STATE OF INDIANA

INDIANA UTILITY REGULATORY COMMISSION

VERIFIED PETITION OF SOUTHERN INDIANA GAS & ELECTRIC COMPANY D/B/A VECTREN ENERGY DELIVERY OF INDIANA, INC. REQUESTING THE INDIANA UTILITY REGULATORY COMMISSION TO APPROVE CERTAIN DEMAND SIDE MANAGEMENT PROGRAMS AND GRANT COMPANY AUTHORITY TO RECOVER COSTS, INCLUDING PROGRAM COSTS, INCENTIVES AND LOST MARGINS, ASSOCIATED WITH THE DEMAND SIDE MANAGEMENT PROGRAMS PURSUANT TO SENATE ENROLLED ACT 412 AND 170 IAC 4-8-1 ET. SEQ. VIA THE COMPANY'S DEMAND SIDE MANAGEMENT ADJUSTMENT	)	**CAUSE NO. 44645**

PETITIONER'S SUBMISSION OF CASE-IN-CHIEF

Petitioner Southern Indiana Gas and Electric Company d/b/a Vectren Energy Delivery of Indiana, Inc., ("Vectren South"), by counsel, hereby submits the Verified Direct Testimony and Exhibits of Robert C. Sears, Michael P. Huber, Richard G. Stevie, J. Cas Swiz and Scott E. Albertson.

Dated this 29th day of June, 2015.

Respectfully Submitted,

SOUTHERN INDIANA GAS & ELECTRIC COMPANY D/B/A VECTREN ENERGY DELIVERY OF INDIANA, INC.

/s/ *Michelle D. Quinn*

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that on this 29th day of June 2015 a copy of the foregoing was served by electronic mail transmission upon the following:

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Michelle D. Quinn

STATE OF INDIANA

INDIANA UTILITY REGULATORY COMMISSION

VERIFIED PETITION OF SOUTHERN INDIANA GAS & ELECTRIC COMPANY D/B/A VECTREN ENERGY DELIVERY OF INDIANA, INC. REQUESTING THE INDIANA UTILITY REGULATORY COMMISSION TO APPROVE CERTAIN DEMAND SIDE MANAGEMENT PROGRAMS AND GRANT COMPANY AUTHORITY TO RECOVER COSTS, INCLUDING PROGRAM COSTS, INCENTIVES AND LOST MARGINS, ASSOCIATED WITH THE DEMAND SIDE MANAGEMENT PROGRAMS PURSUANT TO SENATE ENROLLED ACT 412 AND 170 IAC 4-8-1 ET. SEQ. VIA THE COMPANY'S DEMAND SIDE MANAGEMENT ADJUSTMENT	)	**CAUSE NO. 44645**

<u>VERIFIED PETITION</u>

Southern Indiana Gas and Electric Company d/b/a Vectren Energy Delivery of Indiana, Inc. ("Vectren South," "Petitioner," or "Company") petitions the Indiana Utility Regulatory Commission ("Commission") for approval of the demand side management ("DSM") plan as outlined in the Vectren South 2016-2017 Electric DSM Plan ("2016-2017 Plan") and for authority to recover all program costs, including lost margins, financial incentives, and capital costs associated with the 2016-2017 Plan through its Demand Side Management Adjustment mechanism ("DSMA") pursuant to Senate Enrolled Act 412 ("SEA 412"), Ind. Code §§ 8-1-2-42(a), 8-1-8.5-9 and 170 IAC 4-8-5 and 4-8-6. In accordance with 170 IAC 1-1.1-8 and 1-1.1-9 of the Commission's Rules of Practice and Procedure, Petitioner respectfully submits the following information in support of this Petition:

1. <u>Petitioner's Corporate and Regulated Status.</u> Petitioner is an operating public utility, incorporated under the laws of the State of Indiana, with its principal office and place of business located at One Vectren Square, 211 NW Riverside Drive, Evansville, Indiana 47708. Petitioner is engaged in rendering electric utility service in the state of Indiana and owns, operates, manages and controls, among other things, plant and equipment within the state of Indiana used for the generation, transmission distribution and furnishing of such service to the public. Petitioner is a "public utility" within the meaning of Ind. Code § 8-1-2-1 and is an electricity supplier within the meaning of SEA 412 and Ind. Code §§ 8-1-2.3-2(b) and 8-1-8.5-9 and is subject to the jurisdiction of the Commission in the manner and to the extent provided by the Public Service Commission Act, as amended, and other pertinent laws of the State of Indiana.

2. **<u>Petitioner's Operations.</u>** Petitioner provides electric utility service to approximately 140,000 customers in six (6) counties in southwestern Indiana. Petitioner renders such electric utility service by means of utility plant, property, equipment and related facilities owned, leased, operated, managed and controlled by it which are used and useful for the convenience of the public in the production, treatment, transmission, distribution and sale of electricity.

3. **<u>Senate Enrolled Act 412</u>**. The 2015 Indiana General Assembly recently enacted new legislation related to energy efficiency ("EE") that requires electric utilities in Indiana to file a plan with the Commission for approval at least one (1) time every three (3) years beginning not later than 2017. SEA 412 was codified at Ind. Code § 8-1-8.5-10. The plan must contain EE goals, EE programs to achieve the EE goals, program budgets and program costs, and evaluation measurement and verification ("EM&V") procedures that must include independent EM&V. The legislation establishes ten (10) factors the Commission must consider when determining whether a plan is reasonable and if the Commission finds the plan to be reasonable, then the utility is allowed to recover costs associated with implementation of the plan, including program costs, financial incentives and lost margins. One factor the Commission must consider when determining the reasonableness of a plan filed for approval is the link between the plan and the utility's Integrated Resource Plan ("IRP").

Vectren South has authority to offer its current portfolio of EE programs through December 31, 2015 and is seeking approval of the Vectren South 2016-2017 Electric DSM Plan ("2016-2017 Plan") to be filed in this proceeding. The 2016-2017 Plan contains EE goals, a portfolio of EE programs and demand response ("DR") programs (collectively "DSM") designed to achieve the goals, program budgets and costs and a plan for independent EM&V of the programs included in the 2016-2017 Plan.

4. **Petitioner's 2016-2017 Plan.** The 2016-2017 Plan is a portfolio of cost effective EE and DR programs designed to save approximately 1% of adjusted retail sales, excluding the roughly 80% of eligible load that has opted out of participation in Company sponsored DSM programs as a result of Senate Enrolled Act 340 ("SEA 340"). The 2016-2017 Plan is designed to save more than 36 million kilowatt hours (kWh) of energy and produce nearly 8,300 kilowatts (kW) in peak demand reduction in 2016, and nearly 38 million kWh of energy savings and more than 7,100 kW in peak demand reduction in 2017. Vectren South has estimated the program budgets associated with these levels of savings to be approximately $8.6 million in 2016 and approximately $8.1 million in 2017, not including capital investments or other program costs such as financial incentives and lost margins.

7. **Ratemaking Mechanism.** Vectren South will continue to recover costs associated with the 2016-2017 Plan via the demand side management adjustment mechanism ("DSMA"). Petitioner's DSMA includes the following components: (1) the direct load control ("DLC") component, which recovers or passes back the difference between the actual amount of DLC credits and the amount of such credits included in base rates, as well as the costs associated with the Company's DLC inspection and maintenance program; (2) the energy efficiency funding component, which recovers program costs associated with offering Commission-approved DSM programs; (3) recovery of performance incentives as most recently approved in Cause No. 44495, which includes performance incentives for all DSM programs, except the conservation voltage reduction ("CVR") Program and Income Qualified Weatherization Program; (4) the lost margin component, that recovers EM&V verified lost margins associated with large commercial and industrial customer participation in the Company's DSM programs, as approved in Cause No. 43938, as well as the lost margin component, that recovers lost margins associated with residential and small general service customer participation in the Company's DSM programs, as approved in

Cause No. 43405 DSMA 9 S1. In addition, Vectren South will incur financing costs associated with its investment in CVR. In lieu of immediate recovery of the full capital expenditure amount, Vectren South is proposing to recover the needed return on and of the CVR program investment in the DSMA until the Company's next base rate case.

8. **Applicable Law.** Vectren South considers the provisions of the Public Service Commission Act, as amended, including IC §§ 8-1-2-4, 8-1-2-12, 8-1-2-42, 8-1-2-46, 8-1-2-61 and 8-1-8.5-10 to be applicable to the subject matter of this Petition, in addition to 170 IAC § 4-8-1 *et seq.* and believes that such traditional statutes and rules provide the Commission authority to approve the relief requested.

9. **Petitioner's Counsel.** Robert E. Heidorn (Atty. No. 14264-49), P. Jason Stephenson (Atty. No. 21839-49) and Michelle D. Quinn (Atty. No. 24357-49), Vectren Corporation, One Vectren Square, 211 N.W. Riverside Drive, Evansville, Indiana 47708 are counsel for Petitioner and are duly authorized to accept service of papers in this Cause on Petitioner's behalf.

10. **Request for Prehearing Conference.** Pursuant to 170 IAC § 1-1.1-15(b) of the Commission's Rules of Practice and Procedure, Petitioner requests that a date be promptly fixed for a prehearing conference and preliminary hearing for the purpose of fixing a procedural schedule in this proceeding and considering other procedural matters.

WHEREFORE, Southern Indiana Gas and Electric Company d/b/a Vectren Energy Delivery of Indiana, Inc. respectfully requests that the Commission: (1) promptly publish notice; (2) make such other investigation; (3) hold such hearings as are necessary or advisable in this Cause; (4) approve the 2016-2017 Plan; and (6) issue a Final Order in this proceeding.

Respectfully Submitted,

SOUTHERN INDIANA GAS & ELECTRIC COMPANY D/B/A VECTREN ENERGY DELIVERY OF INDIANA, INC.

Robert C. Sears
Vice President, Customer Energy Solutions

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d/b/a Vectren Energy Delivery of Indiana, Inc.

VERIFICATION

I, Robert C. Sears, Vice President, Customer Energy Solutions, affirm under the penalties of perjury that the statements and representations in the foregoing Petition are true to the best of my knowledge, information and belief.

Robert C. Sears

Dated: June 26, 2015

CERTIFICATE OF SERVICE

The undersigned hereby certifies that on this 26th day of June 2015 a copy of the foregoing Petition was served by electronic mail transmission upon the Indiana Office of Utility Consumer Counselor to:

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/s/ *Michelle D. Quinn*
Michelle D. Quinn

SOUTHERN INDIANA GAS AND ELECTRIC COMPANY D/B/A VECTREN ENERGY DELIVERY OF INDIANA, INC.

("VECTREN SOUTH")

I.U.R.C. CAUSE NO. 44645

DIRECT TESTIMONY

OF

ROBERT C. SEARS

VICE PRESIDENT, CUSTOMER ENERGY SOLUTIONS

ON

DEMAND SIDE MANAGEMENT POLICY

SPONSORING PETITIONER'S EXHIBIT NO. 1 & ATTACHMENTS RCS-1 THROUGH RCS-2

VERIFIED DIRECT TESTIMONY OF ROBERT C. SEARS

I. INTRODUCTION

Q. Please state your name and business address.

A. My name is Robert C. Sears. My business address is One Vectren Square, Evansville, Indiana 47708.

Q. What position do you hold with Petitioner Southern Indiana Gas and Electric Company d/b/a Vectren Energy Delivery of Indiana, Inc. ("Vectren South" or the "Company")?

A. I am Vice President of Customer Energy Solutions for Vectren Utility Holdings, Inc. ("VUHI"), the immediate parent company of Vectren South. I hold the same position with two other utility subsidiaries of VUHI—Indiana Gas Company, Inc. d/b/a Vectren Energy Delivery of Indiana, Inc. ("Vectren North") and Vectren Energy Delivery of Ohio, Inc. ("VEDO").

Q. Please describe your educational background.

A. I earned a Bachelor of Science degree in electrical engineering technology from the University of Southern Indiana in 1986.

Q. Please describe your professional experience.

A. I have been employed with VUHI or its predecessor companies since 1987 in a variety of positions. Previously, I was Director of Conservation, responsible for managing all aspects of gas and electric demand side management ("DSM") programs for all three VUHI utilities. In 2006, VUHI established the Conservation Connection to provide customers with options to manage their energy bills. Customers can obtain information regarding demand response ("DR") and energy efficiency ("EE") (collectively "DSM") programs, including current rebate programs offered by Vectren South and its affiliated companies. As part of my role as Director of Conservation, I was responsible for overseeing management of the Conservation Connection efforts.

In addition, during the course of my tenure as Director of Conservation, I was involved in the design, development and implementation of four annual electric DSM portfolios and eleven annual gas EE program portfolios in Indiana and Ohio. I have worked closely with the Vectren Oversight Boards and third party consultants to design Company-administered, cost effective EE program portfolios that have performed well. My experience with designing, implementing and evaluating DSM programs dates back to 1992 at Southern Indiana Gas and Electric Company, Vectren South's predecessor company, where I managed both gas and electric DSM programs.

Prior to assuming the role of Director of Conservation, I was Director of Revenue Administration, with responsibility for the management of all aspects of revenue cycle operations, including meter reading, billing, remittance, credit and collection, customer accounting, margin analysis, and customer billing system administration. Prior to that, I was Director of Customer Service, with responsibility for customer service, billing and customer systems support for all VUHI utility operations. I have also held other positions including Manager of Energy Services and Manager of DSM Services, with responsibility for the development, delivery and evaluation of EE and DR programs.

Q. What are your present duties and responsibilities as Vice President of Customer Energy Solutions?

A. As of June 1, 2015, I am responsible for long-term planning for VUHI's three regulated utilities, which includes exploring new technologies and behind-the-meter developments in utility technologies, industrial sales and economic development, compressed natural gas and market research. Just prior to June 1, 2015, I was primarily responsible for the overall planning and operation of the Company's energy marketing/sales initiatives, DSM and conservation programs, economic development activities and revenue cycle operations. In that position, I had oversight of all aspects of marketing natural gas and electricity, economic development, and DSM/conservation for VUHI's energy delivery operations.

Q. Have you previously testified before the Indiana Utility Regulatory Commission ("Commission" or "IURC")?

A. Yes. I most recently testified in Cause No. 44612, where Vectren North sought approval of a special contract to provide natural gas transportation service to Central Indiana Ethanol and have testified in numerous proceedings where Vectren South sought approval of a portfolio of electric DSM programs to be offered at Vectren South. Also, I have testified in various Demand Side Management Adjustment ("DSMA") proceedings, seeking to recover costs associated with offering electric DSM Programs. In addition, I testified in Cause No. 43839, the Company's most recent electric base rate case and have testified in other net metering and AMI/Smart Grid proceedings.

II. PURPOSE

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony is to provide support for approval of the Vectren South 2016–2017 Electric DSM Plan ("2016-2017 Plan"). To that end, I discuss recent changes in the energy efficiency landscape in Indiana and how those changes impacted planning for the 2016 - 2017 Plan. I provide an overview of the 2016–2017 Plan and discuss how DR and EE programs included in the 2016–2017 Plan will be implemented, overseen and evaluated. I provide an overview of the costs associated with the 2016 - 2017 Plan and explain the importance of timely cost recovery associated with customer participation in Company sponsored DSM programs included in the 2016 - 2017 Plan. Finally, I discuss the reasons approval of the 2016 - 2017 Plan is reasonable and in the public interest.

Q. Are you sponsoring any attachments?

A. Yes. I am sponsoring the following attachments:

- Petitioner's Exhibit No. 1, Attachment RCS-1, which is a high-level overview of Vectren South's three-year plan. Calendar year 2018 is presented for information only, as Vectren South is seeking approval of a two-year action plan encompassing years 2016 and 2017.

- Petitioner's Exhibit No. 1, Attachment RCS-2, which is a copy of the 2014 Vectren Corporation Integrated Resource Plan ("IRP").

Q. Were your exhibits prepared by you or under your direction?

A. Yes.

Q. Are there any other Vectren South witnesses sponsoring testimony in this proceeding?

A. Yes. Vectren South's other witnesses discuss the following topics:

1. Petitioner's Witness Michael P. Huber, Manager, Electric DSM & Conservation describes the 2016-2017 Plan, including estimated costs, benefits, load impacts and participation.

2. Petitioner's Witness Richard G. Stevie, Vice President, Integral Analytics ("IA") offers testimony to support development of Vectren South's 2016 - 2017 Plan, including a discussion of the cost benefit analysis which was developed by IA under the direction of Vectren South.

3. Petitioner's Witness J. Cas Swiz, Director, Regulatory Implementation and Analysis discusses the accounting authority and ratemaking treatment requested by Vectren South related to capital expenditures associated with the 2016 - 2017 Plan.

4. Petitioner's Witness Scott E. Albertson, Vice President, Regulatory Affairs & Gas Supply discusses the short-term bill impacts associated with implementation of the 2016-2017 Plan.

Q. Please summarize the relief Vectren South is seeking in this proceeding.

A. Vectren South is requesting authority to implement the DSM programs defined in the 2016 – 2017 Plan beginning January 1, 2016 through December 31, 2017, with the goal of achieving 75 million kilowatt hours ("kWh") in energy savings and 18 thousand kilowatts ("kW") in demand reduction during the two year period. This level of energy savings is roughly equal to a one percent (1%) reduction in eligible energy consumption from current customer usage levels. This amount excludes the approximately eighty percent (80%) of large commercial and industrial ("C&I") customer load that has opted out of participation in Company sponsored DSM programs. The 2016-2017 Plan includes seven (7) C&I programs and eleven (11) residential programs. Apart from approval of the 2016-2017 Plan, the Company seeks to recover all costs associated with offering the DSM programs in the 2016-2017 Plan, including recovery of EE program costs, as defined by the Indiana General Assembly in Senate Enrolled Act 412 ("SEA 412") codified at Ind. Code § 8-1-8.5-10, which includes performance incentives and lost revenues. Vectren South is also requesting authority to incur capital costs associated with the Conservation Voltage Reduction ("CVR") program, as discussed below. Vectren South's proposal related to the CVR program includes a request to recover annually in the DSMA a return on and of the capital investment necessary to implement the CVR program, as discussed by Petitioner's Witness Swiz in his testimony in this proceeding.

III. ELECTRIC ENERGY EFFICIENCY LANDSCAPE IN INDIANA

Q. Please describe recent legislative changes in Indiana impacting EE planning by jurisdictional electric utilities.

A. The EE landscape in Indiana has undergone significant changes in recent years, beginning in 2014 with the enactment of Senate Enrolled Act 340 ("SEA 340"), which not only allowed certain large C&I customers to opt-out of participation in Company sponsored EE programs, but also eliminated the savings targets for jurisdictional electric utilities established by the Commission in Cause No. 42396 ("Phase II Order").

More recently, Indiana enacted SEA 412 which further impacts how utilities plan for and implement EE programs in Indiana. According to SEA 412, beginning not later than calendar year 2017, an electricity supplier, which includes Vectren South, is required to petition the Commission at least one (1) time every three (3) years for approval of a plan that includes: (1) energy efficiency goals; (2) energy efficiency programs to achieve the energy efficiency goals; (3) program budgets and program costs; and (4) evaluation, measurement and verification ("EM&V") procedures that must include independent EM&V.

Once the plan has been submitted for approval, the Commission must make a determination of the overall reasonableness of the plan, considering several factors. Specifically, Ind. Code § 8-1-8.5-10(j) says,

> In making a determination of the overall reasonableness of a plan submitted under subsection (h), the commission shall consider the following:
>
> (1) Projected changes in customer consumption of electricity resulting from the implementation of the plan.
>
> (2) A cost and benefit analysis of the plan, including the likelihood of achieving the goals of energy efficiency programs included in the plan.
>
> (3) Whether the plan is consistent with: (A) The state energy analysis developed by the commission under section 3 of this chapter. (B) The electricity supplier's most recent long range integrated resource plan submitted to the commission.
>
> (4) The inclusion and reasonableness of procedures to evaluate, measure and verify the results of the energy efficiency programs included in the plan, including the alignment of the procedures with applicable environmental regulations,

including federal regulations concerning credits for emissions reductions.

(5) Any undue or unreasonable preference to any customer class resulting, from the implementation of an energy efficiency program or from the overall design of a plan.

(6) Comments provided by customers, customer representatives, the OUCC, and other stakeholders concerning the adequacy and reasonableness of the plan, including alternative or additional means to achieve energy efficiency in the electricity supplier's service territory.

(7) The effect, or potential effect, in both the long term and short term, of the plan on the electric rates and bills of customers that participate in energy efficiency programs compared to the electric rates and bills of customers that do not participate in energy efficiency programs.

(8) The lost revenues and financial incentives associated with the plan and sought to be recovered or received by the electricity supplier

(9) The electricity supplier's current integrated resource plan and the underlying resource assessment.

(10) Any other information the commission considers necessary.

The statute requires the Commission to approve an electricity supplier's plan if, after notice, hearing and consideration of the ten (10) factors listed above, the Commission determines the plan to be reasonable.

Q. How did these changes impact the planning process used to create the 2016-2017 Plan for which Vectren South currently seeks approval?

A. Vectren South proposes a term that enables this and future DSM plans to be synced with our integrated resource plan ("IRP"). Initially, Vectren South was planning to file a three (3) year plan this year, but the Company decided to propose a two year plan so that future DSM plans can be presented in the year following completion of the most recent IRP. Because Vectren South began developing a three (3) year action plan, I am presenting a high level summary of the three year plan, attached to my testimony as Petitioner's Exhibit No. 1, Attachment RCS-1, to demonstrate the Company's current thinking for 2018. In addition, Vectren South continues to monitor the United States Environmental Protection Agency's ("EPA") Clean Power Plan ("CPP") proposed rule and the role EE will play in future carbon emissions reduction mandates. There is a possibility that EE will play a significant role in carbon emissions reduction goals and once the EPA issues a final rule on CPP, then Vectren South will adjust its DSM portfolios as necessary to comply with the rule.

Q. Does Vectren South's 2016-2017 Plan meet the requirements of a plan to be submitted pursuant to SEA 412?

A. Yes. Vectren South's 2016-2017 Plan includes energy efficiency goals that are reasonably achievable, consistent with its 2014 IRP and is designed to save 1% of eligible retail sales. In addition, the 2016-2017 Plan is sponsored by an electricity supplier and designed to implement energy efficiency improvements. The 2016-2017 Plan also includes program budgets and program costs, which are defined as: (1) direct and indirect costs of energy efficiency programs, (2) costs associated with the EM&V of program results, and (3) recovery of lost revenues and performance incentives. The 2016-2017 Plan also requires independent EM&V of the DSM programs.

IV. VECTREN SOUTH'S 2016-2017 PLAN

Q. How was the 2016-2017 Plan developed?

A. The 2016-2017 Plan was designed to be consistent with the energy efficiency goals established in Vectren South's 2014 IRP. As described in more detail below, the 2014 IRP supported a targeted level of 1% eligible annual savings for 2015-2019. The 2016-2017 Plan is also based on the 2015-2019 Market Potential Study ("MPS") that Vectren South completed in April of 2013. The MPS served as an input into both the Company's 2015 Plan approved in Cause No. 44495 and the 2016-2017 Plan for which Vectren South currently seeks approval in this proceeding. Consequently, many of the EE programs included in the 2016-2017 Plan are currently offered by Vectren South as a result of Commission approval received in Cause No. 44495.

Q. Is the 2016-2017 Plan consistent with Vectren South's 2014 IRP?

A. Yes. Vectren South's 2014 IRP was based upon DSM savings of 1% of eligible retail sales and the 2016-2017 Plan is consistent with that level of savings.

Q. How did Vectren South develop energy savings goals in its IRP?

A. Vectren South started with an assumption that it would offer DSM programs designed to generate energy savings of 1% of eligible annual savings for 2015-2019. By eligible energy savings, I mean Vectren South's total energy load reduced by a portion of the customers (70%) that are authorized to opt-out of energy efficiency programs by SEA340. Vectren South assumed this minimum level of energy efficiency efforts because it believes that a cost effective level of DSM energy efficiency may be supported by policy considerations beyond capacity planning. This approach is consistent with proposed regulations such as the Clean Power Plan that would require Vectren South to offer some level of DSM. Vectren South did model the option of offering DSM energy efficiency programs designed to achieve more than the level reflected in the base sales forecast to determine if it is selected as a resource to meet future electric requirements. The IRP modeling demonstrated that no additional DSM energy savings would be selected as the least cost option for Vectren South's customers.

Q. Has the Commission commented on Vectren South's methodology for modeling DSM in the IRP?

A. Yes. On March 3, 2015, the Commission issued the *Draft Report of The Indiana Utility Regulatory Commission Electricity Division Director Dr. Bradley K. Borum Regarding 2014 Integrated Resource Plans* ("Draft Report") and on page 40 of the Draft Report, Dr. Borum said,

> The Commission staff also commends Vectren for being the only utility to make a concerted effort to treat DSM as a resource rather than baking in an estimate in the load forecast. As evidenced by Vectren's comments, they have an appreciation that energy

efficiency is another element of risk that may alter Vectren's long-term resource plans and, therefore, warrants additional scrutiny.

Q. Please provide an overview of the 2016-2017 Plan.

A. The 2016-2017 Plan, which is based in large part on the 2015-2019 MPS, includes a number of integrated natural gas and electric EE ("gas/electric EE") programs to be offered by Vectren South in its combined natural gas and electric service territory. In addition, the 2016-2017 Plan introduces several new programs including CVR, Smart Thermostat Demand Response, Multi-Family Retrofit and Strategic Energy Management ("SEM") as a component of the C&I Custom program. Many of the programs in the 2016-2017 Plan are EE programs, but some of the new programs have a DR component as well. Although Petitioner's Witness Huber describes all of the programs in greater detail, I will discuss the general benefits of DR.

Q. Why did Vectren South decide to include programs that have DR benefits as well as EE benefits in the 2016-2017 Plan?

A. Vectren South has always recognized the benefits of reducing peak energy demand. For that reason, Vectren South first introduced a Direct Load Control ("DLC") program in 1992 and it has been operational since then. In Cause No. 43427, Vectren South sought Commission approval of a portfolio of EE programs that included an expansion of the existing DLC program. However, shortly before issuing an order in Cause No. 43427 approving the plan, the Commission issued the Phase II Order, establishing savings targets based solely on energy savings and not on peak demand reduction. As a result, Vectren South developed a new plan primarily based on reaching the aggressive energy savings targets. The DLC program has continued as it existed at the time, but was not expanded as previously planned in Cause No. 43427. Instead, Vectren South implemented the EE plan approved in Cause No. 43938, which focused on energy savings and included some demand savings associated with the programs as a secondary benefit.

With the changes brought by SEA 412, Vectren South is once again proposing to use a portion of its resources to reduce peak demand and has included two programs in the 2016-2017 Plan that have a DR component.

Q. What are the general benefits of DR?

A. In the short-term, DR allows customers to contribute to energy load reduction during times of peak demand when wholesale market prices are high or reliability may be threatened. A long-run benefit of DR is that it can contribute to reducing the need for future investments in generation capacity. A utility's generation, transmission and distribution system is designed for peak demand rather than average load and reducing peak demand helps to better utilize the system.

Q. Are there other benefits to including DR programs in the 2016-2017 Plan?

A. Yes. There are potential synergies between DR and energy saving programs. The American Council for an Energy-Efficient Economy lists the following potential synergies in its 2005 report by Dan York, Ph.D. and Martin Kushler, Ph.D. titled "Exploring the Relationship Between Demand Response and Energy Efficiency: A Review of Experience and Discussion of Key Issues:"

- EE can reduce demand permanently, at peak as well as non-peak times;
- Focusing on peak-demand reductions can help identify inefficient and non-essential energy uses that could be reduced at other times, thus resulting in broader energy and demand savings;
- Technologies that can enable DR also can be used effectively to manage energy use year-round;
- Experience from DR activities can lead to greater awareness of energy savings opportunities through improved EE;
- Customers who participate in DR programs may be prime candidates for participating in other types of DSM programs such as EE (and vice versa); and

- Program marketing could be more effective at communicating with customers about their energy use by addressing integrated approaches to energy management.

DR programs can also help to better integrate and manage renewable and distributed energy resources by helping to mitigate grid balancing challenges introduced by upcoming increases in intermittent renewable generation resources such as solar and wind.

Q. Where can the Commission find a description of the DSM programs included in the 2016-2017 Plan?

A. A copy of the 2016-2017 Plan is attached to Mr. Huber's testimony as Petitioner's Exhibit No. 2, Attachment MPH-1. In addition, the 2016-2017 Plan is available on Vectren South's website, as well.

V. PROGRAM IMPLEMENTATION, OVERSIGHT AND EVALUATION

Q. How will the EE and DR programs included in the 2016-2017 Plan be administered?

A. Since elimination of the third party administrator at the end of December 2014, Vectren South has been administering the 2015 Plan as approved by the Commission in Cause No. 44495. Vectren South, with direction from the Vectren Oversight Board ("VOB"), will continue to implement the EE and DR programs included in the 2016-2017 Plan and will contract with program implementers, as necessary. Vectren South will maintain its current staffing levels, which include: (1) an Electric DSM Manager who oversees the overall portfolio and staff necessary to support program administration; (2) an Electric DSM Analyst who works with the EM&V Administrator and facilitates measurement and verification efforts; (3) an Electric DSM Financial Analyst who is responsible for all aspects of program reporting, including budget analysis/reporting, scorecard completion and filings; and (4) an Electric DSM Representative who serves as a contact to trade allies regarding program awareness. This group is responsible for the successful administration of the 2015 Plan thus far and will continue to administer the 2016-2017 Plan, as approved by the Commission.

Q. Please describe the role of the VOB?

A. In Cause No. 44495, the Commission approved the merger of Vectren South's Electric Oversight Board with Vectren South and Vectren North's Gas Oversight Board. As a result, the VOB currently consists of the OUCC, Citizens Action Coalition ("CAC"), Vectren North and Vectren South. The role of the VOB is to provide oversight for all natural gas and electric DSM programs. The VOB has authority to add new programs, cease underperforming programs and exceed Commission-approved budgets for DSM programs by up to 10% without having to seek additional authority from the Commission. Historically, the VOB has had the authority to shift funds from sector to sector, but cannot commingle natural gas and electric funds. The VOB has worked well together in the past and for that reason, Vectren South proposes that the Governance Provisions currently in place remain in place during the pendency of the 2016–2017 Plan.

Q. Is Vectren South proposing any changes to the VOB?

A. No, Vectren South is not proposing any changes to the VOB at this time. Vectren South and the VOB have worked well together over the years and the Company desires to continue building upon that strong foundation. Vectren South requests that the VOB continues to retain all of the same authority previously granted to that governing body, which is important because the Company will potentially need to make adjustments to the programs throughout the program term.

Q. Please discuss Vectren South's EM&V plans for the 2016-2017 Plan.

A. Program evaluation will be performed by an independent EM&V Administrator. In general, the independent evaluator will conduct two types of evaluations. A process evaluation will be performed to identify how well the programs were implemented, and an impact evaluation will be performed to examine the more technical effects of the programs, such as energy and demand savings. The process evaluation examines the effectiveness and efficiency with which the programs were designed and delivered. The impact evaluation verifies measure installations, determines participants' free rider and spillover behaviors ("NTG ratio"), reviews the deemed savings values and estimates realized program savings (both kWh and kW). During the evaluation process, an assessment of the program market effects will also be conducted to determine any changes and trends from the prior years, where applicable. For programs being evaluated for the first time, a baseline will be established during the evaluation phase and further analysis will be conducted in subsequent years.

Q. What does Vectren South intend to use as the framework for EM&V for its programs?

A. Vectren South currently uses the statewide EM&V framework adopted by the Demand Side Management Coordination Committee ("DSMCC") as the basis for its evaluation activities. Vectren South along with the other jurisdictional electric utilities and other stakeholders in Indiana are working on updating the statewide framework, which Vectren South anticipates using; however, if that group is unable to agree upon a framework, then Vectren South and Vectren North will work with the VOB to establish a framework for evaluating their natural gas and electric DSM programs in Indiana. The framework is an important reference for the Company, as it is intended to provide a platform for evaluation planning, program implementation and reporting so that evaluation results are both reliable and comparable across programs, administrators, and energy sectors.

Q. Do Vectren South's EM&V procedures align with applicable environmental regulations?

A. Vectren South recognizes that its EM&V procedure will be important for ensuring compliance with the EPA's CPP and as the CPP is finalized, Vectren South will consider any modifications to its EM&V procedures necessary to comply with the requirement.

VI. COST RECOVERY, LOST REVENUES AND PERFORMANCE INCENTIVES

Q. Please describe the financial impact of customer participation in Company sponsored EE programs on Vectren South.

A. Customer participation in Company sponsored EE programs impacts Vectren South's financial condition in the following three significant ways, the Company:

1. incurs costs to develop and implement the EE programs;
2. incurs lost contributions to fixed costs through reduced sales, and
3. foregoes the opportunity to make supply side investment, which is the means under the current regulatory structure for a utility to make a profit.

Q. Please describe the mechanism Vectren South plans to use to recover costs associated with the 2016-2017 Plan.

A. Vectren South plans to continue using its DSMA to recover costs associated with customer participation in Company sponsored EE and DR (including DLC) programs. The DSMA consists of the following components: DLC, Inspection and Maintenance ("I&M"), Energy Efficiency Funding Component ("EEFC"), Large Customer Lost Margin Component, Small Customer Lost Margin Component, and variance. The DSMA is used to recover all costs associated with the Company's EE programs, including program costs, performance incentives, lost revenues and costs associated with the DLC program.

Q. Do the Commission's rules support continuation of Vectren South's cost recovery mechanism?

A. Yes. The Commission's rules found at 170 IAC 4-8-1 *et seq.*, provide support for continuation of Vectren South's recovery mechanism. Specifically, 170 IAC 4-8-3(a) states,

> …[T]he commission has developed a regulatory framework that allows a utility an incentive to meet long term resource needs with both supply-side and demand side options in a least cost manner and ensures that the financial incentive offered to a DSM program participant is fair and economically justified. The regulatory framework attempts to eliminate or offset regulatory or financial bias against DSM, or in favor of a supply-side resource, a utility might encounter in procuring least-cost resource.

In addition, in Cause No. 44495 at 10 (IURC October 15, 2014), the Commission allowed Vectren South to continue recovering costs associated with the 2015 Plan through the DSMA and said,

> The Commission's DSM rules require utilities seeking lost revenue recovery to propose a methodology that addresses the level of free-riders and provides for revised estimates of load impact from DSM program based upon EM&V. 170 IAC 4-8-6(b). We have also required that the revenue margin rates upon which lost revenues are based be reasonably reflective of its operating system today. See Northern Indiana Public Service Co., Cause No. 43912 at 27 (IURC July 27, 2011). Vectren South's DSMA is consistent with Commission requirements.

The DSMA and its various components, which will be used to recover the costs associated with the 2016-2017 Plan, address the "regulatory bias" and allow the Company to continue the type of DSM programs that have been effective in Vectren South's service territory in the past. The Commission has previously found that the DSMA is consistent with Commission requirements and there have been no changes to the DSMA since that finding in October 2014 that would cause the Commission to reach a different conclusion.

Q. Is there other support for continuation of Vectren South's cost recovery mechanism?

A. Yes. The Indiana General Assembly ("IGA" or "Indiana Legislature") defined "program costs" to include: (1) direct and indirect costs of energy efficiency programs; (2) costs associated with the EM&V of program results; and (3) other recoveries or incentives approved by the commission, including lost revenues and financial incentives approved by the commission under subsection (o).

Subsection (o) of SEA 412 says,

> If the commission finds a plan submitted by an electricity supplier under subsection (h) to be reasonable, the commission shall allow the electricity supplier to recover or receive the following: (1) Reasonable financing incentives that: (A) encourage implementation of cost effective energy efficiency programs; or (B) eliminate or offset regulatory or financial bias: (i) against energy efficiency programs; or (ii) in favor of supply side resources; and (2) Reasonable lost revenues.

If the Commission finds Vectren South's 2016-2017 Plan to be reasonable, then subsection (o) supports recovery through the Company's DSMA of reasonable financial incentives and reasonable lost revenues attributable to EE programs.

In addition to state law, federal law also supports cost recovery through Vectren South's cost recovery mechanism. With passage of SEA 412, the Indiana General Assembly now joins the United States Congress and President in recognizing the importance of removing disincentives and motivating utilities to pursue cost effective EE programs. Recovery of costs associated with customer participation in Company sponsored EE programs is founded upon long standing public policy and is consistent with the following sections of the Energy Independence and Security Act ("EISA" or the "Act"):

> (17)—electric utility rate structure shall align incentives with the delivery of cost-effective energy efficiency and promote energy efficiency investments. States shall specifically consider as policy options: removing the throughput incentive and other regulatory and management disincentives to energy efficiency; including the impact on adoption of energy efficiency as one of the goals of retail rate design recognizing that energy efficiency must be balanced with other objectives; adopting rate designs that encourage energy efficiency for

> each rate class; allowing timely recovery of energy efficiency-related costs; and offering home energy audits, offering demand response programs and publicizing efficiency-related information. H.R. 6—Energy Independence and Security Act – Sec. 532 amends PURPA 111(d) and (17).

Congress and the President recognized the importance of removing disincentives and motivating utilities to pursue EE through incentive mechanisms in the ESIA of 2007. The Act encourages state regulators to "integrate energy efficiency into electric and natural gas utility, State and regional plans and adopt policies establishing cost-effective energy efficiency as a priority resource." 16 U.S.C. § 2621(d). It goes on to say that, "States shall specifically consider as policy options: removing the throughput incentive and other regulatory and management disincentives to energy efficiency; providing utility incentives for the successful management of energy efficiency programs; [and] allowing timely recovery of energy efficiency related costs […]." Id.

Q. Has Vectren South historically projected the recovery of program costs, including lost margin recovery?

A. Yes. Vectren South has been projecting program costs in its DSMA for some time. In Cause No. 43938, the Commission approved Vectren South's request to recover lost margins associated with large C&I customer participation in electric DSM programs and the deferral and ultimate recovery of small customer lost margins subject to an EM&V process and approval of the recovery mechanism ultimately proposed in DSMA9 S1. In Cause No. 43405 DSMA9 S1, the Commission approved Vectren South's request to modify its DSMA to include a component to provide for the recovery of lost margins resulting from participation by small customers in Vectren South's approved electric DSM programs.

Q. How does Vectren South project these costs?

A. Vectren South projects lost margins resulting from customer participation in the Company's electric DSM programs in each DSMA period. Each DSMA recovers actual and projected lost margins. Actual lost margins have been verified through an independent EM&V process and are recovered through the incentives and variance component. Projected lost margins are recovered through the large and small customer lost margin components based on two aspects: 1) cumulative lost margins as reflected in actuals and 2) lost margins based on expected savings from additional participation in DSM programs in the program year. The program savings related to lost margins are the combination of prior years' program savings which have been verified by independent EM&V, that continue in the projection period as well as the assumption that 50% of the annualized savings forecasted in the projection period will result in additional lost margin in that 12 month period. Because the programs are implemented throughout the projection period, the program savings are equally allocated to each month of the projection period which results in half of the total energy savings contributing to lost margins for that period. Vectren South considers this approach to be conservative; it uses verified savings as the basis for the projection while also recognizing that additional lost margins will occur based on estimated DSM program implementation during the projection period. The Company's conservative approach is intended to ensure the Company is not over-collecting lost margins from customers; any over/under-collection variance will be recovered in the next DSMA filing.

Q. Has Vectren South accurately projected lost margin on a historical basis?

A. Yes, when considering the conservative approach Vectren South takes. Looking back historically, Vectren South has generally collected less lost margins than were actually incurred. Vectren South will continue to evaluate the overall accuracy of the lost margin projection in its annual DSMA filings and will propose modifications, if appropriate, to further improve the accuracy of the lost margin projection.

Q. Does Vectren South's DSMA include a reconciliation mechanism?

A. Yes. Vectren South has always reconciled forecasted program costs against actual results based on EM&V of the energy efficiency programs under the plan. The reconciliation mechanism will continue during the 2016/2017 Plan.

Q. Why should the Commission authorize recovery by Vectren South of lost margins associated with implementation of the 2016-2017 Plan?

A. The Commission first authorized the recovery of lost margins by Vectren South in 2011, when the Commission approved the Company's 2011-2013 Initial DSM Plan ("2011 Plan") as requested in Cause No. 43938. At that time, the Commission said, "…recovery of lost margins is intended as a tool to remove the disincentive utilities would otherwise face as a result of promoting DSM in its service territory." See *Southern Indiana Gas & Elec. Co.*, Cause No. 43938 at 40-41 (IURC August 31, 2012). The Commission went on to say, "The purpose of recovery of lost margins on verified energy savings from DSM programs is to return the utility to the position it would have been in absent implementation of a DSM measure." *Id.*

The Commission has long recognized the need to remove the disincentive utilities face as a result of promoting DSM programs in their service territories. Lost revenue recovery assists the utility in recovering fixed operating costs that do not vary as a result of lower usage driven by EE. The purpose of electric EE programs is to reduce the consumption of electricity; lost revenue recovery simply allows for timely recovery of the prudently incurred fixed costs that have been approved, as verified through EM&V.

In crafting the 2016-2017 Plan, Vectren South relied upon the 2014 IRP to inform the plan. In keeping with the IRP, the 2016-2017 Plan is designed to reduce energy usage by approximately 1% of eligible retail sales each year of the two year plan. Also, SEA 412 defines program costs as lost revenues. If the Commission finds the 2016-2017 Plan to be reasonable, then subsection (h) of SEA 412 and the Commission's past practice both support recovery of lost revenues associated with implementation of the 2016-2017 Plan by Vectren South.

Q. Does the lost revenue adjustment mechanism currently approved for recovery of lost revenues associated with EE programs make the utility whole?

A. No. Large Customer and Small Customer Lost Margin Components of the DSMA allow Vectren South to address the disincentive the Company has to conserve and to recover some fixed costs associated with decreased usage due to EE programs, but does not make the Company whole since only "net" program savings costs that can be directly attributed to the programs through EM&V are recovered verses the gross program savings and usage reductions due to education and other energy savings efforts of customers that cannot be directly quantified as part of EM&V. In the future, decoupling mechanisms, as exists for Vectren South and Vectren North's gas programs, create better alignment between the Company's interest and the interests of its customer thereby freeing the Company to freely pursue conservation and provide the Company a fair opportunity to recover its fixed costs in an environment where utility energy efficiency programs are a key part of public policy and declining customer usage.

Q. Are lost margins an actual cost resulting from DSM programs that customers will ultimately pay?

A. Yes. Because Vectren South recovers a portion of its Commission approved fixed costs through variable rates, reductions in energy consumption leave Vectren South unable to fully recover these fixed costs in between rate cases (unless recovery is provided through lost margin recovery, decoupled rates or a straight-fixed variable rate structure). Because these fixed costs do not go away as a result of DSM programs, customers will ultimately pay them. Absent lost margin recovery or rate decoupling, Vectren South's customers invest in DSM believing they are avoiding costs (the fixed costs) that, in the long run, will not be avoided customers. Customers should not be sent the false signal of avoiding costs that are not ultimately avoided.

Q. Why should the Commission authorize recovery by Vectren South of performance incentives associated with the 2016-2017 Plan?

A. The purpose of awarding performance incentives is to encourage implementation by the utility of cost effective energy efficiency programs. Awarding performance incentives also eliminates or offsets the regulatory or financial bias against energy efficiency programs or in favor of supply side resources.

The Commission first approved a performance incentive mechanism for Vectren South in an Order issued by the Commission in Cause No. 43427. In that Order, the Commission recognized that its DSM Rules allow for utilities to earn a performance incentive and that there was a strong national trend towards awarding performance incentives for utilities. Specifically, the Commission said, "We note that incentives are authorized pursuant to the Commission's DSM Rules at 170 IAC 4-8-7(a), which states: '[w]hen appropriate, the commission may provide the utility with a shareholder incentive to encourage participation in and promotion of a demand side management program'." See *Southern Indiana Gas & Elec. Co.*, Cause No. 43427 at 34 (IURC December 16, 2009). In Cause No. 43427, the Commission found that not only was the concept of performance incentives appropriate, but also that the mechanism Vectren South proposed included necessary safeguards and it was approved.

Q. Is Vectren South requesting any changes to the performance incentive mechanism?

A. No. The Company is not requesting any changes to the performance incentive mechanism. The performance incentive mechanism will continue to be based upon the performance of programs measured in terms of their actual, independently verified, net energy (kWh) and demand (kW) savings compared to projected net energy and demand savings. To earn an incentive, the savings must be measured and verified by an independent third party. The Company cannot earn an incentive unless the programs, with the incentive payout, pass the Total Resource Cost Test ("TRC") and Utility Cost Test ("UCT") cost-effectiveness tests. Based upon this methodology, there are two separately calculated incentives: the Residential Sector Incentive and the C&I Sector Incentive. The incentive amount for each of these sectors is dependent on the amount of combined savings from each of the sector's individual programs. While the actual formula to calculate the performance incentive is the same ([installed energy savings ÷ planned energy saving] * 50% plus [installed demand savings ÷ planned demand savings] * 50%), the formula will be separately applied to the residential and C&I sectors.

For purposes of calculating the performance incentive, the program costs eligible for the incentive are defined as the actual program delivery costs not to exceed the total program budget approved by the Oversight Board. The program delivery costs will include outreach and education program costs allocated equally between the residential and commercial/industrial sectors minus performance incentives. The performance incentive levels shall remain as defined below, which means that Vectren South must attain at least 64% of its goal to avoid incurring a penalty and will not earn an incentive until the Company reaches 80% of its goal. In no case, shall the actual performance incentive the Company is allowed to earn exceed 10% of the program costs approved in the 2016-2017 Plan. The approved performance incentive matrix is defined as follows:

2016-2017 Performance Incentive Matrix	
Performance Levels	Incentive Levels
0% - 64%	-4%
65% - 79%	0%
80% - 89%	4%
90% - 99%	8%
100%+	10%

In Cause No. 44495, Vectren South entered into a settlement agreement with the OUCC whereby the Parties agreed that the performance incentive mechanism currently in place would remain in place for 2015. The Performance Incentive Matrix was revised so that the cap was lowered and the performance level Vectren South had to achieve to earn a performance incentive was increased. Vectren South is requesting that the performance incentive mechanism currently in place remain in place, unchanged for implementation of the 2016-2017 Plan.

Q. Is Vectren South proposing to earn a performance incentive on all of the programs included in the 2016–2017 Plan?

A. Vectren South is proposing to earn a performance incentive on all programs included in the 2016–2017 Plan, except the CVR and Income Qualified Weatherization programs. As furthered explained by Petitioner's Witness Swiz in his testimony in this proceeding, Vectren South is requesting authority to earn a return on and of the capital investment and other related costs associated with implementing the CVR program; therefore, Vectren South is not seeking authority to earn performance incentives for the CVR program.

Q. Why should the Commission allow Vectren South to earn a return on and of the capital costs associated with the CVR program?

A. Vectren South is requesting this accounting and ratemaking treatment discussed by Witness Swiz because the CVR program deploys capital assets along the energy delivery system to reduce energy and demand consumption by customers, and this type of equipment deployed for the CVR program is typically capitalized as an asset and included in rate base for the utility in base rate proceedings. As such, Vectren South will incur financing costs associated with this investment prior to inclusion in base rates, and in lieu of immediate recovery of the full capital expenditure amount, Vectren South's proposal is to recover the needed return on and of the CVR program investment until the Company's next base rate case. This cost recovery approach was approved by the Commission in its December 30, 2013 Order in Cause No. 43827 DSM3 for Indiana Michigan Power Company.

Q. Other than the inclusion of the CVR program investment, is Vectren South requesting any changes to the DSMA?

A. No. Vectren South is requesting that the Commission continue to authorize the Company to recover, through the DSMA, all program costs, including lost revenues and performance incentives, associated with the 2016-2017 Plan.

VII. <u>VECTREN SOUTH'S 2016-2017 PLAN IS REASONABLE AND IN THE PUBLIC INTEREST</u>

Q. Does the current regulatory framework in Indiana support Vectren South's 2016-2017 Plan as proposed in this proceeding?

A. Yes. The current regulatory framework, including SEA 412, administrative code provisions and prior Commission orders all encourage electric utilities to meet their customers' electricity needs through supply and demand side resource options in a least cost manner. As discussed above, recent changes in Indiana law related to EE provides the basis for a Commission determination of reasonableness related to utility EE plans. Specifically, subsection (j) of SEA 412 lists nine factors the Commission must consider in making a reasonableness determination and Vectren South has demonstrated those factors support plan approval and will provide any additional information the Commission considers necessary to determine the reasonableness of the 2016-2017 Plan. The

Company's 2016-2017 Plan is reasonable and should be approved by the Commission.

Q. Is the 2016-2017 Plan consistent with the State of Indiana's energy analysis developed by the Commission under Ind. Code § 8-1-8.5-3?

A. In December 2013, the State Utility Forecasting Group published the *Indiana Electricity Projections: The 2013 Forecast* (the "2013 Forecast") for the Commission. The 2016-2017 Plan is consistent with the 2013 Forecast from the perspective of the impact of DSM programs on load projections. Like the 2013 Forecast, Vectren South's IRP projects flat electric sales and demand, in part because of DSM programs. *See* Figures 3-7 and 3-8 of the 2013 Forecast. The EE projections in the 2013 Forecast are higher than Vectren South's energy efficiency goals because the 2013 Forecast assumed energy savings based on the goals established by the Commission in the Phase II Order issued in December 2009. SEA 412 terminated those goals. Vectren South is complying with the requirements established in SEA 412, which were adopted after the 2013 Forecast was prepared. By the time Vectren South plans its next round of DSM programs, the Commission will have issued an updated energy analysis pursuant to which Vectren South can plan its next DSM portfolio.

Q. Is Vectren South's 2016-2017 Plan in the public interest?

A. Yes. Approval of the 2016-2017 Plan is in the public interest and approving it will allow Vectren South to continue providing opportunities for customers to reduce their energy usage and make more educated choices about how they consume energy. Vectren South's 2016-2017 Plan promotes the efficient use of energy by better aligning the Company's interests with those of its customers. In addition, it will delay the need to build additional generation, help conserve natural resources and decrease emissions from generating units. Vectren South considers an ongoing level of cost effective DSM a resource for helping customers to manage their energy bills, as well as a resource for meeting future generation needs.

Q. Does the 2016-2017 Plan satisfy the criteria established by the legislature for the Commission to find it reasonable?

A. Yes. As discussed by the witnesses in this case, the 2016-2017 Plan meets the criteria set forth in SEA 412 for the Commission to find it reasonable.

Q. Where does Vectren South describe the projected changes in customer consumption of electricity resulting from implementation of the 2016-2017 Plan?

A. Energy savings associated with the 2016-2017 Plan are the metric that best describes the changes to customer consumption of electricity resulting from implementation of the 2016-2017 Plan. Table 5 on page 10 of the Action Plan defines the savings associated with the 2016-2017 Plan. Specifically, residential customers will save more than twenty million kWh of electricity in 2016 and 2017 and commercial customers will save more than sixteen million kwh in 2016 and more than seventeen million kWh in 2017. Combined those savings represent approximately 1% of eligible retail sales. Petitioner's Witness Huber provides additional details related to the 2016-2017 Plan in his testimony in this proceeding.

Q. Where does Vectren South show the cost and benefit analysis of the 2016-2017 Plan, including the likelihood of achieving the goals of energy efficiency programs included in the plan?

A. The cost effectiveness test results for each program are listed in Table 2 on page 7 of the 2016-2017 Plan. The document discusses the process Vectren South engaged in to develop the plan and explained that a key input into creating the 2016-2017 Plan was the MPS conducted by EnerNOC, Inc. In completing the MPS, EnerNOC began by identifying an Achievable Low portfolio and an Achievable High portfolio and those two portfolios provided guidelines that allowed EnerNOC to create a Recommended Achievable scenario, which was used as a key input into creating the 2016-2017 Action Plan. The goals established in the 2016-2017 Plan are realistic and achievable and discussion of how the plan was developed can be found in the 2016-2017 Plan beginning on page 4.

Q. Where does Vectren South discuss the consistency between the 2016-2017 Plan and the state energy analysis developed by the commission under § 8-1-8.5-3?

A. I discuss the consistency between Vectren South's 2016-2017 Plan and the state energy analysis developed by the Commission under section 3. See the discussion above beginning on page 27 at line 4 above.

Q. Where does Vectren South discuss the consistency between the 2016-2017 Plan and the electricity supplier's most recent long range integrated resource plan submitted to the Commission?

A. I discuss the consistency between Vectren South's 2016-2017 Plan and its 2014 IRP. See the discussion above, beginning on page 10 at line 1 above.

Q. Where does Vectren South identify and explain the reasonableness of procedures used to evaluate, measure and verify the results of the energy efficiency programs included in the plan, including the alignment of the procedures with applicable environmental regulations, including federal regulations concerning credits for emissions reductions.

A. I identify and explain the reasonableness of the procedure used to evaluate, measure and verify the results of the energy efficiency programs included in the 2016-2017 Plan. See the explanation beginning on page 14 at line 28 above.

Q. Does Vectren South discuss any undue or unreasonable preference to any customer class resulting, from the implementation of an energy efficiency program or from the overall design of the 2016-2017 Plan?

A. Petitioners' Witness Huber explained that Vectren South's DSM programs will be available to customers in all customer classes and that the programs as presented in the 2016-2017 Plan do not show undue or unreasonable preference to any customer class. The discussion can be found on lines 21-26 on page 6 in Petitioner's Exhibit No. 2.

Q. Please discuss comments provided by customers, customer representatives, the OUCC, and other stakeholders concerning the adequacy and reasonableness of Vectren South's 2016-2017 Plan, including alternative or additional means to achieve energy efficiency in the electricity supplier's service territory.

A. Vectren South met with its Oversight Board, which includes both the OUCC and CAC, on multiple occasions to discuss the 2016-2017 Plan. Revisions were made to the plan as those discussions occurred. Furthermore, during the pendency of this proceeding, the Commission will have an opportunity to hear directly from the OUCC and other stakeholders regarding the adequacy and reasonableness of the 2016-2017 Plan, including alternative or additional means to achieve energy efficiency in Vectren South's territory.

Q. Where does Vectren South discuss the effect, or potential effect, in both the long term and short term, of the plan on the electric rates and bills of customers that participate in energy efficiency programs compared to the electric rates and bills of customers that do not participate in energy efficiency programs.

A. Petitioner's Witness Albertson discusses the short-term effect, or potential effect, of the 2016-2017 Plan on the electric rates and bills of customers that participate in energy efficiency programs compared to the electric rates and bills of customers that do not participate in energy efficiency programs and Petitioner's Witness Stevie discusses the long-term effect, or potential effect, of the 2016-2017 Plan on the electric rates and bills of customers that participate in energy efficiency programs compared to the electric rates and bills of customers that do not participate in energy efficiency programs.

Q. Where does Vectren South identify the lost revenues and financial incentives associated with the 2016-2017 Action Plan and sought to be recovered or received by the electricity supplier?

A. Lost revenues and financial incentives associated with the 2016-2017 Action Plan are shown in Table 2 on page 23 of Petitioner's Exhibit No. 2, which is Petitioners' Witness Huber's Direct Testimony.

Q. Where can the Commission find a copy of Vectren South's 2014 IRP and underlying resource assessment?

A. Vectren South's 2014 IRP is attached to my testimony as Petitioner's Exhibit 1, Attachment RCS-2. In addition, it is publicly available on Vectren South's website.

Q. Is Vectren South aware of any other information the Commission may need to consider to find the 2016-2017 Plan reasonable?

A. No, Vectren South is not aware of any other information the Commission may need to consider in order to find the 2016-2017 Plan reasonable; however, if the Commission has additional questions or identifies any other information needed to assist with the determination, Vectren South will provide it.

VIII. CONCLUSION

Q. Does this conclude your testimony in this proceeding?

A. Yes, at this time.

VERIFICATION

I, Robert C. Sears, Vice President, Customer Energy Solutions at Vectren Utility Holdings, Inc., affirm under the penalties of perjury that the statements and representations in my foregoing Direct Testimony in this Cause are true to the best of my knowledge, information and belief.

Robert C. Sears

Dated: June 26, 2015

Vectren South 2016-2017 Electric DSM Plan with 2018 Look

Vectren DSM Program Portfolio Impacts and Budget

Program Year	Energy Savings MWh - Annual Incremental	Energy Savings MWh - Cumulative	Peak Demand Savings MW - Annual Incremental	Peak Demand Savings MW - Cumulative	Program Budget $,000
2016	36,317	36,317	8.3	8.3	$8,606
2017	37,791	74,107	7.1	15.4	$8,109
2018	39,404	113,511	11.4	26.9	$10,663
Total	**113,511**		**26.9**		**$27,378**

Program	**Savings (kWh)**			**Demand Savings (kW)**			**Budget**			**TRC**
Residential	**2016**	**2017**	**2018**	**2016**	**2017**	**2018**	**2016**	**2017**	**2018**	
Residential Lighting	6,612,901	6,831,909	6,811,553	839	865	863	$788,506	$897,321	$951,605	2.32
Home Energy Assessment and Weatherization*	1,935,719	1,935,719	1,935,719	290	290	290	$419,910	$429,428	$440,515	1.57
Income Qualified Weatherization*	1,282,577	1,282,577	1,282,577	254	254	254	$598,270	$604,045	$609,820	1.09
Appliance Recycling	1,020,544	1,020,544	1,020,544	152	152	152	$205,094	$207,948	$210,887	1.44
Energy Efficiency Schools*	675,508	675,508	675,508	106	106	106	$117,706	$120,901	$123,047	3.47
Residential Efficient Products*	1,075,888	1,075,888	1,075,888	623	623	623	$622,493	$626,298	$630,210	1.33
Residential New Construction*	146,775	146,775	146,775	68	68	68	$98,441	$99,536	$100,632	1.38
Multi-Family Direct Install Bulbs and Tstats*	335,000	335,000	335,000	20	20	20	$29,777	$30,610	$31,468	3.82
Residential Behavior Savings (without refill)*	6,204,832	5,576,656	5,025,401	1,728	1,553	1,399	$382,000	$366,285	$353,721	1.42
Conservation Voltage Reduction - Residential (2 Substations)***	0	1,481,669	1,252,350	0	508	430	$20,000	$166,861	$354,341	1.34
Residential Smart Thermostat Demand Response	858,000	0	2,145,000	1,800	0	4,500	1,196,455	297,890	$2,425,275	2.19
Outreach Costs	-	-	-	-	-	-	$150,000	$150,000	$150,000	N/A
Residential Total**	**20,147,744**	**20,362,245**	**21,706,315**	**5,880**	**4,439**	**8,705**	**$4,628,652**	**$3,997,123**	**$6,381,520**	**1.74**
Commercial & Industrial (C&I)	**2016**	**2017**	**2018**	**2016**	**2017**	**2018**	**2016**	**2017**	**2018**	**TRC**
Small Business Energy Solutions*	6,000,810	6,000,810	6,000,810	906	906	906	$1,760,611	$1,774,351	$1,789,143	1.31
C&I Prescriptive	6,910,197	6,910,197	6,910,197	1,088	1,088	1,088	$1,042,705	$1,049,906	$1,057,307	3.08
C&I New Construction*	498,526	534,135	534,135	88	94	94	$162,562	$172,897	$175,299	2.03
C&I Audit and Custom	2,557,544	2,906,300	2,906,300	339	385	385	$726,584	$738,386	$748,473	1.11
Multi Family EE Retrofit*	201,785	201,785	201,785	33	33	33	$95,081	$95,081	$95,081	1.38
Conservation Voltage Reduction - Commercial (2 Substations)***	0	875,044	1,144,768	0	163	214	$20,000	$117,146	$263,689	1.05
Outreach Costs	-	-	-	-	-	-	$150,000	$150,000	$150,000	N/A
Commercial & Industrial Total**	**16,168,862**	**17,428,271**	**17,697,995**	**2,454**	**2,669**	**2,720**	**$3,957,543**	**$4,097,767**	**$4,278,992**	**1.56**
Tracking System (Portfolio Level)	-	-	-	-	-	-	$20,000	$20,000	$20,000	N/A
Total Portfolio**	**36,316,606**	**37,790,516**	**39,404,310**	**8,334**	**7,108**	**11,425**	**$8,606,195**	**$8,114,890**	**$10,680,512**	**1.64**

*Cost Sharing with Vectren South Natural Gas
**Sector level cost/benefit scores include Outreach, while portfolio level scores also include Tracking. Neither include utility performance incentives.

Program	**Savings (kWh)**	**Demand (KW)**	**Budget**	**TRC**
Conservation Voltage Reduction Total (2 Substations)***	4,753,831	1,315	$942,037	1.22

***For the purpose of determining cost-effectiveness of CVR, Vectren South included the full implementation cost associated with the CVR program; however, Vectren South is requesting authority to capitalize and defer for future recovery a portion of the cost associated with implementing CVR. The budgets depicted above include the carrying costs, depreciation expenses, annual, ongoing Operation and Maintenance ("O&M") expenses, a representative share of Vectren South's DSM support staff and administration costs and related EM&V costs.

Vectren South 2016-2017 Electric DSM Plan with 2018 Look

Vectren DSM Program Portfolio Impacts and Budget

Program Year	Energy Savings MWh - Annual Incremental	Energy Savings MWh - Cumulative	Peak Demand Savings MW - Annual Incremental	Peak Demand Savings MW - Cumulative	Program Budget $,000
2016	36,317	36,317	8.3	8.3	$8,606
2017	37,791	74,107	7.1	15.4	$8,109
2018	39,404	113,511	11.4	26.9	$10,663
Total	**113,511**		**26.9**		**$27,378**

Program	Savings (kWh)			Demand Savings (kW)			Budget			TRC
Residential	**2016**	**2017**	**2018**	**2016**	**2017**	**2018**	**2016**	**2017**	**2018**	
Residential Lighting	6,612,901	6,831,909	6,811,553	839	865	863	$788,506	$897,321	$951,605	2.32
Home Energy Assessment and Weatherization*	1,935,719	1,935,719	1,935,719	290	290	290	$419,910	$429,428	$440,515	1.57
Income Qualified Weatherization*	1,282,577	1,282,577	1,282,577	254	254	254	$598,270	$604,045	$609,820	1.09
Appliance Recycling	1,020,544	1,020,544	1,020,544	152	152	152	$205,094	$207,948	$210,887	1.44
Energy Efficiency Schools*	675,508	675,508	675,508	106	106	106	$117,706	$120,901	$123,047	3.47
Residential Efficient Products*	1,075,888	1,075,888	1,075,888	623	623	623	$622,493	$626,298	$630,210	1.33
Residential New Construction*	146,775	146,775	146,775	68	68	68	$98,441	$99,536	$100,632	1.38
Multi-Family Direct Install Bulbs and Tstats*	335,000	335,000	335,000	20	20	20	$29,777	$30,610	$31,468	3.82
Residential Behavior Savings (without refill)*	6,204,832	5,576,656	5,025,401	1,728	1,553	1,399	$382,000	$366,285	$353,721	1.42
Conservation Voltage Reduction - Residential (2 Substations)***	0	1,481,669	1,252,350	0	508	430	$20,000	$166,861	$354,341	1.34
Residential Smart Thermostat Demand Response	858,000	0	2,145,000	1,800	0	4,500	1,196,455	297,890	$2,425,275	2.19
Outreach Costs	-	-	-	-	-	-	$150,000	$150,000	$150,000	N/A
Residential Total**	**20,147,744**	**20,362,245**	**21,706,315**	**5,880**	**4,439**	**8,705**	**$4,628,652**	**$3,997,123**	**$6,381,520**	**1.74**
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VECTREN
Live Smart

Vectren Corporation
2014 Integrated Resource Plan

By
Southern Indiana Gas and Electric Company
d/b/a Vectren Energy Delivery of Indiana, Incorporated

November 1, 2014

PAGE

PAGE

PAGE

IRP Proposed Draft Rule Requirements Cross Reference Table

Rule Reference	Rule Description	Report Reference (As Page # or Attachment)
170 IAC 4-7-4	**Methodology and documentation requirements**	
	(a) The utility shall provide an IRP summary document that communicates core IRP concepts and results to non-technical audiences. (1) The summary shall provide a brief description of the utility's existing resources, preferred resource portfolio, short term action plan, key factors influencing the preferred resource portfolio and short term action plan, and any additional details the commission staff may request as part of a contemporary issues meeting. The summary shall describe, in simple terms, the IRP public advisory process, if applicable, and core IRP concepts, including resource types and load characteristics. (2) The utility shall utilize a simplified format that visually portrays the summary of the IRP in a manner that makes it understandable to a non-technical audience. (3) The utility shall make this document readily accessible on its website.	Technical Appendix J and www.vectren.com/irp
	(b) An IRP must include the following: (1) A discussion of the: (A) inputs; (B) methods; and (C) definitions; used by the utility in the IRP.	Included throughout the IRP

Rule Reference	Rule Description	Report Reference (As Page # or Attachment)
170 IAC 4-7-4 Cont.	(2) The data sets, including data sources, used to establish base and alternative forecasts. A third party data source may be referenced. The reference must include the source title, author, publishing address, date, and page number of relevant data. The data sets must include an explanation for adjustments. The data must be provided on electronic media, and may be submitted as a file separate from the IRP, or as specified by the commission.	72, 190-191, Technical Appendix sections: A, B, D, E, F, I
	(3) A description of the utility's effort to develop and maintain a data base of electricity consumption patterns, by customer class, rate class, NAICS code, and end-use. The data base may be developed using, but not limited to, the following methods: (A) Load research developed by the individual utility. (B) Load research developed in conjunction with another utility. (C) Load research developed by another utility and modified to meet the characteristics of that utility. (D) Engineering estimates. (E) Load data developed by a non-utility source.	72
	(4) A proposed schedule for industrial, commercial, and residential customer surveys to obtain data on end-use appliance penetration, end-use saturation rates, and end-use electricity consumption patterns.	92
	(5) A discussion of distributed generation within the service territory and the potential effects on generation, transmission, and distribution planning and load forecasting.	84-85
	(6) A complete discussion of the alternative forecast scenarios developed and analyzed, including a justification of the assumptions and modeling variables used in each scenario.	66-89, 186-200
	(7) A discussion of how the utility's fuel inventory and procurement planning practices, have been taken into account and influenced the IRP development.	190
	(8) A discussion of how the utility's emission allowance inventory and procurement practices for any air emission regulated through an emission allowance system have been taken into account and influenced the IRP development.	51-55
	(9) A description of the generation expansion planning criteria. The description must fully explain the basis for the criteria selected.	186-192

Rule Reference	Rule Description	Report Reference (As Page # or Attachment)
170 IAC 4-7-4 Cont.	(10) A brief description and discussion within the body of the IRP focusing on the utility's Indiana jurisdictional facilities with regard to the following components of FERC Form 715: (A) Most current power flow data models, studies, and sensitivity analysis. (B) Dynamic simulation on its transmission system, including interconnections, focused on the determination of the performance and stability of its transmission system on various fault conditions. The simulation must include the capability of meeting the standards of the North American Electric Reliability Corporation (NERC). (C) Reliability criteria for transmission planning as well as the assessment practice used. The information and discussion must include the limits set of its transmission use, its assessment practices developed through experience and study, and certain operating restrictions and limitations particular to it. (D) Various aspects of any joint transmission system, ownership, and operations and maintenance responsibilities as prescribed in the terms of the ownership, operation, maintenance, and license agreement.	175-183
	(11) An explanation of the contemporary methods utilized by the utility in developing the IRP, including a description of the following:	
	(A) Model structure and reasoning for use of particular model or models in the utility's IRP.	66-67, 186-187
	(B) The utility's effort to develop and improve the methodology and inputs for its:	32, 186
	(i) forecast;	32, 93
	(ii) cost estimates;	32, 99, 190-191
	(iii) treatment of risk and uncertainty; and	32, 190
	(iv) evaluation of a resource (supply-side or demand-side) alternative's contribution to system wide reliability. The measure of system wide reliability must cover the reliability of the entire system, including:	32
	(AA) transmission; and	176-177
	(BB) generation.	32

Rule Reference	Rule Description	Report Reference (As Page # or Attachment)
170 IAC 4-7-4 Cont.	(12) An explanation, with supporting documentation, of the avoided cost calculation. An avoided cost must be calculated for each year in the forecast period. The avoided cost calculation must reflect timing factors specific to the resource under consideration such as project life and seasonal operation. Avoided cost shall include, but is not limited to, the following: (A) The avoided generating capacity cost adjusted for transmission and distribution losses and the reserve margin requirement. (B) The avoided transmission capacity cost. (C) The avoided distribution capacity cost. (D) The avoided operating cost, including fuel, plant operation and maintenance, spinning reserve, emission allowances, and transmission and distribution operation and maintenance.	139, Technical Appendix B
	(13) The actual demand for all hours of the most recent historical year available, which shall be submitted electronically and may be a separate file from the IRP. For purposes of comparison, a utility must maintain three (3) years of hourly data.	Technical Appendix G
	(14) Publicly owned utilities shall provide a summary of the utility's: (A) most recent public advisory process; (B) key issues discussed; (C) how they were addressed by the utility.	20-21, Technical Appendix A
170 IAC 4-7-5	**Energy and demand forecasts**	
	(a) An electric utility subject to this rule shall prepare an analysis of historical and forecasted levels of peak demand and energy usage which includes the following:	
	(1) Historical load shapes, including, but not limited to, the following:	90-92, Technical Appendix C
	(A) Annual load shapes.	
	(B) Seasonal load shapes.	
	(C) Monthly load shapes.	
	(D) Selected weekly and daily load shapes. Daily load shapes shall include, at a minimum, summer and winter peak days and a typical weekday and weekend day.	
	(2) Historical and projected load shapes shall be disaggregated, to the extent possible, by customer class, interruptible load, and end-use and demand-side management program.	
	(3) Disaggregation of historical data and forecasts by customer class, interruptible load, and end-use where information permits.	28, 69
	(4) Actual and weather normalized energy and demand levels.	90

Rule Reference	Rule Description	Report Reference (As Page # or Attachment)
170 IAC 4-7-5 Cont.	(5) A discussion of all methods and processes used to normalize for weather.	72-73
	(6) A minimum twenty (20) year period for energy and demand forecasts.	67-71
	(7) An evaluation of the performance of energy and demand forecasts for the previous ten (10) years, including, but not limited to, the following: (A) Total system. (B) Customer classes or rate classes, or both. (C) Firm wholesale power sales.	94-96
	(8) Justification for the selected forecasting methodology.	66-67, 76-77
	(9) For purposes of subdivisions (1) and (2), a utility may use utility specific data or more generic data, such as, but not limited to, the types of data described in section 4(b)(2) of this rule.	89
	(b) A utility shall provide at least three (3) alternative forecasts of peak demand and energy usage. At a minimum, the utility shall include high, low, and most probable energy and peak demand forecasts based on alternative assumptions such as: (1) Rate of change in population. (2) Economic activity. (3) Fuel prices. (4) Changes in technology. (5) Behavioral factors affecting customer consumption. (6) State and federal energy policies. (7) State and federal environmental policies.	70-71
170IAC 4-7-6	**Resource Assessment**	
	(a) The utility shall consider continued use of an existing resource as a resource alternative in meeting future electric service requirements. The utility shall provide a description of the utility's existing electric power resources that must include, at a minimum, the following information:	189
	(1) The net dependable generating capacity of the system and each generating unit.	189
	(2) The expected changes to existing generating capacity, including, but not limited to, the following: (A) Retirements. (B) Deratings. (C) Plant life extensions. (D) Repowering. (E) Refurbishment.	28
	(3) A fuel price forecast by generating unit.	190-191

Rule Reference	Rule Description	Report Reference (As Page # or Attachment)
170IAC 4-7-6 Cont.	(4) The significant environmental effects, including: (A) air emissions; (B) solid waste disposal; (C) hazardous waste; and (D) subsequent disposal; and (E) water consumption and discharge; at each existing fossil fueled generating unit.	51-58
	(5) An analysis of the existing utility transmission system that includes the following: (A) An evaluation of the adequacy to support load growth and expected power transfers. (B) An evaluation of the supply-side resource potential of actions to reduce transmission losses, congestion, and energy costs. (C) An evaluation of the potential impact of demand-side resources on the transmission network. (D) An assessment of the transmission component of avoided cost.	175-183
	(6) A discussion of demand-side programs, including existing company-sponsored and government-sponsored or mandated energy conservation or load management programs available in the utility's service area and the estimated impact of those programs on the utility's historical and forecasted peak demand and energy.	69, 121-131, 152-171
	The information listed above in subdivision (a)(1) through subdivision (a)(4) and in subdivision (a)(6) shall also be provided for each year of the planning period.	
	(b) An electric utility shall consider alternative methods of meeting future demand for electric service. A utility must consider a demand-side resource, including innovative rate design, as a source of new supply in meeting future electric service requirements. The utility shall consider a comprehensive array of demand-side measures that provide an opportunity for all ratepayers to participate in DSM, including low-income residential ratepayers. For a utility-sponsored program identified as a potential demand-side resource, the utility's IRP shall, at a minimum, include the following:	122-129
	(1) A description of the demand-side program considered.	153-171
	(2) The avoided cost projection on an annual basis for the forecast period that accounts for avoided generation, transmission, and distribution system costs. The avoided cost calculation must reflect timing factors specific to resources under consideration such as project life and seasonal operation.	140
	(3) The customer class or end-use, or both, affected by the program.	153-171
	(4) A participant bill reduction projection and participation incentive to be provided in the program.	153-171

Rule Reference	Rule Description	Report Reference (As Page # or Attachment)
170IAC 4-7-6 Cont.	(5) A projection of the program cost to be borne by the participant.	153-171
	(6) Estimated energy (kWh) and demand (kW) savings per participant for each program.	153-171
	(7) The estimated program penetration rate and the basis of the estimate.	153-171
	(8) The estimated impact of a program on the utility's load, generating capacity, and transmission and distribution requirements.	153-171
	(c) A utility shall consider a range of supply-side resources including cogeneration and nonutility generation as an alternative in meeting future electric service requirements. This range shall include commercially available resources or resources the director may request as part of a contemporary issues technical conference. The utility's IRP shall include, at a minimum, the following:	109, 112
	(1) Identify and describe the resource considered, including the following:	109
	(A) Size (MW).	109
	(B) Utilized technology and fuel type.	109
	(C) Additional transmission facilities necessitated by the resource.	180-182
	(2) A discussion of the utility's effort to coordinate planning, construction, and operation of the supply-side resource with other utilities to reduce cost.	N/A
	(d) A utility shall consider new or upgraded transmission facilities as a resource in meeting future electric service requirements, including new projects, efficiency improvements, and smart grid resources. The IRP shall, at a minimum, include the following: (1) A description of the timing and types of expansion and alternative options considered. (2) The approximate cost of expected expansion and alteration of the transmission network. (3) A description of how the IRP accounts for the value of new or upgraded transmission facilities for the purposes of increasing needed power transfer capability and increasing the utilization of cost effective resources that are geographically constrained.	175-183

Rule Reference	Rule Description	Report Reference (As Page # or Attachment)
170IAC 4-7-6 Cont.	(4) A description of how: (A) IRP data and information are used in the planning and implementation processes of the RTO of which the utility is a member; and (B) RTO planning and implementation processes are used in and affect the IRP.	38-48
170 IAC 4-7-7	**Selection of future resources**	
	(a) In order to eliminate nonviable alternatives, a utility shall perform an initial screening of all future resource alternatives listed in sections 6(b) through 6(c) of this rule. The utility's screening process and the decision to reject or accept a resource alternative for further analysis must be fully explained and supported in, but not limited to, a resource summary table. The following information: (1) Significant environmental effects, including the following: (A) Air emissions. (B) Solid waste disposal. (C) Hazardous waste and subsequent disposal. (D) Water consumption and discharge.	109
	(2) An analysis of how existing and proposed generation facilities conform to the utility-wide plan to comply with existing and reasonably expected future state and federal environmental regulations, including facility-specific and aggregate compliance options and associated performance and cost impacts.	188
	(b) Integrated resource planning includes one (1) or more tests used to evaluate the cost effectiveness of a demand-side resource option. A cost-benefit analysis must be performed using the following tests except as provided under subsection (e): (1) Participant. (2) Ratepayer impact measure (RIM). (3) Utility cost (UC). (4) Total resource cost (TRC). (5) Other reasonable tests accepted by the commission.	137-151
	(c) A utility is not required to express a test result in a specific format. However, a utility must, in all cases, calculate the net present value of the program impact over the life cycle of the impact. A utility shall also explain the rationale for choosing the discount rate used in the test.	138, 153-154
	(d) A utility is required to:	
	(1) specify the components of the benefit and the cost for each of the major tests; and	137-138
	(2) identify the equation used to express the result.	137

Rule Reference	Rule Description	Report Reference (As Page # or Attachment)
170 IAC 4-7-7 Cont.	(e) If a reasonable cost-effectiveness analysis for a demand-side management program cannot be performed using the tests in subsection (b), where it is difficult to establish an estimate of load impact, such as a generalized information program, the cost-effectiveness tests are not required.	137-151
	(f) To determine cost-effectiveness, the RIM test must be applied to a load building program. A load building program shall not be considered as an alternative to other resource options.	N/A
170 IAC 4-7-8	**Resource integration**	
	(a) The utility shall develop candidate resource portfolios from the selection of future resources in section 7 and provide a description of its process for developing its candidate resource portfolios.	186-187
	(b) From its candidate resource portfolios, a utility shall select a preferred resource portfolio and provide, at a minimum, the following information:	193-201
	(1) Describe the utility's preferred resource portfolio.	193-194, 201
	(2) Identify the variables, standards of reliability, and other assumptions expected to have the greatest effect on the preferred resource portfolio.	202-211
	(3) Demonstrate that supply-side and demand-side resource alternatives have been evaluated on a consistent and comparable basis.	171-172
	(4) Demonstrate that the preferred resource portfolio utilizes, to the extent practical, all economical load management, demand side management, technology relying on renewable resources, cogeneration, distributed generation, energy storage, transmission, and energy efficiency improvements as sources of new supply.	84-89, 109, 112, 122-132, 171-172
	(5) Discuss the utility's evaluation of targeted DSM programs including their impacts, if any, on the utility's transmission and distribution system for the first ten (10) years of the planning period.	179, 137-140

Rule Reference	Rule Description	Report Reference (As Page # or Attachment)
170 IAC 4-7-8 Cont.	(6) Discuss the financial impact on the utility of acquiring future resources identified in the utility's preferred resource portfolio. The discussion of the preferred resource portfolio shall include, where appropriate, the following: (A) Operating and capital costs. (B) The average cost per kilowatt-hour, which must be consistent with the electricity price assumption used to forecast the utility's expected load by customer class in section 5 of this rule. (C) An estimate of the utility's avoided cost for each year of the preferred resource portfolio. (D) The utility's ability to finance the preferred resource portfolio.	N/A
	(7) Demonstrate how the preferred resource portfolio balances cost minimization with cost effective risk and uncertainty reduction, including the following. (A) Identification and explanation of assumptions. (B) Quantification, where possible, of assumed risks and uncertainties, which may include, but are not limited to: See below. (i) regulatory compliance; (ii) public policy; (iii) fuel prices; (iv) construction costs; (v) resource performance; (vi) load requirements; (vii) wholesale electricity and transmission prices; (viii) RTO requirements; and (ix) technological progress. (C) An analysis of how candidate resource portfolios performed across a wide range of potential futures.	201-212
	(D) The results of testing and rank ordering the candidate resource portfolios by the present value of revenue requirement and risk metric(s). The present value of revenue requirement shall be stated in total dollars and in dollars per kilowatt-hour delivered, with the discount rate specified.	Technical Appendix H

Rule Reference	Rule Description	Report Reference (As Page # or Attachment)
170 IAC 4-7-8 Cont.	(E) An assessment of how robustness factored into the selection of the preferred resource portfolio.	201-212
	(8) Demonstrate, to the extent practicable and reasonable, that the preferred resource portfolio incorporates a workable strategy for reacting to unexpected changes. A workable strategy is one that allows the utility to adapt to unexpected circumstances quickly and appropriately. Unexpected changes include, but are not limited to, the following: See below. (A) The demand for electric service. (B) The cost of a new supply-side or demand-side technology. (C) Regulatory compliance requirements and costs. (D) Other factors which would cause the forecasted relationship between supply and demand for electric service to be in error.	201-212
170 IAC 4-7-9	**Short term action plan**	
	Sec. 9. A short term action plan shall be prepared as part of the utility's IRP, and shall cover each of the three (3) years beginning with the IRP submitted pursuant to this rule. The short term action plan is a summary of the preferred resource portfolio and its workable strategy, as described in 170 IAC 4-7-8(b)(8), where the utility must take action or incur expenses during the three (3) year period. The short term action plan must include, but is not limited to, the following: (1) A description of each resource in the preferred resource portfolio included in the short term action plan. The description may include references to other sections of the IRP to avoid duplicate descriptions. The description must include, but is not limited to, the following: (A) The objective of the preferred resource portfolio. (B) The criteria for measuring progress toward the objective. (2) The implementation schedule for the preferred resource portfolio. (3) A budget with an estimated range for the cost to be incurred for each resource or program and expected system impacts. (4) A description and explanation of differences between what was stated in the utility's last filed short term action plan and what actually transpired.	215-216

List of Acronyms/Abbreviations

AC	Air Conditioning
ACS	American Community Survey
AMI	Advanced Metering Infrastructure
APWR	Advanced Pressurized Water Reactor
ARRA	American Recovery and Reinvestment Act
ASPEN-OneLiner	Advanced Systems for Power Engineering, Incorporated
AUPC	Average Use Per Customer
B	Water Heating Service – Closed to new customers
BAGS	Broadway Avenue Gas Turbines
BPJ	Best Professional Judgment
BPM	MISO's Business Practice Manual
BTU	British Thermal Unit
CAA	Clean Air Act
CAC	Citizens Action Coalition
CAES	Compressed Air Energy Storage
CAIR	Clean Air Interstate Rule
CAMR	Clean Air Mercury Rule
CCGT	Combined Cycle Gas Turbine
CCR	Coal Combustion Residuals
CDD	Cooling Degree Days
CEII	Critical Electric Infrastructure Information
CFL	Compact Fluorescent Lighting
CHP	Combined Heat and Power
CIL	Capacity Import Limit
CO_2	Carbon Dioxide
CPP	Clean Power Plan
CSAPR	Cross-State Air Pollution Rule
CVR	Conservation Voltage Reduction
CWA	Clean Water Act
DA	Distribution Automation
DGS	Demand General Service
DLC	Direct Load Control
DOE	United States Department of Energy
DR	Demand Response
DRR-1	Demand Response Resource Type 1
DSM	Demand-side Management
DSMA	Demand Side Management Adjustment
EAP	Energy Assistance Program
ECM	Electronically Commutated Motor
EDR	Emergency Demand Response
EEFC	Energy Efficiency Funding Component
EGU	Electric Generating Units
EIA	Energy Information Administration
EISA	Energy Independence and Security Act
ELGS	Effluent Limit Guidelines and Standards
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ESP	Electrostatic Precipitator
EVA	Energy Ventures Analysis, Inc.
FERC	Federal Energy Regulatory Commission
FF	Fabric Filter
FGD	Flue Gas Desulfurization
GADS	Generating Availability Data System
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GS	General Service
GWH	Gigawatt Hour
HAP	Hazardous Air Pollutants
HCi	Hydrochloric Acid

List of Acronyms/Abbreviations (continued)

HDD	Heating Degree Days
HHV	Higher Heating Value
HLF	High Load Factor
HRSG	Heat Recovery Steam Generator
HSPF	Heating Seasonal Performance Factor
HVAC	Heating, Ventilation, and Air Conditioning
ICAP	Interconnection Installed Capacity
IDEM	Indiana Department of Environmental Management
IGCC	Integrated Gasification Combined Cycle
IPP	Independent Power Producers
IRP	Integrated Resource Plan
IOU	Investor-Owned Utility
IURC	Indiana Utility Regulatory Commission
kV	Kilovolt
kVA	Kilovolt-Ampere
kWh	Kilowatt Hour
LBA	Load Balancing Area
LCR	Local Clearing Requirement
LMR	Load Management Receivers
LP	Large Power
LRZ	Local Resource Zone
LOLE	Loss of Load Expectation
LSE	Load Serving Entity
MACT	Maximum Achievable Control Technology Standards
MAPE	Mean Absolute Percentage Error
MARS	Multi-Area Reliability Simulation
MATS	mercury and Air Toxics Standards
MECT	Module E Capacity Tracking
MGD	Millions of Gallons per Day
MISO	Midcontinent Independent System Operator
MLA	Municipal Levee Authority
MMBTU	One million British Thermal Unit
MSA	Metropolitan Statistical Area
MTEP	MISO Transmission Expansion Plan
MW	Megawatt
MWh	Megawatt Hour
NAICS	North American Industry Classification System
NDC	Net Dependable Capacity
NERC	North American Electric Reliability Council
NERC MOD	NERC Modeling, Data, and Analysis
NOAA	National Oceanic and Atmospheric Administration
NO_x	Nitrous Oxide
NPDES	National Pollutant Discharge Elimination System
NPV	Net Present Value
NSPS	New Source Performance Standards
O&M	Operation and Maintenance
ORSANCO	Ohio River Valley Sanitation Commission
OSS	Off Season Service
OUCC	Office of Utility Consumer Counselor
OVEC	Ohio Valley Electric Corporation
PJM	Pennsylvania New Jersey Maryland Interconnection LLC
PM	Particulate Matter
PRM	Planning Reserve Margin
PTI-PSS/E	Power Technologies Incorporated's Power System Simulator Program for Engineers
PV	Photovoltaic
PVRR	Present Value of Revenue Requirements
RBS	Residential Behavioral Savings

List of Acronyms/Abbreviations (continued)

RCRA	Resource Conservation and Recovery Act
REC	Renewable Energy Credit
RECB	Regional Expansion Criteria and Benefits
RFC	Reliability First Corporation
RIM	Ratepayer Impact Measure
RPS	Renewable Portfolio Standard
RS	Residential Service
SAE	Statistically Adjusted End-use
SCADA	Supervisory Control and Data Acquisition
SCGT	Simple Cycle Gas Turbine
SCR	Selective Catalytic Reduction
SEER	Seasonal Energy Efficiency Ratio
SGS	Small General Service
SGT	Steam Turbine Generator
SIP	System Integration Plan
SMR	Small Modular Reactors
SO_2	Sulfur Dioxide
TPA	Third Party Administrator
TRC	Total Resource Cost
TVA	Tennessee Valley Authority
UCAP	Unforced Capacity Rating
VUHI	Vectren Utility Holdings Inc.
ZRC	Zone Resource Credit

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CHAPTER 1

EXECUTIVE SUMMARY

COMPANY BACKGROUND

Vectren Corporation is an energy holding company headquartered in Evansville, Indiana. Vectren's wholly owned subsidiary, Vectren Utility Holdings, Inc. (VUHI), is the parent company for three operating utilities: Indiana Gas Company, Inc. (Vectren North), Southern Indiana Gas and Electric Company (Vectren), and Vectren Energy Delivery of Ohio (VEDO).

Vectren North provides energy delivery services to more than 570,000 natural gas customers located in central and southern Indiana. Vectren provides energy delivery services to over 142,000 electric customers and approximately 110,000 gas customers located near Evansville in southwestern Indiana. VEDO provides energy delivery services to approximately 312,000 natural gas customers near Dayton in west central Ohio.

Vectren's company-owned generation fleet represents 1,158 megawatts (MW)[1] of unforced capacity (UCAP) as shown in Table 1-1.

Table 1-1 Generating Units

Unit	UCAP (MW)	Primary fuel	Commercial Date
Northeast 1	9 MW	Gas	1963
Northeast 2	9 MW	Gas	1964
FB Culley 2	83 MW	Coal	1966
Warrick 4	135 MW	Coal	1970
FB Culley 3	257 MW	Coal	1973
AB Brown 1	228 MW	Coal	1979
BAGS 2	59 MW	Gas	1981
AB Brown 2	233 MW	Coal	1986
AB Brown 3	73 MW	Gas	1991
AB Brown 4	69 MW	Gas	2002
Blackfoot	3 MW	Landfill Gas	2009

[1] Blackfoot landfill gas project is considered behind-the-meter and is therefore currently accounted for as a reduction to load and is omitted from the capacity total

In addition to company owned generating resources, Vectren has access to an additional 30 MW of capacity as a result of its 1.5% ownership interest in Ohio Valley Electric Corporation (OVEC). Vectren is also contracted to receive 80 MW of nominal capacity wind energy through two separate long-term purchase power agreements. The total firm capacity credit for the MISO 2014-2015 planning year for these wind resources is 7.3 MW. Vectren is interconnected with other utilities at both 345 kV and 138 kV and is able to exchange capacity and energy through the market mechanisms of the Midcontinent Independent System Operator (MISO).

THE IRP PROCESS

The Integrated Resource Plan (IRP) process was developed to assure a systematic and comprehensive planning process that produces a reliable, efficient approach to securing future resources to meet the energy needs of the utility and its customers. The IRP process encompasses an assessment of a range of feasible supply-side and demand-side alternatives to establish a diverse portfolio of options to effectively meet future generation needs.

In Indiana, the IRP is also guided by rules of the Indiana Utility Regulatory Commission (IURC). Those rules, found in the Indiana Administrative Code at 170 I.A.C. 4-7-4 through 4-7-9, provide specific guidelines for plan contents and filing with the Commission. On October 14, 2010, the IURC issued an order to commence rulemaking to revise/update the current Indiana IRP rule. The following summer, Vectren participated in a stakeholder process to provide input on updating the rule. The proposed draft rule was sent to stakeholders on October 4, 2012. Although not finalized, Vectren voluntarily followed the proposed draft rule, which is found in the IRP Proposed Draft Rule Requirements Cross Reference Table of this IRP.

Vectren modified its processes to meet the proposed draft rule. Most notably, Vectren incorporated a stakeholder process to gather input from stakeholders and answer stakeholder questions in an open, transparent process. The proposed rule requires at least 2 meetings with stakeholders. On March 20, 2014, Vectren met with stakeholders to discuss the base inputs of the plan, educate stakeholders on IRP related topics, and review the Vectren process. Based on feedback from stakeholders, Vectren added an additional meeting on August 5, 2014 to further discuss major assumptions and data inputs prior to modeling. Finally, on September 24, 2014 Vectren presented a preview of the plan. A summary of the stakeholder meetings can be found in Chapter 2 Planning Process, and the meeting presentations and Q&A summaries are found in the Technical Appendix, section A.

Details of the process used by Vectren to develop the recommended plan in this IRP are found in chapters 2 through 11 of this report. Chapter 11 Action Plan sets forth the action plan for Vectren over the next three years to achieve the long-term resource objectives described in this IRP.

Included in the process is an updated demand and energy forecast (detailed in Chapter 5 Sales and Demand Forecast). Table 1–2, shows a summary of the demand and energy forecast.

VECTREN'S QUANTITATIVE AND QUALITATIVE IRP PROCESS

Historically, Vectren has used modeling to perform the evaluations, screenings, and assessments of various potential scenarios to arrive at a single plan that represented its "Resource Plan Additions." Vectren continues to use the Strategist modeling software from Ventyx, as it has in its last several IRP studies. This software has traditionally been used by some of the other Indiana utilities, as well. The submitted plan was the result of a process that was primarily a quantitative evaluation performed using an industry standard planning model.

The modeling performed by Vectren provides important information to evaluate future resource needs. However, Vectren will also continue to monitor developments that could impact future resource needs. Three developments that Vectren is focusing on for impacts on the near term are:

1. The Clean Power Plan from the Environmental Protection Agency (EPA) and Indiana's approach to implementing this rule.
2. MISO capacity market constraints resulting from the early retirements of coal units as a response to the EPAs MATS rule.
3. The impacts on Vectren's load due to the addition of or loss of large customer load.

While Vectren's models attempt to evaluate the impact those issues may have on its future load, significant uncertainty remains. Vectren must maintain flexibility to adjust its plans based on the outcome of these and other unknown factors. In the case of Vectren, one of the smallest investor-owned electric utilities in the nation, the ramifications of major capacity decisions are particularly important.

Equally important, Vectren believes one of the major objectives of the Commission's reporting and filing requirements regarding the IRP process is to communicate with the IURC regarding the decision processes, evaluations, and judgments that Vectren uses to assist in making the resource planning decisions that are in the long-term best interest of Vectren's customers and the communities it serves. Vectren understands that the action plan which results from the IRP process is to be used as a guide by the Company and the IURC in addressing long-term resource needs, as both attempt to carry out their respective responsibilities in the most effective manner possible.

CHANGES SINCE LAST IRP

While a number of changes have occurred since Vectren's last IRP, four specific changes have had a significant impact on this IRP. First, the IURC's proposed draft IRP rules were released after Vectren's last IRP. Vectren is voluntarily following the new proposed draft IRP rule, which includes a stakeholder process, non-technical summary, more robust risk analysis, and attending an annual contemporary issues meeting in Indianapolis. The IRP Proposed Draft Rule Requirements Cross Reference Table on page three shows the new proposed draft rule and where Vectren addresses each part in this IRP.

Second, Vectren engaged a third party consultant with significant experience conducting IRPs for other parties, Burns & McDonnell, one of the leading engineering design experts in the United States, to aid its preparation of this IRP. For the 2014 IRP, Vectren worked closely with Burns and McDonnell to perform Strategist modeling (including additional DSM modeling). Burns and McDonnell has a great deal of experience in working with companies across the country on resource modeling. They also performed the Technology Assessment, detailing costs for potential resource options. The Technology Assessment can be found in the Technical Appendix, section B.

Third, the EPA has finalized various federal mandates with respect to further environmental regulation of Vectren's generating units and proposed a sweeping greenhouse gas regulation for existing coal-fired generating sources since Vectren's last IRP. As will be discussed in more detail in Chapter 4 Environmental, the EPA finalized its Mercury and Air Toxics Standard (MATS) in 2012, which set first ever plant-wide emission limits for mercury and other hazardous air pollutants and has a compliance deadline of April 2015. MATS has resulted in many announcements of coal plant retirements across the US. As a result, MISO, Vectren's Regional Transmission Operator (RTO), is predicting potential capacity shortfalls in the next few years. In the next two years Vectren intends to spend $70- $90 million on its environmental compliance program to meet not only the MATS rule, but also recent water discharge limits for mercury contained in water discharge permit renewals and mitigate incremental sulfur trioxide (SO_3) emissions resulting from the installation of Vectren's selective catalytic reduction technology under an agreement with the EPA. However, Vectren is projecting to defer recovery of these federally mandated costs until approximately 2020. The assumptions in the IRP are consistent with Vectren's environmental compliance filing.

In addition to the federal mandates referenced above, the EPA released its final rule regulating cooling water structures under Section 316(b) of the Clean Water Act (CWA) on August 15, 2014. Section 316(b) requires that intake structures that withdraw > 2 Million Gallons per Day (MGD) of water, including most electric generating units, use the "Best Technology Available" to prevent and / or mitigate adverse environmental impacts to shellfish, fish, and wildlife in a water body. This rule applies only to the FB Culley plant, as the AB Brown plant already utilizes cooling water towers.

Finally, on June 2, 2014, the EPA issued the Clean Air Act Section 111(d) Greenhouse Gas (GHG) New Source Performance Standards (NSPS) for existing sources, known as the Clean Power Plan (CPP). The CPP sets state-specific carbon reduction goals based on a state's existing generation mix based upon a building block approach and provides guidelines for the development, submission and implementation of state plans to achieve the state goals. As yet, there is little clarity on how the state of Indiana will choose to implement this rule. However, this IRP considers several of the potential building blocks in its assumptions: Demand Side Management (DSM), a potential renewables portfolio standard, and a price for carbon price beginning in 2020.

Fourth, the Indiana General Assembly passed legislation in March of 2014 that modified DSM requirements in Indiana. Senate Enrolled Act No. 340 ("SEA 340") removed requirements for mandatory statewide "Core" DSM programs and energy savings goals effective December 31, 2014. SEA 340 also allows large Commercial and Industrial (C&I) customers who meet certain criteria to opt-out of participating in utility sponsored DSM programs.

Vectren continues to support DSM related energy efficiency efforts as a fundamental part of the services that are provided to customers in order to help them manage their energy bills. Vectren believes that a cost effective level of DSM energy efficiency may be supported by policy considerations beyond the IRP's focus on planning for future resources. Consistent with this belief, Vectren's base sales forecast includes a base level of DSM at a targeted level of 1% eligible annual savings for 2015 – 2019 and 0.5% annually thereafter for customer load that has not opted-out of DSM programs.

Vectren also modeled whether incremental DSM energy efficiency programs would be selected as a resource when competing with supply side options, to meet future electric requirements. Vectren's approach attempts to balance its commitment to a level of cost-effective DSM to help customers manage their energy bills, while evaluating additional DSM resources consistent with least cost planning.

Note that since the last IRP was performed, Broadway Unit 1 (BAGS 1) has quit performing up to specifications. The unit has been on a long-term outage. Therefore, Vectren currently does not get credit for the unforced capacity (UCAP) amount, and it was not included in the analysis as shown in Table 1-1. BAGS 1 is a natural gas peaking unit, and in the past was typically good for approximately 40 MW on a UCAP basis.

PLAN RESULTS / RECOMMENDATIONS

The IRP indicates that Vectren does not need any incremental generation resources or purchase power agreements during the planning horizon. Although the IRP does not project incremental resource needs, Vectren proposes to continue offering DSM programs to help customers use less energy, thus lowering their total bill. The IRP forecasts that there may be some marginal economic benefit to retiring FB Culley 2 in 2020 under certain scenarios. This retirement evaluation is influenced by Vectren's load forecast, carbon costs, and fuel costs. Vectren will continue to evaluate the impact of these components on Culley Unit 2 in successive IRPs to evaluate the optimal time to retire Culley Unit 2.

As mentioned above and discussed in further detail in this IRP, the decision to retire FB Culley 2 will not be made until major near term uncertainties become more clear, most notably how the state of Indiana will implement the EPA's Clean Power Plan (if the plan survives legal challenges). Additionally, Vectren is actively working to attract new industrial customers through economic development activities in southwestern Indiana. If a large customer chooses to locate within the Vectren electric service area, Culley 2 will be required to operate at least in the short term to provide the resources necessary to serve such a customer. Leaving Culley Unit 2 in operation at this time provides Vectren maximum flexibility to adapt to such future developments. Economic modeling does not necessarily account for all such developments that are very possible, and therefore, judgment must also be part of the analysis. Table 1-2 shows the peak and energy forecast. Table 1-3 shows that no capacity additions are currently deemed necessary.

Vectren's base case scenario assumptions are detailed in Chapter 10 Generation Planning. In summary, Vectren assumed a minimum planning margin of 7.3%[1] for each year of the study. Energy savings goals of 1% of eligible customer load were incorporated into the load forecast through 2019. Additionally, incremental energy savings of .5% per year were assumed beginning in 2020 and were carried throughout the rest of the planning period. All assumptions are discussed in depth throughout this IRP.

Sensitivity risk analyses were performed around coal, gas, energy, and carbon pricing, capital costs, and high environmental regulation cost. These results are shown in Chapter 10 Generation Planning.

CONCLUSION

Vectren recognizes that the electric utility industry is experiencing a fast-changing time in terms of potential regulations, environmental mandates, and technology advances. Given the significant impact of any resource decision on both customers and other stakeholders, Vectren will continue to actively monitor developments in the regulatory,

[1] MISO unforced capacity (UCAP) requirement, further discussed in Chapter 3 MISO

environmental, and technology arenas for both their impact on future generation needs and existing facilities. Open communication with the IURC and other parties including the OUCC will be key to Vectren's ability to make the best decisions for all stakeholders.

Table 1-2 Peak and Energy Forecast

Year	Peak (MW)[1]	Annual Energy (GWh)
2014 Proj.	1,145	5,782
2015	1,155	5,914
2016	1,156	5,936
2017	1,113	5,514
2018	1,109	5,503
2019	1,106	5,494
2020	1,106	5,497
2021	1,106	5,492
2022	1,107	5,494
2023	1,107	5,494
2024	1,107	5,496
2025	1,106	5,487
2026	1,106	5,487
2027	1,107	5,492
2028	1,109	5,507
2029	1,110	5,509
2030	1,111	5,517
2031	1,111	5,523
2032	1,113	5,540
2033	1,114	5,548
2034	1,115	5,560
Compound Annual Growth Rate, 2014-2034	-0.1%	-0.2%

[1] Includes wholesale contract sales for 2014

Table 1-3 Base Case Resource Plan

Year	Firm Peak Demand[1] (MW)	UCAP Company Owned Generation (MW)	DLC (MW)	Interruptible (MW)	UCAP Committed Purchases (MW)	Capacity Additions (MW)	Total Resources (MW)	Reserve Margin (%)[2]
2015	1,155	1,155	17	50	38		1,260	9.1%
2016	1,156	1,155	17	50	38		1,260	9.0%
2017	1,113	1,155	18	27	38		1,238	11.2%
2018	1,109	1,155	18	27	38		1,238	11.6%
2019	1,106	1,155	17	28	38		1,238	11.9%
2020	1,106	1,155	17	28	38		1,238	11.9%
2021	1,106	1,155	17	28	38		1,238	11.9%
2022	1,107	1,155	17	28	38		1,238	11.8%
2023	1,107	1,155	17	28	38		1,238	11.8%
2024	1,107	1,155	17	28	38		1,238	11.8%
2025	1,106	1,155	17	28	38		1,238	11.9%
2026	1,106	1,155	17	28	38		1,238	11.9%
2027	1,107	1,155	17	28	38		1,238	11.8%
2028	1,109	1,155	17	28	38		1,238	11.6%
2029	1,110	1,155	17	28	38		1,238	11.5%
2030	1,111	1,155	17	28	38		1,238	11.4%
2031	1,111	1,155	17	28	38		1,238	11.4%
2032	1,113	1,155	17	28	38		1,238	11.2%
2033	1,114	1,155	17	28	38		1,238	11.1%
2034	1,115	1,155	17	28	38		1,238	11.0%

[1] Vectren is not forecasting firm wholesale contracts throughout this forecast.
[2] MISO requires a 7.3% Planning Reserve

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CHAPTER 2

PLANNING PROCESS

INTRODUCTION

Vectren's IRP objectives are based on the need for a resource strategy that provides value to its customers, communities, and shareholders. In addition, this strategy must accommodate the ongoing changes and uncertainties in the competitive and regulated markets. Specifically, Vectren's IRP objectives are as follows:

- Provide all customers with a reliable supply of energy at the least cost reasonably possible
- Develop a plan with the flexibility to rapidly adapt to changes in the market while minimizing risks
- Provide high-quality, customer-oriented services which enhance customer value
- Minimize impacts of Vectren's past and current operations on local environments

PLANNING PROCESS

The planning process is driven by the characteristics of Vectren's markets and the needs of its customers. These elements serve to define the utility's objectives and help establish a long-term forecast of energy and demand.

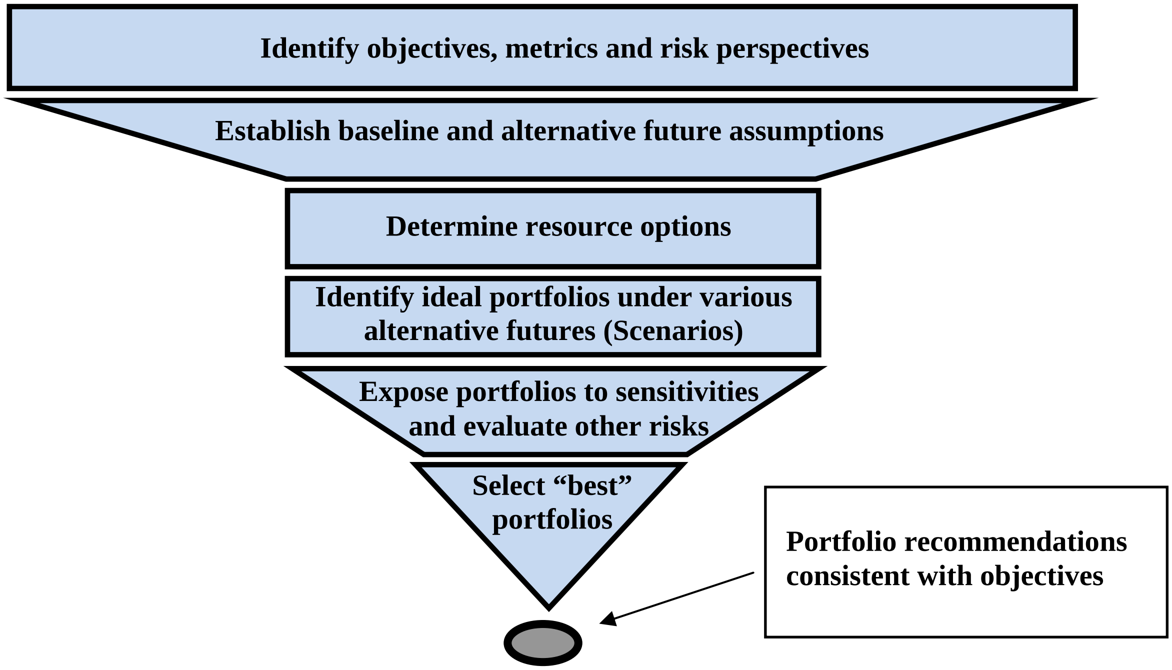
Using the forecast as a baseline, the IRP process entails evaluation of both supply-side and demand-side options designed to address the forecast. These options serve as input into a formal integration process that determines the benefits and costs of various combinations of supply-side and demand-side resources. Because the IRP modeling process requires significant amounts of data and assumptions from a variety of sources, a process is needed to develop appropriate inputs to the models.

