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Public Utility Commission
Attn: Filing Center
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Re: Energy Trust New Buildings Market Specific Incentive Offering

Energy Trust is asking the Commission to approve the following non cost-effective measures in its New Buildings program as exceptions to the cost effectiveness test:

- Radiant Heat and Cooling in offices
- Elective Measures
 - Air Barriers in offices
 - Fan Static Pressure Reduction in offices and retail
 - Phantom Plug Load Reduction in offices

Attached to this cover letter is a supporting document that outlines the issues and details what we're asking for. The attached document also outlines how each request relates to the exceptions to cost effectiveness guidelines established in Commission Order UM 551.

Thank you for your consideration and please let me know if you have any questions or need clarification on these requests.


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New Buildings Market Specific Incentive Offering

Energy Trust of Oregon's New Buildings program has designed and developed a new 'market specific incentive offering' that provides more savings opportunities for the small commercial market. This offer is based on the success with the Small Commercial Efficiency Pilot (SCEP). This offer carries with it four measures which do not pass the societal cost effectiveness test based on current assumptions for performance and cost. However, inclusion of these measures in the offering will allow the program to test for future cost-effectiveness sooner than otherwise would have occurred without the program. **Energy Trust is seeking approval of these measures from the OPUC as exceptions to the cost effectiveness test.**

Background

New Buildings program offers a wide range of services and incentives serving ground-up construction, tenant improvements, and major renovations. Traditionally the program has served a wide range of projects with either a prescriptive incentive typically for small buildings, or a custom incentive that requires building energy modeling typically for large buildings. While this approach has garnered significant savings and will continue be utilized, a new approach is needed to better support small buildings.

Key characteristics of small buildings and traction with this market:

- A majority of projects, 85% of the total program, are small buildings less than 70,000 square feet.
- These projects represent 30% of electric savings and 45% of gas savings with prescriptive measures alone.
- Most small buildings implement one or two energy efficiency features when additional measures that may cost a little more are available. A small commercial owner's investment in energy modeling is high and may not be covered by savings and incentives, prompting a prescriptive, yet comprehensive approach to achieve more savings.

New Offer

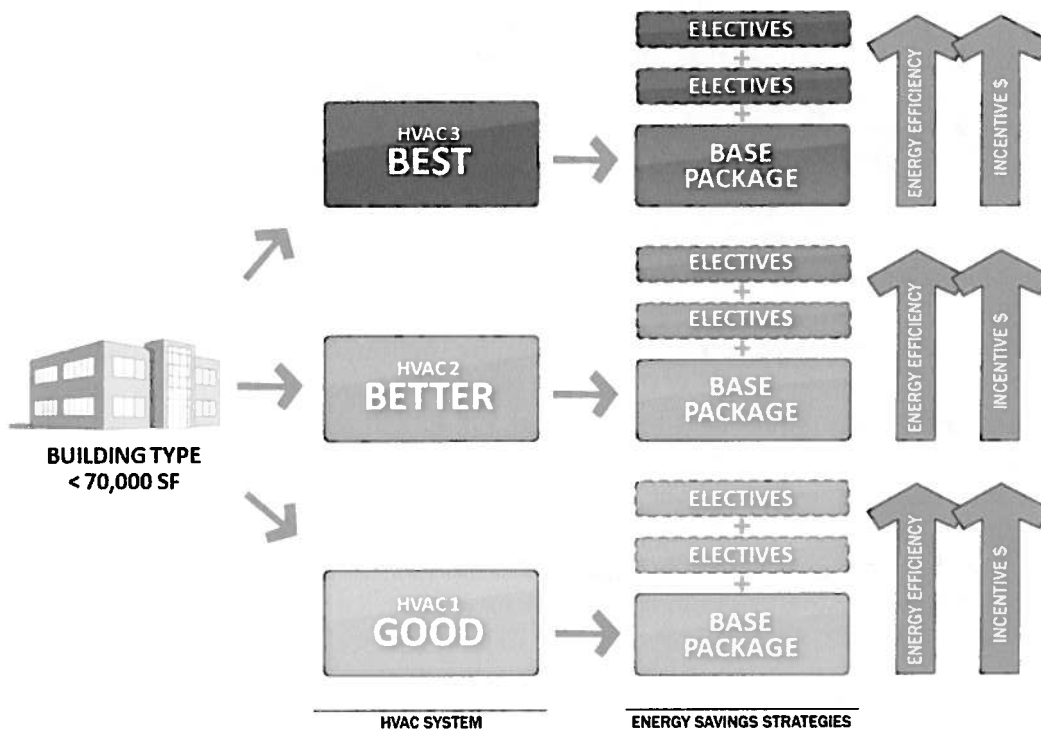
The structure of the new offer is specific to building type: retail, office, restaurant, grocery, schools, and multi-family (mid-rise and high-rise). For each building type, measures are bundled into "Good, Better, and Best" packages. This allows Energy Trust to offer per-square foot incentives for these building types, which aids in quick decision-making for owners.

