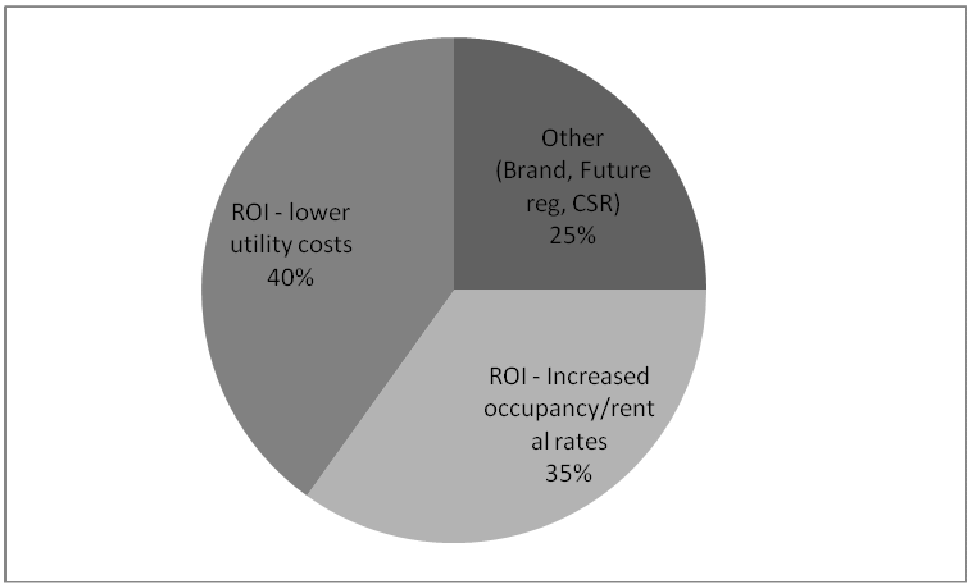

Figure 7: Proportions of Incentive Type Ranked Least Significant by Respondents

Most Valuable Information

Figure 8 reiterates property managers' preoccupation with financial motives as nearly 60% of respondents cited that information on financial returns as the most valuable information when considering green building upgrades.

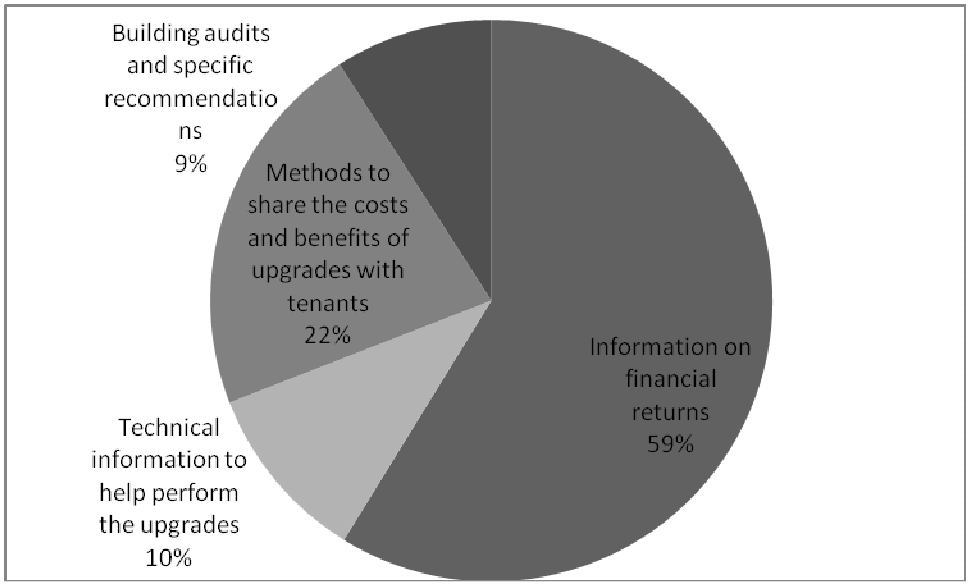

Figure 8: Proportions of Information Ranked Most Valuable by Respondents

4.3.2.2 Barriers depend on improvement category

Property Managers faced varying types of barriers depending on whether building improvements were related to energy, water, or materials procurement. Specifically, barriers were most financially focused for energy upgrades and least financially focused for materials procurement. Although survey respondents focused consistently on financial obstacles and rewards, the relative skew towards financial concerns varied depending on the type of upgrade property managers were considering. When presenting energy and water upgrades in the IRM, SPRI targeted property managers with a heavy focus on financial rewards and resources, such as cost calculators, green leases, and rebate information. However, for materials procurement upgrades, SPRI found that other obstacles and rewards that property managers faced figured almost as prominently in their decision-making as financial motives.

As you can see from Figure 9, the percentage of respondents citing financial barriers, compared to other barriers types, is highest for energy efficiency upgrades, second-highest for water upgrades, and lowest for materials purchasing upgrades. This illustrates that while SPRI can be effective by assisting property managers with overcoming financial barriers and reaping financial rewards in terms of energy and water upgrades, SPRI should

prioritize other resources to help property managers upgrade materials procurement processes.

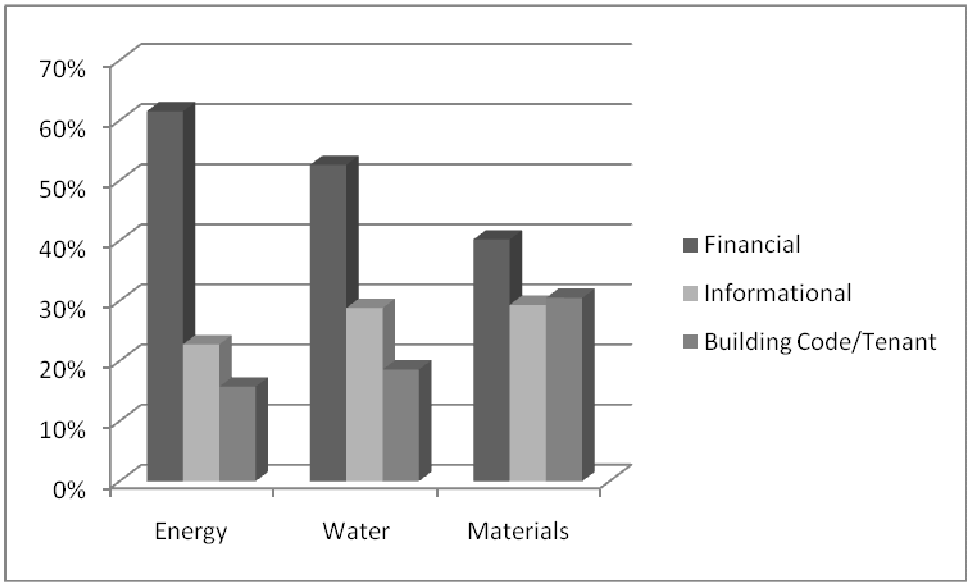

Figure 9: Proportions of Barrier Type Ranked Most Significant – Grouped by Upgrade Category

Figure 10 demonstrates the strong financial prioritization in terms of energy-related upgrades. These are great examples of the type of upgrade where SPRI took a focused approach to providing cost calculators and resources for rebates for property managers.

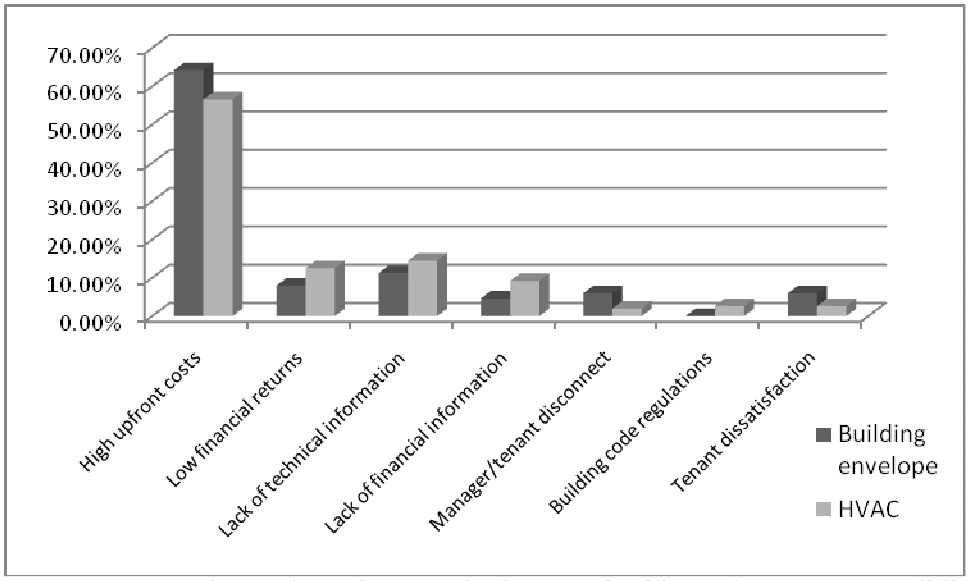

Figure 10: Proportions of Barriers Ranked Most Significant for HVAC & Building Envelope Upgrades

However, for one of the materials-related upgrades, the procurement of green cleaning supplies, lack of technical knowledge was the most frequently cited barrier. In fact, this was the only upgrade where 'Upfront Cost' was not ranked as the most significant barrier. In the IRM this upgrade was addressed with a particular emphasis on technical information.

Another upgrade where SPRI took into account that financial barriers weren't the overriding factor was the installation of hand dryers, for which respondents cited 'Tenant Dissatisfaction" more frequently than for other upgrades. SPRI addressed this in the IRM by showing that recent innovations in hand dryer technology can dramatically improve tenant reaction.

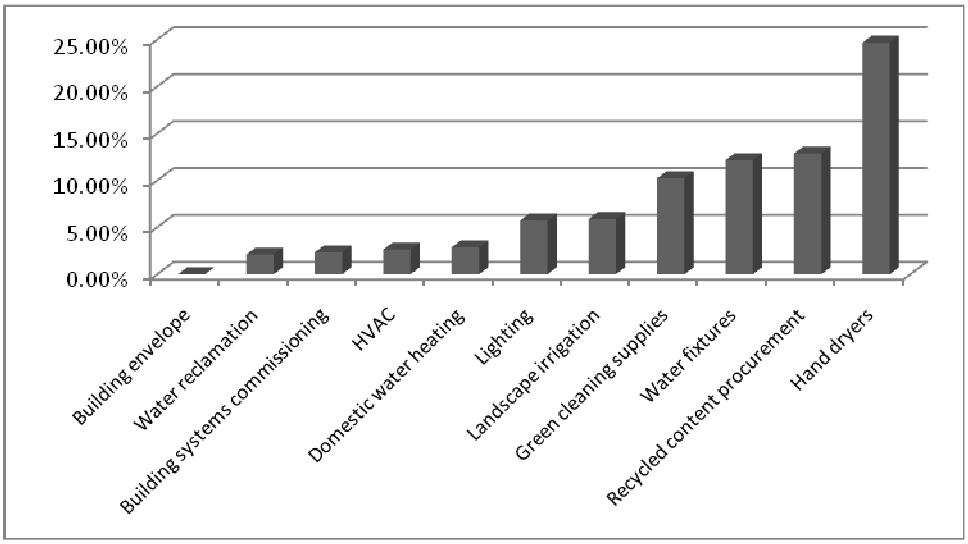

Figure 11: Proportion of Respondents citing "Tenant Dissatisfaction" as the Most Significant Barrier for all Upgrades

4.3.3 Hypothesis Testing Conclusions

4.3.3.1 The amount of property managed (both total square footage and number of properties) does not significantly affect decision-making drivers.

An indicative conclusion from SPRI's hypothesis testing on the impact of explanatory variables on decision-making drivers (such as barriers, incentives, valuable information, and investment criteria), was that the amount of property managed does not affect these drivers. **Appendix F** shows a list of the χ^2 and corresponding p-values for the hypothesis testing conducted with square footage managed and the number of buildings managed as the independent variables and property managers' decision-making drivers as dependent variables.

As the table illustrates, these independent variables do not significantly affect how property managers approach the decision to conduct upgrades on buildings in their portfolio. This is a valuable result for the IRM, as it allowed SPRI to target property managers without regard to size. SPRI was able to construct the IRM uniformly and not have to tailor upgrades to differentiate between property managers based on the varying number of buildings or the varying amount of square footage they manage.

4.3.3.2 Property managers' incentives for performing green building upgrades is affected by their past level of green upgrades.

A vital hypothesis test result was the impact of property managers' past level of green upgrades on buildings in their portfolio on their incentives to conducting further green upgrades. The average level of previous upgrades the respondent had performed significantly impacted their incentives. The respondents with a lower past level:

1. Found ROI through lowered utility rates more important than those with a higher past level.
2. Found other incentives (environmental responsibility, future regulation, and corporate image) less important than those with a higher past level.

SPRI used these results to target the IRM most effectively by focusing less on these other incentives, such as environmental responsibility, future regulation, and corporate image. This test showed implied that property managers who value these incentives have generally already performed more upgrades. This does not mean they should be excluded, but rather that they should be prioritized lower.

There is also a relationship between respondents' incentives and the two most frequently ranked types of information (ROI info and cost-sharing methods). Those driven by ROI through lower utility bills find ROI info most valuable, but less obvious is that those driven by ROI through higher occupancy and rental rates value cost-sharing more. In the IRM, when we provide info on how green building upgrades increase rental/occupancy rates, we are targeting a section of managers that also values manager-tenant contracts more. Practically, this involved adding resources for green leases (contracts that allow managers and tenants to share the costs and benefits of green upgrades).

4.3.4 Investment Requirements

4.3.4.1 Minimum ROI

Most respondents' minimum acceptable ROI with regard to green building upgrades fell into the 6 to 10% range. When targeting the IRM, SPRI assumed that most respondents (95%) refused to accept an ROI less than 3%, and that used the 6-10% timeframe as the reference but acknowledged that a large group (34%) required an ROI higher than 10%.

4.3.4.2 Maximum Timeframe

This section of the survey served to determine the maximum amount of time before realizing a full return on investment. 82% of respondents cited a timeframe of 1-6 years. The IRM was designed with the knowledge that the target audience will rarely accept a timeframe longer than 6 years. Certain upgrades may require a longer timeframe, but the knowledge of property managers' short-term investment preferences was a valuable guideline when constructing the IRM.

5 Interactive Resource Manual

The data collected from our building audits and survey allowed SPRI to target our Interactive Resource Manual (IRM) to best meet the needs of property managers when making green building improvements.
This resource, the IRM, has been built into a web platform that is available online for *all* property mangers at:

www.greenerbuildings.info and www.sustainablepropertyrewards.info

Using the group project budget, these two domain names have been purchased for one year.

5.1 IRM Distribution Method and Target Market

A web-based platform was selected to communicate interactive information to Yardi's property managers. The medium of a website was chosen because of both our survey results and awareness of our target market's technological capabilities.

The national survey asked where they obtained information on green building improvements. As is evident in Figure 12, the internet is an important source of information for 44% of property managers. However the percentage of respondents who answered trade publications approaches 50%. It is possible that information obtained through trade publications is also available online.

