LARGE FILING SEPARATOR SHEET

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Direct Testimony
Martin [illegible] Kushler PHD

Behalf of OCC

of rebated units. The sponsors are confident that there is increasing spillover into the rest of the market.

PROGRAM PERFORMANCE

Cool Choice is geared toward end-use customers using packaged single or split air conditioning or heat pump units, usually rooftop units (RTUs). The initiative covers New Jersey and four New England states: Vermont, Massachusetts, Rhode Island, and Connecticut. There are approximately one million commercial and industrial utility customers in the region. The initiative's strategy is to engage the region's 2,500 HVAC installation contractors, encouraging them to up-sell high-efficiency units to their customers when replacing failed units or for new applications. In addition, the sponsors promote high-efficiency HVAC directly to their C&I customers.

Approximately 920 customers have applied for HVAC equipment rebates through Cool Choice, which has identified and contacted over 2,500 HVAC contractors in the region.

LESSONS LEARNED

Program success takes more than just rebates; it requires persistence and a range of marketing tactics, including contractor outreach, contractor and customer education, technical resources, and information about the program and products targeted. Market players are actively engaged in the markets, and have the knowledge and experience to determine what program services will help them succeed. The players respond positively to clear and substantive messages from people they trust and respect—people they know they can count on when they need services and answers.

PROGRAM AT A GLANCE

Program Name: Cool Choice

Targeted Customer Segment: Commercial and industrial (non-residential) customers.

Program Start Date: Mid-1999

Program Participants: Approximately 920 customers have applied for HVAC equipment rebates through Cool Choice. Additionally, the program has contacted over 2,500 HVAC contractors in the region.

Approximate Eligible Population: One million C&I customers

Participation Rate:
Following are data showing results of the rebate portion of Cool Choice.

Year	Tier 1 Units
2000	385
2001	719
2002 (Oct.)	719
Total Program	1,823

Year	Tier 2 Units
2000	478
2001	1,138
2002 (Oct.)	1,154
Total Program	2,770

Year	PTACs*
2000	1,189
2001	3,402
2002 (Oct.)	NA
Total Program	4,591

Year	Rebate $
2000	$523,232
2001	$1,304,841
2002 (Oct.)	$1,243,713
Total Program	$3,071,786

* PTACs = packaged terminal air conditioners

Annual Energy Savings Achieved: Savings shown below are estimated according to rebate results.

Year	New kWh/yr Savings
2000	1,827,600
2001	3,929,000
2002 (Oct.)	4,786,000
Program Total	10,542,600

Peak Demand (Summer) Savings Achieved: Savings shown below are estimated according to rebate results.

Year	New kW Savings
2000	1,924
2001	3,518
2002 (Oct.)	4,227
Total Program	9,669

Budget: Figures shown under utility costs include program delivery costs, rebate dollars, and sponsor administration. Rebate levels are designed to cover 100 percent of incremental cost; therefore, customer cost is assumed to be nil.

Year	Utility Costs
2000	$1,720,000
2001	$2,293,300
2002 (projected)	$2,176,700
2003 (Projected)	$2,176,700

Funding Sources: Cool Choice is being developed, delivered, and administered by its sponsors. NEEP functions as coordinator of the sponsor groups. Cool Choice funding is provided by its sponsors, by way of system benefits portions of electric utility rates. Cool Choice sponsors are listed below.

- NSTAR Electric
- National Grid USA Companies
    - Massachusetts Electric

  - Narragansett Electric
  - Granite State Electric
- Efficiency Vermont
- Northeast Utilities
  - Connecticut Light and Power
  - Western Massachusetts Electric
- Burlington Electric Department
- Connectiv Power Delivery
- Public Service Electric & Gas
- Unitil
- *United Illuminating*
- Jersey Central Power & Light
- Fitchburg Gas & Electric
- Cape Light Compact

Best Person to Contact for Information about the Program

- Jonathan Linn, Program Manager
- Phone: 207-338-9705
- Fax: 207-338-9594
- Email: jlinn@acadia.net
- Postal address: NEEP, 212 Waterville Rd., Belfast, ME 04915
- URL: http://www.coolchoice.net

Commercial/Industrial HVAC

Rooftop HVAC Maintenance Program
Avista Utilities

PROGRAM OVERVIEW

The Rooftop HVAC Maintenance Program is based on research that Avista had performed on this technology and market. The results of the research revealed a great opportunity for this type of program, and the 2001 energy crisis created the perfect timing for creating and implementing such a program.

The objective was to achieve kWh savings in the summer of 2001 by reducing electric usage in commercial rooftop heating and cooling units through preventative maintenance and repair as well as equipment upgrades. Both large and small commercial customers were targeted, from big box retail and manufacturing plants to fast food restaurants and small retail stores.

This program was developed quickly due to Avista's in-house engineering experts, available research data, and in-house program management resources. Due to the timing of the program launch, Avista was also able to use summer students to add program support and complement its regular staff. The program was developed and launched in less than a month with an initial rollout to local HVAC dealers in the service territory. Avista also tapped into local business organizations such as the restaurant association and building manager group, as well as individual account executive contacts.

The program's main focus was maintaining and improving rooftop units, especially ones that did not already have a maintenance program. The checklist included a 14-point service with a strong emphasis on cleaning as well as replacing and repairing parts such as economizers. The program also offered programmable thermostat installations.

The program had a management team with a strong technical element, as well as administrative and inspection teams for insuring processing and completion.

PROGRAM PERFORMANCE

In just over a three-month period, the program served over 2,000 commercial electric customers at more than 2,700 customer sites. Nearly 8,500 rooftop units were inspected and maintained at these sites. Avista estimates that these measures yield over 13,000,000 kWh annual savings. The company also is surveying customers to see how many of them began maintenance programs as a result of Avista's program. Customers that adopt such routine maintenance programs would provide additional ongoing energy savings, as well as potentially some incremental savings in subsequent years as upgrades and improvements are made from measures identified through routine inspection and maintenance.

One of the primary exemplary program features was the speed with which the program was developed and launched in able to get immediate energy savings as needed to address the energy crisis of 2001. The key to achieving this objective was utilizing the local HVAC dealers to contact and schedule a large amount of customers in a short time. Another key program feature was to contact building owner/operator organizations to publicize the program services. Finally, the biggest key was probably the free cost to the building owner/operator and the direct payment to the dealer for providing services. This feature of providing free services to customers through dealers allowed for rapid dissemination of program information, which was critical to achieving high participation in a short time.

LESSONS LEARNED

If speed to market had not been so important, it would have been beneficial to conduct additional dealer training ahead of the program launch to customers. Avista ended up having to have some dealers return to customer sites to correct deficiencies that were identified by program staff during post-inspection. It also would have been useful to have increased contact with the customers regarding the benefits of the maintenance and how it could affect energy costs, equipment life, and occupancy comfort.

Avista has surveyed customers to determine if there has been any increase in the number of customers that now perform this type of HVAC maintenance due to the program. Avista would like to offer something similar again. However, because of present electric prices that are lower than those experienced in 2001, the program's cost-effectiveness is changed, which would require some changes in the design of the program. Because of the program's success, Avista has received inquiries and provided input to other parties interested in replicating or designing similar offerings.

PROGRAM AT A GLANCE

Program Name: Rooftop HVAC Maintenance Program

Targeted Customer Segment: Commercial customers with rooftop package HVAC units

Program Start Date: May 9, 2001 (Planned as a temporary program during the 2001 energy crisis, the program ran through July 13, 2001.)

Program Participant: More than 2,000 commercial electric customers at more than 2,700 customer sites, inspecting and maintaining nearly 8,500 rooftop units

Approximate Eligible Population: Approximately 18,000

Participation Rate: 11%

Annual Energy Savings Achieve: Over 13,000,000 kWh annual savings

Peak Demand (Summer) Savings Achieved: NA

Budget

Year	Utility Costs
2001	$1,750,000
2002	Not available
2003 (projected)	Not available

Funding Source: The program was funded from Avista's DSM Tariff rider

Best Person to Contact for Information about the Program

- Chris Drake
- Phone: 509-495-8624
- Fax: 509-777-5242
- Email: chris.drake@avistacorp.com
- Postal address: Avista Utilities, P.O. Box 3727, Spokane, WA 99220-3727
- URL: not applicable as program was discontinued.

Commercial/Industrial Lighting

Lighting Efficiency
Xcel Energy

PROGRAM BACKGROUND

Lighting Efficiency was launched in 1985 and has been one of the top DSM performers in Xcel Energy's portfolio of conservation programs in its Minnesota service territory. Xcel Energy provides rebates to customers who purchase and install qualifying lighting equipment. In addition to rebates, Xcel Energy provides low interest financing. Xcel Energy also works as the energy expert for customers. Xcel Energy has a group of account managers assigned to specific customers as well as a Business Solutions Center with phone reps who can help answer any conservation questions customers have.

Lighting Retrofit	**Rebate Levels**
Fluorescent T8 lamps with electronic ballasts	\$9.00 - \$15.00
Fluorescent T5 lamps with electronic ballasts	\$10.00 - \$16.00
Compact fluorescent fixtures	\$4.00 - \$12.00
Industrial multi-CFL fixture	\$25.00
Metal halide & high-pressure sodium fixtures (without 2-level switching)	\$17.00 - \$45.00
Metal halide & high-pressure sodium fixtures (with 2-level switching)	\$30.00 - \$65.00
Pulse-start metal halide fixtures (without 2-level switching)	\$45.00 - \$65.00
Pulse-start metal halide fixtures (with 2-level switching)	\$60.00 - \$85.00
Reflectors	\$0.50/sq. ft.
Occupancy sensors and photocells	\$12.00 - \$36.00
LED exit sign	\$6.00
LED pedestrian signals (walk/don't walk)	\$25.00 - \$40.00
LED traffic signals	\$15.00 - \$65.00

New Construction Lighting	**Rebate Without Auto Controls**	**Rebate With Auto Controls**
Fluorescent T8 lamps with electronic ballasts	\$1.75 - \$2.25	\$2.25 - \$3.00
Fluorescent T5 lamps with electronic ballasts	\$2.00 - \$2.50	\$2.50 - \$3.25
Compact fluorescent lamps/fixtures	\$1.00 - \$1.75	\$1.25 - \$2.25
Industrial multi-CFL fixture	\$8.00	\$9.00
Metal halide & high-pressure sodium	\$6.00 - \$10.00	\$7.75 - \$13.00
Pulse-start metal halide fixtures	\$8.00 - \$12.00	\$9.75 - \$15.00

If a project does not fit within Xcel Energy's set of prescriptive lighting rebate measures, but does save energy, it can be considered under the Custom Efficiency Lighting program. This program takes a look at projects on an individual basis and if it passes certain cost/benefit tests, the customer can receive a rebate of up to $200/kW saved.

The program is structured so that customers follow these steps:

- Customer or vendor installs qualifying lighting equipment at facility.
- Customer, vendor, or Xcel Energy account manager fills out the rebate application form.
- For retrofit projects, the form requires customer or vendor to provide detailed information about existing lighting that is being replaced.
- Customer must sign the form stating that the information submitted is accurate.
- Proof of purchase (detailed invoice) must be submitted with application.
- Customer must apply for a rebate within one year of the purchase date shown on the equipment invoice.
- Xcel Energy conducts random spot checks to keep program participants honest.
- Customer receives rebate check in six to eight weeks.

The objectives of the program are to:

- Lower the overall cost of purchasing higher-efficiency equipment.
- Decrease customers' payback time.
- Reduce customers' energy costs.
- Strengthen customer relationships.
- Comply with regulatory mandates.
- Reduce the need to build new power plants, which benefits the environment.

PROGRAM PERFORMANCE

The key to the success of this program lies mainly in Xcel Energy's internal account management team, vendors, and annual promotions.

Xcel Energy has a core group of knowledgeable account managers that work with its large C&I customers. Due to the strong relationships with their customers, these proactive account managers are very successful in selling the Lighting Efficiency program.

Xcel Energy also maintains strong relationships with lighting vendors. The company makes sure to provide them with updated program information and literature through direct mailings, face-to-face meetings, seminars, trade shows, and newsletters.

The last major key to success of this program has been Xcel Energy's annual promotions. Over the last few years, Xcel Energy has offered customers an additional incentive to retrofit their existing T12 systems to T8 or T5 systems. This has worked extremely well and Xcel Energy has a 70 percent saturation level for remaining T12 systems.

LESSONS LEARNED

The two major lessons that Xcel Energy has learned are: (1) that the small business customer needs a more hands on approach; and (2) that its sales channels (internal account managers and outside vendors) are a huge key to its success.

Xcel Energy plans to continue to provide customers with lighting rebates, training, and energy knowledge and to continue to leverage its vendor relationships.

PROGRAM AT A GLANCE

Program Name: Xcel Energy Lighting Efficiency

Program Start Date: 1985

Program Participants to Date (Annual Totals)

2001: 1395
2002: 1149
2003: 840 (goal)

Eligible Population or Customer Segment: All Xcel Energy business customers located in the Minnesota service territory

Participation Rate: NA

Annual Energy Savings Achieved

2001: 88,452,000 kWh
2002: 66,785,000 kWh
2003: 49,054,192 (goal)

Peak Demand (Summer) Savings Achieved

2001: 20,022 kW
2002: 14,681 kW
2003: 9,669 kW (goal)

Budget: Total budget (includes project delivery, utility administration, marketing, evaluation and rebate incentives): 2001: $5,382,907, 2002: $3,335,999, 2003: $3,463,439 (budget)

Funding Source: Xcel Energy is mandated to spend 2% of its Gross Electric Operating Revenue on electric DSM programs. Customers in its Minnesota service territory are charged a CIP (Conservation Improvement Program) cost on their bill.

Best Person to Contact for Information about the Program

- Lisa Kauffman, Product Portfolio Manager
- Phone: 612-904-5321
- Fax: 612-330-2914
- Email: lisa.a.kauffman@xcelenergy.com
- Postal address: 414 Nicollet Mall—RS7, Minneapolis, MN 55401
- URL: http://www.xcelenergy.com/XLWEB/CDA/0,2795,1-1-4_759_1247-779-5_406_669-0,00.html

Exhibit MGK-3

Document Request #4 (Vectren DSM Action Plan-FINAL Report 09Dec2005).doc

Vectren DSM Action Plan: Final Report

Prepared for:
Vectren Energy Delivery of Indiana, Inc.
Evansville, Indiana

Prepared by:
Forefront Economics Inc.
and
H. Gil Peach & Associates LLC

with contributions from:
Mark E. Thompson
H. Gil Peach
Luisa Freeman-Farvardin
Howard Reichmuth

December 9, 2005

Forefront Economics Inc. and H. Gil Peach and Associates LLC. *Vectren DSM Action Plan: Final Report.* Report prepared for Vectren Energy Delivery of Indiana, Inc., Evansville, IN, Dec. 2005.

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I. EXECUTIVE SUMMARY

This document presents a long-term Demand Side Management (DSM) Action Plan for the Vectren North gas distribution company. The DSM Action Plan was prepared by Forefront Economics Inc. and H. Gil Peach and Associates with consultation and review by a Project Advisory Board consisting of utility management and interested parties. The design, implementation, oversight and cost effectiveness of natural gas DSM programs are addressed in the DSM Action Plan. Findings from our analysis are shown in the table below.

Table 1. Vectren North Total Usage, Technical Potential and Program Savings (millions of therms)

Total Usage	753.8
Technical Potential	351.1
Percent of Total Usage	47.0%
Annual DSM Savings After Five Years	10.7
Percent of Total Usage	1.4%
Percent of Technical Potential	3.0%

The technical potential tells us that if the gas saving technologies identified in this report were applied across all applicable customers, without regard to market or economic constraints, weather normalized annual gas usage could be reduced to nearly half of current consumption. Annual DSM savings, shown in the table, provide a far more realistic savings number for planning purposes. The DSM programs presented in this report are expected to result in nearly 11 million therms of annual energy savings by the fifth year of operation, 1.4 percent of current usage. At less than half the cost per therm of delivered gas supply, the demand side resource is shown to be highly cost effective. Net energy costs in the Vectren North service area are expected to be $37 million lower if the DSM programs are implemented. Most of these benefits accrue to residential and small commercial customers.

The approach taken in developing the set of recommended DSM programs for Vectren North's consideration was generally as follows: (1) conduct a market assessment for determining gas usage and characteristics across customer groups, (2) review a comprehensive list of DSM technologies for saving energy, (3) consider the appropriateness of selected technologies for Vectren North's service territory in terms of markets, cost effectiveness and accessibility to products, (4) group the highest potential technologies into logical sets for marketing and outreach, (5) design program strategies to promote the technologies based on industry best practices, (6) consider the cost effectiveness of the designed program, including costs to Vectren and to participating customers, and (7) describe a final set of recommended program designs that make the most sense for the utility and have a strong potential for delivering cost effective energy savings.

The final set of program designs is listed below:

1. Small Buildings Energy Efficiency Program
2. General Services Energy Efficiency Program
3. Customized Energy Efficiency Program

4. Hospitality Industry Energy Efficiency Program
5. Multi-Family Building Energy Efficiency Program
6. Innovative Energy Efficiency Technologies Research and Demonstration Program
7. Energy Efficient Builder Program
8. New Program Development and Regulatory Affairs
9. Public Education and Outreach Program

All of these programs, with the exception of 6, 8 and 9, are expected to deliver measurable energy savings. Programs 6, 8 and 9 are research and development and program support activities. The programs that deliver energy savings were all subjected to cost effectiveness analysis as described in Section VII; all of these programs showed positive cost effectiveness results.

II. INTRODUCTION

In June 2005, Vectren Energy Delivery of Indiana, Inc. contracted with Forefront Economics Inc. and H. Gil Peach and Associates to develop a Long-Term Demand Side Management (DSM) Action Plan for the Vectren North service territory (Vectren North). Development of the Action Plan was undertaken with the consultation and review of an Advisory Board consisting of representatives of Vectren North, the Citizens Action Coalition of Indiana (CAC), the Indiana Gas Industrial Group (IGIG), and the Indiana Office of Utility Consumer Counselor (OUCC). The Action Plan includes assessment of the potential for cost effective natural gas DSM programs. The design, implementation, oversight and cost effectiveness of natural gas DSM programs are to be addressed in the Action Plan. Vectren North's gas service territory encompasses 41 counties in central Indiana surrounding Indianapolis (excluding Marion County) and the southeastern portion of Indiana.

The DSM planning project was started in June 2005 and was completed with delivery of this report to the Advisory Board on December 9, 2005. Draft reports of research results have been reviewed and discussed with the project Advisory Board at various junctures and comments addressed. A timeline of key project milestones is provided in Figure 1.

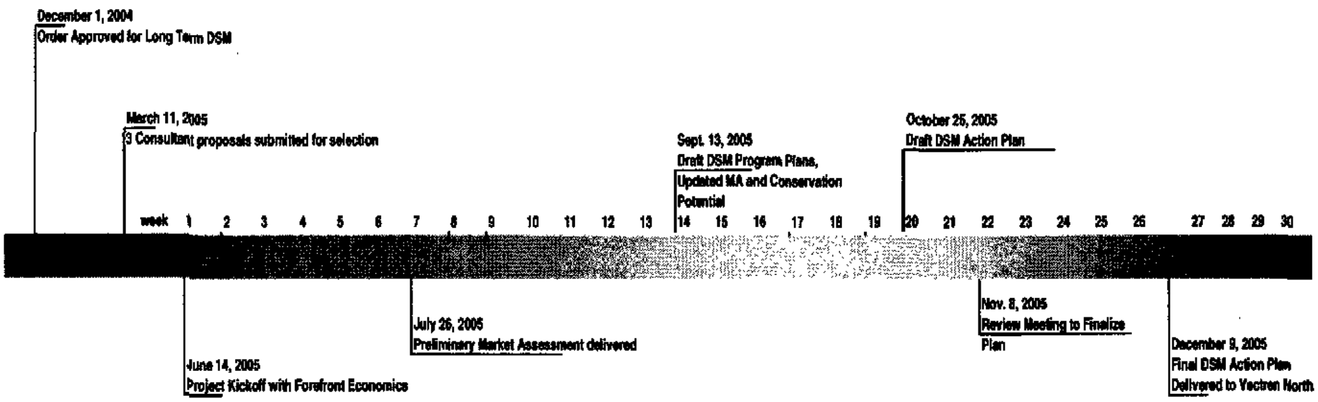

Figure 1. DSM Action Plan Project Timeline

Organization of Report

This document presents a Long-Term DSM Plan for the Vectren North service territory. The DSM planning project that resulted in the recommendations in this report consisted of three primary tasks:

1. Market Assessment
2. Conservation Potential
3. DSM Program Design

While each of these primary areas of activity can be viewed separately, they are related sequentially with each task building on the preceding tasks.

Figure 2 illustrates the flow of work on the project and the sections within this report that correspond to the findings for each task.

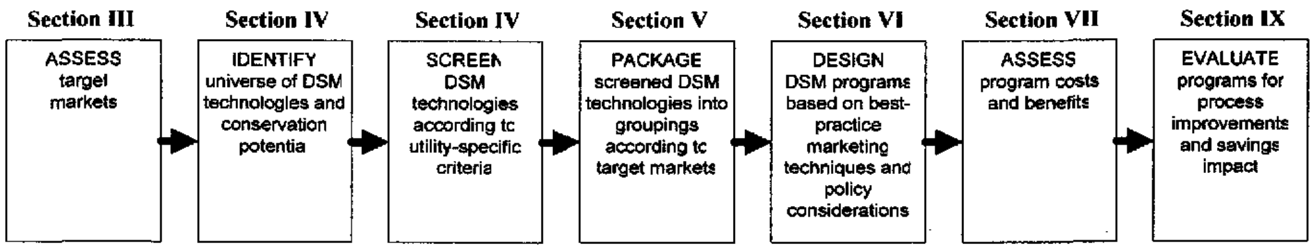

Figure 2. Organization of the Report and Relationship to Project Tasks

III. MARKET ASSESSMENT

Overview

The market assessment begins by describing the Vectren North service territory in terms of households, businesses and customer data. A description of the number of customers in the basic rate classes and a corresponding energy usage model is created for estimating the gas sales to these customers in terms of basic gas energy end-uses; such as, space heat, water heat, cooking, dryers and process energy. The energy end-use estimates are developed in the form of energy usage models that then provide a starting base case for estimating the technical potential and energy savings and cost effectiveness of a wide variety of demand side measures and programs.

The gas energy use estimates are normalized to long-term weather conditions by using the energy usage models applied to a typical or normal year. All energy use and end-use estimates reported here have been normalized to the 30-year monthly temperature averages for Indianapolis. Though the energy use estimates reported here are for a normal year, the models were developed using actual usage and weather data from June 2004 through early August 2005. Usage data were obtained from monthly Revenue Ledger reports.

Customers and Loads by Segment

The Vectren North service territory has about 570,000 customers distributed into the four basic rate classes as presented in Table 2. Monthly gas sales by rate class are presented in Figure 3.

Table 2. Vectren North Customers and Usage (unadjusted for weather) by Rate Schedule

Segment	Customers	Usage (therms/yr)	Percent of Total	Use per Customer (therms/yr)
Residential	519,239	455,618,317	62.4%	877
Commercial	49,633	210,896,404	28.9%	4249
Industrial	184	8,114,466	1.1%	44100
Transport	728	55,428,567	7.6%	76138
Total	**569,784**	**730,057,755**	**100.0%**	

Source: Vectren North Monthly Revenue Ledger Reports, June 2004-May2005

It is evident in Table 2 and Figure 3 that most of Vectren gas sales are to residential customers and that the industrial customers use only a small fraction of the annual sales.

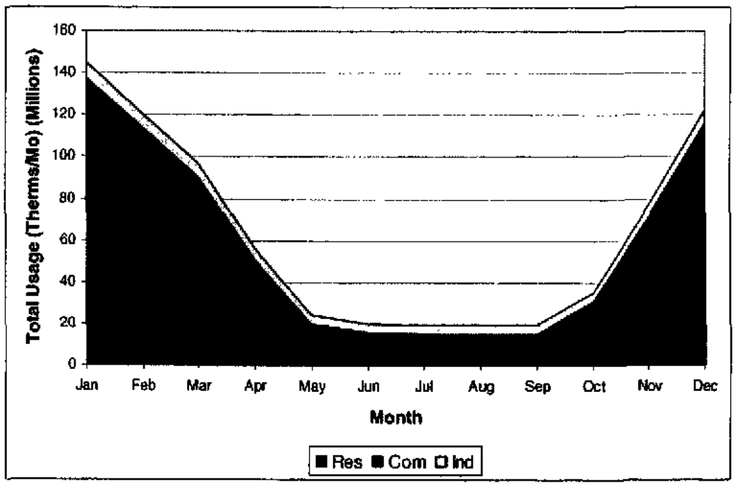

Figure 3. Total Vectren North Gas Sales by Rate Class

End-Use Energy–The monthly energy use of Figure 3 was decomposed into its constituent end-uses by developing simple models for the end-use energy in each sector. When the monthly energy use of Figure 3 is decomposed into end-uses, it appears as in Figure 4.