The goals for this approach are to increase penetration rates at a large scale, achieve widespread adoption of this offer, and to begin moving many projects from "Good" to "Better" and from "Better" to "Best". We feel this is the right middle-ground to achieve deeper penetration and to test how far down the pathway toward "Best" small commercial owners may go.

Opportunities for the new small commercial buildings offer:

- Build packages of pre-vetted measures with bundled savings and incentives for key building types to achieve high volume measure uptake without requiring cost-prohibitive energy modeling.
- A streamlined review and approval process for the customer because each measure in each bundled package has been tested for cost-effectiveness.
- Some packages are strictly prescriptive measures that are put into a single package. Other packages are comprised of pre-modeled savings based on many modeling runs completed by program engineers.

Figure 1 Small Commercial Market Specific Incentive Packages



For retail and offices, typical buildings were pre-modeled to determine the savings and incentive for the packages. Proto-typical energy models were generated in eQuest version 3.64. These models were then reviewed and calibrated with regional energy consumption data to more accurately simulate typical building operating conditions. The following methodology was used to pre-model savings:

- Prototypes and assumptions primarily were based on the Department of Energy (DOE) reference models updated in September 2010¹. The model assumptions and inputs were documented by Pacific Northwest National Labs (PNNL) and were used where possible, as they represent

¹ DOE http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html

standard practices across the United States. Minor model adjustments were made to reflect Oregon-specific code requirements and operating characteristics.

- A strip-mall building type was selected over a stand-alone retail building type for retail as it represents the project types seen most frequently in the program.
- The area used for retail was 22,500 square feet and for office 21,600 square feet. These sizes were used because they represent a fairly standard size for strip-mall retail and for office a size range between a small and medium sized building, which is the target market.
- Additional elective measures that could not be easily modeled were quantified using spreadsheet calculations or by utilizing already existing standard measure savings calculations

Marginally Cost-Effective Energy Measures

Energy Trust seeks to encourage promising innovative energy systems and emerging technologies. For New Buildings to achieve deeper savings and encourage innovative energy systems, emerging technologies must be encouraged where they are most promising. The program seeks to selectively test high priority measures that may be cost-effective, but whose field performance is not fully understood. The program also seeks to encourage implementation of measures where future cost-effectiveness is likely with more field experience or higher volume sales.

Energy Trust follows specific guidelines from the OPUC regarding cost-effectiveness of measures and programs we support. In general, we are directed to only offer incentives to efficiency projects which pass both the utility and societal cost effectiveness tests. Measures which do not pass the tests may be included in programs if they meet the following additional conditions specified by UM551²:

- A. The measure produces significant non-quantifiable non energy benefits. In this case, the incentive payment should be set at no greater than the cost effective limit (defined as present value of avoided costs plus 10%) less the perceived value of bill savings, e.g. two years of bill savings
- B. Inclusion of the measure will increase market acceptance and is expected to lead to reduced cost of the measure
- C. The measure is included for consistency with other DSM program in the region
- D. Inclusion of the measure helps to increase participation in a cost effective program
- E. The package of measures cannot be changed frequently and the measure will be cost effective during the period the program is offered
- F. The measure or package of measures is included in a pilot or research project intended to be offered to a limited number of customers
- G. The measure is required by law or is consistent with Commission policy and/or direction

Some “Best” HVAC designs and electives in the new office and retail markets of the offering are in the early adopter stages of market acceptance and carry a cost premium or have highly variable costs. Others have a lack of cost or performance data to evaluate cost-effectiveness. ***While these measures do not currently pass the program’s cost-effectiveness requirements, they may become cost-effective in***

² OPUC UM551 (OR 94-590) Section 13

the near future. Please refer to Exhibits A, B and C for a complete list of the retail and office measures and their cost-effectiveness.