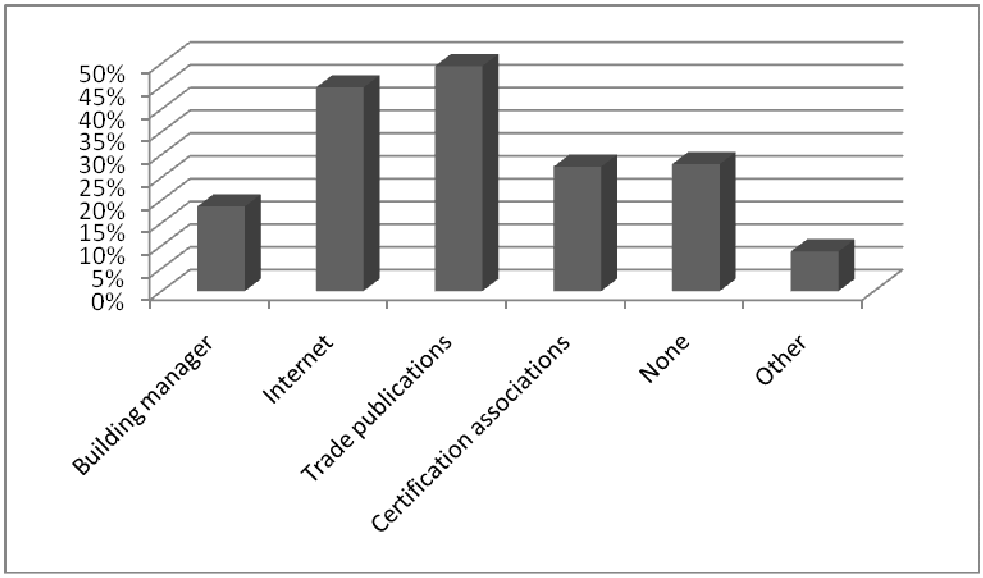

Figure 12: Sources Property Managers Used to Obtain Information (*Percentages do not add up to 100% because respondents could select multiple sources of information***)**

The SPRI team was aware that property managers accessing the IRM online already use Yardi's advanced property management software. One of Yardi's software services, Voyager™, is a fully integrated, browser-based, enterprise management software system[1]. This leads to the assumption that Yardi's customer base has the resources and human capital to use an online system to access electronic information. Although the IRM is targeted towards Yardi's U.S. clients, the content is available to anyone with internet access across the globe. The group did not sign a non-disclosure agreement, and there is no proprietary information in the IRM that would decrease Yardi's competitiveness or release sensitive data[2].

Yardi's international clients were not considered during the initial scoping of the project because each country's building stock will have a different level of efficiency. However, certain best practices, cost calculators, and portions of the self-audit could be utilized by Yardi's international clients. The international market for their software represents an additional billion square feet of commercial space managed by their clients.

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[1] http://www.yardi.com/US/YardiProductLines.asp

[2] The raw survey results will not be included on the site because competitors could analyze various informational metrics on 9% of Yardi's commercial clients.

Resources for green building improvements are available in a variety of locations online, but are rarely simplified. Many of the large green building sites or government resources have broader reach and are complicated to navigate. More importantly, resources are developed with the end user as the recipient of savings, and not the property manager.

Flex Your Power, California's statewide energy efficiency marketing and outreach campaign, is a partnership of California's utilities, residents, businesses, institutions, government agencies and nonprofit organizations. This campaign seeks to improve energy efficiency through all different sectors including commercial, residential, industrial, institutional, and agricultural. Unfortunately, this program is tailored to such a vast array of sectors that it is easy to become overwhelmed with information that may be inconsequential to the average property manager.

In regards to water efficiency, programs are generally developed for the residential consumer. EPA's WaterSense program includes ways to save water in irrigation, fixtures, toilets, and weather based controls. Once again, unless the property manager pays the utility bills, the resident takes advantage of these water savings tips. Our resource seeks to find ways to incentivize property managers to improve the efficiency of their buildings.

SPRI takes a targeted approach with the IRM to synthesize the resources for property managers and green building improvements. SPRI is less of an all-encompassing tool, focusing more on existing commercial buildings, and less on new construction projects.

Research on Yardi's competitor's sustainability initiatives was compiled from data available online. Their main competitors are JD Edwards, MRI, and Real Page who provide similar property and asset management software. These companies generally share their overall sustainability strategies, but do not outline goals on integrating sustainability into their software offerings. Intuit Software (Developer Network or MRI) has publically committed to reducing their carbon footprint by 15% by the end of fiscal year 2010[3], and the company is headquartered in a LEED building. However, based on the external information available, no programs similar to the IRM and SPRI are under development by competitors that specifically aid property managers in greening their buildings. Yardi is in a unique position because their competitor's environmental initiatives focus on greening their own facilities and practices, but do not focus on their clients operations.

[3] http://about.intuit.com/about_intuit/philanthropy/sustainability_goal.jsp

5.2 Layout and Content

The main goal in the development of the IRM was to make it as accessible as possible for our general audience of property managers. The language is general, and does not include verbose scientific discussion related to specific environmental problems or global climate change.

Using the internet as the platform for the IRM is important because it allows for the posting of files, interactive tools (calculators), and potentially even discourse among interested property managers.

Provided below are core components of the IRM:

- Energy
- Water
- Material Procurement
- Self-Audit and Auditing Procedures
- Calculators
    - Energy
        - Delamping
        - Fluorescent Lights
        - Electric Hand Dryers
        - HVAC
        - Computer Monitor Power-Saving
        - Computer Tower Power-Saving
        - Smart Power Strips
    - Water
        - Low-Flow Toilets
        - Low-Flow Urinals
        - Faucet Flow Restrictors

- Case Studies
- Survey Results
- Sitemap

The majority of the content that will be delivered on the website can be found in **Appendix E.**

Ten best practices have been selected for each of our key focus areas; energy, water, and materials procurement. These best practices are not ranked in order of importance. Just as each building presents different opportunities for improvement, specific best practices will be more applicable for some buildings than others. For example, water improvements are more

important in the Southwest than the Pacific Northwest. Payback periods would also vary in different parts of the country due to variation in utility pricing.

5.3 Software Integration

Yardi made it clear from the onset of the project that they were not interested in integrating sustainability aspects directly into their software. This would be a costly strategy, and Yardi currently does not have the internal capacity to properly integrate sustainability into the software. Currently, no overarching software development strategy is recommended.

SPRI is essentially a pilot project that allows Yardi Systems to gauge their clients' interests in sustainability initiatives. If aspects of the IRM are successful the company may allocate future capital resources for investing in development of sustainability integration.

In the survey, Yardi's property managers were asked whether they would be interested in utility tracking software that would monitor energy and water usage in their buildings. 71.5% of respondents rated this program either valuable, very valuable, or extremely valuable.

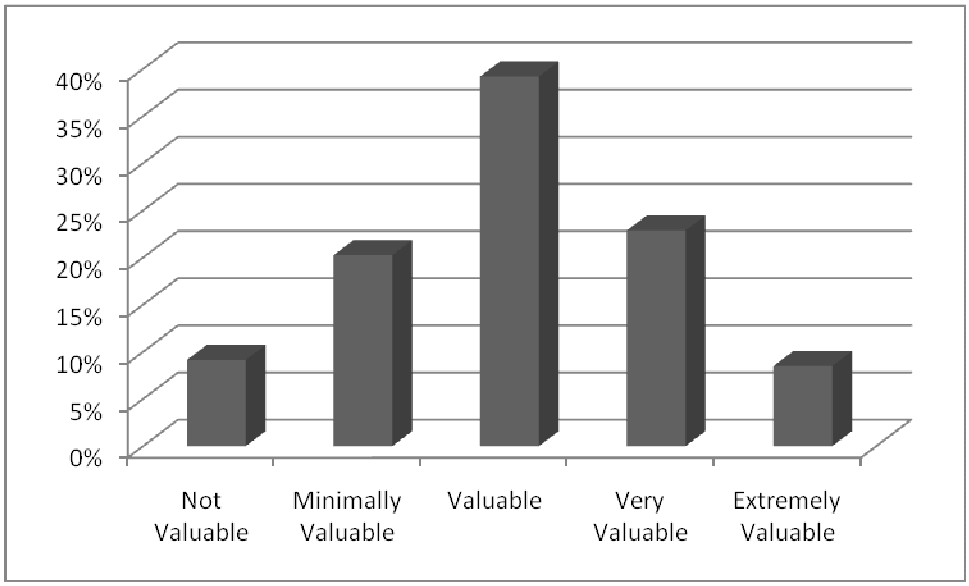

Figure 13: Value of a Utility Software Tracking

SPRI is only an addition to Yardi's current website platform, and is not incorporated into their enterprise software offerings. In future software development cycles Yardi will consider several large upgrades (features) that will be included a new version. Web traffic should be analyzed and Yardi can assess whether an adequate number of property managers are using the IRM. Yardi can effectively leverage SPRI as a pilot project to gauge their client's interest in sustainability. Depending on how strong the feedback from property mangers is, Yardi could integrate aspects of the IRM into their software platform and appropriate the content in future development cycles. Yardi's direct competitors are likely considering this in their future development cycles, and by acting timely, Yardi may be able to capitalize and reap the rewards of being a first mover.

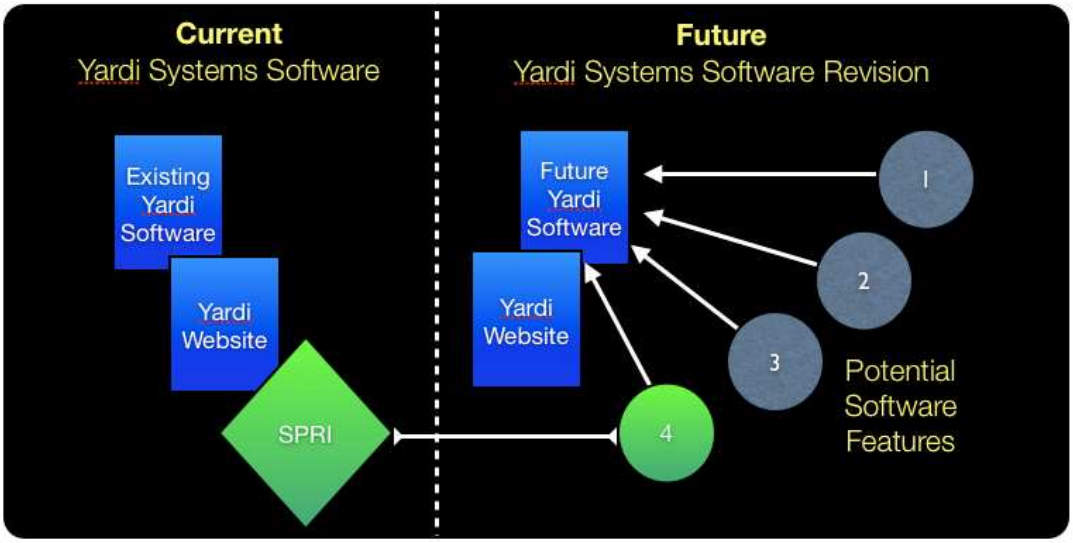

Figure 14: Software Integration Schematic

6 SPRI Market Impact Projections

Yardi Systems is the global leader among software development firms specializing in asset and property management software. The market reach that Yardi commands and the nature of the commercial property management industry are such that the SPRI Interactive Resource Manual (IRM) has the potential to affect significant environmental improvements, given appropriate deployment of the IRM. The following subsections present the potential impact of the IRM, as well as the assumptions built into these calculations.

The commercial property managed through Yardi's software exceeds 8 billion square feet globally, 88 percent of which is within the United States (Giles 2009). These approximately 7 billion domestic square feet represent 10 percent of the domestic commercial building stock (DOE 2009), and is the target of the Sustainable Property Rewards Initiative. This means that even if low implementation rates are achieved, SPRI can be the catalyst for the achievement of significant energy and water use reductions, as well as for the adoption of environmentally preferable procurement practices on a vast scale.

The national survey addressed various aspects of energy and water use as well as materials procurement, and for the purposes of our market projections, we focus our analysis on easily implementable improvements in the energy and water categories. Lighting and water fixture efficiency upgrades both involve relatively minor up-front capital investments and favorable returns on investment, and yield quantifiable environmental benefits. Our market impact projections are based on the assumption that a small percentage of Yardi's client base will utilize the tools provided in the IRM to facilitate some degree of environmental upgrades in their facilities. Based on our survey findings, we modeled differing degrees of adoption across unimproved square footage; that is, commercial space with relatively inefficient lighting systems and water fixtures.

6.1 Lighting Efficiency Improvement Projections

The national survey concluded that 50 percent of commercial square footage managed by Yardi's clients had undergone no lighting efficiency upgrades whatsoever. This equates to over 360 million square feet of space with a high potential for improved energy efficiency in lighting alone. In order to quantify the potential impact of SPRI in terms of environmental performance, we chose a scalable facility upgrade – lighting efficiency – and performed a sensitivity analysis given varying levels of implementation.

A conservative efficiency improvement in lighting energy intensity – 10 percent – was chosen as the improvement assumption and modeled across the total unimproved square footage. This level of improvement was shown to be achievable in each of the SPRI case studies, irrespective of past level of lighting upgrades. The sensitivity analysis yielded resulting environmental benefits for different implementation rates, from 5 percent of total square footage to 50 percent. As previously noted, the 50 percent metric represents the total square footage having undergone no past lighting efficiency improvements. This analysis concludes that if all unimproved square footage managed using Yardi's software were to undergo a lighting efficiency upgrade of 10%, over 1 million metric tons of CO_2 emissions would be avoided annually, or the equivalent of removing over 91,000 large sport utility vehicles from the road.

The following charts present the projected energy, CO_2 and cost savings from these improvements given differing levels of implementation.

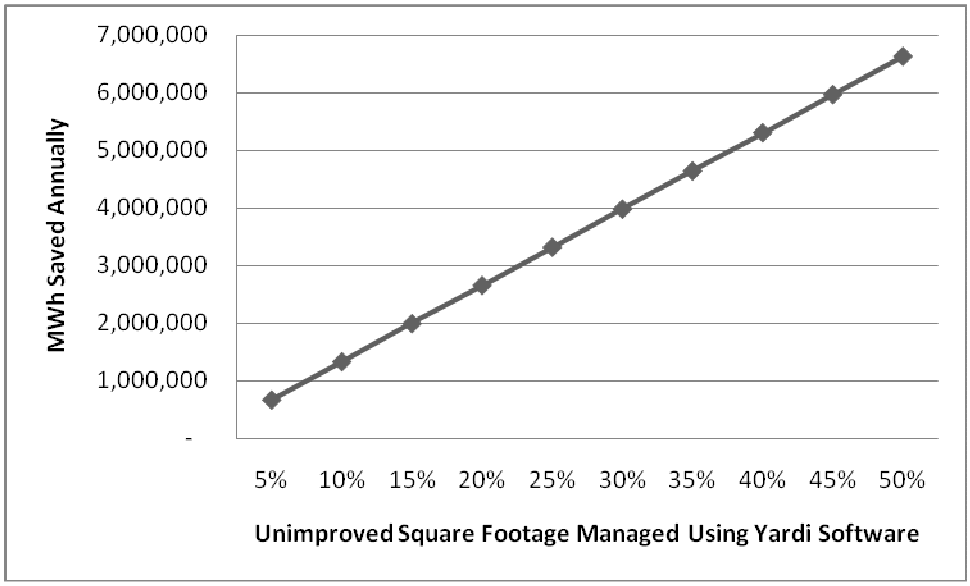

Figure 15: Megawatt Hours Saved through Lighting Efficiency Upgrades

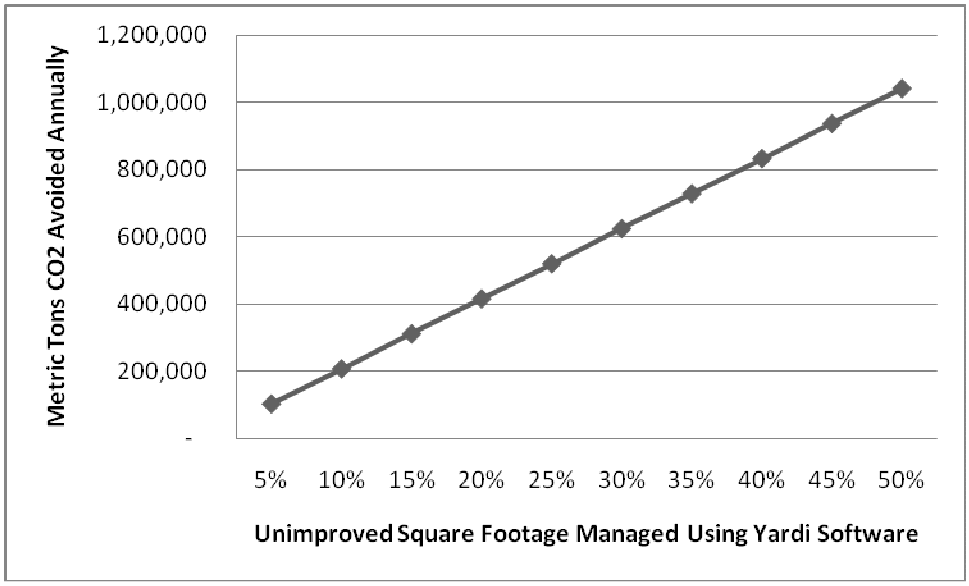

Figure 16: Metric Tons CO2 Avoided through Lighting Efficiency Upgrades

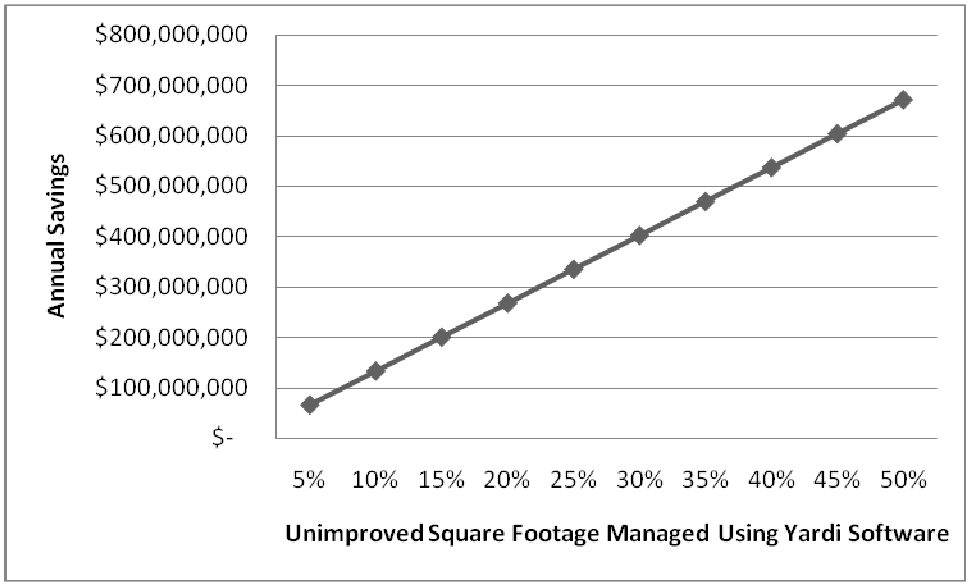

Figure 17: Total Annual Savings Achievable through Lighting Efficiency Upgrades

6.2 Water Efficiency Improvement Projections

Water efficiency upgrades were completed less frequently among Yardi's clients than lighting upgrades, with survey results indicating that 64 percent of square footage managed using Yardi software had undergone no water