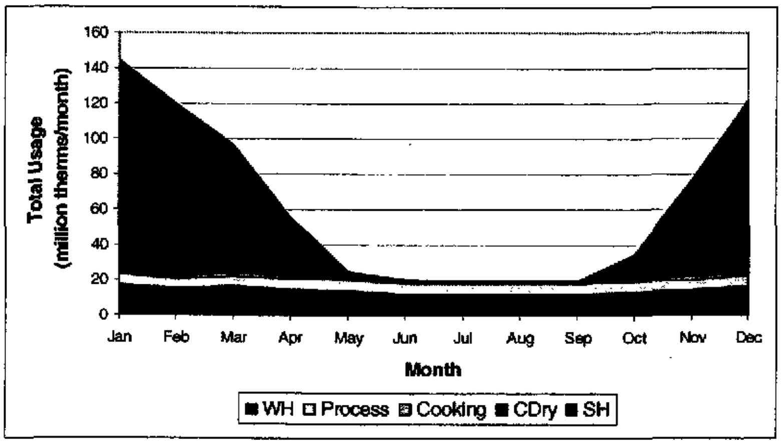

Figure 4. Total Vectren North Gas Sales by Energy End-Use

The monthly information shown in Figure 4 is aggregated into annual end-use estimates in Table 3. The importance of estimating the utility energy sales by end-uses is that end-use energy bears a workable physical relationship to a wide variety of engineering parameters. For example, the magnitude of space heat usage bears a direct relationship to the overall furnace efficiency, while the magnitude of water heat usage bears a direct relationship to gallon per day hot water use and hot water set temperature. Thus, the exercise of mapping the various sector gas end-uses is also creating an end-use model of the utility. It is apparent in Table 3 and Figure 4 that about two-thirds of the gas use is for space heat and about one-fourth of the use is for water heat. Most of these end-uses are in the residential sector.

Table 3. Vectren North Total Annual Gas Use by End-Use

	Normalized Therms/Year	Percent
Furnace (SH)	487,374,460	64.7%
Water Heat (WH)	185,530,313	24.6%
Cooking	17,906,707	2.4%
Clothes Dryer (CDry)	1,867,661	0.2%
Process	61,141,524	8.1%
Total	**753,820,665**	**100.0%**

Source: Our analysis of monthly usage

A visual perspective of the distribution of end-uses in Table 3 is provided in Figure 5, an end-use map of Vectren North gas and transportation sales. Figure 5 is proportioned so that each square equally represents about 1.7 million therms per year; thus the larger the visual area, the larger the usage. The horizontal axis in Figure 5 indicates the market sector, Residential (R), Commercial/Industrial (C), and Transport (T), and the vertical axis represents the fraction of the sector in each end-use. In this figure, red is space heat, blue is water heat, green is cooking or drying, and yellow is process energy.

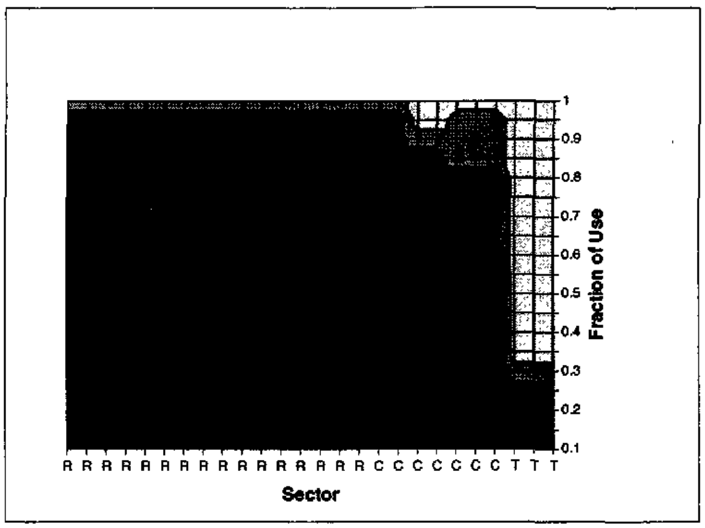

Figure 5. Vectren North End-Use Map

In Figure 5, note the figure is stratified from left to right in terms of average customer size. This stratification constrains the small-scale residential and commercial users, with small forced-air furnaces and residential-scale gas water heaters, to occupy the leftmost two-thirds of the graph. The rightmost portion of the graph shows the end-uses of the larger gas customers, whose space and water heat is via boilers. Thus the graph also generally indicates the type of gas-using appliances matched to the end-uses.

It is quite apparent in Figure 5 that residential-scale space heat and hot water heat are the dominant end-uses, while space and water heat are the most significant end-uses for the commercial sector and parts of the industrial sector as well.

Residential

Service Area Description

The market assessment presented in this section begins with a high-level view of residential housing in the Vectren North service area, followed by a detailed analysis of residential gas loads. As shown in Table 4 below, there were nearly 870,000 occupied housing units in the Vectren service area. Over half of households use utility gas (Vectren) for their primary space heating fuel. Electricity is the second most common heating fuel and is used in one of four homes. Nearly three of every four homes are owner occupied.

Table 4. Housing by Heating Fuel and Tenancy

	Housing Units (thousands)	Percent
Occupied Housing Units	866	100%
By Primary Space Heating Fuel		
Utility Gas Heated	490	57%
Electric	224	26%
Tank Fuel (bottled gas, propane, etc.)	135	16%
Other	17	2%
By Tenancy		
Owner Occupied	632	73%
Renter Occupied	234	27%

Source: 2000 Census Data for Counties in Vectren North Service Area

Residential construction estimated from housing permit data from the Vectren service area is shown in Figure 6. Single family construction trended higher from 1994 through 1999 before leveling off at around 14,000 units a year. In 2004 single family construction hit a peak of nearly 14,700 units. After peaking at 3,600 living units in 1997, multi-family construction has been remarkably flat at around 3,000 units a year.

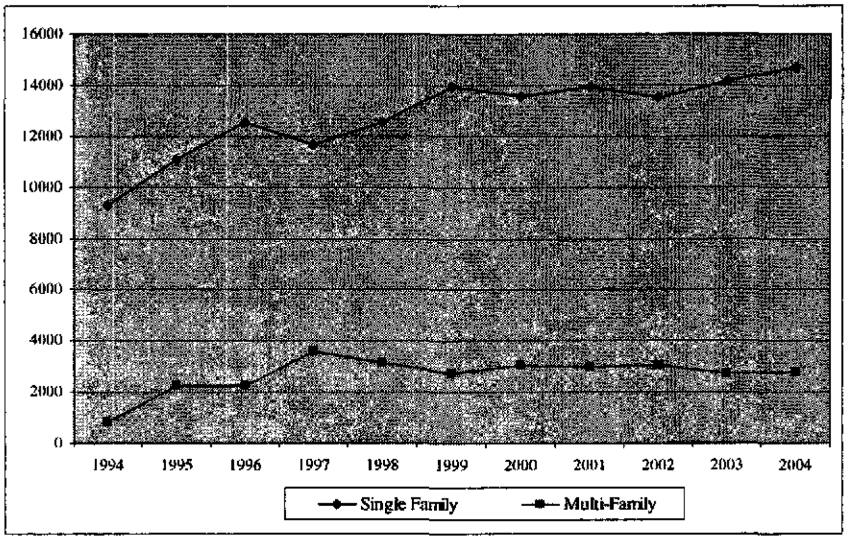

Figure 6. Residential Housing Units Permitted for Construction, Vectren North Service Area

Data shown in Figure 6 are based on monthly permit data lagged to approximate the timing of construction and better align temporally with actual gas service installations. In Table 5 below, total construction and gas service installations are presented. Gas is estimated to serve over 80 percent of single family construction and approximately one-third of new multi-family construction. Market share in multi-family can swing significantly from year-to-year (as evidenced in 2001) due to the influence of a few large projects, a shift in the proportion of low- and high-end multi-family units constructed, and/or differences in the timing of estimated construction and gas service installation.

Table 5. New Gas Services, Construction, and Gas Market Share

	Single Family			Multi-Family		
Year	Gas Connects	Units Built	Percent	Gas Connects	Units Built	Percent
2001	10,383	13,959	74%	1,544	2,993	52%
2002	12,826	13,509	95%	901	3,030	30%
2003	11,577	14,146	82%	936	2,736	34%
2004	12,242	14,685	83%	597	2,774	22%

Source: Connects from Vectren North CIS Data. Units Built Estimated from Housing Permit Data for Vectren North Service Area.

Customer Description

A market segmentation strategy was adopted to describe the residential customer class in greater detail. The segments were also selected to better describe cost effective DSM opportunities which can vary significantly by type of housing and vintage of construction.

Table 6. Number of Residential Customers by Segment

	Single Family	Multi-Family	Total
	(thousands)		
Existing Construction	446.5	31.2	477.7
New Construction	36.3	5.2	41.5
Total	**482.8**	**36.4**	**519.2**

Source: Vectren North CIS Data

Residential customers are segmented by vintage of construction and type of housing. There are typically many important differences between older and newer homes that have large impacts on energy use and conservation potential. Differences in the thermal integrity of the building shell and appliance penetration rates, for example, can lead to large differences in annual usage between older and newer homes. Existing construction is defined as all homes with gas service installed prior to 2001. New construction consists of all homes connected to gas in 2001 and after.

We looked for a clear line of demarcation in selecting a vintage for defining the existing housing stock from new construction. Residential building codes were not found to provide such a line, as the last significant code change for energy usage was found to be a move from 65 to 80 percent AFUE furnaces nearly 15 years ago. We chose to define new construction as homes built in 2001 and after to allow for current usage data for a full three years of consumption (2001-2004). At the request of the Advisory Board, we ran usage analysis by year of construction to see if any clear pattern presented in use per customer by vintage. Results are shown in the table below.

Table 7. Average Weather-Normalized Usage, SF Residential by Meter Set Year

Meter Set Year	Homes in Sample	Annual Therms
1996	46	955
1997	98	896
1998	76	837
2001	470	982
2002	264	942
2003	265	939

Source: Our Analysis of Monthly Vectren North CIS Usage Data

Meter data from each home was included from August 15, 2004, through July 15, 2005, to estimate the weather normalized models used in the analysis. Our sample of existing homes ended with 1998 to provide greater separation between construction practices of new and existing homes. However, as a review of the results indicates, there is no clear trend in average usage for the years examined and, therefore, no clear logic for using one year over another as the definition for new construction in this analysis.

The number of living units per building, single family and multi-family, also enter into the segmentation approach. Single and multi-family units exhibit many differences that impact gas consumption and conservation potential. These differences include size of unit, appliance penetration, building shell integrity and lifestyle attributes. The housing type was determined from the unit number portion of the service address. Premises with non-missing unit numbers were classified as multi-family while units with no unit number were classified as single family buildings.[1]

A large share (86 percent) of residential customers fell into the single family existing segment. Single family new construction makes up about 7 percent of all customers. Multi-family is a relatively small segment of the residential class accounting for a total of 7 percent of all customers, mostly (6 percent) in the existing vintage. Multi-family new construction only accounts for one percent of all residential customers.

[1] Frequency tables of unit number were examined for entries unrelated to unit number such as "NA", "None", or "BOD" (beware of dog) that could bias the classification. These sorts of entries were not found in the data.

Gas Usage Analysis

The number of customers by segment is shown in Table 8. Customer counts represent the mean monthly population levels from mid-2004 through mid-2005.

Table 8. Number of Residential Customers by Segment

Segment	Number of Customers
Existing Single Family	446,546
Existing Multi-Family	31,154
New Construction Single Family	36,347
New Construction Multi-Family	5,192
Total	**519,239**

Source: Vectren North CIS Records, June 2004-May 2005

In this report the partition of residential customers by housing age and type is estimated from service installation records. The current estimates show that most of the housing stock is single family and that most of the single family is existing stock.

Our analysis of customer usage also took advantage of a residential survey Vectren fielded in July. A report was issued by the market research firm dated August 22, 2005, describing the survey results, including appliance installation rates. Since the results in the report were not weighted to the Vectren North service area, we also asked for and were provided SAS datasets with survey results. Using premise and respondent counts within each of the four quadrants surveyed, weights were calculated to allow the results from the stratified sample design to be expressed for the Vectren North area. The results are presented in the table below.

Table 9. Residential Survey Weights by Survey Quadrant

	Quad1	Quad2	Quad3	Quad4	Total
Premise	115,293	96,917	239,681	141,223	593,114
Percent	19%	16%	40%	24%	100%
Sample	366	350	350	350	1,416
Percent	26%	25%	25%	25%	100%
Weight	0.75	0.66	1.63	0.96	4.0

Source: Vectren North Residential Survey Results, August 2005

Appliance installation rates calculated from the weighted survey results are shown in Table 10. The number of respondents was sufficient for results in all segments except new multi-family. Customer survey data provide more current and detailed data on end-uses than the Census data presented in Table 4.

Table 10. Appliance and End-Use Installation Rates from Residential Survey

	Single Family		Multi-Family
	New	Existing	Existing
Number of Respondents	90	1203	105
Appliance or End-Use	**(percent)**	**(percent)**	**(percent)**
Space Heating	94	92	74
Water Heating	80	72	50
Cooking	41	39	31
Clothes Dryer	15	19	11
Decorative Gas Logs	40	11	1
Heat-Rated Gas Fireplace	20	11	9
Gas Fireplace Insert	7	4	1
Gas Stove	2	6	3
Pool Heater	8	3	n/a
Space Heater	12	17	12
Gas Grill	24	17	3

Source: Vectren North Residential Survey Results, August 2005

Gas use for space heating is present in over 90 percent of single family homes with little difference between the existing and new construction segments. Gas water heating is also highly prevalent in single family housing with gas, but more so in new construction than existing. Water heating with gas is found in about 50 percent of multi-family gas customers. Gas cooking and hearth products (logs, fireplaces, inserts, and stoves) are more popular in new construction.

Figure 7 shows that most of the residential gas usage is associated with the existing single family stock and that there is a conspicuous winter peak usage.

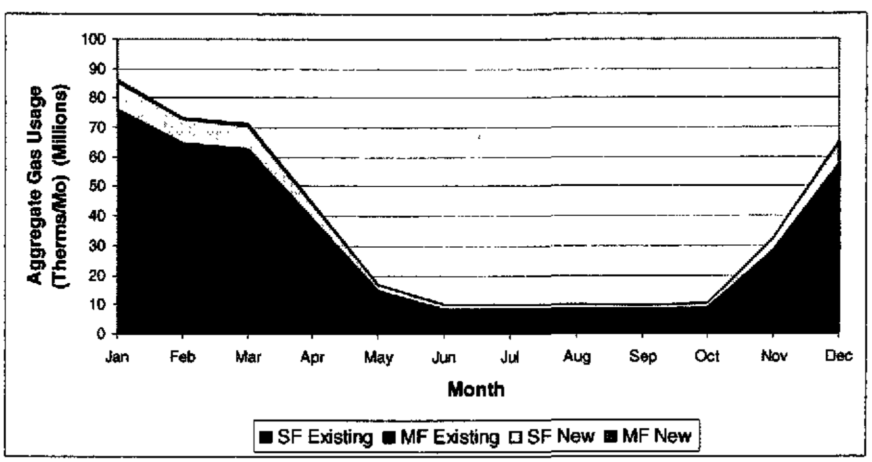

Figure 7. Residential Gas Usage by Housing Type

Overall the residential sector is projected to use about 460 million therms per year, about 63 percent of total utility gas sales. This projection is reported for a "normal" weather year with the same average numbers of customers as May 2004 through May 2005. The final result of the end-use disaggregation is presented in Table 11.

Table 11. Residential Sector Annual Gas Usage by End-Use

End-Use	Therms/Year (millions)	Percent of Total
Furnace	332.5	72.4%
Water Heat	112.0	24.4%
Other	2.8	0.6%
Clothes Dryer	4.6	1.0%
Cooking	7.7	1.7%
Total	**459.6**	**100.0%**

Source: Our analysis of monthly usage data, Vectren North CIS

Table 11 reports the annual gas usage, therms per year, for the most significant of the residential gas usage categories. This annual gas usage is distributed on a month-to-month basis as shown in Figure 8.

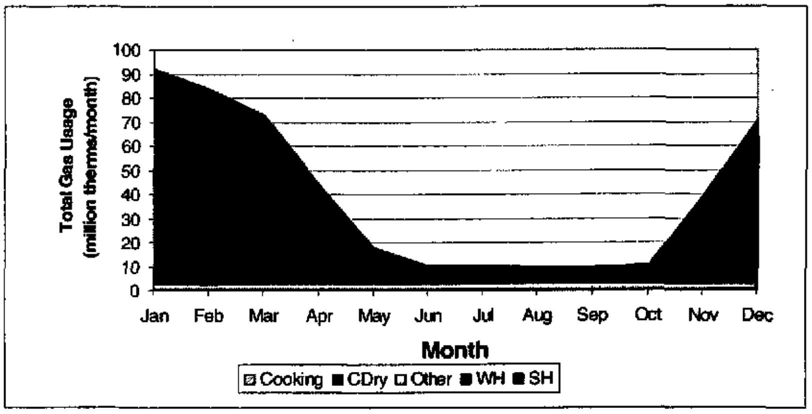

Figure 8. Month-to-Month Normal Gas Usage by End-Use

It is readily apparent in both Table 11 and Figure 8 that the predominant residential gas end-uses are space heat (SH) and water heat (WH). It is also interesting to note the apparent minor role played by the end-uses: cooking, clothes dryer, and other. These end-uses are quite small relative to space heat and hot water. For reference and illustration, these monthly end-use results are presented by month in Table 12.

Table 12. Residential Sector Monthly Usage by End-Use

	Residential Sector End-Uses (therms/month)				
	Cooking	Clothes Dryer	Other	Water Heat	Furnace
January	656,573	388,084	241,446	11,332,405	78,142,664
February	593,033	350,528	218,080	10,319,147	71,036,564
March	656,573	388,084	241,446	10,948,683	59,459,119
April	635,393	375,566	233,658	9,780,461	32,130,159
May	656,573	388,084	241,446	9,177,976	6,816,969
June	635,393	375,566	233,658	8,088,412	0
July	656,573	388,084	241,446	7,846,227	0
August	656,573	388,084	241,446	7,725,536	0
September	635,393	375,566	233,658	7,736,061	0
October	656,573	388,084	241,446	8,713,422	0
November	635,393	375,566	233,658	9,461,397	27,487,779
December	656,573	388,084	241,446	10,832,039	57,439,277
Total Annual	7,730,612	4,569,381	2,842,834	111,961,765	332,512,531
Sector Total		459,617,122			

Source: Our analysis of monthly usage data, Vectren North CIS

Average use per customer for each of the four segments is summarized in the table below. It is interesting to note that existing and new homes have the same total annual load. In both cases new homes have slightly lower space heat usage that is offset by higher base usage. This finding is consistent with the appliance installation rates in Table 11 which show higher installation rates of water heating in new construction than existing. Additional water heat load appears to be the primary reason for the greater base load in new construction.

Table 13. Average Use per Residential Customer (therms)

Segment	Base	Space Heat	Total	Percent Heat
Single Family				
Existing	191	766	957	80%
New	221	732	953	77%
Multi-family				
Existing	82	422	504	84%
New	101	402	503	80%

Source: Our analysis of monthly usage data, Vectren North CIS

All projections of usage to a normal year require the use of some sort of model, however simple. The usage model for the residential sector consists of an assembly of submodels for each end-use in terms of monthly temperature. In the course of this analysis, the model underlying this projection was trued to the actual recorded usages and temperatures for the test year May 2004 through May 2005. This true-up provides a reality check on the total of all the end-uses estimated by the model, though it does not provide a check on any particular end-use. Figure 9 shows that modeled and actual total residential gas usage agree well.

Figure 9 also shows that the total residential usage bears a close correlation to the average monthly temperature. Physically, this is identically the same relationship long noted between heating degree days and gas usage. But in this model, the Mean Month Temperature is used instead of deg days as the temperature variable because it is an absolute reference, not indirect as in a degree day, and because it is more compatible with the structure of the engineering models that are the submodels of the overall residential sector end-use model.

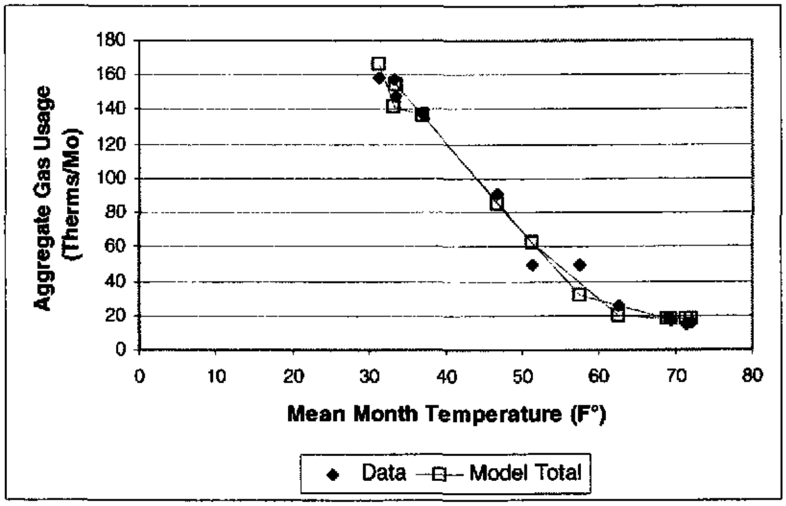

Figure 9. Actual and Modeled Total Residential Gas Usage

Note in Figure 9 the steep, but predictable, change in usage with temperature. This slope provides a check point for the cumulative effect of assumptions regarding heat loss. Usage model parameters (such as, furnace efficiency, distribution efficiency, and shell thermal losses) all act together to determine the heat loss at any given temperature. The cumulative effect of even small errors in these parameters can become a significant over or under statement of gas use. Hence there is a need to calibrate the model against a real world check point. This temperature slope of gas use versus temperature is one of the two real world check points for each of the models.

In Figure 9, the low usage values, base load, occurring at the highest temperatures, is the other check point. These low consumption and high temperature periods represent usages that are not space heat. Taken together, these check points have significant resolving power, sufficient to separate out the base load from the space heat end-use and to provide a close limit on the base load and the total monthly residential gas usage.

A full discussion of the sector usage model and the end-use submodels, as well as test year and normal year, is presented in the Methodology section of the Appendix.

Commercial

Service Area Description

For this analysis the commercial population has been examined from two separate perspectives. First, the population has been classified by the 2005 commercial rates. This classification facilitates reconciliation of results with the general ledger records, but it does not align clearly with commercial business types and gas usage. Second, the population is classified into ten primary business types. This latter method yields more insight into commercial gas end-uses by business type.

As with residential, business attributes in the Vectren service area are first described then followed by a discussion of commercial customers and usage. County-specific data were also used to better relate secondary data to the Vectren service area. Table 14 shows the number of businesses and employment by commercial segments.

Table 14. Number of Businesses and Employment, Vectren North Service Area

	Number of Businesses*	Employment**	Percent	Employees per Business
Construction	6,129	71,774	7.5	11.7
Manufacturing	3,007	182,438	18.9	60.7
Wholesale Trade	2,675	30,220	3.1	11.3
Retail Trade	9,004	153,740	16.0	17.1
Transportation, Warehousing	1,670	38,825	4.0	23.2
Information*	772	13,893	1.4	18.0
Professional, Technical Services	4,065	41,852	4.3	10.3
Health Care, Social Services	4,764	90,034	9.3	18.9
Arts, Entertainment, Recreation	807	19,264	2.0	23.9
Accommodation, Food Services	4,291	82,660	8.6	19.3
Other Private (not Above)	15,636	238,621	24.8	15.3
Total	**52,817**	**963,321**	**100.0**	**18.2**

*Averaged 2001 and 2002 totals from Woods & Poole 2005 State Profile
**2003 totals from STATS Indiana website (www.stats.indiana.edu)

Source: Woods and Poole 2005 State Profile and STATS Indiana Website

There are an estimated 53,000 businesses in the Vectren service area employing a total of nearly one million workers, an average of just over 18 employees per business.[2] About 19 percent of total employment is in manufacturing. Retail trade is the largest non-manufacturing sector accounting for 16 percent of all employment.

As shown in Figure 10,[3] non-manufacturing employment has increased steadily over the last 34 years, increasing an average of 1.5 percent annually. Manufacturing employment, on the other hand, has been mostly flat with periods of upward and downward trend. Overall, manufacturing employment has declined from a high of 246,000 in 1969 to an estimated 209,000 in 2004, a drop of 0.5 percent annually since 1969.

[2] Business counts do not include proprietors and government workers. Employment estimates are likely to be understated by an unknown amount due to non-disclosure requirements of the U.S. Bureau of Economic Analysis. These requirements protect businesses that could be identified in the data when a small number of firms operate in a reporting jurisdiction. Also, certain businesses are exempt from reporting adding to the potential for under reporting.

[3] Employment data in this chart are presented to show long-term trend. Due to differences in the reporting methods of data sources, the data may not agree with other sources presented in this paper.

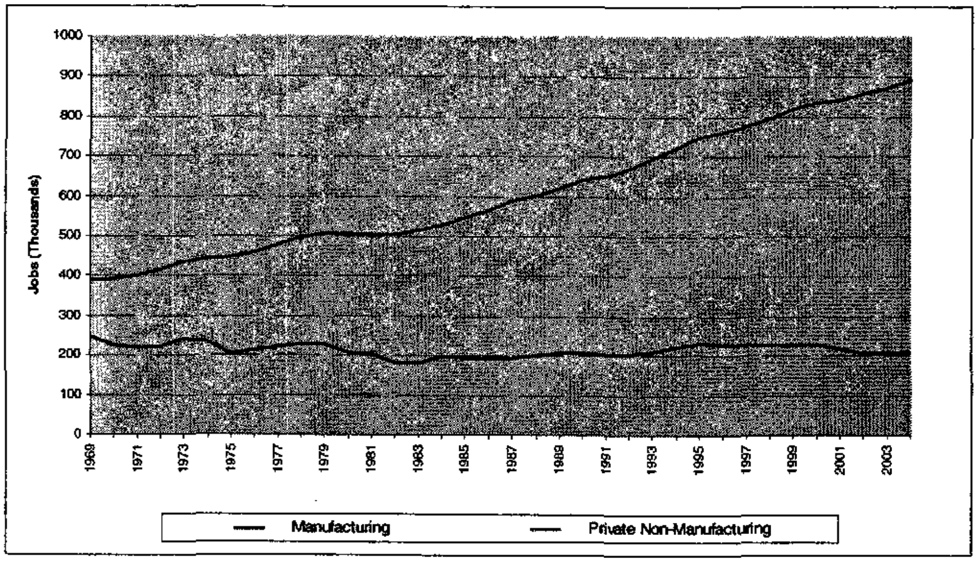

Figure 10. Trends in Employment, Vectren North Service Area

Commercial Building Stock

Descriptive information on the commercial building stock in the Vectren North service area is useful for better understanding the nature of the DSM opportunity. We considered the likely distribution of commercial building stock by building type, age and square feet in our assessment of the applicability of conservation technologies. Unfortunately, we were unable to identify internal or secondary sources to describe the specific service area. We turned instead to the 1999 Commercial Buildings Energy Consumption Survey (CBECS), a national survey of the building characteristics and energy end-uses in over 5000 commercial buildings. Although the CBECS sample includes buildings from all 50 states and the District of Columbia, results at the Census division level are the lowest geographic detail available.

