The Secret To Unleashing Natural Gas Utility Energy Efficiency Programs

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ABSTRACT

Almost universally, state legislative and regulatory bodies have embraced cost-recovery rate structures for local distribution companies engaged in serving broad markets with uneven potential for profitability. Cost-recovery rate design enables utilities to serve users that otherwise would not have had access to service without incurring tremendous up front distribution and pipeline interconnection costs. More recently, this form of rate design has provided some limited benefit to utilities offering energy efficiency services by allowing them to pass program costs on to the ratepayers. . Nevertheless, few utilities are comfortable with a role that unreservedly champions energy efficiency. This is particularly true for investor-owned, natural gas utilities due primarily to their lower avoided costs of energy commodity.

This paper addresses a significant impediment to natural gas efficiency programs, suggests the significance of overcoming the impediment and identifies an alternative regulatory framework for doing so. It begins by suggesting reasons why natural gas utilities have played a limited role in energy efficiency and roughly quantifies the opportunity remaining to save natural gas. It then explores traditional regulatory approaches intended to encourage utilities to offer energy efficiency programs. Finally, a regulatory model is proposed that greatly reduces the penalties for energy efficiency inherent in traditional regulation.

The Absentee Partner

When energy efficiency advocates and practitioners get together to work on collaborative solutions, all too frequently, there is an empty chair at the table. The gas utility, despite its potential additional resources for energy efficiency endeavors, is often less involved in regional and national energy efficiency and market transformation initiatives and programs. At least three reasons exist for this phenomenon.

Lost Margins

The most obvious reason for the utility's reluctance to participate in energy efficiency is concern over lost revenues[1]. While various approaches have been crafted to address this key concern, the problem resulting from a clash between the utility's basic value proposition and a social need to reduce consumption remains essentially unresolved. The issue of lost margins is treated more fully under the heading, "Working Toward Solutions."

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[1] While the problem of lost margin clearly plagues both gas and electric utilities, recent events temporarily diminished lost margin concerns for electric utilities. For some electric utilities in mid 2000, the wholesale cost of power exceeded their retail rates. In that scenario, conserving power meant making it available for sale at a higher margin, thus offsetting reduced retail margins.

Natural Gas Avoided Costs

A second barrier that prevents natural gas utilities from taking a seat at the energy efficiency table is their lower avoided cost of energy. Saving a therm of gas does not justify the same investment in energy efficiency as saving an equivalent amount of electricity.

Table1 illustrates the significant difference in the net present value of avoided costs between gas and electricity for similar end uses in Portland, Oregon. Using kilowatt-hours as a common unit of energy for comparability, the net present values[2] for saving required electricity and natural gas are contrasted. The ratios in the center column illustrate how much more additional expense can be justified to save electricity than to justify saving a comparable amount of natural gas. Saving natural gas with water heating[3] measures like efficient water heaters, clothes washers and dishwashers is nearly four times more difficult to justify economically.

Table 1. Avoided Costs of Natural Gas and Electricity in Portland, Oregon

Residential Electric Applications	Electric (NPV per kWh)	Ratio (Elect:Gas)	Natural Gas (NPV per equivalent kWh)	Residential Gas Applications
Zonal Electric Space Heating @ 100% efficiency, 30 Yr	**$.89**	**2.14:1**	**$0.41**	Gas Furnace Space Heating @ 80% AFUE, 25% Duct Loss
Forced Air Electric Space Heating @100% Efficiency & 25% duct loss, 30 Yr	**$1.19**	**2.86:1**	**$.41**	Gas Furnace Space Heating @ 80% AFUE, 25% Duct Loss
Electric Water Heating @ .90 Energy Factor. 15 year	**$.67**	**3.93:1**	**$.17**	Gas Water Heating @ .59 Energy Factor, 15 year

Source: Hanson, McVey, 2001

Natural Gas Market Density

The majority of efficiency programs are designed to reach low hanging (and densely distributed) fruit. With electricity in almost every American home and business, many opportunities exist to promote electrical energy efficiency. Natural gas on the other hand, is only in 51% of all homes. Additionally, there are far fewer gas applications for homes and businesses that use gas. It is typically limited to space and water heating, cooking and drying. It therefore is not surprising that the list of Energy Star programs applicable to natural gas is short. Table 2 illustrates how much more national attention is given to electric efficiency than to natural gas efficiency.

