STATE OF INDIANA

INDIANA UTILITY REGULATORY COMMISSION

PETITION OF DUKE ENERGY INDIANA, INC. FOR APPROVAL TO OFFER ADDITIONAL ENERGY EFFICIENCY PROGRAMS; FOR APPROVAL OF PROGRAM COST RECOVERY, LOST REVENUES AND INCENTIVES PURSUANT TO 170 IAC 4-8-5, 170 IAC 4-8-6, AND 170 IAC 4-8-7; AUTHORITY TO DEFER COSTS PENDING APPROVAL AND FOR AUTHORITY TO IMPLEMENT ANNUAL TRACKING MECHANISM	)	**CAUSE NO. 43955**

SUBMISSION OF IMPACT AND MINI-PROCESS EVALUATION OF THE NON-RESIDENTIAL SMART $AVER® PRESCRIPTIVE PROGRAM IN INDIANA: CORE PLUS HVAC AND PROCESS MEASURES

Duke Energy Indiana, Inc., by counsel, respectfully submits the Impact and Mini-Process Evaluation of the Non-Residential Smart $aver® Prescriptive Program in Indiana: Core Plus HVAC and Process Measures for the period of January, 2012 through November 2013.

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CERTIFICATE OF SERVICE

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Final Report

Impact and Mini-Process Evaluation of the Non-Residential Smart $aver® Prescriptive Program in Indiana: Core Plus HVAC and Process Measures

Prepared for
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June 1, 2015

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Executive Summary

Significant Impact Evaluation Findings

Metric	Result
Number of Program Participants from January 2012 to November 2013	65 Incentives
Gross Coincident Peak kW per unit	**kW/unit**
Air Compressor VFD (motor hp)	0.000
Air-Cooled Chiller (Ton)	0.127
Guestroom Controls (Ton)	0.152
Gross kWh per unit	**kWh/unit**
Air Compressor VFD (motor hp)	1,120.6
Air-Cooled Chiller (Ton)	355.3
Guestroom Controls (Ton)	653.0
Freeridership rate	51.6%
Spillover rate	1.1%
Total Discounting to be applied to Gross values	50.5%
Net Coincident Peak kW per unit	**kW/unit**
Air Compressor VFD (motor hp)	0.000
Air-Cooled Chiller (Ton)	0.063
Guestroom Controls (Ton)	0.075
Net kWh per unit	**kWh/unit**
Air Compressor VFD (motor hp)	554.7
Air-Cooled Chiller (Ton)	175.9
Guestroom Controls (Ton)	323.2
Measure Life[1]	15yr (Air Compressor VFD) 20yr (Air-Cooled Chiller) 8yr (Guestroom Controls)

- Retrofit projects replacing existing air compressors with new variable frequency drive (VFD) air compressors were operated more than 8,000 hours a year, well above the 4,160 hours assumed in the workpaper, resulting in a large difference in the calculations of energy saved. As a result, the Duke Energy program under-reported energy savings by 1,401,193 kWh. The realization rate for this measure is 178%.
- For the air-cooled chiller projects, the projected savings were revised using building energy simulations based on an expanded set of building prototypes. The savings were

[1] EUL data taken from Indiana TRM.

estimated based on the installed coefficient of performance (COP) and integrated part load value (IPLV) of each project. The realization rate across all projects is 154%.

- For guestroom controls, the savings were calculated using engineering equations based on the Indiana Technical Reference Manual (TRM) and secondary research on guestroom controller energy savings conducted by Noresco. The realization rate for this measure is 103%.

Significant Process Evaluation Findings

Key Findings from the Management Interviews

- Since the Smart $aver Indiana evaluation of lighting measures, Duke Energy is making steady progress towards their objectives of transitioning program tracking data to a new database, and to launching an online application for the Smart $aver Prescriptive program.
- Duke Energy has hired Business Energy Advisors who will play a critical role in their expanded outreach to small- and medium-business customers. These business energy advisors will help SMB customers identify energy savings opportunities.
- The trade ally outreach strategy has been assumed by the Smart $aver program managers and they have collaborated with the trade ally outreach representatives to launch and track progress towards outreach objectives.

Key Findings from the Participant Surveys

- All of the Non-Residential Smart $aver Prescriptive participants surveyed received rebate incentives for non-lighting measures: thirteen participants were surveyed about HVAC/Chiller measures and three participants were surveyed about air compressor measures. Overall, the average total rebate received by participants in this survey was $6,714 per organization (including all installations at all locations) with a median rebate of $4,183.
- About a third of surveyed Prescriptive participants (38%) have previously submitted applications to the Prescriptive program, and a similar percentage (31%) have previously submitted applications to the Smart $aver Custom program.
- The most frequent channels for non-lighting customers learning about the Smart $aver program are through Duke Energy employees (44%) and through trade allies (25%).
- None of the 16 surveyed Smart $aver participants reported that they had problems receiving their rebates.
- The most common reason for purchasing the rebated equipment was to reduce energy costs, mentioned as a reason for participation by 75% of participants overall and is the main reason for participation by 56%. Another 25% mentioned the incentive rebate as a reason for participation and 25% mentioned that their old equipment was in poor condition.
- About half of participants surveyed (56%) replaced existing equipment with their rebated installations (there are no significant differences between HVAC/Chiller and Process measures in terms of replacing existing equipment). Twenty-five percent (25%) of participants replaced units that were less than five years old while 19% replaced equipment that was more than twenty years old. None of the replaced units are described

as having been in "good" condition, though all replaced units were confirmed to be functional at the time of replacement. A plurality of replaced units (44%) are described as having been in "fair" condition while 33% were in "poor" condition; the remaining share of respondents could not describe the condition of the remaining units.

- Most surveyed participants (75%) have installed more high efficiency equipment since participating in Smart $aver: most frequently mentioned are lighting upgrades (by 83% of the 12 participants who made additional high efficiency installations) followed by occupancy sensors and variable frequency drives (both by 17%). When asked to rate the influence of their recent Smart $aver Prescriptive participation on the installation of additional high-efficiency measures, the mean influence rating is 6.2 on a ten-point scale where "10" means most influential.
- Overall satisfaction with the Smart $aver program is high: among all participants surveyed, 81% rated their satisfaction at "8" or higher on a ten-point scale where "10" is most satisfied. The mean satisfaction rating with the program overall is 8.4 and the median satisfaction rating is 9.0.
- The specific aspect of the program that participants are most satisfied with is interactions and communications with Duke Energy staff (mean rating of 9.6 on a ten-point scale), and the aspect they are least satisfied with is the information provided by trade allies (mean rating of 6.1).
- When asked to name their favorite thing about participating in the program, roughly equal numbers said it was receiving an incentive rebate (38%) and the ease and simplicity of participating in this program (31%). When asked to name their least favorite thing about the program, 38% could not name anything, while the most-mentioned complaints involve issues with the list of qualifying equipment (mentioned by 19%; complaints include that the list is confusing, the list is not updated frequently enough, and that the list does not include the measures the customer was seeking).
- Participants surveyed are also satisfied with Duke Energy overall: the mean satisfaction rating is 8.6 on a ten-point scale where "10" means most satisfied, and the median satisfaction rating is 9.0.

Recommendations

Based on the results of the impact evaluation, the TecMarket Works team has the following recommendations:

1. The savings of VFD rebate program is under reported, and it is recommended to use the annual operating hours provided by the customer instead of the currently used 4,160 annual operating hours.

2. Interpolate savings – The application of the chiller savings estimates from the Duke Energy Database to each project was inconsistent. We recommend interpolating the results from the Duke Energy Database according to the actual installed COP and IPLV.

It should be noted that there are several assumptions made that significantly impact the projected savings.

3. Building Type – all air-cooled chiller energy savings reported in the tracking system are based on the same large office building prototype. Several of the projects that applied for incentives are schools and universities, which have different operating hours, building envelope and occupancy characteristics than office buildings. Savings estimates for university buildings were developed for this evaluation. For future programs, it is recommended that a few additional building prototypes be simulated that cover a wider range of building types sites (Large Retail, High School, Community College, Hospital and so on).

4. HVAC System type – For the air-cooled chiller measure, the current calculation uses a weighted average for different HVAC system types (Constant volume reheat system without air-side economizer; Constant volume reheat system with air-side economizer; Variable air volume system with airside economizer). The choice of system type has a significant impact on the results. The recommendation is to either develop custom weights for the different types, based on available data[2], or gather this information as part of the application process and use it to refine the savings estimates.

5. Primary research on guestroom controls. The evaluation is partially based on secondary research conducted by Noresco for guestroom controls in California. If this measure becomes a larger portion of the Duke Energy portfolio, we recommend conducting primary research using field measurement and verification (M&V) activities on systems in Indiana.

Based on the results of the process evaluation, the TecMarket Works team has the following recommendations to add to those already made in the previous evaluation:

> FINDING: While all the strategy templates contain metrics, the results do not seem to be tied to the metrics. In all the strategy templates, the section for tracking Results only provides guidelines to document "quantifiable facts that can be tracked over time to prove success."
>
> RECOMMENDATION: If Duke Energy has not already done so, the Results should be tied to the Metrics in the strategy template, which in turn should be tied to the Objectives. This will reduce confusion on how to describe Results. Specifically, the Results section of these templates could present a graph of the metrics values over time.
>
> RECOMMENDATION: Duke Energy should consider tracking the state of trade ally awareness of the program separately from their participation. This would allow Duke Energy to track the number of trade allies who need introductory information about Smart $aver, versus those who may not be participating due to lack of time, versus those who may not be participating based upon specific market barriers. These high-level views

[2] Secondary system type saturation data from the Commercial Building Energy Consumption Survey (CBECS), or primary data from Duke Energy customer surveys can be used to define HVAC type saturations. Primary HVAC system type data collected on the rebate application are preferable.

of the trade ally population would allow Duke Energy to develop outreach that is more specific to each vendor's specific barriers for not participating.

Introduction and Purpose of Study

This report presents the results of an impact and mini-process evaluation of the Non-Residential Smart $aver® Core Plus Prescriptive Program in Indiana, focusing on HVAC and Process measures. This study follows the earlier impact and process evaluation of the Smart $aver Prescriptive program that focused on lighting measures. This report covers measures in the overall program portfolio not addressed by the Statewide Core Program evaluation.

The Indiana Statewide Core Program impact evaluation was conducted by BuildingMetrics and Noresco and examined HVAC & Process measures.

The process evaluation was conducted by TecMarket Works with Carol Yin of Yinsight as a subcontractor. All surveys were conducted by TecMarket Works staff, with Yinsight conducting management and trade ally interviews.

Summary Overview

Summary of the Evaluation

This document reviews the energy savings methodology for three measures for the Duke Energy's Smart $aver® Prescriptive Incentive Program: air-cooled chiller retrofits, guestroom controls, and variable frequency drive (VFD) retrofits for air compressors. Participants in the Program were paid incentives based on deemed energy savings from workpapers, created by Franklin Energy Systems (FES), and unit energy savings estimates from the Duke Measure Savings Database.

The following three calculation methods for each measure have been reviewed and compared. Conclusions and recommendations are presented in this report.

1. FES work papers and spreadsheets
2. Duke Measure Savings Database
3. Indiana Technical Resource Manual (TRM)

For the process evaluation, the evaluation team conducted in-depth interviews with Duke Energy managers and program staff members at different levels of responsibility for the program. The evaluation team also conducted 20-minute interviews with trade allies who participated in the Smart $aver Prescriptive Indiana program. Finally, TecMarket Works completed telephone surveys with 16 participants who received incentive rebates from this program for the installation of measures included in this study.

Evaluation Objectives

The goal of the impact analysis was to:

- Review program tracking data,
- Review available information from participant applications,
- Compare annual gross kWh savings and summer peak kW to established methodologies,
- Recommend changes or updates to methodologies, and

- Apply recommended changes or updates to all participants and update deemed savings.

The process evaluation of the C&I Smart $aver Prescriptive program has several purposes. First, this process evaluation is intended to help identify areas where the program may be improved, drawing upon the insights of Duke Energy staff across different divisions and upon the insights of a sample of participating customers. Second, this report will document program operations for future reference, including ways in which the program has addressed and overcome past program challenges.

Researchable Issues

Researchable issues for the impact evaluation include:

- What are the measures that drive the energy savings in the Duke Energy portfolio?
- What are the inherent weaknesses in the ex-ante energy and demand savings calculations, and how can they be improved?
- What are the revised energy (kWh) and summer coincident peak demand (kW) savings associated with the important measures included in the Duke Energy portfolio?

The participant survey addressed several research issues that were identified collaboratively by Duke Energy and the TecMarket Works team:

- How did customers hear about the Smart $aver Prescriptive Program?
- What can Duke Energy do to increase participation from trade allies?
- Can the application process be improved?
- Can the program design or operations be improved?

Program Description

The C&I Smart $aver® Prescriptive program influences business customer decisions for saving energy by providing incentives to install qualifying high-efficiency measures such as lighting, HVAC, and motors. Duke Energy's commercial and industrial customers fund this program by paying an energy efficiency rider based upon their kWh usage. The Statewide Core program ("Energizing Indiana") provides other types of lighting and HVAC measures to Duke Energy's commercial and industrial customers. This evaluation study looks at the Smart $aver Prescriptive program only, exclusive of the measures offered by Energizing Indiana.

In the Prescriptive program, customers may install selected energy efficient measures and then send in an application for rebates. Energy efficiency measures that are not part of the Energizing Indiana Prescriptive or Smart $aver Prescriptive programs may still earn a rebate through the Smart $aver Custom program. The eligibility of the custom measures must be approved by Duke Energy through a separate application process prior to installation.

The Smart $aver Prescriptive program is designed to motivate Duke Energy's commercial and industrial customers to install high-efficiency equipment that they otherwise might not have chosen, by offering incentives up to 50% of the project cost on selected equipment. Customers must apply for the incentive within 90 days of installing the equipment, and provide invoices with model numbers as proof. The Smart $aver Prescriptive program is offered in conjunction with the Smart $aver Custom program, which is being evaluated in a separate study. The measures offered through the prescriptive program have pre-calculated ex ante energy savings, while the measures eligible for the custom program require project-specific energy savings calculations to be submitted with each application. The combination of both programs allows Duke Energy customers a flexible range of options to meet their individual needs for energy efficient equipment.

The Smart $aver programs achieve their objectives through a multi-pronged approach. First, Duke Energy's Large Account Management Team provides a channel by which Duke Energy is able to communicate to their large customers any programs that may help with individual customers' current needs. Second, for other customers, the Smart $aver program is presented to the market through "trade allies", the distributors and contractors offering high efficiency equipment. This marketing approach through nurturing a network of trade allies (TAs) has been found successful in past evaluations. Third, Duke Energy conducts outreach directly to small and medium business (SMB) customers. This SMB outreach channel was first implemented in 2013, in coordination with Duke Energy's market segmentation strategy team. Fourth, Duke Energy offers an online store where customers can purchase a selection of equipment with the incentive factored into the product price.

Duke Energy offers the Smart $aver Prescriptive program across all five states in their service territory, and the program is managed by two product managers. Though technically assigned to either the Midwest states or to the Carolinas, these two product managers report that they run Smart $aver as one program, with shared decision-making. The only program differences between the states are due to varying regulatory or cost-effectiveness tests, therefore incentive levels and program offerings might not be identical.

Methodology

Overview of the Evaluation Approach

This process and impact evaluation has multiple components as described below.

Study Methodology

Impact Evaluation

The impact methodology consisted of a review of the program tracking data and available information from the participant applications, and an engineering analysis of the annual gross kWh savings and summer peak kW as compared to the Indiana TRM, Duke Energy Savings Database, and FES methodologies.

Management Interviews

TecMarket Works and Yinsight developed the interview protocol for the Smart $aver Program management that was implemented in April of 2014. The full interview guide can be found in *Appendix E: Management Interview Instrument for Update on Program Operations.*

In-depth interviews were conducted with:

- Three Smart $aver product and services managers
- Manager of the market strategy team
- The Midwest trade ally outreach manager

Eight lighting industry trade allies from Indiana were also interviewed. (Trade allies were randomly selected from the listing of trade allies on the Duke Energy website.) These trade allies held company positions that ranged from President of the company, to office manager, to one electrician, with anywhere from three to 28 years of experience in the field.

Participant Surveys

TecMarket Works and Yinsight developed the customer survey for the Smart $aver Program participants. The survey can be found in *Appendix G: Participant Survey Instrument.*

Data collection methods, sample sizes, and sampling methodology

Impact Evaluation

The impact evaluation employed a review of the program tracking data and available information from the participant applications, and an engineering analysis of the annual gross kWh savings and summer peak kW as compared to the Indiana TRM, Duke Energy Savings Database, and FES methodologies. The analysis was conducted for three measures identified in the tracking data review as important contributors to program savings. The analysis was conducted across all participants receiving rebates for these measures; no sampling was done.

Participant Surveys

The sample frame for the process evaluation, selected from the population list of all Smart $aver Prescriptive Lighting, HVAC and process measure participants provided by Duke Energy[3], consisted of 126 customers that received Lighting incentives, and 80 customers that received HVAC and Process incentives in Indiana. Out of these 206 organizations in Indiana, 163 were called (126 Lighting and 37 HVAC/Process) and of those, 56 completed the survey (40 Lighting and 16 HVAC) for a total response rate of 27% (56 out of 206). At the program level, the combined Lighting and HVAC/Process sample supports a confidence level of 90% with a + or - 9.4% margin of error.

Number of completes and sample disposition for each data collection effort

Impact Evaluation

The evaluation team used a methodology review rather than field M&V on a sample of participants. The results of the methodology review was applied across all participants receiving rebates for these measures.

Participant Surveys

At the measure level, the final sample list for HVAC/Process participants provided by Duke Energy consisted of 80 organizations in Indiana. Out of these 80 organizations, 37 were called, and of those, 16 completed the survey for a total response rate of 20% (16 out of 80).

Expected and achieved precision

Impact Evaluation

As previously mentioned, the impact evaluation used a methodology review rather than statistical sampling. Expected and achieved precision is not applicable.

Participant Surveys

The survey sample methodology had an expected precision of 90% +/- 10% at the program level and an achieved precision of 90% +/-9.4%.

Description of baseline assumptions, methods and data sources

The air-cooled chiller retrofit assumed a normal replacement baseline, where minimum efficiencies based on ASHRAE 90.1 were applied. The baseline for the variable frequency drive (VFD) air compressors retrofits was assumed to be a standard constant-speed compressor of the same capacity. The guestroom controls are an “add-on” measure; the baseline is the existing hotel room HVAC system prior to the addition of guestroom controls. The baseline definitions used in this evaluation are consistent with the baseline definitions used in the Indiana TRM and FES workpapers.

[3] Participants were those who had received incentive checks between January of 2013 through March of 2014.

Description of measures and selection of methods by measure(s) or market(s)

The focus of this impact study is on air-cooled chiller retrofits, guestroom controls, and retrofits of existing industrial air compressors with new VFD air compressors. These measures were identified through a review of the program tracking system. An engineering desk review was conducted for each of the measures studied in the evaluation.

Use of TRM values and explanation if TRM values not used

Engineering algorithms from the Indiana TRM were used as the basis of savings for the air compressor and guestroom control measures. Building energy simulations were used to evaluate the air-cooled chiller measures. Simulations are a more rigorous method of evaluating complex HVAC measures than the simple engineering equations provided in the Indiana TRM.

Threats to validity, sources of bias and how those were addressed

Impact Evaluation

The impact evaluation is based on an engineering review and secondary research. No field M&V was conducted. Biases in the engineering methods and the applicability of secondary research to these measures may exist. To minimize the bias, we focused on using the best available secondary research and engineering methods available to evaluate these measures.

Process Evaluation

No causal relationships were being investigated, so threats to validity are not a concern. Participants may have exhibited the social desirability bias when answering a question relating to the customer's main motive for participating in the Smart $aver program, and when answering questions about satisfaction with the Smart $aver program. To counter this bias, these questions used neutral language wherever possible.

Impact Evaluation

Evaluation Period and Energy Conservation Measures

Program participants and incentives paid from April 1, 2012 through April 8, 2014 were reviewed and segmented by technology (see Figure 1). After reviewing the kWh savings by technology, it was determined that HVAC and Process technologies should be evaluated. Lighting (LEDs) had been evaluated in a previous Indiana Smart $aver Prescriptive evaluation. Linear fluorescent evaluations were performed in the Indiana Energizing Indiana EM&V activities.