fixture efficiency upgrades. The Energy Policy Act (EPAct) of 1992 mandates efficiency levels for lavatory flow and flush fixtures, and these rates were assigned to the baseline case of square footage having undergone no improvements. In other words, these projections assume that all commercial square footage achieves *at least* the level of efficiency mandated by the 1992 EPAct. Because many of the buildings will house water fixtures installed before this mandate went into effect, this assumption builds a significant measure of conservatism into our projections.

By installing more efficient toilets (1.6 gpf to 1.0 gpf), waterless urinals (1.0 gpf to 0.0 gpf) and lavatory sink faucets (2.2 gpm to 0.5 gpm), the average amount of water consumption per occupant can be reduced from 1,521 gallons to 617.5 gallons annually.

If all unimproved square footage managed using Yardi's software was to undergo retrofits of existing lavatory water fixtures, nearly 9 billion gallons of water could be saved annually, or the equivalent of annual irrigation water demand for over 11,100 acres of United States cropland. These upgrades were modeled assuming varying levels of implementation across unimproved square footage to yield total water saved annually, presented in the following chart.

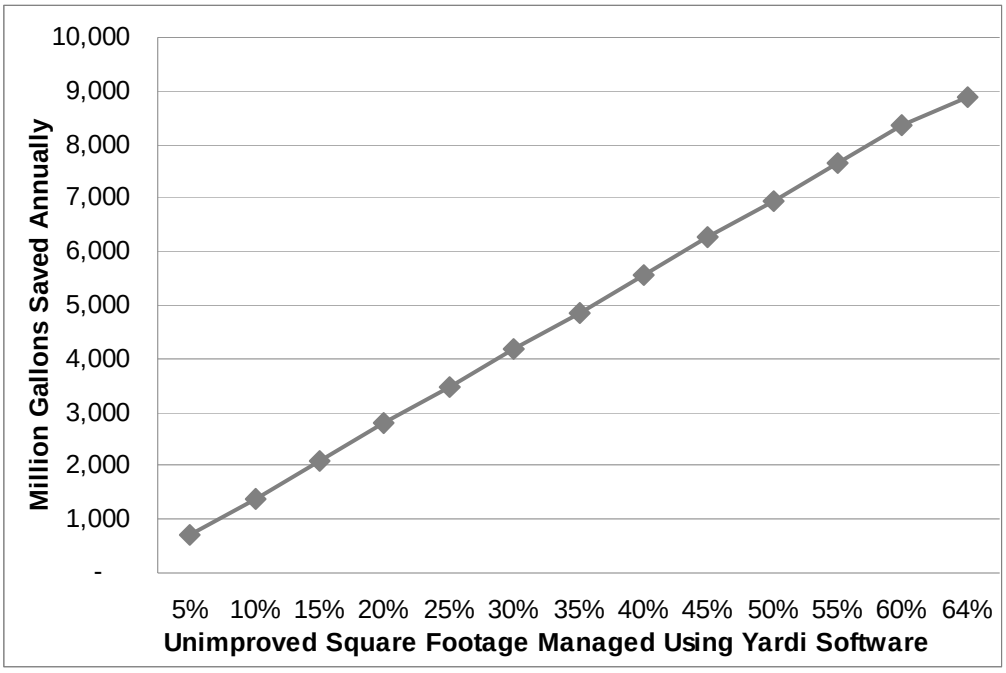

Figure 18: Million Gallons Saved Through Water Efficiency Upgrades

7 Final Proposal to Yardi Systems, Inc.

The Interactive Resource Manual (IRM) was developed by the SPRI team as a resource to distribute to the clients of Yardi Systems. This will contribute to significant reductions in energy use, water use, and the materials used in everyday operations and maintenance of commercial buildings. To conclude this project, we have developed a proposal for Yardi Systems that will illustrate the most effective means by which they can distribute the resources of the IRM to the widest audience.

7.1 Objectives

Three programs are suggested in order to distribute and promote the IRM. The objective of implementing one or more of the following proposed programs concurrently with the release of an Interactive Resource Manual is to increase the response by Yardi Systems' client base to the building improvement goals detailed in the package.

All three recommended programs are designed to provide added incentive for Yardi's clients to improve the efficiency of their buildings in terms of energy, water and materials usage. While the information available in the package should assist in clarifying incentives and overcoming barriers for a client to improve the buildings in their portfolio, the programs should increase the likelihood of a client utilizing the educational package to incorporate the goals of the Sustainable Property Rewards Initiative.

7.2 Overview

The proposed programs are a framework for Yardi Systems to develop within the operating procedures of their departments. They target Yardi Systems' leverage with clients at different levels – within a technical support capacity, a product-based capacity, and a corporate marketing capacity. They are not mutually exclusive, and may be most effective if applied simultaneously.

7.2.1 Program A – Sustainability Co-marketing Campaign

- Overview
  - Co-market sustainability efforts with top-performing clients
- Action Item
  - Create monthly/quarterly sustainability brochures

- Distribute to clients in monthly/quarterly newsletter or as part of a new sustainability newsletter

7.2.2 Program B – Audit and Recommendation Support

- Overview
  - Offer support to clients' efforts to self-audit properties
  - Collect feedback regarding the Interactive Resource Manual
- Action Item
  - Formation of a technical support team

7.2.3 Program C – Software Integration

- Overview
  - Integrate Energy Star Building Portfolio Manager into Yardi Software offering
  - Integrate utility tracking software into Yardi Software offering
- Action Item
  - Link data back-end to Energy Star
  - Develop energy and water database for client use
  - Program

7.3 Deployment Programs Details

The proposed programs are ordered from the lowest level of investment to the highest.

7.3.1 Program A – Sustainability Co-marketing Campaign

A marketing-based approach to incentivize performing green improvements on existing commercial buildings could consist of a campaign that co-markets the sustainability efforts of Yardi Systems and their top-performing clients. One method to encourage building efficiency measures is to distribute a "green newsletter", either as part of Yardi's regular newsletter schedule or as a standalone marketing piece, which either ranks or applies "sustainability" labels to the clients most focused on improving their buildings.

In addition, Yardi can award a client as the most focused on improving their building portfolio in that time period and agree to create co-marketing brochures that both Yardi and the selected client can distribute. The case studies performed by the SPRI team can serve as a framework for the brochures that Yardi can brand and develop into fully marketed brochures.

7.3.2 Program B – Audit and Recommendation

An audit and recommendation program should reflect the regional project conducted by the SPRI team in 2008, but scaled to accommodate a larger portion of Yardi Systems' client base. This ambitious program would require the establishment of a new department or audit team focused on auditing properties nationwide and delivering specific recommendations to the clients managing the properties.

This program has the potential to incorporate the following characteristics:

1) The audit team can set specific efficiency benchmarks for property managers to reach and align their recommendations with the educational package.
2) The audit team can work with property managers who have successfully improved the environmental performance of their buildings to create marketing-oriented case studies that reflect the value of improving existing buildings and reinforce the educational package.
3) The audit team can own the secondary task of continually updating, improving and scaling the educational package to align with their efforts and current green building practices.

7.3.3 Program C – Software Integration

A utility tracking functionality within Yardi Systems' software offerings will allow clients to more accurately benchmark and track their resource usage. Tracking the data, and housing it in Yardi Systems' database, can open an opportunity to pre-populate Energy Star's Portfolio Manager. In doing so, Yardi Systems can differentiate their product from their competitors, offer greater functionality for their client base, and preempt any possibility of energy regulations throughout the building sector.

7.4 Customer Preference

7.4.1 Survey Results

The survey sent out to Yardi clients on December 4th included a section to assess their interest in these programs. They were asked to rate these programs on a scale of 1 to 5 where:

1. Not Valuable
2. Somewhat Valuable
3. Valuable
4. Very Valuable
5. Extremely Valuable

The results of the survey are presented in the Figure 19:

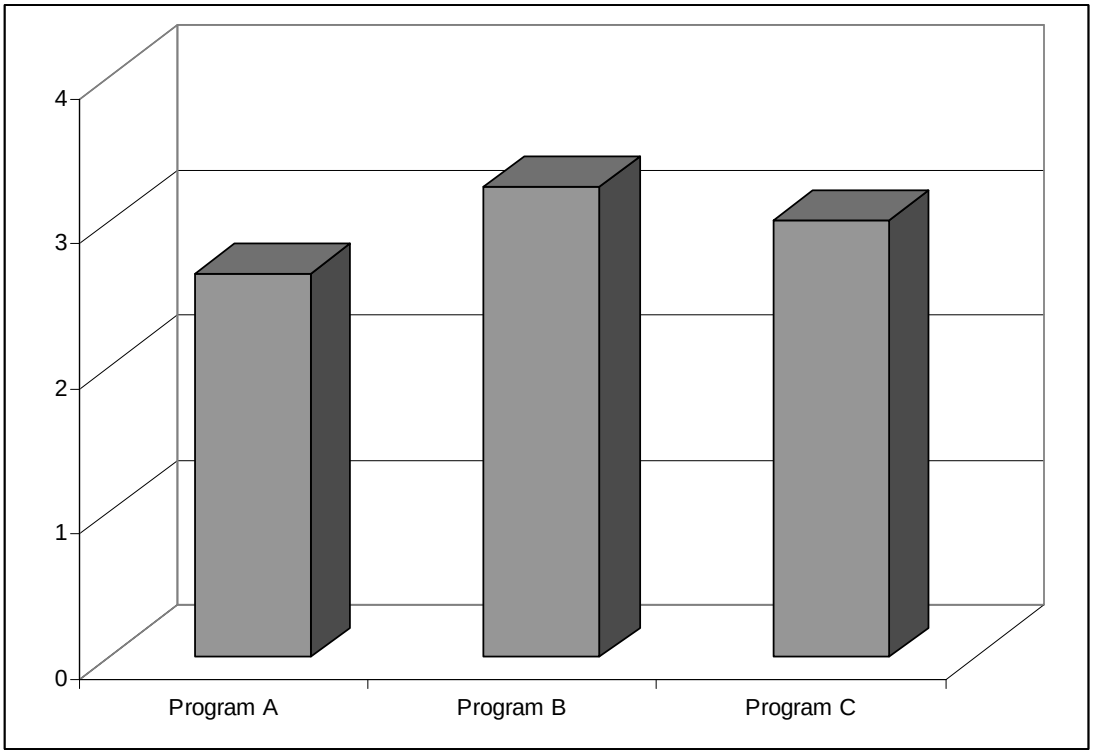

Figure 19- Average Program Rating

7.4.2 Differentiation of Product Lines

The combination of the Interactive Resource Manual, along with these three recommended programs, will improve Yardi Systems' already impressive market share. The Obama administration has outlined a broad policy to reduce the energy consumption throughout America, and a considerable element of this plan includes energy reductions in the building sector and a federal carbon cap-and-trade system.[4] Property managers will require functionality that meets the needs of these new regulations.

Integrating these programs into the Yardi Systems software will lead to product differentiation. By designing software that effectively tracks utilities, carbon emissions, and performance of buildings, property managers will gain the tools necessary to keep up with regulation.

[4] http://www.barackobama.com/pdf/factsheet_energy_speech_080308.pdf

The SPRI team believes that there is potential that Yardi Systems will adopt one or more of the suggested programs. However, in the case that they do not, the IRM stands as a valuable resource to property managers nationwide. By incorporating such resources as financial calculators, self audits, best practices, and case studies that can be utilized by a diverse group of commercial property managers, the IRM provides a resource that can significantly improve the environmental performance of commercial buildings, even without Yardi Systems' implementation.

Appendix A: Self Audit

Self Audit Tool
Instructions

The SPRI Self Audit Tool is intended to facilitate the collection and analysis of your building's environmental performance data. Through a preliminary investigation and a facility walk-through, property managers and building operators can utilize this Tool to gain a whole-building perspective, establish sustainability goals, and identify the appropriate changes necessary in order to meet those goals.

Execution of the SPRI Self-Audit Procedure is a three step process:

1) Complete Form A – *Baseline Establishment*. This step involves gathering basic building information including facility size, space use types and occupation information. Additionally, historical utility data is input into Form A to establish the facility's environmental performance baseline, as well as to compare it to that of similar buildings.

2) Perform a walk-through of the facility using the data sheets provided in Form B – *Physical Data*. Documenting the fixtures and appliances in place throughout a facility is critical. This information will allow users to calculate potential resource and cost savings generated by more efficient upgrade alternatives.

3) Utilize the SPRI Interactive Resource Manual in conjunction with the data gathered through the Self-Audit procedure to identify potential building improvements and cost savings.

SPRI

Self Audit Tool

Form A – Baseline Establishment

Collection of basic building and historical utility usage data is the first step in setting baselines and improvement goals. This form is also used to collect information of the parameters necessary to benchmark your facility using the Energy Star Building Portfolio Manager.

The **Portfolio Manager** is found at https://www.energystar.gov/istar/pmpam/

Complete the form the extent possible.

A. Facility Overview

1. Facility Name _____

2. Address of Facility _____

   _____

3. Year Built _____

4. Square Footage of Entire Facility _____

5. Date _____

6. Mark what kind of property this is?

   _____ A single facility for which my organization owns or manages 90% or more of the floor area.

   _____ A portion of a single facility for which my organization owns or manages less than 90% of the floor area.

   _____ A campus or other collection of multiple facilities at the same geographic location.

7. Mark what type of facility this is?

_____ Courthouse	_____Medical Office	_____ Supermarket/Grocery
_____ Hospital	_____ Office	_____ Warehouse
_____ Hotel/Motel	_____ Dormitory	_____ Data Center
_____ School	_____ Retail	_____ Other

SPRI

Self Audit Tool

Form B – Physical Data

The data collected in the walkthrough will serve as the inputs for the financial calculator tools in the SPRI Interactive Resource Manual. This step will aid Property Managers and Building Operators in identifying inefficient building components, as well as determining which upgrades are financially viable.