Energy Trust is seeking approval from the OPUC for the following proposed non cost effective measures to receive an exception to the cost effectiveness test under conditions specifically tied to the exception categories in UM 551. The measures are defined below with an explanation of how they will be managed and how we believe they do meet at least one of the UM551 conditions.

Radiant heating and cooling in offices

The program has experience with radiant heating in custom offices and other building types. Projects looking to significantly reduce HVAC system energy consumption must consider de-coupling the heating and cooling system from the ventilation system and a radiant floor is one way to do that. Energy Trust has started to see radiant floors or panels in innovative projects with aggressive energy goals. About 30 to 40% of the buildings in the Path to Net Zero pilot installed radiant systems in office and school buildings. This trend also aligns with a recent publication by the New Buildings Institute (NBI) on net zero buildings³.

The cost for radiant heating and cooling can vary significantly. Table 1 includes New Buildings projects, both completed and in design phase and the prototype models used in the program design. These demonstrate incremental cost for the radiant system and examples of Societal BCR and energy savings. The examples demonstrate a wide range of incremental costs, ranging from \$2.50 to \$17.13 per square foot. Differences in the heating and cooling sources explain the discrepancy as well as differences in contractor mark-ups.

Table 1 Example Projects with Radiant Heating and Cooling

Project	System Components	Floor Space (sq.ft.)	Incremental Cost (\$/sq.ft.)	Savings (kWh/sq.ft.)	Savings (therms/sq.ft.)	Societal BCR	Source
Hood River Middle School	Ground source heat pumps, radiant floor	5,600	\$3.56	2.45	0	0.82	ETO NB Program
PCC Newberg	Heat pump chiller, radiant floor, heat recovery ventilators	13,500	\$6.86	4.65	0	0.81	ETO NB Program
Charter Mechanical HQ Office Building	Heat pump chiller, radiant floor, back-up condensing boiler, RTU's	8,000	\$2.50	0.67	0.10	1.00	ETO NB Program

³ New Buildings Institute (NBI). 2012. Getting to Zero 2012 Status Update: A First Look at the Costs and Features of Zero Energy Commercial Buildings. Vancouver, Wash.: New Buildings Institute.

Project	System Components	Floor Space (sq.ft.)	Incremental Cost (\$/sq.ft.)	Savings (kWh/sq.ft.)	Savings (therms/sq.ft.)	Societal BCR	Source
Klamath Road and Maintenance Building	Ground source heat pump, radiant floor, natural ventilation	33,000	\$10.00	6.5	N/A	0.80	ETO NB Program
Program Estimate - based on SCEP Prototype Model	Electric heat pump chiller w/ radiant	21,600	\$17.13	5.3	0	0.48	PECI / Architectural Cost Consultants
Program Estimate- based on SCEP Prototype Model	Condensing boiler and high efficiency chiller w/ radiant	21,600	\$6.72	2.3	0.12	0.84	PECI / Architectural Cost Consultants

The costs used in the cost-effective analysis for the prototype project models in Exhibit A (\$17.13 per square foot for all electric systems and \$6.72 per square foot for gas/electric systems) are conservative and significantly higher than the other examples. Running the cost effectiveness with these higher cost assumptions were done for two reasons, 1) The cost assumptions were based on radiant panels, which are often more expensive than a radiant floor, yet are gaining more interest from designers for other design benefits they bring in addition to energy savings performance, and 2) Although both radiant panels and floors are expected to be installed within this initiative, from a cost effectiveness analysis perspective, a worst case look would be the radiant panels.

These cost assumptions result in societal BCRs of 0.48 for inclusion with electric heat pump systems and 0.84 for condensing boilers/chiller systems. When bundled with the four most common elective measures, the resulting societal BCRs are 0.55 for inclusion with electric heat pump systems and 0.93 for condensing boilers/chiller systems. Exhibit C shows similar bundling impacts for gas and electric radiant floor examples as well. Since the electives account for a relatively small portion of the overall package costs and savings, the BCRs are improved 10-15%.

There are many non-quantifiable monetary benefits to radiant heating, such as an increase in leasable space, increase in floor to ceiling height, increased rent, etc. associated with this measure that were not quantified in our analysis. If they were quantifiable they would increase the societal BCR.

It is recommended that the program allow small commercial projects to receive incentives under the market specific incentive offering for radiant heating and cooling systems for both electric and gas fuel sources in an effort to learn more about these projects and collect project cost data. Because there are so few installations to date and limited cost data available, *we recommend tracking project costs over 2 years to monitor the impact and trends. This is consistent with UM551 conditions A, B and E as described below.*

A: There are known significant non energy benefits associated with this measure that are hard to quantify such as increased leasable space and increased floor to ceiling height resulting in potential for increased rent.

