Black Hills Energy

Five-Year Energy-Efficiency Plan

Prepared for:
Kansas Corporation Commission

Prepared by:
Black Hills Energy

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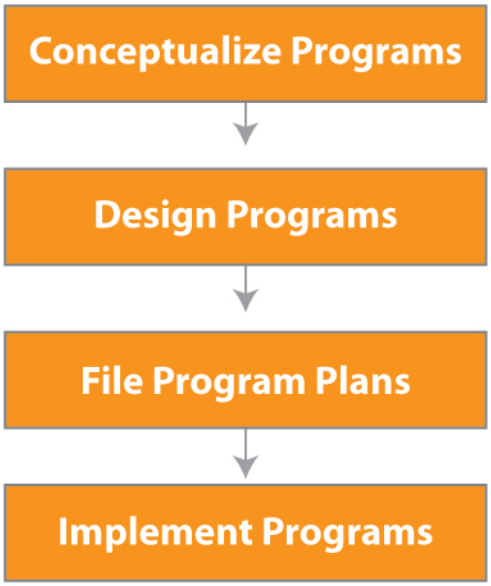
Executive Summary

Black Hills Energy is pleased to present this energy-efficiency plan, pursuant to Docket No. 08-GIMX-442-GIV of the Kansas Corporations Commission. The plan's creation has adhered to a rigorous planning process, culminating in the program designs. The various process phases are shown in Figure ES.1.

Figure ES.1. Program Planning Process



Program Portfolio Overview

Black Hills Energy's energy-efficiency portfolio is composed of three broad categories: residential programs, nonresidential programs, and special programs. Each of these categories is designed to address the needs of various customer types. The residential program category is further separated into the following subcategories: space and water heating programs, envelope measure retrofits, new construction, and an audit program. The nonresidential programs are: prescriptive and custom rebate programs, and the small commercial audit program. The special programs category consists of the low-income programs and school-based energy education.

Program Budgets, Savings, and Cost-Effectiveness

Developing this plan has provided Black Hills Energy with an opportunity to review its program offerings in other states, and explore program improvements and innovative new offerings. The resulting overall budget for Black Hills Energy's energy-efficiency portfolio is $1,473,000 in year 1. Table ES.1 presents each year's budgets for individual programs, including $250,000 for

general across-program training, marketing, software, and administration. For the full five-year budgets, see Appendix D.

The budget reflects Black Hills Energy's commitment toward achieving the greatest amount of cost-effective, energy-efficiency savings feasible over the planning horizon, with an equitable balance of the energy-efficiency costs between participants and ratepayers.

Table ES.1. Program Year 1 Budget Summaries

Program Category		Year 1 Budget
Residential Programs		
R-1 – Residential Audits		$121,000
R-2 – Residential Space and Water Heating		$345,000
R-3 – Residential Envelope Measures Retrofit		$98,000
R-4 – Residential New Construction		$400,000
Nonresidential Programs		
NR-1 – Small Commercial Audits		$30,000
NR-2 – Nonresidential Prescriptive Rebates		$111,000
NR-3 – Nonresidential Custom Rebates		$61,000
Special Programs		
S-1 – Low-Income Programs	S-1.1 – Weatherization	N/A**
	S-1.2 – Affordable Homes (New Construction)	$9,000
	S-1.3 – Weatherization Teams	$9,000
S-2-School-Based Energy Education		$39,000
Across-Program Training, Marketing, Software, and Administration		
		$250,000
Total Budget		
		$1,473,000

*Program budgets rounded to the nearest thousand dollars.
**Low-income Weatherization program to begin in Year 2.

As these programs are new, budgets will ramp up in later years to cover greater participation. Costs also are assumed to inflate at 2.38% per year. Annual budgets by category are provided in Table ES.2. Marketing budgets are front-loaded to heavily promote the programs in years 1 through 3, thus the entire portfolio budget actually decreases slightly in years 4 and 5.

Table ES.2. Annual Utility Budget by Sector by Year

Sector	Year 1	Year 2	Year 3	Year 4	Year 5
Residential	$964,000	$1,318,000	$1,691,000	$1,696,000	$1,690,000
Nonresidential	$202,000	$335,000	$557,000	$534,000	$520,000
Special	$57,000	$388,000	$454,000	$456,000	$458,000
Cross Program	$250,000	$215,000	$220,000	$225,000	$230,000
Total	$1,473,000	$2,257,000	$2,922,000	$2,911,000	$2,898,000

Analyzing program cost-effectiveness is an important part of the planning process, both in terms of meeting regulatory requirements and in selecting and designing programs. Table ES.3, Table ES.4, and Table ES.5 show (respectively) residential, nonresidential, and special programs first-

year therm savings and cost-effectiveness results for the total resource cost (TRC), for the first five years of program activity. Programs without claimed savings are not shown.

Table ES.3. Residential Program TRC Test

Program	First-Year DTh Savings	Five-year Cumulative Benefits	Five-year Cumulative Costs	Benefit/Cost Ratio
R-1 – Residential Audits	1,245	$905,000	$1,296,000	0.70
R-2 – Residential Space and Water Heating	7,364	$3,761,000	$3,753,000	1.00
R-3 – Residential Envelope Measures Retrofit	2,245	$2,144,000	$1,283,000	1.67
R-4 – Residential New Construction	5,495	$2,294,000	$1,799,000	1.27

Table ES.4. Nonresidential Program TRC Test

Program	First-Year DTh Savings	Five-year Cumulative Benefits	Five-year Cumulative Costs	Benefit/Cost Ratio
NR-1 – Small Commercial Audit	42	$27,000	$202,000	0.13
NR-2 – Nonresidential Prescriptive Rebates	7,542	$6,661,000	$2,576,000	2.59
NR-3 – Nonresidential Custom Rebates	3,250	$2,608,000	$1,226,000	2.13

Table ES.5. Special Program TRC Test

Program	First-Year DTh Savings	Five-year Cumulative Benefits	Five-year Cumulative Costs	Benefit/Cost Ratio
S-1 – Low-Income Programs	316	$494,000	$1,151,131	0.43
S-2 – School-Based Energy Education	910	$323,000	$299,000	1.08

Plan Contents

In addition to this Executive Summary, the document consists of the following chapters and appendices:

- Chapter 1 explains the plan development process and discusses various components used in creating the energy-efficiency portfolio.
- Chapter 2 reviews underlying assumptions and data inputs guiding the cost-effectiveness analysis.
- Chapter 3 describes the overall program development strategy.
- Chapters 4, 5, and 6 detail the residential, nonresidential, and special programs (respectively) forming the overall energy-efficiency portfolio. These chapters contain general discussions of topics relevant to the programs as well as detailed descriptions of individual programs, including budgets, participation, measures, impacts, and, where required, cost-effectiveness results.

- Chapter 7 contains rate impacts across the residential, general service commercial/industrial, and non-general service commercial/industrial customers.

- Chapter 8 provides conclusions and a request for plan approval.

- The document concludes with the following appendices, which provide the necessary data to complete filing:

  A. Energy-Efficiency Measures
  B. 2005-2006 Test Year Sales and Customer Data
  C. Rate Tariffs
  D. Detailed Program Benefit-Cost Analysis
  E. Proposed Energy Efficiency and Cost Recovery Tariffs

1. Introduction

Black Hills Energy Philosophy

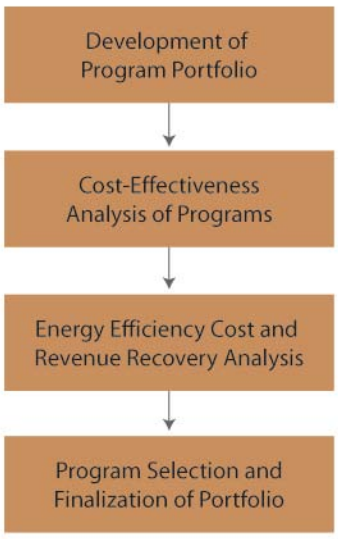
Developing this energy-efficiency plan has provided Black Hills Energy with a strong opportunity to determine the best ways to serve its Kansas customers. Energy efficiency is relevant to multiple arenas of Black Hills Energy's operations. In addition to the vital role energy efficiency plays in Black Hills Energy's resource utilization planning, it serves as a critical element in providing excellent customer service, remaining faithful to environmental stewardship principles, and meeting the Company's responsibilities for the National Action Plan for Energy Efficiency. Given this importance, an overarching goal has been to fully use the process to develop the best possible portfolio of energy-efficiency programs. This chapter focuses on describing the overall process of producing Black Hills Energy's energy-efficiency plan, illustrating how the process incorporated a wide range of information to create a comprehensive suite of cost-effective programs.

Black Hills Energy looks forward both to working expeditiously with the Commission and other interested parties in conducting this proceeding and moving to the next step in this process: rolling out our ambitious plan as soon as possible to maximize customer benefits.

Plan Development Process Overview

Figure 1 illustrates the primary steps used in Black Hills Energy's planning process. Developing Black Hills Energy's energy-efficiency plan incorporated numerous elements to produce a portfolio of energy-efficiency programs, primarily Black Hills Energy's experience of delivering programs within other jurisdictions.

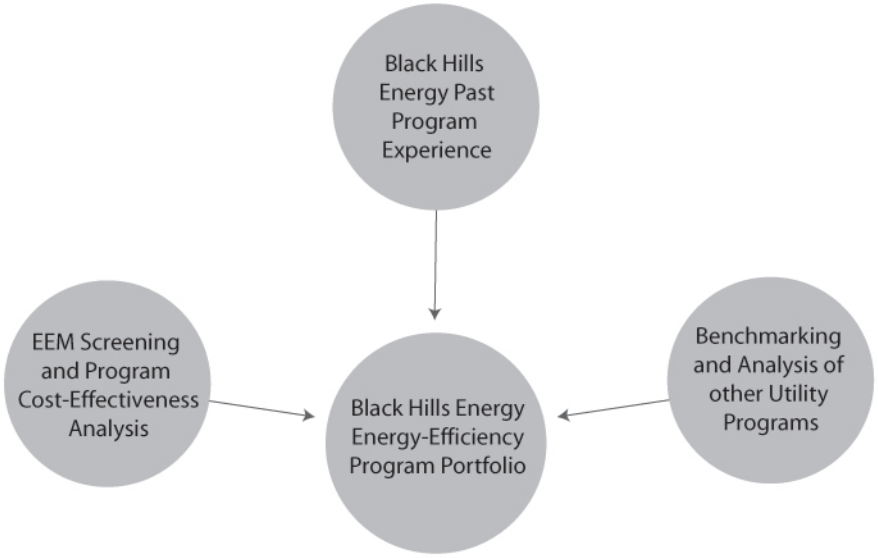
Figure 1. Program Planning Process



Multi-Criteria Approach

Although many process steps followed a specific sequence, with one activity's results necessarily informing the next, the final energy-efficiency program portfolio depended on multiple criteria, with influence throughout the planning process. Figure 2 portrays the elements contributing to the final energy-efficiency programs portfolio.

Figure 2. Criteria for Development of the Program Portfolio



The Role of Other States' Programs

Black Hills Energy, which currently conducts various programs for residential and nonresidential customers in other states, will be offering such programs to its Kansas customers for the first time in 2010. Experience with the company's other programs was used to develop this plan. For example, in Iowa and Colorado, residential customers may receive an audit along with rebates for high-efficiency space and water heating equipment, and home envelope measures. On the commercial and industrial side, Black Hills Energy has offered prescriptive and custom rebates for energy-efficiency upgrades and a small commercial audit program.

Overall, Black Hills Energy's programs have successfully met their participation and savings goals. Given this strong program history, building on this success served as a priority in developing this plan, while incorporating Kansas-specific customer demographics and the most current knowledge and information available from other sources. These combined efforts helped identify new program opportunities and enhance existing programs.

Benchmarking

In addition to looking at its own programs, Black Hills Energy examined the efforts of other utilities throughout the country to identify innovative programs and promising ideas that could aid in creation of the new program portfolio. The benchmarking activities were helpful in identifying areas where Black Hills Energy could improve its offerings. For example, a strong relationship with trade allies appeared as a key factor in successful prescriptive rebate programs. Throughout the planning process, this information proved useful in minimizing deficiencies in the new program portfolio.