The Census division that includes Indiana is the East North Central Division which also contains Ohio, Michigan, Illinois and Wisconsin. We felt that including the entire division as a proxy for central and southern Indiana was not appropriate. CBECS includes a climate zone field that we used to narrow the geographic space to an area that is more likely to be representative. The CBECS survey includes HDD zones of less than 4000, 4000 to 5499, 5500 to 7000, and greater than 7000. Choice of an appropriate climate zone was complicated by the fact that Indianapolis, with just over 5525 HDD a year, lies in the same climate zone as northern Indiana and Chicago. We used a climate zone screen of 4000 to 5499 which includes southern Indiana and the Evansville (HDD=4617) area. However, this left an insufficient number of buildings for analysis. To augment the sample we included two adjacent Census divisions East South Central (Kentucky, Tennessee, Alabama and Mississippi) and West North Central (Missouri, Kansas, Iowa, Nebraska, the Dakotas and Minnesota), keeping the climate screen of 4000 to 5499 HDD. This resulted in the inclusion of commercial buildings markets such as Saint Louis (HDD=4758), Louisville (HDD=4352), and Kansas City (HDD=5250). The climate zone screen eliminated northern and southern markets such as Fort Wayne (HDD=6205) and Nashville (HDD=3677).

This filtering provided a sample of 261 commercial buildings with gas usage. Of these, there were sufficient numbers (at least 20 buildings) in five of the 20 building activity types to report the data. Commercial building stock data are reported in this report for the five building activity types and for all 261 gas buildings. The average year built and distribution of buildings by vintage is shown in the table below.

Table 15. Age of Gas Buildings – Customized Regional Area of CBECS Survey

Principal Building Activity	Count	Year Construction Was Completed (percent)								
		Avg	Before 1920	1920 to 1945	1946 to 1959	1960 to 1969	1970 to 1979	1980 to 1989	1990 to 1995	1996 to 1999
Office/Professional	38	1961	10.5	10.5	18.4	10.5	18.4	15.8	7.9	7.9
Warehouse (Nonrefrig.)	29	1970	3.4	6.9	24.1	6.9	13.8	27.6	10.3	6.9
Education	41	1964	4.9	7.3	29.3	26.8	9.8	7.3	4.9	9.8
Retail (excl. Mall)	20	1950	30.0	5.0	5.0	10.0	5.0	10.0	10.0	25.0
Service	23	1954	17.4	13.0	13.0	13.0	13.0	26.1	4.3	0.0
All Buildings	151	1963	7.7	6.5	14.3	14.6	24.8	18.7	8.1	5.3

Source: Commercial Buildings Energy Consumption Survey, 1999

The average age of gas buildings is over 40 years and more than two-thirds of the stock was built before 1980. Retail and service buildings tend to be older than most building types. Warehouses are the newest building stock, with nearly half of all warehouses using gas constructed in 1980 and after.

Data on square footage of commercial buildings using gas is shown in Table 16. Size of commercial buildings varies significantly by building type. The average size of commercial buildings is around 160,000 square feet. Of the five building types shown in the table, services are by far the smallest building type followed by retail buildings. Offices and warehouses are near the average size for all buildings. The distribution of building size is typically heavily skewed with most buildings in the smaller sizes. For example, even though the average office is over 160,000 square feet, over half of all office buildings are smaller than 50,000 square feet. In other words, the average is much larger than the median of the distribution due to very large office buildings at the tail of the distribution.

Table 16. Size of Gas Buildings – Customized Regional Area of CBECS Survey

Principal Building Activity	Count	Average Square Footage	Square Footage Category (percent)									
			1,000 or Less	1,001-5,000	5,001-10,00	10,001-25,000	25,001-50,000	50,001-100,000	100,001-200,000	200,001-500,000	500,001-1 million	Over 1 million
Office/Professional	38	164,151	0.0	13.2	10.5	21.1	7.9	7.9	5.3	28.9	2.6	2.6
Warehouse (Nonrefrig.)	29	164,897	0.0	3.4	3.4	13.8	13.8	20.7	17.2	20.7	6.9	0.0
Education	41	67,104	0.0	2.4	2.4	9.8	43.9	26.8	7.3	7.3	0.0	0.0
Retail (excl. Mall)	20	44,350	0.0	15.0	10.0	30.0	25.0	5.0	10.0	5.0	0.0	0.0
Service	23	15,826	0.0	34.8	30.4	13.0	17.4	4.3	0.0	0.0	0.0	0.0
All Buildings	151	163,490	0.0	9.2	14.0	25.7	13.7	10.3	7.5	6.2	11.1	2.4

Source: Commercial Buildings Energy Consumption Survey, 1999

The incidence of gas end-use by building type is shown in Table 17 below. It is no surprise that gas usage for space and water heating have the highest saturation levels, averaging 80 and 70 percent respectively. The use of gas for cooking and electricity generation is present in 29 and 5 percent of buildings, respectively. It is interesting to note the presence of cooking loads in all building types, including nearly a quarter of all office buildings using gas.

Table 17. Natural Gas End-Uses in Commercial Buildings – Customized Regional Area of CBECS Survey

Principal Building Activity	Count	Natural Gas Use (percent)						
		Main Heating	Secondary Heating	Cooling	Water Heating	Cooking	Manu-facturing	Generate Elec
Office/Professional	38	92.1	2.6	5.3	55.3	23.7	0.0	2.6
Warehouse (Nonrefrig.)	29	93.1	3.4	0.0	65.5	3.4	3.4	3.4
Education	41	87.8	7.3	0.0	85.4	63.4	0.0	4.9
Retail (excl. Mall)	20	80.0	5.0	0.0	50.0	10.0	0.0	10.0
Service	23	82.6	13.0	0.0	34.8	4.3	0.0	4.3
All Buildings	151	79.9	9.3	1.0	70.4	28.8	0.2	5.0

Source: Commercial Buildings Energy Consumption Survey, 1999

Customer Description

As with residential customers, a segmentation strategy to group customers into segments with similar load and conservation opportunities is desirable. The segmentation approach used for non-residential customers is shown in Table 18.[4]

[4] Note that the data in Table 18 are NAICS-based segments and, hence, will not correspond to the data in Table 2 which shows usage by segments based on rate schedules.

Table 18. Vectren North Non-Residential Premises and Loads by NAICS-Based Segments

Load in Millions of Therms, Actual Usage (unadjusted for weather), August 2004–July 2005

Segment	Premises	Percent	Load	Percent
Commercial				
Grocery	947	2	3.3	1
Hospitals	335	1	13.3	3
Lodging	313	1	3.1	1
Office	9,149	19	45.8	11
Other Health	2,624	6	14.4	3
Restaurants	2,775	6	16.7	4
Retail	5,330	11	19	4
Schools	1,629	3	31.1	7
Wholesale and Warehouse	2,845	6	22.4	5
Unclassified and Other	10,539	22	60.5	14
Total Commercial	**36,486**	**77**	**230**	**53**
Other Non-Residential				
Ag., Mining, Util., and Const.	8,239	17	53.2	12
Manufacturing	2,851	6	149.5	35
Total Other Non-Residential	**11,090**	**23**	**202.7**	**47**
Total Non-Residential	**47,576**	**100**	**432.3**	**100**

Source: Vectren North CIS Data

The segmentation of customer data was based on an extract from the Vectren customer information system (CIS) that included North American Industrial Classification System (NAICS) codes. This project benefited from having current NAICS codes since Vectren recently paid a third party to append NAICS codes to their CIS records. Customers were then segmented into the groups shown in Table 18 based on the codes.

Over three-fourths (78 percent) of all non-residential customers are classified as commercial, based on NAICS. These commercial customers account for just over half of all non-residential loads. In terms of annual loads, offices and schools are the largest commercial segments. Vectren has a large number of retail customers, but they only account for four percent of total non-residential loads.

In the meantime, the preliminary results discussed in the commercial and the industrial sections are based on broadly defined rate-based definitions of segment. These broadly based definitions are valuable for assessing sector loads and disaggregation by major end-uses.

Gas Usage Analysis

The commercial sector usage has been analyzed in terms of the 2005 commercial rates. In the commercial sector, the monthly customer population varies slightly from month to month with an average monthly population of about 50,000. The commercial customers are composed of four basic rate categories: NCM1, NCM2, NCM3 and NC40. The mean monthly populations of these categories are shown in Table 19 along with the estimated number by major end-use.

Table 19. Assumed Commercial Customer Distribution

End-Use	NCM1	NCM2	NCM3	NC40
Total	35,949	11,094	2,494	96
Space Heat	34,871	10,872	2,444	96
Water Heat	34,152	6,656	2,369	77
Cooking	1,797	8,875	1,247	19
Clothes Dryer	1,797	555	125	29

Source: Our analysis of monthly usage, Vectren North Revenue Ledger Reports

Note in Figure 11 that the rate NC40, which has the largest commercial customers, also has so few participants that the aggregate usage is relatively small. The rate NCM1 with about 35,000 participants appears to be space heat dominated. The average heat loss rate is that of a large residence. This group likely consists of small office and retail, where the principal gas use is space heating.

The rate NCM2, with about 11,000 participants, has the largest aggregate usage in the commercial sector. It is characterized by an average heat loss rate equivalent to about five to ten houses and higher hot water use. This rate is probably populated by medium-scale office and retail and by smaller restaurants.

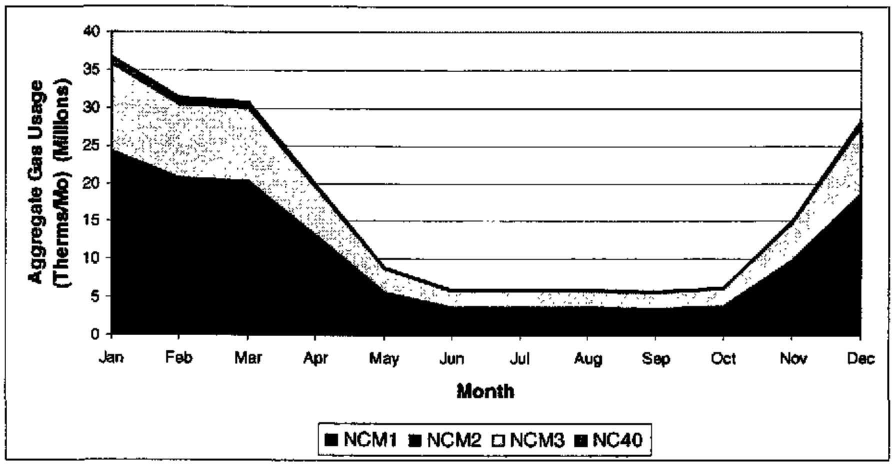

Figure 11. Commercial Monthly Gas Usage by Rate Schedule

The rate NCM3 has only about 2500 participants and these are characterized by an average heat loss rate equivalent of 25 houses with significant hot water use as well. This rate is probably populated with schools, smaller lodging, medium-sized restaurants and laundries.

The rate NC40 has only about 95 participants. The average participant is a large scale operation with an average heat loss rate equivalent to about 60 to 100 houses also with significant hot water use. This rate is probably populated with larger offices and schools and retail, large restaurants, smaller hospitals, and medium-scale lodging.

Notably, each of these rate categories has explicit billing information for the 2005 portion of the test year and the model for the stock in that rate category has been separately reconciled to the usage record. Overall the commercial sector, defined by rate schedule, uses about 213 million therms per year, about 29 percent of total utility gas sales. This projection is reported for a "normal" year which has the same level of customers as May 2004 through May 2005, but has the 30-year average temperatures instead of the actual temperatures. The final result of the end-use disaggregation is presented in Table 20.

Table 20. Commercial Sector Annual Gas Usage by End-Use

End-Use	Therms/Year (millions)	Percent of Total
Space Heat	135.0	63.3
Water Heat	56.1	26.3
Other	9.2	4.3
Clothes Dryer	195.3	0.1
Cooking	12.7	6.0
Total	**213.1**	**100.00**

Source: Our analysis of monthly usage, Vectren North Revenue Ledger Reports

Table 20 reports the annual gas usage, therms per year, for the most significant of the commercial gas rates. This annual gas usage is distributed on a month-to-month basis as shown in Figure 12.

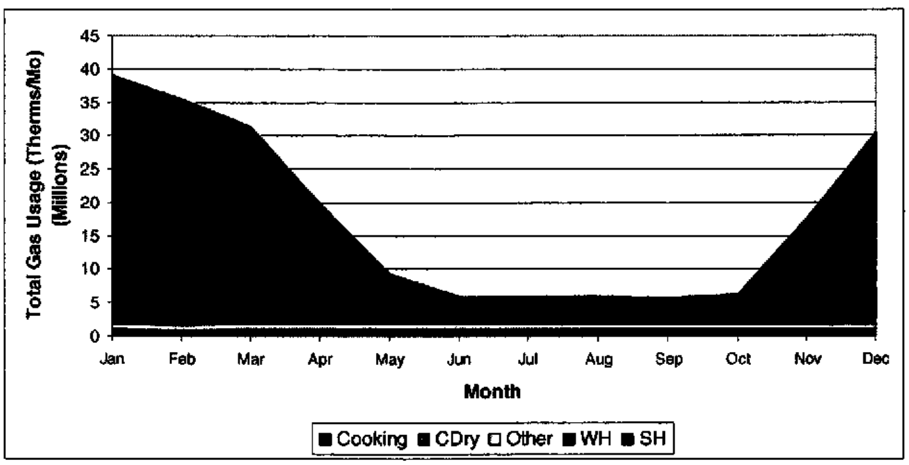

Figure 12. Commercial Monthly Normalized Gas Usage by End-Use

It is readily apparent in both Table 20 and Figure 12 that the predominant commercial gas end-uses are space heat (SH) and water heat (WH). For reference and illustration, these monthly end-use results are presented in Table 21.

Table 21. Commercial Sector Monthly Usage by End-Use

	Commercial Sector End-Uses (therms/month)				
	Cooking	**Clothes Dryer**	**Other**	**Water Heat**	**Furnace**
January	1,077,188	16,591	783,551	5,487,635	31,721,524
February	972,944	14,985	707,723	5,001,111	28,836,848
March	1,077,188	16,591	783,551	5,365,270	24,137,057
April	1,042,440	16,056	758,275	4,861,304	13,043,037
May	1,077,188	16,591	783,551	4,633,637	2,767,306
June	1,042,440	16,056	758,275	4,158,673	0
July	1,077,188	16,591	783,551	4,090,518	0
August	1,077,188	16,591	783,551	4,034,106	0
September	1,042,440	16,056	758,275	3,994,406	0
October	1,077,188	16,591	783,551	4,412,557	0
November	1,042,440	16,056	758,275	4,705,384	11,158,491
December	1,077,188	16,591	783,551	5,309,873	23,317,114
Total Annual	12,683,019	195,343	9,225,676	56,054,474	134,981,377
Sector Total		213,139,888			

Source: Our analysis of monthly usage, Vectren North Revenue Ledger Reports

In addition to the rate schedule based analysis discussed above, loads were also modeled by the segmentation strategy discussed earlier. The results augment the rate schedule based analysis and provide average usage by segment, useful for assessing DSM opportunities by building prototype.

Weather normalized use per customer is shown in Table 22 for base, heat and total load. Base loads are those loads which are not correlated with temperature including water heat, cooking and process loads.[5] Heating load refers to the temperature dependent portion of total load, typically a gas furnace or other space heating device.

Typical of commercial loads, the average use per customer shown in Table 22 reveal large spreads in annual usage between segments. On the low end, grocery and retail customers use just under 4,000 therms a year. Hospitals are by far the commercial segment with the highest use per customer, averaging 10 times the load of typical retail and grocery customers.

It is also interesting to note the heating load as a percentage of total load. Segments with larger heat related loads tend to be comprised a smaller commercial customers with load patterns typical of residential customers. Retail, grocery, and schools all have high percentages (around 70) of heat load. Of these, schools are the only ones that do not appear to fit the category of small commercial.

While restaurants and buildings with food preparation end-uses do not appear to have large total gas consumption, cooking end-uses represent the third highest usage category, as shown earlier in Table 20, at 6 percent. Since there are many opportunities for increasing the energy efficiency of food preparation equipment,

[5] Table 22 is used for identifying segments with high or low average usage per customer. Use Table 18 to compare total loads between segments.

restaurants and other hospitality establishments have been target markets for DSM programs in several jurisdictions, in spite of their relatively lower total gas usage profile.

Table 22. Average Use per Commercial Customer by Segment (therms)

Segment	Base	Heat	Total	Percent Heat
Grocery	1,150	2,705	3,855	70.2
Hospitals	26,488	14,382	40,870	35.2
Lodging	6,361	4,170	10,531	39.6
Office	2,451	2,953	5,404	54.6
Other Health	2,827	3,041	5,868	51.8
Restaurants	4,481	2,062	6,543	31.5
Retail	1,026	2,880	3,906	73.7
Schools	6,073	14,321	20,394	70.2
Wholesale and Warehouse	3,595	4,784	8,379	57.1
Unclassified and Other	2,438	3,747	6,185	60.6

Source: Our Analysis of Usage Data, Vectren North CIS Usage

All projections of usage to a normal year require the use of a usage model, however simple. In the commercial sector, there is a usage model for each of the segments. Each usage model consists of an assembly of submodels for each end-use in terms of monthly temperature. In the course of this analysis, each usage model underlying this projection was trued to the actual recorded temperature and usages for that segment. This true-up provides a reality check on the total of all the end-uses estimated by the model, though it does not provide a check on any particular end-use. Figure 13 shows that modeled and actual total commercial gas usage agree well.

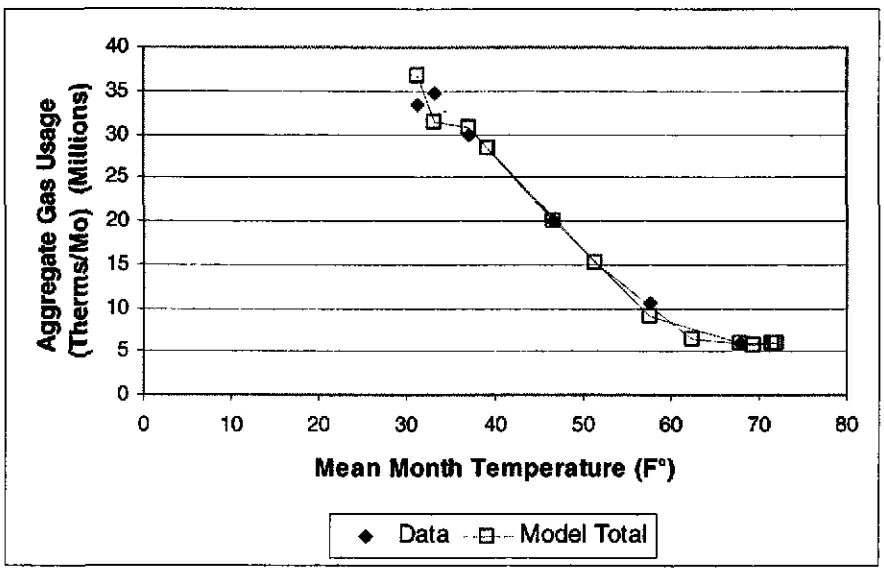

Figure 13. Actual and Modeled Total Commercial Gas Usage

Figure 13 also shows that the total commercial gas usage bears a close correlation to the average monthly temperature. Physically, this is identically the same relationship long noted between heating degree days and gas usage. But in this model, the Mean Month Temperature is used instead of degree days as the temperature variable because it is an absolute reference, not indirect as in a degree day, and because it is more compatible with the structure of the engineering models that are the submodels of the overall commercial sector end-use model.

Note in Figure 13 the steep, but predictable, change in usage with temperature. This slope provides a check point for the cumulative effect of assumptions regarding heat loss, furnace efficiency, distribution efficiency, shell thermal loss and infiltration.

In Figure 13, the low usage values occurring at the highest temperatures, are check points for the sum of usages that are not space heat. Taken together, these check points and the temperature slope have significant resolving power, sufficient to separate out the space heat end-use and to provide a close limit on the base load and the total monthly commercial gas usage.

A full discussion of the sector usage model and the end-use submodels, as well as test year and normal year, is presented in the Methodology section of the Appendix.

Industrial

For this analysis the industrial population has been classified by the 2005 industrial rates. This classification facilitates reconciliation of results with the general ledger records. This definition of the industrial sector includes the industrial commodity gas rates NIN3 and NI40, as well as, the gas transportation customers. While there are some industrial gas commodity sales, most of the industrial gas use is by transportation customers.

In the industrial sector, the monthly industrial customer population for Vectren North varies slightly from month to month with an average monthly population of about 900 customers. In this sector, the industrial customers are assumed to be composed of four basic rate categories: NIN3, NI40, T600x and T700x. For this analysis, the mean monthly populations of these categories in the first six months of 2005 are shown in Table 23.

Table 23. Assumed Industrial Customer Distribution

End-Use	NIN3	NI40	T600x	T700x
Total	136	48	358	370
Furnace	136	48	358	370
Water Heat	136	48	358	370
Process	136	48	358	370
Cooking	27	10	72	74
Clothes Dryer	27	10	72	74

Source: Our analysis of monthly usage, Vectren North Revenue Ledger Reports

Note in Figure 14 that the rate T700x, which has the largest industrial customers, has the majority of the gas usage. While this rate has about 370 customers, most of the gas use is by less than 50 of the largest transportation customers.

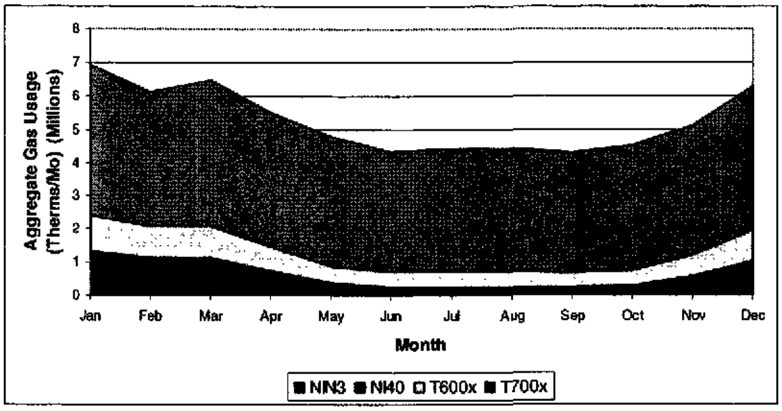

Figure 14. Industrial Monthly Gas Usage by Rate Schedule

The rate T600x with about 350 customers appears to be space heat dominated. The average heat loss rate is that of about 25 residences. This group likely consists of larger buildings including lodging.

The rate NI40, with about 50 participants, has a high average heat loss rate, equivalent to about 50 to 75 residential homes. It also appears to have low usage in late December as if the facility was shut down for part of the month. This rate is probably populated by education institutions.

The rate NIN3 has only about 135 participants and these are characterized by an average heat loss rate equivalent of 25 houses with significant hot water use as well. This rate is probably populated with schools, smaller hotels lodging, medium sized restaurants and laundries.

Notably, each of these rate categories has explicit billing information for the first six months of 2005, the test year, and the model for the average customer in that rate category has been separately reconciled to the usage record. Overall the industrial sector is projected to use about 64 million therms per year, about 9 percent of total utility gas sales. This projection is reported for a "normal" year which has the same level of customers as May 2004 through May 2005, but has the 30-year average temperatures instead of the actual temperatures. The final result of the end-use disaggregation is presented in Table 24.

Table 24. Industrial Sector Annual Gas Usage by End-Use

End-Use	Therms/Year	Percent of Total
Furnace	9,291,196	14.5
Water/Steam	15,928,753	24.8
Process	37,165,425	58.0
Clothes Dryer	724,708	1.1
Cooking	1,007,795	1.6
Total	**64,117,878**	**100.0**

Source: Our analysis of monthly usage, Vectren North Revenue Ledger Reports

Table 24 reports the annual gas usage, therms per year, for the most significant of the industrial gas rates. This annual gas usage is distributed on a month-to-month basis as is shown in Figure 15. It is readily apparent in both Table 24 and Figure 15 that the predominant industrial gas end-uses are process related.

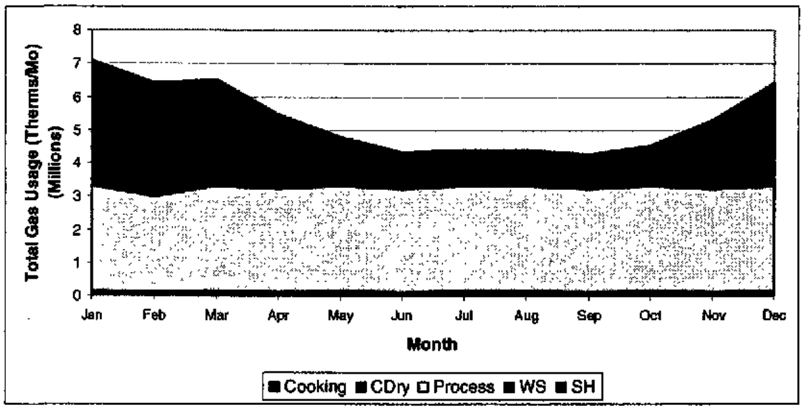

Figure 15. Industrial Monthly Normalized Gas Usage by End-Use

This process energy is quite specific and diverse and actually includes water heating, steam, drying, etc., but for the purposes of this analysis all these process-coordinated uses will be classified into two end-uses: direct process energy and indirect process energy via boilers. The partition into direct and indirect process energy is based on assumptions from the U.S. Department of Energy industrial gas usage statistics.

