

# Natural Gas Demand-Side Management Programs: A National Survey

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## ABSTRACT

This paper reports on a survey of ten gas utilities with comprehensive demand-side management (DSM) programs for their customers. It includes data on budget level, amount of gas savings, ratio of gas savings per program dollar, utility motivation to implement gas DSM programs, cost effectiveness of gas DSM programs as a whole, and whether or not the utility has financial incentives to implement the programs.

The survey shows that leading utilities are spending at least 0.7% of their revenues on gas DSM programs, and reducing gas consumption among their customers by 0.5-1.0% per year. On average, the ten utilities are saving 72,700 MCF (thousand cubic feet) of gas per million dollars of DSM program expenditures. The benefit-cost ratio of the programs surveyed ranges from 1.6 to 5.6, with an average value of 2.7. Most utilities use the Total Resource Cost (TRC) test or a societal benefit-cost test to evaluate cost effectiveness. Finally, our survey indicates that utilities with financial incentives for utility shareholders tend to spend a slightly greater percentage of revenues and save more per dollar spent than utilities without incentives.

## Introduction

There has been an upward trend in natural gas prices since 2002, with wholesale gas prices skyrocketing to as much as \$15 per million Btu (equivalent to about \$15 per thousand cubic feet) in the latter part of 2005. Wholesale gas prices declined to around \$7-8 per thousand cubic feet in early 2006, still high by historical standards. And with markets very tight, the Energy Information Administration (EIA) projects that gas prices will remain high for years to come (EIA 2006).

U.S. natural gas consumption has remained relatively constant at 22 to 23 trillion cubic feet per year over the past decade. The EIA projects that gas use will rise 1.15% per year on average during 2004-2020 (EIA 2006). Increasing natural gas consumption causes a number of problems including:

- It contributes to high energy bills;
- It depletes finite natural gas resources;
- It necessitates more importation of natural gas which is costly, difficult, and increases security risks; and
- It exerts significant upward pressure on prices during this period of very tight gas markets.

Natural gas demand-side management (DSM) programs reduce natural gas consumption by improving the energy efficiency of buildings, space heating systems, water heating, and other gas appliances. This lowers the gas bills of consumers and businesses that adopt these measures, and also provides broader societal benefits including reducing natural gas imports, reducing the

risk of gas shortages, and putting downward pressure on natural gas prices (Elliott and Shipley 2005).

## **Purpose**

This paper presents a survey of gas demand-side management (DSM) programs operated by gas utilities with comprehensive programs for their customers. It includes data on budget level, amount of gas savings, ratio of gas savings per program dollar, utility motivation to implement gas DSM programs, cost effectiveness of gas DSM programs as a whole, whether or not the utility has financial incentives to implement the programs, and other key factors.

The survey covers ten major gas utilities in different regions of the country and presents data for 2004. It pertains to each utility's overall set of gas DSM programs, not individual programs, thereby complementing other studies such as the *America's Best Natural Gas Energy Efficiency Programs* report published by ACEEE (Kushler, York, and Witte 2003). In summary, we provide a snapshot of gas DSM program activity and performance in the United States as of 2004.

## **Methodology**

The authors selected thirteen geographically-dispersed gas utilities we knew were implementing comprehensive DSM programs. Of the 13 utilities and program administrators chosen for this research, ten responded with some results and five answered all of our questions (see Appendix A for a list of individuals contacted). Through additional research, we were able to obtain complete survey results for all ten utilities.

We reviewed existing literature on natural gas DSM programs and obtained contact names for utility and non-utility program administrators. We interviewed approximately 30 utility and non-utility contacts to obtain data for the programs listed below. For information unavailable through contacts, utility websites and annual reports were used. The ten utilities included are: Aquila (MN), Centerpoint Energy (MN), Keyspan (MA), Northwest Natural Gas (OR), NSTAR (MA), Pacific Gas and Electric (CA), Puget Sound Energy (WA), Southern California Gas (CA), Vermont Gas (VT), and Xcel Energy (MN). In each case, we report 2004 program data.

In some cases utilities are contributing DSM program dollars to statewide low-income home weatherization programs; in other cases this is done separately from gas DSM programs. We included the weatherization contribution when it was reported by the utility and was a small part of their overall DSM effort. In cases where this is a separate and/or a large activity, we did not include it as part of the utility's DSM program.<sup>1</sup>

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<sup>1</sup>Low-income weatherization tends to be more costly per unit of energy savings compared to other types of gas DSM programs. PG&E's gas DSM programs, for example, are saving 12 times more gas per program dollar compared to the utility's contribution to low-income home weatherization (Luboff 2006).

