Ensure Quality & Unlock Energy Savings in Small Buildings

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Synopsis

New markets are forming around improving the energy efficiency of smaller buildings. The current focus of the commissioning industry on new construction fails to address the larger opportunities – both the revenue opportunity for the commissioning industry, as well as the opportunity for reduction in energy consumption – in the existing building market.

On average there are about 2,000 existing buildings for every new building built;[1] 98% are less than 100,000 square feet, comprising nearly two-thirds of the total floor area, and consuming nearly 60% of all the energy used by buildings in the U.S. Only about 10% of these buildings have a building automation system.[2] The sheer number of small and medium sized buildings, combined with poor access to data from these buildings, makes traditional processes for selling and executing commissioning difficult. Capitalizing on the existing building market will require new skills and technologies in order to sell the concept of commissioning and to cost effectively execute the jobs. The winners will be the firms that can see the coming market opportunity – and plan for it by building processes, developing resources, and enabling scale. Will you be ready?

About the Authors

Tim Kensok is the Vice President of Market Development for AirAdvice, Inc., a Portland, Oregon-based provider of building performance diagnostic equipment and services. His expertise in this field focuses on HVAC markets and systems, sustainability, and indoor environmental controls. He has conducted extensive research into the performance of commercial buildings and the entire value chain from manufacturers through building owners to tenants.

Jim Crowder, AirAdvice President and CEO, has spearheaded business development and successful technology startups within both established and emerging companies. During his 25-year career, he has created dynamic new divisions within several Fortune 500 companies and led key turnaround efforts in smaller corporations. With AirAdvice, he now brings his history of leadership in growth and innovation to drive sustainability and energy management in homes and commercial buildings.

Introduction

Research indicates significant growth in building commissioning, from a total market of $114 million in 2001 to a projected $1.3 billion in 2008.[3] While these increases are encouraging, closer inspection reveals that the commissioning work performed today is heavily biased toward new construction projects. It is estimated that 75% of the total market is in new construction with only 25% of the work performed in existing buildings.[4]

Capitalizing on the opportunities for retrocommissioning in the existing building market will require new skills and technologies to sell the concept of commissioning and to effectively execute the jobs. The sheer number of small and medium sized buildings, combined with poor access to data from these buildings, makes traditional processes for selling and executing commissioning difficult.

This paper addresses three key areas. First, we examine the current state of the existing buildings market, defining key demographics about the stock of commercial buildings and the level of comfort and energy performance typically seen. Second, we will look at market drivers for energy conservation from the perspective of building owners, focusing on their buying behaviors. Finally, and most importantly, we define a business process for the commissioning consultant for attacking the large opportunity that exists in retrocommissioning of existing buildings. Simplifying the entire sales process – access to real building data, qualifying the opportunity, the skill set required of on-site personnel, energy analysis and modeling, return on investment analysis, reporting and sales presentation – will be invaluable in shifting to the high-volume business model necessary to begin to fully address the existing building market segment.

The Existing Buildings Market

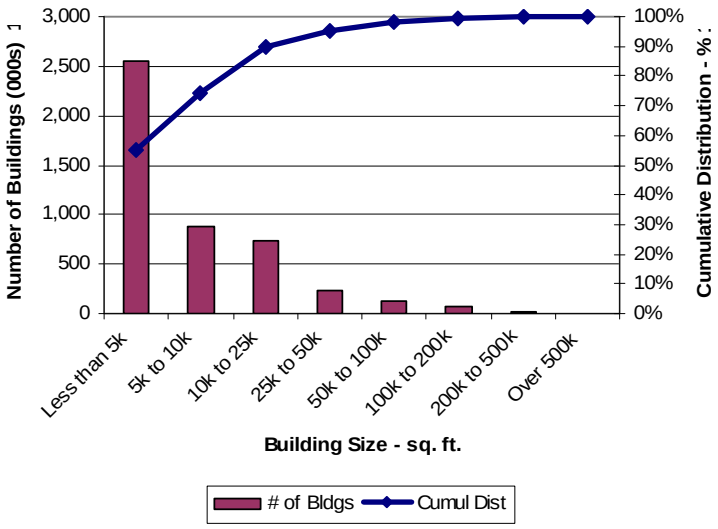
Building Demographics

The current base of commercial buildings is highly skewed toward small and medium sized buildings (see Figure A). Over 90% of all commercial buildings are less than 25,000 square feet; 98% are less than 100,000 square feet. These small and medium-sized buildings (less than 100,000 square feet) consume nearly 60% of the total energy used in all commercial buildings.[5]

The typical process for completing a retrocommissioning study or energy audit requires the firm to invest 20 to

Figure A: Demographics of Existing Buildings

90% of all commercial buildings are less than 25,000 square feet; 98% are less than 100,000 square feet.