For reference and illustration, the monthly end-use results are presented in Table 25.

Table 25. Industrial Sector Monthly Usage by End-Use

	Industrial Sector End-Uses (therms/month)				
	Cooking	*Clothes Dryer*	*Process*	*Water/Steam*	*Furnace*
January	85,594	61,551	3,156,516	1,604,875	2,183,493
February	77,310	55,594	2,851,046	1,461,480	1,984,932
March	85,594	61,551	3,156,516	1,552,879	1,661,430
April	82,833	59,565	3,054,693	1,389,927	897,794
May	85,594	61,551	3,156,516	1,307,252	190,482
June	82,833	59,565	3,054,693	1,155,091	0
July	85,594	61,551	3,156,516	1,122,759	0
August	85,594	61,551	3,156,516	1,105,794	0
September	82,833	59,565	3,054,693	1,105,578	0
October	85,594	61,551	3,156,516	1,241,818	0
November	82,833	59,565	3,054,693	1,344,846	768,074
December	85,594	61,551	3,156,516	1,536,453	1,604,991
Total Annual	**1,007,795**	**724,708**	**37,165,425**	**15,928,753**	**9,291,196**
Sector Total		**64,117,878**			

Source: Our analysis of monthly usage data, Vectren North CIS

Also as perspective, the monthly gas end-uses are presented for a single average building of each of the four commercial rates in Figure 16 through Figure 19.

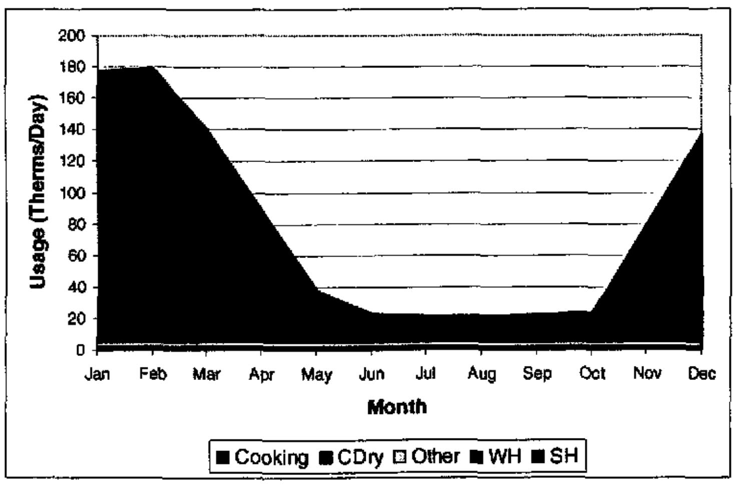

Figure 16. Daily Gas End-Uses - Average Industrial NIN3 Customer

Note in Figure 16 that the average customer in rate NIN3 has a usage profile quite similar to customers in the larger commercial rate categories, NCM3 and NC40.

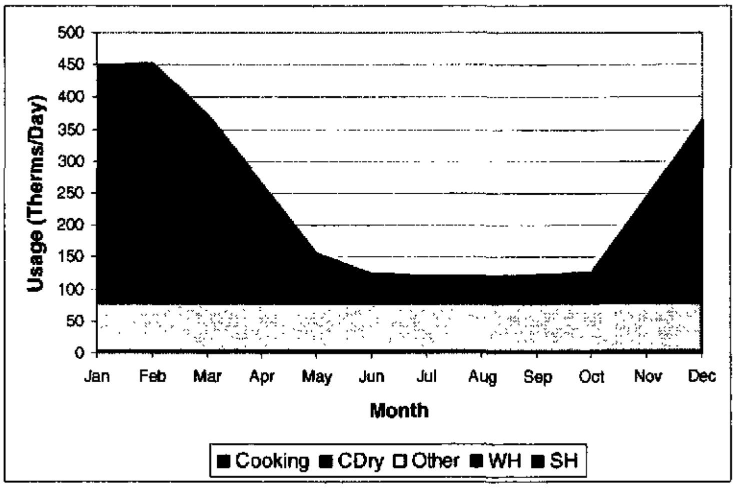

Figure 17. Daily Gas End-Uses - Average Industrial NI40 Customer

The average site in rate NI40 has a high space heat signature as if it were a large complex of buildings. Also there is an anomalously low space heat usage for December through January suggesting that facilities in this rate are not fully used in late December. It walks and talks like a school.

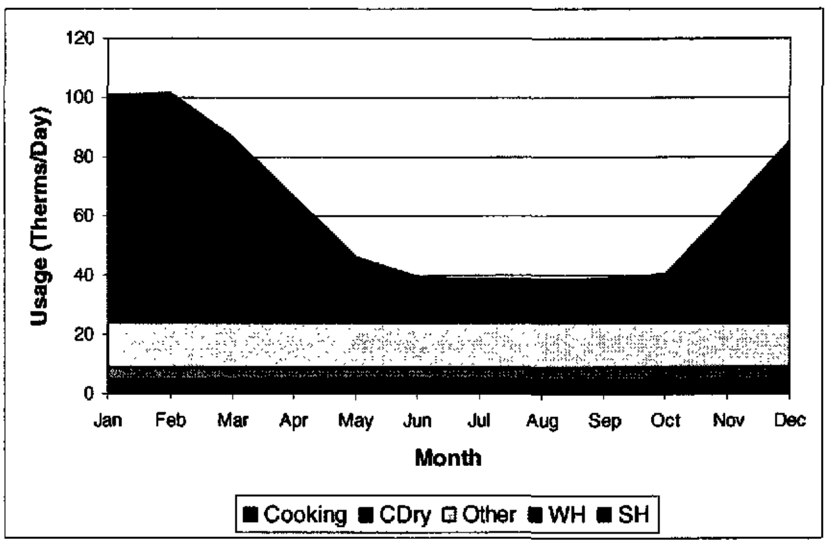

Figure 18. Daily Gas End-Uses - Average Transportation T600x Customer

Average transportation customers in rate T600x are moderately sized and are characterized by a relatively high base load. The total base load for this rate is reasonably well known, but the partition of the base load into its sub end-uses is based on assumptions. It is probable that the end-use mix for the 350 customers in this rate is quite diverse.

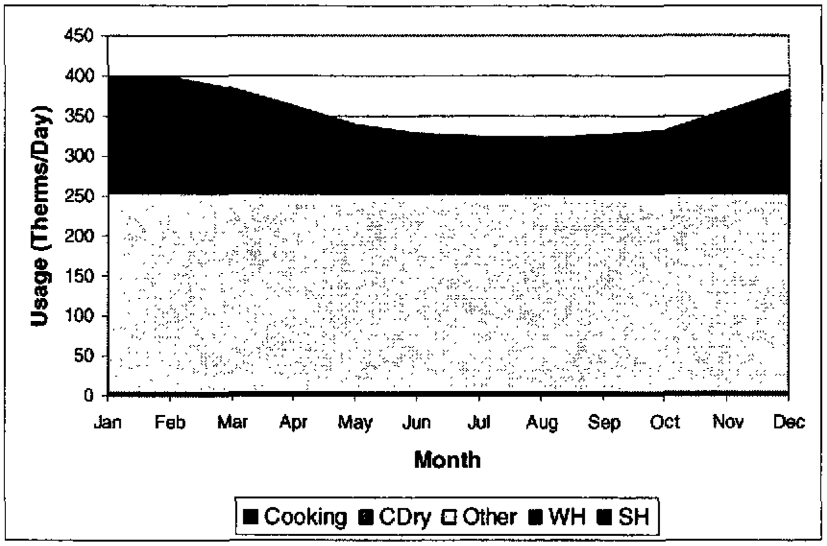

Figure 19. Daily Gas End-Uses - Average Transportation T700x Customer

Transportation customers in rate T700x vary significantly in size, with most of the energy going to a few of the largest customers. Therefore, this average may not be physically representative of any of the customers in this rate. Note in this figure the minimal space heat energy. This may not be space heat per se, but temperature sensitivities of the larger processes.

Industrial customer usage was also analyzed by segment, defined by NAICS codes discussed earlier in this section. These results are shown in Table 26 below.

Table 26. Average Use per Industrial Customer by Segment (therms)

Segment	Base	Heat	Total	Percent Heat
Ag., Mining, Util., and Const.	4,141	2,890	7,031	41.1
Manufacturing	35,069	19,622	54,691	35.9

Customers in the manufacturing segment have a much higher average usage than the Agricultural, Mining, Utilities, and Transportation (AMUT) segment. The two industrial segments are each characterized by low space heating loads relative to the commercial segments discussed earlier, indicative of the higher process loads found in this sector.

All projections of usage to a normal year require the use of a usage model, however simple. In the industrial sector, there is a usage model for each of the four industrial rate categories. And each rate usage model consists of an assembly of submodels for each end-use in terms of monthly temperature. In the course of this analysis, each rate usage model underlying this projection was reconciled to the actual recorded usages for that rate and temperatures for the 2005 portion of the test year, May 2004 through May 2005. The reconciliation provides a reality check on the total of all the end-uses estimated by the model, though it does not provide a check on any particular end-use. Figure 20 shows that modeled and actual total residential gas usage agree well.

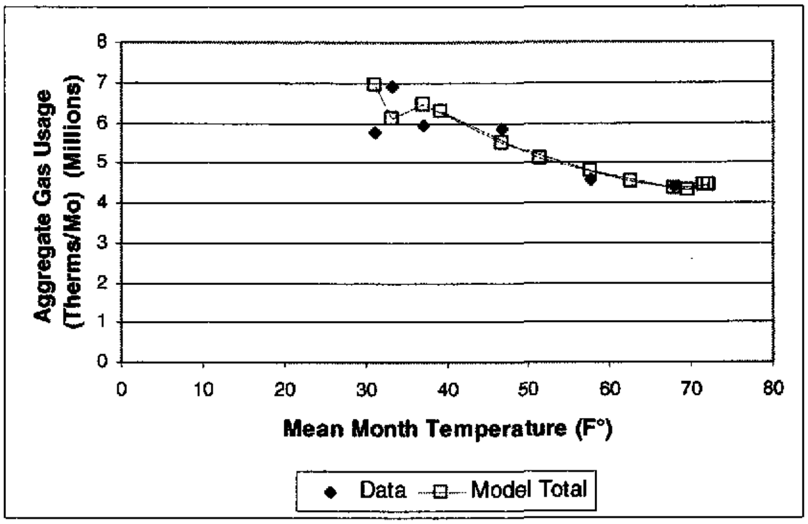

Figure 20. Actual and Modeled Total Industrial Gas Usage

Figure 20 also shows that the total industrial gas usage bears a close correlation to the average monthly temperature. Physically, this is identically the same relationship long noted between heating degree days and gas usage. But in this model, the Mean Month Temperature is used instead of degree days as the temperature variable because it is an absolute reference, not indirect as in a degree day, and because it is more compatible with the structure of the engineering models that are the submodels of the overall industrial sector end-use model.

Note in Figure 20 the steep, but predictable, change in usage with temperature. This slope provides a check point for the cumulative effect of assumptions regarding heat loss, furnace efficiency and distribution efficiency. In Figure 20, the low usage values, occurring at the highest temperatures, are check points for the sum of usages that are not space heat. Taken together, these check points and temperature slope have significant resolving power, sufficient to separate out the space heat end-use and to provide a close limit on the base load and the total monthly industrial gas usage.

A full discussion of the sector usage model and the end-use submodels, as well as, test year and normal year, is presented in the Methodology section of the Appendix.

IV. CONSERVATION POTENTIAL

The work presented in this section is based on modeling results at the segment and rate schedule level of detail. Consequently, the conservation potential assessment is based on the same segmentation scheme discussed earlier in this report. This allows us to present results related to specific technologies.

Overview

This market assessment portion of the work will set forth the energy end-uses by customer segment: residential, commercial, industrial, and transport. Model results by customer segment allow us to discuss the demand side management "technical potential" proceeding from these segments and end-uses. The technical potential is derived by assuming that all customers in each sector use the most efficient available gas technology. In this analysis, technical potential is restricted to meeting existing gas end-uses with gas employed more efficiently. As such, this estimate of technical potential has been restricted to measures that reduce the amount of gas needed to meet end-use loads. The technical potential derived in this analysis does not contemplate fuel switching.

However, there are real world efficiency effects that can increase gas usage without fuel switching, particularly commercial and residential lighting efficiencies and gas-fired combined heat and power. In terms of technical potential, these effects can be large. At this stage of the analysis, these effects have not been included in the technical potential. Later stages of this report will discuss in detail the magnitude of savings and the cost effectiveness of a full range of individual measures and packages of measures.

It became apparent from a review of the modeling work by segment and rate schedule described earlier that many segments shared common load characteristics across four "planning elements". These planning elements are small buildings, large buildings, process energy and restaurants. In the analysis of the end-use energy per average customer at the sector level, it is apparent that about 70 percent of the total gas energy sales are to small buildings, approximately residential scale. These gas sales are to a functionally homogenous array of gas forced air furnaces and tank-style water heaters. These energy sales are designated here as the small buildings planning element.

The sector level analysis also showed that about 23 percent of the total gas energy sales are to large buildings, several to many times residential size. Most of these sales serve the space heat and water heat end-uses, but the gas-using equipment and relevant controls are significantly different than that used in small buildings. This gas-using equipment is a functionally homogenous array of boilers, whole building controls and energy management practices. These energy sales are designated here as the large building planning element.

As a preliminary to demand side management planning, this end-use information, along with other demographics, has been organized into logical demand side planning elements presented in Table 27. These planning elements are derived by re-grouping various residential, commercial and industrial sector customers around common building types and systems.

Table 27. Demand Side Planning Elements

Planning Element	Target Energy Use (million therms/year)	Target Technology	Applicable Population
Small Buildings	515	Residential forced air heaters, duct work, residence thermal integrity	525,000
Large Buildings	176	Boilers, building controls, showerheads, building thermal integrity	11,000
Process Energy	47	Diverse	350
Restaurant	16	Commercial cooking appliances, hot water fixtures	2,500

Source: Our analysis of Vectren North usage, sector and technology data

The small building planning element is composed of the entire residential sector and rate NCM1, about 35,000 customers, of the commercial sector. This population is characterized by residential scale buildings heated by small forced air furnaces and with water heat in residential scale gas hot water heaters.

The large building planning element is composed of the whole commercial sector excluding rate NCM1, the industrial rates NIN3 and NI40, and the 350 smaller transportation customers. This population is characterized by large scale buildings with a predominance of boilers and reasonably complex building controls.

The process energy planning element is composed of the largest 350 industrial transport customers. This population is characterized by its diversity of uses and by the likelihood that the process energy cannot be manipulated without special care for the process.

The restaurant planning element is drawn from the commercial and industrial rate schedules. This population is characterized by a wide range of specifically different gas energy intensive operations underlain by the use of similar gas using equipment in fundamentally similar food preparation processes.

Technical Potential

The technical potential for each of the planning elements was derived by applying all the efficiency measures at once so that interactions between efficiency measures and load reduction measures are properly accounted for. In later stages of the program planning, various measures may be considered individually, but for estimating the total technical potential, all the measures were applied as a package.

In this analysis technical potential for a planning element will be shown as in Figure 21. This figure illustrates the derivation of technical potential; it is for the residential sector only, not the whole small building planning element.

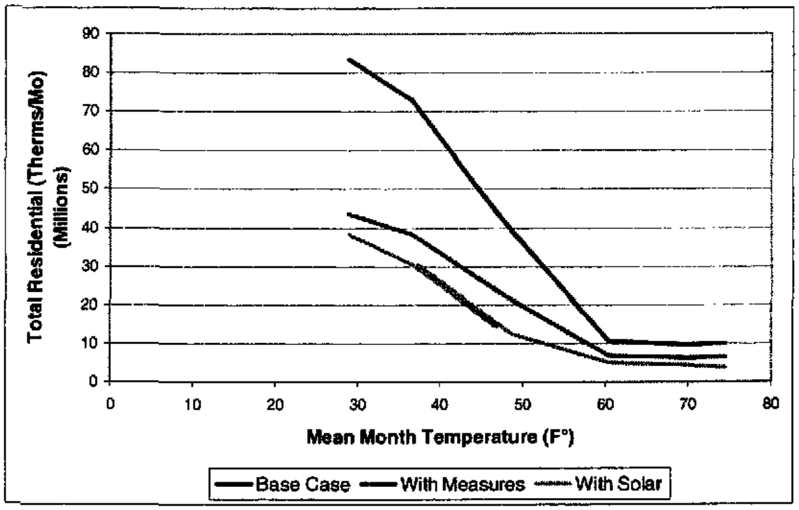

Figure 21. Residential Technical Potential Models

Figure 21 represents the building energy use models for a single average building in the residential sector. In an energy use model of this sort, the line designated as the model specifies the monthly gas usage given a particular average monthly outdoor temperature. The model is then typically used to estimate total normal annual energy use by evaluating the model at each of the average monthly temperatures in a normal year. The blue line is the current performance model for the residential sector. When we express this information in terms of an average residential customer, we find that the warm weather base load is about 20 therms per month. As it gets colder, gas usage increases to about 160 therms per month at 30°F.

The red line shows what happens as the house is insulated better and more efficient gas space and water heaters are used. This more efficient building shows a lower base load due to better showerheads, a tank-less water heater with low standby losses. And it shows significantly lower temperature sensitivity due to a more efficient space heater and refinements to the building shell. Finally, the green line shows the gas usage model with solar energy preheating the hot water and the house properly sited for passive solar gain.

Small Buildings

There is a well developed community of interest and capability directed at residential space heat and water heating efficiency. In most retrofit programs, heating efficiency is approached in the same treatment from its three logical avenues: better furnace and distribution efficiency, lower thermal and infiltration losses, and better controls. The water heating savings potential proceeds from lower flow fixtures, better furnace efficiency, and lower tank standby losses.

One of the largest components of the potential is latest 90+ efficiency furnaces coupled to a leak tested duct system. The next largest component is the improved thermal shell of the structure. Ultimately, all the diverse improvements to small buildings energy use resolve into a change in base load and a change in the temperature slope. Figure 22 shows the model of the aggregated small building use and the model of the same population with all technical savings options employed.

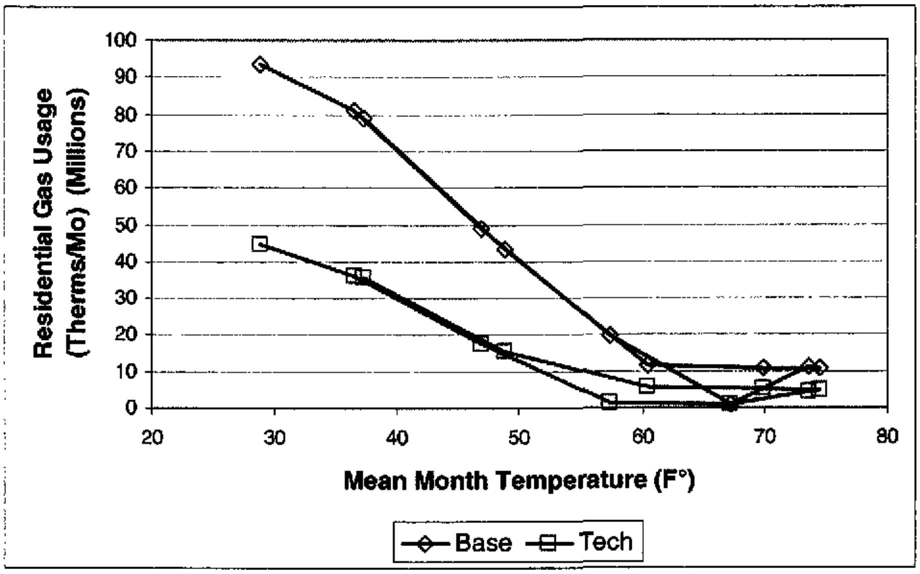

Figure 22. Small Building Technical Potential Models

Figure 22 shows the effect of applying to every building a 90+ furnace, improved building shell, flow efficient hot water fixtures, and even solar water heat and a passive solar space heating component. This reasonably aggressive application of efficiency technology leads to a technical potential with a 54 percent reduction in gas energy use.

Large Buildings

The population of this planning element will have larger buildings with more complex controls than typical residential applications. Usually, there will be a boiler. Often there will be a designated energy manager. This type of situation has been the objective of energy management contractors because there are large enough energy flows to create significant dollar savings.

The largest elements of savings for this group is associated with improved boiler efficiency and improved controls. The thermal integrity of the shell in this group is subject to improvement especially with respect to infiltration. Ultimately, all the diverse improvements to large buildings energy use will resolve into a change in base load and a change in the temperature slope. Figure 23 shows the model of the aggregated large building use and the model of the same population with all technical savings options employed.

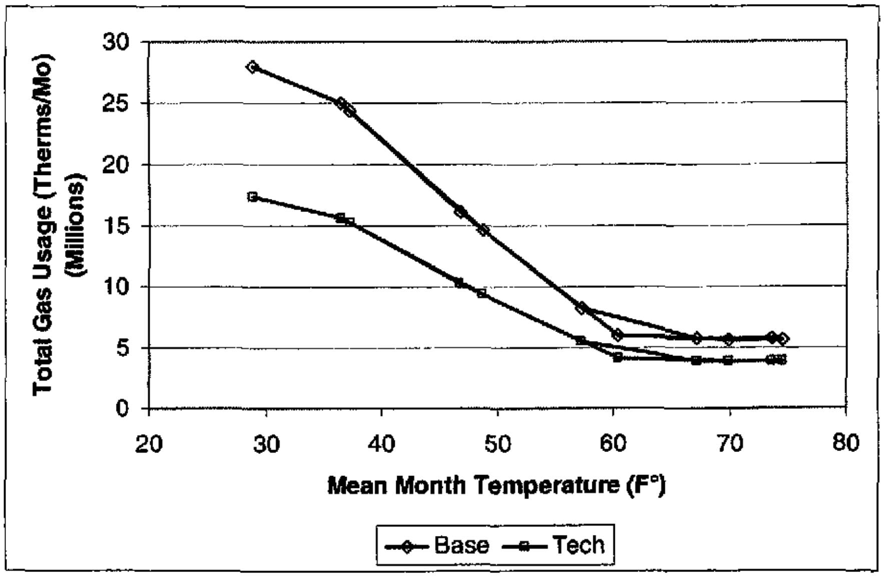

Figure 23. Large Building Technical Potential Models

Figure 23 shows the effect of applying to every building a 90+ boiler, improved building shell, flow efficient hot water fixtures, and improved controls. This reasonably aggressive application of efficiency technology leads to a technical potential with a 38 percent reduction in gas energy use. For the purposes of estimating technical potential, the restaurant planning element has been included in the large building population.

Process Energy

There has been no technical potential estimate for the process energy planning element. Most of the process energy identified in the industrial sector gas usage models is by the top 100 or so gas transportation customers. It is expected that these customers have highly specific and often proprietary processes not subject to "plug and play" program measures. But there may be some fundamental processes in this planning element, such as steam production or controls, which may benefit from program offerings. Such application of applicable measures would clearly have a technical potential, and this technical potential is not currently included in the overall estimate of technical potential. If such measures were included they would in aggregate be a small number and would not significantly change the overall estimate of technical potential.

A summary of the technical potential analysis by planning element is shown in Table 28. Our analysis of technical potential shows that it is technically possible to cut usage in half. However, these estimates are not realistic estimates of actual reductions because they are unconstrained by market, behavioral and budget considerations.

Table 28. Summary of Technical Potential by Planning Element (millions of therms)

Planning Element	Total Load	Technical Potential	
		Percent	Therms
Small Buildings	515	54%	278.1
Large Buildings	176	38%	66.9
Process	47	0%	0.0
Restaurants	16	38%	6.1
Total	**754**	**47%**	**351.1**

Source: Our analysis of monthly usage data and applicable technologies

Conservation Measure Assessment

In order to evaluate technologies for their potential in gas DSM programs, it is necessary to compile detailed information at the energy conservation measure (ECM) level of detail. We compiled this information through an integrated approach that combined an extensive review of industry literature, the detailed analysis of Vectren loads described earlier and our own expert opinion. Detailed assumptions at the ECM level are presented in Table 29 for small buildings and Table 30 for large buildings. A discussion of the approach to measure analysis follows these two tables.