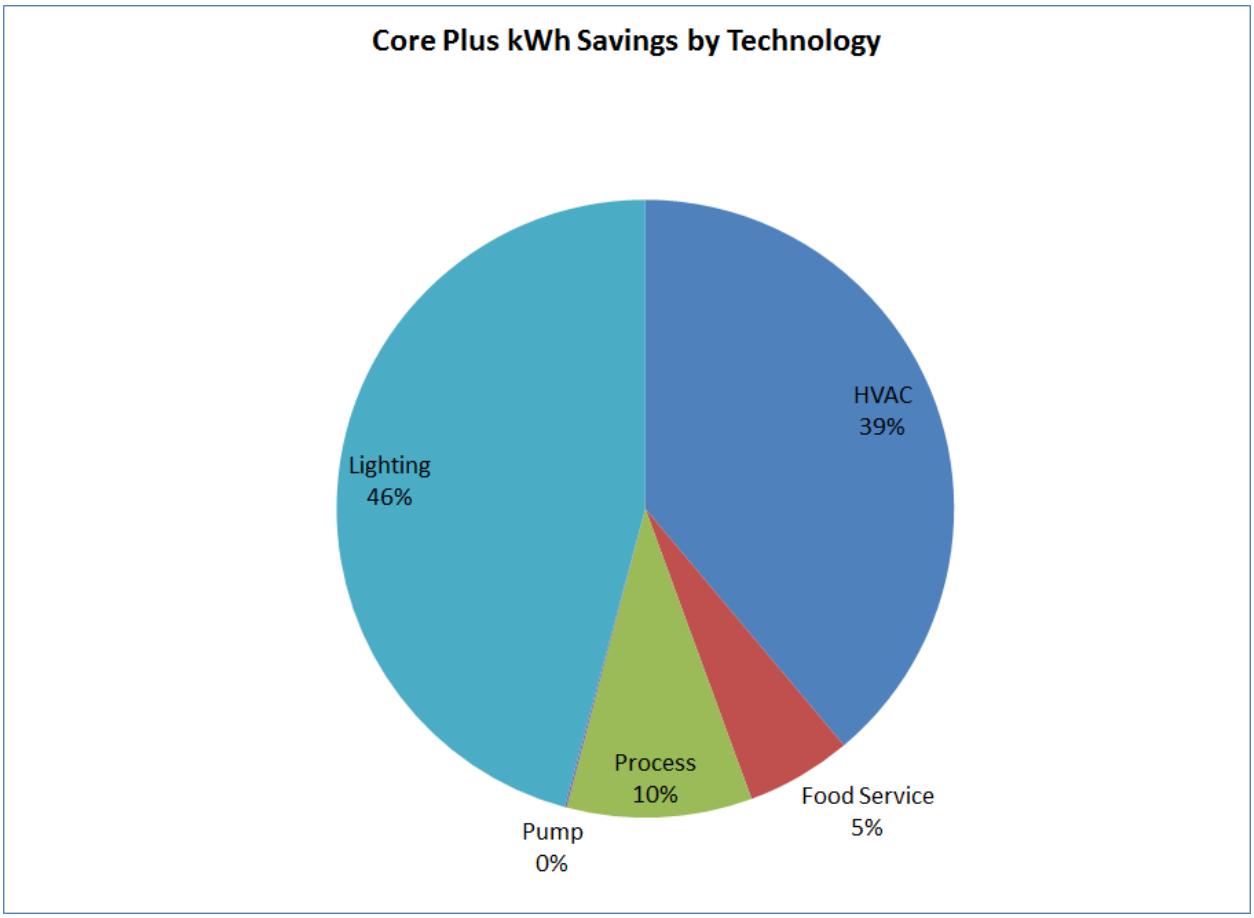


Figure 1. Smart $aver Prescriptive kWh Savings by Technology for Evaluation Period

Figure 2 shows for HVAC measures that air-cooled chiller retrofits and guestroom controls were significant contributors. The air- and water-cooled chiller tune-up measure had been determined to have high freeridership and was therefore removed from impact evaluation consideration.

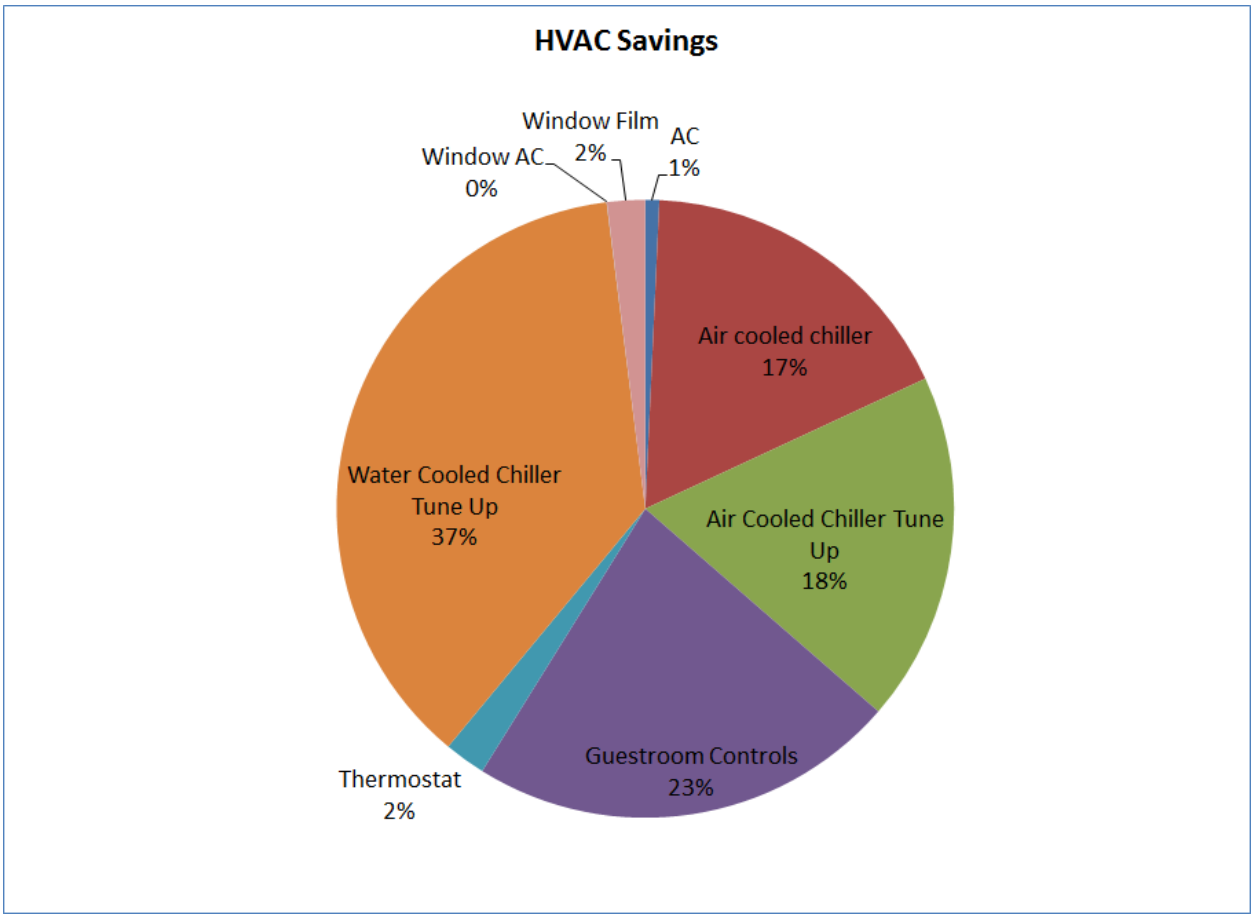


Figure 2. Breakdown of HVAC kWh Savings Shows Air-Cooled Chillers and Guestroom Controls Contributions

For the three measures – air-cooled chiller retrofits, guestroom controls, and variable frequency drive (VFD) retrofits for air compressors – Table 1 summarizes the kWh savings and the number of paid incentives by measure.

Table 1. Measure Summary for Evaluation Period

Group	kWh	N Paid Incentives
Air-cooled chiller	1,247,712	11
Guestroom Controls	1,616,249	34
VFD Air Compressor	1,793,665	20
Total	**4,657,626**	**65**

Process Measure: VFD Air Compressors

Duke Energy Savings Calculation Methodology

For the VFD air compressor measure, there were 20 rebates reported. Each of the rebates was assigned an annual energy savings of 629 kWh per nominal horsepower. The savings were calculated using a typical compressor curve shown in Figure 3, assuming 4,160 annual operating hours at 75% partial loading. Savings were normalized per compressor hp.

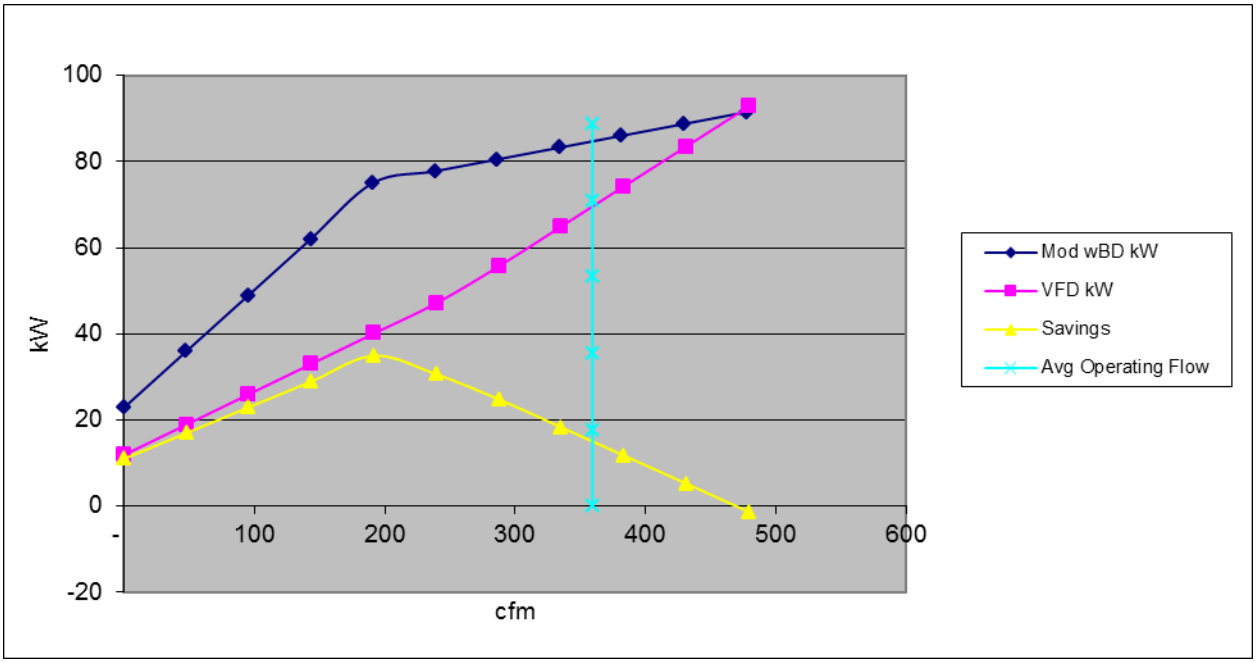


Figure 3. FES Part Load Curves[4]

The shape of the curves shown in Figure 3 is similar to ones published by air compressor manufacturer, Sullair, shown in Figure 4. Data collection of air compressors on previous Duke Energy evaluation projects performed by Noresco confirmed the assumption of 75% average loading for compressor plants.

[4] Source document for FES Part Load Curves is FES-I6 VSD Air Compressors Duke Midwest 09012011.xls

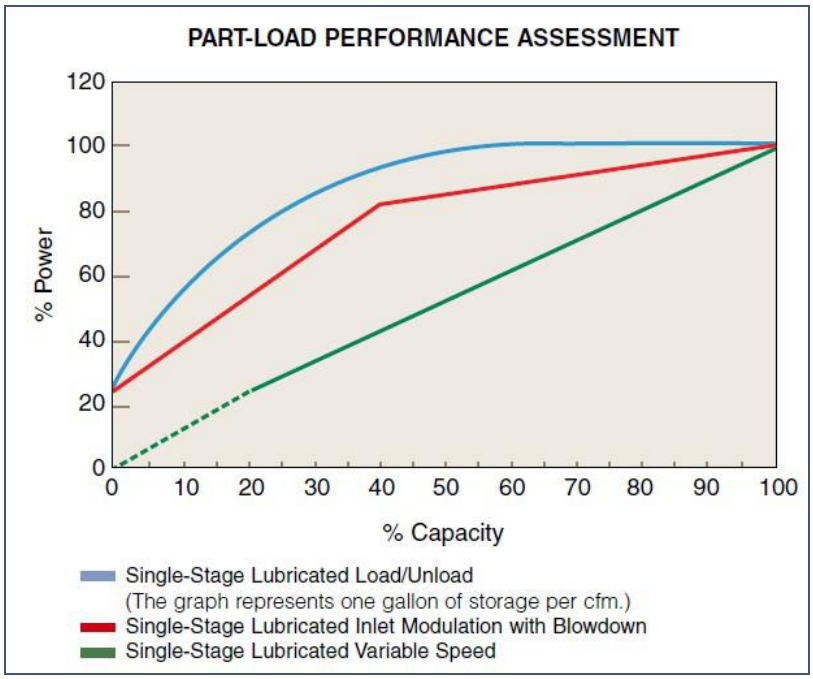


Figure 4. Sullair Part Load Curves[5]

The energy savings factor was calculated using the part load equations from the FES curves at a part load of 75%. The calculated savings factor was compared to the savings factor listed in the Indiana Technical Resource Manual (TRM). The calculated value was more conservative than the listing in the Indiana TRM. The energy savings factors for Load/No Load and Variable Displacement are also listed in Table 2.

Table 2. Energy Savings Factor Comparison

Control Type	Load/No Load	Variable Displacement	Variable Speed Drive
Indiana TRM	10%	17%	26%
FES Curve at 75% Part Load	3%	11%	18%

The energy savings factor was then used to calculate all of the participant rebates based on the annual operating hours reported on the rebate applications shown in Table 3. Most compressors were operated more than 8,000 hours a year, well above the 4,160 hours used to determine the Duke Energy rebate, resulting in a large difference in the calculations of energy saved. As a result, the Duke Energy program would under-report energy savings by 1,401,193 kWh, a realization rate of 178%. A summary list of the 20 participants is referenced in *Appendix A: VFD Air Compressor Application Summary Table*.

The peak demand could be reduced as well, since a variable speed drive provides a performance improvement when a compressor is operating at less than peak capacity. However, the program applications and calculations assume that average peak capacity and average capacity are the same, and there is no reported data or application information to confirm any reductions in

[5] Source document for Sullair Part Load Curves is http://www.sullairinfo.com/Downloads/LIT_S-energy_LS14EN.pdf

design airflow or design capacity. The FES study assumed the full load was 100% of the compressor capacity and the average peak load and average load to be 75% of the compressor capacity. The replacement compressors are expected to be sized correctly to see a peak load at or near 100%.

The energy savings factor of 18% was calculated from the FES curve at 75% average load and used in the following equation to calculate the annual kWh TRM. Then the calculated value was divided by the tracking data value provided by Duke Energy to determine the realization rate.

Annual kWh Savings $= BHP * 0.746 / \eta_{motor} \times HOURS \times ESF$

Table 3. Savings Based on TRM and Reported Hours

App ID	ηmotor	Revised kWh savings from desk review	Savings from Duke Energy Tracking data	kWh savings Difference	Realization Rate
116569	94.5%	14,565	15,728	-1,163	93%
118145	94.5%	248,951	125,827	123,124	198%
118620	94.5%	124,475	62,914	61,561	198%
119511	90.0%	26,140	12,583	13,557	208%
219	94.5%	67,033	33,973	33,060	197%
PSI13-1406347	95.4%	168,906	94,370	74,536	179%
PSI13-1448544	95.2%	121,868	62,914	58,954	194%
PSI13-1406627	94.5%	80,142	59,139	21,003	136%
PSI13-1303983	95.5%	369,516	188,741	180,775	196%
PSI13-1304085	93.5%	14,412	18,874	-4,462	76%
PSI13-1462882	94%	284,532	143,443	141,089	198%
PSI13-1546020	94.5%	53,819	47,185	6,634	114%
PSI13-1544706	96.1%	223,567	125,827	97,740	178%
PSI13-1548137	94.2%	89,092	78,642	10,450	113%
PSI13-1542363	95.7%	245,829	125,827	120,002	195%
PSI13-1547084	94.5%	93,357	47,185	46,172	198%
PSI13-1580028	93.6%	34,431	47,185	-12,754	73%
PSI14-1637621	95.3%	394,527	220,197	174,330	179%
PSI14-1636944	94.9%	169,796	94,370	75,426	180%
PSI14-1639753	95.4%	369,903	188,741	181,162	196%
Total		**3,194,858**	**1,793,665**	1,401,193	**178%**

The Duke Energy calculations based on the FES workpapers estimated savings at 629 kWh per motor hp. Applying the realization rate from Table 3 above provides the following evaluated savings per hp:

Evaluated kWh/hp = 629 x 1.78
= 1120

Air-Cooled Chillers

Savings Calculation Approaches

For this measure, the Duke Energy Measure Savings Database applied a building energy simulation approach whereby the full-load and part-load efficiency ratings for the chiller are used to define DOE-2 model inputs for full-load and part-load efficiency. The simulation models are used to estimate per unit electricity savings (kWh/ton), using an annual simulation across a variety of full load and part load efficiency values, including the code (ASHRAE 90.1) baseline and several increments of full load and part load efficiency that exceed code. The energy savings were estimated in advance by running a set of annual energy simulations for a single building prototype (office). Since details about the HVAC system are not gathered for the application, the savings estimate is derived from a weighted average of three different HVAC system types: a CAV (constant air volume) system with no economizer, a CAV (constant air volume) system with economizer, and a VAV (variable air volume) system with an airside economizer. Equal weights were applied to the three system types, so the energy savings is simply an average of the three runs that correspond to the same chiller efficiency.

TRM Savings Estimate

The TRM savings calculation methodology uses equivalent full load hours (EFLH), dependent on building type and climate, and the part-load efficiency rating (IPLV) to determine electricity savings. Demand savings are calculated using full-load efficiency (coefficient of performance - COP), equipment capacity, and a coincidence factor of 0.74.

Annual kWh Savings = TONS * $((3.516/IPLV_{base}) – (3.516/IPLV_{ee}))$ * EFLH
Summer Coincident Peak kW Savings = TONS * $((3.516/COP_{base}) – (3.516/COP_{ee}))$ * CF

Savings estimates using the TRM approach are much higher than those estimated using simulation. As an example, using the information from the first site listed in Table 5 (App ID 117742) shown on the next page, the savings calculation of 640 kWh/ton is based on an estimated equivalent full load hours for cooling of 1,723 (from the Indiana TRM Manual). The calculation follows:

kWh/ton = $((3.516/IPLV_{base}) – (3.516/IPLV_{ee}))$ * EFLH

IPLV base = 3.05 COP
IPLV ee = .779 kW/ton = 4.5 COP
kWh/ton = (3.516/3.05 - 3.516/4.5) * 1723 = 640 kWh/ton

It is important to note that an EFLH number that better matches the building type for schools and universities would produce a lower savings estimate. Table 4 below shows TRM manual assumptions for equivalent full load hours by building type and HVAC secondary system configuration (CAV no econ, CAV econ, VAV econ). The table indicates, for example, that university buildings are expected to have a 30% lower equivalent run time than large offices (see data highlighted in bold).

Table 4. Indiana TRM EFLH Assumptions for Chiller Upgrades

Building	CAV no econ	CAV econ	VAV econ	Avg.
Community College	1,314	966	736	1,005
Hotel	3,999	3,786	3,732	3,839
Large Retail	2,065	1,289	1,065	1,473
University	1,927	727	950	**1,201**
Large Office	3,302	876	992	**1,723**
High School	1,039	558	426	674
Hospital	3,777	2,182	1,554	2,504

Because of the expected operating difference, an additional set of energy simulations were developed and run to estimate measure savings for university buildings. The results of these simulations were a set of associated energy savings levels (kWh/ton) for different combinations of full-load efficiency and part-load efficiency, similar to those used to develop the savings estimates for office buildings.

Results and Realization Rate

A comparison of reported electricity savings (kWh/ton) and the estimated savings is shown in Table 5 below for the eleven chiller upgrade rebate applications. The full-load efficiency (COP), in units of kW/ton, and part-load efficiency in kW/ton are provided by the applicants and match rated information. An annual simulation of an office building prototype and a university building prototype using these efficiency levels generates savings estimates that are normalized per nominal ton. The project installed cooling tons for each project is also listed in Table 5.

Table 5. Air-Cooled Chiller Measure

App ID	Building Type	Full-Load Eff kW/ton	Part-Load Eff kW/ton	Project Tons	Reported Savings kWh/ton	Estimated Savings kWh/ton	Reported Savings MWh	Estimated Savings MWh
117742	University	1.142	0.779	111	350.1	319.5	38.9	35.5
117967	University	1.061	0.851	116	350.1	291.8	40.6	33.8
118369	University	1.112	0.796	37	350.1	329.6	13.0	12.2
118786	Office	1.224	0.857	304	211.3	280.0	64.2	85.1
119454	University	1.212	0.774	86	381.6	298.8	32.8	25.7
119860	Office	1.212	0.816	3,936	211.3	341.0	831.7	1342.1
PSI13-1494174	University	1.153	0.839	188	211.3	279.0	39.8	52.5
PSI13-1500164	University	1.15	0.839	376	211.3	280.2	79.5	105.5
PSI13-1551217	University	1.142	0.789	140	350.1	313.0	49.0	43.8
PSI13-1547199	University	1.18	0.787	69	381.6	302.1	26.3	20.8
PSI13-1609702	Office	.81	0.56	50	636.0	636.0	31.8	31.8

The evaluated savings were estimated by a two-way interpolation of energy simulation results for a given building, COP and IPLV. As an example, the reported savings for application ID 118786 site were 211.3 kWh/ton. The reported full-load efficiency (COP) and part-load

efficiency were compared against the tabulated simulation results. A two-way interpolation was then performed, starting first by interpolating against IPLV, with a fixed COP, for the two bounding COP values in the table. Next, the savings were interpolated against COP. The example calculation below shows interpolated results for a screw chiller, with reported COP of 2.87 and IPLV of 4.10.

