

Economics of Energy Upgrades

SIEMENS

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Breaking Through Barriers

Executive Summary: For most facility executives, it's no longer a question of whether to improve energy efficiency; it's a matter of how best to achieve that goal. Nevertheless, most facility executives still face obstacles to energy upgrades. By far the most significant are matters connected with gaining top management support for upgrades, especially when it comes to funding. This white paper addresses crucial economic issues facility executives should consider when planning upgrades including:

- Making the case for funding
- Rebates and incentives
- Payback criteria
- Using low- and no-cost measures
- Evaluating performance contracting
- The importance of measurement and verification



The numbers tell the story: Commercial buildings in the United States spend more than \$100 billion on energy each year, and account for 17 percent of the nation's greenhouse gas emissions, according to the U.S. Environmental Protection Agency. Those buildings represent a tremendous opportunity for energy efficiency upgrades, with the potential for individual buildings to achieve substantial savings in the short term and, especially, the long term.

"Energy efficiency upgrades are a hot topic," says Laurie Gilmer, associate with Facility Engineering Associates.

Energy Efficiency Survey

The results of Building Operating Management/Siemens Industry, Inc., Building Technologies' 2010 Energy Efficiency Survey — based on responses from more than 1,000 facility executives on key energy-related issues — support Gilmer's assessment. More than 90 percent of respondents are either planning or implementing upgrades, or have completed them already. (See Figure 1.) These upgrades represent a diverse range of projects. Lighting upgrades, which often offer the quickest paybacks, are the most common, but more than half of respondents have HVAC, energy monitoring and building automation upgrades in their plans. (See Figure 2.)

Completed upgrades have saved a lot of energy. In the past five years, 24 percent of respondents have trimmed energy use by as much as 5 percent, while 41 percent of respondents have saved between 5 and 10 percent. Another 20 percent report savings between 11 and 20 percent. (See Figure 3.)

Respondents see plenty of opportunities for further savings, with 47 percent saying they believe energy consumption could be reduced between 5 and 10 percent, and another 25 percent saying they believe savings could range from 11 to 20 percent. What's more, 12 percent of respondents say they believe they could save more than 20 percent on energy use. (See Figure 4 on page 3.)

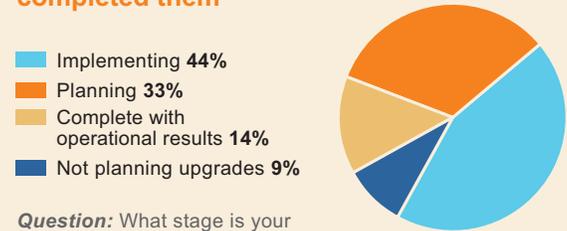
As many facility executives have learned, however, improving energy performance is no small task. Efficiency upgrades are rife with challenges, and none are greater than those connected with money. From justifying projects to measurement and verification of savings, questions of dollars and cents shape energy upgrades from start to finish.

Making the Case for Funding

By a wide margin, Energy Efficiency Survey respondents reported funding as the biggest obstacle to achieving their energy efficiency goals, with management support and approval coming in second. (See Figure 5 on page 3.) The two challenges are closely related: Because upper management controls the checkbook, boardroom support is essential to securing the funding for capital improvements.

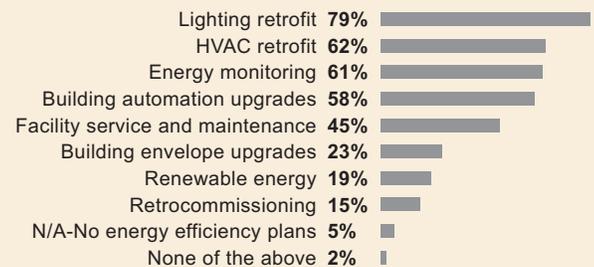
"CFOs don't care about kilowatt hours, lumens or BTUs," says Richard G. Lubinski, president of Think Energy Management. "Their interest is financial performance, and they only talk money. You have to show how these capital improvements add value to your building." Lubinski

FIGURE 1: Almost all companies are planning or implementing energy upgrades, or have completed them



Question: What stage is your company in when it comes to energy efficiency upgrades? Responses = 1,005

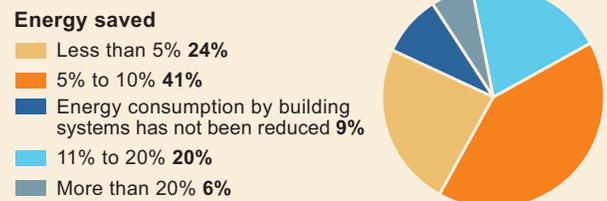
FIGURE 2: Energy plans cover a spectrum of options



(Total exceeds 100 percent because multiple mentions were allowed.)