Measure and Program Screening

The stipulation that programs must be cost-effective from a total resource cost (TRC) perspective proved to be a critical element in the planning process. From the perspective of ratepayers and the utility, this ensured energy-efficiency investments would yield sufficient benefits to warrant their costs. Chapters 4, 5, and 6 present program screening results.

The importance of the cost-effectiveness requirement first came into play while screening energy-efficiency measures (EEMs). Estimated costs and savings were primarily based on California's Database for Energy Efficiency Resources (DEER). The most recent DEER update (2008) served as the primary source, while the 2005 database was used for measures not found in the 2008 update. Some measures Black Hills Energy offers in its other territories had no costs or savings references in DEER. As detailed in Appendix A, for such measures, assumed savings used in Black Hills Energy's Colorado territory have been adjusted by heating degree days to reflect anticipated savings in Kansas.

Analyzing program cost-effectiveness not only required comparing savings benefits of EEMs to their incremental costs; it also incorporated administrative costs, an appropriate mix of EEMs, and reasonable goals for program participation into the calculations. Savings associated with EEMs in a program, multiplied by participants, had to produce sufficient savings to cover EEM costs, administration expenses, and program marketing and training expenses.

Combining different elements resulted in an iterative process where programs were refined to balance costs and savings—in terms of budget, participation, or EEMs—until the appropriate mix was determined. In all cases, a program's design was rooted in the best data available from sources discussed in this chapter; this provided all of Black Hills Energy's programs with a firm footing in reality, which bodes well for their success.

2. Black Hills Energy Data

Black Hills Energy generated natural gas avoided costs pursuant to Commission rules for both the measure- and program-level cost-effectiveness tests that contributed to the development of this energy-efficiency plan. This section explains the various components used to generate energy and capacity avoided costs.

Gas Energy Costs

Calculations for avoided energy costs in the peak and off-peak periods, on a seasonal basis were based on the following formula:

$$Avoided\ Energy\ Costs = (E + VOM) \times (1 + EF) \quad (1)$$

where:

- *E* (energy costs) was the greater of *ME* or *FE*.
- *ME* (current marginal energy costs) was the utility's current marginal energy costs, expressed in dollars per DTh or Mcf during peak and off-peak periods.
- *FE* (future energy costs) was the utility's average future energy costs over the 20-year period, expressed in dollars per DTh or Mcf during peak and off-peak periods.
- *VOM* (variable operations and maintenance costs) was the utility's average variable operations and maintenance costs over the 20-year period, expressed in dollars per DTh or Mcf during peak and off-peak periods.
- *EF* (externality factor) was based on anticipated CO_2 regulatory costs. These costs, per Commission Rules, varied from $10/ton, $25/ton and $40/ton.

Black Hills Energy compared *ME* and *FE*, and determined *FE* costs, derived from NYMEX's Henry Hub Natural Gas settlement prices, provided a higher estimate of gas energy costs.

The remaining inputs necessary to determine avoided costs were:

- Variable operations and maintenance costs (*VOM*) were set equal to zero, as there were no other costs offset from gas energy savings.
- The externality factor (*EF*) for the societal test was calculated based on the cost of carbon and an assumed value of 11.7 lbs CO_2/therm[1].

[1] Based on EIA data http://www.eia.doe.gov/oiaf/1605/coefficients.html

Customer and Load Forecasts

Development of rate impacts associated with the Five-Year Energy Efficiency Plan was based on 2005 – 2006 test-year sales and customer data. These data are presented in Appendix B.

Rates

Natural gas rates used for cost-effectiveness analysis of Black Hills Energy programs and for determining rate impacts are provided in Appendix C.

Discount and Inflation Rates

Other key parameters used in analysis were discount and inflation rates. The discount rate varied across different cost-effectiveness test perspectives, and, as discussed, a variety of input data-specific inflation rates were also used. Table 1 summarizes these values and their associated data sources.

Table 1. Discount and Inflation Rates

	Rate	Data Source
Total Resource Cost Discount Rate	7.67%	After-tax weighted average cost of capital (WACC)
Program Administrator Discount Rate and Ratepayer Impact Test	7.67%	After-tax weighted average cost of capital (WACC)
Participant Discount Rate	10%	Kansas rules
Societal Discount Rate	3% and 7%	Kansas rules
Cost Inflation	2.38%	US Consumer Price Index, Moody's Economy.com, October 2007 Economic Forecast.

3. Overall Program Design

Before describing the individual programs, several elements of demand-side management (DSM) program design require a more general discussion to provide the background necessary to understand Black Hills Energy's comprehensive approach to meeting its energy-efficiency plan objectives.

As discussed in Chapter 1, Black Hills Energy has incorporated information from various sources throughout developing its portfolio. The objective of drawing upon an array of sources was to create a comprehensive and innovative set of programs to serve Black Hills Energy's customers and the state of Kansas by advancing efficient energy use. Also as noted, many programs in this plan are based on programs currently offered in other states. Black Hills Energy has experienced success with these programs, in many cases exceeding participation and savings goals without exceeding projected budgets on a per-participant basis.

Delivery Mechanisms

The primary program delivery mechanism consists of customers purchasing high-efficiency equipment and/or services directly from existing market actors (i.e., contractors, equipment dealers, and retailers). Consequently, successful promotion and administration of programs requires going beyond a "customer-only" focus. Targeting trade allies and leveraging their relationships with Black Hills Energy through promotional activities will increase consumers' awareness and high-efficiency equipment availability. These upstream incentives will add longevity and momentum to market changes engendered by program activity, and will support long-lasting infrastructure development. Black Hills Energy also will support the State Energy Office's Efficiency Kansas program.

Despite the emphasis on customer incentives, components of several programs include strategies to encourage cooperation with trade allies, other utilities, and state and local agencies. In some programs, for example, portions of budgets have been reserved to conduct training and informational outreach activities with trade allies, including dealers and maintenance service providers. These activities have intended to keep key trade allies apprised of the changes in the programs, allowing allies to better assist customers and ensure high-efficiency equipment remains stocked. In addition, a trade ally/dealer "spiff" or rebate will be offered for some measures, with the trade ally receiving a financial reward for promoting high-efficiency equipment to his or her customers. For furnaces and boilers, however, this spiff will be contingent upon proof of quality installations.

Qualifying Energy-Efficiency Measures

Qualifying EEMs represent: more efficient models of end-use appliances, such as water heaters; or technological improvements that can improve an end-use appliance's energy use, such as furnace maintenance. Nearly all the programs encourage adoption of at least one EEM. EEMs qualifying for each program are intended to represent a substantial improvement over standard

market efficiency. In some instances, this has meant some incentivized EEMs have not been readily available to consumers. For example, a program might promote a condensing gas water heater with an Energy Factor (EF) of 0.80 or more, which is not as available in some markets as in others. Such EEMs should, however, become more available over time.

While all programs have incentives for EEMs at efficiency levels available in the current market, the program does not seek to provide incentives EEM participants would adopt in the program's absence. In some cases, such as insulation measures and requirements of local building codes, baseline efficiency levels are clearly defined. Programs then are specifically designed to provide incentives for EEMs to go beyond code. In other cases, such as with furnaces, incentives are designed to encourage participants to select not merely a higher efficiency level, but the highest level available.

Program Beneficiaries

Establishing participation goals for each program requires balancing numerous factors, including the pool of eligible participants, available budget, and past program performance. The number of eligible participants primarily is based on Black Hills Energy's customer profiles and on regional equipment and fuel saturation data.

Each program budget has been developed to balance best practices, including shares of technology costs paid directly by participants, compared to incentive subsidies. Incentives need to be sufficiently large to encourage participation, yet remain small enough to maximize available resources. Conversely, if incentives are too large and preclude customers who can afford to pay some measure and installation costs from having "skin in the game," it is nearly impossible to guarantee quality installations. Similarly, marketing and administrative budgets should be adequate to promote and operate the programs, but not so large as to negatively impact cost-effectiveness.

Finally, in setting participation goals for, two additional factors need to be considered. First, experience with programs in other states has served to determine which programs have been able to meet or exceed their goals and which have fallen short. Given similar incentive and outreach structures, we expect to achieve participation consistent with these other efforts. The second factor to consider has been these programs remain new to Kansas. As such, ramp-up time will be required to develop the necessary infrastructure for effective program delivery. For most of these programs, Year 1 participation levels will increase significantly by year 5.

Impacts

As these programs seek to save energy, impact goals remain a critical program design element, and the portfolio has been conceived to aggressively pursue this. Throughout this process, Black Hills Energy has sought to identify energy savings targets that can most effectively be achieved. The knowledge gained from these efforts has informed the program design, with programs crafted to address major residential and nonresidential end uses where technologies exist to significantly improve energy efficiency.

Because impacts are driven primarily by participation and the respective savings of qualifying EEMs, these components have been tailored to maximize the program's total impacts. The overall portfolio includes programs capturing a wide range of potential savings and are designed to maximize participation given best practice marketing and incentive designs. In addition to ensuring participation while efficiently using budget resources, incentives have been targeted to promote adoption of EEMs maximizing savings and minimizing lost opportunities. In many cases, incentives have been structured to encourage adoption of EEMs with the highest efficiency levels.

In addition, as many of the EEMs promoted by Black Hills Energy will reduce cooling as well as heating requirements, analyses of these measures include secondary electric benefits. For example, a customer installing high R-value ceiling insulation in a single-family home is expected to save approximately 84 therms and 133 kWh annually. Participant benefits include the cooling savings.[2]

Eligibility

To facilitate participation, where feasible, eligibility has been defined as broadly as possible to make programs more inclusive. For most residential programs, eligible participants include customers living in every type of residential structure, including single-family, multifamily, and manufactured homes. Though the low-income programs have specific income requirements, low-income customers are not precluded from participating in other residential programs. For non low-income programs, the only participation limitations are where a customer has recently participated in a program, such as the residential audit, and repeated participation would not render sufficient savings to justify the expense. For the nonresidential sector, the prescriptive program tends to focus more on smaller, commercial facilities. Larger commercial and industrial facilities have unique needs, which are generally better served through the nonresidential custom program.

Training

To improve participation and service quality, the plan places a high priority on training. Given Black Hills Energy's commitment to training and educating contractors and trade allies, training sessions will address a variety of topics, such as:

- Proper sizing and installation of HVAC equipment
- Home Performance with ENERGY STAR
- Green building techniques
- Year 1 utility programs

[2] To do so, we used Black Hills Energy's electric avoided costs, developed for its electric territory in Colorado.

Budgets

The following expenditure areas have been considered in developing program budgets:

- Administrative costs
- Incentives (both customer and trade ally)
- Program delivery costs
- Evaluation costs
- Marketing costs

Generally, incentives consume the bulk of program budgets. Black Hills Energy will seek opportunities to minimize administrative and marketing costs through coordinated delivery and marketing of programs across states Black Hills serves.

Program Evaluation, Measurement and Verification Plan

Evaluation serves as a necessary component of each program by helping determine if an overall portfolio achieve its objectives. Impact evaluation will be conducted for all programs to ensure the portfolio does not fall short of its goals. Evaluation budgets have been based on at most 5% of the total utility cost.

Impact evaluation depths will vary by program, with newer efforts receiving more attention than more tried-and-true offerings. In general, impact evaluations consist of assessing quantifiable program impacts for energy and peak savings. These are typically based on some combination of engineering estimates, installation verifications, samples of meter data from participants, and statistical billing analyses. Impact evaluations will also look at participation rates and measure adoption tendencies. To assist this process, Black Hills Energy will use its Energy Efficiency Information System (EEIS) to track all program participation, expenditures, and savings. Black Hills Energy currently uses EEIS for its Iowa and Colorado territories.

Cost-Effectiveness Calculations

Costs are presented as the present value of the future stream of administrative and incentive costs, and discounted at appropriate rates for different tests. Input sources are detailed in Chapter 2. Benefits are the present values of the future stream of avoided costs for each year of measure life, again discounted at the appropriate rates for different tests. A net-to-gross ratio of 0.8 is assumed in all cases except for the low-income programs for which the ratio is 1.0. Detailed results for the cost-effectiveness analysis are presented in Appendix D, including yearly values for all costs and benefits.[3]

[3] The budget line item “Audit Site Visit and Delivery” in Appendix D refers to the cost of free measures, free and discounted audits, and building inspections.