The process criteria for inputs include:

- Maintain consistency in developing key assumptions across all IRP components
- Incorporate realistic estimates based on up-to-date documentation with appropriate vendors and available market information, as well as internal departments

- Consideration of impacts and experiences gained in prior IRP processes and demand-side program efforts

Vectren follows an integrated resource plan process that is very similar to other utilities throughout the country. In order to stay current with IRP methodologies and techniques, Vectren works with consultants, attends integrated resource planning conferences, and attends the annual contemporary issues meeting (hosted by the IURC). The diagram below illustrates the general process.



Vectren's objective is to serve customers as reliably and economically as possible, while weighing future risks and uncertainties. Vectren begins the process by forecasting customers' electric demand for 20 years. The electric demand forecast considers historical electric demand, economics, weather, appliance efficiency trends (driven by Federal codes and standards), population growth, adoption of customer owned generation (such as solar panels), and Vectren DSM energy efficiency programs (such as appliance rebates). A base, low, and two high peak load forecasts were developed.

The next step in the process is to determine possible alternative futures (scenarios) and determine how to reliably and economically meet customers' future electric demand. Vectren has adequate resource options (power plants, on-going energy efficiency and demand response options) to meet customers' need. The base scenario assumes customer need will be met with existing resources. The second scenario examines the potential impact of retiring FB Culley 2, Vectren's oldest, smallest (83 MW), and most inefficient coal generating unit. Additionally, it is not controlled for NO_x. The final scenario included a possible future where the government enacts a Renewable Portfolio Standard (RPS), requiring 20% of electricity to be produced with renewable resources, such as wind, solar, customer-owned renewable distributed generation, and utility sponsored DSM energy efficiency programs.

Each electric demand forecast is exposed to the base and two alternate futures to determine the most economical way to meet customer needs, resulting in 12 possible plans. The diagram below illustrates each alternative.

		A Base	B FB Culley 2 Unit Retirement	C RPS
1	Base Demand Forecast	Plan A1	Plan B1	Plan C1
2	Low Demand Forecast	Plan A2	Plan B2	Plan C2
3	High (modeled) Demand Forecast	Plan A3	Plan B3	Plan C3
4	High (large load) Forecast[1]	Plan A4	Plan B4	Plan C4

[1] The base demand forecast with a 100 MW firm load addition in 2018

Each plan represents the lowest-cost option to meet customer demand. Several resource options were considered in the analysis to meet customer demand, including various (types and sizes) natural gas powered generation options, additional energy efficiency programs beyond what is already included in the electric demand forecasts, renewables (wind and solar generation), and short-term market capacity purchases.

All model inputs and assumptions are loaded into a modeling tool called Strategist, which is used by many utilities throughout the country. The modeling tool optimizes for the lowest-cost plan to meet customer demand, plus a 7.3% UCAP planning reserve margin.

Each plan was then subjected to additional risk sensitivities to determine which plan is the lowest cost over a wide range of possible future risks. As previously mentioned, resource modeling requires a large number on inputs and assumptions: forecasts for natural gas prices, coal prices, market energy prices, CO_2 prices, costs of resource options, and potential costs for regulations. If the costs of any of these risk factors vary significantly from the base forecasts, the results of the analysis could potentially be different. Each plan (A1-C4) was subjected to varying costs (most often +/- 20%) for the risk factors mentioned above to determine the impact to each plan from the possible future sensitivities.

The remainder of this IRP is organized as follows:

MISO
Chapter 3 - Discusses Vectren's participation in MISO and the implications for resource planning

Environmental
Chapter 4 - Discusses current and pending environmental issues and regulations and the potential considerations for resource decisions

Forecast
Chapter 5 - Contains the electric sales and demand forecast

Supply-Side
Chapter 6 - Describes the electric supply analysis including a review and screening of the various electric supply options
Chapter 7 - Describes the viability and application of renewable and clean energy technologies and renewable energy credits (RECs)
Chapter 9 - Contains a discussion of Vectren's transmission and distribution expansion plan forecast

Demand-Side
Chapter 8 - Presents a discussion of DSM resources including screening results and program concept development

Integration
Chapter 10 - Details the formal integration process which includes conducting sensitivity analyses and obtaining the final resource plan

Short term Action Plan
Chapter 11 - Contains action plans designed to implement the resource plan over the next three years

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CHAPTER 3

MISO

INTRODUCTION

Vectren was an original signer of the Transmission Owners Agreement, which organized the Midwest Independent Transmission System Operator, now known as the Midcontinent Independent System Operator (MISO) and under which authority the MISO administers its Open Access Transmission, Energy and Operating Reserve Markets Tariff (MISO Tariff). As a vertically integrated utility with the responsibility and obligation for serving load within the MISO footprint, Vectren has integrated many functions with the operating procedures of MISO. This integration involves the coordinated operation of its transmission system and generating units, and the functions range from owning and operating generation and transmission, to complying with certain reliability standards. These standards include planning and operation of resources to meet the needs of loads in the future and are set by the North American Electric Reliability Corporation (NERC) and the regional reliability entity Reliability First Corporation, both of which are overseen by the Federal Energy Regulatory Commission (FERC).

MISO OVERVIEW

MISO, headquartered in Carmel, Indiana, with additional offices in Egan, Minnesota, was approved as the nation's first regional transmission organization in 2001. Today, MISO manages one of the world's largest energy and operating reserves markets; the market generation capacity was 175,436 MW as of May 1, 2014. This market operates in 15 states and one Canadian province.

Key Dates

- February 1, 2002 - Transmission service began under MISO Open-Access Transmission Tariff with Vectren as a full Transmission Owning Member
- April 1, 2005 - Midwest markets launch
- April 16, 2008 - NERC certified MISO as Balancing Authority
- January 6, 2009 - Ancillary Services Markets began and MISO became the region's Balancing Authority
- December 19, 2013 – Added South Region

Vectren in Relation to MISO Footprint

With a native peak load of about 1,150 MW, Vectren is approximately 1.4% of the MISO market footprint and is one of 36 local balancing authorities. In addition, the Vectren transmission system supports multiple municipals and a large industrial smelter. The total control area or Local Balancing Area (LBA) is approximately 1,900 MW.

Figure 3-1 below is a drawing of the entire MISO market footprint, and Figure 3-2 shows the MISO Reliability Coordination Area.

Figure 3-1 MISO Market Area

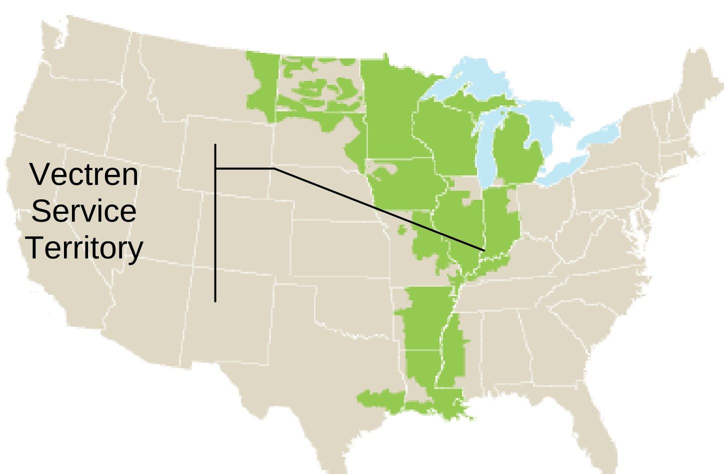
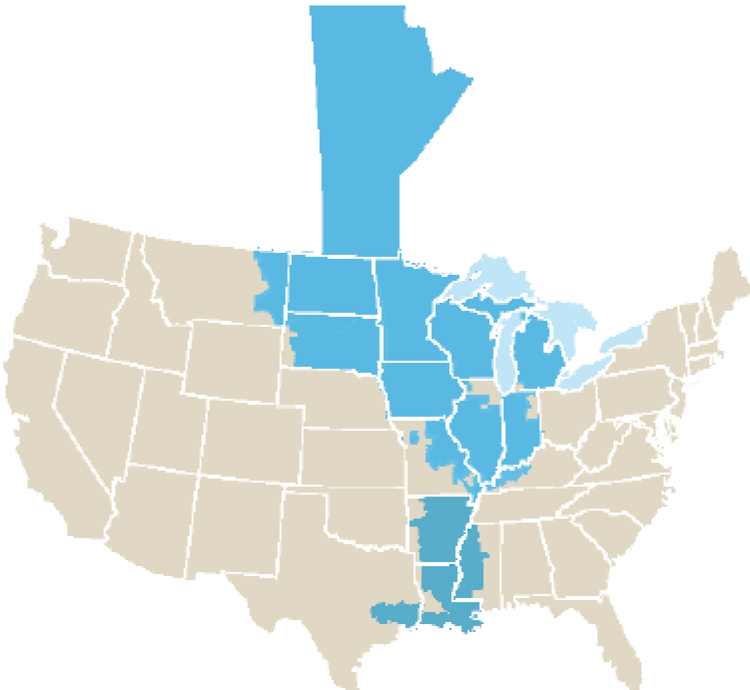


Figure 3-2 MISO Reliability Coordination Area



MISO's GOALS

The goal of MISO's regional transmission planning process is the development of a comprehensive expansion plan that meets both reliability and economic expansion needs. This process identifies solutions for reliability issues that arise from the expected dispatch of network resources. These solutions include evaluating alternative costs between capital expenditures for transmission expansion projects and increased operating expenses from redispatching network resources or other operational actions.

The MISO Board of Directors has adopted six planning principles to guide the MISO regional plan:

1. Make the benefits of an economically efficient energy market available to customers by identifying transmission projects which provide access to electricity at the lowest total electric system costs.
2. Provide a transmission infrastructure that upholds all applicable NERC and Transmission Owner planning criteria and safeguards local and regional reliability through identification of transmission projects to meet those needs.
3. Support state and federal energy policy requirements by planning for access to a changing resource mix.

4. Provide an appropriate cost allocation mechanism that ensures the costs of transmission projects are allocated in a manner roughly commensurate with the projected benefits of those projects.
5. Analyze system scenarios and make the results available to state and federal energy policymakers and other stakeholders to provide context and to inform choices they face.
6. Coordinate transmission planning with neighboring planning regions to seek more efficient and cost-effective solutions.[1]

MISO is designated as Vectren's Planning Authority, under the NERC reliability standards, and in FERC Order 1000, MISO has additional regional planning responsibilities.

MISO PLANNING PROCESS

MISO Transmission Planning Process

MISO's transmission planning process begins with the models for the current planning cycle and includes opportunities for stakeholder input on the integration of transmission service requests, generator interconnection requests, and other studies to contribute to the development of an annual MISO Transmission Expansion Plan (MTEP) report.

The 2013 MTEP recommended $1.48 billion in 317 new projects across the MISO footprint through the year 2023. MISO MTEP process has recommended $17.9 billion total investment since its 2003 inception through the first 10 years.

[1] These Guiding Principles were initially adopted by the Board of Directors, pursuant to the recommendation of the System Planning Committee, on August 18, 2005, and reaffirmed by the System Planning Committee in February 2007, August 2009, May 2011, and March 2013.

MISO's role in meeting Vectren's requirements as a member of ReliabilityFirst for a Planning Reserve Margin

As a result of the Energy Policy Act of 2005, regional entities were delegated authority by FERC to establish standards to provide for reliable operation of the bulk-power system. Vectren is a member of regional entity ReliabilityFirst, and so must comply with regional entity Reliability First standards, including the Planning Resource Adequacy Analysis and the Assessment and Documentation Standard BAL-502-RFC-02. This assessment and documentation standard requires planning coordinators to perform annual resource adequacy analyses. This includes calculating a planning reserve margin (PRM) that will result in the sum of the probabilities for loss of load for the integrated peak hour for all days of each planning year equal to a one day in 10 year criterion. This PRM requirement also includes documenting the projected load, resource capability, and PRM for the years under study, and other particular criteria.

The first planning year the Reliability First Planning Reserve Standard was in effect (June 2008-May 2009), Vectren complied with the ReliabilityFirst Planning Resource Adequacy standard by participating in the Midwest Planning Reserve Sharing Group. The calculated required PRM for Vectren was 14.3% on an installed capacity basis. For planning year June 2009-May 2010 and beyond, Vectren and all other MISO utilities have delegated their tasks assigned to the Load Serving Entities (LSEs) under BAL-502-RFC-02 to MISO. The specific section of the MISO Tariff that addresses planning reserves is Module E-1 Resource Adequacy. Vectren is complying with the ReliabilityFirst Planning Resource Adequacy standard by meeting the MISO Module E individual LSE required PRM. This PRM (UCAP) is 7.3% for planning year June 2014 - May 2015.

MISO's Module E-1

As previously mentioned, Module E-1- Resource Adequacy is the portion of the MISO Tariff which requires MISO to determine the Planning Reserve Margin Requirement, on an unforced capacity (UCAP) basis, that would result in 1 day in 10 Loss of Load Event reliability standard. Module E-1 and its associated business practice manual lays out the mandatory requirements to ensure access to deliverable, reliable and adequate planning resources to meet peak demand requirements on the transmission system. To perform these calculations, MISO requires entities to utilize their Module E Capacity Tracking Tool (MECT) to submit a forecast of demand and list their qualified resources. This same tool is then leveraged to accept offers into MISO's annual Planning Resource Auction (PRA).

Loss of Load Expectation and Determination of Planning Reserve Margins

MISO used a Loss of Load Expectation[1] (LOLE) of 1 day in 10 years as the probabilistic method to determine expected number of days per year for which available generating capacity is insufficient to serve the daily peak demand (load). This LOLE, along with other LSE-specific data, is used to perform a technical analysis on an annual basis to establish the PRM UCAP for each LSE. The PRM analysis considers other factors such as generator forced outage rates of capacity resources, generator planned outages, expected performance of load modifying resources, forecasting uncertainty, and system operating reserve requirements.

For this year, an unforced capacity planning reserve margin of 7.3% applied to the MISO system Coincident Peak Demand has been established for the planning year of June 2014 through May 2015. This value was determined by MISO through the use of the GE Multi-Area Reliability Simulation (MARS) software for Loss of Load analysis.

Effect of Load Diversity

Within Module E-1, individual LSEs maintain reserves based on their Coincident Peak Demand, which is the LSE's demand at the time of the MISO peak. MISO no longer calculates a Load Diversity Factor for LSE's, as this would be different for each LSE. However, each LSE peaks at a different time, and for reference, an LSE can determine

[1] Included in the Technical Appendix, section I

what the PRM UCAP would be when accounting for load diversity by multiplying the PRM UCAP times the ratio of LSE Coincident Peak Demand divided by LSE peak Demand.

Forecast LSE Requirements

LSEs must demonstrate that sufficient planning resources are allocated to meet the LSE Coincident Peak Demand multiplied by one plus the PRM and one plus transmission losses. The submission of this forecast follows MISO's prescribed processes.

LSEs must report their peak demand forecasts for each month of the next two planning years and for each summer period (May-October) and winter period (November-April) for an additional eight (8) planning years for the NERC MOD standards.

Forecasted demand in MISO reflects the expected "50/50" LSE Coincident Peak Demand and includes the effect of all distribution and transmission losses. This means there is a 50% chance that actual demand will be higher and a 50% chance that actual demand will be lower than the forecasted level.

LSEs must also report their Net Energy for Forecasted Demand for the same time periods: monthly for the next two planning years and for each summer period (May-October) and winter period (November-April) for an additional eight (8) planning years for the NERC MOD standards.

LSEs register demand side management into the MECT tool separate from their demand forecasts. These resources are explicitly modeled on the supply side in determination of the PRM.

Resource Plan Requirements

LSEs are obligated to provide MISO with resource plans demonstrating that Zonal Resource Credits (ZRC) will be available to meet their resource adequacy requirements. Generally, the Planning Reserve Margin Requirement (PRMR) is the forecast LSE Peak Demand multiplied by one plus MISO PRM UCAP and one plus transmission losses, unless the state utility commission establishes a PRM that is different from MISO's. Additionally LSEs must meet a Local Clearing Requirement (LCR) for the Local Resource Zone (LRZ) for which the LSE resides, Vectren is in LRZ six. The LCR is equal to the Local Reliability Requirement (LRR) less the Capacity Import Limit (CIL) into that zone. The LRR is established so that the LRZ can also meet the 1 day in 10 LOLE reliability standard by clearing the necessary resources within the LRZ.

If a state utility commission establishes a minimum PRM for the LSEs under their jurisdiction, that state-set PRM will be adopted by MISO for affected LSEs in such state. If a state utility commission establishes a PRM that is higher than the MISO established PRM, the affected LSE's must meet the state-set PRM.[1] Indiana does not have a stated minimum planning reserve margin; therefore, Vectren must meet the PRM of MISO.

Qualification of Resources, Including Unforced Capacity Ratings (UCAP), Conversion of UCAP MW to Zonal Resource Credits

To comply with MISO Resource Adequacy provisions, LSEs must submit data for their eligible resources for MISO to determine the total installed capacity that the resource can reliably provide, called Unforced Capacity Rating (UCAP).

[1] From MISO BPM-011-r13 Resource Adequacy Section 3.5.5 State Authority to set PRM

MISO will calculate unforced capacity for all generation resources interconnected to the MISO Transmission System while respecting the interconnection study results and the results of the aggregate deliverability analysis.

The first step is to compare a Generation Resource Net Dependable Capacity (NDC) to the tested capacity from the interconnection process to determine the total installed capacity that the generation resource can reliably provide, which is the Total Interconnection Installed Capacity (ICAP). A unit's NDC for the Planning Year is determined by averaging the NDC data that is entered into MISO's Generating Availability Data System (GADS) database. The UCAP rating represents the MW's that are eligible to be converted into ZRCs.

Evaluation and Reporting

MISO will maintain databases and will "..provide to states, upon request, with relevant resource adequacy information as available…" per section 69 of the MISO Tariff during relevant time periods, subject to the data confidentiality provisions in section 38.9 of the MISO Tariff.

Vectren's approach to the Voluntary Capacity Auction

Due to the long lead time generally required to build capacity resources, Vectren does not consider MISO's annual Planning Resource Auction an appropriate means to meet the needs of the 20 year Integrated Resource Plan and continues to pursue more traditional means of ensuring adequate resources.

Future of MISO's Module E

MISO proposed Capacity Market

MISO is currently evaluating whether the annual summer based resource adequacy construct contains gaps that prevent it from achieving resource adequacy during all periods of the year. MISO is working to identify seasonal or other changes that will close any identified gaps.

Footprint Changes

On Dec. 19, 2013 MISO began coordinating all RTO activities in the newly combined footprint consisting of all or parts of 15 states with the integration of the MISO south entities which include the LBAs of Entergy Arkansas, Inc., Entergy Texas, Inc., Entergy Mississippi, Inc., Entergy Louisiana, LLC, Entergy Gulf States Louisiana, L.L.C., Entergy New Orleans, Inc., Cleco Power LLC, Lafayette Utilities System, Louisiana Energy & Power Authority, South Mississippi Electric Power Authority and Louisiana Generating, LLC.

DEMAND RESPONSE

Demand response is an integral part of a utility's system, operations, and planning, and helps Vectren meet the obligation to serve all customers. Effective July 1, 2011 and pursuant to Commission order in Cause 34566 MISO 4, Vectren filed Rider DR, which provides qualifying customers the optional opportunity to reduce their electric costs by participating in the MISO wholesale energy market. This rider helps the Company's efforts to preserve reliable electric service through customer provision of a load reduction during MISO high price periods and declared emergency events. This initial Rider DR offers two programs, Emergency Demand Response (EDR) and Demand Response Resource Type 1 ("DRR-1") energy programs.

MISO FORECAST

Based on analysis of load forecasts and planned resources derived from survey responses provided by the load serving entities in its footprint, MISO has created several iterations of resource adequacy forecasts that indicate beginning in 2016, several zones within the footprint may lack the capacity required to meet reserve requirements. MISO continues to assess the accuracy of this analysis and appears to concede that state regulatory commissions remain confident that adequate reserves exist in the near term. However, such studies do highlight the potential reliability issues created by the EPA emissions restrictions, and in particular, the potential for numerous base load coal plant retirements driven by the EPA's Clean Power Plan. Questions regarding available capacity, as well as local reliability concerns will be factored into the Company's planning processes.

Vectren’s Approach to Resource Adequacy

Vectren will continue to comply with MISO’s Module E requirements, which includes the possibility for varying amounts of planning reserves.

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Chapter 4

ENVIRONMENTAL

INTRODUCTION

Compliance planning associated with existing and anticipated environmental laws and regulations in each of the three media (air, water and waste) is discussed in this chapter.

CURRENT ENVIRONMENTAL COMPLIANCE PROGRAMS:

AIR

Acid Rain Program

Vectren's Acid Rain compliance program was approved by the IURC in Cause No. 39347, which authorized the construction of a combined sulfur dioxide (SO_2) scrubber for FB Culley Units 2 and 3. As AB Brown Units 1 and 2 were newer vintage units, the units' original construction included scrubber technology. Vectren relies upon its existing scrubber technology for compliance with acid rain requirements and has sufficient allowance allocations to meet its future acid rain obligations. See, Table 4-1, a listing of current air pollution control devices for each Vectren unit, Table 4-2, a listing of emission rates for each Vectren unit, and Table 4-3 a listing of the acid rain allowances allocated to Vectren units.

Table 4-1 Air Pollution Control Devices Installed

	FB Culley 2	FB Culley 3	Warrick 4	AB Brown 1	AB Brown 2
Commercial Date	1966	1973	1970	1979	1986
MW (UCAP)	83	257	135	228	233
NO_X	Low NO_X Burner	SCR[1]	SCR	SCR	SCR
SO_2	FGD[2]	FGD	FGD	FGD	FGD
PM[3]	ESP[4]	FF[5]	ESP	FF	ESP

[1] Selective Catalytic Reduction
[2] Flue Gas Desulfurization
[3] Particulate Matter
[4] Electrostatic Precipitator
[5] Fabric Filter

Table 4-2 Current (2013) Emission Rates (lbs./mm Btu)

Units	SO_2	Annual NO_X	Ozone Season NO_X
AB Brown 1	0.6400	0.1510	0.1464
AB Brown 2	0.3610	0.1160	0.1091
AB Brown 3	0.0006	0.1800	0.1710
AB Brown 4	0.0006	0.0310	0.0214
FB Culley 2/3	0.1700	0.1190	0.1312
Warrick 4	0.1800	0.2400	0.2740
BAGS 2	0.0006	0.2226	0.2111

Table 4-3 SO2 Acid Rain Allowances Allocated to Vectren Units (per year)

Plant Name	Percent Ownership	2013	2014-2041
AB Brown	100%	10,546	10,546
FB Culley	100%	9,922	9,922
Warrick 4[1]	50%	5,122	5,122

For purposes of compliance year 2014, acid rain allowances will continue to be used for compliance with the SO_2 emission reductions requirements of the Clean Air Interstate Rule (CAIR). As detailed more fully below, the Cross-State Air Pollution Rule (CSAPR) which was originally slated to become effective in two phases during 2012 and 2014, was stayed by the Court in December 2011 and vacated in August 2012. Through a series of appeals, it was reviewed by the US Supreme Court who issued judgment on April 29, 2014 to reverse the lower Court decision and upheld CSAPR. The stay was lifted on October 23, 2014 but an implementation schedule and reallocation of allowances has not been determined at this time. Due to the timing of this recent decision, Vectren is unable to state when CSAPR will go into effect and what the final allowance levels will be for each of its units. Neither the CAIR rule nor CSAPR supersedes the Acid Rain program. Facilities will still be required to annually surrender acid rain allowances to cover emissions of SO_2 under the existing Acid Rain program.

[1] Number of allowances shown are for Vectren's portion of Warrick 4

NO_x SIP Call

Vectren's NO_x SIP Call compliance plan was approved by the IURC in Cause Nos. 41864 and 42248, which authorized Vectren to retrofit selective catalytic reduction (SCR) technology on Culley Unit 3, Warrick Unit 4, and Brown Units 1 and 2. Vectren relies upon its existing SCR technology for compliance with the seasonal NO_x reductions required in the NO_x SIP Call. When CAIR was finalized in March of 2005, the EPA included a seasonal NO_x emission reduction requirement, which incorporated, and in most cases, went beyond the seasonal NO_x emission reductions required under the NO_x SIP Call. For purposes of compliance year 2014, CAIR NO_x seasonal allowances will continue to be used for compliance with the seasonal NO_x emission reductions requirement under the current CAIR rule. CAIR and CSAPR are discussed more fully below.

CAIR and CSAPR

On March 10, 2005, the US Environmental Protection Agency (EPA) finalized its determination in the CAIR rule that emissions from coal-burning Electric Generating Units (EGUs) in certain upwind states result in the transport of fine particles ($PM_{2.5}$) and ozone that significantly contribute to nonattainment of the applicable ambient air quality standards for those pollutants in downwind states. The CAIR rule required revisions to state implementation plans in twenty eight states, including Indiana, requiring further reductions of NO_x and SO_2 from EGUs beyond those required in the NO_x SIP Call and Acid Rain programs. Emissions reductions under the CAIR rule were to be implemented in two phases, with requirements for first phase reductions in 2009 (NO_x) and 2010 (SO_2), and second phase reductions starting in 2015. The Warrick 4 scrubber was constructed to comply with the CAIR regulation and approved in Cause No. 42861. The CAIR rule provided a federal framework for a regional cap and trade system, and those allowances allocated to the Vectren units under the CAIR rule are being used for compliance in 2014 and until the EPA reinstates CSAPR (see below).

On July 6, 2010, the EPA proposed its Clean Air Transport Rule ("Transport Rule") in response to the court's remand of CAIR. In an effort to address the court's finding that CAIR did not adequately ensure attainment of ozone and $PM_{2.5}$ air quality standards in certain Eastern states due to unlimited trading and banking of allowances, the Transport Rule proposal dramatically reduced the ability of facilities to meet the required emission reductions through interstate allowance trading. Like CAIR, the Transport Rule proposal set individual state caps for SO_2 and NO_x; however, unlike CAIR, individual unit allowance allocations were set out directly in the Transport Rule proposal. Interstate allowance trading was severely restricted and limited to trading within a zonal group. On July 7, 2011, the EPA finalized the Transport Rule proposal and renamed the program the Cross State Air Pollution Rule (CSAPR). CSAPR sets individual allowance allocations for Vectren's units directly in the rule. Table 4-4 shows a listing of individual unit allowance allocations under the original CSAPR. Under the original version of CSAPR, any excess CAIR allowances (vintage 2011 or older) that were not needed for compliance in 2011 could not be used for compliance with CSAPR, which was scheduled to become effective January 1, 2012. It is not yet known how, or when, the EPA will revise the effective dates in the reinstated version of the rule. Given the stringent state emission caps, the limited allowance trading available under the CSAPR, and the unknown implementation timing due to the recent lifting of the court ordered stay on October 23, 2014 it is virtually impossible to predict with any certainty the availability of excess allowances for compliance and the costs of those allowances under a reinstated CSAPR.

Table 4-4 CSAPR Allowances Allocated to Vectren Units

	SO_2 Allocation		Annual NO_X		Seasonal NO_X	
	2012	**2014**	**2012**	**2014**	**2012**	**2014**
AB Brown 1	3,761	2,080	1,393	1,376	595	586
AB Brown 2	3,889	2,151	1,440	1,422	601	591
AB Brown 3	1	1	19	19	14	14
AB Brown 4	0	0	6	6	4	4
BAGS 2	0	0	26	26	18	8
FB Culley 2	1,488	925	619	612	268	264
FB Culley 3	2,923	2,799	1,874	1,851	792	780
Warrick 4	2,802	1,550	1,037	1,025	444	437

Vectren's original multi-pollutant compliance plan was approved under IURC Cause No. 42861. While Vectren's original multi-pollutant planning focused on compliance with the CAIR regulation which was in place at the time, the successful execution of the approved multi-pollutant plan would enable Vectren to comply with the SO_2 and NO_x emission caps in the original CSAPR allocation without further significant capital investment; however, while currently well controlled, Vectren will incur increased Operating and Maintenance (O&M) costs attributable to a new regulation, such as an increase in chemical costs to achieve the lower emission targets. With the completion of the Warrick 4 scrubber pursuant to the approved order in Vectren's multi-pollutant proceeding, Vectren's generating system is 100% scrubbed for SO_2 and has selective catalytic reduction technology on all but one unit (FB Culley Unit 2). See Table 4-1. As such, Vectren will be well-positioned to comply with the new, more stringent SO_2 and NO_x caps that are required by a re-instated CSAPR, without reliance on a highly uncertain allowance market or further significant capital expenditures. It is important to note that CSAPR stay was just recently lifted on October 23, 2014, and final implementation dates are still unknown.

Mercury and Air Toxics Rule

The 1990 Amendments to the Clean Air Act (CAA or Act) required that the EPA determine whether EGUs should be required to reduce hazardous air pollutants, including mercury, under § 112 of the Act. In December of 2000, the EPA officially listed coal-fired EGUs as subject to CAA § 112 Maximum Achievable Control Technology (MACT) Standards for mercury, thus lifting a previous exemption from the air toxics requirements. On March 15, 2005, the EPA finalized its Clean Air Mercury Rule (CAMR) which set "standards of performance" under CAA §111 for new and existing coal-fired EGUs and created a nation-wide mercury emission allowance cap and trade system for existing EGUs which sought to reduce utility emissions of mercury in two phases. The first phase cap would have started in 2010, except the CAMR rule was similarly vacated by a reviewing court in March of 2008. Thus, like the CAIR rule, utilities were preparing for compliance with a finalized CAMR regulation that was ultimately found to be deficient by a reviewing court. The reviewing court directed the EPA to proceed with a MACT rulemaking under CAA § 112 which would impose more stringent individual plant-wide limits on mercury emissions and not provide for allowance trading.

On March 16, 2011, the EPA released its proposed MACT for utility boilers. The final rule, known as the Mercury and Air Toxics Standards (MATS) was published in the Federal Register on February 16, 2012. The rule sets plant-wide emission limits for the following hazardous air pollutants (HAPs): mercury, non-mercury HAPs (e.g. arsenic, chromium, cobalt, and selenium), and acid gases (hydrogen cyanide, hydrogen chloride, and hydrogen fluoride). The EPA established stringent plant-wide mercury emission limits (1.2 lb/TBtu for individual unit or 1.0 lb/TBtu for plant average) and set surrogate limits for non-mercury HAPs (total particulate matter limit of .03 lb/MMBtu) and acid gases (HCL limit of .002 lb/MMBtu). The surrogate limits can be used instead of individual limits for each HAP. Compliance with the new limits will be required by April 16, 2015. The Indiana Department of Environmental Management (IDEM), the state permitting authority, has the discretion to grant a compliance extension of up to one year on a case by case basis if a source is unable to install emission controls or make fuel conversions prior to the April 2015 deadline. Vectren was granted a 1-year extension for the AB Brown Unit 2, contingent upon the need for injection of a secondary mercury treatment chemical. The need for the secondary chemical will not be known until after the primary system is operational at the end of 2014. Vectren currently has a MATS Compliance plan before the Commission (IURC Cause 44446) for approval that includes organo sulfide injection at the baseload units (AB Brown 1, AB Brown 2, FB Culley 3, and Warrick 4) with the possibility of an additional HBr injection at AB Brown 2 if needed.

SOLID WASTE DISPOSAL

Scrubber by-products from AB Brown are sent to an on-site landfill permitted by IDEM. During the fall of 2009, Vectren finalized construction of a dry fly ash silo and barge loading facility that would allow for the beneficial reuse of Vectren generated fly ash. Since February 2010, the majority of AB Brown fly ash has been diverted to the new dry ash handling system and sent for beneficial reuse to a cement processing plant in St. Genevieve, Missouri, via a river barge loader and conveyor system. The remainder of the A B Brown fly ash and bottom ash is sluiced to an on-site pond. This major sustainability project will serve to mitigate negative impacts from the imposition of a more stringent regulatory scheme for ash disposal. The majority of Vectren's coal combustion materials are now being diverted from the existing ash pond structures and surface coal mine backfill operations and transported offsite for recycling into a cement application.

Fly ash from the FB Culley facility is similarly transported off-site for beneficial reuse in cement. Until mid-2009, fly ash from the FB Culley facility was sent to the Cypress Creek Mine for backfill pursuant to the mine's surface coal mine permit. In May 2009, FB Culley began trucking fly ash to the St. Genevieve cement plant. Upon completion of the barge loading facility at the AB Brown facility in late 2009, FB Culley's fly ash is now transported to the AB Brown loading facility and shipped to the cement plant via river barge. The FB Culley facility sends its bottom ash to one of two on-site ponds via wet sluicing. The ponds are seven and eighteen acres in size. Scrubber by-product generated by the FB Culley facility is also used for beneficial reuse and shipped by river barge from FB Culley to a wallboard manufacturer. In summary, the majority of Vectren's coal combustion material is no longer handled on site, but is being recycled and shipped off-site for beneficial reuse.

HAZARDOUS WASTE DISPOSAL

Vectren's AB Brown and FB Culley plants are episodic producers of hazardous waste that may include paints, parts washer fluids, or and other excess or outdated chemicals. Both facilities are typically classified as Conditionally Exempt Small Quantity Generators.

WATER

AB Brown and FB Culley currently discharges process and cooling water to the Ohio River under National Pollutant Discharge Elimination System (NPDES) water discharge permits issued by the IDEM. AB Brown utilizes cooling towers while FB Culley has a once through cooling water system.

The Ohio River Valley Sanitation Commission (ORSANCO) regional water quality standards were most recently revised in 2012 and are more restrictive than current EPA standards. ORSANCO is a regional state compact focused on water quality issues for the Ohio River and governs water discharges that enter the Ohio River. Under Vectren's most recent NPDES permits issued in late 2011, Vectren must meet more restrictive mercury limits at its river outfall to comply with the ORSANCO mercury limit of 12 ppt monthly average. To meet the limits, Vectren chose to install two chemical-precipitation water treatment systems at AB Brown and one at FB Culley. The new water treatment systems are included in the pending environmental compliance proceeding before the IURC (Cause No. 44446), and began operation in third quarter 2014.

FUTURE ENVIRONMENTAL REGULATIONS

CARBON REGULATION

On June 2, 2014, the EPA issued the CAA Section 111(d) Greenhouse Gas (GHG) New Source Performance Standards (NSPS) for existing sources, known as the Clean Power Plan (CPP). The CPP sets state-specific carbon reduction goals based on a state's existing generation mix and provides guidelines for the development, submission and implementation of state plans to achieve the state goals. The EPA asserts that the state reduction goals will result in a 30% decrease in CO_2 emissions from 2005 levels by 2030. To insure each state is making adequate progress towards the 2030 goal, an interim emission rate goal for 2020-2029 has also been established.

Indiana's state specific emission rate goals are 1,607 lb CO_2/MWh for the interim period and 1,531 lb CO_2/MWh for a final goal. This equates to a 20% reduction in CO_2 emission rates from 2012 levels. The EPA determined the state specific goals through a portfolio approach that includes improving power plant heat rates, dispatching lower emitting fuel sources more frequently and increasing utilization of renewable energy sources and energy efficiency programs. Specifically, each state's goals were set by taking 2012 emissions data and applying four "building blocks" of emission rate improvements that the EPA has determined are achievable by that state.

The four building blocks used by the EPA to calculate state goals are as follows:

1) Coal fleet heat rate improvement of 6%.
2) Increased dispatch of existing baseload natural gas generation sources to 70%. For Indiana this also includes announced new natural gas combined cycle plants.
3) Renewable energy portfolio of 5% in the interim and 7% in the final stage.
4) Energy efficiency reductions of 1.5% annually starting in 2020.

While individual state goals were based on the EPA's application of the building blocks to 2012 emission rates, states have flexibility through their state implementation plan to implement the building blocks in part or not at all to reach the listed goal, or enter a regional trading program. Since the state plan may include a variety of options, many of which are outside the fence line and control of a power plant, the interim and final CO_2 emission rates will not necessarily apply to individual generating plants or companies within the state. It is yet to be determined how the CPP will directly affect Vectren's generating units.

The final rule is scheduled for June 2015, with individual state implementation plans due by June 2016. States have the option to seek a one year extension, or up to two years if part of a regional or multi-state plan. After the submittal of the state or regional plan, the first annual reporting begins in 2022. This timeline represents the earliest emission reductions will be required, as it is almost certain that this rule will be heavily litigated. Vectren will continue to work with the state of Indiana to ensure that the State's compliance plan is the least cost to Indiana consumers.

WASTE DISPOSAL

Over the course of the last twenty years the EPA has conducted numerous studies and issued two reports to Congress on the management of coal combustion by-products (primarily fly ash, bottom ash, and scrubber by-product), concluding both times that these materials generally do not exhibit hazardous waste characteristics and can be managed properly under state solid waste regulations. In response to the Tennessee Valley Authority's (TVA's) catastrophic ash pond spill in December of 2008, the EPA revisited its regulatory options for the management of coal combustion by-products. On June 21, 2010, the EPA published three options for a proposed rule covering Coal Combustion Residuals (CCRs). Two options would regulate combustion by-products as solid waste under the Resource Conservation and Recovery Act (RCRA) Subtitle D, with the only significant difference being whether existing ponds are retrofitted or closed within five years, or whether utilities will be permitted to continue to use an existing pond for its remaining useful life. The third option would regulate combustion by-products as hazardous waste under RCRA Subtitle C. Under all three options, certain beneficial reuses of coal combustion residuals, such as cement and wallboard applications, will continue to be allowed. The EPA has set December 19, 2014 as the deadline for issuing the final rule.

Uncertainties remain until the rule is finalized. For example, under the Subtitle D proposed rule, unlined ash ponds would have to be closed within five years and groundwater monitoring installed within one year. The proposal, however, did not define whether the term "close" means to cease receiving new material or to have the site completely capped and grass covered within five years. The proposal also failed to take into account site specific circumstances such as size of the pond and the percentage filled when establishing the five year closure timeframe. A majority of the final closure obligation and compliance costs will be focused on historic material that is already in the ponds so a change in future generation will not negate the obligation to comply with the CCR regulation when it is issued. However, as a result of Vectren's previous investments in dry fly ash handling and beneficial reuse activities, the volume of new material added to the ponds since 2009 has been significantly decreased.

As a direct result of the TVA spill referenced above, the EPA undertook to inspect all surface impoundments and dams holding combustion by-products. The EPA conducted site assessments at Vectren's AB Brown and FB Culley facilities and found the facilities' surface impoundments to be satisfactory and not posing a high hazard.

WATER

There are multiple regulatory rulemakings that could, when finalized, require more stringent limits for power plant discharges.

The EPA is developing new Effluent Limit Guidelines and Standards (ELGS) for the Steam Electric Power Generating Point Source Category. A draft was issued June 7, 2013, with a final rule scheduled for September 2015. The draft rule requested comment on 8 different options for treatment standards and compliance locations that ranged from no change of current standards to a requirement for full zero liquid discharge. Of the eight options, the EPA identified four "preferred" options. For the preferred options, the size of Vectren's units would drop the plants out of the requirement for specific treatment and discharge limits for Flue Gas Desulfurization (FGD) waste water or bottom ash transport water in 2 of the 4 options. Instead, IDEM would apply Best Professional Judgment (BPJ) which takes into consideration site specific factors. While Vectren acknowledges that the EPA's final ELGs could further alter discharge parameters and limits, it is not possible at this time to predict the outcome of the final rule. Vectren believes its chosen treatment systems are the most cost effective option for meeting its current permits while limiting potential stranded costs when new regulations take effect.

The EPA released its final rule regulating cooling water structures under Section 316(b) of the Clean Water Act (CWA) on August 15, 2014. Section 316(b) requires that intake structures that withdraw > 2 MGD of water, including most electric generating units, use the "Best Technology Available" to prevent and / or mitigate adverse environmental impacts to shellfish, fish, and wildlife in a water body. The rule lists separate sampling and study programs to minimize entrainment (pulling small organisms into the intake structure) and impingement (trapping or pinning fish against the exterior of the intake structure). In addition, three additional studies are required that look at technical feasibility and treatment costs, cost benefits evaluation, and non-water quality environmental impacts of the potential treatment option. These studies, combined with the results of the in-river fish sampling will help determine potential treatment options.

Seven options were identified as pre-approved methods for complying with impingement mortality standards. While cooling towers are listed as an option, they are not mandated for existing facilities. Vectren does not believe cooling tower retrofits will be required at FB Culley due to its size and location on the Ohio River. The EPA acknowledges that for many facilities, the process of conducting the studies, determining the best treatment option, constructing the selected option, and confirming the adequacy of the treatment may take a minimum of 8 years from the time the rule becomes effective. Vectren's FB Culley units currently use a "once through" cooling water intake system and are affected by this proposed regulation. Vectren's AB Brown units use a closed cooling water system. However, under the final rule Vectren would still be required to submit documentation and study reports to confirm the existing cooling water tower mitigates impingement and entrainment.

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CHAPTER 5

SALES & DEMAND FORECAST

INTRODUCTION

The electric energy and demand forecasts provide the basis for evaluation of supply-side and demand-side options to meet the electric needs of Vectren's customers. These forecasts reflect local and regional economic impacts, the effects of past, present, and proposed Demand Side Management / Demand Response (DSM/DR) programs, mandated efficiency standards, and the effects of normal market forces on electricity sales.

Overview of Vectren's Customers

Vectren provides delivery services to approximately 142,000 electric residential, general service (commercial), and large (primarily industrial) customers with electricity in southwestern Indiana. A high proportion of Vectren's sales are made to electric-intensive general service and large customers. In 2013, about 29% of Vectren's annual retail electric energy sales were consumed by residential customers, 23% of sales were consumed by General Service (GS), and 48% of sales were consumed by more than 100 large customers. Less than 1% served other load (street lights). Significant general service and large load creates complexity in load forecasting. These customers have the ability to significantly impact Vectren's demand for electricity, as economic factors affect their businesses' success.

ELECTRIC LOAD FORECAST OVERVIEW

Vectren developed low, base, and high forecasts of annual energy sales and requirements (e.g. sales plus related delivery losses) and peak loads (e.g. demand plus losses) for the purposes of its IRP. These forecasts, and the activities undertaken to develop them, are described in this section.

Development of the Vectren system-wide long-term electric load forecast involves the aggregation of multiple models. Vectren uses statistically adjusted end use (SAE) modeling and econometric modeling to forecast customer needs for the future. Vectren has investigated the use of pure end-use modeling for forecasting purposes but believes that a combination of statistically adjusted end-use and econometric modeling best accommodates its forecasting needs. End-use modeling involves building and maintaining a detailed end-use database to capture appliance and thermal shell characteristics, as well as end-use consumption information. The basic structure of an end-use model is households multiplied by appliance saturation and unit energy consumption. Each component of the end-use model is modeled separately. For these reasons, end-use modeling is very expensive to develop and maintain. It is meant primarily for long-term modeling (5-20 years). Often, a separate short term forecast is necessary, which is hard to integrate with the long-term forecast. Vectren utilizes statistically adjusted end-use models to forecast residential and general service loads. Large customer needs are forecasted with an econometric linear regression model, while street lighting load is forecasted with a simple trend model. The detail of Vectren's forecasting methodology is discussed later in this chapter.

FORECAST RESULTS

The base case forecasts of annual energy requirements and peak loads for the 2014 - 2034 planning period are provided in Tables 5-1 and 5-2. Annual energy requirements are projected to have a -.2% compound annual growth rate over the twenty year planning period. Peak requirements are projected to have a compound annual growth rate of -.1% over the twenty year planning period.

Table 5-1 Base Case Energy and Demand Forecast

Year	Peak (MW)[1]	Annual Energy (GWh)
2014 Proj.	1,145	5,782
2015	1,155	5,914
2016	1,156	5,936
2017	1,113	5,514
2018	1,109	5,503
2019	1,106	5,494
2020	1,106	5,497
2021	1,106	5,492
2022	1,107	5,494
2023	1,107	5,494
2024	1,107	5,496
2025	1,106	5,487
2026	1,106	5,487
2027	1,107	5,492
2028	1,109	5,507
2029	1,110	5,509
2030	1,111	5,517
2031	1,111	5,523
2032	1,113	5,540
2033	1,114	5,548
2034	1,115	5,560
Compound Annual Growth Rate, 2014-2034 Including Wholesale	-0.1%	-0.2%

[1] Includes wholesale contract sales for 2014

Table 5-2 Base Case Energy Forecast by Customer Class

Year	Residential (GWh)	General Service (GWh)	Large (GWh)	Other (GWh)	Net DSM (GWh)	DG (GWh)	Wholesale (GWh)	Losses (GWh)	Total Requirements (GWh)
2013 Calendar	1,435	1,294	2,744	21			61	267	5,822
2014 Proj.	1,444	1,300	2,739	20	(47)	(1)	61	265	5,782
2015	1,444	1,327	2,926	20	(72)	(1)	0	271	5,914
2016	1,448	1,351	2,945	20	(98)	(2)	0	272	5,936
2017	1,451	1,354	2,563	19	(123)	(3)	0	253	5,514
2018	1,458	1,357	2,567	19	(148)	(3)	0	252	5,503
2019	1,469	1,363	2,569	19	(173)	(5)	0	252	5,494
2020	1,475	1,370	2,574	19	(186)	(7)	0	252	5,497
2021	1,480	1,373	2,577	19	(199)	(9)	0	252	5,492
2022	1,490	1,380	2,579	19	(211)	(12)	0	252	5,494
2023	1,500	1,386	2,579	18	(224)	(17)	0	252	5,494
2024	1,514	1,395	2,578	18	(237)	(23)	0	252	5,496
2025	1,523	1,398	2,579	18	(250)	(32)	0	251	5,487
2026	1,534	1,404	2,579	18	(263)	(37)	0	251	5,487
2027	1,547	1,413	2,581	18	(276)	(42)	0	252	5,492
2028	1,562	1,427	2,584	18	(289)	(48)	0	252	5,507
2029	1,572	1,436	2,588	18	(302)	(55)	0	252	5,509
2030	1,586	1,445	2,593	18	(316)	(62)	0	253	5,517
2031	1,599	1,455	2,598	18	(329)	(71)	0	253	5,523
2032	1,616	1,473	2,604	18	(343)	(81)	0	254	5,540
2033	1,628	1,486	2,611	18	(356)	(93)	0	254	5,548
2034	1,644	1,501	2,619	18	(370)	(106)	0	255	5,560
Compound Annual Growth Rate for (2014-2034)	0.6%	0.7%	-0.2%	-0.7%					-0.2%

Low and high energy and demand forecasts were developed by modifying the assumptions around conservation, distributed generation adoption, economic drivers, population projections, and large customer additions. The difference between the two high growth cases is slow steady growth or a large step up. In the high growth (modeled) forecast, economic growth was increased from approximately 1% to 2%, and population growth was increased from about .3% to .5%. The high growth (large load) case is the same as the base case, with the addition of a large customer in 2018. The results are shown in Table 5-3 and 5-4.

Table 5-3 Base, Low, and High Case Energy Forecasts

Year	Base Annual Requirements		Low Growth Annual Requirements		High Growth (modeled) Annual Requirements		High Growth (large load) Annual Requirements	
	GWh	Growth,%	GWh	Growth,%	GWh	Growth,%	GWh	Growth,%
2014 Proj.	5,782		5,782		5,799		5,782	
2015	5,914	2.3%	5,907	2.2%	5,947	2.6%	5,914	2.3%
2016	5,936	0.4%	5,922	0.3%	5,990	0.7%	5,936	0.4%
2017	5,514	-7.1%	5,320	-10.2%	5,609	-6.4%	5,514	-7.1%
2018	5,503	-0.2%	5,302	-0.3%	5,645	0.6%	6,098	10.6%
2019	5,494	-0.2%	5,287	-0.3%	5,681	0.6%	6,088	-0.2%
2020	5,497	0.1%	5,290	0.1%	5,712	0.5%	6,090	0.0%
2021	5,492	-0.1%	5,285	-0.1%	5,734	0.4%	6,085	-0.1%
2022	5,494	0.0%	5,286	0.0%	5,764	0.5%	6,087	0.0%
2023	5,494	0.0%	5,284	0.0%	5,799	0.6%	6,085	0.0%
2024	5,496	0.1%	5,285	0.0%	5,841	0.7%	6,088	0.0%
2025	5,487	-0.2%	5,273	-0.2%	5,870	0.5%	6,077	-0.2%
2026	5,487	0.0%	5,272	0.0%	5,909	0.7%	6,077	0.0%
2027	5,492	0.1%	5,276	0.1%	5,950	0.7%	6,081	0.1%
2028	5,507	0.3%	5,288	0.2%	5,997	0.8%	6,095	0.2%
2029	5,509	0.1%	5,289	0.0%	6,028	0.5%	6,097	0.0%
2030	5,517	0.1%	5,293	0.1%	6,060	0.5%	6,104	0.1%
2031	5,523	0.1%	5,296	0.0%	6,094	0.6%	6,109	0.1%
2032	5,540	0.3%	5,310	0.3%	6,132	0.6%	6,127	0.3%
2033	5,548	0.1%	5,312	0.0%	6,157	0.4%	6,133	0.1%
2034	5,560	0.2%	5,320	0.1%	6,188	0.5%	6,145	0.2%
Compound Annual Growth Rate for (2014-2034)		-0.2%		-0.4%		0.3%		0.3%

Table 5-4 Base, Low, and High Case Demand Forecasts

Year	Base Annual Requirements		Low Growth Annual Requirements		High Growth (modeled) Annual Requirements		High Growth (large load) Annual Requirements	
	MW	Growth,%	MW	Growth,%	MW	Growth,%	MW	Growth,%
2014 Proj.	1,145		1,145		1,148		1,145	
2015	1,155	0.8%	1,153	0.7%	1,160	1.0%	1,155	0.8%
2016	1,156	0.1%	1,153	-0.1%	1,164	0.3%	1,156	0.1%
2017	1,113	-3.7%	1,088	-5.6%	1,127	-3.2%	1,113	-3.7%
2018	1,109	-0.3%	1,083	-0.5%	1,130	0.3%	1,208	8.6%
2019	1,106	-0.3%	1,079	-0.4%	1,133	0.3%	1,205	-0.3%
2020	1,106	0.0%	1,079	0.0%	1,136	0.3%	1,206	0.0%
2021	1,106	0.0%	1,079	0.0%	1,139	0.3%	1,206	0.0%
2022	1,107	0.1%	1,080	0.0%	1,143	0.3%	1,206	0.0%
2023	1,107	0.0%	1,079	0.0%	1,147	0.4%	1,206	0.0%
2024	1,107	0.0%	1,079	0.0%	1,152	0.4%	1,206	0.0%
2025	1,106	-0.1%	1,077	-0.2%	1,155	0.3%	1,205	-0.1%
2026	1,106	0.0%	1,077	0.0%	1,160	0.4%	1,205	0.0%
2027	1,107	0.1%	1,078	0.1%	1,165	0.4%	1,206	0.1%
2028	1,109	0.2%	1,079	0.1%	1,171	0.5%	1,207	0.1%
2029	1,110	0.1%	1,079	0.0%	1,175	0.3%	1,208	0.0%
2030	1,111	0.1%	1,080	0.0%	1,179	0.3%	1,209	0.1%
2031	1,111	0.0%	1,080	0.0%	1,183	0.3%	1,209	0.0%
2032	1,113	0.2%	1,081	0.1%	1,187	0.4%	1,211	0.1%
2033	1,114	0.1%	1,081	0.0%	1,190	0.2%	1,211	0.1%
2034	1,115	0.1%	1,081	0.0%	1,193	0.3%	1,212	0.1%
Compound Annual Growth Rate for (2014-2034)		-0.1%		-0.3%		0.2%		0.3%

FORECAST INPUTS & METHODOLOGY

Forecast Inputs

Energy Data

Historical Vectren sales and revenues data were obtained through an internal database. The internal database contains detailed customer information including rate, service, North American Industrial Classification System (NAICS) codes (if applicable), usage, and billing records for all customer classes (more than 15 different rate and customer classes). These consumption records were exported out of the database and compiled in a spreadsheet on a monthly basis. The data was then organized by rate code and imported into the load forecasting software.

Economic and Demographic Data

Economic and demographic data was provided by Moody's Economy.com for the nation, the state of Indiana, and the Evansville Metropolitan Statistical Area (MSA). Moody's Economy.com, a division of Moody's Analytics, is a trusted source for economic data that is commonly utilized by utilities for forecasting electric sales. The monthly data provided to Vectren contains both historical results and projected data throughout the IRP forecast period. This information is input into the load forecasting software and used to project residential, GS, and large sales.

Weather Data

The daily maximum and minimum temperatures for Evansville, IN were obtained from DTN, a provider of National Oceanic and Atmospheric Administration (NOAA) data. NOAA data is used to calculate monthly heating degree days (HDD) and cooling degree days (CDD). HDDs are defined as the number of degrees below the base temperature of 65 degrees Fahrenheit for a given day. CDDs are defined as the number of degrees above the base temperature of 65 degrees Fahrenheit for a given day. HDDs and CDDs are averaged on a monthly basis. Normal degree days, as obtained from NOAA, are based on a thirty year period. Historical weather data[1] is imported into the load forecasting software and is used to normalize the past usage of residential and GS customers. Similarly, the projected normal weather data is used to help forecast the future weather normalized loads of these customers.

Equipment Efficiencies and Market Shares Data

Itron Inc. provides regional Energy Information Administration (EIA) historic and projected data for equipment efficiencies and market shares. This information is used in the residential average use model and GS sales model. Note that in 2013 an appliance survey of Vectren's residential customers was conducted to compare its territory market share data with the regional EIA data. In order to increase the accuracy of the residential average use model, regional equipment market shares were altered to reflect those of Vectren's actual territory.

Model Overview

Changes in economic conditions, prices, weather conditions, as well as appliance saturation and efficiency trends drive energy deliveries and demand through a set of monthly customer class sales forecast models. Monthly regression models are estimated for each of the following primary revenue classes:

- Residential (residential average usage and customer models)
- General Service
- Large
- Street Lighting

In the long-term, both economics and structural changes drive energy and demand growth. Structural changes are captured in the residential average use and general service sales forecast models through Statistically Adjusted End-Use (SAE) model specifications. The SAE model variables explicitly incorporate end-use saturation and

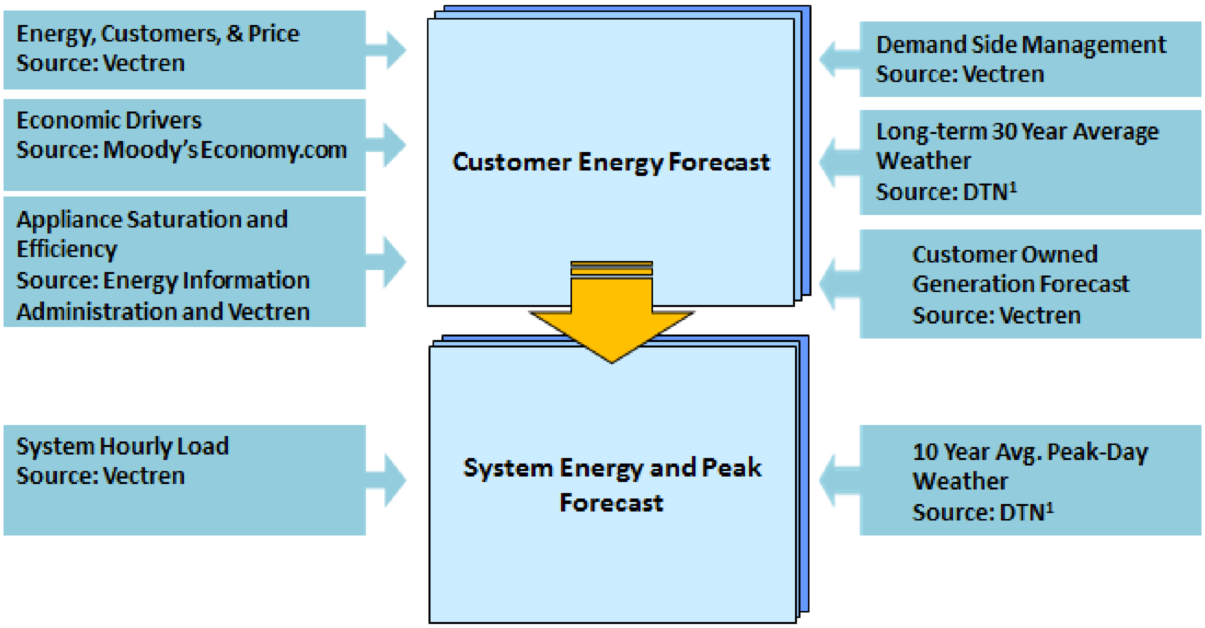
[1] The large sales model also includes CDDs.

efficiency projections, as well as changes in population, economic conditions, price, and weather. End-use efficiency projections include the expected impact of new end-use standards and naturally occurring efficiency gains. The large sales forecast is derived using an econometric model that relates large sales mostly to regional manufacturing Gross Domestic Product (GDP) growth. Street light sales are forecasted using a simple trend and seasonal model. The results of the sales forecast modes are imported into the demand forecast model.

The long-term demand forecast is developed using a “build-up” approach. This approach entails first estimating class and end-use energy requirements and then using class and end-use sales projections to drive system peak demand. The forecast models capture not only economic activity and population projections, but also expected weather conditions, the impact of improving end-use efficiency and standards, and electricity prices.

The long-term system peak forecast is derived through a monthly peak linear regression model that relates monthly peak demand to heating, cooling, and base load requirements. The model variables incorporate changes in heating, cooling, and base-use energy requirements derived from the class sales forecast models as well as peak-day weather conditions. Note that the forecast is adjusted to reflect future Vectren sponsored DSM impacts, expected adoption of customer owned distributed generation, and expected large customer additions. Figure 5-1 shows the general approach.

Figure 5-1: Forecast Approach



[1] Formerly Data Transmission Network, now known as DTN

Analytic Methodology Used in Forecast

Residential Average Use Model

Residential customer usage is a product of heating, cooling, and other load. Both heating and cooling are weather sensitive and must be weather normalized in a model to remove weather noise from projections. Other major drivers of load are historical and projected market saturation of electronics, appliances, and equipment and their respective efficiencies. Vectren's service territory has a high saturation rate of central air conditioning equipment that is growing at a very slow pace, which helps to minimize average use growth. As equipment wears out and is replaced with newer, more efficient equipment, the average energy use per customer (AUPC) is reduced. Although there is increasing use of household electronics and appliances, this is balanced by increasing efficiencies in these areas. High tech devices like televisions, computers, and set-top boxes will see improving efficiencies, driven by innovation, competition, and voluntary agreements like the Energy Star program. Changes in lighting standards are having a large impact on energy consumption and will continue to impact residential customer usage in the years to come.

Even before Vectren sponsored DSM program savings, use per customer is largely flat, increasing only by 0.2% annually through 2024. This is largely due to the continuing phase-out of the most common types of incandescent light bulbs mandated by the Energy Independence and Security Act (EISA) and new end-use efficiency standards recently put in place by the Department of Energy (DOE). Average use begins to increase at a slightly faster rate in the later years, as the Energy Information Administration (EIA) baseline intensity projections only include those end-use standards that are currently law. Note that DOE continues to propose new energy efficiency standards.

The price of electricity and household income also influence average customer energy use. In general, there is a positive correlation between household income and usage. As household income rises, total usage rises. Conversely, there is a negative correlation between price and usage. As price goes up, average use goes down. Finally, the size of the home (number of inhabitants and square footage) and the thermal integrity of the structure affect residential consumption.

The residential average use model is a statistically adjusted end-use (SAE) model that addresses each of the previously discussed drivers of residential usage. SAE models incorporate many of the benefits of econometric models and traditional end-use models, while minimizing the disadvantages of each.

SAE models are ideal for identifying sales trends for short-term and long-term forecasting. They capture a wide variety of relevant data, including economic trends, equipment saturations and efficiencies, weather, and housing characteristics. Additionally, SAE models are cost effective and are easy to maintain and update. In the SAE model, use is defined by three primary end uses: heating (XHeat), cooling (XCool), and other (XOther). XHeat, XCool, and XOther are explanatory variables in the model that explain customer usage. By design, the SAE model calibrates results into actual sales.

$$ResAvgUse_m = B_0 + (B_1 \times XHeat_m) + (B_2 \times XCool_m) + (B_3 \times XOther_m) + e_m$$

The end-use variables incorporate both a variable that captures short-term utilization (Use) and a variable that captures changes in end-use efficiency and saturation trends (Index). The heating variable is calculated as:

$$XHeat = HeatUse \times HeatIndex$$

Where

$$HeatUse = f(HDD, Household\ Income, Household\ Size, Price)$$

$$HeatIndex = g(Heating\ Saturation, Efficiency, Shell\ Integrity, Square\ Footage)$$

The cooling variable is defined as:

$$XCool = CoolUse \times CoolIndex$$

Where

$$CoolUse = f(CDD, Household\ Income, Household\ Size, Price)$$

$$CoolIndex = g(Cooling\ Saturation, Efficiency, Shell\ Integrity, Square\ Footage)$$

XOther captures non-weather sensitive end-uses:

$$XOther = OtherUse \times OtherIndex$$

Where

$$OtherUse = f(Seasonal\ Use\ Pattern, Household\ Income, Household\ Size, Price)$$

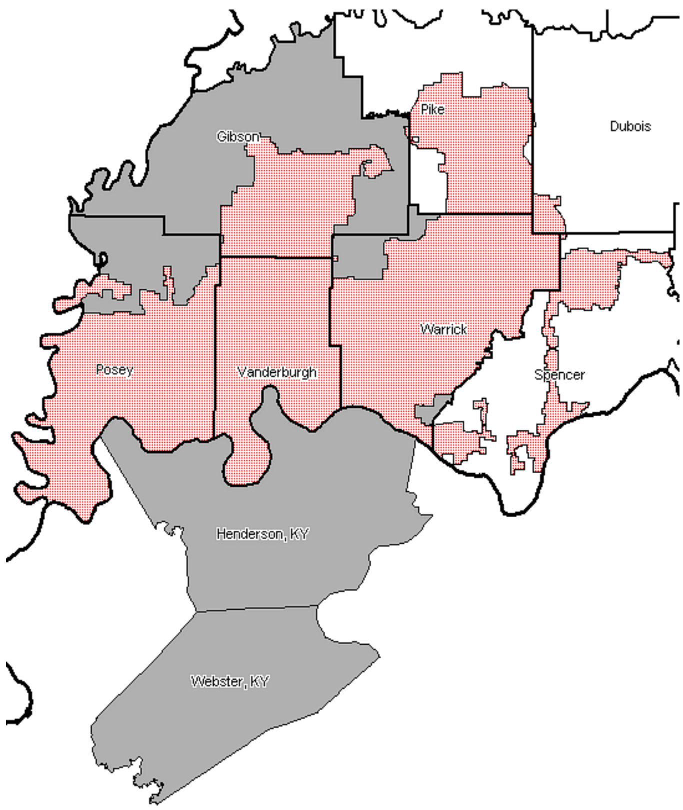
$$OtherIndex = g(Other\ Appliance\ Saturation\ and\ Efficiency\ Trends)$$

Monthly residential usage was regressed on the XHeat, XCool, and XOther variables. The average use model is estimated over the period January 2003 through December 2013. The model explains historical average use well with an Adjusted R^2 of 0.95 and in-sample MAPE of 3.3%.

Residential Customers Model

A simple linear regression model was used to predict the number of residential customers. The number of residential customers was forecasted as a function of population projections for the Evansville Metropolitan Statistical Area (MSA) from Moody's Economy.com. There is a strong correlation between the number of customers and population.

Figure 5-2 Vectren Service Territory Map



The Evansville MSA is a good proxy for the Vectren service territory. Figure 5-2 shows Vectren's service territory (in red) and the Evansville MSA in gray. The number of residential customers is projected to grow an average of .27% per year throughout the planning period. The adjusted R^2 for this model was .992, while the MAPE was .09%.

General Service (GS) Sales Model

Like the residential model, the general service (commercial) SAE sales model expresses monthly sales as a function of XHeat, XCool, and XOther. The end-use variables are constructed by interacting annual end-use intensity projections (EI) that capture end-use efficiency improvements, with non-manufacturing output (GDP) and employment (ComVarm), real price (Pricem), and monthly HDD and CDD:

$$XHeat_m = EI_{heat} \times Price_m^{-0.10} \times ComVar_m \times HDD_m$$

$$XCool_m = EI_{cool} \times Price_m^{-0.10} \times ComVar_m \times CDD_m$$

$$XOther_m = EI_{other} \times Price_m^{-0.10} \times ComVar_m$$

The coefficients on price are imposed short-term price elasticities. A monthly forecast sales model is then estimated as:

$$ComSales_m = B_0 + B_1 XHeat_m + B_2 XCool_m + B_3 XOther_m + e_m$$

Commercial Economic Driver

Output and employment are combined through a weighted economic variable where ComVar is defined as:

$$ComVar_m = (ComEmploy_m^{0.5}) \times (ComOutput_m^{0.5})$$

Employment and nonmanufacturing output are weighted equally. The weights were determined by evaluating the in-sample and out-of-sample model statistics for different sets of employment and output weights.

The resulting commercial sales model performs well with an Adjusted R^2 of 0.95 and an in-sample MAPE of 2.2%.

Commercial sales growth averages 1.9% per year through 2016, as economic growth projections are relatively strong through this period. Real output is projected to increase at 2.2% with employment increasing 1.9%. After 2016, both output and employment growth slow with output averaging 0.5% growth and employment largely flat through 2024. Commercial sales, in turn, slow averaging 0.4% annually between 2016 and 2024.

Large Sales Model

The industrial sales forecast is based on a generalized monthly regression model where industrial sales are specified as a function of manufacturing employment, output, monthly CDD, and monthly binaries to capture seasonal load variation and shifts in the data. The economic driver is a weighted combination of real manufacturing output and manufacturing employment. The industrial economic (IndVar) variable is defined as:

$$IndVar_m = (ManufEmploy_m^{0.3}) \times (ManufOutput_m^{0.7})$$

The imposed weights are determined by evaluating in-sample and out-of-sample statistics for alternative weighting schemes. The final model's Adjusted R^2 is 0.65 with in-sample MAPE of 6.7%. The relatively low Adjusted R^2 and relatively high MAPE are due to the "noisy" nature of industrial monthly billing data.

There are many variables that impact large customer consumption that are not easily forecasted. These unforeseeable impacts make forecasting GS and large customers' usage with a high degree of certainty very difficult, as these customers' usage is extremely sensitive to economic conditions.

Lighting Sales Model

Street light sales are fitted with a simple seasonal exponential smoothing model with a trend term. Street lighting sales have been declining and are expected to continue to decline through the forecast period as increasing lamp efficiency outpaces installation of new street lights. The model yielded an adjusted R^2 of .769 and a MAPE of 5.34%.

Vectren's total energy requirements include forecasted sales for the four sectors described above, wholesale contracts, DSM savings, impact of customer owned distributed generation (DG) and delivery losses. Losses were estimated to be approximately 4.8 percent of requirements. DSM savings and a forecast of customer owned DG are highlighted separately in the sales forecast, and the DSM programs are discussed in detail in Chapter 8 DSM Resources.

Peak Demand Forecast

The Vectren energy forecast is derived directly from the sales forecast by applying a monthly energy adjustment factor to the monthly calendarized sales forecast. The energy adjustment factor includes line losses and any differences in timing between monthly sales estimates and delivered energy (unaccounted for energy). Monthly adjustment factors are calculated as the average monthly ratio of energy to sales.

The long-term system peak forecast is derived through a monthly peak linear regression model that relates monthly peak demand to heating, cooling, and base load requirements:

$$Peak_m = B_0 + B_1 HeatVar_m + B_2 CoolVar_m + B_3 BaseVar_m + e_m$$

The model variables (HeatVarm, CoolVarm, and BaseVarm) incorporate changes in heating, cooling, and base-use energy requirements derived from the class sales forecast models, as well as peak-day weather conditions.

Heating and Cooling Model Variables

Heating and cooling requirements are driven by customer growth, economic activity, changes in end-use saturation, and improving end-use efficiency. These factors are captured in the class sales forecast models. The composition of the models allows historical and forecasted heating and cooling load requirement to be estimated.

The estimated model coefficients for the heating (XHeat) and cooling variables (XCool) combined with heating and cooling variable for normal weather conditions (NrmXHeat and NrmXCool) gives an estimate of the monthly heating and cooling load requirements. Heating requirements are calculated as:

$$HeatLoad_m = B_1 \times ResNrmXHeat_m + C_1 \times ComNrmXheat_m$$

B1 and C1 are the coefficients on XHeat in the residential and commercial models.

Cooling requirements are estimated in a similar manner. As there is a small amount of cooling in the industrial sector, industrial cooling is included by multiplying the industrial model coefficient for the CDD variable by normal monthly CDD. Cooling requirements are calculated as:

$$CoolLoad_m = B_2 \times ResNrmXCool_m + C_2 \times ComNrmXCool_m + D_2 \times NrmCDD_m$$

B2 and C2 are the coefficients on XCool in the residential and commercial models and D2 is the coefficient on CDD in the industrial sales model.

The impact of peak-day weather conditions is captured by interacting peak-day HDD and CDD with monthly heating and cooling load requirements indexed to a base year (2005). The peak model heating and cooling variables are calculated as:

$$HeatVar_m = HeatLoadIdx_m \times PkHDD_m$$

$$CoolVar_m = CoolLoadIdx_m \times PkCDD_m$$

Base Load Variable

The peak model base load variable (BaseVarm) derived from the sales forecast models is an estimate of the non-weather sensitive load at the time of the monthly system peak demand. The base load variable is defined as:

$$BaseVar_m = ResOtherCP_m \times ComOtherCP_m \mid IndOtherCP_m \mid StLightingCP_m$$

Base load requirements are derived for each revenue class by subtracting out heating and cooling load requirements from total load requirements. Using the SAE modeling framework, class annual base load requirements are then allocated to end-uses at the time of monthly peak demand. For example, the residential water heating coincident peak load estimate is derived as:

$$ResWaterCP_m = ResBaseLoad_m \times \left(ResWaterEI_a / ResBaseEI_a \right) \times ResWaterFrac_m$$

Where

ResWaterEI = Annual water heating intensity (water use per household)
ResBaseEI = Annual base-use intensity (non-weather sensitive use per household)
ResWaterFrac = Monthly fraction of usage on at peak (estimates are based on Itron’s hourly end-use load profile database)

End-use load estimates are aggregated by end-use and then revenue class resulting in the base load variable.

Model Results

The model explains monthly peak variation well with an adjusted R^2 of 0.97 and an in-sample MAPE of 2.5%.

CUSTOMER OWNED DISTRIBUTED GENERATION FORECAST

Vectren has been monitoring national and regional distributed generation trends since the 2011 IRP. While a number of technologies continue to influence the electric utility industry, the primary focus is on distributed solar. The present IRP considers the potential for future customer-owned DG growth, specifically in the area of net metered distributed solar photovoltaic (PV) adoption. For modeling purposes, distributed PV is treated as a decrease in demand. A distributed solar forecast was developed using Vectren and Indiana historical net metering information and 3rd party data and assumptions. This forecast is presented below in Table 5-5.

Table 5-5 Distributed Solar Growth Forecast

Year Ending	Historic Peak Planning Capacity (MW)	Distributed Solar Adoption Forecasts: Contribution to Peak Planning Capacity[1] (MW)		
		LOW CASE	HIGH CASE	BASE CASE
2006	0.002			
2007	0.002			
2008	0.003			
2009	0.012			
2010	0.029			
2011	0.051			
2012	0.106			
2013	0.162			
2014		0.2	0.2	0.2
2015		0.3	0.3	0.3
2016		0.4	0.4	0.4
2017		0.5	0.6	0.6
2018		0.7	0.9	0.8
2019		0.9	1.2	1.1
2020		1.3	1.7	1.5
2021		1.7	2.4	2.0
2022		2.3	3.3	2.8
2023		3.0	4.7	3.9
2024		4.1	6.6	5.3
2025		5.5	9.2	7.3
2026		6.2	10.6	8.4
2027		7.0	12.1	9.6
2028		7.8	14.0	10.9
2029		8.9	16.1	12.5
2030		10.0	18.5	14.2
2031		11.3	21.2	16.3
2032		12.7	24.4	18.6
2033		14.3	28.1	21.2
2034		16.2	32.3	24.2

[1] Peak planning capacity is 38% of installed capacity.

Because the IRP is concerned with meeting the annual peak demand, the data presented in Table 5-5 are expressed in terms of megawatts of peak planning capacity, rather than total direct current (DC) gross capacity or total alternating current (AC) inverter capacity. The summer peak typically occurs in late afternoon in mid-to-late summer, whereas maximum solar output is generally at noon in late spring or early summer. Because optimal solar output does not coincide with the summer peak, a factor must be applied to estimate the useful solar capacity from a given PV system at the summer peak. A wide range of peak planning capacity factors have been reported for distributed solar resources.[1] Although MISO has not formally adopted a peak planning capacity factor, PJM, a regional transmission operator, has recommended a factor of 38%.[2] Because of this PJM reference, Vectren has chosen to use this value. There may be further refinements on this going forward as the utility & solar industry further evaluate methodologies for developing this factor, and Vectren may revise this number in future IRPs.

The historical data column reflects the summer peaking capacity of Vectren's reported net metered customer accounts.[3] The High, Low, and Base Case forecasts for the 2014 – 2034 planning horizon are derived from the following information & data sets:

- Vectren historical growth in net metered inverter-rated capacity,
- Indiana historical growth in net metered inverter-rated capacity, and
- Navigant Consulting solar capacity future growth rate assumptions for Indiana.[4]

High Case (applied to the low energy and demand forecast) calculation methodology is as follows:

- Vectren year-end 2013 inverter-rated capacity (426 kW) grows each year in a compounding manner using Navigant's Indiana predicted growth rates as follows:

[1] Sterling, John, and J. McLaren, M. Taylor, K. Cory. Treatment of Solar Resource Generation in Electric Utility Resource Planning. NREL/TP-6A20-60047. October, 2013.
[2] PJM Manual 21: Rules and Procedures for Determination of Generating Capability, revision 11. PJM System Planning Department. March 5, 2014.
[3] Vectren's Customer-Generator Interconnection and Net Metering Report for year ended 12/13/2013.
[4] Navigant Consulting, 5/2/2014.

    - 2014 – 2025: 40% per year
    - 2025 – 2034: 15% per year
- Each year's result is then multiplied by the factor 0.38 to arrive at the peak planning contribution for distributed solar.

Low Case (applied to the high (modeled) energy and demand forecast) calculation methodology is as follows:

- Vectren year-end 2013 inverter-rated capacity (426 kW) grows each year in a compounding manner using slower growth rates as follows:
    - 2014 – 2025: 34.1% per year
    - 2025 – 2034: 12.8% per year
    - These growth rates are a modified version of the High Case's Navigant Indiana rates based on a derived factor.
        - This growth "adjustment" factor is derived by taking historical net metered capacity growth in Vectren territory versus Indiana as a whole.
        - Specifically, this adjustment factor takes the simple average growth rate for Vectren for the years 2010 through 2012 and divides this result by the simple average growth rate for Indiana over the same period.
        - This adjustment factor is 0.852 (or 85.2%). Applying this factor to Navigant's Indiana growth rates yields the 34.1% and 12.8% values given above.
- Each year's result is then multiplied by the factor 0.38 to arrive at the peak planning contribution for distributed solar.

Base Case (applied the base case and high (large load) energy and demand forecasts) calculation methodology is as follows:

- Takes the simple average of the High and Low cases in each year.

- Each year's result is then multiplied by the factor 0.38 to arrive at the peak planning contribution for distributed solar.

The overall approach for the High, Low, and Base cases is a reflection of the difference in the overall net-metered distributed generation customer adoption rates between Vectren and Indiana. It takes a very high level view of how solar adoption may evolve over a relatively long planning horizon. Vectren believes that the long term nature of the IRP process calls for a high level macro approach, and the Navigant assumptions, while very general in nature, represent the results of expert analysis and therefore are an appropriate basis for making this forecast. Navigant did suggest an "adjustment factor" for the Vectren territory because the Vectren service territory is growing at a slower rate than the state of Indiana, resulting in the use of this in the Low case (and indirect use in the Base Case). The High Case utilizes the unadjusted, original Navigant growth rates (where the Vectren growth rate matches the overall state growth rate).

While distributed solar PV, is the most prominent form of distributed generation anticipated in terms of total numbers of customers, it is not the only DG technology to be considered. Cogeneration, or Combined Heat and Power (CHP), is also a key technology category in the context of the IRP. However, because of the case-by-case nature of these potential resources, and the fact that some could be large enough to be modeled as a generation and/or capacity resource, these are covered outside this section on distributed generation.

Additional future technologies in the distributed generation space include:

- Small wind turbines
- Energy storage
- Fuel cells
- Micro turbines
- Other Micro-CHP (e.g. small advanced engine technologies)

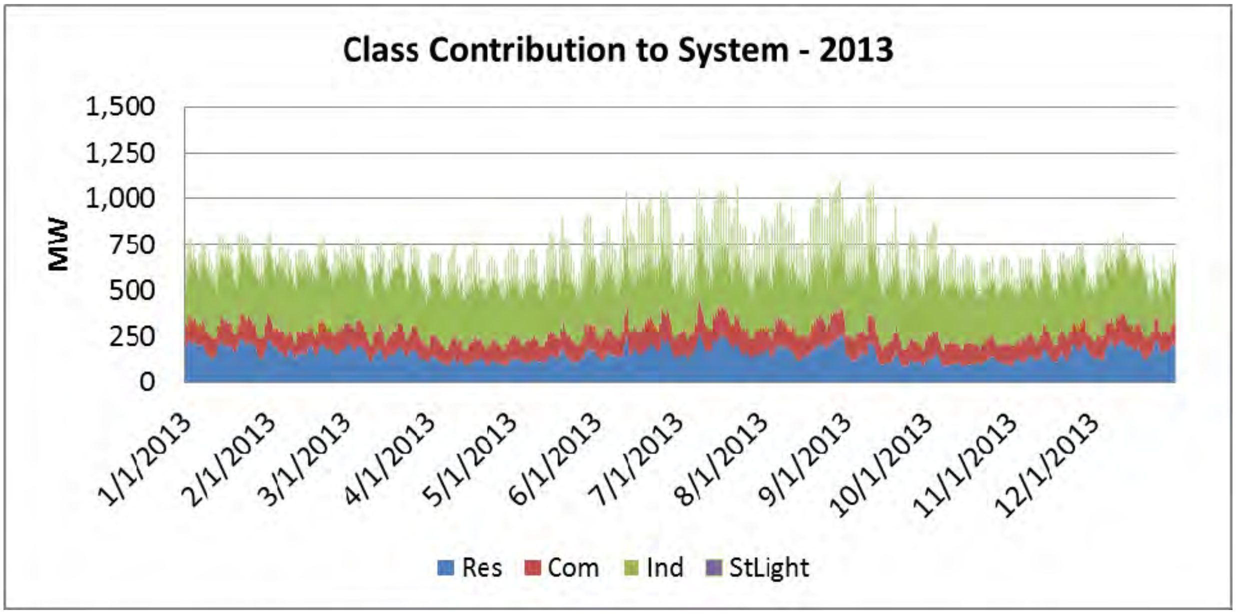
- Micro grids (i.e. customer-sited distribution systems that may include generation and storage technologies)

Each of these technologies will be an important area for the industry to consider in coming years. At this time, none of these are significant enough (or certain enough) to be forecasted as customer-sited DG resources in the present IRP. However, Vectren will continue to monitor and consider how these technologies play into generation planning going forward.

OVERVIEW OF LOAD RESEARCH ACTIVITIES

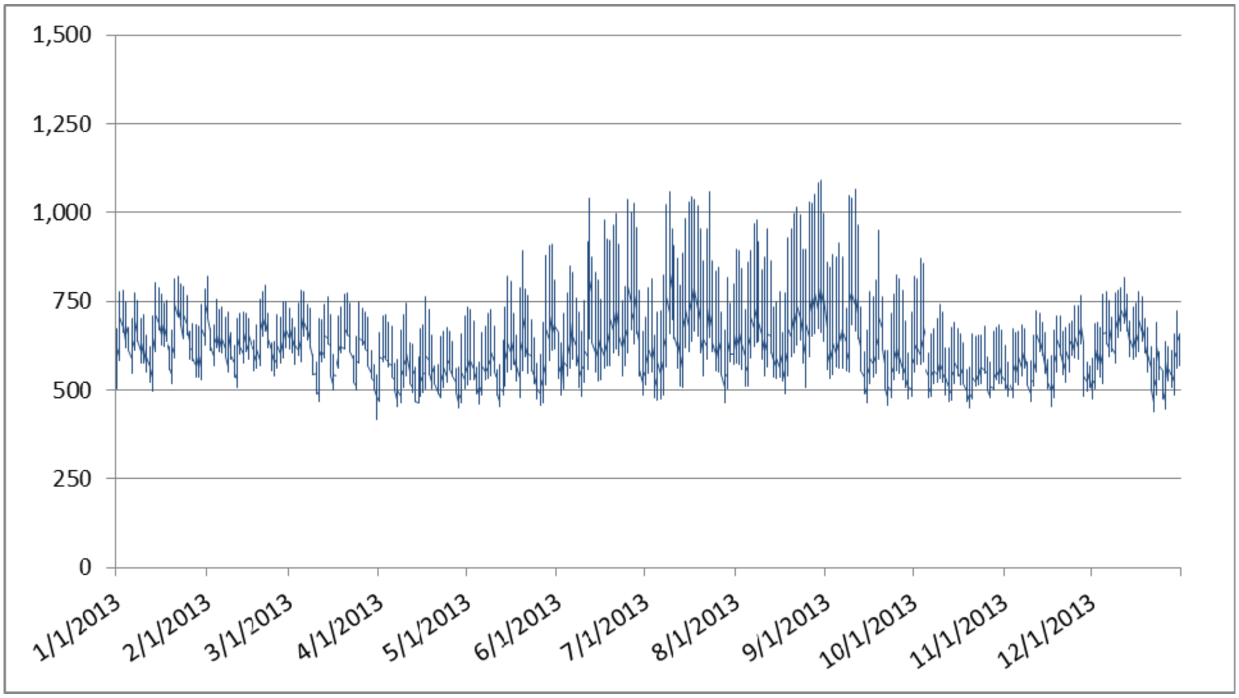
Vectren has interval meters installed on a sample of residential and GS customers. Large customers who have a monthly minimum demand obligation of 300kVA are required to have interval meters installed. Vectren collects and stores this information for analysis as needed. Detailed load shapes are used to better understand customers' usage, primarily for cost of service studies. For this IRP, class load shapes were borrowed from Itron's Indiana library to break down Vectren's hourly load profile by class. The load shapes were applied to historical peak demand. Graph 5-1 shows daily class contribution to peak for 2013.

Graph 5-1 Daily Class Contribution to Peak for 2013 (MW)

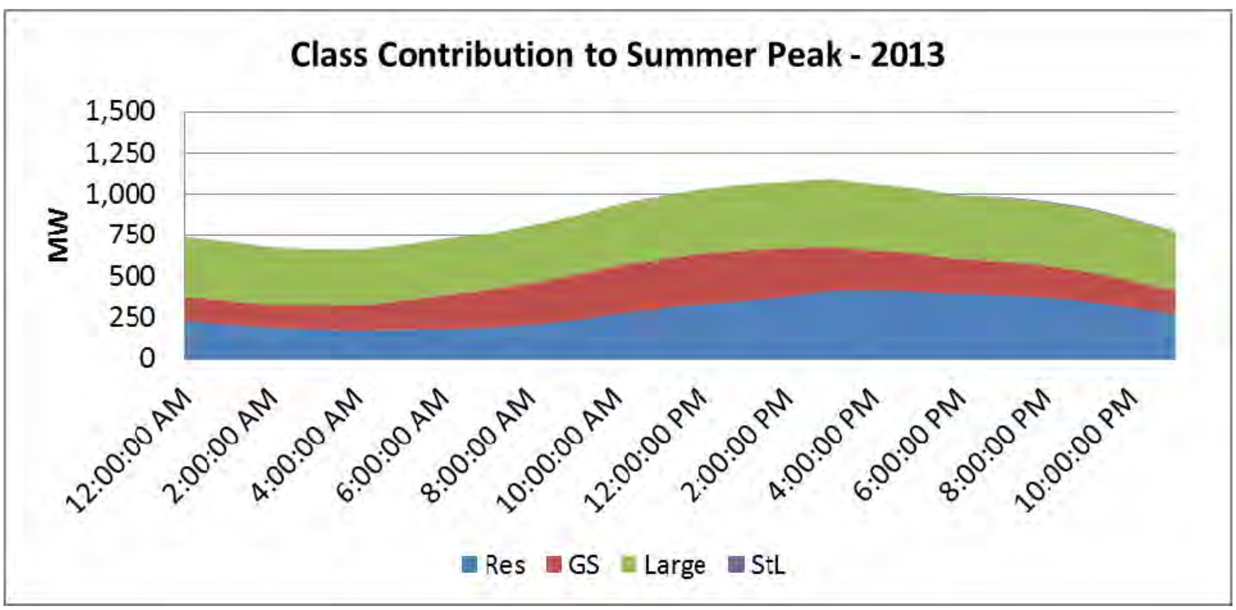


The following graphs (5-2 through 5-4) show the actual system load by day for 2013, the actual summer peak day for 2013 by hour, and the winter peak day for 2013 by hour. Note that these graphs do not include wholesale contract sales. Also additional load shapes are included in the Technical Appendix, section C.

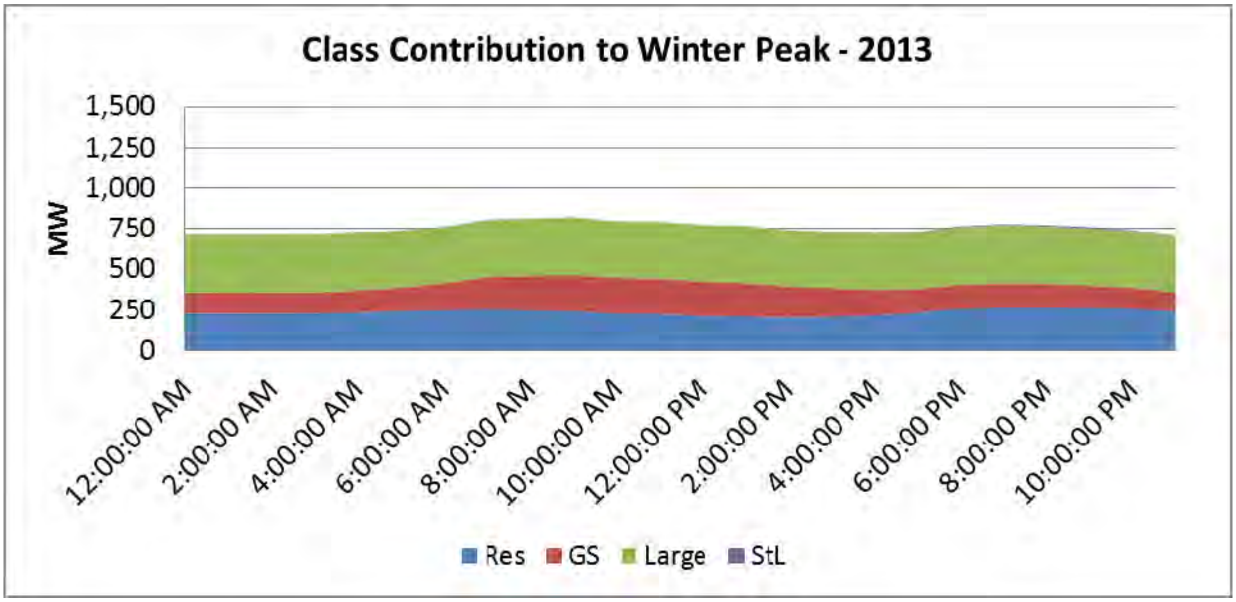
Graph 5-2 Total System Load for 2013 (MW)



Graph 5-3 Summer Peak 2013 (MW)



Graph 5-4 Winter Peak 2013 (MW)



APPLIANCE SATURATION SURVEY AND CONTINUOUS IMPROVEMENT

Vectren typically surveys residential customers every other year. A residential appliance saturation survey was conducted in the summer of 2013. The survey was completed by a representative sample of customers. Results from this survey were used to reflect market shares of actual residential customers. The residential average use model statistics were improved by calibrating East South Central Census regional statistics with the appliance saturation of Vectren's customers. Note that Vectren's service area is technically in the southern most point of the East North Central Census region, bordering the Ease South Central region. Model results were improved by calibrating to the East South Central region.

At this time, Vectren does not conduct routine appliance saturation studies of GS and large customers. These customers are surveyed when needed for special programs. However, Vectren's large and GS marketing representatives maintain close contact with its largest customers. This allows Vectren to stay abreast of pending changes in demand and consumption of this customer group.

Vectren continually works to improve our load forecasting process in a variety of ways. First, Vectren is a member of Itron's Energy Forecasting Group. The Energy Forecasting Group contains a vast network of forecasters from around the country that share ideas and study results on various forecasting topics. Vectren forecasters attend an annual meeting that includes relevant topic discussions along with keynote speakers from the EIA and other energy forecasting professionals. The meeting is an excellent source for end-use forecasting directions and initiatives, as well as a networking opportunity. Vectren forecasters periodically attend continuing education workshops and webinars on various forecasting topics to help improve skills and learn new techniques. Additionally, Vectren discusses forecasts with the State Utility Forecasting Group and other Indiana utilities to better understand their forecasts. We compare and contrast our model assumptions and results to these groups to gain a better understanding of how they interpret and use model inputs.

OVERVIEW OF PAST FORECASTS

The following tables outline the performance of Vectren's energy and demand forecasts. Forecasts from previous IRP filings from 2004 through 2013 were compared to actual values in order to evaluate the reliability of Vectren's past energy and demand forecasts. The following tables show the actual and forecasted values for:

- Total Peak Demand
- Total Energy
- Residential Energy
- GS Energy
- Large Energy

Tables 5-6 through 5-10 present comparisons of actual values versus forecasted values from previous IRP filings. The percentage deviation of the actual values from the most recent forecast is shown in the last column of each table. The deviations of the total energy and total peak forecasts are better than for the individual classes, which is to be expected. <u>Note that all of the forecasted values are weather-normalized, but the actual</u>

loads are not. This comparison would show much closer correlation if the actual loads were normalized to match the forecasts. This is particularly true when predicting the peak hour of the year. For example, weather in 2012 was abnormally hot, with multiple 100 degree days in a row, causing the peak demand to be high. 2013 was much milder and, therefore had a lower peak demand. Another factor affecting forecasts is the economic forecast. The recovery from the Great Recession has been much slower than expected. Another source of potential error is the use of the direct load control program, which reduces the peak demand on hot days by cycling off customer appliances to reduce system load. Note that Vectren is not forecasting any firm wholesale contracts after 2014.

Table 5-6 Total Peak Requirements (MW)

		Forecasts						
Year	Actual	2011	2009	2007	2005	2004	2001	Deviation from most recent forecast, %
2004	1,222						1,325	-8.4%
2005	1,316					1,313		0.2%
2006	1,325				1,326			-0.1%
2007	1,341				1,346			-0.4%
2008	1,166			1,184				-1.6%
2009	1,143			1,216				-6.4%
2010	1,275		1,153					9.6%
2011	1,221		1,179					3.4%
2012	1,205	1,168						-3.1%
2013	1,102	1,168						6.0%
Compound Annual Growth Rate, 2004-2013	-1.15%							

Table 5-7 Total Energy Requirements (GWh)

Year	Actual	Forecasts 2011	2009	2007	2005	2004	2001	Deviation from prior IRP forecast, %
2004	6,303						6,437	-2.1%
2005	6,508					6,624		-1.8%
2006	6,352				6,543			-3.0%
2007	6,527				6,210			4.9%
2008	5,931			6,160*				-3.9%
2009	5,598			6,068				-8.4%
2010	6,221		5,608					9.9%
2011	6,244		5,762					7.7%
2012	5,861	5,896						0.6%
2013	5,822	5,867						0.8%
Compound Annual Growth Rate, 2004-2013	-0.88%							

*Adjusted to include wholesale sales

Table 5-8 Residential Energy Sales (GWh)

Year	Actual	Forecasts 2011	2009	2007	2005	2004	2001	Deviation from prior IRP forecast, %
2004	1,502						1,553	-3.4%
2005	1,571					1,546		1.6%
2006	1,475				1,584			-7.4%
2007	1,631				1,609			1.3%
2008	1,435			1,581				-10.1%
2009	1,449			1,595				-10.0%
2010	1,598		1,467					8.2%
2011	1,515		1,451					4.2%
2012	1,456	1,501						-3.1%
2013	1,427	1,483						-3.9%
Compound Annual Growth Rate, 2004-2013	- 0.57%							

Table 5-9 General Service Energy Sales (GWh)

Year	Actual	Forecasts (GS) 2011	2009	2007	2005	2004	2001	Deviation from prior IRP forecast, %
2004	1,502						1,408	6.3%
2005	1,556					1,500		3.6%
2006	1,515				1,566			-3.4%
2007	1,412				1,594			-12.9%
2008	1,294			1,380				-6.6%
2009	1,299			1,384				-6.5%
2010	1,361		1,275					6.3%
2011	1,335		1,285					3.8%
2012	1,315	1,387						-5.5%
2013	1,303	1,409						-8.2%
Compound Annual Growth Rate, 2004-2013	- 1.57%							

Table 5-10 Large Energy Sales (GWh)

Year	Actual	Forecasts (Large) 2011	2009	2007	2005	2004	2001	Deviation from prior IRP forecast, %
2004	2,346						2,570	-9.5%
2005	2,389					2,619		-9.6%
2006	2,376				2,379			-0.1%
2007	2,538				2,422			4.6%
2008	2,744			2,591				5.6%
2009	2,251			2,598				-15.4%
2010	2,601		2,281					12.3%
2011	2,744		2,445					10.9%
2012	2,714	2,696						0.7%
2013	2,744	2,714						1.1%
Compound Annual Growth Rate, 2004-2013	1.76%							

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CHAPTER 6

ELECTRIC SUPPLY ANALYSIS

INTRODUCTION

The purpose of the electric supply analysis is to determine the best available technologies for meeting the potential future supply-side resource needs of Vectren. A very broad range of supply alternatives were identified in a Technology Assessment described below. These supply alternatives were screened, and a smaller subset of alternatives were chosen for the final planning and integration analysis. Demand side alternatives play a major role in the integrated plan and are discussed in Chapter 8 DSM Resources. The supply-side alternatives which are discussed here fall into two basic categories:

- construction of new generating facilities and
- energy and capacity purchases.

Note that additional DSM energy efficiency programs beyond what was included in the base case energy and demand forecasts were modeled competed with supply-side options to meet future load requirements. This is discussed further in Chapter 8 DSM Resources.

TECHNOLOGY ASSESSMENT

For the 2014 Electric IRP process, Vectren retained the services of Burns & McDonnell, one of the leading engineering design experts in the United States, to assist in performing a Technology Assessment for generation technologies. The Technology Assessment can be found in the Technical Appendix, section B. Below are descriptions of the technologies that were considered from the Technology Assessment.

Natural Gas Technologies

The simple cycle gas turbines (SCGT) utilize natural gas to produce power in a gas turbine generator. The gas turbine cycle is one of the most efficient cycles for the conversion of gaseous fuels to mechanical power or electricity. Typically, SCGTs are used for peaking power due to their fast load ramp rates and relatively low capital costs.

However, the units have high heat rates compared to other technologies. The different classes of SCGTs are shown below in Table 6-1. Please note that for new natural gas fired units, the capital costs shown in the table above are higher than the overnight costs shown in the Technology Assessment document. A 30% contingency for gas infrastructure siting costs and owner's costs was added for final modeling purposes.

Table 6-1 SGCT Classes

Simple Cycle Gas Turbine				
	LM6000	**LMS100**	**E-Class**	**F-Class**
Base Load Net Output (MW)	49.1	106.4	87.5	212.8
Base Load Net Heat Rate (HHV Btu/kWh)	9,570	8,860	11,480	9,940
Base Project Costs (2014$/kW)	$2,047	$1,440	$1,704	$1,228
Fixed O & M Costs (2014$/kW-yr.)	$23.98	$11.18	$16.56	$7.42

The combined cycle gas turbines (CCGT) utilize natural gas to produce power in a gas turbine which can be converted to electric power by a coupled generator, and to also use the hot exhaust gases from the gas turbine to produce steam in a heat recovery steam generator (HRSG). This steam is then used to drive a steam turbine and generator to produce electric power. The use of both gas and steam turbine cycles in a single plant to produce electricity results in high conversion efficiencies and low emissions. For this assessment, a 1x1, 2x1, and 3x1 power block, as shown in Table 6-2, was evaluated with General Electric (GE) 7F-5 turbines as representative CCGT technology. A 1x1 means one gas or steam turbine is coupled with one HRSG. A 2x1 means two gas or steam turbines are coupled with one HRSG. A 3x1 follows the same pattern, meaning that there are three gas or steam turbines coupled with one HRSG.

Table 6-2 CCGT Classes

Combined Cycle Gas Turbine			
	1x1 F-Class Unfired	2x1 F-Class Unfired	3x1 F-Class Unfired
Base Load Net Output (MW)	405.5	815.5	1227.1
Base Load Net Heat Rate (HHV Btu/kWh)	6,610	6,530	6,500
Base Project Costs (2014$/kW)	$1,400	$1,083	$925
Fixed O & M Costs (2014$/kW-yr)	$13.51	$7.62	$5.79

The reciprocating engine is the last of the natural gas alternative technologies evaluated. The reciprocating, or piston, engine operates on the conversion of pressure into rotational energy that will fire on natural gas. Fuel and air are injected into a combustion chamber prior to its compression by the piston assembly of the engine. A spark ignites the compressed fuel and air mixture causing a rapid pressure increase that drives the piston downward. The piston is connected to an offset crankshaft, thereby converting the linear motion of the piston into rotational motion that is used to turn a generator for power production. The reciprocating engine is shown in Table 6-3.

Table 6-3 Reciprocating Engine

Reciprocating Engine	
Base Load Net Output (MW)	100.2
Base Load Net Heat Rate (HHV Btu/kWh)	8,470
Base Project Costs (2014$/kW)	$1,677
Fixed O & M Costs (2014$/kW-yr)	$11.79

Coal Technologies

Pulverized coal steam generators are characterized by the fine processing of the coal for combustion in a suspended fireball. Coal is supplied to the boiler from bunkers that direct coal into pulverizers, which crush and grind the coal into fine particles. The primary air system transfers the pulverized coal from the pulverizers to the steam generator's low NO_x burners for combustion. The steam generator produces high-pressure steam for throttle steam to the steam turbine generator. The steam expansion provides the energy required by the steam turbine generator to produce electricity.

Another type of coal technology that was evaluated was the Integrated Gasification Combined Cycle (IGCC) technology. IGCC technology produces a low calorific value syngas from coal or solid waste that can be fired in a combined cycle power plant. The gasification process itself is a proven technology used extensively for chemical production of products such as ammonia for fertilizer.

See Table 6-4 for further details on the coal technologies evaluated.

Table 6-4 Coal Technologies

Coal			
	Supercritical Pulverized Coal 1	Supercritical Pulverized Coal 2	2x1 Integrated Gasification CC
Base Load Net Output (MW)	425	637.5	482
Base Load Net Heat Rate (HHV Btu/kWh)	10,500	10,200	11,470
Base Project Costs (2014$/kW)	$5,568	$5,080	$10,698
Fixed O & M Costs (2014$/kW-yr)	$32.41	$21.54	$36.88

Waste to Energy Technologies

Stoker boiler technology is the most commonly used waste to energy (WTE) or biomass technology. Waste fuel is combusted directly in the same way fossil fuels are consumed in other combustion technologies. The heat resulting from the burning of waste fuel converts water to steam, which then drives a steam turbine generator for the production of electricity. The two fuel types evaluated in the IRP was wood and landfill gas which are represented in Table 6-5.

Table 6-5 Waste to Energy Technologies

Biomass		
	Wood Stoker Fired	**Landfill Gas IC Engine**
Base Load Net Output (MW)	50	5
Base Load Net Heat Rate (HHV Btu/kWh)	13,500	10,500
Base Project Costs (2014$/kW)	$4,542	$3,261
Fixed O & M Costs (2014$/kW-yr)	$94.49	$182.88

Renewable Technologies

Four renewable technologies were evaluated in the IRP. Those technologies were wind energy, solar photovoltaic, solar thermal, and hydroelectric. Most of the data evaluated was taken from the Technology Assessment, but some data used was from updated studies or real-life examples which will be further discussed below.

Wind turbines convert the kinetic energy of wind into mechanical energy, and are typically used to pump water or generate electrical energy that is supplied to the grid. Subsystems for either configuration typically include a blade or rotor to convert the energy in the wind to rotational shaft energy, a drive train, usually including a gearbox and a generator, a tower that supports the rotor and drive train, and other equipment, including controls, electrical cables, ground support equipment and interconnection equipment. All the data evaluated for wind energy came from the Technology Assessment.

The conversion of solar radiation to useful energy in the form of electricity is a mature concept with extensive commercial experience that is continually developing into diverse mix of technological designs. Solar conversion technology is generally grouped into Solar Photovoltaic (PV) technology, which directly converts sunlight to electricity due to the electrical properties of the materials comprising the cell, and Solar Thermal technology, which converts the radiant heat of the solar energy to electricity through an intermediary fluid.

Photovoltaic (PV) cells consist of a base material (most commonly silicon), which is manufactured into thin slices and then layered with positively and negatively charged materials. At the junction of these oppositely charged materials, a "depletion" layer forms. When sunlight strikes the cell, the separation of charged particles generates an electric field that forces current to flow from the negative material to the positive material. This flow of current is captured via wiring connected to an electrode array on one side of the cell and an aluminum back-plate on the other.

Solar Thermal technology transfers solar energy to an intermediary liquid (typically mineral oil or molten sodium and potassium nitrate salts) in the form of heat, which is then used to boil water and produce steam. That steam is sent to a Steam Turbine Generator (STG) for the production of electricity. The life expectancy of a solar thermal power plant is similar to that of any fossil fueled thermal plant as long as preventative and routing maintenance programs are undertaken.

Vectren recognized that utility scale solar costs are expected to decline over the next few years and decided to have Burns & McDonnell revisit the solar portion of this Technology Assessment, which had a static cost for solar. Burns & McDonnell's

Phoenix office, which has extensive knowledge of the solar industry, developed an asymptotic curve, beginning at $1,880 per KWac in 2014, and declining to $1,500 per KWac in 2020 and staying flat in real terms for the remainder of the planning horizon. The declining cost curve was used for Vectren's IRP modeling. The costs are represented in Table 6-6.

Low-head hydroelectric power generation facilities are designed to produce electricity by utilizing water resources with low pressure differences, typically less than 5 feet head but up to 130 feet. Specially designed low-head hydro turbines are often current driven, and therefore operate at low speeds of 100 to 500 rpm in various configurations and orientations. Since they do not require a large head loss, low-head hydroelectric facilities can be incorporated in a variety of different applications, including rivers, canals, aqueducts, pipelines, and irrigation ditches. This allows the technology to be implemented much more easily than conventional hydropower, with a much smaller impact to wildlife and environmental surroundings. However, power supply is dependent on water supply flow and quality, which are sensitive to adverse environmental conditions such as dense vegetation or algae growth, sediment levels, and drought. Additionally, low-head hydropower is relatively new and undeveloped, resulting in a high capital cost for the relatively small generation output.

