The Energy Efficiency Extra Value Menu: Streamlining Energy Efficiency Delivery

Matthew Socks, Phil Mosenthal, Optimal Energy, Inc.
Donna DeCostanzo, Ashok Gupta, Natural Resources Defense Council

ABSTRACT

Efforts to promote energy efficiency have made enormous strides, but significant opportunity remains to build upon these successes to bring efficiency to scale. Program complexity and a lack of reliable information on efficiency products and services continue to stifle demand. These barriers have resulted in low project volume, further increasing transaction costs and compounding the difficulty of achieving additional efficiency.

This paper discusses the concept and potential implementation of "bundling" efficiency opportunities as a means of surmounting these barriers. In short, bundling represents a simplified approach to achieve comprehensive energy savings in existing homes and buildings by combining efficiency measures and services into discrete, tiered packages with predictable costs and savings. These packages can then be implemented through a streamlined approach, providing a "one-stop shop" for building owners. Drawing upon lessons learned from programs sharing similarities with the approach, efficiency bundling could drive increased participation by providing a single point of contact for building owners, a simple process that eliminates the need to interface with multiple programs, and a comprehensive set of actionable opportunities appropriate for a participant's building. The approach could significantly reduce logistical oversight requirements and the time needed to develop solutions, hire contractors, and implement the projects. By developing uniform packages with proven savings potential, bundling could be promoted through an extensive marketing effort to build recognition and value in the marketplace in conjunction with market-based approaches. It could ultimately expand the market for efficiency services, benefitting program providers, utility programs, contractors, and participants alike.

Introduction

From the emergence of the concept in the 1970s through today, efforts to promote energy efficiency have made enormous strides. An initial focus on resource acquisition has matured into a broader emphasis on market transformation and market-based solutions, enabling increasingly higher levels of savings achievement. A recent study from the American Council for an Energy-Efficient Economy (ACEEE) found that, from 1980 to 2014, efficiency improvements resulted in a 30% drop in overall energy intensity (Nadel, Elliott, and Langer 2015).[1] The most successful energy efficiency programs in the nation have cost-effectively reduced forecasted annual electric and gas energy consumption by 2.8% and 1.4%, respectively (Mass Save 2015).

While these successes are encouraging, the bulk of existing energy efficiency potential remains untapped. Recent state- and utility-level estimates of long-term cost-effective energy efficiency potential range from 10 to 43% for electricity and 16 to 44% for natural gas (Neubauer 2014), but high transaction costs, program complexity, and a lack of reliable information on

[1] Energy intensity as used here is defined as energy use per real dollar of gross domestic product (GDP).

efficient products and services continue to stifle demand. These barriers have resulted in low project volume, further increasing transaction costs and compounding the difficulty of achieving additional efficiency. Even where the financial benefits of efficiency investments are clear, implementing efficiency remains a challenge for consumers and available programs are not always fully utilized. For example, the U.S. Environmental Protection Agency's (EPA) Home Performance with ENERGY STAR® Program promotes whole-house solutions by conducting comprehensive home energy assessments and implementing the recommendations. Since the program's inception in 2002 through the end of 2014, more than 430,000 projects have been completed (EPA 2016). While significant, this represents a cumulative participation rate of less than 0.4% of eligible homes nationwide. Further, in spite of the goal to offer "whole house" solutions, many of these projects do not delve deeper than weatherization and relatively simple instant savings measures such as lamp replacements and faucet aerators (Cadmus 2015).

Significant opportunities remain to build upon lessons learned to address the remaining market barriers, scale up efficiency efforts, and achieve climate and energy policy goals. This paper discusses the concept, history, and potential implementation of "bundling" of efficiency measures and services as a means to achieve these goals. In short, bundling represents a simplified and standardized approach to achieve comprehensive energy savings in existing homes and large buildings by combining efficiency measures and services into standard packages with predictable costs and savings. These packages, or bundles, can then be implemented through a streamlined, turnkey approach designed to limit the burden on building owners. With the goals of increasing participation and making efficiency both easier to pursue and cheaper to implement, bundling could:

- Standardize efficiency measures and services and the methods of marketing, education and delivery
- Reduce transaction costs through scale and standardization
- Simplify program processes and participant decision-making
- Create market demand through branding

Bundling would provide potential participants with a straightforward set of opportunities that are appropriate for their home or building and reduce or eliminate the need for onerous audits. The approach could significantly reduce logistical oversight requirements, as well as the time needed to research and develop solutions, hire contractors, and implement the projects which would all serve to reduce transaction costs. Because of the concept's inherent standardization, bundling could be promoted through a broad marketing and branding effort to build recognition and value in the marketplace. It could ultimately expand the market for efficiency services, benefitting program providers, utility programs, contractors, and participants alike.