Electricity Audit: For each floor or area, complete the following data fields

Building:

Floor	Room Type	Lightbulb Count	Bulb Type	Number of Occupants	Number of PCs	Task Lighting (Yes/No)	Occupancy Sensors (Yes/No)	Number of Light Switches	De-lamp? (Yes/No)

Restroom Water Audit: For each restroom in the facility, complete the following data fields

Bathroom

Floor and Room	# Conventional Toilets	# Low Flow Toilets	Toilet Info.	# Conventional Urinals	# Low Flow Urinals	Urinal Info.	# Old Sinks	# Low Flow Sinks	Sink Info.

Kitchen Water Audit: For each kitchen in the facility, complete the following data fields

Kitchens

Floor and Room	# Conventional Sinks	# Low Flow Sinks	Sink Info	Appliance Info

Materials Usage Audit: For each ongoing consumable or chemical product, complete the following data fields

Materials Usage

Location	Brand and Type	Green Seal (Y or N)	Recycled Content (Y or N)

Appendix B: Case Studies

Multi-tenant Commercial Office Building: A Case Study

This report presents the results of a comprehensive building audit conducted by the Sustainable Property Rewards Initiative (SPRI) team in August of 2008. This audit was developed in cooperation with a leading Santa Barbara area property management firm in order to assess potential green building upgrades existing at a multi-tenant commercial office building under their management. The audit concentrates on building operations relevant to energy usage, water consumption, and materials procurement.

The office building has incorporated assorted efficiency upgrades since its construction, however further opportunities for green operational improvement exist in the facility. The multi-tenant office building has the potential to implement low cost improvements that provide significant reductions in energy usage and operating costs. The audit sums the potential savings for energy to an estimated 25,000 kilowatt hours resulting in the diversion of 147 metric tons of CO_2 from the atmosphere. The decrease in water usage is calculated at over 35,000 gallons saved per year. Net income figures demonstrate the financial viability of the implementation of the included suggested improvements[i]. The initial investment of $2,298.00 will yield an annual savings of $3,354.00 making the return on investment approximately .69 years. Net operating income is increased by $3,354.00 with an increased building asset value of $47,914.29.

It is a common misconception that all green building improvements involve costly equipment upgrades to improve efficiency, however no and low cost solutions can be applied to even relatively efficient buildings with significant result. For property managers that are considering improvements that require substantial upfront capital expenditures, cost-sharing agreements can distribute the costs and savings of upgrades among the property management firm and its tenants.

Project Goals

The SPRI team was commissioned to conduct the audit as a part of a larger program to assist property managers in assessing and prioritizing green building improvements. The objectives of the audit were three-fold:

1. Recognize the diversity and complexity of carrying out commercial building audits in order to craft a self-audit tool for use by property managers;
2. Identify current building efficiency levels; and
3. Identify potential for low cost building upgrades that yield financial savings and reduce overall environmental impact of the commercial building sector.

Property Background

Build Date: 1981
Size: 10 Tenants / 48,880 Square Feet
Location: Santa Barbara, California

This is a commercial office building located in the center of Santa Barbara's downtown business community. The office space is occupied by a diverse mix of 10 professional tenants including financial service firms, law firms, and government agencies. The building features four floors; 48,880 square feet of rentable office space; two elevators with access to all floors; a private underground parking garage; a street level parking lot; and master metered utilities.

Building Performance Audit and Tools

Proper preparation will ensure a successful audit. Advanced tenant notification prior to conducting the audit will allow time for tenants to identify potential inefficiencies within their offices as well as arrange for admittance to all rooms including restricted access areas to ensure accurate audit results. Giving tenants the opportunity to participate in the audit process will also increase the likelihood of satisfactory outcomes for both managers and tenants. In addition to engaging tenants in the audit process, the knowledge and tools we recommend bringing to the building site include:

1. Time allowance of at least 1 hour per 15,000 square feet
2. Audit during normal hours of operation to observe typical energy, water, and materials use behavior
3. Audit sheets
4. Building floor plan including square footage and tenant names
5. Light meter to analyze illumination levels

Analysis and Recommendations: Energy

The U.S. EPA's ENERGY STAR Portfolio Manager provides an initial assessment of the building's current energy performance utilizing the data collected from the building audit and utility bills. This also establishes a benchmark score comparing building performance to similar type office buildings within the national database of facilities. The building energy profile allows for analysis of energy usage and cost savings potential.

Our audit verifies that the majority of the office and common spaces throughout the multi-tenant commercial office building already utilize energy efficient lighting including T-8 fluorescent lamps, compact fluorescent lamps, and LED lighting. In addition, many of the office spaces have installed occupancy sensor lighting controls to automatically manage energy use in unoccupied areas. With the majority of the

building's lighting already highly efficient, the potential for improvement is directed toward energy reduction strategies with a few minor equipment improvements.

1. Delamp

Implementing a delamping strategy involves disconnecting lamps in areas of sufficient natural lighting. Identifying necessary illumination levels, maximizing daylight usage, and minimizing excessive artificial lighting will decreases energy usage with little to no upfront cost. The determination of sufficient lighting levels should incorporate tenant preferences to ensure occupant satisfaction and comfort. Every percent reduction in lamps achieves a proportional increase in energy savings.

a. Eight existing window offices can be delamped from eight lamps to four lamps per office in Tenant X's space.

Suggestion	Investment ($$)	Annual Energy Saved (kWh)	Annual Money Saved ($$)
Delamp 32 lamps (32 watts at 2860 hours)	59[ii]	2920[iii]	292

b. Twenty-eight lamps within the window offices of Tenant Y can be delamped by a third.

Suggestion	Investment ($$)	Annual Energy Saved (kWh)	Annual Money Saved ($$)
Delamp 9 lamps (32 watts at 2860 hours)	16.5[iv]	823[v]	82

c. Tenant Z's space is overly lit with respect to the number of employees working on a regular basis. Delamping the 350 lamps within the office by a third would result in energy and cost savings.

Suggestion	Investment ($$)	Annual Energy Saved (kWh)	Annual Money Saved ($$)
Delamp 115 lamps (32 watts at 2860 hours)	211[vi]	10,524[vii]	1052

2. Buy Long Life Lamps

Replacing the current lamps with longer life lamps will significantly reduce the environmental waste produced from the building in addition to saving money in material costs.

a. Replace GE Ecolux T8 lamps with a nominal life of 20,000 hours to a longer life rating of 30,000 hours. This will save significantly on labor and materials costs, and decrease overall material waste. In order to minimize environmental impact, calculations are based on changing out lamps only after the old lamps have burnt out.

Suggestion	Investment ($$)	Annual Energy Saved (kWh)	Annual Money Saved ($$)
1200 F32T8/TL741 PLUS/ALTO Lamps	0	0	359[viii]

b. Replace the 50 watt mini flood lights existing within the two elevators to LED R20 Flood Lamps. The LED R20 Flood Lamps have a nominal rated life of 50,000 hours, versus the current lamps rated life of 6,000 hours. As we recommend changing these lamps out all at once this will have an expensive upfront cost; however the savings are substantial after two years.

Suggestion	Investment ($$)	Annual Energy Saved (kWh)	Annual Money Saved ($$)
12 LED R20 Flood Lamps	762	1579[ix]	157

3. HVAC Maintenance and Improvement

Although the building performance audit did not include an in-depth analysis of the HVAC system, there were a few noted components that can be improved.

a. Setting the heating system 1 to 3 degrees cooler in the winter, and the cooling system 1 to 3 degrees warmer in the summer can save the building a significant amount of energy and reduce operating costs over time. This must be a suggestion from the property manager in the form of a newsletter or pamphlet.

Suggestion	Investment ($$)	Annual Energy Saved (kWh)	Annual Money Saved ($$)
Reduce/Increase temperature by 3ºF	0	8265	826[x]

b. A qualified HVAC professional should provide a system inspection periodically to ensure that the HVAC systems controls and set points are functioning properly. System tune-ups and upgrades can deliver significant savings with a payback period less than 1 year.

Suggestion	Investment ($$)	Annual Energy Saved (kWh)	Annual Money Saved ($$)
Commission HVAC System	200	1800	180[xi]

Analysis and Recommendations: Water

Similar to the building's lighting, the majority of the water faucets and fixtures are already highly efficient. In the building's future, any new component installations or replacements should continue to be rated at the highest water use efficiency. The replacement of low-flow fixtures, including toilets and urinals, can produce savings resulting from rebate programs[xii] as well as reduced water consumption.

a. High-Efficiency Toilets are defined as fixtures that flush below the 1.3-gpf.

Suggestion	Investment ($$)	Annual Water Saved (gallons)	Annual Money Saved ($$)
4 High Efficiency Toilets in public bathrooms	(1450-1200+400)= 650	36,000	221[xiii]

b. The High Efficiency Urinal is defined as a fixture that flushes at 0.5-gpf or less.

Suggestion	Investment ($$)	Annual Water Saved (gallons)	Annual Money Saved ($$)
2 High Efficiency Urinals in public bathrooms	(800-600+200)= 400	30,000	184[xiv]

Analysis and Recommendations: Materials Procurement

Materials used in the day-to-day operations of office facilities often contribute to poor indoor air quality (IAQ) and can be detrimental to natural resources and human health. Although tenants are often responsible for their own materials procurement, establishing a material purchasing program that encourages the use of environmentally preferable purchases can help reduce the negative impacts of materials use to commercial spaces and the environment.

a. Choosing non-toxic and/or biodegradable materials can help minimize the health impacts to workers and customers, improve IAQ, and reduce water pollution.
b. Choosing materials that are labeled as having low or no VOC content can greatly improve IAQ and reduce health risks to tenants.
c. Purchasing liquid cleaners in concentrated form reduces packaging waste and are often more cost effective.
d. Choosing paper products with recovered and/or recycled content helps to minimize depletion of natural resources and reduce the amount of energy required for primary production.
e. Unbleached paper products should be purchased for all applications necessary.

Net Income Projections

These figures sum the above calculated recommendations only. As these figures do not sum all included recommendations and are not representative of an exhaustive list of all possible improvements existing at the building site, there certainly exists potential for even greater savings.

Total Energy Savings (kWh)	25,911
Total Water Savings (Gallons)	66,000
Investment Cost	$ 2,298.00
Annual Cost Savings	$ 3,354.00
Payback (Years)	0.69
Annual Return on Investment	146%
Increased Net Operating Income	$ 3,354.00
Capitalization Rate	7%
Increased Building Asset Value	$ 47,914.29

References and Calculations

[i] As information regarding the lease structure between property manager and tenants was not disclosed, the costs and returns associated with the upgrades are not allocated between parties.

[ii] ($22 ⁄ 12) * 32 lamps= $59

[iii] (32 Lamps * 32 Watts * 2860 Hours) / 1000= **2,920 kWh saved per year**

[iv] (Labor rate * Labor time per lamp * Number of lamps-
($22 ⁄ 12) * 9 lamps= $16.50

[v] (9 Lamps * 32 Watts * 2860 Hours) / 1000= **823 kWh saved per year**

[vi] ($22 ⁄ 12) * 115 lamps= $211

[vii] (115 Lamps * 32 Watts * 2860 Hours) / 1000= **10,524 kWh saved per year**

[viii] ((Ratio of life to annual burn hours * Number of lamps) * Cost per lamp) + ((Labor cost ⁄ 6) * (Ratio of life to annual burn hours * Number of lamps))

Current Lamps- ((2860/17,000) * 1200 * $1.67) + (((22/6)*(2860/17000)*1200)) = $1077 per year
Long Life Lamps- ((2860/25,500) * 1200 * $1.67) + (((22/6)*(2860/25,500)*1200))= $718 per year

$1077 - $718 = **$359 savings per year**

[ix] (12 Lamps * 50 Watts * 2860 Hours) – (12 Lamps * 4 Watts * 2860 Hours) / 1000= 1579 kWh

[x] Annual Energy Bill * Average % HVAC energy contribution * (Decrease/Increase in ℉/100)

$144,997 * 19% * 3% = **$826 energy savings per year**

[xi] http://www.greenandsave.com/heating/furnaces/heating_system_tune.html

[xii] "Save Water, Save a Buck"

[xiii] (GPF Old Toilet – GPF New Toilet) * Gallons Per Year * Number of Toilets
(1.6-1.3) * 30,000 * 4 = 36,000 gallons per year
36,000 gallons / 748 gallons = 32 hundred cubic feet * $4.60 = **$221 water savings per year**

[xiv] (GPF Old Urinal – GPF New Urinal) * Gallons Per Year * Number of Urinals
((1.0-0.5) * 30,000 * 2 = 30,000 gallons per year
30,000 gallons / 748 gallons = 40 hundred cubic feet * $4.60 = **$184 water savings per year**

Calculation Assumptions
- $22 per hour in labor cost

- 5 minutes labor time for each delamp
- $.10 per kWh
-10 minutes per lamp change
- $22/hour labor cost, and 2860 burn hours per year
- 2860 operating hours (10 hour Weekdays, 5 hour Saturdays)
- HVAC energy contribution is 19%
- Decrease/increase in temperature of 1°results in 1% savings
- Urinals and toilets use 30,000 gallons per year
- $4.62 * acre/foot

Multi-tenant Commercial Office Park: A Case Study

This report presents the results of a comprehensive building audit conducted by the Sustainable Property Rewards Initiative (SPRI) team in August of 2008. This audit was developed in cooperation with a leading Santa Barbara area property management firm in order to assess potential green building upgrades existing at a multi-tenant commercial office park under their management. The audit concentrates on building operations relevant to energy usage, water consumption, and materials procurement.

The office park presents an interesting scenario for energy efficiency upgrades due to the age and historic value of the property's architectural components. Although physical alterations to historic properties are generally avoided, efficiency upgrades and environmental improvements can be implemented without disturbing the architectural integrity of the buildings and surrounding grounds. There are numerous methods and products available that can reduce this office park's environmental impact while preserving its unique style. Custom high-efficiency windows and natural light ducting are two examples of upgrades that could significantly improve efficiency with little impact to the feel of the property's design.

The audit sums the potential savings for energy to an estimated 7,000 kilowatt hours resulting in the diversion of 41 metric tons of CO_2 from the atmosphere. The decrease in water usage is calculated at over 135,000 gallons saved per year. Net income figures demonstrate the financial viability of the implementation of the included suggested improvements[i]. The initial investment of $2,410.00 will yield an annual savings of $1,879.00 making the return on investment approximately 1.28 years. Net operating income is increased by $1,879.00 with an increased building asset value of $26,842.86.

Project Goals

The SPRI team was commissioned to conduct the audit as a part of a larger program to assist property managers in assessing and prioritizing green building improvements. The objectives of the audit were three-fold:

4. Recognize the diversity and complexity of carrying out commercial building audits in order to craft a self-audit tool for use by property managers;
5. Identify current building efficiency levels; and
6. Identify potential for low cost building upgrades that yield financial savings and reduce overall environmental impact of the commercial building sector.

Property Background

Build Date: 1912-1935
Size: 12 Tenants / 92,586 Square Feet
Location: Santa Barbara, California

This historic three-structure office park is used primarily for administrative and professional purposes. Several specialized technology firms as well as one single-screen theater also reside on the commercial property.

Building Performance Audit and Tools

Proper preparation will ensure a successful audit. Advanced tenant notification prior to conducting the audit will allow time for tenants to identify potential inefficiencies within their offices as well as arrange for admittance to all rooms including restricted access areas to ensure accurate audit results. Giving tenants the opportunity to participate in the audit process will also increase the likelihood of satisfactory outcomes for both managers and tenants. In addition to engaging tenants in the audit process, the knowledge and tools we recommend bringing to the building site include:

6. Time allowance of at least 1 hour per 15,000 square feet
7. Audit during normal hours of operation to observe typical energy, water, and materials use behavior
8. Audit sheets
9. Building floor plan including square footage and tenant names
10. Light meter to analyze illumination levels

Analysis and Recommendations: Energy

The U.S. EPA's ENERGY STAR Portfolio Manager provides an initial assessment of the building's current energy performance utilizing the data collected from the building audit and utility bills. This also establishes a benchmark score comparing building performance to similar type office buildings within the national database of facilities. The building energy profile allows for analysis of energy usage and cost savings potential.

Our audit verifies that the age of the buildings and the divergent space uses within the park present numerous opportunities for operational efficiency improvements on the property.

4. Delamp

Implementing a delamping strategy involves disconnecting lamps in areas of sufficient natural lighting. Identifying necessary illumination levels, maximizing daylight usage, and minimizing excessive artificial lighting will decreases energy usage with little to no upfront cost. The determination of sufficient lighting levels should incorporate tenant preferences to ensure occupant satisfaction and comfort. Every percent reduction in lamps achieves a proportional increase in energy savings.

a. Sixty of the 180 lamps in the primary open space in Tenant X's office can be delamped.