Table 6. Interpolation against Tabulated Energy Savings Estimates

COP	IPLV	Savings kWh/ton	IPLV Interpolation
2.86	3.97	211.3	
2.86	4.33	381.6	274.6
3.08	4.00	350.1	
3.08	5.22	499.3	362.8

IPLV interpolation 1:

kWh/ton = 211.3 + (4.10 – 3.97)/(4.33 - 3.97)*(381.6 – 211.3) = 274.6

IPLV interpolation 2:

kWh/ton = 350.1 + (4.10 – 4.00)/(5.22 - 4.00)*(350.1 – 499.3) = 362.8

COP interpolation:

kWh/ton = 274.6 + (2.87 – 2.86)/(3.08 – 2.86)*(362.8 – 274.6) = 280.0

The combined COP and IPLV interpolation resulted in an estimated savings of 280.0 kWh/ton, somewhat higher than the reported estimate of 211.3 kWh/ton. Since the reported savings matched the Duke Energy Measure Savings Database savings estimates without interpolation, it appears that the closest value to the installed system COP and IPLV was assigned rather than interpolating the savings based on the actual COP and IPLV.

Table 7 shows how the unit savings varies with system type, for a given full-load and part-load efficiency level. The per unit savings are much lower for a VAV reheat system, since the baseline system uses less energy than a comparable CAV reheat system.

The energy savings used in the reported results use an average savings of the three types of HVAC distribution systems. The average energy saving results from the three HVAC secondary system types (last column, in bold) is used in the program savings estimate.

Table 7. Unit Savings (kWh/ton) by System Type

	Estimated FES Energy Savings Example, kWh/ton			
Case	**CAV Reheat No Econ**	**CAV Reheat**	**VAV Reheat**	**Average (used in estimates)**
Screw, 1.14 kW/ton FLV, 0.88 FLV	467.9	318.2	264.3	**350.1**
Screw, 1.05 kW/ton FLV, 0.62 PLV	818.7	595.2	494.2	**636.0**

For the 11 air-cooled chiller projects, the reported savings was 1,247,712 kWh, and the revised projected savings using the expanded set of prototypes and interpolating the unit energy savings according to the installed COP and IPLV is 1,923,385 kWh, or a realization rate of 154%. The reported non-coincident peak kW savings was 572 kW, and the revised savings are 932 kW, or a realization rate of 1.63. Since an exact match of the savings was obtained by using equal weights for the different system types (CAV reheat no econ, CAV reheat econ, VAV reheat), the same assumption is used for the revised estimates in lieu of site-specific data on HVAC system type.

While the reduced cooling full-load hours for the University building type tended to reduce the savings, interpolating results based on the actual installed COP and IPLV increased the savings relative to the program estimates. The overall effect was to increase savings relative to the program estimates.

Recommendations

It should be noted that there are several assumptions made that significantly impact the projected savings.

1. Interpolate savings – The application of the savings estimates from the Duke Energy Database to each project used the closest value to the installed COP/IPLV combination with the lowest savings. This provided a conservative estimate of chiller savings. We recommend interpolating the results from the Duke Energy Database according to the actual installed COP and IPLV, as described above to eliminate this bias.

2. Building Type – All results in the tracking system use the same large office building prototype. Several of the projects that applied for incentives are schools and universities, which have different operating hours, building envelope and occupancy characteristics than office buildings. Savings estimates for university buildings were developed for this evaluation. For future programs, it is recommended that a few additional building prototypes be simulated that cover a wider range of building types sites (Large Retail, High School, Community College, Hospital and so on).

3. HVAC System type – For the HVAC system type, the current calculation uses a weighted average for different system types (Constant volume reheat system without air-side economizer; Constant volume reheat system with air-side economizer; Variable air

volume system with airside economizer). The choice of HVAC system type has a significant impact on the results. The recommendation is to either develop custom weights for the different types, based on available data[6], or gather this information as part of the application process and use it to refine the savings estimates.

Although the evaluation looked at a subset of the full range of chiller type and efficiency measures eligible for the Duke Energy program, the realization rate from this evaluation can be used to adjust savings for all eligible chillers, whether they were rebated in this program cycle or not. Note, the realization rate is applicable to non-interpolated ex-ante savings values from the Large Office model. If the program includes additional building types and interpolates the values as recommended above, then the interpolated values by building type should be used directly.

[6] Secondary system type saturation data from the Commercial Building Energy Consumption Survey (CBECS), or primary data from Duke Energy customer surveys can be used to define HVAC system type saturations. Primary HVAC system type data collected on the rebate application are preferable.

Guestroom Controls

Duke Energy Savings Calculation Methodology

The Duke Energy Indiana savings methodology applied estimates of equivalent full load hours for cooling and for heating, and assumed efficiencies, to calculate electricity savings for 34 guestroom control applications. The following assumptions were used:

1. Operating Hours: fixed at 948 EFLH for cooling and 2,152 EFLH for heating
2. EER (energy efficiency ratio) of 11.7 for cooling and HSPF (heating season performance factor) of 11.26 for heating
3. A 20% energy savings factor

These assumptions result in an estimated savings level of 194.5 kWh/ton for cooling and 458.6 kWh/ton for heating, for a total of 653 kWh/ton savings.

Demand reduction was estimated using the same energy savings factor of 20%, resulting in an estimated demand reduction of 0.205 kW/ton.

The Duke Energy savings calculation results in an energy savings level that is uniform across the applications (653 kWh/ton), since the information used in the savings calculation does not vary by site. Thirty-three (33) of the 34 sites used the Smart HVAC Control Switch (model MWS-240) manufactured by Universal Smart Electric Corporation and sold by American Power Solutions. Through communication with the Project Manager at American Power Solutions, the following information was determined:

1. All sites use PTAC (packaged terminal air conditioner) systems for heating and cooling (no fan coils or central equipment).
2. The systems are configured with an 80 degrees F setback in cooling and a 60 degrees F setback for heating, when unoccupied.
3. The systems are occupancy-based, and do not control any receptacles or lighting.

The MWS-240 specifications are shown in *Appendix B: MWS-240 Specifications*.

One site used the Amana DigiSmart DD01E control switch. The specifications for this device are shown in *Appendix C: Amana DigiSmart DD01E Specifications*.

Savings Calculation Methodology

The savings calculation methodology for this measure is summarized below:

For Air-Source Heat Pumps:

- Energy Savings-Cooling (kWh) = (Btu/Hc1000) X 1/EERb X EFLHc X ESF
- Energy Savings-Heating (kWh) = Btu/Hh1000 X 1/EERb X EFLHh X ESF
- Demand Savings (kW) = (Btu/Hc1000) X 1/EERb X ESF X CF

For Gas Heat (Cooling Savings Only):

- Energy Savings (kWh) = (Btu/H1000) X 1/EERb X EFLH X ESF
- Demand Savings (kW) = (Btu/H1000) X 1/EERb X ESF X CF

All of the sites participating in the Prescriptive rebate program used PTHPs (packaged terminal heat pumps). The energy savings from the guestroom controls can be calculated by:

Energy Savings = Energy Savings Cooling + Energy Savings Heating

Energy Savings = ESF x (Btu/Hc1000 x 1/EERb,c x EFLHc + Btu/Hh1000 x 1/EERb,h x EFLHh)

Where Btu/Hc1000 and Btu/Hh1000 are the rated cooling and heating capacities, EERb,c is the rated efficiency in cooling mode, EERb,h is the rated efficiency in heating mode, and EFLHc and EFLHh are the equivalent full load operating hours for cooling and equivalent full load operating hours for heating.

The realization rate is the ratio of the realized energy savings, estimated from available project data, to the claimed energy savings level.

$$\mathrm{Re}\,alizatonRate = \frac{\text{ESFr x (Btu/Hc1000 x 1/EERb, c x EFLHc + Btu/Hh1000 x 1/EERb, h x EFLHh)}}{\text{ESFc x (Btu/Hc1000 x 1/EERb, c x EFLHc + Btu/Hh1000 x 1/EERb, h x EFLHh)}}$$

Since in the equation for Energy Savings above, the values for equivalent full load hours in cooling and heating (EFLHc, EFLHh), the cooling and heating capacity (Btu/Hc1000, Btu/Hh1000) and the rated efficiency (EERb) are equal in both cases, the equation for realization rate reduces to:

Realization Rate = ESFr / ESFc

Where ESFr is the realized energy savings level from this report, and ESFc is the claimed energy savings level for the projects at the time of application.

FES used a combination of data from the Indiana and Ohio TRMs to develop the workpaper for this measure. An energy savings factor (ESF) of 20% was assumed, consistent with the 2009 Ohio TRM. Equivalent full load hours for cooling and heating are taken from the Indiana TRM; EERb is the rated full-load efficiency, and the coincidence factor (CF) is also taken from the Indiana TRM Manual.

Results and Recommendations

The savings estimate for this review applies the results of actual performance monitoring of multiple hotel rooms at different sites with guestroom controls for a study conducted in

California.[7] The controls settings for the guestroom controls will have a large impact on realized energy savings. Some controls will only setback the heating and cooling setpoints of the HVAC unit; others will also control some hardwired lighting and receptacles. Some controls have a programmable thermostat setback level; a setback of at least 5 degrees F is recommended. A study that reviewed performance of guestroom controls at three California hotels[8] using monitored data showed that the demand reduction dropped from 20% with on/off controls (disabling heating and cooling) to a 12% reduction when the system thermostats were only setback 2 degrees F. The same study showed a variation in HVAC savings ranging from 6.5% for 2 degrees F setback to a maximum savings of 24%, when on/off controls were used.

Since a 10 degrees F setback is much closer to fully disabling heating and cooling when unoccupied, the estimated Energy Savings Factor (ESF) is determined by assuming that the 10 degrees F setback provides 80% of the benefit of on/off controls, over the smaller setback. The same interpolation approach of the PG&E (Pacific Gas & Electric) study for demand savings was used to estimate a demand savings factor (DSF in equation below).

$$ESF = SL1 + ControlEffectiveness \times (SL2 - SL1)$$

Where SL1 is the savings level assuming a minimal setback, SL2 is the ideal HVAC savings level, assuming on/off control (heating and cooling entirely disabled when room is unoccupied), and Control Effectiveness is a measure of the amount of setback, normalized by the low and high savings levels in SL1 and SL2. For example, if the room used a 2 degrees F (minimal) setback matching the savings in SL1, the value would be 0. If the room used an on/off control (the most efficient) control strategy, the savings level would be 1.

For this analysis, since the 10 degrees F setback is a deep setback that closely resembles the on/off control for guestroom controls, the value for the control effectiveness is set at 80%. The savings levels for the 2 degrees F setback and on/off control (SL1 and SL2) are derived from the monitored study (Arent, Frey 2009).

$$ESF = 6.5\% + 0.80 \times (24\%-6.5\%) = 20.5\%$$
$$DSF = 12\% + 0.80 \times (20\% - 12\%) = 18.4\%$$

The realization rate for the sites is calculated by applying the same equipment runtime (EFLH) to the simulation, and same efficiency levels. The resulting realization rate is calculated as follows:

$$Realization\ Rate = ESFr / ESFc = 20.5\% / 20\% = 103\%.$$

[7] Arent, John and Donald Frey, 2009. Application Assessment Report #0801: Card-Key Guestroom Controls Study, PG&E Emerging Technologies Program, November 2009.
[8] Ibid.

Table 8. Guestroom Control Unit Savings Calculation

	EERc	ESF	EFLHc	kW/ton cooling	EERh (HSPF)	ESF	EFLHh	Kwh/ton heating	Total
Claimed	11.7	20%	948	194.46	11.26	20%	2152	458.57	653.03
Estimated	11.7	20.5%	948	199.3	11.26	20.5%	2152	470.0	669.4

The total installed capacity for all projects with guestroom controls is 2,475 tons. Across all projects, the estimated savings is 1,657 MWh, slightly higher than the estimate of 1,616 MWh used in the program.

Guestroom controls provide substantial heating and cooling energy savings due to variable occupancy levels. For a more precise savings estimate, it is recommended that the following minimum information be collected for prescriptive applications.

1. HVAC System Type: The savings estimate is based on a heat pump for the building. Many buildings *may* have either packaged terminal air conditioning units (PTACs) with electric resistance heat, packaged terminal heat pump units (PTHPs) or four-pipe fan coils with central plants for medium to large hotels. Savings may differ for these system types based on the heating fuel type and heating and cooling equipment efficiency. Systems that use gas heating (a central plant with gas boiler) will have much lower electricity savings, and will have some gas savings. Based on the equivalent full load hour assumptions, heating electricity savings comprise about 70% of total electricity savings.
2. Equipment Efficiency Ratings: A fixed efficiency of PTHPs was assumed for the project. It is likely that there might be some variation in efficiency levels across the sites, given that different units may have different ages.
3. Control Scheme: The degree of setback of cooling and heating setpoints, and whether or not cooling and heating is disabled when unoccupied, greatly affects the savings levels. While with some devices the setback may be adjustable, it is likely that the setback defined at the time of installation will be used.
4. Devices Controlled: These types of systems also have capability to control receptacles and/or lights, for additional savings. The devices used for the Duke Energy Indiana projects only control HVAC.
5. The ESF used in the analysis is based on secondary research conducted by Noresco for guestroom controls in California. If this measure becomes a larger portion of the Duke Energy portfolio, we recommend conducting primary research using field measurement and verification (M&V) activities on systems in Indiana.

Process Evaluation: Management Interviews

Smart $aver Prescriptive is jointly managed by two Duke Energy product and services managers, who share decision-making for all aspects of the program. The Smart $aver program is supported by a wider team of company experts in market strategy and outreach, by the Large Account Managers, and by other product and services managers who are responsible for implementing components of the program.

The processes and operations of the Smart $aver Prescriptive program have been documented in the recent Indiana Smart $aver evaluation on lighting measures (TecMarket Works, 2014) and will not be discussed in detail here. For this study on Smart $aver HVAC and Process measures, the evaluations team conducted brief interviews with the two program managers and with the manager of the outreach team in October in order to capture any changes that have been made to the program.

Program status. The program managers reported that they have continued to make progress on initiatives reported in the earlier report. The customer participation database was on course to be launched in Q4 of 2014, with the online application to be available in Q1 of 2015. The chiller tune-up initiative was removed from the program offerings in July 2014 due to concerns that it may not be driving customers who would not otherwise conduct the chiller tune-ups. The program managers indicate the measure may be re-considered at a future time. Application processing has also improved, with the program managers reporting that they are able to turn around completed applications within a week.

Business Energy Advisors. Duke Energy has continued to refine their strategy for serving their small- to medium-business (SMB) customers. Duke Energy had previously identified this as a customer segment with many energy efficiency opportunities. Duke Energy has hired four Business Energy Advisors who are intended to be the face of Duke Energy (from a products and services standpoint) to the SMB customers. These SMB customers are those who have a single account, or single meter, with over $60,000 of energy costs per year, who are not assigned to a large account manager. The Business Energy Advisors help these customers to understand their energy usage and to drive energy efficiency projects using the Smart $aver Prescriptive program. The Business Energy Advisors are assigned a portfolio of SMB customers, and at the time of the interviews had already contacted over 400 customers since this service began in September. The Business Energy Advisor model had been used successfully by Duke Energy Progress in the past.

Trade Ally Outreach. The program managers also report that they are borrowing other practices from Duke Energy Progress, and as one example, have begun to require that trade allies that receive incentive checks (at the request of the customer) sign agreements about how they would present the Smart $aver program and their relationship with Duke Energy to the customers. They are also considering requiring all trade allies to sign agreements, even if the customer receives the incentive checks. The trade ally outreach representatives have also developed and delivered to the trade allies a new energy efficiency sales training workshop. One trade ally outreach representative reports, “This was something we wanted to do for a while and it was hugely successful.”

The Smart $aver program managers have assumed responsibility for the trade ally outreach strategy from the segment managers, and have been working closely with the trade ally outreach representatives to implement the strategy. Duke Energy crafted outreach plans for several technologies they identified as having high potential. These plans are delineated in "strategy templates" that specify the activities, geographic region, launch and end dates, and metrics for tracking performance. A brief review of these templates show that the activities consist mainly of communications and outreach (e.g., send email blast, work with associations, hold regional seminars), and in a couple of cases, using market intelligence on construction projects to help locate opportunities. The metrics include number of applications received in the targeted technology areas, number of new trade allies contacted, and total number of trade allies contacted. The strategy templates also provide space for the trade ally representatives in each region to record any comments they hear from trade allies, and to record the results of their strategy-driven outreach efforts.

Duke Energy has also operationalized their strategy for moving new trade allies through progressively more active stages of participation, until the trade ally reaches "Partner" status. The tactics for moving trade allies to Partner status include identifying any trade allies that have had several applications that were either incomplete or rejected, and educating them on how to fill out an accurate and complete application. Another tactic is to visit the top 10 Partners only a few times a quarter.

> FINDING: While all the strategy templates contain metrics, the results do not seem to be tied to the metrics. In all the strategy templates, the section for tracking Results only provides guidelines to document "quantifiable facts that can be tracked over time to prove success."
>
> RECOMMENDATION: If Duke Energy has not already done so, the Results should be tied to the Metrics in the strategy template, which in turn should be tied to the Objectives. This will reduce confusion on how to describe Results. Specifically, the Results section of these templates could present a graph of the metrics values over time.
>
> RECOMMENDATION: There may be value in tracking the state of trade ally awareness of the program separately from their participation. This would allow Duke Energy to track the number of trade allies who need introductory information about Smart $aver, versus those who may not be participating due to lack of time, versus those who may not be participating based upon specific market barriers. This high-level view of the trade ally population would allow Duke Energy to develop outreach that is more specific to each vendor's specific barriers for not participating.

Trade Ally Interviews

The evaluation team interviewed eight trade allies who helped customers in Indiana apply for HVAC and Process measures, randomly selected from the list of HVAC and Process trade allies who signed up with Duke Energy to be listed on their website. These trade allies held company positions that ranged from President to sales staff, with anywhere from 3 to 56 years of experience in the industry. Half of these trade allies also offered lighting measures to customers, but they were asked to restrict their comments to just HVAC and Process measures. While the size of the trade ally sample does not allow us to generalize their comments to the larger trade ally population, they are useful for understanding the range of the trade allies' experiences and opinions.

Five of these trade allies could not recall where they first learned of the Smart $aver program because they were long-term trade allies. Two reported that they first learned about Smart $aver through Energizing Indiana, a statewide energy efficiency incentive program that ran for two years and was due to close in December of 2014. One trade ally learned about Smart $aver from his boss. Only three of the trade allies had attended a Smart $aver presentation, due to their long involvement with Duke Energy incentives.

Trade allies were asked to describe how they raised the Smart $aver incentive to prospective clients. In all cases, trade allies indicated they raised Smart $aver when discussing costs and return on investment. These trade allies were asked to estimate how many of their prospective customers already had heard of the Smart $aver program, and six of the seven trade allies who responded said that at least 50% were already aware. The remaining trade ally estimated 30%, but admitted he could not be sure because he worked with multiple utilities. The trade allies were also asked what percentage of their projects with Duke Energy customers included a measure that received a Smart $aver incentive. Here, the responses ranged from 10% to 100%, with a mean of 48%. Many trade allies work with multiple utilities, and report that they make it part of their service to find all eligible rebates and incentives for their customer.

No customer complaints. Only one of the trade allies report any problems with the Smart $aver program, saying he confused it with Energizing Indiana. Another trade ally reported that one customer said the application paperwork was cumbersome.

Few recommendations for increasing participation from trade allies. When asked how Duke Energy could increase participation from trade allies, there were very few suggestions: Two trade allies suggested more marketing, one suggested streamlining the application process (but could not name any specific way to do so), one wanted Duke Energy to identify leads, and the same trade ally mentioned earlier said that clearing up the confusion with Energizing Indiana would help.

Role of Smart $aver incentives in the market. The trade allies were evenly split on whether the incentives for HVAC and Process measures were high enough to motivate customers to purchase the higher efficiency equipment. One trade ally mentioned that another utility offered $100 per HP, and said that Duke Energy's incentive was not high enough to pay for the incremental cost of a high efficiency system. This suggests that Duke Energy may wish to

include in their trade ally outreach materials more reinforcement about considering life cycle costs over initial costs. Another trade ally who said that the incentive was not high enough said that he would "*never say the rebate by itself was a game-changer. I would keep it as encouragement; while I never saw movement, it still provides value*."

When asked if they would still offer customers high efficiency equipment if there were no Smart $aver incentive, all eight trade allies responded that they would. One said, *"[Energy efficiency] is what we do*." Another said, "*Yes, we were doing that before [learning about Smart $aver]: we lay out the cost savings, the average cost of energy, and show a ROI within three years*." A third trade ally commented, "*the margin is better on high efficiency equipment*." All trade allies reported that they thought the Smart $aver program was still needed on the marketplace.

