# The Good, Better and Best Ways to Overcome Barriers in the Small Commercial Market

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**ABSTRACT**

Commercial energy efficiency incentive programs wrestle with how to best serve the new construction market – in particular small buildings. Modeling energy performance of buildings less than 100,000 square feet may not be justified due to cost and limited savings potential, yet a prescriptive approach does not promote an integrated design process and misses the opportunity to drive deeper savings.

Using lessons learned from a successful two-year pilot, a multidisciplinary team collaborated on the development and promotion of a new offering called "Market Solutions," designed specifically to address the barriers to participation in the new construction small commercial market. Market Solutions provides a per-square-foot incentive for good, better and best incentive packages of cost-effective measures. Savings and incentives are based on prototypical building models created for six different building types. Offerings for office, retail and restaurant building types were introduced in June 2012, with the school, multi-family and grocery offerings following in March 2013.

Early results have been impressive. Since launching the program, 87 projects have enrolled in the six Market Solutions offerings. At least 22 projects will have completed construction by the summer of 2014. We will examine the successes and opportunities for improving our offerings by studying several aspects of Market Solutions, including how well buildings fit within the prototypical building models and ease of use from the perspective of both the owner and the program operation.

## Introduction

Energy Trust of Oregon is an independent nonprofit dedicated to providing energy efficiency and renewable energy incentives for electric and gas customers of Pacific Power, Portland General Electric, NW Natural, and Cascade Natural Gas. Energy Trust's New Buildings program (New Buildings) provides incentives and technical support to new construction, major renovation, and tenant improvement projects. PECI has served as the Program Management Contractor for New Buildings since 2009. New Buildings supports energy efficiency in buildings through a number of different program offerings. Owners of smaller, simpler projects typically apply for incentives for prescriptive measures. Larger, more complex buildings typically utilize the program's modeling or LEED offerings, which calculate incentives per kWh of energy saved as shown in an energy model.

To achieve a high performing building, an integrated design process is often used where multidisciplinary team members work together starting in the early stages of design to reach an energy performance target. Utility efficiency programs can intervene with offerings such as early design and technical assistance incentives for energy modeling, computational fluid dynamics (CFD) and daylighting analysis to aid projects in achieving deeper energy savings. While these tools when coupled with an integrated design process can lead to substantial energy savings in

larger and more complex buildings, the potential energy savings in small buildings does not justify the cost of the analyses, yet small buildings are the largest segment of our market. Many may also move too quickly through the design process to take advantage of early design and technical assistance offerings - the design and construction of many new commercial buildings moves quickly and aims for low first cost. Striking a balance between achieving deeper savings in small buildings without overloading design teams with a time consuming and costly process became the central program design challenge that led to developing, first, the "Small Commercial Efficiency Pilot" in 2009, then "Market Solutions" in 2012.

## First Steps: Small Commercial Efficiency Pilot

The Small Commercial Efficiency Pilot (SCEP) was offered as a new approach to achieving energy savings beyond common standard (prescriptive) measures for small commercial projects. The offering was based on New Building Institute's *Core Performance Guide – Oregon Edition* and provided incentives on a per square foot basis for school, office and retail projects that completed the design process and core performance requirements outlined in the Guide. Savings were based on energy modeling of prototypical buildings for the three buildings types and the two main Oregon climate zones. Completion of the strategies would result in energy savings of 10 – 35 percent over the 2007 Oregon energy code. In addition, Energy Trust partnered with Earth Advantage, an Oregon nonprofit that certifies green buildings, to collaborate on projects that also received the Earth Advantage® Commercial (EAC) green building certification.

While the pilot enrolled and provided incentives to 10 projects, identifying projects that fit within the required guidelines of the pilot proved challenging. Projects needed to be identified early in the design process as well as meet the target building size and types. Of 35 potential projects, only 10 elected to enroll in the offering. Reasons projects did not enroll included: projects were too far along in the design process to incorporate the design strategies, construction timelines were too tight to incorporate all of the SCEP strategies, project designs could not incorporate all of the Core Performance measures, and perceived complexity of the process and the associated design and analysis work that would be required.

The pilot was successful in moving the 10 projects to achieve high energy targets. Pilot projects delivered higher average electrical energy savings (approximately 160 percent higher per square foot than for projects enrolling only in standard measure offerings) and had similar gas savings when compared to similar size and type buildings using the program's standard offering.