Table 29. DSM Technology Assessment, Small Buildings

Primary Assumptions: 1,165 *Average Use*; 175,000 *Population*; 0.05 *Discount Rate*

End Uses	DSM Technologies	Building Type	Pct per Unit Savings	Dwelling Savings (therms/yr)	Number Installations	Per Unit Installed Cost ($)	Dwelling Installed Cost	Average Life of Equipment**	Yearly O&M Costs ($)	Population Prevalence Factor	Potential Savings (million therms/yr)	Levelized Cost ($/therm)
1. Customer-Sited Generation	Solar Water Heater	SF MF all	14	163	70,000	4000.00	4000	25	10.00	0.40	11.42	1.04
2. Residential Space Conditioning	AFUE of 65 to 82 SFe 748 thms/yr space	SF est	20.86	156	35,000	600.00	600	5	10.00	0.20	5.46	0.83
	AFUE 65-.82 MFe	MF est	20.94	98	1,750	600.00	600	5	10.00	0.01	0.17	1.33
	AFUE of 65 to 92 SFe- 748 thms/yr space	SF est	22.57	169	26,250	1100.00	1100	25	10.00	0.15	4.43	0.32
	AFUE of 65 to 92 Mfe	MF est	22.65	106	1,750	1100.00	1100	25	10.00	0.01	0.19	0.51
	AFUE of 82 to 92 SFe 593 thms/yr space	SF est	10.96	65	26,250	500.00	500	25	10.00	0.15	1.71	0.46
	AFUE .82-.92 Mfe	MF est	11.05	41	1,750	500.00	500	25	10.00	0.01	0.07	0.73
	AFUE of 82 to 92 SFn - 432 thms/yr space	SF new	11.11	48	26,250	500.00	500	25	10.00	0.15	1.26	0.63
	AFUE .82-.92 MFn - 247 thms/yr space	MF new	10.93	27	1,750	500.00	500	25	10.00	0.01	0.05	1.11
	EE Windows	SFH	10	117	113,750	19.00	1900	25	0.00	0.65	13.25	0.65
	programmable thermostats	SFH	12	35	61,250	120.00	120	13	2.00	0.35	2.14	0.32
	ceiling insulation (R11-R38)	SFH	8	93	17,500	1.00	1000	25	0.00	0.10	1.63	0.43
	ceiling insulation (R30-R38)	SFH	4	47	17,500	0.50	500	25	0.00	0.10	0.82	0.43
	ceiling insulation (R19-R38)	SFH	6	70	17,500	0.75	750	25	0.00	0.10	1.22	0.43
	house sealing using blower door	SFH	4	47	113,750	300.00	300	13	0.00	0.65	5.30	0.50
	duct seal	SFH	3.5	41	113,750	200.00	200	13	0.00	0.65	4.64	0.38
	wall insulation (R0-R11)	SFH	15	175	26,250	1.25	1250	25	0.00	0.15	4.59	0.29
	wall insulation (R11-R19)	SFH	20	233	8,750	1.75	1750	25	0.00	0.05	2.04	0.30
	proper HVAC sizing	SFH	5	58	17,500	50.00	50	18	0.00	0.10	1.02	0.05
	floor/basement insulation	SFH	10	117	35,000	1.00	1000	25	0.00	0.20	4.08	0.34
	HVAC tune up	SFH	3	40	148,750	75.00	75	3	0.00	0.85	5.95	0.63
	CO Remediation	SFH	12	140	17,500	200.00	200	10	0.00	0.10	2.45	0.14
	Energy Star construction	SFH-new	30	350	17,500	2000.00	2000	50	0.00	0.10	6.12	0.11
3. Load Management	EE water heater with energy factor of 6 or better required	SFH	4.29	50.00	70,000	180.00	180	15	0	0.4	3.50	0.24
	ee water clothes washer	SFH	2.58	30.00	35,000	500.00	500	15	0	0.2	1.05	1.11
4 Residential Appliances	gas clothes dryer (Energy Star)	SFH	1.12	13.00	52,500	100.00	100	18	0	0.3	0.68	0.43
	gas stove/oven	SFH	0.43	5.00	52,500	100.00	100	18	0	0.3	0.26	1.11
5 Water Heating	tank/pipe wrap	SFH	0.17	2.00	122,500	10.00	10	10	0	0.7	0.25	0.50
	low flow fixtures	SFH	2.32	27.00	122,500	25.00	25	10	0	0.7	3.31	0.09
	solar siting	SFH	10.30	120.00	17,500	300.00	200	50	0	0.1	2.10	0.03
	tankless wh reqd	SFH	6.44	75.00	35,000	500.00	500	15	0	0.2	2.63	0.44
	tankless discretionary	SFH	6.44	75.00	17,500	1100	1100	15	0	0.1	1.31	0.98

Table 30. DSM Technology Assessment, Large Buildings

		Primary Assumptions	*16,000 Therms/Year* *11,000 Population*				*0.05 Discount Rate*			
End Uses	**DSM Technologies**	**Building Type**	**Pct per Unit Savings**	**Facility Savings (therms/yr)**	**Facility Installed Cost ($)**	**Average Life of Equipment**	**Yearly O&M Costs ($)**	**Population**	**Potential Savings (million therms/yr)**	**Levelized Cost ($/therm)**
1. Customer-Sited Generation	Solar Water Heater	Office	10	1,600	30,000	25	250	2,000	3.2	1.487
	Packaged Gas Co-Gen	Office						5,000	0.0	
2 C&I Space Conditioning	Roof Insulation	Office	10	1,600	15,000	25	0	2,000	3.2	0.685
	EE Boiler	Office	16	2,560	20,000	20	50	6,000	16.4	0.646
	commissioning - new	Office	10	1,600	2,500	5	0	4,000	6.4	0.361
	Re/Retro-Commissioning	Office	10	1,600	2,500	5	0	10,000	16.0	0.361
									0.0	
	Low-E Windows 1500 ft2	Office-New	5	800	4,500	25	0	4,000	3.2	0.399
	Low-E Windows 1500 ft2 replace	Office	10	1,600	30,000	25		3,500	5.6	1.330
	Controls 50-75% of controls benefit is electric savings so cost represents only about 40% of total	Office Retail	15	2,400	6,000	15	250	3,000	7.2	0.425
3. Load Management	Voluntary Load Control								0.0	
5. Water Heating	Low Flow Fixtures	Office School	4	600	1,000	10	0	2,000	1.2	0.216
	EE Water Heater EF >.6	Office	4	600	3,500	15	0	4,000	2.4	0.562
									0.0	-1.000
6 Cooking and Laundry	Energy Star Gas Oven	Food Prep	20	1,280	5,000	15	0	1,500	1.9	0.376
	ES Gas Stove	Food Prep	20	1,280	4,000	15	0	1,500	1.9	0.301
	ES Gas Clothes Dryer	Laundry	10	640	4,000	15	0	1,000	0.6	0.602
	Commissioning Audit	Food Laundry	10	640	1,300	5	0	2,500	1.6	0.469
7 C&I Other	Process Uses:	Ind								

Cost Effectiveness[6]

A primary consideration in measure screening is an estimate of measure cost effectiveness. This cost effectiveness estimate is derived from subsidiary estimates of the measure cost (first cost and maintenance), measure yield, measure life and an assumed discount rate. For the purposes of this screening exercise, the cost effectiveness estimate will be expressed as a levelized cost (dollars/therm) for the life of the measure. This form of expression for the cost effectiveness, rather than an abstract cost/benefit ratio, permits ready comparison of the subject measure to the immediate or future marginal commodity cost of gas. At this stage of the analysis we are more concerned with the rank ordering of measures by levelized costs than we are with a comparison to avoided costs. A discount rate of five percent was used based on Vectren's weighted cost of capital.

Measure Savings–The screening relies on measure savings that are observable in real world billing histories. Thus the measure savings used in this screening are the net observable savings after and including the effects of take back, measure interactions and background energy usage changes. Competent impact evaluations often report savings at the measure level as in Table 31.

[6] Two types of cost effectiveness analysis are presented in this report. This section deals only with technology assessment using levelized cost. More comprehensive analysis is required at the program level. See Appendix D for a discussion of each type of cost effectiveness analysis.

Table 31. Net Savings by Measure (therms/year)

Measure	Proctor, 1997	Blasnick(1), 1998	Blasnick(2), 1998
Average per Site	172	187	131
Thermostat		91	58
Attic Insulation	52	189	90
Air Sealing	47	70	70
Duct Sealing	44		
Wall Insulation	204		
CO Fix	151		
Furnace Check	28		
Other		54	29

The measure specific estimates in Table 31 were derived by regression from a year of billing and temperature data for each site and they have been normalized to a long-term year. The table shows annual savings from a residential gas efficiency program to about 150 therms per year. The table also shows quite a difference in the savings estimates for a measure such as attic insulation or thermostats. These large differences may be due in part to limited sample sizes for particular measures and they may be due to different participant selection and other program circumstances. But they show, at least, that even with the best available quantification, measure level savings can be quite variable.

In residential applications, these net savings are generally less than noted in competent engineering estimates. For example, Ecotope 1999 estimated duct sealing would lead to savings of 135 therms per year. But this example proceeded from a sample of pre-screened "duct losers" and did not include take back effects. The Proctor and Blasnick work was on housing stock with a preponderance of basement ducts with notoriously limited duct sealing potential. Here again, the savings due to a particular measure can be quite variable.

For this measure screening exercise, the residential measure savings estimates will be drawn predominantly from the Proctor work in 1999 at SIGECO, the first column in Table 31. This work was done on a similar housing stock and climate as expected at Vectren North. It could be argued that the savings to be expected from Vectren North would be greater than those observed at SIGECO because it is slightly colder. No such correction has been made to the savings estimates used in this analysis because it would be a small change to a highly variable number. In practice, the best way to ensure high savings is to identify and enroll program participants with probable efficiency problems.

The large building (commercial) measure savings estimates will rely on engineering ratios to characterize changes in boiler efficiency and controls improvements, the largest measures in this category.

Measure Costs–Cost information for this screening exercise includes the incremental costs of the measures (which may differ depending on context new or existing) and the costs of site access. But the costs do not include the program costs or the often underestimated cost of participant recruitment.

Incremental costs are the costs of acquiring and installing the measure over the base case alternative. Obviously the costs can vary significantly with the size and complexity of the job. With careful design and execution, a program may hope to beat these costs; but for the purposes of this screening, the assumed costs will serve to place the measures in reasonable cost effectiveness categories.

For this screening, a prototypical residential building is assumed for the small building measures and a larger prototype is assumed for the large buildings. In all cases the costs are measured in 2005 dollars.

Particularly important for costs applied to large buildings is the issue of multi-fuel cost sharing. The significant measures related to controls and commissioning typically involve a comprehensive view of building energy use which necessarily includes the control of electrical energy uses, as well as, gas. The benefits of controls and commissioning are often strongly electric savings. There is an inherent multi-fuel cost share for these measures. Therefore, the gas related costs for these measure types are assumed to be one-half the total cost.

Measure Definition–Measures are classified here into generic groups. For example, the measure group classified as commissioning broadly means performance review and correction, and may involve billing review, monitoring, interviewing, and analysis. The measures related to food service or laundry are, in reality, quite diverse covering various fryers, ovens, washers, etc.; but in this exercise they have been classified together.

It is also important to note that the measures considered in the screening do not include combined heat and power (cogeneration) measures. Generally, these measures will increase gas use while decreasing electric use. There is a potential fuel switching issue here, even though in many cases, the combined heat/power approach is clearly the more efficient and environmentally benign approach. In terms of physical potential, combined heat/power is quite large and it has the possibility of dramatically changing the energy landscape for the better. However, at this stage of the analysis, the issue is too large and important to include as if it were a typical DSM measure.

Screening Savings and Full Costs–This screening exercise must necessarily distinguish between measures with minimal overall savings and those which may carry the program in terms of savings. Accordingly, the measures have been characterized by a five-year program savings expectation, therms/yr, resulting from five years of highly aggressive program activity.

For the small buildings, this level of activity is quite aggressive (of the order of 20,000 units per year) and contemplates the participation of one-third of the residential customers, those with the highest annual usage. Participation levels of this magnitude would achieve about 35 percent of the identified technical potential in five years. While unrealistically high, these calculations provide a measure of savings useful for screening and bundling technologies for program planning.

In the case of smaller buildings, the cost effectiveness of addressing the low usage customers can be severely diminished because of lower savings expectations. But as the program proceeds, impact evaluations will provide a guide as to the costs and benefits of including the lower usage customers in the program. For the large buildings, the five year program horizon is even more aggressive than for small buildings and the screening savings would amount to about 60 percent of the technical potential. For large buildings programs there are far fewer participants (of the order of a few thousand), but each site is potentially a complex unique job.

Cost Effectiveness Ranking and Spectrum for Small Buildings–The small building measures are ranked by cost effectiveness in Table 32 along with available savings.

Table 32. Small Building Ranked Measures

Measure	Levelized Cost	Screening Savings
	$/therm	therms/yr
Proper HVAC Sizing	$0.07	1,019,375
Low Flow Fixtures	$0.12	3,307,500
CO Remediation	$0.19	2,446,500
Energy Star Construction	$0.31	6,116,250
EE Water Heater with Energy Factor of 0.6 or Better Required	$0.35	3,500,000
Programmable Thermostats	$0.42	2,143,750
Wall Insulation (R0-R11)	$0.51	4,587,188
AFUE of 65 to 92 SFe - 748 therms/yr Space	$0.52	4,431,000
Duct Seal	$0.52	4,638,156
Wall Insulation (R11-R19)	$0.53	2,038,750
Floor/Basement Insulation	$0.61	4,077,500
Tank/Pipe Wrap	$0.65	245,000
Gas Clothes Dryer (Energy Star)	$0.66	682,500
House Sealing using Blower Door	$0.69	5,300,750
HVAC Tune Up	$0.69	5,950,000
AFUE of 82 to 92 SFe - 593 therms/yr Space	$0.70	1,706,250
Ceiling Insulation (R11-R38)	$0.76	1,631,000
Ceiling Insulation (R30-R38)	$0.76	815,500
Ceiling Insulation (R19-R38)	$0.76	1,223,250
AFUE of 65 to 92 MFe	$0.83	185,500
AFUE of 82 to 92 SFn - 432 therms/yr Space	$0.95	1,260,000
AFUE of 65 to 82 SFe - 748 therms/yr Space	$0.95	5,460,000
AFUE of 82 to 92 MFe	$1.11	71,750
EE Windows	$1.16	13,251,875
AFUE of 65 to 82 MFe	$1.52	171,500
EE Water Clothes Washer	$1.61	1,050,000
AFUE of 82 to 92 MFn - 247 therms/yr Space	$1.68	47,250
Gas Stove/Oven	$1.71	262,500
Solar Water Heater	$1.80	11,417,000

The information in Table 32 is then cast into a cost effectiveness spectrum as in Figure 24. In this figure, the measures have been categorized into three general categories: furnace, shell and contols.

The furnace category includes more efficient furnaces and maintenance/efficiency improvements to existing furnaces. The shell category includes whole house insulation and air sealing measures. The controls category includes the measures that reduce usage, such as, low flow fixtures and solar site for passive gain.

Note in Figure 24 that most of the cost effective savings are associated with furnace improvements and insulation. The most cost effective measures are the flow reduction fixtures, proper furnace sizing and solar orientation for passive gain.

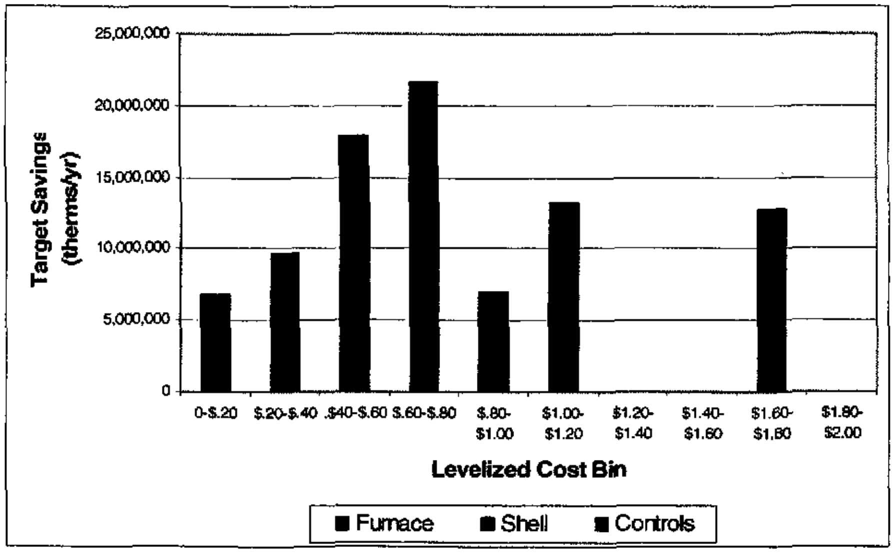

Figure 24. Cost Effectiveness Spectrum - Small Buildings

The most expensive measures are glazing replacements at about $1.16/therm and solar water heat at about $1.70/therm. Both these measures have significant savings potential but are not immediately cost effective to either the utility or the customer. However, in both these cases, there is an amenity benefit and they could be accessed by a partial subsidy ostensibly to cover the energy only benefits of the measures.

Note also in Table 32 and Figure 24 that there is a wide range on the levelized costs for furnace replacements. The cost effectiveness depends on the annual heat load on the furnace. A full range of furnace replacement scenarios is developed in Table 32 and it generally shows that smaller multi-family (or single) residences are not cost effective candidates for upgrade from 82 percent AFUE to 92 percent AFUE. In practice, the cost effectiveness of a furnace replacement at a particular site can be readily estimated from an annual billing history.

Cost Effectiveness Ranking and Spectrum for Large Buildings–The large building measures are ranked in Table 33 by cost effectiveness along with available savings.

Table 33. Large Building Ranked Measures

Measure	Levelized Cost	Screening Savings
	$/therm	therms/yr
Low Flow Fixtures	$0.22	1,200,000
ES Gas Stove	$0.30	1,920,000
Commissioning – New	$0.36	6,400,000
Re/Retro-Commissioning	$0.36	16,000,000
Energy Star Gas Oven	$0.38	1,920,000
Low-E Windows 1500 sq ft	$0.40	3,200,000
Controls 50-75% of Controls Benefit is Electric Savings so Cost Represents only about 40% of Total	$0.43	7,200,000
Commissioning Audit	$0.47	1,600,000
EE Water Heater EF >0.6	$0.56	2,400,000
ES Gas Clothes Dryer	$0.60	640,000
EE Boiler	$0.65	15,360,000
Roof Insulation	$0.67	3,200,000
Low-E Windows 1500 sq ft Replace	$1.33	5,600,000
Solar Water Heater	$1.49	3,200,000

The information in Table 33 is then cast into a cost effectiveness spectrum as in Figure 25. In Figure 25, as in Figure 24, the measures have been categorized into three general categories: furnace, shell, and usage reduction or controls. The furnace category includes more efficient furnaces and maintenance/efficiency improvements to existing furnaces. The shell category includes roof insulation and low-e windows. The controls category includes the measures that reduce usage; such as, low flow fixtures, solar water heat and, more importantly, it includes comprehensive building controls.

Note in Figure 25 that most of the cost effective savings are associated with furnace improvements and commissioning/controls. The most cost effective measures are the flow reduction fixtures, high efficiency windows in new construction, and commissioning and controls.

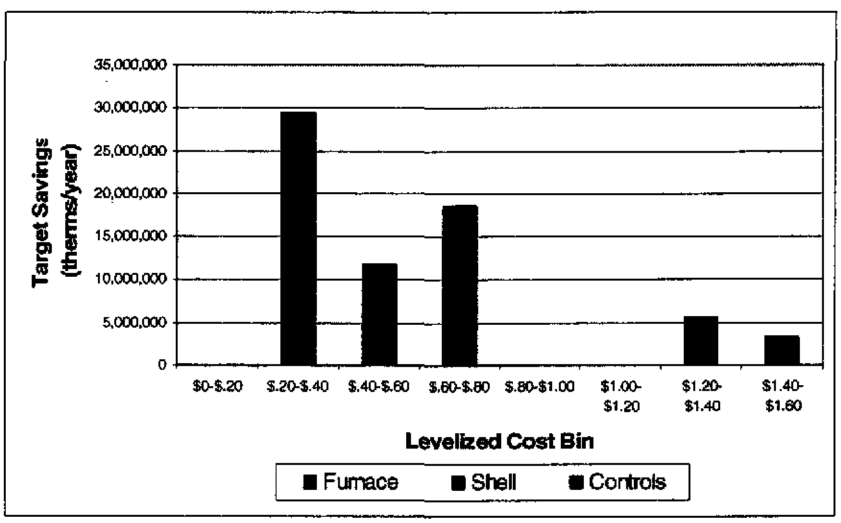

Figure 25. Cost Effectiveness Spectrum - Large Buildings

As with the small buildings the window upgrades and solar water heating are in a cost effectiveness class by themselves.

The furnace improvements in large buildings include new boiler technology with efficiencies in the range of 93 percent plus. An attribute of these new boilers is that they can come to temperature or produce steam much more quickly than older boilers, and they also have finer control on the output. Where modern boilers replace older ones, a smaller boiler is usually suitable and extra savings associated with boiler startup and control are often available.

It is readily apparent that for large buildings the cost effectiveness situation is much different than for small buildings. In large buildings, most of the cost effective savings potential is associated with commissioning and proper control of the energy use. Insulation plays a much smaller role in these buildings.

V. PROGRAM DESIGN PROCESS

The purpose of this section is to describe the program design process, including the melding of market and technology assessment into the DSM program development process. Program designs presented in this report build off of the work presented in the market assessment and conservation potential sections. The program designs presented in this section will provide the reader with important details regarding the portfolio of recommended programs and the target market, end-uses and technologies addressed. Detailed program plans, including program budgets, cost effectiveness analysis and evaluation plans, are presented in subsequent sections of this report.

Approach

The approach taken in developing the DSM Program Plans contained in this report was three-fold:

1. Identify DSM technologies and screen them for consideration in the design of programs
2. Review industry literature regarding gas DSM program approaches and identify best practices from other leading gas companies
3. Apply marketing approaches to packaged DSM technologies and techniques identified in the Vectren DSM technology and market assessment

DSM Program Development Process

The process that has been undertaken in the development of the Vectren DSM programs is presented in Figure 26.

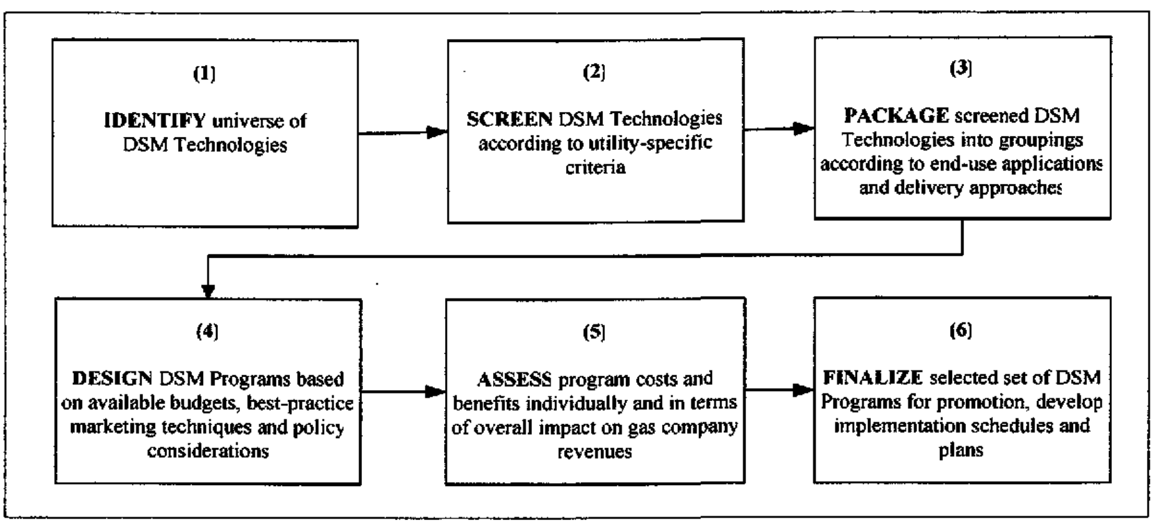

Figure 26. The DSM Program Development Process

This series of six steps in program design is a fairly standard approach that has been used in the development of programs for electric and gas utilities throughout the U.S.[7] It balances the engineering and economic

[7] American Electric Power, UtiliCorp, PacifiCorp, People's Natural Gas, Northeast Utilities, Northwest Natural Gas and others have employed similar models in the past decade.

characteristics of specific end-use technologies with public policy and corporate objectives. The process then considers the specific environmental and market characteristics of the service territory in which the technologies would be promoted. The result is a set of DSM programs that have a high likelihood of success in terms of customer adoption and achievement of program goals.

The following issues were considered in developing the draft DSM Program Plans presented in this report:

- Target Markets Served–What are the potential numbers of customers in each market sector that might be targeted for implementation of the DSM technologies?

To turn groups of technologies into appropriate DSM Programs (Step 3, PACKAGE; and Step 4, DESIGN) these additional contextual factors must be considered, among others:

- Marketing Approach–What types of tools and methods should be used to promote the adoption of technologies? What combination of education, customized information (energy audits), arrangement services (identification of contractors), financing options and direct incentives are required to move the market sectors to take the desired actions?

Once the best programs from a technical perspective have been determined, a final step is performed in considering the appropriate DSM programs to select as the final group to be implemented.

- Regulatory Environment–What policies exist in the regulatory community that might need to be taken into consideration in packaging DSM technologies into programs? Are there some programs that may not be cost effective from a Total Resource Cost (TRC) perspective that should be included for other reasons (e.g., low-income programs, research and development programs, special customer service programs)?
- Related Governmental and Market Programs–Finally, what existing governmental programs (federal or state) and other market programs (lending institutions) might be available to help support the implementation of programs?

Applying the above questions to the set of technically feasible technologies already identified involves a screening process. Screening the universe of DSM technologies requires the application of a set of customized criteria unique to the utility for which programs are to be developed. The criteria usually applied to these data are:

- Market Potential–The potential for a technology to be adopted in a given market as based on current market saturation, availability, price and other measures of market acceptance.
- Economic Requirements–The economic criteria that would be required for the market to adopt the technology, usually a cost-benefit measure (such as a C/B ratio of 1 or better) or a set payback rate (such as five years or less).
- Cost Effectiveness–Usually expressed as levelized costs, provides a measure of the resource cost for comparisons with other technologies. Other standard tests can also be applied. Refer to Appendix C for a detailed description of these standardized tests.

Policy and Regulatory Considerations

Vectren's interest in developing a portfolio of DSM programs for its customers could not be timelier. Recent reports from national news media suggest increases in natural gas prices of 52 percent, mostly due to disruptions to the supply chain caused by Hurricane Katrina.[8] Even prior to the recent disaster, as early as 2003, the American Council for an Energy Efficient Economy (ACEEE) summarized the prudence of offering DSM programs to consumers and utility customers in its report on "Responding to the Natural Gas Crisis: America's Best Natural Gas Energy Efficiency Programs" (ACEEE Report No. U035).