Vectren utilized a previously performed study that included dams in and around Vectren's electric service territory to help provide guidance for this IRP. The study was titled *Hydropower Resource Assessment at Non-Powered USACE Sites* and was prepared by the Hydropower Analysis Center for U. S. Army Corps of Engineers. The study was finalized in July 2013.[1] Since there were no costs in the study, Vectren used a real-life example from a hydroelectric construction project in the area to gather the project costs. This data is represented in table 6-6.

[1] Vectren referenced page 28 of this analysis.

Table 6-6 Renewable Technologies

Renewable				
	Wind	Solar PV	Solar Thermal	Hydroelectric
Base Load Net Output (MW)	50	50	50	50
Capacity Factor (energy annual output)	Intermittent (27%)	Intermittent (19%)	Intermittent (19%)	44%
Base Project Costs (2014$/kW)	$2,296	$1,880[1]	$5,740	$4,966
Fixed O & M Costs (2014$/kW-yr)	$25.40	$17.27	$35.56	$76.20

Energy Storage Technologies

Two energy storage technologies were evaluated in the IRP. The technologies were batteries and Compressed Air Energy Storage (CAES). These are shown in Table 6-7.

Electrochemical energy storage systems utilize chemical reactions within a battery cell to facilitate electron flow, converting electrical energy to chemical energy when charging and generating an electric current when discharged. Electrochemical technology is continually developing as one of the leading energy storage and load following technologies due to its modularity, ease of installation and operation, and relative design maturity.

CAES offers a way of storing off-peak generation that can be dispatched during peak demand hours. To utilize CAES, the project needs a suitable storage site, either above ground or below ground, and availability of transmission and fuel source. CAES facilities use off-peak electricity to power a compressor train that compresses air into an underground reservoir at approximately 850 psig. Energy is then recaptured by releasing the compressed air, heating it (typically) with natural gas firing, and generating power as the heated air travels through an expander.

[1] $1,880 per KWac in 2014, and declining to $1,500 per KWac in 2020 and staying flat in real terms for the remainder of the planning horizon.

Table 6-7 Energy Storage Technologies

Energy Storage		
	Advanced Battery Energy Storage	**Compressed Air Energy Storage**
Base Load Net Output (MW)	10	135
Base Project Costs (2014$/kW)	$4,135	$1,240
Fixed O & M Costs (2014$/kW-yr)	$60.96	$7.11

Nuclear Technologies

Manufacturers have begun designing Small Modular Reactors (SMRs) to create a smaller scale, completely modular nuclear reactor. These modular reactors are on the order of 30 feet in diameter and 300 feet high. The conceptual technologies are similar to Advanced Pressurized Water Reactors (APWR), and the entire process and steam generation is contained in one modular vessel. The steam generated in this vessel is then tied to a steam turbine for electric generation. The benefit of these SMRs is two-fold; the smaller unit size will allow more resource generation flexibility and the modular design will reduce overall project costs while providing increased benefits in the areas of safety and concern, waste management, and the utilization of resources. The 225 MW SMR facility is shown in Table 6-8.

Table 6-8 Nuclear SMR Technology

Nuclear	
	Small Modular Reactor
Base Load Net Output (MW)	225
Base Load Net Heat Rate (HHV Btu/kWh)	10,300
Base Project Costs (2014$/kW)	$5,415
Fixed O & M Costs (2014$/kW-yr)	$90.42

NEW CONSTRUCTION ALTERNATIVE SCREENING

The first step in the analysis of new construction alternatives was to survey the available list of technologies and to perform a preliminary screening of each of the options, eliminating those options that were determined to be unfeasible or marginal. The power supply alternatives Vectren considered include intermediate and peaking options, as well as renewable generation, energy storage, distributed generation, and demand side management. These power supply alternatives were screened using a bus bar cost analysis. This was done in order to reduce the number of alternatives that were evaluated to a manageable level within Strategist, the planning model.

The screening analysis was performed by developing and comparing levelized cost of each resource over a 20 year period. This simple approach is used to identify and limit the number of higher-cost generation alternatives. For screening purposes, estimated costs included fuel, operation & maintenance, and capital costs. Resources were then compared across various capacity factors in order to compare resource costs across all dispatch levels. Intermittent resources were compared at their respective output levels. Demand side management (DSM) and distributed generation (DG) were not considered in the bus bar analysis, but were considered alternatives within the IRP. See Chapter 5 Sales and Demand Forecast and Chapter 8 DSM Resources for more details.

The set of new construction alternatives that was selected for further assessment as a result of the screening process are presented in Table 6-9. The capital cost and O&M characteristics of these selected alternatives were assessed and developed in detail.

Table 6-9 New Construction Alternatives

Resource[1]	Net Operating Capacity (MW)	Fuel Type	Accepted or Rejected as Resource Alternative	Reason to Accept or Reject
7FA CCGT 1x1	405.5	Natural Gas	Accept	Cost Effective Option
7FA CCGT 2x1	815.5	Natural Gas	Reject	Exceeds capacity needs. If pursuit of a Combined Cycle was needed, would consider coordinating with another utility in order to reduce costs.
7FA CCGT 3x1	1227.1	Natural Gas	Reject	Exceeds capacity needs. If pursuit of a Combined Cycle was needed, would consider coordinating with another utility in order to reduce costs.
1xLM6000	49.1	Natural Gas	Accept	Cost Effective for 50 MW or less
1xLMS100	106.4	Natural Gas	Reject	Not Cost Effective compared to alternatives
1xE-Class SCGT	87.5	Natural Gas	Reject	Not Cost Effective compared to alternatives
1xF-Class SCGT	212.8	Natural Gas	Accept	Cost Effective for low capacity factors
100 MW Recips	100.2	Natural Gas	Accept	Cost Effective for 100 MW or less
500 MW Supercritical Pulverized Coal	425	Coal	Reject	Not Cost Effective compared to alternatives
750 MW Supercritical Pulverized Coal	637.5	Coal	Reject	Not Cost Effective compared to alternatives
2x1 Integrated Gasification Combined Cycle	482	Coal	Reject	Not Cost Effective compared to alternatives
Wood Stoker Fired	50	Biomass	Reject	Not Cost Effective compared to alternatives
Landfill Gas IC Engine	5	Biomass	Reject	Not Cost Effective compared to alternatives
10 MW Adv. Battery Energy Storage	10	Energy Storage	Reject	Not Cost Effective compared to alternatives
135 MW Compressed Air Energy Storage	135	Energy Storage	Reject	Not Cost Effective compared to alternatives
50 MW Wind Energy Conversion	50	Renewables	Accept	Cost Effective Renewable Source
50 MW Solar PV	50	Renewables	Accept	Cost Effective Renewable Source
50 MW Solar Thermal	50	Renewables	Reject	Not Cost Effective compared to PV
50 MW Low-head Hydro	50	Renewables	Reject	Not Cost Effective compared to alternatives
Small Modular Nuclear	225	Uranium	Reject	Not Cost Effective compared to alternatives

[1] Resource options could be structured as a PPA or be utility owned

Gas-Fueled Technologies

Two major types of gas-fired power generation technology, representing six alternatives, were selected for the detailed assessment. These were either simple cycle or combined cycle technology.

- Simple cycle gas turbine (SCGT) technology was evaluated for four levels of generating capability.
- Combined cycle gas turbine (CCGT) technology was evaluated for two levels of generating capabilities.

Simple cycle alternatives were included in the final integration analysis. With respect to the combined cycle alternatives, this assumption was made on the basis of capturing economies of scale and high efficiencies while satisfying the reserve margin and capital investment constraints.

Renewable Technologies

Two renewable resources were included in the final integration analysis. The renewable resources were modeled in 50 MW blocks to be evaluated against the other new construction alternative options. The 50 MW blocks are an installed capacity (ICAP) or generation nameplate designation. The renewable technologies that were selected by the bus bar cost analysis included wind and solar photovoltaic (PV). These renewable resources are intermittent resources, meaning that they are not continuously available due to some factor outside direct control. Given that this analysis is based on unforced capacity (UCAP), the resources are converted from the installed capacity to the unforced capacity based on the percentage of the designated resource. For wind, 9.125% was used to calculate the amount of UCAP available. This effectively makes every 50 MW block of wind worth 4.56 MW towards meeting the UCAP requirement. For solar PV, 38% was used to calculate the amount of UCAP available. This makes every 50 MW block of solar PV worth 19 MW towards meeting the UCAP requirement. See Chapter 5 Sales and Demand Forecast for more details.

PURCHASED POWER ALTERNATIVES

Another set of options available for assisting in meeting future supply-side resource requirements is purchased power from the wholesale electric market for both capacity and/or energy needs. Vectren is a participant in the wholesale electric power market and is a member of the ReliabilityFirst (RF), a regional reliability organization operating within the framework of the North American Electric Reliability Council (NERC). Vectren is also a member of MISO, the independent transmission system operator that serves much of the Midwest and Canada.

Estimating the future market price for electric energy available for purchase is difficult. In general, forward market information for "standard" products is available from brokers, counterparties, and published price indices. However, the liquidity and price transparency of the forward market is inversely proportional to the proximity of the delivery date of the product. The forward market becomes much less liquid (less trade volume) as the delivery date of the product moves further out into the future. Price discovery is more difficult as the more forward products are traded less and therefore less transparent.

Capacity prices within MISO are on an upward trend that may last for several years. Vectren does not foresee a near term need for capacity. In the long run, regional reserve margins will approach equilibrium due to a combination of load growth and generation retirements. Capacity prices may converge with replacement build prices as surplus legacy capacity diminishes through unit retirements and market growth. If at some future point in time Vectren foresees a projected need for capacity, purchased power options will be fully and explicitly considered at that time.

CUSTOMER SELF- GENERATION

Customer self-generation or behind the meter generation is likely to increase in the future. As discussed in in Chapter 5 Sales and Demand Forecast, a future trend of distributed rooftop solar has been projected and included in all scenarios. Somewhat more difficult to predict is the industrial adoption of behind the meter generation. One such facility is planned by a large industrial customer with a proposed implementation in 2017. As these types of projects become known they are incorporated into Vectren’s forecasts. They are not however a typical trend, and therefore, are not projected beyond the known projects.

Some large electric customers may be candidates for cogeneration opportunities. Vectren’s marketing department is in periodic discussions with customers most likely to participate in such a project. Should such a scenario develop, Vectren would work with that customer to see if they would benefit Vectren’s customers to participate in such a project by possibly increasing the output of the cogeneration plant and thus supplying the Vectren system with the excess. Such a project can only be evaluated on a case by case basis.

RENEWABLE TECHNOLOGIES

Wind

As will be discussed further in Chapter 7 Renewables and Clean Energy, Vectren has two separate long-term purchase power agreements for a total of 80 MW of wind name plate capacity. These agreements were included in all integration analysis cases for the entire 20 year study period.

Other

Landfill gas projects and biomass are viable renewable sources of energy. However, due to their typically small relative size and unique site situations required for development, they weren't considered explicitly in the Technology Assessment or included in the integration analysis of this IRP. Vectren believes these technologies may be considered for viable projects in the future, primarily in the context of distributed generation as discussed in the following section, and that such projects will be duly evaluated as they develop.

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CHAPTER 7

RENEWABLES

and

CLEAN ENERGY

CURRENT PROJECTS

Vectren currently receives renewable energy from three projects: two purchase power contracts from Indiana wind projects and one landfill methane gas project.

Benton County Wind Farm

The Benton County Wind Farm, located in Benton County, Indiana, began providing electricity to Vectren in May 2007 under a 20 year purchase power agreement. The nominal nameplate rating for this contract is 30 MW, and the expected annual energy to Vectren from this project is 76,500 MWh.

Fowler Ridge II Wind Farm

Vectren began receiving energy from the Fowler Ridge II wind farm, also located in Benton County, Indiana in December of 2009 under a 20 year purchase power agreement. The nominal nameplate rating for this contract is 50 MW, and the expected annual energy to Vectren from this project is 130,500 MWh.

Blackfoot Landfill Gas Project

Vectren owns the Blackfoot Landfill Clean Energy Project located in Pike County, Indiana. Vectren officially took over ownership of this project on June 22, 2009. This facility consists of 2 internal combustion engine-generator sets that burn methane gas collected from the adjacent Blackfoot Landfill. Total nameplate capacity is 3.2 MW gross combined for the two machines. Vectren projects to produce approximately 15,000 MWh per year from this facility. Pending future expansion of the Blackfoot landfill and corresponding development of a viable gas field, Vectren may consider adding an additional generator set to this facility at some point in the future.

RENEWABLE ENERGY CREDITS

In addition to participation in actual renewable energy projects, both through ownership and purchase power agreements, Vectren will also consider purchasing renewable energy credits (RECs) to meet future renewable mandates. Vectren will monitor the market development for RECs over the next several years to determine the soundness of such a strategy.

ADDITIONAL RENEWABLE AND CLEAN ENERGY CONSIDERATIONS

Vectren modeled generation characteristics for output at time of peak load and capacity factor based on its geographic footprint. Additional wind generation with characteristics similar to Vectren's existing wind PPA's was also considered. Demand side management programs were considered as clean energy resource options and competed directly with other supply side options in the model.

Table 7-1 Clean Energy Projections

		Clean Energy Source					
	Retail Sales before conservation programs	Wind Generation	Landfill Gas Generation	Conservation Programs	Year-Over-Year Conservation Increase	Customer-Owned DG	Vectren Clean Energy
Year	GWh	GWh	GWh	GWh	GWh	GWh	% of sales
2014	5,832	207.0	15	157		1	7%
2015	5,991	207.0	15	182	26	1	7%
2016	6,040	207.0	15	208	26	2	8%
2017	5,645	207.0	15	233	25	3	9%
2018	5,661	207.0	15	258	25	3	9%
2019	5,680	207.0	15	283	25	5	9%
2020	5,699	207.0	15	296	13	7	9%
2021	5,710	207.0	15	309	13	9	10%
2022	5,729	207.0	15	321	13	12	10%
2023	5,746	207.0	15	334	13	17	10%
2024	5,769	207.0	15	347	13	23	10%
2025	5,782	207.0	15	360	13	32	11%
2026	5,801	207.0	15	373	13	37	11%
2027	5,825	207.0	15	386	13	42	11%
2028	5,860	207.0	15	399	13	48	12%
2029	5,884	207.0	15	412	13	55	12%
2030	5,913	207.0	15	426	13	62	12%
2031	5,942	207.0	15	439	13	71	13%
2032	5,985	207.0	15	453	14	81	13%
2033	6,018	207.0	15	466	14	93	13%
2034	6,060	207.0	15	480	14	106	14%

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CHAPTER 8

DSM RESOURCES

INTRODUCTION

The demand-side resource assessment process is based on a sequential series of steps designed to accurately reflect Vectren's markets and identify the options which are most reasonable, relevant, and cost-effective. It is also designed to incorporate the guidelines from the IURC. This chapter presents a discussion of the planning and screening process, identification of the program concepts, and a listing of the demand-side management (DSM) options passed for integration. Additionally, IRP DSM modeling is discussed.

HISTORICAL PERFORMANCE

Since 1992, Vectren has utilized DSM as a means of reducing customer load and thereby providing reliable electric service to its customers. Historically, DSM programs provided both peak demand and energy reductions. DSM programs were approved by the Commission and implemented pursuant to IURC orders. These programs were implemented, modified, and discontinued when necessary based on program evaluations. Vectren has managed the programs in an efficient and cost effective manner, and the load reductions and energy savings from the programs have been significant. Between 2010 and 2013, Vectren DSM programs reduced demand by over 25,000 kW and provided annual incremental energy savings of over 130,000,000 kWh. It is anticipated that in 2014, Vectren will save an incremental 58,000,000 kWh of gross energy savings and approximately 15,000 kW in demand savings.

Vectren also operates a Direct Load Control (DLC) program that reduces residential and small commercial air-conditioning and water heating electricity loads during summer peak hours. This demand response program commenced in 1992 and over 27,000 customers are enrolled with approximately 17 MW of peak reduction capacity.

EXISTING DSM RESOURCES and PROGRAMS

Tariff Based Resources

Vectren has offered tariff based DSM resource options to customers for a number of years. Consistent with a settlement approved in 2007 in Cause No. 43111, the Demand Side Management Adjustment ("DSMA") was created to specifically recover all of Vectren's DSM costs, including (at that time) a DLC Component. The Commission, in its order in Cause No. 43427, authorized Vectren to include both Core and Core-Plus DSM Program Costs and related incentives in an Energy Efficiency Funding Component ("EEFC") of the DSMA. The EEFC supports the Company's efforts to help customers reduce their consumption of electricity and related impacts on peak demand. It is designed to recover the costs of Commission-approved DSM programs from all customers receiving the benefit of these programs. In Cause Nos. 43427, 43938, and 44318, the Commission approved recovery of the cost of Conservation Programs via the EEFC. This rider is available to rate schedule RS, B, SGS, DGS, MLA, OSS, LP, and HLF customers.

Interruptible Rates

In addition to the DSM programs described in this chapter, Vectren has offered interruptible rate programs for commercial and industrial customers. Vectren currently has approximately 47 MW of interruptible load under contract, not including the DLC Program. In addition to the riders listed below, Vectren has one customer on a special contract interruptible rate (as approved by the IURC), that makes up approximately 20 MW of the total 47 MW of interruptible load.

<u>Rider IP – 2 Interruptible Power Service</u>

This rider is available to rate schedule DGS, OSS, LP, and HLF customers with an interruptible demand of at least 200 kW who were taking service under this rider during September 1997. This rider is closed to new participants. This rider currently has two customers that represent approximately 6 MW of the total interruptible load.

Rider IC Interruptible Contract Rider

This rider is available to any rate schedule LP or HLF customer electric who can provide for not less than 1,000 kVa of interruptible demand during peak periods. This rider currently has two customers that represent approximately 21MW of the total interruptible load.

Rider IO Interruptible Option Rider

This rider is available to any rate schedule DGS, MLA, OSS, LP, or HLF customer who will interrupt a portion of their normal electrical load during periods of request from Vectren. A Customer's estimated load interruption capability must exceed 250 kW to be eligible. This rider is not applicable to service that is otherwise interruptible or subject to displacement under rate schedules or riders of Vectren. Customers currently taking service under Vectren's rider IP – 2, which is closed to new business, may apply for service under this rider, if eligible, for the balance or renewal of the existing contracts.

Direct Load Control (DLC)

The DLC program provides remote dispatch control for residential and small commercial air conditioning, electric water heating and pool pumps (on existing units only) through radio controlled load management receivers (LMR). The DLC program was implemented in April 1992 by Vectren, with the objective of reducing summer peak demand by direct, temporary cycling of participating central air conditioners and heat pumps and by shedding connected water heating and pool pump loads. Participating customers receive credits on their bills during the months of June through September based on the number and type of equipment participating in the program. The DLC program was identified, in 2007, as part of Vectren's DSM Market Assessment study, prepared by Forefront Economics Inc. and H. Gil Peach & Associates LLC, as "…of high quality and notable for its participation and program longevity." Vectren's customers have achieved significant benefits from the existing DLC program.

The program consists of the remote dispatch and control of a DLC switch installed on participating customers' central cooling units (central air conditioners and heat pumps), as well as electric water heating units where a DLC switch is also installed on the central cooling unit. Vectren can initiate events to reduce air-conditioning and water-heating electric loads during summer peak hours. Vectren can initiate a load control event for several reasons, including: to balance utility system supply and demand, to alleviate transmission or distribution constraints, or to respond to load curtailment requests from the Midcontinent Independent Transmission System Operator, Inc. (MISO), the regional electricity transmission grid authority. The control of central cooling units is typically a 50% cycling strategy and involves cycling the compressor off for 15 minutes out of every half hour during the cycling period. The direct load control of water heating equipment utilizes a shedding strategy. This involves shutting off these units for the duration of the cycling period. Cycling periods can range between two and six hours in duration.

Vectren manages the program internally and utilizes outside vendors for support services, including equipment installation and maintenance. Prospective goals for the program consist of maintaining load reduction capability and program participation while achieving high customer satisfaction. Vectren also utilizes an outside vendor, The Cadmus Group, to evaluate the DLC program and provide unbiased demand and energy savings estimates.

The DLC system has the capability to obtain approximately 17 MW of peak reduction capacity from the DLC system. Over time, the operability of the DLC switches can decline for a variety of reasons, including mechanical failure, contractor or customer disconnection, and lack of re-installation when customer equipment is replaced. In order to continue to obtain the peak demand response benefits from the DLC system, Vectren requested and received Commission approval of a multi-year DLC Inspection & Maintenance Program in Cause No. 43839. This inspection process began in 2011 with approximately 25% of the DLC switches inspected annually and this process will be completed early in 2015. Vectren has proposed in Cause No. 43405 DSMA 12 to continue ongoing maintenance of DLC switches on a five (5) year cycle with approximately 20% inspected annually. The work will continue to be conducted by trained vendors for both the inspection and replacement components of the program. By investing in the inspection and maintenance of the DLC system, Vectren can continue its ability to rely on this demand reduction resource as part of its resource planning.

As of May 2014, Vectren's DLC Program had approximately 27,040 residential customers and 530 commercial customers with a combined total of over 36,000 switches. Note that a customer may have more than one switch at a residence or business.

Cause No. 43839 – Rate Design

In Cause No. 43839, approved by the IURC on May 3, 2011, specific structural rate modifications were proposed by Vectren to better align Vectren's rate design to encourage conservation. These structural changes include:

- For all rate schedules, Vectren separated its variable costs from its fixed costs. These changes are intended, among other things, to provide more clarity and transparency in the rate schedules as to the variable costs that Vectren customers can avoid as customers reduce usage.
- Combined the customers under Rate A (the "Standard" customers) and Rate EH (the "Transitional" customers) into a single rate schedule, called Rate RS - Residential Service. The results of these changes resulted in the elimination of the Rate A declining block rate design in favor of a single block rate design for the Rate RS - Standard customer group versus the previous declining block rates. The transition from a declining block rate design to a flat block rate design has been recognized as a method to encourage energy conservation.
- The availability of Rate RS-Transitional was closed to new customers on May 3, 2012 in order to eliminate the promotion of all-electric space heating. A transition

plan to gradually move the existing Rate RS-Transitional customers to RS-Standard was to be filed for the Commission's consideration within two years of Vectren's most recent electric rate case on May 3, 2011. Vectren filed with the Commission a report on the Transition Plan on April 23, 2013 and recommended that any transition plan be considered in the next base rate case. The Commission has not yet ruled on this matter.

- The availability of the commercial Rate OSS (Off Season Service) was also closed to new customers on May 3, 2012 in order to eliminate the promotion of all-electric space heating. A transition plan to gradually move the existing Rate OSS customers to a comparable Rate DGS was to be filed for the Commission's consideration within two years of Vectren's most recent electric rate case on May 3, 2011. Vectren filed with the Commission a report on the Transition Plan on April 23, 2013 and recommended that any transition plan be considered in the next base rate case. The Commission has not yet ruled on this matter.

In Vectren's last electric base rate case, the Company proposed a decoupling mechanism that would break the link between recovery of fixed costs and energy sales in order to eliminate the financial harm to the Company caused when customers reduce their electric usage, thereby supporting the Company's ability to aggressively promote energy conservation. The Commission ultimately denied this request in their April 27, 2011 Order.

The rate structure listed above is reflected in the long term sales and demand forecast.

MISO DR Program

Vectren rider DR provides qualifying customers the optional opportunity to reduce their electric costs through customer provision of a load reduction during MISO high price periods and declared emergency events. Rider DR currently offers two programs, emergency demand response ("EDR") and demand response resource Type 1 ("DRR-1") energy programs.

Rider DR is applicable to any customer served under rates DGS or OSS with prior year maximum demand greater than 70 kW, MLA, LP, or HLF. A customer may participate in the rider DR only with kVa or kW curtailment load not under obligation pursuant to rider IC or IO or special contract. Customers must offer Vectren a minimum of one (1) MW of load reduction, or the greater minimum load reduction requirement that may be specified by the applicable MISO BPM for the type of resource offered by customer. A customer may participate in an aggregation as described in the Rider DR in order to meet the minimum requirement.

Vectren currently does not have any customers participating in rider DR.

Net Metering – Rider NM

Rider NM allows certain customers to install renewable generation facilities and return any energy not used by the customer from such facilities to the grid. On July 13, 2011 the Commission published an amended net metering rule, which included additional modifications to the rules, including eligibility to all customer classes, increase to the size of net metering facilities (1 MW) and an increase in the amount of net metering allowed (1% of most recent summer peak load or approximately 11.5 MW). The new rules also required that at least forty percent (40%) of the amount of net metering allowed would be reserved solely for participation by residential customers.

Vectren has worked with customers over the past several years to facilitate the implementation of net metering installations. As of July 1st, 2014, Vectren had 69 net metering customers with a total nameplate capacity of 474 kW.

Smart Grid Resources

Smart Grid technology has the potential to enable higher levels of reliability, energy efficiency and demand response, as well as improved evaluation, measurement, and verification of energy efficiency and demand response efforts. Reliability can be improved through distribution automation (DA) enhancements. These enhancements can provide operators with real-time information that allows them to make operational decisions more quickly to restore customers following an outage or possibly avoiding the outage completely. Additionally the enhancements can provide automation that can identify fault location, isolate and restore the customers quickly without operator intervention. The advanced metering infrastructure (AMI) portion of a Smart Grid project, as well as new dynamic pricing offerings, enable those customers who decide to actively manage their energy consumption to have access to significantly more information via enhanced communication. This provides those customers a better understanding and more control of their energy consumption decisions and the resulting energy bills. These improvements can provide benefits toward carbon foot print reduction as a result of the overall lowered energy consumption. The potential DSM benefits related to Smart Grid include:

- Peak reductions resulting from enabling Vectren customers to actively participate in demand response programs via dynamic pricing programs,
- Enhanced load and usage data to the customer to foster increased customer conservation, and
- Conservation voltage and line loss reductions due to the improved operating efficiency of the system.

In 2009, as part of the funding available from the United States Department of Energy (DOE) pursuant to American Recovery and Reinvestment Act (ARRA), Vectren conducted a business case analysis of the broad benefits of a Smart Grid implementation. According to the October 27, 2009 DOE announcement, Vectren did not receive a grant award for the Smart Grid project. Vectren re-evaluated the business case and determined that it would not be prudent to proceed with a broad Smart Grid project at this time due to net costs to customers. As part of this initiative Vectren completed the development of an initial Smart Grid strategy where it identified the need to invest in some foundational communication and information gathering technology in order to support future demand response and load management technology. The initial focus of the strategy is to build out a communication network that will support current and future Smart Grid technology, such as distribution Supervisory Control and Data Acquisition (SCADA), AMI, conservation voltage reduction (CVR), and system automation. Vectren has implemented a fiber optic communication path across its transmission network, connecting at both primary generating stations. Additional fiber installations are in progress across the transmission grid. The build out of the communication system has allowed Vectren to install and monitor additional SCADA points from its distribution substations. These SCADA installations are fundamental to the potential implementation of future conservation and voltage management programs, such as CVR, on the distribution network. Vectren will continue to monitor and evaluate Smart Grid technologies and customer acceptance of Smart Grid enabled energy efficiency and demand response.

Vectren recognizes the potential benefits Smart Grid technology programs offer. While a comprehensive Smart Grid deployment is likely several years in the future, the goal of any Vectren Smart Grid project will be to improve reliability, reduce outage restoration times, and increase energy conservation capabilities. The foundational investments currently being made and those planned over the next few years will enhance Vectren's ability to achieve these benefits.

The potential impacts of a robust Smart Grid implementation that would include dynamic pricing, improved information or conservation voltage reduction have not been explicitly quantified in this IRP because no specific project of this magnitude has been proposed by Vectren. We continue to monitor these technologies for potential future implementation as they become cost effective for our customers.

FEDERAL AND STATE ENERGY EFFICIENCY DEVELOPMENTS

Federal – Codes, Standards and Legislation

Energy efficiency policies are gaining momentum at both the state and Federal level. Although there are numerous activities going on at the state and Federal level the following are components of significant legislation that are approaching implementation, as well as new codes, standards and legislation being considered that will likely have an impact on energy efficiency in the planning horizon.

- On June 2, 2014, the EPA released its Clean Power Plan proposal that, if implemented, will for the first time regulate carbon dioxide (CO_2) emissions from existing power plants at the U.S. federal level. The rule is designed to cut carbon pollution from power plants nationwide by 30 percent from 2005 levels. State compliance includes several paths, one of which is end use energy efficiency. While dependent on the actual state implementation plan, the proposed plan would require reductions of 0.57% starting in 2017 and ramping up to 1.5% annually from 2022-2036. By 2030, the EPA is looking for usage reductions in Indiana of 11.6% in cumulative savings and that number increases to 12.9% in cumulative savings by 2036. As this rule is developed and finalized, it is likely to have potential significant impacts on energy efficiency planning.
- The U.S. Department of Energy's Appliances and Equipment Standards Program develops test procedures and minimum efficiency standards for residential appliances and commercial equipment. On June 27, 2011, amended standards were issued for residential central air conditioners and heat pumps. Central air conditioners and central air conditioning heat pumps manufactured on or after January 1, 2015 will have minimum requirements for Seasonal Energy Efficiency Ratios (SEER) and Heating Seasonal Performance Factors (HSPF).

State – Codes, Standards and Legislation

Since 2009, Indiana has taken several significant steps to enhance energy efficiency policy in the state.

- In 2009, the IURC released the Phase II Generic DSM order. The order established statewide electric savings goals for utilities starting in 2010 at

0.3% of average sales and ramping to 2% per year by 2019, The Phase II order also defined a list of five (5) Core DSM programs to be offered by a statewide Third Party Administrator (TPA) and allowed utilities the option to offer Core Plus programs in an effort to reach the 2% goal.

- As a result, since 2012, a statewide TPA has been running Core DSM Programs in Indiana. In March 2014, the Indiana General Assembly passed legislation which modified DSM requirements in Indiana. Senate Enrolled Act No. 340 ("SEA 340") removed requirements for mandatory statewide "Core' DSM programs and savings requirements established in the Phase II Order. SEA 340 also allows large C&I customers who meet certain criteria to opt-out of participation in utility sponsored DSM programs. Furthermore, the statute goes on to prohibit the Commission from requiring jurisdictional electric utilities to meet the Phase II Order energy savings targets after December 31, 2014 and prohibits jurisdictional electric utilities from renewing or extending an existing contract or entering into a new contract with a statewide third party administrator for an energy efficiency program as established in the Phase II Order.
- As a result of SEA 340, Vectren filed and received approval for a one year DSM plan for 2015 under Cause No. 44495 with a savings target of 1% of eligible customer sales.

VECTREN DSM STRATEGY

Vectren has adopted a cultural change that encourages conservation and efficiency for both its gas and electric customers. Vectren has embraced energy efficiency and actively promotes the benefits of energy efficiency to its employees and customers. Vectren has taken serious steps to implement this cultural change starting with its employees. Vectren encourages each employee, especially those with direct customer contact, to promote conservation. Internal communications and presentations, conservation flyers and handouts, meetings with community leaders, and formal training have all promoted this shift. This cultural shift was a motivating factor in launching a new Vectren motto of "Live Smart" in order to further emphasize efficiency. Vectren's purpose statement is the foundation of the Vectren Strategy related to DSM:

> *Purpose*
> With a focus on the need to conserve natural resources, we provide energy and related solutions that make our customers productive, comfortable and secure.

Customers are a key component of Vectren's values, and Vectren knows success comes from understanding its customers and actively helping them to use energy efficiently.

Vectren will continue to offer cost-effective DSM to assist customers in managing their energy bills and meet future energy requirements. Vectren will include an on-going level of Vectren sponsored DSM in the load forecast and will also consider additional DSM as a source of new supply in meeting future electric service requirements (discussed further in the IRP DSM modeling section of this chapter). DSM savings levels in the load forecast include DSM energy efficiency programs available to all customer classes and a 1% annual savings targets for 2015-2019 and .5% annually thereafter. The 1% of eligible annual savings target assumes that 70% of eligible large customer load will opt-out of DSM programs using the provision provided in SEA340.[1] The load forecast also includes an ongoing level of energy efficiency related to codes and standards embedded in the load forecast projections. Ongoing DSM is also important given the integration of Vectren's gas and electric efficiency programs.

DSM PLANNING PROCESS

The following outlines Vectren's planning process in support of Vectren's strategy to identify cost effective energy efficiency resources. In 2006, as a result of a settlement in

[1] Vectren assumes that 80% of large customers will opt out of Vectren sponsored DSM programs; however, 70% was selected for large sales modeling to capture large customer energy efficiency projects outside of Vectren sponsored programs.

Cause No. 42861, the DSM Collaborative was formed, including Vectren and the Indiana Office of Utility Consumer Counselor ("OUCC") as voting members. The Collaborative provided input in the planning of Vectren's proposed DSM programs. The Oversight Board was formed as a result of Cause No. 43427 and was given authority to govern Vectren'sElectric DSM Programs. When formed, the Oversight Board included Vectren and the OUCC as voting members. The Citizens Action Coalition ("CAC") was added as a voting member of the Oversight Board in 2013 as a result of Cause No. 44318.

The IURC Phase II Order in Cause No. 42693 issued on December 9, 2009 established energy saving goals for all jurisdictional utilities in Indiana. The Phase II Order required all jurisdictional utilities to implement five specified programs, which the Commission termed Core Programs. The Core Programs were administered by a third party administrator (TPA) selected through a process involving the Demand Side Coordination Committee composed of jurisdictional Investor-Owned Utilities (IOU's) and other pertinent key stakeholders.

Additionally, the Commission recognized that achieving the goals set out in the Phase II Order would not be possible with Core Programs alone and encouraged the utilities to implement Core Plus Programs to assist in reaching the annual savings goals. Core Plus programs are those programs implemented by the jurisdictional electric utilities in Indiana designed to fill the gap between savings achieved by the Core programs and the savings targets established by the Commission in the Phase II Order. To develop its own set of Core Plus programs, Vectren modified existing programs approved in Cause No. 43427 and added new programs, which were approved on August 31, 2011 in Cause No. 43938. During this period, Vectren also proceeded to integrate some of its electric programs with existing gas DSM programs.

However, with the passage of SEA 340, mandatory statewide "Core" DSM programs and savings requirements established in the Phase II Order have been removed as of

December 31, 2014 and large C&I customers who meet certain criteria ("Qualifying Customers") are allowed to opt-out of participation in Company sponsored energy efficiency programs. As a result, Vectren has implemented an opt-out process as defined in IURC Cause No. 44441 to allow Qualifying Customers to opt-out. This process includes defined annual opt-out and opt-in periods. The plan that Vectren initially filed for 2015 in IURC Cause No. 44495 on May 31, 2014 assumed a 50% level of opt-out. During the initial opt-out period effective July 1, 2014, approximately 71% of eligible large C&I retail sales opted out of participation in Company sponsored DSM. The higher than anticipated opt-out required Vectren to adjust the 2015 Plan to reflect lower spending and lower available savings potential because of the additional portion of the load that is no longer participating in DSM programs. There is an additional opt-out period in the fall of 2014 effective January 1, 2015. As a result, Vectren revised the 2015 Plan to adjust for an 80% opt-out level effective January 1, 2015. The revised plan was approved by the Oversight Board and is still pending Commission approval as part of Cause No. 44495.

The 2015 Plan was developed during an IRP planning period; therefore, the 2014 IRP could not serve as a key input into the 2015 Plan. As a result, the avoided cost basis from the 2011 IRP was used to develop the 2015 Plan. The framework for the 2015 Plan is a continuation of programs offered in 2014, at a savings level of 1.2% of sales (adjusted for the assumption that 80% of Qualifying Customers will opt-out of the programs). However, there were many steps involved in developing the 2015 Plan. The objective of these steps was to develop a plan based on market-specific information for Vectren, which could be successfully implemented utilizing realistic assessments of achievable market potential.

The first step in the process was retaining EnerNOC to complete a Market Potential Study[1] (MPS), included in the Technical Appendix, section D. At the end of 2012,

[1] Electric Demand Side Management: Market Potential Study and Action Plan, EnerNOC Utility Solutions Consulting, April 22, 2013

Vectren, with guidance from the Vectren Electric Oversight Board, engaged EnerNOC, Inc. to study its DSM market potential and develop an Action Plan. EnerNOC conducted a detailed, bottom-up assessment of the Vectren market in the Evansville metropolitan area to deliver a projection of baseline electric energy use, forecasts of the energy savings achievable through efficiency measures, and program designs and strategies to optimally deliver those savings. The study developed technical, economic and achievable potential estimates by sector, customer type and measure. According to the MPS, EnerNOC performed the following tasks in completing the study:

1. Conducted onsite energy consumption surveys with 30 of Vectren's largest commercial and industrial customers in order to provide data and guidance for these market sectors that had not formerly received focused DSM program efforts.
2. Performed a market characterization to describe sector-level electricity use for the residential, commercial, and industrial sectors for the base year, 2011. This included using existing information contained in prior Vectren and Indiana studies, new information from the aforementioned onsite surveys with large customers, EnerNOC's own databases and tools, and other secondary data sources such as the American Community Survey (ACS) and the Energy Information Administration (EIA).
3. Developed a baseline electricity forecast by sector, segment, and end use for 2011 through 2023. Results presented in this volume focus on the upcoming implementation years of 2015 through 2019.
4. Identified several hundred measures and estimated their effects in five tiers of measure-level energy efficiency potential: Technical, Economic, Achievable High, Achievable Recommended and Achievable Low.
5. Reviewed the current programs offered by Vectren in light of the study findings to make strategic program recommendations for achieving savings.
6. Created recommended program designs and action plans through 2019 representing the program potential for Vectren, basing them on the potential analysis and strategic recommendations developed in the previous steps.

The EnerNOC MPS and other study information were used to help guide the plan design. Study analysis and results details can be found in the MPS and its appendices. For planning purposes Vectren used the "Recommended Achievable" scenario as a guide for developing the 2015 Plan.

The second primary step in the planning process was to hire outside expertise to assist with the plan design and development. Vectren retained Morgan Marketing Partners to assist with designing the 2015 Plan. Rick Morgan, President of Morgan Marketing Partners, was the primary planner working with the Vectren team.

The third primary step in the planning process was to obtain input from various sources to help develop and refine a workable plan. The first group providing input was Vectren's DSM Program Managers who have been overseeing current Vectren programs. In addition, vendors and other implementation partners who operate the current programs were very involved in the process as well. They provided suggestions for program changes and enhancements. The vendors and partners also provided technical information about measures to include recommended incentives, estimates of participation and estimated implementation costs. These data provided a foundation for the 2015 Plan based on actual experience within Vectren's territory. These companies also bring their experience operating programs for other utilities.

Other sources of program information were also considered. Current evaluations were used for adjustments to inputs. In addition, best practices were researched and reviewed to gain insights into the program design of successful DSM programs implemented at other utilities. Once the plan was developed, Vectren obtained feedback and approval from the Oversight Board before finalizing.

DSM SCREENING RESULTS

The last step of the planning process was the cost benefit analysis. Utilizing a cost / benefit model, the measures and programs were analyzed for cost effectiveness. The outputs include all the California Standard Practice Manual results including Total Resource Cost (TRC), Utility Cost Test (UCT), Participant and Ratepayer Impact Measure (RIM) tests. Inputs into the model include the following: participation rates, incentives paid, energy savings of the measure, life of the measure, implementation costs, administrative costs, incremental costs to the participant of the high efficiency measure, escalation rates and discount rates. Vectren considers the following tests and ensures that the portfolio passes the TRC test as this test includes the total costs and benefits to both the utility and the consumer. Table 8-4 below outlines the results of all tests.

The model includes a full range of economic perspectives typically used in energy efficiency and DSM analytics. The perspectives include:

- Participant Test
- Utility Cost Test
- Ratepayer Impact Measure Test
- Total Resource Cost Test

The cost effectiveness analysis produces two types of resulting metrics:

1. Net Benefits (dollars) = NPV ∑ benefits – NPV ∑ costs
2. Benefit Cost Ratio = NPV ∑ benefits ÷ NPV ∑ costs

As stated above, the cost effectiveness analysis reflects four primary tests. Each reflects a distinct perspective and has a separate set of inputs reflecting the treatment of costs and benefits. A summary of benefits and costs included in each cost effectiveness test is shown below in Table 8-1.

Table 8-1 Vectren Cost Effectiveness Tests Benefits & Costs Summary

Test	Benefits	Costs
Participant Cost Test	• Incentive payments • Annual bill savings • Applicable tax credits	• Incremental technology/equipment costs • Incremental installation costs
Utility Cost Test (Program Administrator Cost Test)	• Avoided energy costs • Avoided capacity costs	• All program costs (startup, marketing, labor, evaluation, promotion, etc.) • Utility/Administrator incentive costs
Rate Impact Measure Test	• Avoided energy costs • Avoided capacity costs	• All program costs (startup, marketing, labor, evaluation, promotion, etc.) • Utility/Administrator incentive costs • Lost revenue due to reduced energy bills
Total Resource Cost Test	• Avoided energy costs • Avoided capacity costs • Applicable participant tax credits	• All program costs (not including incentive costs) • Incremental technology/equipment costs (whether paid by the participant or the utility)

The Participant Cost Test shows the value of the program from the perspective of the utility's customer participating in the program. The test compares the participant's bill savings over the life of the DSM program to the participant's cost of participation.

The Utility Cost Test shows the value of the program considering only avoided utility supply cost (based on the next unit of generation) in comparison to program costs.

The Ratepayer Impact Measure (RIM) Test shows the impact of a program on all utility customers through impacts in average rates. This perspective also includes the estimates of revenue losses, which may be experienced by the utility as a result of the program.

The Total Resource Cost (TRC) Test shows the combined perspective of the utility and the participating customers. This test compares the level of benefits associated with the reduced energy supply costs to utility programs and participant costs.

In completing the tests listed above, Vectren used 7.29% as the weighted average cost of capital, which is the weighted cost of capital that was approved by the IURC on April 27, 2011 in Cause No. 43839. For the 2015 Plan, Vectren utilized the avoided costs from Table 8-4 in the 2011 IRP. The avoided costs listed below in Table 8-2 were not yet available when the 2015 Plan was developed and filed with the Commission. As the 2015 Action Plan is finalized in late 2014, Vectren will use the avoided costs from the table below and also for any future modeling of DSM programs for 2016 and beyond. Vectren conducts IRPs every two years. Note that The avoided generating capacity costs are reflective of the estimated replacement capital and fixed operations and maintenance cost for an F-class simple cycle gas turbine, as discussed in Table 6-1 SGCT Classes. The operating and capital costs are assumed to escalate with inflation throughout the study period. The cost assumptions can be found in the Technical Appendix, section B. Transmission and distribution capacity are accounted for within the transmission and distribution avoided cost. Vectren's planning reserve margin position is not factored into the avoided capacity cost as presented. Under the base sales forecast, Vectren does not require additional capacity to meet the planning reserve margin requirement throughout the study period.

The marginal energy cost are reflective of the modeled Vectren system marginal cost of energy from the base scenario under base assumptions. This included variable transaction purchase, emission costs for CO_2 starting in 2020, operation and maintenance, and fuel costs. The marginal system cost reflects the modeled spinning reserve requirement and adjusted sales forecasts accounting for transmission and distribution losses. The variable system costs reflected in this calculation can be found in the Technical Appendix, section B.

Table 8-2 Vectren Avoided Costs

	Capacity Surplus / (Deficit)	Generation Avoided Cost	Transmission / Distribution Avoided Cost	Total Capacity Avoided Cost	Marginal Energy Cost	Marginal Energy Cost
	MW	$/kW	$/kW	$/kW	$/MWh	$/kWh
2015	81	$104.01	$10.40	$114.41	$36.94	$0.0369
2016	80	$105.67	$10.57	$116.24	$43.32	$0.0433
2017	102	$107.36	$10.74	$118.10	$45.01	$0.0450
2018	106	$109.08	$10.91	$119.99	$47.58	$0.0476
2019	109	$110.82	$11.08	$121.91	$49.42	$0.0494
2020	109	$112.60	$11.26	$123.86	$63.16	$0.0632
2021	109	$114.40	$11.44	$125.84	$65.23	$0.0652
2022	108	$116.23	$11.62	$127.85	$67.44	$0.0674
2023	108	$118.09	$11.81	$129.90	$69.84	$0.0698
2024	108	$119.98	$12.00	$131.98	$73.54	$0.0735
2025	109	$121.90	$12.19	$134.09	$76.04	$0.0760
2026	109	$123.85	$12.38	$136.23	$79.06	$0.0791
2027	108	$125.83	$12.58	$138.41	$81.84	$0.0818
2028	106	$127.84	$12.78	$140.63	$85.11	$0.0851
2029	105	$129.89	$12.99	$142.88	$89.11	$0.0891
2030	104	$131.97	$13.20	$145.16	$92.79	$0.0928
2031	104	$134.08	$13.41	$147.49	$96.21	$0.0962
2032	102	$136.22	$13.62	$149.85	$100.77	$0.1008
2033	101	$138.40	$13.84	$152.24	$105.98	$0.1060
2034	100	$140.62	$14.06	$154.68	$110.93	$0.1109

A review of the benefit/cost results for each of the technologies considered in the screening analysis is detailed in Table 8-3. Note that measures with a benefit-cost ration of 0.00 indicates no direct technology costs are applied.

Table 8-3 Vectren DSM Technology Screening Results

Residential Technology Analysis Results

		Participant Test		RIM Test		TRC Test		UCT Test	
ID	Program Name	NPV $	BCR	NPV $	BCR	NPV $	BCR	NPV $	BCR
1	30% Infil. Reduction Electric Furnace no CAC V IQW109	$458	N/A	$118	1.11	$785	3.17	$785	3.17
2	30% Infil. Reduction Electric Furnace w/ CAC V IQW107	$55,076	N/A	$15,424	1.13	$95,634	3.23	$95,634	3.23
3	30% Infil. Reduction Gas Furnace no CAC V IQW111	$55	N/A	($558)	0.18	($478)	0.21	($478)	0.21
4	30% Infil. Reduction Gas Furnace w/ CAC	$19,901	N/A	($58,161)		($29,178)		($29,178)	

		Participant Test		RIM Test		TRC Test		UCT Test	
ID	**Program Name**	**NPV $**	**BCR**	**NPV $**	**BCR**	**NPV $**	**BCR**	**NPV $**	**BCR**
	V IQW110				0.44		0.61		0.61
5	30% Infil. Reduction Heat Pump V IQW108	$6,012	N/A	$226	1.02	$8,981	2.63	$8,981	2.63
6	5th Grade Kit- Air Filter Alarm V RES113	$16,471	N/A	$8,159	1.29	$31,187	7.34	$31,187	7.34
7	5th Grade Kit- Bathroom Aerator 1.0 gpm V RES110	$5,758	N/A	$671	1.07	$7,862	3.52	$7,862	3.52
8	5th Grade Kit- CFL - 13 W V RES111	$40,416	N/A	($28,761)	0.61	$15,287	1.51	$15,287	1.51
9	5th Grade Kit- CFL - 23 W V RES112	$65,788	N/A	($43,510)	0.63	$28,191	1.63	$28,191	1.63
10	5th Grade Kit- Kitchen Flip Aerator 1.5 gpm V RES109	$2,879	N/A	($1,431)	0.79	$2,165	1.65	$2,165	1.65
11	5th Grade Kit- LED Nightlight V RES114	$16,172	N/A	($15,326)	0.50	$4,874	1.46	$4,874	1.46
12	5th Grade Kit- Low Flow Showerhead 1.5 gpm V RES108	$35,128	N/A	($7,034)	0.89	$31,250	2.29	$31,250	2.29
13	Air Source Heat Pump 16 SEER - no gas available REP113	($7,347)	0.57	($2,518)	0.77	($2,546)	0.77	$1,427	1.20
14	Air Source Heat Pump 16 SEER -gas available REP127	($8,537)	0.50	($1,328)	0.87	($2,546)	0.77	$2,617	1.44
15	Air Source Heat Pump 18 SEER - gas available REP129	($2,249)	0.46	$127	1.05	($1,032)	0.73	$1,450	2.04
16	Air Source Heat Pump 18 SEER - no gas available REP115	($2,074)	0.51	($48)	0.98	($1,032)	0.73	$1,275	1.81
17	Appliance Recycling Freezers ARC102	$84,943	5.32	($298)	1.00	$63,369	2.69	$63,612	2.71
18	Appliance Recycling Refrigerators ARC101	$385,674	5.90	($3,125)	0.99	$269,452	2.67	$268,064	2.64
19	Attic Insulation V IQW112	$3,288	N/A	($13,850)	0.35	($9,061)	0.46	($9,061)	0.46
20	Audit Recommendations IQW V IQW114	$11,374	N/A	($40,699)	0.29	($29,325)	0.36	($29,325)	0.36
21	Audit Recommendations V HEA116	$28,561	N/A	($69,232)	0.35	($44,098)	0.45	($44,098)	0.45
22	Bathroom Aerator IQW V IQW103	$2,874	N/A	($615)	0.90	$3,125	2.21	$3,125	2.21
23	Bathroom Aerator V HEA112	$37,299	N/A	$3,890	1.06	$46,598	3.48	$46,598	3.48
24	Central Air Conditioner 16 SEER REP 116	($21,517)	0.75	($19,160)	0.73	($4,056)	0.93	$3,801	1.08
25	Central Air Conditioner 18 SEER REP 117	($40,415)	0.68	($11,391)	0.89	($19,244)	0.83	$28,384	1.43
26	CFL 0-15W RLT104	$611,084	3.01	($105,148)	0.84	$300,024	2.27	$347,738	2.85
27	CFL 16-20W RLT105	$619,795	3.46	($77,706)	0.87	$320,977	2.55	$360,400	3.15
28	CFL 21W or Greater RLT106	$591,307	4.09	($55,275)	0.90	$314,606	2.85	$344,554	3.46
29	Compact Fluorescent Lamps V HEA101	$309,769	N/A	($390,021)	0.45	($80,547)	0.80	($80,547)	0.80
30	Compact Fluorescent Lamps IQW V IQW101	$69,004	N/A	($127,952)	0.38	($49,613)	0.62	($49,613)	0.62
31	Dual Fuel Air Sourc Heat Pump 16 SEER REP128	($8,537)	0.50	($1,328)	0.87	($2,546)	0.77	$2,617	1.44
32	Duct Sealing Electric Heat Pump REP108	$20,945	1.89	$5,993	1.10	$38,174	2.27	$36,074	2.13
33	Duct Sealing Electric Resistive Furnace REP109	$10,758	4.42	($1,045)	0.95	$13,411	2.65	$13,131	2.56
34	Duct Sealing Gas Heating with A/C REP107	$1,482	1.02	$49,405	1.46	$77,922	1.99	$101,547	2.84
35	Ductless Heat Pump 17 SEER 9.5 HSPF REP123	$2,469	2.84	($1,590)	0.73	$1,603	1.61	$1,628	1.63
36	Ductless Heat Pump 19 SEER 9.5 HSPF REP124	$1,819	1.90	($1,508)	0.74	$1,174	1.37	$1,735	1.67
37	Ductless Heat Pump 21 SEER 10.0 HSPF REP125	$790	1.59	($904)	0.71	$391	1.21	$765	1.51
38	Ductless Heat Pump 23 SEER 10.0 HSPF REP126	$461	1.27	($869)	0.73	$165	1.08	$808	1.54

		Participant Test		RIM Test		TRC Test		UCT Test	
ID	**Program Name**	**NPV $**	**BCR**	**NPV $**	**BCR**	**NPV $**	**BCR**	**NPV $**	**BCR**
39	Duel Fuel Air Source Heat Pump 18 SEER REP130	($2,249)	0.46	$127	1.05	($1,032)	0.73	$1,450	2.04
40	ECM HVAC Motor REP118	$9,831	1.11	($49,672)	0.56	($17,936)	0.78	($8,311)	0.88
41	Energy Star Ceiling Fans RLT112	($165)	0.74	($59)	0.84	($29)	0.91	$172	2.26
42	Energy Star Fixtures RLT111	$4,481	1.15	($3,400)	0.88	$8,869	1.54	$15,622	2.63
43	Energy Star Reflector CFL V RLT102	$4,738	1.14	($10,011)	0.65	($1,997)	0.90	$8,065	1.78
44	Energy Star Reflector LED V RLT103	$4,345	1.72	($1,530)	0.87	$5,336	2.01	$7,749	3.70
45	Energy Star Specialty CFL V RLT101	$4,738	1.14	($10,011)	0.65	($1,997)	0.90	$8,065	1.78
46	Furnace Filter Whistle IQW V IQW106	$20,061	N/A	$3,847	1.09	$33,063	3.59	$33,063	3.59
47	Gold Star HERS =<67 All Electric RNC105	$524	1.04	($8,690)	0.71	($1,425)	0.94	$7,088	1.49
48	Gold Star HERS =<67 Electric RNC102	$25,046	2.59	($19,160)	0.78	$24,432	1.55	$26,821	1.64
49	Heat Pump Water Heater REP103	$19,345	1.72	($19,604)	0.74	$8,378	1.18	$21,083	1.62
50	Kitchen Aerator IQW V IQW102	$1,848	N/A	($592)	0.86	$1,812	1.97	$1,812	1.97
51	Kitchen Aerator V HEA111	$37,299	N/A	$3,140	1.05	$45,848	3.35	$45,848	3.35
52	LED 13W RLT109	($1,754)	0.95	($5,037)	0.87	$4,357	1.14	$21,940	2.68
53	LED 22W RLT110	$8,841	1.38	$485	1.01	$18,092	1.90	$29,324	4.29
54	LED 7W RLT107	($2,968)	0.78	($2,138)	0.82	($1,314)	0.88	$5,270	2.11
55	LED 9W RLT108	($5,610)	0.75	($4,383)	0.77	($3,977)	0.78	$6,693	1.87
56	LF Showerhead (Whole House) IQW V IQW104	$18,274	N/A	($10,072)	0.75	$10,674	1.53	$10,674	1.53
57	LF Showerhead (Whole House) V HEA113	$99,709	N/A	($36,798)	0.80	$62,816	1.76	$62,816	1.76
58	Opower OPO101	$487,718	N/A	($188,368)	0.79	$299,349	1.73	$299,349	1.73
59	Pipe Wrap (10', 3/4" Wall) IQW V IQW105	$12,656	N/A	$1,510	1.05	$19,942	3.21	$19,942	3.21
60	Pipe Wrap (5', 3/4" Wall) V HEA114	$28,728	N/A	($6,586)	0.90	$30,232	2.10	$30,232	2.10
61	Platinum Star- EPAct Tax Credit All Electric RNC106	$591	1.13	($3,351)	0.71	($165)	0.98	$2,776	1.50
62	Platinum Star- EPAct Tax Credit Electric RNC103	$10,104	1.60	($12,332)	0.78	$9,998	1.29	$17,159	1.62
63	Pool Heater REP111	$9,209	1.31	($3,752)	0.93	$12,595	1.37	$27,184	2.40
64	programmable thermostat REP104	$37,956	4.10	$30,849	1.41	$78,387	3.90	$81,187	4.36
65	Refrigerator Replacement IQW V IQW113	$195,980	N/A	($51,141)	0.91	$245,594	1.98	$245,594	1.98
66	Siver Star HERS =<75 All Electric RNC104	$3,935	2.61	($4,059)	0.72	$2,951	1.40	$3,588	1.53
67	Siver Star HERS =<75 Electric RNC101	$10,658	3.15	($7,321)	0.79	$10,766	1.65	$11,274	1.71
68	Smart programmable thermostat REP120	$54,240	2.55	$62,384	1.46	$135,466	3.19	$145,966	3.83
69	Variable Speed Pool Pump REP110	$6,147	1.12	$48,252	1.58	$66,439	2.02	$87,439	2.99
70	Water Heater Tank Wrap HEA117	$31,284	N/A	($35,875)	0.56	($4,620)	0.91	($4,620)	0.91

Measures with a benefit-cost ration of 0.00 indicates no direct technology costs are applied.

		Participant Test		RIM Test		TRC Test		UCT Test	
ID	**Program Name**	**NPV $**	**BCR**	**NPV $**	**BCR**	**NPV $**	**BCR**	**NPV $**	**BCR**
1	Anti Sweat - Cooler V CDI101	$53,689	2.18	($39,109)	0.70	$34,169	1.61	$34,169	1.61
2	Anti Sweat - Freezer V CDI102	$33,647	3.96	($7,383)	0.88	$38,540	3.14	$38,540	3.14
3	Barrel Wraps (Inj Mold Only) CIP202	$5,727	6.73	$206	1.03	$5,561	4.57	$5,861	5.65
4	CFL 16-20W Fixture 1 Lamp CIE142	$5,798	2.43	$678	1.06	$8,088	3.09	$10,178	6.69
5	CFL 16-20W Fixture 2 Lamp CIE145	$15,079	4.25	$1,355	1.06	$18,962	4.81	$20,355	6.69
6	CFL 21W+ Fixture 1 Lamp CIE143	$4,265	3.10	$487	1.07	$5,672	3.79	$6,601	7.00
7	CFL 21W+ Fixture 2 Lamp CIE146	$10,271	5.42	$974	1.07	$12,738	5.78	$13,202	7.00
8	CFL Fixture, Direct Install, 18 Watt, Exterior V CDI103	$3,376	N/A	($1,047)	0.86	$3,561	2.35	$3,561	2.35
9	CFL Fixture, Direct Install, 36 Watt, Interior V CDI104	$17,933	N/A	($931)	0.97	$23,544	3.51	$23,544	3.51
10	CFL screw-in: <30W V CDI105	$38,152	N/A	($15,939)	0.76	$24,794	1.94	$24,794	1.94
11	CFL <15W Fixture 1 Lamp CIE141	$2,655	1.65	$295	1.04	$4,295	2.17	$6,617	5.91
12	CFL <15W Fixture 2 Lamp CIE144	$8,794	2.89	$590	1.04	$11,376	3.50	$13,234	5.91
13	Clothes Washer CEE Tier 2 CIP244	($139)	0.71	($21)	0.94	($53)	0.87	$267	4.22
14	Clothes Washer CEE Tier 3 CIP245	($258)	0.57	($31)	0.92	($157)	0.69	$257	3.76
15	Clothes Washer ENERGY STAR/CEE Tier 1 CIP243	($10)	0.94	($5)	0.97	$25	1.16	$138	4.80
16	Cooler - Glass Door 15-30 vol CIP224	$297	3.39	$3	1.01	$361	3.79	$433	8.54
17	Cooler - Glass Door 30-50 vol CIP225	$435	6.30	$7	1.01	$503	5.91	$539	9.05
18	Cooler - Glass Door <15 vol CIP223	$220	4.07	($5)	0.99	$254	4.28	$286	7.32
19	Cooler - Glass Door >50 vol CIP226	$753	10.18	$26	1.03	$869	7.88	$900	10.39
20	Cooler - Reach-In Electronically Commutated (EC) Motor CIP238	$1,773	4.55	($118)	0.96	$2,081	4.87	$2,181	5.99
21	Cooler - Solid Door 15-30 vol CIP220	$149	1.60	($29)	0.94	$202	1.90	$346	5.27
22	Cooler - Solid Door 30-50 vol CIP221	$361	5.40	$2	1.00	$417	5.30	$452	8.37
23	Cooler - Solid Door <15 vol CIP219	$91	2.28	($14)	0.92	$104	2.54	$136	4.84
24	Cooler - Solid Door >50 vol CIP222	$576	8.03	$13	1.02	$663	6.87	$693	9.42
25	Cooler - Walk-In Electronically Commutated (EC) Motor CIP235	$1,462	4.90	($100)	0.96	$1,703	5.13	$1,778	6.27
26	Cooler Anti-Sweat Heater Controls - Conductivity-Based CIP216	$239	2.19	$19	1.04	$334	2.76	$444	6.58
27	Cooler Anti-Sweat Heater Controls - Humidity-Based CIP215	$28	1.19	$2	1.01	$74	1.56	$169	5.62
28	Cooler Controller - occupancy sensor V CDI106	$16,843	6.91	($1,002)	0.97	$21,128	4.18	$21,840	4.68
29	Delamping, T12 to T8, 4' V CDI108	$59,889	N/A	$16,927	1.18	$98,666	9.71	$98,666	9.71
30	Delamping, T12 to T8, 8' V CDI109	$24,811	N/A	$7,020	1.18	$40,883	9.71	$40,883	9.71
31	Delamping, >=400 Watt Fixture V CDI107	$48,989	N/A	$13,958	1.18	$80,821	9.71	$80,821	9.71
32	Demand Controlled Ventilation - CO CIP165	$961	4.34	$383	1.25	$1,589	6.14	$1,704	9.79
33	Demand Controlled Ventilation - CO2 CIP164	$1,922	4.34	$766	1.25	$3,177	6.14	$3,407	9.79
34	Door Closers for Cooler CDI142	$16,426	2.07	($16,277)	0.61	$2,205	1.09	$6,033	1.31

		Participant Test		RIM Test		TRC Test		UCT Test	
ID	Program Name	NPV $	BCR	NPV $	BCR	NPV $	BCR	NPV $	BCR
35	Door Closers for Freezer CDI143	$45,048	3.94	($23,049)	0.73	$26,959	1.78	$30,788	2.00
36	EC Motor Reach-in V CDI110	$8,130	2.14	($3,488)	0.84	$9,163	2.03	$10,939	2.53
37	EC Motor Walk-in V CDI111	$8,309	1.70	($6,787)	0.75	$6,664	1.48	$9,624	1.88
38	EDA - Lighting Power Density Reduction CNC101	$41,883	1.24	$3,144	1.01	$124,901	1.54	$260,146	3.76
39	EDA - Non Lighting Measures CNC102	($41,916)	0.73	($49,757)	0.72	($61,110)	0.68	$69,363	2.18
40	Electric Chiller - Air cooled, with condenser CIP156	$150	2.81	$125	1.42	$347	5.40	$383	9.92
41	Electric Chiller - Air cooled, without condenser CIP157	($25)	0.40	$14	1.66	$0	1.01	$28	5.96
42	Electric Chiller - Water Cooled, Centrifugal 150-300 tons CIP162	$28	1.60	$30	1.32	$83	3.04	$105	6.59
43	Electric Chiller - Water Cooled, Centrifugal <150 tons CIP161	$24	1.39	$37	1.34	$94	2.73	$129	7.59
44	Electric Chiller - Water Cooled, Centrifugal >300 tons CIP163	$76	2.10	$54	1.29	$175	3.80	$201	6.38
45	Electric Chiller - Water Cooled, Rotary Screw 150-300 tons CIP159	$45	2.51	($13)	0.87	$55	2.98	$64	4.38
46	Electric Chiller - Water Cooled, Rotary Screw <150 tons CIP158	$29	1.69	$41	1.46	$94	3.54	$112	7.05
47	Electric Chiller - Water Cooled, Rotary Screw >300 tons CIP160	$53	3.52	$31	1.33	$104	6.07	$106	6.64
48	Electric Chiller Tune-up - Air cooled, with condenser CIP172	$24	3.17	$7	1.18	$30	3.34	$35	5.36
49	Electric Chiller Tune-up - Water Cooled, Centrifugal 150-300 tons CIP178	$9	1.82	$1	1.06	$11	2.01	$16	3.76
50	Electric Chiller Tune-up - Water Cooled, Centrifugal >300 tons CIP179	$8	1.70	$1	1.04	$9	1.88	$14	9.92
51	Electric Chiller Tune-up - Water Cooled, Rotary Screw 150-300 tons CIP175	$10	1.89	$1	1.03	$11	2.02	$16	5.96
52	Electric Chiller Tune-up - Water Cooled, Rotary Screw >300 tons CIP176	$8	1.76	$1	1.07	$11	1.98	$15	7.59
53	ENERGY STAR CEE Tier 1 Window\Sleeve\Room AC < 14,000 BTUH CIP118	$6	1.15	$33	1.63	$51	2.45	$75	7.87
54	ENERGY STAR CEE Tier 2 Window\Sleeve\Room AC < 14,000 BTUH CIP170	($82)	0.34	$54	2.12	($0)	1.00	$75	8.19
55	ENERGY STAR CEE Tier 2 Window\Sleeve\Room AC >= 14,000 BTUH CIP171	($181)	0.27	$101	2.29	($25)	0.88	$75	11.68
56	ENERGY STAR Commercial Dishwasher - Door Type, High Temp CIP249	$4,292	18.17	$501	1.09	$5,552	12.13	$5,502	11.03
57	ENERGY STAR Commercial Dishwasher - Multi-Tank Conveyor, Low Temp CIP252	$5,646	12.64	$884	1.11	$8,216	11.86	$8,229	12.06
58	ENERGY STAR Commercial Dishwasher - Under Counter, High Temp CIP247	$1,580	4.16	$12	1.00	$1,769	4.17	$1,994	6.99
59	ENERGY STAR Commercial Dishwasher - Under Counter, Low Temp CIP246	$119	1.45	($45)	0.89	$140	1.59	$277	3.75
60	ENERGY STAR Commercial Fryer CIP103	$78	1.31	$22	1.06	$175	1.79	$325	5.60
61	ENERGY STAR Commercial Hot Holding Cabinets Full Size CIP104	$1,195	3.15	($1)	1.00	$1,443	3.60	$1,637	5.53
62	ENERGY STAR Commercial Hot Holding Cabinets Half Size CIP105	$101	1.18	($34)	0.95	$227	1.47	$546	4.32
63	ENERGY STAR Commercial Hot Holding Cabinets Three Quarter Size CIP106	$432	1.78	($37)	0.97	$581	2.15	$850	4.61

		Participant Test		RIM Test		TRC Test		UCT Test	
ID	Program Name	NPV $	BCR	NPV $	BCR	NPV $	BCR	NPV $	BCR
64	ENERGY STAR Commercial Ice Machine < 500 lb/day harvest rate CIP114	($123)	0.54	($42)	0.73	($110)	0.51	$55	1.94
65	ENERGY STAR Commercial Ice Machine >=1000 lb/day harvest rate CIP116	($471)	0.53	($91)	0.84	($355)	0.58	$323	3.01
66	ENERGY STAR Commercial Ice Machine >=500 and <1000 lb/day harvest rate CIP115	($4,241)	0.43	($685)	0.80	($3,406)	0.45	$1,659	2.54
67	ENERGY STAR Commercial Steam Cookers 3 Pan CIP107	$1,123	1.32	$36	1.01	$2,215	1.72	$4,265	5.14
68	ENERGY STAR Commercial Steam Cookers 4 Pan CIP108	$2,419	1.69	$4	1.00	$3,575	2.13	$5,375	4.96
69	ENERGY STAR Commercial Steam Cookers 5 Pan CIP109	$2,214	2.27	$64	1.01	$2,934	2.79	$3,709	5.28
70	ENERGY STAR Commercial Steam Cookers 6 Pan CIP110	$2,957	2.69	$72	1.01	$3,743	3.22	$4,393	5.23
71	ENERGY STAR Convection Oven CIP111	$564	2.01	$16	1.01	$779	2.52	$1,049	5.31
72	ENERGY STAR Griddles CIP112	$1,348	2.29	$65	1.02	$1,810	2.84	$2,296	5.61
73	ENERGY STAR Window\Sleeve\Room AC < 14,000 BTUH CIP117	$24	2.20	$35	1.70	$67	4.53	$77	9.64
74	ENERGY STAR Window\Sleeve\Room AC >= 14,000 BTUH CIP119	$47	3.35	$58	1.75	$114	6.57	$123	11.69
75	Faucet Aerators-electric V CDI112	$2,777	N/A	($235)	0.95	$3,378	4.33	$3,378	4.33
76	Fluorescent Exit Sign To LED Exit Sign CIE135	$40,257	2.47	($10,427)	0.87	$44,602	2.78	$48,247	3.25
77	Freezer - Glass Door 15-30 vol CIP232	$611	8.36	($28)	0.97	$657	6.79	$648	6.31
78	Freezer - Glass Door 30-50 vol CIP233	$1,242	15.97	($6)	1.00	$1,366	9.56	$1,332	7.90
79	Freezer - Glass Door <15 vol CIP231	$351	5.94	($21)	0.96	$378	5.44	$385	5.92
80	Freezer - Glass Door >50 vol CIP234	$2,357	12.58	$8	1.00	$2,625	8.63	$2,612	8.33
81	Freezer - Reach-In Electronically Commutated (EC) Motor CIP237	$228	5.57	($13)	0.96	$266	5.65	$276	6.84
82	Freezer - Solid Door 15-30 vol CIP228	$665	9.01	($23)	0.97	$720	7.12	$711	6.64
83	Freezer - Solid Door 30-50 vol CIP229	$872	11.50	($34)	0.97	$932	8.10	$899	6.45
84	Freezer - Solid Door <15 vol CIP227	$262	4.68	($28)	0.93	$273	4.49	$280	4.92
85	Freezer - Solid Door >50 vol CIP230	$1,497	8.36	($58)	0.97	$1,620	6.81	$1,608	6.53
86	Freezer - Walk-In Electronically Commutated (EC) Motor CIP236	$916	8.33	($76)	0.94	$1,020	7.16	$1,020	7.16
87	Freezer Anti-Sweat Heater Controls - Conductivity-Based CIP218	$362	4.62	$23	1.04	$443	4.98	$473	6.82
88	Freezer Anti-Sweat Heater Controls - Humidity-Based CIP217	$249	2.66	($17)	0.96	$291	3.01	$336	4.37
89	Halogen 120W x3 To CMH 150W - Retrofit CIE134	$14,364	6.00	$2,071	1.10	$19,539	6.90	$19,923	7.80
90	Halogen 120W x3 To CMH 150W - Turnover CIE115	$15,464	5.77	$3,054	1.13	$22,016	6.90	$23,168	9.97
91	Halogen 50W x2 To CMH 20W - Retrofit CIE129	$2,561	1.62	$539	1.07	$4,881	2.32	$7,245	6.41
92	Halogen 50W x2 To CMH 20W - Turnover CIE110	$2,706	1.58	$787	1.09	$5,500	2.32	$8,344	7.28
93	Halogen 50W x2 To MH 20W Track - Retrofit CIE126	$618	1.40	$186	1.07	$1,418	2.05	$2,348	6.59
94	Halogen 50W x2 To MH 20W Track - Turnover CIE107	$3,036	1.40	$912	1.07	$6,959	2.05	$11,527	6.59
95	Halogen 65W x3 To CMH 50W - Retrofit CIE131	$9,293	4.06	$1,395	1.09	$13,093	5.16	$14,083	7.53

		Participant Test		RIM Test		TRC Test		UCT Test	
ID	**Program Name**	**NPV $**	**BCR**	**NPV $**	**BCR**	**NPV $**	**BCR**	**NPV $**	**BCR**
96	Halogen 65W x3 To CMH 50W - Turnover CIE112	$9,930	3.90	$2,112	1.13	$14,752	5.16	$16,408	9.68
97	Halogen 75W x2 To CMH 39W - Retrofit CIE130	$4,622	2.27	$739	1.07	$7,264	3.15	$9,049	6.70
98	Halogen 75W x2 To CMH 39W - Turnover CIE111	$5,963	2.27	$954	1.07	$9,372	3.15	$11,676	6.70
99	Halogen 75W x2 To MH 39W Track - Retrofit CIE127	$1,441	1.94	$275	1.08	$2,448	2.75	$3,280	6.79
100	Halogen 75W x2 To MH 39W Track - Turnover CIE108	$8,513	1.94	$1,624	1.08	$14,466	2.75	$19,380	6.79
101	Halogen 75W x3 To CMH 70W - Retrofit CIE132	$8,661	4.27	$1,185	1.09	$12,014	5.33	$12,739	7.21
102	Halogen 75W x3 To CMH 70W - Turnover CIE113	$10,456	4.06	$2,249	1.13	$15,502	5.33	$17,158	9.91
103	Halogen 75W x3 To MH 70W Track - Retrofit CIE128	$2,627	2.83	$433	1.09	$3,936	3.84	$4,589	7.28
104	Halogen 75W x3 To MH 70W Track - Turnover CIE109	$15,521	2.83	$2,559	1.09	$23,256	3.84	$27,117	7.28
105	Halogen 90W x3 To CMH 100W - Retrofit CIE133	$11,327	4.94	$1,481	1.09	$15,438	5.94	$15,981	7.19
106	Halogen 90W x3 To CMH 100W - Turnover CIE114	$12,043	4.72	$2,389	1.13	$17,394	5.94	$18,726	9.56
107	Heat Pump Water Heater 10-50 MBH CIP255	$27,103	3.71	$2,908	1.07	$37,311	4.65	$40,311	6.57
108	HID 101W-175W To T5 Garage 2 Lamp CIE159	($6,247)	0.73	($8,549)	0.52	($10,409)	0.47	($1,040)	0.90
109	HID 176W+ To T5 Garage 3 Lamp CIE160	$834	1.07	($6,812)	0.47	($3,827)	0.61	($1,792)	0.77
110	HID 75W-100W To T5 Garage 1 Lamp CIE158	($12,753)	0.46	($4,919)	0.55	($13,185)	0.31	$87	1.01
111	HID To Induction Lamp and Fixture 55-100W CIE204	($616)	0.47	$55	1.08	($245)	0.75	$574	4.95
112	HID To Induction Lamp and Fixture >100W CIE205	($27,147)	0.36	$3,072	1.16	($13,089)	0.62	$18,771	7.30
113	HID >400W to Exterior LED or Induction CIP199	$17	2.10	$5	1.13	$30	3.15	$38	7.61
114	HID >400W to Garage LED or Induction CIP200	$4	2.10	$1	1.13	$8	3.15	$10	7.61
115	High Efficiency Pumps - 1.5hp CIP203	$103	1.29	$45	1.08	$283	1.93	$503	6.85
116	High Efficiency Pumps - 10hp CIP208	$1,846	12.12	$395	1.16	$2,586	11.00	$2,599	11.58
117	High Efficiency Pumps - 15hp CIP209	$2,339	9.00	$541	1.17	$3,350	9.38	$3,444	12.26
118	High Efficiency Pumps - 20hp CIP210	$4,073	5.79	$942	1.16	$5,945	7.03	$6,305	11.07
119	High Efficiency Pumps - 2hp CIP204	$162	1.92	$27	1.07	$271	2.70	$361	6.23
120	High Efficiency Pumps - 3hp CIP205	$471	3.69	$99	1.13	$701	4.92	$781	8.90
121	High Efficiency Pumps - 5hp CIP206	$1,031	7.05	$226	1.15	$1,477	8.00	$1,533	10.92
122	High Efficiency Pumps - 7.5hp CIP207	$1,579	7.34	$370	1.17	$2,284	8.27	$2,384	12.09
123	Incandescent To CFL 16-20W Screw-In CIE139	$5,023	10.61	($532)	0.91	$3,837	3.82	$3,906	4.03
124	Incandescent To CFL 21W+ Screw-In CIE140	$2,230	8.68	($369)	0.86	$1,593	3.50	$1,535	3.21
125	Incandescent To CFL <15W Screw-In CIE138	$7,100	7.80	($960)	0.89	$5,262	3.41	$5,402	3.64
126	Incandescent Traffic Signal To LED Traffic Signal Pedestrian 12" CIE137	$21,726	2.79	($3,430)	0.91	$21,988	2.81	$28,671	6.25
127	Incandescent Traffic Signal To LED Traffic Signal Round 8" Red CIE136	$4,272	1.59	($1,197)	0.91	$4,931	1.75	$8,940	4.45
128	Industrial Request for Proposals - Elec CUS109	$8,218	1.75	($2,373)	0.91	$10,428	1.75	$17,627	3.63
129	Industrial Staffing Grants - Elec CUS108	$8,218	1.75	($2,373)	0.91	$10,428	1.75	$17,627	3.63
130	Large Industrial Custom Measure - Non	$116,770		($30,687)		$145,242		$227,929	

		Participant Test		RIM Test		TRC Test		UCT Test	
ID	Program Name	NPV $	BCR	NPV $	BCR	NPV $	BCR	NPV $	BCR
	Lighting CUS101		1.89		0.91		1.86		3.63
131	LED A-Line 8-12W CIE162	$10,449	1.99	($2,431)	0.89	$9,009	1.87	$13,755	3.47
132	LED Decoratives 2-4W CIE161	$140	1.23	($172)	0.78	$56	1.10	$335	2.24
133	LED Exterior Wall-Pack 30W-75W CIE174	$2,902	1.36	$366	1.03	$5,720	1.81	$10,512	5.63
134	LED Exterior Wall-Pack 75W+ CIE175	$7,841	1.65	$1,290	1.06	$13,129	2.21	$20,318	6.56
135	LED Exterior Wall-Pack <30W CIE173	$6,377	2.21	$415	1.03	$8,766	2.77	$11,304	5.69
136	LED Fixture <250W, Replacing 400W HID, HighBay V CDI113	$13,142	1.59	($9,928)	0.79	$11,749	1.46	$17,309	1.87
137	LED for Walk in Cooler V CDI114	$10,734	1.19	($33,049)	0.61	($10,205)	0.83	$4,003	1.09
138	LED for Walk in Freezer V CDI115	$5,749	1.20	($16,378)	0.62	($4,388)	0.86	$2,716	1.12
139	LED MR16 4-7W CIE166	$473	1.22	($560)	0.80	$317	1.17	$1,220	2.27
140	LED Open Sign V CDI116	$27,587	4.88	$3,027	1.06	$41,327	4.26	$43,103	4.96
141	LED Outdoor Decorative Post 30W-75W CIE168	$2,902	1.36	$366	1.03	$5,720	1.81	$10,512	5.63
142	LED Outdoor Decorative Post 75W+ CIE169	$7,841	1.65	$1,290	1.06	$13,129	2.21	$20,318	6.56
143	LED Outdoor Decorative Post <30W CIE167	$6,377	2.21	$415	1.03	$8,766	2.77	$11,304	5.69
144	LED PAR 20 7-9W CIE163	$928	1.44	($200)	0.94	$1,123	1.58	$2,292	4.03
145	LED PAR 30 10-13W CIE164	$5,141	1.61	($611)	0.96	$6,093	1.78	$10,756	4.42
146	LED PAR 38 10-21W CIE165	$21,522	2.23	($2,793)	0.93	$21,858	2.30	$28,851	3.93
147	LED Parking Garage/Canopy 30W-75W CIE171	$1,921	1.36	$243	1.03	$3,786	1.81	$6,959	5.63
148	LED Parking Garage/Canopy 75W+ CIE172	$5,191	1.65	$854	1.06	$8,691	2.21	$13,450	6.56
149	LED Parking Garage/Canopy <30W CIE170	$4,274	2.21	$278	1.03	$5,875	2.77	$7,576	5.69
150	LED Recessed Downlight V CDI117	$19,708	2.46	($1,564)	0.97	$28,759	2.64	$32,311	3.31
151	LED, Exit Sign, Retrofit V CDI118	$13,304	N/A	($7,931)	0.74	$11,833	2.13	$11,833	2.13
152	LED, Refrigerated Case, Replaces T12 or T8 V CDI119	$29,418	1.30	($74,323)	0.55	($18,547)	0.83	$6,317	1.07
153	LEDs: 8-12W V CDI122	$30,516	N/A	($7,788)	0.86	$29,919	2.54	$29,919	2.54
154	LEDs: 8-12W V CDI123	$17,175	N/A	($4,383)	0.86	$16,840	2.54	$16,840	2.54
155	LEDs: MR16 track V CDI124	$36,993	N/A	($6,825)	0.90	$38,887	2.86	$38,887	2.86
156	LEDs: MR16 track V CDI125	$20,821	N/A	($3,841)	0.90	$21,887	2.86	$21,887	2.86
157	LEDs: >12W Flood V CDI120	$51,786	N/A	($7,940)	0.91	$56,050	3.02	$56,050	3.02
158	LEDs: >12W Flood V CDI121	$19,420	N/A	($2,978)	0.91	$21,019	3.02	$21,019	3.02
159	Low Flow Pre-Rinse Sprayer - Electric CIP242	$3,052	35.87	($52)	0.98	$2,735	6.90	$2,742	7.01
160	Market Segment Programs - Elec CUS105	$8,218	1.75	($2,373)	0.91	$10,428	1.75	$17,627	3.63
161	MH 1000W Pulse Start To T5 46" 10 Lamp HO - Turnover CIE105	$132,715	8.86	$21,253	1.12	$179,716	9.00	$179,153	8.78
162	MH 1000W Pulse Start To T5 46" 12 Lamp HO - Turnover CIE106	$84,985	6.97	$10,884	1.09	$113,138	7.59	$112,663	7.38
163	MH 1000W To T5 46" 10 Lamp HO - Retrofit CIE124	$132,715	8.86	$21,253	1.12	$179,716	9.00	$179,153	8.78
164	MH 1000W To T5 46" 12 Lamp HO -	$56,388		$7,222		$75,068		$74,753	

		Participant Test		RIM Test		TRC Test		UCT Test	
ID	**Program Name**	**NPV $**	**BCR**	**NPV $**	**BCR**	**NPV $**	**BCR**	**NPV $**	**BCR**
	Retrofit CIE125		6.97		1.09		7.59		7.38
165	MH 1000W To T8VHO 48" 8 Lamp (2 fixtures) CIP187	$4,072	6.43	($183)	0.96	$3,880	4.86	$3,855	4.74
166	MH 150W Pulse Start To T5 46" 2 Lamp HO - Turnover CIE101	$5,637	1.24	$2,653	1.08	$17,219	1.83	$32,224	6.73
167	MH 175W To T5 46" 2 Lamp HO - Retrofit CIE120	$17,621	1.74	$2,785	1.06	$30,921	2.45	$43,557	6.05
168	MH 175W To T5 46" 3 Lamp HO - Retrofit CIE121	($6,991)	0.70	($3,617)	0.81	($4,156)	0.79	$8,480	2.21
169	MH 200W Pulse Start To T5 46" 3 Lamp HO - Turnover CIE102	($131)	0.99	$1,153	1.04	$8,998	1.44	$24,003	5.58
170	MH 200W To LED High Bay 139W CIE118	$317	1.04	($694)	0.92	$1,096	1.16	$5,740	3.70
171	MH 250W To LED High Bay 175W CIE119	$12,997	1.34	($4,175)	0.92	$16,097	1.46	$37,432	3.78
172	MH 250W To LED Low Bay 85 W3 CIE116	$10,051	2.30	($1,166)	0.94	$10,264	2.37	$13,360	4.03
173	MH 250W To T8VHO 48" 4 Lamp CIP184	$2,799	1.93	($496)	0.92	$2,720	1.95	$4,120	3.82
174	MH 320W Pulse Start To T5 46" 4 Lamp HO - Turnover CIE103	$47,012	2.39	$9,667	1.10	$75,276	3.37	$93,276	7.79
175	MH 350W Pulse Start To T5 46" 6 Lamp HO - Turnover CIE104	$1,046	1.06	($1,009)	0.95	$5,628	1.39	$14,628	3.72
176	MH 400W To T5 46" 4 Lamp HO - Retrofit CIE122	$108,061	4.20	$12,814	1.08	$147,878	5.21	$155,753	6.72
177	MH 400W To T5 46" 6 Lamp HO - Retrofit CIE123	$36,116	2.07	$3,997	1.05	$56,539	2.83	$72,289	5.78
178	MH 400W To T8VHO 48" 6 Lamp CIP185	$5,930	2.98	($387)	0.96	$5,849	2.86	$7,049	4.62
179	MH 400W To T8VHO 48" 8 Lamp CIP186	$966	2.29	($151)	0.92	$911	2.24	$1,211	3.77
180	Network PC Power Management Software CIP214	$306	3.55	($97)	0.78	$186	2.21	$252	3.89
181	Night Covers V CDI126	$5,769	1.73	($6,168)	0.64	$651	1.06	$2,640	1.31
182	No controls To Ceiling-Mounted Occupancy Sensors CIE180	$50,987	4.48	($10,188)	0.85	$43,051	3.54	$48,110	5.04
183	No controls To Ceiling-Mounted Occupancy Sensors >500W Connected CIP190	$5,164	8.82	($724)	0.88	$4,510	5.46	$4,638	6.25
184	No controls To Central Lighting Controls (Timeclocks) CIE185	$119	1.10	($395)	0.71	($55)	0.95	$591	2.60
185	No controls To Central Lighting Controls (Timeclocks) >500W Connected CIP195	$49	1.95	($20)	0.81	$38	1.77	$69	4.83
186	No controls To Fixture Mounted Daylight Dimming Sensors CIE183	$916	1.66	($20)	0.99	$1,153	1.90	$1,850	4.15
187	No controls To Fixture Mounted Daylight Dimming Sensors >500W Connected CIP193	$10,648	11.65	$1,487	1.12	$12,210	7.91	$12,210	7.91
188	No controls To Fixture Mounted Occupancy Sensors CIE181	($1,238)	0.70	($801)	0.74	($1,233)	0.65	$1,431	2.65
189	No controls To Fixture Mounted Occupancy Sensors >500W Connected CIP191	$9,148	4.66	($1,448)	0.88	$8,075	3.72	$9,275	6.25
190	No controls To LED Case Lighting Sensor Controls CIP196	$2,123	2.63	$99	1.03	$2,446	2.85	$3,186	6.44
191	No controls To Remote-Mounted Daylight Dimming Sensors CIE182	$2,597	4.55	$292	1.08	$3,001	4.53	$3,249	6.38
192	No controls To Remote-Mounted Daylight Dimming Sensors >500W Connected CIP192	$1,293	8.96	$186	1.12	$1,496	6.97	$1,526	7.91
193	No controls To Switching Controls for Multi-Level Lighting CIE184	($5,195)	0.32	($248)	0.90	($3,936)	0.37	$1,622	3.23
194	No controls To Switching Controls for Multi-Level Lighting >500W Connected CIP194	$771	2.13	$122	1.08	$1,015	2.52	$1,463	7.63

		Participant Test		RIM Test		TRC Test		UCT Test	
ID	Program Name	NPV $	BCR	NPV $	BCR	NPV $	BCR	NPV $	BCR
195	No controls To Wall-Mounted Occupancy Sensors CIE179	$25,210	3.71	($6,241)	0.83	$20,488	3.02	$23,505	4.30
196	No controls To Wall-Mounted Occupancy Sensors >500W Connected CIP189	$5,404	13.87	($724)	0.88	$4,702	6.74	$4,638	6.25
197	Occupancy Sensor, Wall Mount, >200 Watts V CDI128	$46,730	3.19	($16,159)	0.83	$42,841	2.26	$48,172	2.68
198	Occupancy Sensor, Wall Mount, <=200 Watts V CDI127	$6,114	2.15	($4,027)	0.73	$3,842	1.54	$5,176	1.89
199	Outside Air Economizer with Dual-Enthalpy Sensors CIP167	($172)	0.57	($25)	0.90	($109)	0.67	$161	3.49
200	Packaged Terminal Air Conditioner (PTAC) 65,000-135,000 BtuH CIP141	($326)	0.97	$8,588	1.74	$11,611	2.36	$18,111	9.76
201	Packaged Terminal Air Conditioner (PTAC) <65,000 BtuH CIP140	($346)	0.97	$9,198	1.80	$12,198	2.42	$18,698	10.05
202	Packaged Terminal Heat Pump (PTHP) 65,000-135,000 BtuH CIP143	($363)	0.96	$7,591	1.66	$10,572	2.23	$17,072	9.26
203	Packaged Terminal Heat Pump (PTHP) <65,000 BtuH CIP142	($382)	0.96	$8,204	1.71	$11,162	2.30	$17,662	9.55
204	Pellet Dryer Duct Insulation 3in -8in dia CIP201	$839	2.29	($307)	0.80	$553	1.83	$773	2.73
205	Performance Based Industrial Assessments - Elec CUS106	$8,218	1.75	($2,373)	0.91	$10,428	1.75	$17,627	3.63
206	Plug Load Occupancy Sensors CIP212	$262	1.37	($306)	0.70	$87	1.14	$447	2.65
207	Pre-Rinse Spray Valves - ele V CDI129	$6,301	N/A	($1,263)	0.87	$5,890	3.56	$5,890	3.56
208	Programmable Thermostat CDI137	$647,200	N/A	($113,077)	0.91	$621,676	2.28	$621,676	2.28
209	PSMH 1000W To T8VHO 48" 8 Lamp (2 fixtures) CIP197	$5,683	8.58	$1,298	1.17	$8,143	9.10	$8,443	12.96
210	Refrigerated Case Covers CIP239	$250	1.60	($262)	0.62	$24	1.06	$210	1.97
211	Self-Generation Efficiency Improvements - Elec CUS107	$8,218	1.75	($2,373)	0.91	$10,428	1.75	$17,627	3.63
212	Showerheads-electric V CDI130	$3,016	N/A	($231)	0.95	$3,693	4.42	$3,693	4.42
213	Smart Strip Plug Outlet CIP211	($4)	0.98	($29)	0.81	($4)	0.97	$76	2.52
214	Smart Strips CDI138	$11,467	N/A	($35,603)	0.32	($21,432)	0.44	($21,432)	0.44
215	Snack Machine Controller (Non-refrigerated vending) CIP213	$351	1.32	($296)	0.80	$167	1.17	$731	2.64
216	Specialty CFLs: Reflectors V CDI131	$10,774	N/A	($11,491)	0.55	($353)	0.98	($353)	0.98
217	Split System Heat Pump 135,000-240,000 BtuH CIP149	($228)	0.96	$4,336	1.63	$6,096	2.19	$9,896	8.43
218	Split System Heat Pump 240,000-760,000 BtuH CIP150	($4,412)	0.51	$3,369	1.62	$1,382	1.19	$7,782	8.32
219	Split System Heat Pump 65,000-135,000 BtuH CIP148	($127)	0.96	$2,657	1.66	$3,700	2.23	$5,975	9.26
220	Split System Heat Pump <65,000 BtuH CIP147	($19)	0.96	$410	1.71	$558	2.30	$883	9.55
221	Split System Unitary Air Conditioner 135,000-240,000 BtuH CIP153	($129)	0.97	$3,075	1.71	$4,191	2.31	$6,566	8.89
222	Split System Unitary Air Conditioner 240,000-760,000 BtuH CIP154	($5,494)	0.51	$4,791	1.70	$2,332	1.25	$10,332	8.77
223	Split System Unitary Air Conditioner 65,000-135,000 BtuH CIP152	($245)	0.97	$6,441	1.74	$8,708	2.36	$13,583	9.76
224	Split System Unitary Air Conditioner <65,000 BtuH CIP151	($260)	0.97	$6,899	1.80	$9,149	2.42	$14,024	10.05
225	Split System Unitary Air Conditioner >760,000 BtuH CIP155	($14,058)	0.38	$6,711	1.65	($1,651)	0.91	$14,799	7.63
226	Strip Curtains Cooler CDI144	$656	1.01	($36,333)	0.29	($34,476)	0.30	($23,298)	0.39
227	Strip Curtains Freezer CDI145	$86,941	2.62	($64,121)	0.66	$33,008	1.35	$46,464	1.58

		Participant Test		RIM Test		TRC Test		UCT Test	
ID	**Program Name**	**NPV $**	**BCR**	**NPV $**	**BCR**	**NPV $**	**BCR**	**NPV $**	**BCR**
228	System Study CUS102	$47,415	7.16	($6,819)	0.91	$53,528	4.27	$50,651	3.63
229	T12 18" 1 Lamp To Delamp CIE147	$1,061	N/A	$42	1.04	$1,141	16.44	$1,019	6.19
230	T12 24" 1 Lamp To Delamp CIE148	$6,891	N/A	$482	1.06	$7,630	16.44	$7,016	7.33
231	T12 36" 1 Lamp To Delamp CIE149	$2,000	N/A	$205	1.09	$2,282	16.44	$2,160	8.99
232	T12 46" 1 Lamp To T5 46" 1 Lamp CIE154	$342	1.22	($106)	0.95	$606	1.45	$1,469	4.00
233	T12 46" 2 Lamp To T5 46" 2 Lamp CIE155	$6,104	2.32	($79)	0.99	$7,318	2.66	$9,348	4.94
234	T12 46" 3 Lamp To T5 46" 3 Lamp CIE156	$7,448	3.43	$105	1.01	$8,538	3.69	$9,521	5.35
235	T12 46" 4 Lamp To T5 46" 4 Lamp CIE157	$22,669	4.69	$702	1.02	$25,627	4.72	$26,856	5.74
236	T12 48" 1 Lamp To Delamp CIE150	$71,597	N/A	$7,541	1.09	$81,894	16.44	$77,671	9.15
237	T12 6' To Refrigerated Display Case Lighting 6' LED - Cooler CIP181	($2,341)	0.63	($568)	0.86	($1,692)	0.68	$2,308	2.82
238	T12 6' To Refrigerated Display Case Lighting 6' LED - Freezer CIP183	($1,873)	0.63	($454)	0.86	($1,354)	0.68	$1,846	2.82
239	T12 60" 1 Lamp To Delamp CIE151	$3,282	N/A	$393	1.11	$3,804	16.44	$3,651	10.14
240	T12 72" 1 Lamp To Delamp CIE152	$7,243	N/A	$903	1.11	$8,430	16.44	$8,121	10.51
241	T12 96" 1 Lamp To Delamp CIE153	$60,800	N/A	$8,362	1.12	$71,570	16.44	$69,651	11.63
242	T8 2 Lamp 4' To LED 1 Lamp Linear 4' CIE178	($5,043)	0.80	($1,837)	0.92	($524)	0.98	$14,434	3.38
243	T8 2L 4', 28W, CEE V CDI132	$16,306	1.18	($55,730)	0.56	($25,373)	0.74	($3,171)	0.96
244	T8 3 Lamp 4' To LED 2 Lamp Linear 4' CIE177	($2,105)	0.85	($1,588)	0.88	($1)	1.00	$8,063	2.97
245	T8 3L 4', 28W, CEE V CDI133	$6,935	1.33	($12,528)	0.64	($1,118)	0.95	$4,214	1.23
246	T8 4L 4', 28W, CEE V CDI134	$16,613	1.25	($40,353)	0.60	($11,630)	0.84	$4,946	1.09
247	T8 5' To Refrigerated Display Case Lighting 5' LED - Cooler CIP180	($790)	0.37	($75)	0.85	($619)	0.40	$256	2.64
248	T8 5' To Refrigerated Display Case Lighting 5' LED - Freezer CIP182	($790)	0.37	($75)	0.85	($619)	0.40	$256	2.64
249	T8 6L or T5HO 4L Replacing 400-999 W HID V CDI135	$418,460	2.96	($25,775)	0.97	$564,806	2.87	$618,086	3.48
250	T8 HO 96" 2 Lamp To LED Low Bay 85 W3 CIE117	($1,674)	0.93	($3,754)	0.84	($947)	0.95	$11,873	2.64
251	T8 To 21" Tubular Skylight/Light Tube CIP188	($513)	0.59	$7	1.01	($231)	0.78	$644	4.82
252	T8 U-Tube 2 Lamp 2' To LED U-Tube CIE176	($466)	0.68	($143)	0.87	($255)	0.79	$615	2.81
253	Typical Custom Measure - Lighting CUS103	$167,953	1.52	$16,810	1.02	$368,488	1.96	$605,926	5.11
254	Typical Custom Measure - Non-Lighting CUS104	$102,880	1.26	($88,493)	0.87	$134,708	1.29	$431,727	3.48
255	Vending Machine Occ Sensor - Refrigerated Glass Front Cooler CIE187	$1,682	2.08	($350)	0.90	$1,379	1.86	$2,260	4.11
256	Vending Machine Occ Sensor - Refrigerated Beverage CIE186	$7,920	2.70	($1,040)	0.92	$6,757	2.30	$9,401	4.69
257	Vending Miser V CDI136	$16,535	2.75	($10,318)	0.70	$8,774	1.56	$11,142	1.83
258	VFD CHW Pump 20-100hp - Hospital CIP129	$120,238	37.83	$12,528	1.08	$153,600	14.81	$154,962	16.88
259	VFD CHW Pump 20-100hp - Hotel CIP123	$121,367	38.17	$8,185	1.05	$150,572	14.44	$151,934	16.44
260	VFD CHW Pump 20-100hp - Large Office CIP135	$68,869	22.09	$9,241	1.10	$90,464	12.99	$91,826	15.85
261	VFD CHW Pump <20hp - Hospital	$28,808		$2,407		$36,345		$36,591	

		Participant Test		RIM Test		TRC Test		UCT Test	
ID	Program Name	NPV $	BCR	NPV $	BCR	NPV $	BCR	NPV $	BCR
	CIE190		21.11		1.06		12.40		13.44
262	VFD CHW Pump <20hp - Hotel CIE195	$14,539	21.30	$682	1.04	$17,809	12.11	$17,932	13.11
263	VFD CHW Pump <20hp - Large Office CIE200	$16,479	12.50	$1,618	1.07	$21,192	10.09	$21,438	11.29
264	VFD Compressor CIE203	$7,653	2.26	($346)	0.98	$10,538	2.86	$13,879	6.97
265	VFD CW Pump 20-100hp - Hospital CIP131	$34,533	11.58	$5,744	1.12	$47,071	10.07	$49,083	16.45
266	VFD CW Pump 20-100hp - Hotel CIP125	($1,330)	0.59	$283	1.13	($173)	0.94	$1,839	3.66
267	VFD CW Pump 20-100hp - Large Office CIP137	$16,492	6.05	$3,448	1.14	$23,755	7.03	$25,767	14.37
268	VFD CW Pump <20hp - Hospital CIE192	$3,405	6.43	$540	1.11	$4,715	7.11	$5,091	13.84
269	VFD CW Pump <20hp - Hotel CIE197	($155)	0.42	($14)	0.89	($105)	0.52	$56	1.96
270	VFD CW Pump <20hp - Large Office CIE202	$1,511	3.41	$299	1.11	$2,267	4.54	$2,643	10.96
271	VFD HW Pump 20-100hp - Hospital CIP130	$101,456	32.07	$15,040	1.12	$134,271	14.66	$135,883	17.53
272	VFD HW Pump 20-100hp - Hotel CIP124	$128,158	40.25	$11,016	1.07	$161,357	14.80	$162,969	17.17
273	VFD HW Pump 20-100hp - Large Office CIP136	$67,034	21.53	$19,781	1.23	$98,908	14.30	$100,520	18.26
274	VFD HW Pump <20hp - Hospital CIE191	$10,579	17.88	$1,369	1.10	$13,871	12.01	$14,058	14.10
275	VFD HW Pump <20hp - Hotel CIE196	$5,735	22.35	$406	1.05	$7,164	12.49	$7,244	14.33
276	VFD HW Pump <20hp - Large Office CIE201	$6,965	12.11	$1,867	1.20	$10,158	11.08	$10,345	13.59
277	VFD Return Fan 20-100hp - Hospital CIP127	$31,961	10.79	$4,648	1.11	$42,994	9.55	$45,106	16.46
278	VFD Return Fan 20-100hp - Hotel CIP121	($34)	0.99	$113	1.03	$1,184	1.42	$3,296	5.78
279	VFD Return Fan 20-100hp - Large Office CIP133	$22,492	7.89	$4,703	1.15	$32,017	8.33	$34,129	16.12
280	VFD Return Fan <20hp - Hospital CIE188	$7,189	6.02	$947	1.09	$9,799	6.68	$10,657	13.28
281	VFD Return Fan <20hp - Hotel CIE193	($245)	0.66	($70)	0.87	($118)	0.80	$311	2.87
282	VFD Return Fan <20hp - Large Office CIE198	$4,917	4.43	$961	1.12	$7,165	5.57	$8,023	12.30
283	VFD Supply Fan <100hp - Hospital CIP132	$37,387	12.45	$5,784	1.12	$50,452	10.33	$52,564	16.95
284	VFD Supply Fan <100hp - Hotel CIP126	($1,691)	0.48	($451)	0.75	($1,312)	0.51	$800	2.39
285	VFD Supply Fan <100hp - Large Office CIP138	$29,684	10.09	$5,903	1.15	$41,597	9.54	$43,709	16.85
286	VFD Tower Fan 20-100hp - Hospital CIP128	$12,755	4.91	$9,977	1.51	$25,967	8.03	$28,204	20.33
287	VFD Tower Fan 20-100hp - Hotel CIP122	$18,620	6.70	$13,857	1.51	$36,682	9.94	$38,919	21.86
288	VFD Tower Fan 20-100hp - Large Office CIP134	($1,762)	0.46	$371	1.21	($552)	0.79	$1,685	4.72
289	VFD Tower Fan <20hp - Hospital CIE189	$2,538	2.77	$2,268	1.47	$5,713	5.06	$6,643	14.95
290	VFD Tower Fan <20hp - Hotel CIE194	$3,946	3.75	$3,200	1.49	$8,284	6.51	$9,214	17.06
291	VFD Tower Fan <20hp - Large Office CIE199	($946)	0.34	($37)	0.93	($652)	0.44	$279	2.19
292	Water Heater Pipe Insulation - 6' CDI139	$286,572	N/A	($43,293)	0.92	$374,055	4.44	$374,055	4.44
293	Water Heater Setback (manual adj) CDI140	$50,942	N/A	($52,784)	0.51	($122)	1.00	($122)	1.00
294	Window Film CIP139	$14	1.21	($9)	0.89	$20	1.35	$47	2.50

2015 ELECTRIC DSM PLAN – CAUSE NO. 44495

Energy efficiency measures considered for the programs were developed using existing Indiana utility program measures (whenever possible) and measures used in other programs in the region. It should be noted that in any plan measures within programs will change and adapt to changing technology and markets. The 2015 Plan shows a framework of measures and programs that can meet the savings goals; however, it is expected that new measures and opportunities will become available during this period and that some measures will phase out as standards change and they are no longer cost effective.

The technologies listed above were developed as a result of the EnerNOC MPS data and other study information in order to guide the plan design. Vectren then hired outside expertise to assist with plan design and development in order to refine the technologies above into a workable plan. Additionally, input into the plan design was obtained from various sources, such as current program managers and implementation partners, in order to establish a solid foundation for the 2015 Plan that is based on actual experience in Vectren’s territory. Other program information, such as current evaluations and best practices of other successful DSM programs, was used for adjustments to inputs. Lastly, Vectren received feedback and approval from the Oversight Board before finalizing. The result of these efforts, listed in Table 8-4 below, shows the DSM Programs benefit/cost data per the portfolio of programs filed under Cause No. 44495.

Table 8-4 Program Benefit/Cost Results for 2015 DSM Plan[1]

Commercial	TRC	UCT	RIM	Participant
Small Business Direct Install	2.00	2.21	0.83	3.66
Commercial & Industrial Prescriptive	3.75	5.44	1.02	3.25
Commercial & Industrial New Construction	1.09	2.72	0.87	1.00
Commercial & Industrial Custom	1.64	3.82	0.93	1.52
Commercial Sector Portfolio	**2.17**	**3.08**	**0.90**	**2.63**

Residential	TRC	UCT	RIM	Participant
Residential Lighting	2.18	2.88	0.85	2.94
Home Energy Assessments	1.02	1.02	0.56	NA
Income Qualified Weatherization	1.14	1.14	0.66	NA
Appliance Recycling	2.52	2.51	0.97	5.79
Residential Schools	1.89	1.89	0.72	NA
Efficient Products	1.51	2.02	1.05	1.13
Residential New Construction	1.28	1.52	0.75	1.89
Residential Behavior Savings	1.64	1.64	0.77	NA
Residential Sector Portfolio	**1.49**	**1.64**	**0.77**	**3.36**

Total Portfolio	**1.86**	**2.34**	**0.85**	**2.89**

Table 8-4 Program Benefit/Cost Results for 2015 DSM Plan Cont.[2]

Commercial	Lifetime Cost/ kWh	1st Year Cost/ kWh
Small Business Direct Install	$0.04	$0.32
Commercial & Industrial Prescriptive	$0.01	$0.15
Commercial & Industrial New Construction	$0.03	$0.36
Commercial & Industrial Custom	$0.02	$0.23
Commercial Sector Portfolio	**$0.03**	**$0.26**

[1] Commercial sector includes outreach costs for benefit/cost runs, and residential sector includes outreach and tracking costs for benefit/cost runs
[2] Commercial sector includes outreach costs for benefit/cost runs, and residential sector includes outreach and tracking costs for benefit/cost runs

Residential	Lifetime Cost/kWh	1st Year Cost/kWh
Residential Lighting	$0.03	$0.07
Home Energy Assessments	$0.08	$0.35
Income Qualified Weatherization	$0.07	$0.78
Appliance Recycling	$0.04	$0.16
Residential Schools	$0.04	$0.23
Efficient Products	$0.06	$0.67
Residential New Construction	$0.04	$0.92
Residential Behavior Savings	$0.06	$0.07
Residential Sector Portfolio	**$0.05**	**$0.18**
Total Portfolio	**$0.03**	**$0.21**

Commercial	TRC NPV $	UCT NPV $	Participant NPV $	RIM NPV $
Small Business Direct Install	$2,116,270	$2,319,485	$2,311,703	($888,566)
Commercial & Industrial Prescriptive	$3,072,637	$3,419,025	$2,406,007	$76,945
Commercial & Industrial New Construction	$40,071	$305,069	($32)	($71,053)
Commercial & Industrial Custom	$726,468	$1,376,727	($26,798)	$695,808
Commercial Sector Portfolio	**$5,805,446**	**$7,270,305**	**$5,193,787**	**($1,181,366)**

Residential	TRC NPV $	UCT NPV $	Participant NPV $	RIM NPV $
Residential Lighting	$929,179	$1,121,826	$1,838,832	($307,982)
Home Energy Assessments	$15,690	$15,690	$572,651	($572,019)
Income Qualified Weatherization	$115,688	$115,688	$416,861	($468,781)
Appliance Recycling	$320,800	$319,656	$470,616	($15,444)
Residential Schools	$113,569	$113,569	$182,611	($94,479)
Efficient Products	$352,915	$524,039	$82,526	$53,200
Residential New Construction	$39,816	$61,965	$50,858	($61,654)
Residential Behavior Savings	$274,885	$274,885	$487,718	($212,832)
Residential Sector Portfolio	**$1,992,542**	**$2,377,317**	**$4,102,673**	**($1,849,991)**
Total Portfolio	**$7,797,988**	**$9,647,622**	**$9,296,460**	**($3,031,357)**

The following programs were filed in the 2015 Plan in Cause No. 44495.

