TESTIMONY OF WILLIAM STEINHURST
SENIOR CONSULTANT
SYNAPSE ENERGY ECONOMICS, INC.
ON BEHALF OF
CITIZENS ACTION COALITION, INC.
CAUSE NO. 42598 BEFORE THE
INDIANA UTILITY REGULATORY COMMISSION

1. Introduction

Q. PLEASE STATE YOUR NAME AND OCCUPATION.

A. My name is William Steinhurst, and I am Senior Consultant with Synapse Energy Economics (Synapse). My business address is 45 State Street, #394, Montpelier, Vermont 05602. Synapse's main offices are at 22 Pearl St., Cambridge, Massachusetts 02139.

Q. PLEASE OUTLINE YOUR EDUCATIONAL BACKGROUND.

A. I received a B.A. in Physics from Wesleyan University in May, 1970. In May, 1980, I was awarded a Master of Science degree in Statistics from the University of Vermont. In May, 1988, I received a Ph.D. in Mechanical Engineering from the University of Vermont.

Q. PLEASE SUMMARIZE YOUR PROFESSIONAL EXPERIENCE.

A. I have twenty-three years experience in utility regulation and energy policy. Since joining Synapse in 2003, I have worked on renewable portfolio standards and portfolio management practices for default service providers and regulated utilities, power procurement, green marketing, distributed resource issues, economic impact studies, and rate design. Prior to joining Synapse, I served at the Vermont Department of Public Service from 1981 to 2003, first as Planning Econometrician and, beginning in 1986 as Director for Regulated Utility Planning. In those positions, I was responsible for energy efficiency policy and oversight, power procurement approvals, economic forecasting and quantitative methods, cost benefit analysis, long range policy planning, various aspects of rate setting and construction permitting litigation, enforcement proceedings, and integrated resource

planning. Previously, I served as Chief of Research and Statistics and Director of Planning and Research at the Vermont Department of Corrections; as Acting Deputy Commissioner and Director of Planning and Evaluation at the Vermont Department of Social and Rehabilitation Services, and as Director of Planning at the Vermont Agency of Human Services.

I have written or co-authored numerous papers and reports on utility regulation, energy policy, statistics, and modeling. I have consulted for various clients, including the Illinois Energy Office, the Massachusetts Executive Office of Energy Resources, the Natural Resources Defense Council, the Regulatory Assistance Project, the Connecticut Office of Consumer Counsel, the Maine Office of the Public Advocate, AARP, the Conservation Law Foundation, the Vermont Auditor of Accounts, the James River Corporation, the Nova Scotia Utility and Review Board, and the Newfoundland Department of Natural Resources.

I have testified as an expert witness in approximately 30 cases on topics including utility rates and ratemaking policy, prudence reviews, integrated resource planning, demand side management policy and program design, utility financings, regulatory enforcement, green marketing, power purchases, statistical analysis, and decision analysis. I have been a frequent witness in legislative hearings and represented the State of Vermont in numerous structured and informal negotiations addressing energy efficiency, resource planning and distributed resources.

I was the lead author or co-author of Vermont's long-term energy plans for 1983, 1988, and 1991, as well as the 1998 report *Fueling Vermont's Future: Comprehensive Energy Plan and Greenhouse Gas Action Plan*, and Synapse's study *Portfolio Management: How to Procure Electricity Resources to Provide Reliable, Low-Cost, and Efficient Electricity Services to All Retail Customers.*

I have included a detailed resume as Attachment 1 to this prefiled testimony.

Q. HAVE YOU TESTIFIED PREVIOUSLY IN INDIANA?

A. No.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. I have reviewed Vectren North's proposal for mechanisms to mitigate the impact of gas cost increases and instability in the gas commodity market and believe Vectren has missed significant opportunities to do both. Specifically, I will examine Vectren North's energy efficiency programs, or lack of energy efficiency programs. [1] I then offer policy recommendations regarding DSM program design, funding and implementation.

Q. HOW IS YOUR TESTIMONY ORGANIZED?

A. Following this introduction, I first discuss a natural gas utility's general obligations regarding energy efficiency programs and recommend that the Commission declare that Vectren North (the Company) has an inherent obligation to plan for and acquire all cost effective DSM resources. I then review the status of DSM programs in the Company's service territory, as well as gas DSM programs elsewhere. I then discuss the nature of sound DSM program design and recommend certain principles that should govern the Company's DSM programs and their implementation. Next, I discuss several methods for funding DSM programs and recommend that a system benefit charge approach be adopted. In addition, I discuss the level of funding proposed by the Company and recommend a general range of funding that is more in keeping with its least cost service obligations.

Finally, I review a recent trend towards entrusting DSM program development and delivery to an independent (non-utility) third party. I explain the benefits of such an approach and recommend that the Commission adopt it. I also discuss certain transitional processes that I recommend the Commission adopt to govern DSM program development and delivery between now and the time such an independent third party is in place.

2. Energy Efficiency Obligations

[1] They are also often called demand side management (DSM) programs.

Q. HAVING REVIEWED THE COMPANY'S PAST AND PROPOSED ENERGY EFFICIENCY PROGRAMS, AND FROM A BROAD UTILITY POLICY PERSPECTIVE, WHAT DO YOU CONCLUDE REGARDING THE COMPANY'S DSM OBLIGATION?

A. As a matter of public policy, it is appropriate and necessary for the public interest for the Commission to make clear that the acquisition of cost-effective DSM resources, as part of the resource portfolio for meeting the Company's energy needs, is essential to sound and economical management of the Company's public service obligations.

