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Unlocking Energy Efficiency in Small Commercial Buildings through Mechanical Contractors

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Abstract

While buildings smaller than 4,645 square meters account for nearly half of the energy used in U.S. commercial buildings, energy efficiency programs to date have primarily focused on larger buildings. Stakeholder interviews conducted during a scoping study by Lawrence Berkeley National Laboratory (LBNL) indicated interest in energy efficiency from the small commercial building sector, provided solutions are simple and low-cost. To address this need, an Energy Management Package (EMP) was developed to deliver energy management to small commercial buildings via Heating Ventilating and Air Conditioning (HVAC) contractors, since they already serve these clients and the transaction cost to market would be reduced. This energy management approach is unique from, but often complementary to, conventional quality maintenance or retrofit-focused programs targeting the small commercial segment. This paper presents an overview of the EMP, the business model to deliver it, and preliminary demonstration findings

from a pilot use of the EMP. Results from the pilot validated that contractors could deliver the EMP in 4–8 hours per building per year, and that energy savings of 3%–5% are feasible through this approach.

Introduction

Efforts to reduce energy use in the commercial building segment are increasingly expanding to consider small buildings. Of the U.S. commercial building stock, 95% of buildings are 4,645 square meters or less, and these small buildings use 44% of commercial building energy (Commercial Buildings Energy Consumption Survey (CBECS) 2003). However, achieving energy savings in small commercial buildings can be challenging due to low energy expenditures and tight margins on a return on investment (ROI).

In smaller buildings, there is often no dedicated facilities manager supervising building operations, and often facility operations, maintenance, and bill payment responsibilities are split across multiple people. Firms occupying these buildings tend to have lower awareness of energy use patterns than those in larger buildings (Schleich and Gruber 2008). One study of small commercial spaces in a New Jersey mall noted that when interviewed, business owners and managers repeatedly remarked, "I can't do anything about energy costs" (Komor et al. 1989). Smaller building size translates to lower total potential energy and cost savings than in larger buildings, and therefore transaction costs can limit offerings for this segment. Also, the wide variety of small commercial building types make it difficult to develop approaches that are relevant across the entire segment. Smaller buildings may be more sensitive to the payback period of upgrades: a study of small to medium enterprises in manufacturing reported that energy efficiency measures had an implementation rate of 40% overall, and 64% for measures with a payback period of one year or less (implementation rate in this study is the number of identified measures that were actually installed in the facilities) (Alhourani and Saxena 2009).

To address this market, LBNL developed the Contractor's Energy Management Package (EMP) using the continuous energy management process. The continuous energy management process is a set of business practices to continuously track and manage energy use; in the EMP, this process was adapted for application in small commercial buildings. The EMP comprises a set of practical resources for energy management in small commercial buildings including guidelines, worksheets, a simple spreadsheet-based reporting tool, and an associated business model.

This paper is divided into 6 sections. Firstly, it provides a summary of the scoping study done by the authors to better understand the opportunities and barriers to energy management solutions in the small commercial segment, it then presents the structure of the EMP, the business model that contractors can use to offer the EMP, results from a pilot study and demonstration conducted to assess the business model, discussion on feedback from contractors on the EMP and finally conclusions from this work and possible future directions for this work.

Background Scoping Study

To better understand the opportunities and barriers to energy management solutions in the small commercial segment, the authors conducted an analysis that included commercial building energy use microdata from Commercial Buildings Energy Consumption Survey (CBECS), a literature review, and stakeholder interviews.

Microdata Analysis and Literature Review

CBECS 2003 micro data were analyzed to characterize the energy use of U.S. small commercial buildings by building type. Small commercial buildings (defined here as less than 4,645 sq. meters or 50,000 sq. feet) collectively account for $51 billion per year in energy expenditures (CBECS 2003). Figure 1 shows the total annual energy expenditure and mean energy