Question: Which of these are currently part of your organization's energy efficiency plan? Responses = 1,009

FIGURE 3: More than two thirds of companies have reduced energy use 5 percent or more in the past five years



Question: How much have you reduced your energy consumption from building systems in the past five years? Responses = 999

suggests energy efficiency upgrades be presented in terms of return on investment (ROI) and measurable performance values. Successful energy efficiency proposals often resemble corporate executive summaries — all necessary financial data is presented in clear language, and in two to three pages. Additional information can be provided later as needed.

In developing financial projections, Lubinski recommends estimating savings conservatively. This may mean steering

clear of the “best case” numbers contractors and vendors may provide — numbers that may not be achievable in the real world.

“The question becomes, as a facility executive, do you want to be in the position of saving 150 percent of your projections, or do you want to be justifying why the improvements only resulted in 50 percent of projected savings?” asks Lubinski.

Budgeting For Upgrades

Budgets for planned upgrades run the gamut. Asked about funding for energy upgrades, 43 percent of Energy Efficiency Survey respondents indicated that less than \$100,000 per building had been allocated for these initiatives. (See Figure 6.) By contrast, 6 percent reported having more than \$500,000 to spend on energy efficiency.

One reason a solid proposal is so important is that energy projects often face competition from other internal initiatives: 73 percent of Energy Efficiency Survey respondents indicated that they planned to use internal funds as a source for energy efficiency initiatives. (See Figure 7 on page 4.)

Given the challenges in obtaining funding, many facility executives have found it pays to query their local utilities to see what rebates and incentives they currently are offering. Utility and government incentives play important roles in many upgrade projects, as Figure 7 shows.

Payback Criteria

When the time comes to weigh a project’s energy savings against its initial cost, Energy Efficiency Survey data shows that target payback periods vary widely, with 10 percent aiming for payback in 12 to 18 months and 15 percent willing to accept paybacks of four to five years. Another 35 percent of respondents say that targets for ROI vary by project. (See Figure 8 on page 4.)

Gilmer says initial cost is the facility executive’s biggest challenge when selling energy efficiency in the boardroom. She says she believes it’s important to align the upgrades with organizational goals and to recognize that some energy efficient retrofits may not be financially viable for some organizations. “Some organizations want paybacks of less than 20 years, some want less than two years or even 18 months,” says Gilmer.

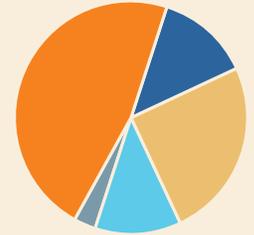
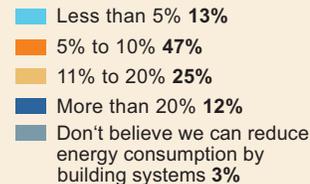
One strategy for selling a hesitant boardroom on energy efficiency is to choose upgrades with a relatively quick payback. For example, replacing an outdated and inefficient lighting system with energy-efficient lamps and fixtures generally has a two-year payback. “If a \$400,000 new lighting investment can save \$200,000, that’s a 50 percent return on investment,” says Lubinski.

Justifying Energy Projects

But for some organizations, longer payback periods make economic sense. For government buildings, schools, churches and major nonprofits, for instance, a six-year payback may be quite acceptable.

FIGURE 4: Almost all companies believe more energy efficiency gains are possible

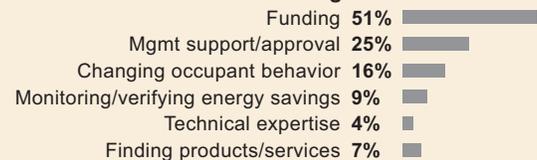
Energy savings potential



Question: How much MORE do you believe you can reduce energy consumption from building systems with the proper actions? Responses = 993

FIGURE 5: Funding is the biggest challenge to energy efficiency

Challenges

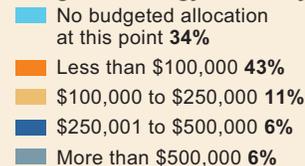


(Percentages add to more than 100 percent because multiple mentions were allowed.)

