Finding Big Potential in Small Businesses: Behavior Change Opportunities and Targeting Approaches from a Statewide Study

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ABSTRACT

Growing interest in behavior-based approaches to energy efficiency has led to a proliferation of programs and efforts to modify behaviors that are aimed at residential energy users. However, people also use energy at work. More than half (54%) of US employees work for small businesses (US Census 2013), yet energy efficiency programs in the business sector often focus on larger commercial and industrial applications.

Small businesses, which may have limited capital for large investments, are good candidates for low-cost behavior change conservation, but there are a limited number of public studies that directly quantify the savings potential of behavior changes among commercial customers in general or small businesses specifically. Our study fills this knowledge gap by estimating the human and technical potential of behavior change among small and medium sized businesses. We integrate our potential estimates with segmentation to provide recommendations for program design and messaging.

To estimate potential, we surveyed 1,440 small businesses in the state of Minnesota. The survey collected data on end uses and equipment, business practices, building details, and control over energy use and decision-making. Drawing on this rich dataset we estimated the potential savings from HVAC, lighting, power management, refrigeration, and kitchen behavior changes. Our potential estimates account for considerations of characteristics such as whether the business pays its own utility bills. The results suggest where and how to target behavior change programs, both geographically and in which business segments, and the magnitude of the potential savings associated with those programs.

Introduction

There are limited public studies to date that directly attempt to quantify the savings potential of behavior changes among smaller sized commercial customers. Our review of research included evaluation and research reports on recently implemented behavior programs targeted at small businesses which tended to focus on walk-through audits (Research into Action 2014; PWP and Michaels Energy 2014) and feedback reports (Miknaitis et al. 2014; Mogilner 2014). Other studies looked at potential in larger commercial businesses (Opinion Dynamics 2013; Energy Center of Wisconsin 2014), specific measures such as controls (PNNL 2012), or particular industries (Market Strategies International 2012) with few studies examining specific behavior change actions in small and medium sized businesses (SMBs). For example, Ehrhardt-Martinez (2016) examined behavior change savings across four US cities and concluded that in three of the four cities examined, lighting related behaviors might result in the largest behavior-based savings. However, Ehrhardt-Martinez did not specifically examine SMBs, but looked at the entire commercial industry.

Funded by a Conservation Applied Research and Development (CARD) grant through the Minnesota Department of Commerce, our study measured the human and technical potential of behavior change across key end uses among SMBs. We defined SMBs as establishments with less than 100 employees to enable cross referencing our dataset with other publicly available data that include number of employees, but not energy usage or demand, such as the US Census County Business Patterns. The studies we reviewed used various definitions of SMBs including number of employees (Market Strategies International 2012; Opinion Dynamics 2013; Research

Into Action 2014), building size (PNNL 2012), and energy use (Miknaitis et al. 2014; PWP and Michael's Energy 2014). In addition, staff size has implications for implementing many behavior change strategies as group dynamics and organizational structure can support or hinder behavior change.

The study achieved three key outcomes that will inform planning and implementation of behavior-based programs for SMBs in Minnesota:

1) Created a statewide commercial customer segmentation to group small and medium business customers based on similar behavior-change opportunities;

2) Produced estimates of the achievable energy savings potential of behavior changes in the commercial sector by measure, segment, utility, and statewide; and

3) Presented segmentation and savings opportunities through a framework of behavior program models to provide practical suggestions for program design and implementation.

Survey Methodology

To identify promising business segments and energy saving actions, and to model their associated electricity, natural gas, and customer utility bill savings, we used a multitude of methods. Our methods included: secondary research and secondary data collection, survey data collection, and building modeling. Using a mixture of methods allowed us to generate savings potential and recommendations that are tailored to Minnesota and are also feasible by recommending program types and approaches based on the business savings potential and business characteristics present in Minnesota SMBs.

Survey Data Collection

The team collected data from 1,440 Minnesota SMBs via a telephone survey administered from June 2016 through early October 2016. Professional interviewers contacted each sampled business and used screening questions to locate someone within the business with knowledge of the company's energy use practices and equipment. The interviewers gathered data on the equipment, energy behaviors, and energy decision-making authority in those businesses.