> *Natural gas customers are facing rapidly rising costs. This has significant adverse effects on individual customers as well as the broader economy...Improved energy efficiency is a concrete step that customers can take to offset price increases, but decades of experience with natural gas customers suggests that they won't necessarily take such a step without facilitation via energy efficiency programs. Moreover, the natural gas price problem creates serious societal costs as well, which strengthens the rationale for affirmative government policies to address this problem through energy efficiency.*
>
> *Energy companies can take the initiative themselves to offer their customers programs, but they also need support from their regulators to make such programs a reality. Regulatory support may come from a variety of mechanisms, which include program cost recovery through rates, financial incentives for meeting established performance targets, and perhaps some type of 'lost revenue' recovery or decoupling of profits from sales volume.*
>
> *...There is little time to spare to create and expand programs to serve customers presently not served by efficiency programs. Generally, financial incentive programs can be created and implemented rather quickly, while programs offering technical assistance and related services take more time to develop and implement...Utility companies, governments and related organizations should view natural gas efficiency programs as both a near-term and long-term element in an overall strategy of helping natural gas customers manage their energy costs, as well as helping our economy deal with higher market energy prices.* (p. 21)

In addition, from a policy perspective, current program design occurs in a post "9/11" context in which security factors should be taken into account where possible. This is different from the earlier context of DSM program design and in some cases it may lead to different kinds of program designs. Further, in the area of gas supply, residential customers now compete with gas generation of electricity and also turn to electricity when they are unable to pay their escalated gas bills. In the past few years as gas costs have risen and remained high, a secondary effect has been an increase in the use of electricity when households cannot pay their gas bills. This creates an increase in electric bills. The net effect at the household level is that energy bills are increasingly interactive and can become difficult or impossible to pay. Both gas and electric utilities in much of the U.S. are now experiencing payment problems unprecedented since the 1930s. These problems will intensify.

- In the area of electricity supply, global warming (about which knowledge is non-controversial in scientific circles) is affecting us with an encroaching problem of physical limits. As an illustration of what this means, recently a travel magazine urged travelers to see Glacier National Park now, because soon there will be no glaciers. Already, tourist observation points in Glacier National Park and in the Swiss Alps no longer provide the view they once did. Similarly, when Scanada Consultants Ltd. recently co-sponsored a repeat of the Sverdrup polar expedition, the team reported people falling through the ice

[8] EIA Short Term Energy Outlook, September 7, 2005. The increase in gas price for the northeastern states is projected at 71%, for the nation as a whole it is 52%. Note that commodity cost of gas is only a portion of the gas bill, so that total bills will go up less than these amounts. Still, this year the size of the effect will be of "energy shock" proportions and this effect occurs in the context of long-term supply shortage.

that had been rock solid about 100 years ago. The primary effect on electricity is in the projected depletion of hydro-generation resources, leading to scarcity and up-pricing in neighboring jurisdictions. This is a classic problem of physical limits. Accordingly, electricity price will continue to increase.

- On the gas side, current industry publications generally accept that the depletion of current fields has occurred–roughly as projected 30 or 40 years ago. Accordingly, gas price will continue to increase. EIA projections of the proportion of gas supply that would have to be made up from liquefied natural gas (LNG) over the next twenty years seem overly optimistic. Given a projection of supply shortage and the unlikely possibility that LNG will prove out to the extent that is needed, gas price may be expected to continue to increase.

Just as with "9/11" security concerns, the physical limits problems for electricity and gas supply are new factors that must play into the development of new DSM program designs and the formulation of rule modifications for the assessment of DSM program designs. Supply problems that markets may not be fluid enough to solve and security concerns were not major elements in prior cycles of DSM. Now, planning has to take these factors into account.

Simply from a technical perspective, we need to move towards gas equipment functioning independent of electricity supply. This may not be achievable in a practical sense from current program designs, but it is a direction in which program design must now move. For example, we need to move towards gas heating that will keep Indiana homes warm during an electric power failure. As a final policy concern, we need to look critically to see if some of the things we mean to accomplish through programs are actually being accomplished. For example, we generally try to install programmable thermostats. Most, if not all, thermostats available on the market are difficult to use, especially by senior citizens, and in low light areas such as hallways. We may need to improve equipment specifications to ensure that the benefits we project for some of our improvements are easy to obtain through better product design.

Target Market Segments

Consideration of the best DSM programs to launch must first address the specific markets to which the programs would be promoted, their needs and likely market behaviors. This section summarizes the market segmentation analysis discussed in detail in the Market Assessment report. The groups of Vectren North customers described below represent the specific target market segments to which DSM technologies and programs will be addressed. The Vectren North service territory serves about 570,000 customers distributed into the four basic rate classes as in Figure 27 and by end-use in Figure 28.

The types of end-uses of gas that dominate each customer sector differ, but are dominated by:

- space heating (furnaces and boilers) and water heating in the residential and commercial sectors, and
- process uses, water heat applications and space heating in the industrial sector.

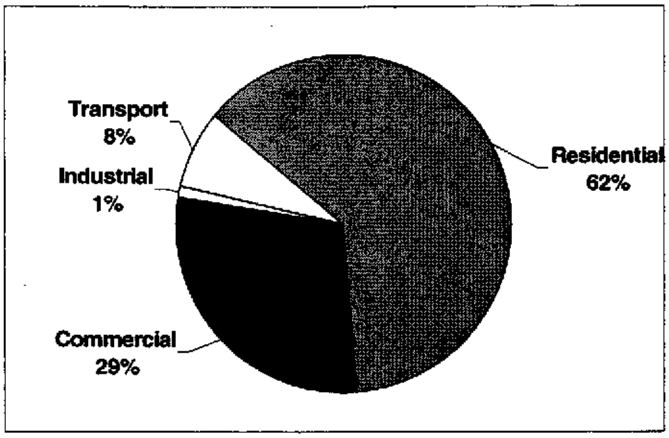

Figure 27. Vectren Customers by Rate Class

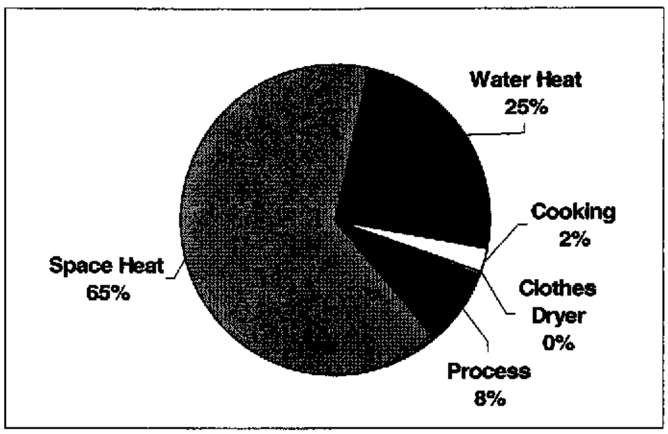

Figure 28. End-Uses of Gas by Vectren Customers

In the previous section of this report conservation potential was addressed by each of four planning elements (see Table 27). These planning elements are derived by re-grouping various residential, commercial, and industrial sector customers around common building types and systems. In this section, we build off of the planning element analysis to address the groups that DSM programs would most logically be targeted to and what specific groups of technologies should be promoted to help increase efficient uses of natural gas within each segment. A description of the planning elements follows:

- The small building planning element is composed of the entire residential sector and about 35,000 customers in the commercial sector. This population is characterized by residential scale buildings heated by small forced air furnaces, and with water heat in residential scale gas hot water heaters.
- The large building planning element is composed of the whole commercial sector and is characterized by large scale buildings, a predominance of boilers and reasonably complex building or facility controls.
- The process energy planning element is composed of the largest 350 industrial transport customers. This population is characterized by its diversity of uses and by the likelihood the process energy cannot be manipulated without special care for the process.
- The restaurant planning element is drawn from the commercial sector. This population is characterized by a wide range of specifically different gas energy intensive operations underlain by the use of similar gas-using equipment in fundamentally similar food preparation processes.

Small Buildings

There is a well developed community of interest and capability directed at residential space heat and water heating efficiency. In most retrofit programs, heating efficiency is approached in the same treatment from its three logical avenues: better furnace and distribution efficiency, lower thermal and infiltration losses, and better controls. The water heating savings potential proceeds from lower-flow fixtures, better furnace efficiency, and lower tank standby losses.

One of the largest components of the potential is the latest 90+ efficiency furnaces coupled to a leak tested duct system. The next largest component is the improved thermal shell of the structure. Ultimately, all the diverse improvements to small buildings energy use resolve into a change in base load and a change in the temperature slope. The effect of applying to every building a 90+ furnace, improved building shell, flow-efficient hot water fixtures, and even solar water heat and a passive solar space heating component leads to a technical potential with a 54 percent reduction in gas energy use. Actual achievable potential is, of course, much less, but the high technical potential defines a key area for effort.

Large Buildings

The population of this planning element will have larger buildings with more complex controls than typical residential applications. Usually, there will be a boiler. Often there will be a designated energy manager. This type of situation has been the objective of energy management contractors because there are large enough energy flows to create significant dollar savings.

The largest elements of savings for this group is associated with improved boiler efficiency and improved controls. The thermal integrity of the shell in this group is subject to improvement especially with respect to infiltration. Ultimately, all the diverse improvements to large buildings energy use will resolve into a change in base load and a change in the temperature slope. The effect of installing a 90+ boiler, improved building shell, flow-efficient hot water fixtures, and improved controls to every building defines the maximum technical potential. This reasonably aggressive application of efficiency technology leads to a technical potential with a 38 percent reduction in gas energy use. Actual achievable potential is, of course, much less, but high technical potential indicates an area for intensive effort. For the purposes of estimating technical potential, the restaurant planning element has been included in the large building population.

Process Energy

There has been no technical potential estimate for the process energy planning element.

Appliance installation rates reported in the Market Assessment section (see Table 10) were also used in considering the likely numbers of customers to which each program would apply, and subsequently, what reasonable level of participation might be expected in the customer segments. In the case of existing homes, the DSM programs target the replacement of existing appliances in most cases. In the case of new housing, estimating participation levels involves looking at the percentage of new households that have not adopted the technologies of interest as being the group to which programs would be targeted.

As noted earlier, identification of technical potential provides the totality of energy savings that is technically feasible, but not achievable for a variety of reasons. Market potential is a measure of the likely uptake of technologies from natural market forces, program incentives or aggressive marketing (or other exogenous factors such as energy price increases or effects of natural disasters). Program participation levels represent an even lower measure of the likely number of customers one can anticipate will elect to install technologies and sign up for services offered through Vectren's DSM programs. Participation levels typically start out low as programs are launched but before advertising or word-of-mouth begins to disseminate information about their offerings. They often follow an "S-shaped" curve, the standard market penetration model for the adoption of products along a typical market cycle. Figure 29 illustrates the concept of the different levels of potential that underlie the program planning process (percentages are merely illustrative).

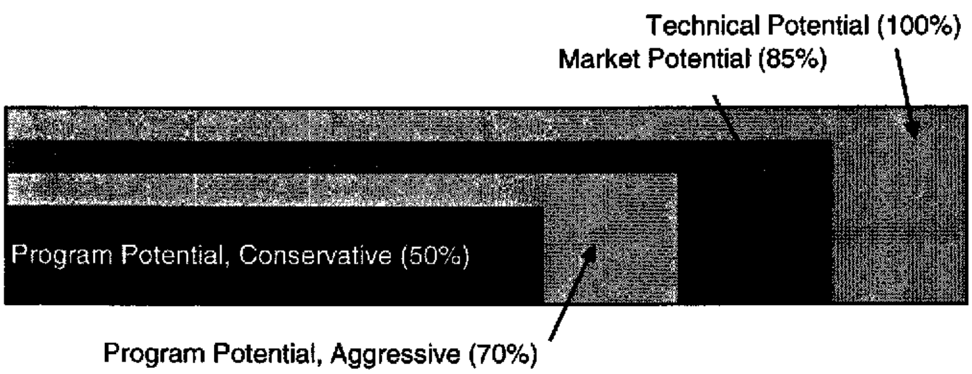

Figure 29. Conceptual Illustration of Technical, Market and Program Potential

Projected participation rates in a program can be set fairly high, at the Aggressive Program Potential level, if one assumes a robust program budget, fairly high incentive levels or a significant marketing and media campaign. For this study, we assume a more conservative program potential in setting the participation rates, which in turn is based on a reasonable program budget (within the range of gas programs in the region based on cited references), leveraging of external partnerships and delivery agents (community-based organizations, trade associations) rather than increasing internal staffing, and more modest incentive levels. This lower range or target for achievement of Program Potential is reasonable given that this would be the first few years of program implementation, and that, if successful, more aggressive budgets and program services might be added in the future.

Technology Screening

This section describes the lists of DSM technologies considered for packaging and promotion through programs. As described in the Conservation Potential section, a comprehensive list of DSM technologies applicable to natural gas end-uses was developed based on existing programs of other utilities and from various industry-published reports. The list of technologies identified for consideration is provided below in Table 34, broken out by small and large building applicability.

Table 34. DSM Technologies for Natural Gas End-Uses and Customer Segments

End-Uses	Small Buildings (Residential and Small Commercial)	Large Buildings (Large Commercial and Industrial)
1. Renewable Energy	solar water heater	solar water heater
2. Space Conditioning	EE furnace - AFUE of 90 or > EE furnace - AFUE of 90 or > EE furnace - AFUE of 82 to 90 EE windows programmable thermostats ceiling insulation (R11-R38) ceiling insulation (R30-R38) ceiling insulation (R19-R38) sealing using blower door wall insulation (R0-R11) wall insulation (R11-R19) proper HVAC sizing floor/basement insulation HVAC airflow calibration Energy Star construction	EE boilers, various sizes commissioning re/retro-commissioning window film low-e windows roof insulation energy efficient construction
3. Appliances	Clothes washer (Energy Star) gas range Gas clothes dryer Heat-rated gas fireplace	clothes washer (Energy Star) gas range gas clothes dryer
4. Water Heating	tank/pipe wrap low flow fixtures EE water heater with energy factor of .6 or better Demand/tank-less water heater	tank/pipe wrap low flow fixtures EE water heater with energy factor of 0.6 or better demand/tank-less water heater
5. Process Uses	Not applicable	custom measures

Technology Characteristics

Each natural gas DSM technology from

Table 34 is then considered in terms of a set of characteristics, such as:

- Sector–residential or commercial/industrial
- Building type to which it applies–the market segments identified in the Assessment phase
- Percent energy savings per unit
- Per unit installed cost in dollars
- Average life of equipment
- Yearly operation and maintenance (O&M) costs, if any
- Levelized costs per unit savings

Data for each technology were presented in an earlier section (see Table 29 and Table 30). These were derived from various sources, including published reports and industry literature listed in the Data Sources and References section of the Appendix. The technologies identified in
Table 34 were then "screened" based on a sorting process for a set of standard variables. This produces a table of ordered technologies (one for small buildings and one for large buildings) based on levelized costs, with secondary ordering by market barriers and the relative need for the program. These subjective factors are described below.

In addition to these engineering and economic characteristics, two indices were created to address the likelihood that each technology would be adopted based on existing market barriers and the particular need for the program given situational factors within the service territory, governmental or regulatory policies, and Vectren's own corporate interests. These two indices, while entirely subjective, provide an opportunity to apply a "reasonableness" measure to the engineering and economic data used in the analysis.

Market Barriers–This index is measured using a score of one to five, with one representing low market barriers and five representing many market barriers to adoption. An index of one implies that the technology is commercially available, is reasonably priced and easily found in the market, is reliable and relatively easy to have it installed and functioning. An index of five implies that the technology is new or relatively untested, is a custom or special order product, is high in price, or has questionable reliability given existing experience in the marketplace. Low rankings suggest that, in order for a technology to be implemented, it will require education of end-users as to its benefits, training of market actors to promote the technology, and possibly incentives to buy down the first cost.

Need for Program–This index is also scored from one, meaning low need, to five meaning a strong need. The index can include such factors as circumstances unique to Vectren's service territory (as determined through the market assessment and through discussions with the Advisory Board and Vectren management) or governmental programs in existence in Indiana being promoted by state agencies or programs of interest to regulators. This factor also would be the place to acknowledge particular needs of certain industrial groups prevalent in Vectren's service territory that might make a targeted program most appropriate.

The economics, engineering characteristics, and subjective factors are used to sort the technologies into a list that provides a preliminary prioritization for further consideration. The resulting list of technologies with cost effectiveness, market barriers and the "need for program" indices is shown below in Table 35.

Table 35. Sorting of DSM Technologies

Small Buildings Technologies	Levelized Cost ($/therm)	Market Barriers (l=low, 5=high)	Need for Program (1-5)	Large Buildings Technologies	Levelized Cost ($/therm)	Market Barriers (1-5)	Need for Program (1-5)
Solar Siting	$0.09	5	3	Low Flow Fixtures	$0.22	1	4-5
Low Flow Fixtures	$0.12	1	3-5	Energy Star Gas Stove	$0.30	3	3
CO Remediation	$0.19	1-3	3-5	Commissioning–New	$0.36	3-4	4
EE Furnace–AFUE of 65 to 90 Required; 5 Yrs on Old Furnace and 25 yrs on 90+	$0.27	4	4-5	Re/Retro-Commissioning	$0.36	3-5	5
Energy Star Construction	$0.31	3	5	Energy Star Gas Oven	$0.38	3	3-4
EE Water Heater with Energy Factor of 0.6 or Better Required	$0.35	2-3	4	Low-E Windows 1500 Ft2	$0.40	3-5	3-5
EE Furnace–AFUE of 82 to 90 Required	$0.39	3-4	4	Controls*	$0.43	3	3-5
Programmable Thermostats	$0.42	2	3-4	Commissioning Audit	$0.47	3	5
Wall Insulation (R0-R11)	$0.51	2	3	EE Water Heater EF >0.6	$0.56	2	4
EE Furnace–AFUE of 65 to 82 Required	$0.51	2	4	Energy Star Gas Clothes Dryer	$0.60	3-5	3
Duct Seal	$0.52	1-2	3	EE Boiler	$0.65	3-4	5
Wall Insulation (R11-R19)	$0.53	3-4	4	Roof Insulation	$0.67	3-5	3
Floor/Basement Insulation	$0.61	4-5	3-4	Low-E Windows 1500 Ft2 Replace	$1.33	3-5	3-4
Tank-less Water Heater Required	$0.64	4-5	3	Solar Water Heater	$1.49	3-5	3
Tank/Pipe Wrap	$0.65	1	3				
Energy Star Gas Clothes Dryer	$0.66	3	3				
House Sealing Using Blower Door	$0.69	3-4	4-5				
HVAC Tune Up	$0.69	1	4				
Ceiling Insulation (R11-R38)	$0.76	2	3-4				
Ceiling Insulation (R30-R38)	$0.76	2	3-4				
Ceiling Insulation (R19-R38)	$0.76	2	3-4				
EE Windows	$1.16	4	2-4				
Gas Stove/Oven	$1.71	4	2-3	*50%-75% of controls benefit is electric savings so cost represents only about 40% of total			
Solar Water Heater	$1.80	4	2-3				

These three sortings provide an ordered set of technologies that would require varying levels of education, market interaction and/or incentives in order to achieve adoption. High scoring technologies would presumably require less subsidy or promotion to achieve penetration, where lower scoring technologies (i.e., lower on the list and those with high market barriers) might require more information or incentives. On the other hand, lower scoring technologies are often packaged with other higher scoring technologies in a single program aimed at the same end-use to improve their overall cost effectiveness. A final step is to verify some of the data identified from secondary sources with that specific to the utility and service territory. Even without this step, experience shows that this screening process usually produces a fairly consistent set of high potential technologies across various utilities.

Technology Groupings

The technology screening process points to a set of DSM programs that group the highest ranking technologies, based on cost effectiveness, in packages targeted at end-uses within specific target segments. The most favorable of the technologies identified through the screening process are then grouped in the next step according to what segments of the target market they would be targeted to and how. For example, weatherization type measures that scored well in the screening process can be grouped together into a low-cost measures program.

Packaging of Technologies into Programs

The following is a discussion of the technologies most appropriate to each customer sector. The specific technologies to be promoted through programs are then described in Table 36 in the next section of the report.

Residential–The Technical Potential Study reveals that Vectren North is, overwhelmingly, a residential sector customer base. Within the residential sector, natural gas serves primarily space heat and water heat end-uses. This suggests that programs that package DSM technologies and techniques aimed at increasing the energy efficiency of gas furnaces, reducing air leaks and improving weatherization of the home would be appropriate. Given the relative rankings of 90+ AFUE gas furnaces and those with slightly lower ratings, two options might be appropriate. One option would be to propose replacing the 80+ furnaces with a new 80+ variable speed furnace; for those more inclined to adopt the higher efficiency technology, the AFUE 90+ could be offered as well. A combination of high efficiency water heater replacements and flow reduction technologies would be appropriate for either a second program or a single program for existing buildings. For low income customers, a program could leverage existing community action agency initiatives (federal weatherization and payment assistance programs) through a coordinated program with added utility money.

Technologies considered in the analysis, but not included in programs at this time, include window replacements for saving energy costs for homes heated with gas and heat-rated gas fireplaces for displacing other supplemental heat sources.

Commercial–Small commercial establishments with building characteristics similar to the residential sector could be targeted through a Small Buildings program, focusing on the end-use technologies noted above. The Technical Potential Study identifies key commercial end-uses, of which space heat and water heat are the largest. Based on the site visits with Vectren representatives, a second program targeted at restaurant/food preparation/kitchen end-uses would also be appropriate due to their number and the opportunity for increased gas energy efficiency.

Renewable Energy–The Technical Potential Study shows curves that include a solar option as a way to increase gas energy efficiency through two technologies: solar water heating as a way to pre-heat the water in storage tanks prior to the need to turn on the gas heating component and small packaged co-generation systems for large residential and small commercial application that use natural gas as a backup.[9]

Industrial–Although individual industrial loads are large, the Technical Potential Study shows that the sum of the industrial load (including transportation customers) is quite small compared with residential. Industrial customers are generally less supportive of prescriptive or mandated utility DSM for their sector while supporting economic applications of DSM technologies on a case-by-case basis. The appropriate approach to offering energy efficiency services to this sector is therefore a custom approach for each interested participant, and/or funding of emerging technology research and development and demonstrations. Some industrial customers expressed potential interest in a technology innovations group or innovative on-site metering options. For the most part, any technology promotion would be most successful if coupled with a rate incentive.

Vehicles–Some gas utilities include natural gas vehicle (NGV) conversions as a conservation program option. This program is targeted at municipal governments, schools and businesses that operate fleets of vehicles. Incentives are provided for covering a portion of conversion costs. In some cases, incentives covering a portion of the incremental costs of NGVs over standard fleet models are provided for new vehicles. These programs assume that fueling stations are available for market use or would be installed on the customer's site.

Application of Marketing Approaches

In the previous step, the screened technologies are then grouped into programs targeted at specific markets. The marketing techniques to be used will depend on: 1) the maturity and availability of the technologies in the marketplace and 2) the specific market barriers that exist that must be overcome in order to achieve desired levels of market penetration. Technologies that have a high first cost may require incentives and those that are relatively new or emerging may require demonstration programs. Technologies that would be packaged with load management systems (load control, innovative rates, or timing devices) may require education regarding benefits that would accrue to customers. The marketing techniques to be used will also depend upon the budgets available for program implementation.

Once the set of technologies applicable to Vectren's service territory is developed, then they are grouped into programs reflecting the customer sectors and whether they would be applied to new or existing applications. The final step in converting the groups of technologies into programs is by adding budget considerations, marketing approaches and policy requirements. The primary factor in designing successful DSM programs is to correctly identify the market barriers to adoption. This is typically done through market research, combined with appliance or equipment saturation data to understand the existing level of penetration for each technology; such data as provided by Vectren has been taken into consideration in this analysis. Other data necessary for program design includes information on technology prices and availability, as well as distribution channels;

[9] This latter program has been promoted in New Jersey under that State's Comprehensive Resources Analysis program. See New Jersey Board of Public Utilities website for more information.

again, the best information available has been used, and the specific data elements can be improved upon during the review and revision process. The resulting programs are described in the next section of the report.

DSM Program Designs

According to the original assignment for the project, Vectren North articulated the goals for DSM program design as follows:

1. Potential programs should give priority to achievable energy savings, customer benefits, cost effectiveness ratios, adoption potential, market transformation capability and ability to replicate in the Vectren North service territory.
2. Individual program plans by customer segments will contain the elements listed:
   a. **Detailed description of the program**–Based on best practices from a variety of sources, including ACEEE's 2003 summary report on best natural gas energy efficiency programs.[10]
   b. **Reasons why the program would be successful in Vectren North's service territory**–Derived from the Market Assessment section of this report and background research from earlier tasks.
   c. **Number of customers within the customer class/segment that are likely to adopt/use the proposed program**–Derived from the Market Assessment section of the report with a percent participation estimate based on experience from other utilities with similar programs; informed by actual results from other utilities offering similar programs.[11]
   d. **Achievable energy savings**–From a variety of sources listed at the end of this report, consistent with the technology assessment and published reports.
   e. **Cost effectiveness ratios/rating per individual program**–Calculated using the Total Resource Cost, Participant, Administrators Cost, and Ratepayer Impact Tests (see Appendix D).
   f. **Marketing plans which should include incentives, rebates and preferred distribution channels and how each reduces existing barriers to proposed program adoption/acceptance**–Based on best practices from a variety of sources listed at the end of this report; incentive amounts based on examples from natural gas companies identified in footnotes and listed in Appendix C.
   g. **Detailed budget plans complete with explanations of anticipated increases/decreases in financial and human resources during the expected life of the program**–Based on best practices from a variety of sources listed at the end of this report and a five-year program life.
   h. **Recommended methodology or tracking tools for recording actual performance to budget**–Based on current standard practice using simple commercially available software (no black boxes or proprietary models recommended).
   i. **Proposed program evaluations and reports**–Based on current standard practice using a logic model approach.