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[2] NPVs are over the specified lives of space heating and water heating equipment as shown.

[3] The case of water heating is cited due to its high load factor and striking low natural gas avoided costs.

Table 2. Energy Star Products by Targeted Fuel

Energy Star Products Addressing Electricity Efficiency		Energy Star Products Addressing Both Natural Gas And Electricity Efficiency
refrigerators room a/c air source heat pumps geothermal heat pumps central air-conditioning TVs VCRs TV-VCRs DVDs home audio systems set-top boxes cordless phones answering machines computers monitors ventilating fans transformers traffic lights exit signs	printers fax machines copiers scanners multifunction units CFLs lamps outdoor lighting fixtures suspended lighting fixtures cabinet lighting ceiling mounted fixtures wall mounted fixtures recessed fixtures architectural fixtures water coolers dehumidifiers ceiling fans	boilers furnaces programmable thermostats roofing products clothes washers dishwashers windows

Source: Energy Star website, 2002.

The disparity in program focus is reflected in a disparity in Energy Star program impacts. According to a 2000 study of Energy Star program impacts, the highest possible savings attributable to natural gas appliances roughly constitutes 5% of total saved energy attributable to the Energy Star Voluntary Labeling Program. (Webber, C., et al, 2000)[4]

While energy efficiency programs have done less with natural gas because the market was more difficult to address, the converse may also be true. Because energy efficiency programs have targeted natural gas use less than electric use, natural gas utilities have been less aware of opportunities to pursue energy efficiency. When you seldom attend parties, you may get fewer invitations. On the other hand, you can never go if you are never invited. As the authors will demonstrate, there is much energy being wasted with old inefficient natural gas appliances. Yet, too often, natural gas utilities move in a separate world, quite outside the energy efficiency community. The poor connection between the natural gas community and the energy efficiency community constitutes a primary barrier to natural gas efficiency.

[4] An updated version of the worksheet in this publication (updated April 20, 2001) is available on the web at http://enduse.lbl.gov/Projects/ESImpacts.html.

Quantifying the Opportunity

In 2000, natural gas consumption in the U.S. was estimated at 22.8 trillion cubic feet and projected to escalate to 33.8 Tcf by the year 2020. (EIA, 2002a) Within the residential, commercial, and industrial sectors consumption in 2000 broke down as follows:

Table 3. 2000 Gas and Electricity Consumption by Sector and End Use

	Natural Gas (Quads)	Electricity (Quads)
Residential	5.14	4.07
Space Heating	3.44	0.42
Water Heating	1.32	0.41
Cooking	0.2	0.11
Clothes Dryers	0.07	0.23
Other	0.12	2.9
Commercial	3.36	3.9
Space Heating	1.5	0.15
Space Cooling	0.01	0.45
Water Heating	0.65	0.15
Cooking	0.21	0.03
Other	0.99	3.12
Industrial	9.79	3.65

Source: EIA, Annual Energy Outlook 2002, Compilation of Data from Reference Case Tables 4, 5, and 6

As Table 3 illustrates, natural gas consumption actually exceeds electricity consumption within the residential and industrial sectors and closely matches that of the commercial sector. Despite the greater density of electric end-uses discussed earlier, natural gas efficiency may prove to be the new low-hanging fruit!

The tide does not seem to be turning, either. Demand for natural gas is predicted to increase by 66% in the Eastern and Western regions of the U.S by 2020. In the East, the largest increases in natural gas consumption are expected to increase with 1.8 trillion cubic feet of incremental consumption. In the West, natural gas demand in the Pacific and West South Central regions is expected to increase by 1.7 trillion cubic feet and 1.8 trillion cubic feet, respectively[5]. (EIA, AEO, 2002b)

Based upon known and generally proven technologies, natural gas consumption could be reduced in the residential and commercial sectors by two quadrillion Btu, or roughly 10% of the US natural gas consumption in 2001, according to a report sponsored by the American Council for an Energy Efficient Economy. These savings could be realized without significant compromise in amenity and more than 80 percent of the savings can be achieved at a cost of less than $ 0.50 per therm. (Suozzo and Nadel, 1998)

[5] Approximately half the projected demand in growth by 2020 is for expected electric generation, but broader use of combined heat and power is one significant way to address the need for greater efficiency. Also, natural gas efficiency in all sectors will help relieve the pressure on supply and dampen price volatility.