Sampling Strategy

The team purchased a list Minnesota of SMBs from a third-party data vendor. Since the US Census County Business Patterns defines number of employees by location or establishment, we implemented the same definition and included business locations with less than 100 employees in the survey. We confirmed the number of employees with the survey respondents. While this includes some businesses that are chains, we also asked about who has control over equipment and settings to identify businesses in which decisions are made on location. To ensure a representative sample of SMBs, the team stratified the sample by number of employees, business segment, and location:

- **Number of employees**: Very small (1 to 9 employees); small (10 to 49 employees); medium (50 to 99 employees) for the establishment location, meaning that if a company is a franchise with multiple locations, the number of employees is based on each individual building location. These definitions align with publicly available data from the 2013 US Census County Business Patterns (2013 CBP).
- **Business segment**: Food service, grocery and convenience, retail, wholesale, education, office. The team identified six business types (plus an "other" category) that we aligned with both the Commercial Buildings Energy Consumption Survey (CBECS) data and NAICS codes. The team identified the top six CBECs building types based on aggregate gas/electric bills and mapped NAICs codes to these types.
- **Location**: Twin Cities versus greater Minnesota. The seven-county Twin Cities Metro Area contains about 60% of SMBs and SMB employees. Consequently, the team stratified the sample to reflect that split.

Survey Instrument

The survey instrument included screening questions and questions on businesses practices, building details, decision-making, and end-uses as described in Table 1.

Table 1. Survey Question Type

Data Class	Types of Data	Rationale for Inclusion
Screening criteria & firmographics	Respondent responsibilities and decision-making authority in the organization	To identify and screen for the individuals most likely to (a) be aware of, and (b) take action in response to their energy use.
	Business type self-report and NAICs codes	To align with NAICs codes and screen for eligible business types
	Size of the organization: Number of employees	To screen for eligible businesses (<100 employees) and to align with census data to map back to the GIS database, for segmentation.
	Sales volume	To align with census data to map back to the GIS database, for segmentation.
Building detail	Building type: Free-standing, multi-unit; exterior materials window coverage, insulation	To support engineering estimates and assumptions and to better classify businesses based on opportunities.
	Building ownership: Lease or own	To determine the types of actions businesses take to reduce their use.
Business practices	Hours of operation: Hours during the day in which the business is occupied	To determine how impactful various end use behavior or setting modifications may be on the business.
	Decision-making practices: Determine who makes decisions about equipment purchases, maintenance, and operations	To identify whether decisions are made by the business owner, property manager, landlord, or corporate office.
End use detail	End uses and settings: Identify the presence of end uses in the business, including: heating, cooling, lighting, plug load, and specialty equipment by sector	To identify the specific end uses in place within the data to inform segmentation and the engineering estimates of the savings potential of end use behaviors.
	End use practices: Determine any regular practices undertaken within the business, such as regular shutting down of equipment, temperature setbacks, etc.	To inform the engineering estimates of the savings potential of end use behaviors.
	Control over key end use practices: The extent to which the respondent has control over the management of end uses, such as HVAC, lighting, plug load, settings	To determine whether there are barriers to behavior modifications within the business due to competing priorities and users.

Measure Selection Methodology

The study focused on energy saving actions that can be accomplished through behavior changes or by installing controls to automate those behaviors as described in our working definitions of commercial behavioral measures: “Any elective action, policy or default that manages the use of equipment (or space) in a business. This could include (1) employee behaviors, (2) building operator behaviors and maintenance practices, or (3) management or control of equipment or space that is facilitated by technology, such as occupancy sensors, EMS/BAS, timers (which could also include a measure-based solution to managing equipment).” We selected 10 measures for our models through a three-phase process:

1. **Measure identification.** We assembled a broad list of 26 behavioral measures based on literature reviews, market experience, and stakeholder input. We focused on measures that were applicable to our six business segments, had evidence of savings potential, and were appropriate for the MN climate.

2. **Measure prioritization for survey fielding.** We prioritized each measure as high, medium or low priority based on the applicability of the measure across segments (e.g., is it broad-reaching or niche?) and rough estimates of relative per-unit savings based on professional judgment and our literature review. In addition, we considered the potential to design a program or initiative around the behavioral measure, either through existing or new programs.