Some discussion is worth noting regarding assumed participation rates in the program designs. First, the participation levels indicated in the program designs, and used in the analyses, represent target participation levels that reflect the level of funding suggested and the size of the target markets for each program. They are relatively conservative and would need to be adjusted after experience in the field to reflect Vectren's actual market response to the programs. While it is useful to see what other utilities and public benefits entities have achieved in terms of percentage participation rates for similar programs, such figures are not comparable for a

[10] Kushler, Martin, et al.; *Responding to the Natural Gas Crisis: America's Best Natural Gas Energy Efficiency Programs.* ACEEE Report No. U035 (Dec. 2003).
[11] Primarily People's Natural Gas; see References for citation.

variety of reasons and offer only scant insights into what might be achievable for Vectren. First, one must consider differing program budgets and pre-program market conditions such as conservation awareness levels, market interest and willingness to invest in energy efficiency over other consumer choices. Critical to what one might expect to achieve in terms of participation levels are factors such as energy costs in general and gas rates in particular. Given the prediction that gas rates will increase significantly over the time period that these programs are introduced, the participation levels may indeed be too conservative. The fact is, only time and experience will tell. If programs become quickly over-subscribed, Vectren will need to consider either reducing incentive levels to spread annual budgets out over time or accelerating the five-year budgets to be able to serve more customers than planned for.

The other reason why the experience of other energy efficiency programs elsewhere is of very limited value is that the numbers available in published reports are themselves not comparable or easily converted into useful data. Most program status reports and evaluation studies state how many participants each program has achieved, rather than reporting what percentage of eligible customers have participated. Their chief value is in viewing participation levels and rates over time, from year to year, rather than compared to market potential. This makes any comparison to what might be achievable to Vectren a moot exercise.

With those caveats, the program designs by necessity incorporate reasonable levels of market uptake given the program budgets, incentives and training/education (collective market stimuli) that are based on other similar program offerings, and evaluation experience of identified "best practice" natural gas programs in the literature. And while one has to select a set of numbers as a starting point from which to develop a plan, in every case where a new initiative is undertaken, it is logical to expect the plan to adjust as experience and market conditions reveal more realistic outcomes.

VI. DSM PROGRAM PLANS

The table below provides a summary of the recommended DSM Programs and the technologies that would be promoted to the appropriate market segments. Each program is discussed in the following text.

Table 36. Recommended Programs and Technology Groupings

Program Type	Target Market	End-Uses	DSM Technologies
1. Small Buildings Energy Efficiency Program	Existing residential (single family up to 4 units) and small commercial buildings (defined by square footage, employees or gas usage)	Heating, water heating, cooking, laundry, fireplaces	Energy efficient furnaces, duct sealing, weatherization measures, blower door, EE water heaters, flow restriction measures, tank and pipe wraps, gas ranges, clothes washers (for home with gas water heating), dryers, setback thermostats and natural gas fireplaces
2. General Services Energy Efficiency Program	Existing and new medium to large commercial and industrial facilities	Heating, water heating	Boiler replacement, water heating equipment
3. Customized Energy Efficiency Program	Existing and new large commercial and industrial facilities	Heating, water heating, process uses	All identified gas end-uses
4. Hospitality Industry Energy Efficiency Program	Restaurants, bakeries, institutional housing, hotels, hospitality facilities and other cooking facilities	Cooking and food preparation	Energy efficient gas ranges, ovens, broilers, warmers and related processes
5. Multi-Family Building Energy Efficiency Program	Multi-family buildings with 5 or more units, dormitories, hotels, other large residential facilities	Common area boilers, water heating and laundry; individual unit water heating, weatherization	Energy efficient furnaces, duct sealing, weatherization measures, blower-door, EE water heaters, flow restriction measures, tank wraps
6. Innovative Energy Efficiency Technologies Research and Demonstration Program	All markets	All gas end-uses	Emerging high efficiency natural gas technologies, use of renewable technologies to off-set or enhance gas technologies
7. Energy Efficient Builder Program	Residential and non-residential new construction	Any gas end-uses being considered	Design incentives to upgrade planned gas equipment to energy efficient options, reduced hook-up fees and/or line extension costs
8. New Program Development and Regulatory Affairs	All sectors	All end-uses	Emerging technology research and demonstration and regulatory liaison activities
9. Public Education and Outreach Program	All sectors	All end-uses	All technologies

Program 1. Small Buildings Energy Efficiency Program

The Small Buildings program would provide Vectren's existing residential and small business customers with three services:

1. A comprehensive energy audit providing a package of low-cost weatherization measures plus specific recommendations of equipment and techniques for using gas more efficiently,
2. Assessment of the home's air leakage/infiltration levels through the use of blower door technology, and

3. A menu of technology-specific incentives for recommended measures.

The primary natural gas technologies promoted through this program are presented in Table 37 below.

Table 37. Measures and Incentives - Small Buildings Energy Efficiency Program[12]

Measures	Incentive Amounts
1.High Efficiency Gas Furnaces (replacement)–92% AFUE	$150
2.High Efficiency Gas Water Heaters (replacement) - 0.62% Energy Factor	$50
3.High Efficiency Gas Range	$30[13]
4.High Efficiency Gas Dryer	$30[14]
5.ENERGY STAR Setback Thermostats[15]	$30
6.Horizontal Axis ENERGY STAR Clothes Washers[16]	$100
7.Weatherization Measures (low-cost)	$50
8.Blower Door Treatment	No cost

This program is modeled off of the New York State Energy Research and Development Authority's Home Performance with ENERGY STAR program, cited in a recent ACEEE report as being an exemplary natural gas energy efficiency program.[17] The premise of this type of program is to identify energy saving opportunities through a highly trained contractor skilled in conducting energy audits plus blower door treatment of the home. The contractor then makes a customized set of recommendations, showing applicable incentives and free measures, and proceeds to install the equipment upon approval by the customer.

Rational for Program

This program would address the largest segment of Vectren's customer base with cost-saving information and incentives to help mitigate the increasing costs of natural gas use associated with the primary end-uses of space and water heating. It would provide customers with information about the condition and safe use of their existing equipment, improve the efficiency of their homes and facilities through weatherization measures, and reduce their consumption of gas through upgrading appliances to higher efficiency new models.

Program Participation and Savings

Estimated participation and savings over a five-year period is presented in Table 38 below. Approximately 525,000 residential and small commercial buildings are estimated to be potential participants in this program. After five years, the program is expected to treat nearly 40,000 homes and small businesses (7.5 percent of potential participants) and deliver 7.8 million therms of annual gas savings. Savings per participant are based on the weighted average savings of individual measures.

[12] Based on various utility programs, see Appendix B.
[13] Based on NJNG.
[14] Based on NJNG.
[15] Based on Aquila.
[16] Based on Interstate Power and Light.
[17] Kushler, Martin, et al.; Dec. 2003.

Table 38. Estimated Participation and Savings - Small Buildings Energy Efficiency Program

Potential Participants:			525,000
Per Participant Savings:			198
Program Year	**Number of Participants**	**Percent Participation**	**Therms Saved**
Year 1	2,625	0.5%	520,800
Year 2	5,250	1.0%	1,041,600
Year 3	7,875	1.5%	1,562,400
Year 4	10,500	2.0%	2,083,200
Year 5	13,125	2.5%	2,604,000
Cumulative	**39,375**	**7.5%**	**7,812,000**

Marketing Plans

The primary barrier to the adoption of higher efficiency appliances is first-cost, as these products typically sell for a premium over standard gas appliances. The first-cost barrier is overcome through targeted incentives for the upgrading of equipment to higher efficiency products such that the incrementally higher cost over standard equipment is reduced or eliminated.

A second barrier may be the lack of knowledge as to how much customers might save on their gas bills from weatherization and installing such equipment. This barrier is overcome through the energy audit, where Vectren contractors conduct a walk-through review of the facility's gas-using equipment and related building conditions (air leaks, thermostat settings, condition of hot water pipes and water tank, faucets, etc). Literature may also be provided to show home and business owners what behavioral changes affect energy consumption.

The program would be promoted by an energy audit contractor in combination with point-of-purchase information at area equipment retailers and distributors of natural gas equipment for the residential and small commercial markets. Incentives would be paid directly to customers mailing in receipts to the vendor on behalf of Vectren.

Detailed Budget Plans

An estimated five-year budget for this program is provided below in Table 39. The anticipated cost to Vectren for offering this program to customers involves budgets for:

1. Vectren administrative costs to develop, advertise, oversee and monitor the program
2. A vendor contract to market and deliver energy audits to customers, usually charged on a per completed audit basis plus a management fee
3. A per audit charge subsidized by Vectren[18]
4. Costs for selected low-cost measures that can be installed at the time of the audit (flow restrictors, pipe wrap, etc.)
5. Incentives for the installation of recommended measures as demonstrated through the provision of receipts by the customer

[18] Evaluation studies have shown that charging the customer a portion of the audit fee, for example $35, helps to attract the more serious buyers who intend to act on the recommendations, and results in a higher perception of value on the part of the customer for the audit service than if it was offered for free. Low income customers may be offered the service for a reduced rate or for free if the fee is problematic.

Costs to participating customers include:

1. Customer's share of the per audit fee
2. Customer's share of the costs of covered measures and equipment
3. Installation costs

Table 39. Estimated Five-Year Program Budget - Small Buildings Energy Efficiency Program

	Cost per Part.	Year 1	Year 2	Year 3	Year 4	Year 5	5-Year Total	Pct of Total
Fixed Program Costs								
Start Up Costs		$25,000					$25,000	0.2%
Staffing, Admin. and Overhead		$263,732	$263,732	$263,732	$263,732	$263,732	$1,318,660	10.6%
General Public Education		$358,237	$358,237	$358,237	$358,237	$358,237	$1,791,185	14.4%
Total Fixed		**$646,969**	**$621,969**	**$621,969**	**$621,969**	**$621,969**	**$3,134,845**	**25.2%**
Variable Program Costs								
Incentives	$150.00	$393,750	$787,500	$1,181,250	$1,575,000	$1,968,750	$5,906,250	47.5%
Program Expenses	$70.00	$183,750	$367,500	$551,250	$735,000	$918,750	$2,756,250	22.1%
Monitoring and Evaluation	$16.48	$43,252	$86,503	$129,755	$173,007	$216,258	$648,775	5.2%
Total Variable	**$236.48**	**$620,752**	**$1,241,503**	**$1,862,255**	**$2,483,007**	**$3,103,758**	**$9,311,275**	**74.8%**
Total Budget		**$1,267,721**	**$1,863,472**	**$2,484,224**	**$3,104,976**	**$3,725,727**	**$12,446,120**	**100.0%**

Performance Tracking

The audit vendor contract should include monthly reporting of numbers of audits performed, measures installed and complete justification for invoiced amounts to be compared against program budgets. Program incentives paid should be supported by documentation from participating customers such as receipts or contractor's invoices itemizing the measures and appliances installed.

Coordination with Low-Income Program

Development of recommendations for low-income issues is a separate area and was not included in tasks for development of the DSM Action Plan. However, given the need for a balanced understanding for planning, documentation of greatly increased need for low-income and moderate income customer service planning and assistance is provided in this report in the section on Alternative Forecast and Policy Parameters (Section VIII), both in the low-income subsection and, more generally, in the discussion of alternative forecast. General low-income recommendations are provided at the end of the Section.

The Small Buildings Energy Efficiency Program is the DSM program in this report that overlaps with low-income residential services. The most efficient way to combine the DSM objectives of the Small Buildings Energy Efficiency Program with low-income customer service objectives is to coordinate the Small Buildings Energy Efficiency Program with the federal Low-Income Home Energy Assistance Program (LIHEAP), administered through Indiana's Energy Assistance Program, which provides financial assistance to low-income households to maintain utility services during the winter heating season, along with low-income home weatherization services delivered in each county through the Community Action Agencies.[19] In a coordinated program, generally, all utility DSM incentive amounts in the Small Buildings Energy Efficiency Program (or a tailored equivalent) are used to "buy down" costs of equivalent functions or items in the Community Action Agency Weatherization Assistance Program.

Beginning January 1, 2005, eligible customers of Vectren, who have applied for the state's LIHEAP through local Community Action Agencies, were automatically enrolled in the new Universal Service Program and will receive bill reductions in addition to LIHEAP. Monthly bill reductions will range from 9 to 32 percent of the total bill (not including LIHEAP benefits), depending on the consumer's income level. The pilot Universal Service Program also provides additional funding for weatherization. This type of coordination is the most cost effective and efficient way to combine residential DSM objectives with low-income customer service objectives.[20]

Program 2. General Services Energy Efficiency Program

This program would serve existing large commercial and industrial facilities with prescriptive equipment rebates for upgrading heating, water heating and gas cooling systems; boiler replacement, water heating equipment, tune ups (building commissioning) and control systems. An optional Targeted Technical Assessment service would be available on a cost-shared basis from trained contractors for those customers wishing to have a professional assessment of energy savings opportunities performed on their facility before making decisions. Larger and customized retrofits would be covered under the Custom Program (Program 3). The suggested incentive levels for selected measures are listed in Table 40 below.

[19] During cold winter months, this program helps prevent utility companies from shutting off home heating service to low-income families. During hot summer months, the Energy Assistance Program provides limited funds for the purchase of fans, distributed at the local level. The state eligibility criterion is currently set low, at 125% of the current federal poverty level, which equates to one-half of a level of self-sufficiency income for a family. This appears to leave a gap to be addressed for working families who also experience income problems but are above the state eligibility level for the Community Action Agency Weatherization Assistance Program. The Company and the Advisory Board may want to take this into account with modifications so that there will be some participation in the Small Buildings Energy Efficiency Program within this income group.

[20] The two key references for development of coordinated utility and Community Action Agency Weatherization Assistance Programs are Hill and Brown (1995) and MacGregor and Oppenheim (2002). Hill and Brown show how to optimize cost-benefit results for coordinated programs with separate, but complementary, objectives and cost-benefit criteria. MacGregor and Oppenheim provide information on the general state of coordinated utility/Community Action Agency programs, including the strengths and problems of coordinated programs using Massachusetts and Texas examples. Hill, Lawrence J. and Marilyn A. Brown, "Cost-Effectiveness of Coordinated Programs," *Evaluation Review*, Vol. 19, No. 2, Pp. 181-195. MacGregor, Theo and Jerrold Oppenheim, *Coordination between Utility and DOE Low-Income Weatherization: What do Public Utility Commissioners Need to Know?* Monograph prepared for Oak Ridge National Laboratory Energy Division and UT-Battelle, LLC, 2002. (Also available online at www.democracyandregulation.com)

Table 40. Measures and Incentives – General Services (G/S) Energy Efficiency Program

Measures	Incentive Amounts
1. Water heaters–50 gal or more	$150
2. Boilers–various sizes and types	$750 to $7,500
3. Boiler tune ups and controls	$250 up to $5,000
4. Gas cooling systems	$6 per ton
5. High efficiency forced air furnace–92% AFUE	$100
6. Other equipment to be determined	varies
7. Building commissioning	varies

Rational for Program

Helping the commercial and industrial sector reduce operating costs is a standard part of good utility operations, and providing information and incentives for encouraging equipment upgrades falls into that category. While it can be assumed that many large customers have in-house or consultant expertise on board to manage the building's energy consumption, these individuals are often most concerned with keeping things operational rather than attempting more complex improvements. Improvements and changes must therefore be proposed in terms of improving the bottom line by reducing operating costs, improving performance or productivity, or some other value that is in line with business considerations.

This program therefore targets those business customers who know what they want done (e.g., boiler replacement), but need some incentive to make the best available equipment choice for reducing gas use. Those unsure of what opportunities exist may elect to have a Targeted Technical Assessment performed through the program. Those that need more customized information on their building and process systems would apply under the Custom Program, discussed in the next section.

Building commissioning refers to a process that takes place when a facility is newly constructed, and it involves checking that all of the installed building systems are working properly and at design efficiencies. Like automobiles, however, buildings can change soon after they are occupied and operating. Changes in scheduled occupancy, building use, additions and renovations or deployment of new equipment can all greatly alter the effective operations of building systems. Re-commissioning is like a building tune-up and it is aimed at correcting for any building changes that have affected the major building systems. Experience has shown that periodic re-commissioning can often contribute significant savings in both gas and other fuel savings.

Building control systems are often associated with electric savings, but they can have a significant positive effect on natural gas consumption as well. Any time electronic controls are installed they can be used to improve the operation of any energy related building system and thus produce energy saving benefits.[21]

[21] Due to the dual benefits of building controls, a partnership may be sought with the affected electric utilities to share some costs of this program.

Program Participation and Savings

Estimated participation and savings over a five-year period is presented in Table 41 below. Around 11,000 large commercial buildings are estimated to be potential participants in this program. After five years, nearly 800, or seven percent of potential participants, are expected to be treated by the program. Each participant is expected to save an average of just under 2,000 therms a year for a total resource of 1.5 million therms after five years of program operation.

Table 41. Estimated Participation and Savings – General Services Energy Efficiency Program

Potential Participants:			**11,000**
Per Participant Savings:			1,998
Program Year	**Number of Participants**	**Percent Participation**	**Therms Saved**
Year 1	55	0.5%	109,890
Year 2	110	1.0%	219,780
Year 3	165	1.5%	329,670
Year 4	220	2.0%	439,560
Year 5	220	2.0%	439,560
Cumulative	**770**	**7.0%**	**1,538,460**

Marketing Plans

Many business owners and building operators are reluctant to consider non-critical investments, taking the approach of "If it isn't broken, why fix it?" They tend to be risk-averse and are generally wary of new and emerging technologies, particularly when standard options are less expensive and considered to have more predictable, reliable performance. Even those who keep up with the latest technology options have difficulty justifying retiring a piece of equipment before it has failed or the incremental cost of replacing it with a higher efficiency option. This program would overcome the primary market barrier of cost by subsidizing a portion of the increased cost to bring retrofit equipment more in line with standard, less efficient options.

Detailed Budget Plans

An estimated five-year budget for this program is provided below in Table 42. The anticipated cost to Vectren for offering this program to customers involves budgets for:

1. Vectren administrative costs to develop, advertise, oversee and monitor the program
2. A vendor contract to market and deliver Targeted Technical Assessments to customers, usually charged on a square footage basis plus a management fee
3. A per audit charge subsidized by Vectren
4. Incentives for the installation of recommended measures as demonstrated through the provision of receipts by the customer or the job scope if a Targeted Technical Assessment is performed

Costs to participating customers include:

1. Customer's share of the assessment fee
2. Customer's share of the costs of covered measures and equipment
3. Installation costs

Table 42. Estimated Five-Year Program Budget – General Services Energy Efficiency Program

	Cost per Part.	Year 1	Year 2	Year 3	Year 4	Year 5	5-Year Total	Pct of Total
Fixed Program Costs								
Start Up Costs		$25,000					$25,000	1.1%
Staffing, Admin. and Overhead		$51,938	$51,938	$51,938	$51,938	$51,938	$259,690	11.3%
General Public Education		$70,549	$70,549	$70,549	$70,549	$70,549	$352,745	15.4%
Total Fixed		**$147,487**	**$122,487**	**$122,487**	**$122,487**	**$122,487**	**$637,435**	**27.8%**
Variable Program Costs								
Incentives	$2,000.00	$110,000	$220,000	$330,000	$440,000	$440,000	$1,540,000	67.1%
Program Expenses	$0.00	$0	$0	$0	$0	$0	$0	0.0%
Monitoring and Evaluation	$151.92	$8,356	$16,711	$25,067	$33,423	$33,423	$116,980	5.1%
Total Variable	**$2,151.92**	**$118,356**	**$236,711**	**$355,067**	**$473,423**	**$473,423**	**$1,656,980**	**72.2%**
Total Budget		**$265,843**	**$359,198**	**$477,554**	**$595,910**	**$595,910**	**$2,294,415**	**100.0%**

Program 3. Customized Energy Efficiency Program

The Customized Energy Efficiency Assessment Program is for large buildings and industrial facilities with complex features or operations that require assistance to identify energy saving options. This program would serve existing large commercial and industrial facilities with customized information for making improvements to their gas end-use operations. Its main feature is a Targeted Technical Assessment conducted by a qualified engineering firm, under contract to Vectren, with the customer's portion of the costs reimbursed by Vectren if they proceed with the recommendations.[22] Participants may also take advantage of the prescriptive equipment rebates offered under Program 2 for upgrading heating, water heating and gas cooling systems; boiler replacement, water heating equipment, tune ups and control systems.

Table 43. Incentives - Customized Energy Efficiency Program

Incentives are Calculated as the Lesser of:
Buydown to a two-year payback
$0.70 per therm saved
50% of incremental cost

This program is modeled after the NYSERDA Flexible Technical Assistance Program (Flex-Tech) cited in ACEEE's report on best natural gas energy efficiency programs.[23] Incentive levels are based on People's Natural Gas C/I Custom Rebate Program.[24]

[22] Under this program, all participants would receive the Targeted Technical Assessment as a precondition of receiving incentives.
[23] ACEEE, U035, Dec. 2003.
[24] People's Natural Gas Conservation Improvement Program filing (June 1998).

Rational for Program

While other programs may have some participation from industrial accounts, the Customized Energy Efficiency program is the only funded program in the DSM Action Plan targeted to the industrial segment. This program accounts for 5 percent of the total DSM program budget. Large volume customers have unique and individual needs when it comes to energy efficiency opportunities. Yet, engineering assessments of building systems for identifying those opportunities can be very costly, and as a result, cost-conscious building and facilities managers are sometimes reluctant to be comprehensive in considering building improvements. Increasing costs of gas might help open this market, but help is often still needed in identifying and prioritizing energy efficiency improvements. By subsidizing the costs of energy assessments and sharing the cost with customers, Vectren can help them identify a broader range of improvements that can help customers reduced their gas bills. The Technical Assessment can also serve as the entry point for the General Services Energy Efficiency Program by having the contractor complete an application form for any equipment qualifying for incentives. For equipment or improvements not specifically identified in Program 2, a customized rebate can be calculated based on anticipated therms saved.

Some programs contract with one firm to conduct Technical Assessment studies, while others have several firms each with a different specialty. Some programs prevent the firms doing the assessments from also bidding to install equipment, and others do not.

Program Participation and Savings

Estimated participation and savings over a five-year period is presented in Table 44 below. This program is characterized by relatively few potential participants (350), but with large savings per participant, nearly 11,000 therms annually. Although the number of potential participants in this program is based on the number in the process planning element (large industrial transport customers), other industrial customers with process loads may be good candidates for this program. Only a few participants are expected a year, so that after five years of program operation, fewer than three dozen firms have taken advantage of this program. By then the program is expected to deliver nearly 371,000 therms of resource annually.

Table 44. Estimated Participation and Savings - Customized Energy Efficiency Program

Potential Participants:			350
Per Participant Savings:			10,900
Program Year	**Number of Participants**	**Percent Participation**	**Therms Saved**
Year 1	4	1.0%	43,600
Year 2	5	1.5%	54,500
Year 3	7	2.0%	76,300
Year 4	9	2.5%	98,100
Year 5	9	2.5%	98,100
Cumulative	**34**	**9.5%**	**370,600**

Marketing Plans

Larger facilities are often too complex to immediately reveal what opportunities exist to reduce energy consumption and costs. The first step then is in convincing business energy managers, building operators and manufacturing managers that upgrading equipment to high energy efficient models is a good business decision. This involves conducting a technical assessment of the facility, identifying opportunities specific to the individual customer's operations, and calculating the economics of the investment to be made against savings in energy costs and perhaps maintenance down the road.

The specific product of the Technical Assessment service is a detailed specification and economic analysis of recommendations that could then be put out for bid to qualified contractors, or implemented in-house. Once work is completed, Vectren's engineering firm that did the Technical Assessment would conduct an inspection to verify what work was completed, collect documentation as to the equipment installed, and calculate any incentives due to the customer from Vectren (refunded Technical Assistance fee plus rebates).

Other gas programs[25] that offer customized services use the following types of criteria for determining rebate amounts:

1. Technical Assessment studies are covered up to $2,500 or not to exceed 50 percent of total cost, with an additional $2,500 reimbursed if measures are installed
2. All projects must pass a TRC benefit/cost test with a result greater than 1.0
3. The incentive buys down the costs of installation to a two-year payback
4. Rebate amount is 50 percent of the incremental cost, or 25 percent of equipment cost
5. Rebate is calculated on a custom basis with each installation passing a cost/benefit test
6. Rebate level is set at some percentage of cost up to a maximum level

All work for this program would be handled through contracts with one or more engineering firms. Vectren would hire a qualified engineering firm(s) to offer Technical Assessment services to commercial/industrial customers and perform inspections of completed projects. The contractor would also be trained in helping customers apply for the incentives under the prescriptive program, Program 2. The contractor would present the customer with a standardized report identifying the opportunities, recommended equipment and technical upgrades, and qualification for rebates, if any. The contractor would be responsible for marketing the program to Vectren's large commercial/industrial customers.

While it is beyond the scope of this project to identify all possible audit firms, there are likely to be several possibilities available. Not withstanding the use of other audit providers, we recommend that the Indiana Clean Manufacturing and Safe Materials Institute (CMTI) be recruited as a partner in the marketing and implementation of this program.[26] CMTI has valuable experience assisting Indiana industries with the adoption

[25] Center Point Energy Minnegasco, Xcel Energy, Aquila.
[26] CMTI is affiliated with Purdue University and is located in West Lafayette, Indiana. Lynn Corson, Director, can be reached by phone at (765) 463-4749.

of manufacturing processes that are less harmful to the environment, some with energy saving benefits. The advantages of partnering with CMTI for delivery of the Customized Energy Efficient Program include their:

- familiarity with Indiana industry with over 10 years of experience delivering technical-based solutions to manufactures,
- familiarity with existing state and federal programs, including energy programs from the US DOE, for maximum leverage of program funds with other funding sources,
- experience with translating technical recommendations to standard business economics such as payback periods and benefit cost ratios, and
- ability to target selected industries for adoption of proven methods and practices.