School Energy Efficiency Program

Program

The Energy Efficient Schools Program is designed to impact students by teaching them how to conserve energy and to produce cost effective electric savings by influencing students and their families to focus on conservation and the efficient use of electricity.

The program consists of a school education program for 5th grade students attending schools served by Vectren. To help in this effort, each child that participates will receive a take-home energy kit with various energy saving measures for their parents to install in the home. The kits, along with the in-school teaching materials, are designed to make a lasting impression on the students and help them learn ways to conserve energy.

Eligible Customers

The program will be available to selected 5th grade students/schools in the Vectren electric service territory.

Energy/Demand Savings

The proposed savings are attributed to the take-home kits provided to the elementary school children for parents to install. For modeling purposes, the energy savings estimate is 216 kWh per participant and .020 kW.

Table 8-5 School Energy Efficiency Program Data

Market	Program	Number of Participants	Energy Savings kWh	Peak Demand kW	Total Program Budget $
Residential	**Residential Schools**				
	2015	2,600	560,786	52	$ 128,033
Per Participant Avg Energy Savings (kWh)					216
Per Participant Avg Demand Savings (kW)					0.020
Participant Incremental Cost					$ -
Weighted Avg Measure Life					7
Net To Gross Ratio					96%

Residential Lighting Program

Program

The Residential Lighting Program is a market-based residential DSM program designed to reach residential customers through retail outlets. The program design consists of a buy-down strategy to provide the incentive to consumers to facilitate their purchase of energy-efficient lighting products. This program is justified based on direct energy savings targets, but also has a significant market transformation opportunity.

The program not only empowers customers to take advantage of new lighting technologies and accelerate the adoption of proven energy efficient technologies, but also allows the customers to experience the benefits of energy efficiency and decrease their energy consumption.

Eligible Customers

Any residential customer who receives electric service from Vectren is eligible.

Energy/Demand Savings

The program is designed to provide an incentive for the purchase and installation of CFL bulbs. For modeling purposes, the savings estimates per bulb are 32 kWh annually with demand savings of 0.004 kW.

Table 8-6 Residential Lighting Program Data

Market	Program	Number of Measures	Energy Savings kWh	Peak Demand kW	Total Program Budget $
Residential	Residential Lighting				
	2015	261,316	8,334,008	978	$ 596,567
Per Participant Avg Energy Savings (kWh)					32
Per Participant Avg Demand Savings (kW)					0.004
Participant Incremental Cost					$ 3.63
Weighted Avg Measure Life					6
Net To Gross Ratio					49%

Home Energy Assessments

Program

The Home Energy Assessment Program targets a hybrid approach that combines helping customers analyze and understand their energy use via an on-site energy assessment, as well as providing direct installation of energy efficiency measures including efficient low-flow water fixtures and CFL bulbs.

Collaboration and coordination between electric and gas conservation programs will be explored and, to the extent possible, implemented for greatest efficiencies.

Eligible Customers

Any residential customer who receives electric service from Vectren at a single-family residence is eligible, provided the home:

- Was built prior to 1/1/2010;
- Has not had an audit within the last three years; and,
- Is owner occupied or non-owner occupied where occupants have the electric service in their name.

Energy/Demand Savings

For modeling purposes, the energy savings estimate is 1,036 kWh and .164 kW per participant.

Table 8-7 Home Energy Assessments Program Data

Market	Program	Number of Participants	Energy Savings kWh	Peak Demand kW	Total Program Budget $
Residential	**Home Energy Assessments**				
	2015	2,000	2,072,900	328	$ 716,163
Per Participant Avg Energy Savings (kWh)					1,036
Per Participant Avg Demand Savings (kW)					0.164
Participant Incremental Cost					$ -
Weighted Avg Measure Life					6
Net To Gross Ratio					88%

Income Qualified Weatherization

Program

The Low Income Weatherization program is designed to produce long-term energy and demand savings in the residential market. The program will provide weatherization upgrades to low income homes that otherwise would not have been able to afford the energy saving measures. The program will provide direct installation of energy saving measures, educate consumers on ways to reduce energy consumption, and identify opportunities for additional weatherization measures.

Collaboration and coordination between gas and electric low income programs along with state and federal funding, is recommended to provide the greatest efficiencies among all programs.

Eligible Customers

The Residential Low Income Weatherization Program targets single-family homeowners and tenants, who have electric service in their name with Vectren and with a total household income up to 200% of the federally-established poverty level. Priority will be given to:

a. Single parent households with children under 18 years of age living in dwelling.
b. Households headed by occupants over 65 years of age.
c. Disabled homeowners as defined by the Energy Assistance Program (EAP).
d. Households with high energy intensity usage levels.

Energy/Demand Savings

For modeling purposes, the energy savings estimate is 1,822 kWh per participant annually with demand savings of 0.453 kW.

Table 8-8 Income Qualified Weatherization Program Data

Market	Program	Number of Participants	Energy Savings kWh	Peak Demand kW	Total Program Budget $
Residential	Income Qualified Weatherization				
	2015	564	1,027,651	256	$ 798,474
Per Participant Avg Energy Savings (kWh)					1,822
Per Participant Avg Demand Savings (kW)					0.453
Participant Incremental Cost					$ -
Weighted Avg Measure Life					15
Net To Gross Ratio					100%

Appliance Recycling

Program

The Residential Appliance Recycling program encourages customers to recycle their old inefficient refrigerators and freezers in an environmentally safe manner. The program recycles operable refrigerators or freezers so the appliance no longer uses electricity and is recycled instead of being disposed of in a landfill. An older refrigerator can use as much as twice the amount of energy as new efficient refrigerators. An incentive of $50 will be provided to the customer for each operational unit picked up.

Eligible Customers

Any residential customer with an operable secondary refrigerator or freezer receiving electric service from Vectren is eligible.

Incentive

The program offers customers free pick-up of working refrigerators or freezers and a $50 cash incentive.

Energy/Demand Savings

The program is designed to remove the old, secondary refrigerator or freezer. The savings estimate is 1,230 kWh per measure annually, with a summer demand savings of 0.397 kW.

Table 8-9 Residential Appliance Recycling Program Data

Market	Program	Number of Participants	Energy Savings kWh	Peak Demand kW	Total Program Budget $
Residential	**Appliance Recycling**				
	2015	1,058	1,301,338	420	$ 212,366
Per Participant Avg Energy Savings (kWh)					1,230
Per Participant Avg Demand Savings (kW)					0.397
Participant Incremental Cost					$ 92.96
Weighted Avg Measure Life					8
Net To Gross Ratio					53%

Residential Efficient Products

Program

To assist customers with the purchase of energy efficient products, prescriptive incentives will be provided on efficient electric measures and equipment (qualifying air conditioning units, heat pumps, thermostats, etc.) above the standard baseline. The program will be promoted through trade allies and appropriate retail outlets.

Eligible Customers

Any residential customer located in the Vectren electric service territory is eligible.

Incentive

Incentives are provided to customers to reduce the difference in first cost between the lower efficient technology and the high efficient option.

Energy/Demand Savings

For modeling purposes, the energy/demand savings estimates are 514 kWh annually per participant (measure) and demand savings of .403 kW.

Table 8-10 Residential Efficient Products Data

Market	Program	Number of Measures	Energy Savings kWh	Peak Demand kW	Total Program Budget $
Residential	**Efficient Products**				
	2015	1,500	771,461	605	$ 516,189
Per Participant Avg Energy Savings (kWh)					514
Per Participant Avg Demand Savings (kW)					0.403
Participant Incremental Cost					$ 421.53
Weighted Avg Measure Life					15
Net To Gross Ratio					73%

Residential Behavioral Savings Program

Program

The Residential Behavioral Savings (RBS) program motivates behavior change and provides relevant, targeted information to the consumer through regularly scheduled direct contact via mailed and emailed home energy reports. The report and web portal include a comparison against a group of similarly sized and equipped homes in the area, usage history comparisons, goal setting tools, and progress trackers. The Home Energy Report program anonymously compares customers' energy use with that of their neighbors of similar home size and demographics. Customers can view the past twelve months of their energy usage and compare and contrast their energy consumption/ costs with others in the same neighborhood. Once a consumer better understands how they use energy, they can then start conserving energy.

Program data and design was provided by OPower, the implementation vendor for the program. OPower provides energy usage insight that drives customers to take action by selecting the most relevant information for each particular household, which ensures maximum relevancy and high response rate to recommendations.

Eligible Customers

Residential customers who receive electric service from Vectren are eligible.

Energy/Demand Savings

To identify the measurable savings, Vectren proposes to have a set of customers who receive the letter with energy tips and suggestions and a set of control customers who do not receive the letter. The energy consumption of the 2 groups will be compared to determine the measurable savings. For modeling purposes, the annual energy savings was estimated at 126 kWh per participant with demand savings of .041 kW.

Table 8-11 Residential Behavioral Savings Program Data

Market	Program	Number of Participants	Energy Savings kWh	Peak Demand kW	Total Program Budget $
Residential	**Behavioral Savings**				
	2015	50,400	6,350,400	2,051	$ 432,202
Per Participant Avg Energy Savings (kWh)					126
Per Participant Avg Demand Savings (kW)					0.041
Participant Incremental Cost					$ -
Weighted Avg Measure Life					1
Net To Gross Ratio					100%

Residential New Construction

Program

The Residential New Construction Program will provide incentives and encourage home builders to construct homes that are more efficient than current building codes. The Residential New Construction Program will work closely with builders, educating them on the benefits of energy efficient new homes. Homes may feature additional insulation, better windows, and higher efficiency appliances. The homes should also be more efficient and comfortable than standard homes constructed to current building codes.

Program incentives are designed to be paid to both all-electric and combination homes that have natural gas heating and water heating. It is important to note that the program is structured such that an incentive will not be paid for an all-electric home that has natural gas available to the home site.

The Residential New Construction Program will address the lost opportunities in this customer segment by promoting energy efficiency at the time the initial decisions are being made. This will ensure efficient results for the life of the home.

Eligible Customers

Any home builder constructing a home to the program specifications in the Vectren electric service territory is eligible.

Incentives

Incentives will be based on a rating tier qualification and are designed to be paid to both all-electric and combination homes that have natural gas space heating.

Energy/ Demand Savings

For modeling purposes, the savings estimates per home are calculated at 1,898 kWh and .309 kW, based upon the blended savings estimate of all participating homes. The specific energy and demand impacts will vary by size and composition of the home and will be characterized through follow-up evaluation and verification procedures.

Table 8-12 Residential New Construction Program Data

Market	Program	Number of Participants	Energy Savings kWh	Peak Demand kW	Total Program Budget $
Residential	Residential New Construction				
	2015	68	129,048	21	$ 119,092
Per Participant Avg Energy Savings (kWh)					1,898
Per Participant Avg Demand Savings (kW)					0.309
Participant Incremental Cost					$ 844.56
Weighted Avg Measure Life					25
Net To Gross Ratio					95%

Commercial and Industrial Prescriptive Program

Program

The Commercial and Industrial (C&I) Prescriptive Program is designed to provide financial incentives on qualifying products to produce greater energy savings in the C&I market. The rebates are designed to promote lower electric energy consumption, assist customers in managing their energy costs and built a sustainable market around energy efficiency. Program participation is achieved by offering incentives structured to cover a portion of the customer’s incremental cost of installing prescriptive efficiency measures.

Eligible Customers

Any participating commercial or industrial customer receiving electric service from Vectren is eligible.

Incentive

Incentives are provided to customers to reduce the difference in first cost between the lower efficient technology and the high efficient option.

Energy/Demand Savings

For modeling purposes, the energy savings estimate is 487 kWh per participant (measure) and demand savings of .089 kW.

Table 8-13 Commercial and Industrial Prescriptive Program Data

Market	Program	Number of Measures	Energy Savings kWh	Peak Demand kW	Total Program Budget $
Commercial & Industrial	Commercial & Industrial Prescriptive				
	2015	10,470	5,103,942	935	$ 769,573
Per Participant Avg Energy Savings (kWh)					487
Per Participant Avg Demand Savings (kW)					0.089
Participant Incremental Cost					$ 102.29
Weighted Avg Measure Life					14
Net To Gross Ratio					80%

Commercial and Industrial Audit and Custom Efficiency Program

<u>Program</u>

The Commercial and Industrial Custom Program promote the implementation of customized energy saving measures at qualifying customer facilities. Incentives promoted through this program serve to reduce the cost of implementing energy reducing projects and upgrading to high-efficiency equipment. Due to the nature of a custom energy efficiency program, a wide variety of projects are eligible.

The technical audit or compressed air system study offers an assessment to systematically identify energy saving opportunities for customers and provides a mechanism to prioritize and phase-in projects that best meet customer needs. In turn, the opportunities identified from the audit can be turned in for the customized efficiency program. These two components work hand in hand to deliver energy savings to Vectren commercial and industrial customers.

<u>Eligible Customers</u>

Any participating commercial or industrial customer receiving electric service from Vectren is eligible.

<u>Incentive</u>

Vectren will provide a customer incentive based on the estimated kWh savings at a modeled rate of .12 cents per kWh, and is paid based on the first year annual savings reduction.

<u>Energy/Demand Savings</u>

The custom nature of the program makes it difficult to develop a prototypical example. Each building will have very site specific projects and impacts. For modeling purposes the energy/demand savings estimates are 95,248 kWh per participant (measure) and demand savings of 15.455 kW.

Table 8-14 Commercial and Industrial Audit & Custom Efficiency Program Data

Market	Program	Number of Projects	Energy Savings kWh	Peak Demand kW	Total Program Budget $
Commercial & Industrial	Commercial & Industrial Custom				
	2015	22	2,095,450	340	$ 488,274
Per Participant Avg Energy Savings (kWh)					95,248
Per Participant Avg Demand Savings (kW)					15.455
Participant Incremental Cost					$ 41,400.96
Weighted Avg Measure Life					12
Net To Gross Ratio					99%

<u>Commercial and Industrial New Construction Program</u>

<u>Program</u>

The Commercial and Industrial New Construction Program provides value by promoting energy efficient designs with the goal of developing projects that are more energy efficient than current Indiana building code. Incentives promoted through this program serve to reduce the incremental cost to upgrade to high-efficiency equipment over standard efficiency options for Vectren customers. The program includes equipment with easily calculated savings and provides straightforward and easy participation for customers.

Eligible Customers

Any participating commercial or industrial customer receiving electric service from Vectren is eligible.

Incentive

The program is designed to pay .12 cents per kWh saved up to $100,000 based on the first year energy savings determined in the final energy model.

Energy/Demand Savings

For modeling purposes the estimated energy/demand savings per participant are 35,100 kWh and 6.286 kW.

Table 8-15 Commercial and Industrial New Construction Program Data

Market	Program	Number of Participants	Energy Savings kWh	Peak Demand kW	Total Program Budget $
Commercial & Industrial	Commercial & Industrial New Construction				
	2015	14	491,400	88	$ 177,373
Per Participant Avg Energy Savings (kWh)					35,100
Per Participant Avg Demand Savings (kW)					6.286
Participant Incremental Cost					$ 24,517.34
Weighted Avg Measure Life					14
Net To Gross Ratio					95%

Small Business Direct Install

Program

The program provides value by directly installing energy efficient products such as high efficiency lighting, low flow water saving measures and vending machine controls. The program helps businesses identify and install cost effective energy saving measures by providing an on-site energy assessment customized for their business.

Eligible Customers

Any participating Vectren small business customer with a maximum peak energy demand of less than 300 kW is eligible.

Incentive

In addition to the low cost measures installed during the audit, the program will also pay a cash incentive of up to 75% of the cost of any recommended improvements identified through the audit.

Energy/Demand Savings

For modeling purposes the estimated energy/demand savings per participant are 6,001 kWh and 1.622 kW.

Table 8-16 Small Business Direct Install Program Data

Market	Program	Number of Projects	Energy Savings kWh	Peak Demand kW	Total Program Budget $
Commercial	**Small Business Direct Install**				
	2015	1,000	6,001,171	1,622	$ 1,909,188
Per Participant Avg Energy Savings (kWh)					6,001
Per Participant Avg Demand Savings (kW)					1.622
Participant Incremental Cost					$ 868.98
Weighted Avg Measure Life					10
Net To Gross Ratio					100%

DSM Portfolio Objective and Impacts

Vectren plans to reduce residential and commercial/industrial customer usage by 34,240 MWh in 2015. Vectren also projects to achieve a reduction in summer peak demand of 7.69 MW in 2015. In implementing these programs, consideration will be given to utilizing small businesses when feasible. Table 8-17 outlines the portfolio and the associated programs, as well as the projected energy/demand impacts, program costs, and customer participation of DSM programs offered under Cause No. 44495.

Table 8-17 Projected Energy and Peak Savings – Cause No. 44495

COMMERCIAL	2015 kWh Total	2015 kW
Small Business Direct Install	6,001,171	1,622
Commercial & Industrial Prescriptive	5,103,942	935
Commercial & Industrial New Construction	491,400	88
Commercial & Industrial Custom	2,095,450	340
Commercial Total	**13,691,963**	**2,985**

RESIDENTIAL	2015 kWh Total	2015 kW
Residential Lighting	8,334,008	978
Home Energy Assessments	2,072,900	328
Income Qualified Weatherization	1,027,651	256
Appliance Recycling	1,301,338	420
Residential Schools	560,786	52
Efficient Products	771,461	605
Residential New Construction	129,048	21
Behavior Savings	6,350,400	2,051
Residential Total	**20,547,593**	**4,711**

While Vectren believes this level of savings is achievable, it will require robust programs for all classes of retail customers.

Given the market assessment, collaborative process, portfolio cost/benefit modeling efforts, and DSM program portfolio proposal, Vectren used the projected demand-side reductions from the programs as an input into the IRP process, rather than allowing the integration modeling to independently select some level of DSM to meet customer requirements. With respect to DSM, the programs that pass cost effectiveness testing are input into the integration analysis as a resource. IRP DSM modeling is discussed later in this chapter.

Customer Outreach and Education

Program

This program will raise awareness and drive customer participation as well as educate customers on how to manage their energy bills. The program will include the following goals as objectives:

- Build awareness;
- Educate consumers on how to conserve energy and reduce demand;
- Educate customers on how to manage their energy costs and reduce their bill;
- Communicate Vectren's support of customer energy efficiency needs; and
- Drive participation in the DSM programs.

This annual program will include paid media, web-based tools to analyze bills, energy audit tools, and energy efficiency and DSM program education and information. Informational guides and sales promotion materials for specific programs will also be included.

Vectren will oversee the outreach and education programs for the DSM programs. Vectren will utilize the services of communication and energy efficiency experts to deliver the demand and energy efficiency message.

Eligible Customers

Any Vectren electric customer will be eligible.

Energy/Demand Savings

This communications effort differs from typical DSM programs in that there are no direct estimates of participants, savings, costs, and cost-effectiveness tests. Such estimates are considered impractical for these types of overarching efforts to educate consumers and drive participation in other DSM programs. The California Standard Practice Manual (p. 5) addresses this issue as follows:

"For generalized information programs (e.g., when customers are provided generic information on means of reducing utility bills without the benefit of on-site evaluations or customer billing data), cost-effectiveness tests are not expected because of the extreme difficulty in establishing meaningful estimates of load impacts."

This effort is the key to achieving greater energy savings by convincing the families and businesses making housing/facility, appliance and equipment investments to opt for greater energy efficiency. The first step in convincing the public and businesses to invest in energy efficiency is to raise their awareness. It is essential that a broad public education and outreach campaign not only raise awareness of what consumers can do to save energy and control their energy bills, but to prime them for participation in the various DSM programs. The budget is $150,000 each for Residential and Commercial programs, for a total of $300,000.

Table 8-18 DSM Outreach & Education Program Budget

Customer Outreach	Residential	Business	Total Program Costs
Outreach	$150,000	$150,000	$300,000

IRP DSM MODELING

Vectren continues to support DSM related energy efficiency efforts as a fundamental part of the services that are provided to customers in order to help them manage their energy bills. The Market Potential study, developed by EnerNoc on behalf of the Vectren Oversight Board, illustrated a level of ongoing DSM energy efficiency is cost effective and Vectren believes the inclusion of the described level of ongoing DSM energy efficiency is best reflected in the base case sales forecast. DSM energy efficiency programs included in the base sales forecast are available to all customer classes at a targeted level of 1% eligible annual savings for 2015 – 2019 and 0.5%

annually thereafter for customer load that has not opted-out of DSM programs. Vectren believes that a cost effective level of DSM energy efficiency may be supported by policy considerations beyond capacity planning which are not always captured in the IRP modeling process.

Vectren did model the option of offering DSM energy efficiency programs designed to achieve more than the level reflected in the base case sales forecast to determine if it is selected as a resource to meet future electric requirements. Vectren's approach attempts to balance its commitment to a level of cost-effective DSM, while evaluating additional DSM resources consistent with least cost planning. Below is a list of major assumptions included in Vectren's IRP DSM modeling.

Vectren began by creating savings blocks based on 0.5% of eligible sales based on a projection that 80% of large customers will opt out of Vectren sponsored DSM programs. The maximum amount of possible additional DSM that could be selected was 2% (embedded savings + additional modeled blocks) in 2018-2019. Beyond 2019, the model was limited to selecting 1.5% (embedded + additional modeled blocks) of total eligible sales, consistent with the proposed Clean Power Plan (111d). Levelized costs were based on the Market Potential study and Vectren's 2015 Plan. Consistent with the Market Potential study, each block cost more than the last and increased over time. Levelized costs of energy saved began at approximately 3 cents per kWh for the first available block in 2015 and increased to approximately 6.4 cents for the last available block in 2034. In order to minimize ramping costs, DSM programs were required to run for at least 3 consecutive years.

Based on these assumptions, DSM successfully competed with resource alternatives within the planning model to help meet future load requirements. DSM was selected in several resource plans as discussed further in Chapter 10 Generation Planning.

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CHAPTER 9

TRANSMISSION AND DISTRIBUTION PLANNING

INTRODUCTION

In accordance with IURC Rule 170 IAC, Vectren analyzed its transmission and distribution system's ability to meet future electric service requirements reliably and economically through the year 2034. This chapter describes the criteria applied in the analysis and the system conditions studied. The study was conducted to maintain compliance with the requirements of the Midcontinent Independent System Operator (MISO), the *Reliability* First (RF) in conjunction with NERC requirements, as well as Vectren's internal planning criteria. Internal Long Range Plans are completed annually. In addition, Vectren has worked closely with MISO Transmission Expansion Plans (MTEP) and RF in performing regional studies, which include proposed projects identified in Vectren studies.

Modeling of the transmission system was conducted with steady-state conditions using the Power Technologies Inc.'s Power System Simulator Program for Engineers (PTI-PSS/E). The models and the studies and assessment on these models comply with all NERC, RF, MISO and IURC requirements, and they include real and reactive flows, voltages, generation dispatch, load, and facilities appropriate for the time period studied. The primary criteria for assessing the adequacy of the internal Vectren transmission system were (1) single contingency outages of transmission lines and transformers during peak conditions, and (2) selected double and multiple contingencies. Interconnections were also assessed by examining single, double, and other multiple contingencies.

In addition, short circuit models were developed and analyzed through the use of Advanced Systems for Power Engineering, Inc.'s short circuit program (ASPEN-OneLiner).

Dynamic simulation was also performed using PTI-PSS/E to examine the performance of the interconnected transmission system to various electrical faults. The Vectren system remains stable for a variety of faulted conditions.

METHODOLOGY

The distribution system review covers native load as described in previous chapters in this IRP. The Transmission system review also covers loads connected to Vectren's transmission system such as municipals and Independent Power Producers (IPP's) that Vectren is not obligated to serve or include in its generation resources. The primary reason is to determine impacts or limitations in the transmission capacity to serve the Vectren native load. Vectren adheres to the transmission planning criteria developed and published by MISO in its document MISO *Transmission Expansion Planning*; (MTEP) and by RF through NERC in its *Reliability Standards* under *Transmission Planning (TPL-001 through TPL-004)*.

The basis for the selection of RF reliability criteria offers five points for member recognition.

1. The need to plan bulk electric systems that will withstand adverse credible disturbances without experiencing uncontrolled interruptions.

2. The importance of providing a high degree of reliability for local power supply but the impossibility of providing 100 percent reliability to every customer or every local area.

3. The importance of considering local conditions and requirements in establishing transmission reliability criteria for the local area power supply and the need, therefore, to view reliability in local areas primarily as the responsibility of the individual RFC members. However, local area disturbances must not jeopardize the overall integrity of the Bulk Electric System.

4. The importance of mitigating the frequency, duration and extent of major Bulk Electric System outages.

5. The importance of mitigating the effect of conditions that might result from events such as national emergencies, strikes, or major outages on other regional networks.

SYSTEM INTEGRITY ANALYSIS – 2013 (SEASONAL ANNUAL, INCLUDES SPRING, SUMMER, FALL, AND WINTER)

Based on initial conditions for load, generation, and system topology the following tests were conducted.

1. Single contingency:
   - Outage of any line
   - Outage of any transformer
   - Outage of any generator
2. Multiple contingencies:
   - Double outage of any combination of generators, lines and transformers
   - Double outages of generators
   - Sensitivity outages: two lines or transformers under different Generation dispatch scenarios
3. Extreme Contingencies:
   - Loss of all generation at a plant site
   - Loss of entire switchyard with associated load, generation and line connectivity where three or more 100kV or higher voltage lines are connected

As a result of these tests, various system operational or construction improvements have been postulated. These improvements may be either operator action, (such as shifting generation or switching lines), or the installation of actual substations, the construction of transmission lines, or the upgrading of facilities. Required construction improvements have been prioritized by where they fall in the contingency spectrum. Improvements that must be made in response to a single line outage have higher priority than improvements resulting from a more unlikely occurrence.

SYSTEM INTEGRITY ANALYSIS – 2018 (NEAR TERM – WITHIN 1-5 YEARS)

Using updated load and generation forecasts and included planned upgrades, the same analysis is performed for the 2013 system. Contingency analysis is also the same as for the 2013 system.

SYSTEM INTEGRITY ANALYSIS – 2022 (LONG TERM – 6-10 YEARS)

Using updated load and generation forecasts and included planned upgrades, the same analysis is performed for the 2013 system. Contingency analysis is the same as for the 2013 system.

TRANSMISSION ADEQUACY SUMMARY TABLE

Table 9-1 shows the Vectren generation and load resources, as summarized from previous chapters, as well as the generation and load resources expected to be served from the transmission system for the entire Vectren Local Balancing Authority (LBA) as coordinated by MISO.

Table 9-1 Transmission Import Adequacy/Shortfall Assessment

Year	Vectren Available Gen (MW)[1]	IPP's & other Gen (MW)	Vectren Firm Peak Demand (MW)[2]	Muni's & Other Load (MW)	Proj. Inter-Change (MW)	Trans. System Import Cap (MW)
2014	1,155	596	1,145	690	-84	728
2015	1,155	680	1,155	690	-10	802
2016	1,155	680	1,156	690	-11	801
2017	1,155	680	1,113	690	32	844
2018	1,155	680	1,109	690	36	848
2019	1,155	680	1,106	690	39	851
2020	1,155	680	1,106	690	39	851
2021	1,155	680	1,106	690	39	851
2022	1,155	680	1,107	690	38	850
2023	1,155	680	1,107	690	38	850
2024	1,155	680	1,107	690	38	850
2025	1,155	680	1,106	690	39	851
2026	1,155	680	1,106	690	39	851
2027	1,155	680	1,107	690	38	850
2028	1,155	680	1,109	690	36	848
2029	1,155	680	1,110	690	35	847
2030	1,155	680	1,111	690	34	846
2031	1,155	680	1,111	690	34	846
2032	1,155	680	1,113	690	32	844
2033	1,155	680	1,114	690	31	843
2034	1,155	680	1,115	690	30	842

The table reflects that if all available internal generation is on line the expected net interchange would be negative for years 2014 through 2016 and positive or exporting for all years beyond 2017. This reliability measure indicates that additional import transmission capacity is not needed for our generation to serve our load. However, the table does not reflect several other factors such as potential purchases and sales. The

[1] Values from Table 10-1 Characteristics of Existing Generation Resources
[2] Values from Table 5-4 Base Case Demand Forecast

table reflects total generation capability and not a reasonable economic dispatch under all conditions. It is likely that renewable energy resources may be imported using the transmission system in lieu of running local generation. It is assumed that the gas peaking turbines would likely not be dispatched during some near peak summer conditions, in which it is not only possible, but likely that the expected interchange could be importing 300-400 MW. These values are also supported by actual historical interchange. In any event, MISO will dispatch the available resources to serve the load based on N-1 contingency analysis and economics and losses. With the largest generation resource on the Vectren system at 300 MW, the transmission system capacity is adequate under reasonable expected resource dispatches and contingencies and additional growth. Within each PSS/E case, the actual load, generation dispatch, firm purchases and sales, and expected interchange is appropriate for the time period.

RECOMMENDATIONS: 2014 - 2034

No transmission facilities were identified specifically due to proposed generation interconnections, transmission service requests or energy resources in this IRP process. Since the projected load growth is essentially flat and no new generation resources or retirements are planned, no new transmission facilities have been identified. In addition, significant upgrades were constructed in 2012 as a result of the MISO Regional Expansion Criteria and Benefits (RECB) process. The completed projects include the construction of a new 345 kV line from the Duke Gibson Station to the Vectren AB Brown Station to the BREC Reid Station. The Duke Gibson to Vectren AB Brown to BREC Reid EHV Substation is complete and energized. This project also included the construction of a 345/138 kV substation at Vectren's AB Brown Station which is also complete. A new 138kV line (Z77) from FB Culley Substation to Oak Grove Substation to Northeast Substation is complete. This facility allows for better generation dispatch diversity with lower congestion costs under contingencies. However, recent generation and load changes in the Commonwealth of Kentucky are expected to impact the Vectren system due to flow through congestion. MISO is considering Market Congestion Projects for mitigation of the projected congestion costs, and a project will only move forward if the benefits exceed the costs metric. Multiple distribution substation upgrades were completed to include Bergdolt and Libbert Substations. Leonard Rd 69kV Switching substation should be complete in 2014 and will support a greater number of contingencies for substransmission on Evansville's west side. Demand side management and energy conservation is expected to provide some load reduction on the Vectren system.

Local load growth areas have been identified for potential new business loads. Near term projections indicate the need for at least 2 more distribution substations tentatively identified as Roesner Road and Princeton South areas, as well as potentially a new plant.

The specific projects to be completed in the future years will depend on the load growth, the location of generation facilities, and/or on the source of purchased power. General recommendations are as follows:

1. A number of 69 kV transmission upgrades will be needed. An engineering evaluation will be conducted for upgrading the identified lines to higher operating temperature and for reconductoring some lines.
2. A number of substations will need to be modified.
3. Several new 138 and 69 kV lines and substations are planned to be added in this timeframe.
4. New high voltage interconnections with neighboring utilities are being investigated, including 345 kV facilities, to improve import capability and improve regional reliability.
5. If new generation capacity is added within the Vectren system, transmission facilities would also be planned to incorporate the new power source.

6. If new generation capacity were acquired outside the Vectren system, additional new interconnections may be needed. These projects would be investigated and would require involvement of other utilities.

All of these potential transmission projects would be planned with and coordinated through the MISO.

COST PROJECTIONS:

Vectren is projecting its annual transmission, substation, and distribution expenditures to remain flat to slightly decrease over the next five years. The primary factors are that there is not a recommendation to add new generation sources in this IRP that causes new construction and the existing transmission system is adequate for full deliverability of the existing generation sources. A reason for part of the decrease is the 345kV project was completed in 2012 and spending in following years are expected to be lower. However, the Federal Stimulus Plan funding is expected to force some transmission and distribution relocations increasing in some areas due to roadway improvements. Approximately half of these are expected to be reimbursable with the remaining cost incurred by Vectren. Also, increasing demands for Smart Grid technology and infrastructure are resulting in some additional expenditure. New business and load growth forecast is expected to stay relatively flat. The need for import capability due to generation additions and retirements are expected to remain mostly unchanged as well. Tables 9-2 and 9-3 reflect both previous annual costs and projected annual spend:

Table 9-2 Actual Expenditures

	Dist. Feeder	Dist. Substation	Trans. Lines	Trans. Substation
2009	$27.3M	$5.2M	$27.2M	$20.2M
2010	$15.4M	$5.2M	$40.6M	$10.5M
2011	$26.6M	$6.5M	$24.8M	$1.4M
2012	$19.2M	$4.6M	$33.5M	$4.7M
2013	$23.8M	$2.8M	$14.9M	$4.8M

Table 9-3 Planned Expenditures

	Dist. Lines	Dist. Substation	Trans. Lines	Trans. Substation
2014	$28.9M	$4.3M	$8.5M	$4.5M
2015	$27.0M	$5.8M	$7.4M	$4.8M
2016	$27.0M	$7.9M	$5.2M	$4.8M
2017	$27.5M	$6.7M	$8.8M	$2.3M
2018	$27.6M	$4.5M	$8.6M	$4.3M

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CHAPTER 10

GENERATION PLANNING

INTRODUCTION

The purpose of the generation plan is to develop the optimal strategy for adding the resources as necessary to reliably meet the future demand requirements of Vectren's electric customers. The plan is integrated in that both supply-side and demand-side alternatives were considered and evaluated. The optimal plan is defined as the best possible combination of resource additions that result in reliable service at the lowest cost to customers over the twenty year planning horizon. The optimal resource plan is determined by evaluating all of the possible resource combinations and choosing the plan that minimizes the Net Present Value (NPV).

APPROACH

The process of determining the best resource plan was approached as an optimization problem. Vectren's consultant, Burns and McDonnell, utilized the Strategist software tool developed and supported by Ventyx of Atlanta, GA. Strategist is a strategic planning system that integrates financial, resource, marketing, and customer information. Strategist allows for addressing all aspects of integrated planning at the level of detail required for informed decision making. Strategist handles production costing, capital expenditure and recovery, financial and tax implications, and optimization all within one software system.

An optimization method has three elements: an objective, constraints, and alternatives. For the electric integration process, the three elements can be summarized as follows:

Objective

The objective of the integration analysis was to determine the optimal resource plan by minimizing the NPV. For the purposes of this discussion, the planning period NPV is defined as the net present value of operating costs including fuel plus capital costs. Power purchases and sales are also included in the NPV analysis for the 20 year period, 2015 – 2034. NPV numbers were developed by integrating three scenarios with four different energy forecasts. The generation options within the scenarios, along with the alternative generation (discussed in Chapter 6 Electric Supply Analysis and Chapter 7 Renewables and Clean Energy), additional DSM (discussed in Chapter 8 DSM Resources) and purchasing capacity from the market were compared against the capacity needs of the four energy forecasts yielding twelve plans of the least cost NPV. These twelve plans were then vetted against multiple sensitivities to see which plan would be the most versatile given a wide range of possible outcomes.

Constraints

The primary constraint was to maintain a minimum planning reserve margin (PRM). MISO has moved to an unforced capacity (UCAP) PRM in the last couple of years. The UCAP accounts for the amount of installed capacity (ICAP) or nameplate capacity available at system's mega-watt peak hour of the peak day after discounting for the time that the generating facility is not available due to historical outages such as maintenance and repairs. The UCAP PRM is subject to change each year depending on MISO's projected need. For the year 2014, MISO set forth a UCAP PRM of 7.3%. This means that Vectren must maintain at least 7.3% over the peak demand of its customers on a UCAP basis. The goal is to determine the minimum planning reserve margin that would result in the MISO system experiencing less than one loss of load event every ten years. Other constraints include the project development and build times for new construction alternatives, transmission import constraints, reliability considerations, and the characteristics of existing resources and demand.

Alternatives

A broad array of alternative generation and DSM was included in the optimization analysis. The full range of supply-side resource alternatives were identified and discussed in Chapter 6 Electric Supply Analysis. Likewise, the demand-side alternatives were covered in Chapter 8 DSM Resources.

DISCUSSION OF KEY INPUTS AND ASSUMPTIONS

The NPVs were determined by evaluating all of the pertinent costs that could impact future resource additions. The NPVs include the operating and maintenance (O&M) costs of existing and new facilities and the financial costs associated with capital investments. O&M costs include both fixed and variable expenses such as fuel, production labor, maintenance expenses, and chemical costs for environmental controls.

Please note that this analysis does not explicitly include all of Vectren's Power Supply and Energy Delivery costs related to serving retail electric customers. Costs that would be common to all of the potential resource plans (e.g., allocated admin and general costs, transmission and distribution costs, other embedded costs, etc.) were not included because they had no impact on the comparative economic analysis. The considered costs were primarily related to O&M and new capital associated with power generation activities. Therefore, comparisons between the base case and alternate scenarios should be viewed within this context.

Electric Demand Forecast

As mentioned in the prior section, the electric peak and energy forecast is discussed in detail in Chapter 5 Sales & Demand Forecast. The four demand forecast results used in the optimization analysis are summarized in Table 5-3. The four forecasts consist of a base, a low, and two separate high demand forecasts.

Characteristics of Existing Generating Resources

The operating characteristics of existing Vectren owned electric generating resources, as they were simulated for the purposes of the integration analysis are summarized in Table 10-1. These characteristics were applied to all years of the study period.

Table 10-1 Characteristics of Existing Generating Resources

Resource Name	UCAP (MW)	Primary Fuel	Resource type	EFOR (%)	Estimated Full Load Heat Rate (Btu/kwhn)
AB Brown 1	228	coal	steam	4.9	10,800
AB Brown 2	233	coal	steam	3.6	10,700
FB Culley 2	83	coal	steam	7.4	11,700
FB Culley 3	257	coal	steam	4.3	10,400
Warrick 4	135	coal	steam	10.2	10,200
AB Brown 3	73	gas	combustion turbine	0.0	12,000
AB Brown 4	69	gas	combustion turbine	3.6	11,700
BAGS 2	59	gas	combustion turbine	3.6	13,000
Northeast 1	9	gas	combustion turbine	2.7	15,000
Northeast 2	9	gas	combustion turbine	2.7	15,000
Blackfoot[1]	3	landfill gas	IC engine	5.0	9,000

Existing Purchased Power

Vectren has an existing and ongoing firm purchased capacity and energy commitment with the Ohio Valley Electric Corporation (OVEC). The UCAP of this commitment equals 30 MW. It was also assumed that this resource would be present throughout the 20-year study period.

Finally, as discussed in Chapter 7 Renewables and Clean Energy, Vectren has two long-term purchase power agreements for wind energy. These purchases were assumed to be in place for the entire IRP study period. The UCAP for Vectren's wind capacity is approximately 9.1% or 7.3 MW of the 80 MW of wind.

[1] Blackfoot is "behind the meter" and is accounted for as a credit to load

Fuel Prices

The cost of fuel is one of the largest cost components of the analysis. Therefore, the assumptions that are made regarding future fuel prices are a very important variable for developing a least cost resource plan.

Vectren utilized data from three sources to develop the fuel price forecasts for this IRP. The natural gas price forecast is an average of U.S. Energy Information Administration (EIA) Annual Energy Outlook (AEO) 2014 Reference case[1], Wood Mackenzie long term forecast[2], and Black & Veatch's natural gas forecast[3]. Basis assumptions were applied to simulate the delivered burner tip gas cost to Vectren generators. To develop the coal price forecast; Vectren utilized the same three sources and averaged their coal forecasts together to develop the IRP forecast.

An important factor to consider when developing or analyzing long-term fuel price forecasts is the impact that the Clean Power Plan (discussed in Chapter 4 Environmental) may have on the forecasts. Another factor to consider is the uncertainty of markets in the future. The further out the forecast goes the more uncertain the projection becomes. Market conditions and customer demand are continually evaluated when procuring fuel for use in Vectren's electric generation units. Vectren maintains an adequate supply of coal in physical inventory on the ground at each of plant location to ensure reliable service to customers as a prudent contingency in the event of unforeseen supply interruptions due to weather, labor, etc. Table 10-2 shows the average annual delivered base case fuel price forecasts for coal and natural gas.

[1] Included in the Technical Appendix, section E
[2] Wood Mackenzie long term forecasts are subscription based and proprietary.
[3] Black and Veatch's long term forecasts are subscription based and proprietary.

Table 10-2 Base Fuel Price Projection

IRP Base Case Delivered Forecasts		
	Real 2014$/MMBtu	
Year	**Coal**	**Natural Gas**
2015	2.57	4.65
2016	2.54	4.86
2017	2.54	5.03
2018	2.59	5.31
2019	2.62	5.46
2020	2.60	5.66
2021	2.61	5.71
2022	2.64	5.72
2023	2.63	5.82
2024	2.67	6.06
2025	2.65	6.15
2026	2.65	6.28
2027	2.67	6.33
2028	2.68	6.43
2029	2.71	6.59
2030	2.71	6.72
2031	2.71	6.82
2032	2.74	6.99
2033	2.80	7.16
2034	2.81	7.35

Environmental Considerations

Chapter 4 Environmental discusses environmental issues in detail. Variable cost impacts associated with running FGD, SCR and other environmental equipment were included in the revenue requirement calculations as part of the integration analysis.

Financial Assumptions

The financial assumptions with respect to capital investments required to add new construction resource alternatives are summarized in Chapter 6 Electric Supply Analysis. Additional information can be found in the Technology Assessment in the Technical Appendix, section B. Additional information regarding the projected costs energy efficiency programs can be found in Chapter 8 DSM Resources. The declining costs of utility scale solar (50 MW blocks) were modeled as an asymptotic curve beginning at $1,880 per KWac in 2014 and declining to $1,500 per KWac in 2020 and staying flat in real terms for the remainder of the planning horizon.

General Inflation Forecast

The general inflation forecast used in the assumptions is 1.6%. This inflation rate comes from the Federal Reserve Bank of St. Louis. This is also very close to the compound annual growth rate used in the EIA AEO 2014 for the years that are covered in the IRP.

Additional Considerations

The energy industry landscape has been changing at a fast pace, affecting both electric utilities and their customers. Although there is little clarity on how the state of Indiana will choose to implement the EPA's Clean Power Plan, it could drive substantial changes to the mix of resources available to meet customer electric demand. The EPA's MATS rule has resulted in numerous announcements of coal plant retirements across the US. As a result, MISO is predicting potential capacity shortfalls in the next few years. With low natural gas prices, some large industrial customers are considering generating their own electricity, which could affect future energy forecasts. Additionally, the proportion of residential and commercial customers installing solar panels to generate electricity continues to rise, which will effectively lower future demand for energy from the system.

Vectren has taken all of these factors into consideration in the 2014 IRP by either modeling assumed inputs, as is the case with customer-owned solar panels, or outside of modeling in the risk analysis. The combination of these factors makes the future very uncertain. Vectren continues to evaluate these developments and plan for the future with an emphasis on keeping costs as low and fair as possible for all customers, while maintaining reliability and meeting regulations.

INTEGRATION ANALYSIS RESULTS

Base Demand Forecast (Growth Scenario 1)

Plans A-1 B-1 and C-1 represent the base demand forecast in combination with the three basic portfolio themes of “A”- Base (serve customers with existing resources & DSM), “B” – FB Culley 2 Unit Retirement Scenario and “C” – Renewable Portfolio Standard. It should be noted that no new capacity is required under this load forecast. Therefore, the resource additions in plan C-1 are driven by the renewable energy constraints unique to the renewable portfolio scenario.

This case represents the base set of assumptions and inputs as presented in the preceding sections of this chapter. For this analysis, no additional constraints were introduced that would prevent the planning model from selecting the set of future supply-side or demand side resources that resulted in the lowest NPV.

Table 10-3 shows the resource plan for the base demand forecast and the associated NPV’s. Plans A-1 and B-1 are essentially the same with only about 0.5 % difference in the NPV’s. Plan C-1 which is 2.4% higher reflects the capital expense of additional renewable resources. All three plans are the same through 2019 where a DSM block is selected in the more expensive plan C-1. This will be re-evaluated in future IRP cycles as various uncertainty factors are resolved over time.

Table 10-3 Base Demand Forecast (Growth Scenario 1)

Energy Sales Case :	**Base Demand Forecast**		
Scenario :	**Base**	**FB Culley 2 Unit Retirement**	**RPS[1]**
Plan ID :	**Plan A1**	**Plan B1**	**Plan C1**
2015			
2016			
2017			
2018			
2019			0.5% DSM[2] Block (2019-2034)
2020		Shutdown FB Culley 2	0.5% DSM Block (2020-2034)
2021			
2022			
2023			
2024			Solar PV (1x50 MW)
2025			Solar PV[3] (4x50 MW)
2026			
2027			
2028			
2029			
2030			
2031			
2032			
2033			
2034			
NPV[4]	$4,874,614	$4,848,213	$4,991,616
% Difference	0.0%	-0.5%	2.4%

[1] RPS = Renewable Portfolio Standard
[2] DSM = Demand Side Management
[3] PV = Photovoltaic
[4] Net Present Value inclusive of wholesale adjustment (2014 $)

Low Demand Forecast (Growth Scenario 2)

Plans A-2, B-2 and C-2 represent the low demand forecast in combination with the three basic portfolio themes of “A”- Base (serve customers with existing resources & DSM), “B” – FB Culley 2 Unit Retirement Scenario and “C” – Renewable Portfolio Standard. It should be noted that no new capacity is required under this load forecast. Therefore, the resource additions in plan C-2 are driven by the renewable energy constraints unique to the renewable portfolio scenario.

This case represents the base set of assumptions and inputs as presented in the preceding sections of this chapter. For this analysis, no additional constraints were introduced that would prevent the planning model from selecting the set of future supply-side or additional demand side resources that resulted in the lowest NPV.

Table 10-4 shows the resource plan for the base demand forecast and the associated NPV’s. Plans A-2 and B-2 are essentially the same with only about 0.7 % difference in the NPV’s. Plan C-2 which is 2.1% higher reflects the capital expense of additional renewable resources. All three plans are the same through 2017 where a DSM block is selected in the more expensive plan C-2.

Table 10-4 Low Demand Forecast (Growth Scenario 2)

Energy Sales Case :	Low Demand Forecast		
Scenario :	**Base**	**FB Culley 2 Unit Retirement**	**RPS[1]**
Plan ID :	**Plan A2**	**Plan B2**	**Plan C2**
2015			
2016			
2017			0.5% DSM[2] Block (2017-2034)
2018			
2019			
2020		Shutdown FB Culley 2	0.5% DSM Block (2020-2034)
2021			
2022			
2023			
2024			
2025			Solar PV[3] (4x50 MW)
2026			
2027			
2028			
2029			
2030			
2031			
2032			
2033			
2034			
NPV[4]	$4,771,789	$4,739,585	$4,871,859
% Difference	0.0%	-0.7%	2.1%

[1] RPS = Renewable Portfolio Standard
[2] DSM = Demand Side Management
[3] PV = Photovoltaic
[4] Net Present Value inclusive of wholesale adjustment (2014 $)

High (modeled) Demand Forecast (Growth Scenario 3)

Plans A-3, B-3 and C-3 represent the High (modeled) demand forecast in combination with the three basic portfolio themes of “A”- Base (serve customers with existing resources & DSM), “B” – FB Culley 2 Unit Retirement Scenario and “C” – Renewable Portfolio Standard. It should be noted that no new capacity is required under this load forecast as can be seen in case A-3. However, the assumed retirement of Culley unit 2 in 2020 in conjunction with the increase in load drives some capacity additions in case B-3. The resource additions in plan C-3 are driven by the renewable energy constraints unique to the renewable portfolio scenario. However, the timing of the resources is slightly different due to interim renewable constraint in the renewable portfolio scenario.

This case represents the base set of assumptions and inputs as presented in the preceding sections of this chapter. For this analysis, no additional constraints were introduced that would prevent the planning model from selecting the set of future supply-side or additional demand side resources that resulted in the lowest NPV.

Table 10-5 shows the resource plan for the high (modeled) demand forecast and the associated NPV’s. Plans A-3 and B-3 are essentially the same with only about 0.3% difference in the NPV’s. Plan C-3 which is 2.1% higher reflects the capital expense of additional renewable resources. The higher load growth in combination with the assumed retirement of Culley 2 suggests that more energy efficiency measures should be implemented soon if that combination of were to occur. However, a mere 0.2% difference in the NPV’s between plan A-3 and B-3 is not enough to drive such a major change.

Table 10-5 High (modeled) Demand Forecast (Growth Scenario 3)

Energy Sales Case :	High (modeled) Demand Forecast		
Scenario :	**Base**	**FB Culley 2 Unit Retirement**	**RPS[1]**
Plan ID :	**Plan A3**	**Plan B3**	**Plan C3**
2015		0.5% DSM[2] Block (2015-2034)	
2016			
2017			
2018			
2019			
2020		0.5% DSM Block ('20-'34) Shutdown FB Culley 2	1.0% DSM Block (2020-2034)
2021			
2022			
2023			
2024			Solar PV[3] (1x50 MW)
2025			Solar PV (4x50 MW)
2026			
2027			
2028			
2029			
2030			
2031		Mkt Cap[4] (2MW)	
2032		Mkt Cap (6MW)	
2033		Mkt Cap (8MW)	
2034		Solar PV (1x50 MW)	
NPV[5]	$5,064,159	$5,049,163	$5,168,352
% Difference	0.0%	-0.3%	2.1%

[1] RPS = Renewable Portfolio Standard
[2] DSM = Demand Side Management
[3] PV = Photovoltaic
[4] Mkt Cap = Market Capacity Purchase
[5] Net Present Value inclusive of wholesale adjustment (2014 $)

High (large load) Demand Forecast (Growth Scenario 4)

Plans A-4, B-4 and C-4 represent the high (large load) demand forecast in combination with the three basic portfolio themes of "A"- Base (serve customers with existing resources & DSM), "B" – FB Culley 2 Unit Retirement Scenario and "C" – Renewable Portfolio Standard. It should be noted that no new capacity is required under this load forecast as can be seen in case A-4. However, the assumed retirement of Culley unit 2 in 2020 in conjunction with the increase in load drives a capacity addition in case B-4. The resource additions in plan C-4 are driven by the renewable energy constraints unique to the renewable portfolio scenario. However, the timing of the resources is slightly different due to interim renewable constraint in the renewable portfolio scenario.

This case represents the base set of assumptions and inputs as presented in the preceding sections of this chapter. For this analysis, no additional constraints were introduced that would prevent the planning model from selecting the set of future supply-side resources that resulted in the lowest NPV.

Table 10-6 shows the resource plan for the high (large load) demand forecast and the associated NPV's. Plan A-4 is the lowest cost plan under this load growth scenario, beating plans B-4 and C-4 by 1.9% and 2.5% respectively. Plans B-4 and C-4 reflect the capital expense of additional resources. These scenarios are significantly higher than plan A-4 in the near term. Note that all three plans are the same through 2018 where a DSM block is selected in the more expensive plan C-1.

Table 10-6 High (large load) Demand Forecast (Growth Scenario 4)

Energy Sales Case :	High (large load) Demand Forecast		
Scenario :	Base	FB Culley 2 Unit Retirement	RPS[1]
Plan ID :	Plan A4	Plan B4	Plan C4
2015			
2016			
2017			
2018			0.5% DSM[2] Block (2018-2034)
2019			
2020		Block of CCGT[3] (200 MW) Shutdown F.B Culley 2	0.5% DSM Block (2020-2034)
2021			
2022			
2023			
2024			Solar PV[4] (2x50 MW)
2025			Solar PV (4x50 MW)
2026			
2027			
2028			
2029			
2030			
2031			
2032			
2033			
2034			
NPV[5]	$5,156,487	$5,254,385	$5,283,860
% Difference	0.0%	1.9%	2.5%

[1] RPS = Renewable Portfolio Standard
[2] DSM = Demand Side Management
[3] CCGT = Combined Cycle Gas Turbine
[4] PV = Photovoltaic
[5] Net Present Value inclusive of wholesale adjustment (2014 $)

Integration Analysis Results Summary

As mentioned previously, the Strategist output is the lowest-cost plan for customers. The plan summary table 10-7 shows the costs for each plan A1-C4. Note that the costs represent the total present day value of serving Vectren customers under various portfolio mixes to meet customer demand for each scenario. The costs include capital for new resources, operating and maintenance costs, etc. for each plan over the 20-year forecast. Renewable Portfolio Standard (RPS) scenario plans were all the most expensive because they require new generation to be built and additional energy efficiency programs, which are paid for by customers, to meet the renewables requirement. Although no fuel is consumed by renewable resources, there are still costs associated with building and maintaining facilities. Renewables are intermittent resources, making them generally more expensive to help meet capacity requirements. Additionally, retiring FB Culley 2 prematurely, in the event of a large customer addition, could be very costly to customers. The cost of serving customers with existing resources, compared to retiring FB Culley 2 in 2020, were essentially the same under the low, base and high electric forecasts. Due to the risks associated with prematurely retiring FB Culley 2, discussed below in the Sensitivity and Risk Analysis section of this report, Vectren plans to serve customers with existing generation, plan A1 (Base electric forecast and Base scenario) in the near term. Vectren will conduct IRPs in 2016 and 2018. The plans are very similar or identical during the first few years. Therefore, no immediate action is required. The plans will be re-evaluated in future IRP cycles as various uncertainty factors are resolved over time.

Table 10-7 Plan Summary Table

		A	B	C
		Base Scenario	FB Culley 2 Unit Retirement Scenario	RPS Scenario
1	Base Demand Forecast	$4,874,614 0.0%	*$4,848,213* *-0.5%*	$4,991,616 2.4%
2	Low Demand Forecast	$4,771,789 0.0%	*$4,739,585* *-0.7%*	$4,871,859 2.1%
3	High (modeled) Demand Forecast	$5,064,159 0.0%	*$5,049,163* *-0.3%*	$5,168,352 2.1%
4	High (large load) Demand Forecast	*$5,156,487* *0.0%*	$5,254,385 1.9%	$5,283,860 2.5%

Note: Percent difference is reported on the same sales forecast basis
NPV = 2014 $000's @ 5.6%

SENSITIVITY AND RISK ANALYSIS

Each plan was subjected to additional risk sensitivities to determine which plan is the lowest cost over a wide range of possible future risks. As previously mentioned, resource modeling requires a large number of inputs and assumptions over a 20-year timeframe. It is impossible to precisely predict future prices of commodities such as fuel and other assumed economic factors such as carbon prices. Therefore, several future possibilities were considered. The 12 expansion plan scenarios were stress tested in regard to their sensitivity to variation in natural gas prices, coal prices, electric energy market prices, carbon prices, and capital costs of new resources. One additional stress test was added for a high regulation cost uncertainty. The parameters for these stress tests can be seen in table 10-8. The range of cost sensitivities for natural gas, coal and electric energy were stressed +/- 20%, which is consistent with the sensitivity percentages used in the MISO Transmission Expansion Plan 15 (MTEP 15). The large MISO stakeholder constituency reaches consensus on these ranges; therefore, Vectren believes that these are reasonable ranges. At the suggestion of some stakeholders, Vectren used the Synapse 2013 mid case CO_2 pricing as the high sensitivity and the MTEP 15 CO_2 mid case as the low sensitivity. Capital costs for new resources were stressed +30/-10 percent as it is much more common throughout the industry to see cost underestimates than cost overestimates upon actual project completions. The high regulation cost was a stress test of adding the capital for a cooling tower at FB Culley in 2022.[1]

[1] [1] While Vectren continues to believe that it is unlikely that the state will require a cooling water tower retrofit at Culley under regulations recently finalized implementing Clean Water Act §316b, Vectren included this as a high cost sensitivity. Construction costs would commence starting in 2022, after the required ecological and technological study feasibility period.

Table 10-8 Sensitivity Summary Table (Used For Stress Tests)

Sensitivities	High	Low	Potential Sources
Natural Gas Forecasts	+20%	-20%	MTEP 15
Coal Forecast	+20%	-20%	MTEP 15
Market Energy Forecast	+20%	-20%	MTEP 15
CO_2 Forecast	$15.5/Ton	$10.3/Ton	Synapse, MTEP 15
Capital Cost	+30%	-10%	Burns and McDonnell Tech Assessment
High Regulation Cost*	$40m	-	Future Regulatory Scenario[1]

[1] While Vectren continues to believe that it is unlikely that the state will require a cooling water tower retrofit at Culley under regulations recently finalized implementing Clean Water Act §316b, Vectren included this as a high cost sensitivity. Construction costs would commence starting in 2022, after the required ecological and technological study feasibility period.

Stress Test of Base Demand Forecast (Growth Scenario 1)

Plan A-1 B-1 and C-1 stress test results are shown in table 10-9. Similarly to the results shows in table 10-3, plans A1 and B1 are essentially the same over a wide variety of possible future sensitivities. Plan C1 remains the most expensive.

Table 10-9 Stress Tests Results for Base Demand Forecast (Growth Scenario 1)

	Base (Plan A1)	FB Culley 2 Unit Retirement (Plan B1)	RPS (Plan C1)
Base	$4,874,614	$4,848,213	$4,991,616
High Gas	$4,908,570	$4,883,867	$5,024,377
Low Gas	$4,826,209	$4,797,668	$4,944,615
High Coal	$5,268,181	$5,221,310	$5,381,876
Low Coal	$4,471,184	$4,466,032	$4,591,643
High Market	$4,727,528	$4,737,505	$4,821,102
Low Market	$4,957,322	$4,895,134	$5,099,072
Low Carbon Price	$4,704,763	$4,681,858	$4,836,921
High Carbon Price	$5,336,590	$5,302,147	$5,415,470
High Capital Cost	$4,874,614	$4,848,213	$5,047,790
Low Capital Cost	$4,874,614	$4,848,213	$4,972,892
High Regulation Cost	$4,900,481	$4,867,614	$5,017,484

Stress Test of Low Demand Forecast (Growth Scenario 2)

Plan A-2 B-2 and C-2 stress test results are shown in table 10-10. Similarly to the results shows in table 10-4, plans A2 and B2 are essentially the same over a wide variety of possible future sensitivities. Plan C2 remains the most expensive.

Table 10-10 Stress Tests Results for Low Demand Forecast (Growth Scenario 2)

	Base (Plan A2)	FB Culley 2 Unit Retirement (Plan B2)	RPS (Plan C2)
Base	$4,771,789	$4,739,585	$4,871,859
High Gas	$4,804,936	$4,774,367	$4,904,004
Low Gas	$4,724,382	$4,690,021	$4,825,580
High Coal	$5,162,681	$5,110,118	$5,259,798
Low Coal	$4,371,289	$4,360,256	$4,474,450
High Market	$4,610,079	$4,613,296	$4,689,627
Low Market	$4,870,385	$4,803,750	$4,992,076
Low Carbon Price	$4,608,762	$4,579,376	$4,722,725
High Carbon Price	$5,215,962	$5,175,885	$5,282,560
High Capital Cost	$4,771,789	$4,739,585	$4,915,631
Low Capital Cost	$4,771,789	$4,739,585	$4,857,268
High Regulation Cost	$4,797,656	$4,758,986	$4,897,726

Stress Test of High (modeled) Demand Forecast (Growth Scenario 3)

Plan A-3 B-3 and C-3 stress test results are shown in table 10-11. Similarly to the results shows in table 10-5, plans A3 and B3 are essentially the same over a wide variety of possible future sensitivities. Plan C3 remains the most expensive.

Table 10-11 Stress Tests Results for High (modeled) Demand Forecast (Growth Scenario 3)

	Base (Plan A3)	FB Culley 2 Unit Retirement (Plan B3)	RPS (Plan C3)
Base	$5,064,159	$5,049,163	$5,168,352
High Gas	$5,099,475	$5,086,180	$5,202,306
Low Gas	$5,014,048	$4,997,322	$5,119,822
High Coal	$5,462,101	$5,425,041	$5,562,663
Low Coal	$4,655,886	$4,663,907	$4,763,874
High Market	$4,943,471	$4,956,522	$5,022,702
Low Market	$5,116,818	$5,076,415	$5,248,386
Low Carbon Price	$4,881,866	$4,876,097	$4,999,192
High Carbon Price	$5,563,573	$5,525,040	$5,628,969
High Capital Cost	$5,064,159	$5,050,009	$5,224,526
Low Capital Cost	$5,064,159	$5,048,881	$5,149,626
High Regulation Cost	$5,090,027	$5,068,564	$5,194,219

Stress Test of High (large load) Demand Forecast (Growth Scenario 4)

Plan A-4 B-4 and C-4 stress test results are shown in table 10-12. Similarly to the results shows in table 10-6, plan A4 is significantly less expensive in the near term than plans B4 and C4.

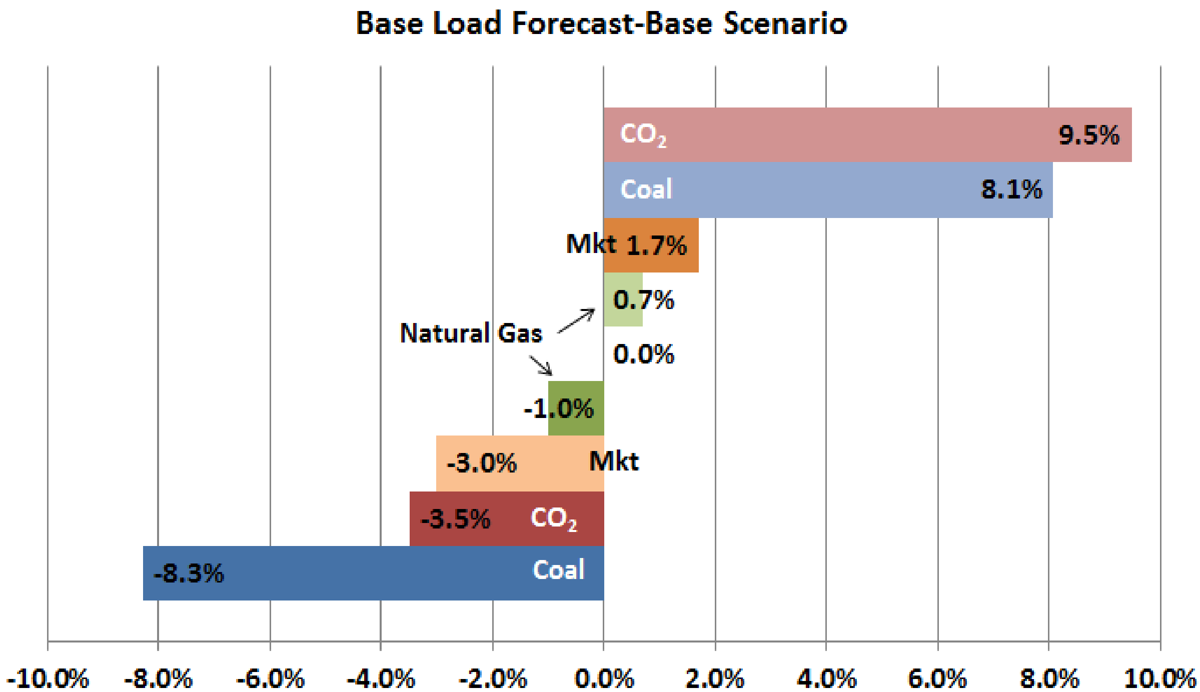
Table 10-12 Stress Tests Results for High (large load) Demand Forecast (Growth Scenario 3)

	Base (Plan A4)	FB Culley 2 Unit Retirement (Plan B4)	RPS (Plan C4)
Base	$5,156,487	$5,254,385	$5,283,860
High Gas	$5,192,745	$5,317,261	$5,318,391
Low Gas	$5,105,576	$5,163,552	$5,234,683
High Coal	$5,556,624	$5,646,923	$5,679,926
Low Coal	$4,745,742	$4,853,216	$4,877,383
High Market	$5,049,403	$5,098,566	$5,147,775
Low Market	$5,194,651	$5,328,227	$5,353,361
Low Carbon Price	$4,970,102	$5,093,626	$5,112,573
High Carbon Price	$5,665,492	$5,711,718	$5,749,275
High Capital Cost	$5,156,487	$5,322,627	$5,441,585
Low Capital Cost	$5,156,487	$5,231,638	$5,240,428
High Regulation Cost	$5,182,354	$5,273,786	$5,309,727

Relative Influence of Stress Test Factors

The relative influence of the stress tests on the net present values can be seen in table 10-13.

Table 10-13 Relative Influence of Stress Tests on Net Present Values

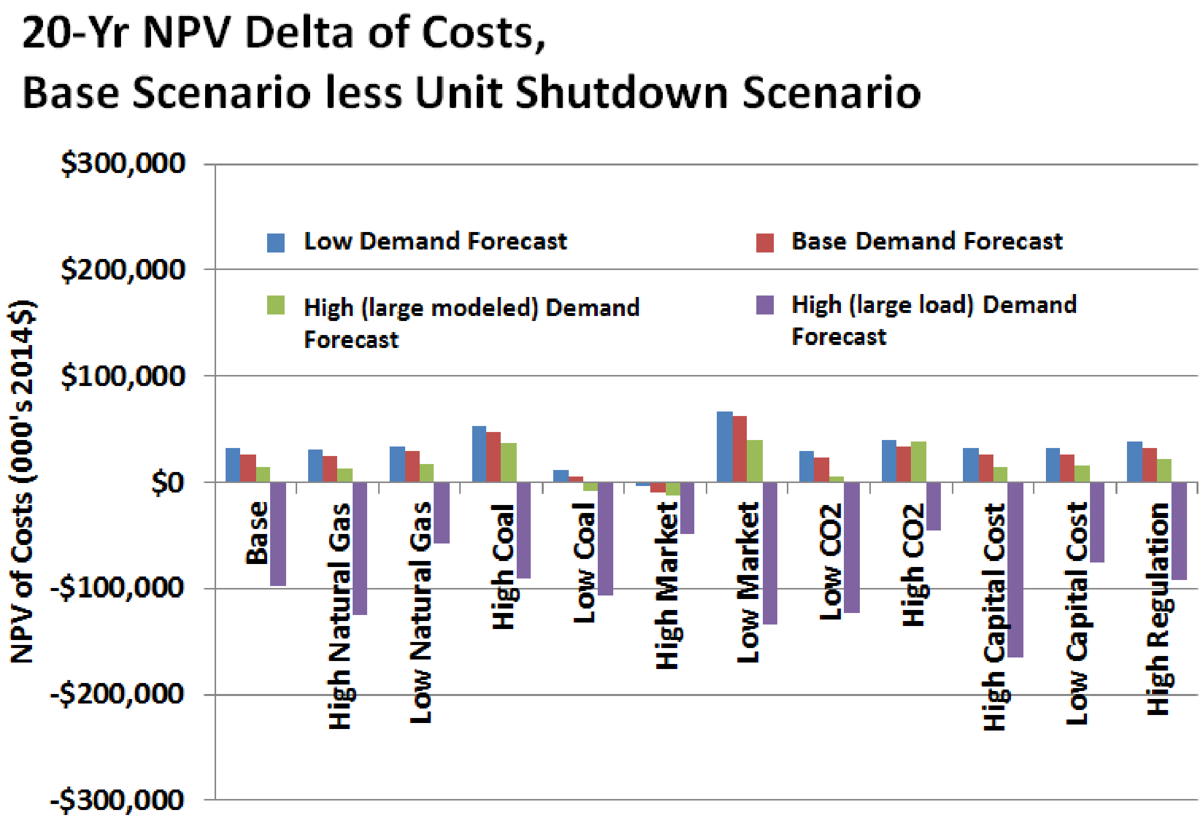


Risk Comparison

Under most risk factors, the cost of continuing operation of FB Culley or retirement in 2020 are essentially the same. As illustrated below in Table 10-14, the cost risk to customers if Vectren prematurely retires F.B. Culley 2 is potentially large under the high (large load) demand forecast.

Table 10-14 shows the risk comparison across all sensitivities and sales forecasts for the base scenario compared to the coal retirement scenario. This graph illustrates that the differences across three of the four sales forecasts are relatively small compared to the large savings in the high (large load) demand forecast. Stated differently, the positive bars represent the extra cost of not retiring FB Culley 2 under 3 of the 4 demand scenarios. The negative bars represent the savings under 1 of the 4 sales scenarios by not retiring FB Culley 2 in 2020. The high (large load) growth scenario savings are much greater across all sensitivities by not retiring a unit. Vectren is actively working to attract new industrial customers through economic development activities in southwestern Indiana. If a large customer chooses to locate within the Vectren electric service area, it will be significantly less expensive to serve that additional load with existing resources in the near term.

Table 10-14 Comparison of Risks



Therefore, there are significant risks to retiring Culley unit 2 in the next few years. Vectren is making no decision at this time on a retirement date for several reasons. The graph above illustrates the risk of the high large load addition. Other significant risks include how the state of Indiana implements the Clean Power Plan, load uncertainties, and potential MISO shortfalls. There is little clarity on how Indiana intends to implement CO_2 guidelines. Depending on the direction that is taken, the plan may vary. Second, one of Vectren's largest customers is still finalizing plans for their co-generation unit. Vectren needs to better understand how this will affect the load forecast. Finally, with several coal plants shutting down within the MISO market, there is potential that not enough generation will be available to reliably serve the overall market. A decision about the assumed retirement of FB Culley 2 in 2020 in scenarios B1-B4 will not be made until near-term risk factors become clearer.

CONCLUSION

Based on Vectren's electric demand forecast, which includes cost effective DSM energy efficiency programs for customers, Vectren does not require additional resources. The IRP analysis indicates it is essentially the same cost to continue to operate FB Culley 2 or retire it in the near future. The decision to retire this unit is subject to a number of risks and uncertainties. Vectren is making no decision at this time on a retirement date.

As mentioned in the Risk Analysis section of this report, there are four major risks of retiring FB Culley 2 in the next few years:

1. How Indiana intends to implement CO_2 guidelines, the EPA's Clean Power Plan (111d)
2. Uncertainty about customer load due to the installation of a large co-generation unit
3. The possibility of a new large customer addition
4. Uncertainty around potential capacity shortfalls within the MISO market

Based on the risk associated with retiring FB Culley 2, Vectren will keep plan A-1 as the plan of choice in the near term, but will continue to evaluate the changing technology, environmental and regulatory developments, as well as customer costs and reliability needs. More time and analysis is needed to make a decision on the timing of retiring FB Culley 2. Note that there will be two more IRPs prepared prior to 2020.

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CHAPTER 11

ACTION PLAN

INTRODUCTION

These are the next steps the organization will take to achieve a reasonable long-term cost to retail customers with full consideration of the complex issues facing the industry in the next few years.

SUPPLY-SIDE RESOURCES

The overall objective of this study and review is to ensure that Vectren is properly positioned to meet its obligation to serve the needs of its Indiana retail customer base. Over the next several years, Vectren will continue to monitor changing market factors and risks including, but not limited to, increased environmental regulations including the EPA Clean Power Plan, large customer load, fuel price volatility, escalation of capital costs, increased emphasis on conservation measures, demand response, Smart Grid/AMI, and RTO related developments, particularly the possibility of MISO shortfalls. These items will be monitored both for their potential impact on future capacity needs and their impact on the operation of existing assets.

Vectren projects to have the generating capacity needed to meet the needs of its customers without adding any additional assets in all scenarios. All 12 plans explored are very similar or identical during the first few years. No immediate action is required. Vectren will conduct additional analysis, including another IRP in 2016. A decision about the assumed retirement of FB Culley 2 in 2020 will not be made until near term risk factors become clearer.

DEMAND-SIDE RESOURCES

Vectren plans to continue to pursue DSM, energy efficiency, and demand response opportunities by working through collaborative efforts with the IURC and OUCC. Vectren will continue to implement the 2015 DSM Plan as filed under Cause No. 44495, which was recently approved by the Commission. The programs outlined in the 2015 DSM Plan are designed to cost effectively reduce energy use and electric demand by approximately 1% of eligible retail sales. While Vectren's current resources are adequate to meet the needs of its customers, Vectren believes that conservation is in their customers' best interest. Helping customers learn to conserve energy will benefit customers through lower bills, the environment through lower emissions, and rates through the reduced need for additional system capacity in the future.

Vectren is in the process of developing a three-year Action Plan for 2016-2018 electric DSM programs. The programs outlined in this three-year Action Plan will be designed to reduce energy use by approximately 1– 1.5% of eligible retail sales. There are several variables that currently exist that may have impact on this planning process. The EPA Clean Power Plan proposal, Federal appliance and equipment minimum efficiency standards and state legislation relating to energy efficiency could all impact the savings goals for the next three years. Vectren is currently monitoring such rules and regulations and will continue to incorporate these factors into this planning process, as required.

Vectren will closely monitor trends regarding Smart Grid/AMI throughout the country. Vectren will work collaboratively with key stakeholders to determine the appropriate implementation strategy for Smart Grid/AMI in the Vectren territory.

TRANSMISSION AND DISTRIBUTION

Vectren will work closely with MISO to determine those transmission projects that will improve overall grid reliability within its service territory and those in the surrounding area. Vectren will implement system upgrades as needed to ensure reliable service to its customers. In addition, ongoing internal studies will monitor additions of industrial and commercial load in different locations within the Vectren service territory.

Detailed budgets for the short-term plan will be developed during Vectren's normal budgeting process.

SOUTHERN INDIANA GAS AND ELECTRIC COMPANY D/B/A VECTREN ENERGY DELIVERY OF INDIANA, INC.

("VECTREN SOUTH")

I.U.R.C. CAUSE NO. 44645

DIRECT TESTIMONY

OF

MICHAEL P. HUBER

MANAGER, ELECTRIC DSM & CONSERVATION

ON

ELECTRIC DEMAND SIDE MANAGEMENT 2016-2017 PROGRAM PORTFOLIO

SPONSORING PETITIONER'S EXHIBIT NO. 2 & ATTACHMENTS MPH-1 THROUGH MPH-3

VERIFIED DIRECT TESTIMONY OF MICHAEL P. HUBER

I. INTRODUCTION

Q. Please state your name and business address.

A. My name is Michael P. Huber and my business address is One Vectren Square, Evansville, Indiana 47708.

Q. By whom are you employed and in what capacity?

A. I am employed by Vectren Utility Holdings, Inc. ("VUHI"), the immediate parent company of Southern Indiana Gas and Electric Company d/b/a Vectren Energy Delivery of Indiana, Inc. ("Vectren South"), Indiana Gas Company, Inc. d/b/a Vectren Energy Delivery of Indiana, Inc. ("Vectren North") and Vectren Energy Delivery of Ohio, Inc. ("VEDO"). Vectren South has both a gas division and an electric division. I am the Manager of Electric Demand Side Management and Conservation for VUHI.

Q. What is your educational background?

A. I received a Bachelor of Science degree in business administration from the University of Southern Indiana in 1992.

Q. What is your business experience?

A. My professional experience began in 1995 at Kimball International based in Jasper, Indiana. I worked there as a sales coordinator and later as Manager of Customer Service and Director of Customer Service. I began working for VUHI in 2001 and have held a variety of positions. Previously, I was Manager of Gas Conservation, with responsibility for the management of all aspects of the gas conservation portfolio for all three VUHI regulated utilities. Prior to that, I was Manager of Conservation Marketing, with responsibility for all program communications for the gas and electric conservation programs. I have also held other positions including Manager of Customer Service Programs, Manager of Marketing and Contact Center Supervisor.

Q. Have you previously testified before the Indiana Utility Regulatory Commission ("Commission")?

A. Yes. I recently testified in Cause No. 44495 in which the Commission approved Vectren South's 2015 Plan. I also testified in Vectren South's most recent Demand Side Management Adjustment ("DSMA") proceeding docketed as Cause No. 43405 DSMA 12.

Q. Are you sponsoring any attachments in this proceeding?

A. Yes. I am sponsoring the following attachments:

- Petitioner's Exhibit No. 2, Attachment MPH-1, which is the Vectren South 2016-2017 Electric DSM Plan ("2016-2017 Plan");
- Petitioner's Exhibit No. 2, Attachment MPH-2, which is the EnerNOC Market Potential Study ("MPS"); and
- Petitioner's Exhibit No. 2, Attachment MPH-3, which is the Cadmus Evaluation of the 2013-2014 Programmable and Smart Thermostat Program.

Q. Were your testimony and exhibits in this proceeding prepared by you or under your supervision?

A. Yes, they were.

II. PURPOSE

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony is to: (1) describe the demand response ("DR") programs and energy efficiency ("EE") programs (collectively "Demand Side Management" or "DSM") programs included in the 2016-2017 Plan, including integrated gas and electric EE programs ("Gas/Electric EE Programs") to be offered by Vectren South from January 1, 2016 through December 31, 2017 (the "Extension Period"); (2) define the annual budget associated with the 2016-2017 Plan; and (3) discuss how Vectren South plans to implement and evaluate all EE and DR programs included in the 2016-2017 Plan.

III. VECTREN SOUTH'S 2016-2017 PLAN

Q. What was Vectren South's goal in creating the 2016-2017 Plan?

A. The 2016-2017 Plan was developed in conjunction with the 2014 Integrated Resource Plan ("IRP") planning process and therefore the 2014 IRP served as a key input into the 2016-2017 Plan. Consistent with the 2014 IRP, the goal for the 2016-2017 Plan was to create a plan for reducing energy usage by 1% of retail sales adjusted for an opt-out rate of 80% of eligible load, and to introduce into the marketplace two programs with a DR component.

Q. How was the 2016-2017 Plan developed?

A. There were many steps involved in developing the 2016-2017 Plan. The objective of these steps was to develop a plan based on market-specific information for Vectren South which could be successfully implemented utilizing realistic assessments of achievable market potential.

The first step in the process was to review the results of the MPS that was completed in 2013 where the "Recommended Achievable" scenario was used to help guide program design. The MPS was developed using a bottom-up approach to establish baseline consumption by end use and technology. This approach has a built-in check for realistic savings, as it starts with a market baseline that ties to the sales forecast and builds measures and programs from there. Also, and perhaps most importantly, this method allows us to explicitly model the application of equipment codes and standards as they are instituted in specific years. The measures and baseline units available for purchase are refreshed in every year of the analysis, such that as a new standard comes online in a given year, the previous minimum standard unit will go off the market and not be available for the model to consider.

The second step in the planning was to develop energy efficiency goals through Vectren South's IRP that are reasonably achievable and designed to achieve an optimal balance of energy resources in Vectren South's energy efficiency program. Mr. Sears explains in more detail how energy efficiency goals were developed in Vectren South's IRP.

The third step in the planning process was to hire outside expertise to assist with the plan design and development. Vectren South retained EMI Consulting to assist with designing the 2016-2017 Plan. Matthew Rose, Director of EMI Consulting, was the primary planner working with the Vectren South team. Additionally, input was obtained from the Vectren South program managers who oversee administration of current Vectren South programs, as well as from vendors and other implementation partners who operate current programs. They provided suggestions for program changes and enhancements. They also provided technical information and recommendations about measures to include, incentives, estimates of participation and estimated implementation costs. This data provided a foundation for the 2016-2017 Plan based on actual experience within Vectren South's service territories.

Other sources of program information were also considered. Current evaluations were used for adjustments to inputs as well as applicable Technical Reference Manuals ("TRM"). In addition, best practices were researched and reviewed to gain insights into the program design of successful EE and DR programs implemented at other utilities. Considering all of the above, adjustments were made to delivery mechanisms, measure bundles, participation rates, and other factors as appropriate to fine-tune the data for the two-year Extension Period.

The last step was cost benefit analysis. Vectren South retained Richard Stevie, Vice President of Forecasting with Integral Analytics, to complete the cost benefit modeling. Utilizing DSMore, the measures and programs were analyzed for cost effectiveness. The DSMore tool is used in many states across the country to determine cost-effectiveness. The outputs include the California Standard Practice Manual results for the total resource cost test ("TRC"), utility cost test ("UCT"), participant test and ratepayer impact measure test ("RIM"). Inputs into the model include participation rates, incentives paid, energy savings of the measure, life of the measure, implementation costs, administrative costs, and incremental costs to the participant of the high efficiency measure. Financial inputs such as escalation rates and discount rates are provided by Vectren South and match the Company's other financial plans.

Q. Does the 2016-2017 Plan include programs for all customer classes?

A. Yes. The programs are designed to reduce the electric demand and energy usage of customers served under the Residential, General Service and Industrial rate schedules. Specifically, programs are available to customers served under rate tariffs RS, B, SGS, DGS, MLA, OSS, LP and HLF.

Q. Will approval and implementation of the 2016-2017 Plan result in any undue or unreasonable preference to any customer class?

A. No. The 2016-2017 Plan is designed to allow all customers the opportunity to participate in DSM programs, even those customers who previously opted-out of participation pursuant to Senate Enrolled Act 340 are allowed to opt-in if they so choose.

Q. Please provide an overview of the 2016-2017 Plan.

A. The 2016-2017 Plan was designed to continue the current program offerings, while expanding and modifying some program designs and adding new programs.

Vectren South has taken advantage of the opportunity to expand its Gas/Electric EE Program offerings in Vectren South's service territory. Table MPH-1 below compares the existing 2015 offerings to the new 2016-2017 Plan:

Table MPH-1 – 2015/2016-2017 Program Comparison

2016-2017 Electric DSM Programs	Existing or New Program	Integrated with Vectren South Gas
Residential Programs		
Residential Lighting	Existing	
Home Energy Assessment & Weatherization	Existing with additon of buy-down weatherization	X
Energy Efficient Schools (Kits)	Existing	X
Appliance Recycling	Existing	
Behavior Savings	Existing	X
Residential New Construction	Existing	X
Multi-Family Direct Install	Existing	X
Residential Efficient Products	Existing	X
Conservation Voltage Reduction (CVR)	New	
Smart Thermostat Demand Response	New	
Commercial & Industrial Programs		
C&I Custom	Existing	
C&I Prescriptive	Existing	
C&I New Construction	Existing	X
Small Business Direct Install	Existing	X
Conservation Voltage Reduction (CVR)	New	
Multi-Family Retrofit	New	X

Q. Does the 2016-2017 Plan include programs that were not included in the MPS?

A. Yes. The Conservation Voltage Reduction and Residential Smart Thermostat DR programs were not included in the MPS and are included as new programs in the 2016-2017 Plan.

IV. <u>CONSERVATION VOLTAGE REDUCTION INCLUDED IN 2016-2017 PLAN</u>

Q. Please describe the benefits that exist with implementing Conservation Voltage Reduction ("CVR") on Vectren South's electric distribution system.

A. CVR is technology that will allow Vectren South to leverage real-time information about the grid and use it to reduce waste, increase reliability and save money for both the customer and the utility. With this technology, utilities actively influence the usage of electricity and cause a desired change in load shape through the use of remote communicating field devices. These remote field devices are used in the utility's energy delivery system and function as demand-side measures. This technology allows instantaneous communication to occur between remote field devices and a central control processor, which optimizes the distribution system delivery voltage used by Vectren South customers, while still managing compliance within voltage delivery levels required of utilities in Indiana. This technology conserves energy and reduces demand through the application of lower circuit voltages and tighter voltage control bandwidths across the entire length of the distribution circuits on which it is applied. Both residential and C&I customers on the CVR distribution circuit will receive the benefit of the optimized voltage profile.

Q. Please describe the planning process the Company engaged in when adding the CVR program to the 2016-2017 Plan.

A. Vectren South has been considering implementing voltage reduction technology for several years. Prior to developing the 2016-2017 Plan, the Company identified five substations on Vectren South's system that would be ideal candidates for CVR technology. Vectren South plans to complete installation of CVR technology on the first substation in 2017 and to complete CVR technology installation on additional substations in future program years. To accomplish this goal, the Company has engaged an engineering firm to conduct an engineering study to confirm that the five substations previously identified by Vectren South's engineering department are, in fact, the best substations on Vectren South's system to begin the process. The engineering study, which will be completed by late summer/early fall 2015, will be used by Vectren South to refine EE and DR savings and finalize the priority of CVR installation in the various substations.

Q. Is the CVR program included in the 2016-2017 Plan cost effective?

A. Yes. Vectren South plans to complete installation on one substation in calendar year 2017. While Vectren South plans to install the technology on additional substations, the Company is only requesting authority to complete installation on one substation at this time. The TRC associated with installation of CVR technology on one substation is 1.26, which means the program is cost effective. Vectren South modeled the full implementation cost of CVR and utilized a conservative estimate of two and one half percent (2.5%) voltage reduction level.

Voltage reduction programs similar to what Vectren South is proposing with the CVR Program have been proven to produce cost effective and verifiable energy savings in the same manner as other DSM programs but at a more predictable level. All customers receiving electric service from a CVR circuit are subject to the tighter voltage bandwidth created by the program. There is no free ridership or spillover with CVR and the program does not rely on incentives to motivate customer participation.

Q. How were energy savings and implementation costs determined for CVR?

A. In late 2013, Vectren South's engineering department contacted a vendor and requested an estimate for CVR at five substations, which includes 20 circuits, selected by Vectren South based upon proximity and load. At the same time, Vectren South contacted a different vendor and requested preliminary energy and demand savings information associated with implementation of CVR at the selected substations. Since then, Vectren South has received an updated cost estimate from the vendor for implementing CVR on four circuits and updated energy and demand savings data from its current program evaluator. The updated data received from those vendors formed the foundation for the energy savings and implementation costs for the CVR program included in the 2016-2017 Plan.

Vectren South has commissioned a full engineering study that will be completed in late summer/early fall 2015 that will refine cost estimates, confirm the best substations to implement first and identify the technology that will work best with the existing infrastructure in Vectren South's service territory. Vectren South will work with the Vectren Oversight Board ("Oversight Board") to incorporate the results from the study into the final program design.

Q. Please describe the process Vectren South will use to evaluate the CVR program.

A. The independent evaluator selected by the Oversight Board to evaluate the Company's programs will evaluate the CVR program. Vectren South will work with the Oversight Board to consider the best way to evaluate the CVR program during the planning period and as the program is implemented to ensure that the program can be evaluated as effectively and efficiently as possible. During the process of selecting an independent EM&V administrator, the Oversight Board will work to ensure that the administrator has considered how best to evaluate the CVR program. Specifically, Vectren South anticipates that, in evaluating the CVR program, the EM&V administrator will consider the following factors:

1) the amount of peak demand reduction and yearly energy consumption from the program, including seasonality effects. Vectren South anticipates that utility-grade metering will be used to quantify the average per-circuit energy and demand reduction for the distribution circuits controlled. The EM&V administrator will utilize standard industry CVR M&V protocols and methods to verify the level of demand and energy reductions. The energy reductions will also be translated into customer savings using standard methods and knowledge of the customers served by the feeders impacted by CVR;

2) the effectiveness of the program delivery mechanism including, but not limited to, program operation and processes; and

3) other operational benefits associated with CVR through review of feeder parameters.

Q. Will opt-out customers benefit from CVR?

A. The substation that Vectren South modeled for cost effectiveness did not include any customers who have elected to opt-out of DSM programs as of January 1, 2015. However, the substations where Vectren South intends to implement CVR will be based upon the recommendation from the engineering study and could include opt-out customers. Vectren South will work with the Oversight Board to determine the best way to treat opt-out customers who benefit from this program.

Q. Please discuss the cost recovery proposed for the CVR Program.

A. Given that the technology to be installed on the substations will remain part of the infrastructure for the life of the measure, Vectren South is seeking authority to capitalize the costs associated with purchasing this technology and to earn a return of and on this investment annually in the DSMA. Specifically, Vectren South is seeking authority to recover the following CVR-related costs through the annual DSMA: (1) carrying costs, (2) depreciation expense, (3) annual and ongoing Operation and Maintenance ("O&M") expense, (4) a representative share of Vectren South's DSM support staff and administration costs, and (5) related EM&V cost. Petitioner's Witness J. Cas Swiz will discuss Vectren South's proposal for recovering CVR program costs in more detail in his testimony in this proceeding.

V. RESIDENTIAL SMART THERMOSTAT INCLUDED IN 2016-2017 PLAN

Q. Please describe the benefits that exist with including the Residential Smart Thermostat DR Program in the 2016-2017 Plan?

A. Vectren South's residential DR programs are an increasingly important part of how the Company provides services to its customers. The current system that Vectren South utilizes for its Direct Load Control ("DLC") program leverages one-way communication switches that do not provide the opportunity for customers to interact with the Company. Leveraging "smart devices" such as a "smart thermostat" for DR allows the Company to reach beyond the meter to interact with customers as well as monitor energy usage and patterns. These smart devices, which reside on the customer's side of the electric meter, work in conjunction with a third party vendor platform to communicate with customers' air conditioning systems. The program provides the Company with increased customer contact opportunities and the ability to facilitate customers' shift of their energy usage to reduce peak system loads. The smart thermostats offer energy savings and increased load reduction, deliver verifiable DR, and provide a platform for customer engagement.

The Residential Smart Thermostat DR Program is designed to analyze the different approaches of demand response that are available through smart thermostats. The program design has been proven to reduce peak system load as well as deliver year-round energy savings for customers. For this program, Vectren South will analyze the Honeywell and Nest DR platform. Early in 2016 Vectren South will install, at no additional cost to the customer, a total of 2,000 smart thermostats (1,000 Honeywell and 1,000 Nest) and will leverage the platforms to manage DR events during the summer of 2016. Vectren South will work with an independent evaluator on a billing analysis to measure the effectiveness of both program designs in 2017. Based on the billing analysis results, Vectren South will work with the Oversight Board on possible expansion of the program with one of those two vendors in 2018 and beyond.

Q. Does Vectren South have any prior experience with smart thermostat program implementation?

A. Yes. In 2013-2014, Vectren South offered a small Gas/Electric EE Program in its combination natural gas and electric service territory to compare the EE performance of a standard programmable thermostat verses that of a smart thermostat. The Nest Thermostat was selected as the smart thermostat in this program. At the direction of the Oversight Board, CLEAResult, the third party administrator for Vectren South's natural gas programs and the rebate fulfillment contractor for Vectren South's electric residential rebate program, worked with Water and Energy Solutions, a program implementer, to install three hundred (300) Nest smart thermostats and three hundred (300) programmable thermostats. The program also included a control group of three thousand eight hundred forty five (3,845) households that did not have a new thermostat installed.

Cadmus was hired to evaluate the program and the results were positive. The Cadmus study found that program participants with the Nest Thermostat reduced their heating gas consumption by approximately 12.5%, compared to only 5% for participants with a programmable thermostat. On the cooling side, participants in the Nest and programmable thermostat groups reduced cooling electric consumption by approximately the same amount, 13.9% and 13.1% respectively. Additional details related to the study and the results thereof can be found in Petitioner's Exhibit No. 2, Attachment MPH-3.

Q. Given Vectren South's success with the Nest program results, why is the Company proposing to install Honeywell smart thermostats as a part of the Residential Smart Thermostat DR program in the 2016-2017 Plan?

A. The 2013-2014 study compared only the energy savings benefits associated with a standard programmable thermostat and that of a smart thermostat such as Nest and did not measure the DR aspect. The Residential Smart Thermostat DR program that is included in the 2016-2017 Plan is designed to analyze the different approaches of DR that are available through smart thermostats. Nest and Honeywell utilize different platforms for DR and the comparison and billing analysis will provide Vectren South and the Oversight Board with information on which platform produces the most cost-effective EE and DR results for potential expansion of this program in future program years.

VI. DESCRIPTION OF OTHER PROGRAMS INCLUDED IN THE 2016-2017 PLAN

Q. Please describe the Residential Lighting program.

A. The Residential Lighting program is a market-based residential DSM program designed to reach residential customers through retail outlets. The program consists of a buy-down strategy that provides incentives to consumers to facilitate the purchase of energy-efficient lighting products.

The Residential Lighting program provides the following value: customers are empowered to take advantage of new lighting technologies, adoption of proven energy efficient technologies is accelerated, and participants experience the benefits of energy efficiency and decreased energy consumption.

Q. Please describe the Home Energy Assessment and Weatherization program.

A. The Home Energy Assessment and Weatherization program is an integrated Gas/Electric EE Program to be offered by Vectren South in its combination gas and electric service territory. To be eligible, Vectren South customers: (1) must live in a home that was built prior to January 1, 2010; (2) must not have had an assessment within the last three (3) years; and (3) must either own and occupy the residence or occupy the residence and receive utility service in the customer's name. This program combines an on-site energy assessment with direct installation of certain specified measures at no additional cost to the customer. While this program is offered as part of Vectren South's current portfolio, a new element to the design is introduced in the 2016-2017 Plan. Specifically, Vectren South will offer participating customers the opportunity to take advantage of deeper retrofit measures through a buy-down of forty percent (40%) of the cost of the measures. The additional measures available for buy-down include improved air sealing, insulation, electronically commutated motor ("ECM") replacement, light-emitting diode ("LED") bulbs and programmable thermostats.

Q. Please describe the Income Qualified Weatherization program.

A. The Income Qualified Weatherization ("IQW") program is an integrated Gas/Electric EE Program to be offered by Vectren South in its combination gas and electric service territory. The IQW program is designed to provide weatherization upgrades to low income homes that otherwise would not have been able to afford the energy saving measures. The program provides direct installation of energy-saving measures and educates consumers on ways to reduce energy consumption. To participate in this program, customers must take electric service from Vectren South in their name and have a total household income less than 200% of the federal poverty guideline. Under this program, priority will be given to customers who are: (1) single parents with children under 18 living in the dwelling; (2) head of the household and are over 65 years of age; and (3) qualified for and receive Home Energy Assistance Program ("EAP") funds based upon the Indiana Housing and Community Development Authority's EAP guidelines. Additionally, the program will address any moderate health and safety issue identified through the assessment, such as gas leaks, venting repairs, small repairs to furnaces, etc. The program is currently offered by Vectren South, but has been expanded in the 2016-2017 Plan to include additional measures that may be installed, if necessary, as recommended in the MPS as part of the IQW Plus Program. Those measures include: specialty compact fluorescent lamps ("CFL"), exterior LED, smart power strips, duct repair/insulation, whole house fans and programmable thermostats.

Q. Please describe the Appliance Recycling program.

A. The Residential Appliance Recycling program encourages customers to recycle their old, inefficient refrigerators and freezers in an environmentally safe manner. The program recycles operable refrigerators or freezers so the appliance no longer uses electricity and is recycled instead of being disposed of in a landfill. An older refrigerator can use as much as twice the amount of energy as new efficient refrigerators. An incentive of $50 will be provided to the customer for each operational unit picked up.

Q. Please describe the Energy Efficient Schools program.

A. The Energy Efficient Schools program is an integrated gas/electric program to be offered by Vectren South in its combination gas and electric service territory. The program is designed to impact students by teaching them how to conserve energy and to produce cost effective electric savings by influencing students and their families to focus on conservation and the efficient use of electricity. The program consists of a school education program for 5th grade students attending schools served by Vectren South. To help in this effort, each child that participates will receive an energy kit. The kits are brought home to the parents and parents install these energy saving measures in the home. The kits, along with the in-school teaching materials, are designed to make a lasting impression on the students and help them learn ways to conserve energy.

Q. Please describe the Residential Efficient Products program.

A. The Residential Efficient Products program is a continuation of an existing program and is designed to assist customers with the purchase of new energy efficient products. Prescriptive incentives will be provided to customers who purchase efficient electric measures and equipment above the standard baseline. This program will be promoted through trade allies and appropriate retail outlets and will be available to any residential electric customer located in Vectren South's service territory.

Q. Please describe the Residential New Construction program.

A. The Residential New Construction program will provide incentives and encourage home builders to construct homes that are more efficient than current building codes. This program is an integrated Gas/Electric EE Program that will be offered by Vectren South in its combination gas and electric service territory. The Residential New Construction Program will work closely with builders, educating them on the benefits of energy efficient new homes. Homes may feature additional insulation, better windows, and higher efficiency appliances.

The homes should also be more efficient and comfortable than standard homes constructed to current building codes.

Program incentives are designed to be paid to both all-electric and combination homes that have natural gas heating and water heating. The program is structured such that an incentive will not be paid for an all-electric home that has natural gas available to the home site.

The Residential New Construction Program will address the lost opportunities of this customer segment by promoting energy efficiency at the time the initial decisions related to new home construction are being made. This will ensure efficient results for the life of the home.

Q. Please describe the Multi-Family Direct Install program.

A. The Residential Multi-Family Direct Install program reached market saturation during 2014 for properties with electric water heating in the Vectren South territory and is not being offered as a stand-alone program. This program is being continued as part of the Vectren South gas program to serve properties with natural gas water heating. Vectren South's electric division will cover the incremental cost to install CFL bulbs as part of the Vectren South gas program. Additionally, Vectren South will cost share for the installation of programmable thermostats that include benefits for both natural gas and electric customers.

Q. Please describe the Residential Behavior Savings program.

A. The Residential Behavior Savings program motivates behavior change and provides relevant, targeted information to the consumer through regularly scheduled direct contact via mailed and/or emailed home energy reports ("HERS"). The direct contact helps the consumer to better understand their energy use and compares their usage on a rating scale verses similar households in the same general neighborhood. Once a consumer understands better how they use energy, they can then start conserving energy.

Program data and design was provided by OPower, the implementation vendor for the program. OPower provides energy usage insight that drives customers to take action by selecting the most relevant information for each particular household, which ensures maximum relevancy and high response rate to recommendations. Vectren South is maximizing the effectiveness of this program by delivering HERS to eligible households that meet program cost-effectiveness requirements as prescribed by the Commission. Eligibility is determined by site and customer eligibility criteria including quality of data, usage and outlier usage scenarios. A subset of customers are also placed into the control group, and do not receive HERS, to ensure that measurement and verification of the program's energy savings adheres to the industry gold standard, as outlined by the U.S. Department of Energy's SEE Action Network.

This program is a continuation of an existing program and is open to customers in Vectren South's combination gas and electric service territory.

Q. Please describe the Small Business Direct Install program.

A. The Small Business Direct Install program provides value by directly installing energy efficient products such as high efficiency lighting, low flow water saving measures and vending machine controls. The program helps businesses identify and install cost effective energy saving measures by providing an on-site energy assessment customized for their business. The program has been very well received in the marketplace and has been expanded in the 2016-2017 Plan to include any participating Vectren South small business customer with a maximum peak demand of less than 400 kilowatts ("kW"). The maximum peak demand in 2015 was less than 300 kW. This program is a Gas/Electric EE Program and will be available to small business owners located in Vectren South's combination gas and electric service territory.

Q. Please describe the C&I Prescriptive program.

A. The C&I Prescriptive program is designed to provide financial incentives on qualifying products to produce greater energy savings in the C&I market. The rebates are designed to promote lower electric energy consumption, assist customers in managing their energy costs, and build a sustainable market around energy efficiency. Program participation is achieved by offering incentives structured to cover a portion of the customer's incremental cost of installing prescriptive efficiency measures.

Q. Please describe the C&I New Construction program.

A. The C&I New Construction program provides value by promoting energy efficient designs with the goal of developing projects that are more energy efficient than current Indiana building code. Incentives promoted through this program serve to reduce the incremental cost to upgrade to high-efficiency equipment over standard efficiency options for Vectren South customers. The program includes equipment with easily calculated savings and provides straightforward and easy participation for customers. This program is a Gas/Electric EE Program and will be available to eligible C&I customers located in Vectren South's combination gas and electric service territory.

Q. Please describe the C&I Custom program.

A. The C&I Custom program promotes the implementation of customized energy savings measures at qualifying customer facilities. Incentives promoted through this program serve to reduce the cost of implementing energy reducing projects and upgrading to high-efficiency equipment. Due to the nature of a custom energy efficiency program, a wide variety of projects are eligible.

The technical audit offers an assessment to systematically identify energy saving opportunities for customers and provides a mechanism to prioritize and phase-in projects that best meet customer needs. In turn, the opportunities identified from the audit can be turned in for the customized efficiency program. These two components work hand in hand to deliver energy savings to Vectren South's C&I customers.

Q. Has Vectren South made any changes to the C&I Custom program as included in the 2016-2017 Plan?

A. Yes. Vectren South has expanded the C&I Custom program to include a pilot initiative focused on strategic energy management ("SEM"). SEM programs aim to continuously improve energy performance over the long term through organizational transformation focused on equipping facility management and staff with the organizational and technical skills required to reduce energy waste. The outcome of a successful SEM program is reduced energy consumption through operational and maintenance improvements.

An SEM program should utilize the ISO 50001 standard, which provides a well-defined framework for structuring various technical and management tactics included as part of the overall strategy. The ISO 50001 training and technical support initiative will provide interested customers additional education on the ISO 50001 standard and the benefits for pursuing the certification. Training on the ISO 50001 management system, as well as organizational and technical assistance will be offered to customers that are interested in participating in this initiative.

To prepare facility operators to complete an SEM strategy, the program will offer optional training as well as technical assistance and potential bonus incentives for companies agreeing to pursue ISO 50001 and/or Superior Energy Performance ("SEP").

This program is a Gas/Electric EE Program and will be available to eligible C&I customers located in Vectren South's combination gas and electric service territory.

Q. Please describe the Multi-Family Energy Efficiency Retrofit program.

A. The Multi-Family Energy Efficiency Retrofit program is a new and separate initiative included as a part of the Multi-Family Direct Install program. Vectren South will offer this program at a small scale of 10 buildings, until program results are evaluated and the program is determined to be cost effective. If the program is determined to be cost effective then Vectren South will work with the Oversight Board to expand the program. This program provides value by directly installing energy efficient products such as high efficiency lighting, occupancy sensors, and programmable thermostats. The program helps identify and install cost effective energy saving measures by providing an on-site energy assessment customized for the facility. This program will focus on assessments and direct installation of measures in multi-family common areas and deeper retrofit of apartment units.

Q. Please describe the Outreach and Education program.

A. The Outreach and Education Program includes a communication plan to promote efficiency, disseminate conservation information and increase general awareness. The messages will specifically focus on directing customers to available programs and resources, such as the DLC program and the rebate programs. The messages developed for the paid media campaign are designed to assist customers in reducing their consumption. As a result, in addition to formal programs, reductions in usage will also be triggered by simply changing customer behaviors such as turning back thermostats, and using on-line tools available at vectren.com that clearly demonstrate the energy savings that can be realized by installing high efficiency equipment.

The outreach program associated with the 2016-2017 Plan will include paid media, web based tools to analyze bills, and energy audit tools. The Conservation Connection website will also have enhanced features on energy conservation and DSM program education and information. Informational guides and sales promotion materials for specific programs will be included as part of the outreach and education effort. Vectren South also plans to utilize outreach efforts similar to those used to promote gas efficiency including leveraging general corporate sponsorships, employee communications and customer emails as opportunities to promote conservation.

VII. 2016-2017 DSM BUDGET

Q. What are the estimated participation costs and benefits associated with the 2016-2017 Plan?

A. The 2016-2017 Plan has an estimated cost of $16.7 million, with $8.6 million in 2016 and $8.1 million in 2017. These amounts include anticipated evaluation costs and the total cost to implement the CVR program. The Company is proposing to capitalize and defer for future recovery the costs associated with installing CVR technology and to recover through the annual DSMA filings carrying costs and annual depreciation expense on CVR program investments. Petitioner's Witness Swiz will provide additional details about Vectren South's proposal.

In addition, Vectren South is requesting authority to roll forward into the next program year any unused and approved budget funds from 2016 and 2017 that remain unspent at the end of the year. This approval ensures that all funds approved by the Commission for use by Vectren South to save energy will be used for that purpose.

The 2016-2017 Plan establishes a portfolio of programs to achieve energy savings of 74,107 megawatt hours ("MWh") of energy savings, with 36,317 MWh to be saved in 2016 and 37,791 MWh in 2017. The total peak demand reduction is 15,443 kilowatts ("kW") with 8,334 kW of peak demand reduction scheduled in 2016 and 7,109 kW in 2017. Table MPH-2 below outlines the program goals and shows participation, energy/demand impacts and program costs at the Residential and C&I sector level.