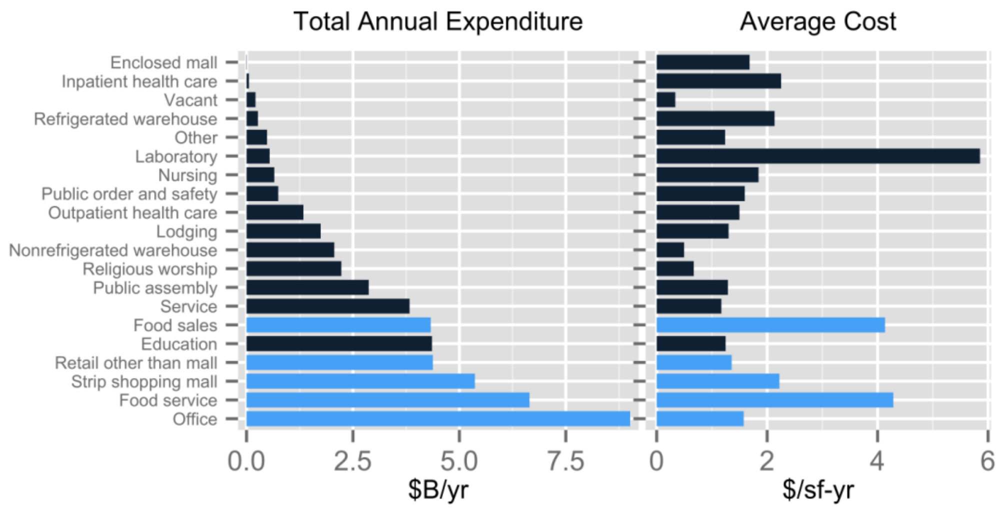

Fig. 1. Annual energy expenditure versus average annual cost per square foot

expenditure per square foot by building type for the wide range of small commercial building types. Building weights provided in the CBECS database were used to extrapolate from the survey results to nationwide impacts, and all costs are in 2003 dollars. Four building types were targeted in this study: retail, office, food service, and food sales, which collectively comprise 58% of the total annual energy expenditure for small commercial buildings.

A recent DOE scoping report (Langner et. al 2013) and commissioning meta-analysis work (Mills et al. 2004; Mills 2009; Mills and Mathew 2009) were used to inform market impacts. In addition, an analysis of the results of the National Small Business Association (NSBA) 2011 Energy Survey (NSBA 2011) indicate that there exists a moderate demand for energy efficiency services amongst small commercial businesses. Of 200 NSBA members surveyed, 52% were very concerned and 40% were moderately concerned about future energy costs (NSBA 2011), although survey respondents were self-selecting and likely do not represent a cross-section of U.S. small business owners. Despite the interest level, only 16% of NSBA businesses surveyed had had an energy audit in the past two years.

Interviews

Eighteen industry stakeholders were interviewed, including utility program managers, software vendors, heating, ventilation, and air-conditioning contractors, and contractor association representatives. Interviews were conducted by phone and were 20–30 minutes long. The HVAC industry contacts included both contractors participating in utility efficiency programs and those not involved with the efficiency community. Interviews contained some specific questions to understand characteristics of the target market and obtain feedback on potential technical features and delivery models informing design of the EMP. The interview format and questions were customized for each stakeholder group

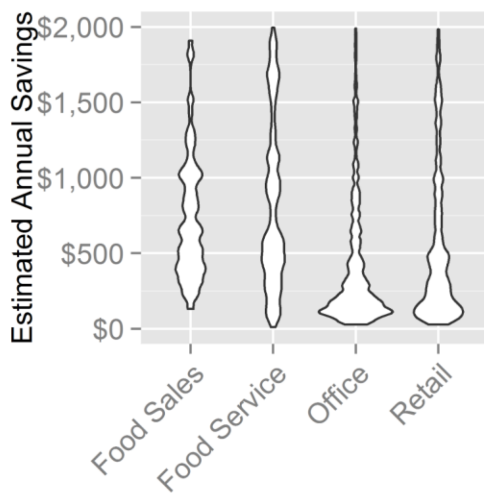

Fig. 2. Estimated annual energy expenditure savings

and generally covered: demand from small commercial customers for energy efficiency services; what types of energy analysis they currently provide small commercial customers and how results are used; what tools they use, how tools can be improved, if there is a need for new tools; and what the business model and pricing is for small commercial energy services.

Overall, contractors reported that perhaps a quarter of the small commercial market is motivated to reduce energy use, and that a larger segment is aware of potential savings but may be wary of making investments. Few energy management tools and services are specifically targeted to this market segment, but interviews indicated potential interest, particularly in benchmarking and tracking building performance information. Consistent feedback indicated that any tools or services developed should be simple to use and provide actionable information. For energy management to be marketable, given the limited utility costs for smaller buildings, it will likely be necessary to lower transaction costs so that energy management offerings cost tens to hundreds of dollars per year per building.

Contractors and contractor associations interviewed acknowledged a range in attitudes. As one contractor noted: “It depends on the customer. Some get it, and see the value, some do not.” One contractor commented, “Building owners and tenants are busy running the business day to day. They don’t get to bigger picture issues on what do to control costs. So it comes down to the contractor.” Another contractor agreed with this point: “Customers seem oblivious to energy efficiency. I say to them, ‘This is your money—you’re letting your tenant spend your money. Are you ok with that?’ And then they usually think about it and then come back and say, ‘No I’m not—What can we do about it?’” It appears that generally small business owners are motivated to save money and are receptive to energy efficiency as a means to cut costs, but a lack of awareness can impede uptake.