Working Toward Solutions

Given the tremendous saving potential of natural gas efficiency, it seems imperative for the natural gas industry to seriously engage in energy efficiency efforts. What can be done to assist natural gas utilities in playing a bigger role?

Lost Margin Recovery – A Partial Solution

A number of states have allowed utilities to recover lost margins resulting from successful utility energy efficiency programs. Under such mechanisms, potential programs are scrutinized quite thoroughly to assure that ratepayers get adequate value for their investments. The process of this scrutiny tends to raise certain issues with a fair degree of predictability.

Free-ridership is a frequent concern on the part of regulators asked to approve these mechanisms. Lost margin recovery mechanisms are premised on the assumption that only two neat categories of energy efficiency exist. In the first, energy efficiency "just happens" because it is market-viable, cost-effective for the consumer and would happen without any intervention. The second kind of energy efficiency would not happen without intervention. Utilities and regional program implementers are discouraged from offering the former and encouraged to offer the latter.

Reality, however, is slightly more complex with lots of gray area between "must intervene" and "must not intervene." In a survey conducted by NW Natural, seventy percent of residential customers expressed interest in learning more about saving energy or better managing their energy bills (NW Natural, 2001). However, what may constitute free-ridership for a customer with a high propensity to act to save energy, may be essential to move others to action. For others, any attempted market-based intervention may fail.

Complicating the concept of free-ridership further is the offsetting issue "free drivership" which shows up around the geographic and time boundaries of programs. Program communications may move significant numbers of households to adopt a new efficient technology for which the program may not count savings, thereby making recovery of the associated lost margins impossible for the utility.

Other challenges may be raised over questions of distributed attribution. When utilities collaborate in a project in diverse ways (one provides printed material; another provides a rebate), how are the savings attributed to each partner?

Finally, "non-energy benefits" which may include everything from the aesthetics of replacement windows to the cleaning effectiveness of efficient clothes washers are commonly hypothesized to be the true drivers of efficient technology adoption. Consequently, if the savings cannot be attributed to the utility's program, no lost margins will be recovered.

Lost margin recovery mechanisms have indeed made many energy efficiency programs possible and thus have proven to be quite valuable. Yet, for the reasons given above, discussions around these mechanisms are nearly always contentious in regulatory approval and review processes. Perhaps at root, the problem with margin recovery mechanisms is that they lend credibility to the assumption that utilities are appropriately in the business of selling as much energy as possible by compensating for the loss of inefficient energy consumption[6]. They nurture the schizophrenic notion that utilities should pursue both load growth and energy efficiency. Clearly, if a programmatically viable alternative could be developed that better aligned the interests of ratepayers with the utility and its shareholders; it would be superior to the margin recovery mechanism.

Performance-Based Ratemaking – A Difficult Solution

The concept of performance-based ratemaking (PBR) came into vogue in the early nineties as a means of improving the overall cost-effectiveness of delivering utility services. Generally, PBRs provide incentives for utilities to reduce costs associated with service provision without degradation in service levels. If a utility can do so, its shareholders stand to earn a higher return than under traditional, cost-of-service rate design.

While PBR brings balance and accountability to the utility ratemaking, the benefits come at the expense of simplicity. On the surface, benchmarking merely requires the measurement and benchmarking of key service measures such as number of outages, overall customer service levels, employee safety performance, and other metrics developed to protect the interests of customers and other stakeholder groups. The complexity comes in the process of finding agreement between regulatory bodies and the utility and the setting of subsequent performance targets.