Among the reasons supporting this conclusion is the overriding obligation of the Company to provide least cost service and the fact that substantial efficiency resources are available at life cycle present value costs less than the life cycle cost of supplying and delivering gas. Without such actions, the Company cannot be said to have fulfilled its obligation to deliver service at costs that are reasonable.

Q. WHAT IS LEAST COST PLANNING AND YOUR UNDERSTANDING OF INDIANA'S REQUIREMENT FOR GAS UTILITIES TO PERFORM LEAST COST PLANNING?

A. As I understand it, Indiana law has no *per se* requirement for gas utilities to do "least cost planning" as it does for electric utilities. However, Indiana law does state that, "Every public utility is required to furnish reasonably adequate service and facilities."[2] In addition, the Commission is charged with inquiring into "the management of the business of all public utilities,"[3] and the Commission has broad discretion to disallow for purposes of setting rates any imprudent expenditures.[4] Indiana law also requires gas utilities to make "...every reasonable effort to acquire long-term gas supplies so as to provide gas to its retail customers at the lowest gas cost reasonably possible..." Ind. Code 8-1-2-42(g)(3)(A).

[2] Ind. Code § 8-1-2-4.
[3] Ind. Code § 8-1-2-48
[4] L.S.Ayers & Co. v. Indianapolis Power & Light Co., 169 Ind. App. 652, 351 N.E.2d 814 (1976).

Given this policy background in Indiana, it would seem clear that gas utilities in Indiana must demonstrate the least cost nature of their capital investments in order to recover their costs. With respect to least-cost planning, the Commission has stated that, "[it] is a planning approach which will find the set of options most likely to provide utility services at the lowest cost once appropriate service and reliability levels are determined with the goal of minimizing long run costs of providing adequate and reliable services to customers.[5]

Q. ARE THERE OTHER INDIANA CODE PROVISIONS THAT YOU BELIEVE SUPPORT A POLICY OF LEAST COST PLANNING?

Yes, there are. For example, customers may file a complaint with and get relief from the Commission if a utility's rates or services are unreasonable and inadequate. Ind. Code 8-1-2-54 states,

> "Upon a complaint made against any public utility . . . that any of the rates, tolls, charges or schedules . . . are in any respect unreasonable or unjustly discriminatory, or that any regulation, measurement, practice or act whatsoever affecting or relating to the service of any public utility, or any service in connection therewith, is in any respect unreasonable, unsafe, insufficient or unjustly discriminatory, or that any service is inadequate or can not be obtained, the commission shall proceed, with or without notice, to make such investigation as it may deem necessary or convenient.

Also, Indiana Code 8-1-2-69 provides that:

> Whenever, upon the investigation made under the provisions of this chapter, the commission shall find any regulations, measurements, practices, acts, or service to be unjust, unreasonable, unwholesome, unsanitary, unsafe, insufficient, preferential, unjustly discriminatory, or otherwise in violation of any of the provisions of this chapter, or shall find that any service is inadequate or that any service which can be reasonably demanded can not be obtained, the commission shall determine and declare and by order fix just and reasonable measurements, regulations, acts, practices, or service to be furnished, imposed, observed, and followed in the future in lieu of those found to be unjust, unreasonable, unwholesome,

[5] In Re SIGECO, Cause No. 38738 (1989), 1989 Ind. PUC LEXIS 378, 9-10 (Ind. PUC, 1989)

> unsanitary, unsafe, insufficient, preferential, unjustly discriminatory, inadequate, or otherwise in violation of this chapter, as the case may be, and shall make such other order respecting such measurement, regulation, act, practice, or service as shall be just and reasonable.

Another example is the Alternative Utility Regulation Act, which applies to both gas and electric utilities, and in which the Indiana General Assembly declared the "provision of safe, adequate, efficient, and economical retail energy services is a *continuing goal of the commission* in the exercise of its jurisdiction."[6] *Emphasis* added. Although each of these provisions may individually have specific legal consequences, taken generally and collectively together they indicate a policy of requiring gas utilities to provide gas service at the lowest reasonable cost consistent with prudent management.

Q. IS THERE EVIDENCE GENERALLY THAT ENERGY EFFICIENCY AND DSM CAN CONTRIBUTE TO PROVIDING REASONABLE AND ADEQUATE NATURAL GAS SERVICE AT THE LOWEST COST?

Yes, there is. While not as numerous as studies of electricity DSM potential, studies have shown that enormous untapped energy efficiency resources are available in the natural gas sector, that those resources are adequate to meet a large part of present and future demand for electricity, and that they are more economical and more efficient than producing and delivering natural gas.[7]

For these reasons, acquisition of substantial cost-effective efficiency resources is feasible and is consistent with the Company's responsibility to provide natural gas service at least cost.

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[6] Ind. Code § 8-1- 2.5-1(1)

[7] See, for example, M. Kushler, D. York, and P. Witte, 2003, *Responding to the Natural Gas Crisis: America's Best Natural gas Energy Efficiency Programs*: ACEEE; D. York and M. Kushler, 2004, *Tapping Our Hidden Reserves: America's Exemplary Natural Gas Energy Efficiency Programs*, a Report presented at the 2004 ACEEE Summer Study on Energy Efficiency in Buildings; F. Coito and M. Rufo, 2003a, *California Statewide Residential sector Energy Efficiency Potential Study, Final Report, Volume 1 of 2 Main Report*: KEMA-XENERGY Inc.; and F. Coito and M. Rufo, 2003b, *California Statewide Commercial Sector Natural Gas Energy Efficiency Potential Study, Final Report, Volume 1 of 2 Main Report*: KEMA-XENERGY Inc.