4. Residential Programs

Introduction

This chapter describes Black Hills Energy's proposed portfolio of residential sector energy-efficiency programs. The chapter begins with a general discussion of key program components, followed by detailed descriptions of each program. Table 2 shows Black Hills Energy's portfolio of proposed residential programs.

Table 2. Black Hills Energy Residential Programs

Category	Sub-Category (If Applicable)
R-1 – Residential Audits	
R-2 – Residential Space and Water Heating Program	R-2.1 – Furnace/Boiler Replacement and Maintenance Services
	R-2.2 – Water Heater Replacement
	R-2.3 – Innovative Space and Water Heating Technologies
R-3 – Residential Envelope Measures Retrofit	
R-4 – Residential New Construction	

R-1 – Residential Audit Program

Program Description

The Residential Audit Program is composed of two components: a free audit and a Home Performance with ENERGY STAR (HPwES) audit. The HPwES program is slated to start in year 2. Both audits aim to provide customers with recommendations about ways they can reduce energy consumption in their homes. Audit recommendations may include: suggested behavioral changes; suggestions on implementing low-cost and easy-to-install energy-saving equipment; and suggestions on repairing, upgrading, or replacing larger, relatively expensive equipment or systems.

Program Savings Goal

Projected program savings are 1,245 DTh in year 1, up to 4,548 DTh in year 5. Savings are obtained through the free, low-cost measures provided to the audit participants; the HPwES program includes savings from measures installed to complete the test-out audit.

Program Framework/Strategy

Relationship to Other Programs

The Residential Audit program is considered as the entrée into the residential portfolio of programs. This program is the necessary first step for customers interested in participating in the Residential Envelope Measures program.

Marketing Strategy

The Residential Audit program will be promoted through bill inserts and various media, including newspaper advertising. Customers who contact Black Hills Energy's call center, especially those calling with billing inquiries, will be referred to the program.

All residential customers are eligible to participate if they live in older homes (greater than 10 years old) with natural gas as their space heating fuel. Customers may receive only one audit during a five-year period. Targeted customers will include those with above-average consumption and those contacting Black Hills Energy with high bill complaints.

Program Delivery

Black Hills Energy will contract with a third-party auditing firm to deliver this program. While on site, auditors of both audit types will assess:

- Insulation levels
- Infiltration levels
- Equipment efficiency and operating condition
- Behavior-related factors influencing energy consumption

Auditors will install (or instruct participating customers on how to install) a number of low-cost energy-saving measures. Auditors also will provide participants with educational information on how to manage their energy usage and costs, and will refer participants to Black Hills Energy's other, applicable energy-efficiency programs.

The HPwES audit goes beyond the free audit by performing diagnostic testing (with a blower door and, if requested, an infrared scan) to quantify and more precisely identify air leakage sites. Specially trained contractors, HPwES auditors will conduct two visits per home:

- An initial, "test-in" visit, assessing the home's performance before any energy-saving upgrades have been undertaken. The HPwES auditor will produce a report detailing energy-saving recommendations and will perform, at minimum, the blower-door test.

- A follow-up, "test-out" visit, assessing the home's performance after the participant has installed three of the top five recommended energy-saving measures.

Participants who install building shell measures are eligible to receive incentives through the Black Hills Energy's Envelope Measures Retrofit program. Participants who install three of the

top five energy savings measures may be eligible to receive an ENERGY STAR label for their home.

Measures and Incentives

Audit participants will be offered the following energy-efficiency measures at no cost:

- Outlet gaskets
- Faucet aerators
- Pipe insulation
- Low-flow showerheads
- Low-cost infiltration measures

On average, a participating customer will receive about $30 worth of measures during the audit.

Program Budget

In addition to covering the cost of the free audit, Black Hills Energy will also cover the cost of low-cost measures distributed during the audit (a total value over $200 per home). For those choosing an HPwES audit, Black Hills Energy will cover the cost of the audits, less $100. Black Hills Energy also will offer a $200 bonus rebate for customers successfully completing both test-in and test-out audits.

The program's first year proposed annual budget is $121,000, as shown in Table 3. As the HPwES program is not expected to launch until year 2, these incentives are not reflected in the year 1 budget. For the full five-year budgets, see Appendix D.

Table 3. Residential Audit Program Budget

Category	Year 1 Amount
Total Annual Budget	$121,000
Incentives	$0
Program Administration	$5,000
Program Evaluation	$6,000
Audit Site Visit and Delivery	$96,000
Marketing and Training	$14,000

Program Beneficiaries

Free audit participation is projected at 479 participants in year 1, and up to 1,330 in year 5. HPwES participation is expected at 50 in years two through five.

Program Benefit-Cost Analysis

Table 4 and Table 5 present results from the cost-effectiveness analysis, based on five years of program activity. Dollars are rounded to the nearest $100.

Table 4. Residential Audits Benefit-Cost Analysis

Perspective	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
Total Resource Cost (TRC)	$1,295,973	$904,872	-$391,101	0.70
Program Administrator (PAC)	$1,277,388	$892,610	-$384,778	0.70
Ratepayer (RIM)	$2,317,419	$892,610	-$1,424,809	0.39
Participant (PART)	$203,886	$1,097,419	$893,534	5.38

Table 5. Residential Audits Societal Test Benefit-Cost Analysis

Discount Rate	CO_2 Cost ($/ton)	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
3%	$10	$1,435,924	$1,277,803	-$158,122	0.89
	$25	$1,435,924	$1,382,608	-$53,317	0.96
	$40	$1,435,924	$1,487,413	$51,488	1.04
7%	$10	$1,314,569	$995,959	-$318,610	0.76
	$25	$1,314,569	$1,077,918	-$236,651	0.82
	$40	$1,314,569	$1,159,876	-$154,693	0.88

Program Evaluation, Measurement and Verification Plan

The Residential Audit program's impact evaluation will examine two savings areas:

- Savings achieved through installation of low-cost measures provided through the audits, and through adoption of behavioral changes made in response to audit recommendations.

- Savings achieved through adoption of major measures recommended through the audit process. These savings may be identified or tracked through referrals and participation in Black Hills Energy's other rebate programs.

Savings primarily will be assessed using engineering estimates, though some short-term monitoring and/or billing analysis may be conducted to validate this technique. Savings measured through the HPwES diagnostic testing will also be used to inform, evaluate, and potentially adjust engineering savings estimates.

R-2 – Residential Space and Water Heating Program

The Residential Space and Water Heating Program includes several program components:

- R-2.1 – Furnace and Boiler Replacement and Maintenance Services
- R-2.2 – Water Heater Replacement
- R-2.3 – Innovative Space and Water Heating Technologies

While program components under the Residential Space and Water Heating Program umbrella are somewhat independent of the others, they have common elements, which in many cases will

require coordination with the same set of trade allies, and are supported by a similar programmatic infrastructure. Cost-effectiveness of the overall Residential Space and Water Heating Program follows a discussion of individual program components.

Program Savings Goal

Projected savings for this program are 7,364 DTh in year 1, increasing to 13,338 DTh in year 5.

R-2.1 – Furnace and Boiler Replacement and Maintenance Services

Program Description

The Residential Furnace and Boiler Replacement and Maintenance Services program will provide incentives to customers who upgrade their existing furnaces and boilers to higher-efficiency units. Incentives are also available for performing prescribed maintenance on gas furnaces and boilers. All residential customers living in structures with one to four units, including manufactured homes, are eligible to participate in the program.

Program Framework/Strategy

Marketing Strategy

Black Hills Energy will conduct targeted promotional activities with customers, heating contractors, and retailers, and will directly market the program to residential customers through bill inserts, the company Web site, and other mass media outlets, as appropriate (i.e., newspaper or radio advertising). Black Hills Energy will also offer heating contractors marketing materials and available funding for cooperative advertising. Further, the tiered dealer spiff is designed to induce contractors to more actively promote increasing numbers of the highest efficiency furnaces and boilers to their customers. Black Hills Energy will explore the possibility of maintaining a list of qualified contractors, based on those contractors' completion of a training program.

Part of the budget has been allocated for marketing and promotional activities targeting trade allies to ensure they are aware of the program and clearly understand its requirements. Black Hills Energy will provide contractors with training opportunities on quality installation practices as well as required maintenance procedures leading to energy savings and improved performance of heating systems.

The program targets residential customers with gas heating, with a special emphasis on achieving a higher participation rate among owners of rental units. This may be done through promotions targeted to property owners and recognition of participating landlords. In addition, because the program includes high-efficiency boilers, more property owners will be able to participate.

Program Delivery

This program will be delivered by Black Hills Energy, which will utilize relationships with individual contractors who promote the rebates directly to their customers.

Measures and Incentives

Measures qualifying for the Furnace and Boiler Replacement and Maintenance Services program include: residential furnaces with an Annual Fuel Utilization Efficiency (AFUE) of 94% or higher; and residential boilers with an AFUE of 85% or higher, in addition to furnace and boiler maintenance. These minimum efficiency levels are significantly higher than current federal minimum efficiency standards (78% AFUE for gas furnaces and 80% AFUE for boilers).

As shown in Table 6, the higher a furnace's or boiler's efficiency, the higher a customer's incentive. Incentives were intentionally structured to encourage customers to request and install the most efficient equipment available.

In addition to offering customer incentives, Black Hills Energy will offer dealer/contractor spiffs to encourage quality installation practices. The spiffs will be available to trade allies attending Black Hills Energy-approved training sessions and whose furnace and boiler installations comply with specifications prescribed by Black Hills Energy (e.g., Manual J). Black Hills Energy will encourage customers to achieve greater savings by repairing and sealing ducts at the same time as equipment installation. This measure is also offered as part of the Envelope Measures Retrofit program. Further, Black Hills Energy will develop specific maintenance protocols, including procedures to improve furnace and boiler performance (such as burner cleaning, flue gas analysis, and filter replacement).

As with customer incentives, trade ally spiffs increase with higher-efficiency equipment. Spiffs are calculated as the sum of one labor hour (estimated as $75) and a percentage of the customer incentive.

Table 6. Furnace and Boiler Rebates and Maintenance Services Projected Participation

Measure	Efficiency	Customer Incentive	Dealer Spiff	Year 1 Projected Participation
Furnace	94% ≤ AFUE < 96%	$325	$125	600
	AFUE ≥ 96%	$400	$155	29
Boiler	85% ≤ AFUE < 89%	$150	$90	2
	AFUE ≥ 90%	$400	$155	20
Furnace/Boiler Maintenance	NA	$30	--	295
Duct repair and sealing	NA	$200	--	15
Duct Insulation	R-8	$150	--	15

Program Beneficiaries

Expected program participation for the furnace component is 629 the first year, increasing to 1,062 in year 5. Of 629 participants with furnace installations in year 1, Black Hills Energy assumed:

- Ninety-five percent will receive the $325 incentive for furnaces with an AFUE of 94% to 95.9%; and

- Five percent will receive the maximum incentive of $400 for furnaces with an AFUE equal to or greater than 96%.

Because the saturation of natural gas-fired boilers is considerably lower than that of natural gas-fired furnaces, the potential number of boiler participants is considerably less than the potential number of furnace participants. Participation for boiler measures included the following assumptions:

- Nine percent of boiler rebate participants will receive the $150 incentive, associated with boilers with an AFUE of 85% to 89.9%; and

- Ninety-one percent of participants will receive the $400 incentive, associated with boilers with an AFUE equal to or greater than 90%.

Program Budget

The program has a proposed year 1 budget of $316,800, comprised of the components listed in Table 7. The budget projection assumes half the dealers will participate in and qualify for the spiff.