Energy efficiency services might, or might not, be specified as a key service measure category. To the extent that they are not, management would be left to determine the value of efficiency programs vis-à-vis their contribution to the benchmarked service measures. Intuitively, if management perceived that existing service levels were positively influenced by efficiency services, PBR would tend to encourage cost-effective investment in efficiency services. In the case of Southern California Edison (SCE), the California Public Utilities Commission elected to isolate energy efficiency expenditures, thereby subjecting these expenditures to separate performance measures unique from typical operational measures. Under this scenario, incentives for DSM and conservation expenditures are allowed based upon energy efficiency program performance as opposed to the broader operational indicators of the entire company (such as number of outages, employee safety performance, etc.). (California PUC Sheet Numbers 27699-E, 24255-E, 26597-E, and 20386-E)

Performance Based Ratemaking is, in some sense, the missing piece in utility regulation that ironically has been gaining in popularity while the energy industry has been undergoing deregulation. Nevertheless, PBR, by itself, is not the sole solution. It does not remove the utility's basic business interest in load building and therefore, does not align the interests of utility and customers' interests in reducing energy costs.

NW Natural's Proposal – An Elegant Solution

NW Natural is an investor-owned, natural gas utility based in Portland, Oregon, serving most of Western Oregon and part of Southwest Washington. As part of its Integrated Resource Planning, the company seeks to provide cost-effective energy efficiency programs to its customers. Since the early nineties, the company has been able to recover lost margins resulting from a number of its energy efficiency programs including programs to promote high efficiency showerheads, water heaters, furnaces and clothes washers. While the

[6] Yet, utilities will not forfeit revenues based upon a system that offers them no viable alternatives for success.

company's lost margin mechanism[7] has made these programs possible, there is more the company could do to promote energy efficiency. Currently, NW Natural is prepared to launch a new program designed to target customers who most need weatherization help. It also is in the early stages of planning for programs that would promote Energy Star appliances, programmable thermostats and high-efficiency, instantaneous water heaters. The company is also interested in helping its customers fix leaking ductwork. Presently, none of these programs has been launched by NW Natural due to concerns over the lost margin impacts that these programs would have on company earnings and the complexity of finding suitable ways to recover lost margins.

Summary of NWN's proposed solution. NW Natural recently proposed to state regulators a mechanism designed to remove the remaining barrier (the "more is better" value proposition) to its offering of additional energy efficiency programs. The proposal, called "Distribution Margin Normalization" (DMN) would essentially "decouple" NWN margins from its throughput of commodity.

The company's filing with the Oregon Public Utility Commission consisted of two parts and was intended to address the needs of natural gas customers and the company's shareholders as gas commodity prices rose and became quite volatile in 2000 and 2001. The first part of the company's proposal included funding for public purposes similar to those required by OR SB 1149 which required electric IOUs to collect funds for Oregon "public purposes" including among others, energy efficiency market transformation.

The second part of the proposal would implement DMN by first establishing a balancing account for distribution margin. Then, each month, the company would compare the actual average usage of residential and commercial customers to the expected average usage assumed for these customers in the company's most recent rate case. Any difference in therms times the applicable margin revenue would be booked to the balancing account for collection or refund.

As proposed, NW Natural's DMN would apply to all residential and commercial customers present on its system during the company's last rate case test year. New residential and commercial customers who are new to the system would be excluded from the "normalized" group of customers in order to eliminate controversy over what to assume for these customers' usage levels. Likewise, industrial customers would be excluded because their loads vary dramatically from month to month and year to year for reasons that are often unrelated to commodity prices. (Carver, P., et. al., 2001)

[7] In 1994, the Oregon Public Utility Commission approved NW Natural's Conservation Resource Adjustment mechanism (NNG Advice No. OPUC 93-27A), which allows for the recovery of lost margin revenue resulting from energy savings achieved through approved energy efficiency programs.

Objectives of distribution margin normalization. DMN allows the company to recover the margin revenue associated with a fixed sales volume regardless of actual sales. It is equivalent (from the company's perspective) to straight-fixed variable rate design[8], but from the customer's standpoint, still sends a volumetric price signal. Should actual sales be lower than the fixed level, the company recovers the margin shortfall though an adjustment to rates. If sales exceed the fixed target, the company refunds the excess margin.