Table MPH-2 – 2015/2016-2017 Program Goals and Budget

Vectren South - Residential Impacts, Participation, & Budget						
Program Year	**Participants/ Measures**	**Annual Energy Savings MWh**	**Annual Peak Demand Savings kW**	**Program Budget $,000**	**Incremental Lost Revenue Resulting from Plan Savings $,000**	***Performance Incentive, 10% Maximum Payout, $,000**
2016	297,428	20,148	5,880	$4,639	$861	$402
2017	296,583	20,362	4,439	$4,007	$834	$324
Total	**594,011**	**40,510**	**10,320**	**$8,646**	**$1,696**	**$726**

Vectren South - Commercial & Industrial Impacts, Participation, & Budget						
Program Year	**Participants/ Measures**	**Annual Energy Savings MWh**	**Annual Peak Demand Savings kW**	**Program Budget $,000**	**Incremental Lost Revenue Resulting from Plan Savings $,000**	***Performance Incentive, 10% Maximum Payout, $,000**
2016	29,953	16,169	2,454	$3,968	$414	$395
2017	30,056	17,428	2,669	$4,108	$410	$399
Total	**60,009**	**33,597**	**5,123**	**$8,075**	**$824**	**$794**

Vectren South - Portfolio Impacts, Participation, & Budget						
Program Year	**Participants/ Measures**	**Annual Energy Savings MWh**	**Annual Peak Demand Savings kW**	**Program Budget $,000**	**Incremental Lost Revenue Resulting from Plan Savings $,000**	***Performance Incentive, 10% Maximum Payout, $,000**
2016	327,381	36,317	8,334	$8,606	$1,275	$797
2017	326,639	37,791	7,109	$8,115	$1,244	$723
Total	**654,020**	**74,107**	**15,443**	**$16,721**	**$2,520**	**$1,519**

*Vectren South is not requesting utility performance incentives on the Conservation Voltage Reduction (CVR) and Income Qualified Weatherization Programs therefore program costs relating to either program are not included.

Q. In creating its 2016-2017 Plan, did Vectren South consider the impact of integrated Gas/Electric EE Programs on both its electric division and its gas division?

A. Yes. The program design and budget for Gas/Electric EE Programs are reflective of a cost share between Vectren South's gas division and Vectren South's electric division based on the benefits the program is providing to each division. Please refer to Table MPH-1 for a listing of the programs that are integrated with Vectren South's gas division.

Q. Are the budget and savings targets for the 2016-2017 Plan consistent with actual program experience?

A. Yes. The forecasted 2015 DSM Plan program budget approved by the Commission in Cause No. 44495 was approximately 1.91% of participating customer revenue and the savings target was approximately 1.02% of participating customer sales. These approved 2015 levels served as the starting point in developing the 2016-2017 Plan. The 2016-2017 Plan budget and goals referenced in Table MPH-1 reflects a budget of approximately 1.84% of participating customer revenue in 2016 and 1.71% in 2017 and a savings goal of 1.07% of participating customer sales for 2016 and 1.17% for 2017. The budget and savings targets established in the 2016-2017 Plan assume that 80% of eligible load will opt-out of participation in Company-sponsored EE and DR programs. As of January 1, 2015, approximately 76% of eligible load has opted-out.

Q. What has Vectren South learned from its historical program experience that supports the estimate of the budget for its 2016-2017 Plan?

A. Vectren South made modifications to the 2016-2017 Plan based on lessons learned and EM&V results. In general, Vectren South learned that markets need time to react to program offerings. While uptake for some programs were immediate, such as the upstream Residential Lighting program, other programs have taken longer to attract desired participation levels.

As some of the programs have matured, the less expensive, higher savings programs have reached or are reaching market saturation and as such, the 2016-2017 Plan includes more expensive programs that remain cost effective, but are less cost effective than the lower cost programs offered in prior years. For example, Vectren South discontinued the multi-family direct install program as a stand-alone program for electric heated properties at the end of 2014 due to market saturation. The 2016-2017 Plan includes a new program designed for a deeper retrofit of more expensive, but still cost-effective, measures to provide savings for this group of customers. The 2016-2017 Plan has also expanded Vectren South's Home Energy Audit to include deeper retrofit measures as recommended in the MPS.

The Small Business Direct Install Program has been expanded in 2016-2017 to include any participating Vectren South small business customer with a maximum peak demand of less than 400 kW. The program has been very well received in the marketplace. The maximum peak demand in 2015 was less than 300 kW.

VI. PROGRAM IMPLEMENTATION, EVALUATION AND REPORTING

Q. How does Vectren South plan to implement DSM programs included in the 2016-2017 Plan?

A. Implementation of the DSM programs included in the 2016-2017 Plan requires significant investment in internal and external resources. Detailed implementation planning will need to be completed as well as the selection of implementation partners. Vectren South has issued a Request for Proposal ("RFP") for the purpose of selecting one residential and one C&I gas and electric implementer for Gas/Electric EE Programs in Vectren South's service territory. Final vendor selections will be made by the Oversight Board. The non-integrated programs, including Residential Lighting, Appliance Recycle, Behavior Savings, CVR and Smart Thermostat DR, were not part of the RFP process. Vectren South will work with the Oversight Board on a vendor selection process for those programs.

Contract execution will be contingent upon Commission approval of the programs. The general requirements for implementing the DSM programs contained in the 2016-2017 Plan include the following:

- Selection of implementation partners;
- Development of detailed procedures for program administration;

- Development of the communication plan, promotional approaches such as marketing and program support materials;
- Detailed review and development of qualifying equipment lists, related impacts and procedures for determining qualifying measures;
- Development of tracking procedures and procurement of appropriate tracking system provider; and,
- Training of program staff.

Q. How will Vectren South measure the results of EE programs included in the 2016-2017 Plan?

A. Evaluation for all programs in the 2016-2017 Plan will be conducted by an independent evaluator. Evaluation activity will occur every year for the prior year's programs. In general, the independent evaluator will perform two types of evaluations, a process evaluation and an impact evaluation. The process evaluation will be performed to identify how well programs are implemented. The objective of the process evaluation is to examine the effectiveness and efficiency with which programs are designed and delivered. An impact evaluation will also be performed to examine the more technical effects of the programs such as energy savings. The goals of the impact evaluation are to verify and measure installations, determine participants' free-rider and spillover behaviors (the Net-to-Gross ratio), review the deemed savings values and estimate realized program savings.

During the evaluation process, an assessment of the program market effects will also be conducted to determine any changes and trends from the prior year, where applicable. For programs being evaluated for the first time, a baseline will be determined during the evaluation phase and further analysis will be conducted in subsequent years. Vectren South submits its annual evaluation reports to the Commission each year as part of its DSMA.

Q. How does Vectren South report program progress to the Commission?

A. In addition to submitting its annual evaluation report to the Commission, Vectren South has filed a scorecard with the Commission on or before July 1st of each year since July 1, 2010. Pursuant to the Final Order issued by the Commission on December 9, 2009 in Cause No. 42693 ("Phase II Order"), the Commission requires all jurisdictional electric utilities in Indiana to make a compliance filing by July 1st of each year to report on projected or actual program progress. Therefore, since July 1, 2010, Vectren South has been filing a scorecard in the Phase II Order Docket. Given the recent changes to the energy efficiency regulatory landscape discussed by Petitioner's Witness Sears in his Direct Testimony in this Cause, Vectren South is requesting authority, beginning in 2016, to submit its scorecard as part of its annual DSMA, instead of filing it in the Cause No. 42693 Docket. Granting this request allows Vectren South to provide the Commission with a concise report, as part of an ongoing docket, on prior year program performance based upon EM&V results, as well as a projection of the current year's program performance. In addition, the DSMA is the mechanism within which Vectren South recovers costs associated with the programs; therefore, allowing Vectren South to submit the scorecard as part of the DSMA provides the Commission a concise program performance reference point for review at the same time costs are approved. Furthermore, if the Commission closes the Docket in Cause No. 42693, stakeholders and other interested parties will be able to find the information they are accustomed to seeing in the annual DSMA filing.

VII. CONCLUSION

Q. Does this conclude your testimony?

A. Yes, at this time.

VERIFICATION

I, Michael P. Huber, Manager, Electric DSM and Conservation at Southern Indiana Gas & Electric Company d/b/a Vectren Energy Delivery of Indiana, Inc., affirm under the penalties of perjury that the statements and representations in the foregoing Direct Testimony are true to the best of my knowledge, information and belief.

Michael P. Huber

Michael P. Huber
Dated: June 26, 2015

Vectren South
2016 - 2017 Electric DSM Plan

May 20, 2015

Prepared by:
Southern Indiana Gas & Electric Company
d/b/a Vectren Energy Delivery of Indiana Inc. (Vectren South)

Table of Contents

I. Introduction

Southern Indiana Gas and Electric Company d/b/a Vectren Energy Delivery of Indiana, Inc. ("Vectren South" or "Company") provides energy delivery services to approximately 142,000 electric customers and 111,000 natural gas customers located in southwestern Indiana. Vectren South is a direct, wholly owned subsidiary of Vectren Utility Holdings, Inc. ("VUHI") and an indirect subsidiary of Vectren Corporation ("Vectren"), headquartered in Evansville IN. This Vectren South 2016 - 2017 Electric DSM Plan ("2016 - 2017 Plan") describes the details of the electric Energy Efficiency ("EE") and demand response ("DR") programs Vectren South plans to offer in its service territory in 2016 - 2017.

Vectren South designed the 2016 - 2017 Plan to save electric energy and reduce electric demand to cost effectively reduce energy use by approximately 1% of eligible retail sales. The 2016 - 2017 Plan recommends electric EE and DR programs for the residential, commercial, and industrial sectors in Vectren South's service territory. Where appropriate, it also describes opportunities for coordination with some of Vectren South's gas conservation programs to leverage the best total EE and DR opportunities for customers and to share costs of delivery.

Vectren South DSM Strategy

Vectren South has worked to instill a culture of conservation throughout the entire organization, including within its employees and customers. Vectren South has embraced EE and DR and actively promotes the benefits of EE and DR to its employees and customers. Vectren South has taken steps to implement this conservation culture starting with its employees. Vectren South encourages each employee, especially those with direct customer contact, to promote conservation and has provided employees with the tools they need to encourage customers to conserve and participate in Company sponsored EE and DR programs. Vectren South has used internal communications and presentations, conservation flyers and handouts, meetings with community leaders, and formal training to promote this culture of conservation. This cultural shift was a motivating factor in Vectren South creating Conservation Connection and launching its "Live Smart" motto to further emphasize EE, DR, and conservation. Vectren South's purpose statement is the foundation of the Vectren Strategy related to DSM:

> *Purpose:*
>
> *With a focus on the need to conserve natural resources, we provide energy and related solutions that make our customers productive, comfortable and secure. Customers are a key component of Vectren's values, and Vectren knows success comes from understanding its customers and actively helping them to use energy efficiently.*

As evidence of its long-term commitment to EE, Vectren South's recently completed 2014 Integrated Resource Plan ("2014 IRP") includes EE and DR programs for all customer classes and sets an annual savings target of 1% of retail sales for 2015 - 2019 and .5% annually thereafter. The 1% savings target assumes that 80% of eligible large customer load will opt-out of participation in Company sponsored EE and DR programs, as provided for in Senate Enrolled Act 340 ("SEA 340"). The load forecast also includes an ongoing level of EE related to codes and standards embedded in the load forecast projections. Ongoing EE and DR programs are also important given the integration of Vectren South's natural gas and electric EE and DR programs.

Vectren South EE and DR Planning Process

Vectren South has been offering a variety of EE programs since April 2010 and has engaged in a similar planning process each time a new portfolio is presented to the Indiana Utility Regulatory Commission ("Commission") for approval. Many factors, including past Commission orders establishing energy savings targets and subsequent passage of SEA 340 abolishing those targets and providing a mechanism for certain eligible customers to opt-out of participation in Company sponsored EE and DR programs, have influenced the planning process over the years.

The 2016 - 2017 Plan was developed in conjunction with the 2014 IRP planning process and therefore the 2014 IRP served as a key input into the 2016 - 2017 Plan. Consistent with the 2014 IRP, the framework for the 2016 - 2017 Plan was modeled at a savings level of 1% of retail sales adjusted for an opt-out rate of 80% eligible load. Once the level of EE and DR programs to be offered from 2016 through 2017 was established, Vectren South engaged in a three-step process to develop the 2016 - 2017 Plan. The objective of the planning process was to develop a plan based upon market-specific information for Vectren South's territory, which could be successfully implemented utilizing realistic assessments of achievable market potential.

The first step in the process was to utilize the EnerNOC Market Potential Study ("MPS") that was completed in 2013. Vectren South, with guidance from the Vectren Oversight Board ("VOB"), engaged EnerNOC, Inc. to study its EE and DR market potential and develop an Action Plan. EnerNOC conducted a detailed, bottom-up assessment of the Vectren South market in the Evansville metropolitan area to deliver a projection of baseline electric energy use, forecasts of the energy savings achievable through efficiency measures, and program designs and strategies to optimally deliver those savings. The study developed technical, economic and achievable potential estimates by sector, customer type and measure.

The EnerNOC MPS and other study information were used to help guide the 2016 - 2017 Plan design. Study analysis and results details can be found in the MPS and its appendices. For planning purposes Vectren South used the "Recommended Achievable" scenario as a foundation for developing the 2016 - 2017 Plan.

The second primary step in the planning process was to hire outside expertise to assist with the plan design and development. Vectren South retained EMI Consulting to assist with designing the 2016 - 2017 Plan. Matthew Rose, Director of EMI Consulting, was the primary planner working with the Vectren South team.

The third primary step in the planning process was to obtain input from various sources to help develop and refine a workable plan. The first group providing input was Vectren South's EE and DR Program Managers who have been overseeing current Vectren South programs. In addition, vendors and other implementation partners who operate the current programs were very involved in the process as well. They provided suggestions for program changes and enhancements. The vendors and partners also provided technical information about measures to include recommended incentives, estimates of participation and estimated implementation costs. These data provided a foundation for the 2016 - 2017 Plan based on actual experience within Vectren South's territory. These companies also bring their experience operating programs for other utilities. Once the draft version of the 2016-2017 Plan was developed, Vectren South solicited feedback from the VOB for consideration in the final design.

Other sources of program information were also considered. Current evaluations and the Indiana Technical Resource Manual ("TRM") were used for adjustments to inputs. In addition, best practices were researched and reviewed to gain insights into the program design of successful EE and DR programs implemented at other utilities.

EE and DR Screening Results

The last step of the planning process was the cost benefit analysis. Vectren South retained Richard Stevie, Vice President of Forecasting with Integral Analytics, to complete the cost benefit modeling. Utilizing DSMore the measures and programs were analyzed for cost effectiveness. The DSMore tool is nationally recognized and used in many states across the country to determine cost-effectiveness. Developed and licensed by Integral Analytics based in Cincinnati Ohio, the DSMore cost-effectiveness modeling tool takes hourly prices and hourly energy savings from the specific measures/technologies being considered for the EE program, and then correlates both to weather. This tool looks at over 30 years of historic weather variability to get the full weather variances appropriately modeled. In turn, this allows the model to capture the low probability, but high consequence weather events and apply appropriate value to them. Thus, a more accurate view of the value of the efficiency measure can be captured in comparison to other alternative supply options.

Utilizing a cost/benefit model, the measures and programs were analyzed for cost effectiveness. The outputs include all the California Standard Practice Manual results including Total Resource Cost ("TRC"), Utility Cost Test ("UCT"), Participant Cost Test ("PCT") and Ratepayer Impact Measure ("RIM") tests. Inputs into the model include the following: participation rates, incentives paid, energy savings of the measure, life of the measure, implementation costs, administrative costs, incremental costs to the participant of the high efficiency measure, and escalation rates and discount rates. Vectren South considers the results of each test and ensures that the portfolio passes the TRC test as it includes the total costs and benefits to both the utility and the consumer.

The model includes a full range of economic perspectives typically used in EE and DSM analytics. The perspectives include:

- Participant Cost Test
- Utility Cost Test
- Ratepayer Impact Measure Test
- Total Resource Cost Test

The cost effectiveness analysis produces two types of resulting metrics:

1. Net Benefits (dollars) = NPV ∑ benefits – NPV ∑ costs
2. Benefit Cost Ratio = NPV ∑ benefits ÷ NPV ∑ costs

As stated above, the cost effectiveness analysis is performed using each of the four primary tests. The results of each test reflect a distinct perspective and have a separate set of inputs demonstrating the treatment of costs and benefits. A summary of benefits and costs included in each cost effectiveness test is shown below in Table 1.

Table 1. Vectren South Cost Effectiveness Tests Benefits & Costs Summary

Test	Benefits	Costs
Participant Cost Test	• Incentive payments • Annual bill savings • Applicable tax credits	• Incremental technology/equipment costs • Incremental installation costs
Utility Cost Test (Program Administrator Cost Test)	• Avoided energy costs • Avoided capacity costs	• All program costs (startup, marketing, labor, evaluation, promotion, etc.) • Utility/Administrator incentive costs
Rate Impact Measure Test	• Avoided energy costs • Avoided capacity costs	• All program costs (startup, marketing, labor, evaluation, promotion, etc.) • Utility/Administrator incentive costs • Lost revenue due to reduced energy bills

Test	Benefits	Costs
Total Resource Cost Test	• Avoided energy costs • Avoided capacity costs • Applicable participant tax credits	• All program costs (not including incentive costs) • Incremental technology/equipment costs (whether paid by the participant or the utility)

The Participant Cost Test shows the value of the program from the perspective of the utility's customer participating in the program. The test compares the participant's bill savings over the life of the EE/DR program to the participant's cost of participation.

The Utility Cost Test shows the value of the program considering only avoided utility supply cost (based on the next unit of generation) in comparison to program costs.

The Ratepayer Impact Measure (RIM) Test shows the impact of a program on all utility customers through impacts in average rates. This perspective also includes the estimates of revenue losses, which may be experienced by the utility as a result of the program.

The Total Resource Cost (TRC) Test shows the combined perspective of the utility and the participating customers. This test compares the level of benefits associated with the reduced energy supply costs to utility programs and participant costs.

In completing the tests listed above, Vectren South used 7.29% as the weighted average cost of capital, as, approved by the Commission on April 27, 2011 in Cause No. 43839. For the 2016 - 2017 Plan, Vectren South utilized the avoided costs from Table 8-2 in the 2014 IRP.

Table 2 below confirms that all programs pass the TRC at greater than one.

The total portfolio for the Vectren South programs passes the TRC test for both Residential and Commercial & Industrial programs.

Table 2. Vectren South 2016 - 2017 Plan Cost Effectiveness Results without Performance Incentive

COMMERCIAL & INDUSTRIAL	TRC	UCT	RIM	Participant	Lifetime Cost/kWh**	1st Year Cost/kWh**	TRC NPV $	UCT NPV $
Small Business Direct Install	1.28	2.33	0.74	1.56	$0.03	$0.29	$1,732,739	$4,554,660
Commercial & Industrial Prescriptive	3.00	4.07	0.87	3.25	$0.02	$0.15	$5,485,762	$6,202,259
Commercial & Industrial New Construction	1.99	2.49	0.79	3.03	$0.03	$0.33	$400,143	$481,736
Commercial & Industrial Custom	1.07	2.74	0.77	1.18	$0.02	$0.28	$260,765	$2,468,576
Multi-Family Energy Efficient Retrofit	1.35	2.12	0.75	1.53	$0.03	$0.47	$100,549	$206,130
Conservation Voltage Reduction***	1.06	1.06	0.51	NA	$0.06	$0.15	$50,032	$50,032
Outreach	NA	NA	NA	NA	NA	NA	($289,808)	($289,808)
Commercial & Industrial Sector Portfolio*	**1.54**	**2.62**	**0.77**	**1.93**	**$0.02**	**$0.24**	**$7,740,183**	**$13,673,586**

RESIDENTIAL	TRC	UCT	RIM	Participant	Lifetime Cost/kWh**	1st Year Cost/kWh**	TRC NPV $	UCT NPV $
Residential Lighting	2.30	2.95	0.56	4.23	$0.03	$0.12	$2,711,715	$3,165,966
Home Energy Assessments & Weatherization	1.53	1.80	0.46	8.49	$0.04	$0.22	$508,549	$656,140
Income Qualified Weatherization	1.06	1.06	0.40	NA	$0.07	$0.47	$68,181	$68,181
Appliance Recycling	1.40	1.40	0.39	9.77	$0.04	$0.20	$160,494	$159,188
Energy Efficient Schools	3.39	3.39	0.53	NA	$0.02	$0.17	$551,397	$551,397
Residential Efficient Products	1.31	2.07	0.69	1.54	$0.05	$0.58	$586,114	$1,288,936
Residential New Construction	1.36	2.65	0.71	1.37	$0.03	$0.67	$133,067	$315,685
Multi-Family Direct Install	3.69	3.69	0.44	NA	$0.02	$0.09	$156,955	$156,955
Residential Behavior Savings	1.45	1.45	0.44	NA	$0.06	$0.06	$325,442	$325,442
Residential Smart Thermostat Demand Response	1.56	1.30	0.78	NA	$0.21	$1.39	$1,366,716	$886,947
Conservation Voltage Reduction***	1.38	1.38	0.52	NA	$0.06	$0.12	$515,434	$515,434
Outreach	NA	NA	NA	NA	NA	NA	($289,808)	($289,808)
Residential Sector Portfolio*	**1.57**	**1.71**	**0.56**	**5.00**	**$0.05**	**$0.22**	**$6,794,259**	**$7,800,464**
Tracking	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**($38,641)**	**($38,641)**
Total Portfolio*	**1.55**	**2.10**	**0.65**	**2.92**	**$0.04**	**$0.23**	**$14,495,801**	**$21,435,409**

*Sector level cost/benefit scores include Outreach, while portfolio level cost/benefit scores also include Tracking. Neither include utility performance incentives.
**Cost/kwh values do not include utility performance incentives
***1st Year Cost/kWh calculated by dividing total budget for 2016 and 2017 by the 2017 savings.

CVR is split in the table above based on Residential and Commercial & Industrial impacts and are included in the sector and total portfolio results. Table 3 below represents the combined total for the CVR program.

Table 3. Vectren South 2016 - 2017 CVR Cost Effectiveness Results without Performance Incentive

Conservation Voltage Reduction	TRC	UCT	RIM	Participant	Lifetime Cost/kWh	1st Year Cost/kWh*	TRC NPV $	UCT NPV $
Residential and Commercial & Industrial Combined	1.26	1.26	0.52	NA	$0.06	$0.13	$565,467	$565,467

*1st Year Cost/kWh calculated by dividing total budget for 2016 and 2017 by the 2017 savings.

Table 4 below demonstrates that even with the Utility Performance Incentive set at the maximum of 10%, each sector, as well as the total portfolio, remains cost-effective.

Table 4. Vectren South 2016 - 2017 Plan Cost Effectiveness Results with Utility Performance Incentive

2016 - 2017 Portfolio - Including Utility Performance Incentives	TRC	UCT	RIM	Participant	Lifetime Cost/kWh	1st Year Cost/kWh	TRC NPV $	UCT NPV $
Commercial & Industrial Sector Portfolio*	1.46	2.40	0.75	1.93	$0.03	$0.26	$6,973,481	$12,906,884
Residential Sector Portfolio*	1.48	1.61	0.55	5.00	$0.06	$0.24	$6,090,588	$7,096,793
Tracking	NA	NA	NA	NA	NA	NA	($38,641)	($38,641)
Total Portfolio*	**1.47**	**1.95**	**0.64**	**2.92**	**$0.04**	**$0.25**	**$13,025,428**	**$19,965,036**

*Sector level cost/benefit scores include Outreach and utility performance incentives, while portfolio level cost/benefit scores also incude Tracking. Vectren South is not requesting utility performance incentives on the CVR and Income Qualified Weatherization Programs therefore program costs relating to either program are not included.

Integration with Vectren South Gas

Opportunities exist to gain both natural gas and electric savings from some EE measures. When this occurs savings will be captured by the respective utility. For the programs where integration opportunities exist, Vectren South has allocated implementation costs based on the net benefits split between natural gas and electric. Vectren South has a separate pending filing for 2016 - 2020 gas conservation programs and the same methodology was utilized in that plan. Below is a list of programs that Vectren South has identified as integrated:

- Home Energy Assessments and Weatherization
- Income Qualified Weatherization
- Energy Efficient Schools
- Residential New Construction
- Multi-Family Direct Install
- Residential Behavior Savings Program
- C&I New Construction
- Small Business Direct Install
- Multi-Family EE Retrofit

Oversight and Governance of EE and DR Programs

The VOB provides input into the planning and evaluation of Vectren South's EE programs. The VOB was formed in 2010 pursuant to the Final Order issued in Cause No. 43427 and included the OUCC and Vectren South as voting members. The Citizens Action Coalition ("CAC") was added as a voting member of the VOB in 2013 pursuant to the Final Order issued in Cause No. 44318. In 2014, the Vectren South Electric Oversight Board merged with the Vectren South Gas Oversight Board and Vectren North Gas Oversight to form one governing body, the VOB.

II. 2016 - 2017 Plan Objectives and Impact

The framework for the 2016 - 2017 Plan are consistent with the goals stated in the 2014 IRP and were designed to reach a reduction in sales of 1% of eligible retail sales, including the option for eligible large customer "opt-out'.

A. Plan Savings

The 2016 - 2017 Plan goal was calculated based on a percentage of forecasted weather normalized electric sales for 2016 and 2017 with a target of 1% of eligible retail sales. The forecast utilized to calculate the 2016 – 2017 Plan goal is consistent with Vectren South's 2014 IRP sales forecast. Goals are based on "gross" energy savings assuming 80% of eligible large customers will "opt-out" of the program. To reach the usage reduction goal of 1% of eligible retail sales, the savings targets for Residential and C & I were designated based on the percentage of sales revenue that each sector represents. Table 5 below demonstrates the portfolio, Residential and C&I energy savings targets at the 1% eligible retail sales level:

Table 5. Vectren South 2016 - 2017 Plan Portfolio Summary Planned Energy Savings

Portfolio Summary	2016 kWh Total	2017 kWh Total
Residential Total	20,147,744	20,362,245
Commercial & Industrial Total	16,168,861	17,428,270
Portfolio Total	**36,316,606**	**37,790,515**

Table 6 below lists the Commercial & Industrial and Residential programs' individual gross energy savings targets split by program:

Table 6. Vectren South 2016 - 2017 Plan Program Planned Energy Savings

COMMERCIAL & INDUSTRIAL	2016 kWh	2016 kW	2017 kWh	2017 kW
Small Business Direct Install	6,000,810	906	6,000,810	906
Commercial & Industrial Prescriptive	6,910,197	1,088	6,910,197	1,088
Commercial & Industrial New Construction	498,526	88	534,135	94
Commercial & Industrial Custom	2,557,544	339	2,906,300	385
Multi-Family Energy Efficient Retrofit	201,785	33	201,785	33
Conservation Voltage Reduction	0	0	875,044	163
Commercial & Industrial Total	**16,168,861**	**2,454**	**17,428,270**	**2,669**

RESIDENTIAL	**2016 kWh**	**2016 kW**	**2017 kWh**	**2017 kW**
Residential Lighting	6,612,901	839	6,831,909	865
Home Energy Assessments & Weatherization	1,935,719	290	1,935,719	290
Income Qualified Weatherization	1,282,577	254	1,282,577	254
Appliance Recycling	1,020,544	152	1,020,544	152
Energy Efficient Schools	675,508	106	675,508	106
Residential Efficient Products	1,075,888	623	1,075,888	623
Residential New Construction	146,775	68	146,775	68
Multi-Family Direct Install	335,000	20	335,000	20
Residential Behavior Savings	6,204,832	1,728	5,576,656	1,553
Residential Smart Thermostat Demand Response	858,000	1,800	0	0
Conservation Voltage Reduction	0	0	1,481,669	508
Residential Total	**20,147,744**	**5,880**	**20,362,245**	**4,439**

CVR is split in the table above based on Residential and Commercial & Industrial savings and are included in the sector and total portfolio results. Table 7 below represents the combined total for the CVR program.

Table 7. Vectren South 2016 - 2017 Conservation Voltage Reduction Planned Energy Savings

Conservation Voltage Reduction	**2016 kWh**	**2016 kW**	**2017 kWh**	**2017 kW**
Commercial & Industrial	0	0	875,044	163
Residential	0	0	1,481,669	508
Conservation Voltage Reduction Total	**0**	**0**	**2,356,713**	**671**

B. Comparison of Savings to Market Potential Study

The program design used the MPS for guidance to determine if the plan estimates were reasonable. While building from the bottom up with estimates from program implementers to help determine participation, this comparison to the MPS allowed the planning team to determine if the results were reasonable.

The MPS resulted in the following three scenarios for the plan: Low Achievable, High Achievable, and Recommended. It is important to note that the MPS was completed prior to the enactment of SEA340 and large customer opt-out. Therefore the MPS assumed all sales are eligible and the 2016 – 2017 Plan assumes an opt-out level of 80% of large customer sales. Tables 8 and 9 below compare the 2016 - 2017 Plan to the recommended savings estimates.

Table 8. EnerNOC MPS vs. Vectren South's 2016 - 2017 Plan for 2016

MPS Recommended MWh*		Vectren Plan MWh	
	2016	**2016**	
Commercial & Industrial Prescriptive	17,217	6,910	Commercial & Industrial Prescriptive
Commercial & Industrial Custom	17,519	2,558	Commercial & Industrial Custom
Commercial Schools	987	0	Commercial Schools
Strategic Energy Management	1,663	0	Strategic Energy Management
Commercial & Industrial New Construction	1,459	499	Commercial & Industrial New Construction
Small Business Direct Install	2,134	6,001	Small Business Direct Install
Multi-Family Energy Efficient Retrofit	NA	202	Multi-Family Energy Efficient Retrofit
Residential Lighting	10,167	6,613	Residential Lighting
Residential Efficient Products	3,697	1,076	Residential Efficient Products
Residential Income Qualified	1,799	1,283	Income Qualified Weatherization**
Residential Income Qualified Plus	141		
Residential New Construction	203	147	Residential New Construction
Multi Family Direct Install	448	335	Multi Family Direct Install
Home Energy Assessments	2,911	1,936	Home Energy Assessments & Weatherization
Whole House	2,037	0	Whole House
Residential School Kit	1,037	676	Energy Efficient Schools
Appliance Recycling	802	1,021	Appliance Recycling
Residential Behavioral Savings	5,177	6,205	Residential Behavioral Savings
Residential Smart Thermostat Demand Response	NA	858	Residential Smart Thermostat Demand Response
Totals	**69,397**	**36,317**	**Totals**

*The MPS was completed prior to the enactment of SEA340 and large customer opt-out. Therefore the MPS assumed all sales are eligible and the 2016 – 2017 Plan assumes an opt-out level of 80% of large customer sales.

**Vectren South is implementing some but not all of the measures recommended in the Market Potential Study for the Residential Income Qualified Plus Program.

Table 9. EnerNOC MPS vs. Vectren South's 2016 - 2017 Plan for 2017

MPS Recommended MWh*		Vectren Plan MWh	
	2017	**2017**	
Commercial & Industrial Prescriptive	19,297	6,910	Commercial & Industrial Prescriptive
Commercial & Industrial Custom	19,766	2,906	Commercial & Industrial Custom
Commercial Schools	1,081	0	Commercial Schools
Strategic Energy Management	2,757	0	Strategic Energy Management
Commercial & Industrial New Construction	1,611	534	Commercial & Industrial New Construction
Small Business Direct Install	2,278	6,001	Small Business Direct Install
Multi-Family Energy Efficient Retrofit	NA	202	
Conservation Voltage Reduction (Commercial & Industrial)	NA	875	Conservation Voltage Reduction (Commercial & Industrial)
Residential Lighting	10,230	6,832	Residential Lighting
Efficient Products	4,716	1,076	Residential Efficient Products
Residential Income Qualified	1,527	1,283	Income Qualified Weatherization**
Residential Income Qualified Plus	144		
Residential New Construction	232	147	Residential New Construction
Multi Family Direct Install	NA	335	Multi Family Direct Install
Home Energy Assessments	3,092	1,936	Home Energy Assessments & Weatherization
Whole House	2,153	0	Whole House
Residential School Kit	1,030	676	Energy Efficient Schools
Appliance Recycling	802	1,021	Appliance Recycling
Residential Behavioral Savings	5,177	5,577	Residential Behavioral Savings
Conservation Voltage Reduction (Residential)	NA	1,482	Conservation Voltage Reduction (Residential)
Totals	**75,892**	**37,791**	**Totals**

*The MPS was completed prior to the enactment of SEA340 and large customer opt-out. Therefore the MPS assumed all sales are eligible and the 2016 – 2017 Plan assumes an opt-out level of 80% of large customer sales.

**Vectren South is implementing some but not all of the measures recommended in the Market Potential Study for the Residential Income Qualified Plus Program.

C. Budgets

The program budgets were built based upon many inputs. First the measures were assigned incentives based upon existing program incentives, proposed incentives and leveraged evaluation recommendations. Program budgets were discussed with both current and potential delivery providers as a basis for the development of this plan. The second primary input for the costs were estimates for implementation informed by the current statewide program implementation costs. This helps to assure that the estimates are realistic for successful delivery. The third cost area is the administrative costs made up of the internal costs for Vectren South management of the programs and implementers and other costs such as marketing. Administrative costs were allocated back to programs and measures based on the percent of savings these programs and measures represent. The last cost area is the Evaluation, Measurement and Verification ("EM&V") costs based on 5% of the budget. Table 10 below lists the summary budgets by program.

Table 10. 2016 – 2017 Vectren South Plan Summary Budget

Commercial & Industrial	2016	2017	Total Program Costs
Small Business Direct Install	$1,760,611	$1,774,351	$3,534,962
Commercial & Industrial Prescriptive	$1,042,705	$1,049,906	$2,092,611
Commercial & Industrial New Construction	$162,562	$172,898	$335,460
Commercial & Industrial Custom	$726,584	$738,386	$1,464,971
Multi-Family Energy Efficient Retrofit	$95,081	$95,081	$190,162
Conservation Voltage Reduction*	$20,000	$117,146	$137,147
Outreach	$150,000	$150,000	$300,000
Commercial & Industrial Total	**$3,957,543**	**$4,097,768**	**$8,055,312**

Residential	2016	2017	Total Program Costs
Residential Lighting	$788,506	$897,321	$1,685,827
Home Energy Assessments & Weatherization	$419,910	$429,428	$849,339
Income Qualified Weatherization	$598,270	$604,045	$1,202,315
Appliance Recycling	$205,094	$207,948	$413,042
Energy Efficient Schools	$117,706	$120,901	$238,607
Residential Efficient Products	$622,492	$626,298	$1,248,790
Residential New Construction	$98,441	$99,536	$197,977
Multi-Family Direct Install	$29,776	$30,610	$60,387
Residential Behavior Savings	$382,000	$366,285	$748,285
Residential Smart Thermostat Demand Response	$1,196,455	$297,890	$1,494,345
Conservation Voltage Reduction*	$20,000	$166,861	$186,861
Outreach	$150,000	$150,000	$300,000
Residential Total	**$4,628,652**	**$3,997,122**	**$8,625,774**

Portfolio	2016	2017	Total Program Costs
Tracking	$20,000	$20,000	$40,000

Portfolio Total	$8,606,195	$8,114,891	$16,721,086

* With Commission approval, Vectren South will capitalize the costs to implement the CVR program and will seek to recover through the annual DSMA Rider the carrying costs and depreciation expense associated with the implementation along with annual, ongoing Operation and Maintenance ("O&M") expense, a representative share of Vectren South's DSM support staff and administration costs and related EM&V cost. The CVR budget in Table 10 is reflective of this request.

CVR is split in the table above based on Residential and Commercial & Industrial budget and are included in the sector and total portfolio results. Table 11 below represents the combined total for the CVR program.

Table 11. 2016 – 2017 Conservation Voltage Reduction Summary Budget

Portfolio	2016	2017	Total Program Costs
Total Conservation Voltage Reduction*	$40,000	$284,007	$324,007

* With Commission approval, Vectren South will capitalize the costs to implement the CVR program and will seek to recover through the annual DSMA Rider the carrying costs and depreciation expense associated with the implementation along with annual, ongoing Operation and Maintenance ("O&M") expense, a representative share of Vectren South's DSM support staff and administration costs and related EM&V cost. The CVR budget in Table 11 is reflective of this request.

Key Inputs

The programs are based on known existing measures and technologies. The measure savings were calculated using the Indiana TRM, any Company specific evaluation data and input from existing implementation partners. When a measure was not in the Indiana TRM, then other TRMs were referenced including Michigan and Illinois. If needed, estimates were made from actual projects or experience of the implementation contractors.

III. Program Administration

Vectren South will serve as the program administrator for the 2016 - 2017 Plan. Vectren South will likely utilize third party program implementers to deliver specific programs or program components where specialty expertise is required and will look to utilize a single implementer for integrated natural gas/electric Residential and a single implementer for integrated natural gas/electric C&I programs. Contracting directly with specialty vendors avoids an unnecessary layer of management, oversight and expense that occurs when utilizing a third-party administration approach.

There are three major components of program administration that were considered in the 2016 - 2017 Plan. They include: internal labor/program support, program tracking and customer outreach/education.

A. Internal Labor/Program Support

Based upon the EE and DR programs proposed in the 2016 - 2017 Plan, Vectren South is proposing to maintain the staffing levels that were previously approved to support the portfolio. The following four (4) positions are included as part of this 2016 - 2017 Plan:

- Electric DSM Manager – Oversees the overall portfolio and staff necessary to support program administration. Serves as primary contact for regulatory and oversight of programs.
- Electric DSM Analyst – Works with the selected EM&V Administrator and facilitates measurement and verification efforts, assists with program reporting/tracking.
- Electric DSM Financial Analyst – Responsible for all aspects of program reporting including, budget analysis/reporting, scorecards and filings.
- Electric DSM Representative – Serves as contact to trade allies regarding program awareness. Also serves as point of contact for residential and commercial/industrial customers to assist with responding to program inquiries.

Additionally, internal labor includes the following indirect costs which will be incurred to support the portfolio:

- Conservation Connection resources to answer customer inquiries on Vectren South programs
- Memberships with EE organizations such as Consortium for Energy Efficiency (CEE) and Midwest Energy Association (MEA)
- Annual license and maintenance fees for the online energy audit and bill analyzer tool
- Staff Development & Training

Vectren South allocated the costs of the proposed staffing and support requirements in the fixed cost budgets of the respective EE programs.

B. Program Tracking

Program tracking includes license and maintenance fees necessary to support the database that serves as the repository for all program data and reporting.

C. Customer Outreach and Education

Vectren South's Customer Outreach and Education program serves to raise awareness and drive customer participation as well as educate customers on how to manage their energy bills. The program includes the following goals as objectives:

1. Build awareness;
2. Educate consumers on how to conserve energy and reduce demand;
3. Educate customers on how to manage their energy costs and reduce their bill;
4. Communicate support of customer EE needs; and
5. Drive participation in the EE and DR programs.

The marketing approach includes paid media as well as web based tools to help analyze bills, energy audit tools, EE and DSM program education and information. Informational guides and sales promotion materials for specific programs are included in this budget.

This effort is the key to achieving greater energy savings by convincing the families and businesses making housing/facility, appliance and equipment investments to opt for greater EE. The first step in convincing the public and businesses to invest in EE is to raise their awareness.

It is essential that a broad public education and outreach campaign not only raise awareness of what consumers can do to save energy and control their energy bills, but to prime them for participation in the various EE and DR programs. The annual program outreach and education budget is $150,000 each for Residential and Commercial & Industrial programs, for a total of $300,000.

Table 12. 2016 – 2017 Customer Outreach and Education Budget

Customer Outreach	Residential	Commercial & Industrial	Total Outreach Costs
2016	$150,000	$150,000	$300,000
2017	$150,000	$150,000	$300,000
Total	**$300,000**	**$300,000**	**$600,000**

Marketing Plans

This effort will provide funding for cross-program public education activities, outreach, marketing and promotion to raise awareness of the benefits and methods of improving EE in homes and commercial & industrial businesses. Beyond EE education, an objective will be to motivate participation in the programs.

Types of activities that will be included in this effort are:

- Enhancement of the Conservation Connection website to include the latest electric EE information for residential and commercial & industrial use.
- Targeted educational campaign for businesses to support the programs.
- Targeted educational campaign for residences to support the programs.
- Targeted training and educational program for trade allies.
- Distribution of federal Energy Star and other national organization materials in the service territory.

Delivery Organization

Vectren South will oversee outreach and education for the programs. The Company will work closely with its implementation partners to provide consistent messaging across different program outreach and education efforts. Vectren South will utilize the services of communication and EE experts to deliver the EE and DR message.

IV. Program Descriptions

The 2016 - 2017 Plan is built from the existing programs currently being offered by Vectren South to its customers. The existing programs will continue to be offered by Vectren South through implementation partners. The programs in the 2016 - 2017 Plan include:

- Residential Lighting
- Home Energy Assessments and Weatherization
- Income Qualified Weatherization
- Appliance Recycling
- Energy Efficient Schools
- Residential Efficient Products
- Residential New Construction
- Multi-Family Direct Install
- Residential Behavior Savings Program
- Small Business Direct Install
- Commercial & Industrial Prescriptive Rebates
- Commercial & Industrial New Construction
- Commercial & Industrial Custom Program

The 2016 - 2017 Plan also includes several new programs that Vectren South will implement and then measure the cost and savings estimates for potential expanded program offerings. These programs include:

- Residential Smart Thermostat Demand Response
- Conservation Voltage Reduction (CVR)
- Multi-Family EE Retrofit

A. Residential Lighting

Program Description

The Residential Lighting Program is a market-based residential EE program designed to reach residential customers through retail outlets. The program consists of a buy-down strategy that provides incentives to consumers to facilitate the purchase of EE lighting products. The program as designed takes the Energy Independence and Security Act (*EISA*) policies into account by including a shift from compact fluorescent lamps ("CFL") bulbs to light emitting diodes ("LED") bulbs starting in 2016. The program not only empowers customers to take advantage of new lighting technologies and accelerate the adoption of proven energy efficient technologies, but also allows the customers to experience the benefits of EE and decrease their energy consumption.

Eligible Customers

Any residential customer who receives electric service from Vectren South.

Marketing Plan

The program is designed to reach residential customers through retail outlets. Proposed marketing efforts include point of purchase promotional activities, the use of utility bill inserts and coordinated advertising with selected manufacturers and retail outlets.

Barriers/Theory

The program addresses the market barriers by empowering customers to take advantage of new lighting technologies through education and availability in the marketplace; accelerating the adoption of proven energy efficient technologies through incentives to lower price; and working with retailers to allow them to sell more high efficient products.

It is assumed that participants will be adding new LED bulbs over time. The annual adoption levels for LED bulbs are as follows:

2016: LEDs assume an estimated 21.2% of qualifying bulb market share

2017: LEDs assume an estimated 29.5% of qualifying bulb market share

The inputs developed for this program reflect the blended values assuming a mixture of bulbs. The impacts and costs will vary each year as the mixture of bulbs changes.

Initial Measures, Products and Services

The measures will include a variety of ENERGY STAR-qualified lighting products currently available at retailers in Indiana, including CFLs, LEDs, fixtures, and ceiling fans.

Table 13. Residential Lighting Program Budget & Energy Savings Targets

Market	Program	2016	2017	Total Program
Residential	Residential Lighting			
	Number of Measures	233,168	233,899	467,067
	Energy Savings kWh	6,612,901	6,831,909	13,444,810
	Peak Demand kW	839	865	1,705
	Total Program Budget $	$788,506	$897,321	$1,685,827
	Per Participant Avg Energy Savings (kWh)*			28.8
	Per Participant Avg Demand Savings (kW)*			0.004
	Weighted Avg Measure Life*			8
	Net To Gross Ratio			57%

Table 14. Residential Lighting Estimated Energy Savings & Budget

Residential	kWh Total	kW	Administration	Other	Implementation	Incentives	Total Program Costs
Residential Lighting	13,444,810	1,705	$120,000	$80,768	$408,618	$1,076,441	$1,685,827
2016	6,612,901	839	$60,000	$37,750	$201,488	$489,268	$788,506
2017	6,831,909	865	$60,000	$43,018	$207,130	$587,173	$897,321

Table 15. Residential Lighting Cost Effectiveness

Residential	TRC	UCT	RIM	Participant	Lifetime Cost/kWh	1st Year Cost/kWh	TRC NPV $	UCT NPV $
Residential Lighting	2.30	2.95	0.56	4.23	$0.03	$0.12	$2,711,715	$3,165,966

Program Delivery

Vectren South will oversee the program and may partner with an implementation provider to deliver the program.

Evaluation, Measurement and Verification

The implementation contractor will verify the paperwork of the participating retail stores. They will also spot check stores to assure that the program guidelines are being followed. A third party evaluator will evaluate the program using standard EM&V protocols.

B. Home Energy Assessments and Weatherization

Program Description

The Home Energy Assessment and Weatherization Program targets a hybrid approach that combines helping customers analyze and understand their energy use via an on-site energy assessment, providing direct installation of EE measures including efficient low-flow water fixtures and CFL bulbs, and providing deeper retrofit measures for customers who choose to pay 40% of the deeper retrofit measure cost.

Eligible Customers

Any residential customer who receives electric service from Vectren South at a single-family residence, provided the home:

- was built prior to 1/1/2010;
- has not had an audit within the last three years; and
- is owner occupied or non-owner occupied where occupants have the electric service in their name.

Marketing Plan

Proposed marketing efforts include utilizing Vectren South online audit tools, bill inserts as well as other outreach and education efforts and promotional campaigns throughout the year to ensure participation levels are maintained.

Barriers/Theory

The primary barrier addressed through this program is customer education and awareness. Often customers do not understand what opportunities exist to reduce their home energy use. This program not only informs the customer but helps them start down the path of energy savings by directly installing low cost measures. The program is also a "gateway" to other Vectren South gas and electric programs.

Initial Measures, Products and Services

The direct install measures available for installation at no cost include:

- CFL lamps
- Low flow kitchen and bath aerators
- Low flow showerheads
- Pipe wrap

For customers who elect to move forward with the deeper retrofit measures recommended in the audit report, the following measures are available at buy-down price of up to 40% of the installation costs:

- Improved air sealing
- Attic insulation (R11-R38)
- Wall insulation (R5-R13)
- Knee wall insulation
- ECM motor replacement
- LED 13 watt bulb (60 watt replacement)
- Programmable thermostat
- Duct sealing

Table 16. Home Energy Assessments & Weatherization Program Budget & Energy Savings Targets

Market	Program	2016	2017	Total Program
Residential	**Home Energy Assessments & Weatherization**			
	Number of Homes	2,125	2,125	4,250
	Energy Savings kWh	1,935,719	1,935,719	3,871,438
	Peak Demand kW	290	290	580
	Total Program Budget $	$419,910	$429,428	$849,339
	Per Participant Avg Energy Savings (kWh)*			910.9
	Per Participant Avg Demand Savings (kW)*			0.137
	Weighted Avg Measure Life*			6
	Net To Gross Ratio			88%

Table 17. Home Energy Assessments & Weatherization Estimated Energy Savings & Budget

Residential	kWh Total	kW	Administration	Other	Implementation	Incentives	Total Program Costs
Home Energy Assessments & Weatherization	3,871,438	580	$90,000	$40,813	$601,000	$117,526	$849,339
2016	1,935,719	290	$45,000	$20,147	$296,000	$58,763	$419,910
2017	1,935,719	290	$45,000	$20,665	$305,000	$58,763	$429,428

Table 18. Home Energy Assessments and Weatherization Cost Effectiveness

Residential	TRC	UCT	RIM	Participant	Lifetime Cost/kWh	1st Year Cost/kWh	TRC NPV $	UCT NPV $
Home Energy Assessments & Weatherization	1.53	1.80	0.46	8.49	$0.04	$0.22	$508,549	$656,140

Program Delivery

Vectren South will oversee the program and may partner with an implementation provider to deliver the program.

Integration with Vectren South Natural Gas

Vectren South will offer this integrated natural gas/electric EE program in its combined natural gas and electric service territory. Vectren South has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

To assure compliance with program guidelines, field visits with auditors will occur as well as spot check verifications of measure installations. A third party evaluator will evaluate the program using standard EM&V protocols.

C. Income Qualified Weatherization

Program Description

The Income Qualified Weatherization program is designed to produce long term energy and demand savings in the residential market. The program is designed to provide weatherization upgrades to low income homes that otherwise would not have been able to afford the energy saving measures. The program provides direct installation of energy-saving measures and educates consumers on ways to reduce energy consumption.

Collaboration and coordination between gas and electric low-income programs along with state and federal funding is recommended to provide the greatest efficiencies among all programs.

Eligible Customers

The Residential Low Income Weatherization Program targets single-family homeowners and tenants, who have electric service in their name with Vectren South, and with a total household income up to 200% of the federally-established poverty level. Priority will be given to:

a. Single parent households with children under 18 years of age living in dwelling.
b. Households headed by occupants over 65 years of age.
c. Disabled homeowners as defined by the EAP.
d. Households with high energy intensity usage levels.

Marketing Plan

Vectren South will provide a list to the implementation contractor of high consumption customers who have received Energy Assistance Program ("EAP") funds within the past 12 months to help prioritize those customers who will benefit most from the program. This will also help in any direct marketing activities to specifically target those customers.

Barriers/Theory

Lower income homeowners do not have the money to make even simple improvements to lower their bill and often live in homes with the most need for EE improvements. They may also lack the knowledge, experience, or capability to do the work. Health and safety can also be at risk for low income homeowners, as their homes typically are not as "tight", and indoor air quality can be compromised. This program provides those customers with basic improvements to help them start saving energy without needing to make the investment themselves.

Initial Measures, Products and Services

Measures available for installation will vary based on the home and include:

- CFL standard lamps
- CFL specialty lamps
- Exterior LED lamps
- Low flow kitchen and bath aerators
- Low flow showerheads
- Pipe wrap
- Furnace filter whistles
- Infiltration reduction
- Attic insulation
- Duct repair, seal and insulation
- Refrigerator replacement
- Whole house fan
- Programmable thermostat
- Smart power strips

Table 19. Income Qualified Weatherization Program Budget & Energy Savings Targets

Market	Program	2016	2017	Total Program
Residential	**Income Qualified Weatherization**			
	Number of Homes	564	564	1,128
	Energy Savings kWh	1,282,577	1,282,577	2,565,154
	Peak Demand kW	254	254	508
	Total Program Budget $	$598,270	$604,045	$1,202,315
	Per Participant Avg Energy Savings (kWh)*			2,274.1
	Per Participant Avg Demand Savings (kW)*			0.450
	Weighted Avg Measure Life*			6
	Net To Gross Ratio			100%

Table 20. Income Qualified Weatherization Estimated Energy Savings & Budget

Residential	kWh Total	kW	Administration	Other	Implementation	Incentives	Total Program Costs
Income Qualified Weatherization	2,565,154	508	$90,000	$52,048	$1,060,267	$0	$1,202,315
2016	1,282,577	254	$45,000	$25,899	$527,371	$0	$598,270
2017	1,282,577	254	$45,000	$26,149	$532,896	$0	$604,045

Table 21. Income Qualified Weatherization Cost Effectiveness

Residential	TRC	UCT	RIM	Participant	Lifetime Cost/kWh	1st Year Cost/kWh	TRC NPV $	UCT NPV $
Income Qualified Weatherization	1.06	1.06	0.40	NA	$0.07	$0.47	$68,181	$68,181

Program Delivery

Vectren South will oversee the program and may partner with an implementation provider to deliver the program.

Integration with Vectren South Natural Gas

Vectren South will offer this integrated natural gas/electric EE program in its combined natural gas and electric service territory. Vectren South has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

To assure quality installations, 10% of the installations will be field inspected. A third party evaluator will evaluate the program using standard EM&V protocols.

D. Appliance Recycling

Program Description

The Residential Appliance Recycling program encourages customers to recycle their old inefficient refrigerators and freezers in an environmentally safe manner. The program recycles operable refrigerators and freezers so the appliance no longer uses electricity, and keeps 95% of the appliance out of landfills. An older refrigerator can use up to three times the amount of energy as new efficient refrigerators. An incentive of $50 will be provided to the customer for each operational unit picked up.

Eligible Customers

Any residential customer with an operable secondary refrigerator or freezer receiving electric service from Vectren South.

Marketing Plan

The program will be marketed through a variety of mediums, including the use of utility bill inserts, retail campaigns coordinated with appliance sales outlets as well as the potential for direct mail, web and media promotional campaigns.

Barriers/Theory

Many homes have second refrigerators and freezers that are very inefficient. Customers are not aware of the high energy consumption of these units. Customers also often have no way to move and dispose of the units, so they are kept in homes past their usefulness. This program educates customers about the waste of these units and provides a simple way for customers to dispose of the units.

Table 22. Appliance Recycling Program Budget & Energy Savings Targets

Market	Program	2016	2017	Total Program
Residential	**Appliance Recycling**			
	Number of Measures	952	952	1,904
	Energy Savings kWh	1,020,544	1,020,544	2,041,088
	Peak Demand kW	152	152	305
	Total Program Budget $	$205,094	$207,948	$413,042
	Per Participant Avg Energy Savings (kWh)*			1,072.0
	Per Participant Avg Demand Savings (kW)*			0.160
	Weighted Avg Measure Life*			8
	Net To Gross Ratio			53%

Table 23. Appliance Recycling Estimated Energy Savings & Budget

Residential	kWh Total	kW	Administration	Other	Implementation	Incentives	Total Program Costs
Appliance Recycling	2,041,088	305	$120,000	$20,178	$177,664	$95,200	$413,042
2016	1,020,544	152	$60,000	$9,975	$87,519	$47,600	$205,094
2017	1,020,544	152	$60,000	$10,203	$90,145	$47,600	$207,948

Table 24. Appliance Recycling Cost Effectiveness

Residential	TRC	UCT	RIM	Participant	Lifetime Cost/kWh	1st Year Cost/kWh	TRC NPV $	UCT NPV $
Appliance Recycling	1.40	1.40	0.39	9.77	$0.04	$0.20	$160,494	$159,188

Program Delivery

Vectren South will oversee the program and may partner with an implementation provider to deliver the program.

Evaluation, Measurement and Verification

Recycled units will be logged and tracked to assure proper handling and disposal. The utility will monitor the activity for disposal. Customer satisfaction surveys will also be used to understand the customer experience with the program. A third party evaluator will evaluate the program using standard EM&V protocols.

E. Energy Efficient Schools

Program Description

The Energy Efficient Schools Program is designed to impact students by teaching them how to conserve energy and to produce cost effective electric savings by influencing students and their families to focus on conservation and the efficient use of electricity.

The program consists of a school education program for 5th grade students attending schools served by Vectren South. To help in this effort, each child that participates will receive a take-home energy kit with various energy saving measures for their parents to install in the home. The kits, along with the in-school teaching materials, are designed to make a lasting impression on the students and help them learn ways to conserve energy.

Eligible Customers

The program will be available to selected 5th grade students/schools in the Vectren South electric service territory.

Marketing Plan

The program will be marketed directly to elementary schools in Vectren South electric service territory as well as other channels identified by the implementation contractor. A list of the eligible schools will be provided by Vectren South to the implementation contractor for direct marketing to the schools via email, phone, and mail (if necessary) to obtain desired participation levels in the program.

Barriers/Theory

This program addresses the barrier of education and awareness of EE opportunities. Working through schools, both students and families are educated about opportunities to save. As well, the families receive energy savings devices they can install to begin their savings.

Initial Measures, Products and Services

The kits for students will include:

- Low flow showerhead
- Low flow kitchen aerator
- Low flow bathroom aerator
- LED bulbs (2)
- LED nightlight
- Air filter alarm

Table 25. Energy Efficient Schools Program Budget & Energy Savings Targets

Market	Program	2016	2017	Total Program
Residential	**Energy Efficient Schools**			
	Number of Kits	2,400	2,400	4,800
	Energy Savings kWh	675,508	675,508	1,351,016
	Peak Demand kW	106	106	211
	Total Program Budget $	$117,706	$120,901	$238,607
	Per Participant Avg Energy Savings (kWh)*			281.5
	Per Participant Avg Demand Savings (kW)*			0.044
	Weighted Avg Measure Life*			8
	Net To Gross Ratio			96%

Table 26. Energy Efficient Schools Estimated Energy Savings & Budget

Residential	kWh Total	kW	Administration	Other	Implementation	Incentives	Total Program Costs
Energy Efficient Schools	1,351,016	211	$60,000	$11,607	$167,000	$0	$238,607
2016	675,508	106	$30,000	$5,706	$82,000	$0	$117,706
2017	675,508	106	$30,000	$5,901	$85,000	$0	$120,901

Table 27. Energy Efficient Schools Cost Effectiveness

Residential	TRC	UCT	RIM	Participant	Lifetime Cost/kWh	1st Year Cost/kWh	TRC NPV $	UCT NPV $
Energy Efficient Schools	3.39	3.39	0.53	NA	$0.02	$0.17	$551,397	$551,397

Program Delivery

Vectren South will oversee the program and may partner with an implementation provider to deliver the program.

Integration with Vectren South Natural Gas

Vectren South will offer this integrated natural gas/electric EE program in its combined natural gas and electric service territory. Vectren South has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

Classroom participation will be tracked. A third party evaluator will evaluate the program using standard EM&V protocols.

F. Residential Efficient Products

Program Description

The program is designed to incent customers to purchase energy efficient appliances and equipment by covering part of the larger incremental cost. The program will be promoted through trade allies and appropriate retail outlets.

Eligible Customers

Any residential customer located in the Vectren South electric service territory.

Marketing Plan

The marketing plan includes program specific marketing materials that will target contractors and trade allies in the Heating, Ventilation and Air Conditioning ("HVAC") industry. The HVAC industry will be marketed to by using targeted direct marketing, direct contact by the program vendor personnel, trade shows and trade association outreach. Vectren South will also use web banners, bill inserts, and mass market advertising.

Barriers/Theory

First cost is one of the key barriers to the adoption of EE technology. Customers do not always understand the long term benefits of the energy savings from these efficient alternatives. Trade allies are also often reluctant to sell the higher cost items as they do not want to be the high cost bidder. Incentives help address this first cost issue and provide a good reason for Trade Allies to promote these higher efficient options.

Initial Measures, Products and Services

Details of the measures, savings, and incentives can be found in Appendix A. Measures included in the program will change over time as baselines change, new technologies become available and customer needs are identified.

Table 28. Residential Efficient Products Program Budget & Energy Savings Targets

Market	Program	2016	2017	Total Program
Residential	**Residential Efficient Products**			
	Number of Measures	2,216	2,216	4,432
	Energy Savings kWh	1,075,888	1,075,888	2,151,776
	Peak Demand kW	623	623	1,247
	Total Program Budget $	$622,492	$626,298	$1,248,790
	Per Participant Avg Energy Savings (kWh)*			485.5
	Per Participant Avg Demand Savings (kW)*			0.281
	Weighted Avg Measure Life*			16
	Net To Gross Ratio			74%

Table 29. Residential Efficient Products Estimated Energy Savings & Budget

Residential	kWh Total	kW	Administration	Other	Implementation	Incentives	Total Program Costs
Residential Efficient Products	2,151,776	1,247	$180,000	$60,202	$253,188	$755,400	$1,248,790
2016	1,075,888	623	$90,000	$29,946	$124,846	$377,700	$622,492
2017	1,075,888	623	$90,000	$30,256	$128,342	$377,700	$626,298

Table 30. Residential Efficient Products Cost Effectiveness

Residential	TRC	UCT	RIM	Participant	Lifetime Cost/kWh	1st Year Cost/kWh	TRC NPV $	UCT NPV $
Residential Efficient Products	1.31	2.07	0.69	1.54	$0.05	$0.58	$586,114	$1,288,936

Program Delivery

Vectren South will oversee the program and may partner with an implementation provider to deliver the program.

Integration with Vectren South Natural Gas

Vectren South will offer this integrated natural gas/electric EE program in its combined natural gas and electric service territory. Vectren South has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

There will be 100% paper verification that the equipment/products purchased meet the program efficiency standards and a field verification of 10% of the measures installed. A third party evaluator will review the program using appropriate EM&V protocols.

G. Residential New Construction

Program Description

The Residential New Construction Program will provide incentives and encourage home builders to construct homes that are more efficient than current building codes. The Residential New Construction Program will work closely with builders, educating them on the benefits of energy efficient new homes. Homes may feature additional insulation, better windows, and higher efficiency appliances. The homes should also be more efficient and comfortable than standard homes constructed to current building codes.

Program incentives are designed to be paid to both all-electric and combination homes that have natural gas heating and water heating. Builders can select from two rebate tiers for participation. Gold Star homes must achieve a HERS rating of 65 or less. Platinum Star homes must meet a HERS rating of 60 or less. It is important to note that the program is structured such that an incentive will not be paid for an all-electric home that has natural gas available to the home site.

The Residential New Construction Program will address the lost opportunities in this customer segment by promoting EE at the time the initial decisions are being made. This will ensure efficient results for the life of the home.

Eligible Customers

Any home builder constructing a home to the program specifications in the Vectren South electric service territory.

Marketing Plan

In order to move the market toward an improved home building standard, education will be required for home builders, architects and designers as well as customers buying new homes. A combination of in-person meetings with these market participants as well as other educational methods will be necessary.

Barriers/Theory

There are three primary barriers addressed by the Residential New Construction program. The first is customer knowledge. The HERS rating system allows customers to understand building design and construction improvements through a rating system completed by professionals. The second barrier is first cost. The program provides incentives to help reduce the first cost of the EE upgrades. The third barrier is the lack of skill and knowledge of the builders. The program provides opportunities for builders and developers to gain knowledge and skills concerning EE building practices and coaches them on application of these skills.

Incentive Strategy

Incentives will be based on the rating tier qualification. For all-electric homes, where Vectren South natural gas service is not available, the initial incentives will be:

Tier	Total Incentive	Vectren Electric Incentive Portion
Platinum Star	$1,000	$1,000
Gold Star	$900	$900

For homes with central air conditioning and Vectren South natural gas space heating the electric portion of the incentive will be:

Tier	Total Incentive	Vectren Electric Incentive Portion
Platinum Star	$1,000	$500
Gold Star	$900	$450

Incentives will be paid to the builder.

Table 31. Residential New Construction Program Budget & Energy Savings Targets

Market	Program	2016	2017	Total Program
Residential	Residential New Construction			
	Number of Homes	103	103	206
	Energy Savings kWh	146,775	146,775	293,550
	Peak Demand kW	68	68	136
	Total Program Budget $	$98,441	$99,536	$197,977
	Per Participant Avg Energy Savings (kWh)*			1,425.0
	Per Participant Avg Demand Savings (kW)*			0.660
	Weighted Avg Measure Life*			25
	Net To Gross Ratio			86%

Table 32. Residential New Construction Estimated Energy Savings & Budget

Residential	kWh Total	kW	Administration	Other	Implementation	Incentives	Total Program Costs
Residential New Construction	293,550	136	$20,000	$11,577	$61,000	$105,400	$197,977
2016	146,775	68	$10,000	$5,741	$30,000	$52,700	$98,441
2017	146,775	68	$10,000	$5,836	$31,000	$52,700	$99,536

Table 33. Residential New Construction Cost Effectiveness

Residential	TRC	UCT	RIM	Participant	Lifetime Cost/kWh	1st Year Cost/kWh	TRC NPV $	UCT NPV $
Residential New Construction	1.36	2.65	0.71	1.37	$0.03	$0.67	$133,067	$315,685

Program Delivery

Vectren South will oversee the program and may partner with an implementation provider to deliver the program.

Integration with Vectren South Natural Gas

Vectren South will offer this integrated natural gas/electric EE program in its combined natural gas and electric service territory. Vectren South has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

Field inspections of the home will occur during construction at least once and upon completion. All paperwork will be reviewed and the HERS ratings archived. A third party evaluator will evaluate the program using standard EM&V protocols.

H. Multi-Family Direct Install

Program Description

The Multi-Family Direct Install Program reached market saturation during 2014 for properties with electric water heating in the Vectren South territory and is not being offered as a stand-alone program. This program is being continued as an integrated natural gas and electric EE program to serve properties with natural gas water heating. Vectren South's electric division will cover the incremental cost to install CFL bulbs as part of Vectren South's natural gas division's EE program during 2016 - 2017. Additionally, Vectren South's electric division will cost share for the installation of programmable thermostats that include both natural gas and electric benefits.

Eligible Customers

Multi-Family properties with Vectren South natural gas and electric service.

Table 34. Multi-Family Direct Install Program Budget & Energy Savings Targets

Market	Program	2016	2017	Total Program
Residential	Multi-Family Direct Install			
	Number of Measures	5,500	5,500	11,000
	Energy Savings kWh	335,000	335,000	670,000
	Peak Demand kW	20	20	40
	Total Program Budget $	$29,776	$30,610	$60,387
	Per Participant Avg Energy Savings (kWh)*			60.9
	Per Participant Avg Demand Savings (kW)*			0.004
	Weighted Avg Measure Life*			6
	Net To Gross Ratio			100%

Table 35. Multi-Family Direct Install Estimated Energy Savings & Budget

Residential	kWh Total	kW	Administration	Other	Implementation	Incentives	Total Program Costs
Multi-Family Direct Install	670,000	40	$0	$2,876	$57,511	$0	$60,387
2016	335,000	20	$0	$1,418	$28,359	$0	$29,776
2017	335,000	20	$0	$1,458	$29,153	$0	$30,610

Table 36. Multi-Family Direct Install Cost-Effectiveness

Residential	TRC	UCT	RIM	Participant	Lifetime Cost/kWh	1st Year Cost/kWh	TRC NPV $	UCT NPV $
Multi-Family Direct Install	3.69	3.69	0.44	NA	$0.02	$0.09	$156,955	$156,955

I. Residential Behavior Savings

Program Description

The Residential Behavioral Savings (RBS) Program motivates behavior change and provides relevant, targeted information to the consumer through regularly scheduled direct contact via mailed and emailed home energy reports. The report and web portal include a comparison against a group of similarly sized and equipped homes in the area, usage history comparisons, goal setting tools, and progress trackers. The Home Energy Report program anonymously compares customers' energy use with that of their neighbors of similar home size and demographics. Customers can view the past twelve months of their energy usage and compare and contract their energy consumption and costs with others in the same neighborhood. Once a consumer understands better how they use energy, they can then start conserving energy.

Eligible Customers

Residential customers who receive natural gas and electric service from Vectren South are eligible to participate in this integrated natural gas and electric EE program.

Barriers/Theory

The Residential Behavioral Savings program provides residential customers with better energy information through personalized reports delivered by mail, email and an integrated web portal to help them put their energy usage in context and make better energy usage decisions. Behavioral science research has demonstrated that peer-based comparisons are highly motivating ways to present information. The program will leverage a dynamically created comparison group for each residence and compare it to other similarly sized and located households.

Implementation & Delivery Strategy

The program will be delivered by OPower and include energy reports and a web portal. Customers typically receive between 4 - 6 reports annually. These reports provide updates on energy consumption patterns compared to neighbors and provide energy savings strategies to reduce energy use. They can promote other Vectren South programs to interested customers. The web portal is an interactive system for customers to perform a self-audit, monitor energy usage over time, access energy savings tips and be connected to other Vectren South gas and electric programs.

Table 37. Residential Behavior Savings Program Budget & Energy Savings Targets

Market	Program	2016	2017	Total Program
Residential	**Residential Behavior Savings**			
	Number of Participants	48,400	43,500	91,900
	Energy Savings kWh	6,204,832	5,576,656	11,781,488
	Peak Demand kW	1,728	1,553	3,280
	Total Program Budget $	$382,000	$366,285	$748,285
	Per Participant Avg Energy Savings (kWh)*			128.2
	Per Participant Avg Demand Savings (kW)*			0.036
	Weighted Avg Measure Life*			1
	Net To Gross Ratio			100%

Table 38. Residential Behavior Savings Estimated Energy Savings & Budget

Residential	kWh Total	kW	Administration	Other	Implementation	Incentives	Total Program Costs
Residential Behavior Savings	11,781,488	3,280	$100,000	$33,285	$615,000	$0	$748,285
2016	6,204,832	1,728	$50,000	$17,000	$315,000	$0	$382,000
2017	5,576,656	1,553	$50,000	$16,285	$300,000	$0	$366,285

Table 39. Residential Behavior Savings Cost Effectiveness

Residential	TRC	UCT	RIM	Participant	Lifetime Cost/kWh	1st Year Cost/kWh	TRC NPV $	UCT NPV $
Residential Behavior Savings	1.45	1.45	0.44	NA	$0.06	$0.06	$325,442	$325,442

Program Delivery

Vectren South will oversee the program and partner with OPower to deliver the program.

Integration with Vectren South Natural Gas

Vectren South will offer this integrated natural gas/electric EE program in its combined natural gas and electric service territory. Vectren South has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

To understand the savings with behavior programs detailed evaluation protocols will need to be used including having matching control groups of non-participants. Billing analysis will compare the participant and non-participant groups. A third party evaluator will complete the evaluation of this program and work with Vectren South to select the participant and non-participant groups.

J. Small Business Direct Install

Program Description

The Small Business Direct Install Program provides value by directly installing EE products such as high efficiency lighting, low flow water saving measures and vending machine controls. The program helps businesses identify and install cost effective energy saving measures by providing an on-site energy assessment customized for their business.

Eligible Customers

Any participating Vectren South business customer with a maximum peak energy demand of less than 400 kW.

Marketing Plan

The Small Business Direct Install Program will be marketed through direct mailing, trade associations, educational seminars, and direct personal communication from Vectren South staff and third party contractors.

Barriers/Theory

Small business customers generally do not have the knowledge, time or money to invest in EE upgrades. This program assists these small businesses with direct installation and turn-key services to get measures installed at no or low out-of-pocket cost.

There is an implementation contractor in place providing suggested additions and changes to the program based on results and local economics.

Initial Measures, Products and Services

The program will have two types of measures provided. The first are measures that will be installed at the time of the assessment at no additional cost. They will include but are not limited to the following:

- LEDs: 8-12W
- LEDs: MR16 track light
- LEDs: > 12 W flood light
- Vending machine miser
- Pre-rinse spray values
- Programmable thermostat turn down
- Faucet aerators
- Showerheads

- Cooler controller-occupancy sensor

The second types of measures are recommended during the assessment and require the customer to pay a portion of the labor and materials. These measures include:

- LED lighting
- Linear fluorescent lighting
- LED exit and outdoor lights
- Pipe insulation
- Programmable thermostats (100% discount)
- Delamping
- ECM in refrigeration equipment
- Smart switches
- Anti-sweat heater controls
- LED lighting for display cases

Incentive Strategy

In addition to the low cost measures installed during the audit, the program will also pay a cash incentive of up to 50% of the cost of any recommended improvements identified through the assessment.

Table 40. Small Business Direct Install Program Budget & Energy Savings Targets

Market	Program	2016	2017	Total Program
Commercial & Industrial	Small Business Direct Install			
	Number of Measures	17,235	17,235	34,470
	Energy Savings kWh	6,000,810	6,000,810	12,001,619
	Peak Demand kW	906	906	1,812
	Total Program Budget $	$1,760,611	$1,774,351	$3,534,962
	Per Participant Avg Energy Savings (kWh)*			348.2
	Per Participant Avg Demand Savings (kW)*			0.053
	Weighted Avg Measure Life*			10
	Net To Gross Ratio			98%

Table 41. Small Business Direct Install Estimated Energy Savings & Budget

Commercial & Industrial	kWh Total	kW	Administration	Other	Implementation	Incentives	Total Program Costs
Small Business Direct Install	12,001,619	1,812	$120,000	$168,822	$965,000	$2,281,140	$3,534,962
2016	6,000,810	906	$60,000	$84,041	$476,000	$1,140,570	$1,760,611
2017	6,000,810	906	$60,000	$84,781	$489,000	$1,140,570	$1,774,351

Table 42. Small Business Direct Install Cost Effectiveness

Commercial & Industrial	TRC	UCT	RIM	Participant	Lifetime Cost/kWh	1st Year Cost/kWh	TRC NPV $	UCT NPV $
Small Business Direct Install	1.28	2.33	0.74	1.56	$0.03	$0.29	$1,732,739	$4,554,660

Program Delivery

Vectren South will oversee the program and may partner with an implementation provider to deliver the program.

Integration with Vectren South Natural Gas

Vectren South will offer this integrated natural gas and electric EE program in its combined natural gas and electric service territory. Vectren South has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

To assure quality installation, 10% of the installations will be inspected. A third party evaluator will evaluate the program using standard EM&V protocols.

K. Commercial & Industrial Prescriptive Rebates

Program Description

The Commercial & Industrial (C&I) Prescriptive Program is designed to provide financial incentives on qualifying products to produce greater energy savings in the C&I market. The rebates are designed to promote lower electric energy consumption, assist customers in managing their energy costs, and build a sustainable market around EE.

Program participation is achieved by offering incentives structured to cover a portion of the customer's incremental cost of installing prescriptive efficiency measures.

Eligible Customers

Any participating commercial or industrial customer receiving electric service from Vectren South.

Marketing Plan

Proposed marketing efforts include trade ally outreach, trade ally meetings, direct mail, face-to-face meetings with customers, web-based marketing, and coordination with key account executives.

Barriers/Theory

Customers often have the barrier of higher first cost for EE measures which precludes them from purchasing the more EE alternative. They also lack information on high efficiency alternatives. Trade allies often run into the barrier of not being able to promote more EE alternatives because of first cost. Trade allies also gain credibility with customers for their EE claims when a measure is included in a utility prescriptive program. Through the program the Trade allies can promote EE measures directly to their customers encouraging them to purchase more efficient equipment while helping customers get over the initial cost barrier.

The range of qualifying measures and prescriptive incentive amounts may change over time due to market economics and possible baseline changes.

Initial Measures, Products and Services

High efficient lighting and lighting controls for various applications will be the primary measures included. In addition variable frequency drives (VFD) for HVAC system and compressors will be included in the program. Details of the measures, savings and incentives can be found in Appendix A.

Implementation & Delivery Strategy

The program will be delivered primarily through the trade allies working with their customers. Vectren South and its implementation partners will work with the trade allies to make them aware of the offerings and help them promote the program to their customers. The implementation partner will provide training and technical support to the trade allies to become familiar with the EE technologies offered through the program. The program will be managed by the same implementation provider as the Commercial & Industrial Custom program so that customers can seamlessly receive assistance and all incentives can be efficiently processed through a single procedure.

Incentive Strategy

Incentives are provided to customers to reduce the difference in first cost between the lower efficient technology and the high efficient option. There is no fixed incentive percentage amount based on the difference in price because some technologies are newer and need higher amounts. Others have been available in the marketplace longer and do not need as much to motivate customers. Incentives will be adjusted to respond to market activity and bonuses may be available for limited time if required to meet goals.

Table 43. Commercial & Industrial Prescriptive Program Budget & Energy Savings Targets

Market	Program	2016	2017	Total Program
Commercial & Industrial	**Commercial & Industrial Prescriptive**			
	Number of Measures	12,222	12,222	24,444
	Energy Savings kWh	6,910,197	6,910,197	13,820,393
	Peak Demand kW	1,088	1,088	2,176
	Total Program Budget $	$1,042,705	$1,049,906	$2,092,611
	Per Participant Avg Energy Savings (kWh)*			565.4
	Per Participant Avg Demand Savings (kW)*			0.089
	Weighted Avg Measure Life*			11
	Net To Gross Ratio			80%

Table 44. Commercial & Industrial Prescriptive Estimated Energy Savings & Budget

Commercial & Industrial	kWh Total	kW	Administration	Other	Implementation	Incentives	Total Program Costs
Commercial & Industrial Prescriptive	13,820,393	2,176	$120,000	$100,139	$490,472	$1,382,000	$2,092,611
2016	6,910,197	1,088	$60,000	$49,855	$241,850	$691,000	$1,042,705
2017	6,910,197	1,088	$60,000	$50,284	$248,622	$691,000	$1,049,906

Table 45. Commercial & Industrial Prescriptive Cost Effectiveness

Commercial & Industrial	TRC	UCT	RIM	Participant	Lifetime Cost/kWh	1st Year Cost/kWh	TRC NPV $	UCT NPV $
Commercial & Industrial Prescriptive	3.00	4.07	0.87	3.25	$0.02	$0.15	$5,485,762	$6,202,259

Program Delivery

Vectren South will oversee the program and may partner with an implementation provider to deliver the program.

Evaluation, Measurement and Verification

Site visits will be made on 10% of the installations to verify the correct equipment was installed. Standard EM&V protocols will be used for the third party evaluation of the program.

L. Commercial & Industrial New Construction

Program Description

The Commercial and Industrial New Construction Program provides value by promoting EE designs with the goal of developing projects that are more EE than current Indiana building code. Incentives promoted through this program serve to reduce the incremental cost to upgrade to high-efficiency equipment over standard efficiency options for Vectren South customers. The program includes equipment with easily calculated savings and provides straightforward and easy participation for customers.

The program provides incentives as part of the facility design process to explore opportunities in modeling EE options to craft an optimal package of investments. Once designed, the program also offers incentives to reduce the higher capital cost for EE solutions.

The program requires qualifying facilities must exceed Indiana Energy Code for commercial or industrial buildings by at least 10 percent. Facilities earn $0.12 per kWh saved (over a conventional building energy performance) up to $100,000 based on first year energy savings.

Eligible Customers

Any participating commercial or industrial customer receiving electric service from Vectren South.

Marketing Plan

The Commercial & Industrial New Construction Program will be marketed through trade ally meetings, trade association training, educational seminars, and direct personal communication from Vectren South staff and third party contractors.

Barriers/Theory

There are three primary barriers addressed by the new construction program. The first is knowledge. For commercial and industrial buildings is it the knowledge and experience of the design team including the owner, architect, lighting and HVAC engineers, general contractor and others. This team may not understand new technologies and EE options that could be considered. The second barrier is cost. There is a cost during the design phase of the building in modeling EE options to see what can cost-effectively work within the building. The program provides incentives to help reduce the design cost for the consideration of EE upgrades. The third barrier is the first cost of the high efficiency upgrades in equipment and materials. The incentives from the standard programs will provide incentives to help reduce this first cost.

Implementation & Delivery Strategy

Standard Energy Design Assistance ("EDA") targets buildings that are less than 100,000 square feet, but is also available for larger new buildings that are beyond the schematic design phase or are on an accelerated schedule. Commercial and industrial new construction projects for buildings greater than 100,000 square feet still in the conceptual design phase qualify for Vectren South's Enhanced EDA incentives. The Vectren South implementation partner staff expert will work with the design team through the conceptual design, schematic design and design development processes providing advice and counsel on measures that should be considered and EE modeling issues. Incentives will be paid after the design team submits completed construction documents for review to verify that the facility design reflects the minimum energy savings requirements.

Incentive Strategy

All buildings in Vectren South's service territory receiving electric service qualify for the measure incentives available in the Prescriptive and Custom programs. In addition Vectren South will provide incentives to help offset some of the expenses for the design team's participation in the EDA process with the design team service incentive. The design team service incentive is a fixed amount based on the new conditioned square footage and is paid to the designated design team lead provided that the proposed EE projects associated with the construction documents exceed a minimum energy savings threshold. Vectren South will offer a one-time, lump-sum incentive to building owners for participation in the Enhanced EDA program. Facilities must exceed Indiana Energy Code requirements by 10 percent in order to qualify for an Enhanced EDA incentive. Facilities earn $0.12 per kilowatt hour (kWh) saved up to $100,000 based on the first-year energy savings determined in the final energy model.

Facility Size – Square Feet	Design Team Incentives	Minimum Savings
Small <25,000	$750	25,000 kWh
Medium 25,000 - 100,000	$2,500	75,000 kWh
Large >100,000	$3,750	150,000 kWh
Enhance Large >100,000	$5,000	10% beyond code

Table 46. Commercial & Industrial New Construction Program Budget & Energy Savings Targets

Market	Program	2016	2017	Total Program
Commercial & Industrial	**Commercial & Industrial New Construction**			
	Number of Projects	14	15	29
	Energy Savings kWh	498,526	534,135	1,032,661
	Peak Demand kW	88	94	182
	Total Program Budget $	$162,562	$172,898	$335,460
	Per Participant Avg Energy Savings (kWh)*			35,609.0
	Per Participant Avg Demand Savings (kW)*			6.280
	Weighted Avg Measure Life*			13
	Net To Gross Ratio			95%

Table 47. Commercial & Industrial New Construction Estimated Energy Savings & Budget

Commercial & Industrial	kWh Total	kW	Administration	Other	Implementation	Incentives	Total Program Costs
Commercial & Industrial New Construction	1,032,661	182	$60,000	$16,219	$124,950	$134,290	$335,460
2016	498,526	88	$30,000	$7,842	$59,850	$64,870	$162,562
2017	534,135	94	$30,000	$8,377	$65,100	$69,420	$172,898

Table 48. Commercial & Industrial New Construction Cost Effectiveness

Commercial & Industrial	TRC	UCT	RIM	Participant	Lifetime Cost/kWh	1st Year Cost/kWh	TRC NPV $	UCT NPV $
Commercial & Industrial New Construction	1.99	2.49	0.79	3.03	$0.03	$0.33	$400,143	$481,736

Program Delivery

Vectren South will oversee the program and may partner with an implementation provider to deliver the program.

Integration with Vectren South Natural Gas

Vectren South will offer this integrated natural gas and electric EE program in its combined natural gas and electric service territory. Vectren South has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

All construction documents will be reviewed and archived. A third party evaluator will evaluate the program using standard EM&V protocols.

M. Commercial & Industrial Custom

Program Description

The Commercial and Industrial Custom Program promotes the implementation of customized energy saving measures at qualifying customer facilities. Incentives promoted through this program serve to reduce the cost of implementing energy reducing projects and upgrading to high-efficiency equipment. Due to the nature of a custom EE program, a wide variety of projects are eligible.

The technical audit or compressed air system study offers an assessment to systematically identify energy saving opportunities for customers and provides a mechanism to prioritize and phase-in projects that best meet customer needs. In turn, the opportunities identified from the audit can be turned in for the customized efficiency program. These two components work hand in hand to deliver energy savings to Vectren South commercial and industrial customers.

The 2016-2017 Plan includes a pilot initiative within the C&I Custom Program focused on strategic energy management (SEM). SEM programs aim to continuously improve energy performance over the long term through organizational transformation focused on equipping facility management and staff with the organizational and technical skills required to reduce energy waste. The outcome of a successful SEM program is reduced energy consumption through operational and maintenance improvements.

An SEM program should utilize the ISO 50001 standard, which provides a well-defined framework for structuring various technical and management tactics included as part of the overall strategy. The ISO 50001 training and technical support initiative will provide interested customers additional education on the ISO 50001 standard and the benefits for pursuing the certification. Training on the ISO 50001 management system, as well as organizational and technical assistance will be offered to customers that are interested in participating in this initiative.

To prepare facility operators to complete an SEM strategy, this pilot initiative within the Custom Program will offer optional training as well as technical assistance and potential bonus incentives for companies agreeing to pursue ISO 50001 and/or Superior Energy Performance (SEP).

Eligible Customers

Any participating commercial or industrial customer receiving electric service from Vectren South.

Marketing Plan

Proposed marketing efforts include coordination with key account representatives to leverage the contacts and relationships they have with the customers. Direct mail, media outreach, trade shows, trade ally meetings, and educational seminars could also be used to promote the program.

Barriers/Theory

Applications of some specific EE technologies are unique to that customer's application or process. The energy savings estimates for these measures are highly variable and cannot be assessed without an engineering estimation of that application; however, they offer a large opportunity for energy savings. To promote the installation of these high efficient technologies or measures, the Commercial & Industrial Custom program will provide incentives based on the kWh saved as calculated by the engineering analysis. To assure savings, these projects will require program engineering reviews and pre approvals. Energy assessments offered will help remove customer barriers regarding opportunity identification and energy savings potential. The large commercial and industrial education provides a systematic approach to integrating energy management into an organization's business practices and creating lasting energy management processes that produce reliable energy savings.

Initial Measures, Products and Services

All technologies or measures that save kWh qualify for the program. Facility energy assessments, technical assistance and energy management educational services will be offered to eligible and motivated customers to implement multiple EE measures.

Implementation & Delivery Strategy

The implementation partner for this program will provide engineering field support to customers and trade allies to calculate the energy savings. Customers or trade allies with a proposed project will complete an application form with the energy savings calculations for the project. The implementation team will review all calculations and where appropriate complete site visits to assess and document pre installation conditions. Customers will be informed and funds reserved for the project. Implementation engineering staff will review the final project information as installed and verify the energy savings. Incentives are then paid on the verified savings expected.

The implementation partner will work collaboratively with Vectren South staff to recruit and screen customers for receiving facility energy assessments, technical assistance and energy management education. The program will seek to gain customer commitment towards setting up an energy management process and implementing multiple EE improvements. The implementation partner will help customers achieve agreed upon milestones in support for their commitment.

Incentive Strategy

Incentives will be calculated on a per kWh basis. The initial kWh rate will be $0.12/kWh and is paid based on the first year annual savings reduction. Rates may change over time and vary with some of the special initiatives. Incentives will not pay more than 50% of the project cost nor provide incentives for projects with paybacks less than 12 months. As part of the SEM pilot initiative, bonus incentives may be offered to customers pursuing either ISO 50001 and/or Superior Energy Performance (SEP). Vectren South will offer a cost share on facility energy assessments that will cover up to 100% of the assessment cost. Energy education, technical assistance, and company-wide coaching will be offered to large commercial and industry customers that generate an agreement with Vectren South to implement strategies and projects that result from receiving those activities.

Table 49. Commercial & Industrial Custom Program Budget & Energy Savings Targets

Market	Program	2016	2017	Total Program
Commercial & Industrial	Commercial & Industrial Custom			
	Number of Projects	22	25	47
	Energy Savings kWh	2,557,544	2,906,300	5,463,844
	Peak Demand kW	339	385	724
	Total Program Budget $	$726,584	$738,386	$1,464,970
	Per Participant Avg Energy Savings (kWh)*			116,252.0
	Per Participant Avg Demand Savings (kW)*			15.404
	Weighted Avg Measure Life*			11
	Net To Gross Ratio			99%

Table 50. Commercial & Industrial Custom Estimated Energy Savings & Budget

Commercial & Industrial	kWh Total	kW	Administration	Other	Implementation	Incentives	Total Program Costs
Commercial & Industrial Custom	5,463,844	724	$165,000	$69,760	$424,530	$805,680	$1,464,970
2016	2,557,544	339	$100,000	$34,599	$210,025	$381,960	$726,584
2017	2,906,300	385	$65,000	$35,161	$214,505	$423,720	$738,386

Table 51. Commercial & Industrial Custom Cost Effectiveness

Commercial & Industrial	TRC	UCT	RIM	Participant	Lifetime Cost/kWh	1st Year Cost/kWh	TRC NPV $	UCT NPV $
Commercial & Industrial Custom	1.07	2.74	0.77	1.18	$0.02	$0.28	$260,765	$2,468,576

Program Delivery

Vectren South will oversee the program and may partner with an implementation provider to deliver the program.

Evaluation, Measurement and Verification

Given the variability and uniqueness of each project, all projects will be pre-approved. Pre and post visits to the site to verify installation and savings will be performed as defined by the program implementation partner. Monitoring and verification may occur on the largest projects. A third party evaluator will be used for this project and use standard EM&V protocols.

V. New Program Initiatives

A. Residential Smart Thermostat Demand Response

Program Description

Vectren South's residential DR programs are an increasingly important part of how the Company provides services to its customers. The current system that Vectren South utilizes for its Direct Load Control ("DLC") program leverages one-way communication switches that do not provide the opportunity for customers to interact with the Company. Leveraging "smart devices" such as a "smart thermostat" for DR allows the Company to reach beyond the meter to interact with customers. These smart devices are connected to Wi-Fi and reside on the customer's side of the electric meter and are used by the program to communicate with customers' air conditioning systems. The program provides the Company with increased customer contact opportunities and the ability to facilitate customers' shift of their energy usage to reduce peak system loads. The smart thermostats offer energy savings and increase load reduction, deliver verifiable DR, and provide a platform for customer engagement. The Residential Smart Thermostat DR program is designed to analyze the different approaches of DR that are available through smart thermostats. For this program, Vectren South will analyze both Honeywell and Nest DR platforms. Vectren South will install, at no additional cost to the customer, a total of approximately 2,000 smart thermostats (1,000 Honeywell and 1,000 Nest) in customer homes during 2016. Vectren South will leverage the platform to manage DR events during the summer of 2016. Vectren South will work with an independent evaluator on a billing analysis to measure the effectiveness of both programs designs in 2017. Based on the billing analysis results Vectren South will work with the Vectren Oversight Board on possible expansion of the program in 2018 and beyond.

Eligible Customers

Any residential customer who receives electric service from Vectren South at a single-family residence. Approximately 2,000 customers will be included in the program.

Marketing Plan

Vectren South will market directly to potential customers. Vectren South will work with the independent evaluator to identify customers for the program.

Barriers/Theory

An opportunity exists to reduce residential energy use through enhancing users' control of home heating and cooling systems. In the past few years, smart thermostat manufacturers have introduced a new generation of residential space-conditioning control technologies, such as wireless communicating programmable thermostats. Users can control these thermostats from a thermostat keypad, a web or mobile device. The enhanced control afforded by Wi-Fi enabled thermostats reduces the costs of controlling the space heating and cooling systems and creates potential for energy savings by enabling users to better align home space conditioning with occupancy and actual demand. Smart thermostats provide customers increased visibility and control of their energy use through their mobile devices and Apps. In a more direct sense, the Company benefits because it can communicate with customers on their mobile device through "push" notifications (messages sent to the customers through their Apps) to call a DR event and receive a response back from the customer.

Initial Measures, Products and Services

Customers participating in the program will receive either a Honeywell or Nest Wi-Fi enabled smart thermostat.

Table 52. Residential Smart Thermostat Demand Response Program Budget & Energy Savings Targets

Market	Program	2016	2017	Total Program
Residential	**Residential Smart Thermostat Demand Response**			
	Number of Measures	2,000	0	2,000
	Energy Savings kWh	858,000	0	858,000
	Peak Demand kW	1,800	0	1,800
	Total Program Budget $	$1,196,455	$297,890	$1,494,345
	Per Participant Avg Energy Savings (kWh)*			429.0
	Per Participant Avg Demand Savings (kW)*			0.900
	Weighted Avg Measure Life*			15
	Net To Gross Ratio			100%

Table 53. Residential Smart Thermostat Demand Response Estimated Energy Savings & Budget

Residential	kWh Total	kW	Administration	Other	Implementation	Incentives	Total Program Costs
Residential Smart Thermostat Demand Response	858,000	1,800	$70,000	$352,240	$972,105	$100,000	$1,494,345
2016	858,000	1,800	$30,000	$212,240	$904,215	$50,000	$1,196,455
2017	0	0	$40,000	$140,000	$67,890	$50,000	$297,890

Table 54. Residential Smart Thermostat Demand Response Cost Effectiveness

Residential	TRC	UCT	RIM	Participant	Lifetime Cost/kWh	1st Year Cost/kWh	TRC NPV $	UCT NPV $
Residential Smart Thermostat Demand Response	1.56	1.30	0.78	NA	$0.21	$1.39	$1,366,716	$886,947

Program Delivery

Vectren South will oversee the program and will partner with Honeywell and Nest to deliver the program.

Evaluation, Measurement and Verification

A third party evaluator will evaluate the program using standard EM&V protocols.

B. Conservation Voltage Reduction (CVR)

Program Description

The Conservation Voltage Reduction (CVR) Program is an energy savings and optimization program that requires some description to understand in the context of the Vectren South 2016 - 2017 Plan. CVR achieves energy conservation through automated monitoring and control of voltage levels provided on distribution circuits. End use customers realize lower energy and demand consumption when CVR is applied to the distribution circuit from which they are served.

A distribution circuit facilitates electric power transfer from an electric substation to utility meters located at electric customer premises. Electric power customers employ end-use electric devices (loads) that consume electrical power. At any point along a single distribution circuit, voltage levels vary based upon several parameters, mainly including, but not exclusive of, the actual electrical conductors that comprise the distribution circuit, the size and location of electric loads along the circuit, the type of end-use loads being served, the distance of loads from the power source, and losses incurred inherent to the distribution circuit itself. All end-use loads require certain voltage levels to operate and standards exist to regulate the levels of voltage delivered by utilities. In Indiana, Vectren South is required to maintain a steady state +/- 5% of the respective baseline level as specified by ANSI C84.1 (120 volt baseline yields acceptable voltage range of 114 volts to 126 volts).

Historically, utilities including Vectren South have set voltage levels near the upper limit at the distribution circuit source (substation) and have applied voltage support devices such as voltage regulators and capacitors along the circuit to assure that all customers are provided voltages within the required range. This basic design economically met the requirements by utilizing the full range (+/- 5%) of allowable voltages while only applying independent voltage support where needed. This basic design has worked well for many years. However, in the 1980's, utilities recognized that loads on the circuits would actually consume less energy if voltages in the lower portion of the acceptable range were provided. In fact, many utilities, including Vectren South, established emergency operating procedures to lower voltage at distribution substations by 5% during power shortage conditions.

The recent focus on EE and the availability of technology that allows monitoring and tighter control of circuit voltage conditions has led to development of automated voltage control schemes which coordinate the operation of voltage support devices and allow more customers on the circuit to be served at voltages in the lower portion of the acceptable range.

Industry studies have shown that certain end-use loads consume more power with higher voltage levels applied to them, resulting in less efficient operation than if voltage in the lower half of the acceptable range is applied. Additionally, when higher power consumption is experienced on a distribution circuit, the circuit itself experiences higher levels of system losses. Energy and demand reductions can be realized through the deployment of control technology to a distribution circuit where the bandwidth of voltage is more tightly controlled along the entire length of the distribution circuit. Reduced losses on the distribution circuit are also realized through reduced end-use power consumption.

Independent measurement and verification has verified that, on average, a 1% reduction in voltage on distribution circuits translates into an approximate 1% reduction in end-use consumption (energy and demand) and distribution circuit losses (energy and demand). Of that 1% power consumption reduction at the circuit level, approximately 96% is end-use consumption reduction and 4% is loss reduction.

Energy and demand savings occur when CVR is applied to distribution circuits. Once applied, a step change in energy and demand consumption by customers is realized, dependent upon where customer loads are located within the voltage zones, the load characteristics of the circuit, and how end-use loads respond to the voltage reduction. The resultant energy and demand consumption reduction persists at the new levels as long as tighter voltage bandwidth operation is applied. As a result, ongoing energy and demand savings persists for the duration of the life of the CVR equipment and as long as the equipment is maintained and operated in the voltage bandwidth mode.

Eligible Customers

Vectren South has identified substations that will benefit from the CVR program. For this program, one substation will be selected for implementation in 2017.

Barriers/Theory

CVR is both a DR and an EE program. First, it seeks to cost effectively deploy new technology to targeted distribution circuits, in part to reduce the peak demand experienced on Vectren's electrical power supply system. The voltage reduction stemming from the CVR program operates to effectively reduce consumption during the times in which system peaks are set and as a result directly reduces peak demand. CVR also cost effectively reduces the level of ongoing energy consumption by end-use devices located on the customer side of the utility meter as many end-use devices consume less energy with lower voltages consistently applied. Like an equipment maintenance service program, the voltage optimization allows the customer's equipment to operate at optimum levels which saves energy without requiring direct customer intervention or change.

Initial Measures, Products and Services

Vectren South will install the required communication and control equipment on the appropriate circuits from the substation. No action is required of the customers.

Table 55. Conservation Voltage Reduction (CVR) Program Budget & Energy Savings Targets

With Commission approval, Vectren South will capitalize the costs to implement the CVR program and will seek to recover through the annual DSMA Rider the carrying costs and depreciation expense associated with the implementation along with annual, ongoing Operation and Maintenance ("O&M") expense, a representative share of Vectren South's DSM support staff and administration costs and related EM&V cost. The budget below is reflective of this request.

Market	Program	2016	2017	Total Program
Residential	**Conservation Voltage Reduction**			
	Number of Participants	0	5,324	5,324
	Energy Savings kWh	0	1,481,669	1,481,669
	Peak Demand kW	0	508	508
	Total Program Budget $	$20,000	$166,861	$186,861
	Per Participant Avg Energy Savings (kWh)*			278.3
	Per Participant Avg Demand Savings (kW)*			0.095
	Weighted Avg Measure Life*			15
	Net To Gross Ratio			100%

Market	Program	2016	2017	Total Program
Commercial & Industrial	**Conservation Voltage Reduction**			
	Number of Participants	0	558	558
	Energy Savings kWh	0	875,044	875,044
	Peak Demand kW	0	163	163
	Total Program Budget $	$20,000	$117,146	$137,147
	Per Participant Avg Energy Savings (kWh)*			1,568.2
	Per Participant Avg Demand Savings (kW)*			0.292
	Weighted Avg Measure Life*			15
	Net To Gross Ratio			100%

Table 56. Conservation Voltage Reduction (CVR) Estimated Energy Savings & Budget

Residential	kWh Total	kW	Administration	Other	Implementation	Incentives	Total Program Costs
Conservation Voltage Reduction	1,481,669	508	$40,000	$68,891	$77,970	$0	$186,861
2016	0	0	$20,000	$0	$0	$0	$20,000
2017	1,481,669	508	$20,000	$68,891	$77,970	$0	$166,861

Commercial & Industrial	kWh Total	kW	Administration	Other	Implementation	Incentives	Total Program Costs
Conservation Voltage Reduction	875,044	163	$40,000	$40,685	$56,461	$0	$137,146
2016	0	0	$20,000	$0	$0	$0	$20,000
2017	875,044	163	$20,000	$40,685	$56,461	$0	$117,146

Total	kWh Total	kW	Administration	Other	Implementation	Incentives	Total Program Costs
Conservation Voltage Reduction	2,356,713	671	$80,000	$109,576	$134,431	$0	$324,007
2016	0	0	$40,000	$0	$0	$0	$40,000
2017	2,356,713	671	$40,000	$109,576	$134,431	$0	$284,007

Table 57. Conservation Voltage Reduction (CVR) Cost Effectiveness

For the purpose of determining cost-effectiveness of CVR, Vectren South modeled the full implementation cost. Infrastructure costs, that are required to set up the system and that can be leveraged in future expansion of the program; do not allow a one (1) substation program to demonstrate cost effectiveness. With Commission approval, Vectren South would propose to implement a second substation in 2018. The TRC for a two (2) substation program is cost-effective at a TRC of 1.37.

Residential	TRC	UCT	RIM	Participant	Lifetime Cost/kWh	1st Year Cost/kWh	TRC NPV $	UCT NPV $
Conservation Voltage Reduction	1.38	1.38	0.52	NA	$0.06	$0.12	$515,434	$515,434

Commercial & Industrial	TRC	UCT	RIM	Participant	Lifetime Cost/kWh	1st Year Cost/kWh	TRC NPV $	UCT NPV $
Conservation Voltage Reduction	1.06	1.06	0.51	NA	$0.06	$0.15	$50,032	$50,032

Conservation Voltage Reduction	TRC	UCT	RIM	Participant	Lifetime Cost/kWh	1st Year Cost/kWh	TRC NPV $	UCT NPV $
Residential and Commercial & Industrial Combined	1.26	1.26	0.52	NA	$0.06	$0.13	$565,467	$565,467

Program Delivery

Delivery of the CVR Program will be achieved through the installation of control logic, telecommunication equipment, and voltage control equipment in order to control the voltage bandwidth on CVR circuits within voltage compliance levels required by the Indiana Utility Regulatory Commission.

Evaluation, Measurement and Verification

A third party evaluator will evaluate the program using standard EM&V protocols.

C. Multi-Family EE Retrofit

Program Description

The Multi-Family EE Retrofit program provides value by directly installing, on a cost-share basis, EE in multi-family common areas and units. Applicable measures include, but are not limited to, the following: high efficiency lighting, occupancy sensors, insulation, air sealing, and electronic commutated motors (ECM). The program helps to identify and install cost effective energy saving measures by providing an on-site energy assessment customized for the facility.

Eligible Customers

Multi-Family properties with Vectren South natural gas and electric service.

Marketing Plan

A highly-targeted marketing strategy will be employed. Recruitment efforts will target property management companies in an effort to secure agreements to address multiple properties through a single point of contact before targeting owners and managers of individual properties. Marketing tactics will include outreach to property management associations, in-person visits to property management firms and properties, and targeted media and mailings.

Barriers/Theory

There are many barriers to multi-family owners and tenants taking energy savings actions. The primary barrier is that the landowner usually does not pay the utility bill and the tenant does not have the authority to take action. This program direct installs low cost energy savings devices to save energy for the tenant and help them with their energy bill while not requiring large investments in improving the property due to the cost-sharing incentive. It is hoped that the landlords will not only take advantage of this program but will then proceed to install larger building improvements through the other program offerings.

Table 58. Multi-Family Energy Efficient Retrofit Program Budget & Energy Savings Targets

Market	Program	2016	2017	Total Program
Commercial & Industrial	**Multi-Family Energy Efficient Retrofit**			
	Number of Units	100	100	200
	Energy Savings kWh	201,785	201,785	403,570
	Peak Demand kW	33	33	66
	Total Program Budget $	$95,081	$95,081	$190,162
	Per Participant Avg Energy Savings (kWh)*			2,017.9
	Per Participant Avg Demand Savings (kW)*			0.330
	Weighted Avg Measure Life*			16
	Net To Gross Ratio			100%

Table 59. Multi-Family Energy Efficient Retrofit Estimated Energy Savings & Budget

Commercial & Industrial	kWh Total	kW	Administration	Other	Implementation	Incentives	Total Program Costs
Multi-Family Energy Efficient Retrofit	403,570	66	$10,000	$9,056	$26,000	$145,106	$190,162
2016	201,785	33	$5,000	$4,528	$13,000	$72,553	$95,081
2017	201,785	33	$5,000	$4,528	$13,000	$72,553	$95,081

Table 60. Multi-Family Energy Efficient Retrofit Cost Effectiveness

Commercial & Industrial	TRC	UCT	RIM	Participant	Lifetime Cost/kWh	1st Year Cost/kWh	TRC NPV $	UCT NPV $
Multi-Family Energy Efficient Retrofit	1.35	2.12	0.75	1.53	$0.03	$0.47	$100,549	$206,130

Program Delivery

Vectren South will oversee the program and may partner with an implementation provider to deliver the program.

Integration with Vectren South Natural Gas

Vectren South will offer this integrated natural gas and electric EE program in its combined natural gas and electric service territory. Vectren South has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

A third party evaluator will evaluate the program using standard EM&V protocols.