The Concept of Bundling Energy Efficiency Services and Measures

The core of the bundling concept is simple: promote multiple efficiency measures and services with predictable costs and savings as discrete bundles. These bundles, organized into tiers of increasing depth of savings and costs, represent a simplified choice for potential participants. The participant would be presented with a clear "menu" of bundles applicable to his or her particular building type and needs. This menu would include preliminary estimates of the costs associated with a specific bundle as well as the anticipated savings.

Combining multiple measures within a single project is not, in and of itself, a new concept. For years, many custom programs have attempted to develop comprehensive projects by combining short payback measures with medium-to-long payback measures to achieve long-term, deep energy savings while still promoting financially attractive options for participants. Some programs have even promoted à la carte measure packages by offering increased incentives or financing at reduced interest rates for projects that incorporate measures addressing more than one end-use. Further, "direct install" programs have found significant success in residential and small business markets through the turn-key implementation of multiple, pre-approved, low-cost, easy to install measures.

Despite the intent to develop more comprehensive projects, existing programs have had varying levels of success. Many projects in large buildings do not get deeper than the most attractive lighting retrofits, and even residential programs envisioned as whole house approaches often do not get further than initial weatherization measures. The bundling concept outlined in this paper aims to address this challenge by standardizing the measures, making participation as user-friendly as possible, and providing a single point of contact for the building owner to target more than just the highest-impact or lowest-cost opportunities. The measure bundles, designed to offer appealing initial savings, will enable a simplicity of process that encourage building owners to pursue deeper savings through subsequent tiers of bundles.[2] Promoting efficiency improvements through bundles could streamline project implementation, simplify participant decision-making, and reduce transaction costs through economies of scale.

Streamlined Processes. The bundling concept has the benefit of front-loading project analysis such that some of the initial investigation is already complete before the program provider sets foot on site. By analyzing the costs and benefits of efficiency opportunities for a representative set of prototypical buildings exhibiting a wide range of building characteristics, as well as leveraging data from audits and completed projects, standard measure bundles could be developed that are likely to be cost-effective and offer attractive rates of return. In fact, as discussed below, several jurisdictions have already developed measure bundles to serve a wide range of building types. Instead of requiring an onerous whole building energy audit before any upgrades are performed, a relatively simple screening process could be used to select the appropriate first tier bundle for a specific home or building. This means that the specifics of the project and gaining participant buy-in can be completed more quickly, as most of what the participant would need to know for decision-making purposes would already be available during the initial site visit. While more complex second tier opportunities would likely require additional site-specific analysis, ready-made analysis tools could be developed to quickly and easily evaluate savings once on-site investigation is performed in parallel with the installation of the first tier bundle.

Most are familiar with the old aphorism "better is the enemy of good," but it's easy to lose sight of this when attempting to optimize solutions for a given project. If a standard bundle of measures can achieve good results on average, the benefits to be gained through broader adoption and economies of scale will likely outweigh those of pursuing a largely customized project for each participant.

[2] In this document we use the generic term "program provider" to represent the party responsible for overall program oversight. This program provider could be the electric or gas utility, a private firm, or even a government entity.

Simplified Participant Decision-Making. Traditional approaches to pursuing comprehensive efficiency typically begin with a whole building energy audit or assessment to identify opportunities. These options are then presented to the customer for consideration. For some participants, the task of selecting options may prove daunting. Many studies have suggested that too many options may lead to "choice overload," negative effects including decreased motivation to choose or make any choice at all (Schreibehenne, Greifeneder, and Todd 2010).[3] Perhaps more importantly, it is likely that participants do not possess the necessary expertise to make an informed decision and the array of available options only exacerbates this decision paralysis. Significantly reducing the number of choices a participant must make actually becomes a consumer benefit and could lead to higher program participation. In addition, it allows for streamlining transactions and delivery of services to achieve economies of scale.