B: Providing an incentive will increase market adoption and lower the cost of installations over the timeframe.

E: As the initiative launches, it's important to have an offer to the market that won't change often and includes promising core measures like this one from the beginning that has good reason to become cost effective over the next 2 years as project costs are tracked.

Electives

The marginally cost-effective elective measures are:

- Air Barriers in offices (they are cost-effective in retail),
- Fan Static Pressure Reduction, and
- Phantom Plug Load Reduction.

The following illustrates the elective measures that are borderline cost-effective, provides an explanation for why they are borderline cost-effective, and provides justification for why they should be incentivized in the offering. *We recommend including these measures in the market specific offering.* Energy Recovery was also found to be below the cost-effective threshold and was removed from the list of electives and is not recommended for this offering.

Air Barriers in offices: Air barriers were not found to be cost-effective in office simulations (BCRs of 0.64 and 0.80 in Exhibit B), despite proving cost-effective in retail spaces, for two reasons. First, the costs of this measure are difficult to quantify and are conservative based on limited experience; installation and material costs can vary significantly based on the building construction type. The cost values used in the analysis were based on cost estimates developed in the SCEP Pilot which have yet to be validated with the actual market experience we expect to receive through this initiative. Second, operating hours, and subsequently savings, are lower in the office space compared to retail.

It is anticipated that this measure will not be utilized unless a project is pursuing a "Best" system type. In this scenario, envelope improvements may allow the mechanical system to be downsized, making the HVAC system upgrade more feasible and less expensive.

Air barriers are a requirement in the Oregon Reach code and 2012 International Energy Conservation Code (IECC). *It is recommended that this measure be included in the program offering to encourage best design practices in envelope construction. This is consistent with UM551 conditions D and E.*

D: Inclusion of this measure will increase participation in the program, specifically the "Best" track

E: As the initiative launches, this option is important to have from the beginning to combine with others (1) to increase the potential for mechanical system downsizing, which could lower costs, possibly rendering the measure cost-effective on a net cost basis, and (2) because with market acceptance the cost will decline (or be found to be lower than our initial estimate). We will revisit the measure within 2 years to assess how costs evolve.

Fan Static Pressure Reduction: This measure is associated with reducing fan static pressure and can be achieved in several ways at a wide range of costs (e.g. larger ductwork, more efficient fans, turning vanes in ducts). One potential reduction strategy, efficient fan wheels is cost-effective and is included in other offerings.

Since the offering does not prescribe which pressure reduction strategy is preferred, costs for this analysis were established based on typical costs of a combination of the strategies that might be implemented to achieve this measure. Based on the best assumptions, societal BCRs for this measure are 0.76 for offices and 0.89 for retail. There is potential for lower costs for static pressure reduction if design teams choose an appropriate reduction strategy that optimizes the design for each building rather than the general assumptions used in the analysis.

Design-build projects, the target market of this offering, often currently don't attempt to right-size HVAC equipment and identify ways to minimize fan energy. Providing an incentive will help to address that issue by increasing the knowledge base of the design teams around this opportunity leading to system optimization. *This is generally a best design practice that can be promoted by the program and incentivized, and it is recommended that it be included in the offering. This is consistent with UM551 conditions B and E.*

B: Providing an incentive will increase market adoption and lower the cost of installations over the timeframe

E: As the initiative launches, this option is important to have from the beginning to combine with others (1) to increase the potential for mechanical system downsizing, which could lower costs, possibly rendering the measure cost-effective on a net cost basis, and (2) because with market acceptance the cost will decline (or be found to be lower than our initial estimate). We will revisit the measure within 2 years to assess how costs evolve.

Phantom Plug Load Reduction: Phantom plug load reduction costs are variable based on the implementation strategy. The analysis assumed smart strips would be installed to control peripheral loads during off-peak hours, though a less expensive approach, using IT management software, could also be used.

The current cost of smart strips available on the market ranges from \$10-\$45. The more expensive models include features beyond energy efficiency – such as surge protectors. The cost used in the analysis was \$25 per smart strip. If average costs reduced to \$22 per smart strip, phantom plug load reduction would pass the cost-effectiveness test, increasing the BCR from 0.89 to 1.0. This cost reduction is foreseeable in the next few years as smart-strips gain market volume and contractors buy smart strips at bulk or wholesale rates.