Q. HOW MUCH GAS DSM POTENTIAL IS THERE IN INDIANA?

A. As far as I know, there is no gas DSM potential study available for Indiana. The role of DSM potential studies is discussed further below. For the moment, I will only observe that such a study will be necessary eventually to guide DSM program design, but in the short run clear targets of opportunity for cost-effective gas DSM exist in very large amounts. So, even without such studies, I believe that there is a significant potential in gas energy efficiency improvements through gas DSM activities in Indiana.

For example, a recent study by ACEEE that examined successful experiences in gas DSM programs across the U.S., and two other studies by KEMA-XENERGY, Inc., on significant gas DSM potentials in California, shed light on the likely potential in Indiana from two different perspectives.

Q. PLEASE EXPLAIN THE ACEEE STUDY AND ITS IMPLICATIONS FOR INDIANA.

A. The ACEEE study summarizes performance of over 30 gas DSM programs across the U.S. (See Attachment 3 to this prefiled testimony.)[8] Among those programs are seven that delivered substantial savings with a life time cost of conserved energy ranging from $0.07 per therm to $0.80 per therm, averaging $0.38 per therm. To put that into perspective, the cost of natural gas for the residential sector in the Midwest during the winter season has been from $0.72 per therm to $0.92 per therm for the past few years.[9] Nine of the programs in the study provided benefit-cost ratios, and those ranged from 1.08 to 5.05, averaging 1.98. It is worth noting that during the years covered by these benefit-cost ratios natural gas prices were somewhat lower than they are now or are expected to be in the near future, but all the programs were cost-effective at those prices. If prices remain higher than pre-2003 levels, the programs would likely be even more cost-effective.

[8] Kushler, et al., *op. cit.*
[9] EIA, "Residential Natural Gas Prices: Information for Consumers," available at

The implication of this study for Indiana is that substantial amounts of cost effective gas DSM resources are available in both residential and commercial/industrial sectors.

Q. PLEASE EXPLAIN THE GAS DSM EXPERIENCE AND RECENT STUDIES OF THE REMAINING POTENTIAL FOR CALIFORNIA AND THE IMPLICATIONS FOR INDIANA.

A. California has a long history of gas DSM programs. As a result, California has saved 2 billion therms over the past 25 years.[10] Therefore, studies of whether there is additional cost effective gas DSM potential in California are of particular interest, because if after all that investment there is yet more potential, we may be confident that a permanent gas DSM mandate is appropriate. And, in fact, two recent studies show that significant potential in natural gas energy efficiency improvements remains in California, despite past successes.

One of the studies examined the residential sector and found a remaining cost effective gas DSM potential of between 51 million therms to 238 million therms over 10 years.[11] (See Attachment 4 to this prefiled testimony.) That savings translates into gross benefits ranging from $320 million to $1 billion even under the authors' base case energy cost projection. The low end savings would be achieved by continuing California utilities' existing level of funding ($28 million per year) and the high end value represents the estimated savings under the authors' "Max Achievable" funding scenario (a DSM budget of $80 million per year).[12] As a result, the residential sector yields net avoided-cost benefits of $9 million to $260 million under those two scenarios with benefit-cost ratios of 1.03 and 1.34, respectively.

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http://www.eia.doe.gov/oil_gas/natural_gas/analysis_publications/natbro/gasprices.htm

[10] F. Coito and M. Rufo, 2003b, *op. cit.*

[11] Coito and Rufo, 2003a, *op. cit.,* E-1.

[12] Max Achievable potential is 64 percent of the total economic potential for the residential sector and 73 percent for the commercial sector, and is defined as "maximum achievable potential that could occur if all customers were made fully aware and knowledgeable of cost-effective efficiency measures and all incremental costs were paid for by the

The other study estimated efficiency potentials in the commercial sector.[13] This study concluded that the commercial sector could save from 30 million therms to 193 million therms over 10 years, depending on the funding level. (See Attachment 5 to this prefiled testimony.) The program costs vary from $9 million per year for continuing current programs to $65 million per year under the authors' Max Achievable scenario. The monetary savings are estimated to range from $143 million to $784 million for these scenarios, which translates into net benefits of $40 million to $206 million during the next 10 years. The benefit-cost ratios range from 1.36 to 1.46.

I would note that these studies took a conservative approach to estimating savings potential, because they focused on retrofit measures and excluded the savings potential from DSM during major renovations and new construction, neglected environmental and economic development benefits, and did not consider the impact of lower natural gas demand on market prices and volatility. Such "lost opportunity" savings are usually quite substantial and among the least expensive to obtain. Further, the studies were limited to commercially available technologies and do not consider efficiency technologies still in the pipeline, even though they represent estimates for savings over a long period of program implementation.

Taking into consideration California's past successes and the substantial future potential for gas DSM that still remains, it seems reasonable to conclude that tremendous gas energy efficiency potentials exist in Indiana. Certainly, the lack of gas DSM programs to date suggests that significant untapped opportunities exist. With increased funding for efficiency programs, Indiana should be able to substantially reduce future gas consumption and gain significant benefits for ratepayers, contribute to economic growth in Indiana and help protect the environment and human health.

Q. PLEASE EXPLAIN RECENT TRENDS IN THE NATURAL GAS MARKET AND THE IMPLICATION OF THOSE TRENDS FOR INDIANA.

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program." (Coito and Rufo, 2003a, E-7)
[13] Coito and Rufo, 2003b, *op. cit.*.