Reduced Transaction Costs. The barriers to energy efficiency are well understood. While priorities vary by market, in general, high initial project costs are often cited as the primary barrier to participation. The bundling concept can effectively reduce transaction costs through standardization and economies of scale. Through the use of standard bundles, participants could in many cases avoid the cost of an expensive energy audit. Further, programs could explore bulk purchase pricing with distributors, and programs could even partner directly with equipment manufacturers to procure high efficiency equipment for the program without the additional features that commonly increase equipment costs without a corresponding improvement in energy performance (i.e., the so-called "bells and whistles" issue identified in many equipment incremental cost studies). As project volume increases, there may be additional opportunities to treat clusters of buildings simultaneously leading to better utilization of equipment, staff, and dispatching.

History of Past, Current, and Future Bundling Initiatives

Several previous and current efforts sharing similarities with the approach discussed in this paper are acknowledged here. In recent years, several studies have been conducted investigating the feasibility of developing standard measure bundles. In 2011, the National Renewable Energy Laboratory published a study detailing measure packages designed to achieve 15% and 30% savings in existing homes (Casey and Booten 2011). Citing a need for additional understanding of how packages of measures, as opposed to single measure installations, affect home energy use, the study used BEopt (Building Energy Optimization) software to assess the impact of measure packages in 37 locations across the United States. The identified packages were intended as "simple starting points" that stakeholders could use to educate themselves about how to cost-effectively reduce energy use in existing homes. In another study, Yee, Milby, and Baker (2014) compared completed project data from the Illinois Home Performance with ENERGY STAR (IHP) program to cost-optimized measure packages developed with BEopt modeling software for 12 single-family housing archetypes in the Chicago metropolitan area. While primarily intended to identify any significant divergence between the cost-optimized measure packages and the measures actually installed through the IHP program, the study also

[3] However, it should be noted that the authors of this meta-analysis found that "adverse effects due to an increase in the number of choice options are not very robust…" but acknowledged the possibility "that choice overload does reliably occur depending on particular moderator variables…" (Schreibehenne, Greifeneder, and Todd 2010, 421).

concluded that "…home categorization may help reduce some of the time and energy that goes into home energy audits… Establishment of minimum recommended measures for each housing type will allow home performance contractors to quickly recommend optimal measures" (Yee, Milby, and Baker 2014, 20). Finally, recent work by the National Renewable Energy Laboratory aims to reduce transaction costs associated with the implementation of energy efficiency in small buildings by developing a simple spreadsheet tool to identify packages of measures likely to be cost-effective given certain building characteristics (Langner, Hendron, and Bonnema 2014). The tool is the result of detailed building energy simulation focusing on 11 efficiency measures and 81 baseline small office building prototypes.

While the development of feasible standardized measure packages alone is encouraging, several efforts had moved beyond the theoretical into actual implementation. In 2012, the Pratt Center for Community Development launched their Retrofit Standardization Study to investigate a simplified, scalable approach to pursuing energy efficiency projects in small residential buildings in New York City (Pratt Center 2015). This study focused on using audit findings from 22 similar small residential buildings to identify a common set of measures that could be implemented across a broader population of buildings without the need to perform detailed, site-specific audits. Eight of these homes were selected to participate in a second phase of research where one of four measure packages was installed. Building upon the results of this study, the Pratt Center launched the EnergyFit NYC Pilot in January 2016. Initially focused on one- and two-family, attached, gas-heated, masonry homes, the pilot will install a limited package of air-sealing, insulation, and health and safety measures in eligible homes with the long term goal of expanding these services citywide across a broader range of residential building types. Similarly, Farley and Ruch (2013) identified three common multifamily building types in Chicago and conducted an audit on a representative building of each type. For each building type, energy modeling software was used to identify retrofit packages that balanced cost-effectiveness with depth of savings. Finally, the identified measures were installed. The study investigated the feasibility of designing prescriptive retrofit measure packages achieving 25% source energy savings, and concluded that "[w]hile the prescriptive approach should always involve some level of common-sense tailoring to specific buildings… it is a time- and cost-saving approach to retrofitting buildings that could be applicable to many climates" (Farley and Ruch 2013, 17).