Most trade allies felt the applications were straightforward, simple, and easy. One trade ally suggested an online application would make it easier than having to email the application to Duke Energy. Another trade ally was also a manufacturer, and he said because his company does not itemize equipment separately from the other services in the bid, his company was concerned that breaking out the equipment costs would reveal his company's pricing strategy, and "this gives customers a hunting license."

None of the trade allies said they used any information or technical assistance from Duke Energy; only one said that he directed customers to the Duke Energy Smart $aver website.

Trade allies were also asked if any new measures should be added to the Smart $aver Prescriptive program. Only four had suggestions that included dryers, vacuum systems, soft starters for VFDs, larger sizes for VFDs, and to re-continue the discontinued thermal storage (but the trade ally admitted he was not sure whether it had indeed been discontinued.)

Overall, the eight trade allies rated the Smart $aver program highly on a scale of 0 (extremely dissatisfied) to 10 (extremely satisfied), with seven of eight giving a rating of 8 or above, and one giving a rating of 7. This last trade ally said he would be more satisfied if Smart $aver expanded the range of VFD sizes. Similarly, the trade allies rated Duke Energy well, with six of eight giving a rating of 8 or above. One trade ally gave a rating of 7, saying he had trouble finding the right person to talk to when trying to find out what a customer's rate was, and the last trade ally gave a rating of 4, saying he was dissatisfied with to time Duke Energy takes to respond to homeowners who request service, saying it now takes a week whereas in the past it took one day. This same trade ally rated his satisfaction with Smart $aver as "8".

Participant Surveys

This survey focused on customers whose organizations, according to program tracking records, received a rebate from Duke Energy for the purchase of new HVAC/Chiller or Process measures. Out of 37 organizations contacted in Indiana, 16 completed the survey for a total response rate of 43.2% (16 out of 37). Thirteen surveyed respondents received incentives for HVAC/Chiller installations and three received incentives for Process (air compressor) installations.

Non-Residential Smart $aver Prescriptive Equipment Installations

The customer data provided by Duke Energy specified the equipment installation which resulted in a Smart $aver rebate for respondents, which is characterized in Table 9. The largest number of surveyed participants installed HVAC measures (43.8% or 7 out of 16), with six participants (37.5%) having Chiller measures performed and three (18.8%) installing air compressors (Process measures). Some survey participants' organizations installed multiple types of measures at multiple locations.

Table 9. Equipment Installations That Received Smart $aver Rebates (n=16)

	Indiana (count)	Indiana (percent)
HVAC: Guestroom energy management controls	3	18.8%
HVAC: Setback / programmable thermostats	3	18.8%
HVAC: Window film	1	6.3%
Chillers: tune-up	4	25.0%
Chillers: thermostat	1	6.3%
Chillers: air-cooled scroll/screw chiller	1	6.3%
Process: Air compressor	2	12.5%
Process: Air compressor equipped with VFD	1	6.3%

Columns total to more than 100% because customers could have more than one type of measure installed.

Table 10 shows the range and distribution of incentives received by survey participants. Total rewards for all installations at all locations by these customers ranged from $45 to $37,239, with a mean of $6,714 and a median of $4,183. These sixteen survey participants received a combined 34 rebates (an average of about two per respondent), with a range of one to nine rebates received per organization.

The three surveyed participants with rebates for Process measures (air compressors) received an average of $9,450 in rewards per organization and all received one rebate apiece, while the 13 participants with HVAC /Chiller measures received an average total reward of $6,083 and there were a total of 31 rebates distributed across these 13 organizations. The median reward totals are $5,625 for participants with Process measures and $3,215 for HVAC/Chiller measures.

Table 10. Amount of Smart $aver Incentive Rebate (n=16)

	Indiana (count)	Indiana (percent)
$500 or less	4	25.0%
$501 to $4,000	4	25.0%
$4,001 to $7,999	5	31.3%
$8,000 or more	3	18.8%
Minimum rebate	$45	
Maximum rebate	$37,239	
Median rebate	$4,183	
Average rebate	$6,714	

Participation in the Non-Residential Smart $aver Program

Table 11 shows that all respondents were aware that their companies participated in the Smart $aver program (aided awareness 100%), all respondents confirmed that they are employees of the participant companies, and all respondents confirmed that their companies purchased Process or HVAC/Chiller measures for which they received a Smart $aver rebate.

Table 11. Awareness of the Non-Residential Smart $aver Program (n=16)

	Indiana (count)	Indiana (percent)
Unaided awareness	16	100.0%
Aided awareness	16	100.0%
Confirmed employee of participant company	16	100.0%
Confirmed rebate for measure(s)	16	100.0%

The most common way that non-lighting participants learning about the Non-Residential Smart $aver program is from Duke Energy representatives (43.8%), followed by trade allies (25.0%) and the Duke Energy website (12.5%). Two customers (12.5%) learned about the program from Vectren Corporation and one from a local community group. None of the surveyed respondents mentioned Energizing Indiana as their first source of awareness of the program.

Table 12. Sources of Awareness of Non-Residential Smart $aver Program (n=16)

Percentage mentioning factor	Indiana (count)	Indiana (percent)
From a Duke Energy employee (account manager / marketing rep)	7	43.8%
From trade allies	4	25.0%
Duke Energy website	2	12.5%
Information provided by a third party: "*Vectren Corporation*"	2	12.5%
Information provided by a third party: "*Indian Community Group*"	1	6.3%
Information provided by the Energizing Indiana program	0	0.0%
Don't know	0	0.0%

Surveyed participants in the Smart $aver Prescriptive program were asked if they have also submitted applications in the past to the Smart $aver Prescriptive and Custom programs. These

responses are shown in Table 13: about a third of surveyed participants (37.5%) have previously submitted applications to Smart $aver Prescriptive, and nearly as many (31.3%) have submitted an application to Smart $aver Custom (including 25.0% who previously participated in both Prescriptive and Custom). A plurality of nearly half (43.8%) report that they have not previously applied to either of these programs.

Table 13. Past Participation in Non-Residential Smart $aver Prescriptive and Custom Programs (n=16)

	Indiana (count)	Indiana (percent)
Previously submitted applications to Prescriptive program	6	37.5%
Previously submitted applications to Custom program	5	31.3%
Have not previously submitted applications to either program	7	43.8%
Not sure if previously submitted applications to either program	2	12.5%

Columns total to more than 100% because respondents could apply to multiple programs.

Applying for Rebates through the Smart $aver Program

Table 14 indicates that about two-thirds of these participants got their incentive applications either online at the Duke Energy website (43.8%) or directly from Duke Energy representatives (25.0%). A minority of respondents got their applications from trade allies (12.5%) and third party consultants (12.5%).

Table 14. Source of Rebate Application (n=16)

	Indiana (count)	Indiana (percent)
Duke Energy website / online	7	43.8%
Duke Energy representative / program staff	4	25.0%
Trade allies	2	12.5%
Consultant / other third party company	2	12.5%
Don't know	1	6.3%

As seen in Table 15, a majority of surveyed participants filled out the application form themselves (75.0%, including two respondents who filled out the application with assistance from trade allies), though in two cases (12.5%) it was someone else at the respondent's company who filled out the application. Two participants (12.5%) report that a third party company filled out their applications: these third party organizations are Electric Power Solutions and Energy Systems Group. None of these participants report that a trade ally filled out their application for them, though in three cases (18.8%) trade allies did assist with application paperwork.

Table 15. Who Filled Out the Rebate Application for Your Company? (n=16)

	Indiana (count)	Indiana (percent)
I did (respondent)	10	62.5%
Respondent with assistance from trade ally	2	12.5%
Someone else from respondent's company	1	6.3%
Someone else from respondent's company with assistance from trade ally	1	6.3%
Third party company, listed above	2	12.5%
Trade ally	0	0.0%
Don't know	0	0.0%

Program participants who filled the application out themselves were asked to rate their satisfaction with the ease of understanding the application on a ten-point scale where "10" means most satisfied and "1" means very dissatisfied. The mean rating given by eleven participants who filled out applications is 8.0, and the median and modal rating is also "8 out of 10". The distribution of ratings is shown in Figure 5.

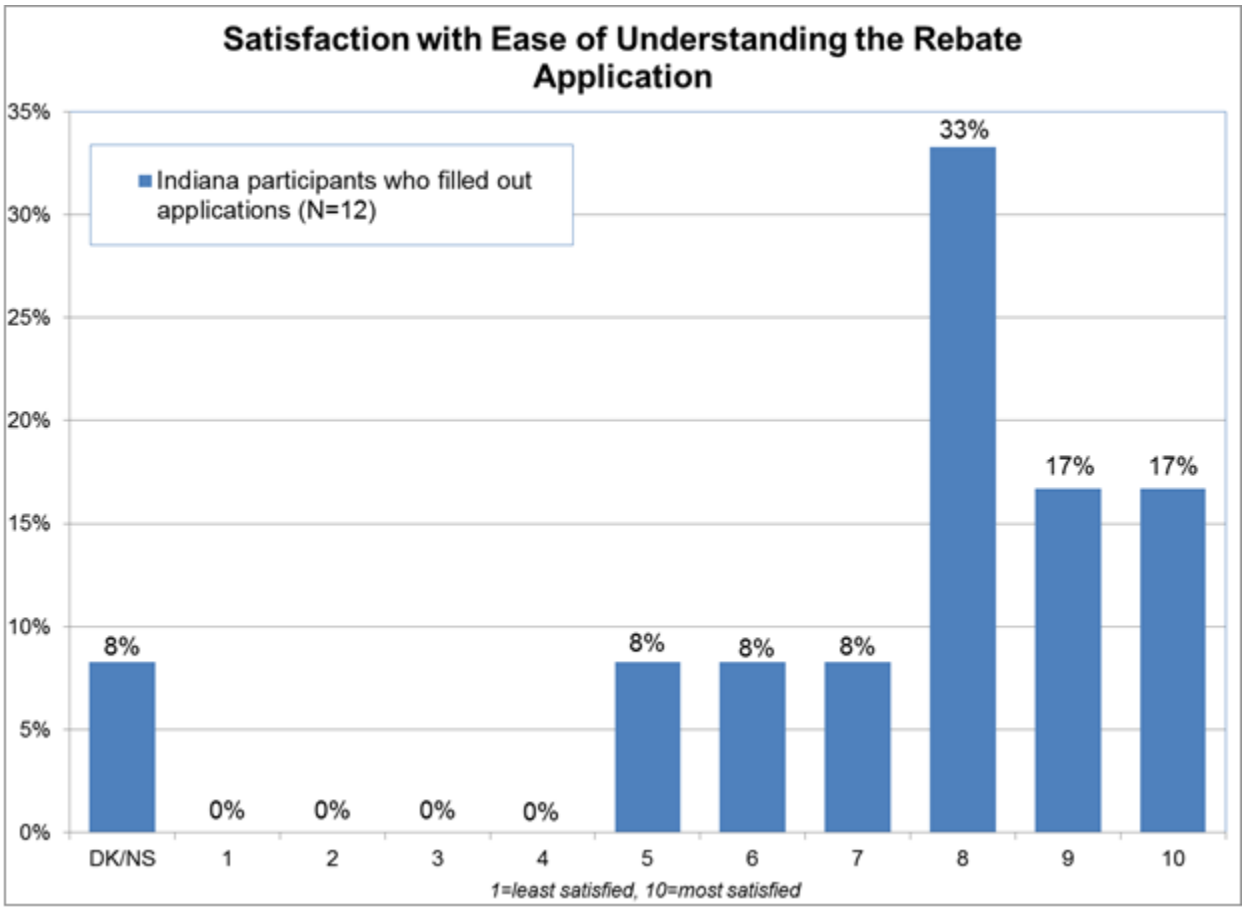


Figure 5. Satisfaction with Ease of Understanding the Rebate Application
(Base: n=12 respondents who filled out applications themselves)

Three participants who rated their satisfaction with this aspect of the program at "7" or lower on a ten-point scale were asked what could be done to improve the situation: one customer complained that they had to "bug" their contractor for information required by the application and that this process was very time-consuming, while another customer had to call Duke Energy telephone support and wished they could have found the information they needed on the website instead. The third customer giving a low rating did not have any comments or suggestions.

As Table 16 indicates, half of respondents (50.0%) submitted the application for Smart $aver themselves, and in another 12.5% of cases someone else from their company did the paperwork. Duke Energy representatives were involved in submitting three of these applications (18.8%), and two were submitted by third parties (Energy Systems Group and Electric Power Solutions).

Table 16. Who Submitted the Application to Duke Energy? (n=16)

	Indiana (count)	Indiana (percent)
I did (respondent)	8	50.0%
Someone else from respondent's company	2	12.5%
Duke Energy representative	2	12.5%
Duke Energy representative and trade ally	1	6.3%
Third parties, listed above	2	12.5%
Trade ally	0	0.0%
Don't know	1	6.3%

Table 17 indicates that none (0%) of surveyed participants reported problems receiving their Smart $aver rebates, although three (18.8%) could not recall. This is a marked improvement from the number of problems reported in the Indiana Smart $aver Prescriptive Lighting report, and may be due to the continued improvements in application processing.

Table 17. Problems Receiving Smart $aver Rebates (n=16)

	Indiana (count)	Indiana (percent)
Had problems receiving Smart $aver rebate	0	0.0%
Did not have problems receiving rebate	13	81.3%
Don't know	3	18.8%

Reasons for Participating in Non-Residential Smart $aver

Table 18 shows that the most frequently mentioned reason for organizations' participation in Non-Residential Smart $aver is to reduce energy costs, mentioned by three-quarters (75.0%) of surveyed participants overall and the first reason mentioned by a majority (56.3%) of participants. Old equipment working poorly (25.0%) and the program incentive (25.0%) were each mentioned by a quarter of participants, and 18.8% mentioned preventative maintenance and planning for future needs. Recommendations from trade allies (18.8%) and Duke Energy representatives (12.5%) were a factor for a minority of participants, and none (0%) mentioned Energizing Indiana.

Table 18. Reasons for Purchasing Smart $aver-Rebated Equipment (n=16)

	First mention (count)	First mention (percent)	Total mentions (count)	Total mentions (percent)
Wanted to reduce energy costs	9	56.3%	12	75.0%
Old equipment working poorly	3	18.8%	4	25.0%
The program incentive	2	12.5%	4	25.0%
Preventative maintenance / planning for future needs	3	18.8%	3	18.8%
Recommendation of trade ally	1	6.3%	3	18.8%
Recommendation of Duke Energy representative	2	12.5%	2	12.5%
Wanted to reduce maintenance / labor costs	1	6.3%	1	6.3%
Remodeling / making improvements	1	6.3%	1	6.3%
Past experience with this program	1	6.3%	1	6.3%
Past experience with a different Duke Energy program	1	6.3%	1	6.3%
Wanted to increase customer satisfaction	0	0.0%	1	6.3%
Wanted equipment that generates less heat	0	0.0%	1	6.3%
Environmental concerns	0	0.0%	1	6.3%
Recommendation of someone other than Duke Energy or trade allies ("*government*")	0	0.0%	1	6.3%
Information provided by Energizing Indiana	0	0.0%	0	0.0%
Don't know	0	0.0%	0	0.0%

Columns total to more than 100% because respondents could name multiple reasons, including multiple first-mentioned reasons.[9]

Units Replaced by Smart $aver-rebated Equipment

Table 19 shows that a slight majority of surveyed participants (56.3%) replaced an existing system with their rebated equipment (by measure, existing equipment was replaced for 53.8% of HVAC/Chiller rebates and 66.7% of Process rebates). A quarter of surveyed participants (25.0%) replaced a unit that was less than five years old while about a third (31.3%) replaced units that were more than ten years old. By measure, only 42.9% (3 out of 7) of these HVAC/Chiller installations replaced equipment that was at least ten years old, while both (100% of 2) Process measures replaced equipment that was more than ten years old.

[9] Respondents were asked "*what kind of factors motivated you to purchase the energy-saving [measure]*?", followed by "*were there any other reasons*?" until they could not give any more responses. Responses are ranked according to the order they were given, but some customers gave multiple reasons when the question was asked the first time.

Table 19. Replacing Existing Units and Age of Replaced Units (n=16)

	Indiana (count)	Indiana (percent)
Newly installed unit replaced an existing unit	9	56.3%
Replaced a unit less than 5 years old	4	25.0%
Replaced a unit 5 to less than 10 years old	0	0.0%
Replaced a unit 10 to less than 20 years old	2	12.5%
Replaced a unit 20 years to less than 30 years old	2	12.5%
Replaced a unit 30 or more years old	1	6.3%
Don't know age of replaced unit	0	0.0%

As seen in Table 20, none of the rebated installations replaced units that were described as being in "good" working condition, while a plurality of 44.4% were described as being in "fair" working condition. Another 33.3% were described as being in "poor" working condition, although no respondents reported that their previous equipment was not working at all. Two of these participants (22.2%) confirmed that their replaced units were in working condition, but could not describe the quality of their condition. Both of the Process measures replaced existing equipment that was in "poor" condition, while most HVAC/Chiller measures (57.1% or 4 out of 7) replaced units that were described as being in "fair" condition.

Table 20. Condition of Units Replaced by Smart $aver Installation (n=9)

Base: 9 participants whose rebated equipment replaced existing equipment	Indiana (count)	Indiana (percent)
Replaced unit was in good condition	0	0.0%
Replaced unit was in fair condition	4	44.4%
Replaced unit was in poor condition	3	33.3%
Replaced unit was not in working condition	0	0.0%
Don't know replaced unit's condition	2	22.2%

Influence of the Non-Residential Smart $aver Program

Table 21 indicates that overall 62.5% of the respondents in this survey say that without the Smart $aver program, their organizations would have purchased their new units when they did anyway. Only 25.0% would have continued using the old unit, while one participant would have delayed their purchase for 12 months and another would have purchased a used air compressor instead of the rebated new unit that they did purchase.

Table 21. Actions Taken If Smart $aver Program Had Not Been Available (n=16)

	Indiana (count)	Indiana (percent)
Would have bought the new unit at the same time	10	62.5%
Would have bought the new unit within less than a year	0	0.0%
Would have bought the new unit one to three years from now	1	6.3%
Would have bought the new unit more than three years from now	0	0.0%
Would have waited to purchase new units, don't know how long	0	0.0%
Would have purchased a used unit	1	6.3%
Would have continued using the old unit	4	25.0%

Surveyed participants were asked to rate the influence of the program incentive and information on the level of energy efficiency of their new equipment. Figure 6 shows the distribution of ratings. The incentive had somewhat more influence than the program information: the mean influence of the incentive rebate is 4.75 and the mean influence of the program information is only 3.71, while the median influence ratings are 4.5 for the incentive and 4.0 for the program information.

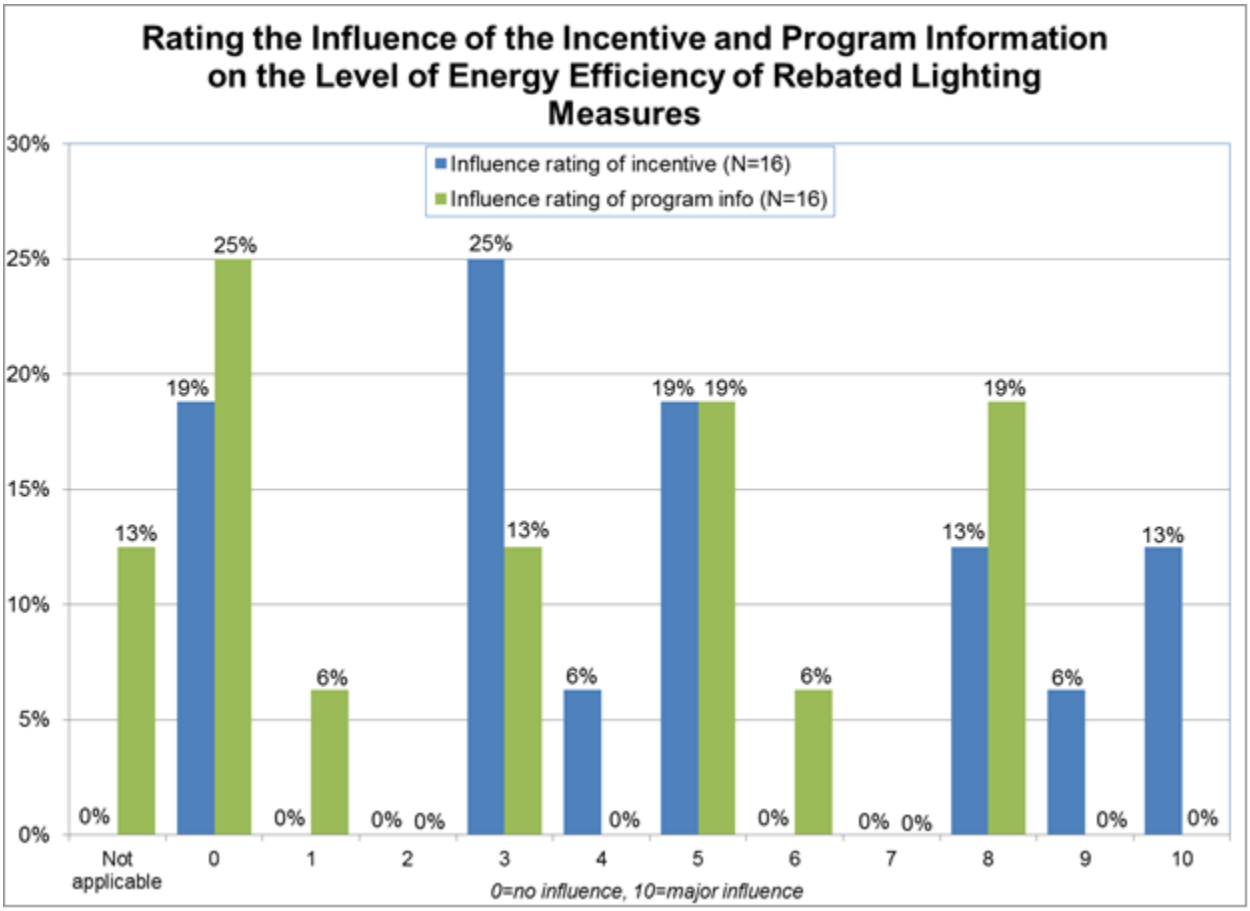


Figure 6. Influence of the Incentive and Program Information on the Level of Energy Efficiency of the Rebated Equipment (n=16)

It is worth reiterating a point made in the Lighting evaluation report that Smart $aver has an opportunity to help move customers towards their decisions to install high efficiency equipment, but seems to be leaving that opportunity unused. Most considerations of program influence will credit a program for providing technical information, assistance, and information about non-energy benefits to the customer, if all of those can be shown to drive customers to adopting energy efficient equipment. If Duke Energy can provide this information to customers, they will likely participate in higher numbers in the future.