As projects move to more innovative and efficient HVAC and lighting designs, plug loads become a larger piece of overall building energy consumption. *This measure can be used as a demonstration to encourage projects to go beyond HVAC and lighting, and is recommended to be included in the market specific offering. This is consistent with UM551 condition B.*

B: Inclusion of this measure will increase participation in the program by offering an option for an end use not currently covered. The cost assumption is just \$2 higher than what would need to be seen in the market for a BCR = 1 and increased adoption is likely to influence a downward price trend.

Recommendations

Energy Trust of Oregon recommends that the OPUC approves the following non cost-effective measures in the New Buildings program's new 'market specific incentive offer' as exceptions to the cost effectiveness test.

- Radiant Heat and Cooling in offices
- Elective measures
 - Air Barriers in offices
 - Fan Static Pressure Reduction in offices and retail
 - Phantom Plug Load Reduction in offices.

The program expects a wide range of costs for these measures, with some installations meeting societal BCR targets and others not. As builders make prudent design choices to incorporate these measures, actual costs are expected to be lower than the typical costs used in Energy Trust of Oregon's analysis. The costs these measures will likely fall as builders make less expensive design choices and market volume reduces off-the-shelf costs. Inclusion of these measures in the offering will allow the New Buildings program to increase market acceptance of emerging technologies. Energy Trust of Oregon will monitor the incremental costs for two years.

EXHIBIT A – Retail and Office Base Package Cost-effectiveness Results

#	Energy Efficiency Measure Description	Business Type	EUL (yrs)	Electric Energy (kWh/yr)	Gas Energy (therms/yr)	Measure Incremental Cost	Combined Utility System BCR	Combined Societal BCR
1	Retail - Electric - Good Package	Retail	15	16,600	0	\$13,600	9.12	1.11
2	Retail - Electric - Better Package - Split system/ERV	Retail	15	30,500	0	\$18,100	9.12	1.54
3	Retail - Electric - Better Package - Enhanced Ventilation	Retail	15	34,700	0	\$15,000	9.12	2.11
4	Retail - Electric - Best Package - Mini-split w/ERV	Retail	15	34,700	0	\$22,100	9.12	1.43
5	Retail - Gas - Good Package	Retail	15	15,700	100	\$13,600	9.24	1.12
6	Retail - Gas - Better Package - Condensing furnace	Retail	15	15,700	600	\$14,100	9.71	1.41
7	Retail - Gas - Better Package - Enhanced Ventilation	Retail	15	19,100	1,200	\$15,000	9.97	1.91
8	Retail - Gas - Best Package - condensing furnace and enhanced ventilation	Retail	15	18,400	1,500	\$15,500	10.12	1.99
9	Office - Electric - Good Package - PSZ	Office	15	20,370	0	\$11,760	9.12	1.58
10	Office - Electric - Good Package - VAV	Office	15	17,430	0	\$11,760	9.12	1.35
11	Office - Electric Better Package - enhanced ventilation	Office	15	23,310	0	\$14,070	9.12	1.51
12	Office - Electric - Best package - VRF	Office	20	81,900	0	\$26,460	11.71	3.63
13	Office - Electric - Best package - WSHP	Office	20	77,700	0	\$91,980		
14	Office Electric - Best package - Radiant	Office	30	114,240	0	\$359,730		
15	Office - Gas - Good Package - PSZ	Office	15	21,210	0	\$11,760	9.12	1.64
16	Office - Gas - Good Package - VAV	Office	20	24,990	0	\$11,760	11.71	2.49
17	Office - Gas - Better Package - enhanced ventilation	Office	15	23,940	0	\$14,070	9.12	1.55
18	Office - Gas - Better package - condensing furnace	Office	15	23,940	1,470	\$17,010	9.96	2.09
19	Office - Gas - Better package - condensing boiler, VAV	Office	20	24,990	630	\$37,170		0.99
20	Office Gas - Best package - Radiant	Office	30	49,770	2,730	\$141,120		