Question: What is your biggest challenge to achieving your energy efficiency goals? Please rank the following in order of importance. Responses = 795

FIGURE 6: One-third of companies have no budget for energy efficiency initiatives

Budget for energy efficiency



Question: How much funding, on a per-building basis, has been allocated for energy efficiency initiatives? Responses = 932

Another category of energy users that tends to embrace longer paybacks is those interested in achieving LEED certification for an existing building.

In addition, “softer” or less easily quantifiable benefits of energy-efficiency upgrades — improvements in comfort and productivity, a decreased carbon footprint, or the opportunity to earn Energy Star or LEED certification — may tip the scales in favor of an upgrade whose payback is less immediate.

Another approach, one favored by some performance contract vendors that may be looking to achieve savings

over a 10- to 15-year period, is to bundle good energy efficiency improvements that have longer paybacks with low-cost, quick payback improvements.

Evaluating Performance Contracting

Sometimes energy-efficiency improvements that are necessary for the continued well-being of a facility simply cannot be funded. Figure 6 shows that 34 percent of Energy Efficiency Survey respondents have no budget for upgrades. In these situations, a growing number of facility executives and building owners are turning to contracts with performance-contracting vendors. As Figure 7 shows, 19 percent of respondents plan to use performance contracts to fund energy efficiency measures.

Often, these arrangements are long-term contractual relationships in which the vendor manages and arranges funding for the upgrades with the promise of enough energy savings to recoup the expenditures over 10 or 15 years.

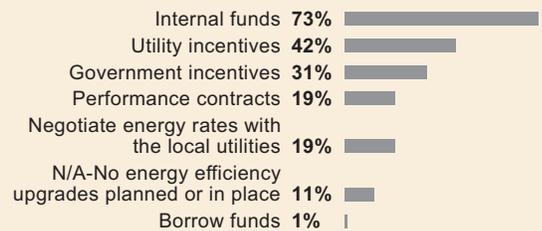
Ordinarily, performance contracts begin with a step that is crucial for any energy upgrade process: a comprehensive energy audit. The type of audit required for a given project may vary. The American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE) delineates three levels of energy audit, depending on what energy efficiency measures are planned. For low and no-cost measures, a Level One audit showing return on investment is often sufficient. A Level Two audit is best for larger capital expenditures or to evaluate alternatives such as various HVAC systems, complex lighting upgrades or new chillers. Level Three audits are investment-grade, used primarily to reassure lenders that mortgages in building sales include adequate capital to cover any needed upgrades.

Guaranteed Energy Savings

Crittenden Regional Hospital (CRH) in West Memphis, Ark., is a 50-year-old health care facility that needed multiple infrastructure and capital improvements. However, rising energy costs and operational expenses made finding room in the capital budget very challenging. Following a bidding process, CRH staff selected a performance contracting firm to perform an energy and infrastructure analysis of its facilities. For several months, the firm interviewed staff, conducted site evaluations and took measurements. Eventually, the firm proposed a number of ideas that would reduce energy costs, increase productivity, and improve the hospital's infrastructure while working within CRH's operating budget.

Under the terms of CRH's performance contract, capital improvements totaling almost \$2.6 million will be paid for through projected energy and operational savings of \$3.9 million over 15 years. Improvements will include lighting retrofits, a new chiller and chilled water piping, new chilled water pumps and variable frequency drives, a new cooling tower, a new heat exchanger, a new boiler, and a new energy-management controls system. The project guarantees annual energy and operational savings equivalent to \$260,000 annually for 15 years.

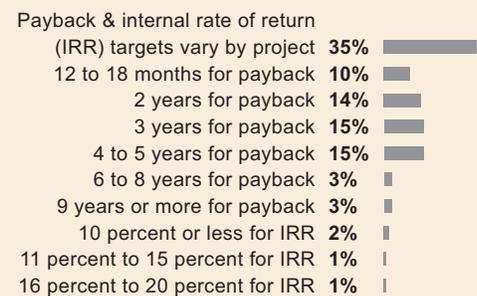
FIGURE 7: Internal dollars are the biggest source of funding for energy efficiency efforts



(Total exceeds 100 percent because multiple mentions were allowed.)