Table 7. Furnace and Boiler Replacement and Maintenance Services Program Budget

Category	Year 1 Amount
Total Annual Budget	$316,800
Customer Incentives ▪ See Measure Table for Rebate and Participation Levels	$229,000
Dealer Incentives ▪ See Measure Table for Rebate and Participation Levels	$41,000
Program Administration	$11,000
Marketing and Training	$21,100
Evaluation	$14,700

Program Evaluation, Measurement and Verification Plan

Black Hills Energy will assess the program impacts using engineering estimates and data collected through program tracking efforts. Baseline usage characteristics will be determined

through surveying a sample of program participants. The program participant survey will be designed to collect the following information:

- Age and efficiency of existing equipment and efficiency and type (e.g., furnace, boiler, Munchkin boiler) of new equipment;
- The likelihood installed equipment has been properly sized (assessed partly by whether the contractor met program requirements and received the dealer spiff);
- Size and type of dwelling;
- Number and age of occupants; and
- Other information impacting participants' energy-use characteristics.

Engineering estimates primarily will be validated through a pre- and post-billing analysis of a sample of program participants. This will involve comparing weather-normalized consumption before and after installation of energy-efficient equipment or a maintenance service. These energy-saving estimates will be compared with engineering estimates, and engineering estimates will be adjusted as necessary.

R-2.2 – Water Heater Replacement

Program Description

The Water Heater Replacement program offers customers incentives to upgrade to higher efficiency levels when replacing water-heating equipment. As with the Furnace and Boiler Replacement and Maintenance Services program, incentives are structured to encourage customers to install the highest efficiency level available.

Given the limited availability of higher tier equipment at present, it is anticipated most participants will select equipment in the first efficiency tier. However, given current Federal ENERGY STAR water heater standards, more extensive contractor outreach and education efforts, and higher incentive levels, higher-efficiency water heaters are expected to become more available and participation at higher-efficiency levels will likely increase.

Program Framework/Strategy

Marketing Strategy

Water heater replacements generally occur following failure of an existing unit. Therefore, contractors and/or retail outlets must learn of the Water Heater Replacement program. Consequently, program promotion will particularly focus on developing strong trade ally marketing and communications. Dealer spiffs structured to encourage stocking the higher-efficiency units will also be a key component of the program's marketing strategy. Dealers will be required to complete manufacturer-sponsored training on installation guidelines for higher-

efficiency water heaters to receive the spiff. Budget has been allocated to contractor education and marketing to encourage more dealers to stock higher-efficiency water heating units. In addition, bill inserts will be used to inform customers of this program (and others). Auditors will inform customers of the program if, during residential audit, their water heaters appear to be nearing the end of their useful lives.

Depending on the purchase method, customers will provide purchase and installation documentation of qualifying unit or may, in some cases, be able to earn an "instant rebate" from participating equipment dealers or contractors.

Residential customers replacing an existing water heater comprise the target market.

Program Delivery

This program will be delivered by Black Hills Energy, which will utilize relationships with individual contractors who promote the rebates directly to their customers.

Measures and Incentives

Domestic water heaters with a 0.67 EF or higher are eligible for this program, the tiers designed to match ENERGY STAR standards taking effect September 9, 2010. Table 8, below, shows rebates and projected numbers of participants for each efficiency level.

Table 8. Rebate Levels for Natural Gas Water Heaters

Efficiency Level	Customer Rebate	Dealer Spiff	Year 1 Projected Participation
0.67 ≤ EF> 0.80	$75	$10	100
Condensing (EF ≥ 0.80)	$300	$60	5
Tankless water heater (EF ≥ 0.82)	$300	$60	40

Program Beneficiaries

First year participation is projected at 145 residential customers or water heaters. In year 5, these rates are expected to rise to 300, given greater program awareness and development of marketing and contractor education.

Program Budget

In year 1, the program will have a $26,700 proposed annual budget. Budget components are shown in Table 9.

Table 9. Year 1 Residential Water Heater Replacement Program Budget

Category	Year 1 Amount
Total Annual Budget	$26,700
Customer Incentives ▪ See Measure Table for Rebate and Participation Levels	$21,000
Dealer Incentives ▪ See Measure Table for Rebate and Participation Levels	$1,800
Program Administration	$900
Marketing and Communication	$1,800
Evaluation	$1,200

Program Evaluation, Measurement and Verification Plan

Program impacts will be assessed based on engineering estimates and program participation tracking. Key customer characteristics affecting consumption and savings will be collected by surveying a sample of participants. Data collected will include:

- Efficiency of equipment replaced, and efficiency and type (e.g., storage or tankless) of replacement equipment;
- Occupancy characteristics including number and ages;
- Usage characteristics (e.g., number and length of showers, use of hot water for laundry, etc.); and
- Engineering calculation inputs will be reviewed and revised, if necessary, based on customer survey results.

R-2.3 – Innovative Space and Water Heating Technologies

Program Description

The Residential Innovative Space and Water Heating Technologies program has two purposes: encouraging adoption of more recent-to-market, energy-efficient technologies; and ensuring Black Hills Energy's energy-efficiency portfolio includes savings opportunities through less common space and water heating applications. Program measures address both space and water heating end uses.

Program Framework/Strategy

Marketing Strategy

The program will be promoted through trade ally education, bill inserts, Black Hills Energy's Web site, and other media outlets.

The program targets the following groups: Black Hills Energy residential customers replacing water heaters and/or space heating equipment and dealers of the given measures. As the program promotes new and innovative technologies, it will appeal to early adopter customers or those wanting to be on the technological frontier.

Program Delivery

This program will be delivered by Black Hills Energy, which will utilize relationships with individual contractors who promote the rebates directly to their customers.

Measures and Incentives

Table 10 shows measures qualifying for incentives through the Innovative Space and Water Heating Technologies initiative. Similarly to the furnace and boiler replacement program, the dealer spiff for the integrated space and water heating unit only will be available to contractors demonstrating proof of proper equipment sizing (e.g., Manual J) to Black Hills Energy. Although no drain water heat recovery and multi-zone thermostats participants are expected in year 1, some participants are expected in years three through five.

Table 10. Innovative Space and Water Heating Technologies

Measure Description	Customer Rebate Level	Dealer Spiff	Year 1 Projected Participation
Drain Water Heat Recovery	$300	$60	0
Integrated Space and Water Heat	$500	$175	2
Multi-Zone Thermostats	$300	$60	0

Program Beneficiaries

Because the program promotes new or not fully commercialized technologies, limited participation is expected: program participation is estimated at only two participants for the first year and up to six by the fifth year.

Program Budget

The proposed year 1 budget for the program is $1,475, as shown in Table 11. The budget projection assumes half of the dealers will receive the rebate for the integrated space and water heating unit.

Table 11. Year 1 Innovative Space and Water Heating Program Budget

Category	Year 1 Amount
Total Annual Budget	$1,475
Customer Incentives ▪ See Measure Table for Rebate and Participation Levels	$1,000
Dealer Incentives ▪ See Measure Table for Rebate and Participation Levels	$175
Program Administration	$100
Marketing and Communications	$100
Evaluation	$100

Program Evaluation, Measurement and Verification Plan

Evaluation of this initiative will focus on verifying performance of the relatively new technologies installed. Short-term monitoring and billing analysis are possible approaches for assessing energy impacts of included measures.

Overall Residential Space and Water Heating Program Results

Program Budget

The proposed year 1 budget for the program is $345,000, as shown in Table 12. For the full five-year budgets, see Appendix D.

Table 12. Year 1 Residential Space and Water Heating Program Budget

Category	Year 1 Amount
Total Annual Budget	$345,000
Customer Incentives ▪ See Measure Table for Rebate and Participation Levels	$251,000
Dealer Incentives ▪ See Measure Table for Rebate and Participation Levels	$43,000
Program Administration	$12,000
Marketing and Communications	$23,000
Evaluation	$16,000

Program Benefit-Cost Analysis

Table 13 and Table 14 present results from cost-effectiveness analysis of the Space and Water Heating program, based on five years of program activity.

Table 13. Residential Space and Water Heating Program Benefit-Cost Analysis

Perspective	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
Total Resource Cost (TRC)	$3,752,690	$3,760,785	$8,095	1.00
Program Administrator (PAC)	$2,204,599	$3,760,785	$1,556,187	1.71
Ratepayer (RIM)	$6,485,477	$3,760,785	-$2,724,692	0.58
Participant (PART)	$3,060,259	$5,099,113	$2,038,854	1.67

Table 14. Residential Space and Water Heating Program Societal Test Benefit-Cost Analysis

Discount Rate	CO_2 Cost ($/ton)	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
3%	$10	$4,128,295	$6,274,630	$2,146,335	1.52
	$25	$4,128,295	$6,759,244	$2,630,949	1.64
	$40	$4,128,295	$7,243,858	$3,115,563	1.75
7%	$10	$3,802,603	$4,216,919	$414,316	1.11
	$25	$3,802,603	$4,549,597	$746,994	1.20
	$40	$3,802,603	$4,882,275	$1,079,672	1.28

R-3 – Residential Envelope Measures Retrofit Program

Program Description

The Residential Envelope Measures Retrofit program provides incentives to customers improving their homes' efficiency through installing insulation and other thermal envelope measures. The program covers a wide range of measures, including: ceiling, wall, and foundation insulation and infiltration measures (e.g., caulking, weatherstripping). Incentive levels are set as a percentage of the total cost, and are capped at a specified value that varies by measure.

Program Framework/Strategy

Marketing Strategy

The residential audit program will serve as a key vehicle for marketing the program. Customers must participate in the audit program to qualify for the Residential Envelope Measures Retrofit program; if customers arrange for installation of insulation or other thermal envelope measures, based on residential audit recommendations, they may be eligible for rebates. To receive rebate payment, a participating customer will provide Black Hills Energy with documentation of materials purchased or work completed.

Black Hills Energy will consider maintaining a list of "qualified" contractors, depending on customers' need for such information.

The program targets Black Hills Energy's residential space heating customers living in older housing, where insulation levels have not been improved or increased.

Program Delivery

This program will be delivered by Black Hills Energy, which will utilize relationships with individual contractors who promote the rebates directly to their customers.

Measures and Incentives

Table 15 lists eligible measures, efficiency levels, and proposed rebate levels. Insulation measure rebates are structured to cover roughly two-thirds of measures' incremental costs and to encourage customers to adopt the highest efficiency levels technically feasible.

Table 15. Envelope Measures Retrofit Incentives

Measure Description	Min Efficiency Level	Rebate Level	Year 1 Projected Installations
Insulation (ceiling)	R-38	70% up to $750	143
Insulation (wall)	R-11	70% up to $750	11
Insulation (floor)	R-25	70% up to $750	8
Insulation (rim and band joist)	R-10	70% up to $50	2
Insulation (foundation)	R-13	70% up to $750	0
Insulation (duct)	R-8	70% up to $150	9
Thermal (Storm) Door	R-5	$25	10
Infiltration control (weatherstripping, caulking, etc)		70% up to $200	143
Canned lighting air tight sealing		70% up to $200	11
Duct repair and sealing		70% up to $200	9

Program Beneficiaries

Participation is projected at: 174 customers in year 1; and 602 customers in year 5.

Program Budget

The program has a proposed year 1 budget of $98,300, comprised of the components shown in Table 16. For the full five-year budgets, see Appendix D.

Table 16. Envelope Measures Retrofit Program Budget

Category	Year 1 Amount
Total Annual Budget	$98,300
Incentives ▪ See Measure Table for Rebate and Participation Levels	$75,300
Program Administration	$5,000
Marketing and Communications	$13,000
Evaluation	$5,000

Program Evaluation, Measurement and Verification Plan

Impact evaluation of this program will include tracking participation and key information about participants, including:

- Baseline conditions in the home;
- Measures installed (e.g., level and quantity of insulation installed); and
- Household occupancy and other factors that may impact savings levels.

Post-installation inspections may be conducted to verify installations are complete and performing properly. Billing analysis may also be conducted on a sample of homes.

Savings Goal

Projected program savings are: 2,246 DTh in year 1; and 7,766 DTh in year 5.

Program Benefit-Cost Analysis

Table 17 and Table 18 present cost-effectiveness analysis results from the Envelope Measures program, based on five years of program activity.