VI. Appendix A – Program Measure Listings, Participation and Initial Incentives

Residential

Measures	Program Name	Measure Life	Install Adjusted Savings per unit (kWh)	2016 Total Paticipation	2017 Total Paticipation	NTG	Average Incentive Paid Per Unit	Incremental Cost per unit
Energy Star Specialty CFL V	Residential Lighting	5	32	1,166	0	49%	$2	$10
Energy Star Reflector CFL V	Residential Lighting	5	32	1,166	0	49%	$2	$10
CFL 0-15W	Residential Lighting	5	24	151,592	137,527	49%	$1	$2
CFL 16-20W	Residential Lighting	5	35	9,023	8,186	49%	$1	$3
CFL 21W or Greater	Residential Lighting	5	44	19,851	18,010	49%	$1	$3
LED 7W	Residential Lighting	15	27	9,327	11,695	80%	$6	$16
LED 9W	Residential Lighting	15	30	16,322	21,051	80%	$6	$16
LED 13W	Residential Lighting	15	38	4,663	8,186	80%	$6	$16
LED 22W	Residential Lighting	15	46	466	7,017	80%	$6	$20
Energy Star Reflector LED V	Residential Lighting	15	37	18,653	21,051	80%	$6	$15
Energy Star Fixtures	Residential Lighting	15	49	932	1,169	49%	$8	$30
Energy Star Ceiling Fans	Residential Lighting	10	108	6	6	49%	$15	$86
Compact Fluorescent Lamps V	Home Energy Assessments & Weatherization	5	35	24,000	24,000	88%	$0	$0
Kitchen Aerator V	Home Energy Assessments & Weatherization	10	232	500	500	88%	$0	$0
Bathroom Aerator V	Home Energy Assessments & Weatherization	10	232	500	500	88%	$0	$0
LF Showerhead (Whole House) V	Home Energy Assessments & Weatherization	5	417	1,000	1,000	88%	$0	$0
Pipe Wrap (5', 3/4" Wall) V	Home Energy Assessments & Weatherization	15	65	1,000	1,000	88%	$0	$0
Audit Recommendations V	Home Energy Assessments & Weatherization	1	263	1,000	1,000	88%	$0	$0
Air Sealing	Home Energy Assessments & Weatherization	6	89	15	15	88%	$58	$144
Attic Insulation	Home Energy Assessments & Weatherization	6	1	13,117	13,117	88%	$0.34	$0.85
Wall Insulation	Home Energy Assessments & Weatherization	6	1	5,634	5,634	88%	$0.26	$0.65
Knee Wall Insulation	Home Energy Assessments & Weatherization	6	3	100	100	88%	$0.24	$0.60
Prescriptive Duct Sealing	Home Energy Assessments & Weatherization	6	326	100	100	88%	$208	$520
Programmable Thermostat	Home Energy Assessments & Weatherization	6	176	50	50	88%	$13	$31
Prescriptive Duct Sealing-Ht Pump	Home Energy Assessments & Weatherization	6	894	2	2	88%	$400	$1,000
Programmable Thermostat-Ht Pump	Home Energy Assessments & Weatherization	6	430	2	2	88%	$50	$125
ECM Motor Replacement	Home Energy Assessments & Weatherization	6	733	25	25	88%	$400	$1,000
LED 13 Watt	Home Energy Assessments & Weatherization	6	46	875	875	88%	$15	$38
Assessment	Home Energy Assessments & Weatherization	6	0	125	125	88%	$52	$130

Measures	Program Name	Measure Life	Install Adjusted Savings per unit (kWh)	2016 Total Paticipation	2017 Total Paticipation	NTG	Average Incentive Paid Per Unit	Incremental Cost per unit
Energy Star Specialty CFL V	Income Qualified Weatherization	5	40	8,126	8,126	100%	$0	$0
Energy Star Speciality CFL - Interior	Income Qualified Weatherization	5	31	1,628	1,628	100%	$0	$0
Screw-in LED	Income Qualified Weatherization	15	46	500	500	100%	$0	$0
Smart Power Strips	Income Qualified Weatherization	4	23	250	250	100%	$0	$0
Duct Repair, Seal, Insulation	Income Qualified Weatherization	20	326	56	56	100%	$0	$0
Kitchen Aerator IQW V	Income Qualified Weatherization	10	225	131	131	100%	$0	$0
Bathroom Aerator IQW V	Income Qualified Weatherization	10	225	204	204	100%	$0	$0
LF Showerhead (Whole House) IQW V	Income Qualified Weatherization	5	411	102	102	100%	$0	$0
Pipe Wrap (10', 3/4" Wall) IQW V	Income Qualified Weatherization	15	80	127	127	100%	$0	$0
Furnace Filter Whistle IQW V	Income Qualified Weatherization	15	105	339	339	100%	$0	$0
30% Infil. Reduction Electric Furnace w/ CAC V	Income Qualified Weatherization	15	2,512	43	43	100%	$0	$0
30% Infil. Reduction Heat Pump V	Income Qualified Weatherization	15	1,245	9	9	100%	$0	$0
30% Infil. Reduction Electric Furnace no CAC V	Income Qualified Weatherization	15	2,314	0	0	100%	$0	$0
30% Infil. Reduction Gas Furnace w/ CAC V	Income Qualified Weatherization	15	336	283	283	100%	$0	$0
30% Infil. Reduction Gas Furnace no CAC V	Income Qualified Weatherization	15	38	3	3	100%	$0	$0
Attic Insulation V	Income Qualified Weatherization	15	339	17	17	100%	$0	$0
Refrigerator Replacement IQW V	Income Qualified Weatherization	17	1,251	282	282	100%	$0	$0
Audit Recommendations IQW V	Income Qualified Weatherization	1	155	564	564	100%	$0	$0
IQW Healthy and Safety	Income Qualified Weatherization	1	0	564	564	100%	$0	$0
Programmable Thermostat	Income Qualified Weatherization	15	176	100	100	100%	$0	$0
Whole House Fan	Income Qualified Weatherization	20	338	56	56	100%	$0	$0
Refrigerator Recycling	Appliance Recycling	8	1,092	761	761	53%	$50	$93
Freezer Recycling	Appliance Recycling	8	990	191	191	53%	$50	$93
Low Flow Showerhead	Energy Efficient Schools	5	100	2,400	2,400	96%	$0	$0
Faucet Aerators	Energy Efficient Schools	10	126	2,400	2,400	96%	$0	$0
LED Night Light	Energy Efficient Schools	10	7	2,400	2,400	96%	$0	$0
Filter Tone Alarm	Energy Efficient Schools	10	6	2,400	2,400	96%	$0	$0
9W LED	Energy Efficient Schools	15	21	4,800	4,800	96%	$0	$0
Heat Pump Water Heater	Residential Efficient Products	10	2,076	39	39	90%	$300	$700
Programmable Thermostat	Residential Efficient Products	15	176	350	350	80%	$20	$35
Duct Sealing Gas Heating with A/C	Residential Efficient Products	20	326	175	175	80%	$225	$450
Duct Sealing Electric Heat Pump	Residential Efficient Products	20	756	53	53	80%	$400	$450
Duct Sealing Electric Resistive Furnace	Residential Efficient Products	20	2,878	7	7	80%	$400	$450
Variable Speed Pool Pump	Residential Efficient Products	10	1,170	70	70	80%	$300	$750

Measures	Program Name	Measure Life	Install Adjusted Savings per unit (kWh)	2016 Total Paticipation	2017 Total Paticipation	NTG	Average Incentive Paid Per Unit	Incremental Cost per unit
Pool Heater	Residential Efficient Products	10	4,068	9	9	80%	$1,000	$3,254
Air Source Heat Pump 16 SEER - no gas available	Residential Efficient Products	18	1,025	12	12	51%	$400	$1,439
Air Source Heat Pump 16 SEER -gas available	Residential Efficient Products	18	1,025	12	12	51%	$300	$1,439
Dual Fuel Air Sourc Heat Pump 16 SEER	Residential Efficient Products	18	1,025	12	12	51%	$300	$1,439
Air Source Heat Pump 18 SEER - no gas available	Residential Efficient Products	18	1,170	2	2	80%	$600	$2,398
Air Source Heat Pump 18 SEER - gas available	Residential Efficient Products	18	1,170	2	2	80%	$500	$2,398
Duel Fuel Air Source Heat Pump 18 SEER	Residential Efficient Products	18	1,170	2	2	80%	$500	$2,398
Central Air Conditioner 16 SEER	Residential Efficient Products	18	344	123	123	51%	$300	$714
Central Air Conditioner 18 SEER	Residential Efficient Products	18	462	105	105	80%	$500	$1,192
ECM HVAC Motor	Residential Efficient Products	10	350	350	350	51%	$100	$250
Smart Programmable Thermostat	Residential Efficient Products	15	429	175	175	80%	$100	$200
Ductless Heat Pump 17 SEER 9.5 HSPF	Residential Efficient Products	15	3,939	1	1	80%	$750	$959
Ductless Heat Pump 19 SEER 9.5 HSPF	Residential Efficient Products	15	3,972	1	1	80%	$750	$1,439
Ductless Heat Pump 21 SEER 10.0 HSPF	Residential Efficient Products	15	4,093	1	1	80%	$1,000	$1,918
Ductless Heat Pump 23 SEER 10.0 HSPF	Residential Efficient Products	15	4,115	1	1	80%	$1,000	$2,398
Energy Efficient Room/Window AC	Residential Efficient Products	9	60	150	150	90%	$25	$80
Energy Star Refrigerator-CEE Tier 3	Residential Efficient Products	13	207	185	185	90%	$25	$250
Attic Insulation Integrated	Residential Efficient Products	25	781	212	212	70%	$250	$850
Wall Insulation Integrated	Residential Efficient Products	25	946	124	124	70%	$250	$850
Attic Insulation Electric Only	Residential Efficient Products	15	781	10	10	80%	$450	$850
Wall Insulation Electric Only	Residential Efficient Products	15	946	5	5	80%	$450	$850
Gold Star Vectren South HERS =<65	Residential New Construction	25	1,060	52	52	80%	$450	$1,475
Platinum Star Vectren South HERS =< 60	Residential New Construction	25	1,255	42	42	95%	$500	$1,669
Gold Star Vectren South HERS =<65 All Electric	Residential New Construction	25	4,093	7	7	80%	$900	$2,403
Platinum Star Vectren South HERS =< 60 All Electric	Residential New Construction	25	5,161	2	2	95%	$1,000	$3,792
OPower	Residential Behavior Savings	1	128	48,400	43,500	100%	$0	$0
CFL - 13W	Multi-Family Direct Install	5	44	3,000	3,000	100%	$0	$0
CFL - 23W	Multi-Family Direct Install	5	58	2,000	2,000	100%	$0	$0
Programmable Thermostat	Multi-Family Direct Install	15	176	500	500	95%	$0	$0

Commercial & Industrial

Measures	Program Name	Measure Life	Install Adjusted Savings per unit (kWh)	2016 Total Paticipation	2017 Total Paticipation	NTG	Average Incentive Paid Per Unit	Incremental Cost per unit
Cooler Controller - occupancy sensor V CDI106	Small Business Direct Install	10	1,209	28	28	100%	$0	$0
Faucet Aerators-electric V CDI112	Small Business Direct Install	10	184	20	20	100%	$0	$0
LEDs: >12W Flood V CDI121	Small Business Direct Install	8	231	100	100	100%	$0	$0
LEDs: 8-12W V CDI122	Small Business Direct Install	8	136	164	164	100%	$0	$0
Pre-Rinse Spray Valves - ele V CDI129	Small Business Direct Install	5	7,454	3	3	100%	$0	$0
Showerheads-electric V CDI130	Small Business Direct Install	10	250	1	1	100%	$0	$0
Programmable Thermostat Turn Down	Small Business Direct Install	5	65	20	20	100%	$0	$0
EC Motor Reach-in V CDI110	Small Business Direct Install	15	345	4	4	100%	$56	$150
EC Motor Walk-in V CDI111	Small Business Direct Install	15	392	4	4	100%	$119	$250
LED Fixture <250W, Replacing 400W HID, HighBay V CDI113	Small Business Direct Install	15	660	28	28	100%	$133	$500
LED for Walk in Cooler V CDI114	Small Business Direct Install	16	202	10	10	100%	$40	$300
LED for Walk in Freezer V CDI115	Small Business Direct Install	16	208	10	10	100%	$40	$300
LED Open Sign V CDI116	Small Business Direct Install	12	1,418	200	200	100%	$50	$200
LED Recessed Downlight V CDI117	Small Business Direct Install	15	257	1,165	1,165	100%	$35	$95
LED, Exit Sign, Retrofit V CDI118	Small Business Direct Install	16	83	270	270	100%	$33	$30
LED, Refrigerated Case, Replaces T12 or T8 V CDI119	Small Business Direct Install	16	272	140	140	100%	$60	$300
LEDs: >12W Flood V CDI120	Small Business Direct Install	8	231	169	169	100%	$30	$44
LEDs: 8-12W V CDI123	Small Business Direct Install	8	136	840	840	100%	$23	$35
LEDs: MR16 track V CDI125	Small Business Direct Install	8	165	500	500	100%	$23	$35
Occupancy Sensor, Wall Mount, <=200 Watts V CDI127	Small Business Direct Install	8	186	90	90	100%	$38	$60
T8 6L or T5HO 4L Replacing 400-999 W HID V CDI135	Small Business Direct Install	12	1,139	305	305	100%	$133	$300
Programmable Thermostat CDI137	Small Business Direct Install	5	905	125	125	100%	$130	$125
Strip Curtains Cooler CDI144	Small Business Direct Install	4	422	2	2	100%	$157	$445
Strip Curtains Freezer CDI145	Small Business Direct Install	4	2,974	2	2	100%	$157	$445
1 Lamp 4ft T12 to 1 Lamp 4ft 28W or 25W T8	Small Business Direct Install	10	79	400	400	100%	$18	$95
2 Lamp 4ft T12 to 2 Lamp 4ft 28W or 25W T8	Small Business Direct Install	10	100	1,480	1,480	100%	$22	$97
3 Lamp 4ft T12 to 3 Lamp 4ft 28W or 25W T8	Small Business Direct Install	10	181	100	100	100%	$30	$97
4 Lamp 4ft T12 to 4 Lamp 4ft 28W or 25W T8	Small Business Direct Install	10	206	28	28	100%	$34	$78
1 Lamp 8ft T12 to 2 Lamp 4ft 28W or 25W T8	Small Business Direct Install	10	112	100	100	100%	$23	$78
2 Lamp 8ft T12 to 4 Lamp 4ft 28W or 25W T8	Small Business Direct Install	10	122	10	10	100%	$38	$79
4 Lamp 4ft T12 to 3 Lamp 4ft 28W or 25W T8 - Delamp	Small Business Direct Install	10	297	8	8	100%	$39	$85
4 Lamp 4ft T12 to 2 Lamp 4ft 28W or 25W T8 - Delamp	Small Business Direct Install	10	388	5,000	5,000	100%	$36	$85
3 Lamp 4ft T12 to 2 Lamp 4ft 28W or 25W T8 - Delamp	Small Business Direct Install	10	272	40	40	100%	$36	$93
2 Lamp 4ft T12 to 1 Lamp 4ft 28W or 25W T8 - Delamp	Small Business Direct Install	10	200	58	58	100%	$37	$93
4 Lamp 8ft T12 to 4 Lamp 28W or 25W T8 - Delamp	Small Business Direct Install	10	614	281	281	100%	$50	$95
2 Lamp 2ft T12 U-tube to 2 Lamp 2ft T8 Linear w/ Reflector	Small Business Direct Install	10	160	273	273	100%	$26	$357
2 Lamp 8ft T12 to 2 Lamp 4ft HPT8 w/ Reflector	Small Business Direct Install	10	304	3,000	3,000	100%	$48	$355
LED Exterior <30W	Small Business Direct Install	12	403	350	350	80%	$198	$125
LED Exterior 30W-75W	Small Business Direct Install	12	497	300	300	80%	$226	$250

Measures	Program Name	Measure Life	Install Adjusted Savings per unit (kWh)	2016 Total Paticipation	2017 Total Paticipation	NTG	Average Incentive Paid Per Unit	Incremental Cost per unit
LED Exterior75W+	Small Business Direct Install	12	932	650	650	80%	$337	$375
LED Exterior1000W MH Replacement	Small Business Direct Install	12	3,003	100	100	80%	$506	$750
MH 150W Pulse Start To T5 46" 2 Lamp HO - Turnover	Commercial and Industrial Prescriptive	15	252	158	158	80%	$25	$150
MH 200W Pulse Start To T5 46" 3 Lamp HO - Turnover	Commercial and Industrial Prescriptive	15	194	158	158	80%	$25	$150
MH 320W Pulse Start To T5 46" 4 Lamp HO - Turnover	Commercial and Industrial Prescriptive	15	499	225	225	80%	$40	$150
MH 350W Pulse Start To T5 46" 6 Lamp HO - Turnover	Commercial and Industrial Prescriptive	15	187	113	113	80%	$40	$150
MH 1000W Pulse Start To T5 46" 10 Lamp HO - Turnover	Commercial and Industrial Prescriptive	15	1,886	113	113	80%	$125	$150
MH 1000W Pulse Start To T5 46" 12 Lamp HO - Turnover	Commercial and Industrial Prescriptive	15	1,441	95	95	80%	$125	$150
MH 250W To LED Low Bay 85 W3	Commercial and Industrial Prescriptive	8	800	39	39	80%	$80	$200
T8 HO 96" 2 Lamp To LED Low Bay 85 W3	Commercial and Industrial Prescriptive	8	286	50	50	80%	$40	$200
MH 200W To LED High Bay 139W	Commercial and Industrial Prescriptive	8	354	39	39	80%	$40	$200
MH 250W To LED High Bay 175W	Commercial and Industrial Prescriptive	8	457	194	194	80%	$50	$200
MH 175W To T5 46" 2 Lamp HO - Retrofit	Commercial and Industrial Prescriptive	15	347	158	158	80%	$25	$150
MH 175W To T5 46" 3 Lamp HO - Retrofit	Commercial and Industrial Prescriptive	15	103	158	158	80%	$25	$150
MH 400W To T5 46" 4 Lamp HO - Retrofit	Commercial and Industrial Prescriptive	15	854	225	225	80%	$40	$150
MH 400W To T5 46" 6 Lamp HO - Retrofit	Commercial and Industrial Prescriptive	15	408	225	225	80%	$40	$150
MH 1000W To T5 46" 10 Lamp HO - Retrofit	Commercial and Industrial Prescriptive	15	1,886	113	113	80%	$125	$150
MH 1000W To T5 46" 12 Lamp HO - Retrofit	Commercial and Industrial Prescriptive	15	1,441	63	63	80%	$125	$150
Fluorescent Exit Sign To LED Exit Sign	Commercial and Industrial Prescriptive	16	83	911	911	80%	$20	$30
Incandescent Traffic Signal To LED Traffic Signal Round 8" Red	Commercial and Industrial Prescriptive	10	299	61	61	80%	$30	$120
Incandescent Traffic Signal To LED Traffic Signal Pedestrian 12"	Commercial and Industrial Prescriptive	10	946	61	61	80%	$50	$200
Incandescent To CFL <15W Screw-In	Commercial and Industrial Prescriptive	3	92	305	305	80%	$2	$3
Incandescent To CFL 16-20W Screw-In	Commercial and Industrial Prescriptive	3	128	130	130	80%	$2	$3
Incandescent To CFL 21W+ Screw-In	Commercial and Industrial Prescriptive	3	165	25	25	80%	$5	$5
T12 48" 1 Lamp To Delamp	Commercial and Industrial Prescriptive	10	149	845	845	80%	$5	$0
T12 96" 1 Lamp To Delamp	Commercial and Industrial Prescriptive	10	286	384	384	80%	$5	$0
T12 46" 1 Lamp To T5 46" 1 Lamp	Commercial and Industrial Prescriptive	10	46	62	62	80%	$6	$25
T12 46" 2 Lamp To T5 46" 2 Lamp	Commercial and Industrial Prescriptive	10	91	185	185	80%	$9	$25
T12 46" 3 Lamp To T5 46" 3 Lamp	Commercial and Industrial Prescriptive	10	137	123	123	80%	$12	$25
T12 46" 4 Lamp To T5 46" 4 Lamp	Commercial and Industrial Prescriptive	10	191	246	246	80%	$15	$25
HID 75W-100W To T5 Garage 1 Lamp	Commercial and Industrial Prescriptive	7	76	156	156	80%	$35	$150
HID 101W-175W To T5 Garage 2 Lamp	Commercial and Industrial Prescriptive	7	114	156	156	80%	$60	$150
HID 176W+ To T5 Garage 3 Lamp	Commercial and Industrial Prescriptive	7	152	78	78	80%	$94	$150
LED Decoratives 2-4W	Commercial and Industrial Prescriptive	6	65	21	21	80%	$10	$29
LED A-Line 8-12W	Commercial and Industrial Prescriptive	6	118	371	371	80%	$10	$29
LED PAR 20 7-9W	Commercial and Industrial Prescriptive	8	100	53	53	80%	$10	$40
LED PAR 30 10-13W	Commercial and Industrial Prescriptive	8	114	212	212	80%	$10	$40
LED PAR 38 10-21W	Commercial and Industrial Prescriptive	8	193	350	350	80%	$20	$50
LED MR16 4-7W	Commercial and Industrial Prescriptive	8	71	53	53	80%	$15	$40
LED Outdoor Decorative Post <30W	Commercial and Industrial Prescriptive	12	403	42	42	80%	$50	$125

Measures	Program Name	Measure Life	Install Adjusted Savings per unit (kWh)	2016 Total Paticipation	2017 Total Paticipation	NTG	Average Incentive Paid Per Unit	Incremental Cost per unit
LED Outdoor Decorative Post 30W-75W	Commercial and Industrial Prescriptive	12	497	32	32	80%	$100	$250
LED Outdoor Decorative Post 75W+	Commercial and Industrial Prescriptive	12	932	32	32	80%	$150	$375
LED Parking Garage/Canopy <30W	Commercial and Industrial Prescriptive	12	403	28	28	80%	$50	$125
LED Parking Garage/Canopy 30W-75W	Commercial and Industrial Prescriptive	12	497	21	21	80%	$100	$250
LED Parking Garage/Canopy 75W+	Commercial and Industrial Prescriptive	12	932	21	21	80%	$150	$375
LED Exterior Wall-Pack <30W	Commercial and Industrial Prescriptive	12	403	50	50	80%	$50	$125
LED Exterior Wall-Pack 30W-75W	Commercial and Industrial Prescriptive	12	497	50	50	80%	$100	$250
LED Exterior Wall-Pack 75W+	Commercial and Industrial Prescriptive	12	932	50	50	80%	$150	$375
T8 U-Tube 2 Lamp 2' To LED U-Tube	Commercial and Industrial Prescriptive	12	61	19	19	80%	$75	$75
T8 3 Lamp 4' To LED 2 Lamp Linear 4'	Commercial and Industrial Prescriptive	12	131	115	115	80%	$125	$125
T8 2 Lamp 4' To LED 1 Lamp Linear 4'	Commercial and Industrial Prescriptive	12	102	249	249	80%	$100	$100
No controls To Wall-Mounted Occupancy Sensors	Commercial and Industrial Prescriptive	8	286	222	222	80%	$20	$42
No controls To Ceiling-Mounted Occupancy Sensors	Commercial and Industrial Prescriptive	8	560	222	222	80%	$20	$66
No controls To Fixture Mounted Occupancy Sensors	Commercial and Industrial Prescriptive	8	143	200	200	80%	$15	$125
No controls To Remote-Mounted Daylight Dimming Sensors	Commercial and Industrial Prescriptive	8	560	11	11	80%	$20	$65
No controls To Fixture Mounted Daylight Dimming Sensors	Commercial and Industrial Prescriptive	8	143	28	28	80%	$15	$50
No controls To Switching Controls for Multi-Level Lighting	Commercial and Industrial Prescriptive	8	143	28	28	80%	$20	$274
No controls To Central Lighting Controls (Timeclocks)	Commercial and Industrial Prescriptive	8	187	11	11	80%	$25	$103
Vending Machine Occ Sensor - Refrigerated Beverage	Commercial and Industrial Prescriptive	5	1,612	222	222	80%	$50	$216
Vending Machine Occ Sensor - Refrigerated Glass Front Cooler	Commercial and Industrial Prescriptive	5	1,209	7	7	80%	$50	$216
VFD Return Fan <20hp - Hospital	Commercial and Industrial Prescriptive	15	1,907	7	7	80%	$40	$199
VFD Tower Fan <20hp - Hospital	Commercial and Industrial Prescriptive	15	855	7	7	80%	$40	$199
VFD CHW Pump <20hp - Hospital	Commercial and Industrial Prescriptive	15	6,714	7	7	80%	$40	$199
VFD HW Pump <20hp - Hospital	Commercial and Industrial Prescriptive	15	5,696	3	3	80%	$40	$199
VFD CW Pump <20hp - Hospital	Commercial and Industrial Prescriptive	15	2,034	3	3	80%	$40	$199
VFD Return Fan <20hp - Hotel	Commercial and Industrial Prescriptive	15	150	4	4	80%	$40	$199
VFD Tower Fan <20hp - Hotel	Commercial and Industrial Prescriptive	15	1,176	7	7	80%	$40	$199
VFD CHW Pump <20hp - Hotel	Commercial and Industrial Prescriptive	15	6,776	4	4	80%	$40	$199
VFD HW Pump <20hp - Hotel	Commercial and Industrial Prescriptive	15	7,162	1	1	80%	$40	$199
VFD CW Pump <20hp - Hotel	Commercial and Industrial Prescriptive	15	73	1	1	80%	$40	$199
VFD Return Fan <20hp - Large Office	Commercial and Industrial Prescriptive	15	1,387	7	7	80%	$40	$199
VFD Tower Fan <20hp - Large Office	Commercial and Industrial Prescriptive	15	62	7	7	80%	$40	$199
VFD CHW Pump <20hp - Large Office	Commercial and Industrial Prescriptive	15	3,893	7	7	80%	$40	$199
VFD HW Pump <20hp - Large Office	Commercial and Industrial Prescriptive	15	3,806	3	3	80%	$40	$199
VFD CW Pump <20hp - Large Office	Commercial and Industrial Prescriptive	15	1,047	3	3	80%	$40	$199
VFD Compressor	Commercial and Industrial Prescriptive	15	944	20	20	80%	$75	$300
HID To Induction Lamp and Fixture 55-100W	Commercial and Industrial Prescriptive	16	114	6	6	80%	$20	$200
HID To Induction Lamp and Fixture >100W	Commercial and Industrial Prescriptive	16	381	53	53	80%	$40	$800
Barrel Wraps (Inj Mold Only)	Commercial and Industrial Prescriptive	5	1,439	7	7	80%	$40	$80
Clothes Washer CEE Tier 2	Commercial and Industrial Prescriptive	10	542	1	1	80%	$60	$475

Measures	Program Name	Measure Life	Install Adjusted Savings per unit (kWh)	2016 Total Paticipation	2017 Total Paticipation	NTG	Average Incentive Paid Per Unit	Incremental Cost per unit
Clothes Washer CEE Tier 3	Commercial and Industrial Prescriptive	10	542	1	1	80%	$70	$604
Clothes Washer ENERGY STAR/CEE Tier 1	Commercial and Industrial Prescriptive	10	542	1	1	80%	$50	$347
Cooler - Glass Door <15 vol	Commercial and Industrial Prescriptive	12	957	1	1	80%	$50	$143
Cooler - Glass Door >50 vol	Commercial and Industrial Prescriptive	12	1,037	1	1	80%	$70	$164
Cooler - Glass Door 15-30 vol	Commercial and Industrial Prescriptive	12	617	1	1	80%	$55	$249
Cooler - Glass Door 30-50 vol	Commercial and Industrial Prescriptive	12	845	1	1	80%	$60	$164
Cooler - Reach-In Electronically Commutated (EC) Motor	Commercial and Industrial Prescriptive	15	325	10	10	80%	$35	$50
Cooler - Solid Door <15 vol	Commercial and Industrial Prescriptive	12	496	1	1	80%	$50	$143
Cooler - Solid Door >50 vol	Commercial and Industrial Prescriptive	12	1,688	1	1	80%	$70	$164
Cooler - Solid Door 15-30 vol	Commercial and Industrial Prescriptive	12	617	1	1	80%	$55	$249
Cooler - Solid Door 30-50 vol	Commercial and Industrial Prescriptive	12	951	1	1	80%	$60	$164
Cooler - Walk-In Electronically Commutated (EC) Motor	Commercial and Industrial Prescriptive	15	354	8	8	80%	$35	$50
Cooler Anti-Sweat Heater Controls - Conductivity-Based	Commercial and Industrial Prescriptive	12	700	3	3	80%	$50	$200
Cooler Anti-Sweat Heater Controls - Humidity-Based	Commercial and Industrial Prescriptive	12	550	3	3	80%	$50	$300
Demand Controlled Ventilation - CO	Commercial and Industrial Prescriptive	15	747	3	3	80%	$75	$115
Demand Controlled Ventilation - CO2	Commercial and Industrial Prescriptive	15	747	5	5	80%	$75	$115
Electric Chiller - Air cooled, with condenser	Commercial and Industrial Prescriptive	20	305	1	1	80%	$30	$82
Electric Chiller - Air cooled, without condenser	Commercial and Industrial Prescriptive	20	35	5	5	80%	$10	$82
Electric Chiller - Water Cooled, Centrifugal <150 tons	Commercial and Industrial Prescriptive	20	216	1	1	80%	$30	$125
Electric Chiller - Water Cooled, Centrifugal >300 tons	Commercial and Industrial Prescriptive	20	174	1	1	80%	$30	$69
Electric Chiller - Water Cooled, Centrifugal 150-300 tons	Commercial and Industrial Prescriptive	20	177	1	1	80%	$30	$92
Electric Chiller - Water Cooled, Rotary Screw <150 tons	Commercial and Industrial Prescriptive	20	168	1	1	80%	$30	$83
Electric Chiller - Water Cooled, Rotary Screw >300 tons	Commercial and Industrial Prescriptive	20	178	1	1	80%	$30	$42
Electric Chiller - Water Cooled, Rotary Screw 150-300 tons	Commercial and Industrial Prescriptive	20	181	1	1	80%	$30	$60
Electric Chiller Tune-up - Air cooled, with condenser	Commercial and Industrial Prescriptive	5	186	1	1	80%	$8	$22
Electric Chiller Tune-up - Water Cooled, Centrifugal >300 tons	Commercial and Industrial Prescriptive	5	89	1	1	80%	$8	$22
Electric Chiller Tune-up - Water Cooled, Centrifugal 150-300 tons	Commercial and Industrial Prescriptive	5	96	1	1	80%	$8	$22
Electric Chiller Tune-up - Water Cooled, Rotary Screw >300 tons	Commercial and Industrial Prescriptive	5	92	1	1	80%	$8	$22
Electric Chiller Tune-up - Water Cooled, Rotary Screw 150-300 tons	Commercial and Industrial Prescriptive	5	101	1	1	80%	$8	$22
ENERGY STAR CEE Tier 1 Window\Sleeve\Room AC < 14,000 BTUH	Commercial and Industrial Prescriptive	12	136	1	1	80%	$16	$80
ENERGY STAR Commercial Dishwasher - Door Type, High Temp	Commercial and Industrial Prescriptive	15	14,143	1	1	80%	$500	$500
ENERGY STAR Commercial Dishwasher - Multi-Tank Conveyor, Low Temp	Commercial and Industrial Prescriptive	20	17,465	1	1	80%	$750	$970
ENERGY STAR Commercial Dishwasher - Under Counter, High Temp	Commercial and Industrial Prescriptive	10	7,471	1	1	80%	$350	$1,000
ENERGY STAR Commercial Dishwasher - Under Counter, Low Temp	Commercial and Industrial Prescriptive	10	1,213	1	1	80%	$150	$530
ENERGY STAR Commercial Fryer	Commercial and Industrial Prescriptive	12	983	1	1	80%	$100	$500
ENERGY STAR Commercial Hot Holding Cabinets Full Size	Commercial and Industrial Prescriptive	12	5,256	1	1	80%	$500	$1,110
ENERGY STAR Commercial Hot Holding Cabinets Half Size	Commercial and Industrial Prescriptive	12	1,862	1	1	80%	$250	$1,110
ENERGY STAR Commercial Hot Holding Cabinets Three Quarter Size	Commercial and Industrial Prescriptive	12	2,847	1	1	80%	$350	$1,110
ENERGY STAR Commercial Ice Machine < 500 lb/day harvest rate	Commercial and Industrial Prescriptive	9	397	3	3	80%	$100	$537
ENERGY STAR Commercial Ice Machine >=1000 lb/day harvest rate	Commercial and Industrial Prescriptive	9	1,693	1	1	80%	$250	$2,008
ENERGY STAR Commercial Ice Machine >=500 and <1000 lb/day harvest rate	Commercial and Industrial Prescriptive	9	958	1	1	80%	$175	$1,485

Measures	Program Name	Measure Life	Install Adjusted Savings per unit (kWh)	2016 Total Paticipation	2017 Total Paticipation	NTG	Average Incentive Paid Per Unit	Incremental Cost per unit
ENERGY STAR Commercial Steam Cookers 3 Pan	Commercial and Industrial Prescriptive	12	5,183	1	1	80%	$750	$3,500
ENERGY STAR Commercial Steam Cookers 4 Pan	Commercial and Industrial Prescriptive	12	5,488	1	1	80%	$1,000	$3,500
ENERGY STAR Commercial Steam Cookers 5 Pan	Commercial and Industrial Prescriptive	12	6,410	1	1	80%	$1,250	$3,500
ENERGY STAR Commercial Steam Cookers 6 Pan	Commercial and Industrial Prescriptive	12	6,972	1	1	80%	$1,500	$3,500
ENERGY STAR Convection Oven	Commercial and Industrial Prescriptive	12	3,235	1	1	80%	$350	$1,113
ENERGY STAR Griddles	Commercial and Industrial Prescriptive	12	6,996	1	1	80%	$700	$2,090
ENERGY STAR Window\Sleeve\Room AC < 14,000 BTUH	Commercial and Industrial Prescriptive	12	136	1	1	80%	$12	$40
ENERGY STAR Window\Sleeve\Room AC >= 14,000 BTUH	Commercial and Industrial Prescriptive	12	215	1	1	80%	$14	$40
ENERGY STAR CEE Tier 2 Window\Sleeve\Room AC < 14,000 BTUH	Commercial and Industrial Prescriptive	12	117	1	1	80%	$20	$250
ENERGY STAR CEE Tier 2 Window\Sleeve\Room AC >= 14,000 BTUH	Commercial and Industrial Prescriptive	12	206	1	1	80%	$22	$500
Freezer - Glass Door <15 vol	Commercial and Industrial Prescriptive	12	1,338	1	1	80%	$100	$142
Freezer - Glass Door >50 vol	Commercial and Industrial Prescriptive	12	8,579	1	1	80%	$350	$407
Freezer - Glass Door 15-30 vol	Commercial and Industrial Prescriptive	12	2,226	1	1	80%	$150	$166
Freezer - Glass Door 30-50 vol	Commercial and Industrial Prescriptive	12	4,407	1	1	80%	$200	$166
Freezer - Reach-In Electronically Commutated (EC) Motor	Commercial and Industrial Prescriptive	15	409	1	1	80%	$45	$50
Freezer - Solid Door <15 vol	Commercial and Industrial Prescriptive	12	458	1	1	80%	$100	$142
Freezer - Solid Door >50 vol	Commercial and Industrial Prescriptive	12	5,488	1	1	80%	$350	$407
Freezer - Solid Door 15-30 vol	Commercial and Industrial Prescriptive	12	868	1	1	80%	$150	$166
Freezer - Solid Door 30-50 vol	Commercial and Industrial Prescriptive	12	3,074	1	1	80%	$200	$166
Freezer - Walk-In Electronically Commutated (EC) Motor	Commercial and Industrial Prescriptive	15	620	1	1	80%	$45	$50
Freezer Anti-Sweat Heater Controls - Conductivity-Based	Commercial and Industrial Prescriptive	12	1,483	3	3	80%	$100	$200
Freezer Anti-Sweat Heater Controls - Humidity-Based	Commercial and Industrial Prescriptive	12	1,165	3	3	80%	$100	$300
Heat Pump Water Heater 10-50 MBH	Commercial and Industrial Prescriptive	15	2,903	3	3	80%	$2,000	$4,000
HID >400W to Exterior LED or Induction	Commercial and Industrial Prescriptive	16	3,266	75	75	80%	$200	$2
HID >400W to Garage LED or Induction	Commercial and Industrial Prescriptive	16	3,266	25	25	80%	$200	$2
High Efficiency Pumps - 1.5hp	Commercial and Industrial Prescriptive	15	617	1	1	80%	$60	$350
High Efficiency Pumps - 10hp	Commercial and Industrial Prescriptive	15	5,952	1	1	80%	$240	$332
High Efficiency Pumps - 15hp	Commercial and Industrial Prescriptive	15	7,848	1	1	80%	$280	$585
High Efficiency Pumps - 20hp	Commercial and Industrial Prescriptive	15	7,246	1	1	80%	$320	$850
High Efficiency Pumps - 2hp	Commercial and Industrial Prescriptive	15	900	1	1	80%	$100	$350
High Efficiency Pumps - 3hp	Commercial and Industrial Prescriptive	15	1,841	1	1	80%	$120	$350
High Efficiency Pumps - 5hp	Commercial and Industrial Prescriptive	15	3,528	1	1	80%	$160	$341
High Efficiency Pumps - 7.5hp	Commercial and Industrial Prescriptive	15	5,438	3	3	80%	$200	$498
Low Flow Pre-Rinse Sprayer - Electric	Commercial and Industrial Prescriptive	5	3,727	1	1	80%	$25	$35
MH 1000W To T8VHO 48" 8 Lamp (2 fixtures)	Commercial and Industrial Prescriptive	7	1,921	5	5	80%	$125	$150
MH 250W To T8VHO 48" 4 Lamp	Commercial and Industrial Prescriptive	7	549	20	20	80%	$50	$150
MH 400W To T8VHO 48" 6 Lamp	Commercial and Industrial Prescriptive	7	884	20	20	80%	$60	$150
MH 400W To T8VHO 48" 8 Lamp	Commercial and Industrial Prescriptive	7	648	5	5	80%	$60	$150
Network PC Power Management Software	Commercial and Industrial Prescriptive	4	135	10	10	80%	$3	$12
No Controls To Ceiling-Mounted Occupancy Sensors >500W Connected	Commercial and Industrial Prescriptive	8	1,143	10	10	80%	$40	$66
No Controls To Central Lighting Controls (Timeclocks) >500W Connected	Commercial and Industrial Prescriptive	8	381	1	1	80%	$20	$103
No Controls To Fixture Mounted Daylight Dimming Sensors >500W Connected	Commercial and Industrial Prescriptive	8	1,143	20	20	80%	$40	$50

Measures	Program Name	Measure Life	Install Adjusted Savings per unit (kWh)	2016 Total Paticipation	2017 Total Paticipation	NTG	Average Incentive Paid Per Unit	Incremental Cost per unit
No Controls To LED Case Lighting Sensor Controls	Commercial and Industrial Prescriptive	8	675	10	10	80%	$30	$130
No Controls To Remote-Mounted Daylight Dimming Sensors >500W Connected	Commercial and Industrial Prescriptive	8	1,143	3	3	80%	$30	$65
No Controls To Switching Controls for Multi-Level Lighting >500W Connected	Commercial and Industrial Prescriptive	8	1,143	3	3	80%	$30	$274
No Controls To Wall-Mounted Occupancy Sensors >500W Connected	Commercial and Industrial Prescriptive	8	1,143	10	10	80%	$30	$42
Outside Air Economizer with Dual-Enthalpy Sensors	Commercial and Industrial Prescriptive	10	350	1	1	80%	$50	$400
Packaged Terminal Air Conditioner (PTAC) <65,000 BtuH	Commercial and Industrial Prescriptive	15	669	20	20	80%	$75	$500
Packaged Terminal Air Conditioner (PTAC) 65,000-135,000 BtuH	Commercial and Industrial Prescriptive	15	1,341	10	10	80%	$150	$1,000
Packaged Terminal Heat Pump (PTHP) <65,000 BtuH	Commercial and Industrial Prescriptive	15	669	20	20	80%	$75	$500
Packaged Terminal Heat Pump (PTHP) 65,000-135,000 BtuH	Commercial and Industrial Prescriptive	15	1,341	10	10	80%	$150	$1,000
Pellet Dryer Duct Insulation 3in -8in dia	Commercial and Industrial Prescriptive	5	347	10	10	80%	$30	$65
Plug Load Occupancy Sensors	Commercial and Industrial Prescriptive	8	169	10	10	80%	$20	$70
PSMH 1000W To T8VHO 48" 8 Lamp (2 fixtures)	Commercial and Industrial Prescriptive	15	1,921	5	5	80%	$60	$150
Refrigerated Case Covers	Commercial and Industrial Prescriptive	5	158	4	4	80%	$15	$42
Smart Strip Plug Outlet	Commercial and Industrial Prescriptive	8	24	10	10	80%	$15	$15
Snack Machine Controller (Non-refrigerated vending)	Commercial and Industrial Prescriptive	5	343	10	10	80%	$30	$108
Split System Heat Pump <65,000 BtuH	Commercial and Industrial Prescriptive	15	669	1	1	80%	$75	$500
Split System Heat Pump 135,000-240,000 BtuH	Commercial and Industrial Prescriptive	15	1,966	4	4	80%	$250	$1,500
Split System Heat Pump 240,000-760,000 BtuH	Commercial and Industrial Prescriptive	15	3,120	2	2	80%	$400	$4,500
Split System Heat Pump 65,000-135,000 BtuH	Commercial and Industrial Prescriptive	15	1,341	4	4	80%	$150	$1,000
Split System Unitary Air Conditioner <65,000 BtuH	Commercial and Industrial Prescriptive	15	669	15	15	80%	$75	$500
Split System Unitary Air Conditioner >760,000 BtuH	Commercial and Industrial Prescriptive	15	3,253	4	4	80%	$500	$6,500
Split System Unitary Air Conditioner 135,000-240,000 BtuH	Commercial and Industrial Prescriptive	15	1,966	3	3	80%	$250	$1,500
Split System Unitary Air Conditioner 240,000-760,000 BtuH	Commercial and Industrial Prescriptive	15	3,120	3	3	80%	$400	$4,500
Split System Unitary Air Conditioner 65,000-135,000 BtuH	Commercial and Industrial Prescriptive	15	1,341	8	8	80%	$150	$1,000
T12 6' To Refrigerated Display Case Lighting 6' LED - Cooler	Commercial and Industrial Prescriptive	8	252	25	25	80%	$40	$250
T12 6' To Refrigerated Display Case Lighting 6' LED - Freezer	Commercial and Industrial Prescriptive	8	252	20	20	80%	$40	$250
T8 5' To Refrigerated Display Case Lighting 5' LED - Cooler	Commercial and Industrial Prescriptive	8	145	5	5	80%	$25	$250
T8 5' To Refrigerated Display Case Lighting 5' LED - Freezer	Commercial and Industrial Prescriptive	8	145	5	5	80%	$25	$250
T8 To 21" Tubular Skylight/Light Tube	Commercial and Industrial Prescriptive	10	413	3	3	80%	$50	$500
VFD CHW Pump 20-100hp - Hospital	Commercial and Industrial Prescriptive	15	402,820	1	1	80%	$2,400	$6,530
VFD CHW Pump 20-100hp - Hotel	Commercial and Industrial Prescriptive	15	406,540	1	1	80%	$2,400	$6,530
VFD CHW Pump 20-100hp - Large Office	Commercial and Industrial Prescriptive	15	233,560	1	1	80%	$2,400	$6,530
VFD CW Pump 20-100hp - Hospital	Commercial and Industrial Prescriptive	15	122,020	1	1	80%	$2,400	$6,530
VFD CW Pump 20-100hp - Hotel	Commercial and Industrial Prescriptive	15	4,380	1	1	80%	$2,400	$6,530
VFD CW Pump 20-100hp - Large Office	Commercial and Industrial Prescriptive	15	62,840	1	1	80%	$2,400	$6,530
VFD HW Pump 20-100hp - Hospital	Commercial and Industrial Prescriptive	15	341,760	1	1	80%	$2,400	$6,530
VFD HW Pump 20-100hp - Hotel	Commercial and Industrial Prescriptive	15	429,740	1	1	80%	$2,400	$6,530
VFD HW Pump 20-100hp - Large Office	Commercial and Industrial Prescriptive	15	228,340	1	1	80%	$2,400	$6,530
VFD Return Fan 20-100hp - Hospital	Commercial and Industrial Prescriptive	15	114,420	1	1	80%	$2,400	$6,530
VFD Return Fan 20-100hp - Hotel	Commercial and Industrial Prescriptive	15	9,000	1	1	80%	$2,400	$6,530
VFD Return Fan 20-100hp - Large Office	Commercial and Industrial Prescriptive	15	83,220	1	1	80%	$2,400	$6,530
VFD Supply Fan <100hp - Hospital	Commercial and Industrial Prescriptive	15	132,300	1	1	80%	$2,400	$6,530

Measures	Program Name	Measure Life	Install Adjusted Savings per unit (kWh)	2016 Total Paticipation	2017 Total Paticipation	NTG	Average Incentive Paid Per Unit	Incremental Cost per unit
VFD Supply Fan <100hp - Hotel	Commercial and Industrial Prescriptive	15	3,540	1	1	80%	$2,400	$6,530
VFD Supply Fan <100hp - Large Office	Commercial and Industrial Prescriptive	15	106,920	1	1	80%	$2,400	$6,530
VFD Tower Fan 20-100hp - Hospital	Commercial and Industrial Prescriptive	15	51,320	1	1	80%	$2,400	$6,530
VFD Tower Fan 20-100hp - Hotel	Commercial and Industrial Prescriptive	15	70,560	1	1	80%	$2,400	$6,530
VFD Tower Fan 20-100hp - Large Office	Commercial and Industrial Prescriptive	15	3,700	1	1	80%	$2,400	$6,530
Window Film	Commercial and Industrial Prescriptive	10	4	25	25	80%	$3	$3
T8 1L 4', 28W, CEE V	Commercial and Industrial Prescriptive	12	25	285	285	80%	$4	$33
T8 2L 4', 28W, CEE V	Commercial and Industrial Prescriptive	12	50	1,500	1,500	80%	$7	$67
T8 4L 4', 28W, CEE V	Commercial and Industrial Prescriptive	12	80	800	800	80%	$14	$93
T8 3L 4', 28W, CEE V	Commercial and Industrial Prescriptive	12	79	320	320	80%	$11	$80
EDA - Lighting Power Density Reduction	Commercial & Industrial New Construction	15	72,000	4	5	95%	$6,840	$10,274
EDA - Non Lighting Measures	Commercial & Industrial New Construction	10	45,000	4	4	95%	$4,275	$12,400
EDA - Design Team Participation Incentives - Small Buildings	Commercial & Industrial New Construction	10	0	1	1	95%	$750	$750
EDA - Design Team Participation Incentives - Med Buildings	Commercial & Industrial New Construction	10	0	3	3	95%	$2,500	$2,500
EDA - Design Team Participation Incentives - Large Buildings	Commercial & Industrial New Construction	10	0	1	1	95%	$5,000	$5,000
Commercial & Industrial Custom Project	Commercial & Industrial Custom	11	116,252	22	25	99%	$13,970	$66,551
MF- Duct Repair and Sealing	Multi-Family Energy Efficient Retrofit	15	271	50	50	100%	$114	$152
MF-Programmable thermostat	Multi-Family Energy Efficient Retrofit	20	115	50	50	100%	$90	$120
MF-Infiltration Upgrade	Multi-Family Energy Efficient Retrofit	5	562	90	90	100%	$9	$12
MF-Refrigerator Early Replacement	Multi-Family Energy Efficient Retrofit	10	226	5	5	100%	$205	$273
General Assessment	Multi-Family Energy Efficient Retrofit	20	0	100	100	100%	$0	$125
LED Exit Signs	Multi-Family Energy Efficient Retrofit	16	83	40	40	100%	$10	$30
4' T8 32W Lamps, Utility Space	Multi-Family Energy Efficient Retrofit	10	88	80	80	100%	$12	$36
4' T8 32W Lamps, Hallway	Multi-Family Energy Efficient Retrofit	10	193	80	80	100%	$7	$21
Occupancy Sensor	Multi-Family Energy Efficient Retrofit	8	701	20	20	100%	$25	$75
MF - ECM	Multi-Family Energy Efficient Retrofit	10	733	100	100	100%	$83	$250

ELECTRIC DEMAND SIDE MANAGEMENT: MARKET POTENTIAL STUDY AND ACTION PLAN

Volume 1: Executive Summary

Report Number 1432

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CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Background

Energy efficiency (EE) efforts are increasing in magnitude and gaining traction in Indiana, building on the momentum of recently established statewide electric energy efficiency targets. Vectren Energy Delivery of Indiana (Vectren) is investigating the electric energy efficiency potential for their service territory. The findings of this investigation will lead directly into the development of a portfolio of energy efficiency programs to be delivered to customers over the time period 2015 to 2019.

Toward this end, Vectren has contracted with EnerNOC Utility Solutions (EnerNOC) to conduct a Market Potential Study and assemble an Action Plan that considers all metered electric customers in the residential, commercial, and industrial sectors for this time period.

EnerNOC conducted a detailed, bottom-up assessment of the Vectren market in the Evansville metropolitan area to deliver a projection of baseline electric energy use, forecasts of the energy savings achievable through efficiency measures, and program designs and strategies to optimally deliver those savings. This report describes the study approach and results.

Report Organization

This report is presented in 4 volumes as outlined below. This document is **Volume 1: Executive Summary**.

- Volume 1, Executive Summary
- Volume 2, Market Potential and Action Plan Report
- Volume 3, Detailed Appendices: Market Potential Study
- Volume 4, Detailed Appendices: Action Plan & Program Write-ups

Definitions of Potential

In this study, we estimate the potential for energy efficiency savings. The savings estimates represent net savings[1] developed into three types of potential: technical potential, economic potential, and achievable potential. Technical and economic potential are both theoretical limits to efficiency savings. Achievable potential embodies a set of assumptions about the decisions consumers make regarding the efficiency of the equipment they purchase, the maintenance activities they undertake, the controls they use for energy-consuming equipment, and the elements of building construction. Because estimating achievable potential involves the inherent uncertainty of predicting human behaviors and responses to market conditions, we developed low and high achievable potential as boundaries for a likely range. The various levels are described below.

- **Technical potential** is defined as the theoretical upper limit of energy efficiency potential. It assumes that customers adopt all feasible measures regardless of their cost. At the time of existing equipment failure, customers replace their equipment with the most efficient option available. In new construction, customers and developers also choose the most efficient

[1] Savings in "net" terms instead of "gross" means that the baseline forecast includes naturally occurring efficiency. In other words, the baseline assumes that natural early adopters continue to make purchases of equipment and measures at efficiency levels higher than the minimum standard.

equipment option. Examples of measures that make up technical potential for electricity in the residential sector include:

- Ductless mini-split air conditioners with variable refrigerant flow
- Ground source (or geothermal) heat pumps
- LED lighting

Technical potential also assumes the adoption of every other available measure, where applicable. For example, it includes installation of high-efficiency windows in all new construction opportunities and furnace maintenance in all existing buildings with furnace systems. These retrofit measures are phased in over a number of years, which is longer for higher-cost and complex measures.

- **Economic potential** represents the adoption of all ***cost-effective*** energy efficiency measures. In this analysis, the cost effectiveness is measured by the total resource cost (TRC) test, which compares lifetime energy and capacity benefits to the incremental cost of the measure. If the benefits outweigh the costs (that is, if the TRC ratio is greater than 1.0), a given measure is considered in the economic potential. Customers are then assumed to purchase the most cost-effective option applicable to them at any decision juncture.
- **Achievable High potential** estimates customer adoption of economic measures when delivered through efficiency programs under ideal market, implementation, and customer preference conditions. Information channels are assumed to be established and efficient for marketing, educating consumers, and coordinating with trade allies and delivery partners. Achievable High potential establishes a maximum target for the EE savings that an administrator can hope to achieve through its EE programs and involves incentives that represent a substantial portion of the incremental cost combined with high administrative and marketing costs.
- **Achievable Low potential** reflects expected program participation given significant barriers to customer acceptance, non-ideal implementation conditions, and limited program budgets. This represents a lower bound on achievable potential.

CHAPTER | 2

ANALYSIS APPROACH AND DATA DEVELOPMENT

This section describes the analysis approach taken for the study and the data sources used to develop the potential estimates.

Analysis Approach

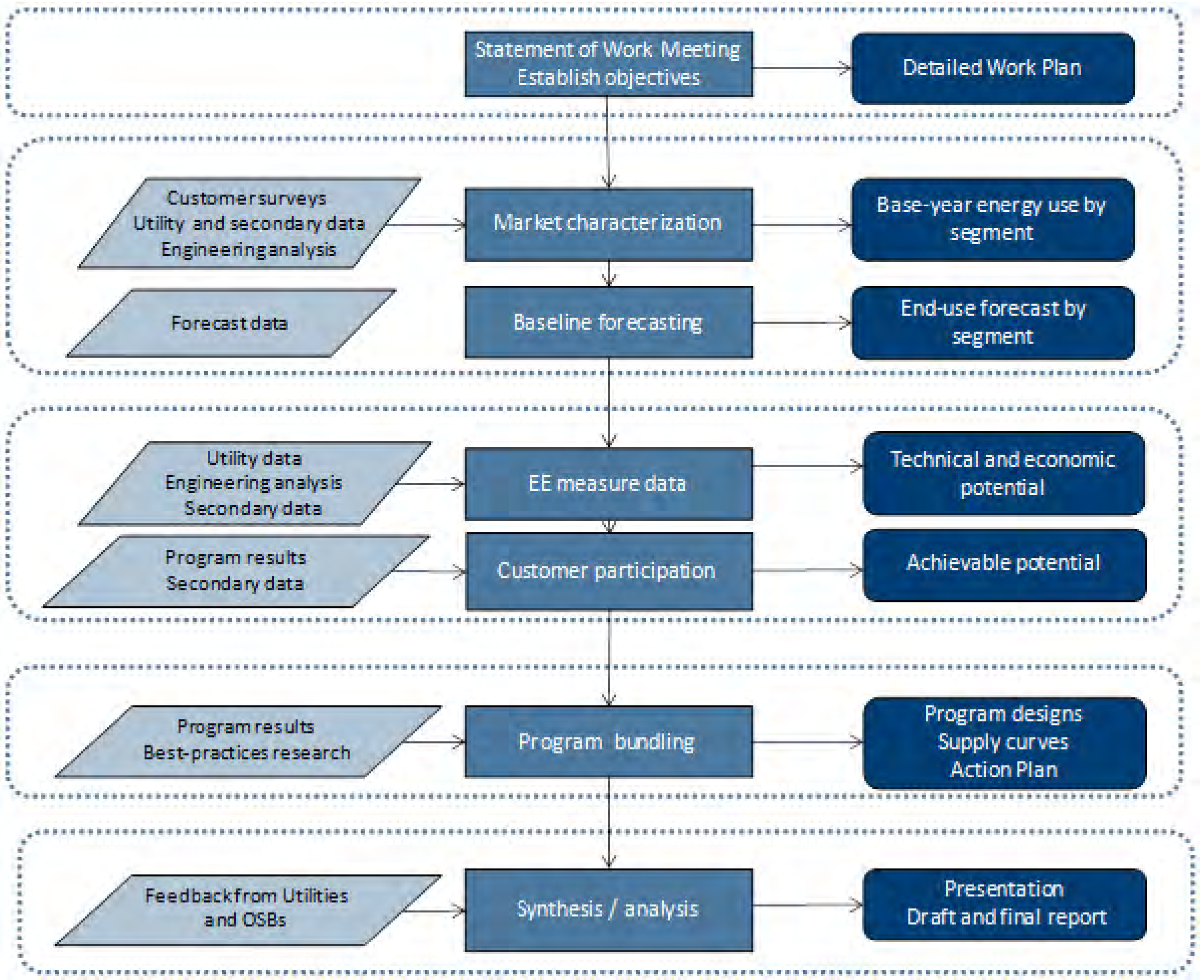
To perform the energy efficiency analysis, EnerNOC used a bottom-up analysis approach as shown in

Figure 2-1. This involved the following steps.

1. Held a meeting with the client project team to refine the objectives of the project in detail. This resulted in a work plan for the study.
2. Conducted onsite energy consumption surveys with 30 of Vectren's largest commercial and industrial customers in order to provide data and guidance for these market sectors that had not formerly received focused DSM program efforts.
3. Performed a market characterization to describe sector-level electricity use for the residential, commercial, and industrial sectors for the base year, 2011. This included using existing information contained in prior Vectren and Indiana studies, new information from the aforementioned onsite surveys with large customers, EnerNOC's own databases and tools, and other secondary data sources such as the American Community Survey (ACS) and the Energy Information Administration (EIA).
4. Developed a baseline electricity forecast by sector, segment, and end use for 2011 through 2023. Results presented in this volume focus on the upcoming implementation years of 2015 through 2019. Results beyond 2019 are available in the Appendices.
5. Identified several hundred measures and estimated their effects in four tiers of measure-level energy efficiency potential: *Technical, Economic, Achievable High,* and *Achievable Low*.
6. Reviewed the current programs offered by Vectren in light of the study findings to make strategic program recommendations for achieving savings.
7. Created detailed program designs and action plans through 2019 representing the program potential for Vectren, basing them on the potential analysis and strategic recommendations developed in the previous steps.

The analysis approach for all these steps is described in further detail throughout the remainder of this chapter.

Figure 2-1 Overview of Analysis Approach



Data Development

A discussion of the data sources used in this study, as well as how they were applied, is found in Chapter 2 of the main body of the report. In general, data were used according to the hierarchy given below and adapted to local conditions whenever possible, for example, by using local sources for measure data and local weather for building simulations.

- Vectren and Indiana specific data first
- EnerNOC's databases and analysis tools
- Other secondary data and reports if necessary

CHAPTER | 3

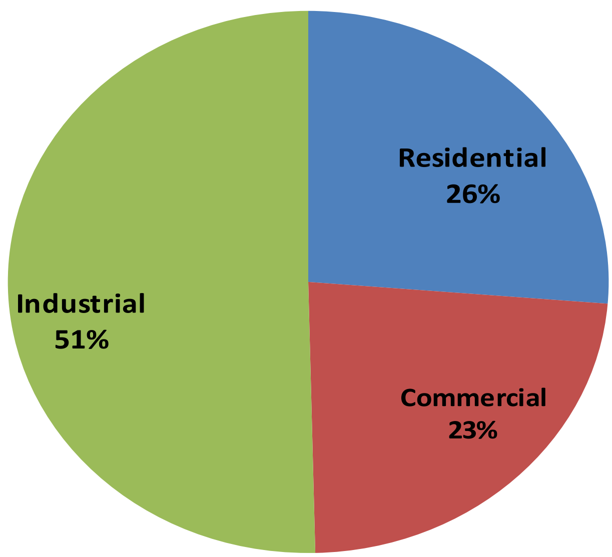
MARKET CHARACTERIZATION AND MARKET PROFILES

In this section, we describe how customers in the Vectren service territory use electricity in the base year of the study, 2011. It begins with a high-level summary of energy use by sector and then delves into each sector in detail.

Energy Use Summary

Total electricity use for the residential, commercial, and industrial sectors for Vectren in 2011 was 5,646 GWh. As shown in Figure 3-1, the largest sector is industrial, accounting for 51% of load at 2,845 GWh. The remaining use is in the residential and commercial sectors, at 1,483 GWh and 1,318 respectively.

Figure 3-1 Sector-Level Electricity Use, 2011



Residential Sector

The total number of households and electric sales for the service territory were obtained from Vectren's customer database. In 2011, there were 122,961 households in the Vectren territory that used a total of 1,483 GWh of electricity. We allocated these totals into the two residential segments based on the Vectren South 2010 baseline survey results.

Figure 3-2 shows the distribution of electric energy consumption by end use for all homes. Three main electricity end uses —appliances, space heating and cooling — account for over 50% of total use. The most energy allocated to any single category is 21% for cooling, which includes central AC, heat pumps, and room AC. Other categories with substantial energy use are space heating and appliances. Appliances include refrigerators, freezers, stoves, clothes washers, clothes dryers, dishwashers, and microwaves. The remainder of the energy falls into the electronics, lighting, water heating and the miscellaneous category – which is comprised of furnace fans, pool pumps, and other "plug" loads (hair dryers, power tools, coffee makers, etc).

Figure 3-2 Residential Electricity by End Use (2011), All Homes

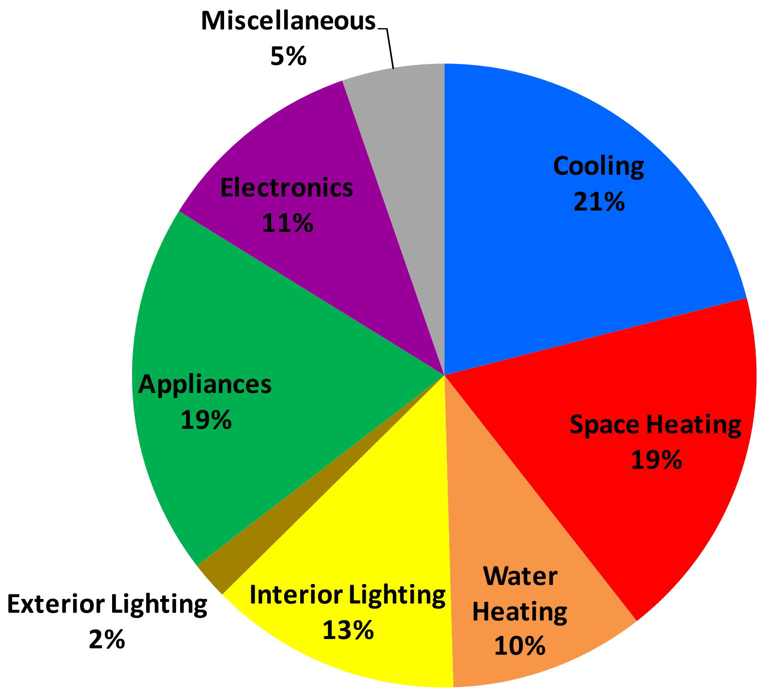
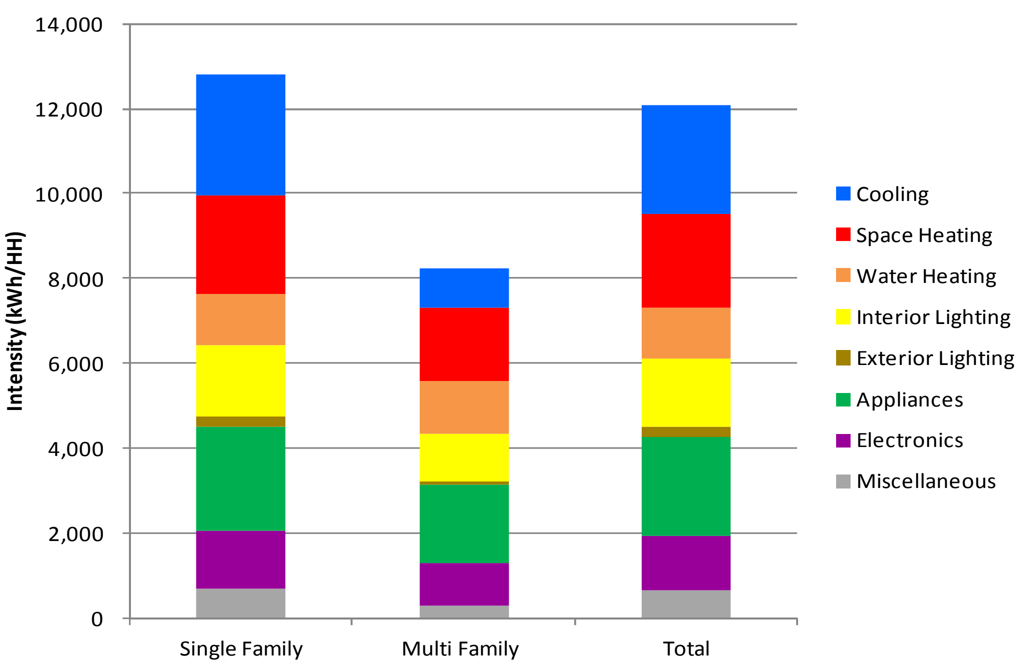


Figure 3-3 presents the electricity intensities by end-use and housing type, as well as all homes on average.

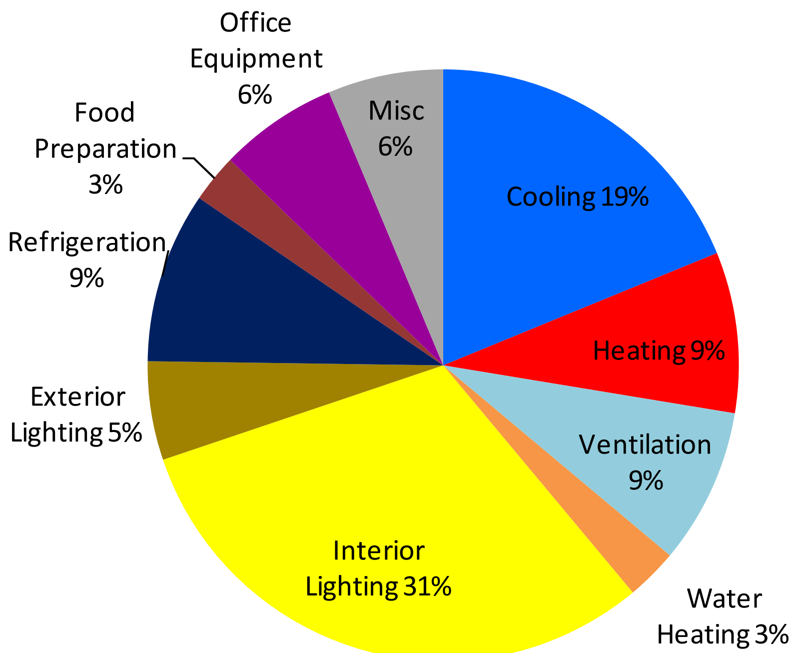
Figure 3-3 Residential Electricity Intensity by End Use and Segment (kWh/household, 2011)



Commercial Sector

The total electric energy consumed by commercial customers in Vectren's service area in 2011 was 1,318 GWh. Figure 3-4 shows the distribution of electricity consumption by end use for all commercial building types. Electric usage is dominated by lighting, with interior and exterior varieties accounting for over one third of consumption. After lighting, the largest end uses are cooling, heating, ventilation, and refrigeration. The remaining end uses comprise 6% or less of total usage: office equipment, miscellaneous, water heating, and food preparation.

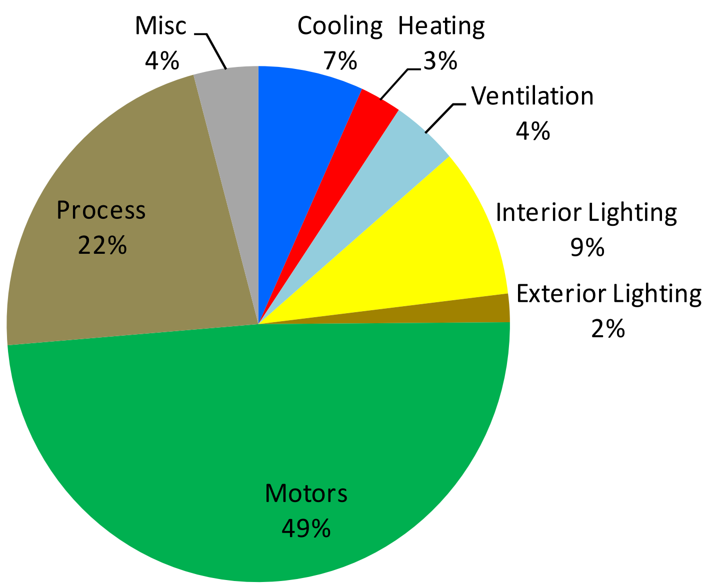
Figure 3-4 Commercial Electricity Consumption by End Use (2011), All Building Types



Industrial Sector

The total electric energy consumed by industrial customers in Vectren in 2011 was 2,845 GWh. Figure 3-5 shows the distribution of electricity energy consumption by end use for all industrial customers. Motors are clearly the largest overall end use for the industrial sector, accounting for 49% of energy use. Note that this end use includes a wide range of industrial equipment, such as air compressors and refrigeration compressors, pumps, conveyor motors, and fans. The process end use accounts for 22% of energy use, which includes heating, cooling, refrigeration, and electro-chemical processes. Lighting is the next highest, followed by cooling, ventilation, miscellaneous, and space heating.

Figure 3-5 Industrial Electricity Use by End Use (2011), All Industries



CHAPTER 4

BASELINE FORECAST

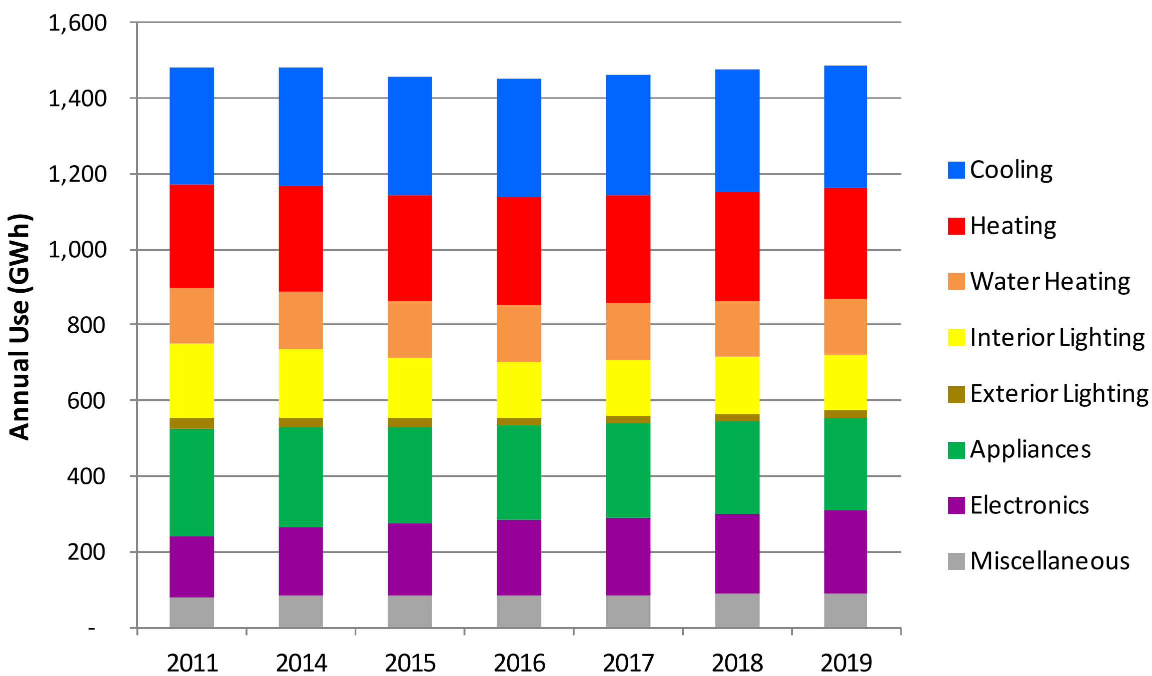
Prior to developing estimates of energy-efficiency potential, a baseline end-use forecast was developed to quantify what the consumption is likely to be in the future in absence of new efficiency programs and naturally occurring efficiency. The baseline forecast serves as the metric against which energy efficiency potentials are measured. This chapter presents the baseline forecast for electricity for each sector.

Residential Sector

The baseline forecast incorporates assumptions about economic growth, electricity prices, and appliance/equipment standards and building codes that are already mandated as described in Chapter 2 of the main report.

Figure 4-1 present the baseline forecast for electricity at the end-use level for the residential sector as a whole. Overall, residential use increases slightly from 1,483 GWh in 2011 to 1,488 GWh in 2019, an increase of only 0.3%, which is essentially a flat forecast year over year. This reflects the impact of the EISA lighting standard, additional appliance standards adopted in 2011, and modest customer growth.

Figure 4-1 Residential Electricity Baseline Forecast by End Use

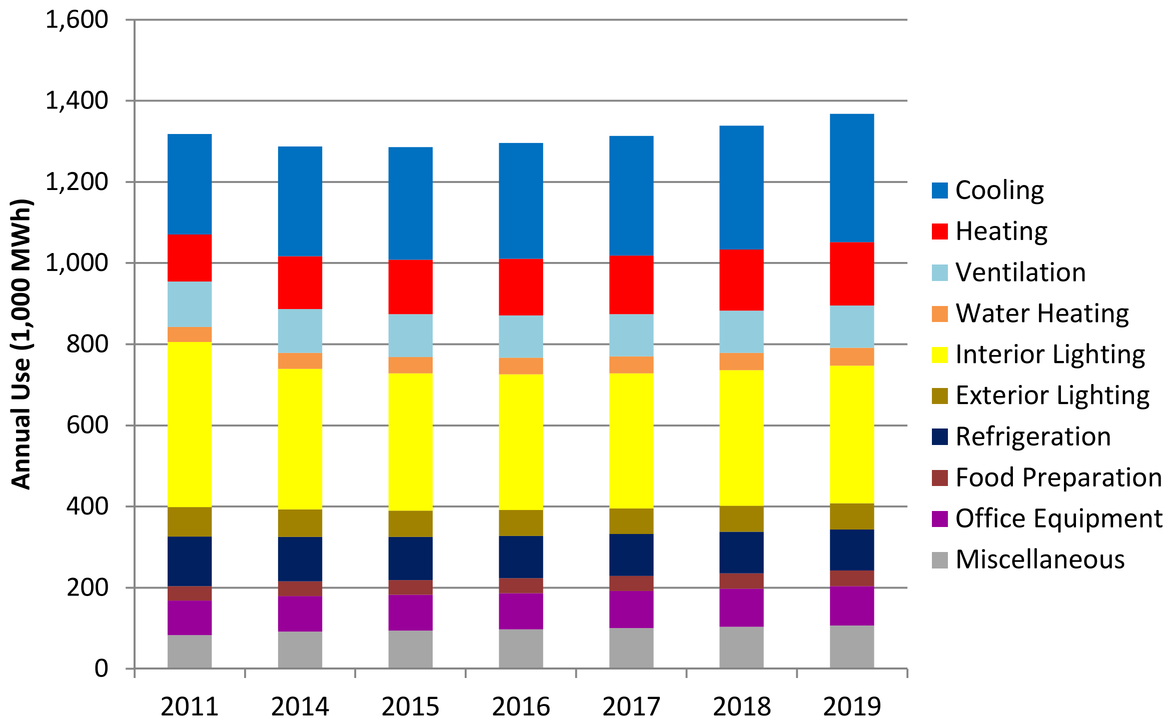


Commercial Sector

Electricity use in the commercial sector grows modestly during the overall forecast horizon, starting at 1,318 GWh in 2011, and increasing to 1,368 GWh in 2019.

Figure 4-2 present the electricity baseline forecast at the end-use level for the commercial sector as a whole. Usage is declining in the early years of the forecast, due largely to the phasing in of codes and standards such as the EISA 2007 lighting standards and EPACT 2005 refrigeration standards.

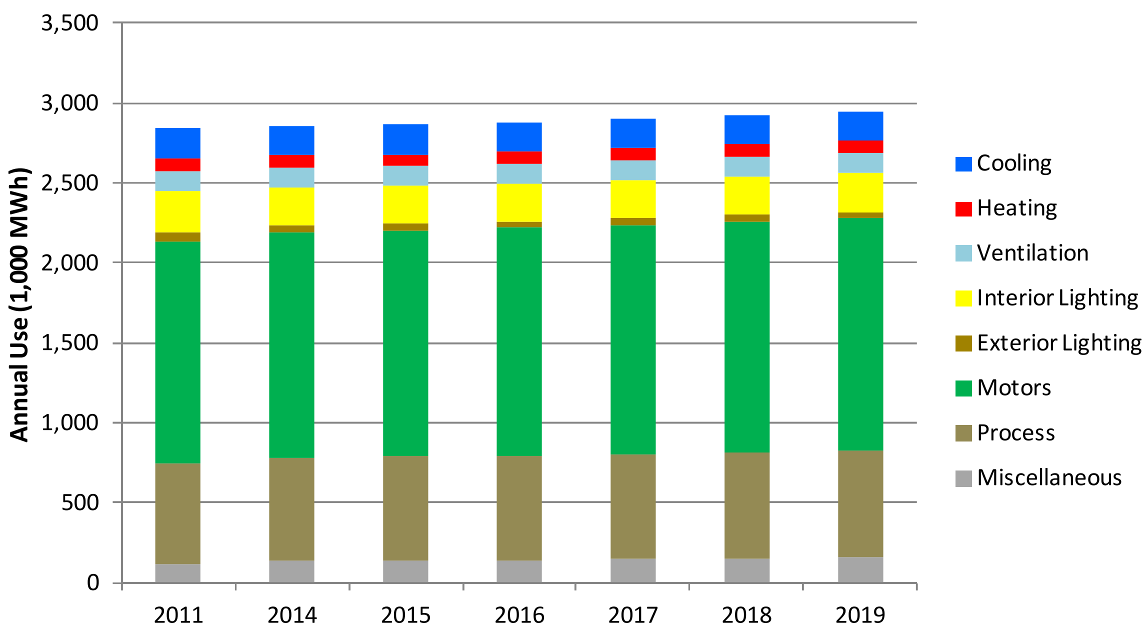
Figure 4-2 Commercial Electricity Baseline Forecast by End Use



Industrial Sector

Figure 4-3 present the electricity baseline forecast at the end-use level for the industrial sector. Overall, industrial annual electricity use increases modestly from 2,845 GWh in 2011 to 2,943 GWh in 2019. This comprises an overall increase of 3.5%, or 0.4% per year, which is colored by slow but recovering economy.

Figure 4-3 Industrial Electricity Baseline Forecast by End Use



Baseline Forecast Summary

Table 4-1 and Figure 4-4 provide a summary of the baseline forecast for electricity by sector for the entire Vectren service territory. Overall, the forecast shows only a slight incline in electricity use, driven primarily by oncoming codes and standards and a challenging macroeconomic environment.

Table 4-1 Electricity Baseline Forecast Summary (GWh)

Sector	2011	2014	2015	2016	2017	2018	2019	% Change	Avg. Growth Rate
Residential	1,483	1,482	1,459	1,453	1,463	1,476	1,488	0.3%	0.0%
Commercial	1,318	1,288	1,286	1,296	1,313	1,339	1,368	3.7%	0.5%
Industrial	2,845	2,861	2,863	2,877	2,896	2,922	2,943	3.5%	0.4%
Total	**5,646**	**5,630**	**5,608**	**5,626**	**5,673**	**5,738**	**5,799**	**2.7%**	**0.3%**

Figure 4-4 Electricity Baseline Forecast Summary (GWh)

CHAPTER | 5

ENERGY EFFICIENCY MEASURES

The energy efficiency measures and assumptions used in this analysis are detailed in Chapter 5 of the Volume 2 main report as well as Volume 3 appendices B, C, and D. Table 5-1 summarizes the number of equipment and non-equipment measures evaluated for each segment within each sector.

Table 5-1 Number of Measures Evaluated

	Residential	Commercial	Industrial	Total Number of Measures
Equipment Measures Evaluated	35	40	28	**103**
Non-Equipment Measures Evaluated	45	82	69	**196**
Total Measures Evaluated	**80**	**122**	**97**	**299**

CHAPTER | 6

MEASURE-LEVEL ENERGY EFFICIENCY POTENTIAL

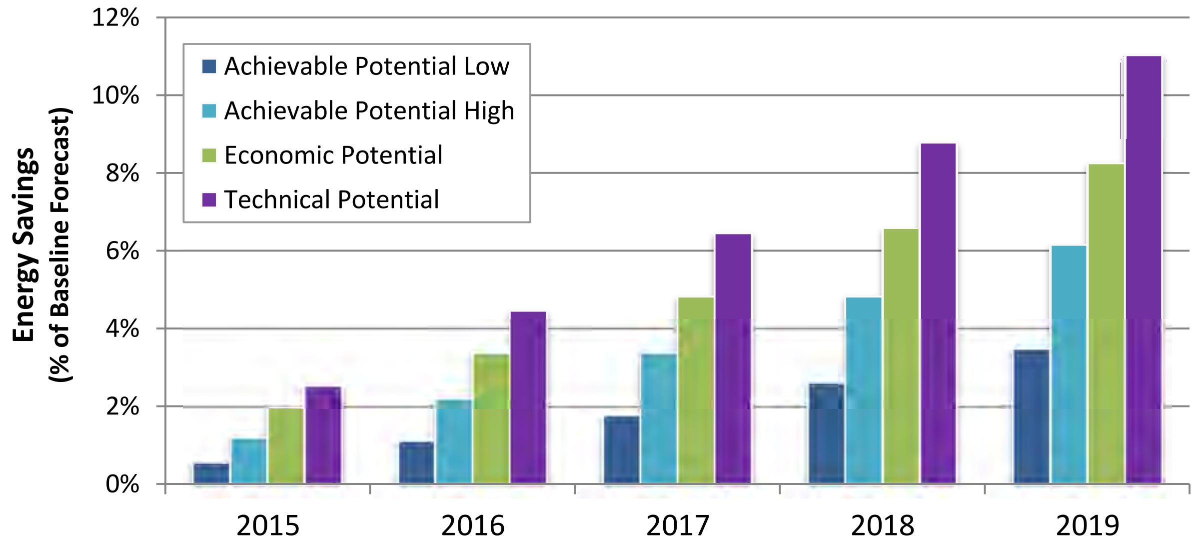
Table 6-1 and Figure 6-1 summarize the electric energy-efficiency savings for all measures at the different levels of potential relative to the baseline forecast. Note that the subsequent steps of measure bundling, program design and program delivery will hone and refine these results later in Chapter 8.[2]

Table 6-1 Overall Measure-Level Electricity Efficiency Potential

	2015	2016	2017	2018	2019
Baseline Forecast (GWh)	**5,608**	**5,626**	**5,673**	**5,738**	**5,799**
Cumulative Savings (GWh)					
Achievable Low Potential	32	63	100	151	203
Achievable High Potential	67	125	192	277	357
Economic Potential	112	191	274	377	478
Technical Potential	142	251	366	504	640
Energy Savings (% of Baseline)					
Achievable Low Potential	0.6%	1.0%	1.8%	2.6%	3.5%
Achievable High Potential	1.2%	2.2%	3.4%	4.8%	6.2%
Economic Potential	2.0%	3.4%	4.8%	6.6%	8.2%
Technical Potential	2.5%	4.5%	6.5%	8.8%	11.0%

[2] Utilities typically have a small subset of large commercial and industrial customers that comprise a disproportionate share of load and demand. In Vectren's case, there is one particular industrial customer that comprises a full 24% of the C&I load. If this customer were not to participate in EE programs, the savings potential would drop commensurately in the C&I sectors, which would remove approximately 15% from the overall savings potential in all sectors.

Figure 6-1 Overall Measure-Level Electricity Efficiency Potential



Overview of Measure-Level Energy Efficiency Potential by Sector

Table 6-2, summarize the range of electric achievable potential by sector. The commercial sector accounts for the largest portion of the savings, followed by residential, and then industrial.

Table 6-2 Electric Achievable Potential by Sector (GWh)

	2015	2016	2017	2018	2019
Achievable Low Cumulative Savings (GWh)					
Residential	9.4	15.7	22.1	32.4	43.4
Commercial	12.1	22.8	36.0	53.0	71.8
Industrial	10.7	24.3	42.2	65.4	87.4
Total	**32.2**	**62.7**	**100.3**	**150.9**	**202.6**
Achievable High Cumulative Savings (GWh)					
Residential	20.4	32.0	43.8	60.9	76.8
Commercial	25.3	45.7	69.2	97.9	127.1
Industrial	21.7	47.2	79.4	118.7	152.7
Total	**67.3**	**124.9**	**192.5**	**277.4**	**356.7**

CHAPTER | 7

MEASURE-LEVEL ENERGY EFFICIENCY POTENTIAL BY SECTOR

This chapter presents the results of the energy efficiency analysis for all measures at the sector level. First, the residential potential is presented, followed by the commercial, and lastly, industrial. Note that the subsequent steps of measure bundling, program design and program delivery will hone and refine these results later in Chapter 8.

Residential Electricity Potential

Figure 7-1 depicts the residential electricity potential energy savings estimates graphically.

Figure 7-1 Residential Electric Energy Efficiency Potential Savings

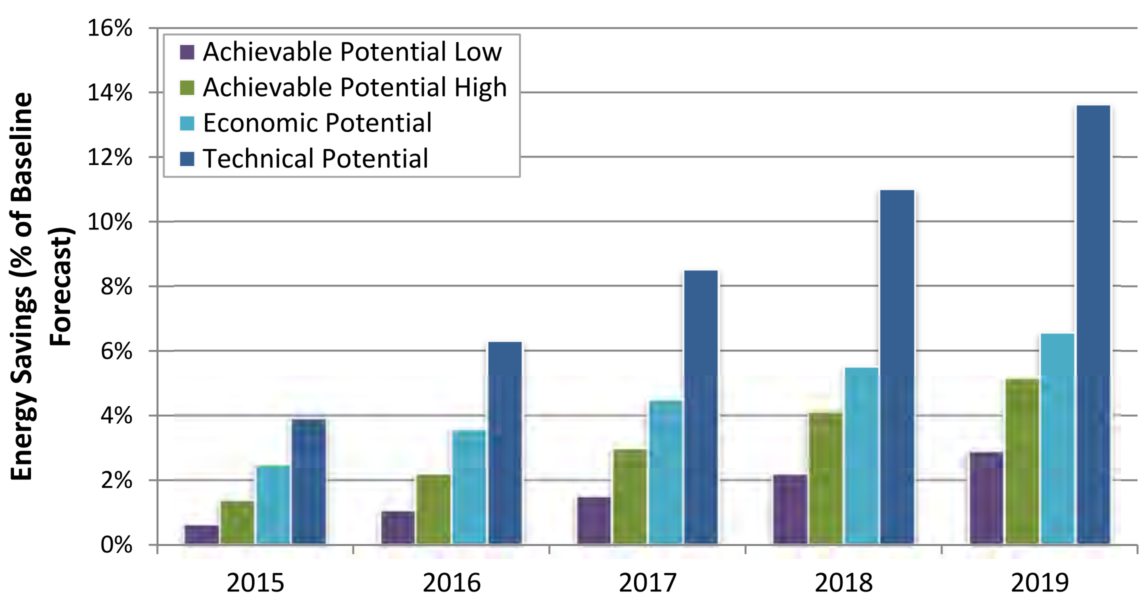
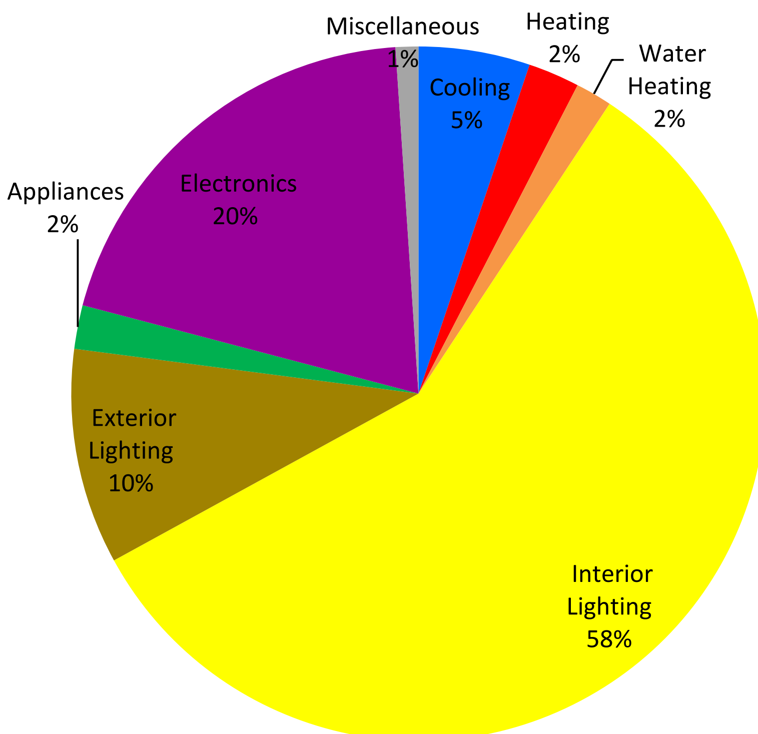


Figure 7-2 focuses on the residential achievable low potential in 2017. Lighting equipment replacement accounts for the highest portion of the savings in the near term as a result of the efficiency gap between CFL lamps and advanced incandescent lamps, even those that will meet the EISA 2007 standard. Electronics, cooling, and appliances also contribute significantly to the savings. Detailed measure information is available in Volume 3 Appendices. The key measures comprising the potential are listed below:

- Lighting: mostly CFL lamps and specialty bulbs
- Electronics (reduce standby wattage, televisions, set top boxes, PCs)
- Second refrigerator/ freezer removal

- HVAC: Removal of second room AC unit, efficient air conditioners, ducting repair/sealing, insulation, home energy management system and programmable thermostats

Figure 7-2 Residential Electric Achievable Low Potential by End Use in 2017



Commercial Electricity Potential

Figure 7-3 depicts these potential energy savings estimates graphically.

Figure 7-3 Commercial Energy Efficiency Potential Savings

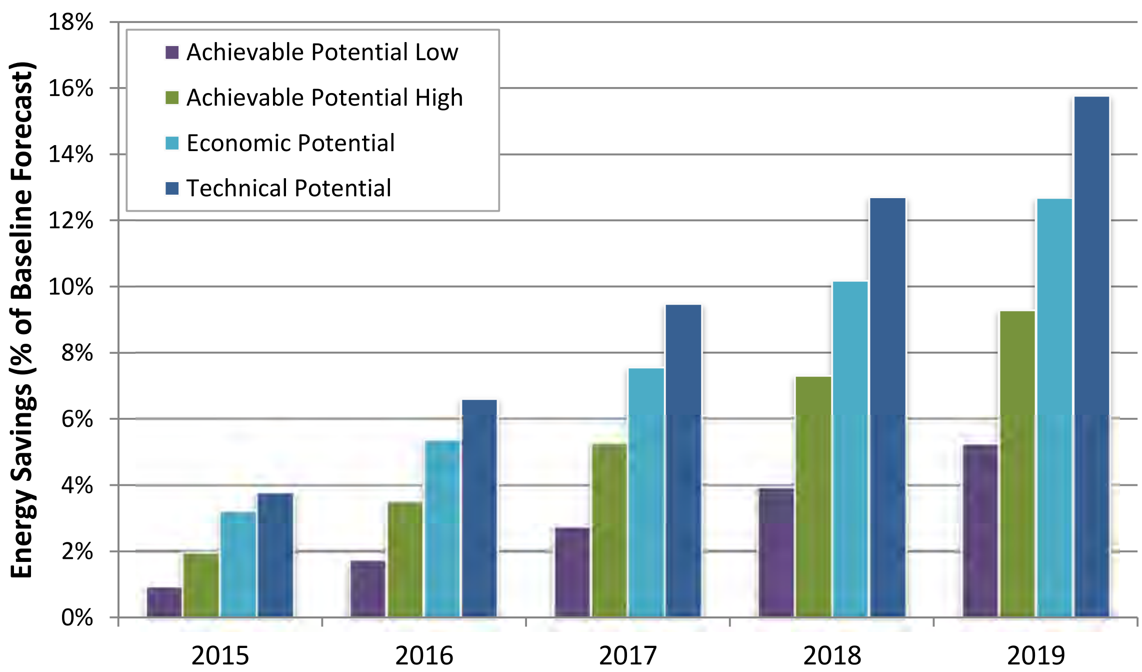
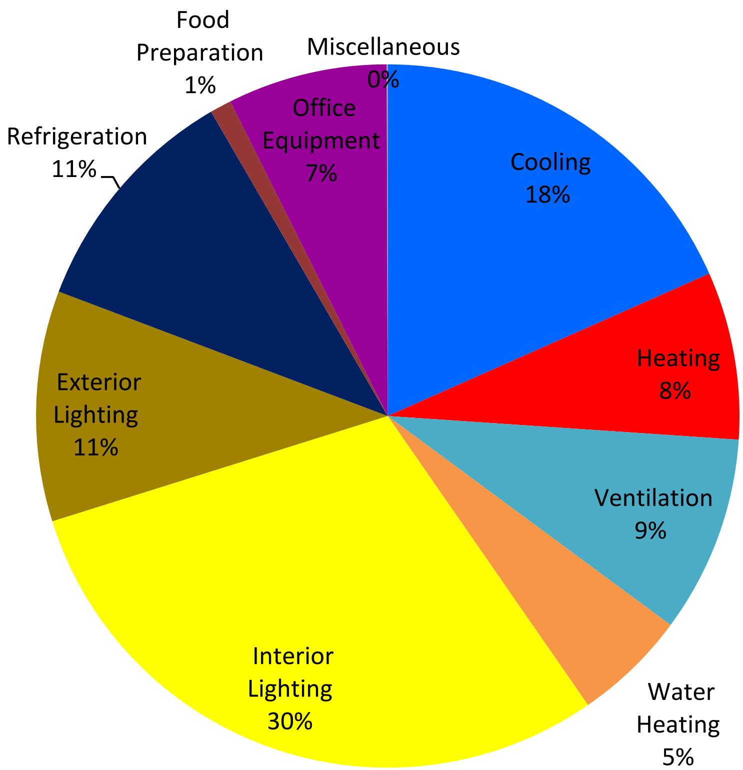


Figure 7-4 focuses on achievable potential savings by end use. Not surprisingly, interior lighting delivers the highest achievable savings throughout the study period. In 2017, Cooling is second, and exterior lighting is third. Regarding refrigeration, it is interesting to point out a relatively new control and sensing technology that vendors such as "eCube" are using to regulate the system energy. The technology consists of a solid, waxy food simulant that is fitted around a thermostat sensor that would otherwise measure air temperature. The refrigeration controls therefore attempt to regulate the temperature of food, which changes more slowly and gradually than air, thereby reducing the frequency of refrigeration on/off cycles. Refrigeration energy savings are then followed in descending order by cooling, ventilation, office equipment, and small amounts of the other end uses.
Detailed measure information is available in the Volume 3 Appendices. The key measures comprising the potential are listed below:

- Lighting – CFLs, LED lamps, linear fluorescent, daylighting controls, occupancy sensors, and HID lamps for exterior lighting
- Energy management systems & programmable thermostats
- Ventilation – variable speed control
- Refrigeration – efficient equipment, control systems, decommissioning
- Efficient office equipment – computers, servers

Figure 7-4 Commercial Achievable Low Potential Electricity Savings by End Use in 2017



Industrial Electricity Potential

The Vectren industrial sector accounts for 51% of total energy consumption, making for prime efficiency opportunities. Figure 7-5 present the savings for the various types of potential considered in this study.

Figure 7-5 Industrial Electric Potential Savings

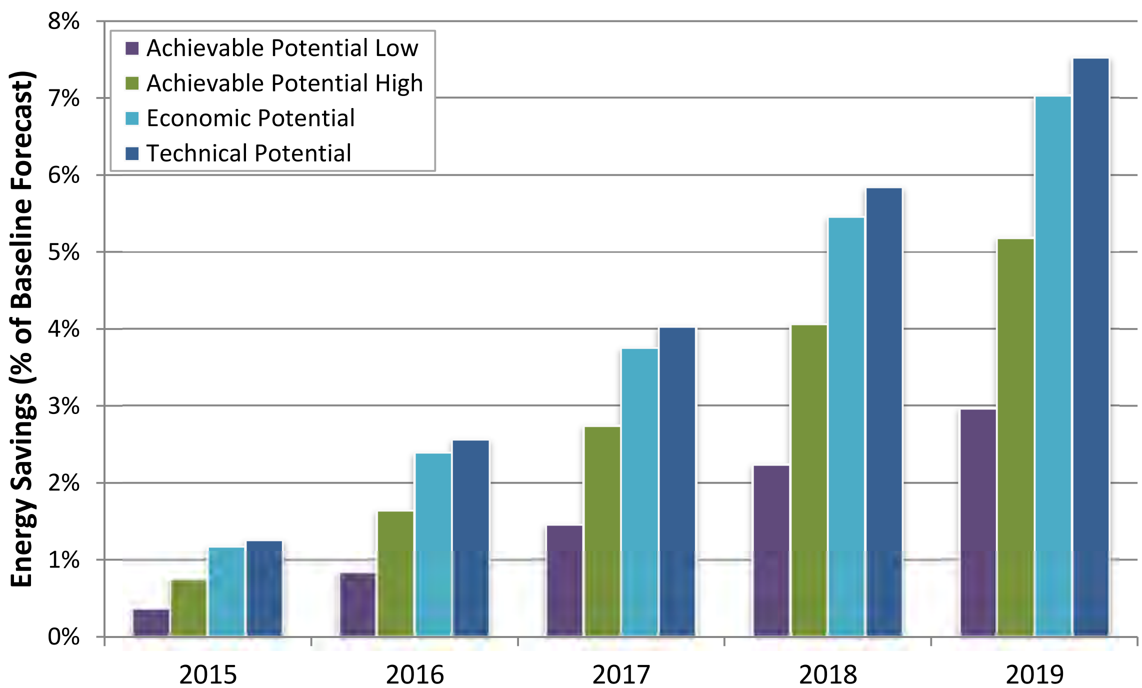


Figure 7-6 illustrates the achievable potential savings by electric end use in 2017 for the industrial sector. The largest shares of savings opportunities are in the motors and machine drives. Potential savings for straight motor equipment change-outs are being eliminated due to the National Electrical Manufacturer's Association (NEMA) standards, which now make premium efficiency motors the baseline efficiency level. As a result, potential savings are incrementally small to upgrade to even more efficient levels. All the savings opportunities in this end use come from controls, timers, and variable speed drives, which improve system efficiencies where motors are utilized. These system-level measures and upgrades are also applicable to a large swath of applications for heating, cooling, and electrochemical processes. Since the plastics industry is so prominent in the Vectren service territory, measures such as injection molding barrel insulation are very promising sources of potential savings.

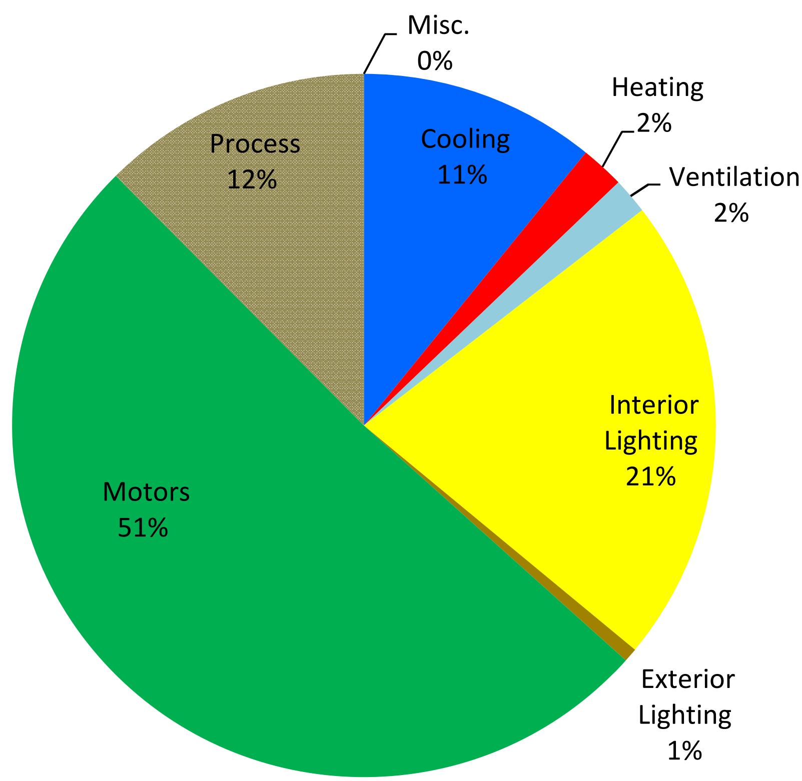
Beyond motors and processes, there are large opportunities for savings in lighting and cooling; and smaller opportunities in ventilation and space heating. Detailed measure information is available in the Volume 3 Appendices. The key measures comprising the potential are listed below:

- Motors – drives and controls
- Process – timers and controls

- Application optimization and control – fans, pumps, compressed air
- Efficient high bay lighting
- Efficient ventilation systems

- Energy management systems & programmable thermostats

Figure 7-6 Industrial Achievable Low Electricity Potential Savings by End Use in 2017



CHAPTER | 8

PROGRAM POTENTIAL AND ACTION PLAN

The Action Plan is the heart of the study. This is where the multitude of energy efficiency measures covered in previous chapters get bundled into delivery mechanisms to take on the form of specific energy efficiency programs. Several changes and adjustments occur in the translation from the market potential assessment to the program designs in the Action Plan, as the measure mix may change due to program delivery considerations. Table 8-1 below lists the distinct programs that emerge from this exercise to deliver an effective and balanced portfolio of energy savings opportunities across all customer segments.

Table 8-1 Portfolio of Energy Efficiency Programs Included in Action Plan

Residential Programs	Commercial & Industrial Programs
Lighting	Prescriptive
Efficient Products	Custom Incentives
Income Qualified Weatherization (IQW)	Schools Program
IQW Plus	Strategic Energy Management (SEM)
New Construction	Business & Multi Family New Construction
Multi Family Direct Install	Small Business Direct Install
Home Energy Assessment	
School Kit	
Whole House Plus	
Appliance Recycling	
Behavioral Feedback Tools	

Programmatic Framework

Each program contemplates and outlines a programmatic framework for administrators and implementers. The items considered and developed for this framework include those listed below. Detailed write-ups delve into the specific recommendations for each program in Volume 4 of this report.

- Target market
- Implementation strategy, including delivery channels, marketing, education and outreach
- Program issues, risks and risk management strategies
- Eligible measures and incentives
- Evaluation, measurement and verification requirements and guidance
- Administrative requirements
- Estimated participation
- Program budget

- Program energy savings and demand reduction
- Cost effectiveness

The state of Indiana has mandated efficiency targets for regulated electric utilities, specifying that they reach certain levels of savings by implementing a required set of programs, known as Core programs, and that they should make up any shortfall between the targets and the Core program savings with a flexible or optional set of Core Plus programs, which can be designed to suit each utility. The Residential Lighting, Income Qualified Weatherization, Home Energy Assessment, School Kit, and Business Prescriptive programs are Core programs; and the remainder are Core Plus. These distinctions are outlined later in the program highlights and descriptions.

The total amount of energy efficiency savings required by the state targets, in gross incremental savings per year, is shown as a percent of the baseline forecast in Table 8-2 below.

Table 8-2 Indiana State Goals, Gross Incremental Electricity Savings as % of Baseline

2015	2016	2017	2018	2019
1.30%	1.50%	1.70%	1.90%	2.00%

Using Achievable High and Achievable Low as Guidelines

The first step toward creating the recommended Action Plan was to create two separate scenarios that corresponded to the measure-level energy efficiency potentials assessed in the previous chapter: Achievable Low and Achievable High. After applying all the delivery and cost structures, each of the Low and High portfolios resulted in a set of program potential savings and estimated budgets.

These portfolios provided guidelines, allowing us create the Recommended Action Plan by interpolating between Low and High, optimizing to consider the Indiana state goals, past program experience, industry benchmarks, and feedback from Vectren and Stakeholders.

Figure 8-1 below shows the resulting Gross MWh savings per year for the three separate portfolios, along with a black, dotted line indicating the level of the state goals. Note that the recommended portfolio is not able to meet the state goals in any year. Note also that the savings on this chart are in terms of Gross incremental savings since the Indiana goals are expressed as such, and that all other potential savings in this report are given in terms of Net incremental or Net cumulative savings.[3]

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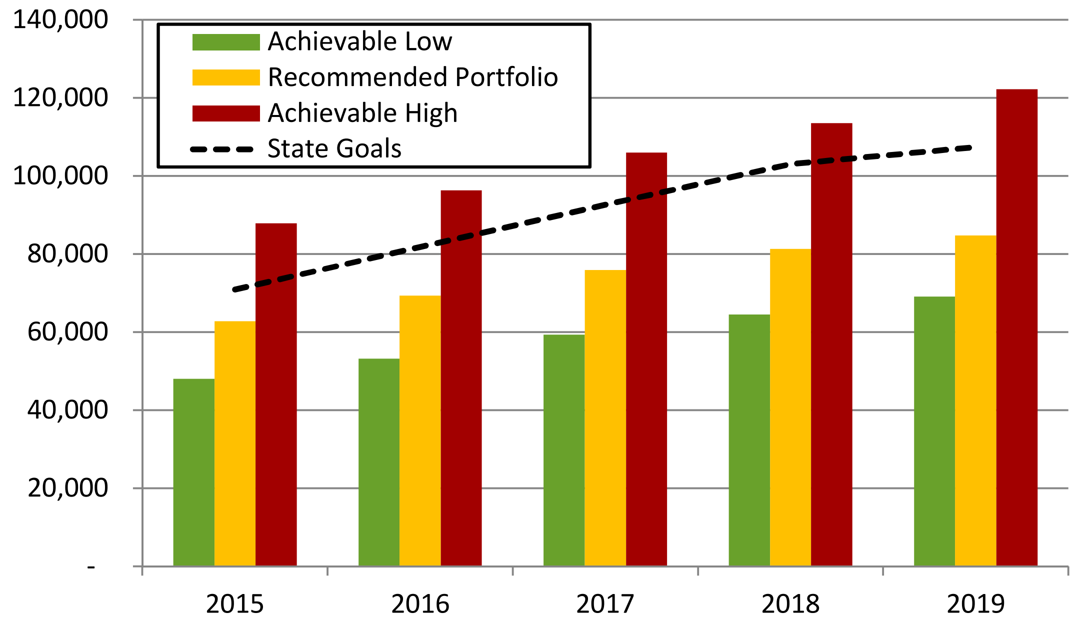
[3] Utilities typically have a small subset of large commercial and industrial customers that comprise a disproportionate share of load and demand. In Vectren's case, there is one particular industrial customer that comprises a full 24% of the C&I load. If this customer were not to participate in EE programs, the savings potential would drop commensurately in the C&I sectors, which would remove approximately 15% from the overall savings potential in all sectors.