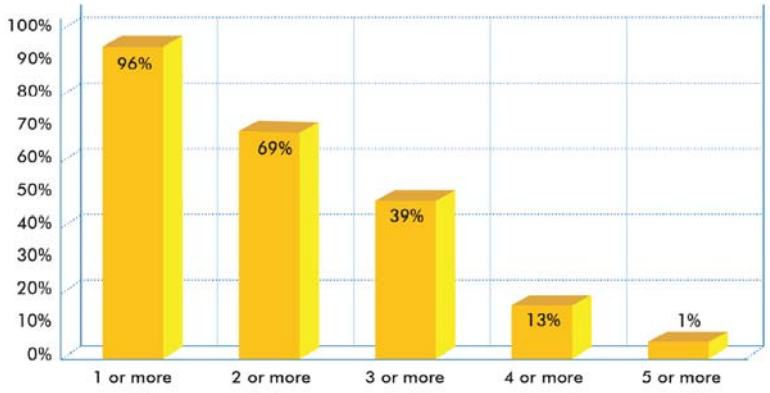
40 hours of skilled engineering time to qualify the opportunity and scope the complete audit project. This creates capacity and scale issues for the firm proposing the audit in that they can afford to commit resources only to large scale projects where the implementation phase will help recover the high cost associated with early stages of the audit process.

The result is that the small and medium- sized buildings segment remains a tremendously underserved market.

The State of Building Performance

In October 2007, the *AirAdvice State of Building Performance 20*07 was published.[6] This report summarized a wealth of research exploring the relationship between building performance parameters, specifically in reference to building comfort, energy efficiency, and the effectiveness of ventilation and temperature controls.

Figure B: Nearly All Buildings Have Issues
Over 9 out of 10 commercial buildings fail to meet fundamental conditions of acceptable comfort and energy efficiency.

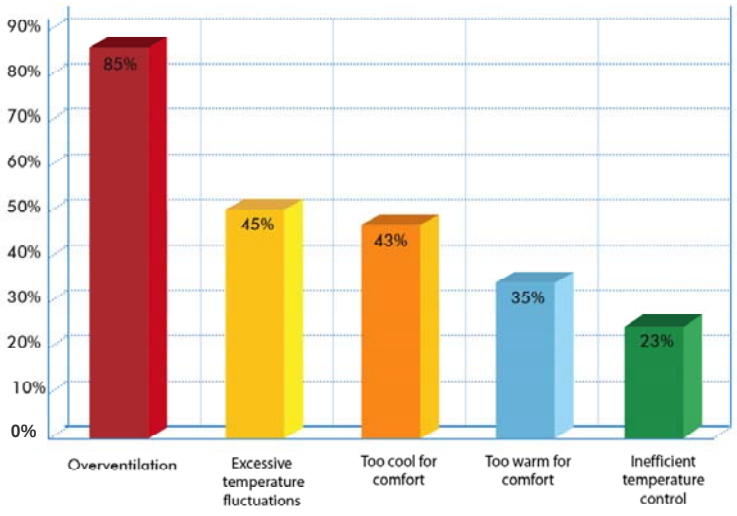


In an analysis of five fundamental elements of comfort and energy efficiency – temperatures that are too warm or too cool, fluctuate excessively, or fail to match the setpoint, and evidence of over-ventilation – it was found that 96% of buildings analyzed had at least one parameter out of bounds (see Figure B).

More detailed analysis showed that (see Figure C):

- Over 80% of buildings surveyed showed evidence of over-ventilation. Improving ventilation control offers significant potential for energy savings – up to 40% of the total HVAC cost in many cases.
- Conditions likely to generate comfort complaints – temperatures that were too cool, too warm, or fluctuated excessively, were present in over 75% of buildings surveyed.
- Nearly one-quarter of buildings experienced inefficient temperature control where the actual temperature was significantly above the heating setpoint or below the cooling setpoint.