Table 17. Envelope Measures Retrofit Program Benefit-Cost Analysis

Perspective	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
Total Resource Cost (TRC)	$1,283,181	$2,143,550	$860,369	1.67
Program Administrator (PAC)	$957,596	$2,051,492	$1,093,896	2.14
Ratepayer (RIM)	$3,414,767	$2,051,492	-$1,363,276	0.60
Participant (PART)	$1,092,957	$2,822,239	$1,729,282	2.58

Table 18. Residential Envelope Measures Retrofit Program Societal Test Benefit-Cost Analysis

Discount Rate	CO_2 Cost ($/ton)	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
3%	$10	$1,426,989	$3,457,653	$2,030,664	2.42
	$25	$1,426,989	$3,718,056	$2,291,067	2.61
	$40	$1,426,989	$3,978,459	$2,551,470	2.79
7%	$10	$1,302,267	$2,391,223	$1,088,956	1.84
	$25	$1,302,267	$2,574,064	$1,271,797	1.98
	$40	$1,302,267	$2,756,906	$1,454,638	2.12

R-4 – Residential New Construction Program

Program Description

The Residential New Construction Program is designed to promote construction of energy-efficient single- and multifamily homes by providing new home builders with incentives to install high-efficiency, natural gas-fired space and water heating equipment and more robust thermal envelope measures. The Residential New Construction program, using a comprehensive approach to overall efficiency, is designed to minimize lost energy savings opportunities in each structure. The program offers flexibility by allowing each builder to participate through: a prescriptive path, in which the builder must install a specified set of energy-efficiency measures; or a performance path, in which the builder must meet specified energy performance targets. Under either path, qualifying homes may be eligible to receive ENERGY STAR new home labels.[4]

Program Framework/Strategy

Marketing Strategy

Through phone, mail, e-mail, in-person visits, and presences at industry meetings and events, extensive outreach to private sector trade allies will be conducted to gain allies' buy-in and support of the program. Black Hills Energy's marketing and communications efforts will emphasize presenting customers with targeted, education-oriented marketing materials to stimulate increased demand for energy-efficient new homes. Such outreach and education has proven crucial to successful new construction programs offered elsewhere in the county.

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[4] In addition to meeting Black Hills Energy's prescriptive standard, ENERGY STAR requires compliance with the following requirements to qualify for an ENERGY STAR New Homes label: (1) completion of a Thermal Bypass Inspection Checklist requiring two site visits (the first prior to installation of the drywall, and the second after construction has been completed, with the inspection performed through Black Hills Energy's Residential New Construction program satisfying the second ENERGY STAR inspection requirement); (2) if applicable, inclusion of a "right-sized" central air conditioner with SEER $\geq$ 13; and (3) inclusion of five or more ENERGY STAR-qualified appliances, light fixtures, ceiling fans with lighting fixtures, and/or ventilation fans.

Inspection of all singly-built homes will be required at the project's completion. For multiple homes built within the same subdivision, Home Energy Rating System (HERS) raters will use the "ENERGY STAR for Homes Revised Sampling Protocol Guidelines" to determine the number of homes that must be inspected. Based on Black Hills Energy own experience Black Hills Energy will emphasize that the inspections are viewed as partnership-building events rather than policing activities, and builders will be given the opportunity to resolve any issues identified during inspections. A portion of the HERS Rating cost will be covered by Black Hills Energy.

The program will target builders constructing, within Black Hills Energy's Kansas service area, new residential facilities that use natural gas as their primary space heating fuel. While most participating buildings are expected to construct single-family homes (as has been the case historically), Black Hills Energy will strive to include new multifamily structures in the program by targeting marketing messages to landlords and developers of multifamily dwellings.

Program Delivery

This program will be delivered by Black Hills Energy, which will utilize relationships with individual home builders who promote the rebates directly to their customers.

Measures and Incentives

Participating home builders may meet the program's efficiency standards by installing a prescribed set of energy-efficiency measures or by demonstrating that homes conform to the program's specified energy-consumption standards. Homes qualifying under the prescriptive path must include the equipment specified in Table 19.

Table 19. Prescriptive Path Requirements

Equipment Type	Minimum Qualifying Efficiency Level
Heating Equipment	▪ 94% AFUE natural gas furnace, or ▪ 85% AFUE natural gas boiler, or ▪ 0.84 CAE integrated natural gas space and water heater
Thermostat	▪ ENERGY STAR qualified or 5+1+1/5+2/7-day programmable thermostat
Ductwork	▪ ≤ 4 CFM to outdoors per 100 square feet ▪ R-6 insulation on ducts in unconditioned spaces ▪ All sheet metal joints, supplies, and returns sealed with duct mastic, aluminum tape, or other approved sealant
Envelope	▪ R-38 ceiling insulation ▪ R-13 wall insulation ▪ R-30 floor insulation (above unheated space) ▪ R-10 slab insulation, 2 foot depth ▪ R-10 continuous, or R-13 cavity foundation insulation ▪ R-5 doors
Infiltration	▪ ≤ 6 air changes per hour based on blower door test at 50 Pascals (ACH50) ▪ Mechanical ventilation recommended but not required
Windows	▪ ENERGY STAR qualified windows ▪ Windows ≤ 18% of above-grade conditioned floor area
Water Heater	▪ 0.67 EF, or ▪ 0.84 CAE integrated natural gas space and water heater

Some of these requirements exceed those of the ENERGY STAR Qualified Homes National Builder Option Package.[5]

Builders wishing to qualify their homes under the performance path may opt to participate in one of two tiers: Tier 1-qualified homes achieve a HERS Rating of 85 or lower; Tier 2-qualified homes achieve a HERS Rating of 75 or lower. The performance path allows builders to determine for themselves the specific set of measures they will install to meet the program's performance requirements. For example, one builder might choose to put in a EF 0.80 condensing water heater, while another might choose a tankless water heater. However, to develop savings and costs estimates for cost-effectiveness assessment, Black Hills Energy identified measures that, taken together, meet Tier 1 and Tier 2 criteria, as shown in Table 20.

Table 20. Residential New Construction Requirements

Measure Description	Equipment Included in Modeling	
	Tier 1 HERS	Tier 2 HERS
AFUE 94% Furnace	X	
AFUE 96% Furnace		X
EF 0.67 Water Heater	X	
EF 0.80 Water Heater (condensing or tankless)		X
Ceiling Insulation R-38	X	X
Floor Insulation R-38		X
Slab Insulation R-13		X
Wall Insulation R-19	X	X
Duct Insulation R-8	X	X

Builders participating under either the prescriptive or the performance path must provide proof of proper heating system sizing and installation, similar to that required by the Furnace and Boiler and Maintenance Services Replacement program.

The incentives are designed to cover more than three-quarters of the incremental cost of meeting the requirements. Table 21 shows these incentives and year 1 participation projections for all three qualifying options.

Table 21. Residential New Construction Incentives and Year 1 Participation

Path	Requirements	Incentive	Year 1 Projected Participation
Prescriptive	Measure list specified above	$1,500	129
Performance Tier 1	75 < HERS ≤ 85	$1,500	66
Performance Tier 2	HERS ≤ 75	$5,000	3

[5] For detailed ENERGY STAR Qualified Homes National Builder Option Package details, see: http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/Nat_BOP_Final_062807.pdf.

Program Beneficiaries

Participation is expected to be: 198 in year 1, increasing to 201 in year 5. In other territories, Black Hills Energy has historically seen participants move from the prescriptive to performance path, and a similar trend is anticipated for Kansas. As such, in year 1, 65% of builders are expected to participate in the prescriptive path, dropping to 55% in year 5.

Program Budget

Table 22 presents the year 1 program budget. For the full five-year budgets, see Appendix D.

Table 22. Residential New Construction Program Budget

Category	Year 1 Amount
Total Annual Budget	$399,900
Incentives ▪ See Measure Table for Rebate and Participation Levels	$328,200
Audit Site Visit and Delivery (HERS rating)	$20,700
Program Administration	$16,000
Marketing and Communications	$17,000
Evaluation	$18,000

Program Evaluation, Measurement and Verification Plan

Program tracking will be performed to assess the number of participating homes employing each of the various energy-efficiency measures to meet targeted performance standards. Data will be gathered from customers and builders, along with information on baseline building practices.

Based on the HERS rating or prescriptive specifications, an estimate of per-participant consumption and savings estimates will be computed. Some short-term monitoring and/or billing analysis may be performed for a sample of participating homes systems to validate these savings estimates.

Savings Goal

Projected program savings are: 2,320 DTh in year 1; and 2,378 DTh in year 5.

Program Benefit-Cost Analysis

Table 23 and Table 24 present the cost-effectiveness analysis the results for the New Construction program, based on five years of program activity.

Table 23. Residential New Construction Program Benefit-Cost Analysis

Perspective	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
Total Resource Cost (TRC)	$1,799,441	$2,293,554	$494,113	1.27
Program Administrator (PAC)	$1,824,059	$2,214,736	$390,678	1.21
Ratepayer (RIM)	$4,444,734	$2,214,736	-$2,229,997	0.50
Participant (PART)	$1,399,432	$3,580,628	$2,181,196	2.56

Table 24. Residential New Construction Program Societal Test Benefit-Cost Analysis

Discount Rate	CO_2 Cost ($/ton)	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
3%	$10	$1,961,099	$3,704,680	$1,743,581	1.89
	$25	$1,961,099	$4,095,695	$2,134,596	2.09
	$40	$1,961,099	$4,379,600	$2,418,501	2.23
7%	$10	$1,820,938	$2,492,009	$671,071	1.37
	$25	$1,820,938	$2,761,159	$940,221	1.52
	$40	$1,820,938	$2,956,378	$1,135,439	1.62

Combined Residential Program Portfolio Cost-Effectiveness

Table 25 and Table 26 show the cost-effectiveness of the four residential programs, combined into a single portfolio.

Table 25. Residential Programs Benefit-Cost Analysis

Perspective	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
Total Resource Cost (TRC)	$8,131,285	$9,102,762	$971,476	1.12
Program Administrator (PAC)	$6,263,642	$8,919,623	$2,655,982	1.42
Ratepayer (RIM)	$16,662,397	$8,919,623	-$7,742,774	0.54
Participant (PART)	$5,756,534	$12,599,401	$6,842,866	2.19

Table 26. Residential Programs Societal Test Benefit-Cost Analysis

Discount Rate	CO_2 Cost ($/ton)	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
3%	$10	$8,952,307	$14,714,765	$5,762,458	1.64
	$25	$8,952,307	$15,955,603	$7,003,295	1.78
	$40	$8,952,307	$17,089,329	$8,137,022	1.91
7%	$10	$8,240,378	$10,096,111	$1,855,732	1.23
	$25	$8,240,378	$10,962,738	$2,722,360	1.33
	$40	$8,240,378	$11,755,435	$3,515,056	1.43

5. Nonresidential Programs

Introduction

This chapter describes Black Hills Energy's proposed portfolio of nonresidential sector energy-efficiency programs. The chapter begins with a general discussion of key program components, then describes each program in detail. Table 27 presents Black Hills Energy's portfolio of proposed nonresidential programs.

Table 27. Black Hills Energy Nonresidential Programs

Program
NR-1 – Small Commercial Audits
NR-2 – Nonresidential Prescriptive Program
NR-3 – Nonresidential Custom Program
NR-4 – Industrial Sector Outreach

NR-1 – Small Commercial Audits

Program Description

The Small Commercial Audits Program will promote efficiency for small business customers, including on-site analysis to identify energy-efficiency opportunities. Targeted customers are eligible for a comprehensive energy audit performed by a professional energy auditor. The program will utilize software to assess and develop recommendations for the following energy-use categories:

- Heating system: controls, efficiency, and operating characteristics
- Domestic hot water use
- Thermal envelope factors
- Commercial cooking

Program Framework/Strategy

Marketing Strategy

The program will be promoted through bill inserts and targeted marketing to specific segments of the commercial customer base. For example, the program could be marketed through presentations to trade associations or trade publications targeting restaurant owners and operators in Black Hills Energy's area. The program will also be promoted through Black Hills Energy's Web site, bill inserts, and other media outlets, as appropriate.

Customers with facilities less than 25,000 square feet will be eligible to receive this service. The program will also target commercial customers with more intensive natural gas consumption, such as restaurants.