A. Natural gas prices have been increasing and the degree of the increase in the past four years is significantly higher than historic increases. (See Attachment 6 to this prefiled testimony.) According to the Industrial Energy Consumers of America (IECA), the average natural gas price at the Henry Hub was $2.39 during the 46 months before June 2000 and averaged $4.44 for the following 46 months from June 2000 to March 2004. IECA estimated that during the last 46 months since natural gas prices began to increase in June 2000, U.S. consumers have paid over $130 billion more for natural gas than they have paid in the previous 46 month period.[14]

Also, during the past four years, natural gas prices became more volatile. (See Attachment 7 to this prefiled testimony.) In February 2003, the Henry Hub recorded $18.85 per Mcf, which is roughly 4 times higher than the average price in the same year. (See Attachment 8 to this prefiled testimony.) Annualized standard deviations of gas prices between July 1999 and June 2003 averaged over 50%, compared to less than 40% in the preceding four years. Fast growing demand for natural gas due to increases in natural gas consumption for power plants and residential heating has outpaced production capacity and has caused this unusual price increase and volatility.[15] Given the current situation, the ability of natural gas DSM programs to reduce natural gas prices and volatility is increasingly important because DSM works to reduce customers' natural gas consumption, which eventually provides downward pressure on wholesale markets. I discuss this issue further below.

Q. HOW IS THE NATURAL GAS MARKET EXPECTED TO MOVE IN THE FUTURE?

A. Natural gas prices are expected to remain high in the short and long term. According to Energy Information Administration's Short-Term Energy Outlook released in

[14] Industrial Energy Consumers of America, April 15, 2004, 46 Month Natural Gas Crisis has Cost U.S. Consumers Over $130 Billion. http://www.ieca-us.com/downloads/natgas/$130billion.doc
[15] M. Kushler, D. York, and P. Witte, 2003.

August 2004, natural gas spot prices at the Henry Hub are predicted to average $6.21 per Mcf ($0.60 per therm) this year and $6.60 per Mcf ($ 0.64 per therm) in 2005. [16]

The American Council for an Energy Efficient Economy (ACEEE) also predicts higher natural gas prices in the future, which results in higher natural gas bills for consumers.

> Residential retail prices for 2003-04 are projected to be $2 per thousand cubic feet (Mcf) [$0.19 per therm] higher than for 2002-03, with the higher prices projected to persist for at least the next four years. These residential consumers will begin to experience the price increases this fall with a national average 36% increase in natural gas bills.[17]

In the long term, EIA predicts higher natural gas prices than historical trends. Annual Energy Outlook 2004 concludes that gas prices at its reference scenario will average $3.40 per Mcf ($0.33 per therm) in 2010 and $4.40 per Mcf ($0.43 per therm) in 2025.[18] The National Petroleum Council also estimated higher prices for natural gas. NPC predicts that the average annual prices at Henry Hub could range from $5 per Mcf ($0.49 per therm) to $7 per Mcf ($0.68 per therm) by 2025 unless any measures such as to increase energy efficiency and supply diversity and to reduce regulatory uncertainty are taken.[19] Natural gas price volatility is expected to remain an issue of concern.[20]

The consensus is that gas markets are likely to remain unstable and unclear, but there is good reason to believe that gas prices and price volatility are likely to be higher than historical values. In order to avoid this uncertainty and reduce natural gas prices, Indiana should start implementing gas DSM and increase investments in energy efficiency.

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[16] http://www.futuresbuzz.com/eia.html
[17] Kushler, M., York, D., and Wite P., 2003, *Responding to the Natural Gas Crisis: America's Best Natural Gas Energy Efficiency Programs*. Washington, D.C., American Council for an Energy-Efficient Economy, Available at http://www.aceee.org/store/proddetail.cfm?CFID=569382&CFTOKEN=28344766&ItemID=373&CategoryID=7
[18] EIA, 2004, "Annual Outlook with Projections to 2025" in *Annual Energy Outlook 2004*, available at http://www.eia.doe.gov/oiaf/aeo/gas.html
[19] National Petroleum Council, 2003, *Balancing Natural Gas Policy: Fueling the Demands of a Growing Economy*, Washington, D.C.
[20] B. Henning, 2002, *Natural Gas Supply: Understanding Gas Price Volatility,* presentation at NASEO Winter Fuels Outlook, available at http://www.naseo.org/events/winterfuels/2002/presentations/Henning.pdf

Q. HOW CAN DSM AVOID OR REDUCE PRICE VOLATILITY AND HELP CONTRIBUTE TO NATURAL GAS PRICE REDUCTION?

A. The goal of natural gas DSM is to strategically conserve natural gas by improving energy efficiency where cost effective, thereby reducing overall demand for natural gas.[21] Thus gas DSM measures directly protect consumers from rising and volatile natural gas prices. But they also provide indirect, though powerful, protection from rising gas prices and increasing volatility through the ability of those savings to exert downward pressure on gas markets.[22]

Lawrence Berkeley National Laboratory (LBNL) recently compared a dozen modeling studies that looked at the impacts of renewable energy and energy efficiency on natural gas prices in order to quantify the impact those savings have on market prices for gas.[23] These studies include five studies by EIA, five studies by the Union of Concerned Scientists (UCS), one study by the Tellus Institute, and one by ACEEE. As a result of their examination of these studies, LBNL concluded that "each 1% reduction in natural gas demand could lead to a long-term average wellhead price reduction of 0.75% to 2.5, with some of the models predicting even more aggressive price reductions."[24]

Q. WHAT OTHER BENEFITS CAN NATURAL GAS DSM PROVIDE?

A. In addition to lowering natural gas prices, reducing natural gas bills, and avoiding risks associated with price volatility, natural gas DSM can help (1) defer investments in natural gas networks; (2) enhance energy independence; (3) protect the environment and

[21] Efficiency measures affecting end uses present at times of peak requirements or high prices are particularly valuable as they reduce the need for capital expenditures, storage, and other costs driven by peak demand. Interruptible load arrangements are, of course, also of value for this purpose, but the driving consideration is the total benefit of programs, not just their impact on peak demand.