Figure C: Overventilation Most Common Issue
Overventilation was the most common building performance issue identified.



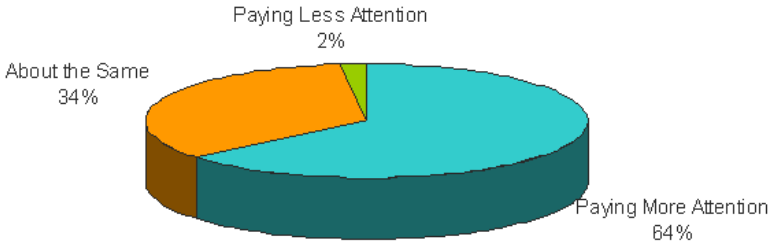
This offers an additional savings potential of 10 to 20% in many cases.

Market Drivers for Energy Conservation

Market dynamics are causing unprecedented interest in energy conservation. The Building Owners and Managers Association (BOMA) recently announced its *7 Point Challenge*, with a goal of 30% reduction in energy use by 2012 as a key component.[7] ASHRAE and the U.S. Department of Energy announced that they will work together to increase building energy efficiency standards for the year 2010 by 30% over 2004 standards.[8]

These initiatives are reflected in the attitudes of company executives and what they are paying attention to, or "mindshare." A recent survey reported that nearly two-thirds of companies report paying more attention to energy efficiency than they were a year ago (see Figure C).[9]

Figure C: Energy Efficiency Capturing Mindshare
Companies are paying more attention to energy efficiency than they were a year ago



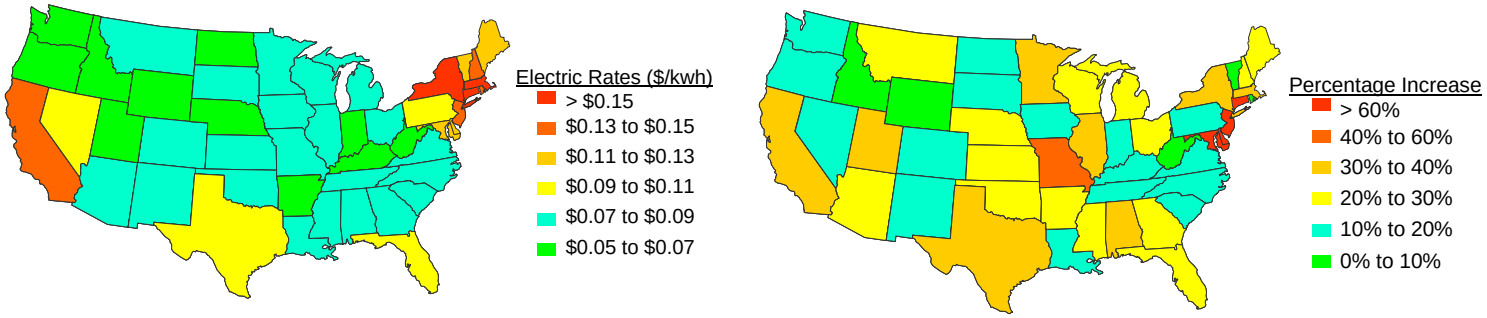
This interest in energy efficiency is being driven by three key forces:

1. Rising Energy Costs
2. Green / Sustainability Factors
3. Utility Supply and Demand

Rising Energy Costs

The national average electric rate has risen 29.4% from $0.0732 per kilowatt-hour in December 2004 to $0.0947 per kilowatt-hour in June 2007. However, the rates paid and the recent increases are not uniform across the country. Many states experience electric rates and/or have suffered increases that are more than twice the national average (see Figure D).[10]

Figure D: Electric Rates and Percentage Increases Vary Greatly
States with large populations experience some of the highest electric rates, and at the same time, the largest percentage increase, multiplying the perception of high utility costs.