Figure 8-1 Gross Incremental Electricity Savings (MWh)



The remainder of this report focuses on the delivery of the Recommended Portfolio specifically, and further details of the Achievable Low and Achievable High program portfolios are available in the analysis workpapers.

Recommended Program Action Plan

While the economic potential shown in the Action Plan meets the aggressive Indiana state goals, the recommended program Action Plan falls short.

Figure 8-2 shows the net incremental energy savings in each year of the study by program. Figure 8-3 shows the annual budgets for the portfolio. Note again that the savings presented here are Net, and not Gross.

Figure 8-2 Recommended Action Plan - Net Incremental Energy Savings (MWh)

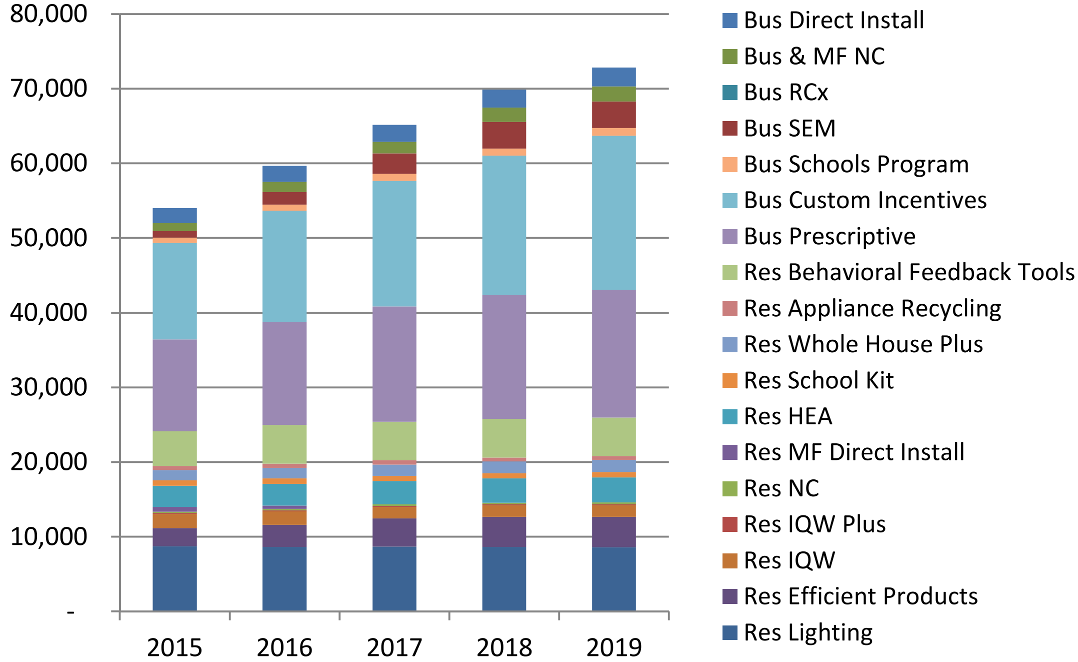


Figure 8-3 Recommended Action Plan - Annual Utility Budgets

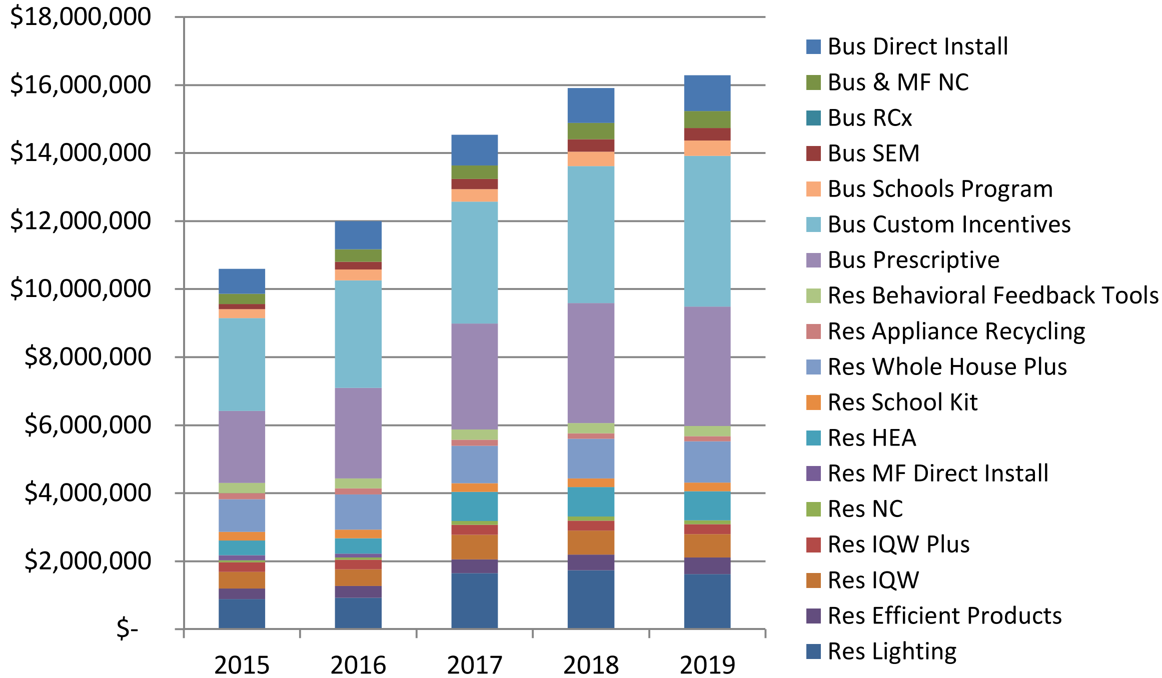


Table 8-3 below shows the detailed annual savings and budgets for the recommended portfolio.

Table 8-3 Vectren Recommended Electric Energy Efficiency Portfolio Summary

Program	Total Utility Costs (000$)					Total Net Incremental Energy Savings (MWh)					Total Net Incremental Demand Savings (kW)				
	2015	2016	2017	2018	2019	2015	2016	2017	2018	2019	2015	2016	2017	2018	2019
Res Lighting	891	924	1,648	1,737	1,619	8,738	8,642	8,696	8,621	8,590	525	520	523	518	516
Res Efficient Products	309	349	406	455	496	2,425	2,957	3,773	4,061	4,096	259	310	385	420	438
Res IQW	491	491	728	712	680	1,876	1,799	1,527	1,517	1,518	116	112	95	94	94
Res IQW Plus	282	282	291	291	291	142	141	144	143	142	88	87	87	86	86
Res NC	57	64	107	116	119	193	193	220	236	248	24	26	29	32	35
Res MF Direct Install	146	115	-	-	-	610	448	-	-	-	44	32	-	-	-
Res HEA	434	452	861	872	855	2,846	2,911	3,092	3,218	3,354	138	140	149	155	161
Res School Kit	252	252	252	252	252	741	726	721	715	711	132	131	130	130	130
Res Whole House Plus	966	1,037	1,105	1,163	1,213	1,343	1,426	1,507	1,579	1,646	936	994	1,049	1,100	1,146
Res Appliance Recycling	174	174	174	165	155	561	561	561	528	495	143	143	143	135	126
Res Behavioral Feedback Tools	300	300	300	300	300	4,659	5,177	5,177	5,177	5,177	1,299	1,443	1,443	1,443	1,443
Bus Prescriptive	2,120	2,660	3,119	3,527	3,510	12,310	13,774	15,438	16,535	17,112	8,088	9,683	11,231	14,842	13,627
Bus Custom Incentives	2,725	3,157	3,578	4,025	4,426	12,906	14,891	16,801	18,698	20,595	8,027	9,329	10,587	11,946	13,206
Bus Schools Program	268	324	372	422	454	719	839	919	938	1,027	110	135	155	174	192
Bus SEM	150	225	298	373	373	832	1,663	2,757	3,589	3,589	141	281	495	635	635
Bus & MF NC	298	364	395	479	493	1,109	1,386	1,530	1,902	2,009	587	725	749	960	939
Bus Direct Install	737	826	908	1,025	1,056	1,977	2,134	2,278	2,399	2,526	648	720	797	925	982
Residential Total:	4,301	4,440	5,872	6,062	5,979	24,134	24,981	25,418	25,795	25,977	3,704	3,938	4,034	4,113	4,175
Business Total:	6,298	7,557	8,669	9,851	10,311	29,851	34,686	39,723	44,060	46,857	17,602	20,873	24,013	29,482	29,581
Portfolio Total:	**10,599**	**11,996**	**14,542**	**15,913**	**16,290**	**53,986**	**59,667**	**65,140**	**69,855**	**72,834**	**21,306**	**24,811**	**28,047**	**33,596**	**33,757**

Cost Effectiveness

With the program savings and budgets, we perform the industry standard cost-effectiveness tests to gauge the economic merits of the portfolio. Each test compares the benefits of the EE programs to their costs – using its own unique perspectives and definitions – all defined in terms of net present value of future cash flows. The definitions for the four standard tests most commonly used in EE program design are described below.

- **Total Resource Cost test (TRC).** The benefits in this test are the lifetime avoided energy costs and avoided capacity costs. The costs in this test are the incremental measure costs plus all administrative costs spent by the program administrator.
- **Utility Cost Test (UCT).** The benefits in this test are the lifetime avoided energy costs and avoided capacity costs, the same as the TRC benefits. The costs in this test are the program administrator's incentive costs and administrative costs.
- **Participant Cost Test (PCT).** The benefits in this test are the lifetime value of retail rate savings (which is another way of saying "lost utility revenues"). The costs in this test are those seen by the participant; in other words: the incremental measure costs minus the value of incentives paid out.
- **Rate Impact Measure test (RIM).** The benefits of the RIM test are the same as the TRC benefits. The RIM costs are the same as the UCT, except for the addition of lost revenue. This test attempts to show the effects that EE programs will have on rates, which is almost always to raise them on a per unit basis. Thus, costs typically outweigh benefits from the point of view of this test, but the assumption is that absolute energy use decreases to a greater extent than per-unit rates are increased — resulting in lower average utility bills.

The cost effectiveness results for the Vectren Recommended Portfolio are shown in Table 8-4, sporting lifetime TRC benefits of $177 million dollars and costs of $92 million dollars for a robust TRC ratio of 1.92.

Table 8-4 Vectren Recommended Action Plan Cost Effectiveness summary

	TRC Ratio	TRC Benefits	TRC Costs	UCT Ratio	PCT Ratio	RIM Ratio
Res Lighting	1.47	$12,729,504	$8,638,583	2.33	7.39	0.44
Res Efficient Products	2.31	$5,767,547	$2,494,058	3.55	11.18	0.51
Res IQW	0.99	$2,475,435	$2,503,149	0.99	-	0.35
Res IQW Plus	0.56	$650,864	$1,166,742	0.56	-	0.35
Res NC	1.02	$453,989	$443,548	1.23	9.82	0.42
Res MF Direct Install	1.47	$383,335	$260,561	1.69	20.72	0.41
Res HEA	1.90	$5,286,017	$2,783,242	1.90	-	0.42
Res School Kit	1.14	$1,165,755	$1,024,230	1.14	-	0.38
Res Whole House Plus	1.07	$8,212,627	$7,653,155	1.85	2.47	0.66
Res Appliance Recycling	1.05	$723,032	$686,727	1.05	-	0.40
Res Behavioral Feedback Tools	1.18	$1,442,788	$1,220,290	1.18	-	0.42
Bus Prescriptive	2.06	$50,575,254	$24,584,518	4.21	3.91	0.83
Bus Custom Incentives	2.52	$70,292,200	$27,918,583	4.87	5.25	0.82
Bus Schools Program	0.69	$2,168,631	$3,155,364	1.46	1.96	0.45
Bus SEM	1.61	$1,821,203	$1,133,881	1.61	-	0.43
Bus & MF NC	2.06	$5,972,921	$2,896,189	3.66	5.04	0.75
Bus Direct Install	1.85	$6,808,569	$3,675,085	1.85	-	0.56
Residential Total:	1.36	$39,290,894	$28,874,285	1.83	8.54	0.47
Business Total:	2.17	$137,638,778	$63,363,620	4.00	4.87	0.78
Portfolio Total:	**1.92**	**$176,929,672**	**$92,237,905**	**3.17**	**5.61**	**0.68**

CHAPTER | 9

CONCLUSIONS AND RECOMMENDATIONS

The results of this study reveal that significant energy efficiency opportunities exist for Vectren in Southern Indiana, despite aggressive appliance and efficiency standards and a challenging macroeconomic environment.

Our program analysis shows that Vectren can achieve Net incremental electric energy savings of 53,986 MWh in 2015, increasing to 72,834 MWh in 2019. This equates to Gross incremental savings of 62,818 MWh in 2015 and 84,809 MWh in 2019, all by implementing the programs and measures presented in this report.

Vectren's energy-efficiency programs are relatively young compared to other programs in the nation, but have made significant impacts already and are building appreciable market momentum. Based on our market potential assessment and program design analysis, EnerNOC provides the following high-level recommendations for the portfolio. We fully expect that Vectren, the stakeholders, and the implementers will consider the plans and recommendations in this report now, at the outset of the forthcoming implementation cycle; and that they will adopt the elements that are appropriate, adjust the elements that fit differently when translated into the trenches and front lines of program delivery, and continue to revisit the report as a reference throughout the next years as situations and markets continue to change and evolve.

General Recommendations

- **Increase focus on non-residential programs:** Our study shows that a large portion of the program savings from energy efficiency efforts will come from the commercial and industrial sectors. Vectren has already begun to shift budget and focus toward the C&I sectors, as evidenced by budgeting trends in 2013 and 2014 as well as the primary market research conducted on large C&I customers as part of this study. Increasing program efforts in the C&I sectors will not only lead to harvesting larger EE savings, but to increased business competitiveness and decreased operating costs for customers. Additionally, these sectors offer larger projects, which can be attained and bundled more readily and efficiently.
- **Continued collaboration among stakeholders:** The discourse and information sharing between stakeholders, utilities, and EnerNOC on this study has been effective and transparent. Continuing this trend is of paramount importance to the future success of programs. It is essential to cultivate a mutual understanding of the dynamic nature of the energy efficiency industry due to its intrinsic linkage with human behavior and the customer mind. Ongoing interactions should be marked by an understanding of collaboration, flexibility, and continuous improvement.
- **Deliver electric and natural gas programs jointly when possible:** Vectren also has a broad array of natural gas energy efficiency programs to help its natural gas customers save on their gas bills. Administrative efficiencies and economies of scale can be reached with dual fuel program offerings in applicable programs like HEA and IQW, where both electric and gas savings can be obtained without creating duplicative, administrative cost structures. Further, Indiana's concept of a statewide Therm Bank provides an excellent platform to deliver joint electric and natural gas programs on a straightforward and highly cost-effective basis. In this paradigm, if it proves feasible and appropriate to management and to

stakeholders, Vectren could share costs across its electric and gas programs to extend their reach and effectiveness.

Residential Recommendations

- **Focus on lighting:** The largest share of achievable energy efficiency potential in the residential sector continues to come from CFLs. This is in spite of the forthcoming EISA standards that will reduce their per-unit savings compared to the new baseline. Also, Vectren should focus strong attention on specialty lamps, as they are not affected by the EISA standard, and prepare for the entrance of LED lamps into their programs in the later years of the portfolio.
- **Implement and monitor behavioral feedback programs:** The behavioral modification program to be implemented by OPower is shown in the program plans to comprise a significant amount of Vectren's portfolio savings. This initiative was added at the program design stage, and was not included in our bottom-up, measure level potential analysis. This is due to the fact that it is not a specific action or piece of equipment, per se, as well as the fact that it does not go through the typical customer-adoption model that other measures encounter. The program is simply delivered to as many participants as the planners deem appropriate, and produces a statistically measured energy reduction effect in a treatment group (vs. a control group that does not receive the program treatment). It should be monitored carefully, however, as it is a new and emerging opportunity. Relatively little is known about the specific actions that customers perform to reduce their energy usage in this program, and it may undergo meaningful change in customer responsiveness and evaluation paradigms in the coming years. Additionally, savings under this program will not persist after the program is ended, and must be continually renewed each year with additional cost and effort, whereas the savings from a capital equipment measure can last 10 to 20 years.
- **Develop deeper, follow-on measures in existing programs:** Some current Vectren program delivery structures are pursuing low-cost measures through rapid customer touches with direct-install components only. We have recommended the addition of more deep, involved measures to capitalize on customer touches as much as possible. While you are in the home of a customer, it makes better sense to cross-sell these other measures and harvest as many energy savings as you can. This would include major equipment replacements and shell measures such as duct sealing and insulation.
- **Consider social media avenues for targeted program delivery:** As internet social media paradigms become the norm in today's wired society, companies like Groupon, Amazon Local Deals, and Living Social have assembled a nationwide network of businesses into a well-oiled, rebate-issuing machine. Vectren should consider if there are opportunities to link their energy efficiency trade ally network to one of these companies to facilitate the target marketing, processing, and delivery of rebates. These vendors have sophisticated tracking systems and databases that may facilitate EM&V reporting on the back end as well.

Commercial & Industrial Recommendations

- **Aggressively pursue lighting savings:** The commercial sector in particular has significant savings potential in lighting equipment, both interior and exterior. Notably, LED lamps are showing as cost effective in the commercial sector due to aggressive forecasts of cost reductions, as well as higher hours of operation than their non-economic counterparts in residential settings. Savings are also available through occupancy sensors, timers, and energy management systems. Vectren should strongly pursue lighting savings to accelerate the phase out of T12 fluorescent lighting. In particular, program efforts can help intercept building operators before they make purchase and stocking decisions that could lead to the hoarding of T12 lamps.

- **Focus industrial program efforts on motor controls and system optimizations**: The savings for the industrial sector are all about control and optimization of motors and processes. Low-cost retrofits can often have significant energy impacts with minimal disruption of (and often times improvement of) business processes.
- **Target niches with segment specific programs**: There are specific business segments that offer considerable savings potential, but will not typically be reached by standard rebates and generic business programs. Consider initiating specifically targeted sub-programs within business standard and custom for areas such as: hotels and lodging, food preparation equipment in restaurants, and refrigeration equipment in grocery stores.
- **Implement new programs:** We have identified additional programs that show promise to expand Vectren's portfolio of programs to address Indiana's aggressive statewide savings goals. These programs are as follows:
    1. *Strategic Energy Management*. For large customers, SEM initiatives can deliver substantial savings over long time horizons. This means coming alongside the larger customers to create a customized, multi-year plan, identify metrics, set goals, and provide technical assistance and attention from dedicated account executives or energy coaches.
    2. *Business and Multifamily New Construction*. A program to encourage more rapid adoption of efficient building design practices is a very relevant addition to the Vectren portfolio.

About EnerNOC

EnerNOC's Utility Solutions Consulting team is part of EnerNOC's Utility Solutions, which provides a comprehensive suite of demand-side management (DSM) services to utilities and grid operators worldwide. Hundreds of utilities have leveraged our technology, our people, and our proven processes to make their energy efficiency (EE) and demand response (DR) initiatives a success. Utilities trust EnerNOC to work with them at every stage of the DSM program lifecycle – assessing market potential, designing effective programs, implementing those programs, and measuring program results.

EnerNOC's Utility Solutions deliver value to our utility clients through two separate practice areas – Implementation and Consulting.

- Our Implementation team leverages EnerNOC's deep "behind-the-meter expertise" and world-class technology platform to help utilities create and manage DR and EE programs that deliver reliable and cost-effective energy savings. We focus exclusively on the commercial and industrial (C&I) customer segments, with a track record of successful partnerships that spans more than a decade. Through a focus on high quality, measurable savings, EnerNOC has successfully delivered hundreds of thousands of MWh of energy efficiency for our utility clients, and we have thousands of MW of demand response capacity under management.
- The Consulting team provides expertise and analysis to support a broad range of utility DSM activities, including: potential assessments; end-use forecasts; integrated resource planning; EE, DR, and smart grid pilot and program design and administration; load research; technology assessments and demonstrations; evaluation, measurement and verification; and regulatory support.

The team has decades of combined experience in the utility DSM industry. The staff is comprised of professional electrical, mechanical, chemical, civil, industrial, and environmental engineers as well as economists, business planners, project managers, market researchers, load research professionals, and statisticians. Utilities view EnerNOC's experts as trusted advisors, and we work together collaboratively to make any DSM initiative a success.

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Evaluation of the 2013–2014 Programmable and Smart Thermostat Program

January 29, 2014

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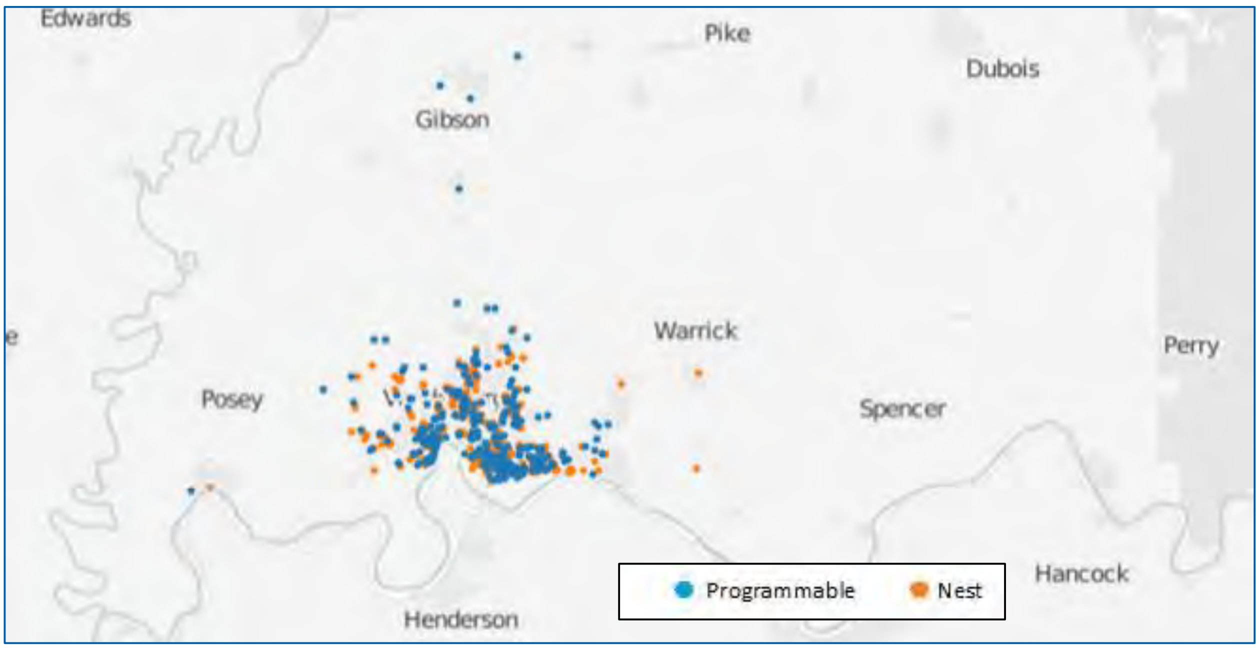
Table of Contents

Executive Summary

In 2013-2014, the Vectren Corporation (Vectren), a natural gas and electric provider, offered a thermostat program to residential customers who used manual thermostats in their homes. CLEAResult, the program administrator, worked with their subcontractor, Water and Energy Solutions, Inc. (WES) to install 300 Nest and 300 programmable thermostats in the homes of randomly selected Vectren natural gas and electric (i.e., dual-fuel) customers who previously underwent a home energy assessment (through the Energizing Indiana Program). In addition to the new thermostats, customers received training on proper operation of their new thermostats.

WES installed the thermostats between October 14, 2013, and January 24, 2014. Figure 1 shows a map of the thermostat installation locations by thermostat type.

Figure 1. Map of Completed Thermostat Installations for Vectren Thermostat Program



Vectren hired Cadmus to evaluate the program and determine the energy savings from the Nest thermostat over the baseline (manual thermostats) and conventional programmable thermostats. Specifically, the objectives of the evaluation are to:

1. Evaluate the amount (therms) and percentage of gas saved on heating; and
2. Evaluate the amount (kWh) and percentage of electricity saved on cooling.

Cadmus assessed energy savings using pre- and post-installation billing data. Table 1 shows the evaluated gas savings as a percentage of heating gas usage, and Table 2 shows the evaluated electric savings as a percentage of cooling electric usage.

Table 1. Nest and Programmable Thermostat Gas Savings as Percentage of Heating Gas Usage

Thermostat Group	Group	Sample Size	Pre Usage (therms)	Savings (therms)	Savings (%)	Range of Savings (therms)	Range of Savings (%)
Nest	Participant	197	548	55	10.0%	47 to 63	8 to 11%
	Control	2,611	575	-14	-2.5%	-12 to -17	-2 to -3%
	Adjusted Gross	**197**	**548**	**69**	**12.5%**	**60 to 77**	**11 to 14%**
Programmable	Participant	184	602	15	2.5%	8 to 22	1 to 4%
	Control	2,611	575	-14	-2.5%	-12 to -17	-2 to -3%
	Adjusted Gross	**184**	**602**	**30**	**5.0%**	**22 to 37**	**4 to 6%**

Table 2. Nest and Programmable Thermostat Electric Savings as Percentage of Cooling Electric Usage

Thermostat Group	Group	Sample Size	Pre Usage (kWh)	Savings (kWh)	Savings (%)	Range of Savings (kWh)	Range of Savings (%)
Nest	Participant	191	3,080	357	11.6%	206 to 508	7 to 17%
	Control	2,714	3,001	-70	-2.3%	-18 to -122	-1 to -4%
	Adjusted Gross	**191**	**3,080**	**429**	**13.9%**	**270 to 589**	**9 to 19%**
Programmable	Participant	205	2,537	273	10.8%	131 to 415	5 to 16%
	Control	2,714	3,001	-70	-2.3%	-18 to -122	-1 to -4%
	Adjusted Gross	**205**	**2,537**	**332**	**13.1%**	**181 to 483**	**7 to 19%**

Participants with the Nest thermostat reduced their heating gas consumption by approximately 12.5%, compared to only 5.0% for participants with a programmable thermostat. The Nest saved more gas than the programmable thermostat by keeping the average home temperature approximately 0.2 degrees lower than the homes with a programmable thermostat in the heating season, and an average of 0.7 degrees lower during the daytime on weekdays, when homes are commonly unoccupied. We assume temperature reductions in Nest homes are attributable to its Auto-Away feature, which automatically sets back the temperature when it senses no one is home.

Participants in the Nest and programmable thermostat groups reduced cooling electric consumption by approximately the same amount (13.9% and 13.1%, respectively). Despite nearly the same percentage savings, Nest participants had a slightly higher average air conditioner run time (1.8%) compared to programmable thermostat participants (1.2%). The baseline cooling electric usage in the Nest participant group was 21% higher than the baseline for the programmable thermostat group, so we would expect the air conditioner run time for Nest participants to be higher. We assume the higher baseline usage in the Nest participant group is attributable to the Nest participant homes having higher occupancy (and thus higher cooling loads) compared to the programmable thermostat homes (see occupancy data in Demographics section).

Introduction

In 1995, the U.S. Environmental Protection Agency (EPA) began promoting programmable thermostats with the ENERGY STAR® label. Utility companies started offering rebate programs based on claims that programmable thermostats could save 10% to 30% of residential heating and cooling energy if users programmed setbacks when the home was unoccupied or occupants were sleeping.[1] However, evaluations of these programs showed low realization rates and many studies found that only about half of users actually programmed their thermostats due to the poor user interface designs and complicated settings.

Two conditions can decrease or eliminate savings benefits from programmable thermostats. They are:

1. Some users with manual thermostats already use temperature setbacks regularly, essentially duplicating the operation of a programmable thermostat.
2. Not all users program their programmable thermostats. Some users set the thermostats at a constant temperature setpoint. Several studies have shown that consumers find programmable thermostats difficult to operate, so they often do not program the thermostat at all.[2] One study found that only 47% of programmable thermostats are actually programmed in an energy saving manner.[3]

In a 2013 study, Cadmus observed both conditions (Table 3). Study participants responded to surveys about their thermostat behavior. The portion of thermostats set to regular, scheduled setpoints does not differ much by technology, but programmable thermostats are left at a constant setpoint more often, possibly because of the difficulty of programming.

Table 3. Programmable and Manual Thermostat Behavior Patterns from 2013 Cadmus Study*

Behavior	Manual Thermostats	Programmable Thermostats
Regular Scheduled Setpoints	48%	56%
Manual With Changing Setpoints	36%	14%
Constant Setpoint	16%	29%

*Totals may not sum due to rounding.

1 U.S. Environmental Protection Agency. *Summary of Research Findings from the Programmable Thermostat Market.* Memo to Manufacturers on Programmable Thermostat Specification Review. Washington, D.C. 2003. Available online: https://www.energystar.gov/ia/partners/prod_development/revisions/downloads/thermostats/Summary.pdf

2 Nevius, M., and Pigg, S. "Programmable Thermostats That Go Berserk: Taking a Social Perspective on Space Heating in Wisconsin." Proceedings of the 2000 ACEEE Summer Study on Energy Efficiency in Buildings, 8.233-238.244, 2000.

3 Meier, A., et al. (Lawrence Berkeley National Laboratory and University of California Davis). "How People Actually Use Thermostats." Presented at American Council for an Energy Efficient Economy proceedings, Pacific Grove, California, August 15-20, 2010.

Based in part on the findings of programmable thermostat program evaluations, the EPA suspended ENERGY STAR® labeling of programmable thermostats in 2009. Since then, the nation's top thermostat manufacturers have released a new generation of Wi-Fi-enabled, smart thermostats designed with more user-friendly programming in addition to wireless control options.

In 2013-2014, Vectren, administered a thermostat program to evaluate the impact of a smart thermostat, the Nest Learning Thermostat (Nest), on energy usage compared to baseline (manual) and programmable thermostats.

The utilities chose to evaluate the Nest because of its unique features. Nest's Auto-Away feature applies proprietary algorithms to occupancy data to determine when the home is unoccupied and activate temperature setbacks. The Auto-Schedule feature learns users' behaviors based on how they set the thermostat and automatically programs a setback schedule. In addition, users can control the Nest remotely using a smartphone, tablet, or computer, and publishes a monthly energy report via e-mail. The thermostat also has features useful to utility programs and evaluators: continuous communication to back-end databases of setpoints, space temperatures, and HVAC run times, among other data. The ability to monitor thermostats via the Internet also allows utilities to offer lower cost demand response programs.

The Vectren program enrolled 600 dual-fuel (gas and electric) customers with manual thermostats.[4] Customers were randomly selected from a database of customers who had received a home energy audit. These customers were assigned to two treatment groups—half received a Nest thermostat and half received a standard programmable thermostat.

Participants receiving the Nest were required to have Internet in their home so that they could use the Wi-Fi features. The utilities chose the Honeywell TH211 to represent a conventional programmable thermostat in this evaluation. Figure 2 shows the Honeywell TH211 and Nest thermostat installed in participant homes.

Figure 2. Programmable (left) and Nest (right) Thermostats Installed in Program Participant Homes

[4] A small percentage of participants had programmable thermostats that they operated manually

Evaluation Objectives and Methods

The objective of the program was to evaluate the amount (therms) and percentage of gas saved on heating and the amount (kWh) and percentage of electricity saved on cooling using a Nest compared to conventional manual and programmable thermostats.

Cadmus evaluated energy savings for three groups of customers identified as having a manual thermostat in home energy audit data.[5]

1. 300 households received a Nest thermostat;
2. 300 households received a standard programmable thermostat; and
3. A control group of 3,845 households continued to use a manual thermostat (did not have a new thermostat installed as part of the study).

We compared energy savings from the Nest and programmable thermostats using a pre-/post-installation billing analysis of participants' energy consumption. We used the control group to determine adjusted gross savings from the Nest and programmable thermostats.

To support the energy billing analysis, we installed indoor temperature loggers and air conditioner run time loggers in half the participant homes. We used the indoor temperature data to determine average indoor temperature by hour and by day of week and categorized the patterns of use. We used the air conditioner run time data to determine average air conditioner run time by hour and day of week. We also conducted pre- and post-installation surveys to assess participant behavior and determine any changes over the study period that might eliminate the participant from the analysis.

Methods

Cadmus assessed energy savings and participant behavior using a combination of billing data, metered data, and customer survey data. Table 4 summarizes the evaluation activities completed to collect and analyze these data.

[5] A small percentage of participants had programmable thermostats that were unprogrammed and operated as manual thermostats.

Table 4. Vectren Thermostat Program Evaluation Activities

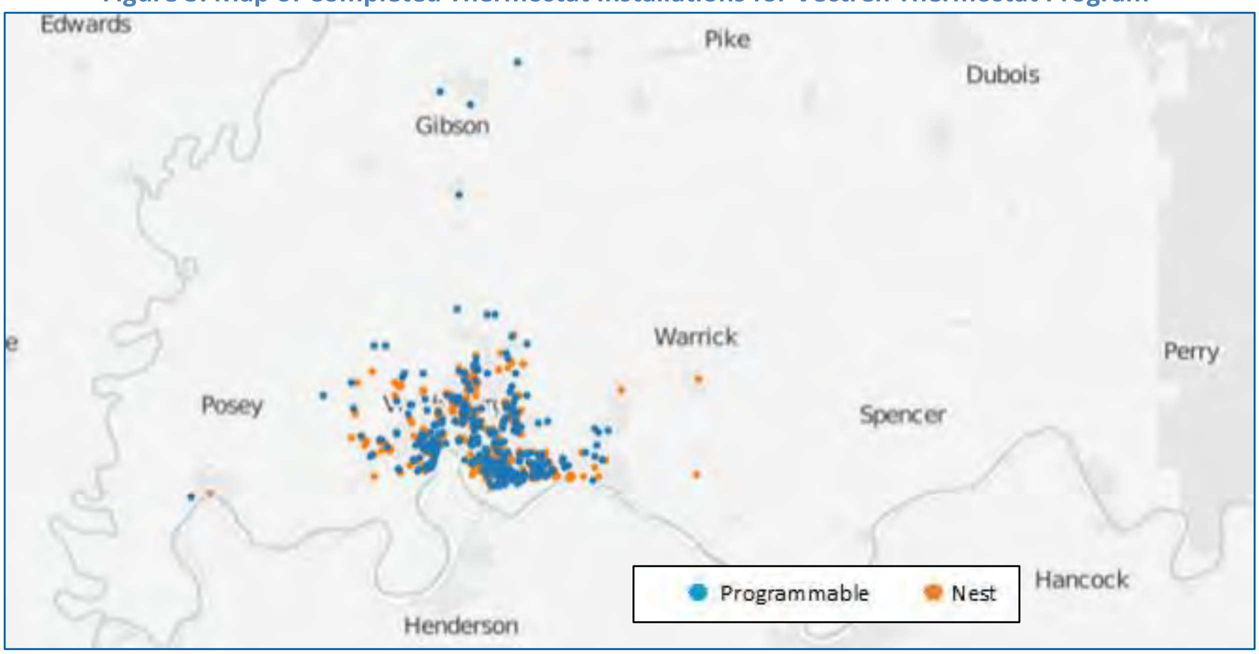
Activity	Group 1: Nest Thermostats	Group 2: Programmable Thermostats	Group 3: Control*
On-site data collection	Y	Y	N
Pre-installation survey	Y	Y	N
Metering ambient household space temperature	Y	Y	N
Metering air conditioner run time	Y	Y	N
Pre- and post-installation billing analysis	Y	Y	Y
Post-installation Survey	Y	Y	N

* This group allowed Cadmus to establish a base case for the billing analysis.

On-site Data Collection

Water and Energy Solutions, Inc. (WES) completed thermostat installations in 600 Vectren dual-fuel customer homes between October 14, 2013 and January 24, 2014, providing half the homes with a Nest thermostat and half with a standard programmable thermostat. Figure 3 shows a map of the thermostat installation locations by thermostat type. WES followed the protocols outlined in Appendix B.

Figure 3. Map of Completed Thermostat Installations for Vectren Thermostat Program



Pre-installation Survey

At the time of installation, WES used an iPad to survey customers about how they used their old thermostat and to collect demographic information. The survey is attached as Appendix A.

Space Temperature and Air Conditioner Run-time Metering

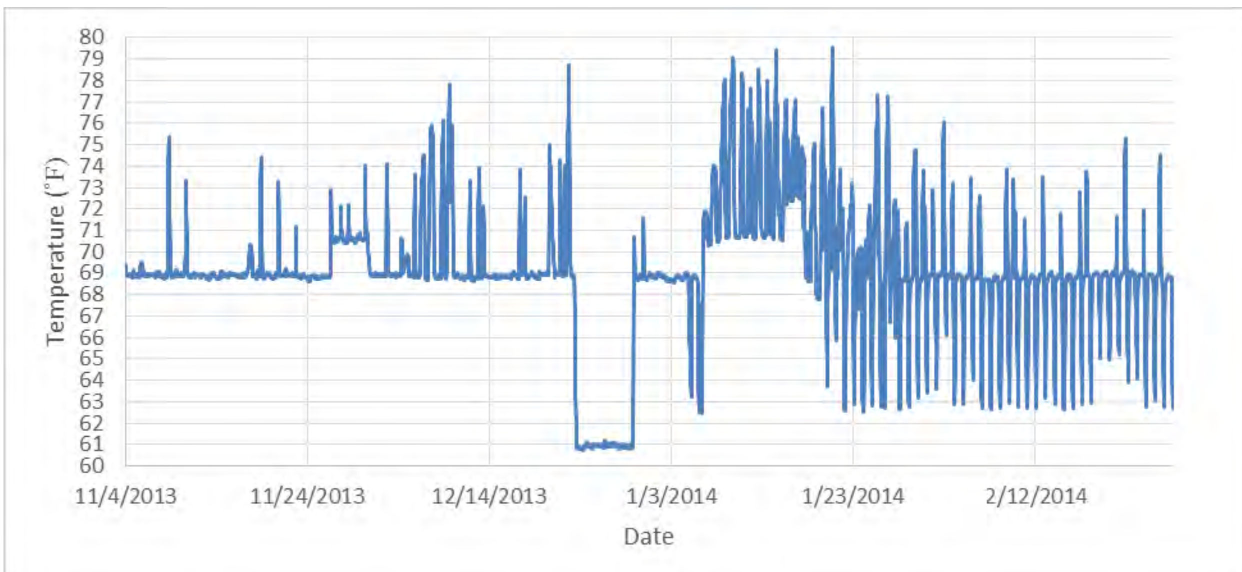
Cadmus collected space temperatures and air conditioner run times from approximately half the Nest and programmable thermostat homes. At the time of the thermostat installation, WES technicians installed an Onset UX100-003 logger next to each participant's thermostat to record the space temperature every five minutes. WES also installed an Onset UX90-004 logger on each participant's air conditioner condenser to record air conditioner run time.

WES installed indoor temperature meters and air conditioner run-time meters in 300 (50%) of the homes:[6] Half were installed in Nest homes and half were installed in programmable thermostat homes.

Analysis of Participant Behavior

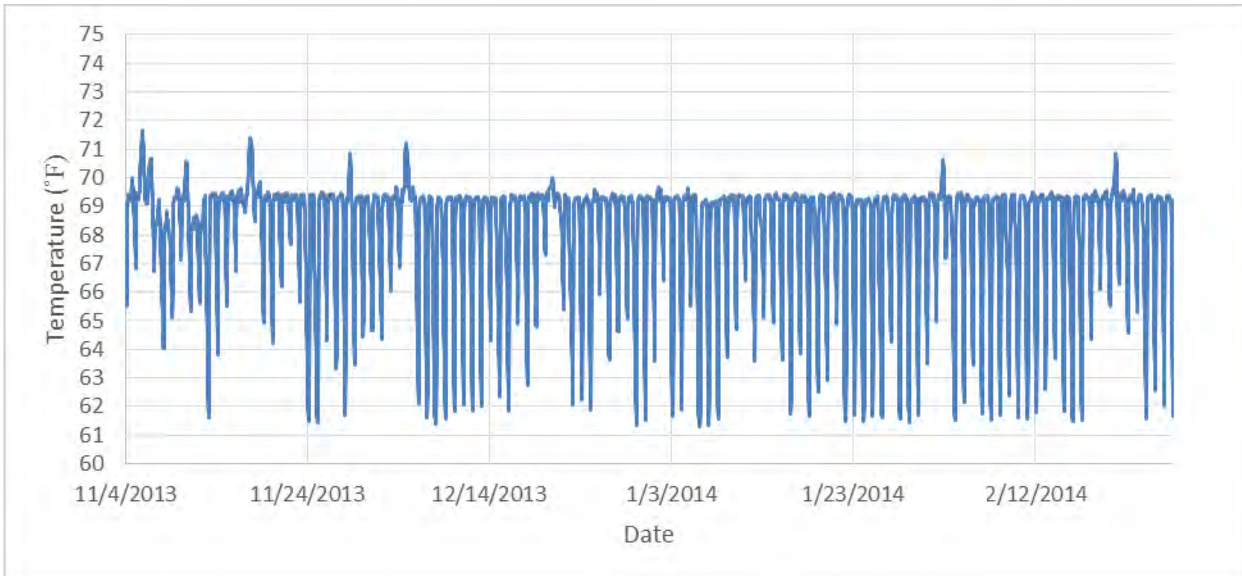
To understand how programmable thermostat participants actually used their thermostats, we assessed space temperature data for each participant who returned a temperature logger. We noted if the participant established a programmed schedule of setbacks or used the programmable thermostat as if it were a manual thermostat. Figure 4 and Figure 5 show example temperature data for two participants, one in each of the two behavior categories.

Figure 4. Temperature Data for a Participant with Irregular Behavior



6 WES collected indoor temperature data so that Cadmus could review and categorize the behavior of participants, and collected air conditioner run-time data so that Cadmus could investigate any anomalous findings in the billing analysis.

Figure 5. Temperature Data for a Participant with Programmed Setpoints



Pre-/Post- Billing Analysis

Cadmus provided Vectren with names and addresses for the 600 program participants and 3,845 nonparticipants (control group) sampled from Energizing Indiana Home Energy Audit data. Vectren provided the data fields outlined in Table 5 for each customer's gas and electric bills September 2012 through September 2014.

Table 5. Requested Billing Data Fields

Field	Definition
Provided by Cadmus	
Customer name	Customer's First and Last Names
Service street address	Street Address
Service city	City
Service zip code	Zip Code
Provided by Vectren	
Billing Account Number	Customer's Billing Account Number
Premise/Location Number	Location Account Number (tied to the premise)
Billing Days	Number of Billing Days in Each Month
Usage	Monthly Usage (kwh or therms) for Each Month
Read Date	Date of Meter Reads in Each Month
Meter Read Code	Meter Read Code (indicates whether the meter reading was estimated or true)
Account Status	Indicates Active, Inactive, or Closed

We evaluated gas savings attributable to the program by conducting a billing analysis, following these steps:

1. Matched thermostat installation dates and customer information to the billing data;
2. Used participant zip codes to map to the nearest weather station;
3. Obtained daily average temperature weather data from September 2012 through September 2014 for seven National Oceanic and Atmospheric Administration weather stations, representing all participant zip codes;
4. Used daily temperatures to determine base 45-85 heating degree days (HDDs) and cooling degree days (CDDs) for each weather station; also mapped the typical meteorological year 3 (TMY3) normal heating and cooling degree days by zip code for each home ;[7] and
5. Matched billing data periods with the CDDs and HDDs from associated stations.

Pre- and Post-installation Period Definitions

WES installed thermostats for Vectren customers between October 2013 and late January 2014.

For participants, Cadmus defined the pre-installation period as before the installation of the new thermostat, and the post-installation period as after the installation of a new thermostat. For the control group (nonparticipants), Cadmus based the control group pre- and post-installation periods on the average installation dates of the participants. We used the average participant installation date of November 16, 2013.

Using the billing data from September 2012 through September 2014, Cadmus paired the pre- and post-installation months to ensure that we compared the same months before and after thermostat installation.[8]

Gas Billing Analysis Model

Cadmus estimated savings from each customer using a PRInceton Scorekeeping Method (PRISM) specification using pre- and post-installation billing data for each customer in the Nest group, programmable thermostat group, and control group. These models provided weather-normalized pre- and post-installation annual usage for each participant and nonparticipant.

Through this regression model approach, we obtained estimates of energy savings for each group and each customer. For each participant and control home, Cadmus estimated heating-only PRISM models in both the pre- and post-installation periods to weather-normalize raw billing data. Each model allows the heating reference temperature to range from 45 degrees to 85 degrees.

[7] Cadmus used the PRISM models to select the best base temperature for each home.

[8] In order to obtain the most reliable estimate of pre-period normalized usage, Cadmus estimated a model using all 12 pre-installation period months.

The PRISM model specification we used is:

$$ADC_{it} = \alpha_i + \beta_1 HDD_{it} + \varepsilon_{it}$$

Where for each customer 'i' and month 't':

ADC_{it}	=	The average daily gas consumption in the pre- or post-installation program period
α_i	=	The participant intercept representing the average daily base load
β_1	=	The model space heating slope
HDD_{it}	=	The base 45-85 average daily HDDs for the specific location
ε_{it}	=	The error term

From the above model, Cadmus computed weather-normalized annual consumption (NAC) for each heating reference temperature as follows:

$$NAC_i = \alpha_i * 365 + \beta_1 LRHDD_{it} + \varepsilon_{it}$$

Where:

NAC_i	=	The normalized annual consumption
α_i	=	An intercept representing the average daily base load for each participant
$\alpha_i * 365$	=	The annual base load consumption (non-weather sensitive)
β_1	=	The heating slope (usage per HDD from the model above)
$LRHDD_{it}$	=	Annual, long-term HDDs of a typical month year (TMY3) in the 1991–2005 series from the National Oceanic and Atmospheric Administration, for Evansville, Indiana
$\beta_1 LRHDD_{it}$	=	The weather-normalized, weather-sensitive annual heating usage, also known as HEATNAC
ε_{it}	=	The error term

Cadmus screened and removed accounts that yielded negative heating NACs from the analysis. From the various models with correct signs on all of the parameters, we chose the best model of each participant's pre- and post-installation periods based on that with the highest R-squared value.

Gas Data Screening

Cadmus screened and removed the following gas customers from the analysis:

- Customers with less than seven pre-installation paired months or less than seven post-installation paired months;
- Customers that yielded total NACs less than 200 therms;
- Customers that yielded negative heating NACs;
- Customer bills that contained outliers, vacancies, or equipment changes; and
- Customers whose post-installation survey responses indicated vacancies, changes in occupants, or equipment changes

Table 6, Table 7, and Table 8 present the gas attrition levels for the Nest, programmable thermostat, and control group customers from the screening criteria above, respectively. For participants, the attrition was primarily due to insufficient paired billing data, removal of outliers, and surveys indicating changes, while the control group attrition was primarily due to insufficient paired billing data.

Table 6. Nest Thermostat Gas Account Attrition

Sample Screen	Remaining		Dropped from Sample	
	Participants	Percentage	Number	Percentage
Original Nest sample	300	100%	0	0%
Insufficient pre- and/or post-period data (less than seven pre-period and six post-period months)	246	82%	54	18%
PRISM screens	240	80%	6	2%
Removal of outliers*	206	69%	34	11%
Surveys Indicate Changes	197	66%	9	3%
Final Nest Analysis Sample	**197**	**66%**	**103**	**34%**

* This entailed an account-level inspection of pre- and post-period usage data to assess vacancies, equipment changes, and other anomalies.

Table 7. Programmable Thermostat Gas Account Attrition

Sample Screen	Remaining		Dropped from Sample	
	Participants	Percentage	Number	Percentage
Original programmable thermostat sample	300	100%	0	0%
Insufficient pre- and/or post-period data (less than seven pre-period and six post-period months)	265	88%	35	12%
PRISM screens	261	87%	4	1%
Removal of outliers*	202	67%	59	20%
Surveys Indicate Changes	184	61%	18	6%
Final Programmable Thermostat Analysis Sample	**184**	**61%**	**116**	**39%**

* This entailed an account-level inspection of pre- and post-period usage data to assess vacancies, equipment changes, and other anomalies.

Table 8. Control Group Thermostat Gas Account Attrition

Sample Screen	Remaining		Dropped from Sample	
	Participants	Percentage	Number	Percentage
Original Nonparticipant Sample	3845	100%	0	0%
Insufficient pre- and/or post-period data (less than seven pre-period and six post-period months)	2851	74%	994	26%
PRISM screens	2800	73%	51	1%
Removal of outliers*	2611	68%	189	5%
Surveys Indicate Changes	2611	68%	0	0%
Final Control Group Analysis Sample	**2611**	**68%**	**1234**	**32%**

* This entailed an account-level inspection of pre- and post-period usage data to assess vacancies, equipment changes, and other anomalies.

After screening, the final gas analysis sample included 197 Nest thermostat participants (66%), 184 programmable thermostat participants (61%), and 2,611 control group customers (68%).

Electric Billing Analysis Model

Cadmus estimated savings from each customer using a PRInceton Scorekeeping Method (PRISM) specification using pre- and post-installation billing data for each customer in the Nest group, programmable thermostat group, and control group. These models provided weather-normalized pre- and post-installation annual usage for each participant and nonparticipant.

Through this regression model approach, we obtained estimates of energy savings for each group and each customer. For each participant and control home, we estimated heating-only PRISM models in both the pre- and post-installation periods to weather-normalize raw billing data. Each model allows the heating reference temperature to range from 45 degrees to 85 degrees and the cooling reference temperature to range from the heating reference temperature to 85 degrees.

The PRISM model specification we used is:

$$ADC_{it} = \alpha_i + \beta_1 HDD_{it} + \beta_2 CDD_{it} + \varepsilon_{it}$$

Where for each customer 'i' and month 't':

ADC_{it} = The average daily electric consumption in the pre- or post-installation program period

α_i = The participant intercept representing the average daily base load

β_1 = The model space heating slope

HDD_{it} = The base 45-85 average daily HDDs for the specific location

β_2 = The model space cooling slope

HDD_{it} = The base 45-85 average daily CDDs for the specific location

ε_{it} = The error term

From the above model, Cadmus computed weather-normalized annual consumption (NAC) for each heating and cooling reference temperature as follows:

$$NAC_i = \alpha_i * 365 + \beta_1 LRHDD_{it} + \beta_2 LRCDD_{it} + \varepsilon_{it}$$

Where:

NAC_i	=	The normalized annual consumption
α_i	=	An intercept representing the average daily base load for each participant
$\alpha_i * 365$	=	The annual base load consumption (non-weather sensitive)
β_1	=	The heating slope (usage per HDD from the model above)
$LRHDD_{it}$	=	Annual, long-term HDDs of a typical month year (TMY3) in the 1991–2005 series from the National Oceanic and Atmospheric Administration, for Evansville, Indiana
$\beta_1 LRHDD_{it}$	=	The weather-normalized, weather-sensitive annual heating usage, also known as HEATNAC
β_2	=	The cooling slope (usage per CDD from the model above)
$LRCDD_{it}$	=	Annual, long-term CDDs of a typical month year (TMY3) in the 1991–2005 series from the National Oceanic and Atmospheric Administration, for Evansville, Indiana
$\beta_2 LRCDD_{it}$	=	The weather-normalized, weather-sensitive annual cooling usage, also known as COOLNAC
ε_{it}	=	The error term

We screened and removed from the analysis any accounts that yielded negative cooling NACs and negative base load. If a model heating slope was negative, we estimated a cooling-only PRISM model. From the various models with correct signs on all of the parameters, we chose the best model of each participant's pre- and post-installation periods based on the one with the highest R-squared value.

Electric Data Screening

Cadmus screened and removed the following electric customers from the analysis:

- Customers with less than seven pre-installation paired months or less than seven post-installation paired months;
- Customers that yielded cooling NACs less than 100 kWh;
- Customers that yielded negative base load NACs;
- Customer bills that contained outliers, vacancies, or equipment changes; and
- Customers whose post-installation survey responses indicated vacancies, changes in occupants, or equipment changes.

Table 9, Table 10, and Table 11 present the electric attrition levels for the Nest, programmable thermostat, and control group customers from the screening criteria above, respectively. For participants, the attrition was primarily due to insufficient paired billing data, removal of outliers, and survey data indicating changes, while the control group attrition was primarily due to insufficient paired billing data.

Table 9. Nest Thermostat Electric Account Attrition

Sample Screen	Remaining		Dropped from Sample	
	Participants	Percentage	Number	Percentage
Original Nest sample	300	100%	0	0%
Insufficient pre- and/or post-period data (less than seven pre-period and seven post-period months)	247	82%	53	18%
PRISM screens	245	82%	2	1%
Removal of outliers*	210	70%	35	12%
Surveys Indicate Changes	191	64%	19	6%
Final Nest Analysis Sample	**191**	**64%**	**109**	**36%**

* This entailed an account-level inspection of pre- and post-period usage data to assess vacancies, equipment changes, and other anomalies.

Table 10. Programmable Thermostat Electric Account Attrition

Sample Screen	Remaining		Dropped from Sample	
	Participants	Percentage	Number	Percentage
Original programmable thermostat sample	300	100%	0	0%
Insufficient pre- and/or post-period data (less than seven pre-period and seven post-period months)	275	92%	25	8%
PRISM screens	269	90%	6	2%
Removal of outliers*	236	79%	33	11%
Surveys Indicate Changes	205	68%	31	10%
Final Programmable Thermostat Analysis Sample	**205**	**68%**	**95**	**32%**

* This entailed an account-level inspection of pre- and post-period usage data to assess vacancies, equipment changes, and other anomalies.

Table 11. Control Group Thermostat Electric Account Attrition

Sample Screen	Remaining		Dropped from Sample	
	Participants	Percentage	Number	Percentage
Original nonparticipant sample	3845	100%	0	0%
Insufficient pre- and/or post-period data (less than seven pre-period and seven post-period months)	3039	79%	806	21%
PRISM screens	2971	77%	68	2%
Removal of outliers*	2714	71%	257	7%
Surveys Indicate Changes	2714	71%	0	0%
Final Control Group Analysis Sample	**2714**	**71%**	**1131**	**29%**

* This entailed an account-level inspection of pre- and post-period usage data to assess vacancies, equipment changes, and other anomalies.

After screening, the final gas analysis sample included 191 Nest thermostat participants (64%), 205 programmable thermostat participants (68%), and 2,714 control group customers (71%).

Model-Specific Evaluated Savings (Average Participant)

Since the control group pre-installation period usage was not identical to the participant pre-installation usage, Cadmus used a percentage of pre-installation usage approach to obtain adjusted gross participant savings (via the following formula):

$$Adj. Gross\ Savings = Participant\ Pre\ Usage\left(\frac{Change\ In\ Participant\ Usage}{Participant\ Pre\ Usage} - \frac{Change\ in\ Control\ Group\ Usage}{Control\ Group\ Pre\ Usage}\right)$$

Through this process, we obtained the percentage reduction of energy use in both the participant groups and the control group (specifically, we determined savings as a percentage of Pre-NAC, PREHEATNAC, or PRECOOLNAC).[9] Then, we calculated the percentage reduction as the change in participant usage minus the change in control group usage. Multiplying this adjusted gross percentage reduction by the participant pre-installation period usage, we obtained the adjusted gross participant savings, effectively accounting for any differences in pre-installation period heating usage between participants and the control group.

Post-installation Survey

In July 2014, Cadmus distributed a post-installation survey by mail to collect information on participants' behaviors and satisfaction with their new thermostat. This survey screened out any customers who added equipment, changed equipment, or showed prolonged vacancies. The survey is attached as Appendix C.

[9] For gas savings, this method was applied both in terms of total usage (NAC) and total heating usage (HEATNAC). For electric savings, this method was applied in terms of cooling usage (COOLNAC).

Results

Response Rates

In July 2014, Cadmus mailed customer surveys to all 600 Vectren program participants. We also sent instructions to the 300 participants who received loggers on how to remove and mail back their loggers. Table 12 shows the logger and survey return rates as of November 7, 2014.

Table 12. Logger and Survey Return Rates (as of November 7, 2014)

Returned Item	Count	Response Rate
Temperature Logger	239	80%*
Motor Run-time Logger	192	64%*
Surveys	332	55%**

*Return rate as percentage of participants who received loggers (300 participants)

**Return rate as percentage of participants who received surveys (all 600 participants)

Of the participants who received loggers, 80% returned the temperature loggers and 64% returned the run time loggers. These response rates are lower than expected and may be due to the length of the study period. Because the loggers were in place over six months, participants may not have felt as responsible for returning them as they might in a shorter study. To increase response rates, we mailed a letter to participants in September, reminding them to return the loggers. After participants received the letters, we called them to see if they received the letter and offered to explain how to remove the loggers.

Cadmus received mail-in surveys back from 55% of participants. This response rate is higher than expected. Mail-in surveys typically have response rates of 10-15%.

Energy Savings

Results of Gas Billing Analysis: Model-Specific Evaluated Savings (Average Participant)

Table 13 shows the participant and control group changes in gas usage by thermostat type.

Table 13. Gas Savings as Percentage of Total Gas Usage

Thermostat Group	Group	Sample Size	Pre Usage (therms)	Savings (therms)	Savings (%)	Range of Savings (therms)	Range of Savings (%)
Nest	Participant	197	744	55	7.4%	47 to 63	6 to 8%
	Control	2,611	766	-14	-1.9%	-12 to -17	-2%
	Adjusted Gross	**197**	**744**	**69**	**9.3%**	**60 to 77**	**8 to 10%**
Programmable	Participant	184	778	15	1.9%	8 to 22	1 to 3%
	Control	2,611	766	-14	-1.9%	-12 to -17	-2%
	Adjusted Gross	**184**	**778**	**30**	**3.9%**	**22 to 37**	**3 to 5%**

The control group increased its gas usage by approximately 2%, which might be normal year on year change. Cadmus applied the adjusted gross savings formula to determine the difference in these percentage savings. For participants, the Nest thermostats achieved adjusted average gross savings of 69 therms, with a pre-installation period usage of 744 therms. This represents a 9.3% reduction of pre-period usage. The programmable thermostats achieved adjusted gross savings of 30 therms, with a pre-installation period usage of 778 therms. This represents a 3.8% reduction of pre-installation period usage.

Cadmus also evaluated gas savings as a percentage of pre-period heating usage (Table 14).

Table 14. Gas Savings as Percentage of Heating Gas Usage

Thermostat Group	Group	Sample Size	Pre Heating Usage (therms)	Savings (therms)	Savings (%)	Range of Savings (therms)	Range of Savings (%)
Nest	Participant	197	548	55	10.0%	47 to 63	8 to 11%
	Control	2,611	575	-14	-2.5%	-12 to -17	-2 to -3%
	Adjusted Gross	**197**	**548**	**69**	**12.5%**	60 to 77	**11 to 14%**
Programmable	Participant	184	602	15	2.5%	8 to 22	1 to 4%
	Control	2,611	575	-14	-2.5%	-12 to -17	-2 to -3%
	Adjusted Gross	**184**	**602**	**30**	**5.0%**	22 to 38	**4 to 6%**

The Nest thermostats saved 12.5% of heating gas usage and the programmable thermostats saved 5.0% of heating gas usage.

Results of Electric Billing Analysis: Model-Specific Evaluated Savings (Average Participant)

Table 15 shows the participant and control group changes in electric usage by thermostat type.

Table 15. Electric Savings as Percentage of Total Electric Usage

Thermostat Group	Group	Sample Size	Pre Usage (kWh)	Savings (kWh)	Savings (%)	Range of Savings (kWh)	Range of Savings (%)
Nest	Participant	191	10,730	357	3.3%	206 to 508	2 to 5%
	Control	2,714	10,606	-70	-0.7%	-18 to -122	-1 to 0%
	Adjusted Gross	**191**	**10,730**	**429**	**4.0%**	**270 to 589**	**3 to 5%**
Programmable	Participant	205	9,020	273	3.0%	131 to 415	1 to 5%
	Control	2,714	10,606	-70	-0.7%	-18 to -122	-1 to 0 %
	Adjusted Gross	**205**	**9,020**	**332**	**3.7%**	**181 to 483**	**2 to 5%**

The control group increased its electric usage by approximately 1%, which might be normal year on year change. Cadmus applied the adjusted gross savings formula to determine the difference in these percentage savings. For participants, the Nest thermostats achieved adjusted average gross savings of 429 kWh, with a pre-period usage of 10,730 kWh. This represents a 4.0% reduction of pre-installation period usage. The programmable thermostats achieved adjusted gross savings of 332 kWh, with a pre-installation period usage of 9,020 kWh. This represents a 3.7% reduction of pre-installation period usage.

Cadmus also evaluated gas savings as a percentage of pre-installation period cooling usage (Table 16).

Table 16. Electric Savings as Percentage of Cooling Electric Usage

Thermostat Group	Group	Sample Size	Pre Usage (kWh)	Savings (kWh)	Savings (%)	Range of Savings (kWh)	Range of Savings (%)
Nest	Participant	191	3,080	357	11.6%	206 to 508	7 to 17%
	Control	2,714	3,001	-70	-2.3%	-18 to -122	-1 to -4%
	Adjusted Gross	**191**	**3,080**	**429**	**13.9%**	**270 to 589**	**9 to 19%**
Programmable	Participant	205	2,537	273	10.8%	131 to 415	5 to 16%
	Control	2,714	3,001	-70	-2.3%	-18 to -122	-1 to -4 %
	Adjusted Gross	**205**	**2,537**	**332**	**13.1%**	**181 to 483**	**7 to 19%**

The control group increased cooling electric usage by approximately 2%, which might be normal year on year change. Cadmus applied the adjusted gross savings formula to determine the difference in these percentage savings. For participants, the Nest thermostats achieved adjusted average gross savings of 429 kWh, with a pre-installation period cooling electric usage of 3,080 kWh. This represents a 13.9% reduction in pre-installation period cooling electric usage. The programmable thermostats achieved adjusted gross savings of 332 kWh, with a pre-installation period cooling electric usage of 2,537 kWh. This represents a 13.1% reduction in pre-installation period cooling electric usage.

Benchmarking

Table 17 shows a comparison of the gas savings results of this evaluation compared with those from other Cadmus thermostat evaluations using pre/post billing analysis methods.

Table 17. Summary of Cadmus Thermostat Gas Savings Study Results*

Date	Location	T-stat Type	Original Sample Size	Control Group	Evaluated Sample Size	Attrition Rate	Savings per Participant (Therms)	Precision at 90% Confidence
July 2011	Indiana	Programmable	68	N/A	61	10%	37	±21%
July 2011	Indiana	Programmable	283	N/A	255	10%	43	±21%
July 2011	Indiana	Programmable	371	N/A	334	10%	35	±21%
September 2012	Massachusetts	Ecobee Wi-Fi	86	N/A	43	50%	86 (11%)	±31%
July 2013	New Hampshire	Venstar ColorTouch T5800	29	N/A	23	21%	69 (8%)	±20%
September 2014	Indiana	Nest	300	600	197	31%	69 (9.3%)	±12%
September 2014	Indiana	Programmable	300	600	184	33%	30 (3.8%)	±26%

Participant Temperature Settings and Behavior

Cadmus used participant survey responses and space temperature logger data to understand how participants set their thermostats.

Pre-Installation Period

This section describes the results of Cadmus' temperature setting analysis and participant behavior analysis during the pre-installation period.

Temperature Settings

Cadmus used participant responses from the pre-installation customer surveys to assess heating and cooling setpoints by hour and by day of the week in the pre-installation period. These setpoints were reported by participants; we did not verify or measure these numbers. Figure 6 shows the weekday and weekend heating setpoints reported by participants. Figure 7 shows the weekday and weekend cooling setpoints reported by participants.

Figure 6. Self-reported Pre-installation Heating Setpoints Using Manual Thermostat Weekdays vs. Weekend (Weekday n=517; Weekend n=515)

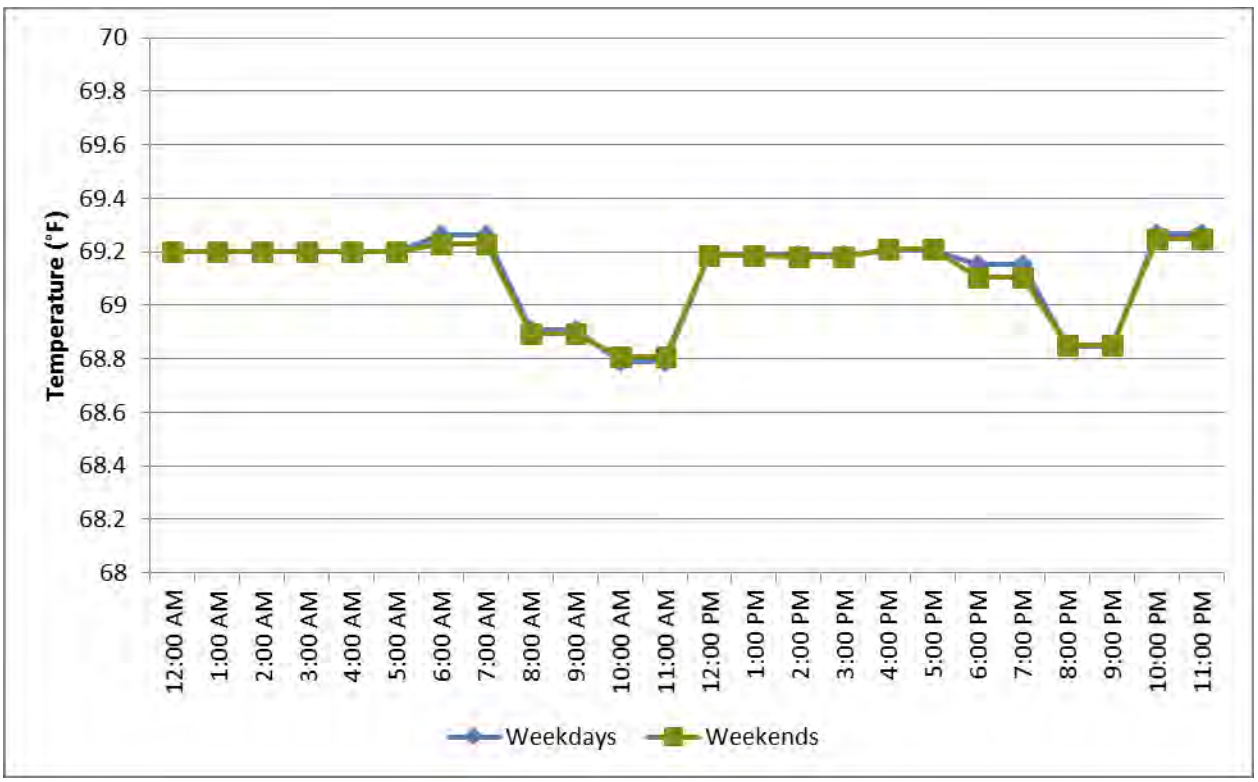
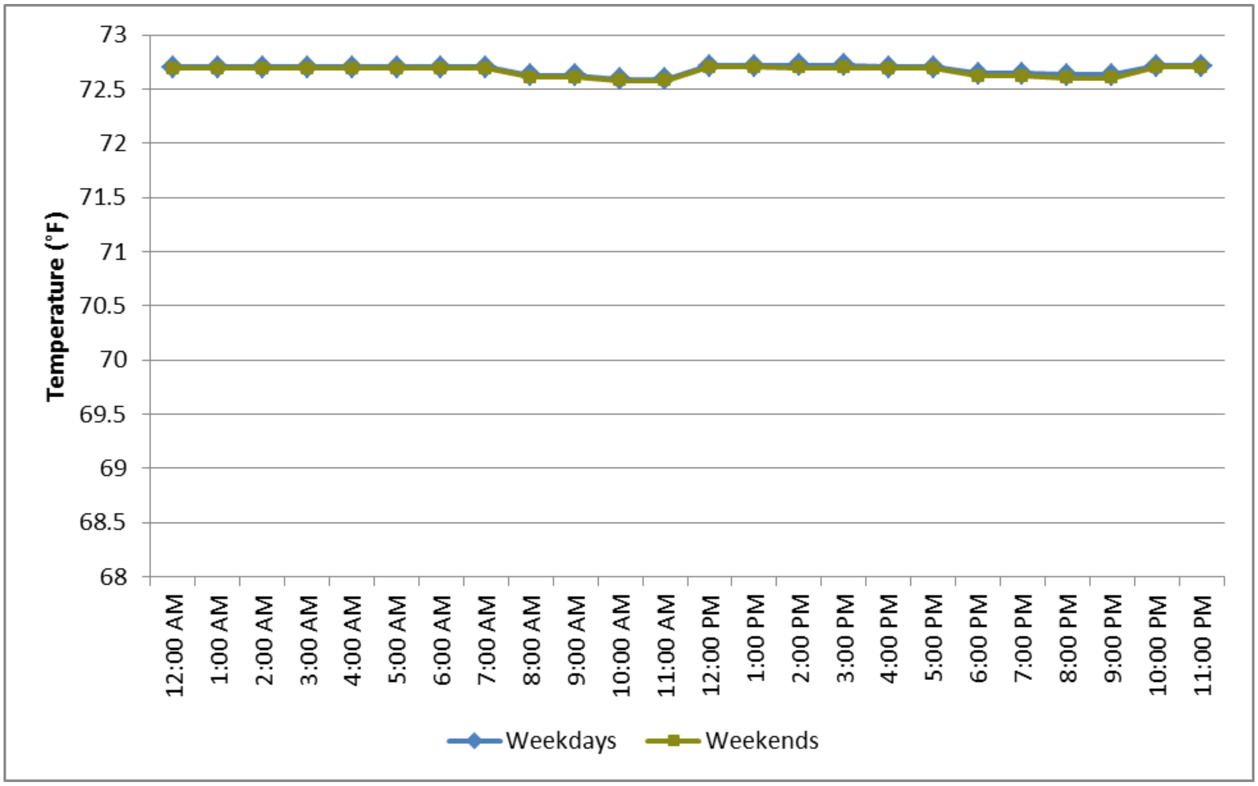


Figure 7. Self-reported Pre-installation Cooling Setpoints Using Manual Thermostat Weekdays vs. Weekend (Weekday n=516; Weekend n=516)



Five hundred seventeen program participants (86%) reported their baseline weekday heating setpoints and 515 (86%) reported their baseline weekend heating setpoints. From 8:00 a.m. to 11:00 a.m. and 8:00 p.m. to 9:00 p.m. on weekdays and weekends, the average reported setpoint is approximately 0.4 degrees lower than other times of day, indicating a possibly popular time for participants to use setbacks. During all hours of the day, the average reported setpoint is approximately 69.2 degrees.

A total of 516 program participants (86%) reported their baseline weekday and weekend cooling setpoints. On weekdays and weekends, the reported cooling season temperature settings were within 0.03 degrees for each hour of the day. For both weekdays and weekends, the average reported setpoint was 72.7 degrees. Based on participant responses, there is no period of the day or week where there is a significant setback.

Participant Behavior

Cadmus assessed the baseline behaviors of the participants based on their survey responses (Table 18).

Table 18. Self-reported Pre-installation Behavior Using Manual Thermostat*

Behavior	Count	Percentage
I manually change the thermostat settings using a regular daily schedule	424	81%
I manually change the thermostat settings using no set schedule (depending on weather and/or home activity)	75	14%
I use a single setpoint throughout each season (winter, spring, summer, fall)	22	4%
Total	**521**	**100%**

*Totals may not sum due to rounding

A total of 521 (87%) of program participants reported how they controlled their manual thermostats prior to participating in the program. The majority of participants (95%) reported manually changing their temperature settings. Eighty-five percent of these participants (81% of total) reported manually changing the thermostat settings using a regular daily schedule. Fifteen percent (14% of total) reported manually changing the thermostat settings using no set schedule. The remaining participants (4%) reported using a single setpoint.

Cadmus compared these survey responses to research we completed with another client in 2013. The results are summarized in Table 19.

Table 19. Comparison of Self-reported Behavior between Vectren Study and 2013 Cadmus Study*

Behavior	Manual Thermostats (2013 Cadmus Study)	Manual Thermostats (2013-2014 Vectren Nest Evaluation)
Regular Scheduled Setpoints	48%	81%
Manual With Changing Setpoints	36%	14%
Constant Setpoint	16%	4%

The behavior of Vectren program participants differs greatly from the behavior of the participants in the 2013 study. Vectren program participants control their thermostats with a regular schedule much more frequently and use changing setpoints or a single setpoint much less frequently. These results suggest Vectren program participants may already practice regular setbacks and might not have as large a potential for energy savings as the population in the 2013 study.

Post-Installation Period

This section describes the results of Cadmus' space temperature, air conditioner run time, and participant behavior analysis for the post-installation period.

Temperature Setting in Heating Season

Two hundred thirty-nine Vectren program participants (80%) returned their temperature loggers as of November 7, 2014. Cadmus used logger data to evaluate the average heating season home temperatures by hour and by day of the week for the programmable thermostat and Nest treatment groups. Figure 8 and Figure 9 show average indoor temperature in the heating season for programmable thermostats and Nest, respectively,

Figure 8. Average Hourly Metered Indoor Temperature During Heating Season for Programmable Thermostats (n=239)

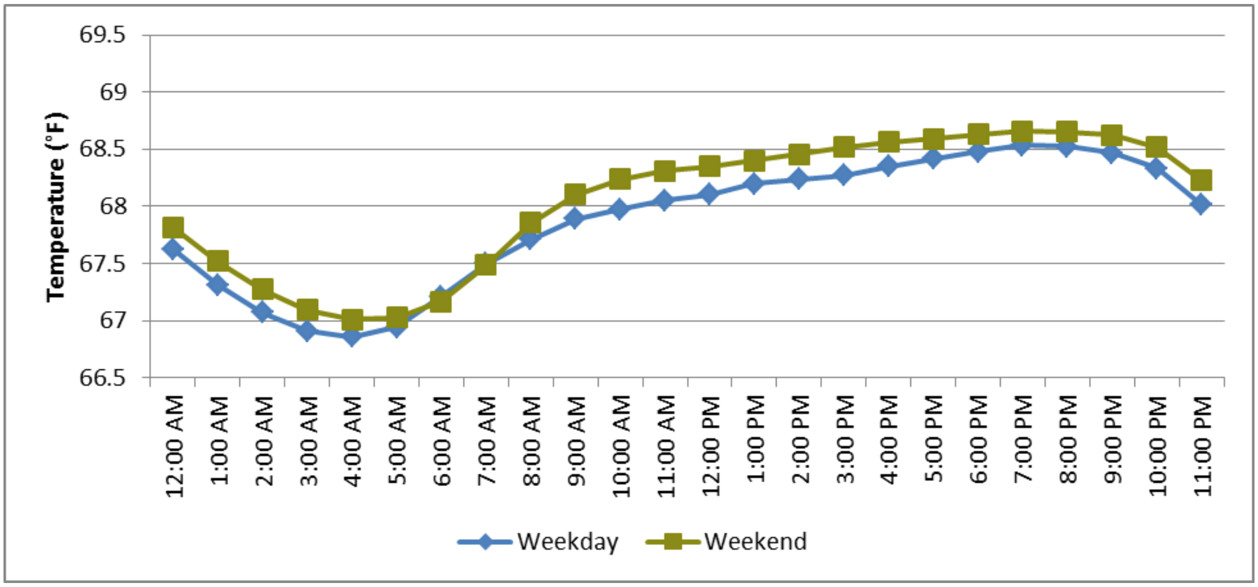
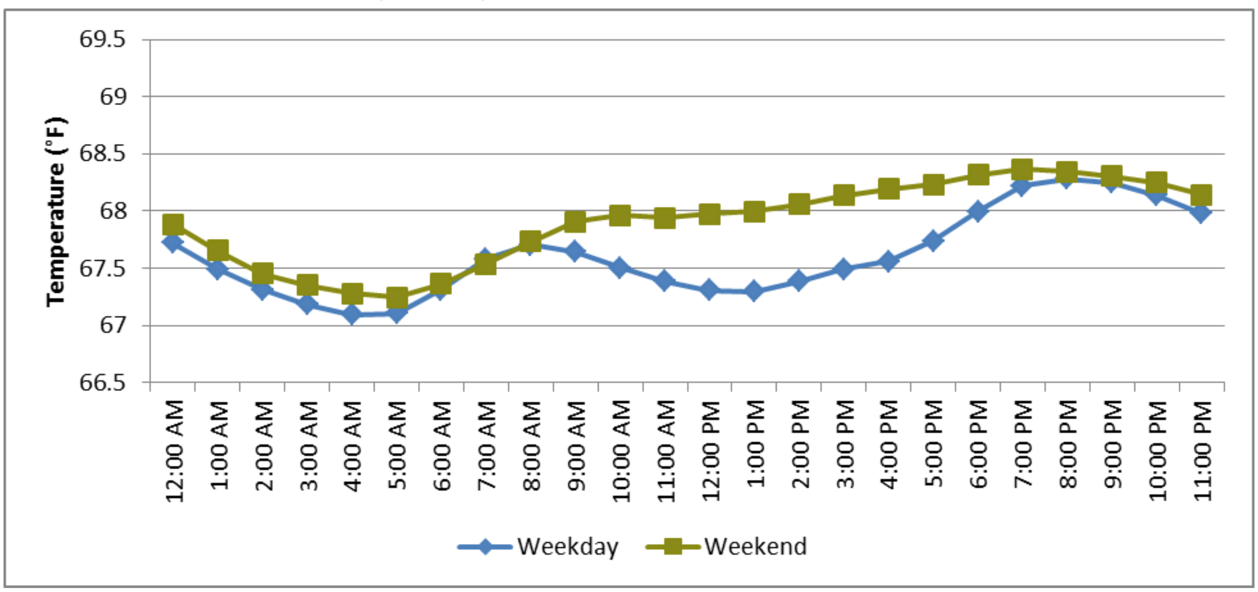


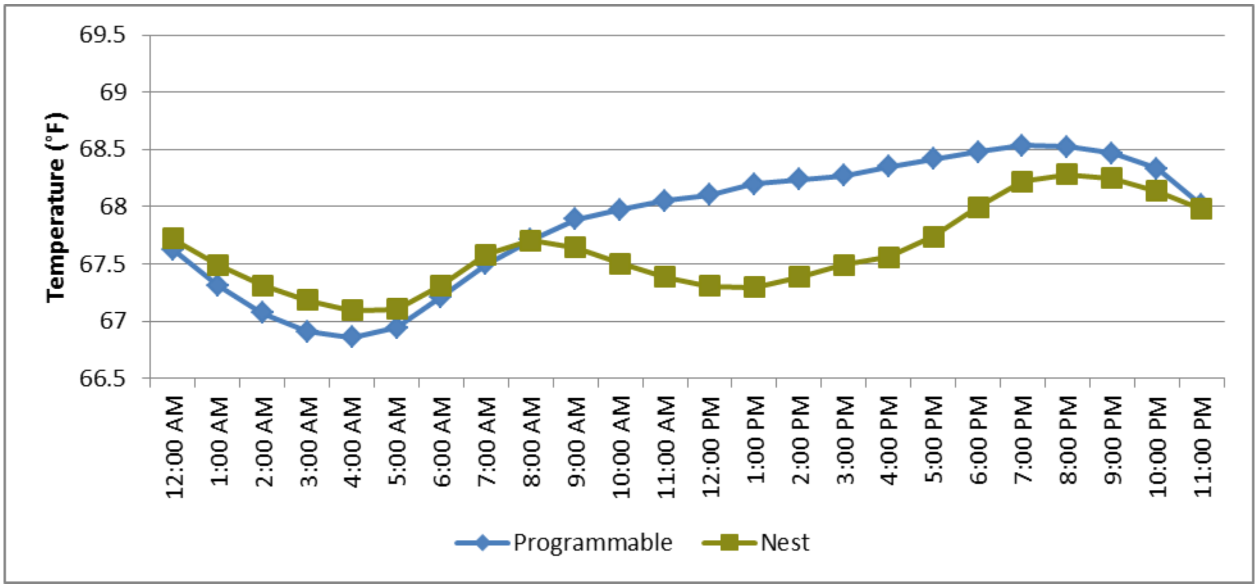
Figure 9. Average Hourly Metered Indoor Temperature During Heating Season for Nest Thermostats (n=239)



Programmable thermostat users have similar indoor temperatures for weekdays and weekends, while Nest users appear to have a slight reduction in temperature from 9:00 a.m. to 6:00 p.m. on weekdays. During this period, the temperature in Nest homes is on average 0.7 degrees cooler on weekdays than on weekends. Because this is a common time period for homes to be unoccupied, we assume this is attributable to either the Nest's Auto-Away feature, which automatically triggers a setback when it senses the home is unoccupied, or its Auto-Schedule feature, which uses data on how participants manually set their thermostat to automatically program a schedule of setbacks.

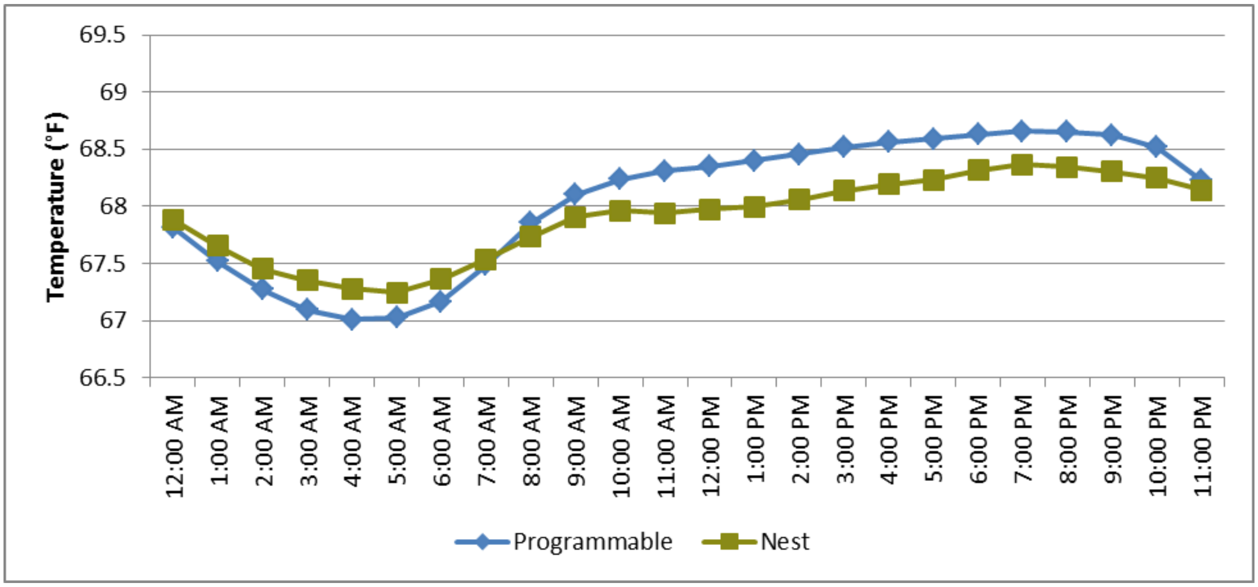
Figure 10 and Figure 11 show a comparison of programmable thermostat and Nest participant indoor temperatures on weekdays and weekends, respectively.

Figure 10. Average Hourly Metered Indoor Temperature on Weekdays During Heating Season (n=239)



During weekdays, homes with programmable thermostats had lower nighttime temperatures compared to homes with Nest thermostats. Between the hours of 12:00 a.m. and 7:00 a.m., the average hourly temperature was 0.2 degrees lower than homes with a Nest thermostat. During the daytime, however, the homes with Nest thermostats had lower indoor temperatures compared to programmable thermostat homes. Between 9:00 a.m. and 10:00 p.m., indoor temperature was 0.5 degrees cooler in Nest homes than in programmable thermostat homes, on average. The difference in average hourly temperature ranges from 0.2 degrees to 0.9 degrees during this period. These data suggest the Nest thermostat used the Auto-Away feature or Auto-Schedule feature to implement setbacks during daytime hours when many participants were away from home.

Figure 11. Average Hourly Metered Indoor Temperature on Weekends During Heating Season (n=239)



Like on weekdays, the programmable thermostat homes had slightly lower indoor temperatures at night. Similar to weekdays, the Nest homes had lower indoor temperatures compared to programmable thermostat homes during the day; however, the difference in indoor temperature during the day was not as large on weekends as it was on weekdays. Between the hours of 9:00am and 10:00pm on weekends, the average hourly indoor temperature ranges from 0.2 to 0.4 degrees cooler in Nest homes than in programmable thermostat homes. On average, the temperature was 0.3 degrees cooler in Nest homes during this period.

Figure 12 and Figure 13 compare the metered weekday and weekend temperature settings, respectively, of programmable thermostat and Nest thermostat participants to the baseline setpoints they reported using with their manual thermostats.

Figure 12. Self-reported Setpoints for Manual Thermostats Compared to Metered Indoor Temperatures for Programmable and Nest Thermostats (Weekdays)

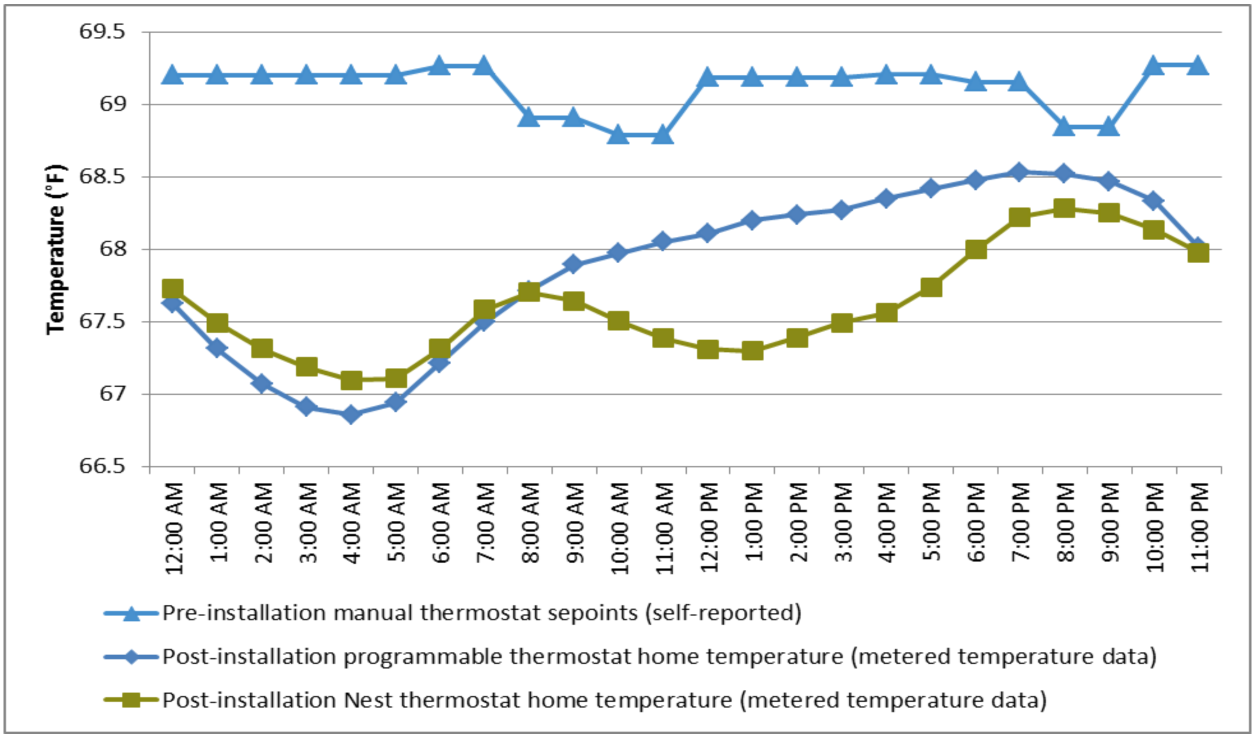
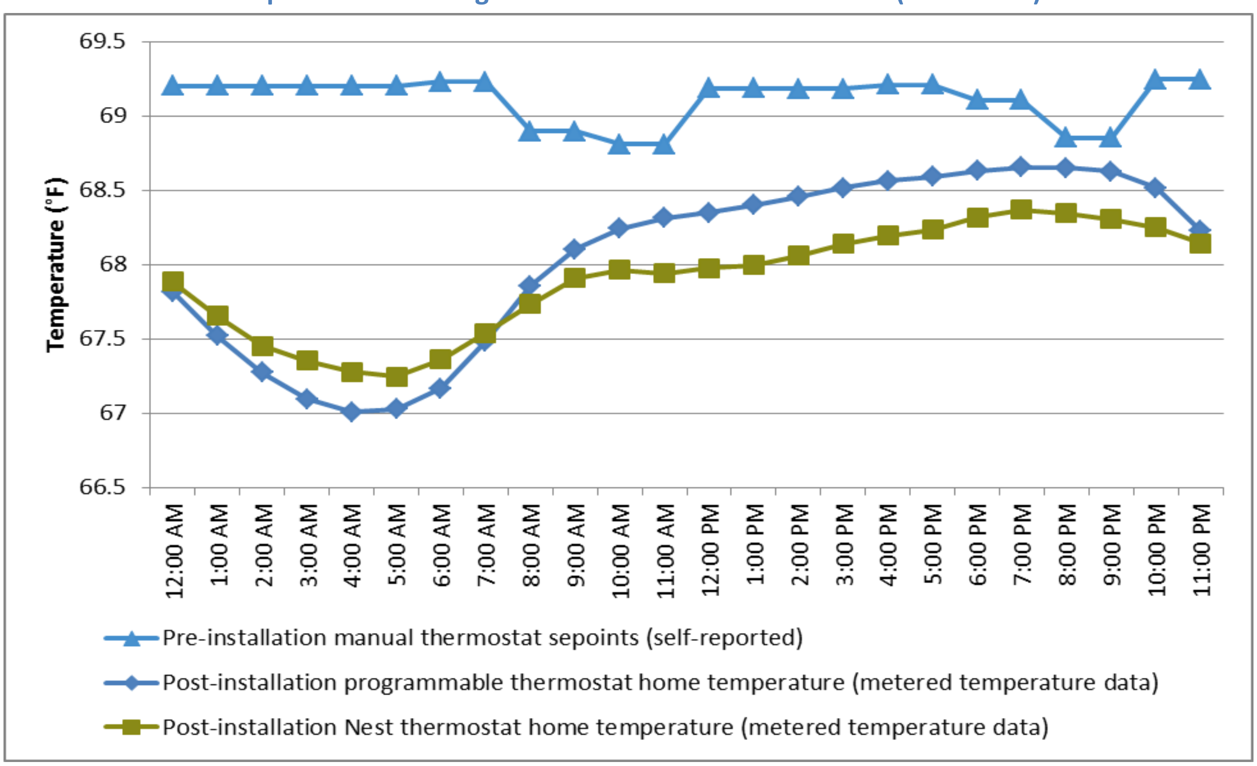


Figure 13. Self-reported Setpoints for Manual Thermostats Compared to Metered Indoor Temperatures for Programmable and Nest Thermostats (Weekends)



Compared to participants' self-reported baseline heating setpoints, participants with Nest and programmable thermostats had lower indoor temperatures during the heating season, with the Nest participants having the lowest daytime temperatures and the programmable thermostat participants having the lowest nighttime temperatures. Homes with Nest thermostats had the biggest difference in indoor temperature compared to programmable thermostat homes between the hours of 10:00 AM and 6:00 PM on weekdays, when the average hourly temperature was 0.7 degrees lower than homes with a programmable thermostat. We assume this is attributable either to Nest's Auto-Away feature, which automatically triggers a setback when it senses the home is unoccupied, or its Auto-Schedule feature, which uses data on how participants manually set their thermostat to automatically program a schedule of setbacks. Homes with programmable thermostats had the lowest indoor temperatures between the hours of 12:00 AM and 7:00 AM on weekdays and weekends, when the average hourly temperature was 0.2 degrees lower than homes with a Nest thermostat. On average, the homes with Nest thermostats had indoor temperatures 0.2 degrees lower than the homes with the programmable thermostats.

Cooling Season Temperature Settings

Cadmus used the indoor temperature logger data to evaluate the average indoor temperatures in the cooling season by hour and by day of the week for the programmable thermostat and Nest treatment groups. Figure 14 and Figure 15 show average indoor temperatures for programmable and Nest thermostats, respectively.

Figure 14. Average Hourly Metered Indoor Temperature During Cooling Season for Programmable Thermostats (n=239)

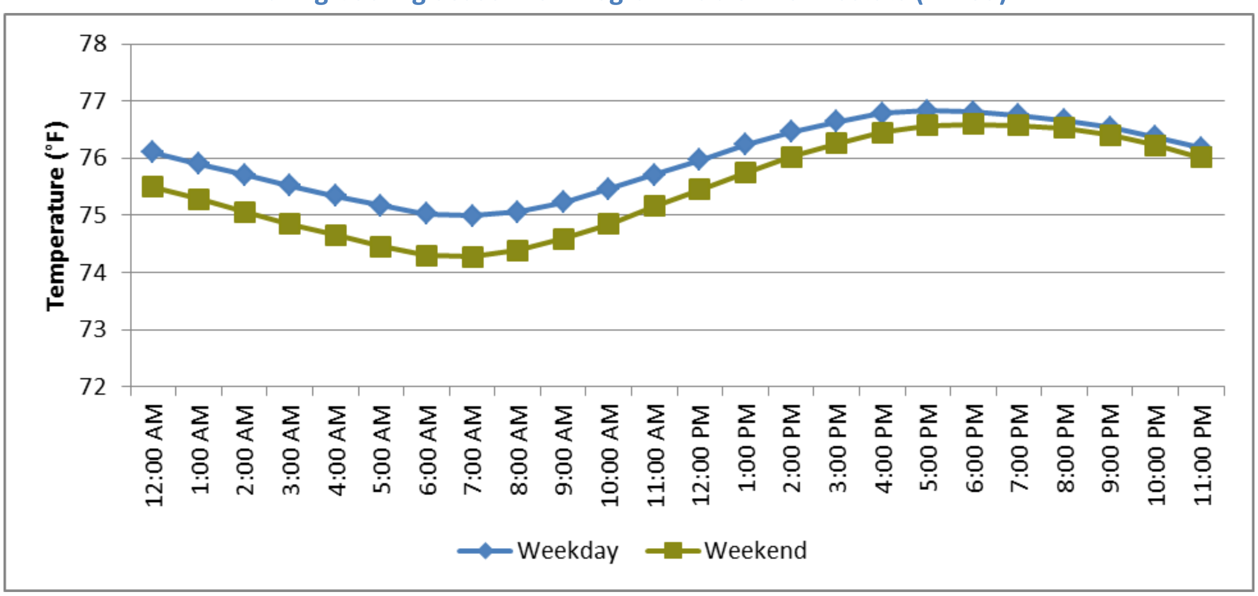
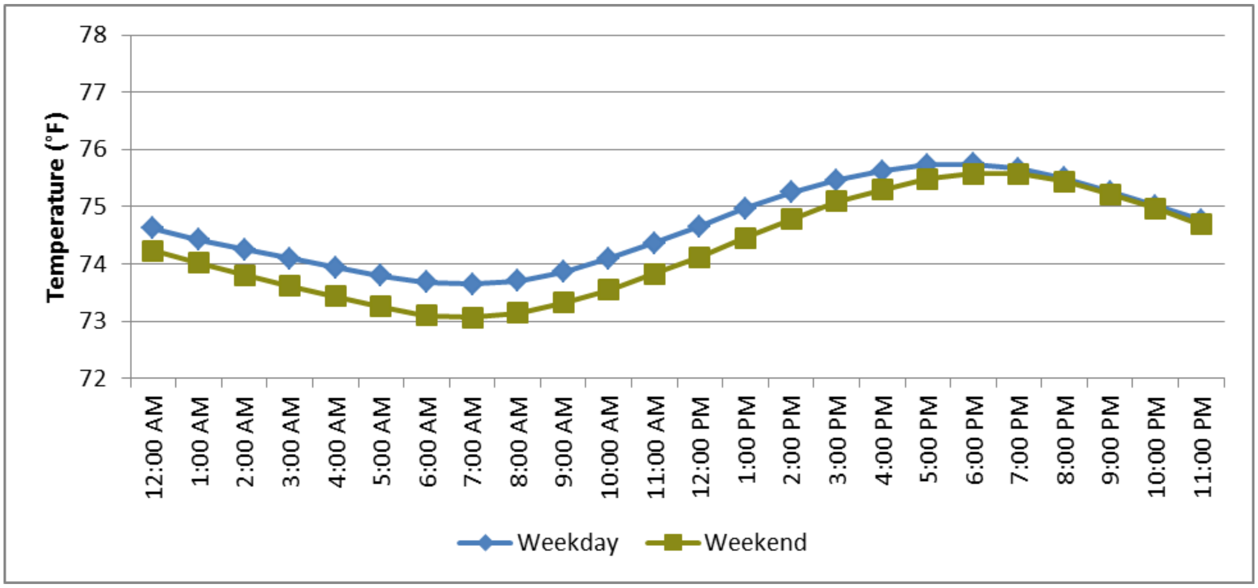


Figure 15. Average Hourly Metered Indoor Temperature During Cooling Season for Nest Thermostats (n=239)



Both programmable thermostat and Nest thermostat users have slightly cooler indoor temperatures on weekends compared to weekdays. On weekends, the indoor temperature in programmable thermostat homes is on average 0.5 degrees cooler compared to weekdays. For Nest homes, the average indoor temperature is 0.4 degrees cooler on weekends compared to weekdays. The metered indoor temperature data show that home indoor temperatures peak at approximately 5:00 p.m. or 6:00 p.m. and continue to drop until 7:00 a.m. Because air conditioner run time also drops during this period (see Air Conditioner Run Time Analysis section), we assume the drop in indoor temperature is primarily attributable to a drop in outdoor temperature at night.

Figure 16 and Figure 17 show a comparison of programmable thermostat and Nest participant indoor temperatures on weekdays and weekends, respectively.

Figure 16. Average Hourly Metered Indoor Temperature on Weekdays During Cooling Season (n=239)

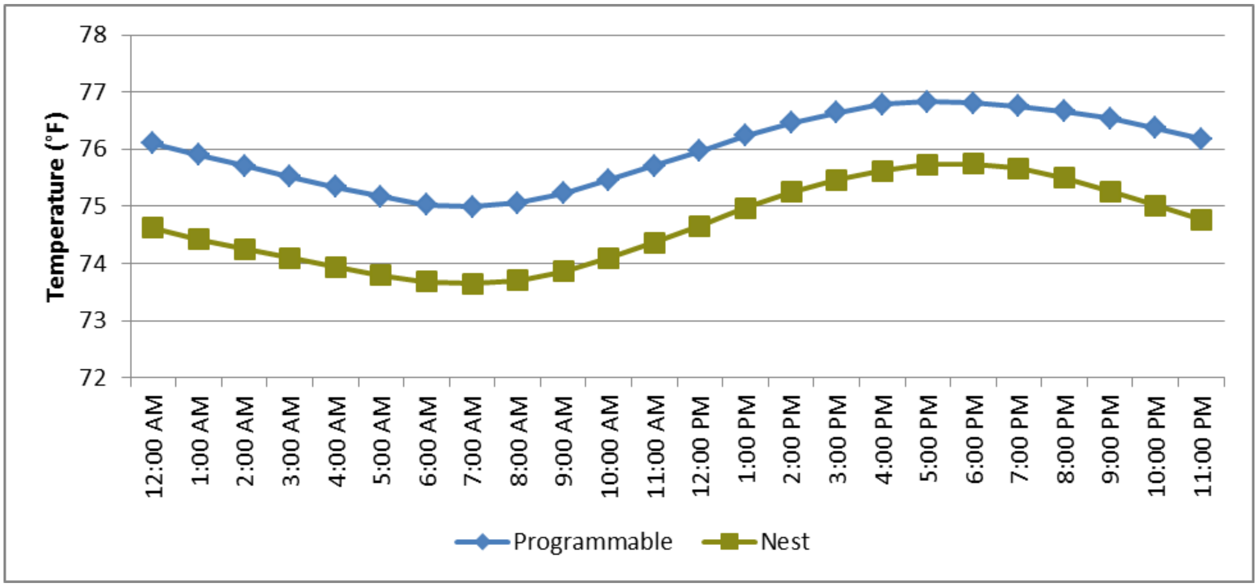
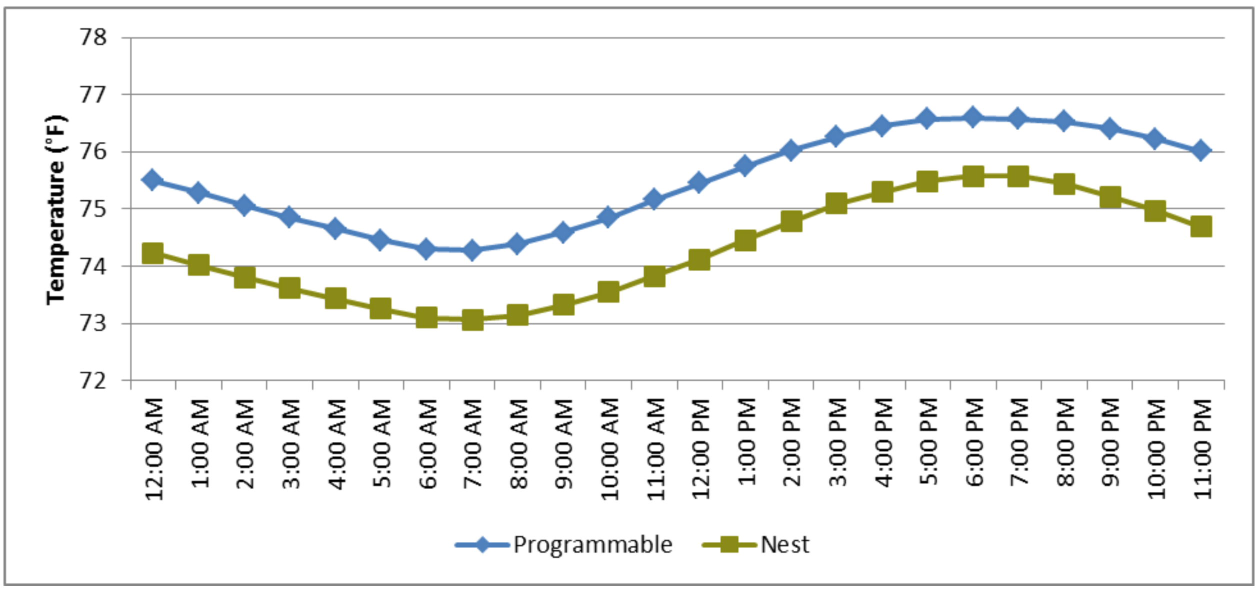


Figure 17. Average Hourly Metered Indoor Temperature on Weekends During Cooling Season (n=239)



During weekdays and weekends, homes with the Nest thermostat had lower indoor temperatures than homes with programmable thermostats. The indoor temperature in Nest homes were 1.3 degrees cooler than programmable thermostat homes on weekdays and 1.2 degrees cooler than programmable thermostat homes on weekends. Indoor temperature data for both participant groups show the same profile of temperature peaks and drops, with the Nest homes consistently approximately one degree cooler than the programmable thermostat homes.

Figure 18 and Figure 19 compare the metered weekday and weekend indoor temperatures, respectively, of programmable thermostat and Nest participants to the baseline behavior they reported using with their manual thermostats.