Some factors affecting demand for energy efficiency services may be regional, including levels of environmentalism, strength of the regional economy, and government regulation. Additionally, fifteen cities, two states and one county have instituted energy benchmarking and disclosure requirements, which may increase demand for simplified energy analysis, although regulations generally target larger buildings. (Institute for Market Transformation 2015)

Most utilities and software vendors interviewed did not primarily focus on the small building segment. Transaction costs were consistently reported as a significant barrier. Utility programs targeting small commercial buildings include incentivized direct-install retrofit and equipment tune-up programs, but these programs are capital intensive, which often limits their scale. Software vendors thought the challenge was to automate as much of the data analysis and reporting as possible, while still providing individualized performance feedback and recommendations. One software vendor noted that automated analysis of interval meter data is straightforward, and it was really the streamlined handling of interval data input files in diverse formats that enabled a low price point.

The contractors interviewed reported very little analysis of energy use data in the small commercial sector, beyond limited ENERGY STAR benchmarking. But most contractors thought that energy analysis and tracking would be of interest to some of their customers. One energy information system (EIS) vendor stated, “Our report covers a year of data, but most customers do it again every three to six months. It’s not intended as a tracking tool, but it is sort of being used that way.” One contractor with a number of school district maintenance contracts commented, “The school districts want tracking.” Overall, the contractors interviewed seemed interested to learn more about available energy management tools, but engagement can be challenging. For example, none of the HVAC contractors interviewed had logged into their own utility web portal to view personal or company energy usage. Some contractors expressed frustration with existing energy management tools for being too complicated and time-consuming to learn. Although most vendors interviewed focused on web delivery of information, two interviewees stressed that the target market was more responsive to a one- or two-page paper document. One utility program executive commented, “E-mails are just deleted, phone calls are disruptive, but a paper document can be brought home and read in a free moment.” Several interviewees emphasized the need for information delivery to be direct and brief. Parker et al. (Parker et. al. 2009) concluded that multiple different intervention strategies for energy efficiency are more effective than single intervention strategy, depending on the motivation of the customer, and that providing business advice or a help line was one of the most versatile strategies.

The scoping studies revealed which subsectors were the best candidates for the EMP. The interviews also provided valuable insights into key design features of the package elements.

Energy Management Package Overview

The goal of developing the EMP was to develop a marketable approach to deliver whole-building efficiency services to small commercial buildings. To minimize initial investments thought to be less palatable to small building owners, the EMP was designed to focus on low- and no-cost energy conservation measures. The measures targeted were primarily operational, such as setting and maintaining appropriate thermostat set points, as well as scheduling for thermostats and lighting, but they also included some low-cost retrofit measures such as installing occupancy sensors or replacing inefficient lighting sources.

Structure: The EMP comprises a set of practical resources for energy management in small commercial buildings, including guidelines, worksheets, a simple spreadsheet-based reporting tool, and an associated business model. While a variety of delivery channels were considered, including deployment by utilities and direct purchase from software vendors, the focus here is on deployment of the EMP by HVAC or mechanical contractors. These contractors have existing relationships with small commercial customers and visit the buildings regularly for maintenance and service. The EMP is divided into five technical elements:

1. Benchmarking and analysis of monthly energy use data
2. Analysis of interval electricity data
3. An hour-long walk-through onsite
4. Communication with the building owner
5. Checking results

The EMP is designed to provide simple, step-by-step guidance for HVAC or mechanical contractors so that specialized training is minimized and the technical elements can be learned. Each element contains guidelines to serve as a reference, as well as a worksheet to be completed for each building. The EMP is designed to leverage existing, low-cost or free software tools for analysis portions. A list of relevant software tools is also provided in the EMP for informational purposes, but is neither an endorsement nor a comprehensive list. The EMP document is a portable document format (PDF) file, with some associated multimedia elements. The recommended process is similar to the approach for small commercial buildings outlined by Haberl and Komor (1989), although the current availability of interval data (e.g., Green Button data) and inexpensive online software tools greatly reduces the barriers to implementing this approach.

The technical elements of the EMP are outlined in more detail below:

Element 1 – Benchmarking and analysis of monthly energy use data: A contractor can use either the ENERGY STAR score or the energy use intensity (annual site energy use per square meter) for the previous 12 months to convey to the owner how their building is performing relative to peers. Those with larger portfolios can also use this metric to identify which buildings might benefit most from energy management and upgrades. Monthly electricity and fuel use is plotted to illustrate seasonal patterns and trends from year to year. To focus efficiency efforts, this analysis can highlight step changes in energy consumption.

Element 2 – Analysis of interval electricity data: A contractor can use up to 12 months of hourly or sub-hourly interval electricity data to determine how much energy is used at specific times of day, revealing opportunities associated with scheduling, overnight setbacks, and base load, peak load, and irregular behavior. This is conducted using an interval data analysis tool.