Program Delivery

The commercial audit program will be delivered through local auditors, contracted by Black Hills Energy. Customers will contact Black Hills Energy to schedule their audit, and will be charged a nominal $50 fee for scheduling. In turn, the auditor may provide, and in some cases install, low-cost measures during the audit.

Measures and Incentives

Low-cost measures the auditor may provide and/or install may include:

- Low-flow spray heads
- Hot water pipe insulation
- Water heater thermostat setback
- Programmable thermostat

Program Beneficiaries

In the first year, an estimated 20 commercial customers will participate in this program, ramping up to 76 customers in year 5.

Program Budget

The Small Commercial Audit program's total budget is $30,300 for the first year. Table 28 shows the proposed program budget breakdown. For the full five-year budgets, see Appendix D.

Table 28. Year 1 Small Commercial Audit Program Budget

Category	Year 1 Amount
Total Annual Budget	$30,300
Site Visits (@ $350 each)	$6,000
Low Cost Measure	$800
Program Administration	$4,000
Marketing and Communications	$18,000
Evaluation	$1,500

Program Evaluation, Measurement and Verification Plan

The program's impact evaluation will consider two saving areas:

- Savings achieved through installation of the low-cost measures (provided through the audit) and behavioral changes made in response to audit recommendations.

- Savings achieved through adoption of major measures recommended through the audit process; these savings may be identified or tracked through referrals or participation in the other rebate programs.

- Savings based on engineering estimates; some short-term monitoring and/or billing analysis may be conducted to validate engineering estimates.

Savings Goal

Projected program savings are: 42 DTh in year 1, and 159 DTh in year 5.

Program Benefit-Cost Analysis

Table 29 and Table 30 present cost-effectiveness analysis results based on five years of program activity.

Table 29. Small Commercial Audits Benefit-Cost Analysis

Perspective	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
Total Resource Cost (TRC)	$202,183	$26,938	-$175,245	0.13
Program Administrator (PAC)	$202,198	$26,938	-$175,260	0.13
Ratepayer (RIM)	$233,011	$26,938	-$206,073	0.12
Participant (PART)	$9,091	$36,269	$27,178	3.99

Table 30. Small Commercial Audits Societal Test Benefit-Cost Analysis

Discount Rate	CO_2 Cost ($/ton)	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
3%	$10	$222,202	$35,507	-$186,695	0.16
	$25	$222,202	$35,657	-$186,545	0.16
	$40	$222,202	$35,808	-$186,394	0.16
7%	$10	$204,846	$28,047	-$176,800	0.14
	$25	$204,846	$28,166	-$176,680	0.14
	$40	$204,846	$28,285	-$176,561	0.14

NR-2 – Nonresidential Prescriptive Rebates

Program Description

The Nonresidential Prescriptive Rebate Program is designed to provide a full range of energy-efficiency options for space and water heating, and for commercial cooking equipment, again primarily focusing on the small business sector. This program offers cash rebates to nonresidential customers purchasing high-efficiency gas equipment and incentives to dealers selling such equipment.

Program Delivery and Promotional Strategies

Marketing Strategy

The program will rely on trade ally support for promoting and processing Nonresidential Prescriptive Rebates. Outreach to this group will be necessary for the program to succeed. For customers, the program will be promoted through bill inserts and through the small commercial audit program.

This program's targets the equipment change-out market: that is, nonresidential customers whose equipment has stopped working and must be replaced; and dealers of high-efficiency equipment. The target market includes nonresidential customers replacing units in existing buildings and those purchasing equipment for the first time. A number of measures will also target the restaurant segment, including: high-efficiency broilers and conveyor ovens; and ENERGY STAR-rated steam cookers, convection ovens, and fryers. Including trade ally rebates will extend marketing to trade allies.

Program Delivery

This program will be delivered by Black Hills Energy, which will utilize relationships with individual contractors who promote the rebates directly to their customers.

Measures and Incentives

Table 31 lists the wide array of measures this program offers with proposed customer and dealer rebate levels. Although minimal participation is expected for some measures in early program years, participation is expected to increase in later years. The rebates are designed to cover as much as to two-thirds the measure's incremental cost and be consistent with similar residential incentives. Tiered incentive levels are included to promote higher-efficiency measures. Dealer rebates also will be offered, based on the number of units sold, to promote the high-efficiency measures. To help ensure furnaces and boilers are properly sized and installed, dealer rebates for those units will be contingent upon providing documentation showing proper installation practices (e.g., Manual J calculations) and/or requiring contractors to complete a training course. Water heater spiffs will be contingent on contractors completing a manufacturer-sponsored training course. For space heating equipment, the rebate is designed to cover approximately an hour of contractor's time ($75), plus a percentage of the customer rebate.

Table 31. Nonresidential Prescriptive Program Measure List

Measures	Efficiency	Customer Rebate Levels	Dealer Spiffs	Year 1 Projected Participation
Furnace	94% ≤ AFUE < 96%	$325	$125	15
	AFUE ≥ 96%	$400	$155	3
High-Efficiency Boiler (<300 kBTUh)	85% ≤ AFUE < 89%	$150	$90	2
	AFUE ≥ 90%	$400	$155	2
Storage Water Heater (≤ 60 Gal.)	0.67 ≤ EF < 0.79	$75	$10	3
Condensing Water Heater	≥0.80 EF	$300	$60	1

Measures	Efficiency	Customer Rebate Levels	Dealer Spiffs	Year 1 Projected Participation
(≤ 60 gal)				
Tankless Water Heater	≥ 0.82 EF	$300	$60	2
Setback Thermostat (Professional Installation)	ENERGY STAR or 7-day/5+2 day/5+1+1 day scheduling	$50		33
Setback Thermostat (Self-Installation)	ENERGY STAR or 7-day/5+2 day/5+1+1 day scheduling	$25		59
Convection oven	ENERGY STAR	$200	$20	1
Conveyor Oven	High Efficiency (≥ 23%)	$500	$50	-
Fryer	ENERGY STAR	$500	$50	-
Broiler	High Efficiency (≥ 34%)	$100	$10	-
Steam Cooker	ENERGY STAR	$500	$50	-
Insulation Upgrades	at least to R-19 floor, R-38 ceiling, and/or R-21 Wall	70% of total cost, max $10k		11
Infiltration Control (weather-stripping)	To 0.35 ACH or better	70% of total cost, max $1,500		2
Vent Damper (for boilers)	NA	$125		-
Swimming Pool Covers	Transparent	$250		-
Spa Covers	≥ R-14	$50		-

Program Beneficiaries

For year 1, 134 measure installations are estimated for the program, increasing to 355 in year 5. Participation, based on the number of customers, is expected to be approximately half of the measures; that is, on average, each customer (participant) will install two measures.

Program Budget

Table 32 shows category break-outs for the program's total year 1 budget of $110,600. For the full five-year budgets, see Appendix D.

Table 32. Nonresidential Prescriptive Program Budget

Category	Year 1 Amount
Total Annual Budget	$110,600
Customer Incentives	$69,000
Dealer Rebates	$1,600
Program Administration	$14,000
Marketing and Training	$21,000
Evaluation	$5,000

Program Evaluation, Measurement and Verification Plan

Black Hills Energy will assess program impacts using engineering estimates and data collected through program tracking efforts. Baseline usage characteristics will be determined through surveying a sample of program participants. The program participant survey will be designed to collect the following information:

- Age and efficiency of existing equipment;
- Size, type, and operating characteristics of a facility;
- Attitudes and awareness regarding efficiency options and behaviors; and
- Other information impacting participants' energy use characteristics.

Engineering estimates primarily will be validated through pre- and post-billing analysis of a program participant sample. Pre- and post-consumption may be normalized for weather and/or business activity, as appropriate, to allow comparison. These estimates will be compared with engineering estimates, and engineering estimates will be adjusted as necessary.

Savings Goal

Projected program savings are: 7,542 DTh in year 1, increasing to 23,940 DTh in year 5.

Program Benefit-Cost Analysis

Table 33 and Table 34 present cost-effectiveness analysis results, based on five years of program activity.

Table 33. Nonresidential Prescriptive Rebates Benefit-Cost Analysis

Perspective	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
Total Resource Cost (TRC)	$2,575,663	$6,660,855	$4,085,192	2.59
Program Administrator (PAC)	$1,096,293	$6,345,891	$5,249,598	5.79
Ratepayer (RIM)	$8,797,694	$6,345,891	-$2,451,803	0.72
Participant (PART)	$2,151,193	$7,170,586	$5,019,393	3.33

Table 34. Nonresidential Prescriptive Rebates Societal Test Benefit-Cost Analysis

Discount Rate	CO_2 Cost ($/ton)	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
3%	$10	$2,866,926	$10,673,189	$7,806,263	3.72
	$25	$2,866,926	$11,473,031	$8,606,105	4.00
	$40	$2,866,926	$12,272,874	$9,405,948	4.28
7%	$10	$2,614,325	$7,418,112	$4,803,787	2.84
	$25	$2,614,325	$7,980,724	$5,366,400	3.05
	$40	$2,614,325	$8,543,337	$5,929,013	3.27

NR-3 – Nonresidential Custom Rebates

Program Description

The Nonresidential Custom Rebates Program buys down energy-efficient upgrades to a two-year payback, or up to one-half the incremental cost of the equipment, whichever is less. Specifically, the Custom Rebate Program provides incentives for installing energy-efficient natural gas equipment not specified in the Prescriptive Rebate Program. Generally, this includes measures that widely vary in cost, depending on a facility's specifics, and for large equipment, such as boilers > 300 kBTUh. Because usually the program requires expert analyses to determine potential energy savings, base case, incremental cost, and other project parameters, funding is provided to support this analysis.

Program Delivery and Promotional Strategies

The program will be promoted through account management relationships with customers and various trade allies, including engineers and equipment providers. Potential participants would submit an application for consideration. The project would be evaluated based on the same cost-effectiveness criteria used for program analysis. Once approved, the customer would receive a rebate that would ensure a two-year payback, capped at one-half of the measure's incremental cost, upon documentation of the project's completion.

This initiative targets larger, nonresidential customers.

Program Delivery

This program will be delivered by Black Hills Energy, which will utilize relationships with individual contractors who promote the rebates directly to their customers.

Measures and Incentives

Given the individual analysis conducted for each proposed project, any technology could be considered for the program, provided a customer can demonstrate cost-effective natural gas savings. However, Black Hills Energy expects most program activity to include applications for the following technologies:

- Boiler and furnace retro-commissioning
- Large boilers (>300 kBTUh)
- Process-related equipment for industrial or agricultural customers
- Heat recovery devices and automated ventilation control sensors
- Windows
- Boiler turbulators

Program Beneficiaries

For the program's first year, 13 program participants are projected, increasing to 41for year 5. Most participants are expected to install one measure.

Budget

Table 35 breaks out the program's total year 1 budget of $60,600. For the full five-year budgets, see Appendix D.

Table 35. Nonresidential Custom Rebates Program Budget

Category	Year 1 Amount
Total Annual Budget	$60,600
Incentives	$19,500
Program Administration	$7,000
Technical Assistance	$14,100
Marketing and Training	$17,000
Evaluation	$3,000

Program Evaluation, Measurement and Verification Plan

Black Hills Energy will assess program impacts using analysis and engineering estimates developed for specific projects; these will consider both baseline usage characteristics and the adoption of proposed efficiency measures. Data analysis may include:

- Validation of engineering estimates primarily done through pre-and post-billing analysis of a sample of program participants; and

- Pre- and post-consumption normalized for weather and/or business activity, as appropriate, to allow comparison. These estimates will be compared with engineering estimates, and the engineering estimates will be adjusted as necessary.

Savings Goal

Program projected savings are 3,250 DTh in year 1, increasing to 10,250 in year 5.

Program Benefit-Cost Analysis

Table 36 and Table 37 present cost-effectiveness analysis results, based on five years of program activity.