Figure 18. Self-reported Setpoints for Manual Thermostats Compared to Metered Indoor Temperatures for Programmable and Nest Thermostats (Weekdays)

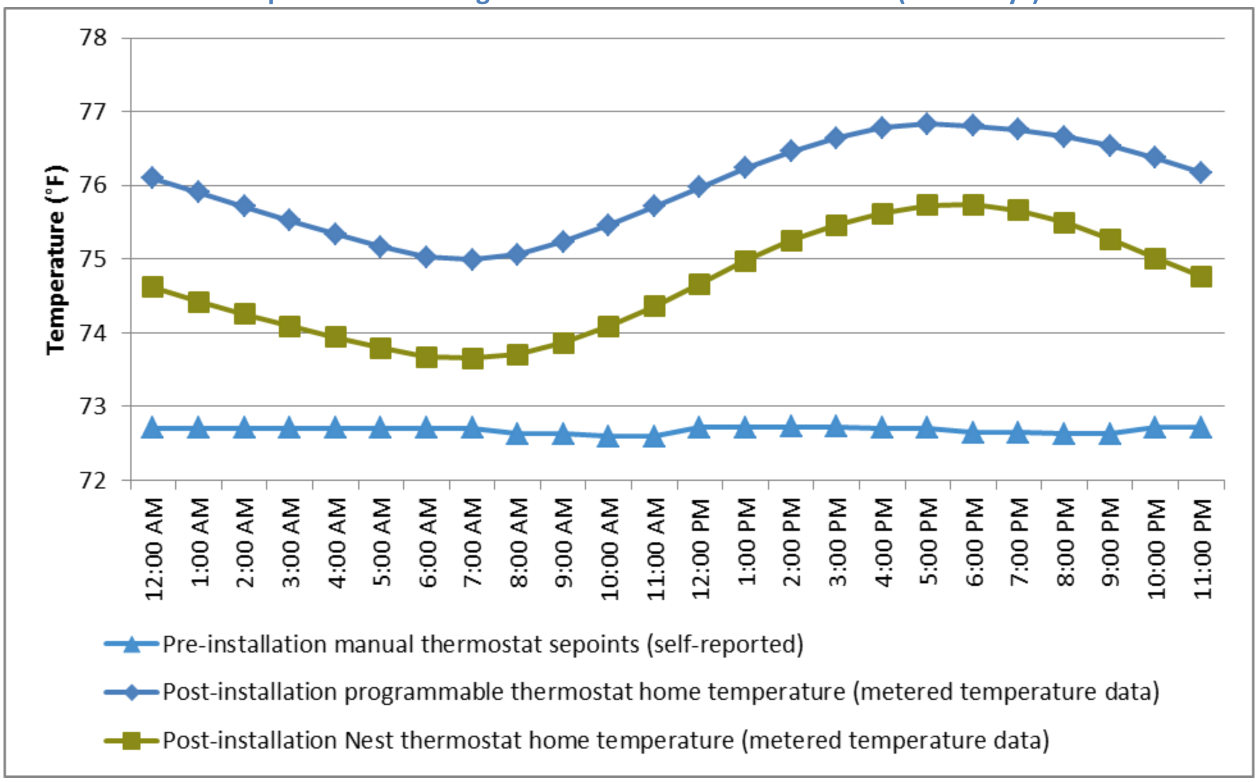
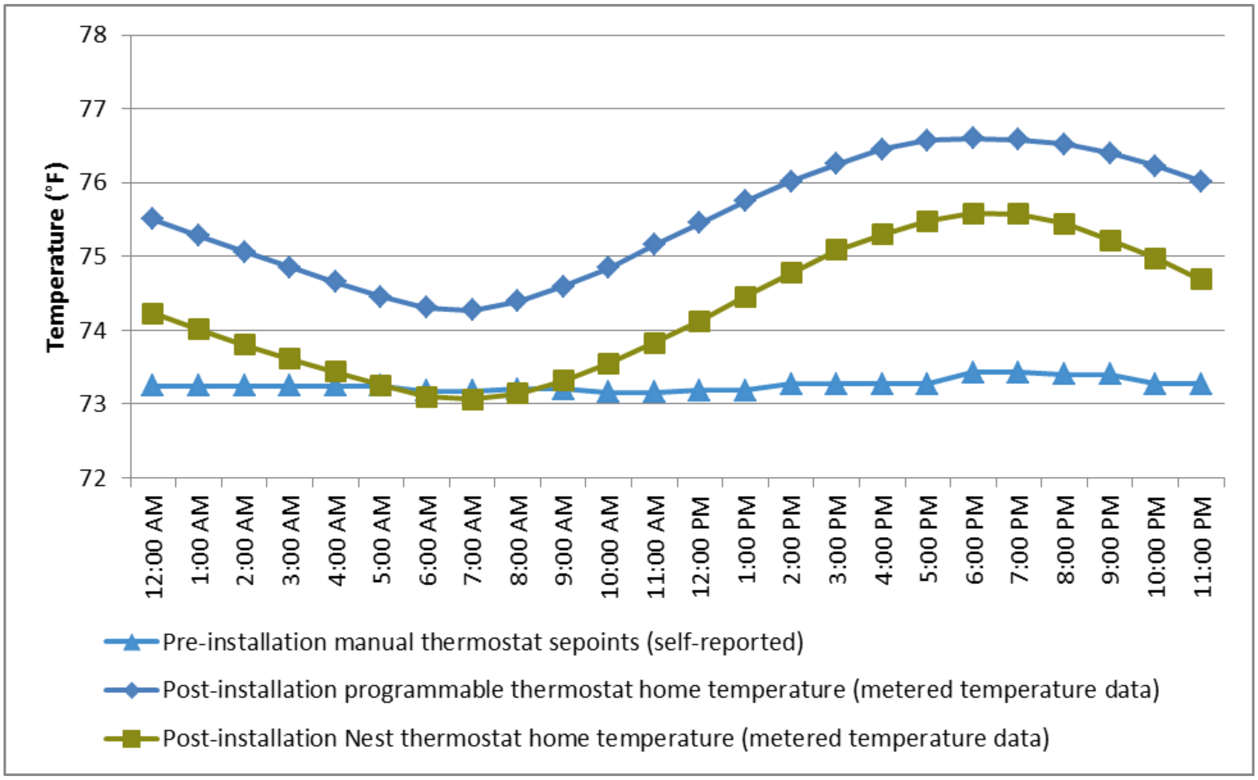


Figure 19. Self-reported Setpoints for Manual Thermostats Compared to Metered Indoor Temperatures for Programmable and Nest Thermostats (Weekends)



Compared to participants' self-reported baseline cooling setpoints, participants with Nest and programmable thermostats had higher indoor temperatures during the cooling season, with the programmable thermostat participants having the highest indoor temperatures. For both participant groups, the highest indoor temperatures occurred between the hours of 7:00 a.m. and 5:00 p.m. or 6:00 p.m. This is also the period when air conditioner run time was highest (see Air Conditioner Run Time Analysis section), so we assume indoor temperatures begin to drop at 5:00 p.m. or 6:00 p.m. due to a drop in outdoor temperature at night. On average, the homes with programmable thermostats had indoor temperatures 1.3 degrees warmer than the homes with the Nest thermostats.

Air Conditioner Run Time in Cooling Season

Cadmus used participant air conditioner run time logger data to understand how participants used their air conditioners. Figure 20 and Figure 21 show the average hourly metered air conditioner run time on weekdays and weekends, respectively.

Figure 20. Average Hourly Metered Air Conditioner Run Time During Cooling Season on Weekdays (n=192)

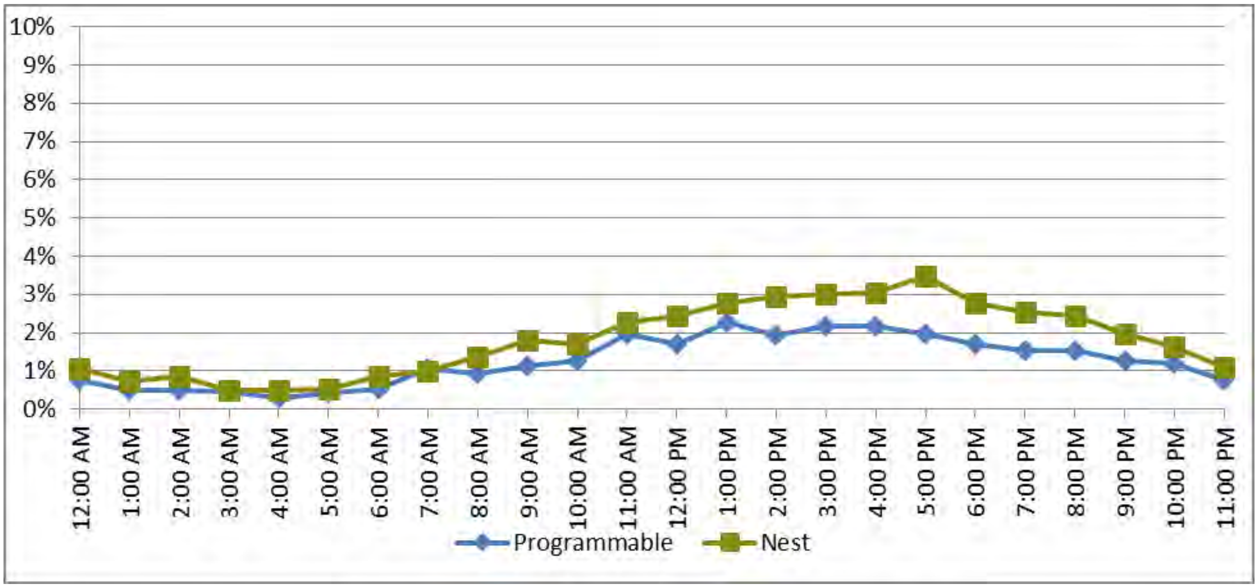
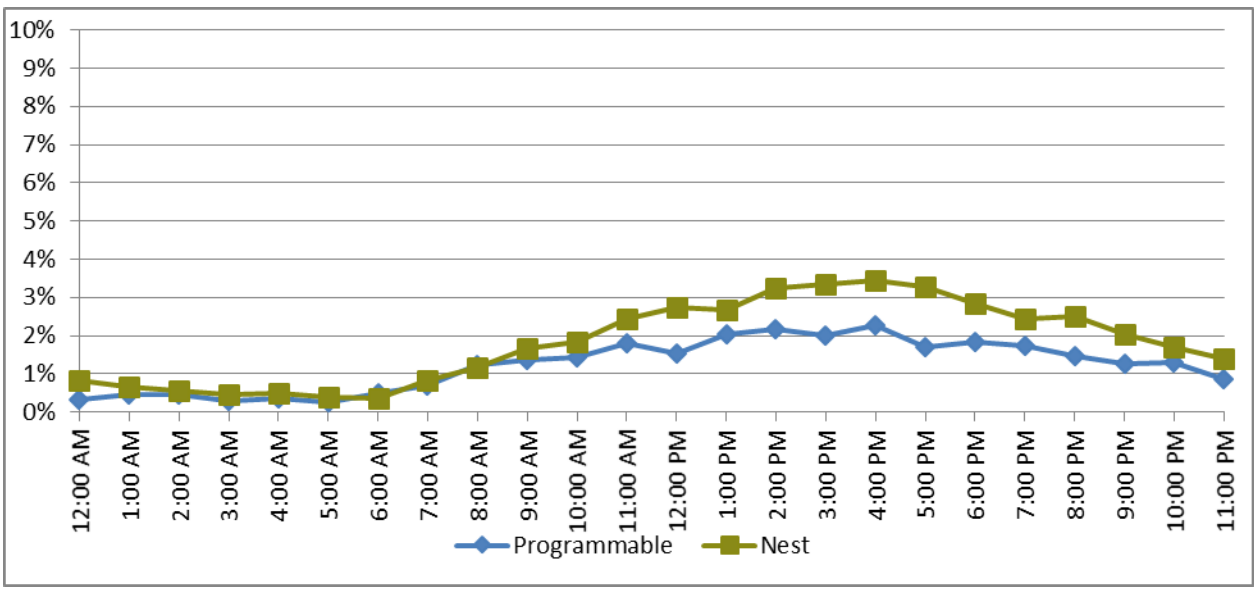


Figure 21. Average Hourly Metered Air Conditioner Run Time During Cooling Season on Weekends (n=192)



On weekdays and weekends, homes with the Nest thermostat had slightly higher air conditioner run times compared to programmable thermostat homes (1.8% compared to 1.3% on weekdays and 1.8% compared to 1.5% on weekends). The overall average run time was 1.8% in Nest homes and 1.2% in programmable thermostat homes. The slightly higher run times in Nest homes is expected because the Nest participant group had a 21% higher pre-installation cooling electric usage. We assume the higher pre-installation usage in the Nest participant group is attributable to the Nest participant homes having higher occupancy (and thus higher cooling loads) compared to programmable thermostat homes (see occupancy data in Demographics section).

Participant Behavior

Participant behavior is a primary driving factor for achieving energy savings with thermostats. To assess participant behavior among programmable thermostat users, Cadmus evaluated how participants operated their thermostats using their survey data and metered indoor temperature data. To assess behavior among Nest participants, we evaluated participant engagement with the thermostat by looking at Wi-Fi connectivity.

Programmable Thermostat Operation

Cadmus categorized the programmable thermostat participants' post-installation behaviors based on their survey responses and space temperature data. Table 20 shows programmable thermostat participant behavior based on their survey responses.

Table 20. Self-reported Programmable Thermostat Participant Behavior (Based on Survey Responses)

Participant Behavior	Manual (Baseline) (n=521)	Programmable (n=176)
I manually change the thermostat settings	96%	46%
I use a single setpoint	4%	32%
I rely on my thermostat to change	N/A*	22%
Total	100%	100%

*Manual thermostat users cannot rely on their thermostat to change because they cannot program schedules.

Compared to baseline (pre-installation) case, a significantly higher percentage of programmable thermostat participants reported using a single setpoint (32% compared to 4%). Based on participant responses, programmable thermostats converted approximately one-fifth of participants from manually adjusting their thermostat to programming their thermostats.

Table 21 shows participants' categorized behavior based on temperature data compared to their survey responses for programmable thermostat users.

Table 21. Programmable Thermostat Behavior (Based on Metered Temperature Data)

Assumed Thermostat Setting	Survey Responses (n=176)	Temperature Logger Data (n=125)
Rely on Thermostat Program	22%	37%
Override Thermostat Program	78%	51%
Cannot Determine	N/A	12%
Total	**100%**	**100%**

When comparing the results of the temperature data analysis and survey responses, programmable thermostat participants appear to rely on their thermostat program more than is reported. This may be because some participants manually adjust their thermostat with regular setbacks, making their temperature setting profile appear like a programmed schedule. However, only 37% of participants appear to have relied on their thermostat program by the end of the study period.

Nest Participant Engagement

Cadmus also assessed Nest participants' engagement with their thermostat using data provided by Nest Labs. Table 22 shows the level of customer engagement of program participants with Nest thermostats compared to the general (nonparticipant) population of Nest users in Indiana who ordered a thermostat from nest.com.

Table 22. Customer Engagement of Program Nest Population Compared to Indiana Nest Population*

Population of Nest Users	Nests Shipped	Nests Connected**	Nests Connected (%)	Nests Registered***	Nests Registered (% of Connected)	Nests Registered (% of Total)
Program	300	249	83.0%	185	74.3%	61.7%
Indiana****	N/A	N/A	95.3%	N/A	90.0%	85.8%

*Data provided by Nest Labs

**Connected thermostats include all Nests that were ever connected to the internet

***Registered Nests include all Nests that were "paired" to a structure, which occurs when the customer sets up an account so they can use the app, web account, etc.

**** The Indiana Nest population "connected" rate is based on Indiana orders from nest.com. The "registered" rate is based on all Indiana connected devices.

Program participants with the Nest thermostat were less likely to connect their thermostat to the internet and register their Nest compared to the general population of Nest users in Indiana who ordered a thermostat from nest.com. Eighty-three percent of program participants connected their Nest thermostat to the internet, whereas 95% of Nest users in Indiana connected their thermostats to the internet. Readers should note that we would expect users who use the internet to order a thermostat from nest.com to be more likely to connect their thermostat to the internet.

Although the Nest's Auto-Schedule and Auto-Away feature work without an internet connection, there are several features participants cannot use without an internet connection: the Nest's HVAC control algorithms cannot receive the latest updates, participants cannot control their thermostat remotely using a smartphone, tablet or computer, and participants cannot receive the monthly e-mailed energy reports. Because participants who did not connect their Nest could not use these features, the program population might have less potential for energy savings than the general population of Indiana residents who purchased a Nest thermostat outside of the program. Readers should note, however, that Cadmus did not evaluate the impact of algorithm updates, remote control, or monthly energy reports on participant energy use.

Of the participants who did connect their thermostats to the internet, 74% of program participants registered their thermostats compared to 90% of users in Indiana with internet-connected Nests. The lower percentage of registered Nests among program participants might indicate that program participants were slightly less engaged with their thermostats than the general population of Nest users in Indiana. The reason for this disparity in engagement might be because the program was designed to offer the Nest for free; customers were not necessarily motivated to engage with their Nest on their own. The lower level of engagement in registering the thermostat could be an indicator of less engagement in using Nest's features (such as the remote control and energy reports) and could consequently be an indicator of slightly lower potential for energy savings compared to registered thermostats. However, readers should note that our analysis of the indoor temperature profiles indicate the Auto-Away and Auto-Schedule features are the key cause of savings with Nest and these features work even if the thermostat is not connected or registered. Still, a program designed to offer incented thermostats, rather than free thermostats, could attract customers who are more likely to be engaged with their thermostat and consequently might increase energy savings potential slightly.

Participant Demographics and Satisfaction Ratings

Cadmus used participant surveys to collect demographic and satisfaction ratings from program participants. This section assesses the differences in demographics between the programmable and Nest thermostat groups and how these might have caused the observed differences in energy savings and indoor temperatures. Evaluated demographics include participant age, occupancy, household income, and home age.

Demographics

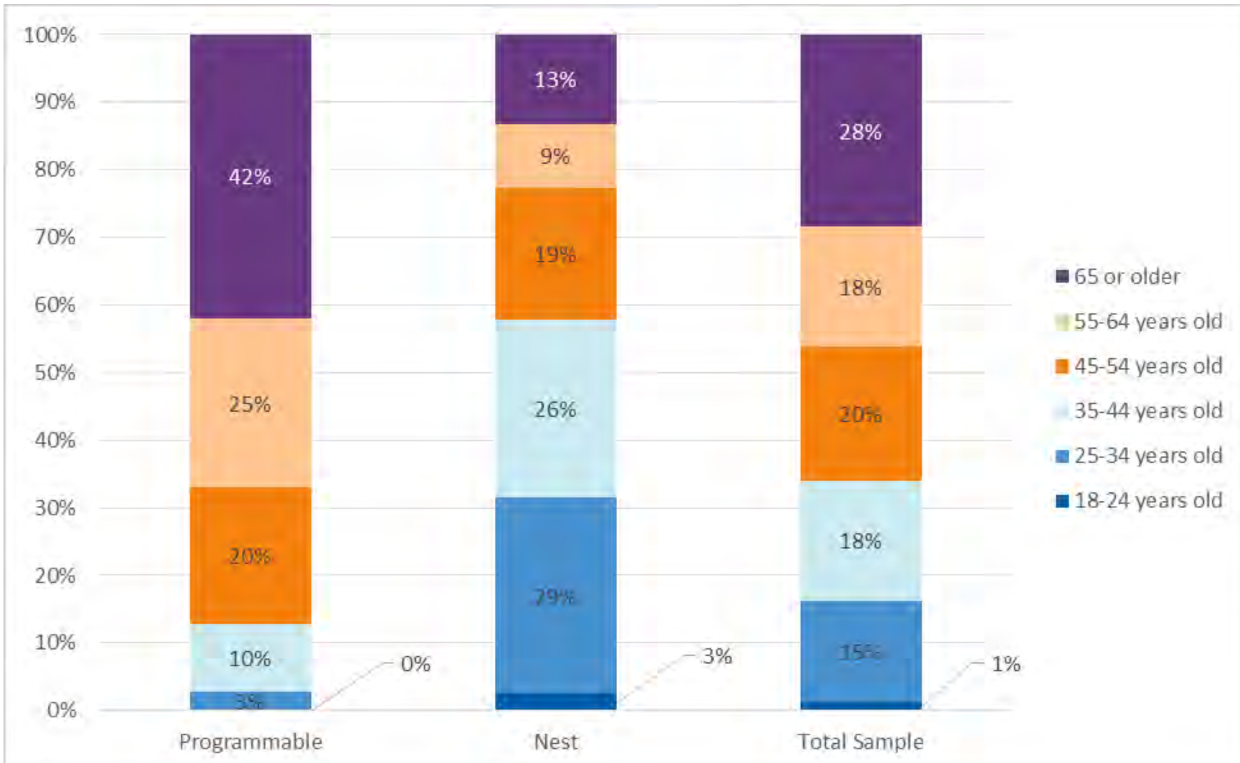
Cadmus used the pre-installation survey to assess the demographics of the participant population.

Participant Age

Of the 583 participants who responded to the pre-installation survey, 338 (58%) provided their age. Figure 22 shows the ages of participants as reported in the participant surveys.

Figure 22. Age of Participant Population by Participant Group

($n_{progrrammable}$=179, n_{nest}=159, n_{total}=338)



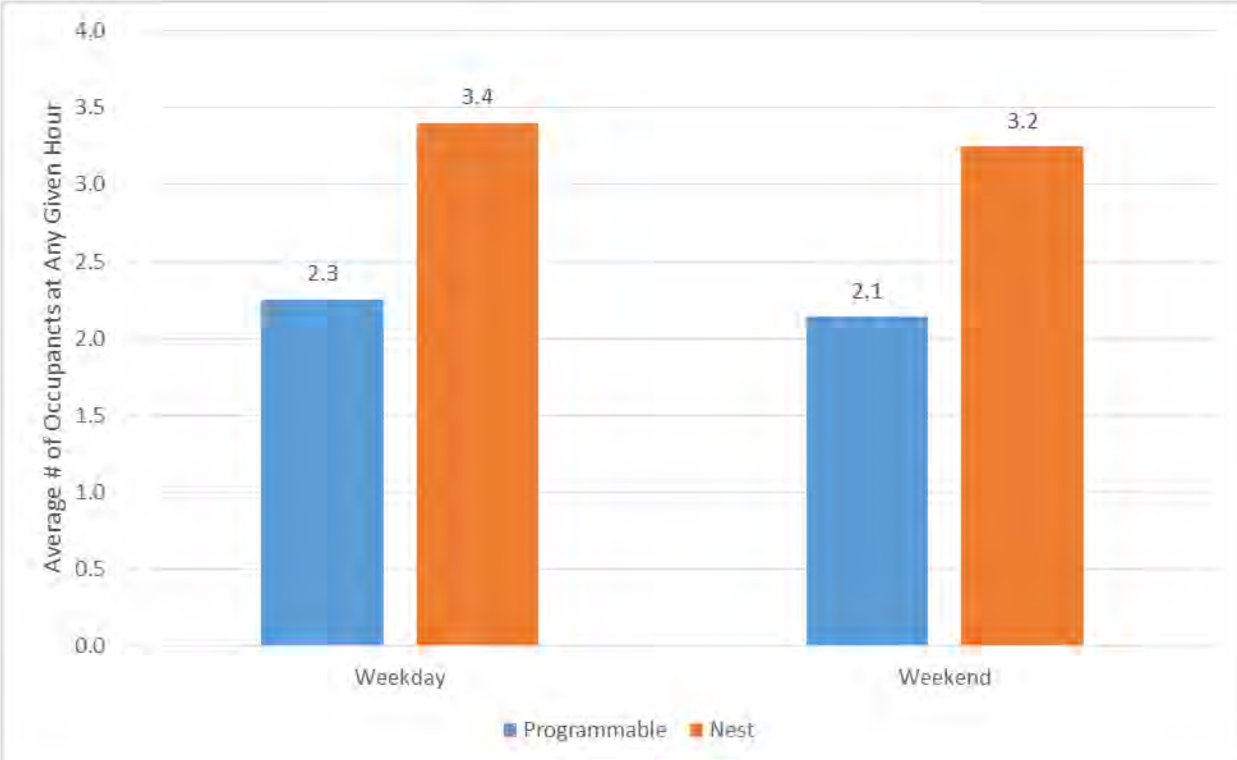
Of the participants who reported their age, 46% are over 55 years of age, with 28% over the age of 65. Based on the survey responses, the programmable thermostat group had more than three times the participants over age 65 compared to the Nest thermostat group (42% compared to 13%). Participants over the age of 65 are more likely to be retired and home on weekdays. Assuming this is true for the sample, the potential for energy savings from weekday daytime setbacks is lower in homes with participants over age 65 compared to under age 65. The loss of potential for weekday daytime savings for this demographic is greater in homes with the Nest than programmable thermostat because Nest's Auto-Away and Auto-Schedule features have the largest impact on savings during this period (as shown in temperature data analysis). In addition, assuming participants over age 65 are less likely to use smartphone, tablet, and computer technologies, this demographic is less likely to control Nest remotely and view monthly energy report e-mails.

Occupancy

In the pre-installation survey, we asked participants to provide the number of home occupants for each hour of the day on weekdays and weekends. Of the 583 participants who responded to the survey, 500 (86%) reported their home occupancy. Based on survey responses, there was no significant difference in occupancy during daytime versus nighttime, so we averaged the reported occupancy for each hour. The average number of occupants for any given hour on weekdays and weekends are shown by participant group in Figure 23.

Figure 23. Household Occupancy by Participant Group

($n_{progrrammable}$=**249**, n_{nest}=**251**)



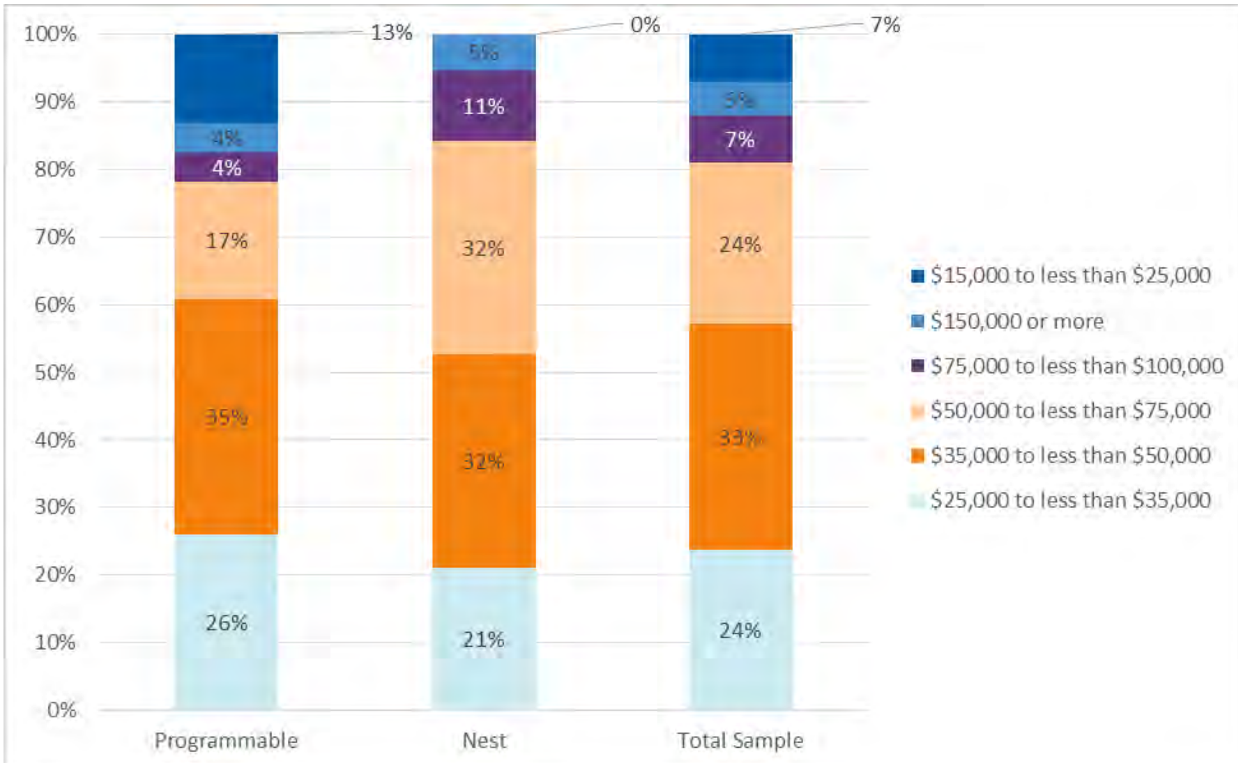
The average number of occupants for any given hour was higher in Nest homes compared to programmable thermostat homes. On weekdays, Nest thermostat homes reported having an average of 3.4 occupants, whereas programmable thermostat homes reported having an average of 2.3 occupants. On weekends, Nest thermostat homes reported having an average of 3.2 occupants, whereas programmable thermostat homes reported having an average of 2.1 occupants. The higher occupancy in Nest thermostat homes could explain why the baseline cooling loads were 11% higher per square foot in Nest homes compared to programmable thermostat homes (2.0 kWh/sqft compared to 1.8 kWh/sqft) and why the air conditioner run times were higher in Nest homes compared to programmable thermostat homes (35% compared to 25%).

Household Income

Of the 583 participants who responded to the survey, 42 (7%) reported their income. Income levels by participant group are shown in Figure 24.

Figure 24. Reported Household Income by Participant Group

($n_{progrrammable}$=23, n_{nest}=19, n_{total}=42)



Based on survey responses, the household incomes in the Nest participant group were higher compared to the programmable thermostat participant group. In the Nest participant group, 48% reported household incomes $50,000 or greater, compared to 38% of the participants in the programmable thermostat group. When interpreting these results, readers should note that only 7% of program participants reported their household income, and 21% more Nest participants reported their income compared to programmable thermostat participants (23 Nest participants compared to 19 programmable thermostat participants).

Home Age

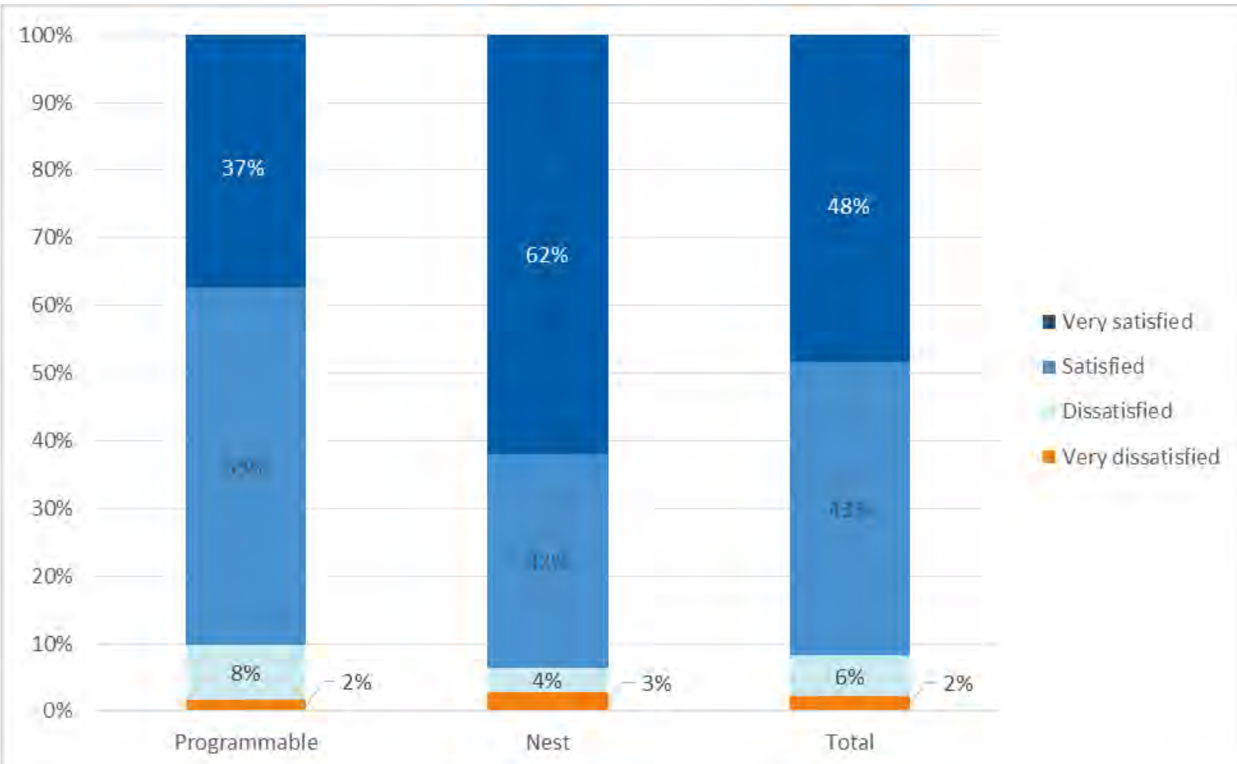
Of the 583 participants who responded to the survey, 84% (492) reported their home age. We received similar response rates from both participant groups: 83% (249) Nest participants and 81% (243) of programmable thermostat participants reported home age. The average year of home construction in both groups was approximately the same (1962 in Nest homes and 1961 in programmable thermostat homes).

Satisfaction with Thermostat

Cadmus used the post-installation survey to assess participants' satisfaction with their thermostats. Figure 25 show participant satisfaction with the programmable thermostat and the Nest thermostat, respectively, as reported in their customer surveys.

Figure 25. Satisfaction with Thermostat by Participant Group

($n_{progrrammable}$=174, n_{nest}=142; n_{total}=316)



Although a similar percentage of participants in each group were satisfied with their thermostat (90% of programmable thermostat users and 94% of Nest users reported being with "satisfied" or "very satisfied"), more participants with the Nest thermostat reported being "very satisfied" (62% of Nest participants compared to 37% of programmable thermostat participants). Participants with a standard programmable thermostat were more likely than participants with a Nest thermostat to be "very dissatisfied" with their thermostat. Four percent of survey respondents with a programmable thermostat and 1% of survey respondents with a Nest thermostat reported being "very dissatisfied." Most of the respondents with a programmable thermostat who reported being "dissatisfied" or "very dissatisfied" cited the thermostat was difficult to use or program. Not enough Nest participants provided responses to identify any common reasons for being dissatisfied.

Conclusions

Gas Savings

Overall, participants with the Nest thermostat reduced their heating gas consumption by approximately 12.5%, compared to only 5.0% for those who used a standard programmable thermostat. Our findings indicate the gas savings are higher in the Nest thermostat homes due to a reduction in indoor temperature during the daytime on weekdays. On weekdays between 9:00 a.m. and 10:00 p.m., the temperatures in Nest homes was an average of 0.7 degrees lower than homes with a programmable thermostat. Because this is a common time for homes to be unoccupied, we assume the reduction in temperature during this period is attributable either to Nest's Auto-Away feature, which automatically triggers a setback when it senses the home is unoccupied, or its Auto-Schedule feature, which uses a data on how participants manually set their thermostat to automatically program a schedule of setbacks.

The Auto-Away feature has an especially significant impact on participants who frequently override their thermostat setbacks by automatically reinstating setbacks when they go away. (Note that programmable thermostat cannot reinstate an overridden setback until the next setback period.) Based on our analysis of thermostat operation, 51-78% of programmable thermostat users override their programmed schedule. As a result, the Nest has greater potential than the programmable thermostat to capture savings during the daytime on weekdays, when many participants might leave home without turning down their thermostats.

Electric Savings

Participants in the Nest and programmable thermostat groups reduced cooling electric consumption by approximately the same amount (13.9% and 13.1%, respectively). Despite nearly the same percentage of savings, Nest participants had a slightly higher average air conditioner run time (1.8%) compared to programmable thermostat participants (1.2%). The baseline cooling electric usage in the Nest participant group was 21% higher than the baseline for the programmable thermostat group, so we would expect the air conditioner run time for Nest participants to be higher. We assume the higher pre-installation usage in the Nest participant group is attributable to the Nest participant homes having higher occupancy (and thus higher cooling loads) compared to programmable thermostat homes.

Participant Satisfaction

Participants with a Nest thermostat were more likely to report being satisfied with their thermostat than participants with a programmable thermostat. Of participants who responded to a customer survey, 90% of programmable thermostat users and 94% of Nest thermostat users reported that they were "satisfied" or "very satisfied" with their thermostat.

Interpreting Results

When interpreting the results of this study, readers should take the following considerations into account.

Program Design

Depending on the design of future thermostat programs, this program might not represent an appropriate comparison of the Nest and programmable thermostat savings. This program design included professional installation of the Nest and programmable thermostats. Without a professional installer, a major advantage of the Nest thermostat is that it is designed to be easy for the user to adopt a schedule of setbacks. With the Auto-Schedule feature, the Nest automatically programs a schedule of setbacks using data on how participants manually set their thermostat. Alternatively, a standard programmable thermostat must be programmed by the user. As described in the introduction, and as shown in our analysis of thermostat operation, many users discontinue (or never start) using a programmed schedule. If future program designs do not include professional installation of the thermostats, then the Nest might yield more savings in comparison to the programmable thermostat than this study indicates.

Another characteristic of this program design that might slightly reduce the energy savings potential compared to other program designs is the offering of the thermostats for free. Because the thermostats were free, customers were not necessarily motivated to engage with their programmable or smart thermostat on their own. A program designed to offer incented thermostats, rather than free thermostats, could attract customers who are more likely to be engaged with their thermostat and consequently slightly increase energy savings potential.

Persistence of Savings

When interpreting the results of this study, readers should note that this evaluation only assessed the energy savings impact of Nest and programmable thermostats in the first year after the thermostat installation; the energy savings impact might change over time. Savings from a standard programmable thermostat might degrade over time if users override their schedules. Based on our analysis of thermostat operation, 51-78% of programmable thermostat users override their programmed schedule. In contrast, savings from the Nest thermostat have the potential to increase over time due to the Auto-Schedule feature learning over time and automatically scheduling setbacks, and due to automatic algorithm updates for thermostats connected to internet.

Energy Savings Potential

When comparing the energy savings potential between the Nest and programmable thermostats, readers should note that because the Nest is connected to the internet, users have the potential to participate in additional energy efficiency utility programs that programmable thermostat users cannot. For example, two programs Nest offers to utility partners are the Rush Hour Rewards program and Seasonal Savings program. The Rush Hour Rewards program is a demand response program that pays participants for allowing the Nest thermostat to automatically adjust their temperature settings before and during peak demand hours to reduce demand. The Seasonal Savings program tunes-up participants' setback schedules at the beginning of each winter and summer season in an effort to ensure users maintain energy-efficient schedules. Readers should note that Cadmus has not evaluated the energy savings impact of any of Nest's utility programs.

Appendix A: Pre-Installation Survey

Program Explanation

Thank you for participating in the Vectren thermostat study. The information gathered from this survey will help us evaluate your thermostat technology.

Estimated Time: 10-15 minutes

Program Awareness

1. What motivated you to participate in this study? Please check all that apply.

   ☐ Keep up with latest technology and trends

   ☐ Saving money on my energy bills

   ☐ Saving energy

   ☐ Having a thermostat that gives me more control over room temperature

   ☐ Getting a free thermostat

   ☐ Wanting to replace a broken thermostat

   ☐ Wanting to replace a poorly working thermostat

   ☐ Participating in another Vectren program (if yes, please specify below)
   Vectren program (if applicable): ___________________________

General Thermostat Settings

2. Which of the following best describes how you use your current thermostat?

   ☐ I manually change the settings using a regular schedule

   ☐ I manually change the settings using no regular schedule (depending on weather and/or home activity)

   ☐ I use a single setpoint throughout each season (winter, spring, summer, fall)

   ☐ Other: ____

3. How do you plan to use your new thermostat?

   ☐ I plan to program my thermostat with different temperatures for different times of day

   ☐ I plan to let my thermostat learn my schedule and program itself (Nest participants only)

   ☐ Other: ____

4. In general, how do you decide what temperature to set your thermostat to? Please check all that apply.

☐ Based on comfort

☐ Based on trying to keep my utility bill low

5. Please select any supplemental heating you use:

☐ Electric space heater

☐ Gas fireplace

☐ Wood burning stove/fireplace

☐ Other supplemental heating (if applicable):___________________

☐ N/A

Heating Season Settings

6. How do you typically set your thermostat on a weekday during the heating season?

6am-8am	8am-10am	10am-12pm	12pm-2pm	2pm-4pm	4pm-6pm	6pm-8pm	8pm-10pm	10pm-12am	12am-6am

7. How do you typically set your thermostat on a weekend during the heating season?

6am-8am	8am-10am	10am-12pm	12pm-2pm	2pm-4pm	4pm-6pm	6pm-8pm	8pm-10pm	10pm-12am	12am-6am

8. How do you typically set you thermostat when you are away for an extended period of time, such as for vacation, during the heating season?

☐ Temperature: _____

☐ I turn my thermostat off

☐ I do not adjust my thermostat when away for an extended time

Cooling Season

9. How do you typically set your thermostat on a weekday during the cooling season?

6am-8am	8am-10am	10am-12pm	12pm-2pm	2pm-4pm	4pm-6pm	6pm-8pm	8pm-10pm	10pm-12am	12am-6am

10. How do you typically set your thermostat on a weekend during the cooling season?

6am-8am	8am-10am	10am-12pm	12pm-2pm	2pm-4pm	4pm-6pm	6pm-8pm	8pm-10pm	10pm-12am	12am-6am

11. How do you typically set your thermostat when you are away for an extended period of time, such as for vacation, during the cooling season?

☐ Temp: _____

☐ Off

☐ I do not adjust my thermostat when away during the daytime

12. I plan to continue using the same weekday, weekend, and away thermostat settings with my new thermostat.

☐ True

☐ False

If you selected False, please describe how you plan to change your thermostat settings.

____

Demographics

13. How informed are you about all the ways you can save energy in your home?

☐ Very informed

☐ Somewhat informed

☐ Neither informed nor uniformed

☐ Somewhat uninformed

☐ Very uninformed

14. Do you own or rent your home?

☐ Own

☐ Rent

15. What is the approximate age of your home?

☐ ______ years

☐ Don't know

16. How many people typically occupy your home during weekdays?

Temp	6am-8am	8am-10am	10am-12pm	12pm-2pm	2pm-4pm	4pm-6pm	6pm-8pm	8pm-10pm	10pm-12am	12am-6am
Adults										
Teenagers										
Children										
Infants										

17. How many people typically occupy your home during weekends?

Temp	6am-8am	8am-10am	10am-12pm	12pm-2pm	2pm-4pm	4pm-6pm	6pm-8pm	8pm-10pm	10pm-12am	12am-6am
Adults										
Teenagers										
Children										
Infants										

18. Which of the following best describes your total annual household income before taxes?

☐ Less than $15,000

☐ $15,000 to less than $25,000

☐ $25,000 to less than $35,000

☐ $35,000 to less than $50,000

- ☐ $50,000 to less than $75,000
- ☐ $75,000 to less than $100,000
- ☐ $100,000 to less than $150,000
- ☐ $150,000 or more
- ☐ I prefer not to answer this question

19. Which of the following best describes your age?
    - ☐ Less than 18 years old
    - ☐ 18-24 years old
    - ☐ 25-34 years old
    - ☐ 35-44 years old
    - ☐ 45-54 years old
    - ☐ 55-64 years old
    - ☐ 65 years or older

20. Gender
    - ☐ Male
    - ☐ Female

Customer Satisfaction

Please select a rating to indicate your satisfaction with the following:

21. The contractor was knowledgeable about the Nest Thermostat Program.

    1—Strongly Disagree 2—Disagree 3—Neutral 4—Agree 5—Strongly Agree

22. The contractor conducted himself/herself in a professional manner.

    1—Strongly Disagree 2—Disagree 3—Neutral 4—Agree 5—Strongly Agree

23. I was satisfied with the time it took for my thermostat to be installed.

    1—Strongly Disagree 2—Disagree 3—Neutral 4—Agree 5—Strongly Agree

24. My overall experience in the Vectren program was positive.

    1—Strongly Disagree 2—Disagree 3—Neutral 4—Agree 5—Strongly Agree

25. Additional Comments:

____

Vectren Smart Thermostat Release Information

As a participant in VECTREN's Smart Thermostat Program and upon completion of installation, you will be required to provide an electronic signature on the Customer Agreement of Terms & Conditions form. By signing the form, you agree to the terms and conditions detailed below. The terms and conditions are as follows:

- Vectren reserves the right to alter or discontinue the Smart Thermostat Program and all other Vectren rebate offers at any time without notice.
- Programmable thermostats are limited and are available on a first-come, first-served basis.
- Vectren does not guarantee that energy efficiency measures installed, or services provided through this program, will result in energy and cost savings.
- Vectren reserves the right to deny or limit any request for services.
- No warranties on product or service installations are provided by Vectren. The program provider, WES, warrants installation services and all products for defects in workmanship or materials for one (1) year following installation. Home owners should call (866) 611-5404 for service.
- Vectren and the Program Administrator, CLEAResult, disclaim any and all liability, loss or damage, and make no guarantees related to participation in the Smart Thermostat Program, including liability arising out of the use or installation of the equipment, sharing of any energy usage and billing data with third parties, and any taxes that may be imposed as a result of participation in the program.
- Participant agrees and consents to Vectren sharing participant's energy usage and billing data collected during the data collection period with other third parties. Participant agrees to waive any and all liability arising out of Vectren sharing participant's energy usage and billing data with other third parties.

Please Sign Below to Accept   Email

________________________   ___________________________

Click to Accept and Complete Survey

[The website then notified customer if they had missed any questions in the survey. If complete, the site provides a timestamp of when the survey was completed.]

Appendix B: Air Conditioner/Heat Pump Data Collection

This appendix outlines the types of air conditioner and heat pump data Cadmus collected to analyze savings for the Nest Thermostat Program.

Condenser

Cadmus collected the following information on the program participant condensers:

- Information collected:
    - Type (air conditioner or heat pump)
    - Make
    - Model number
    - Serial number
    - Refrigerant type (e.g., R-410A or R-22)
    - Year or age (as available)
    - Efficiency rating as available (SEER, EER, HSPF (for heat pump only), COP (for heat pump only)
- Photographs (such as those shown in Figure 26) taken of:
    - Condenser
    - Nameplate (must be legible)

Figure 26. (Left to right): Standard 2.5-Ton Carrier Air Conditioner, Standard 2.5-Ton Carrier Heat Pump, Nameplate of Heat Pump

Evaporator

Cadmus collected the following data of the program participant and evaporators:

- Information collected:
    - Make
    - Model number

  - Serial number
  - Metering device (e.g., fixed orifice or TXV)
- Photographs (such as that shown to the right) taken of nameplate

Air Handler

Cadmus collected the following information and photographs of the program participant air handlers:

- Information collected:
  - Make
  - Model number
  - Serial number
  - Fan motor type (PSC or ECM)
- Photographs (such as those shown above) taken of fan motor (where accessible)

Survey Collection

Cadmus field technicians had participant customers fill out a program survey while they were on-site installing equipment. The homeowner would fill out a survey, which was contained on an iPad tablet and took about 10 minutes.

Thermostat and HVAC Meter Installation

Data Collection

Cadmus collected heating and cooling system make and model information, as well as thermostat type and homeowner-preferred setpoints for each season. We recorded a description of the thermostat's scheduled program (where applicable).

Types of Loggers

Cadmus installed the following types of loggers:

- Thermostat temperature and humidity (Onset UX100-003 Temp/RH Logger, shown below)

- Motor on/off (Onset UX90-004 State Logger, shown below)

Installation Procedure – Thermostat Logger

Cadmus' installation procedure for thermostat loggers was to calibrate and launch them prior to arriving at the home. To install, Cadmus placed the thermostat temperature logger on or near each thermostat in the home. Figure 27 shows proper placement of a thermostat logger.

Figure 27. Thermostat Logger Installed Near Programmable (left) and Nest (right) Thermostats

If Cadmus could not place the logger on top of the thermostat, we used 3M double-sided adhesive to attach it to the thermostat. We avoided using adhesive on any walls, as removal can be difficult. If Cadmus could not place the logger on or attach it to the thermostat, or if the homeowner preferred to have it out of sight, Cadmus asked the homeowner to suggest a location that is representative of the indoor temperature controlled by the thermostat.

In order to ensure accurate data collection, Cadmus did not place any loggers in the following areas:

- Drawers or closet
- Near lights

- Near windows
- Near doors
- In or near the kitchen
- Near auxiliary heat sources, such as a unitary electric heater or fireplace, with the exception of rooms that are heated by secondary sources and do not contain the primary heating thermostat
- In or near bathrooms
- Near any type of electric load that generates heat (such as a TV or computer)

Cadmus recorded the following data during site visits, in addition to taking a photograph of the logger:

- Thermostat location
- Logger type and serial number
- Site identification number

Installation Procedure – Air Conditioner Logger

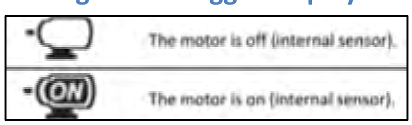
Cadmus installed run-time loggers to record the precise time the air conditioner condensers turned on and off. The run-time data loggers recorded motor on and off conditions by sensing an alternating current magnetic field. These motor loggers are not normally weatherproof, so Cadmus placed them in weatherproof heat-sealed plastic bags. We calibrated each logger's sensitivity (set to maximum sensitivity) and launched it prior to arriving at the home. Cadmus installed these loggers either on top of the condenser (Figure 28) or on the conduit to the condenser (Figure 29).

Figure 28. Motor Logger on Condenser

Figure 29. Motor Logger on Electric Conduit to Condenser

Cadmus verified proper placement of each motor logger by noting the logger response when the motor was running. Figure 30 shows the LED icons the logger displayed to show when the motor was on or off.

Figure 30. Logger Display



In addition to taking a photograph of each air conditioner logger, Cadmus recorded the following information during the site visit:

- Condenser location
- Logger type and serial number
- Site identification number

Appendix C: Post-Installation Customer Surveys

Cadmus mailed post-installation customer surveys to participants on July 17, 2014. We created one version for participants who received loggers, which included instruction on removing and returning the loggers, and one version for participants who did not receive loggers. Blank copies of each survey version are below.

Instructions

1. Please fill in each bubble completely.
2. Please return by July 25, 2014.
3. To return, place in included pre-paid bubble mailer with temperature sensor(s) and air conditioner logger and leave in any USPS mailbox.
4. If your mailbox has a signal flag, you can leave package in your mailbox and raise the flag to signal pick-up.

1. What type of thermostat do you have?
   - O Honeywell
   - O Nest

2. How do you control your thermostat?
   - O I manually adjust the temperature as needed
   - O I use a single temperature setting
   - O I rely on my thermostat to change the temperature at different times of day
   - O I use a mobile app to adjust the temperature as needed (Nest owners only)

3. Did the number of occupants in your home increase or decrease since your thermostat was installed?
   - O Yes, increased (# of additional occupants:____)
   - O Yes, decreased (# of fewer occupants: ____)
   - O No

4. Since your thermostat was installed, were any new appliances or equipment installed in your home that require additional **natural gas** usage?
   - O Yes (Items:____________________________)
   - O No

5. Since your thermostat was installed, were any new appliances or equipment installed in your home that require additional **electricity** usage?
   - O Yes (Items: ____________________________)
   - O No

6. Were you away from your home during the 2013-2014 heating season (winter months)?
   - O Yes (approximate # of days: ____)
   - O No

7. If you answered "Yes", were you away more, less, or about the same as the previous winter (2012-2013)?
   - O More
   - O Less
   - O About the same

8. Were you away from your home during the 2014 cooling season (summer months)?
   - O Yes (approximate # of days: ____)
   - O No

9. If you answered "Yes", were you away more, less, or about the same as the previous summer (2013)?
   - O More
   - O Less
   - O About the same

10. Other than weather, were there any other changes that occurred since your thermostat was installed that would cause your energy usage to be higher or lower than the previous year?
    - O Yes, higher
    - O Yes, lower
    - O No
    - O If Yes, describe: _________________________
      ____

11. How satisfied are you with your current thermostat?
    - O Very satisfied
    - O Satisfied
    - O Dissatisfied
    - O Very dissatisfied

12. If you answered "Dissatisfied" or "Very dissatisfied", please describe why: _________________________
    ____

13. How satisfied are you with the Vectren thermostat program?
    - O Very satisfied
    - O Somewhat satisfied
    - O Not too satisfied
    - O Not at all satisfied

14. If you answered "Dissatisfied" or "Very dissatisfied", please describe why: _________________________
    ____

15. Please provide us with any feedback about the program: ___________________________________
    ____

Thank You!

Your feedback will help to improve our programs. To be entered in a drawing to win a

$250 gift card

please enter your contact information below.*

Name: ___________________________________

Address: _________________________________

Phone: __________________________________

If you have questions, please contact the Cadmus Group at 617-673-7139.

Instructions

1. <u>Please fill in each bubble completely</u>.
2. Please return by July 25, 2014.
3. To return, fold survey in thirds, seal with included sticker, and leave in any USPS mailbox. Postage is already paid.
4. If your mailbox has a signal flag, you can leave envelope in your mailbox and raise the flag to signal pick-up.

1. What type of thermostat do you have?
   - O Honeywell
   - O Nest

2. How do you control your thermostat?
   - O I manually adjust the temperature as needed
   - O I use a single temperature setting
   - O I rely on my thermostat to change the temperature at different times of day
   - O I use a mobile app to adjust the temperature as needed (Nest owners only)

3. Did the number of occupants in your home increase or decrease since your thermostat was installed?
   - O Yes, increased (# of additional occupants:____)
   - O Yes, decreased (# of fewer occupants: ____)
   - O No

4. Since your thermostat was installed, were any new appliances or equipment installed in your home that require additional **natural gas** usage?
   - O Yes (Items:____________________________)
   - O No

5. Since your thermostat was installed, were any new appliances or equipment installed in your home that require additional **electricity** usage?
   - O Yes (Items: ____________________________)
   - O No

6. Were you away from your home during the 2013-2014 heating season (winter months)?
   - O Yes (approximate # of days: ____)
   - O No

7. If you answered "Yes", were you away more, less, or about the same as the previous winter (2012-2013)?
   - O More
   - O Less
   - O About the same

8. Were you away from your home during the 2014 cooling season (summer months)?
   - O Yes (approximate # of days: ____)
   - O No

9. If you answered "Yes", were you away more, less, or about the same as the previous summer (2013)?
   - O More
   - O Less
   - O About the same

10. Other than weather, were there any other changes that occurred since your thermostat was installed that would cause your energy usage to be higher or lower than the previous year?
    - O Yes, higher
    - O Yes, lower
    - O No
    - O If Yes, describe: _________________________

      ____

11. How satisfied are you with your current thermostat?
    - O Very satisfied
    - O Satisfied
    - O Dissatisfied
    - O Very dissatisfied

12. If you answered "Dissatisfied" or "Very dissatisfied", please describe why: _________________________

    ____

13. How satisfied are you with the Vectren thermostat program?
    - O Very satisfied
    - O Somewhat satisfied
    - O Not too satisfied
    - O Not at all satisfied

14. If you answered "Dissatisfied" or "Very dissatisfied", please describe why: _________________________

    ____

15. Please provide us with any feedback about the program: ________________________________

    ____

Thank You!

Your feedback will help to improve our programs. To be entered in a drawing to win a

$250 gift card

please enter your contact information below.*

Name: ____________________________________

Address: __________________________________

Phone: ____________________________________

If you have questions, please contact the Cadmus Group at 617-673-7139.

SOUTHERN INDIANA GAS AND ELECTRIC COMPANY
d/b/a VECTREN ENERGY DELIVERY OF INDIANA, INC.

("VECTREN SOUTH")

I.U.R.C. CAUSE NO. 44645

DIRECT TESTIMONY

OF

RICHARD G. STEVIE

VICE PRESIDENT, INTEGRAL ANALYTICS,

ON

COST EFFECTIVENESS OF VECTREN SOUTH'S 2016-2017 DEMAND SIDE MANAGEMENT PLAN

SPONSORING PETITIONER'S EXHIBIT NO. 3 & ATTACHMENT RGS-1

VERIFIED DIRECT TESTIMONY OF RICHARD G. STEVIE

INTRODUCTION

Q. Please state your name, title and business address.

A. My name is Richard G. Stevie. I am employed as Vice President, Forecasting, by Integral Analytics, Inc. ("IA"). My business address is 123 East Fourth Street, Suite 300, Cincinnati, Ohio 45202. I am submitting this testimony on behalf of Southern Indiana Gas and Electric Company d/b/a Vectren Energy Delivery of Indiana, Inc. ("Vectren South" or the "Company").

Q. Please describe Integral Analytics.

A. IA is an analytical software and consulting firm focused on operational, planning, and market research solutions for the energy industry. IA excels at sophisticated and accurate analytical approaches to valuation. Its analytical, programming, and statistical methods offer clients more precise valuation, faster and more affordably. As part of its set of software tools, IA developed the DSMore model which is used for valuing the cost-effectiveness of energy efficiency and demand response programs across 30 States. IA excels at insuring more accurate valuations by capturing all avoided costs and the covariance between prices and loads, and values these impacts across 40 years of actual hourly weather patterns, which ensures accuracy in quantifying avoided costs.

Q. Please briefly describe your educational background and business experience.

A. I received a Bachelor's degree in Economics from Thomas More College in May 1971. In June 1973, I was awarded a Master of Arts degree in Economics from the University of Cincinnati. In August 1977, I received a Ph.D. in Economics from the University of Cincinnati. In 2012, I was named a Research Fellow for the Economics Center at the University of Cincinnati.

Since joining IA in 2012, I have been involved in projects on cost-effectiveness analysis of energy efficiency and demand response programs, system load forecasting, spatial load forecasting for distribution planning, rate negotiation, big data/smart grid analytics, and utility planning analytics. In addition, I have presented/written papers on estimating the value of electric service, regulatory stakeholder objectives, cost of energy efficiency, and energy efficiency cost recovery mechanisms.

Prior to joining IA, I was Chief Economist for Duke Energy. During my tenure with Duke Energy, I managed several key analytical functions including economic forecasts, projections of energy sales and peak load demands, customer research on energy usage, market research, product development analytics, evaluation of energy efficiency and demand response program cost-effectiveness, and measurement and verification of energy efficiency and demand response impacts. I have been involved in many regulatory proceedings and provided expert witness testimony on numerous utility economic issues in Ohio, Kentucky, Indiana, North Carolina, and South Carolina. The principle areas of testimony involved load forecasting, cost-effectiveness analysis of energy efficiency and demand response programs, measurement and verification plans for energy efficiency and demand response programs, market pricing for energy, regulatory recovery mechanisms for energy efficiency, weather normalization of energy sales, and assessment of economic conditions.

Before the merger with Duke Energy, I was General Manager of Market Analytics for Cinergy Corp. and prior to that Senior Economist with the Cincinnati Gas & Electric Company. In addition, I was a past Director of Economic Research for the Public Staff of the North Carolina Utilities Commission. While working at the Public Staff, I provided expert testimony on numerous issues including cost of capital, capital structure, operating ratio, and rate design.

For over twenty years, I chaired the Regional Economic Advisory Committee for the Greater Cincinnati Chamber of Commerce. As chair of the committee, I led the development and presentation of the Chamber's Annual Economic Outlook. In addition, I have appeared in numerous local forums to provide views on the economy.

Q. Are you a member of any professional organizations?

A. Yes, I am a member of the American Economic Association, the National Association of Business Economists, the International Association for Energy Economics, and the Association of Energy Services Professionals.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to present the results of the cost-effectiveness analysis of the Vectren South 2016 - 2017 Electric DSM

Action Plan ("2016 - 2017 Plan") which was developed under the direction of Vectren South. I also discuss the process to evaluate the cost-effectiveness of the Vectren South proposed conservation voltage reduction program.

Q. Are you sponsoring any attachments?

A. Yes. I am sponsoring Petitioner's Exhibit No. 3, Attachment RGS-1, which is a Benefit/Cost Test Matrix.

COST-EFFECTIVENESS MODELLING

Q. What are the cost effectiveness tests you performed?

A. As required by the Indiana Utility Regulatory Commission ("IURC" or "Commission"), the 2016 - 2017 Plan considers the Utility Cost Test ("UCT" also known as the Program Administrator Cost Test), the Total Resource Cost Test ("TRC Test"), the Ratepayer Impact Measure Test ("RIM"), and the Participant Test.

Q. How were these tests evaluated?

A. The tests were evaluated using the DSMore model.

Q. What is the DSMore model?

A. DSMore is a financial analysis tool designed to evaluate the costs, benefits, and risks of energy efficiency programs and measures. DSMore estimates the value of an energy efficiency measure at an hourly level across distributions of weather and/or energy costs or prices. By examining energy efficiency performance and cost effectiveness over a wide variety of weather and cost conditions, the Company is in a better position to measure the risks and benefits of employing energy efficiency measures versus traditional generation capacity additions, and further, to ensure that demand side resources are compared to supply side resources on a level playing field.

The analysis of energy efficiency cost-effectiveness has traditionally focused primarily on the calculation of specific metrics, often referred to as the California Standard tests: UCT, RIM Test, TRC Test, Participant Test, and Societal Test. For this proceeding, test results will be reported for the previously mentioned set of tests required by the IURC. DSMore can be utilized to provide the results of those tests for any type of energy efficiency program (demand response and/or energy saving).

Test results are also developed for a range of weather conditions, including normal weather, and under various cost and market price conditions. Because DSMore is designed to be able to analyze extreme conditions, one can obtain a distribution of cost-effectiveness outcomes or expectations. Avoided costs for energy efficiency tend to increase with increasing market prices and/or more extreme weather conditions due to the covariance between load and costs/prices. Understanding the manner in which energy efficiency cost effectiveness varies under these conditions allows a more precise valuation of energy efficiency programs and demand response programs.

Generally, the DSMore model requires the user to input specific information regarding the energy efficiency measure or program to be analyzed as well as the cost and rate information of the utility. These inputs enable one to then analyze the cost-effectiveness of the measure or program.

Q. What energy efficiency program or measure information is input into the model?

A. The information required on an energy efficiency program or measure includes, but is not limited to:

- Number of program participants, including free ridership or free drivers;
- Projected program costs, contractor costs and/or administration costs;
- Customer incentives, demand response credits or other incentives;
- Measure life, incremental customer costs and/or annual maintenance costs;
- Load impacts (kWh, kW and the hourly timing of reductions); and
- Hours of interruption, magnitude of load reductions or load floors.

Q. What utility information is input into the model?

A. The utility information required for the model includes, but is not limited to:

- Discount rate;
- Loss ratio, either for annual average losses or peak losses;
- Rate structure, or tariff appropriate for a given customer class;

- Avoided costs of energy, capacity, transmission & distribution; and
- Cost escalators.

Q. How are programs or measures modeled?

A. An analyst or program manager at Vectren South develops the inputs for the program or measure using information on expected program costs, load impacts, customer incentives necessary to drive customers' participation, free rider expectations, and expected number of participants. This information was used in runs of the DSMore model to determine cost-effectiveness.

In DSMore, the load impacts of the program or measure may be analyzed as a percent of savings reduction from the current level of use, as proportional to the load shape for the customer, or as an hourly reduction in kWh and/or kW. These approaches apply to energy saving programs and measures. For demand response programs, the analyst must provide information on the amount of the expected load reduction and the possible timing of the reduction.

Q. What is the source of the data for the program or measure?

A. Program managers and analysts at Vectren South develop the inputs for each program or measure for the DSMore runs.

Q. What is the source for the utility inputs to the model?

A. Vectren South staff provided information on the required utility inputs with guidance from IA.

<u>COST-EFFECTIVENESS TESTS</u>

Q. Please describe how energy efficiency programs and measures are analyzed.

A. Evaluating cost-effectiveness of energy-efficiency programs involves following the procedures specified in the California Standard Practice Manual ("SPM")[1]. Evaluation of Vectren South's proposed energy efficiency and demand response programs followed the tests as defined by the SPM which have been used since their development in 1983. At a high level, the tests utilize estimates of the net present value of the financial stream of costs versus benefits, *e.g.*, the cost to implement the measures is valued against the savings or avoided costs. The resultant benefit/cost ratios, or tests, provide a summary of each program's cost-effectiveness relative to the benefits of the projected load impacts. The principal tests for screening energy efficiency measures are the Participant Test, the UCT, the RIM Test, and the TRC Test. The following paragraphs provide a summary of the applicable tests.

- The Participant Test compares the benefits to the participant through bill savings plus incentives from the utility relative to the incremental costs to the participant for implementing the energy efficiency measure. The costs can include capital cost as well as increased annual operating cost, if applicable.

1 Evaluation of the Energizing Indiana programs relied upon the Indiana Evaluation Framework which based its cost-effectiveness approaches primarily on the California Standard Practice Manual. The only difference was that the results reported for the Energizing Indiana programs did not include utility administrative costs in the computation of the test results.

- The UCT compares utility benefits (avoided costs) to incurred utility costs to implement the program, and does not consider other benefits such as participant savings or societal impacts. This test compares the cost (to the utility) to implement the measures with the savings or avoided costs (to the utility) resulting from the change in magnitude and/or the pattern of electricity consumption caused by implementation of the program. Avoided costs are considered in the evaluation of cost-effectiveness based on the projected cost of power, including the projected cost of the utility's environmental compliance for known regulatory requirements. The cost-effectiveness analyses also incorporate avoided transmission and distribution costs, and load (line) losses.

- The RIM Test, or non-participants test, indicates if rates increase or decrease over the long-run as a result of implementing the program. The RIM Test compares the same benefits as the UCT (utility avoided costs) to the total costs to the utility including the utility costs to implement the programs and lost revenues.

- The TRC test compares the total benefits to the utility and to participants relative to the costs to the utility to implement the program along with the costs to the participant. The benefits to the utility are the same as those computed under the UCT. The benefits to the participant are the same as those computed under the Participant Test, however, customer incentives are considered to be a pass-through benefit to customers. As such, customer incentives or rebates are not included in the TRC. The TRC Test represents a combination of the Participant Test and the RIM or non-participants test.

Petitioner's Exhibit No. 3, Attachment RGS-1 provides a more detailed summary of the items included in the respective tests.

Q. Would you discuss information provided by each of the tests?

A. Yes. Each one of the tests provides an insight into the cost-effectiveness of the programs from the perspective of different stakeholders: participant (Participant Test), non-participants (RIM), the utility and ratepayers (UCT, and society as a whole (TRC). The use of multiple tests can ensure the development of a reasonable set of energy efficiency programs, indicate the likelihood that customers will participate, and also protect against cross-subsidization.

In general, programs must pass the Participant Test or the programs will not be successful in the market place, i.e., will not be adopted by potential participants. The bill savings (see line 1 on Petitioner's Exhibit No. 3**,** Attachment RGS-1) that provide a benefit to the program participants represent lost revenues to the utility (see line 21 on Petitioner's Exhibit No. 2, Attachment RGS-1).

The UCT, in essence, provides the same type of information as the benefit cost analysis conducted by Integrated Resource Planning (IRP) models. The UCT evaluates the long-run implications for utility revenue requirements, just like in an IRP. For example, if a program passes the UCT, it means that long-run requirements for ratepayers will be lower than not implementing the program.

The RIM Test is similar to the UCT except that the lost revenues, the bill savings from the Participant Test, now show up as a cost. These lost revenues have to be spread for recovery across all the utility's customer sales to enable the utility to cover its costs. That is why the RIM Test is called the non-participants test. If a program fails the RIM Test, it indicates that rates would likely have to increase. What the RIM Test does not tell us is whether rates would increase more if the program were not implemented. That is why this test is viewed with a significant level of skepticism. Having a program pass the RIM Test is definitely a more positive outcome than not passing the test. However, the value of the test is limited. Generally, programs that target energy efficiency tend to fail the RIM Test.

Finally, there is the TRC Test. The TRC Test actually represents the sum of the components of the Participant Test and the non-participants or RIM Test. This is why it is viewed as a comprehensive test since impacts on participants and non-participants are considered. One point to note is that while the TRC Test does not explicitly include lost revenues, in combining the components of the two tests, the utility bill savings and the incentives paid to customers by the utility which are benefits in the Participant Test are offset by the lost revenues and customer incentives (costs in the RIM

Test). These components cancel each other out and are not included in the calculation of the TRC Test. Typically, if a program passes the UCT, it will pass the TRC Test unless the participant's cost to implement the energy efficiency measure is large relative to the program benefits.

Again, each test provides insights into a very complex issue. Understanding the implications when a program passes or fails a test helps in deciding whether or not to implement the program or judge its success.

Q. What were the results of the cost-effectiveness analysis?

A. The Company seeks, in part, approval to implement the following set of programs.

RESIDENTIAL CUSTOMER PROGRAMS

- Residential Lighting;
- Home Energy Assessment;
- Income Qualified Weatherization;
- Energy Efficient Schools;
- Appliance Recycling;
- Residential Efficient Products;
- Residential New Construction;
- Multi-Family Direct Install;
- Residential Behavior.

COMMERCIAL & INDUSTRIAL PROGRAMS

- Commercial & Industrial Prescriptive Rebate;

- Commercial & Industrial New Construction;
- Small Business Direct Install;
- Commercial & Industrial Custom.

NEW PROGRAM INITIATIVES

- Residential Smart Thermostat Demand Response;
- Conservation Voltage Reduction (CVR);
- Multi-Family Energy Efficiency Retrofit;

The table provided below provides the cost-effectiveness test results for each program as well as the portfolio in total. For several programs, the Participant Test could not be calculated since there were no costs to participants for adopting the program. These are represented by "NA" on the table. All of the programs pass the TRC and UCT cost effectiveness Tests, but not the RIM Test. While the programs do not pass the RIM Test, this should not be interpreted to mean the programs are not cost-effective. In these cases, one should look to the UCT test as passage of that test reveals whether or not one can expect the long-run revenue requirements for ratepayers would increase or decrease.

Vectren South 2016-2017 Electric DSM Action Plan				
Program Name	Cost-Effectiveness Results			
Residential Programs	TRC	UCT	RIM	PT
Residential Lighting	2.30	2.95	0.56	4.23
Home Energy Assessments & Weatherization	1.53	1.80	0.46	8.49
Income Qualified Weatherization	1.06	1.06	0.40	NA
Appliance Recycling	1.40	1.40	0.39	9.77
Energy Efficient Schools	3.39	3.39	0.53	NA
Residential Efficient Products	1.31	2.07	0.69	1.54
Residential New Construction	1.36	2.65	0.71	1.37
Multi-Family Direct Install	3.69	3.69	0.44	NA
Residential Behavior Savings	1.45	1.45	0.44	NA
Residential Smart Thermostat Demand Response	1.56	1.30	0.78	NA
Conservation Voltage Reduction (Residential)	1.38	1.38	0.52	NA
Residential Sector Portfolio (No Utility Performance Incentive)	1.57	1.71	0.56	5.00
Residential Sector Portfolio (With Utility Performance Incentive)	1.48	1.61	0.55	5.00
Commercial & Industrial (C&I) Programs				
Small Business Direct Install	1.28	2.33	0.74	1.56
C&I Prescriptive	3.00	4.07	0.87	3.25
C&I New Construction	1.99	2.49	0.79	3.03
C&I Custom	1.07	2.74	0.77	1.18
Multi-Family Energy Efficient Retrofit	1.35	2.12	0.75	1.53
Conservation Voltage Reduction (C&I)	1.06	1.06	0.51	NA
C&I Sector Portfolio (No Utility Performance Incentive)	1.54	2.62	0.77	1.93
C&I Sector Portfolio (With Utility Performance Incentive)	1.46	2.40	0.75	1.93
Conservation Voltage Reduction (Residential & C&I)	1.26	1.26	0.52	NA
Total Portfolio (No Utility Performance Incentive)	1.55	2.10	0.65	2.92
Total Portfolio (With Utility Performance Incentive)	1.47	1.95	0.64	2.92

Q. What does your analysis show concerning the long-term effect, or potential effect, of the 2016-2017 Plan on the electric rates and bills of customers that participate in Vectren South's energy efficiency programs compared to the electric rates and bills of customers that do not participate in the Company's energy efficiency programs?

A. The long-term effect on rates and bills of participants are demonstrated through the Participant Test, which compares the benefits to the participant through bill savings plus incentives from the utility relative to the incremental costs to the participant for implementing the energy efficiency measure. A score greater than 1 indicates the customer is saving more money than expended, thus reducing the participant's energy bill over the life of the measure. All of the programs included in Vectren South's 2016-2017 Plan have a Participant Test score greater than 1, except for those programs where the Participant Test score could not be calculated because there were no costs to participants for participating in the program. As a result, all participants would benefit from the programs. The long-term effect on rates and bills of non-participants are demonstrated through the RIM Test, which is also called the non-participant test. It spreads lost revenues across all the utility's customer sales to enable the utility to cover its costs. If a program's RIM Test has a score lower than 1, it indicates that rates would likely have to increase over time. A rate increase in and of itself should not be viewed negatively given that DSM programs create a demand side resource that allows utilities to avoid the cost of a supply side resource, which has its own costs that would increase rates. As I stated earlier, the RIM Test does not tell us whether rates would increase more if the programs were not implemented, which is one reason the value of the RIM Test is limited. None of the programs in Vectren South's 2016-2017 Plan pass the RIM Test, but generally, programs that target energy efficiency tend to fail the RIM Test.

Q. Given your review of Vectren South's 2016-2017 Plan, the analysis of the goals and cost benefit modeling results, do you believe that the Company's 2016-2017 Plan is cost effective?

A. Yes.

<u>CONSERVATION VOLTAGE REDUCTION</u>

Q. Please describe the conservation voltage reduction (CVR) program.

A. The CVR program is described in the testimony of Company witness Huber. In general, the program involves the installation of technology to reduce customer electricity consumption by 2.5% through the application of lower circuit voltages.

Q. How was the CVR program evaluated for cost-effectiveness?

A. The Vectren South CVR program cost-effectiveness evaluation involved analysis of a two-year implementation for one substation and a three-year implementation including two substations.

The cost-effectiveness evaluation was set up in a two-fold manner. For the two-year implementation, the selected substation load was broken into a residential portion and a business portion based upon the respective number of residential and business customers served via the substation. It was assumed that the CVR program could achieve a 2.5 percent reduction in electricity consumption for each customer class. The results for both customer segments were combined together for the full cost-effectiveness results.

The full cost of the required infrastructure for the program was included in the two-year implementation, even though this infrastructure could be used for future substation programs. The two-year implementation was found to be cost-effective with TRC and UCT results of 1.26.

The cost-effectiveness analysis was expanded to include a second substation in a three-year implementation analysis. In this situation, the program continues to be cost-effective with TRC and UCT results of 1.22.

Q. Does this conclude your testimony?

A. Yes.

BENEFIT/COST TEST MATRIX

BENEFIT/COST TEST MATRIX				
Benefits:	Participant Test	Utility Test	Ratepayer Impact Test	Total Resource Cost Test
1. Customer Electric Bill Decrease	X			
2. Customer Non-electric Bill Decrease	X			
3. Customer O&M and Other Cost Decrease	X			X
4. Customer Income Tax Decrease	X			X
5. Customer Investment Decrease	X			X
6. Customer Rebates Received	X			
7. Utility Revenue Increase			X	
8. Utility Electric Production Cost Decrease		X	X	X
9. Utility Generation Capacity Credit		X	X	X
10. Utility Transmission Capacity Credit		X	X	X
11. Utility Distribution Capacity Credit		X	X	X
12. Utility Administrative Cost Decrease		X	X	X
13, Utility Cap. Administrative Cost Decrease		X	X	X
14. Non-electric Acquisition Cost Decrease				X
15. Utility Sales Tax Cost Decrease		X	X	X
Costs:				
16. Customer Electric Bill Increase	X			
17. Customer Non-electric Bill Increase	X			X
18. Customer O&M and Other Cost Increase	X			X
19. Customer Income Tax Increase	X			X
20. Customer Capital Investment Increase	X			X
21. Utility Revenue Decrease			X	
22. Utility Electric Production Cost Increase		X	X	X
23, Utility Generation Capacity Debit		X	X	X
24. Utility Transmission Capacity Debit		X	X	X
25. Utility Distribution Capacity Debit		X	X	X
26. Utility Rebates Paid		X	X	
27. Utility Administrative Cost Increase		X	X	X
28. Utility Cap. Administrative Cost Increase		X	X	X
29. Non-electric Acquisition Cost Increase				X
30. Utility Sales Tax Cost Increase		X	X	X

VERIFICATION

I, Richard G. Stevie, Vice President, Integral Analytics, affirm under penalties of perjury that the foregoing representations are true and correct to the best of my knowledge, information and belief.

Richard G. Stevie

Date: May 22, 2015

SOUTHERN INDIANA GAS AND ELECTRIC COMPANY
D/B/A VECTREN ENERGY DELIVERY OF INDIANA, INC.

("VECTREN SOUTH")

I.U.R.C. CAUSE NO. 44645

DIRECT TESTIMONY

OF

J. CAS SWIZ

DIRECTOR, REGULATORY IMPLEMENTATION AND ANALYSIS

ON

ACCOUNTING AUTHORITY & RATEMAKING TREATMENT FOR CAPITAL COSTS ASSOCIATED WITH THE 2016-2017 PLAN

SPONSORING PETITIONER'S EXHIBIT NO. 4 & ATTACHMENTS JCS-1 THROUGH JCS-2

VERIFIED DIRECT TESTIMONY OF J. CAS SWIZ

I. INTRODUCTION

Q. Please state your name and business address.

A. My name is J. Cas Swiz and my business address is One Vectren Square, Evansville, Indiana 47708.

Q. By whom are you employed and in what capacity?

A. I am employed by Vectren Utility Holdings, Inc. ("VUHI"), the immediate parent company of Southern Indiana Gas and Electric Company d/b/a Vectren Energy Delivery of Indiana, Inc. ("Vectren South"), Indiana Gas Company, Inc. d/b/a Vectren Energy Delivery of Indiana, Inc. ("Vectren North") and Vectren Energy Delivery of Ohio, Inc. ("VEDO"). Vectren South has both a gas division and an electric division. I am Director, Regulatory Implementation and Analysis for VUHI.

Q. Please describe your educational background?

A. I am a 2001 graduate of the University of Evansville with a Bachelor of Science degree in Accounting and a 2005 graduate of the University of Southern Indiana with a Masters of Business Administration degree.

Q. Please describe your professional experience?

A. From 2001 to 2003, I was employed by ExxonMobil Chemical as a Product and Inventory Accountant. Since 2003, I have been employed with VUHI in various accounting capacities. In 2008, I was named Manager, Regulatory and Utility Accounting, and in November 2012, I was named Director, Regulatory Implementation and Analysis.

Q. What are your present duties and responsibilities as Director, Regulatory Implementation and Analysis?

A. I am responsible for the financial analysis and implementation of all regulatory initiatives of Vectren South (and VUHI's other utility subsidiaries), as well as the preparation of accounting exhibits submitted in various regulatory proceedings.

Q. Are you familiar with the books, records, and accounting procedures of Vectren South?

A. Yes, I am.

Q. Are Vectren South's books and records maintained in accordance with the Uniform System of Accounts ("USoA") and generally accepted accounting principles ("GAAP")?

A. Yes.

Q. Have you previously testified before the Indiana Utility Regulatory Commission ("Commission")?

A. Yes. I have testified before the Indiana Utility Regulatory Commission ("IURC" or "Commission") on behalf of Vectren South in numerous Fuel Adjustment Clause ("FAC") proceedings under Cause No. 38708 and Gas Cost Adjustment ("GCA") proceedings under Cause No. 37366, and on behalf of Vectren North in GCA proceedings under Cause No. 37394. I have also testified before the Public Utilities Commission of Ohio on behalf of VEDO.

II. PURPOSE

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony is to discuss how Vectren South plans to account for carrying costs and depreciation expense associated with the capital expenditures the Company plans to make related to the Conservation Voltage Reduction ("CVR") program, which Vectren South proposes be included in the Vectren South 2016-2017 Electric DSM Plan ("2016-2017 Plan"), as described by Petitioner's Witness Michael P. Huber. I discuss the deferral authority related to

CVR requested by Vectren South and sponsor the calculation of carrying costs and depreciation expense on Vectren South's proposed capital expenditures related to the CVR program.

Q. Are you sponsoring any attachments in this proceeding?

A. Yes. I am sponsoring the following attachments:

- Petitioner's Exhibit No. 4, Attachment JCS-1, which is the calculation of the estimated annual carrying cost and depreciation associated with the CVR Program investment.
- Petitioner's Exhibit No. 4, Attachment JCS-2, which is the calculation of the weighted average cost of capital ("WACC") rate, as of December 31, 2014, used for the carrying cost calculation.

Q. Were your testimony and exhibits in this proceeding prepared by you or under your supervision?

A. Yes, they were.

III. ACCOUNTING AUTHORITY & RATEMAKING TREATMENT FOR CVR

Q. Please summarize the accounting authority Vectren South is requesting.

A. Vectren South requests approval for the recovery, via the Demand Side Management Adjustment ("DSMA") mechanism, of annual depreciation and operating expenses associated with the proposed CVR Program investment, along with recovery in the DSMA of the annual carrying costs on this capital investment. Vectren South Witness Michael P. Huber discusses the specific operating expenses estimated, which include (1) ongoing Operation and Maintenance ("O&M") expense, (2) ongoing software support expenses, (3) a representative share of Vectren South's DSM support staff and administration costs, and (4) related Evaluation, Measurement, and Verification (EM&V) costs.

Q. Why should the Commission allow Vectren South to earn a return on and of the capital costs associated with the CVR program?

A. Vectren South is requesting this accounting and ratemaking treatment as the CVR program deploys capital assets along the energy delivery system to reduce energy and demand consumption by customers, and this type of equipment deployed for the CVR program is typically capitalized as an asset and included in rate base for the utility in base rate proceedings. As such, Vectren South will incur financing costs associated with this investment prior to inclusion in base rates, and in lieu of immediate recovery of the full capital expenditure amount in the DSMA, Vectren South's proposal is to recover the needed return on and of the CVR program investment in the DSMA until the Company's next base rate case. This cost recovery approach was approved by the Commission in Indiana Michigan Power Company Cause No. 43827 DSM 3 (Order December 30, 2013).

Q. Please describe Petitioner's Exhibit No. 4, Attachment JCS-1.

A. Petitioner's Exhibit No. 4, Attachment JCS-1 summarizes the estimated level of depreciation expense and carrying costs for 2016 through 2017 that are proposed to be recovered in the DSMA, along with the estimated level of operating expenses. Page 1 is an annual summary of each component. Pages 2 through 4 show the detailed calculation of the monthly depreciation and carryings costs on the CVR Program investment, based on initial estimates, by Federal Energy Regulatory Commission ("FERC") USoA designation.

Q. What is the estimated depreciation rate assumed on the CVR Program investments?

A. The depreciation rates assumed for the estimated depreciation expense are the approved depreciation rates for Vectren South in its most recent approved depreciation study (Cause No. 43111). The estimate of the investment, by FERC USoA, divides the costs between three accounts with the following approved rates – (1) Account 303, Intangible Plant, with an annual rate of 10%, (2) Account

362, Station Equipment, with an annual rate of 2.53%, and (3) Account 397, Communication Equipment, with an annual rate of 5%.

When an investment is complete and placed-in-service (used and useful), depreciation is calculated at 50 percent of the monthly depreciation rate for the initial month based on the gross plant investment. For each month thereafter, depreciation is calculated at 100 percent of the monthly depreciation rate on the gross plant investment. For estimating purposes only, Attachment JCS-1 assumes the investments will be completed in June of 2017.

Q. Please describe how the monthly carrying costs will be calculated.

A. Vectren South will calculate the monthly carrying costs using its approved weighted average cost of capital ("WACC"), grossed up for income taxes, and multiplied by the net plant balance (gross investment less accumulated depreciation) as of the end of the prior month. The WACC rate used is based on the most recent approved after-tax rate of return (7.29%) for Vectren South in Cause No. 43839. This calculation reflects the incremental pre-tax cost, both debt and equity, of financing the investment.

Q. Please describe Petitioner's Exhibit No. 4, Attachment JCS-2.

A. Petitioner's Exhibit No. 4, Attachment JCS-2 reflects the calculation of the WACC for Vectren South in Cause No. 43839. The approved capital structure includes: (1) long-term debt, (2) common equity, (3) customer deposits, (4) cost free capital, included deferred income taxes, and (5) investment tax credits. The weighted average cost of equity is grossed up for income taxes, both state and federal at current rates, to derive the pre-tax cost of capital of 10.20% used for the monthly carrying cost calculation.

Q. Will Vectren South project these carrying costs for recovery in the annual DSMA filing?

A. Yes. The Company will include in each annual DSMA filing a projected level of carrying costs on the approved CVR Program investments.

Q. Please explain the accounting entries that will be recorded monthly as these expenses are recovered.

A. On a monthly basis, Vectren South will receive DSMA revenues which will include the recovery of projected depreciation expenses, operating expenses, and carrying costs on capital investments. Vectren South will calculate the actual carrying costs and depreciation on CVR Program investments, using the calculation described above and reflected in Attachment JCS-1. The DSMA revenues will be compared against the actual depreciation expense, operating expense, and carrying costs for the current month, and any difference will be recorded as an over recovery (revenues greater than costs) or under recovery (revenues less than costs) against a regulatory asset, FERC Account 182.3, with a corresponding offset recorded to operating revenues, FERC Account 400. The recording of these entries will ensure that any deviation between recoveries and actual expenses will become an adjustment in future DSMA filings.

Vectren South will continue this accounting and the recovery of these CVR Program investment costs in the DSMA until its next base rate case, at which point the investment will be included in the Company's rate base.

Q. What is the estimated level of carrying costs, deferred depreciation, and incremental operating expenses for the CVR Program investments assumed for the 2016-2017 Plan supported by Witnesses Robert C. Sears and Michael P. Huber?

A. Attachment JCS-1, Page 1 summarizes the impacts by year. The total levels of expenses for the CVR Program investments by year are $40,000 for calendar year 2016 and $277,941 for calendar year 2017.

VII. <u>CONCLUSION</u>

Q. Does this conclude your testimony?

A. Yes, it does.

VERIFICATION

I, J. Cas Swiz, Director, Regulatory Implementation and Analysis at Southern Indiana Gas & Electric Company d/b/a Vectren Energy Delivery of Indiana, Inc., affirm under the penalties of perjury that the statements and representations in the foregoing Direct Testimony are true to the best of my knowledge, information and belief.

J. Cas Swiz

Dated: 5/26/2015

Vectren South-Electric
Conservation Voltage Reduction (CVR) Program
Estimated Depreciation and Carrying Costs
For Program Years 2016-2017

		2016	2017
1	Summary:		
2	Estimated Depreciation Expense	$ -	$ 55,104
3	Estimated Carrying Costs	$ -	$ 79,327
4	Total Estimated Depreciation and Carrying Costs	$ -	$ 134,431
5	Total Estimated Annual Operating Expenses	$ 40,000	$ 149,576
6	Total Estimated Program Costs (Annual)	$ 40,000	$ 284,007
7	Total Estimated Net Plant Balance (End of Year)	$ -	$ 1,525,755

Vectren South-Electric
Conservation Voltage Reduction (CVR) Program
Estimated Depreciation and Carrying Costs
For Program Years 2016-2017

			2016	2017
1	Estimated Capital Investment (Annual)			
2	Account 303 - Intangible Plant	[A]	$ -	$ 713,974
3	Account 362 - Station Equipment	[A]	$ -	$ 526,734
4	Account 397 - Communication Equipment	[A]	$ -	$ 340,152
5	Total Estimated Capital Investment (Annual)		$ -	$ 1,580,860

				Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16
6	Estimated Capital Investment (Monthly)														
7	Account 303 - Intangible Plant	[B]	Even	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
8	Account 362 - Station Equipment	[B]	Even	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
9	Account 397 - Communication Equipment	[B]	Even	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
10	Total Estimated Capital Investment (Monthly)			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

				Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16
11	Estimated Monthly Plant Additions														
12	Account 303 - Intangible Plant	[C]	June	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
13	Account 362 - Station Equipment	[C]	June	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
14	Account 397 - Communication Equipment	[C]	June	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
15	Total Estimated Monthly Plant Additions			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

				Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16
16	Estimated Cumulative Gross Plant Balance														
17	Account 303 - Intangible Plant		Sum of All Months	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
18	Account 362 - Station Equipment		Sum of All Months	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
19	Account 397 - Communication Equipment		Sum of All Months	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
20	Total Estimated Cumulative Gross Plant Balance			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

			Depreciation Rate	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16
21	Estimated Depreciation Expense (Monthly)														
22	Account 303 - Intangible Plant	[D]	10.00%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
23	Account 362 - Station Equipment	[D]	2.53%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
24	Account 397 - Communication Equipment	[D]	5.00%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
25	Total Estimated Depreciation Expense (Monthly)			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

				Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16
26	Estimated Accumulated Depreciation Balance														
27	Account 303 - Intangible Plant		Sum of All Months	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
28	Account 362 - Station Equipment		Sum of All Months	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
29	Account 397 - Communication Equipment		Sum of All Months	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
30	Total Estimated Accumulated Depreciation Balance			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

				Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16
31	Net Plant Balance														
32	Account 303 - Intangible Plant		Gross - Accumulated Depr	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
33	Account 362 - Station Equipment		Gross - Accumulated Depr	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
34	Account 397 - Communication Equipment		Gross - Accumulated Depr	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
35	Total Plant Additions			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

			Pre-Tax ROR	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16
36	Estimated Carrying Costs														
37	Account 303 - Intangible Plant	[E]	10.20%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
38	Account 362 - Station Equipment	[E]	10.20%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
39	Account 397 - Communication Equipment	[E]	10.20%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
40	Total Carrying Costs			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

[A] Allocation between Plant Classes estimated currently - still finalizing based on overall project estimate.
[B] Spend by month currently modeled as even over 6 months (Jan-Jun) each year.

[C] Mid-Year convention on in-service - assume June 30 in-service date.

[D] Gross Plant Balance (Prior Period) x Depreciation Rate/12 (Monthly) + Gross Plant Additions (Current Month) x 50% (Half-Month convention) x Depreciation Rate/12 (Monthly)

[E] Net Plant (Prior Period) x Pre-Tax Rate of Return/12 (Monthly)

Vectren South-Electric
Conservation Voltage Reduction (CVR) Program
Estimated Depreciation and Carrying Costs
For Program Years 2016-2017

Line	Description	Note	Basis	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17
1	Estimated Capital Investment (Annual)														
2	Account 303 - Intangible Plant	[A]													
3	Account 362 - Station Equipment	[A]													
4	Account 397 - Communication Equipment	[A]													
5	Total Estimated Capital Investment (Annual)														
6	Estimated Capital Investment (Monthly)			Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17
7	Account 303 - Intangible Plant	[B]	Even	$ 118,996	$ 118,996	$ 118,996	$ 118,996	$ 118,996	$ 118,996	$ -	$ -	$ -	$ -	$ -	$ -
8	Account 362 - Station Equipment	[B]	Even	$ 87,789	$ 87,789	$ 87,789	$ 87,789	$ 87,789	$ 87,789	$ -	$ -	$ -	$ -	$ -	$ -
9	Account 397 - Communication Equipment	[B]	Even	$ 56,692	$ 56,692	$ 56,692	$ 56,692	$ 56,692	$ 56,692	$ -	$ -	$ -	$ -	$ -	$ -
10	Total Estimated Capital Investment (Monthly)			$ 263,477	$ 263,477	$ 263,477	$ 263,477	$ 263,477	$ 263,477	$ -	$ -	$ -	$ -	$ -	$ -
11	Estimated Monthly Plant Additions			Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17
12	Account 303 - Intangible Plant	[C]	June	$ -	$ -	$ -	$ -	$ -	$ 713,974	$ -	$ -	$ -	$ -	$ -	$ -
13	Account 362 - Station Equipment	[C]	June	$ -	$ -	$ -	$ -	$ -	$ 526,734	$ -	$ -	$ -	$ -	$ -	$ -
14	Account 397 - Communication Equipment	[C]	June	$ -	$ -	$ -	$ -	$ -	$ 340,152	$ -	$ -	$ -	$ -	$ -	$ -
15	Total Estimated Monthly Plant Additions			$ -	$ -	$ -	$ -	$ -	$ 1,580,860	$ -	$ -	$ -	$ -	$ -	$ -
16	Estimated Cumulative Gross Plant Balance			Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17
17	Account 303 - Intangible Plant		Sum of All Months	$ -	$ -	$ -	$ -	$ -	$ 713,974	$ 713,974	$ 713,974	$ 713,974	$ 713,974	$ 713,974	$ 713,974
18	Account 362 - Station Equipment		Sum of All Months	$ -	$ -	$ -	$ -	$ -	$ 526,734	$ 526,734	$ 526,734	$ 526,734	$ 526,734	$ 526,734	$ 526,734
19	Account 397 - Communication Equipment		Sum of All Months	$ -	$ -	$ -	$ -	$ -	$ 340,152	$ 340,152	$ 340,152	$ 340,152	$ 340,152	$ 340,152	$ 340,152
20	Total Estimated Cumulative Gross Plant Balance			$ -	$ -	$ -	$ -	$ -	$ 1,580,860	$ 1,580,860	$ 1,580,860	$ 1,580,860	$ 1,580,860	$ 1,580,860	$ 1,580,860
21	Estimated Depreciation Expense (Monthly)		Depreciation Rate	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17
22	Account 303 - Intangible Plant	[D]	10.00%	$ -	$ -	$ -	$ -	$ -	$ 2,975	$ 5,950	$ 5,950	$ 5,950	$ 5,950	$ 5,950	$ 5,950
23	Account 362 - Station Equipment	[D]	2.53%	$ -	$ -	$ -	$ -	$ -	$ 555	$ 1,111	$ 1,111	$ 1,111	$ 1,111	$ 1,111	$ 1,111
24	Account 397 - Communication Equipment	[D]	5.00%	$ -	$ -	$ -	$ -	$ -	$ 709	$ 1,417	$ 1,417	$ 1,417	$ 1,417	$ 1,417	$ 1,417
25	Total Estimated Depreciation Expense (Monthly)			$ -	$ -	$ -	$ -	$ -	$ 4,239	$ 8,478	$ 8,478	$ 8,478	$ 8,478	$ 8,478	$ 8,478
26	Estimated Accumulated Depreciation Balance			Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17
27	Account 303 - Intangible Plant		Sum of All Months	$ -	$ -	$ -	$ -	$ -	$ 2,975	$ 8,925	$ 14,874	$ 20,824	$ 26,774	$ 32,724	$ 38,674
28	Account 362 - Station Equipment		Sum of All Months	$ -	$ -	$ -	$ -	$ -	$ 555	$ 1,666	$ 2,776	$ 3,887	$ 4,997	$ 6,108	$ 7,218
29	Account 397 - Communication Equipment		Sum of All Months	$ -	$ -	$ -	$ -	$ -	$ 709	$ 2,126	$ 3,543	$ 4,961	$ 6,378	$ 7,795	$ 9,212
30	Total Estimated Accumulated Depreciation Balance			$ -	$ -	$ -	$ -	$ -	$ 4,239	$ 12,716	$ 21,194	$ 29,672	$ 38,149	$ 46,627	$ 55,104
31	Net Plant Balance			Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17
32	Account 303 - Intangible Plant		Gross - Accumulated Depr	$ -	$ -	$ -	$ -	$ -	$ 710,999	$ 705,049	$ 699,099	$ 693,150	$ 687,200	$ 681,250	$ 675,300
33	Account 362 - Station Equipment		Gross - Accumulated Depr	$ -	$ -	$ -	$ -	$ -	$ 526,178	$ 525,068	$ 523,957	$ 522,847	$ 521,736	$ 520,626	$ 519,515
34	Account 397 - Communication Equipment		Gross - Accumulated Depr	$ -	$ -	$ -	$ -	$ -	$ 339,444	$ 338,026	$ 336,609	$ 335,192	$ 333,774	$ 332,357	$ 330,940
35	Total Plant Additions			$ -	$ -	$ -	$ -	$ -	$ 1,576,621	$ 1,568,143	$ 1,559,666	$ 1,551,188	$ 1,542,710	$ 1,534,233	$ 1,525,755
36	Estimated Carrying Costs		Pre-Tax ROR	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17
37	Account 303 - Intangible Plant	[E]	10.20%	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,043	$ 5,993	$ 5,942	$ 5,892	$ 5,841	$ 5,791
38	Account 362 - Station Equipment	[E]	10.20%	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,473	$ 4,463	$ 4,454	$ 4,444	$ 4,435	$ 4,425
39	Account 397 - Communication Equipment	[E]	10.20%	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,885	$ 2,873	$ 2,861	$ 2,849	$ 2,837	$ 2,825
40	Total Carrying Costs			$ -	$ -	$ -	$ -	$ -	$ -	$ 13,401	$ 13,329	$ 13,257	$ 13,185	$ 13,113	$ 13,041

[A] Allocation between Plant Classes estimated currently - still finalizing based on overall project estimate.

[B] Spend by month currently modeled as even over 6 months (Jan-Jun) each year.

[C] Mid-Year convention on in-service - assume June 30 in-service date.

[D] Gross Plant Balance (Prior Period) x Depreciation Rate/12 (Monthly) + Gross Plant Additions (Current Month) x 50% (Half-Month convention) x Depreciation Rate/12 (Monthly)

[E] Net Plant (Prior Period) x Pre-Tax Rate of Return/12 (Monthly)

Vectren South-Electric
Weighted Average Cost of Capital
As Approved in Cause No. 43839 [A]

			Balance ($000's)	Weighting	Cost Rate	Weighted Average Cost of Capital	Tax Gross-Up Factor [B]	Pre-Tax Weighted Average Cost of Capital	
1	Long-Term Debt	$	630,437	43.58%	6.25%	2.72%		2.72%	[E]
2	Common Equity	$	628,785	43.46%	10.40%	4.52%	60.856%	7.43%	[D]
3	Total Investor Provided Capital	$	1,259,222	87.04%		7.24%		10.15%	
4	Customer Deposits	$	7,072	0.49%	3.43%	0.02%		0.02%	[E]
5	Cost Free Capital [C]	$	174,603	12.07%	0.00%	0.00%		0.00%	[E]
6	Investment Tax Credit	$	5,723	0.40%	8.32%	0.03%		0.03%	[E]
7	Total Capitalization	$	1,446,620	100.00%		7.29%		10.20%	

[A] Petitioner's Exhibit No. MSH-R3, Adjustment A54R, Page 3 of 3.

[B] Tax Gross-Up Factor:

One	100.000%
Less: Current State Tax Rate	6.375%
Federal Taxable	93.625%
One Less Federal Income Tax	65.000%
Effective Gross-Up Factor	60.856%

	Pre-Tax Return	
Equity (Net Income Driver)	7.43%	Σ [D]
All Other (Debt)	2.77%	Σ [E]
	10.20%	

[C] Cost Free Capital comprised of:

Deferred Income Taxes	$	340,597
Customer Advances for Constru	$	4,614
SFAS 106 Liability	$	16,451
Total Cost Free Capital	$	361,661

SOUTHERN INDIANA GAS AND ELECTRIC COMPANY D/B/A VECTREN ENERGY DELIVERY OF INDIANA, INC.

("VECTREN SOUTH")

I.U.R.C. CAUSE NO. 44645

DIRECT TESTIMONY

OF

SCOTT E. ALBERTSON

VICE PRESIDENT, REGULATORY AFFAIRS AND GAS SUPPLY

ON

RATE AND BILL IMPACTS OF THE VECTREN SOUTH 2016-2017 ELECTRIC DSM PLAN

SPONSORING PETITIONER'S EXHIBIT NO. 5

VERIFIED DIRECT TESTIMONY OF SCOTT E. ALBERTSON

Q. Please state your name and business address.

A. My name is Scott E. Albertson. My business address is One Vectren Square, Evansville, Indiana 47708.

Q. What position do you hold with Petitioner Southern Indiana Gas and Electric Company d/b/a Vectren Energy Delivery of Indiana, Inc. ("Vectren South" or the "Company")?

A. I am Vice President, Regulatory Affairs and Gas Supply for Vectren Utility Holdings, Inc. ("VUHI"), the immediate parent company of Vectren South. I hold the same position with two other utility subsidiaries of VUHI—Indiana Gas Company, Inc. d/b/a Vectren Energy Delivery of Indiana, Inc. ("Vectren North") and Vectren Energy Delivery of Ohio, Inc. ("VEDO").

Q. Please describe your educational background.

A. I received a Bachelor of Science degree in mechanical engineering from Rose-Hulman Institute of Technology. I have been a professional engineer in Indiana since 1990.

Q. Please describe your professional experience.

A. I have over 30 years' experience in the utility industry. I began my career with Ohio Valley Gas Corporation in a project engineering position. I have worked at VUHI and its predecessor companies since 1987 in a variety of positions including Operations Staff Manager, Assistant Chief Engineer, Director of Engineering Projects, Director of Engineering, and Director of Technical Services. I was named Director of Regulatory Affairs for VUHI in 2004, and was promoted to my current position effective July 1, 2012.

Q. What are your present duties and responsibilities as Vice President, Regulatory Affairs and Gas Supply?

A. I have responsibility for coordinating regulatory and rate matters of the regulated utilities within VUHI in proceedings before the Indiana and Ohio utility regulatory commissions. In addition, I am also responsible for overseeing the gas supply function for VUHI's three gas utilities.

Q. Have you previously testified before the Commission?

A. Yes. I have testified in Vectren North's two most recent general rate cases (Cause Nos. 43298 and 42598), in Vectren South's two most recent gas general rate cases (Cause Nos. 43112 and 42598), and in Vectren South's most recent electric general rate case (Cause No. 43839). I have also testified in numerous GCA, FAC, and other regulatory proceedings on behalf of Vectren North and Vectren South.

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony is to address the requirement pursuant to Senate Enrolled Act 412 ("SEA 412") specific to the impact on electric rates and customer bills resulting from a proposed energy efficiency plan. Petitioner's Witness Robert C. Sears discusses the requirements of SEA 412 in greater detail. My testimony will focus on the provision in Indiana Code 8-1-8.5-10(j)(7) that requires the Commission to consider, when making a determination of the overall reasonableness of an energy efficiency plan,

> The effect, or potential effect, in both the long term and the short term, of the plan on the electric rates and bills of customers that participate in energy efficiency programs compared to the electric rates and bills of customers that do not participate in energy efficiency programs.

Q. What are the estimated annual impacts of the Company's 2016-2017 Electric DSM Plan ("2016-2017 Plan" or "Plan") on the bills of Vectren South's customers?

A. The first table below shows the estimated impact on a standard Vectren South residential customer using 1,000 kWh per month. The second table shows the estimated impact on the Company's Commercial and Industrial ("C&I") customers. These estimated Plan impacts include projected program costs, lost revenues, variances and incentives, and include only the impact of Vectren South's Demand Side Management Adjustment ("DSMA") on the base rate bills of residential customers, and on base rate revenues associated with C&I customers.

2016 – 2017 Plan Bill Impact Estimates – Residential Standard 1,000 kWh per month			
Monthly Charges	**Current**	**Proposed 2016 Program Year**	**Proposed 2017 Program Year**
Customer Facilities Charge	$ 11.00	$ 11.00	$ 11.00
Energy Charge for All kWh Used	$ 0.097120	$ 0.097120	$ 0.097120
Fuel Charge	$ 0.038890	$ 0.038890	$ 0.038890
Variable Production Charge	$ 0.004750	$ 0.004750	$ 0.004750
DSMA	$ 0.007482	$ 0.008578	$ 0.008095
Monthly Bill Total	$ 159.24	$ 160.34	$ 159.86
Annual Bill Total	$ 1,910.88	$ 1,924.08	$ 1,918.32
Percent Change (Year over Year)		0.69%	(0.30)%

2016 – 2017 Plan Bill Impact Estimates - C & I			
	Projected Base Revenue (1)	**DSM Plan Costs** (2)	**Percent Change**
2016	$ 137,030,035	$ 9,956,648	0.02%
2017	$ 137,056,475	$ 8,183,465	(1.29)%

(1) Total Base Revenues, including the same base rate components as for residential customers (customer facilities charge, energy charge, fuel charge, variable production charge), plus base rate demand charge revenues (where applicable) and DSMA revenues, for the 12 month period ending April 2015.

(2) Includes all costs recoverable in the DSMA (program costs, lost revenues, variances and incentives).

Q. Why do the 2017 Plan Costs result in a bill or revenue decrease for all customers?

A. A projected DSMA variance, based on information available currently, has been included in the DSM Plan costs shown for 2016. For purposes of this analysis, the Company has not estimated the variance component that would be included in the DSMA to be in effect in 2017.

Q. What effect does the 2016-2017 Plan have on the electric rates and bills of customers that participate in the programs offered in the Plan?

A. The short term effect of the Plan for participating customers is reduced energy consumption which can result in lower energy bills than those shown in the tables above. After each of these program years, customers will no longer pay program costs or performance incentives associated with the Plan, however the lost revenues attributed to the Plan will continue throughout the life of each of the Energy Efficiency ("EE") measures that drove the lost revenues.

Petitioner's Witness Stevie discusses how certain cost effectiveness tests may be used as proxies for long term effects of the Plan on customer rates and bills.

Q. How will the Plan impact residential customers who do not participate in EE programs?

A. The tables above actually demonstrate the impact on non-participants. Those customers will pay costs approved for recovery in the DSMA (as shown in the tables) but will not realize the benefit of reduced energy usage and the corresponding reduction to their bill.

Q. Does this conclude your testimony in this proceeding?

A. Yes, at this time.

VERIFICATION

I, Scott E. Albertson, Vice President, Regulatory Affairs and Gas Supply, Vectren Utility Holdings, Inc., affirm under the penalties of perjury that the statements and representations in my foregoing Direct Testimony in this Cause are true to the best of my knowledge, information and belief.

Scott E. Albertson
Dated: June 26, 2015