Element 3 – One-hour Walkthrough: This element outlines a one-hour onsite walkthrough that contractors can do to identify low- and no-cost energy efficiency measures such as adjustments to thermostat and lighting controls. The worksheet for this element contains a checklist of fifteen items that can be answered by walking through the occupied spaces and speaking with the site manager or owner.

Element 4 – Communicating with the building owner: This element guides the contractor through summarizing building performance, identifying efficiency measures, and pitching measures to the building owner. Interviewees commented that fast and straightforward reporting is critical to selling efficiency measures, so a simple spreadsheet is included that automatically generates a summary of performance findings and a table of the measures recommended by the contractor. Non-energy benefits such as improved lighting conditions and thermal comfort are also discussed. Results from the benchmarking, analysis and walkthrough (Elements 1, 2 and 3) can be communicated to clients using the summary generator spreadsheet.

Element 5 – Checking results: This element covers how contractors can use the use tools from Elements 1 and 2 to verify savings, and how to verify that scheduling, setback changes, and other improvements have been implemented. Further steps are included for those interested in more substantial upgrades. Contractors are encouraged to institute a schedule for continued energy management to ensure that savings persist, and can communicate these findings to clients using the same guidance provided in Element 4.

Delivery channels: Delivering the EMP through HVAC or mechanical contractors helps in lowering the critical transaction cost to deliver energy management services. The proposed business model associated with this service offering is described in detail in the next section.

In addition to the constraint of the cost to deploy the EMP, data availability also limits what analysis and recommended measures could be included in the EMP. For example, sub-metered electricity data for HVAC equipment or temperature probes in occupied spaces are not typically available in small commercial buildings, and installing any new metering would exceed the cost constraints. Most small commercial buildings do have access to monthly electricity and fuel usage totals, and some have access to interval electricity data from utility smart meters. To minimize data collection cost and hassle, only very limited information beyond monthly and/or interval data is necessary to complete the EMP.

Iterative design: The design, format and content of the EMP were developed through an iterative process with multiple rounds of feedback. Beyond stakeholder interviews discussed above, continued feedback was solicited from HVAC contractors and energy management professionals. Two HVAC contractors provided extensive feedback during development on the content, format, and delivery of the EMP. Industry representatives formally reviewed the EMP through the Department of Energy (DOE) peer review process and several of these reviewers provided additional feedback as the EMP evolved. The material was also presented to HVAC contractors at a workshop on technological advances in energy efficiency, and participants provided quantitative feedback on aspects of the business model.