Question: How do you plan to fund energy efficiency initiatives? Responses = 938

FIGURE 8: Payback targets vary widely



Question: Do energy efficiency projects have to hit a specific target for payback period or internal rate of return (IRR)? Responses = 910

James Carter, Jr., chief executive officer of CRH, says he is excited about the anticipated savings, and about the benefits that are harder to quantify.

"We have already seen the morale of the staff improve and heard the positive feedback from patients," says Carter. "Performance contracting allowed CRH to provide a more comfortable and healthier environment for all its occupants."

Savings Exceed Projections

Steven Jalowiec, the administrative director for facility operations at Western Connecticut's Waterbury Hospital, echoes Carter's satisfaction. "We are realizing huge savings," says Jalowiec, "well beyond what we were expecting."

Waterbury's upgrades and improvements were based on a detailed engineering energy audit — conducted by a performance contracting firm — that identified the most promising system and building improvements. The result was a series of retrofits and upgrades that were projected to produce annual energy savings of 947,000 kilowatts of electricity and 418,000 therms of natural gas. The improvements also promised to reduce greenhouse gas emissions by 65 million pounds — the equivalent of 69,000 barrels of oil — over 10 years.

In addition to guaranteed savings, some performance contracts also use “shared savings” in the contract’s early years to offset costs of other capital improvements. That was the case at Waterbury. In 2007, the first year of its performance contract, Waterbury received a check for \$350,000 from initial energy savings, which Jalowiec used to offset the cost of other needed capital improvements. Three years later, financial rewards continue to exceed projections.

Waterbury’s agreement, signed in August 2006, defined a two-phase program of HVAC and building envelope upgrades. Lights, HVAC, energy monitoring and building automation — the top four upgrades reported by facility executives in the Energy Efficiency Survey in Figure 2— were included in the plan, along with building envelope upgrades (No. 6 on facility executives’ lists, according to Figure 2). The 574,000-square-foot facility received new heating and air conditioning, a new boiler and steam plant, new laundry facilities and plumbing retrofits, weather stripping, lighting improvements, and the completion of its energy management system.

Jalowiec explains the results are based on a “very complete verification program that starts with the contract.” The performance contracting vendor prepares a detailed annual report that proves the energy savings, as part of a performance contract extending 10 years. Clauses in the contract specify that if energy savings are not what they were projected to be, Waterbury Hospital receives a rebate.

Using Low- and No-cost Measures

With 34 percent of Energy Efficiency Survey respondents having no budget for energy upgrades, it’s not a surprise that low-cost and no-cost measures are often the way to get started with efficiency improvements. They can make a significant difference.

“Energy Star has studied old buildings and new buildings and what they found is older buildings, even with less efficient equipment, can operate as well as or better than their younger counterparts,” says Gilmer. “What we’re seeing is a return to energy management — things like turning off the lights, closing the outside doors, etc.”

John M. Studebaker, president of Studebaker Energy Consulting, looks at such elements as altering hours of operations to benefit from time-of-use and off-peak energy pricing, interruptible power rates and commodity utility purchasing. “How can we reduce the energy costs without any physical changes?” asks Studebaker. Such ideas may seem simple, but they give facility executives a way to demonstrate to financial decision-makers the dollar impact of using energy wisely.

“You can then argue, ‘here’s where we are; here’s where we are going,’” Gilmer says.

The Importance of Measurement and Verification

Chad Mendell, vice president of Environmental Systems Design, says he believes measuring and verifying the energy savings delivered by upgrades and improvements is very important. Gilmer and Studebaker agree: Continuously

Facilities Report Green Plans

Sustainability has become an important issue in a growing number of companies. But goals for sustainability vary widely. For example, when asked to describe their long term visions for greening facilities, 56 percent said they planned to make some green upgrades but not seek certification under the LEED for Existing Buildings: Operations and Maintenance (EBOM) program. But a significant number of respondents – 28 percent – said they would seek LEED-EBOM certification for at least some buildings.