Finally, two additional measure bundling efforts are currently in development. The Rocky Mountain Institute recently announced their Commercial Energy+ Initiative (CE+). Citing a need for a more "industrialized" approach to pursuing energy efficiency in existing commercial buildings, CE+ would "…provide a package of configurable, ready-to-deploy efficiency measures and technologies that can be procured and deployed at scale to make buildings immediately smarter, more energy efficient, and more interactive with the electricity grid" (Guevara-Stone 2016). With an initial focus on Chicago, RMI is targeting deployment of the CE+ approach in 50 commercial buildings by 2017. Meanwhile, the New York State Energy Research and Development Authority is planning to investigate "energy efficiency packages" as described in the recent Clean Energy Fund Information Supplement (NYSERDA 2015). NYSERDA plans to develop optimized sets of measure packages catering to specific building types–including residential, commercial, and industrial buildings–and vintages. While still in the early planning stages, NYSERDA intends to develop and conduct a set of pilot studies to determine whether this approach can actually deliver high performance efficiency solutions at a lower aggregate cost than competing approaches.

These efforts both exemplify the interest in finding streamlined solutions to efficiency implementations and provide encouragement that the practical issues associated with the bundling concept discussed in this paper can be addressed.

Example Measure Bundles

It is important to note that there is no "one-size-fits-all" approach to measure bundles. While single family residences exhibit some degree of homogeneity, there will be significantly more variation in systems, operating parameters, and the associated opportunities in large buildings. Further, local building practices and different climate zones will likely require different solutions, so a regional approach to bundle development is appropriate. To some extent, availability of efficient equipment and local energy codes may also affect the composition of measure bundles. In spite of these issues, it is likely that foundational measure bundles can be established that require only minor modifications to be suitable for implementation in a particular region.

The balance of bundled measures and services would differ somewhat between single family homes and large buildings. In general, bundles for single family homes would prioritize efficiency measures and place less emphasis on efficiency services. Since most homes typically share similar characteristics, a first tier bundle might include the following relatively low-cost efficiency measures:

Single Family Home | Tier 1 Example

- Sealing the home for air leaks in tandem with a blower-door test
- Sealing and insulating duct work in unconditioned spaces
- Installing (additional) attic insulation
- Replacing all screw-in lamps with LEDs
- Installing a smart thermostat
- Installing advanced power strips for the primary entertainment system and home office
- Installing low-flow showerheads and faucet aerators

In parallel with the implementation of the first tier bundle, a brief visual inspection of building systems would be performed. The inspection would provide critical information to help determine the applicability of a second tier bundle which would include more capital-intensive measures such as:

Single Family Home | Tier 2 Example

- Installing additional wall insulation
- Replacing the existing heating and central air-conditioner equipment with more efficient options
- Replacing the existing water heater with a more efficient option
- Replacing the existing refrigerator with an ENERGY STAR-qualified refrigerator

For smaller commercial properties, it is feasible to develop more prescriptive bundles as described in the context of residential buildings. In fact, Langner, Hendron, and Bonnema (2014) did just that for buildings in Michigan, but large commercial buildings represent a different challenge. Because large buildings typically exhibit greater diversity in their systems, a first tier bundle applicable to these buildings would prioritize energy efficiency services that are more

universally applicable and could provide valuable building intelligence, thereby facilitating additional equipment upgrades and services. For example, a first tier bundle might include:

Large Building | Tier 1 Example

- Conducting a simple energy assessment
- Performing energy performance benchmarking
- Performing basic retro-commissioning
- Enrolling facilities personnel in a building operator training program

The assessment would likely be consistent with an American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) "Level 1—Walk-Through Analysis" and would include a billing analysis to evaluate the building's utility expenses and a brief on-site visit (ASHRAE 2004). The assessment would identify low-cost opportunities for energy savings and would also yield a list of potential capital improvements meriting further consideration. A subsequent second tier bundle would combine both additional services (e.g., technical assistance, contractor selection, incentives/financing assistance) and equipment upgrade measures to develop a bundle specifically suited for that particular building. Such a bundle might consist of the following:

Large Building | Tier 2 Example

- Comprehensive lighting design
- Boiler replacement
- Variable speed drives for HVAC fans
- Demand-controlled ventilation

Further, the bundle would include capital planning support to ensure both planned and unplanned future building improvements incorporate efficiency opportunities. In this way, participants would be given a roadmap for how to address such opportunities when they become available.