Suggestion	Investment ($$)	Annual Energy Saved (kWh)	Annual Money Saved ($$)
Delamp 60 lamps (32 watts at 2860 hours)	110[ii]	5500	550[iii]

b. The halls throughout the entire complex use more light than necessary. By turning off every third lamp, savings can be realized during every business hour of the day. Calculations are not available, as the team was unable to gain access to the type and quantity of bulbs in these overhead lamps.

5. Buy Long Life Lamps

Replacing the current lamps with longer life lamps will significantly reduce the environmental waste produced from the building in addition to saving money in material costs.

a. Replace GE Ecolux T8 lamps with a nominal life of 20,000 hours to a longer life rating of 30,000 hours. This will save significantly on labor and materials costs, and decrease overall material waste. In order to minimize environmental impact, calculations are based on changing out lamps only after the old lamps have burnt out.

Suggestion	Investment ($$)	Annual Energy Saved (kWh)	Annual Money Saved ($$)
1200 F32T8/TL741 PLUS/ALTO Lamps	0	0	320[iv]

b. Replace incandescent EXIT signs with LED signs,
c. Install low impact natural lighting devices such as solar tubes in common areas.
d. Occupancy sensors in restrooms, hallways, and non-regularly occupied spaces throughout the complex are recommended.

6. HVAC Maintenance and Improvement

Although the building performance audit did not include an in-depth analysis of the HVAC system, there were a few noted components that can be improved.

a. Particularly in office space Y, tenants were observed running air conditioning while keeping windows and doors open. Installing reflective window film can be a simple and effective way to reduce heat exposure in these areas. California's Express Efficiency Program offers rebates up to $1.35 per square foot of window treated (applicable only for southern facing windows).

b. A qualified HVAC professional should provide a system inspection periodically to ensure that the HVAC systems controls and set points are functioning properly. System tune-ups and upgrades can deliver significant savings with a payback period less than 1 year. The following calculation is based on a standard commercial savings estimate, but with such an old system in place, we believe the savings will be significantly larger for the office park.

Suggestion	Investment ($$)	Annual Energy Saved (kWh)	Annual Money Saved ($$)
Commission HVAC System	200	1800	180[v]

Analysis and Recommendations: Water

The extensive landscaped areas existing on the property require an irrigation schedule tailored to optimize efficiency. Water audit services offered by the local water district provide clear methods to decrease water consumption and free rain sensors to participants. Further reduction of water consumption can be achieved by enacting a policy to replace any component installations with those rated at the highest water use efficiency. The replacement of low-flow fixtures, including toilets and urinals, can produce savings resulting from rebate programs[vi] as well as reduced water consumption.

c. Implement weather-based irrigation controls which do not irrigate during storm events. An irrigation system utilizing soil moisture sensors in representative areas of landscaping irrigate only when soil moisture content drops beneath a predetermined threshold.

d. Minimize turf area where feasible and replace with permeable xeriscaped native surfaces.

e. High-Efficiency Toilets are defined as fixtures that flush below the 1.3-gpf.

Suggestion	Investment ($$)	Annual Water Saved (gallons)	Annual Money Saved ($$)
10 High Efficiency Toilets in public bathrooms	(3500-3000+1000)= 1500	90,000	552[vii]

f. The High Efficiency Urinal is defined as a fixture that flushes at 0.5-gpf or less.

Suggestion	Investment ($$)	Annual Water Saved (gallons)	Annual Money Saved ($$)
3 High Efficiency	(1200-900)=	45,000	277[viii]

Urinals in public bathrooms	600		

Analysis and Recommendations: Materials Procurement

Materials used in the day-to-day operations of office facilities often contribute to poor indoor air quality (IAQ) and can be detrimental to natural resources and human health. Although tenants are often responsible for their own materials procurement, establishing a material purchasing program that encourages the use of environmentally preferable purchases can help reduce the negative impacts of materials use to commercial spaces and the environment.

f. Choosing non-toxic and/or biodegradable materials can help minimize the health impacts to workers and customers, improve IAQ, and reduce water pollution.
g. Choosing materials that are labeled as having low or no VOC content can greatly improve IAQ and reduce health risks to tenants.
h. Purchasing liquid cleaners in concentrated form reduces packaging waste and are often more cost effective.
i. Choosing paper products with recovered and/or recycled content helps to minimize depletion of natural resources and reduce the amount of energy required for primary production.
j. Unbleached paper products should be purchased for all applications necessary.
k. The majority of tenant-occupied spaces at the office park contain no recycling receptacles, making a comprehensive waste-reduction effort difficult. Due to the relatively low number of tenants at the property, it may prove feasible to support the appointment of a recycling 'champion' from each firm or building to implement a more coordinated recycling program

Net Income Projections

These figures sum the above calculated recommendations only. As these figures do not sum all included recommendations and are not representative of an exhaustive list of all possible improvements existing at the building site, there certainly exists potential for even greater savings.

Total Energy Savings (kWh)	25,911
Total Water Savings (Gallons)	66,000
Investment Cost	$ 2,298.00
Annual Cost Savings	$ 3,354.00
Payback (Years)	0.69
Annual Return on Investment	146%

Increased Net Operating Income	$ 3,354.00
Capitalization Rate	7%
Increased Building Asset Value	$ 47,914.29

References and Calculations

As information regarding the lease structure between property manager and tenants was not disclosed, the costs and returns associated with the upgrades are not allocated between parties.

[ii] [ii] ($22 ⁒ 12) * 60 lamps= $59

[iii] $\frac{60\_lamps \times 32\_watts \times 2860\_hours}{1000}$ = 5491 kWh saved per year

[iv] ((Ratio of life to annual burn hours * Number of lamps) * Cost per lamp) + ((Labor cost ⁒ 6) * (Ratio of life to annual burn hours * Number of lamps))

Current Lamps- ((2860/17,000) * 1200 * $1.67) + (((22/6)*(2860/17000)*1200)) = $1077 per year
Long Life Lamps- ((2860/25,500) * 1200 * $1.67) + (((22/6)*(2860/25,500)*1200))= $718 per year

$1077 - $718 = **$359 savings per year**

[v] http://www.greenandsave.com/heating/furnaces/heating_system_tune.html

[vi] "Save Water, Save a Buck"

[vii] (GPF Old Toilet – GPF New Toilet) * Gallons Per Year * Number of Toilets
(1.6-1.3) * 30,000 * 4 = 36,000 gallons per year
36,000 gallons / 748 gallons = 32 hundred cubic feet * $4.60 = **$221 water savings per year**

[viii] (GPF Old Urinal – GPF New Urinal) * Gallons Per Year * Number of Urinals
((1.0-0.5) * 30,000 * 2 = 30,000 gallons per year
30,000 gallons / 748 gallons = 40 hundred cubic feet * $4.60 = **$184 water savings per year**

Calculation Assumptions

- $22 per hour in labor cost
- 5 minutes labor time for each delamp
- $.10 per kWh
-10 minutes per lamp change
- $22/hour labor cost, and 2860 burn hours per year
- 2860 operating hours (10 hour Weekdays, 5 hour Saturdays)
- HVAC energy contribution is 19%
- Decrease/increase in temperature of 1°results in 1% savings
- Urinals and toilets use 30,000 gallons per year
- $4.62 * acre/foot

Multi-tenant Retail Shopping Center: A Case Study

This report presents the results of a comprehensive facilities audit conducted by the Sustainable Property Rewards Initiative (SPRI) team in July of 2008. This audit was developed in cooperation with a leading Santa Barbara area property management firm in order to assess potential green building upgrades existing at a multi-tenant retail shopping center under their management. The audit concentrates on building operations relevant to energy usage, water consumption, and materials procurement.

This retail complex has not yet implemented an overall environmental improvement strategy. The audits conducted by the SPRI team found each tenant and retail space to be unique, often using lighting to create aesthetic themes and focus customer attention on specific products or areas. Despite these trends, tenants have taken advantage of free lamp improvement audit offered by Southern California Edison and attempted to perform energy savings measures, making additional recommendations not only relevant, but appreciated.

It is a common misconception that all green building improvements involve costly equipment upgrades to improve efficiency, however no and low cost solutions can be applied to even relatively efficient buildings with significant result. Property managers that are considering improvements that require substantial upfront capital expenditures can use cost-sharing agreements such as green leases to distribute the costs and savings of upgrades among the property management firm and its tenants.

Project Goals

The SPRI team was commissioned to conduct the audit as a part of a larger program to assist property managers in assessing and prioritizing green building improvements. The objectives of the audit were three-fold:

7. Recognize the diversity and complexity of carrying out commercial building audits in order to craft a self-audit tool for use by property managers;
8. Identify current building efficiency levels; and
9. Identify potential for low cost building upgrades that yield financial savings and reduce overall environmental impact of the commercial building sector.

Property Background

Build Date: 1976-1982
Size: 125,041 Square Feet
Location: Goleta, California

The retail shopping center was completed in 1982. Each retail tenant pays individual utilities including electricity and water, while landscaping and outdoor lighting costs are shared by all tenants based on square footage. The shopping center includes a mix of local, regional, and national businesses. The audit focused on a 125,000 square foot area of the complex.

Building Performance Audit and Tools

Proper preparation will ensure a successful audit. Advanced tenant notification prior to conducting the audit will allow time for tenants to identify potential inefficiencies within their retail spaces as well as arrange for admittance to all rooms including restricted access areas to ensure accurate audit results. Giving tenants the opportunity to participate in the audit process will also increase the likelihood of satisfactory outcomes for both managers and tenants. In addition to engaging tenants in the audit process, the knowledge and tools we recommend bringing to the site include:

11. Time allowance of at least 1 hour per 15,000 square feet
12. Audit during normal hours of operation to observe typical energy, water, and materials use behavior
13. Audit sheets
14. Building floor plan including square footage and tenant names
15. Light meter to analyze illumination levels

Analysis and Recommendations: Energy

The U.S. EPA's ENERGY STAR Portfolio Manager provides an initial assessment of the building's current energy performance utilizing the data collected from the building audit and utility bills. This also establishes a benchmark score comparing building performance to similar type office buildings within the national database of facilities. The building energy profile allows for analysis of energy usage and cost savings potential.

As the majority of the retail spaces have not implemented energy saving techniques, the potential for improvement is great. In this case however, increasing the efficiency of appliances and lamps will be balanced with industry standards ensuring proper handling of food products, and adequate lighting for advertisement purposes.

7. Delamp

Implementing a delamping strategy involves disconnecting lamps in areas of sufficient natural lighting. Identifying necessary illumination levels, maximizing daylight usage, and minimizing excessive artificial lighting will decreases energy usage with little to no upfront cost. The determination of sufficient lighting levels should incorporate tenant preferences to ensure occupant satisfaction and comfort. Every percent reduction in lamps achieves a proportional increase in energy savings. As this recommendation is one that is ultimately decided upon by the tenant, property managers can distribute marketing material focusing on financial savings to encourage adoption.

8. Outdoor Detectors and Photosensors

The installation of motion detecting sensors outdoors decreases electricity use in areas that are not heavily trafficked. These are common spaces, and all tenants can benefit from the reduced costs. (Note: For security purposes, the property manager should decide which areas are appropriate to install motion sensors.) Proper cleaning of the photosensors is necessary to ensure lighting during proper hours.

9. Lighting

Increasing lighting efficiency and replacing current lamps with longer life lamps will significantly reduce the environmental waste and save money in material costs.

a. Replace current incandescent exit signs with Tritium signs. These signs, while expensive, are guaranteed to last up to 20 years. Based on the following calculations, they pay themselves back in less than 7 years.

Suggestion	Investment ($$)	Annual Energy Saved (kWh)	Annual Money Saved ($$)
Replace 6 exit signs with Tritium exit signs	978	1576[i]	157

b. Change magnetic ballasts to electronic ballasts, this increase lighting efficiency 15-20%.
c. Replace inefficient mercury high intensity (HID) discharge lamps with high efficiency low-pressure or high-pressure sodium HID lamps.

Analysis and Recommendations: Water

The majority of the water faucets and fixtures have also not been improved upon, and are only as efficient as current plumbing codes require. As the landscaping is found to be minimally water intensive, the primary focus of the property management firm's efforts should be on the fixtures located within the building. Any new component installations or replacements should be rated at the highest water use efficiency. The replacement of low-flow fixtures, including toilets and urinals, can produce savings resulting from rebate programs[ii] as well as reduced water consumption.

g. High-Efficiency Toilets are defined as fixtures that flush below the 1.3-gpf.

Suggestion	Investment ($$) less "Save Water, Save a Buck" rebate plus $100 per fixture in labor	Annual Water Saved (gallons)	Annual Money Saved ($$)
10 High Efficiency Toilets in public bathrooms	(3500-3000+1000)= 1500	60,000	368[iii]

h. The High Efficiency Urinal is defined as a fixture that flushes at 0.5-gpf or less.

Suggestion	Investment ($$) less "Save Water, Save a Buck" rebate plus $100 per fixture in labor	Annual Water Saved (gallons)	Annual Money Saved ($$)
5 High Efficiency Urinals in public bathrooms	(2000-1500+500)= 1000	60,000	307[iv]

Analysis and Recommendations: Materials Procurement

Materials used in the day-to-day operations of office facilities often contribute to poor indoor air quality (IAQ) and can be detrimental to natural resources and human health. Although tenants are often responsible for their own materials procurement, establishing a material purchasing program that encourages the use of environmentally preferable purchases can help reduce the negative impacts of materials use to commercial spaces and the environment.

l. Choosing non-toxic and/or biodegradable materials can help minimize the health impacts to workers and customers, improve IAQ, and reduce water pollution.
m. Choosing materials that are labeled as having low or no VOC content can greatly improve IAQ and reduce health risks to tenants.
n. Purchasing liquid cleaners in concentrated form reduces packaging waste and are often more cost effective.
o. Choosing paper products with recovered and/or recycled content helps to minimize depletion of natural resources and reduce the amount of energy required for primary production.
p. Unbleached paper products should be purchased for all applications necessary.

Green Leases

Green leases are a contractual method of allocating the costs and savings associated with upgrades between managers and tenants. Parameters described in the lease agreement can help to distribute the costs of building improvements between the parties. Both the property management firm and their tenants can benefit from green leasing; a landlord may reduce building operating costs, increase occupancy rates and increase the building's value. A tenant can reduce operating expenses and increase employee productivity. This is recommended as a general policy for this property management firm

Aggregated Financial Investments and Savings

These figures sum the above calculated recommendations only. As these figures do not sum all included recommendations and are not representative of an exhaustive list of all possible improvements existing at the building site, there certainly exists potential for greater savings.

All Suggestions	Investment ($$)	Annual Savings ($$)	Payback Period (years)
Aggregated investment and savings	3478	832	4.18

References and Calculation

[i] (Old lamp wattage * Hours per year) / 1000
(30 watts * 8760 hours) / 1000 = 13 kWh

[ii] "Save Water, Save a Buck"

[iii] (GPF Old Toilet – GPF New Toilet) * Gallons Per Year * Number of Toilets
((1.0-0.5) * 20,000 * 10 = 60,000 gallons per year
60,000 gallons / 748 gallons = 80 hundred cubic feet * $4.60 = **$368 water savings per year**

[iv] (GPF Old Urinal – GPF New Urinal) * Gallons Per Year * Number of Urinals
((1.0-0.5) * 20,000 * 5 = 50,000 gallons per year
50,000 gallons / 748 gallons = 66 hundred cubic feet * $4.60 = **$307 water savings per year**

Calculation Assumptions

- $22 per hour in labor cost
- 5 minutes labor time for each delamp
- $.10 per kWh
-10 minutes per lamp change
- $22/hour labor cost, and 2860 burn hours per year
- 2860 operating hours (10 hour Weekdays, 5 hour Saturdays)
- HVAC energy contribution is 19%
- Decrease/increase in temperature of 1°results in 1% savings
- Urinals and toilets use 30,000 gallons per year
- $4.62 * acre/foot

Single tenant Commercial Office Building: A Case Study

This report presents the results of a comprehensive building audit conducted by the Sustainable Property Rewards Initiative (SPRI) team in September of 2008. This audit was developed in cooperation with the owner/operator of the single tenant commercial office building in order to identify existing opportunities for green building upgrades. The audit concentrates on building operations relevant to energy usage, water consumption, and materials procurement.