EXHIBIT B – Retail and Office Elective Measure Cost-effectiveness Results

ECM #	Energy Efficiency Measure Description	Business Type	Measure Lifetime (yrs)	Electric Energy (kWh/yr)	Gas Energy (therms/yr)	Measure Incremental Cost	Combined Utility System BCR	Combined Societal BCR
1	25% LPD reduction	Retail	13	8,300	0	\$5,100	3.97	1.29
2	Energy Recovery - Gas HVAC only	Retail	20	(19,600)	1,400	\$12,500		NA
3	Air Barrier- Electric heating	Retail	45	3,800	0	\$4,200	18.20	1.65
4	Air Barrier - Gas heating	Retail	45	800	300	\$4,200	22.10	1.68
5	High performance windows- Electric heating	Retail	15	1,300	0	\$700	9.12	1.69
6	High performance windows- Gas heating	Retail	15	1,700	0	\$700	9.12	2.21
7	Variable flow supply fans	Retail	15	18,000	0	\$6,000	9.12	2.74
8	Fan static pressure reduction	Retail	15	2,300	0	\$2,400		NA
9	Economizers on units < 5 tons	Retail	15	2,300	0	\$1,400	9.12	1.50
10	Heat pump water heater	Retail	18	3,700	0	\$700	10.67	5.64
11	25% LPD reduction	Small Office	13	9,030	0	\$6,720	4.039	1.086
12	Energy Recovery - Gas HVAC only	Small Office	20	(47,250)	840	\$27,300		NA
13	Air Barrier- Electric heating	Small Office	45	2,100	0	\$5,880		0.636
14	Air Barrier- Gas heating	Small Office	45	420	210	\$5,880		0.706
15	High performance windows - electric heating	Small Office	15	5,670	0	\$1,470	9.117	3.517
16	High performance windows- Gas heating	Small Office	15	5,250	63	\$1,470	9.341	3.656
17	Variable flow supply fans	Small Office	15	13,230	0	\$13,230		NA
18	Fan static pressure reduction	Small Office	15	4,200	0	\$5,040		0.783
19	Phantom Plug load reduction	Small Office	6	5,670	0	\$2,520		0.640
20	Peak plug load reduction	Small Office	15	5,250	0	\$2,730	9.117	1.753
21	Occupancy sensors in common areas	Small Office	13	12,390	0	\$2,730	4.039	3.667
22	Heat pump water heater	Small Office	18	3,150	0	\$1,470	10.675	2.287

EXHIBIT C - Office Best Package (Radiant Heating) Bundled with Electives Cost-effectiveness Results

	Energy Efficiency Measure Description	Business Type	EUL	Electric Energy (kWh/yr)	Gas Energy (therms/yr)	Incremental Cost	Combined Utility System BCR	Combined Societal BCR
Office - Radiant Panels - Electric	BASE PACKAGE ONLY - NO ELECTIVES	Small Office	30	114,240	0	\$ 359,730.00		0.5
	LOWEST SAVINGS ELECTIVES: BASE, AIRBARRIER, FAN STATIC PRESSURE, LIGHTING CONTROLS, PEAK PLUG REDUCTION	Small Office	30	128,940	0			0.5
	HIGHEST SAVINGS ELECTIVES: BASE, LPD, FAN STATIC, AIR BARRIER, VFD ON FANS	Small Office	30	142,800	0	\$ 372,393.00		0.6
	MOST COMMON - LPD REDUCTION, FAN STATIC, LIGHT CONTROL, PEAK PLUG LOAD REDUCTION	Small Office	30	135,870	0	\$ 390,600.00		0.6
Office - Radiant Panels - Gas	BASE PACKAGE ONLY - NO ELECTIVES	Small Office	30	49,770	2,730	\$ 373,233.00		0.8
	LOWEST SAVINGS ELECTIVES: BASE, AIRBARRIER, FAN STATIC PRESSURE, LIGHTING CONTROLS, PEAK PLUG REDUCTION	Small Office	30	62,790	2,940			0.9
	HIGHEST SAVINGS ELECTIVES: BASE, LPD, FAN STATIC, AIR BARRIER, VFD ON FANS	Small Office	30	78,330	2,940	\$ 153,783.00		1.0
	MOST COMMON - LPD REDUCTION, FAN STATIC, LIGHT CONTROL, PEAK PLUG LOAD REDUCTION	Small Office	30	71,400	2,730	\$ 171,990.00		0.9
Office - Radiant Floor - Electric	BASE PACKAGE ONLY - NO ELECTIVES	Small Office	30	114,240	0	\$ 163,170.00		0.6
	LOWEST SAVINGS ELECTIVES: BASE, AIRBARRIER, FAN STATIC PRESSURE, LIGHTING CONTROLS, PEAK PLUG REDUCTION	Small Office	30	128,940	0	\$ 287,784.00		0.6
						\$ 300,447.00		0.6