Objective #1: Align the interests of the company with those of its customers. NW Natural has observed from its ongoing primary research, that residential and commercial customers want advice regarding how to manage their consumption, and hence, their bills. (NW Natural, 2001) Most utilities are interested in providing some level of this sort of help. However, under the current regulatory structure, every therm of gas that a customer saves represents, to the utility, lost revenue, un-recovered fixed costs, and earnings problems for shareholders. Utilities have had to grow accustomed to a strange game of tug-of-war, wherein they must pull the rope from both the customer's side as well as the investor's.

Essentially, for energy utilities to be in conflict with customers with regard to energy efficiency is unnecessary since a customer's total annual usage has almost nothing to do with the company's fixed costs of service. The utility requires the same plant investment and the same number of employees regardless of how much energy a customer uses. NW Natural's DMN proposal provides the benefit of straight fixed variable pricing while still transmitting a volumetric conservation price signal to the end user.

Objective #2: Reduce volatility. The energy market in recent years has been characterized by growing volatility. End users have had to budget around unstable energy prices. Unpredictable earnings have resulted in a "feast to famine" scenario for utilities. NW Natural's DMN would reduce volatility not only in its own earnings, but also in customers' energy bills.

Table 4 illustrates the effect of DMN on the residential retail cost of one therm under assumptions of both high and low elasticity responses to fluctuations in temperature. "For purposes of illustration, sales fluctuations resulting from various weather scenarios were tempered by the effect of price elasticity…If prices increased by…fifteen percent, and elasticity is assumed to be –0.1, then any change in sales driven by weather will be reduced by 1.5% [9] The effect is to soften the weather induced sales swings on the assumption the same price effects that reduce (or increase) sales overall will have a similar effect on weather driven heating loads" (Hanson and McVey, 2001)

Table 4. Effect of DMN on Following Season's Retail Rates

Weather	Low Elasticity Case	High Elasticity Case	Billing Effect
Colder – 20 year low	-$0.020	-$0.005	Refund
Normal Weather	$0.024	$0.041	Collect
Warmer– 20 year high	$0.061	$0.079	Collect

Source: Hanson, McVey, 2001

[8] Straight-fixed variable rate design passes all fixed wholesale costs through to retail customers as fixed periodic charges while transmitting variable costs to the retail customer as variable charges.
[9] Elasticity of –0.1 x price increase of .015 = 1.5% change in sales.

“Thus, in the high elasticity case, the response to extreme cold weather only slightly offsets the strong price response, … resulting in a -$0.005 per therm refund to customers in the following heating season.” Even in the worst case (20 year high temperature in the high elasticity case), the incremental effect of the mechanism on retail rates would result in a collection of about $0.08 per therm in the following heating season and would be less than the rate reduction expected to result from a decrease in the wholesale cost of gas. Additionally, unusually high collections could be spread over several years. (Hanson, McVey, 2001)

The experience of others corroborates NW Natural’s conclusions on the effect of decoupling on retail rates. A group of energy efficiency advocates representing NW Energy Coalition, Natural Resources Defense Counsel, Community Action Directors of Oregon and the Oregon Office of Energy have filed testimony with the Oregon Public Utility Commission in favor of NW Natural’s proposed DMN. In it, they provide substantive examples of how decoupling mechanisms like NW Natural’s have reduced volatility in several states. (Carver, P. et. al., 2001)

Of particular relevance in the testimony is a “Lawrence Berkeley Laboratory (LBL) report, The Theory and Practice of Decoupling. [It] provides details on the historic impacts of ERAM [electric rate adjustment mechanism[10]] in California as it examines the first decade of ERAM results. The report concludes that ERAM ‘has had a negligible effect on rate levels and has, for PG&E, actually reduced rate volatility.’ In addition, ‘…the clearing of ERAM balances has accounted for only a small proportion of the total change in revenue requirements between 1983-1993.’ In its first six years in operation in California, ERAM reduced operating revenues for California’s three largest utilities nine times and increased them eight times; the average adjustment was one-fourth of one percent. The LBL report also estimates a decrease in the standard deviation of annual rate changes for two utilities (for PG&E, 9.5% to 7.5%; for SDG&E, 7.9% to 7.4%). Based on these estimates, they conclude that there has been no risk shifting at all for these two California utilities. ‘The record in California indicates that the risk-shifting accounted for by ERAM is small or non-existent and, in any case, ERAM has contributed far less to rate volatility than have other adjustments to rates, such as the fuel-adjustment clause.’ Instead, they conclude, ERAM has been accompanied by rate risk reductions to customers and profit risk reductions to utilities. The LBL report also concluded that decoupling did not insulate management from the need to focus on expenses and customers.” (Eto, J., Stoft, S., and Beldon, T., 1993)