Implementing the Bundling Concept

While the concept of measure bundling is simple, implementation of the concept as a practical program will require a sophisticated, integrated approach among a primary organization providing program oversight, a network of qualified contractors, and institutions providing financing. The measure bundling pilot projects discussed by Pratt (2015) and Farley and Ruch (2013) were both fairly small in scope. In both studies, the objective of investigating the feasibility of the identified measure packages took precedence over vetting potential implementation models. Therefore, practical implementation of the bundling concept is still in its infancy. Even without extensive bundling program experience to draw upon, industry best practices should be followed to increase the probability of program success.

One key problem with existing efficiency programs is that participants often need to interface with more than one program (e.g., applying for building shell measure incentives through a weatherization program but having to apply for equipment incentives through a separate prescriptive incentive program). Acquiring financing—if it is offered at all—may require working through yet another program. Finally, participants may have to endure numerous visits from contractors throughout this process, causing considerable inconvenience. In addition

to being overly complex for the participant, these issues also represent a significant administrative burden and can add additional costs throughout the program delivery process. A recent report from ACEEE on exemplary energy efficiency programs summarizes some of the key components of successful programs stating:

> [s]implifying processes to make participation simpler for customers is important to increase the number of program participants… A related common trait is "one-stop shopping" and similar approaches. The customer-facing elements of the program are more comprehensive so that participants' experience is less confusing and complicated (Nowak et al. 2013, 9).

Ideally, implementation of the bundling concept would be supported with the "one-stop shop" approach. Such approaches provide participants with a single point-of-contact in tandem with a comprehensive suite of efficiency services. Further, participants are provided with guidance through every step of the process from initial contact to project completion. Using such an approach, a potential participant interested in installing an efficiency bundle would only interface with a single, participant-facing program provider. For example, interested potential participants might call an advertised hotline to discuss their interest in the program, have any initial questions answered, and possibly arrange for the program provider to visit their home or building to implement a first tier bundle.

Behind the scenes, a program framework for uniform delivery, cost-estimation, and the projection of participant benefits would be developed to ensure all participants have a comparable, quality experience. A network of qualified contractors would also need to be created to implement all types of potential measures quickly and efficiently. These contractors would also benefit from the arrangement as it would reduce the costs of customer acquisition.[4] In addition, utility programs providing financial incentives to support bundling projects would benefit through the contributions to program savings goals. A successful program would both leverage existing market resources and support the development and promotion of training and certification programs.

The bundling concept would also serve to address participant first cost bias, the propensity of potential participants to make purchasing decisions based on first costs as opposed to life-cycle costs. As federal, state, and utility incentives are available for many efficiency measures, the promoted measure bundles could be designed to leverage these incentives to the fullest extent possible to reduce first costs. New incentives could even be designed to specifically support applicable bundles. This approach would be of particular importance in cases where the local utility is the program provider. A successful efficiency bundling program would also offer financing at attractive rates. Nowak et al. (2013) point out that "[f]inancing had become widespread among exemplary programs, both electric and gas, business and residential, new and mature, large and small. Programs are partnering with banks, nonprofit organizations, and state government lending institutions." However, financing alone is unlikely to significantly boost participation rates. For example, a recent evaluation of Massachusetts' Home Energy Services (HES) Initiative found that 40% of participants statewide indicated "upfront/out of pocket cost

[4] In fact, it would be possible for the contractors, themselves, to serve as the program providers, offering comprehensive energy management, efficiency, and financing solutions to building owners. This prospect would represent a transformed market where private firms pursue efficiency as a business opportunity without market intervention.

too large" as a top reason for not installing recommended measures (Cadmus 2015, 33). When participants were asked about what could have been done to further encourage the installation of the recommended measures, only 8% suggested providing access to low-cost loans (Cadmus 2015, 34). Financing is a successful strategy to overcome first cost bias, but it must be coupled with a simplified participant-facing implementation strategy with an emphasis on reducing first costs.