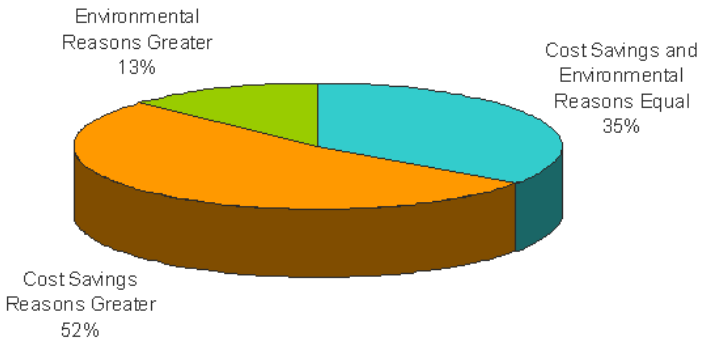


Green / Sustainability Factors

The desire for companies and government to be green and promote a reputation of sustainability is increasingly a factor in how investments in energy savings are viewed. While cost savings are still the primary driver for making energy savings investments, environmental reasons are now viewed as equal or greater in nearly half of the companies surveyed (see Figure E).[11]

Figure E: Environmental Reasons an Increasing Factor in Energy Savings Investments

Nearly half of companies report environmental reasons as equal or greater than cost savings when making investments in energy savings.

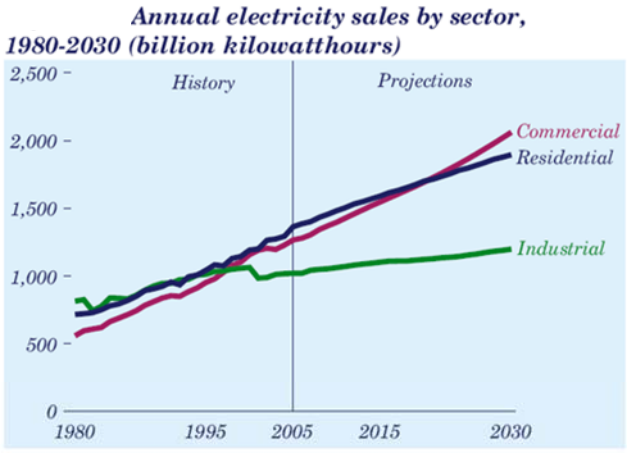


Utility Supply and Demand

Electric utilities in the U.S. face very difficult challenges ahead. Demand for electricity continues to increase, with recent estimates projecting a 41% increase in demand by the year 2030, compared to 2005 usage (see Figure F).[12] At the same time, the ability of utilities to increase supply is extremely limited. Plans for the construction of new coal-fired or nuclear power plants are met with vigorous opposition by environmental groups and the local communities affected. While promising, renewable energy sources such as wind or solar power are expected to contribute no more than 3% of the total demand, even by 2030.[13]

Figure F: Demand for Electricity Continues to Rise

Projected growth in demand for electricity is expected to increase 41% by 2030. Where will the supply come from?



Facing rising demand from customers and with limited options for increasing supply, utilities increasingly see energy conservation as one of the best alternatives to meet their customers' expectations. It is more feasible for utilities to incentivize conservation through rebate programs funded by rate payers than to aggressively pursue even greater increases in energy supplies. These conservation programs have the potential to be an important catalyst in creating demand for retrocommissioning services.

Buyer Behaviors

Studies of the HVAC system buying behaviors of building owners and facilities managers have shown that purchases of these systems that have a large and direct effect on energy consumption are largely made in a very reactive manner.[14] Less than 1 in 6 HVAC system replacements are done so as part of proactive, energy management-based decision. The vast majority, over 85%, are simply replaced as the result of equipment failure. This study estimated that the potential market for HVAC system retrofits that could be financially justified on the basis of energy savings is at least twice the market currently served.

The study reported a single, overwhelming factor in creating a proactive, energy-based decision to retrofit equipment: energy audits. Of all HVAC retrofits, 80% of those conducted as part of an energy management-based decision were preceded by an energy audit or commissioning study. The conclusion of the study was that energy audits are prime drivers of HVAC energy retrofits.[15]

Utility Programs as a Catalyst

A potential source of funding that is often overlooked is utility rebate programs for energy audits or retrocommissioning studies. Most utilities have programs available that pay for a significant portion of this cost. Here are a just a few examples:

ConservationWise from Xcel Energy[16]

This program provides for study rebates covering up to 50% of the cost of a retrocommissioning study, with a maximum potential rebate of $15,000. In addition, when the study's recommendations are implemented, cash rebates of up to half the cost of improvements that conserve electricity and/or natural gas can be earned.