These additional savings did come at a cost in terms of significant involvement by both program staff and project participants. Program staff estimated that about two times the effort was required over projects enrolling only in standard measure offerings, with even greater effort required for projects pursuing the Earth Advantage certification. This additional interaction with project teams was shown to be beneficial to participants, aiding them in the process of designing energy efficient buildings. In fact, project owners surveyed in the process evaluation valued the extensive support from program staff second only to the lower cost Earth Advantage certification.

Based on the SCEP, several recommendations were developed by program staff to deliver a new program offering targeted at the small commercial market:

- Provide simpler bundles of measures that maintain flexibility and target incrementally higher savings
- Develop prototype building energy models that can be used to revise energy savings based on measure substitutions as well as variations in scheduling
- Identify ways to incentivize more efficient HVAC system choices
- Align with future code requirements

## Market Solutions: Good, Better, Best

The initial approach for a new program offering for the small commercial market was to develop packages of measures for specific building types and projects that were less than 70,000 sq ft Base packages of measures for good, better and best HVAC system choices were developed, with additional measures analyzed as electives that could be combined with the base package measures (see Figure 1). The base packages were created to have robust energy savings while still being cost effective and exceeding code and typical design practice. For example, a building owner would choose either a good, better or best base package, and then add any applicable electives, depending on the needs of the owner and their desire to increase savings and incentives. Building types initially developed included office, retail strip mall and restaurant. This was followed nine months later by primary school, multi-family and grocery.

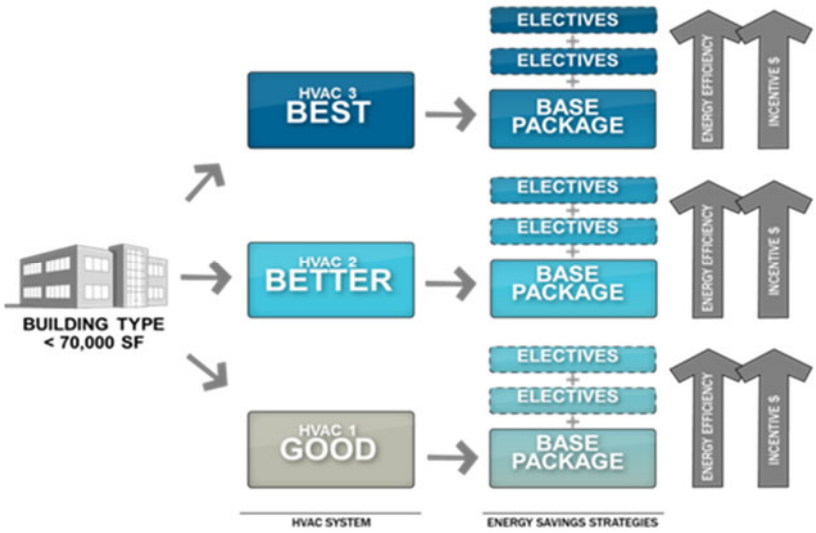


Figure 1. General structure for Market Solutions offerings.

The goal was to provide comprehensive packages of incentives that would increase the energy savings seen on a per-project basis through an efficient program delivery mechanism. For office, retail, primary school and multi-family building types, the incentives were based on energy savings measures modeled in prototypical buildings, with the incentives offered on a per square foot basis. The market would be supported with design specifications that would lead to increased energy savings through installation of individual measures as well as efficient HVAC selection – something that is not easily done through prescriptive offerings. Table 1 illustrates the incentive structure used for the retail building type.

Table 1. Retail incentive structure

| Incentive Tier | Base Incentive | Base + 2 Electives | Base + 4 Electives |
|---|---|---|---|
| Best | $0.60/sq ft | $0.70/sq ft | $0.80/sq ft |
| Better | $0.50/sq ft | $0.60/sq ft | $0.70/sq ft |
| Good | $0.40/sq ft | $0.50/sq ft | $0.60/sq ft |

For restaurants and grocery stores, process-related loads contribute significantly to the overall building energy use. Basing savings and incentives on the building square footage was thus not deemed to be the most appropriate method, and packages were developed based on standard incentive offerings, with the same goal of encouraging projects to pursue more efficiency measures from multiple energy end uses. In this structure, projects would receive a bonus incentive for implementing more measures and measure categories (see Table 2). Development of these offerings will be discussed more in the following sections.