Objective #3: Reduce contentiousness in rate cases. The experience of many utilities and regulators with the issue of “normal use” in rate cases is long and often painful. Determining “normal” use per customer is almost as difficult as the return on equity issue, and can be more significant of an issue in terms of revenue requirement involved. Determining normal use depends on how normal weather is measured, and how one goes about determining use per customer as a function of weather, as well as other variables affecting consumption.

DMN eliminates the temptation to “game” normal use per customer by either the utility or the state commission. Even if the wrong usage per customer is developed in a rate case, the DMN will automatically adjust revenues to the level of the distribution margin per customer established in the rate case. Thus, neither customers nor company are advantaged or disadvantaged by the outcome of the commission’s decision on normal use per customer.

[10] Similar to NW Natural’s proposed, Distribution Margin Normalization

The DMN mechanism would eliminate a source of conflict in rate cases that simply does not need to exist. (Hanson and McVey, 2001)

Objective #4: Preserve volumetric price signals to conserve energy. A final advantage worthy of noting is that NW Natural's proposed mechanism does not unnecessarily interfere with price signals. Decoupling preserves the conservation signals that volumetric rates transmit to customers during peak periods, helping to rationalize capacity efficiently. From the company's perspective, however, costs are recovered as they are incurred.

Likewise, deferred revenue requirement, in the form of collections or refunds, could be held in a deferred account until there were opportunities to amortize balances when the amortization does not exacerbate higher rates. In the example for NW Natural, it is likely, in the near term, that customers will experience a rate reduction next Purchased Gas Adjustment (PGA) cycle due to lower gas costs. That would be a good time to flow through surcharges, if any. In the event of a cold winter and where the company had refunds, they could be returned to customers somewhat contemporaneously in a lump sum to help offset the higher heating bills. (Hanson and McVey, 2001)

Conclusion

Despite significant potential for natural gas efficiency, most gas utilities are not as involved in energy efficiency as electric utilities. For natural gas utilities to become more involved in energy efficiency, significant momentum must be overcome. For the majority of gas utilities, energy efficiency has not historically been at the fore of their thinking. Neither has gas efficiency been the primary object of energy efficiency organizations. Further, their lower avoided costs of saving energy makes energy efficiency harder to cost-justify for the gas utility. Consequently, extra effort must be exerted to help natural gas utilities embrace energy efficiency.

The maxim, "you get what you reward" applies to utility rate structures. If the utility is rewarded primarily for increased throughput, increased throughput will be the first priority of the utility. Mechanisms that temporarily restore lost margins will not turn the utility aside from its abiding mission to build load. Performance-based ratemaking with its embedded rewards for excellent service, safety and even energy efficiency, will not divert the utility from its pursuit of revenue growth through growth in throughput.

Conversely, if the utility is rewarded with earnings created though excellent management regardless of throughput, concern over throughput will fade away. Without that distraction of fickle weather, volatile commodity costs and their impacts on earnings, utility managers will focus more on pleasing customers and managing costs and assets. These objectives can be well served with energy efficiency offerings.

NW Natural's DMN or similar mechanisms would change the way utilities serve their customers and make business decisions and the new utility might evolve into a company quite different from the old-fashioned stereotypical distribution company. As its value proposition would be freed from the perpetual need to move more and more commodity, it would focus on evolving its services to be more and more attuned to the needs if its market.

Just as gas utilities could benefit from a new, undistracted focus on helping their customers save energy, the energy efficiency community could also benefit from the utility's new ability to support energy efficiency. Gas utilities, as well as electric utilities, could lend their longstanding customer trust relationships, billing systems and IT resources to national and regional initiatives.

A growing national consumption of energy is not good for society, but it is still good for utilities. Change in regulatory policy, such as NW Natural's proposed Distribution Margin Normalization would achieve, will align the success of the utility with society's best interests.

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