3. **Measure opportunity.** Using survey responses and rough-cut estimates of savings for each measure, we narrowed the list to 10 measures with the highest saving potential. To estimate savings potential, we first developed a series of rules using survey and secondary data for each measure to flag the businesses that have an opportunity to reduce energy use by changing behavior related to the measure. The ten measures with the most opportunity that became the focus of the study include measures in HVAC, lighting, power management, refrigeration, and kitchens as described in Table 2.

Table 2. Measures selected

End use	Measure	Measure description	Business has opportunity to implement if
HVAC	Thermostat setbacks	Set back heating and/or cooling set-points during periods of no occupancy.	Business is not open 24/7 and has a thermostat that can be controlled by owner/employee and there is less than a 3 degree difference in temperature settings between occupied and unoccupied hours.
	HVAC regular maintenance	Regular maintenance of HVAC equipment (e.g., service contract).	Business has heating or cooling equipment and does not already do regular maintenance and someone other than a corporate office is responsible for maintenance.
Lighting	Lighting optimized to occupancy	Turn off lights (or lights turn off automatically) during periods of no occupancy.	Business is not open 24/7 and percent of lights left on exceeds amount typically needed for safety/egress (based on ASHRAE) and lights are not controlled by occupancy sensors.
	Lighting optimized to daylight	Dim or turn off lights (or lights turn off or dim automatically) during periods of sufficient natural light.	Business is not only open during evening/night hours and lights are not controlled by daylight sensors and respondent thinks there is an opportunity to turn off lights during the day.
Power Management	Computer power management	Turn off computers/monitors or set them to low power mode or implement power-management software.	Business is not open 24/7 and has at least one computer in regular use and computer settings are not implemented to put computers to sleep at the end of the day.
	Equipment power management	Turn off printers, multifunction devices, or other plug loads or set them to low power mode.	Business is not open 24/7 and has at least one printer/multi-function imaging device and a business owner or employee/subcontractor is responsible for maintaining computer equipment and computer settings.

End use	Measure	Measure description	Business has opportunity to implement if
Refrigeration in Food Sales	Refrigerated display case air leakage*	Reduce air leakage (apply night curtains)	Business has open refrigerated display cases or open freezer cases and the business does not pull down a curtain on a nightly basis.
	Refrigeration maintenance**	Regular refrigeration maintenance	Business has open refrigerated pr freezer display cases, refrigerated or freezer display cases with doors, walk-in coolers or walk-in freezers and does not already conduct regularly scheduled maintenance and either the business owner, facility manager, employee, or external contractor is responsible for maintenance on refrigeration equipment.
	Refrigeration lighting**	Turn off lights in refrigeration overnight.	Business is not open 24/7 and business has open refrigerated pr freezer display cases, refrigerated or freezer display cases with doors, walk-in coolers or walk-in freezers
Kitchen	Kitchen exhaust fan**	Turn off exhaust during periods of no cooking	The business has kitchen exhaust hoods that have manual hoods that are always on or are switched off only when business is closed.

*Savings evaluated only for the Grocery/Convenience segment.

**Savings evaluated only for the Food Service, Grocery/Convenience, Food Sales, and Education (schools with commercial kitchens) segments.

Potential Savings Estimates Methodology

Building Modeling for Technical Potential

Technical Potential. We used building energy modeling to quantify the electricity and natural gas savings from the 10-identified energy saving actions across six business segments. To accomplish this, we first developed building models representing the characteristics of the SMBs in the study, using DOE2.2 as the modeling engine.

The building energy models were informed by the project survey, CBECS microdata and other secondary literature sources. We developed baseline models to represent the existing small commercial building stock in Minnesota, with separate models for each of the six business segments, and variants of these models for different tenant types, sizes and HVAC systems within each segment (144 models in total).

Next, we defined measure inputs using survey responses and secondary literature sources, including the Minnesota Technical Reference Manual (TRM) where applicable. Savings for each measure were based on comparing predicted energy consumption for the baseline condition and the implemented-measure condition. We performed quality control on measure savings estimates to ensure reasonable predictions. The result was a series of more than 11,000 sets of modeling results representing the existing energy consumption of small commercial buildings in Minnesota that can predict savings specific to Minnesota for each energy saving action.