[22] Note these effects are also created by any other measures that reduce natural gas consumption, such as renewable energy and electric DSM.

[23] R. Wiser, M. Bolinger, & M. Clair, 2004, *Putting Downward Pressure on Natural Gas Prices: The Impact of Renewable Energy and Energy Efficiency*, Lawrence Berkeley National Laboratory, presented at the 2004 ACEEE Summer Study on Energy Efficiency in Buildings..

[24] Ibid., page 8-307.

public health; (4) assist low-income customers; and (5) create jobs and stimulate the local economy.

- *Deferring investments in natural gas networks*. Natural gas DSM helps reduce gas peak demand, thereby potentially deferring or avoiding expensive upgrades and construction of natural gas distribution and transmission pipelines and storage. Consequently natural gas DSM could provide a significant benefit to gas utilities and consumers. The financial benefits to utilities also include reduced expenses for bad debt and customer service associated with high bills.
- *Enhancing energy independence and diversity*. As a result of natural gas demand increase, LNG import is predicted to increase in the future. The amount of natural gas to be imported in 2025 is predicted to be 7.24 trillion cubic feet, more than twice the current level. This prediction is mainly driven by a significant increase in imported liquefied natural gas (LNG), which is predicted to reach 4.8 trillion cubic feet in 2025, eleven times the current imported LNG level.[25] The United States will therefore depend more on foreign countries to meet its natural gas needs, leaving the country in a potentially more vulnerable position from both an economic and a security perspective. Natural gas DSM can play a role in maintaining and enhancing energy independence and diversity
- *Improving the environment*. Even though natural gas is a relatively clean fuel in comparison to oil and coal, it is a limited resource and emits green house gases (GHGs) and nitrogen oxides (NOx) when it is burned, which contributes to global climate change. The extraction of natural gas can emit a poisonous gas, hydrogen sulphide. Further, gas pipeline siting creates a variety of land use and safety concerns. Every therm saved through efficiency results in less natural gas consumption and thus reduces the above human health, pollution, and environmental impacts.
- *Creating jobs and stimulating local economy.* First, natural gas DSM often utilizes local resources, such as local labor and technologies, and thus DSM expenditures stay

in the local economy. Second, lower natural gas bills keep more money in-state and can help reduce natural gas market prices as discussed earlier, lowering the cost of production for local businesses. As a result, natural gas DSM programs contribute to increasing the disposal income of local people and making local businesses and industries more competitive.

- *Helping low-income customers.* Low-income customers bear a far greater financial burden, proportionally, than non-low income customers when prices are increased because the energy burden (the percentage of a household's income required to pay its energy costs) on low-income customers is significantly higher than for other residential customers. In 2002/2003 in Indiana, low-income customers below 50% of federal poverty level paid 37% or more of their annual income simply for their home energy bills, while the comparable burden on customers between 150% and 185% of the federal poverty level was only 6.8%. (See Attachment 10 to this prefiled testimony.) Fisher, Sheehan & Colton point out that "actual low-income energy bills exceeded affordable energy bills in Indiana by nearly $235 million at 2002/2003 winter heating fuel prices." Natural gas DSM programs help alleviate such burdens by making natural gas bills more affordable for low-income customers. Further, utilities and ratepayers benefit from reduced bad debt, late payment, shut off and reconnect expense.

Q. DO YOU HAVE AN OVERALL RECOMMENDATION REGARDING THE COMPANY'S DSM OBLIGATION?

A. Yes. I recommend that the Commission find that the Company has an inherent obligation to provide least cost service, that to do so it is essential to acquire cost-effective efficiency resources and to treat them on a "level playing field" with purchasing, transmission and distribution resources both in planning and in the funding and implementation of resource plans.

[25] EIA, 2004, *Annual Energy Outlook 2004*, available at http://www.eia.doe.gov/oiaf/aeo/aeoref_tab.html

Q. HOW SHOULD SUCH EFFICIENCY PROGRAMS BE CONCEIVED? WHAT SHOULD BE THEIR SCOPE?

A. I recommend that the Commission clearly enunciate certain efficiency program design principles, set out in section 4 of my testimony below, as part of the DSM obligation of the Company.

3. Gas DSM Programs in the Company's Service Territory and Elsewhere.

Q. WHAT HAVE BEEN THE RESULTS OF THE COMPANY'S DSM PROGRAMS?

A. To the best of my knowledge, the Company has not implemented any DSM programs aside from transferring certain funds to Community Action Agencies to supplement Low Income Weatherization services.

Q. WHAT IS THE STATUS OF NATURAL GAS DMS PROGRAMS IN OTHER STATES?

A. There is one comprehensive study conducted by ACEEE regarding natural gas DSM programs across the U.S.[26] It is called *Responding to the Natural Gas Crisis: America's Best Natural Gas Energy Efficiency Program*. In 2003, ACEEE surveyed 50 states and District of Columbia for natural gas DSM programs. They found that there were 22 states that had utility-funded natural gas DSM programs in place. There were also four states where gas DSM programs were under consideration, not including Indiana.