## Results

Table 1 lists the amount of utility spending on natural gas DSM programs, the percentage of retail revenues that was spent on the programs, the natural gas savings attributed to the programs in terms of first year savings, the percentage of gas sales that was saved, the amount of gas saved per million dollars of program activity, and the Benefit-Cost Ratio (BCR) determined by the utility or other program administrator.

**Table 1. Overview of 2004 Gas DSM Programs Surveyed**

	Program spending (million \$)	% of retail revenues	Gas savings (MCF/yr) (1)	% of gas sales saved	MCF/yr saved per million dollars (2)	Benefit-Cost Ratio (3)
<b>Aquila (MN) (4)</b>	2.1	1.4	146,000	0.5	69,000	--
<b>Centerpoint</b>	5.6	0.5	720,000	0.5	129,000	2.6
<b>Keyspan</b>	12.0	1.0	490,000	0.4	41,000	3.00
<b>Northwest Natural Gas (5)</b>	4.7	0.7	85,000	0.1	18,000	--
<b>NSTAR</b>	3.9	0.8	71,500	0.2	18,000	2.29
<b>PG&amp;E</b>	21.7	0.7	2,040,000	0.7	94,000	2.1
<b>PSE</b>	3.8	0.4	311,000	0.5	82,000	1.93
<b>So Cal Gas</b>	21.0	0.6	1,100,000	0.3	53,000	2.67
<b>Vermont Gas</b>	1.1	1.6	57,000	1.0	57,000	5.6
<b>Xcel (MN)</b>	4.0	0.7	663,000	0.9	166,000	1.56
<b>Average (6)</b>	7.9	0.8	564,000	0.5	72,700	2.7
<b>Median</b>	4.3	0.7	400,500	0.5	63,000	2.4

Notes:

- (1) An MCF is one thousand cubic feet, and is equivalent to 10.26 therms.
- (2) First year energy savings per million dollars of program expenditures.
- (3) For utilities which report a variety of benefit-cost ratios, we present the value based on the Total Resource Cost (TRC) test.
- (4) Aquila uses the societal test for determining the DSM benefit-cost ratio but did not provide a value for 2004 programs.
- (5) DSM programs, other than low-income home weatherization, are now implemented by the Energy Trust of Oregon (ETO) for Northwest Natural Gas Company. Includes both DSM programs and low-income weatherization in Oregon only.
- (6) Average weights all utilities equally.

Our survey shows that these ten utilities were spending between 0.4% and 1.6% of their retail revenues on DSM programs, and were reducing their gas consumption by 0.1% to 1.0% per year, from programs implemented in 2004 alone. On average (and without weighting by utility size), the utilities spent 0.8% of revenues and reduced gas sales by 0.5% from DSM programs implemented in 2004. In absolute terms, only three utilities (SoCal Gas, PG&E, and Keyspan) were spending over \$10 million per year on their DSM efforts. Taken together, the ten utilities saved about 5.6 billion cubic feet of gas per year as a result of DSM programs implemented in 2004. We want to note, however, that the energy savings and cost effectiveness data in Table 1

have not been independently verified and may be estimates rather than results from impact evaluations. Therefore, comparisons should be made with caution.

Spending a small percentage of revenues on DSM programs may sound trivial, but it can result in substantial natural gas savings. Southern California Gas Company, for example, spent 0.58% of retail gas revenues on gas DSM programs in 2004, amounting to over \$21 million, and saved 1.1 billion cubic feet of gas that year as a result. PG&E spent a similar amount of money and reported saving about 2.0 billion cubic feet of gas in 2004.

Three of ten utilities spent 1% or more of their revenues on DSM programs, but this higher spending level did not necessarily lead to greater gas savings as a fraction of total sales. The percentage of natural gas sales saved ranged from 0.2% or less (NSTAR and NW Natural Gas) to 1% (Vermont Gas). Four programs fell below 0.5% savings, and six accomplished 0.5% savings or higher, as a fraction of total gas sales.

In the case of Northwest Natural Gas, a utility bill surcharge provides over \$8 million per year of funding for energy efficiency programs. But actual program expenditures were well below this level in 2004 due to a transition in program implementation from the utility to the Energy Trust of Oregon (Gordon 2006). This also reduced the amount of energy savings achieved in 2004, as a fraction of total gas sales.

Table 1 includes the amount of gas saved per unit of DSM program expenditures. This ratio varies from as little as 18,000 MCF/yr per million dollars (Northwest Natural Gas and NSTAR) to 166,000 MCF/yr per million dollars (Xcel Energy). Five of the utilities report saving at least 65,000 MCF/yr per million dollars.

We believe this wide disparity in savings per program dollar is due to a number of factors, including: 1) variations in climate (greater savings potential in colder climates), 2) differing emphases among utilities (more savings per program dollar from commercial-industrial programs compared to residential programs), 3) differing levels of utility subsidy (some utilities pay a large fraction of the cost of efficiency measures, others a smaller fraction), and 4) the degree to which the DSM effort supports low-income home weatherization (weatherization provides relatively limited energy savings per dollar of program expenditures). In addition, there are likely to be differences in the way energy savings are measured among the utilities, such as whether or not savings are adjusted to exclude estimated “free riders.” We did not obtain information on the methodologies used to estimate energy savings.