The final step in estimating the total technical potential for the measures across the state—and for estimating potential by county and utility service territory—was to extrapolate the survey-based estimates of building characteristics and measure opportunity to the state population of businesses, and to apply the modeled energy savings to this population. We accomplished this using a purchased database of all Minnesota businesses and applying statistical techniques to extrapolate the survey data to the population. We used geographic information systems (GIS) tools to allocate potential to counties and utility service territories.

Achievable potential. To derive estimates of more realistically achievable potential for the 10 measures, we applied a series of factors that address the willingness and compliance aspects of implementing measures. We developed factors based on research on participation in SMB programs (Nadel, Pye, and Jordan 1994; Martinez 2016), compliance with repeated behaviors like turning off lights (Rea, Dillon, and Levy 1987; Sussman and Gifford 2012), hand-washing in food service (Allwood et al. 2004), and professional judgment. Accordingly, we acknowledge that these factors are estimates and should be verified by additional research before full implementation. Drawing on the limited data available in the studies cited, we tried to be conservative in our estimates of achievability.

We first defined each measure in terms of repetitiveness and whether controls are available to assist in implementing a measure. An example of a measure that could be applied daily—either manually or with controls—is thermostat setback. In contrast, refrigeration maintenance is an example of a behavioral measure that occurs infrequently and has no associated control mechanism. For measures where automatic controls are a possibility, we assigned a factor for each measure that reflects an estimated percent of businesses that will implement these controls. This factor is different depending on whether the building is leased or owned, because businesses will have varying levels of motivation to invest in controls due to the split incentive issue. Of businesses that would be willing to implement a measure at all, we generally assumed that 25% and 10% of owned- and leased-spaced businesses, respectively, would implement automatic controls. Thermostat setback stands as a special case in this regard, since many businesses already have the relevant automatic control (a programmable thermostat), but simply do not use the automated feature. We further assume a manual-compliance factor for repetitive measures for businesses that choose to implement the measure manually. This reflects the fraction of time where a manual control is applied, as even the most well-intentioned person may forget to take an action regularly.

Finally, we applied an overall willingness-to-implement factor, which reflects the idea that even if there were a program incentivizing measure implementation, not all businesses would be willing to do so. They may have competing priorities for their attention and time, or they may not see the value of implementing the measure. We applied a 30% willingness factor to all measures. Please refer to Table 3 to review the associated achievability factors for each measure.

Uncertainty Estimation

Below we detail the several sources of uncertainty around the estimates of potential achievable savings. As this is one of few studies to look at the potential achievable (what are businesses likely to do) savings from behavior changes in SMBs, we document the sources of uncertainty carefully. While there is considerable uncertainty in the overall magnitude of achievable behavioral savings, the study's findings regarding which business types and measures are the most important ones are robust.

The many sources of uncertainty in potential studies have been well documented and studies typically identify uncertainty around human behavior as the largest source of uncertainty (Kema 2012). Likewise, in this study, the largest source of uncertainty for achievable potential arises in the factors used to translate theoretical technical potential into more realistically achievable savings.

Sampling uncertainty. The survey sample uncertainty is a result of slightly different results due to random variations between samples; this uncertainty is higher for subgroups where the number of survey respondents is lower. For example, among retail establishments, the margin of error for the proportion of businesses with an opportunity for thermostat setback is ±12 percentage points. This uncertainty also affects the statistical models used to extrapolate the survey results to the larger population of Minnesota businesses.

Aggregate potential savings uncertainty. In terms of aggregate potential savings, we calculate that sampling and extrapolation uncertainty amount to about ±14 percent uncertainty around our point estimates of statewide achievable potential, across all segments and all factors.