The programs in the 22 states fell into two groups: (1) individual programs and (2) comprehensive program portfolios and collaboratives. Individual programs were of two main types: residential and commercial/industrial programs. Residential programs included retrofit, audit, space heating equipment, windows, new construction, low-income single family, multifamily, and appliances programs. Commercial/industrial programs included technical assistance and demonstration, building and equipment retrofit, new

[26] M. Kushler, D. York, and P. Witte, 2003, *Responding to the Natural Gas Crisis: America's Best Natural gas*

construction, and small business programs. Comprehensive program portfolios and collaboratives served all types of customers and provided a comprehensive range of products and services to help customers improve their energy efficiency.

4. DSM Program Design

Q. WHAT PRINCIPLES OF GOOD DSM PROGRAM DESIGN DO YOU RECOMMEND FOR ADOPTION BY THE COMMISSION?

A. I recommend that the Commission adopt, at a minimum, the following requirements to advance the design and delivery of well-designed DSM programs, including gas DSM programs:

1. Seek opportunities to overcome existing market barriers, both to ensure that energy savings are achieved in the short- to medium-term, and to promote the transformation of the efficiency market over the long-term.
2. Be designed to minimize "lost opportunities." Lost opportunities occur when efficiency measures are not installed at the time when it is most cost-effective to do so (e.g., the construction of a new building or facility, building renovations, and the purchase of new appliances or equipment) or when some measures are left out of a DSM intervention (e.g., arbitrarily limiting or excluding cost effective measures at the time of a customer's engagement with a DSM program).
3. Be designed to avoid "cream skimming." Cream-skimming occurs when only the most cost-effective efficiency measures are installed, even though additional or different, higher-cost measures would be cost effective. Cream-skimming can lead to lost opportunities, because revisiting a customer to install the remaining measures may involve prohibitive transaction costs and certainly would require additional transaction costs that need not be incurred.

Energy Efficiency Programs: ACEEE.

4. Be designed to provide efficiency savings to all types of customer classes and subclasses. This will promote equitable use of the efficiency funds, and will help maintain customer and political support for DSM.
5. Be cost effective by design. This will help increase the societal value of the efficiency expenditures, and will help maintain customer and political support for the DSM charge.
6. Seek to address as many different cost-effective end-uses as possible.
    a. For residential customers the key natural gas efficiency measures include: hot water heating measures (including energy efficient water heaters, water heater insulation, pipe insulation, set point reductions, resource-efficient clothes washers, low flow shower heads, and faucet aerators) and space heating measures (including weatherization, installation of energy-efficient windows and other building shell measures, duct sealing and insulation, high efficiency furnaces and boilers, and improved controls), efficient clothes dryers, and building design measures, such as shade trees.
    b. For commercial and industrial customers the key natural gas efficiency measures include: hot water heating measures as described above; heating ventilation and air conditioning (HVAC) measures (including shell measures as described above, efficient boilers and heat distribution and improved control systems), and process heat measures.
7. Competitively bid key elements of the program in order to harness market forces, lower costs, and help develop the market for efficiency vendors and service companies.

Q. WHAT GENERAL APPROACHES TO YOU RECOMMEND FOR GOOD DSM PROGRAM DELIVERY?

A. I recommend that the Commission adopt, at a minimum, the following requirements for DSM program implementation, including gas DSM programs:[27]

[27] M. Kushler, D. York, and P. Witte, 2003, op. cit.

1. Programs should draw on a variety of delivery mechanisms as necessary to achieve high levels of participation by consumers. Those mechanisms should include financial incentives, technical assistance, marketing and education activities.
2. Program design and delivery should pay close attention to the needs and readiness to participate of all relevant groups, including the various types of customers, trade allies (retailers of energy efficiency products and energy consuming equipment, building contractors, architects and building engineers, developers, and institutions that finance purchase, construction and renovation of buildings).
3. Program designs, incentives and eligibility criteria should be consistent and chosen to facilitate ready participation by customers, contractors, retailers and the like, but programs should also include flexibility where appropriate to maximize savings and participation and to accommodate effective and efficient service in situations where multiple programs are relevant to a particular audience or customer location, especially in the large commercial and industrial sector, where technology specific measures may be needed.
4. "Whole-house" and "whole-building" approaches should be employed in relevant residential and commercial/industrial programs to take advantage of savings (both energy and cost) available from integrated design of measures and building systems.
5. Strategic partnerships should be developed with retailers and wholesalers of energy consuming and energy saving equipment and of building components, builders, architects and engineers, manufacturers of energy consuming and energy saving equipment, and trade associations of such entities. Such partnerships or collaborations should include activities to provide energy efficiency training and education for those parties.
6. As markets for various energy efficient technologies mature and energy efficient levels of building and equipment standards progress, programs should be updated to continue delivering maximum additional savings while reducing free ridership.
7. A comprehensive portfolio of programs should be developed both because this approach will avoid creation of lost opportunities and because comprehensive programs provide more efficient program delivery.

8. Program effectiveness should be reviewed objectively and routinely; adjustments to incentives, marketing and other services should be made promptly in order to achieve high levels of participation and maximum savings.

Q. IN WHAT WAYS CAN ONE MEASURE THE COST-EFFECTIVENESS OF DSM PROGRAMS?

A. Five tests have been developed to consider efficiency costs and benefits from different perspectives. These tests are described below.