CMTI would likely need to invest some resources before they were ready to market and provide technical services as part of this program. However, other potential service providers would likely require even greater investment and would not be in a position to capitalize on the benefits listed above.

Detailed Budget Plans

An estimated five-year budget for this program is provided below in Table 45. The anticipated cost to Vectren for offering this program to customers involves budgets for:

1. Vectren administrative costs to develop, advertise, oversee and monitor the program
2. A vendor contract to market and deliver Targeted Technical Assessments to customers, usually charged on a square footage basis plus a management fee
3. A per audit charge subsidized by Vectren
4. Incentives for the installation of recommended measures as demonstrated through the provision of receipts by the customer or the job scope if a Targeted Technical Assessment is performed

Costs to participating customers include:

1. Customer's share of the assessment fee
2. Customer's share of the costs of covered measures and equipment
3. Installation costs

Table 45. Estimated Five-Year Program Budget - Customized Energy Efficiency Program

	Cost per Part.	Year 1	Year 2	Year 3	Year 4	Year 5	5-Year Total	Pct of Total
Fixed Program Costs								
Start Up Costs		$25,000					$25,000	2.8%
Staffing, Admin. and Overhead		$12,511	$12,511	$12,511	$12,511	$12,511	$62,555	6.9%
General Public Education		$16,995	$16,995	$16,995	$16,995	$16,995	$84,975	9.4%
Total Fixed		**$54,506**	**$29,506**	**$29,506**	**$29,506**	**$29,506**	**$172,530**	**19.2%**
Variable Program Costs								
Incentives	$20,000.00	$80,000	$100,000	$140,000	$180,000	$180,000	$680,000	75.5%
Program Expenses	$0.00	$0	$0	$0	$0	$0	$0	0.0%
Monitoring and Evaluation	$1,419.59	$5,678	$7,098	$9,937	$12,776	$12,776	$48,266	5.4%
Total Variable	**$21,419.59**	**$85,678**	**$107,098**	**$149,937**	**$192,776**	**$192,776**	**$728,266**	**80.8%**
Total Budget		**$140,184**	**$136,604**	**$179,443**	**$222,282**	**$222,282**	**$900,796**	**100.0%**

Program 4. Hospitality Industry Energy Efficiency Program

This program is targeted to restaurants, bakeries, institutional housing (nursing homes, colleges, schools), hotels, hospitality facilities and other cooking facilities that employ natural gas for cooking and food preparation. The program promotes installation of energy efficient booster water heaters, dishwashers, fryers, griddles and gas ranges to replace aging equipment in existing facilities and/or as the efficient option for new facilities. Incentives cover the incremental added cost of the equipment and installations. As with the General Services Energy Efficiency Program, an optional Targeted Technical Assessment service would be available on a cost-shared basis from trained contractors for those customers wishing to have a professional assessment of energy savings opportunities performed on their facility before making decisions. The suggested incentive levels for selected measures are listed in the table below.

Table 46. Measures and Incentives - Hospitality Industry Energy Efficiency Program[27]

Measures	Incentive Amounts
1. High efficiency booster water heater	$500 per unit
2. High efficiency dishwasher/warewasher	$500
3. High efficiency gas range	$30[28]
4. High efficiency gas fryer	$300
5. High efficiency griddle	$100
6. Convection/conveyor ovens	$200-$250
7. Combination ovens (thermostatic control)	$1000
8. Infrared Upright broiler	$600
9. Infrared charbroiler	$200

This program is modeled after a similar offering of the People's Natural Gas (C/I Food Services Program)[29] and CenterPoint Energy Minnegasco's Foodservice Equipment Program.[30]

Rational for Program

This program promotes energy efficiency in the commercial/industrial sector's food services and related facilities (e.g., nursing homes) by encouraging customers to install the equipment listed above. Other utility food service programs have shown that the key barriers to energy efficiency for this sector are inadequate information and lack of subsidies or rebates to help reduce first-costs. This equipment has the potential to provide significant operating cost savings to customers, both existing and new construction. The rebates provided will help customers overcome first-cost barriers to implementation. .

Program Participation and Savings

Estimated participation and savings over a five-year period is presented in Table 47 below. There are an estimated 3,100 potential participants for this program. This estimate is based on NAICS codes in Vectren

[27] Based on PNG.
[28] Same as residential/small building equipment.
[29] PNG (1998).
[30] See Appendix E.

North CIS records. Nearly 300 of these customers are expected to participate in this program after five years of program operation. Average annual savings of just over 1,500 therms per participant are expected from this program.

Table 47. Estimated Participation and Savings - Hospitality Industry Energy Efficiency Program

Potential Participants:			3,100
Per Participant Savings:			1,542
Program Year	**Number of Participants**	**Percent Participation**	**Therms Saved**
Year 1	31	1.0%	47,802
Year 2	47	1.5%	72,474
Year 3	62	2.0%	95,604
Year 4	78	2.5%	120,276
Year 5	78	2.5%	120,276
Cumulative	**296**	**9.5%**	**456,432**

Marketing Plans

This program would be promoted via direct mail and other contacts to qualifying food service operations, businesses and institutions. Educational material explaining the benefits of the equipment retrofits and incentives offered will be provided. Some customers may avail themselves of incentives through the Customized Energy Efficiency Program. Trade allies (restaurant equipment providers, distributors and installers) will also be notified about the program to assist in marketing it to their customers. Participation and energy savings information will be obtained from customer applications and receipts and invoices for installed equipment that shows manufacturer ratings and consumption data.

Detailed Budget Plans

An estimated five-year budget for this program is provided below in Table 48. The anticipated cost to Vectren for offering this program to customers involves budgets for:

1. Vectren administrative costs to develop, advertise, oversee and monitor the program
2. A vendor contract to market and deliver Targeted Technical Assessments to customers, usually charged on a square footage basis plus a management fee
3. A per audit charge subsidized by Vectren
4. Incentives for the installation of recommended measures as demonstrated through the provision of receipts by the customer or the job scope if a Targeted Technical Assessment is performed

Costs to participating customers include:

1. Customer's share of the assessment fee
2. Customer's share of the costs of covered measures and equipment
3. Installation costs

Table 48. Estimated Five-Year Program Budget - Hospitality Industry Energy Efficiency Program

	Cost/ Part.	Year 1	Year 2	Year 3	Year 4	Year 5	5-Year Total	Pct of Total
Fixed Program Costs								
Start Up Costs		$25,000					$25,000	2.2%
Staffing, Admin. and Overhead		$15,409	$15,409	$15,409	$15,409	$15,409	$77,045	6.7%
General Public Education		$20,931	$20,931	$20,931	$20,931	$20,931	$104,655	9.0%
Total Fixed		**$61,340**	**$36,340**	**$36,340**	**$36,340**	**$36,340**	**$206,700**	**17.9%**
Variable Program Costs								
Incentives	$3,000.00	$93,000	$141,000	$186,000	$234,000	$234,000	$888,000	76.7%
Program Expenses	$0.00	$0	$0	$0	$0	$0	$0	0.0%
Monitoring and Evaluation	$211.92	$6,569	$9,960	$13,139	$16,530	$16,530	$62,728	5.4%
Total Variable	**$3,211.92**	**$99,569**	**$150,960**	**$199,139**	**$250,530**	**$250,530**	**$950,728**	**82.1%**
Total Budget		**$160,909**	**$187,300**	**$235,479**	**$286,870**	**$286,870**	**$1,157,428**	**100.0%**

Program 5. Multi-Family Building Energy Efficiency Program

This program would serve existing five or more unit multi-family buildings with prescriptive equipment rebates for upgrading heating, water heating and gas cooling systems; boiler replacement, water heating equipment, tune ups and control systems. Building occupants and tenants will be given a package of free low-cost weatherization measures for self-installation. The suggested incentive levels for selected measures are listed in the table below.

Table 49. Measures and Incentives - Multi-Family Building Energy Efficiency Program

Measures	Incentive Amounts
1. Water heaters–50 gal or more	$150
2. Boilers–various sizes and types	$750 to $7,500
3. Boiler tune ups and controls	$250 up to $5,000
4. Gas cooling systems	$6 per ton
5. High efficiency forced air furnace–92% AFUE	$100
6. Weatherization measures	varies

Rational for Program

Residents of multi-family buildings are often more vulnerable to energy price increases than the general population, as heating costs can represent a higher proportion of living expenses, whether included in rent or paid directly to a utility. This program targets landlords of multi-family buildings with incentives to upgrade common equipment such as heating systems and water heaters or gas cooling. It also provides assistance to tenants to give them a direct way to reduce energy costs in their individual units with a package of low-cost measures; such as, window film, caulk and weather stripping, and hot water pipe wraps.

Program Participation and Savings

Estimated participation and savings over a five-year period is presented in Table 50 below. The unit of participation in this program is a building with five or more living units. We estimated potential participants by starting with the 36,000 total multi-family units from the Market Assessment section. From there we arrive at our estimate of 2,160 potential buildings by applying assumptions that are based loosely on Census data. We assume that 60 percent of multi-family units are in buildings of five or more units and that these buildings average ten units per building (2,160 = (36,000 * 0.6) / 10)). Annual savings per participant is expected to average nearly 1,400 therms per building. After five years the program is expected to deliver annual savings of 272,000 therms.

Table 50. Estimated Participation and Savings – Multi-Family Building Energy Efficiency Program

Potential Participants:			2,160
Per Participant Savings:			1,367
Program Year	**Number of Participants**	**Percent Participation**	**Therms Saved**
Year 1	32	1.5%	43,744
Year 2	38	1.8%	51,946
Year 3	43	2.0%	58,781
Year 4	43	2.0%	58,781
Year 5	43	2.0%	58,781
Cumulative	**199**	**9.3%**	**272,033**

Marketing Plans

Landlords are typically slow to adopt above-standard equipment, unless economic pressures caused by such situations as increased energy prices make their buildings less competitive, with tenants less able to afford rents or utility bills. Too many business owners and building operators are reluctant to consider non-critical investments, taking the approach of "If it isn't broken, why fix it?" They tend to be risk-averse and are generally wary of new and emerging technologies, particularly when standard options are less expensive and considered to have more predictable, reliable performance. Even those who keep up with the latest technology options have difficulty justifying retiring a piece of equipment before it has failed or the incremental cost of replacing it with a higher efficiency option. This program would overcome the primary market barrier of cost by subsidizing a portion of the increased cost to bring retrofit equipment more in line with standard, less efficient options.

Detailed Budget Plans

An estimated five-year budget for this program is provided below in Table 51. The anticipated cost to Vectren for offering this program to customers involves budgets for:

1. Vectren administrative costs to develop, advertise, oversee and monitor the program
2. A vendor contract to market and deliver building assessments to landlords, plus a management fee
3. A per audit charge subsidized by Vectren
4. Incentives for the installation of recommended measures as demonstrated through the provision of receipts by the customer or the job of an assessment

Costs to participating customers include:

1. Landlord's share of the assessment fee
2. Landlord's share of the costs of covered measures and equipment
3. Installation costs

Table 51. Estimated Five-Year Program Budget - Multi-Family Building Energy Efficiency Program

	Cost per Part.	Year 1	Year 2	Year 3	Year 4	Year 5	5-Year Total	Pct of Total
Fixed Program Costs								
Start Up Costs		$25,000					$25,000	3.8%
Staffing, Admin. and Overhead		$9,184	$9,184	$9,184	$9,184	$9,184	$45,920	6.9%
General Public Education		$12,475	$12,475	$12,475	$12,475	$12,475	$62,375	9.4%
Total Fixed		**$46,659**	**$21,659**	**$21,659**	**$21,659**	**$21,659**	**$133,295**	**20.0%**
Variable Program Costs								
Incentives	$2,500.00	$80,000	$95,000	$107,500	$107,500	$107,500	$497,500	74.7%
Program Expenses	$0.00	$0	$0	$0	$0	$0	$0	0.0%
Monitoring and Evaluation	$177.50	$5,680	$6,745	$7,632	$7,632	$7,632	$35,322	5.3%
Total Variable	**$2,677.50**	**$85,680**	**$101,745**	**$115,132**	**$115,132**	**$115,132**	**$532,822**	**80.0%**
Total Budget		***$132,339***	***$123,404***	***$136,791***	***$136,791***	***$136,791***	***$666,117***	***100.0%***

Program 6. Innovative Energy Efficiency Technologies Research and Demonstration Program

This program would provide funding to the Indiana Clean Manufacturing Technology and Safe Materials Institute (CMTI) for conducting research into emerging gas technologies that contribute to increased energy efficiency in industrial applications. There are no direct incentives to customers under this program, rather it provides a funding stream to support research into technologies that may be added to the portfolio of programs offered by Vectren in the future. Case studies would be supported at some customer sites on a case-by-case basis, such that field demonstrations could be performed and studied for potential future market application.

Rational for Program

This program is targeted to industrial and other large gas users who already tend to be early adopters of cost effective technologies for their business operations. These customers would have less of a need for the other DSM programs targeted at the large building sector because they have already taken steps to maximize their buildings' energy efficiency. Even so, this target market segment is typically staying on the cutting edge of new developments that can help them stay competitive. This program is therefore targeted at those interested in learning about emerging technologies that may be developed through research and demonstration. The Institute identified to receive funding from this initiative conducts research into new products and processes for increasing the competitiveness of Indiana's industries. While not limited to technologies that use natural gas, these research projects and demonstrations invariably have an energy component, and thus strong implications for industry's bottom line. By providing direct funding to the Institute for specific gas-related projects and those that have gas efficiency as a secondary benefit, Vectren will ensure that its most innovative large customers will benefit from its DSM program portfolio.

An advisory committee or other forum may be established, consisting of a representative group of these customers to help provide suggestions for research, participate in demonstrations of new products, and review the results of program-funded projects. Annual funding request from CMTI would be reviewed annually to confirm adequacy of subsequent year's funding levels. Research would be monitored by the Advisory Committee to assess whether funding is being adequately supported through research into natural gas technologies and related projects.

Program Participation and Savings
Not applicable.

Cost effectiveness Ratios/Rating per Individual Program
Not applicable.

Marketing Plans
Not applicable.

Program 7. Energy Efficient Builder Program

This program would promote the incorporation of high efficiency design features in new homes, plus installation of high efficiency equipment above standard appliances, furnaces and windows. The program would be targeted at builders of subdivision and track homes. The suggested incentive levels for selected measures are listed in the table below.

Table 52. Measures and Incentives - Energy Efficient Builder Program

Measures	Incentive Amounts
1. Design incentives for adopting Energy STAR HomeBuilder standards on x% of new homes built	$750 per home meeting energy savings criteria
2. High efficiency windows	$100 per window
3. Other incentives as offered under the Small Buildings Program would be provided for installed equipment	See Program 1

Rational for Program
New construction is the best and most cost effective opportunity for incorporating major energy efficiency measures and construction practices in homes. An incentive is paid to builders for each unit that meets an energy savings criteria above standard design of 300 therms. The goal of the program is to ultimately move the new housing market toward a high efficiency standard practice without the need for incentives in the future.

Program Participation and Savings

Estimated participation and savings over a five-year period is presented in Table 53 below. Based on Vectren North's new residential gas connects, this program would be available to an estimated 13,000 units annually. Over the first five years of the program, about 550 homes are expected to be built under this program (0.9 percent of new construction). After five years of operation the program is expected to deliver 214,000 therms of savings annually.

Table 53. Estimated Participation and Savings - Energy Efficient Builder Program

Potential Participants:			13,000
Per Participant Savings:			387
Program Year	**Number of Participants**	**Percent Participation**	**Therms Saved**
Year 1	65	0.5%	25,155
Year 2	98	0.8%	37,926
Year 3	130	1.0%	50,310
Year 4	130	1.0%	50,310
Year 5	130	1.0%	50,310
Cumulative	**553**	**0.9%**	**214,011**

Marketing Plans

This program would target large-volume builders in the service territory with education, training and incentives for adopting Energy STAR Home standards in a proportion of the homes they build.

Detailed Budget Plans

An estimated five-year budget for this program is provided below in Table 54. The anticipated cost to Vectren for offering this program to customers involves budgets for:

1. Vectren administrative costs to develop, advertise, oversee and monitor the program
2. A vendor contract to market and deliver builder training and plans review
3. Incentives to builders for each home built that meets 300 therm energy savings for design features incorporated

Costs to participants would be at the discretion of the builders, and may include:

1. Customer's share of the costs of covered measures and equipment
2. Installation costs

Table 54. Estimated Five-Year Program Budget - Energy Efficient Builder Program

	Cost per Part.	Year 1	Year 2	Year 3	Year 4	Year 5	5-Year Total	Pct of Total
Fixed Program Costs								
Start Up Costs		$25,000					$25,000	2.0%
Staffing, Admin. and Overhead		$7,225	$7,225	$7,225	$7,225	$7,225	$36,125	2.9%
General Public Education		$9,814	$9,814	$9,814	$9,814	$9,814	$49,070	3.9%
Total Fixed		**$42,039**	**$17,039**	**$17,039**	**$17,039**	**$17,039**	**$110,195**	**8.9%**
Variable Program Costs								
Incentives	$1,920.00	$124,800	$188,160	$249,600	$249,600	$249,600	$1,061,760	85.4%
Program Expenses	$0.00	$0	$0	$0	$0	$0	$0	0.0%
Monitoring and Evaluation	$129.05	$8,388	$12,647	$16,776	$16,776	$16,776	$71,363	5.7%
Total Variable	**$2,049.05**	**$133,188**	**$200,807**	**$266,376**	**$266,376**	**$266,376**	**$1,133,123**	**91.1%**
Total Budget		**$175,227**	**$217,846**	**$283,415**	**$283,415**	**$283,415**	**$1,243,318**	**100.0%**

Program 8. New Program Development and Regulatory Affairs

This program is a support program; it does not deliver direct energy savings, but rather serves as a budget line item to allow for new project developments and coordinated interaction with regulatory and legislative bodies for development of policies supportive of DSM activities (e.g., improved energy efficiency building codes and standards).

Two additional program areas are the corn stove promotion and the "real" programmable thermostat demonstration. Corn stoves are pellet stoves and approved corn stoves have federal air quality waivers because they have virtually no emissions. If there is any thought that supply problems will lead to the kind of price increase projected by the EIA for the coming winter or to eventual problems of physical supply at any price, then it makes sense to provide a small discount program for corn stoves. The advantage of the corn stove is that it burns corn pellets, a "green" fuel that is sustainable from the service territory; also, that the household stoves can provide a warm room should there be security problems with either the gas or the electric system. This is not put forward as a fuel replacement program, but as a fuel diversity program so that, should it be necessary to ration fuel, flexibility will have been established in the home heating end-use so that rationing will have a mitigated impact in heating and health.

A small demonstration program is proposed, working with CAP agencies, to design a real programmable thermostat. There is a need for a programmable thermostat that can be easily read in a darkened room or hallway and that is easy to operate. While there is a range of products available on the market, they do not meet these two criteria and most programmable thermostats are as friendly to program as a VCR. Development of a real programmable thermostat would enable the benefits inherent in the product concept to be actually achieved.

Rational for Program

It is critical to fund an ongoing campaign to educate legislators and regulatory staffs about policy tools that are necessary to support DSM programs. A Vectren representative would play the role of corporate liaison to the regulatory and legislative community to share Vectren plans as well as communicate critical information back to Vectren's DSM team regarding state and federal programs and positions regarding the natural gas energy savings activities being pursued by Vectren.

Program 9. Public Education and Outreach Program

This program would provide funding for cross-program public education activities to raise awareness of the benefits and methods of improving energy efficiency in homes and businesses.[31] DSM portfolios in other jurisdictions often include significant public education programs to support the direct energy savings programs, as well as, encourage consumers to take actions on their own to increase energy efficiency. The effects of education and outreach programs are difficult to measure, even though program evaluations consistently show that people who go on to participate in programs have increased awareness of energy efficiency options and often sign up for programs in some measure because of the educational outreach activities. Non-participant surveys also show increased awareness of energy efficiency options due to public education campaigns, with some of these customers taking actions on their own.

This program is not subject to cost effectiveness screening, which is deemed inappropriate according to the California Standard Practice Manual:

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

Types of activities that would be included in this program are:

- General mass media campaign for the public on pending gas price increases and ways to help control utility bills through energy efficiency measures and actions
- Development of (update of the) Vectren North website to include the latest energy efficiency information for commercial, residential and school use
- Targeted educational campaign for businesses
- Targeted training and educational program for trade allies
- Distribution of federal ENERGY STAR and other national organization materials in the service territory
- A schools curriculum program to educate teachers and direct students to available educational materials on the Web about energy efficiency opportunities

[31] Note that it is assumed that the individual program budgets include funds for development of program-specific advertising materials, such as brochures; this program covers public awareness and education campaign materials that would address all programs within a market sector. The funding is therefore not duplicative.

The schools program component would proceed as follows:

- Develop an energy education outreach program targeting Vectren North service territory schools K-12.
- Provide energy curricula to schools that teach students the fundamentals of energy and how to change behavior to conserve.
- Secure consultant services to provide teacher training and classroom materials.
- Provide teacher training.

Rational for Program

The energy efficiency market is made up primarily of private sector activities, which can be significantly influenced by public sector actions. The key to greater energy efficiency is convincing the families and businesses making housing, appliance and equipment purchases to opt for greater energy efficiency. The first step in convincing the public and businesses is to raise their energy efficiency awareness. These program elements are designed to work in tandem to increase the public's understanding of the benefits to them and society created through greater energy efficiency.

Although it is likely that customers within Vectren North's service territory have been exposed to some public education material from electric utilities, there is a need for a major outreach initiative on gas energy savings opportunities. This is particularly so because of media warnings of significant increases in gas prices which are anticipated for this winter (2005 -2006) due to the effects of hurricanes Katrina and Rita. More directly to the point of this Plan, since Vectren's programs will all be new to the marketplace, it is imperative that a broad public education and outreach campaign be launched to not only raise awareness of what consumers can do to save energy and control their energy bills, but to prime them for participating in the various DSM program offerings that will be implemented over the next several months following regulatory approval. Without a significant public outreach campaign, it would be difficult to achieve the levels of participation represented in this Plan as reasonable targets for the programs.

Program Participation and Savings

This program would address markets by sector–general public, businesses and institutions, trade allies and school children and teachers. There would be no "participants" per se, although for direct contact activities, feedback forms and other means of identifying those exposed to the educational materials can be developed.

Marketing Plans

Not applicable.

Detailed Budget Plans

The various educational program elements are adapted from the successful New York program, which is carried out in partnership with the federal Energy Star Program. The general public education or Awareness-Raising Program will use the Energy Star ratings as a platform for its "buy energy efficient appliances" message. A breakdown of budgetary items for the program elements described is shown in Table 55 below. The budget item and amounts should be used to generate ideas for implementation. We would expect budget allocation decisions between media channels and specific media buys to be best made by program implementers. Flexibility is also required on the timing of education expenses. It may be desirable, for example, to front load spending in the early years of program implementation. Accordingly, the budget figures in Table 55 are for the full five-year period rather than try to estimate the timing of expenses.

Table 55. Public Education Budget Items and Amounts

Budget Item	Budget
Produce Public Service Announcements	$150,000
Develop an Energy Star Promotional Program	$480,000
Develop and Printing of Literature	$150,000
In-House Production of Print Material	$90,000
Quarterly Meetings with Trade Allies and Business Leaders	$75,000
Purchasing Promotional Items	$105,000
Educational Pages on Website	$195,000
TV, Radio and Print Advertising	$1,200,000
Total 5-Year Budget:	**$2,445,000**

Performance Tracking

General public awareness questions will be added to ongoing corporate satisfaction surveys (typically conducted by Customer Service staffs at most utilities).

VII. PROGRAM COST EFFECTIVENESS

Program cost effectiveness analysis answers the question of would we be better off with the DSM program compared to not having the program. The answer almost always depends on who is asking the question. In other words, better off from whose perspective? Standard DSM cost effectiveness analysis includes four perspectives that will be addressed in this report:

- Total Resource Cost (TRC)
- Participant
- Ratepayer Impact (RIM)
- Administrators Cost (formerly named Utility Cost)

A detailed discussion of cost effectiveness methodology, including the four standard tests listed above, is included in Appendix D. In this section we present the results of the cost effectiveness analysis beginning with a summary of total budget and therm savings across all programs followed by a discussion of avoided gas costs. Cost effectiveness results are then presented for each perspective and DSM program.

Expected Program Costs

The total program budget and cumulative therm savings over the first five years of program activity is shown in Table 56 below. We recommend a minimum of five years for program implementation and tuning for maximum effectiveness.

Table 56. Total Program Budget

	Small Building	G/S EE	Customized	Hospitality	MF Buildings	EE Home Builders	All Programs	Dollars per Customer	Percent of Revenue
Year 1	$1,268	$266	$140	$161	$132	$175	$2,142	$3.76	0.3%
Year 2	$1,863	$359	$137	$187	$123	$218	$2,888	$5.07	0.4%
Year 3	$2,484	$478	$179	$235	$137	$283	$3,797	$6.66	0.5%
Year 4	$3,105	$596	$222	$287	$137	$283	$4,630	$8.12	0.6%
Year 5	$3,726	$596	$222	$287	$137	$283	$5,251	$9.21	0.7%
Total	**$12,446**	**$2,294**	**$901**	**$1,157**	**$666**	**$1,243**	**$18,708**	**$32.82**	

Program budgets include fixed costs for fully loaded program staff and expenditures for general public education and awareness. Public education spending is discussed in the Program Plans section. Staffing assumptions to administer the collective bundle of programs are listed in the table below. Staffing and public education expenditures have been allocated back to each program based on the distribution of cumulative savings. Total program cost is shown in the table below.