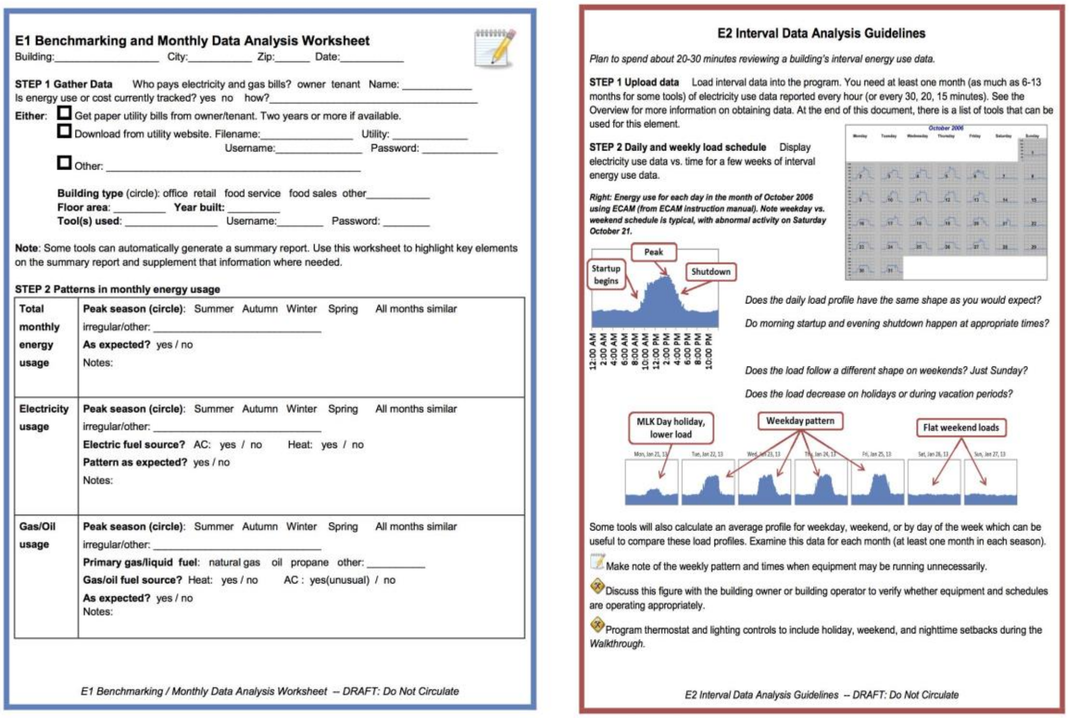

Fig. 3. Technical elements of EMP (Note: ECAM=energy charting and metrics tool

Business Model

Given the high transaction costs associated with delivering energy management to small commercial buildings, the major benefit to contractors offering this service is to build customer trust, differentiate from competition and get new clients. Rather than spend money on advertising to improve customer recruitment and retention, a contractor could deliver added value through utility cost savings. To this end, contractors have appreciated how this package can help quantify savings for other improvements they may have made at a site, such as installing high efficiency equipment or repairing an economizer. Thus, this offering would likely be most attractive to contractors and building owners who are value-oriented rather than price-oriented. Beyond strengthening customer relationships and dependence on the HVAC company, benefits to the contractor include differentiating the company, gaining credibility through affiliation with a recognized program or protocol, and identifying additional service opportunities.

Estimated savings targets of 3%–5% translate to annual utility savings for customers of $200–$900, based on average national energy prices (CBECS 2003). Additionally, the value of non-energy benefits could also be significant. In addition to saving money and reducing environmental impacts, energy upgrades have been associated with improved indoor environmental conditions including lighting quality, thermal comfort, and productivity. One contractor commented, “We’ve found thermal comfort and energy efficiency often go hand-in-hand.” Additional benefits for the customer include reducing the cost and hassle associated with maintenance and savings from utility bill validation. Some businesses may also value addressing environmental impacts.

	Contractor	Customer
Contractor premium	+$200	-$200
Recruitment	+$300	NA
Labor Cost/Adjustments	-$400	-$150
Estimated Savings	NA	$550
Total Profit	$100	$200

Fig. 4. EMP costs and benefits

In a multiple choice survey, a group of contractors was asked how much they would charge to offer the EMP. Responses ranged from $0 to $400–$500, with a median response of $300–$400. Responses to how much they spend to recruit customer accounts in small commercial buildings ranged from $100–$200 to “more than $800,” with a median response of $400–$600. Figure 4 shows the example costs and benefits from offering the EMP as part of a service contract.

A contractor could charge a premium of $200 on a service contract. If the energy management offering leads to the recruitment or retention of one additional customer this could generate an additional $300 of revenue per year, based on a $1,500 service contract with 20% profit margin. There may be additional revenue from any energy upgrades performed by the contractor. Costs to implement the EMP are estimated to be about $400–$500 per year, based on 4–8 hours of labor. The labor cost can be minimized by using salaried office staff to perform analysis at times of the year with lower service volume, minimizing the technician hours required. Thus, the annual profit for each customer in the program would be $100–$300. For the customer in this example, the EMP may lead to a net benefit to the customer of as much as $550 in the first year. Since most measures identified with the EMP have simple payback periods of less than two years, the net annual savings for the customer may increase.

In interviews, contractors tended to prefer contract integration over offering energy management as a separate service. One contractor commented, “Rather than charging $1,500/yr, I would charge $1,700 or $1,750, and incorporate this into what I would offer them, because our pricing is competitive, and you’re adding value in the maintenance spiel and can monitor usage.” Another contractor discussed the financial benefits of energy management: “Customers are with you for 7–9 years. At 20% margin.... it gets to be complicated. If it were just based off the energy costs—the software, the technician’s hours—it doesn’t pencil out. We wouldn’t do it just for that. Energy management only makes sense if you then sign them up for a multi-year maintenance contract." Contractors viewed the costs to implement the EMP as a means to add value to their business, with the objective of lowering advertising costs and growing the customer base.

Results

Pilot Project

A pilot project was conducted to assess the business model for the EMP. Results indicated the benefits of the offering as well as some barriers to implementation. Partner HVAC contractors in Northern California were asked to identify two buildings of less than 4645 square meter with single-use space used for retail, office, food service, or food sales. Other criteria for demonstration sites were that the building owner was highly motivated to perform energy conservation measures, that interval and monthly energy use data were available, and that the buildings were not already high performance buildings. After encountering challenges in a multi-tenant building, "owner-occupied" or "single-tenant" was added to the pilot site criteria. Overall, four contractors began the pilot process over a six-month period: one contractor (hereafter referred to as "the pilot partner") had two pilot sites, two contractors were too busy to continue, and one contractor was not able to get the building owner to send energy data.