One-third of companies will seek LEED-EBOM certification

56% We will optimize current operations and make some green upgrades over time, based on cost/benefit analysis, but not seek certification under LEED for Existing Buildings: Operations and Maintenance

28% We plan to follow green best practices and may have some of our facilities certified under LEED-EBOM

11% We will only go far enough to meet regulatory requirements

5% We are committed to having all of our facilities certified under LEED-EBOM

Question: Which of the following best describes your long-term vision (i.e., 8 to 10 years) for greening your facilities? Responses = 888

A similar diversity of responses came in response to a question about visions of the future for facilities. “Optimize building performance” received the highest marks, with 54 percent of respondents rating it first. The most ambitious goal – “Evolve from a consumer of global resources to a contributor to sustainability” – received the lowest score, with 15 percent of respondents rating it the top priority.

Optimizing building performance is top goal in vision of future of facilities

54% Optimize building performance to operate at peak energy efficiency

37% Balance occupant safety/comfort with operational costs

25% Extend life cycle of building automation systems

15% Evolve from a consumer of global resources to a contributor to sustainability

(Percentages add to more than 100 percent because multiple mentions were allowed.)

Question: Please rate the following attributes on a scale of 1 to 5, with 1 being extremely integral to your vision of the future of your facility and 5 being not integral to your vision. Responses = 1137

Benchmarking Lays Groundwork for Energy Gains

A key step in planning energy upgrades is benchmarking, which rates the performance of a facility as compared to buildings that are in the same industry or that have other characteristics in common. Benchmarking can help identify which buildings offer the best opportunities for improvement and indicate where low- or no-cost savings may be found. Benchmarking numbers can also help persuade top management to support an upgrade by showing that other buildings have better energy performance – an independent validation of the facility executive's claims.

Perhaps the best-known energy benchmark comes from Energy Star. The Energy Star Portfolio Manager ranks a facility's energy consumption on a scale of 1 to 100 relative to similar

buildings nationwide. For example, a rating of 82 means the facility is performing better than 82 percent of all similar buildings nationwide. Benchmarking can be conducted before and after an upgrade to verify the impact of energy-efficiency improvements. Many commercial buildings, such as offices, supermarkets and retail outlets are eligible to use Portfolio Manager for benchmarking purposes.

Benchmarking also is important for facility executives and building owners interested in pursuing rebates and incentives from their local utilities. A number of utilities, including San Diego Gas and Electric Company (SDGE), require the benchmarking score and submission of an Energy Star Statement of Energy Performance with the application. To receive the benchmark

score, facility executives must input one year of energy data for the building. To assist facility customers, utilities like SDGE may offer an automated benchmarking service, which uploads meter data directly into the Portfolio Manager account. For buildings not eligible to receive a benchmarking score, a supplemental benchmarking form may be required by the utility.

Another benchmarking resource is available through Building Owners and Managers Association (BOMA) International. The 2010 Experience Exchange Report presents comprehensive data on income and operating expenses for multi-tenant offices, corporate buildings and medical facilities. Among its many details are energy data and costs from the 4,200 buildings reporting into its database annually.

measuring and tracking energy, they say, provides decision-makers with critical answers on the backside of a project. "How much did we actually save? Did we save what we expected to save?" Gilmer asks. "And was it worth it?"

Measurement and verification of energy savings is critical as they must be "documentable and traceable," adds Studebaker.

However, Mendell says that "in the day-to-day operations of a building, there often isn't time to do much verification of energy savings."

This observation is borne out in results of the Energy Efficiency Survey, which reveal that only 30 percent of respondents measure energy savings from upgrades, with 70 percent estimating energy savings rather than obtaining precise measurements. (See Figure 9 on page 7.)

The good news is that Energy Efficiency Survey respondents have a range of energy measurement tactics/tools in place, even if they are not using them to evaluate upgrades. The most common by far is tracking utility bills. (See Figure 10 on page 7.)

What's more, a significant number report plans to use technology like submeters and building automation systems to measure efficiency upgrades, as Figure 10 shows.

Gilmer says she likes measurement and verification that can be accomplished in a busy facility executive's schedule. She thinks the best advice is "to keep it simple. Monitor and measure only significant processes. Don't go overboard," she says. "If the measurements and verifications don't add or improve energy efficiency efforts — if it's just information — it's just not going to get done."

Studebaker points out that energy-saving data can be assessed through means as simple as comparing monthly energy consumption, post-upgrade, to consumption during the same period a year earlier. Sometimes even these

simple measures can produce important discoveries: Gilmer cites one instance in which an energy-use review revealed an HVAC system was using more energy than projected. With a simple adjustment to the flow of outside air through the system, the company was able to enjoy energy savings again. Without monitoring and verification of energy savings, however, an issue like this might compromise savings indefinitely.