Table 2. Grocery incentive structure

| Incentive Tier | Incentive |
|---|---|
| Best | Standard Incentive + 20% Bonus |
| Better | Standard Incentive + 15% Bonus |
| Good | Standard Incentive + 10% Bonus |

**Office, Retail**

Energy models were created for each of the building types using eQUEST v3.64. These models were largely based on the U.S. Department of Energy (DOE) reference models[1], along with inputs documented in the Pacific Northwest National Laboratory (PNNL) Technical Support Documents (Thornton et al. 2010), (Liu et al. 2006). Other sources of information on the baseline models included the Core Performance models developed for the SCEP, data from projects enrolled in New Buildings, as well as the experience of New Buildings' engineering staff. The energy models were updated to reflect 2010 Oregon Energy Efficiency Specialty Code and were calibrated to regional energy consumption data[2] as well as historical program data. Sensitivity analyses were also conducted to determine impacts of various choices concerning key design variables. Finally the models were peer reviewed to ensure assumptions and final results were reasonable.

Baseline systems from the reference models were typically in line with the baseline system selections indicated by the Oregon State Energy Efficient Design (SEED) Appendix L, as is used by New Buildings for custom projects employing whole building energy analysis. Designers and contractors working in the Energy Trust region were also consulted both on features included in a typical building as well as a listing of typical efficiency measures. All model configurations were run for three Oregon climate zones, represented by Portland, Redmond and Astoria.

[1]For input on building geometry, construction, etc. Accessed June 2014. http://energy.gov/eere/buildings/commercial-reference-buildings

[2]For comparison of building energy use index. Accessed June 2014. https://neea.org/resource-center/regional-data-resources/commercial-building-stock-assessment and http://www.eia.gov/consumption/commercial/

System selections for the better and best options as well as the efficiency measures were determined based on project experience and reference documents such as the *Advanced Energy Design Guides* (ASHRAE 2011) and the *Oregon Reach Code*. See Table 3 which illustrates the good, better, and best system selections for the small office offering. The small office actually includes multiple good, better and best as well as very best options, which were included based on an understanding of the market potential for multiple system types with increasing energy efficiency.

Table 3. Small office systems by heating type

| Incentive Tier | Gas Heating | Electric Heating |
|---|---|---|
| Good | Efficient rooftop unit with code required elements | |
| Good | Efficient VAV w/ 80% boiler; economizers as required by code | Efficient VAV w/electric reheat or hybrid heat source; economizers as required by code |
| Better | Efficient unit with economizers (where not required by code) | |
| Better | Efficient rooftop unit with condensing furnace; economizers as required by code | NA |
| Better | Efficient VAV with condensing boiler; economizers as required by code | NA |
| Best | NA | Efficient WSHP with DOAS |
| Best | NA | Efficient VRF heat pump with DOAS |
| Very Best | Radiant floor or ceiling panels | |
| Electives: additional lighting power density reductions, air barrier, static pressure reduction, efficient domestic hot water heaters, plug load reduction strategies, high performance windows, and special measures | | |

Once the system types and efficiency measures for each building had been identified, the base bundle packages were selected for each of the good, better and best options. In addition to measures related to the HVAC system choice, reduced lighting power density was also included in the base bundle packages. Remaining efficiency measures were categorized as elective measures. Elective measures with significantly higher savings were identified as premium electives.

Savings for the bundles and elective measures were weighted based on historical data on the number of projects within each climate zone. All measures were tested for cost-effectiveness using a total resource cost test and a utility cost test. For many of the individual measures, estimates of incremental costs were available from existing measure information and by contacting local equipment representatives. However, for system changes, it was determined that estimates of incremental costs should be obtained from a cost consultant. Estimates of total system costs were obtained for 15 different system configurations and used to determine incremental costs. Savings for these packages range from 4 – 35 percent for the very best system

bundle. Additional savings are possible with the addition of elective measures. An initial third party evaluation of the offerings found that baseline models are accurate representations of new construction and that the overall measure savings are reasonable.

The retail model is of a strip mall with eight individual retail spaces. Two of the spaces are twice as large as the other six spaces with a total of 25,000 sq ft. System types include packaged single zone air conditioners with gas furnace or heat pumps. The best option does include a mini-split heat pump system. Table 4 illustrates the good, better and best system choices available for the retail offering. Saving for these packages ranges from 7 – 24 percent, with additional savings from elective measures possible.