In addition to leveraging incentives and providing project financing, the bundling concept can standardize products and services, enabling significant economies of scale in marketing, procurement, installation, administration, and transaction costs that can all serve to reduce both participant costs and overall program administration costs. Moreover, these benefits will only expand over time as participation rates increase.

Marketing the Bundling Concept

A key aspect of a successful bundling program will be in ensuring effective outreach to participants through a dedicated marketing effort. Building trust in the initiative will be critical, and developing a recognizable brand and exploring novel engagement pathways could also play important roles in bringing the program to scale. The discussion that follows provides brief overviews of these and other marketing elements that could be used by program providers to promote a bundling program.

The majority of participants will not be experts in energy efficient practices and technologies, so there is a certain level of trust the participant must have in the program provider. Energy service companies (ESCOs) typically address this issue of trust and savings uncertainty by offering performance guarantees that ensure participants will capture energy cost savings consistent with projections or the ESCO is on the hook to cover the difference. Performance guarantees, historically limited to high energy users, are now being offered for single family home projects (Sealed 2016). Provided reliable costs and savings estimates can be developed, a similar guarantee could be used by a bundling program. In addition, the program could establish trust by demonstrating that the projected savings are real, for example, by using performance data from similar, completed projects. Because the approach could be delivered at scale, and use a standardized bundle that is known on average to be cost-effective, offering some sort of performance assurance can be made a low risk to program providers through substantial risk diversification.

The development of a recognizable brand could also be a core element of a marketing effort that, with enough exposure, would eventually build value in the marketplace. In addition to energy cost savings, the brand would represent real financial value that could be promoted when it comes time to sell a home or large building. For jurisdictions with time of sale building energy use disclosure laws, this would be an added benefit, as installing an efficiency bundle would increase energy performance, boosting the marketability of the property. An effective marketing strategy would seek to develop a positive feedback loop where successful projects are leveraged through promotional materials to increase the visibility of the initiative, which in turn would lead to increased participation.

For single family homes, a novel marketing approach would be to promote the program through employers with a large number of employees. Such companies have immediate access to a significant number of likely homeowners who might be interested in energy efficiency services. The efficiency bundles could even be offered to a company's employees at a discount. Further, as trust in the program provider is an important component of any successful program, it

may be advantageous to pursue co-branding opportunities. Co-branding a bundling initiative with a large and respected company, for example, would instantly add credibility. Such methods of increasing participant trust, especially as the initiative gets off the ground, will be critical.

For large buildings, candidate participants could be targeted directly through the use of benchmarking data. Such data sets are becoming increasingly publicly available, even for private buildings, due to legislation and local laws. A bundling program could even incorporate benchmarking services into a first tier bundle to help participants satisfy legislative requirements. In such cases, the results of the benchmarking could be used as a marketing strategy to persuade building owners to pursue deeper savings. If a program provider is able to show that a potential participant's building has far higher energy costs than other similar buildings, it may not be as difficult to convince the participant to invest in a second tier bundle. Even in cases where the benchmarking results are less favorable, the benchmarking service could still serve as an important "foot in the door" to establish productive relationships upon which to build.

Unfortunately, the majority of states and municipalities do not currently require energy benchmarking, and therefore benchmarking should not be relied upon as the sole form of program outreach to large building owners. In addition to using more traditional methods of outreach (e.g., leveraging relationships of contractor networks, engaging building owners associations and local chambers of commerce), the initiative could work directly with municipalities to boost participation through mayoral challenges. These initiatives typically urge building owners to voluntarily reduce their energy consumption by some level over an established timeframe and publicly recognize participants that succeed. A bundling program could be promoted in tandem with such a challenge as a means of achieving energy reduction targets.