Table 3. Achievability factors

Tenure	Measure	Repetitive activity?	Controls possible?	% Who implement controls (a)	Manual factor (b)	Overall compliance factor (c) a+b*(1-a)	Willingness factor (d)	Overall achievability factor c*d
Own	Thermostat setback, have existing programmable	yes	NA	100%	0.50	1.000	30%	0.300
	Thermostat setback, don't have existing programmable	yes	yes	25%	0.35	0.513	30%	0.154
	HVAC regular maintenance	no	NA	0%	1.00	1.000	30%	0.300
	Lighting optimized to occupancy	yes	yes	25%	0.35	0.513	30%	0.154
	Lighting optimized to daylight	yes	yes	25%	0.35	0.513	30%	0.154
	Computer power management	yes	yes	25%	0.35	0.513	30%	0.154
	General equipment power management	yes	no	0%	0.35	0.350	30%	0.105
	Refrigerated-display-case air leakage	yes	no	0%	0.35	0.350	30%	0.105
	Refrigeration lighting management	yes	no?	0%	0.35	0.350	30%	0.105
	Refrigeration maintenance	no	NA	0%	1.00	1.000	30%	0.300
	Kitchen exhaust management	yes	yes	25%	0.35	0.513	30%	0.154
Lease	Thermostat setback, have existing programmable	yes	NA	100%	0.50	1.000	30%	0.300
	Thermostat setback, don't have existing programmable	yes	yes	10%	0.35	0.415	30%	0.125
	HVAC regular maintenance	no	NA	0%	1.00	1.000	30%	0.300
	Lighting optimized to occupancy	yes	yes	5%	0.35	0.383	30%	0.115
	Lighting optimized to daylight	yes	yes	5%	0.35	0.383	30%	0.115
	Computer power management	yes	yes	25%	0.35	0.513	30%	0.154
	General equipment power management	yes	no	0%	0.35	0.350	30%	0.105
	Refrigerated-display-case air leakage	yes	no	0%	0.35	0.350	30%	0.105
	Refrigeration lighting management	yes	no?	0%	0.35	0.350	30%	0.105
	Refrigeration maintenance	no	NA	0%	1.00	1.000	30%	0.300
	Kitchen exhaust management	yes	yes	5%	0.35	0.383	30%	0.115

Energy modeling uncertainty. An additional source of uncertainty is the energy modeling used to estimate the magnitude of the savings from the various measures, which we conservatively estimated at ±25 percent[1]. Our uncertainty estimates are therefore reasonable for energy savings estimates for those published models.

Overall combined uncertainty. The many sources of uncertainty in potential studies have been well documented and studies typically identify uncertainty around human behavior as the largest source of uncertainty (for example, see Itron et al 2008; Kema 2012). Likewise, in this study, the largest source of uncertainty for achievable potential arises in the factors used to translate theoretical technical potential into more realistically achievable savings. We estimated uncertainty bounds for the various achievability factors described above, and factored these into the analysis. When combined with the sampling and modeling uncertainty above, the uncertainty in aggregate achievable potential is increased to ±70 percent. We estimated this overall uncertainty by re-estimating the models through 500 iterations with varying adjustment and achievability factors selected.[2] While this indicates that there is considerable uncertainty in the overall magnitude of achievable behavioral savings, the study's findings regarding which business types and measures are the most important ones are robust.

For ease of reading, we report the point estimates of achievable savings only, but the reader should note that each estimate has wide band of uncertainty.

Results

Statewide Savings Opportunities

The 10 behavior-based energy savings actions, shown in Table 2, have the technical potential to save 1.4 billion kWh and 41.2 million therms statewide, representing 1.5% and 1% of electric and gas retail sales in Minnesota, respectively.

We estimate total achievable savings of between 73 to 418 million kWh and between 2.4 and 13.3 million therms. We calculated a total benefit of $8.4 and $48.62 million in customer bill savings for SMBs statewide. Counties that are densely populated have the greatest savings potential due to the sheer concentration of businesses, but the distribution of opportunities by measure and business type is similar across utility service territories and counties.

Measure and Segment-Specific Savings Opportunities

We summarize the measure and segment-specific savings opportunities in Table 4. The sections below elaborate on these findings. We provide detailed descriptions of findings by measure and segment in our forthcoming report (Dougherty et al 2017).

Findings by Energy-Saving Measure

Thermostat setbacks. Of the actions included in this study, thermostat setbacks comprise the largest share of savings: 32% of electricity savings; 61% of natural gas savings; and 41% of total utility bill savings. Thermostat

[1] This is a conservative estimate because ASHRAE Guideline 14-2014 (https://www.ashrae.org/standards-research--technology/standards--guidelines/titles-purposes-and-scopes#Gdl14) has two threshold criteria for an energy model to be considered calibrated to actual measured building performance: 15% CV(RSME) for monthly data and 30% for hourly data. Additionally, Abdullah et al (2014) claims 10-30% from a review of several sources.