The office building itself is fairly new, with many of its components already operating at highly efficient levels. Further reduction of environmental impact is however attainable through strategies designed to decrease overall energy usage. Challenges faced by property managers trying to organize the efficiency goals of a diverse group of tenants are avoided here. An office building that is operated by one company can design coordinated and consolidated efforts that can improve the environmental performance of the entire property.

The audit sums the potential savings for energy to an estimated 110,209 kilowatt hours resulting in the diversion of 648 metric tons of CO_2 from the atmosphere. The decrease in water usage is calculated at over 172,000 gallons saved per year. Net income figures demonstrate the financial viability of the implementation of the included suggested improvements. The initial investment of $10,909.00 will yield an annual savings of $12,433.00 making the return on investment approximately .88 years. Net operating income is increased by $12,433.00 with an increased building asset value of $177,614.00.

Project Goals

The SPRI team was commissioned to conduct the audit as a part of a larger program to assist property managers in assessing and prioritizing green building improvements. The objectives of the audit were three-fold:

10. Recognize the diversity and complexity of carrying out commercial building audits in order to craft a self-audit tool for use by property managers.
11. Identify current building efficiency levels.
12. Identify potential for low cost building upgrades that yield financial savings and reduce overall environmental impact of the commercial building sector.

Property Background

Build Date: 2004
Size: 1 Tenant / 61,000 Square Feet
Location: Goleta, California

This owner operated commercial office building is two stories with 350 employees working during general business hours (Mon-Fri, 8-5). As a result of the company's web-based software platform, a large data center is located in the middle of the

space. The company pays for utilities including electricity and water and purchases cleaning materials through a local janitorial and maintenance company.

Building Performance Audit and Tools

Proper preparation will ensure a successful and efficient audit. In this case, familiarity with the building and its occupants can prove advantageous in identifying areas for improvement and increasing the likelihood of satisfactory outcomes for both managers and employees. Additional recommendations for the auditor include:

16. Time allowance of at least 1 hour per 15,000 square feet
17. Audit during normal hours of operation to observe typical energy, water, and materials use behavior
18. Audit sheets
19. Building floor plan including square footage and tenant names
20. Light meter to analyze illumination levels

Analysis and Recommendations: Energy

The U.S. EPA's ENERGY STAR Portfolio Manager provides an initial assessment of the building's current energy performance utilizing the data collected from the building audit. This also establishes a benchmark score comparing building performance to similar type office buildings within the national database of facilities. The building energy profile allows for analysis of energy usage and cost savings potential.

Our audit confirms that the majority of the office and common spaces throughout the single tenant commercial office building currently utilize energy efficient lighting including T-8 fluorescent lamps, compact fluorescent lamps, and LED lighting. Many of the office spaces have also installed occupancy sensor lighting controls to automatically manage energy use in unoccupied spaces. Energy reduction strategies and minor equipment upgrades will be most effective in improving the environmental performance of the building and lowering energy costs.

1. Delamp

Implementing a delamping strategy involves disconnecting lamps in areas of sufficient natural lighting. Identifying necessary illumination levels, maximizing daylight usage, and minimizing excessive artificial lighting will decreases energy usage with little to no upfront cost. The determination of sufficient lighting levels should incorporate tenant preferences to ensure occupant satisfaction and comfort. As every percent reduction in lamps achieves a proportional increase in energy savings, the performance of this building can be significantly improved by delamping the light fixtures that contain three lamps apiece.

a. One of five light fixtures throughout the entire building can be delamped.

Suggestion	Investment ($$)	Annual Energy Saved (kWh)	Annual Money Saved ($$)
Delamp 500 lamps (32 watts at 2860 hours)	59[i]	45760[ii]	4576

2. Buy Long Life Lamps

Replacing the current lamps with longer life lamps will significantly reduce the environmental waste produced from the building in addition to saving money in material costs.

a. Replace GE Ecolux T8 lamps with a nominal life of 20,000 hours to a longer life rating of 30,000 hours. This will save significantly on labor and materials costs, and decrease overall material waste. In order to minimize environmental impact, calculations are based on changing out lamps only after the old lamps have burnt out.

Suggestion	Investment ($$)	Annual Energy Saved (kWh)	Annual Money Saved ($$)
Replace GE Ecolux with F32T8/TL741PLUS/ALTO Lamps	0	0	359[iii]

3. HVAC Maintenance and Improvement

Although the building performance audit did not include an in-depth analysis of the HVAC system, there were a few noted components that can be improved.

d. Setting the heating system 1 to 3 degrees cooler in the winter, and the cooling system 1 to 3 degrees warmer in the summer can save the building a significant amount of energy and reduce operating costs over time. This must be a suggestion from the property manager in the form of a newsletter or pamphlet.

Suggestion	Investment ($$)	Annual Energy Saved (kWh)	Annual Money Saved ($$)
Reduce/Increase temperature by 3°F	0	15154	1515[iv]

e. A qualified HVAC professional should provide a system inspection periodically to ensure that the HVAC systems controls and set points are functioning properly. System tune-ups and upgrades can deliver significant savings with a payback period less than 1 year.

Suggestion	Investment ($$)	Annual Energy Saved (kWh)	Annual Money Saved ($$)
Commission HVAC system	200	1800	180[v]

4. Utilize Smart Power Strips

The use of smart power strips minimizes unnecessary energy consumption by employee workstations not in use. This recommendation is especially applicable in an owner-operated building, as property managers with numerous tenants may find this upgrade impractical.

a. Purchase one smart power strip per workstation.

Suggestion	Investment ($$)	Annual Energy Saved (kWh)	Annual Money Saved ($$)
350 Smart Power Strips	8750	47495[vi]	4749

5. Perform Best Practice Upgrades on Data Center

a. Hot/Cool aisle configuration to reduce cooling needs
b. Blanking panels to reduce air mixture
c. Vinyl curtains to reduce air mixture
d. Server consolidation to reduce wasted energy use

Analysis and Recommendations: Water

Similar to the building's lighting, the majority of the water faucets and fixtures are already highly efficient. In the building's future, any new component installations or replacements should continue to be rated at the highest water use efficiency. The replacement of low-flow fixtures, including toilets and urinals, can produce savings resulting from rebate programs as well as reduced water consumption.

i. High-Efficiency Toilets are defined as fixtures that flush below the 1.3-gpf.

Suggestion	Investment ($$) less "Save Water, Save a Buck" rebate plus $100 per fixture in labor	Annual Water Saved (gallons)	Annual Money Saved ($$)
6 High Efficiency Toilets in public bathrooms	(2100-1800+600)= 900	72,000[vii]	440

j. The High Efficiency Urinal is defined as a fixture that flushes at 0.5-gpf or less.

Suggestion	Investment ($$) less "Save Water, Save a Buck" rebate plus $100 per fixture in labor	Annual Water Saved (gallons)	Annual Money Saved ($$)
5 High Efficiency Urinals in public bathrooms	(2000-1500+500)= 1000	100,000[viii]	614

k. The Goleta Water District provides a free water audit program that can also provide recommendations to decrease water consumption. This is a no cost, high reward program that offers free rain sensors following their audit of the property.
l. Install weather based irrigation controls (rain sensors).
m. Install rainwater capture and storage system.

Analysis and Recommendations: Materials Procurement

Materials used in the day-to-day operations of office facilities often contribute to poor indoor air quality (IAQ) and can be detrimental to natural resources and human health. Although tenants are often responsible for their own materials procurement, establishing a material purchasing program that encourages the use of environmentally preferable purchases can help reduce the negative impacts of materials use to commercial spaces and the environment.

q. Choosing non-toxic and/or biodegradable materials can help minimize the health impacts to workers and customers, improve IAQ, and reduce water pollution.
r. Choosing materials that are labeled as having low or no VOC content can greatly improve IAQ and reduce health risks to tenants.
s. Purchasing liquid cleaners in concentrated form reduces packaging waste and are often more cost effective.
t. Choosing paper products with recovered and/or recycled content helps to minimize depletion of natural resources and reduce the amount of energy required for primary production.
u. Unbleached paper products should be purchased for all applications necessary.

Net Income Projections

These figures sum the above calculated recommendations only. As these figures do not sum all included recommendations and are not representative of an exhaustive list of all possible improvements existing at the building site, there certainly exists potential for even greater savings.

Total Energy Savings (kWh)	110,209
Total Water Savings (Gallons)	172,000
Investment Cost	$ 10,909.00
Annual Cost Savings	$ 12,433.00
Payback (Years)	0.88
Annual Return on Investment	114%
Increased Net Operating Income	$ 12,433.00
Capitalization Rate	7%
Increased Building Asset Value	$ 177,614.00

References and Calculations

[i] ($22 ⁄ 12) * 50 lamps= $59 = **$92**

[ii] (50 Lamps * 32 Watts * 2860 Operating Hours) / 1000= **4,576 kWh saved per year**

[iii] ((Ratio of life to annual burn hours * Number of lamps) * $ per lamp) + ((Labor cost ⁄ 6) * (Ratio of life to annual burn hours * Number of lamps))

Current Lamps- ((2860/17,000) * 1200 * $1.67) + (((22/6)*(2860/17000)*1200)) = $1077 per year
Long Life Lamps- ((2860/25,500) * 1200 * $1.67) + (((22/6)*(2860/25,500)*1200))= $718 per year

$1077 - $718 = **$359 savings per year**

[iv] (Annual Energy Bill * % Average HVAC energy contribution * Estimate % savings per Decrease/Increase in 3℉) / $.10

$265,860 * 19% * 3% = **$1515 energy savings per year**

[v] http://www.greenandsave.com/heating/furnaces/heating_system_tune.html

[vi] (Number of Smart Power Strips * Non-Operating Hours * (Watts of Monitor on Power Save + Watts of PC tower on Power Save)/ 1000

(350 * 5900 * 23) / 1000 = **$47495**

[vii] (GPF Old Toilet – GPF New Toilet) * Gallons Per Year * Number of Toilets
(1.6-1.3) * 40,000 * 6= 72,000 gallons per year
(72,000 gallons / 748 gallons) = 32 hundred cubit feet * $4.60 = **$442 water savings per year**

[viii] (GPF Old Urinal – GPF New Urinal) * Gallons Per Year * Number of Urinals
((1.0-0.5) * 40,000 * 5 = 100,000 gallons per year
(100,000 gallons / 748 gallons) = 133 hundred cubic feet * $4.60 = **$614 water savings per year**

Appendix C: National Survey

1. Default Section

This survey pertains to the operations of **commercial buildings only**. Please answer questions accordingly.

1. Job Title.

- ◯ Owner/Landlord
- ◯ Director of Property Management
- ◯ Facilities Manager
- ◯ Accounting Manager
- ◯ Administrator/Assistant
- ◯ Marketing Manager
- ◯ Site Manager
- ◯ Information Technology

2. Where are the majority of your properties located?

- ◯ Northeast
- ◯ Northwest
- ◯ Mid-Atlantic
- ◯ Pacific
- ◯ Midwest
- ◯ Southeast
- ◯ Southwest

3. Estimate the number of facilities in your portfolio.

4. Estimate the square footage managed by your property management firm.

2. Energy

All bulleted items are examples and do not necessarily incorporate all possible energy efficiency upgrades.

1. Estimate the degree to which your property management firm has incorporated the following energy efficiency upgrades in its portfolio.

	None	Some	Most	All	Unknown
Building envelope • High performance insulation • High efficiency windows • High efficiency doors • Cool or green roofing	◯	◯	◯	◯	◯
Domestic water heating • On-demand water heaters • Solar water heaters	◯	◯	◯	◯	◯
HVAC (Heating, Ventilation and Air Conditioning) • Variable speed drives on fans and motors • High efficiency coolers • High efficiency boilers • Automated climate controls and sensors	◯	◯	◯	◯	◯
Lighting • High efficiency lamps • Electronic ballasts • Automated lighting controls (occupancy sensors, timers) • Natural lighting Design	◯	◯	◯	◯	◯
Building systems commissioning • Energy monitoring • Performance auditing	◯	◯	◯	◯	◯

3. Water

All bulleted items are just examples and do not necessarily incorporate all possible green building upgrades.

1. Estimate the degree to which your property management firm has incorporated the following water efficiency upgrades in its portfolio.

	None	Some	Most	All	Unknown
Landscape Irrigation • Rain sensors • • Xerascaping	◯	◯	◯	◯	◯
Fixtures • Low-flow toilets • Dual flush toilet • Low-flow faucets • Low-flow/waterless urinals	◯	◯	◯	◯	◯
Water Reclamation • Rainwater capture and storage • Municipally supplied greywater	◯	◯	◯	◯	◯

4. Materials

All bulleted items are just examples and do not necessarily incorporate all possible green building upgrades.

1. Estimate the degree to which your property management firm has improved materials procurement practices in its portfolio.

	None	Some	Most	All	Unknown
Green Cleaning Supplies • Low VOC • Water soluble • Non-toxic	◯	◯	◯	◯	◯
Recycled Material Procurement • Printer paper • Tissue paper	◯	◯	◯	◯	◯
Electric hand dryers	◯	◯	◯	◯	◯

5. Barriers

1. Based on your company's business strategy, rank the following barriers when making green building improvements
(1 – Most Significant Barrier, 7 – Least Significant Barrier).

	1	2	3	4	5	6	7
Lack of technical/performance information	◯	◯	◯	◯	◯	◯	◯
Building code regulations	◯	◯	◯	◯	◯	◯	◯
Tenant dissatisfaction	◯	◯	◯	◯	◯	◯	◯
High upfront costs	◯	◯	◯	◯	◯	◯	◯
Misalignment of manager/tenant incentives	◯	◯	◯	◯	◯	◯	◯
Low financial returns	◯	◯	◯	◯	◯	◯	◯
Lack of information on financial returns	◯	◯	◯	◯	◯	◯	◯

2. Associate the *most significant* barrier for each of the following green building improvements.

	High upfront costs	Low financial returns	Lack of info on financial returns	Manager-Tenant incentive misalignment	Building code regulations	Tenant dissatisfaction	Lack of technical/performance information
Building envelope	◯	◯	◯	◯	◯	◯	◯
Domestic water heating	◯	◯	◯	◯	◯	◯	◯
HVAC	◯	◯	◯	◯	◯	◯	◯
Lighting	◯	◯	◯	◯	◯	◯	◯
Building systems commissioning	◯	◯	◯	◯	◯	◯	◯
Landscape irrigation	◯	◯	◯	◯	◯	◯	◯
Water fixtures	◯	◯	◯	◯	◯	◯	◯
Water reclamation	◯	◯	◯	◯	◯	◯	◯
Green cleaning supplies	◯	◯	◯	◯	◯	◯	◯
Recycled content procurement	◯	◯	◯	◯	◯	◯	◯
Hand dryers	◯	◯	◯	◯	◯	◯	◯

6. Background Data

1. What is the *minimum annual return on investment* that you would accept when allocating funds toward building upgrades?

- ◯ 0%
- ◯ 1-2%
- ◯ 3-5%
- ◯ 6-10%
- ◯ Greater than 10%
- ◯ Unknown

2. What is the *maximum time frame* for return on investment that you would accept when allocating funds toward building upgrades?

- ◯ 1-2 years
- ◯ 3-4 years
- ◯ 5-6 years
- ◯ 7-8 years
- ◯ 9-10 years
- ◯ 11+ years
- ◯ Unknown

3. Rank the type of information that would be most valuable when considering upgrades for your facilities?
(1–Most Valuable Information, 4–Least Valuable Information)

	1	2	3	4
Information on financial returns	◯	◯	◯	◯
Technical information to help perform the upgrades	◯	◯	◯	◯
Methods to share the costs and benefits of upgrades with tenants	◯	◯	◯	◯
Building audits and specific recommendations	◯	◯	◯	◯

4. Which of the following sources have you used to obtain information about green building upgrades?

- [ ] Building manager
- [ ] Internet
- [ ] Trade publications
- [ ] Certification associations (USGBC, ASHRAE, Energy Star, etc.)
- [ ] None
- [ ] Other (please specify)

5. Assuming a green building educational package was provided to you, what is the most effective means of distribution?

- [ ] Print
- [ ] Digital copy (PDF)
- [ ] Email
- [ ] Website
- [ ] Other (please specify)

7. Incentives

DEFINITIONS

Green building[1] is the practice of increasing the efficiency with which buildings use resources — energy, water, and materials — while reducing building impacts on human health and the environment during the building's lifecycle.