While simple verification strategies like comparing monthly usage may suffice in many situations, others — including companies pursuing LEED certification, and those installing campus-wide energy efficiency measures or complex systems involving large capital expenditures — demand more sophisticated verification and measurement procedures. In these instances, outside engineering expertise may be required in the form of consulting services from an architect or professional engineer with practical energy experience or a certified energy manager (CEM). Facility executives might also look for experts through energy engineering associations or any of a number of specialty certifiers.

"A vendor may run the measurement and verification reports, but have them independently verified," Lubinski says. "An independent energy consultant acts as the owner's representative. He or she will look at the numbers and verify they are reasonable and/or question any that appear strange and unusual."

A More Efficient Future

Overwhelmingly, respondents to the Energy Efficiency Survey expressed the intention to pursue energy-efficiency improvements with the goals of optimizing their facilities' performance and maximizing occupant comfort and security. Achieving these goals will require wise investments in

improvements that balance efficiency outcomes with initial costs, and that build upon the opportunities available in today's energy marketplace. In many cases, partnerships with outside firms may play a crucial role. The Energy Efficiency Survey showed that respondents planned to work with a range of firms, including utilities, architects and engineers, contractors and distributors, energy service companies (ESCOs), and facility management service providers. (See Figure 11.)

Although choices abound in terms of the types and extent of improvements available to facility executives, one thing is clear: Doing nothing isn't much of an option. As Studebaker explains: "If you wait until the cost of energy truly impacts your bottom line, you have been wasting a lot of money." ■

Methodology

The survey was sent via e-mail to a random sample of 12,000 *Building Operating Management* subscribers on March 19, 2010. Reminders were sent to non-respondents on March 23, March 26 and March 31, 2010. A total of 427 subscribers chose to opt out of the survey or failed to respond due to an invalid e-mail address, yielding a final sample of 11,573.

The survey was closed for responses on April 6, 2010. With 1,012 qualified responses returned and with a net sample of 11,573, the rate of response for the email survey was computed to be 8.7 percent.

The overall estimated margin of error for this study is +/- 3.06 percent at the 95 percent confidence level.

Demographics of survey sample

- 42% Commercial Office
- 35% Educational: K-12/Colleges/Universities
- 16% Healthcare
- 14% Government
- 14% Industrial
- 13% Retail
- 11% Multi-Family/Mixed use
- 4% Hospitality

(Total exceeds 100 percent because multiple mentions were allowed.)

Question: Please indicate the types of facilities you/your firm own or manage. Responses = 894

- 43% 100,000 to 499,999 sq. ft.
- 20% 500,000 to 999,999 sq. ft.
- 23% 1 million to 4,999,999 sq. ft.
- 6% 5 million to 9,999,999 sq. ft.
- 8% 10 million or more sq. ft.

Question: Please indicate the total square feet of buildings you/your firm own or manage. Responses = 883

FIGURE 9: Less than one-third of companies measured reported energy results

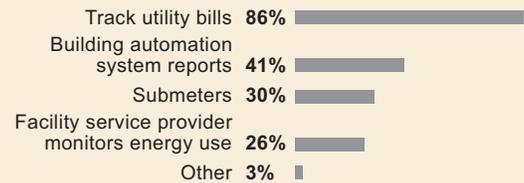
- Measured energy gains 30%
- Estimated energy gains 70%



Question: Is the answer to question 3 an estimate or is it based on measured energy use?
Responses = 979

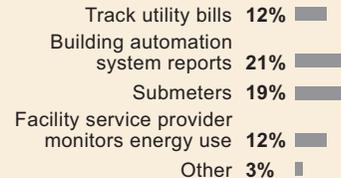
FIGURE 10: Many companies plan additional measurement tactics/tools to measure energy efficiency improvements

M&V tactics/tools: In place



(Percentages add to more than 100 percent because multiple mentions were allowed.)

M&V tactics/tools: Planned



(Multiple mentions were allowed.)

Question: What measurement tactics/tools, if any, do you have in place or planned for the future to measure energy efficiency improvements? Responses = 907

FIGURE 11: Companies look to partners to help achieve energy goals



(Total exceeds 100 percent because multiple mentions were allowed.)

Question: Do you currently work with, or have plans to work with, any of the following partners to achieve your goals? Responses = 893