Most respondents (56.3%) say that they would have purchased exactly the same equipment without the Smart $aver incentive rebate, as shown in Table 22. Another 18.8% would have

selected a model that was less efficient than the rebated unit that they did purchase, 6.3% would have done a different project and 18.8% don't know what they would have done.

Table 22. Actions Taken if Smart $aver Financial Incentive Had Not Been Available (n=16)

	Indiana (count)	Indiana (percent)
Would have selected exactly the same energy efficiency without the financial incentive	9	56.3%
Would have selected a different energy efficiency without the financial incentive: almost as high efficiency as the model purchased	0	0.0%
Would have selected a different energy efficiency without the financial incentive: significantly more efficient than old model but not as efficient as the model purchased	1	6.3%
Would have selected a different energy efficiency without the financial incentive: somewhat higher efficiency than old model	1	6.3%
Would have selected a different energy efficiency without the financial incentive: similar efficiency to old model	1	6.3%
Would not have done the same project without the financial incentive	1	6.3%
Not sure what organization would have done without the financial incentive	3	18.8%

Table 23 shows that even more respondents (81.3%) would have selected exactly the same equipment without the program information and technical assistance compared to what they would have done without the incentive. None would have selected less efficient equipment without the program information and technical assistance, 6.3% would have done a different project, and 12.5% don't know what they would have done.

Table 23. Actions Taken if Smart $aver Program Information and Technical Assistance Had Not Been Available (n=16)

	Indiana (count)	Indiana (percent)
Would have selected exactly the same energy efficiency without the technical assistance	13	81.3%
Would have selected a different energy efficiency without the technical assistance: almost as high efficiency as the model purchased	0	0.0%
Would have selected a different energy efficiency without the technical assistance: significantly more efficient than old model but not as efficient as the model purchased	0	0.0%
Would have selected a different energy efficiency without the technical assistance: somewhat higher efficiency than old model	0	0.0%
Would have selected a different energy efficiency without the technical assistance: similar efficiency to old model	0	0.0%
Would not have done the same project without the technical assistance	1	6.3%
Not sure what company would have done without the technical assistance	2	12.5%

As noted earlier, there is less technical information currently available on the Smart $aver website than in past years. This points out an opportunity to easily increase customer satisfaction and perhaps increase participation rates, reiterating the need for the above recommendation to put more Smart $aver resources on the web site.

A majority of surveyed participants (75.0%) have installed more high efficiency equipment since participating in Smart $aver, as seen in Table 24. More than half have installed more equipment at their location (combined 56.3%), and more than a third have installed more equipment at other locations (combined 37.5%). Only 25.0% have not installed any additional high efficiency equipment.

Table 24. Other High Efficiency Installations Since Participating in Smart $aver (n=16)

	Indiana (count)	Indiana (percent)
Installed more high efficiency equipment – only at this location	6	37.5%
Installed more high efficiency equipment – only at other locations	3	18.8%
Installed more high efficiency equipment – at both this and other locations	3	18.8%
Have not installed more high energy efficiency equipment	4	25.0%
Don't know	0	0.0%

Table 25 shows what types of equipment were installed by organizations that made other high efficiency installations after participating in Smart $aver. By far the most common category is lighting upgrades (83.3% of respondents who installed more high efficiency equipment), with LED installations being the most-mentioned type of lighting upgrade (58.3%). Two participants installed occupancy sensors and two installed variable frequency drives (both 16.7%).

Table 25. Other Energy Efficient Installations Which Were Influenced by Smart $aver (n=12)

Base: 12 respondents who said they installed more high energy efficient equipment since participating in Smart $aver	Indiana (count)	Indiana (percent)
Total lighting upgrades	10	83.3%
LED lighting upgrades	7	58.3%
T8 lighting upgrades	2	16.7%
T5 lighting upgrades	2	16.7%
Delamping fluorescent fixtures (using fewer bulbs)	1	8.3%
Exterior lighting upgrades	1	8.3%
Other lighting upgrade: "*retrofit CFLs and LEDs to 25w*"	1	8.3%
Occupancy sensors / lighting controls	2	16.7%
Variable frequency drives (VFD)	2	16.7%
New motors for air handlers	1	8.3%
Chiller upgrade	1	8.3%
Food service equipment	1	8.3%
New roofs	1	8.3%
"*Daylight harvesting lighting project*"	1	8.3%

Columns total to more than 100% because respondents could give multiple responses.

Respondents were asked how they knew these installations were energy efficient; their responses are shown in Table 26. More than half of participants (58.3%) mentioned equipment specifications or information from the manufacturer, while 16.7% mentioned information from trade allies and 16.7% mentioned standard efficiency ratings such as Energy Star. Three

participants (25.0%) stated that they knew their new equipment was using less energy due to occupancy sensors or delamping fixtures resulting in fewer lights being turned on.

Table 26. How Do You Know This Equipment Is High Efficiency? (n=12)

Base: 12 respondents who said they installed more high energy efficient equipment since participating in Smart $aver	**Indiana (count)**	**Indiana (percent)**
Equipment specifications / information from manufacturer	7	58.3%
Delamping / occupancy sensors save energy because there are fewer lights in use	3	25.0%
Information from trade allies	2	16.7%
Energy Star, DesignLights Consortium (DLC) or other standard efficiency ratings	2	16.7%
Respondent did their own research	2	16.7%
Information from Duke Energy	1	8.3%
Information from a third party (Electric Power Solutions)	1	8.3%
Referrals / recommendations of other users	1	8.3%

Columns total to more than 100% because respondents could give multiple responses.

Participants were asked if they received incentive payments for any of the additional high efficiency installations they have done since participating in Smart $aver. Overall, 66.7% of customers who did additional installations received incentives for at least some of those installations, as seen in Table 27.

Across 24 installations described by the twelve participants with additional installations, 15 of these installations (62.5%) received incentives while seven installations (29.2%) did not; for two of these installations (8.3%) the customer did not know if an incentive payment was involved or not.

Half of these participants (50.0%) confirm receiving a rebate from Duke Energy, while 16.7% received rebates from Energizing Indiana and one customer (8.3%) was not sure which of these two programs had paid their incentive. There are also two participants who stated that they did not receive rebates, however another company they were working with may have and passed the savings on to the participant: in one of these cases, the rebate was collected by a third party company though the program was not identified, and in the other case the respondent is not sure if there was an incentive or who paid it, but believes that their vendor might have received an incentive and passed the savings on to the customer.

Table 27. Incentive Rebates for Additional Equipment Installations (n=12)

Base: 12 respondents who said they installed more high energy efficient equipment since participating in Smart $aver	**Indiana (count)**	**Indiana (percent)**
Received incentive for any additional installation	8	66.7%
Received incentive from Duke Energy	6	50.0%
Received incentive from Energizing Indiana	2	16.7%
Received incentive from Duke Energy or Energizing Indiana, but not sure which	1	8.3%
Electric Power Solutions received an incentive and passed the savings on, but not sure who paid this incentive	1	8.3%
Respondent did not receive incentive, but thinks the vendor may have and passed the savings on (source of incentive unknown)	1	8.3%
Did not receive incentive for any additional installations	3	25.0%

Columns total to more than 100% because respondents could receive multiple incentives for multiple installations.

Figure 7 shows that most participants (66.7%) rated the influence of Smart $aver on their organization's installation of additional high efficiency-equipment at "8" or higher a ten-point scale where "10" is the most influential. However, every participant giving an influence rating of less than "8" rated the influence of the program at "1 out of 10", the lowest possible rating. Overall, the mean influence rating is 6.17, and the median rating is 8.0.

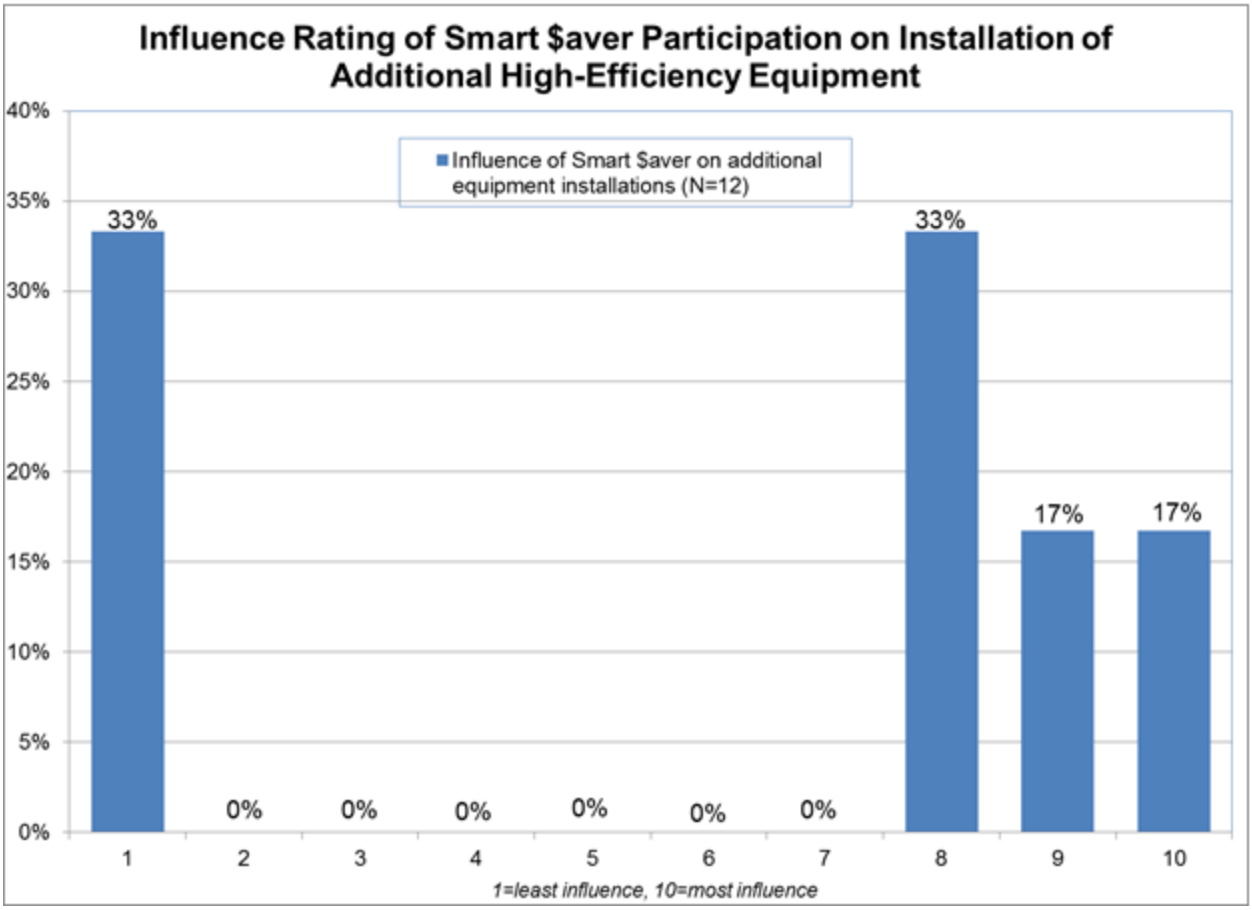


Figure 7. Influence of Smart $aver on Installation of Other High Efficiency Equipment
(Base: n=12 respondents who installed other high efficiency equipment since participating in Smart $aver)

Four participants rated the influence of the program at "7" or less on a ten-point scale where "10" is most influential (all four of these participants rated the influence of the program at "1 out of 10", the lowest possible rating). These customers were asked what they considered the most important influence on their additional post-program installation decisions; these responses are listed below.

- *Energy Systems Group was the most important influence. Our municipality tends to be more reactive than proactive when it comes to purchasing new equipment. We wait until old equipment breaks down completely before replacing it.*
- *I consider energy savings to be the most important influence.*
- *I consider our desire to become more energy efficient, along with the rebates, to be the most important influences.*
- *It was already in our integrated energy master plan.*

Survey participants were asked "w*hat other actions, if any, have you taken in your company to save energy and reduce utility bills as a result of what you learned in this program*?" These additional actions are summarized in Table 28. Two-thirds of customers (68.8%) said they took additional actions based on what they learned from participating in this program; the most commonly-mentioned actions are additional lighting upgrades (18.8%) and recycling programs (12.5%).

Table 28. Other Efficiency Actions Taken Which Were Influenced by Smart $aver (n=16)

	Indiana (count)	Indiana (percent)
Efficient lighting upgrades	3	18.8%
Instituted or improved company recycling program	2	12.5%
Scheduling regular maintenance	1	6.3%
Joined PowerShare program	1	6.3%
Occupancy sensors / motion detectors	1	6.3%
Programmable thermostats	1	6.3%
Caulked windows	1	6.3%
Shut off unneeded equipment during slow times	1	6.3%
Coordinated an equipment shutdown methodology / refined processes for maximum efficiency	1	6.3%
Nothing / don't know	5	31.3%

Multiple responses were accepted for this question, so columns total to more than 100%.

Satisfaction with the Smart $aver Program

Figure 8 indicates that Smart $aver participants were generally very satisfied with the program as a whole: 81.3% of surveyed participants rated their satisfaction with the program at "8" or higher on a ten-point scale where "10" is highest. The mean satisfaction rating is 8.38 while the median and mode is "9 out of 10".

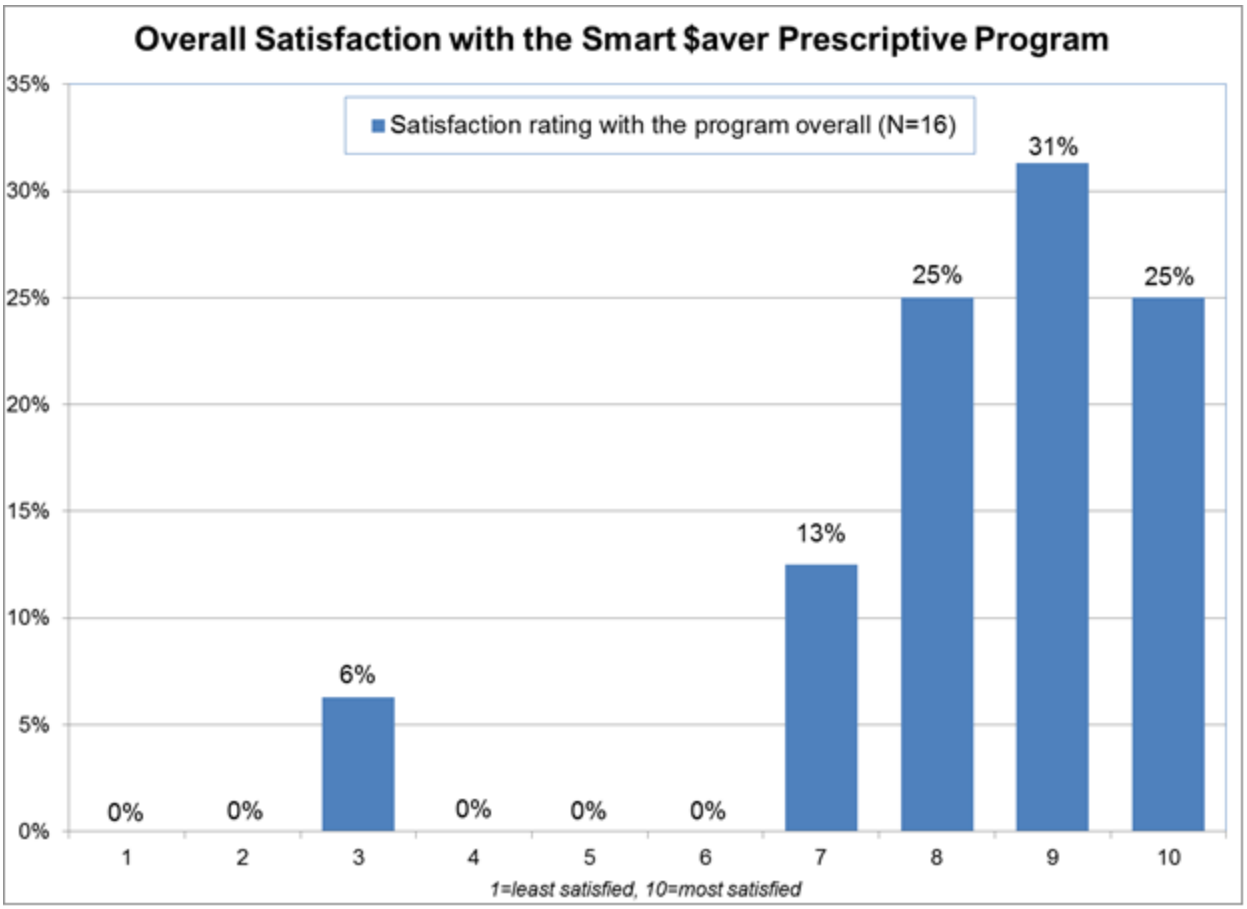


Figure 8. Overall Satisfaction with the Smart $aver Prescriptive Program (n=16)

Three respondents who rated their overall satisfaction with Smart $aver at "7" or less on a ten-point scale were asked what could be done to improve the program; their responses are listed below.

- *The incentives and energy savings resulting from the new equipment aren't sufficient to pay back the cost of the equipment within 18 months;* [redacted] *overestimated the amount of energy I would save. Duke Energy can make sure that this program works properly: In order to receive subsidies, vendors should be held accountable for the energy savings estimates they provide their customers.* (Satisfaction rating "3 out of 10")
- *Incentives are too low, take too long to be paid, and vendors don't know enough about the program. I would also like to see the latest lighting technologies continually added to the list of qualifying equipment.* (Satisfaction rating "7 out of 10")
- *In terms of what we paid in to what we got out, it wasn't worth it. Our Bloomington campus opted out of both Energizing Indiana and Duke Energy Custom and Prescriptive.* (Satisfaction rating "7 out of 10")

The specific aspect of the Smart $aver program with the lowest level of participant satisfaction is the information about the program provided by trade allies, with a mean rating of only 6.11 on a ten-point scale where "10" is highest and a median rating of just "5 out of 10"; this aspect of the program has room for improvement.

Trade allies may be providing incorrect information due to some confusion with the Energizing Indiana program. If this is the case, the discontinuation of Energizing Indiana would help to remove that confusion.

> RECOMMENDATION: Duke Energy should delve deeper into the reasons behind the dissatisfaction with the trade allies, by conducting a satisfaction survey with HVAC/Process participants in the first half of 2015 that probes the sources of dissatisfaction with information provided by trade allies. This will allow Duke Energy to determine whether this dissatisfaction is an aberration, based upon confusion with Energizing Indiana, or if it is based on processes that Duke Energy can improve in the future.

The aspect of the program that is most satisfying to participants is their interactions with Duke Energy staff, with a mean rating of 9.58 and median ratings of "10 out of 10". All of the other aspects of the program rated by participants received mean satisfaction ratings between 7.5 and 9.0 and median ratings between 8.0 and 9.0, indicating high levels of participant satisfaction. Overall satisfaction with Duke Energy is also high, with a mean rating of 8.63 and median rating of "9 out of 10".

Table 29. Satisfaction with the Smart $aver Program and Duke Energy (n=16)

	Valid responses (count)	Mean rating	Median rating
Interactions and communications with Duke Energy staff	12	9.58	10.0
The info provided by Duke Energy account manager	9	8.89	9.0
The variety of technologies covered by the program	12	8.42	8.5
The time it took to receive the incentive	14	8.36	8.0
The info provided by the Smart $aver website	10	7.90	8.0
The amount of the incentive offered	15	7.67	8.0
The info provided by trade allies	9	6.11	5.0
Satisfaction with the Smart $aver Prescriptive program overall	16	8.38	9.0
Satisfaction with Duke Energy overall	16	8.63	9.0

Surveyed participants who rated their satisfaction with different aspects of the program at "7" or less on a ten-point scale were asked what could be done to improve these aspects of the program. These responses are summarized below; there are no comments about improving interactions with Duke Energy employees because no survey respondents gave low satisfaction ratings for this aspect of the program.