- *The Participant Test*. The goal of this test is to determine the impact of efficiency on the customer that participates in the efficiency program. The costs include all the direct expenses incurred by the customer to purchase, install and operate an efficiency measure. The benefits include the reduction in the customer's energy bills, as well as any financial incentive paid by the program administrator.
- *The Energy System Test*. The goal of this test is to determine the impact of efficiency on the total direct cost of providing energy service. This test is most consistent with the way that supply-side resources are evaluated by traditional utilities. The costs include all expenditures by the program administrator implementer (or program administrator) to design, plan, administer, monitor and evaluate efficiency programs. The benefits include all the avoided energy acquisition costs, as well as avoided transmission and distribution costs.
- *The Total Resource Cost (TRC) Test*. The goal of this test is to determine the total cash costs and benefits of the efficiency program, regardless of who pays and benefits from it. The costs include all the expenditures by the program administrator, plus all the direct costs incurred by the customer. The benefits include all the avoided utility costs, plus any other cost savings for the customer such as avoided water costs, reduced operations and maintenance costs to the customer, or non-energy benefits to customers.
- *The Societal Cost Test*. The goal of this test is to determine the total costs and benefits of efficiency to all of society, including more difficult to quantify benefits such as environmental benefits and economic development impacts. The costs and benefits are the

same as for the TRC Test, except that the benefits also include monetized values of environmental and economic development benefits.

- *The Ratepayer Impact Measure (RIM) Test*. The goal of this test is to determine the impact on those customers that do not participate in the energy efficiency programs, by measuring the impact on electric or gas rates. The costs include all the expenditures by the program administrator, plus the "lost revenues" to the utility as a result of having to recover fixed costs over fewer sales. The benefits include the avoided utility costs.

Q. WHAT COST-EFFECTIVENESS TEST DO YOU RECOMMEND FOR DSM PROGRAMS?

A. The Societal Cost Test is the best standard for evaluating the cost-effectiveness of efficiency programs. This is the only test that includes all benefits and costs to all members of society. Ideally, environmental impacts from avoided resources (generation, transmission and distribution) should be quantified, monetized and included as part of the avoided costs of energy efficiency.

The Energy System Test is the next best standard for evaluating the cost-effectiveness of efficiency programs. This test indicates the extent to which total energy costs will be reduced as a result of the program administrator's efficiency investments. This test is consistent with the methodology that vertically-integrated utilities use to evaluate the cost-effectiveness of various power supply resources.

I recommend that the Commission adopt one of these tests for screening energy efficiency measures and programs.

5. Funding Energy Efficiency Programs

Q. HOW SHOULD THE AMOUNT OF FUNDING THAT IS ALLOCATED FOR DSM PROGRAMS BE DETERMINED?

A. The level of program funding should be sufficient to make a substantial impact on the energy efficiency industry. Ideally, budgets would be large enough to support all cost-effective energy efficiency programs, and to achieve market transformation of key efficiency measures.

Determination of funding levels should be driven by the market potential for DSM and the cost-effectiveness of those programs. This should begin with performing detailed market potential studies. Once those studies are completed, a variety of programs would be selected and designed to acquire that potential resource and then analyzed for cost-effectiveness.

Q. DOES THIS MEAN THAT THE COMPANY'S EXISTING CONTRIBUTIONS TO DSM PROGRAMS SHOULD BE PUT "ON HOLD" OR CANCELLED UNTIL AFTER A MARKET POTENTIAL STUDY?

A. No, it does not. It is important to note that in almost any utility jurisdiction there will be a number of programs that can be implemented without benefit of a market potential study because those programs are designed to meet obvious end-uses. Such programs include low-income weatherization, incentives for certain efficient equipment and new construction efficiency programs for all customer classes. The purpose of the market potential studies recommended here is not to state the potential of DSM for obvious end-uses, and they should *not* be a reason for suspending the Company's existing contributions to low-income weatherization programs. Rather, such studies can and should be done in parallel with that activity and, possibly, additional high priority programs and will reveal important information about less obvious end-uses as well as ways in which program design can achieve greater saturation levels.

Q. HOW DOES THE COMPANY CURRENTLY DETERMINE ITS LEVEL OF FUNDING FOR DSM PROGRAMS?

A. To my knowledge, Vectren has no outright gas DSM programs, only some Low-income programs that resulted from settlements – therefore what funding there is comes from the company's PR efforts or negotiated settlements.

Cost-effective DSM is part of the Company's public service obligation, and the Company ought to be proposing to implement all cost-effective programs, not picking and choosing and implementing programs at its desired pace.

Q. WHAT ARE THE LEADING METHODS FOR FUNDING ENERGY EFFICIENCY PROGRAMS FOR GAS AND ELECTRIC UTILITIES?

A. Two primary methods are used to fund utility energy efficiency programs. The traditional method is to include the costs of the programs in the utility revenue requirements in rate cases. Vermont Gas Systems is an example of a utility that uses this approach. A different method has become more common in recent years. That is the use of a rate surcharge, commonly called a system benefits charge or SBC. For example, in states that have restructured their electric utility industry, this approach has been widely accepted. On the natural gas side, the Energy Trust of Oregon receives about $3.4 million dollars per year for gas DSM from a 1.5% surcharge on retail sales in Oregon by Northwest Natural Gas.[28] Additional examples of natural gas DSM programs funded by SBCs include some or all of the gas utilities in California, New Hampshire, New Jersey, Oregon, Washington, and Wisconsin.[29]

System benefits charges are typically volumetric, that is, a set amount of money per unit of energy consumed, such as cents/therm or a set percentage of the bill, as in Oregon. A system benefit charge is usually shown as a separate line item on the customer's bill with an appropriate label, such as "Efficiency Charge" or "System Benefit Charge."