The eight utilities that reported information on the cost effectiveness of their DSM programs found that the programs are very cost effective, with overall benefit-cost ratios (BCRs) ranging from 1.6 to 5.6. Six of the utilities reported an overall BCR of 2.0 or greater, the median BCR is 2.4, and the average BCR for all eight utilities reporting this information was 2.7. Most utilities use either the Total Resource Cost (TRC) test or a societal benefit-cost test to determine cost effectiveness. It should be noted that the BCRs are based on natural gas prices as of 2004. Given the substantial increase in gas prices since 2004, gas DSM programs should be even more cost effective today.

Table 2 lists program components of the ten utilities’ DSM programs. All programs serve residential and commercial customers, and all but two serve industrial customers. Programs for low-income households and incentives for high efficiency equipment and building retrofit are the most popular types of programs.

**Table 2. Natural Gas DSM Program Components**

	Residential	C&I	Weather-ization	Low income	Audits	Retrofits/ Equipment	New construction	Other
<b>Aquila</b>	X	X		X	X		X	Tree planting, Rebates
<b>Centerpoint</b>	X	X		X		X		
<b>Keyspan</b>	X	X (1)	X	X	X	X		
<b>NW Natural Gas</b>	X	X (1)	X	X	X	X	X	Administered by Energy Trust of Oregon
<b>NSTAR</b>	X	X	X	X		X	X	Rebates, not for large industrial.
<b>PG&amp;E</b>	X	X		X (2)		X	X	Incentives, agricultural
<b>PSE</b>	X	X	X	X	X	X	X	Education
<b>So Cal Gas</b>	X	X		X	X	X	X	Training for C&I, multi-lingual programs
<b>Vermont Gas</b>	X	X				X	X	Works with Efficiency Vermont to promote DSM
<b>Xcel (MN)</b>	X	X		X	X	X		

Notes:

- (1) Program is not offered to industrial customers
- (2) PG&E provides funding for low-income home weatherization program, but the spending and savings for this program are not included in this analysis.

## General trends and tendencies

Most of the gas utilities included in this survey are eligible for shareholder incentives (five of the utilities) or are able to decouple gas sales and fixed cost recovery (three of the utilities). These policies overcome (or help to overcome) the financial disincentive that gas utilities face when they implement energy efficiency programs under traditional rate regulation. The utilities with shareholder incentives, namely Aquila, Centerpoint, Keyspan, NSTAR and Xcel Energy, tend to save more per unit of program expenditures than the utilities without such incentives, and also spend a slightly greater percentage of revenues on gas DSM programs than utilities without incentives.

Two utilities use outside organizations to administer or help promote their DSM programs, Northwest Natural Gas through the Energy Trust of Oregon<sup>2</sup> (ETO) and Vermont Gas through Efficiency Vermont.<sup>3</sup> These programs were designed by state utility commissions,

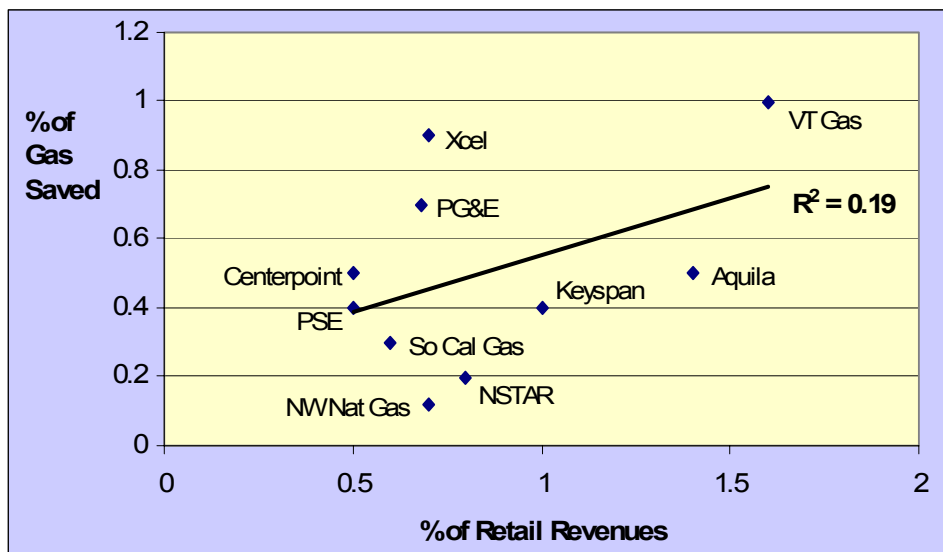
<sup>2</sup><http://www.energytrust.org/Frames/Frameset.html?mainFrame=http%3A//www.energytrust.org/Pages/about/index.html>