[2] We used bootstrapping to estimate overall uncertainty. We looped through 500 iterations. For each iteration, we a) bootstrap re-sampled the survey data, re-ran the logit models, and re-extrapolated to the population (sampling and extrapolation uncertainty. b) Chose a random adjustment to adjust modeled energy savings (energy modeling uncertainty). c) Chose random values for the achievability factors within range that varied from +/- 5 percentage points to +/-30 percentage points. Finally, we calculated the empirical 95% confidence interval from the 500 sets of estimates.

setbacks comprise a large share of achievable opportunity in each segment. Many businesses have a programmable thermostat, but have not adjusted the settings to save energy. Furthermore, 46% of the estimated achievable electricity savings occur in buildings with natural gas heat that have an opportunity for heating setbacks, while 80% of achievable natural gas savings occur in buildings that also have a cooling setback opportunity, offering opportunities for joint electricity/natural gas programs through thermostat initiatives.

Kitchen exhaust. Kitchen exhaust has the second highest achievable potential accounting for 14% of overall electric savings and 34% of overall gas savings. Nearly all (97% of both electric and gas) of the kitchen exhaust potential occurs in the food service segment with much smaller opportunities in grocery and education segments. Most (86%) businesses with an exhaust fan operate the fan manually, turning the fan on in the morning and turning it off at the close of business. However, during a typical day, there are often periods of time where no cooking occurs, and significant savings can be realized by turning the fans down or off either through manual adjustments or by installing automatic controls.

Refrigeration. Savings from refrigeration measures occur in the food service, grocery, and education segments. The measures, which include applying night curtains, lighting, and maintenance, account for 81% of potential electricity savings in the grocery segment and 25% of electricity savings in food service.

Power management and lighting. While power management and lighting are a smaller portion of overall savings (16% in total), they account for most of the savings (after thermostat setbacks) in the education and office segments.

Findings by Business Segment

Based on reviewing business characteristics and associated savings potentials for measures by segments, we recommended measures, program types and program approaches for each business segment to implement. For recommended behavioral measures, our recommendations are based on implementing measures with the highest potential savings by segment. For recommending program types, our recommendations are based on recommending programs that align with the business characteristics. We considered the following types of programs for each segment (Dougherty et al 2015):

1. **Asynchronous Feedback Programs** provide feedback to customers after energy consumption has occurred, often in the form of a report that shows historical energy usage and usage compared to other customers.
2. **Diagnostics Programs** include audit or energy assessment programs delivered in-person, online, or with coaching.
3. **Community-Based Programs** use in-person outreach and trusted community members to prompt energy-saving actions.
4. **Energy Champions** are one element of Continuous Energy Improvement Programs.
5. **Competitions** include programs where individuals or organizations compete in events, contests, or challenges and may include games.

We also recommend specific program approaches for each segment. This includes unique considerations such as establishing startup/shutdown schedules and using checklists.

Similar themes across all business segments include 1) thermostat setbacks appear across all segments with high potential savings; 2) in the segments other than office and education, most business owners have control over equipment purchase and maintenance; and 3) except for the education segment, most SMBs have less than 50 employees. Table 4, below, compares the segments by business characteristics and potential savings while program types and approaches are briefly highlighted in the following narrative. A more comprehensive description of recommended program types and approaches can be found in the full report.

Food service. The food service segment accounts for 32% of total electricity achievable savings, driven largely by opportunities to reduce kitchen exhaust fan usage along with opportunities for refrigeration maintenance and

thermostat setbacks. This segment is a good candidate for implementing start-up/shut down schedules to prompt energy saving actions, competitions between franchise members, and community-based approaches.

Grocery/convenience. The grocery segment accounts for 21% of total electricity achievable savings with 81% of the segment's savings coming from refrigeration measures. The segment is a good candidate for implementing checklists, schedules, and competitions to prompt energy saving actions.

Retail. Savings opportunities in retail come largely from thermostat setbacks, HVAC maintenance, and lighting optimization. The best program approaches for this segment include: 1) diagnostic programs that pair on-site audits or direct-install programs with education about behavior-based energy saving actions; 2) using schedules or checklists as prompts; 3) competitions between members of a franchise; and 4) community-based approaches in malls or retail/business districts.