Table 4. Retail: Strip mall systems by heating type

| Incentive Tier | Gas Heating (AC with Gas Heating) | Electric Heating (HP Systems) |
|---|---|---|
| Good | Efficient unit with DCV and economizers (units > 5 tons) | |
| Better | Efficient unit with DCV and economizers (ALL units) | |
| Better | Efficient unit with condensing furnace and DCV, economizers (units > 5 tons) | Efficient unit with ERV, DCV and economizers (units > 5 tons) |
| Best | Efficient unit with condensing furnace and DCV, economizers (ALL units) | Mini split heat pump with ERV and DCV |
| Electives: additional lighting power density savings, ENERGY STAR equipment, air barrier, static pressure reduction, efficient domestic hot water heaters, and high performance windows | | |

**Multi-Family and Primary Schools**

A process similar to that used for development of the office and retail offerings was followed for both the multi-family and primary school offerings. For the primary school the eQUEST model used for the Small Commercial Efficiency Pilot was used. Program outreach staff also reached out to school districts to obtain additional input on items such as typical operating schedules. For the system selection, SEED Appendix L indicates that for a 50,000 sq ft building, the baseline system is VAV. However, packaged single zone heat pumps and air conditioning units with gas furnace were considered to be the more common system type and were thus used in the baseline model. The low operating hours and climate of the Pacific Northwest meant that the primary school had a very low cooling load. This limited the number of cost-effective HVAC-related efficiency measures. The result was that the tiered offerings were not tied to increasingly efficient HVAC systems. Instead, the tiers are based on projects completing additional electives. In order to enable a wider range of projects to enroll in this offering, a second model was created with a VAV baseline system. From this it was determined that the elective measures offered had similar energy savings for both system types, thus the offering could be used for projects with either packaged single zone or VAV systems. Table 5 illustrates the structure of the primary school offering. Savings for this offering ranged from 2-10 percent, depending on the number and type of electives installed.

Table 5. Tiered offering for primary schools

| Incentive Tier | Requirement |
|---|---|
| Good | 15% reduction in lighting power density above current code requirements + 10% reduction in fan static pressure + 2 electives |
| Better | Good requirements + 4-5 electives |
| Best | Good requirements + 6 additional electives |
| Electives: Exterior lighting reductions, bi-level lighting in corridors, plug load reduction strategies, ENERGY STAR cooking equipment, efficient domestic hot water heaters, air barrier, condensing boiler, and VFD on supply fan | |

The multi-family offering was designed around buildings with three or more stories. The most common HVAC system for this building type is the packaged terminal air conditioner (PTAC) with either electric resistance heating or natural gas furnace heating. This fact is supported by both SEED Appendix L as well as Northwest Energy Efficiency Alliance (NEEA) market studies. The relatively low cost of this system type precludes more expensive HVAC systems from being cost-effective. Thus, as with the primary school offering, the multi-family offering was designed around a single HVAC system of PTACs, with better and best offerings requiring projects to install additional elective measures, as shown in Table 6. However, for multi-family, one elective measure identified as cost-effective was installation of packaged terminal heat pumps or ductless split systems. This is not required for the better or best offering but does count as a premium elective. Savings were found to be anywhere from 4-15 percent for the multi-family offering.

Table 6. Tiered offering for multi-family residential

| Incentive Tier | Requirement |
|---|---|
| Good | Achieve 15% reduction in lighting power density in common areas below current code requirements<br>+ Use ENERGY STAR products for 80% of the lighting fixtures installed in units<br>+ Install low-flow fixtures on kitchen sink, bathroom sink and shower<br>+ Provide ENERGY STAR refrigerators and clothes washers |
| Better | Good requirements + at least 3 electives |
| Best | Good requirements + at least 5 electives |
| Electives: Exterior lighting reductions, bi-level lighting in corridors, ENERGY STAR bath fans, roof insulation, efficient domestic hot water heaters, air barrier, energy recovery ventilator, packaged terminal heat pump or ductless mini-split heat pump, and high efficiency condensing furnace | |

**Grocery and Restaurant**

For the grocery and restaurant offerings, the good, better, best strategy was still followed, but the packages were not based on modeled HVAC systems. Instead, a project qualified for the good offering by installing a minimum of three to four standard measures depending on building type. Additional measures then qualified the project for the better and best offerings. Incentive amounts were based on the standard measure offerings with an incentive bonus of 10-30 percent depending on the offering. In order to determine the measures that would qualify for each tier, analysis of past projects in New Buildings identified the most common measures as well as the average number of measures implemented by a single project.