Long Island Power Authority[17]

This program provides for 50% of the commissioning cost for electric energy related systems (fuel fired heating systems or non-energy systems not funded) up to a maximum of $50,000.

Southern California Edison[18]

Last but certainly not least, our host sponsor Southern California Edison, in a program administered by PECI, offers incentives up to $0.10 per square foot, paid directly to the retrocommissioning provider for investigation of building operations; and up to $0.05 per square foot, paid to the owner for the implementation of recommendations.

Building a strategy around the rebate programs available in the markets you serve, and marketing a specific offering that meets the requirements of those programs, has great potential for growing your base of retrocommissioning business.

A Scaleable Business Model

Critical Success Factors

In order to design a business model that can be successfully scaled up to make a measurable impact on energy use, there are three critical success factors that must be met.

Manage Labor Content

In smaller buildings, the total energy savings potential is also smaller. The ultimate cost of the retrocommissioning project and the firm's upfront cost to prepare the proposal must be smaller in roughly the same proportion in order for the model to scale. Managing the cost of labor that is needed to properly qualify opportunities, prepare proposals, and ultimately execute the project can be a challenge using current methods.

New methods are emerging that bring a high degree of automation into the tasks of initially benchmarking the energy performance of the building, which allows the commissioning consultant to more effectively select the buildings most likely to result in significant energy savings. Additionally, automated methods of data collection, analysis, and reporting reduce the amount of labor required to perform an initial assessment of energy performance, even in buildings with minimal controls automation.

Reduced Level of Expertise Required

Beyond the cost aspect of labor content, a second challenge is simply staffing enough qualified personnel in order to handle the increased volume of smaller projects. It will be necessary to use a process that requires less senior engineering personnel, and ideally builds "bench strength" of more junior engineers or technicians as they gain important field experience. Automating the data capture process and using expert systems to help diagnose building performance and uncover potential ECMs are critical in reducing the level of expertise required to economically accomplish the initial assessment of energy performance. This allows firms to make more strategically effective use of senior engineering resources.

Simplified Sales Process

It is likely that owners of small and medium-sized buildings have not been exposed to retrocommissioning services and thus, may be less likely to have direct knowledge of the potential benefits. Even though the return on investment is likely to be favorable, these owners may be surprised at the cost ($0.40 to $0.60 per square foot) associated with traditional retrocommissioning tools and processes. It will be necessary to simplify the sales process and provide a lower entry price point to "warm" these owners up to the concept of retrocommissioning.

Automation is again the key to overcoming this potential obstacle. By starting with a simple, automated benchmarking and energy assessment process, valuable insight into the performance of the building can be gained, initial low- and no-cost energy conservation measures can be

identified and implemented – all while educating a new customer on the benefits of larger scale implementation of retrocommissioning.

Business Process

Here we define five steps in a business process that is tailored to retrocommissiong small and medium-sized buildings. This process is outlined graphically in Figure H on the following page.

1. **Portfolio Benchmarking**
   It is critical that labor resources be applied to those buildings that offer the greatest potential for energy savings. For that reason, we recommend that the first step be an initial energy benchmarking of the building or the portfolio of buildings in question.

   For most building types, the best tool available traditionally has been the EPA's ENERGY STAR® Portfolio Manager™. However, recent advances now allow for an automated link to the ENERGY STAR website that have greatly simplified the data entry and ongoing data management compared to the manual entry required by Portfolio Manager.

   Once buildings are benchmarked, a rough approximation of savings potential can be made, giving guidance toward the viability of investing additional resources in analyzing each individual building.

2. **On-Site Energy Survey**
   As discussed earlier, an on-site energy survey is a critical step in getting agreement from an owner to move forward with the implementation of energy conservation measures. The goal of this step is to provide a rapid assessment of energy performance and opportunities for improvement, with a minimum of labor input – in most cases, less than two hours of technician's time.