[1]Frej, Anne B., editor. Green Office Buildings: A Practical Guide to Development. Washington, D.C.: ULI--The Urban Land Institute, 2005. Pp 4-8

1. Based on your company's business strategy, rank the following incentives when making green building improvements
(1-Most Important Incentive, 6-Least Important Incentive).

	1	2	3	4	5	6
Increased rental rates	◯	◯	◯	◯	◯	◯
Return on investment from decreased utility costs	◯	◯	◯	◯	◯	◯
Corporate brand/image	◯	◯	◯	◯	◯	◯
Increased occupancy rates	◯	◯	◯	◯	◯	◯
Anticipation of future government regulation	◯	◯	◯	◯	◯	◯
Environmental responsibility	◯	◯	◯	◯	◯	◯

8. Programs

Rate the value of the following programs based on their potential to improve your portfolio's environmental performance.

1. Program A:

An on-site audit of the buildings in your portfolio, followed by specific recommendations on how to implement green building improvements. The recommendations would demonstrate what improvements to make, how to perform them, and the potential financial returns the improvements would provide.

◯ Not Valuable ◯ Minimally Valuable ◯ Valuable ◯ Very Valuable ◯ Extremely Valuable

2. Program B:

The distribution of utility tracking software to monitor the energy and water usage of buildings. The software would track utility data from all of the buildings in your portfolio and compare performance over time.

◯ Not Valuable ◯ Minimally Valuable ◯ Valuable ◯ Very Valuable ◯ Extremely Valuable

3. Program C:

A tiered certification program that acknowledges your property management firm's increasing efficiency in energy, water and materials usage.

◯ Not Valuable ◯ Minimally Valuable ◯ Valuable ◯ Very Valuable ◯ Extremely Valuable

9. Feedback

After completion of the survey, visit our project website at www.bren.ucsb.edu/~yardi, or email us at yardi@bren.ucsb.edu.

1. If you have any general questions or comments, please place them in the text box. This is not required for the completion of the survey.

Appendix D: Survey Results

Sustainable Property Rewards Initiative- Commercial Buildings

1. Job Title.

	Response Percent	Response Count
Owner/Landlord	24.9%	104
Director of Property Management	23.0%	96
Facilities Manager	1.7%	7
Accounting Manager	39.5%	165
Administrator/Assistant	7.2%	30
Marketing Manager	0.0%	0
Site Manager	1.0%	4
Information Technology	2.9%	12
answered question		418
skipped question		3

2. Where are the majority of your properties located?

	Response Percent	Response Count
Northeast	14.3%	60
Northwest	6.2%	26
Mid-Atlantic	5.7%	24
Pacific	19.5%	82
Midwest	16.2%	68
Southeast	17.3%	73
Southwest	20.9%	88
answered question		421
skipped question		0

3. Estimate the number of facilities in your portfolio.	
	Response Count
	421
answered question	**421**
skipped question	0

4. Estimate the square footage managed by your property management firm.	
	Response Count
	421
answered question	**421**
skipped question	0

5. Estimate the degree to which your property management firm has incorporated the following energy efficiency upgrades in its portfolio.

	None	Some	Most	All	Unknown	Response Count
Building envelope • High performance insulation • High efficiency windows • High efficiency doors • Cool or green roofing	27.4% (98)	**43.3% (155)**	11.5% (41)	2.5% (9)	15.4% (55)	358
Domestic water heating • On-demand water heaters • Solar water heaters	**53.4% (189)**	22.9% (81)	4.2% (15)	3.7% (13)	15.8% (56)	354
HVAC (Heating, Ventilation and Air Conditioning) • Variable speed drives on fans and motors • High efficiency coolers • High efficiency boilers • Automated climate controls and sensors	13.9% (49)	**47.9% (169)**	22.4% (79)	4.2% (15)	11.6% (41)	353
Lighting • High efficiency lamps • Electronic ballasts • Automated lighting controls (occupancy sensors, timers) • Natural lighting Design	10.8% (38)	**45.2% (159)**	25.9% (91)	7.4% (26)	10.8% (38)	352
Building systems commissioning • Energy monitoring • Performance auditing	**39.7% (138)**	29.3% (102)	12.1% (42)	4.0% (14)	14.9% (52)	348
					answered question	358
					skipped question	63

6. Estimate the degree to which your property management firm has incorporated the following water efficiency upgrades in its portfolio.

	None	Some	Most	All	Unknown	Response Count
Landscape Irrigation • Rain sensors • • Xerascaping	**54.5% (187)**	20.4% (70)	7.6% (26)	3.2% (11)	14.3% (49)	343
Fixtures • Low-flow toilets • Dual flush toilet • Low-flow faucets • Low-flow/waterless urinals	15.2% (52)	**47.5% (163)**	19.8% (68)	5.8% (20)	11.7% (40)	343
Water Reclamation • Rainwater capture and storage • Municipally supplied greywater	**67.7% (233)**	11.6% (40)	3.8% (13)	1.2% (4)	15.7% (54)	344
					answered question	345
					skipped question	76

7. Estimate the degree to which your property management firm has improved materials procurement practices in its portfolio.

	None	Some	Most	All	Unknown	Response Count
Green Cleaning Supplies • Low VOC • Water soluble • Non-toxic	26.5% (88)	**38.6% (128)**	11.1% (37)	3.9% (13)	19.9% (66)	332
Recycled Material Procurement • Printer paper • Tissue paper	18.5% (62)	**42.9% (144)**	14.9% (50)	8.3% (28)	15.5% (52)	336
Electric hand dryers	**52.6% (170)**	23.5% (76)	5.9% (19)	3.1% (10)	14.9% (48)	323
					answered question	338
					skipped question	83

8. Based on your company's business strategy, rank the following barriers when making green building improvements (1 – Most Significant Barrier, 7 – Least Significant Barrier).

	1	2	3	4	5	6	7	Rating Average	Response Count
High upfront costs	**64.7% (119)**	12.5% (23)	4.3% (8)	4.3% (8)	4.3% (8)	5.4% (10)	4.3% (8)	1.00	184
Low financial returns	7.8% (14)	**35.2% (63)**	20.1% (36)	12.8% (23)	9.5% (17)	8.4% (15)	6.1% (11)	1.00	179
Lack of technical/performance information	7.5% (13)	9.2% (16)	16.8% (29)	**22.5% (39)**	18.5% (32)	14.5% (25)	11.0% (19)	1.00	173
Lack of information on financial returns	7.2% (12)	15.6% (26)	**24.6% (41)**	14.4% (24)	17.4% (29)	10.8% (18)	10.2% (17)	1.00	167
Misalignment of manager/tenant incentives	6.8% (12)	11.9% (21)	12.5% (22)	15.9% (28)	10.8% (19)	**21.6% (38)**	20.5% (36)	1.00	176
Building code regulations	5.8% (10)	7.0% (12)	13.4% (23)	16.9% (29)	18.6% (32)	**20.9% (36)**	17.4% (30)	1.00	172
Tenant dissatisfaction	7.4% (13)	9.7% (17)	11.9% (21)	15.9% (28)	16.5% (29)	13.6% (24)	**25.0% (44)**	1.00	176
							answered question		**216**
							skipped question		**205**

1. Based on your company's business strategy, rank the following barriers when making green building improvements (1 – Most Significant Barrier, 7 – Least Significant Barrier).

	1	2	3	4	5	6	7	Rating Average	Response Count
High upfront costs	**64.7% (119)**	12.5% (23)	4.3% (8)	4.3% (8)	4.3% (8)	5.4% (10)	4.3% (8)	1.00	184
Low financial returns	7.8% (14)	**35.2% (63)**	20.1% (36)	12.8% (23)	9.5% (17)	8.4% (15)	6.1% (11)	1.00	179
Lack of technical/performance information	7.5% (13)	9.2% (16)	16.8% (29)	**22.5% (39)**	18.5% (32)	14.5% (25)	11.0% (19)	1.00	173
Lack of information on financial returns	7.2% (12)	15.6% (26)	**24.6% (41)**	14.4% (24)	17.4% (29)	10.8% (18)	10.2% (17)	1.00	167
Misalignment of manager/tenant incentives	6.8% (12)	11.9% (21)	12.5% (22)	15.9% (28)	10.8% (19)	**21.6% (38)**	20.5% (36)	1.00	176
Building code regulations	5.8% (10)	7.0% (12)	13.4% (23)	16.9% (29)	18.6% (32)	**20.9% (36)**	17.4% (30)	1.00	172
Tenant dissatisfaction	7.4% (13)	9.7% (17)	11.9% (21)	15.9% (28)	16.5% (29)	13.6% (24)	**25.0% (44)**	1.00	176
								answered question	**216**
								skipped question	**205**

2. Associate the *most significant* barrier for each of the following green building improvements.

	High upfront costs	Low financial returns	Lack of info on financial returns	Manager-Tenant incentive misalignment	Building code regulations	Tenant dissatisfaction	Lack of technical/performance information	Response Count
Building envelope	**63.8% (104)**	8.0% (13)	11.7% (19)	4.9% (8)	6.1% (10)	0.0% (0)	5.5% (9)	163
Domestic water heating	**32.9% (50)**	27.6% (42)	17.1% (26)	5.3% (8)	2.6% (4)	3.3% (5)	11.2% (17)	152
HVAC	**56.1% (92)**	12.2% (20)	14.6% (24)	9.1% (15)	1.8% (3)	3.0% (5)	3.0% (5)	164
Lighting	**37.1% (56)**	17.2% (26)	15.9% (24)	14.6% (22)	2.6% (4)	6.0% (9)	6.6% (10)	151
Building systems commissioning	**38.8% (54)**	11.5% (16)	15.1% (21)	7.9% (11)	8.6% (12)	2.2% (3)	15.8% (22)	139
Landscape irrigation	**27.9% (41)**	22.4% (33)	19.0% (28)	4.8% (7)	7.5% (11)	5.4% (8)	12.9% (19)	147
Water fixtures	**31.6% (48)**	21.1% (32)	16.4% (25)	5.9% (9)	3.3% (5)	12.5% (19)	9.2% (14)	152
Water reclamation	**36.9% (58)**	16.6% (26)	15.9% (25)	5.7% (9)	6.4% (10)	1.9% (3)	16.6% (26)	157
Green cleaning supplies	19.7% (29)	17.0% (25)	12.9% (19)	15.6% (23)	2.0% (3)	10.2% (15)	**22.4% (33)**	147
Recycled content procurement	**21.5% (32)**	18.8% (28)	16.8% (25)	11.4% (17)	1.3% (2)	14.8% (22)	15.4% (23)	149
Hand dryers	**24.7% (39)**	19.6% (31)	12.0% (19)	10.1% (16)	0.6% (1)	24.1% (38)	8.9% (14)	158
							answered question	**180**
							skipped question	**241**

1. What is the *minimum annual return on investment* that you would accept when allocating funds toward building upgrades?

	Response Percent	Response Count
0%	2.2%	4
1-2%	2.2%	4
3-5%	12.2%	22
6-10%	**30.9%**	**56**
Greater than 10%	24.9%	45
Unknown	27.6%	50
	answered question	**181**
	skipped question	**240**

2. What is the *maximum time frame* for return on investment that you would accept when allocating funds toward building upgrades?

	Response Percent	Response Count
1-2 years	9.3%	17
3-4 years	**30.1%**	**55**
5-6 years	27.3%	50
7-8 years	6.0%	11
9-10 years	7.1%	13
11+ years	1.1%	2
Unknown	19.1%	35
	answered question	**183**
	skipped question	**238**

3. Rank the type of information that would be most valuable when considering upgrades for your facilities?
(1–Most Valuable Information, 4–Least Valuable Information)

	1	2	3	4	Rating Average	Response Count
Information on financial returns	**65.0% (106)**	17.8% (29)	10.4% (17)	6.7% (11)	1.00	163
Technical information to help perform the upgrades	11.0% (17)	**39.0% (60)**	34.4% (53)	15.6% (24)	1.00	154
Methods to share the costs and benefits of upgrades with tenants	23.6% (37)	**29.3% (46)**	**29.3% (46)**	17.8% (28)	1.00	157
Building audits and specific recommendations	10.5% (17)	17.3% (28)	21.6% (35)	**50.6% (82)**	1.00	162
					answered question	**186**
					skipped question	**235**

4. Which of the following sources have you used to obtain information about green building upgrades?

	Response Percent	Response Count
Building manager	18.0%	33
Internet	44.3%	81
Trade publications	**49.7%**	**91**
Certification associations (USGBC, ASHRAE, Energy Star, etc.)	26.8%	49
None	27.9%	51
view Other (please specify)	8.7%	16
	answered question	**183**
	skipped question	**238**

5. Assuming a green building educational package was provided to you, what is the most effective means of distribution?

	Response Percent	Response Count
Print	21.2%	39
Digital copy (PDF)	38.6%	71
Email	**42.4%**	**78**
Website	25.5%	47
view Other (please specify)	1.1%	2
	answered question	**184**
	skipped question	**237**

1. Based on your company's business strategy, rank the following incentives when making green building improvements (1-Most Important Incentive, 6-Least Important Incentive).

	1	2	3	4	5	6	Rating Average	Response Count
Increased rental rates	18.3% (31)	**29.6% (50)**	16.6% (28)	11.2% (19)	10.7% (18)	13.6% (23)	1.00	169
Increased occupancy rates	21.2% (35)	**26.1% (43)**	22.4% (37)	13.3% (22)	13.9% (23)	3.0% (5)	1.00	165
Return on investment from decreased utility costs	**40.0% (74)**	14.1% (26)	18.9% (35)	14.6% (27)	6.5% (12)	5.9% (11)	1.00	185
Corporate brand/image	7.3% (13)	8.5% (15)	14.1% (25)	21.5% (38)	23.2% (41)	**25.4% (45)**	1.00	177
Anticipation of future government regulation	8.0% (14)	10.8% (19)	12.5% (22)	12.5% (22)	23.3% (41)	**33.0% (58)**	1.00	176
Environmental responsibility	11.6% (20)	15.0% (26)	19.7% (34)	**23.7% (41)**	18.5% (32)	11.6% (20)	1.00	173
						answered question		**205**
						skipped question		**216**

16. Program A: An on-site audit of the buildings in your portfolio, followed by specific recommendations on how to implement green building improvements. The recommendations would demonstrate what improvements to make, how to perform them, and the potential financial returns the improvements would provide.

	Response Percent	Response Count
Not Valuable	9.0%	15
Minimally Valuable	16.3%	27
Valuable	33.7%	56
Very Valuable	25.3%	42
Extremely Valuable	15.7%	26
answered question		166
skipped question		255

17. Program B: The distribution of utility tracking software to monitor the energy and water usage of buildings. The software would track utility data from all of the buildings in your portfolio and compare performance over time.

	Response Percent	Response Count
Not Valuable	9.1%	15
Minimally Valuable	19.4%	32
Valuable	39.4%	65
Very Valuable	24.2%	40
Extremely Valuable	7.9%	13
answered question		165
skipped question		256

18. Program C: A tiered certification program that acknowledges your property management firm's increasing efficiency in energy, water and materials usage.

	Response Percent	Response Count
Not Valuable	13.9%	23
Minimally Valuable	31.3%	52
Valuable	33.1%	55
Very Valuable	18.1%	30
Extremely Valuable	3.6%	6
answered question		166
skipped question		255

19. If you have any general questions or comments, please place them in the text box. This is not required for the completion of the survey.	
	Response Count
	10
answered question	**10**
skipped question	**411**

Appendix E: Web Content:

Intro

Incorporating sustainability into your company strategy can conserve our natural resources, reduce greenhouse gas emissions, and save you money. Property managers have the ability to reduce the environmental impact of the estimated 4.5 million existing commercial buildings in the U.S. using negative and low cost options with substantial result.

This resource can assist those already involved in green improvement projects, or those that need guidance on where to begin. The establishment of a baseline of your building's current performance is a key step toward reducing inefficiencies within operations, and for this reason we include detailed self audit tools to help get you started. If you are already targeting these inefficiencies by implementing sustainable improvements, there may be additional options and resources available to further reduce the impact of your building's operations.