The information provided by trade allies received the largest number of low ratings, and most of these comments are about a general lack of awareness of the program on the part of trade allies. Participants who gave low ratings for the variety of technologies covered by the program all mentioned that the program could do better at including the latest lighting technologies, with two

specifically mentioning LEDs. Predictably, customers who give low ratings for the amount of incentives generally wish for the incentives to be higher.

Information provided by trade allies (n=6)

- My vendor was unaware of the program until I told them about it. (n=2)
- Vendors need to be more aware of the program.
- I always had to request information from them; it was difficult to get a breakdown of services to fill out the paperwork.
- No suggestions (n=2)

Amount of the incentive (n=5)

- Raise the incentive amounts (n=2)
- Incentives should be set to result in a 12-month payback on new equipment.
- Incentives should be set to result in an 18-month payback on new equipment.
- Clarify the incentive amounts within the measure descriptions.

Information provided by the Smart $aver website (n=4)

- Site navigation could be improved.
- Improve the search function; the LED section is currently 37 pages long. Allow me to enter the product number to find qualifying equipment more easily.
- It is difficult to find the application forms and the list of qualifying equipment.
- The website should make it easier to determine which form to fill out, and should better clarify the program requirements.

Variety of technologies covered (n=3)

- Offer more LED technologies.
- The list of qualifying equipment needs to be updated more frequently; also want to see LED signage added.
- I would like to see the latest lighting technologies continually being added to the equipment list.

Time it took to receive the incentive payment (n=3)

- Incentives should be paid within one week of receiving the application.
- I wish there had been more communication from Duke Energy about when to expect payment, or else payment could have been made through a credit on my utility bill.
- I wish there was an online tracking system so it would be easier to follow up on payment status.

Information provided by the Duke Energy account manager (n=1)

- My account manager could contact me more frequently.

Two surveyed participants rated their satisfaction with Duke Energy overall at "7" or less on a ten-point scale and were asked what could be done to improve the situation: one of these customers had no comments and the other stated that they have had issues with online billing analyses and their account history.

What Participants Liked Most and Least about the Smart $aver Program

Table 30 categorizes the open-ended responses of participants when they were asked what they liked most about the non-residential Smart $aver prescriptive program. About a third of customers surveyed (37.5%) mentioned the incentive rebate saving them money on upfront costs, and nearly as many mentioned the ease and simplicity of participation (31.3%). One participant (6.3%) could not name a favorite thing because they were dissatisfied with their participation in the program.

Table 30. What Do You Like Most About the Non-Residential Smart $aver Program? (n=16)

	Indiana (count)	Indiana (percent)
Like immediate rebate / incentive / recouping upfront costs	6	37.5%
Like how easy it was / simplicity	5	31.3%
Liked information / knowledge gained	1	6.3%
Like saving money on bills / return on investment	1	6.3%
Like that the program encourages my company to implement new technologies	1	6.3%
Like fixed amounts for prescriptive incentives (less wait for approval)	1	6.3%
Nothing (negative opinion of the program)	1	6.3%

Next, Table 31 categorizes respondents' least favorite things about participating in the non-residential Smart $aver prescriptive program. The most frequently mentioned complaints involve the list of qualifying equipment (18.8%), the Smart $aver website (12.5%) and requests for Duke Energy to provide more assistance to participating customers (12.5%). About a third of surveyed participants (37.5%) could not name a least favorite aspect of the program.

Table 31. What Do You Like Least About the Non-Residential Smart $aver Program? (n=16)

	Indiana (count)	Indiana (percent)
Issues with qualifying equipment, listed below	3	18.8%
Issues with Smart $aver website, listed below	2	12.5%
Duke Energy could have provided more assistance (program updates, on-site visits, help planning projects)	2	12.5%
Incentives are too low / projects don't pay for themselves quickly enough	1	6.3%
Application process was difficult	1	6.3%
Program requires us to hire a subcontractor instead of doing the work ourselves	1	6.3%
Don't know / nothing	6	37.5%

Three participants report that their least favorite thing about the program relates to the list of qualifying equipment: one complains that the list is confusing, another that it takes Duke Energy too long to update the list with the latest technologies, and one customer wants "*2x2 LED panels*" added to the equipment list.

Two participants report that their least favorite thing about the program relates to the Smart $aver website: one of these customers complains that the search function needs improvement and the other simply says they "*dislike*" the site.

Improving the Non-Residential Smart $aver Program

Respondents were asked what additional services they would like to see provided by the Smart $aver program. Two-thirds (68.8%) had no suggestions, and the only suggestion made by more than one survey respondent was to provide (or improve) energy savings estimates (12.5%). The complete list of suggestions is shown in Table 32.

Table 32. What Additional Services Would You Like the Smart $aver Program to Provide? (n=16)

	Indiana (count)	Indiana (percent)
Provide energy savings estimates / more accurate estimates	2	12.5%
Include control measures in the Prescriptive program (takes too long to get these projects approved through the Custom program)	1	6.3%
Provide more frequent program updates and on-site visits	1	6.3%
Implement online tracking system for customers to check the status of applications and payments	1	6.3%
Don't know / nothing	11	68.8%

As a follow-up question, respondents were asked if there were any other things they would like to see changed about the Smart $aver program. Only two respondents (12.5%) had additional suggestions which have not already been mentioned: both of these customers request that VFDs over 50 horsepower be added to the Prescriptive program's offerings.

- *The program is somewhat vague about what the classification is for some lighting fixtures: are they parking garage fixtures, are they downlights? I don't know how to classify them. For Energizing Indiana, they seem to top out at 50 horsepower on VFDs. Is Duke going to pick up VFDs when Energizing Indiana ends in December?*
- *The Custom program wasn't beneficial; it was almost a waste of time. The equipment list needs to be expanded in Prescriptive, such as including VFDs over 50 HP.*

Participation in Energizing Indiana

Surveyed participants in the Smart $aver Prescriptive program were asked if they have also participated in Energizing Indiana. As seen in Table 33, only a quarter of survey respondents are certain that they have participated in Energizing Indiana (25.0%) while a majority are not sure

(56.3%) and only 18.8% are certain that their companies have not participated in Energizing Indiana.

Table 33. Smart $aver Participants' Participation in Energizing Indiana (n=16)

	Indiana (count)	Indiana (percent)
Participated in Energizing Indiana	4	25.0%
Did not participate in Energizing Indiana	3	18.8%
Not sure if participated in Energizing Indiana	9	56.3%

Most customers who participated in both Smart $aver and Energizing Indiana first heard about both programs at the same time (75.0%) and one heard about Energizing Indiana first (25.0%); none of the surveyed customers learned about Smart $aver before Energizing Indiana.

Table 34. Program Awareness: Energizing Indiana and Smart $aver (n=4)

Base: 20 customers who participated in both Smart $aver and Energizing Indiana	Indiana (count)	Indiana (percent)
Heard about Duke Energy Smart $aver first	0	0.0%
Heard about Energizing Indiana first	1	25.0%
Heard about both programs at the same time	3	75.0%

The three customers who heard about both programs at the same time were asked "*did you learn about them through Duke Energy's marketing and outreach, or from Energizing Indiana's own marketing and outreach?*" Two of these participants (66.7%) replied that they heard about both of these programs from Duke Energy marketing, and one (33.3%) could not recall how they learned about these programs.

The customer who heard about the Energizing Indiana program first was asked "*Did you learn about Smart $aver through Energizing Indiana's marketing and outreach, or from Duke Energy's own marketing and outreach?*" This participant replied that they heard about Smart $aver from Energizing Indiana's outreach efforts.

Customers who participated in both programs were asked if they felt there were any aspects of Energizing Indiana that should be incorporated into Duke Energy's Smart $aver program; three out of four (75.0%) made recommendations for improving Smart $aver by incorporating elements of Energizing Indiana which are listed below, while one participant (25.0%) did not recommend incorporating any elements of Energizing Indiana into Smart $aver.

- *From what I understand, Energizing Indiana will cease to exist by the end of this year. I would like to see Smart $aver adopt any incentives that are now being offered exclusively through Energizing Indiana.*
- *Smart $aver should include VFDs, lighting pieces, rooftop HVAC units, air handlers and food service items such as refrigerators, freezers, and cookers.*
- *Smart $aver should include VFDs over 50 HP.*

Customers who participated in both programs were asked if they would prefer a different

division of incentives between Smart $aver and Energizing Indiana. As seen in Table 35, half of these customers have no preference, one (25.0%) says the current division is fine and one (25.0%) would prefer that all incentives be paid by Energizing Indiana[10].

Table 35. Preference for Division of Incentives Between Smart $aver and Energizing Indiana (n=4)

Base: 4 customers who participated in both Smart $aver and Energizing Indiana	**Indiana (count)**	**Indiana (percent)**
Prefer all incentives paid by Energizing Indiana	1	25.0%
Prefer all incentives paid by Smart $aver	0	0.0%
Prefer one payer, don't care which it is	0	0.0%
The current division is fine	1	25.0%
No preference at all	2	50.0%

Characteristics of Respondent Organizations

More than half of the respondents surveyed for this evaluation (56.3%) represent commercial enterprises, as seen in Table 36. A quarter are industrial concerns (25.0%) and 18.8% are non-profit and public sector organizations.

[10] Energizing Indiana will be discontinued at the end of 2014.

Table 36. Survey Respondent's Organization (n=16)

	Indiana (count)	Indiana (percent)
Total non-profit and public sector	**3**	**18.8%**
School district / university / college	2	12.5%
Community service / church / non-profit	0	0.0%
Municipal facilities / libraries / local government	1	6.3%
Total industrial	**4**	**25.0%**
Industrial / heavy manufacturing	2	12.5%
Light manufacturing	2	12.5%
Contractors	0	0.0%
Farming / agriculture	0	0.0%
Total commercial	**9**	**56.3%**
Transportation / automotive	0	0.0%
Retail (non-food)	1	6.3%
Property management / condo association	0	0.0%
Restaurants	1	6.3%
Healthcare / hospitals	2	12.5%
Convenience / grocery stores	0	0.0%
Office	0	0.0%
Warehouse	0	0.0%
Hotel / resort	3	18.8%
Bank / financial	1	6.3%
Data center	1	6.3%

Respondents in this survey were asked their job title at the organization where the Smart $aver-rebated equipment was installed, which is reported in Table 37. The most common job titles among respondents are "president" or "general manager" (25.0%) and variations of "facilities manager" (25.0%).

Table 37. Survey Respondent's Job Title at Organization (n=16)

	Indiana (count)	Indiana (percent)
Facilities Manager / Director	4	25.0%
Other facilities management / maintenance position	1	6.3%
Operations Manager / Director	0	0.0%
Proprietor / Owner	2	12.5%
President / CEO / COO / VP / GM	4	25.0%
Other Manager / Director / Supervisor	0	0.0%
CFO	0	0.0%
Other financial / administrative position	3	18.8%
Energy Manager / Coordinator / Analyst	1	6.3%
Engineer / electrician / inspector / researcher	1	6.3%
"Real Estate" or "Property" title	0	0.0%
Government position	0	0.0%

Net-to-Gross Methodology

Freeridership

TecMarket Works utilized two different sets of multiple questions asked of each surveyed participant which are scored independently, and then combined to estimate freeridership.

For the first set of calculations, the primary "gateway" question asks if they would have purchased equipment without the program and, if so, when that would have occurred. This question is designed to segregate the respondents into groups associated with their intent to buy a new unit or not (not the efficiency of that purchase). The second question within this first set asks those who say they would have delayed their purchase to estimate how long they would have delayed the purchase. Together these two questions provide the foundation from the first set of questions to be used to move to the second set of questions that will be used for estimating the level of energy impacts that are attributable to freeridership rather than savings that are program induced (net savings).

The first question within the first set of questions asked survey respondents what their behavior would have been if the Smart $aver program had not been available. The four categories of responses were:

a.) bought a new unit at the same time
b.) bought a new unit at a later time
c.) bought a used unit at the same time or a later time
d.) continued to use the currently installed unit and not purchase a new or used unit

The breakdown of responses to the gateway question can be seen in Table 38. Participants who indicated that they would have bought the same unit at the same time were assigned 100% freeridership. Participants answering that they would have continued using the existing unit were assigned 0% freeridership.

Participants who indicated that they would have bought their units at a later time are asked an additional question for determining when they would have purchased the units in the absence of the program. Each response to this question was converted to a gateway freerider percentage as presented in Table 38.

From the foundational set of questions, the equivalent freerider rate (the number of units that count toward freeridership) is the product of the freerider percentages multiplied by the number of respondents/units.

Table 38. Program Freeridership

Gateway Question Response	Non-lighting measures (freeriders)
Same unit at same time (100% freerider)	10 (10)
Same unit within 6 months (75% freerider)	0 (0)
Same unit 6-12 months later (50% freerider)	1 (0.5)
Same unit 12-24 months later (25% freerider)	0 (0)
Same unit more than 24 months later (0% freerider)	0 (0)
Same unit, don't know when (mean % freerider of the five rows above = 95.4% for Non-lighting)	0 (0)
Used unit at the same time (50% freerider)	1 (0.5)
Continued using old unit (0% freerider)	4 (0)
TOTAL COUNT	**16**
Freeriders	**11.0**
Freerider %	**68.8%**

The second set of freerider calculations is based on an additional set of multiple questions which ask what participants would have done without the Smart $aver incentive, and without the Smart $aver program information and technical assistance. This set of questions focuses on the efficiency level of equipment that would have been purchased without the program.

The three categories of responses to these questions were:

a.) bought unit with at least the same efficiency level
b.) bought a unit with a lower efficiency level
c.) not sure what organization would have done

The breakdown of responses to these questions can be seen in Table 39 and Table 40. Participants who indicated that they would have bought the same efficiency level without the incentive or program information were assigned the average gateway freeridership calculated in Table 38 (68.8% for Non-lighting measures). Participants answering that they would have selected a different efficiency level were assigned a lower percentage of freeridership depending on how much less efficient their choice would have been in the absence of the incentive or program information. If they would have purchased a unit of the same efficiency level as the old unit that was replaced, then 0% freeridership is assigned (there would have been no savings without the program since they would have installed a new unit with the same level of efficiency as the old unit).

Table 39. Program Freeridership Based on Financial Incentive

Response for "without financial incentive"	Non-lighting Measures (freeriders)
Would have selected same efficiency level without financial incentive (freerider percent based on planned time of purchase times 100%)	9 (6.19)
Would have made a different choice without financial incentive: almost as efficient as new model (freerider percent based on planned time of purchase times 75%)	0 (0)
Would have made a different choice without financial incentive: significantly more efficient than old model (freerider percent based on planned time of purchase times 50%)	1 (0.34)
Would have made a different choice without financial incentive: somewhat more efficient than old model (freerider percent based on planned time of purchase times 25%)	1 (0.17)
Would have made a different choice without financial incentive: similar to old model (freerider 0%)	1 (0)
Would not have done this project without financial incentive (freerider 0%)	1 (0)
Not sure what company would have done without financial incentive (freerider percent based on mean of all columns above)	3 (1.55)
TOTAL COUNT	**16**
Freeriders	**8.25**
Freerider %	**51.6%**

Table 40. Program Freeridership Based on Information and Assistance

Response for "without program information and technical assistance"	Non-lighting Measures (freeriders)
Would have selected same efficiency level without information/technical assistance (freerider percent based on planned time of purchase times 100%)	13 (8.94)
Would have made a different choice without information/technical assistance: almost as efficient as new model (freerider percent based on planned time of purchase times 75%)	0 (0)
Would have made a different choice without information/technical assistance: significantly more efficient than old model (freerider percent based on planned time of purchase times 50%)	1 (0.34)
Would have made a different choice without information/technical assistance: somewhat more efficient than old model (freerider percent based on planned time of purchase times 25%)	0 (0)
Would have made a different choice without information/technical assistance: similar to old model (freerider 0%)	0 (0)
Would not have done this project without program information/technical assistance (freerider 0%)	0 (0)
Not sure what company would have done without information/technical assistance (freerider percent based on mean of all columns above)	2 (1.33)
TOTAL COUNT	**16**
Freeriders	**10.61**
Freerider %	**66.3%**

Since the program included both an incentive payment and technical assistance/program information, each of which can motivate a decision to go with the more efficient choice, a two path analysis approach was used for assessing freeridership within the second set of questions. One path was scored for the influence of the incentive and another path was scored for the analysis of the effect of the technical assistance and program information. The final per-participant freeridership estimate is the lower of the two estimates from the two paths. These results are presented for each measure in Table 39 and Table 40. Thus, freeridership for the Smart $aver Prescriptive program in Indiana is estimated at 51.6% for non-lighting measures. Note that this freerider analysis was conducted using only a portion of surveyed participants (those with non-lighting measures). The evaluation plan was designed to achieve statistically significant estimates of freeridership at the program level (including lighting measures).

Four of the sixteen surveyed non-lighting participants were surveyed about chiller tune-up measures. If these participants are not included in the freerider calculations, then the freeridership for non-lighting measures not including tune-ups is 45.0%. See *Appendix D: Freeridership Calculations Not Including Chiller Tune-Ups* for the calculation tables which show this result.

Validity and Reliability of the Freerider Estimation Approach

The field of freeridership assessment as specified in the California Evaluation Protocols basic estimation approach requires the construction of questions that allow the evaluation contractor to

estimate the level of freeridership. The basic approach used in this evaluation is based on the results of a set of freerider questions incorporated into participant survey instruments that meets the reliability standards for freerider questions. The approach used in this assessment examines the various ways in which the program impacts the customer's acquisition and use of equipment incented as part of the Non-Residential Smart $aver Prescriptive program, and allocates a freeridership factor for each of the types of responses contained in the survey questions. The allocation approach assigns high freeridership values to participants who would have acquired the same equipment on their own, and that factor is influenced by their stated intentions regarding the timing and efficiency level of this acquisition. The scoring approach is proportional to the degree to which the participant would have acquired and used equivalent equipment on their own.

Spillover

In order to estimate the spillover savings attributed to the program several questions were added to the participant questionnaire. These questions were asked to determine the extent to which the program's information and incentives caused additional non-incented spillover actions to be taken by the participants. A total of 16 survey participants answered the net-to-gross question battery.

Survey participants were asked if they had taken any actions above and beyond those rebated by the program at their company or at any other locations. If the respondent indicated that they had not purchased or installed any other type of high efficiency equipment or made energy efficiency improvements since their participation in the program, the spillover level was set to zero and no spillover credit was provided. Respondents that had taken additional measures were asked about the type of equipment and where it was installed. However, no spillover savings were provided to those respondents that took additional actions for which an incentive was received.

In order for a measure to count toward spillover, a survey respondent must indicate that their experience with the program caused, to some degree, the action to be taken by rating the influence of their experience with the program on their decision to do so on a scale from one to ten with ten being the most influential. This rating is referred to as the participant's attribution score. No spillover savings was credited to participants with an attribution score of one out of ten.

If a participant indicated that the program was influential in their purchase and use decision, then their spillover savings was adjusted by the fractional amount of the strength of their attribution score. That is, if the respondent indicated an attribution score of seven out of ten, then their spillover savings were multiplied by 0.7 to estimate their spillover contribution to the program net-to-gross ratio.

Table 41. Spillover Measures and Attribution

Measure	Quantity	Attribution Score	EUL[11]	kWh Savings	Spillover kWh Savings
LED interior lighting	80	9	8	11,272	10,145
LED exterior lighting	45	10	12	12,600	12,600
Delamping	40	10	5	3,976	3,976
TOTAL/AVERAGE		**9.7**	**9.4**	**27,848**	**26,721**

Table 41 shows each measure taken by the 16 survey participants for which enough information was provided to calculate energy savings. Spillover energy savings were estimated from the customer description of the measure taken and ex-ante savings estimates from the Duke Energy Midwest Master Database for that measure. The spillover savings were not subject to ex-post evaluation. Actions taken by respondents that provided insufficient data to estimate impact received zero spillover credit. Actions that were determined, or believed, to be implemented outside of Duke Energy territory also received zero spillover credit. Although the spillover savings were not subject to ex-post evaluation, the approach taken is believed to provide the spillover estimates that are significantly below the actual achieved spillover savings.

Table 42 shows the spillover percentage for the program of 1.1%.

Table 42. Spillover Percentage

Survey Respondent kWh Savings Excluding Spillover	Survey Respondent Spillover kWh savings	Spillover Percentage
2,368,048	26,721	1.1%

While TecMarket Works notes that the spillover savings documented in this report are lower than actually achieved, it should be understood that the assignment of spillover is, to a limited degree, subjective in that its accuracy depends on the ability of the attribution score to accurately estimate the degree of causation as well as the recall ability of the participant.