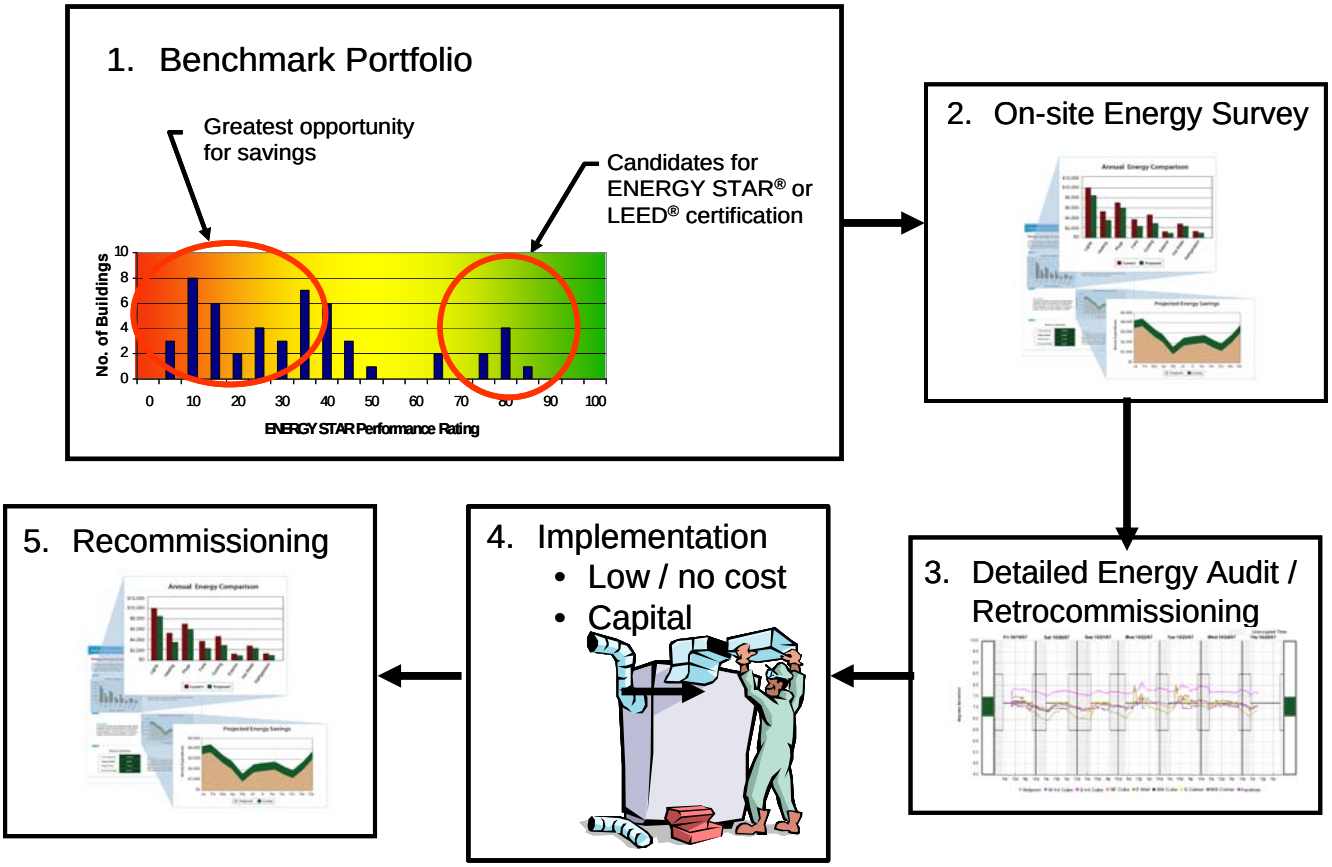
   Again, recent technological advances in wireless communications, energy modeling, and automated analysis and reporting have greatly reduced the amount of labor required to conduct an initial energy assessment, especially in buildings without automated control systems. This is a critical step in the process of scaling up to handle large numbers of small and medium-sized buildings.

3. **Retrocommissioning Study**
   In many small buildings, the initial energy survey may be sufficient to move directly to implementation. However, in larger, more complex systems, the initial energy survey may naturally lead to a more traditional retrocommissioning study. Having already completed the energy survey offers the advantage of significantly improved insight to the performance of the building. This has the desired effect of lowering the cost of follow-on services, as well as documenting the savings potential so the owner can make a more informed decision about the financial viability of investing additional resources in improving building performance.

4. **Implementation**
   Implementation of the energy conservation measures is, of course, the most critical step of all. Identifying issues and generating recommendations that are never implemented contribute nothing to the overall goal of reducing energy use. By identifying low- and no-cost conservation measures earlier in the process, the probability of these recommendations being implemented increases. However, the same level of tenacity and project management skills will be required to ensure a successful implementation step.