Wholesale/warehouse. Savings opportunities for the wholesale segment come predominantly from thermostat setbacks and lighting optimization, though there are also savings through HVAC maintenance and power management. The best program approaches include diagnostic programs that use on-site auditors to encourage additional actions and feedback reports.

Education. The education segment has opportunities to save energy through thermostat setbacks, lighting, and computer power management as well as small savings through HVAC and refrigeration maintenance, and kitchen exhaust fans. Competitions between classrooms and pairing in-school efforts with K12 energy education kit programs are good strategies for encouraging energy saving actions in this segment.

Office. The office segment has the greatest number of businesses. The main sources of savings are thermostat setbacks, daylighting, and computer power management. Medium-sized businesses are good candidates for competitions while small and very small businesses may benefit from feedback reports with specific energy-saving tips.

Conclusion

This study considers the potential impact of implementing SMB behavioral based programs by estimating the achievable potential of behavior change among small businesses in Minnesota across key measures and six business segments. We found strong potential for thermostat setbacks which are applicable to all business segments. Among the six business segments examined, food service has the highest potential savings due to opportunities to save through thermostat setbacks and improved use of kitchen exhaust fans. The office segment has the second highest savings potential. Feedback and competitions in the office segment should orient around thermostat setbacks, computer power management and daylighting to have the greatest impact.

Small business owners may view any change as potentially disruptive and the actual savings potential of behavior change approaches for small businesses has been largely unknown. While this study provides a crucial first step to understand which behavioral measures and which business segments are the most impactful in terms of energy savings, other factors, such as savings relative to revenue should be considered when designing programs. An important consideration for implementers is to understand the economic impacts and constraints on SMBs to implement energy efficiency programs. A driving factor for businesses agreeing to implement energy efficiency programs is the return on investment and the capacity of the business to allocate resources to energy conservation without straining their resources. The recommendations in the report highlight approaches to integrate energy-saving behaviors into business practices, existing programs, or into activities that also foster teamwork or boost morale. The findings from this study can help implementers finesse their program messaging to align with the business characteristics, in addition to implementing programs that target measures and segments with high savings potential.

Table 4. Segment descriptions

Characteristics	Food service	Grocery and convenience	Office	Retail	Wholesale	Education
Savings potential Utility bills Kwh Therms	$10.8 million 80.4 million kWh 3.8 million therms	$4.8 million 51.8 million kWh 0.4 million therms	$6.9 million 60.7 million kWh 2.1 million therms	$1.8 million 14.7 million kWh 0.5 million therms	$1.6 million 13.1 million kWh 0.5 million therms	$2.5 million 25.1 million kWh 0.5 million therms
Measures with most opportunity	• Thermostat • Refrigerator maintenance • Kitchen exhaust	• Refrigerator maintenance • Refrigerator lighting • Thermostat	• Thermostat • Computer power management • Day lighting	• Thermostat • HVAC maintenance • Day lighting	• Thermostat • Occupancy lighting • Day lighting	• Thermostat • Occupancy lighting • Computer power management
Suggested behavioral program approaches	• Prompts • Community-based • Competitions	• Prompts • Community-based • Competitions	• Feedback • Competitions	• Diagnostic • Prompts • Community-based • Competitions	• Diagnostic • Feedback	• Competitions • Add-on to K12 programs
Equipment purchase and maintenance tends to be handled by:	Business owner or employee	Business owner or employee	Property manager (HVAC/Lighting) Business owner (computers)	Business owner or employee	Business owner or employee	Facility manager or employee
Buildings tend to be:	Leased or owned; free standing, mall, or multi-tenant	Owned; free standing	Leased; free standing or multi-tenant	Leased; free standing, mall, or multi-tenant	Leased and owned; free standing	Leased and owned; freestanding
Businesses usually responsible for utility bills	Yes	Yes	Yes, but 27% do not pay a bill	Yes	Yes	Yes, 21% do not pay a bill
Franchises common	Yes	Yes	No	Yes	No	No
Businesses tend to be:	Very small (1-9 employees) and small (10-49 employees)	Very small (1-9 employees)	Very small (1-9 employees)	Very small (1-9 employees) and small (10-49 employees)	Very small (1-9 employees) and small (10-49 employees)	Small (10-49 employees) and Medium (50-99 employees)

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