Program Net-to-Gross Adjustment

The average net-to-gross ratio for the non-lighting measures in the Smart $aver program is 49.5%. It should be noted that this net-to-gross ratio only includes adjustments for freeridership and short term participant spillover. Estimates for short and long term non-participant spillover and short and long term market effects are not included in this study and would be savings in addition to that documented in this report. While a short term participant net-to-gross ratio of 0.495 indicates the program saved less energy that what is reflected in the gross energy projected savings estimates, this savings level is only part of the savings that are achieved by energy efficiency programs. Additional evaluation efforts are needed to document short and long term non-participant spillover and short and long term market effects.

[11] EUL = Effective Useful Life

The net-to-gross ratio is then calculated as follows:

Program Freeridership = 51.6%
Program Spillover = 1.1%

NTGR = 1 + (spillover – freeridership)
= 1+ (0.011 – 0.516)
= 0.495

Total Gross and Net Impacts

The total first year gross and net savings are tabulated for each of the non-lighting measures studied in the impact evaluation and summarized in Table 43.

Table 43. First Year Gross and Net Savings by Measure

Metric	Result
Number of Program Participants from January 2012 to November 2013	65 Incentives
Gross Coincident Peak kW per unit	**kW/unit**
Air Compressor VFD (motor hp)	0.000
Air-Cooled Chiller (Ton)	0.127
Guestroom Controls (Ton)	0.152
Gross kWh per unit	**kWh/unit**
Air Compressor VFD (motor hp)	1,120.6
Air-Cooled Chiller (Ton)	355.3
Guestroom Controls (Ton)	653.0
Freeridership rate	51.6%
Spillover rate	1.1%
Total Discounting to be applied to Gross values	50.5%
Net Coincident Peak kW per unit	**kW/unit**
Air Compressor VFD (motor hp)	0.000
Air-Cooled Chiller (Ton)	0.063
Guestroom Controls (Ton)	0.075
Net kWh per unit	**kWh/unit**
Air Compressor VFD (motor hp)	554.7
Air-Cooled Chiller (Ton)	175.9
Guestroom Controls (Ton)	323.2
Measure Life[12]	15yr (Air Compressor VFD) 20yr (Air-Cooled Chiller) 8yr (Guestroom Controls)

[12] EUL data taken from Indiana TRM.

Lifecycle savings were estimated by applying the EUL assumptions from Table 43 to each measure. The lifecycle gross and net kWh savings are shown in Table 44.

Table 44. Gross and Net Lifecycle Savings

Metric	Result
Number of Program Participants from January 2012 to November 2013	65 Incentives
Gross lifecycle kWh per unit	**kWh/unit**
Air Compressor VFD (motor hp)	16,809.0
Air-Cooled Chiller (Ton)	7,106.0
Guestroom Controls (Ton)	5,224.0
Net lifecycle kWh per unit	**kWh/unit**
Air Compressor VFD (motor hp)	8,320.5
Air-Cooled Chiller (Ton)	3,517.5
Guestroom Controls (Ton)	2,585.6

Appendix A: VFD Air Compressor Application Summary Table

App ID	Horse Power	Model Number	Operation Hours	kWh target	NonCoinc kW Target	Summer Coinc kW Target	Measure Life	kWh gross w/o losses	NonCoinc kW gross w/o losses	Summer Coinc kW gross w/o losses	Total kWh gross w/o losses
116569	25	1809V/A	4,100	629	0.1512	0.1512	15	629	0.1512	0.1512	15,728
118145	200	V2005-2002	8,760	629	0.1512	0.1512	15	629	0.1512	0.1512	125,827
118620	100	7509V	8,760	629	0.1512	0.1512	15	629	0.1512	0.1512	62,914
119511	20	IRN20H-CC	8,760	629	0.1512	0.1512	15	629	0.1512	0.1512	12,583
219	54	S423008	8,736	629	0.1512	0.1512	15	629	0.1512	0.1512	33,973
PSI13-1406347	150	R110N	8,000	629	0.1512	0.1512	15	629	0.1512	0.1512	94,370
PSI13-1448544	100	R75N-A100	8,640	629	0.1512	0.1512	15	629	0.1512	0.1512	62,914
PSI13-1406627	94	VS45-70A	6,000	629	0.1512	0.1512	15	629	0.1512	0.1512	59,139
PSI13-1303983	300	R225NE-145W	8,760	629	0.1512	0.1512	15	629	0.1512	0.1512	188,741
PSI13-1304085	30	IRN 30H-CCLV	3,345	629	0.1512	0.1512	15	629	0.1512	0.1512	18,874
PSI13-1462882	228	VS170	8,736	629	0.1512	0.1512	15	629	0.1512	0.1512	143,443
PSI13-1546020	75	75VFD	5,050	629	0.1512	0.1512	15	629	0.1512	0.1512	47,185
PSI13-1544706	200	R160N	8,000	629	0.1512	0.1512	15	629	0.1512	0.1512	125,827
PSI13-1548137	125	GA90VSD-AFF 460v	5,000	629	0.1512	0.1512	15	629	0.1512	0.1512	78,642
PSI13-1542363	200	QGV-200	8,760	629	0.1512	0.1512	15	629	0.1512	0.1512	125,827
PSI13-1547084	75	5507V	8,760	629	0.1512	0.1512	15	629	0.1512	0.1512	47,185
PSI13-1580028	75	L55RS	3,200	629	0.1512	0.1512	15	629	0.1512	0.1512	47,185
PSI14-1637621	350	ZR315VSDIMD	8,000	629	0.1512	0.1512	15	629	0.1512	0.1512	220,197
PSI14-1636944	150	GA 110 VSD-125	8,000	629	0.1512	0.1512	15	629	0.1512	0.1512	94,370
PSI14-1639753	300	R225NE	8,760	629	0.1512	0.1512	15	629	0.1512	0.1512	188,741

Appendix B: MWS-240 Specifications


MWS-240.pdf

Appendix C: Amana DigiSmart DD01E Specifications

DigiSmart DT DS DD Wireless EMS.pdf

Appendix D: Freeridership Calculations Not Including Chiller Tune-Ups

The freeridership section of this report beginning on page 61 shows how freeridership was calculated based on the responses of 16 surveyed non-lighting participants. The result of this calculation is an estimate of 51.6% freeridership for all surveyed non-lighting measures.

The tables below show how these calculations would work if the four participants who received chiller tune-ups are not included and freeridership is estimated only based on the responses of the remaining 12 survey respondents. The freeridership estimate for this set of non-lighting measures (not including chiller tune-ups) is 45.0% as shown in Table 46.

For a complete description of the methodology used in these calculations, see *Net-to-Gross Methodology* beginning on page 56.

Table 45. Program Freeridership (Without Tune-Ups)

Gateway Question Response	Non-lighting measures (freeriders)
Same unit at same time (100% freerider)	7 (7)
Same unit within 6 months (75% freerider)	0 (0)
Same unit 6-12 months later (50% freerider)	1 (0.5)
Same unit 12-24 months later (25% freerider)	0 (0)
Same unit more than 24 months later (0% freerider)	0 (0)
Same unit, don't know when (mean % freerider of the five rows above = 95.4% for Non-lighting)	0 (0)
Used unit at the same time (50% freerider)	1 (0.5)
Continued using old unit (0% freerider)	3 (0)
TOTAL COUNT	**12**
Freeriders	**8.0**
Freerider %	**66.7%**

Table 46. Program Freeridership Based on Financial Incentive (Without Tune-Ups)

Response for "without financial incentive"	Non-lighting Measures (freeriders)
Would have selected same efficiency level without financial incentive (freerider percent based on planned time of purchase times 100%)	6 (4.00)
Would have made a different choice without financial incentive: almost as efficient as new model (freerider percent based on planned time of purchase times 75%)	0 (0)
Would have made a different choice without financial incentive: significantly more efficient than old model (freerider percent based on planned time of purchase times 50%)	1 (0.33)
Would have made a different choice without financial incentive: somewhat more efficient than old model (freerider percent based on planned time of purchase times 25%)	1 (0.17)
Would have made a different choice without financial incentive: similar to old model (freerider 0%)	1 (0)
Would not have done this project without financial incentive (freerider 0%)	1 (0)
Not sure what company would have done without financial incentive (freerider percent based on mean of all columns above)	2 (0.90)
TOTAL COUNT	**12**
Freeriders	**5.40**
Freerider %	**45.0%**

Table 47. Program Freeridership Based on Information and Assistance (Without Tune-Ups)

Response for "without program information and technical assistance"	Non-lighting Measures (freeriders)
Would have selected same efficiency level without information/technical assistance (freerider percent based on planned time of purchase times 100%)	9 (6.00)
Would have made a different choice without information/technical assistance: almost as efficient as new model (freerider percent based on planned time of purchase times 75%)	0 (0)
Would have made a different choice without information/technical assistance: significantly more efficient than old model (freerider percent based on planned time of purchase times 50%)	1 (0.33)
Would have made a different choice without information/technical assistance: somewhat more efficient than old model (freerider percent based on planned time of purchase times 25%)	0 (0)
Would have made a different choice without information/technical assistance: similar to old model (freerider 0%)	0 (0)
Would not have done this project without program information/technical assistance (freerider 0%)	0 (0)
Not sure what company would have done without information/technical assistance (freerider percent based on mean of all columns above)	2 (1.27)
TOTAL COUNT	**12**
Freeriders	**7.60**
Freerider %	**63.3%**

Since the program included both an incentive payment and technical assistance/program information, each of which can motivate a decision to go with the more efficient choice, a two path analysis approach was used for assessing freeridership within the second set of questions. One path was scored for the influence of the incentive and another path was scored for the analysis of the effect of the technical assistance and program information. The final per-participant freeridership estimate is the lower of the two estimates from the two paths. These results are presented for each measure in Table 46 and Table 47. Thus, freeridership for the Smart $aver Prescriptive program in Indiana is estimated at 45.0% for non-lighting measures, when chiller tune-ups are not included.

Appendix E: Management Interview Instrument for Update on Program Operations

1. Have there been any aspects of the program's operations or design that have changed since our interview in April of 2014?
    a. Please describe what has changed, and why the change was made. What do you hope to improve with this change?
2. Is the program on track to launch the online application? If not, why not?
3. Is the program on track to use the new customer participation database? If not, why not?

Appendix F: Trade Ally Interview Instrument

Name: _____

Title: _____

Position description and general responsibilities:

_____

_____

_____

We are conducting this interview to obtain your opinions about and experiences with Duke Energy's Non-Residential Smart $aver program. We'll talk about your understanding of the Smart $aver Program and its objectives, your thoughts on improving the program, and the technologies the program covers. The interview will take about 10-15 minutes to complete. May we begin?

Understanding the Program

We would like to ask you about your understanding of the Smart $aver program. We would like to start by first asking you…

1. Can you please tell me what your company does?
    a. Manufacturer
    b. Distributor
    c. Wholesalers
    d. Retailer
    e. General Contractor
    f. Installer
    g. Consulting/Engineering
    h. Other_____
2. What is your job title and what are your responsibilities in your company?
3. How long have you been in this profession?
4. How did you first learn about Smart $aver?
5. How long have you been a partner in the Smart $aver Program? (When did you first submit a Smart $aver Prescriptive application?)
6. Are you listed as a trade ally? Have you gotten any leads from the DE website?

7. Have you submitted applications for Prescriptive incentives only, Custom incentives only, or both?
    a. Prescriptive only
    b. Custom only
    c. Both

Customer Motivation

8. When you are talking with a customer, how do you usually bring up the Smart $aver incentive during the course of the discussion?
    a. _____

9. When you are talking with a new prospective customer, how frequently have they already heard of Duke Energy's Smart $aver program? Would you say...?
    a. Almost Never
    b. About 25% of the time
    c. About 50% of the time
    d. About 75% of the time
    e. Almost always
    f.
10. What kinds of problems or issues have come up in the Smart $aver program?

11. Have you heard of any customer complaints that are in any way associated with this program?

TA Reasons for Participation in the Program

We would like to better understand why contractors become partners in the Smart $aver Program.

12. Please give me an estimate: What percentage of your projects or sales includes equipment that received a Smart $aver Prescriptive incentive? (If they can't remember Prescriptive separate from Custom, have them estimate together.)

13. How do you think Duke Energy can get more contractors to participate in this program?

Program Design and Design Assistance

14. Do you feel that the proper technologies and equipment are being covered through the program?

    a. Are the incentive levels appropriate? How do they impact the choice by the customers of the higher efficient equipment?

    b. Are there other technologies or energy efficient systems that you think should be included in the program?

    c. Are there components that are now included that you feel should not be included? What are they and why should they not be included?

Program Participation Experiences

The next few questions ask about the process for submitting participation forms and obtaining the incentive payments.

15. Do you think the process could be streamlined in any way? How?

16. Who submits application?

17. How long does it take between the time that you apply for your incentive, to the time that you and your customer receive the payments? Is this a reasonable amount of time? What should it be? Why?

18. Have you attended any presentations made by Duke Energy's Smart $aver program staff?

    a. If yes, how did you hear about these?
    b. Can you please rate the usefulness of the presentation you most recently attended, on a scale of 0 to 10, 0 indicates Not useful at all and 10 indicates always useful
    c. Is there any information you would like Duke to provide at these presentations, that they are not currently providing about the Prescriptive program?

19. What kinds of interactions have you had with Duke Energy? Who have you interacted with, and what was the purpose of those interactions? (Do not read the following options, since this is a qualitative survey)
    a. Large Account Managers
    b. Smart $aver Outreach Representatives
    c. The Smart $aver Custom program managers
    d. Duke Energy's Energy Efficiency Engineers?
    e. Other (e.g. If a specific person is mentioned by name)

20. Do you feel that communications between you and Duke Energy's Smart $aver program staff is adequate? How might this be improved?

21. Do you use any information or technical assistance from Smart $aver staff when making proposals to customers?
    a. If so, how would you rate the usefulness of this information or technical assistance on a scale of 0 to 10 where 0 indicates not useful at all and 10 indicates always useful?

22. Overall, what about the Smart $aver Program do you think works well and why? If you work with other utilities, what about the Smart $aver program stands out, in terms of either positives or negatives?

23. What changes would you suggest to improve the program?

24. There are no plans to terminate the program, but we would like to know how the program affects contractors. If the program were to be discontinued, would you still offer the same energy efficient equipment options?

25. In your opinion is the Smart $aver program still needed? Why?

Recommended Changes from the Participating Contractors

26. Are there any other changes that you would recommend to Duke Energy for their Program not already discussed?

Satisfaction Ratings

27. Sat 7. Considering all aspects of the program, what numerical rating would you give you overall satisfaction with the Smart $aver® Prescriptive Program?

( ) 0 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) DK/NS

If score is 7 or less ask:

28. Sat-7a. What could have been done to make this better, or have we already covered it?

_____

29. Sat 8. How would you rate your overall satisfaction with Duke Energy?

( ) 0 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) DK/NS

30. If score is 7 or less ask:

31. Sat-8a. What could have been done to make this better, or have we already covered it?

_____

_____

That concludes this survey, thank you very much for taking the time to help Duke Energy improve this program. Thank You!

Appendix G: Participant Survey Instrument

Enter Month and Year
Installation Date*

_____

for answering machine 1st through penultimate attempts:
Hello, my name is [*full name***] and I am calling from TecMarket Works on behalf of Duke Energy to conduct a customer survey about the Smart $aver Prescriptive Program. I'm sorry I missed you. I'll try again another time.**

for answering machine - Final Attempt:
Hello, my name is [*full name]* and I am calling from TecMarket Works on behalf of Duke Energy to conduct a customer survey about the Smart $aver Prescriptive Program. This is my last attempt at reaching you, my apologies for any inconvenience.

if person answers
Hello, my name is [*full name]*. I am calling from TecMarket Works on behalf of Duke Energy to conduct a customer survey about the Smart $aver Prescriptive Program. May I speak with _____ please?

If person talking, proceed. If person is called to the phone reintroduce. If not home, ask when would be a good time to call and schedule the call-back:
We are conducting this survey to obtain your opinions about Duke Energy's Smart $aver Prescriptive Program in which you participated. We are not selling anything. The survey will take about 15 minutes and your answers will be confidential, and will help us to make improvements to the program to better serve others. May we begin the survey?

1a. What does your company do?*

_____

1b. What is your role within your company?*

_____

2. Do you recall participating in the Smart $aver Program?
( ) Yes
( ) No
( ) DK/NS

If No or DK/NS, ask
This program was provided through Duke Energy. In this program, Duke Energy provides non-residential customers an incentive for purchasing and installing new qualifying energy-efficient motors, pumps, HVAC, or lighting systems. Customers can select equipment off a predetermined list on the Duke Energy website and send in an application for the Smart Saver Prescriptive incentive up to 90 days after the installation is completed.

3. Do you remember participating in this program?
( ) Yes
( ) No
( ) DK/NS

If No or DK/NS, thank them, terminate interview and go to next participant.

4. Are you an employee of the company that will be using the equipment, or are you the vendor or contractor who sold or installed this equipment?
( ) Employee, Owner, end-user *(This choice will continue the survey.)*
( ) Contractor
( ) Other *please specify* _____

if "Contractor", Carol will conduct a "Trade Ally" survey. John Miller will schedule interview with Carol.

if "Other", they are not eligible for the survey.

> **Thank you so much for this information. We will update our records that you are neither an employee nor a vendor. This will conclude our survey. Thank you for your time and participation.**

5. Did your company also participate in Energizing Indiana, "a united effort by the Indiana Utility Regulatory Commission, participating utilities, and consumer organizations to offer comprehensive energy efficiency programs that bring savings to communities across the state"?
( ) Yes
( ) No
( ) DK/NS

6. Have you submitted other applications in the past, to either the Smart $aver Custom or Prescriptive Programs?*
( ) No
( ) Yes, Both
( ) Yes, Custom only
( ) Yes, Prescriptive only
( ) DK/NS

7. For Duke Energy's Smart Saver Prescriptive Program, our records indicate that you recently purchased [*equipment***]. Is this correct? If not, what was the equipment that you purchased for the incentive?**
If they do not remember which project, tell them the name of the city and date of incentive check or checks if more than one project is listed in the spreadsheet. And/or give them the "Measure Description" if that is included on the call sheet.
( ) HVAC _____
( ) Process _____
( ) Lighting _____
( ) Pump _____
( ) Motor _____
( ) Refrigeration _____
( ) Other _____

7b. *Measure**
To be piped into future questions. Edit as needed, based upon customer's response to q7.
_____

8. Please think back to the time when you were scoping the project and deciding on the equipment, perhaps recalling things that occurred in your company shortly before and after your purchase. Let me give you a few seconds to think back to what else was affecting the scope of that project, and how you were planning to fund it.
(Wait 5 sec).