The offering is also meant to encourage projects to look at all energy end uses for cost-effective energy savings. For the restaurant offering, projects must choose measures from multiple categories, including kitchen equipment, HVAC, hot water heating, lighting and refrigeration. For the grocery offering, to reach the better tier, at least one measure must be either HVAC or lighting. For the best tier, both HVAC and lighting options must be included. Summaries of the restaurant and grocery offerings are included in Tables 7 and 8.

Table 7. Tiered offering for restaurant

| Incentive Tier | # of Equipment Options | Incentives |
|---|---|---|
| Good | 3 or 4 | Standard Incentive + 10% Bonus |
| Better | 5 | Standard Incentive + 20% Bonus |
| Best | 6 | Standard Incentive + 30% Bonus |
| Equipment Options: efficiency cooking equipment (convection oven, food holding cabinet, gas fryer, gas griddle, steam cooker), ENERGY STAR commercial dishwashers, efficient domestic hot water heaters, VFD on kitchen exhaust hood, high efficiency AC/HP, and efficient lighting | | |

Table 8. Tiered offering for grocery

| Incentive Tier | Installation Requirements | Incentives |
|---|---|---|
| Good | Install electronically commutated motors (ECMs) and three additional equipment options | Standard Incentive + 10% Bonus |
| Better | Install ECMs and three additional equipment options, at least one of which must be HVAC or lighting | Standard Incentive + 15% Bonus |
| Best | Install ECMs and four additional equipment options (must include both HVAC and lighting options) | Standard Incentive + 20% Bonus |
| Equipment Options: night covers, LED case lights, anti-sweat heater controls, VFD on condenser fans, efficient walk-in cooler or freezer, floating head pressure control, efficient domestic hot water heaters, infrared radiant heaters, ENERGY STAR cooking equipment, VFD on kitchen exhaust hood, high efficiency AC/HP, and efficient lighting | | |

Restaurants have typically been a difficult market to influence in large part due to the quick turn nature of the construction as well as tight project budgets. And the grocery business is one of low margins and tough competition. The intent of these offerings is to provide an easy to understand, streamlined way to package existing, familiar standard measures and to leverage a bonus incentive to encourage these projects to achieve deeper energy savings. The good package provides an easy entry point into the offering. New Buildings' outreach staff can then use this to encourage owners to go one step further and install additional efficiency measures and attain higher incentives.

## How Is It Working?

Implementation of the Market Solutions offering has been successful in a number of ways. Since the program roll out in July 2012, 22 projects with over 482,000 sq ft have received incentives through the Market Solutions offerings. No schools have closed to date; however, projects in all of the other five market sections have been completed. An additional 65 projects are currently enrolled in the Market Solutions offerings. While it is difficult to compare the number of projects that close year-over-year, 14 Market Solution projects closed in 2013 as compared with 58 projects that received prescriptive incentives and are one of the six Market Solutions building types. Given that three of the building types did not roll out until March 2013, this shows significant uptake by the market. Projects are also pursuing higher levels of energy efficiency as can be seen in Table 9. Figure 2 further breaks down the 22 closed projects by building type and offering tier. It is encouraging that 55 percent of the projects enrolled in the better and best packages.

Table 9. Savings of Market Solutions versus prescriptive only offering

| | Market Solutions | | | Prescriptive Offering | | |
|---|---|---|---|---|---|---|
| | No. of Completed Projects | Average Savings per Project kWh/yr | Average Savings per Project therms/yr | No. of Completed Prescriptive Projects | Average Savings per Project kWh/yr | Average Savings per Project therms/yr |
| Multi-family | 6 | 82,039 | 3,004 | 25 | 35,635 | 529 |
| Grocery | 2 | 128,439 | 81 | 4 | 80,932 | 0 |
| Restaurant | 7 | 8,553 | 1,750 | 16 | 6,108 | 1,074 |
| Office | 6 | 33,136 | 26 | 3 | 361 | 225 |
| Retail | 1 | 67,414 | 2,952 | 6 | 9,662 | 111 |