<sup>3</sup>Efficiency Vermont was created by: the Vermont Public Service Board, the Vermont Legislature (in response to a request from the Vermont Department of Public Service), all of the state's twenty-two electric utilities, and a dozen consumer and environmental groups. Efficiency Vermont is administered by the Vermont Energy Investment

following passage of legislation calling for such action. In both of these states, gas and electricity DSM programs are funded by public benefits charges on customers' utility bills. In the case of Vermont Gas, the utility administers the DSM program and works with Efficiency Vermont on promotion and implementation.

As shown in Figure 2, there is a moderate correlation between the percentage of overall revenues spent on gas DSM programs and the percentage of natural gas saved by the programs, with the savings percentage increasing as the spending percentage increases. However, some utilities such as Xcel Energy, PG&E, and Vermont Gas save much more gas per dollar of spending than other utilities. Both PG&E and Xcel Energy achieve a large amount of gas savings from very effective programs directed to their commercial and industrial customers (Kushler, York and Witte 2003). Also, natural gas is relatively expensive in California and Vermont, meaning that DSM expenditures as a percentage of revenues are lower in these states than would be the case if gas prices were more typical.

**Figure 2. Percentages of Gas Sales Saved and Retail Revenues Expended, 2004 Gas DSM Programs**



Another issue we investigated was whether the utilities offer DSM programs to all customers or just to their full service customers (i.e., excluding larger customers that purchase gas commodity on the wholesale market and pay the utility for transport only). The response to this question was about evenly split with five utilities offering programs to full service customers only, four to all customers, and one utility (Aquila) offering programs to full service customers in one state and all customers in another state.

In general, program managers reported a high degree of satisfaction with the gas DSM programs. Most of the utilities plan to increase natural gas DSM funding levels in the future due to state mandates and/or rising gas prices, and many are exceeding their energy savings goals or requirements.

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Corporation (VEIC), an independent non-profit energy services organization under contract to the Vermont Public Service Board. <http://www.encyvermont.org/index.cfm?L1=147&L2=340&sub=bus>

Gas and electric utilities in California have implemented large-scale DSM programs for over 20 years. In 2004, gas utility spending on DSM programs was moderate (i.e., 0.6-0.7% of revenues). However, gas DSM spending will increase in the near future due to new energy savings goals and program funding levels approved by the California Public Utilities Commission (CPUC). Funding for the gas DSM programs during 2006-2008 will more than double the previous amount, averaging about \$110 million per year statewide. The goal is to save over 4.6 billion cubic feet per year by 2008 (CPUC 2005).

By 2013, gas savings is expected to reach over 43 billion cubic feet as a result of gas DSM programs implemented in California during 2004-2013, equivalent to the gas consumption of one million households. If the goals are achieved, it will cut growth in gas consumption in California by almost half (WGA 2006).

## Conclusion

A number of gas utilities across the country implement noteworthy gas DSM programs for their customers. The leading utilities were spending at least 0.7% of revenues on these programs and were saving 0.5 - 1.0% of their gas sales as of 2004. In most cases, state regulators have either decoupled gas sales and fixed cost recovery or adopted some form of shareholder incentive related to DSM program performance. Utilities with shareholder incentives tend to save natural gas more per unit of program expenditures than the utilities without such incentives, and also spend a slightly greater percentage of revenues on gas DSM programs than utilities without incentives.

Based on our survey, there appears to be a moderate correlation between spending as a fraction of revenues and gas savings as a fraction of gas sales. The more money that is spent on gas DSM programs, the more energy that is saved, in percentage terms. However, there is a wide variation in the amount of gas savings achieved per million dollars of DSM program expenditures. Finally, gas DSM programs appear to be very cost-effective. The utilities we surveyed reported overall benefit-cost ratios in the range of 1.6 to 5.6, with most in excess of 2.0.

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## Appendix A: Individuals and Organizations Contacted

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Angela Kline	Centerpoint/ Minnegasco
Charlie Olsson, Lou Lelli	NSTAR
Chris Neme	Efficiency Vermont
Fred Gordon, Elaine Krause	Energy Trust of Oregon
Jay Luboff	PG&E
Jim Grevatt, Karen Horne	Vermont Gas
John Hanson	NW Natural Gas
Marty Kushler, Neal Elliott	ACEEE
Matt Daunis	Aquila
Rachel Sours-Page	Xcel Energy
Rick Anderson and Lance DeLaura	SoCal Gas Company
Subid Wagley	Keyspan
William Hopkins, Michael Wehling	Puget Sound Energy