Table 36. Nonresidential Custom Rebates Benefit-Cost Analysis

Perspective	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
Total Resource Cost (TRC)	$1,225,992	$2,607,851	$1,381,859	2.13
Program Administrator (PAC)	$510,807	$2,607,851	$2,097,044	5.11
Ratepayer (RIM)	$3,480,423	$2,607,851	-$872,572	0.75
Participant (PART)	$873,249	$2,694,341	$1,821,091	3.09

Table 37. Nonresidential Custom Rebates Societal Test Benefit-Cost Analysis

Discount Rate	CO_2 Cost ($/ton)	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
3%	$10	$1,359,030	$4,051,669	$2,692,639	2.98
	$25	$1,359,030	$4,375,076	$3,016,046	3.22
	$40	$1,359,030	$4,698,483	$3,339,453	3.46
7%	$10	$1,243,661	$2,902,918	$1,659,256	2.33
	$25	$1,243,661	$3,137,100	$1,893,439	2.52
	$40	$1,243,661	$3,371,282	$2,127,621	2.71

NR-5 Industrial Sector Outreach

Traditionally, the industrial sector has been underserved by utility-sponsored, energy-efficiency programs. To help increase awareness and provide training and education for industrial customers, Black Hills Energy intends to partner with the Department of Energy Industrial Technologies Program (DOE-ITP). The DOE-ITP offers several support layers for industrial energy-efficiency programs:

- Industrial Assessment Center: offers free site assessments for small- to medium-sized manufacturing facilities (with sales less than $100 million and energy costs from $100,000 to $2.5 million). Currently, the nearest industrial assessment center to Black Hills Energy's Kansas territory is at Oklahoma State University in Stillwater, OK.

- Save Energy Now: process-specific assessments at larger facilities. Specifically for Black Hills Energy customers, options include process heating and steam systems assessments. Utility account reps are encouraged to work with facility managers before and after assessment.

- Training: BestPractices training sessions on Steam Systems and Process Heating. The DOE-ITP offers instructors and material support for an End User Training one-day workshop or a more advanced Specialist Qualification 2½-day workshop.

- Co-branding of flyers: The DOE-ITP will create training or other informational flyers and technical information sheets, co-branded with the utility. In addition to increasing customer awareness, this will provide positive public relations between the utility and the industrial sector.

As specifics have yet to be determined, neither program-specific costs nor savings are included for the industrial sector. However, the across-program training, marketing, and administration budget includes monies for such training and educational campaigns.

Combined Nonresidential Program Cost-Effectiveness

Table 38 and Table 39 show cost-effectiveness of the four nonresidential programs combined (not including the Industrial Sector Outreach).

Table 38. Nonresidential Programs Benefit-Cost Analysis

Perspective	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
Total Resource Cost (TRC)	$4,003,838	$9,295,643	$5,291,806	2.32
Program Administrator (PAC)	$1,809,298	$8,980,680	$7,171,382	4.96
Ratepayer (RIM)	$12,511,128	$8,980,680	-$3,530,448	0.72
Participant (PART)	$3,033,533	$9,901,195	$6,867,662	3.26

Table 39. Nonresidential Programs Societal Test Benefit-Cost Analysis

Discount Rate	CO_2 Cost ($/ton)	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
3%	$10	$4,448,158	$14,760,365	$10,312,207	3.32
	$25	$4,448,158	$15,883,765	$11,435,607	3.57
	$40	$4,448,158	$17,007,165	$12,559,007	3.82
7%	$10	$4,062,833	$10,349,076	$6,286,244	2.55
	$25	$4,062,833	$11,145,990	$7,083,158	2.74
	$40	$4,062,833	$11,942,905	$7,880,072	2.94

6. Special Programs

Several programs, listed in Table 40, round out the portfolio by either lending value to Black Hills Energy's customers and Kansas's citizens or meeting the specific needs of special customer classes.

Table 40. Special Programs

Program Category	Program
S-1 – Low-Income Programs	S-1.1 – Weatherization
	S-1.2 – Affordable Housing (New Construction)
	S-1.3 – Weatherization Teams
S-2 – School-Based Energy Education	

S-1 – Low-Income Programs

Black Hills Energy will offer energy-efficiency programs targeted to the most vulnerable energy customers in their service area, seeking to provide a range of energy-efficiency services to low-income customers:

- S-1.1 Weatherization
- S-1.2 Affordable Housing (New Construction)
- S-1.3 Weatherization Teams

Savings Goal

Projected savings from all low-income programs are: 316 DTh in year 1, increasing to 1,685 DTh in year 5.

S1.1 – Weatherization

Program Description

The program will provide funding to local organizations to improve weatherization in homes or apartments occupied by low-income customers, utilizing non-profit and community action agencies delivering weatherization in Black Hills Energy's service territory. Part of the funding will be earmarked for agencies to encourage upgrades to high-efficiency space and water heating equipment (i.e., AFUE = 94% or more gas furnaces, and EF=0.67 or more gas water heaters). Given the overlap with American Reinvestment and Recovery Act funds, this program will not be offered until year 2 (and continuing into later years).

Program Budget

Overall program funding is shown in Table 41. This program will begin in year 2.

Table 41. Low-Income Weatherization Program Budget

Category	Year 2 Amount
Total Annual Budget	$305,900
Weatherization Services	$274,300
Program Administration	$16,300
Evaluation	$15,300

S-1.2 – Affordable Housing

Program Description

Black Hills Energy offers increased incentives for energy-efficient technologies and building envelope measures in homes built through non-profit organizations, such as Habitat for Humanity, Community Housing Initiatives, and Community Development Corporations. Similar to the Residential New Construction program, Black Hills Energy will provide incentives for homes qualifying for the ENERGY STAR label, under either the performance (Home Energy Rating) or prescriptive (Builder Option Package) options.

Affordable homes meeting the ENERGY STAR standard will receive a $1,500 incentive to cover the increased cost of high-efficiency equipment and thermal envelope upgrades. Additionally, Black Hills Energy will provide a $100 incentive for ENERGY STAR horizontal clothes washers in homes where high-efficiency gas dryers have been installed.

Program Budget

Table 42 shows the program's budget.

Table 42. Affordable Homes Program Budget

Category	Year 1 Amount
Total Annual Budget	$9,000
Incentives	$8,000
Program Administration	$500
Evaluation	$500

S-1.3 – Weatherization Teams

Program Description

Black Hills Energy's Weatherization Teams effort brings together volunteers from company staff and the community to offer simple weatherization measures and services to low-income households across Black Hills Energy's service territory. Black Hills Energy provides a complete energy audit of each selected home prior to the volunteer work day. The audit identifies simple infiltration reduction opportunities, low-cost energy efficiency retrofits, and minor repairs to increase selected homes' energy efficiency. These issues may include:

- Caulking around doors and windows
- Weather stripping around door and windows
- Installing of door sweep(s)
- Installing plastic window film on the interior and exterior
- Filling/sealing holes in sidewalls and foundation
- Hot water heater blankets
- Hot water pipe insulation
- Furnace filter replacements
- High-efficiency showerheads
- Programmable thermostats
- Kitchen and bathroom high-efficiency faucet aerators

Weatherization teams may also perform simple health and safety improvements in homes.

Program Budget

Table 43 shows the program's budget.

Table 43. Weatherization Teams Program Budget

Category	Year 1 Amount
Total Annual Budget	$9,200
Delivery	$8,300
Program Administration	$460
Evaluation	$460

Combined Low-Income Savings and Cost-Effectiveness

Program Benefit-Cost Analysis

Table 44 and Table 45 present cost-effectiveness analysis, results, based on five years of program activity.

Table 44. Combined Low-Income Benefit-Cost Analysis

Perspective	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
Total Resource Cost (TRC)	$1,151,131	$494,387	-$656,744	0.43
Program Administrator (PAC)	$1,151,131	$494,387	-$656,744	0. 43
Ratepayer (RIM)	$1,716,120	$494,387	-$1,221,733	0.29
Participant (PART)	$971,484	$1,452,190	$480,706	1.49

Table 45. Combined Low-Income Societal Test Benefit-Cost Analysis

Discount Rate	CO_2 Cost ($/ton)	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
3%	$10	$1,281,539	$752,700	-$528,839	0.59
	$25	$1,281,539	$813,371	-$468,168	0.63
	$40	$1,281,539	$874,043	-$407,496	0.68
7%	$10	$1,168,472	$523,792	-$644,680	0.45
	$25	$1,168,472	$593,546	-$574,926	0.51
	$40	$1,168,472	$638,467	-$530,005	0.55

S-2 – School-Based Energy Education

Program Description

The School-Based Energy Education Program seeks long-term energy savings via enhanced energy-efficiency awareness among youth in Black Hills Energy's service territory. The program centers on the idea that energy-efficiency awareness can be greatly enhanced among the young, who have less formulated ideas about energy consumption and are, therefore, more easily able to develop a conservative mindset regarding home energy use. Engendering these subtle-yet-significant behavioral changes primarily will be conducted through development of a specific curriculum to complement existing natural science-based education.

The program will include a kit of low-cost measures to help ideas and concepts resonate with participating students. The curriculum and kit will provide hands-on and educational methods for students to evaluate impacts of energy-efficient retrofits and behavioral changes. For example, a flow meter will accompany the low-flow showerhead, permitting students to quantify their use of water before and after installation. Such comparisons will provide a concrete example of how their actions save energy and help the environment.

Program Framework/Strategy

Marketing Strategy

The program will be promoted to school districts and teachers through direct contact, education associations, and other methods, as appropriate. The program will target middle school-aged children and their households.

Program Delivery

This program will be delivered by a third-party implementer that provides educational material and measure kits directly to the schools.

Measures

The kit, supplied to each student and teacher participating in the program, will include the following measures:

- 14-Watt compact fluorescent lamp (CFL)
- High-efficiency showerhead
- Faucet aerator
- Filter Tone™ alarm
- Electroluminescent LimeLite® Nightlight
- Educational workbooks

Teachers will also receive a complete energy education curriculum, including recommended lesson plans, activities, and tests.

Program Beneficiaries

The program seeks to provide energy education to every student within the service territory. It is unlikely, however, all schools or districts will be willing or able to participate. As such, a participation goal of half of all eligible students may prove more achievable. In the program's first year, 700 students and their families will be served, with participation increasing to 2,000 by year 5. The program will make accommodations to include any additional schools deciding to offer energy education to their students, with the goal of 50% participation within the time frame of the next energy-efficiency plan.

Program Budget

The program has a $38,800 proposed budget for year 1. Table 46 shows specific budget components. Delivery includes all outreach, curriculum materials, and measures. For the full five-year budgets, see Appendix D.

Table 46. School-Based Energy Education Program Budget

Category	Year 1 Amount
Total Annual Budget	$38,800
Delivery	$35,000
Evaluation	$1,900
Program Administration	$1,900

Program Evaluation, Measurement and Verification Plan

The program is designed to allow continuous process and impact evaluation through various data collection activities students are asked to complete. Information provided by students on baseline energy consumption characteristics, adoption of energy-saving behaviors due to the energy education, and measure installations will provide the basis for determining program impacts. In addition, interviews with educators will be conducted to assess the effectiveness of curriculum materials and program's fit with other classroom activities.

Savings Goal

Projected program savings are: 910 DTh in year 1, and 2,600 DTh into year 5.

Program Benefit-Cost Analysis

Table 47 and Table 48 present cost-effectiveness analysis results, based on five years of program activity.

Table 47. School-Based Energy Education Benefit-Cost Analysis

Perspective	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
Total Resource Cost (TRC)	$298,600	$323,477	$24,877	1.08
Program Administrator (PAC)	$363,973	$287,271	-$76,702	0.79
Ratepayer (RIM)	$747,056	$287,271	-$459,784	0.38
Participant (PART)	$248,862	$661,650	$412,788	2.66

Table 48. School-Based Energy Education Societal Test Benefit-Cost Analysis

Discount Rate	CO_2 Cost ($/ton)	Total Discounted Costs ($)	Total Discounted Benefits ($)	Net Present Value ($)	Benefit/Cost Ratio
3%	$10	$331,699	$411,793	$80,095	1.24
	$25	$331,699	$443,048	$111,350	1.34
	$40	$331,699	$474,303	$142,604	1.43
7%	$10	$302,993	$349,782	$46,788	1.15
	$25	$302,993	$376,340	$73,347	1.24
	$40	$302,993	$402,898	$99,905	1.33

7. Energy-Efficiency Cost Recovery

This chapter discusses rate impacts associated with the Five-Year Energy Efficiency Plan across residential and nonresidential customer classes. Rate impacts are divided into two categories: Black Hills Energy's cost of running the planned programs; and recovery of fixed costs approved by the Commission for but lost due to energy-efficiency program operations.