To assess the EMP business model, a number of metrics were tracked during the pilot, including the time taken to train partner contractors on tools and analysis. For each demonstration site, the time spent on each technical element was tracked, as were the energy efficiency measures recommended and completed. Table 1 summarizes the pilot results.

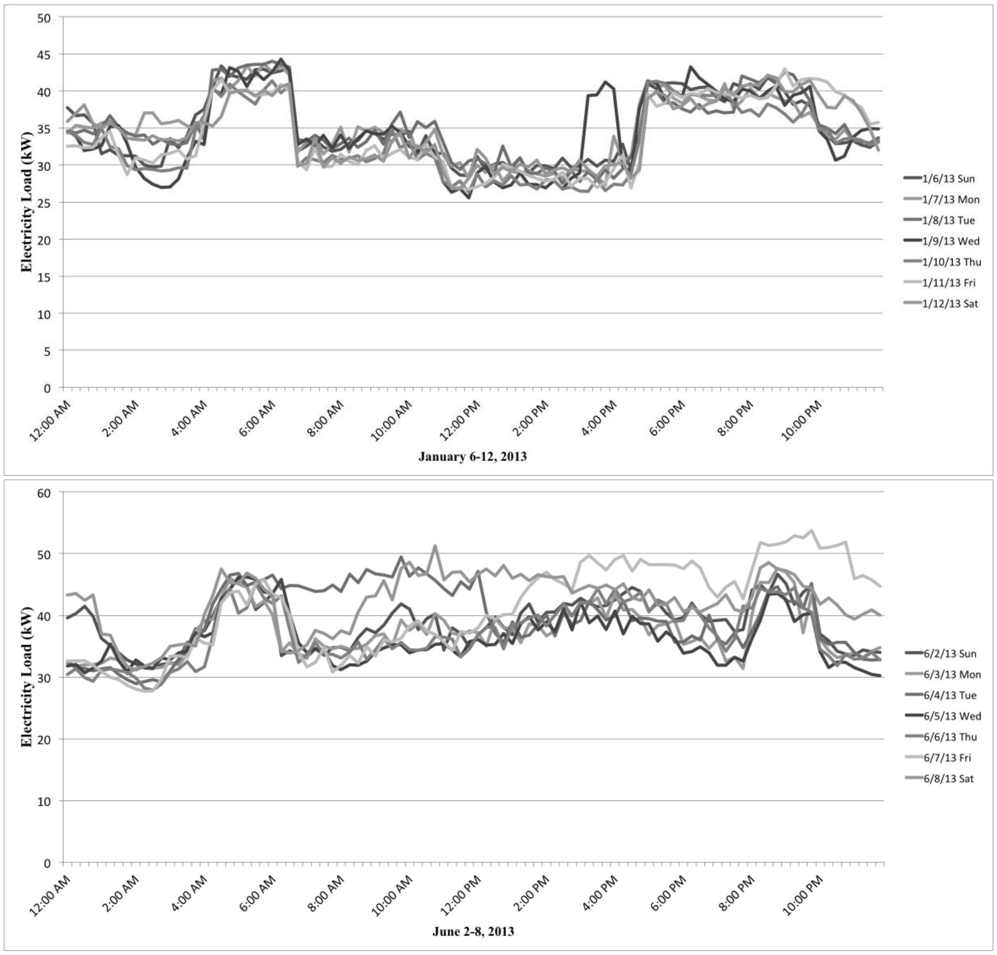

Fig. 5. Results from site in pilot project: (a) daily load profiles for 1 week in January; (b) daily load profiles for 1 week in June, for site in pilot project

Overall, the pilot validated the key elements of the business model that it was designed to test, although for only one to two sites. The training time was reasonable, and the time to execute the EMP was within the target range, although further validation of these quantities for a larger number of contractors is needed. The estimated savings expected were also within the target range. A larger-scale demonstration under way with 15–20 contractors across the United States (U.S.) will help to validate further these aspects of the business model, as well as to establish the value to the contractor more generally and to determine whether they plan to continue to offer the EMP.

Demonstration

A larger-scale demonstration of the EMP was conducted in late 2014 specifically to validate whether contractors and their clients find value in the offering. Sixteen partner contractors nationwide identified a total of 24 sites for the demonstration shown in figure 6 below. Sites included office, retail, food service, and food sales, and buildings ranged from 185 to 4,552 square meters and totaled over 37,161 square meters. The majority of the demonstration sites were owner occupied buildings, which was preferred, and the remainder were single tenant buildings. A number of the contractors chose to include their own office building as a demonstration site to pilot the EMP.