This is a comprehensive and consolidated source of information, focused on energy, water and materials usage in the U.S. commercial building sector to allow for the true assessment of the costs and benefits associated with green building improvements. Take advantage of green upgrade incentives and overcome the barriers of implementation. Keep your company competitive and ahead of industry regulation, and make a commitment to improving the performance of your building.

Energy - Intro

Minimizing inefficient use of energy within building operations can result in the reduction of greenhouse gas emissions as well as substantial cost savings. There exist many opportunities to reduce the overall energy demand of your building in areas such as lighting, ventilation and temperature. The following green improvements have been proven economical and can reduce the environmental impact of your building.

Best Practices

High-Efficiency Lamps

Lamp upgrades can yield high energy savings and monetary returns, but in order to squeeze the most output from a lighting system using the least power, electronic ballasts should be utilized wherever feasible. Electronic ballasts operate at a higher efficacy than their magnetic counterparts, and have the added benefit of eliminating the flicker effect associated with fluorescent lighting.

Delamping

It is frequently the case that significant energy savings can be achieved through a combination of a very simple strategy and a tactful approach. By simply removing a portion of the overhead bulbs in a workspace, or encouraging the use of task lamps, measurable energy savings can be achieved with zero capital input. Occupant cooperation is critical, and often the best approach is to raise awareness that the decision to use less light can and will have a significant impact, both in terms of energy savings and in the bottom line of their company or facility.

Automated Controls

Automated lighting controls can include occupancy sensors, timers, and photosensors, each of which aims to reduce or eliminate lighting when it is not needed in specific zones of a building. Timers and occupancy sensors of controls can be very inexpensive to install, and are most appropriate for common areas such as copy rooms, restrooms, and conference rooms where lights might get left on inadvertently. While photosensors often require a larger capital input, they have, in effect, the greatest potential for energy savings because they shut off lighting in certain areas when sufficient daylight is present.

High-Efficacy Lamps

Lighting represents a large component of overall energy demand – 30% in a typical commercial office building – and it is also an area that can yield a high return on investment. There is a vast array of products to choose from when it comes to ‘energy-efficient lamps,’ and a measure that is often overlooked is a lamp’s efficacy – the lamp’s light output per watt of energy used. High-efficacy lamps provide the most light for the amount of energy consumed, and are available as linear or compact fluorescent lamps for use in building interiors, as well as high discharge metal halide lamps for exterior applications.

LED Exit Signs

Light Emitting Diodes (LEDs) are an extremely low-power lighting technology ideal for a facility's exit sign illumination. LED exit signs with input wattages of as low as 2 watts are currently available. When one considers the continuous operation of exit signs, the number of signs in a typical building, and the fact that incandescent signs use roughly 40 watts, LED alternatives have a quick and predictable payback period.

Variable Frequency Drive (VFD) Ventilation Systems

A Variable Frequency Drive (VFD) is a device designed to control the frequency of electrical power supplied to motors in a building's heating, ventilation and air conditioning (HVAC) system. These motors run fans and pumps which are used to move air and cooling fluids throughout buildings for space heating and cooling applications, as well as simply for ventilation. By ramping down the amount of or liquid being forced through the facility's HVAC system when demand is low, VFDs reduce energy demand considerably.

Occupancy-Based Ventilation Controls

Occupancy-based ventilation controls operate on much the same principle as automated lighting controls; when occupancy is low, temperature or carbon dioxide sensors communicate a reduced ventilation need to the heating, ventilation, and air conditioning (HVAC) system. In effect, occupancy-based ventilation controls allow the minimum amount of energy to be spent on ventilation while still maintaining a comfortable and safe indoor environment.

HVAC Controls

Heating, ventilation and air conditioning (HVAC) systems are typically controlled by a centralized computer interface which allows the building engineer or manager to control such parameters as temperature set points, air changes and time schedules. An analysis of existing HVAC commands and tenant requirements can often present opportunities for energy savings. For example, some tenants may not need a building or individual floor cooled on the weekend, while others may report that certain zones are consistently over-cooled. HVAC controls can be regarded as a means for fine tuning with a goal of gaining the maximum efficiency allowable by the building's existing system.

Energy Star Equipment

Energy Star is an energy efficiency certification system administered jointly by the U.S. Environmental Protection Agency and Department of Energy. The system provides a credible guideline for purchasing departments to follow

when upgrading numerous electronics, including large appliances such as refrigerators and dishwashers as well as computers office equipment. In addition to product certification, Energy Star provides a valuable benchmarking tool which is useful in benchmarking and evaluating an entire facility's energy performance.

Building Envelope

A building's envelope consists of its foundation, walls, roof, doors and windows. A blower door test can tell a building manager a great deal about the tightness of their facility's envelope, and there are many products on the market – including low-emissivity windows and insulation – which can help to provide a better between the interior and exterior environments. Approximately one third of a typical commercial office building's energy usage is attributable to heating and cooling. Because this is such a significant cost, any tightening of a poorly-insulated building's envelope will yield consistent savings.

Water - Intro

Increasing water usage efficiency can increase the sustainability of your commercial property. Incorporating green improvements into your building's regular maintenance schedule by upgrading and replacing fixtures, aerators and valves are low cost measures that may yield significant savings. Use of native plant species and efficient irrigation systems are only a few of the available methods that can further reduce the water demands of your property while increasing its value.

Best Practices

High-Efficiency Flow Fixtures

The U.S. Department of Energy estimates that restroom plumbing fixtures account for approximately 60% of the total water use in commercial buildings. Upgrading older high-flow fixtures to high-efficiency, low-flow fixtures that reduce water use below the current code requirements can yield significant resource and financial savings. Modification of flow fixtures such as faucets and showerheads requires minimal cost and greatly enhances the fixture's water-efficiency. Devices known as flow restricting aerators are universally threaded and can be fit to any standard sink or lavatory faucet. Replacing or installing 0.5 gallon per minute (gpm) aerators in the place of 2.2 gpm flow fixture aerators can yield significant savings.

Low-flow & Dual-flush Toilets

The U.S. Department of Energy estimates that restroom plumbing fixtures account for approximately 60%of the total water use in commercial buildings. There are many high-efficiency, low-flow toilet fixtures available that exceed code requirements and maximize water savings. High-efficiency low-flow toilets use 1.3 gallons per flush (gpf), which is nearly 20% less than both the current International and Uniform Plumbing Codes (IPC/UPC). Dual-flush toilets optimize efficient water-use by allowing the user to select either a 1.6 gpf full flush or a 0.8 gallon half flush depending on need.

Waterless & Low-flow Urinals

High-flow urinals installed pre-1992 typically use between 3.5 – 5.0 gpf. However, the Energy Policy Act of 1992 requires that all new urinals must consume 1.0 gpf or less. In recent years, innovative urinal technologies have emerged that use very little to no water at all. The waterless urinal uses no water, but utilizes a formulated liquid membrane that allows fluid to drain through while sealing unpleasant odors beneath. Under a typical commercial facility restroom usage, each waterless urinal saves approximately 40,000 gallons of water annually. High-efficiency low-flow urinals use less than 1 pint per flush, approximately 90% less than the code requirement.

High-efficiency Landscape Irrigation Systems

According to the Federal Energy Management Program, more than 50% of commercial irrigation water is wasted due to evaporation, improper control systems, and lack of maintenance. Effectively designing and installing high-efficiency irrigation technologies such as drip irrigation and weather- or sensor-based control systems can help reduce consumption and yield significant cost savings. Drip irrigation is a low-flow system that minimizes wasted water by allowing water to drip directly to the roots of the plant. Weather- or sensor-based control systems use local climate conditions to deliver an optimal irrigation schedule to the landscape. The EPA's Water Sense Professional Partners program identifies professionals are certified for their expertise in these and other water-efficient irrigation technology and techniques.

Drought-tolerant & Xeriscape Landscape Selection

In many geographic regions throughout the U.S. use traditional turf landscaping. This type of landscaping consumes significant amounts of water for irrigation purposes and requires additional costs and energy to maintain. Alternative types of landscape selections such as drought-tolerant plants or xeriscaping techniques can reduce irrigation water consumption by 50 to 75%

compared to conventional turf landscapes. Xeriscape is an approach to landscaping that utilizes appropriate design, soil preparation, irrigation, plant selection, mulching and maintenance to reduce irrigation demands. Xeriscape uses native or adapted plants that are more pest resistant, require less fertilizer or pesticides, and have much lower irrigation demands.

Rainwater Collection Systems

Rainwater collection systems can provide significant cost savings by reducing the amount of purchased potable water for use in landscape irrigation, boilers, cooling towers, and to flush toilets where code permits. In most conventional collection systems, rainwater runoff is collected for the building rooftops and from parking lots and directed into a storage tank after running through a debris screen and simple filtration system. Storage tanks can be located above- or below-ground and is sized according to the available collection area, annual rainfall, intended use of rainwater and desired investment level. In most areas of the U.S. it is possible to collect 80% of the rainwater that falls on the roof or parking areas. Although systems vary greatly due to regional rainfall differences, the general rule-of-thumb for estimating cost is $1 per gallon of rainwater storage capacity.

Graywater Recycling Systems

Graywater systems recapture and filter non-potable water from baths, showers, hand washing sinks, and washing machines for use in landscape irrigation, boilers, cooling towers, and to flush toilets where code permits. One benefit of recycling on-site graywater is that it can replace or reduce the amount of purchased potable water for irrigation and toilets yielding significant cost savings. In addition to water use savings, graywater systems also have the potential to reduce the sewer system charges further contributing to financial savings. There are several methods used to treat gray water ranging from settling tanks, disinfectants and filters. Graywater is treated to remove solids, prevent odors, and eliminate other health hazards.

Water Submetering

Submetering water supply lines for separate tenant spaces within a multi-tenant commercial facility helps owners and property managers identify water consumption trends and target potential areas for improvement. Water submetering enables individual tenants to be directly responsible for the water and sewage cost of only their own water consumption. Tenants who have submetered water are more likely to practice more responsible water usage and willingly participate in water conservation strategies. Submetering gives

tenants a financial incentive to become more efficient, monitor water consumption, and report and detect water leaks in a timely manner.

Cooling Tower Water-efficiency Maintenance

The U.S. Department of Energy estimates that heating and cooling systems account for approximately 40% of total water used in commercial buildings. Cooling towers use a majority of this water. There are many low-cost maintenance strategies that ensure that cooling towers are operating effectively and using water in the most efficient manner. One simple strategy that applies to all water using technologies is checking for leaks on a regular basis and fixing them in a timely manner. This saves money by reducing wasted water and prevents higher maintenance costs for problematic areas left unchecked. Further information on cooling tower water-efficiency maintenance strategies is included in the Sydney Water Best Practice Guidelines for Water Conservation in Commercial Buildings.

Materials Procurement - Intro

A transition to materials usage procedures associated with reduced environmental impacts can conserve resources, reduce waste, and improve the well-being of building occupants. The use of harmful and unsustainable materials in day-to-day operations within the commercial building sector is known to damage human and environmental health, and can be avoided with the implementation of included best practices.

Best Practices

Green Cleaning Supplies

Many janitorial cleaning products used in commercial buildings are known to be hazardous to human health and degrade indoor air and water quality. According to the California Department of General Services, approximately 6 percent of professional janitors are injured by chemical products that they use. For these reasons it is important to implement a green cleaning supply policy that incorporate non-toxic, low-VOC cleaning products and environmentally preferable janitorial supplies. Specifications for these types of products can be found in the Green Seal GS 37 standard and in the U.S. EPA’s Comprehensive Procurement Guidelines.

Ongoing Consumables

Ongoing consumables are products purchased on a continual basis for the day-to-day operations of a commercial facility. Due to the magnitude of

resource inputs and waste generated by these types of products, small improvements in ongoing consumable procurement practices will substantially reduce environmental impacts attributed to a facility's operations.

Durable Goods

Durable goods are high-value products that are purchased on an infrequent basis. In the commercial setting these products include furniture, computer supplies, appliances, and electronics. Although these goods are typically purchased on an infrequent basis, considerations should include lifespan, energy efficiency, and sustainable materials content of the product. In addition, incorporating a strategy that reuses and recycles durable goods should be a high priority.

Low Mercury Bulbs

According to the U.S. Department of Energy, 92 percent of commercial buildings use fluorescent lighting fixtures. Although fluorescent lighting consumes significantly less energy they do contain a small amount of mercury than can problematic if not properly disposed. Several fluorescent lamps manufacturers offer reduced mercury content models with minimal mercury content per unit of light output.

Sustainable Packaging Strategies

The quantity of materials used in commercial building operations results in a great deal of disposable packaging waste. Disposable packaging is costly to dispose of and negatively affects the quality of the environment. Simple operational adjustments should be made to reduce the amount of disposable packaging used in commercial buildings. Promoting business strategies that work with material suppliers encourage using reusable shipment packaging and bulk-quantity reusable containers will yield financial savings and help to conserve natural resources.

Waste Reduction Strategy

Commercial businesses generate a substantial amount of waste from daily operations and incur costly waste removal expenses on an annual basis. Implementing an effective waste reduction strategy that incorporates the "three R's" principle – reduce, reuse, recycle – will conserve valuable natural resources and will yield significant savings on materials and waste removal expenses. Although commercial business operations vary in the types of waste they generate, waste reduction programs can range from simple educational initiatives to whole-scale operational strategy changes.

Educate Occupants for Sustainable Operations

Much of the success of sustainable commercial building operational improvements depends on generating effective participation of businesses and tenants within the facility. As property managers implement operational improvements within commercial buildings they should educate tenants of the financial, occupational health, business efficiency, and environmental benefits the improvements provide. Managers should also provide information and assistance to tenants that helps ensure the effective operation and continual improvement of the sustainable strategies implemented.

Electric Hand Dyers

Electric hand dryers in restrooms dramatically reduce the amount of material waste generated by a facility by eliminating the use of paper towels for hand drying. Although electric hand dryers do use electricity at the point of use whereas paper towels obviously do not, when examined from a life-cycle perspective, they actually save energy. In 2002, Environmental Building News estimated that virgin paper towels use more than three times the energy of dryers, while recycled towels use twice as much.

Maintenance Equipment

Maintenance equipment, if outdated and not kept up, can be inefficient and polluting. Of particular concern is gasoline-powered machinery such as mowers, weed eaters and leaf blowers. In many cases, it may not be economically feasible to replace these items before the end of their useful life. A low-cost action to improve efficiencies and reduce the impact on local air quality is to implement a regular inspection and maintenance program to keep all maintenance equipment – old and new – running at an optimal capability. When feasible, gas-powered equipment should be replaced with rechargeable battery powered items, thus reducing fossil fuel consumption, air quality degradation and noise pollution associated with the building and site maintenance.

Facility Alterations and Additions

The inputs to and waste generated by construction activities, as well as the working conditions created during and after these activities have potentially significant environmental impacts and potentially harmful health effects. Environmentally conscious construction and renovation practices should be established and followed during all facility alteration and addition projects.

Appendix F: Survey X2 Chart

Dependent Variable	Independent Variable	degrees freedom	X2 Value	P-value
Barrier Type (Financial; Tenant/Building)	# of Properties Managed	2	4.214	0.122
Barrier Type (Financial; Tenant/Building)	Square Footage Managed	2	2.487	0.288
Incentive Type (ROI - utility; ROI - occ./rental rates; Other)	# of Properties Managed	4	1.094	0.895
Incentive Type (ROI - utility; ROI - occ./rental rates; Other)	Square Footage Managed	4	3.032	0.553
Maximum Timeframe (1-4 yrs; 5-8 yrs)	# of Properties Managed	2	4.167	0.125
Maximum Timeframe (1-4 yrs; 5-8 yrs)	# of Properties Managed	2	2.046	0.36
Maximum Timeframe (1-4 yrs; 5-8 yrs)	Square Footage Managed	2	4.416	0.353
Maximum Timeframe (1-4 yrs; 5-8 yrs)	Square Footage Managed	2	0.662	0.718
Most Valuable Information (Cost-sharing, ROI Info)	# of Properties Managed	2	0.552	0.759
Most Valuable Information (Cost-sharing, ROI Info)	Square Footage Managed	2	1.868	0.393

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