5. **Recommissioning**
   Automated benchmarking and energy surveys offer new and exciting potential as a simplified process for the verification of savings and recommissioning of buildings with little or no building automation. Applying the same low-cost, high-volume process in the same building on a repeated basis is an invaluable method of ensuring that energy conservation measures are persistent. In addition, recent technological advances in the generation and analysis of real-time meter data offer great potential to immediately spot negative trends in energy usage, independent of uncontrollable variables such as weather.

Figure H: Business Process
This 5-step process for retrocommissioning integrates automated energy benchmarking and energy surveys to simplify the analysis and reduce labor requirements.



Analysis of Market and Savings Potential

What would it take to double the size of the commissioning market through a focus on retrocommissioning small and medium-sized buildings? Is there enough benefit to owners in the form of energy savings to justify the expense? The following analysis provides an initial indication to address both of these questions.

Market Potential

In the U.S., there are 4.5 million buildings less than 100,000 square feet in size. Assuming revenue of $10,000 per building, less than 3% of the total building stock would need to be retrocommissioned to generate an additional $1.3 billion in revenue for the industry, effectively doubling the size of today's industry.

This would require 130,000 buildings to be evaluated. Drawing from a pool of commissioning consultants, ESCOs, independent energy engineers, and perhaps some of the more sophisticated mechanical service and controls contractors, it is likely that at least 2,000 potential service providers could be identified. This would then require an average of just 65 buildings per firm to achieve the desired scale. Many larger, multi-location firms could handle many times that figure.

Energy Savings Potential

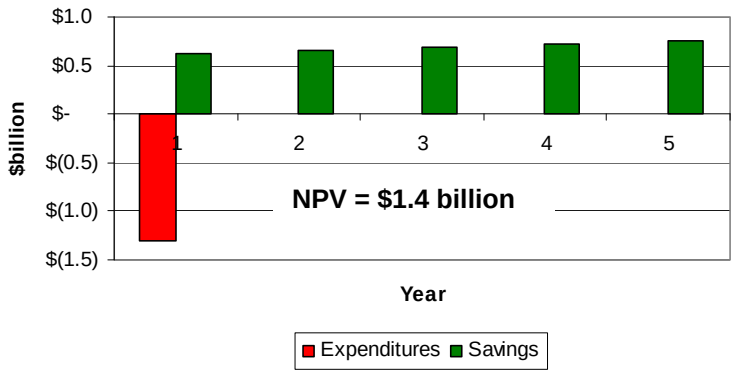
These 4.5 million buildings 100,000 square feet and under consume 918 billion kWh of electricity and 30 billion therms of natural gas, resulting in a total annual energy spend of approximately $137 billion. Assuming that only 3% of the building stock was evaluated, the energy use under evaluation would be $4.1 billion.

Estimating the savings potential at a conservative 15% yields $600 million in annual savings. Building a discounted cash flow model of the savings that result from the initial investment in retrocommissioning (see Figure G) shows a positive net present value of $1.4 billion accruing to the building owners.

This industry analysis of the scalability of the model shows both that it is feasible to deliver the service and that the service is financially viable.

Figure G: Return on Investment

Even for small and medium-sized buildings, investing in retrocommissioning offers a solid financial return on investment.



Conclusion

If as a country we are serious about reducing energy consumption and our carbon footprint, we must, as an industry, move beyond the disproportionate focus on new construction projects and address the stock of existing buildings. Because of the building demographics, addressing the stock of existing buildings requires a viable approach to serve the vast numbers of small and medium-sized buildings.

This is where we have focused our effort – in taking a fresh look at the opportunities for energy savings in commercial buildings by focusing on small and medium-sized buildings, the largest segment (in terms of the number of buildings). We have identified the market drivers, from the perspective of both the building owners and the utilities that are faced with the challenge of satisfying increased demand with limited supply. We have quantified the financial opportunity, both for the owner and for our industry, which stands to also benefit as we deliver on the potential to reduce energy consumption. Finally, we have outlined a scaleable business model that can deliver the key requirements necessary to address the energy performance of the stock of small and medium-sized buildings, and to accelerate the process of reducing the economic and environmental impact of those buildings.

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