Table 1. Summary of pilot results

Metric	**Estimate from Pilot**
Time it takes the contractor to learn the EMP	About 2 hrs (based on one contractor)[a]
Time it takes to deliver the EMP *Target: 6–8 hrs./yr*	3.5–6 hrs for the complete EMP (extrapolated from two sites) *Site A: 2 hrs for Monthly Data Analysis and Walkthrough* *Site B: 2 hrs 30 min for Monthly and Interval Data Analysis,[b] Walkthrough, and Communication of Results to Owner*
Additional revenue to the contractor from implementing improvements	Negligible. *Contractor stated it was not likely to be profitable due to small profit margin on labor.*
Site energy savings *Target: 3%–5%*	Site B: approximately 3% energy savings, 7% utility cost savings estimated (primarily from electricity conservation measures)
Utility cost savings *Target: $120–$900/yr*	Site B: approximately $2,000/yr estimated savings

[a] Complete training included overview, demonstration of tools with sample data, and some guidance with initial

analysis. While only one contractor completed the training, three others participated in an initial, 90-minute session that covered the overview material and the pilot project. [b] Authors uploaded the interval data to the software ahead of time, because data did not arrive in .xml format, so uploading data may typically take additional time.

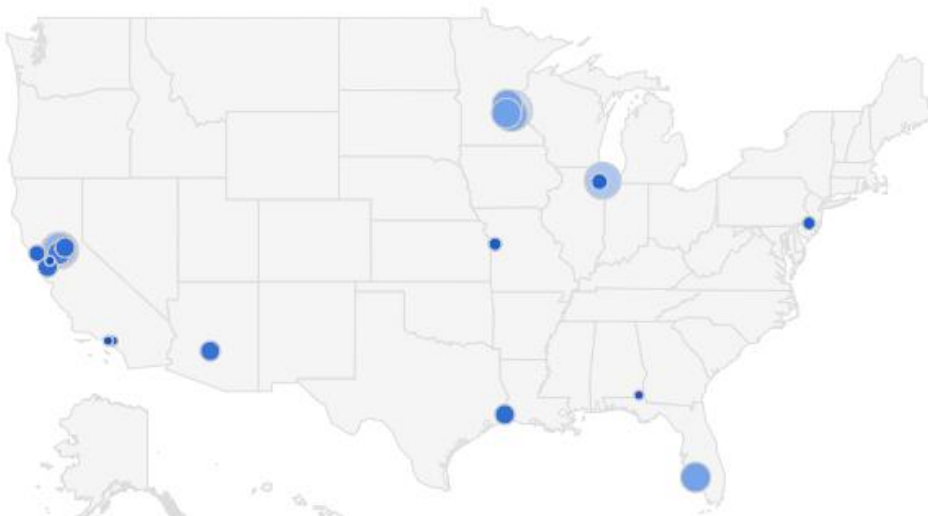

Fig. 6. Demonstration sites across the United States

One partner contractor used heat map visualizations of interval data to identify that the chiller was running each weekend. Heat maps provide a quick way to identify patterns in interval data that may correspond with equipment scheduling or setback issues.

Of the 16 recruited contractors, one-quarter remained highly engaged with the program over the course of the demonstration, while another quarter were moderately engaged. Of the highly engaged contractors, two groups stood out: individuals who served as energy efficiency specialists within larger HVAC firms and individuals in small firms who had high personal interest in energy efficiency. Factors reported for slow progress included: a high summer business load and difficulty accessing data and prioritizing demonstration action items over daily urgent issues. To provide technical advice and peer learning opportunities, the LBNL team offered five 60–90 minute workshops by web conference. Participation in the workshops was strongly correlated with progress at sites.

To gain insights into the experiences of the partner contractors of the demonstration, a web-based survey was conducted. Overall, the feedback was positive, with strongly favorable feedback from highly engaged partners.

- Two-thirds of respondents said they plan to offer the complete package to clients in the future.
- One-third of the respondents agreed that offering the package strengthened their relationship with their customer.
- Over 75% of respondents rated the quality and utility of the EMP materials as “high” or “exceptional.”

Discussion

Overall, the feedback received to date has been largely positive, although challenges did arise. Two factors important to the success of such projects stand out: data access and availability, and participant commitment.

1. **Data access and availability.** Data access and availability, particularly to third parties, remains a significant barrier to the successful deployment of novel approaches to operational efficiency. Whether considering monthly data or interval smart meter data, the diversity in utility processes (customer web-portals, permission forms, electronic versus hard copies, etc.) as well as data formats and protocols are daunting and sufficiently complex to hinder the efforts of a number of service providers. The situation becomes even more difficult when attempting to associate available data with compatible commercially available low- and no-cost benchmarking and analysis tools. The LBNL team was able to provide technical assistance to support partners under this effort; however, the industry will benefit greatly from widespread adoption of mechanisms such as Green Button Connect. Reducing the effort required for building owners to authorize

third-party data access would be beneficial (for example, providing an online or e-mail authorization process that can be initiated by third-party contractors), as data access was a consistent source of delay in the pilot demonstration.