Remaining Barriers to the Bundling Concept

As previously noted, past and current bundling efforts have primarily focused on bundle development and placed less emphasis on implementation methods. As a result, several barriers will need to be successfully addressed before widespread deployment is possible. None of these issues are insurmountable, and their significance will likely diminish with continued program research and development. However, they should be considering when pursuing a bundling strategy.

Measure Bundle Development. Developing an effective measure bundle for a particular region will require region-specific energy modeling or similar analysis. Bundle development needs to consider building construction characteristics, energy codes, climate impacts, local equipment and labors costs, existing equipment saturations, and a host of other factors that may vary from location to location. While an existing bundle from another jurisdiction may provide a useful starting point, the need for customization will be inevitable. While this may increase the burden of designing a successful program, a national framework for developing measure bundles could be established to streamline these efforts.

More Expensive Projects. The bundling approach's emphasis on comprehensive packages of measures will likely put upward pressure on initial participant costs. Put simply, installing more measures will cost more. These relative increases in project costs may deter some potential participants. As discussed earlier, market research has consistently shown that capital costs are the primary barrier to pursuing energy efficiency opportunities. While some projects are limited

by access to capital, many building owners are hesitant to pursue large projects even when adequate financing is available. The bundling approach is an attempt to bring transaction costs down by streamlining processes and standardizing retrofit packages to achieve scale, but it's acknowledged that these cost reductions are unlikely to materialize immediately. Encouragingly, there is evidence in the marketplace that this issue is being successfully addressed. The NY Green Bank, a division of NYSERDA, recently finalized a deal to provide $7.5 million in financing toward energy efficiency retrofits on up to 400 homes in New York State (NY Governor's Office 2016). This equates to a project cost of nearly $19,000 per home. Project costs are repaid with bill savings and the performance risk is shifted to the implementer through a guaranteed savings arrangement. Such fully financed and guaranteed savings arrangements could increase customer appetites for more expensive projects.

Measure Bundle Applicability. Many of the benefits of the bundling approach are the result of standardizing the package of measures. There will inevitably be cases where some measures in a given package are not appropriate for a given building. This may stem from previous energy efficiency improvements by the building owner, issues with the existing building (e.g., warped door frames preventing air sealing), or customer preferences (e.g., low-flow showerheads undesirable where rain showerheads already exist). One potential way to address this issue would be through the development of customizable bundles. Through the use of iterative, parametric building energy simulations, a multitude of measure bundles could be developed in anticipation of these project variations. The appropriate bundle develop through such modeling could be selected with a simple software tool and site-specific information. NREL developed such a tool for use with small commercial offices (Langner, Hendron, and Bonnema 2014). Something similar could be done across many different building types. Even this approach is unlikely to address all special circumstances, but opportunities would still exist for customers to engage with conventional efficiency programs.

Delivering a Singular Program Experience. The "one-stop shop" approach is a pillar of the bundling concept. Ideally, participants would only interface with a single program representative, but as bundle complexity increases, specialized contractor skill sets may be required. For example, whereas a single home performance contractor might be capable of singlehandedly implementing all of the measures in a less aggressive package of measures, multiple disciplines may be required for second tier opportunities. It will be critical for trade allies to work together to deliver a singular experience; thus, if a contractor is serving as a de facto program representative, a bundling program's contractor training and certification plans must ensure such coordination is prioritized.

Conclusion

The bundling concept is a novel approach with the potential to address numerous barriers to get efficiency to scale and realize the enormous benefits that untapped efficiency potential represents. It could significantly increase participation rates by making program engagement easier. It could reduce participant confusion and facilitate decision-making and at the same time promote cost-effective energy efficiency, boost energy savings, and lead to more comprehensive projects. While additional research and pilot initiatives will likely be required to address the remaining practical barriers, measure bundling is an intriguing concept worthy of continued attention. With a well-designed bundling program, participants may not need to interface with

multiple programs with different applications and eligibility requirements. Participants may not need to worry about which measures are appropriate for their home or building. Participants may not need to first invest in an audit or other exploratory diagnostic services without knowing whether there will ultimately be actionable recommendations they want to pursue. Participants may not need to select equipment, find installation contractors, or figure out how to pay for the project. They would simply need to select a particular bundle, and the rest of the process would proceed with minimal effort required of the building owner until the project is installed and operational.

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