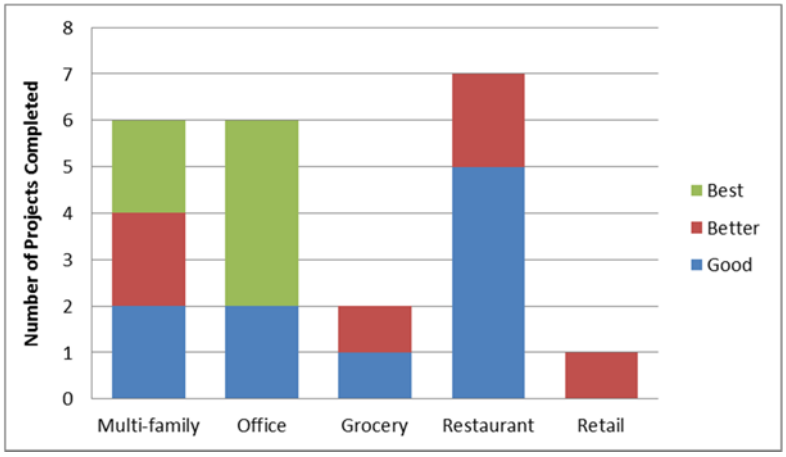


Figure 2. Completed and enrolled Market Solutions projects by offering and incentive tier.

From an outreach perspective, project designers and owners like the idea of an offering based on project square footage. By having an early estimate of the incentive, the project team can justify including all the energy efficiency measures and prevent them from being removed in the value engineering process. Workbooks designed to calculate the incentives were developed for each offering and include information on the equipment and specifications that can be used by the project team. This helps to reduce confusion over program requirements, as well as serving as a specification guideline for contractors working on the project.

These solutions were developed to provide flexibility to project teams in reaching energy efficiency goals. The program has been working with participants to replace measures that are not applicable with other efficiency measures. This has proven to be useful, particularly with measures that scale well such as lighting power density. There is concern that heating and cooling related measures do not scale as well and additional study may be undertaken to better define the measures that may or may not be substituted.

## Limitations

Uptake in certain sectors has not been as high as expected, particularly for office and retail buildings. Analysis initially completed prior to development of the Market Solutions program indicated significant potential for office and retail projects. While there are still a large number of projects of these types enrolled in New Buildings, there are aspects of these projects that do not lend themselves to these solutions. The following issues have been identified as limitations to greater uptake.

### Project Timing

If the program is not able to enroll the project until late in the design process, it may be too costly or time-consuming for the owner to make changes to fit the package offerings. Other projects may be moving too quickly to incorporate necessary design features. As the solutions become more well-known in the design and construction market, this should become less of an issue.

### Project Scope

Ground-up construction of new retail and office space is still slow, with most projects enrolling as tenant improvements. For many of these projects, there is limited opportunity to impact all of the energy-consuming systems required by the packages, particularly the HVAC systems. For other projects, not all tenant spaces have been leased prior to project completion such that lighting and other improvements are left incomplete. In order for the projects to qualify for participation in Market Solutions, the project owner must be willing to show that new tenants will meet the proposed requirements.

### System Selection

Many projects are interested in designing HVAC systems that are not options in the Market Solutions packages, in particular variable refrigerant flow (VRF) is being used in an increasing number of projects. While the office solution does include VRF, it has not been included in the other packages in part due to concerns over cost-effectiveness. The program is currently investigating whether VRF should be included in additional offerings, but questions around costs, cost-effectiveness, and estimates of energy savings must first be addressed.

## Moving Forward

As these offerings become more well-known in the market, we expect that uptake will continue to grow. Energy Trust will be updating the packages of offerings to respond to market demands, such as including VRF systems. The program has also made minor revisions to address issues around lighting in multi-family and counting of individual pieces of kitchen equipment in restaurant projects. Addressing these issues is expected to further increase the uptake of the offering.

One drawback to this type of program offering is that the analysis is completed at one point in time, using requirements of the current applicable energy code as well as estimates of

incremental costs and avoided costs currently in effect. In July 2014, updates to the Oregon energy code will take effect. Avoided costs that are used to calculate the cost-effectiveness of measures within the packages have also changed since the original development. Given the significant level of analysis that went into identifying the cost-effective measures included in each of the packages, updating these offerings may prove to be challenging. While there is strong preference to maintain the offerings to reduce confusion in the marketplace, some changes may need to be made to account for increasing code requirements and changes that affect the cost-effectiveness of measures.

At this time, the projects have not been occupied long enough to collect data on actual operations to compare to the estimates based on prototype modeling. The program does plan to collect utility data on these projects to compare with the expected energy expenditure. This analysis will look at the energy consumption of similar projects enrolled in the program that participated in other offerings, energy use of similar type projects that did not participate in New Buildings, as well as energy use of the projects enrolled in Market Solutions.

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