2. **Participant commitment.** Volunteer efforts to trial a new process/technology, with even a modest time commitment, can easily become a second priority to participants; even with motivated and interested participants who see value in the effort. The authors expect that this is due to the everyday reality of core business needs that quickly trump "extras," combined with natural human tendencies to delay non business-critical activities. In some cases, participants simply did not consider the extra effort worth their time and commitment. For example, of the contractors surveyed for this study, four strongly agreed that offering the EMP was worth the effort, while three were neutral. Calls, webinars, peer learning sessions, and technical assistance are relatively easy modes of engagement; however, actions that require contractors to be more proactive, such as acquiring data, making a site visit, or using new tools, can be more difficult. Finally, several participants mentioned that seasonal fluctuations in contractor workload was a factor in their ability to progress through each step in the EMP, suggesting that regional "high seasons" also be considered in demonstration timing and scheduling.
3. **Software Tools.** Most existing online tools for energy management that are applicable to small buildings fall into three categories: (1) tools designed to analyze monthly data, (2) benchmarking tools, and (3) tools designed to visualize interval data as used in EMP Element 2. Some tools do cover 1 and 2, or are implementing functionality to do so, and some interval data tools also provide visualization of monthly trends. None of the available tools surveyed could be used to complete 1, 2, and 3. There is no technical barrier that prevents a single tool from completing these three components. A single tool that could automate data collection, provide visualization

for analysis of monthly and interval energy usage, and provide benchmarking could significantly reduce the time required to provide energy management to small commercial buildings. In the words of one of the study's pilot contractors, "it would be really nice if there was one tool that could do all of this." Pilot experiences indicated that the time required for contractors to acquire and upload data could easily surpass the time required for the analysis itself, and that contractors are resistant to learn and use multiple tools for energy management.

Overall, the reception for the EMP has been mostly positive, with industry professionals acknowledging there is significant energy-saving potential from enabling contractors familiar with small commercial sites to track performance and verify savings. Utility program managers and training venues that work with energy auditors and mechanical contractors have expressed interest integrating the approach into programs and offerings. Some reviewers of this work in the energy efficiency community have highlighted the difficulties of working with trade allies in HVAC to provide energy services. Some claimed that the skills required would be beyond those of the contractors, that the work would be outside their interest area, or that having contractors pursue and verify savings would lead to a conflict of interest, since it could show that equipment is not performing as advertised. But another reviewer noted, "it will create differentiation for those contractors that over time will help influence others to raise their performance to this level." The target audience is currently contractors looking to deliver high-value service, summarized by one reviewer: "apart from the top 10%–20% of the contractors in a given region, most contractors are caught up with day-to-day challenges and issues in running their businesses and selling services." Reflecting these issues, the contracting firms most engaged in EMP demonstration efforts have been larger firms with a dedicated staff member for energy efficiency services. Alternatives to achieving energy efficiency in the small commercial sector, however, are very limited. Low-cost tools and analysis for energy management could be adopted by utility programs for use either by program-affiliated contractors or on customer-facing website portals to support this approach.

Conclusions

To target energy savings potential in small commercial buildings, the EMP was developed to identify low-cost savings opportunities through continuous energy management delivered by HVAC or mechanical contractors. Lowering transaction costs was identified as critical to the adoption of energy management in this sector. Recent advances in energy usage data access and formatting, combined with online tools to analyze these data, provide new opportunities to apply energy management in smaller buildings. Clients may need to justify energy efficiency expenses, and commoditized energy management tools allow contractors to deliver building-specific information at low cost. While initial demonstration project results indicate that existing free software tools can be used by HVAC contractors to deliver marketable energy management offerings, lowering the transaction costs associated with data access and analysis would make such offerings more attractive.

In addition to concluding contractor demonstrations, LBNL also conducted post demonstration training outreach in Seattle, Pittsburgh, Cleveland, the Bay Area and Central Valley (in California) to make participants aware of the EMP and encourage market pull for delivery of the EMP. Participants were from utilities, contractor affiliated industry organizations and contracting companies. While there were some challenges during the training, such as data access and getting some of the participants to familiarize themselves with the software tools, the participants found the EMP useful. The training materials and the entire package can be found at the LBNL Energy Information System (EIS) website (LBNL 2015).

Alternate channels could be explored for the deployment of the package, including opportunities to engage building owners through green business certification programs and city-level energy initiatives such as the 2030 District program. Additionally, software vendors have been receptive to how products might be tailored to better serve the small commercial markets. On the national level, standardization in data access protocols for both monthly and interval utility energy use data could significantly reduce barriers to adoption of this approach.

Acknowledgements

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