Program Cost Recovery

The Black Hills Energy's annual cost for proposed energy-efficiency programs during the five-year budget time frame averages $2.5 million per year. Table 49 shows breakouts for each program area.

Table 49. Average Annual DSM Budget

Program Area	Average Annual Budget
Residential	$1,471,940
Nonresidential	$429,851
Public Purpose	$362,589
General Administration	$227,749
Total	$2,492,129

To allocate program totals to each revenue class, we determined the relative share of residential spending to the sum of residential and nonresidential spending (82.4%). We then allocated both public purpose and general program administration budgets to the residential and nonresidential sectors by this ratio. Table 50 and Table 51 show the recovery of these costs through our proposed Energy-Efficiency Cost Recovery (EECR) rider factor in year 1.

Table 50. Residential and Nonresidential EECR

Class	Year 1
Residential	
Program Expenses - Residential	$963,978
Program Expenses - Public Purpose and General Administration	$253,971
Program Expenses - Total	$1,217,949
Baseline Consumption Forecast (therms)	68,764,711
Customers	94,010
Cumulative Program Savings (therms) - Residential	163,488
Cumulative Program Savings (therms) - Public Purpose and General Administration	10,144
Cumulative Program Savings (therms) - Total	173,632
Net EE Consumption	68,591,079
EECR Residential	**$0.01776**

Class	Year 1
Nonresidential	
Program Expenses - Nonresidential	$201,512
Program Expenses - Public Purpose and General Administration	$53,091
Program Expenses - Total	$254,603
Baseline Consumption Forecast (therms)	29,410,117
Customers	9,509
Cumulative Program Savings (therms) - Nonresidential	108,334
Cumulative Program Savings (therms) - Public Purpose and General Administration	2,120
Cumulative Program Savings (therms) - Total	110,454
Net EE Consumption	29,299,663
EECR Nonresidential	**$0.00869**

Table 51. Total EECR Impact

Average Rate Impact (per therm)	Residential	Nonresidential
Year 1 Average EECR	$0.0178	$0.0087
Average Annual Consumption Per Customer (therms)	730	3,081
Average Annual Bill Impact	$13	$27

Based on the most recent approved test year data, weather-normalized residential consumption after accounting for year 1 program savings is 730 therms per customer. The residential customer EECR, estimated to be $0.0178 per therm, has an impact on average residential customer bills of approximately $13 per year.

Similarly, annual consumption per customer over the same period for eligible nonresidential customers is 3,081 after accounting for year 1 program impacts. Combining this estimate with the nonresidential EECR of $0.0087 per therm, yields an average nonresidential customer bill impact of $27 per year.

Additionally, Black Hills Energy will establish an EECR balancing account. The account will track and book the difference between the calculated EECR adjustment and EECR actually collected. Regular true-ups at semi-annual intervals will convert the balance remaining in the EECR balancing account to a $/therm credit or surcharge, which will be collected as part of the EECR for the following period.

Lost Fixed Cost Recovery

Introduction

Black Hills Energy's natural gas rates in Kansas are designed to recover both fixed and variable costs. Historically, however, the Company's natural gas rates have been set to recover a substantial portion of fixed costs through a volumetric charge. This characteristic leaves Black

Hills Energy highly susceptible to under- or over-collecting its fixed costs due to changes in natural gas usage.

For a gas distribution company, the majority of costs are fixed in the short term. These costs include: recovery of the physical plant investments, and operating and maintenance costs. Costs associated with natural gas itself are passed through to the customer, based on actual costs incurred by the distribution company. Traditional ratemaking includes both fixed and volumetric rates. The monthly customer charge is intended to reflect fixed costs associated with simply having a customer on the system—metering and customer accounting, for example.

Many core distribution costs (from customer to city gate) are also fixed, and do not vary with volume, at least in the short term. However, this customer charge is not typically set at a level sufficient to recover all fixed costs. Consequently, a significant portion of fixed costs are still recovered through the rate's volumetric portion. This creates a basic mismatch between underlying costs and rates intended to recover those costs. Increases or decreases in natural gas purchased will cause the utility to over- or under-collect its fixed costs.

The financial problem has been widely recognized by organizations as diverse as the American Gas Association and the Natural Resources Defense Council:

> The vast majority of the non-commodity costs of running a gas distribution utility are fixed and do not vary significantly from month to month. However, traditional utility rates do not reflect this reality. Traditional utility rates are designed to capture most of approved revenue requirements for fixed costs through volumetric retail sales of natural gas, so that a utility can recover these costs fully only if its customers consume a certain minimum amount of natural gas (these amounts are normally calculated in rate cases and generally are based on what customers consumed in the past). Thus, many states' rate structures offer—quite unintentionally—a significant financial disincentive for natural gas utilities to aggressively encourage their customers to use less natural gas, such as by providing financial incentives and education to promote energy-efficiency and conservation techniques.[6]

We estimate Black Hills Energy's revenue losses at approximately $1M over the Five-Year Energy Efficiency Plan. These significant losses will become even more pronounced as programs continue in later years.

Black Hills Energy's Proposed Revenue Normalization Mechanism (RNM)

The proposed Revenue Normalization Mechanism (RNM) is intended to adjust the Company's revenues to match the expected weather-normalized revenues associated with the Company's approved revenue level. The RNM adjustment will be incorporated into the EECR tariff, and will account for changes in usage per customer and changes in numbers of customers. Actual revenues collected will be compared to revenues approved in the most recent base rate

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[6] Joint Statement of the American Gas Association and the Natural Resources Defense Council, Submitted to the National Association of Regulatory Utility Commissioners, July 2004, Page 2.

proceeding, then will be adjusted for changes in the number of customers to determine the amount of over- or under-collection. This amount will then be converted to a rate per therm, and added to or subtracted from the next period's billings. In actual implementation, there will be a two or three month lag to allow for calculation of the under/over collection and the per-therm adjustment.

Calculation of the RNM adjustment to Black Hills Energy's distribution rates will be developed separately for each customer class, and will work as follows:

1. Data will be extracted from Black Hills Energy's customer billing system. These include the number of customers, total therms, therms per customer, non-gas commodity revenues, and non-gas commodity revenue per customer.

2. The approved test-year, non-gas revenue per customer will be applied to the number of actual customers to yield the approved revenue over the historical period.

3. The difference between approved revenue and actual revenue will be amount collected or refunded through the RNM.

4. The amount to be collected or refunded through the RNM will be converted to a per therm charge based on the forecast of base revenues for the next period.

5. A difference between the calculated RNM adjustment and RNM actually collected will likely occur due to differences between forecasted therm sales used to develop the $/therm adjustment and actual therm sales. This difference will be booked to a balancing account. A true-up will occur semi-annually, at the same time as the EECR balancing account true-up, to convert the balance remaining in the RNM balancing account to a $/therm credit or surcharge, which will be collected as part of the RNM for the next period.

Table 52 shows the average annual rate RNM impacts over the first year of Black Hills Energy's energy-efficiency program plan.

Table 52. Year 1 Revenue Normalization Mechanism Charge

	Residential	Non-Residential
Test Year Distribution-Commodity Charge Revenue	$9,987,387	$3,648,619
Test Year Therms	68,764,711	29,410,117
DSM Savings, Year 1 (therms)	173,632	110,494
Test Year Therms Less Year 1 DSM Savings	68,591,079	29,299,663
Lost Revenue, Year 1	$25,218	$13,703
Lost Revenue Shortfall Percentage, Year 1	0.25%	0.38%
Average Base Rate Impact, Year 1	$0.000368	$0.000468

The proposed tariffs are given in Appendix E.

8. Conclusion/Request for Plan Approval

From the various societal cost test perspective, the following, proposed programs meet the cost-effectiveness requirements of the Kansas Corporation Commission for energy-efficiency programs designed for residential and nonresidential customers. Black Hills Energy, therefore, requests approval from the Commission to implement and recover program costs and revenue losses from these programs:

- R-1 – Residential Audit
- R-2 – Residential Space and Water Heating Program
- R-3 – Residential Envelope Measures Retrofit
- NR-1 – Small Commercial Audits
- NR-2 – Nonresidential Prescriptive Rebates
- NR-3 – Nonresidential Custom Rebates
- S-1 – Low-Income Programs
- S-2 – School-Based Energy Education

Table 53, Table 55, and Table 57 present annual gas savings impacts for the residential, nonresidential, and special programs, respectively. Peak therm impacts are shown in Table 54, Table 56, and Table 58, for the residential, nonresidential, and special programs, respectively. These figures are based on the assumptions and inputs used in conducting the cost-effectiveness analysis for each program.

Table 53. Residential Program Cumulative Gas Savings (DTh) by Program Year

Program	Year				
	One	Two	Three	Four	Five
R-1 – Residential Audit	1,245	3,355	4,548	4,548	4,548
R-2 – Residential Space and Water Heating	5,187	8,866	11,589	11,589	11,589
R-3 – Envelope Measures Retrofit	2,262	3,926	7,826	7,826	7,826
R-4 – Residential New Construction	5,495	5,550	5,647	5,647	5,647
Total	14,190	21,696	29,610	29,610	29,610

Table 54. Residential Program Peak Demand Gas Savings (Therms) by Program Year

Program	Year				
	One	Two	Three	Four	Five
R-1 – Residential Audit	141	379	513	513	513
R-2 – Residential Space and Water Heating	562	960	1,251	1,251	1,251
R-3 – Envelope Measures Retrofit	255	443	884	884	884
R-4 – Residential New Construction	620	627	638	638	638
Total	1,578	2,409	3,285	3,285	3,285

Table 55. Nonresidential Program Cumulative Gas Savings (DTh) by Program Year

Program	Year				
	One	Two	Three	Four	Five
NR-1 – Small Commercial Audits	42	81	159	159	159
NR-2 – Nonresidential Prescriptive Rebates	7,542	14,668	23,939	23,939	23,939
NR-3 – Nonresidential Custom Rebates	3,250	6,250	10,250	10,250	10,250
Total	10,833	20,999	34,348	34,348	34,348

Table 56. Nonresidential Program Peak Demand Gas Savings (Therms) by Program Year

Program	Year				
	One	Two	Three	Four	Five
NR-1 – Small Commercial Audits	6	11	22	22	22
NR-2 – Nonresidential Prescriptive Rebates	926	1,794	2,904	2,904	2,904
NR-3 – Nonresidential Custom Rebates	446	857	1,406	1,406	1,406
Total	1,377	2,663	4,332	4,332	4,332

Table 57. Special Programs Cumulative Gas Saving (DTh) by Program Year

Program	Year				
	One	Two	Three	Four	Five
S-1 – Low-Income Programs	316	1,612	1,685	1,685	1,685
S-2 – School-Based Energy Education	884	1,381	2,525	2,525	2,525
Total	1,200	2,992	4,209	4,209	4,209

Table 58. Special Programs Peak Demand Gas Savings (Therms) by Program Year

Program	Year				
	One	Two	Three	Four	Five
S-1 – Low-Income Programs	31	176	184	184	184
S-2 – School-Based Energy Education	100	156	285	285	285
Total	131	332	469	469	469

Further, Black Hills Energy requests approval to implement the R-1–Residential Audits and NR-1 – Nonresidential Audits programs, which are not cost-effective, but are critical to achieving the participation levels projected for the other programs.

Black Hills Energy also requests approval to implement the suite of low-income and schools-based programs. These programs provide significant informational and educational benefits to Black Hills Energy customers and Kansas residents. They also serve to equitably distribute energy-efficiency programs benefits across customer groups.

Overall, Black Hills Energy believes the comprehensive suite of programs described above provide substantial value for its customers in Kansas in excess of their costs. For the five-year

program horizon, the programs' total discounted benefits, calculated for the TRC test, are $19,216,269. Compared to the total discounted program costs of $14,574,668, the overall portfolio yields a total resource benefit-cost ratio of 1.32, above the 1.0 threshold. Black Hills Energy will intend to launch the programs within 90 days or less of Commission approval of the plan.

List of Appendices