8a. What kinds of factors motivated you to purchase the [*equipment***] ?***
(Do not read list, place a "1" next to the response that matches best)
(Then ask: **Were there any other reasons?** *(Number responses above in the order they are provided - Repeat until 'no' response)*

If there is a followup question, put rank and reply in box e.g. "1, my supervisor"
The program incentive requirements _____
Wanted to reduce energy costs _____
The information provided by the Smart $aver Program _____
The information provided by other Duke Energy program _____
The information provided by the Energizing Indiana program _____
The information provided by another organization (non- Duke Energy, non-Energizing IN) _____
Past experience with the Smart $aver Prescriptive or Custom program _____
Because of past experience with another Duke Energy program
ask **What program?** _____
Recommendation by Duke Energy Account Manager or representative _____
Recommendation from other utility program
ask **What program?** _____
Recommendation of dealer/contractor _____
Recommendation of someone else
ask **Who?** _____
Advertisement in newspaper
ask **For what program?** _____
Radio advertisement
ask **For what program?** _____
DK/NS _____
Other _____

9. How did you first hear about the program?*
(Do not read list, check one response)
( ) The information provided by the Smart $aver Program
( ) The information provided by other Duke Energy program
ask **What program?** _____
( ) The information provided by the Energizing Indiana program
( ) The information provided by another organization (non- Duke Energy, non-Energizing IN)
ask **What organization?** _____
( ) Past experience with this Smart Saver Program
( ) Because of past experience with another Duke Energy program
ask **What program?** _____
( ) Recommendation by Duke Energy Account Manager or representative
( ) Recommendation from other utility program
ask **What program?** _____
( ) Recommendation of dealer/contractor
( ) Recommendation of someone else
ask **Who?** _____
( ) Advertisement in newspaper
ask **For what program?** _____
( ) Radio advertisement
ask **For what program?** _____
( ) Other *Please specify* _____
( ) DK/NS

10. Did you get this [*equipment***] to replace existing [***equipment***]?**
( ) Yes
( ) No
( ) DK/NS

If "No" or "DK/NS", skip to q16

13. About how old was the [*equipment***] you replaced?***
( ) Less than 5 years old
( ) 5 to less than 10 years old
( ) 10 to less than 20 years old
( ) 20 years to less than 30 years old
( ) 30 or more years old
( ) DK/NS

14. Was the old [*equipment***] working or not working?**
( ) Yes, working
( ) No, not working *skip to q16*
( ) DK/NS

15. Was the old [*equipment*] in good, fair, or poor working condition?*
( ) Good
( ) Fair
( ) Poor
( ) DK/NS

16. Where did you get your incentive application?*
[Use list as prompt as necessary. Record one response.]
( ) Contractor or Equipment Vendor
( ) Website/on-line
( ) Duke Energy Account Manager
( ) Other Duke Energy representative
( ) Consulting Engineer, Architect or Energy Consultant
( ) Other *Please specify* _____
( ) Refused
( ) DK/NS

17. Who filled out the program incentive application for your company?*
( ) I did (customer)
( ) Someone from my company did
( ) The contractor
( ) The salesperson
( ) Someone from Duke Energy
( ) Other _____

If they filled it out
17a. Using a 1 to 10 scale where a 1 means that you are very dissatisfied and a 10 means that you are very satisfied, please rate the ease of understanding the incentive application.*
( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If score is 7 or less
17b. How can this be improved?*

_____

18. Who submitted the application to Duke Energy?*
( ) I did (customer)
( ) Someone from my company did
( ) The contractor
( ) The salesperson
( ) Someone from Duke Energy
( ) Other _____

19. Did you have any problems receiving the incentives?*
( ) Yes
( ) No
( ) DK/NS

If yes to Q19, ask
19b. Please explain the problem and how it was resolved. Was it resolved to your satisfaction?*

_____

20. Please indicate from the following choices what action you would have taken if the program had not been available*
( ) I would have continued using the old [*equipment***],**
( ) I would have bought a used [*equipment* **] at the same time or later time,**
( ) I would have bought a new [*equipment* **] at the same time, or**
( ) I would have bought a new [*equipment* **]at a later time.**

If "same time or later time" or "later time" checked for Q20, then ask Q20b
20b. How many months later would you have bought a new [*equipment***]?***

_____

21. On a scale of 0 to 10, where a 0 means that the program had zero influence and a 10 means that the program had a major influence, please rate the level of influence the program incentive had on the level of energy efficiency of your new equipment?*
Scale of 0 to 10 is correct in this case
( ) 0 ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

22. Do you think that you would have selected the same level of energy efficiency if the program's financial incentive would not have been available to you?*
( ) No. We would make a somewhat different equipment selection
( ) No. We would not do the same project
( ) Not sure what we would do
( ) Yes. We would make exactly the same equipment choice
( ) Other _____

If "no – different selection" checked in Q22, then ask Q22b
22b. You indicated that without the program's financial incentive you would have bought [*equipment***] with a different level of energy efficiency. If the program were not available do you think you would have bought a unit that is. . .***
( ) Similar in efficiency to your previous model,
( ) Somewhat higher efficiency than your previous model,
( ) Significantly more efficient than your previous model but not as efficient as the one you bought, or
( ) Almost as efficient as the model you bought?
( ) DK/NS

23. Aside from the financial incentive, Duke Energy also provides information and/or technical assistance on the benefits of using energy efficient equipment. On a scale of 0 to 10, where a 0 means that the program had zero influence and a 10 means that the program had a major influence, please rate the level of influence the program information and/or technical assistance had on the level of energy efficiency of your new equipment?*
( ) 0 ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If score is 7 or less
23b. What information source do you consider the most important influence on your choice of this particular equipment?*

_____

24. Do you think that you would have selected the same level of energy efficiency if the Duke Energy Smart $aver Program information and/or technical assistance would not have been available to you?*
( ) No. We would make a somewhat different equipment selection
( ) No. We would not do the same project
( ) Not sure what we would do
( ) Yes. We would make exactly the same equipment choice
( ) Other _____

If "no – different selection" checked in q24, then ask q24b
24b. You indicated that without the program's information and/or technical assistance you would have bought Lighting with a different level of energy efficiency. If the program were not available do you think you would have bought a unit that is. . .*
( ) **Similar in efficiency to your previous model,**
( ) **Somewhat higher efficiency than your previous model,**
( ) **Significantly more efficient than your previous model but not as efficient as the one you bought, or**
( ) **Almost as efficient as the model you bought?**
( ) DK/NS

25. When firms have experience with energy efficiency programs or products, they sometimes make similar decisions to continue the energy savings in other parts of their business. Since the time you participated in the Smart $aver Prescriptive Program, have you purchased and installed on your own initiative any additional types of high efficiency equipment or made energy efficiency improvements at your company including other locations?*
( ) Yes, only at this company
( ) Yes, only at other locations
( ) Yes, at both company and other locations
( ) No
( ) DK/NS

If "yes" to q25, ask q26 to q30.

(Probe to get exact type and quantity and location)

26. What type and quantity of additional high efficiency equipment did your company install on its own?*

	Type	Quantity	Address
1	_____	_____	_____
2	_____	_____	_____
3	_____	_____	_____
4	_____	_____	_____

For each type listed above,

27. How do you know that this additional equipment is high efficiency? For example, was it Energy Star rated?*

1 _____
2 _____
3 _____
4 _____

(For each type listed above)

28. Did you receive an incentive for installing any of this additional equipment?*

	Yes	None	DK/NS
1	( )	( )	( )
2	( )	( )	( )
3	( )	( )	( )
4	( )	( )	( )

(For each type listed above)
Enter 'none' if no incentive was received for an installation

29. Who gave this incentive?*

	Who
1	_____
2	_____
3	_____
4	_____

30. On a scale from 1-10, with 1 indicating that you strongly disagree, and 10 indicating that you strongly agree, please rate your agreement with the following statement: "My experience with the Smart $aver Prescriptive Program in *[month & year]* influenced my decision to install additional high efficiency equipment on my own."*

( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If score is 7 or less

30b. What do you consider the most important influence on your choice of this particular equipment?*

_____

31. What other actions, if any, have you taken in your company to save energy and reduce utility bills as a result of what you learned in this program?*
Enter 'none' if no actions were taken
1 _____
2 _____
3 _____
4 _____

For q32 to q35, enter "None" if customer answers Nothing, DK, NS, etc.

32. What do you like most about this program, if anything?*
_____

33. What do you like least about this program, if anything?*
_____

34. What additional services would you like the program to provide that it does not now provide?*
_____

35. Are there any other things that you would like to see changed about the program?*
_____

We would like to ask you a few questions about your satisfaction with various aspects of the program. For these questions we would like you to rate your satisfaction using a 1 to 10 scale where a 1 means that you are very dissatisfied with that aspect and a 10 means that you are very satisfied.

How would you rate your satisfaction with:

36. The amount of the incentives provided by the program*
( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If score is 7 or less
36b. How can this be improved?*
_____

37. The time it took to receive the incentive*
( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If score is 7 or less
37b. How can this be improved?*
_____

38. The variety of technologies covered in the program*
( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If score is 7 or less
38b. What would you like to see added?*

_____

39. The information provided by your assigned account manager, if you have one, about the Smart $aver Prescriptive Program?*
( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If score is 7 or less
39b. How can this be improved?*

_____

40. The information provided by your vendor or contractor about the Smart $aver Prescriptive Program?*
( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If score is 7 or less
40b. How can this be improved?*

_____

41. The information provided on the website about the Smart $aver Prescriptive Program?*
( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If score is 7 or less
41b. How can this be improved?*

_____

42. The interactions and communications with Duke Energy staff.*
( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If score is 7 or less
42b. How can this be improved?*

_____

44. Now, considering all aspects of the program, how would you rate your overall satisfaction with the Smart $aver Prescriptive Program on a scale from 1 to 10 where 1 means very dissatisfied and 10 means very satisfied?*
( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If score is 7 or less
44b. How can this be improved?*

_____

45. How would you rate your overall satisfaction with Duke Energy?*
( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10 ( ) NA ( ) DK/NS

If score is 7 or less
45b. How can this be improved?*

_____

Ask Q46-Q50 for Indiana respondents who answered "yes" to Q5 (participated in Energizing Indiana) –
OTHERWISE SKIP AHEAD TO Q51 NOW

46. Which program did you hear about first, Duke Energy's Smart $aver or Energizing Indiana?*
( ) Smart $aver
( ) Energizing Indiana
( ) DK/NS
( ) Other _____
( ) Both at same time

If 'both at same time' or 'other'
46a. Did you learn about them through Duke Energy's marketing and outreach, or from Energizing Indiana's own marketing and outreach?*
( ) From Duke Energy
( ) From Energizing Indiana
( ) DK/NS
( ) Other _____

If Smart $aver first
47. Did you learn about Energizing Indiana through Duke Energy's marketing and outreach, or from Energizing Indiana's own marketing and outreach?*
( ) From Duke Energy
( ) From Energizing Indiana
( ) DK/NS

If Energizing Indiana first
48. Did you learn about Smart $aver through Energizing Indiana's marketing and outreach, or from Duke Energy's own marketing and outreach?*
( ) From Duke Energy
( ) From Energizing Indiana
( ) DK/NS

49. Are there any aspects of Energizing Indiana that you would like to see incorporated into Duke Energy's Smart $aver Prescriptive Program?*
( ) Yes *specify* _____
( ) No
( ) DK/NS

50. What is your preference for the division of prescriptive incentives between Smart $aver and Energizing Indiana?*
( ) The current division is fine with me.
( ) I don't have a preference at all.
( ) I would prefer that all the prescriptive incentives be offered by Energizing Indiana
( ) I would prefer that all the prescriptive incentives be offered by Smart $aver
( ) Other preference _____

51. We have reached the end of the survey. Do you have any comments that you would like for me to pass on to Duke Energy?*

_____

That's all the questions I have for you today. Thank you for your time!

_____
Trade Ally Instructions
John Miller will schedule an interview between Carol Yin and Trade Ally.
Give TA John's contact info, and notify John immediately via email.

_____
"Other" Instructions

Thank you so much for this information. We will update our records that you are neither an employee nor a vendor. This will conclude our survey. Thank you for your time and participation.

Appendix H: Prototypical Building Descriptions

Large Office

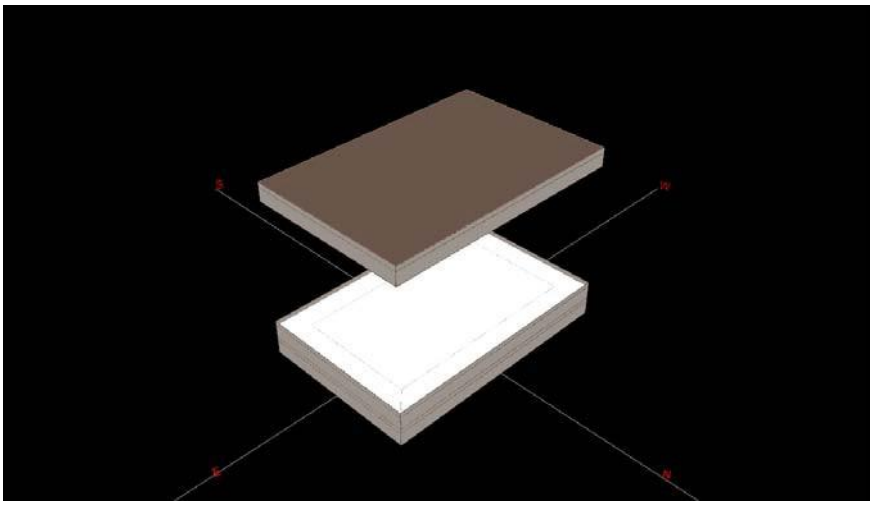
A prototypical building energy simulation model for a large office building was developed using the DOE-2.2 building energy simulation program. The characteristics of the prototype are summarized below:

Large Office Prototype Building Description

Characteristic	Value
Vintage	Existing (1970s) vintage
Size	350,000 square feet
Number of floors	10
Wall construction and R-value	Glass curtain wall, R-7.5
Roof construction and R-value	Built-up roof, R-13.5
Glazing type	Multipane; Shading-coefficient = 0.84 U-value = 0.72
Lighting power density	Perimeter offices: 1.55 W/SF Core offices: 1.45 W/SF
Plug load density	Perimeter offices: 1.6 W/SF Core offices: 0.7 W/SF
Operating hours	Mon-Sat: 9am – 6pm Sun: Unoccupied
HVAC system types	1. Central constant volume system with perimeter hydronic reheat, without economizer; 2. Central constant volume system with perimeter hydronic reheat, with economizer; 3. Central VAV system with perimeter hydronic reheat, with economizer
HVAC system size	Based on ASHRAE design day conditions, 10% over sizing
Chiller type	Water-cooled and air-cooled
Chilled water system type	Constant volume with 3 way control valves,
Chilled water system control	Constant CHW Temp, 45 deg F setpoint
Boiler type	Hot water, 80% efficiency
Hot water system type	Constant volume with 3 way control valves,
Hot water system control	Constant HW Temp, 180 deg F setpoint
Thermostat setpoints	Occupied hours: 75 cooling, 70 heating Unoccupied hours: 80 cooling, 65 heating

Each set of measures was run using each of three different HVAC system configurations – a constant volume reheat system without economizer, a constant volume reheat system with economizer and a VAV system with economizer. The constant volume reheat system without economizer represents system with the most heating and cooling operating hours, while the VAV system with economizer represents a system with the least heating and cooling hours. This presents a range of system loads and energy savings for each measure analyzed.

A computer-generated sketch of the prototype is shown below. Note, the middle floors, since they thermally equivalent, are simulated as a single floor, and the results are multiplied by 8 to represent the energy consumption of the 8 middle floors.



Large Office Building Rendering

University

A prototypical building energy simulation model for a university building was developed using the DOE-2.2 building energy simulation program. The simulations were driven using TMY3 long-term average weather data. The model is really four identical buildings oriented 90 degrees apart. The characteristics of the prototype are summarized below.

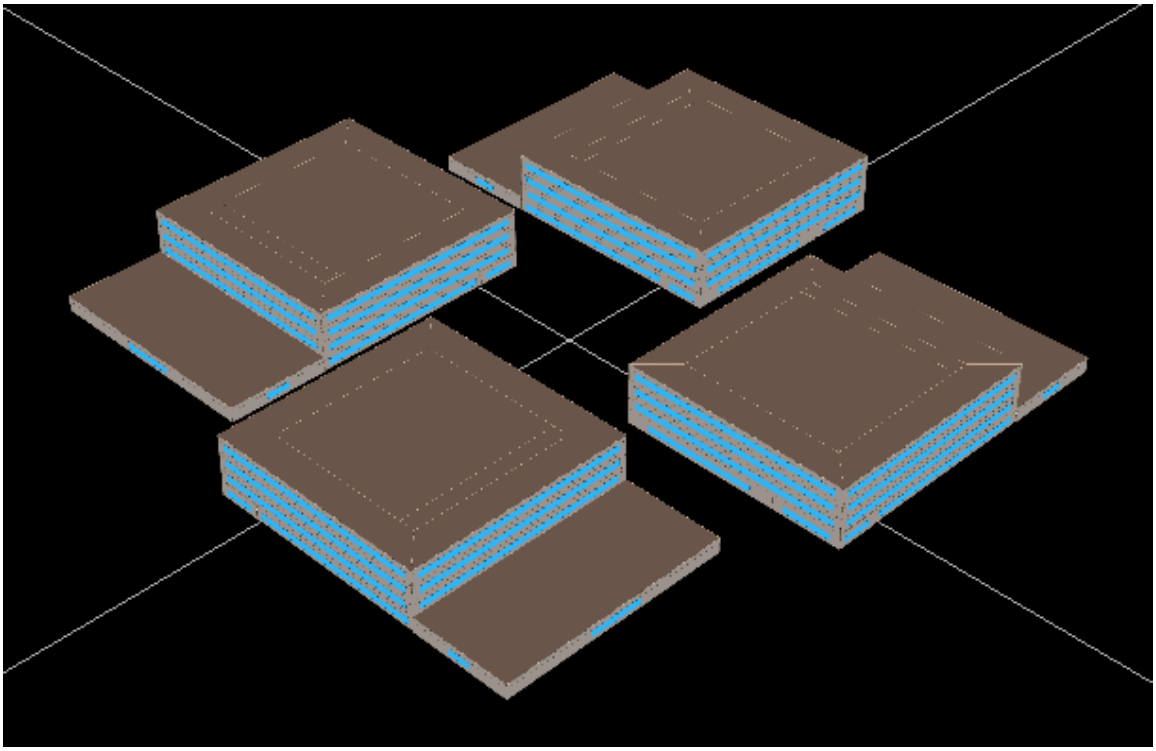
University Prototype Building Description

Characteristic	Value
Vintage	Existing (1970s) vintage
Size	4 buildings, 200,000 square feet each; oriented 90° from each other Classroom: 431,160 SF Computer room: 27,540 SF Dining area: 24,000 SF Kitchen: 10,500 SF Office: 226,800 SF Total: 800,000 SF
Number of floors	4
Wall construction and R-value	Insulated frame wall with R-7.5
Roof construction and R-value	Wood frame with built-up roof, R-13.5
Glazing type	Double pane clear, SHGC = 0.73; U-value = 0,72
Lighting power density	Classroom: 3.6 W/SF Computer room: 3.6 W/SF Dining area: 1.5 W/SF Office: 2.0 W/SF Kitchen: 3.6 W/SF
Plug load density	Classroom: 1.1 W/SF Computer room: 5.5 W/SF Dining area: 0.6 W/SF Office: 1.6 W/SF Kitchen: 3.3 W/SF
Operating hours	Mon-Fri: 8am – 10pm Sat: 8am – 7pm Sun: closed
HVAC system type	Combination PSZ and built-up with centrifugal chiller and hot water boiler.
HVAC system size	400 SF/ton
Thermostat setpoints	Occupied hours: 76 cooling, 72 heating Unoccupied hours: 81 cooling, 67 heating
Chiller type	Water-cooled and air-cooled
Chilled water system type	Variable volume with 2 way control valves
Chilled water system control	Constant CHW Temp, 45 deg F setpoint
Boiler type	Hot water, 80% efficiency
Hot water system type	Variable volume with 2 way control valves
Hot water system control	Constant HW Temp, 180 deg F setpoint

Each set of measures was run using each of three different HVAC system configurations: a constant volume reheat system without economizer, a constant volume reheat system with economizer, and a VAV system with economizer. The constant volume reheat system without economizer represents a system with the most heating and cooling operating hours, while the

VAV system with economizer represents a system with the least heating and cooling hours. This presents a range of system loads and energy savings for each measure analyzed.

A computer-generated sketch of the prototype is shown below.



University Rendering

Appendix I: DSMore Table

Impacts / Technology	Product code	State	EM&V gross savings (kWh/unit)	EM&V gross kW (customer peak/unit)	EM&V gross kW (coincident peak/unit)	Unit of measure	Combined spillover less freeridership adjustment	EM&V net savings (kWh/unit)	EM&V net kW (customer peak/unit)	EM&V net kW (coincident peak/unit)	EM&V load shape (yes/no)	EUL (whole number)
Air Compressor VFD		Indiana	1120.6	0.000	0.000	motor hp	50.5%	554.7	0.000	0.000	No	15
Air-Cooled Screw Chiller COP = 2.86, IPLV = 3.12 per ton		Indiana	49.7	0.024	0.019	Ton	50.5%	24.6	0.012	0.009	No	20
Air-Cooled Screw Chiller COP = 2.86, IPLV = 3.48 per ton		Indiana	247.7	0.120	0.095	Ton	50.5%	122.6	0.059	0.047	No	20
Air-Cooled Screw Chiller COP = 2.86, IPLV = 3.97 per ton		Indiana	325.8	0.158	0.125	Ton	50.5%	161.3	0.078	0.062	No	20
Air-Cooled Screw Chiller COP = 2.86, IPLV = 4.33 per ton		Indiana	588.2	0.285	0.225	Ton	50.5%	291.2	0.141	0.111	No	20
Air-Cooled Screw Chiller COP = 3.08, IPLV = 3.36 per ton		Indiana	296.4	0.144	0.113	Ton	50.5%	146.7	0.071	0.056	No	20
Air-Cooled Screw Chiller COP = 3.08, IPLV = 3.80 per ton		Indiana	472.9	0.229	0.181	Ton	50.5%	234.1	0.113	0.090	No	20
Air-Cooled Screw Chiller COP = 3.08, IPLV = 4.00 per ton		Indiana	539.7	0.261	0.207	Ton	50.5%	267.2	0.129	0.102	No	20
Air-Cooled Screw Chiller COP = 3.08, IPLV = 5.22 per ton		Indiana	769.8	0.373	0.295	Ton	50.5%	381.0	0.185	0.146	No	20
Air-Cooled Screw Chiller COP = 3.36, IPLV = 3.66 per ton		Indiana	546.4	0.265	0.209	Ton	50.5%	270.5	0.131	0.103	No	20
Air-Cooled Screw Chiller COP = 3.36, IPLV = 4.15 per ton		Indiana	708.3	0.343	0.271	Ton	50.5%	350.6	0.170	0.134	No	20
Air-Cooled Screw Chiller COP = 3.36, IPLV = 4.42 per ton		Indiana	769.6	0.373	0.294	Ton	50.5%	380.9	0.184	0.146	No	20
Air-Cooled Screw Chiller COP = 3.36, IPLV = 5.69 per ton		Indiana	980.5	0.475	0.375	Ton	50.5%	485.3	0.235	0.186	No	20
Guestroom Controls		Indiana	653.0	0.205	0.152	Ton	50.5%	323.2	0.102	0.075	No	8
Program wide												

Notes: 1. Chiller savings are based on the kWh and NCP kW realization rates from the evaluation applied to non-interpolated ex-ante savings values from the Large Office model. If the program includes additional building types and interpolates the values, then the interpolated values by building type should be used directly.
2. Guestroom control savings are relevant to PTAC units with electric heat only.