An SBC is a mechanism for supporting energy efficiency programs using funds that are collected from all customers in the state. The charge should be applied to each therm of natural gas consumed by customers and collected by local distribution companies. It is important to distinguish between an SBC as defined here and the other mechanisms that are used to recover DSM outlays. An SBC is a stable, dedicated funding source for system benefit programs, unlike recoveries that are rolled into rates, which simply allow the Company to recover whatever level of spending it chooses to allocate for efficiency programs.

[28] Kushler, York and Wite, 2003, *op. cit.*
[29] IndEco and Navigant Consulting, 2004, *DSM in North American Gas Utilities*; M. Kushler, D. York, and P. Wite, 2003, *Responding to the Natural Gas Crisis: America's Best Natural Gas Energy Efficiency Programs*, ACEEE

An SBC to support energy efficiency is particularly important whenever there is potential for introduction of retail competition because it offers the best means of implementing energy efficiency programs. For those states that have not restructured, an SBC provides a secure source of funding for energy efficiency initiatives, and creates certainty regarding the level of efficiency that will be implemented. For those states that have, or might, restructure, an SBC provides a competitively-neutral source of funding from all customers, regardless of which competitive suppliers serve each customer.

Q. WHICH FUNDING APPROACH DO YOU RECOMMEND IN THIS CASE?

A. I recommend that the Commission implement a system benefit charge approach to funding gas energy efficiency programs. There are several reasons for this recommendation. First, an SBC segregates the approved level of funding and helps to ensure that it is available for and used for the intended purpose. In fact, it would make sense to require the utility to transfer those funds to a fiscal agent who would disburse them back to the program upon documented expenditures for the intended purpose. Second, a separate line item charge on the customer bill presents an honest and clear picture to the customer of how much money is going towards gas energy efficiency programs and may, in fact, encourage customer participation in such programs. Third, an SBC is consistent with and would provide for an easier transition of funding mechanisms should Indiana adopt a statewide independent administrator approach for delivering DSM, as has been proposed in legislation and is currently a subject in the Commission's generic investigation into DSM.

Q. WHAT LEVEL OF FUNDING DO YOU RECOMMEND FOR GAS ENERGY EFFICIENCY PROGRAMS IN THIS CASE?

A. Funding levels for natural gas energy efficiency programs among the states range from virtually zero to about 2.1% of retail revenue. See, for example Attachment 12 to this prefiled testimony. Given the substantial potential for economic and environmental benefits to Indiana and the lack of significant prior funding of gas DSM programs, I

recommend a funding level of 2% of revenue. It may be that during the first start up year, a smaller amount would be appropriate, depending on the implementation plan.

6. Independent Administration Specifics

Q. WHO SHOULD BE RESPONSIBLE FOR DELIVERY OF ENERGY EFFICIENCY PROGRAMS?

A. I recommend that the Commission require efficiency programs be delivered by an independent third party administrator. For convenience sake, I will sometimes refer to that administrator as an Independent Administrator or IA. In some settings, such an IA is called an Efficiency Utility or EU, but that should not be taken to mean that it would be a regulated utility. Rather, the IA should be an independent corporation or other entity *completely* without affiliation with any utility and operating under a contract issued by the Commission.

Attachment 2 to this prefiled testimony is a report prepared by myself and Scudder Parker of Synapse Energy Economics, Inc. The report analyzes the advantages and disadvantages of an IA and discusses best practices and essential characteristics of a successful IA. I will summarize some of the key findings and recommendations of that report here.

There is a recent trend to designate an independent third party to administer SBC-funded DSM programs, especially state-wide programs. Cases in point are Efficiency Vermont, Efficiency Maine, and Energy Trust of Oregon.

Designation of an IA to deliver DSM programs removes the disincentive created when a utility is charged with reducing its customers energy demand. Such an IA has, under proper contracting practices, a clear incentive to implement DSM programs vigorously and effectively, since the sale of energy is not its responsibility. It can minimize the cost and complexity associated with regulatory scrutiny of numerous utility DSM programs and can even serve a stateside area, providing equal and efficient statewide services. Standardization of a state's DSM approach will also create a robust market for efficiency products and support services, benefiting the entire state economy.

For best results from IA program delivery (or any means of delivery for that matter), stable, long-term, dedicated funding, such as may be provided by an SBC, is important.

Q. HAVEN'T YOU ARGUED ABOVE THAT THE COMPANY IS OBLIGATED TO ACQUIRE SUCH RESOURCES ON ITS OWN? IF SO, WHY SHOULDN'T THE COMPANY BE REQUIRED TO DELIVER THOSE EFFICIENCY PROGRAMS?

A. Yes, the Company does have an obligation to provide least cost service, but I recommend independent, third party DSM program administration, partly because of the benefits just discussed and partly because of the Company's lack of history with designing and managing its own DSM programs. The Company's lack of comprehensive DSM programs argues for a more committed, competent and aggressive administrator. That approach to implementation would also avoid any issues relating to a utility's disincentive to succeed in conserving energy.

Q. WON'T IT TAKE QUITE A SOME TIME TO ORGANIZE AND RAMP UP AN INDEPENDENT, THIRD PARTY EFFICIENCY PROGRAM ADMINISTRATOR? IF SO, WHAT SHOULD BE DONE IN THE MEANTIME? SHOULD THE COMPANY'S EXISTING EFFICIENCY PROGRAMS BE CONTINUED?

A. It will take a while for an IA to be selected and become fully operational, but perhaps not as long as one might think. There are several successful models and a growing literature on how to implement third party efficiency administration and do it correctly. I believe that an IA could be up and running about one year to one-and-a-half years from an order mandating one, possibly less if the recommendations below are adopted. However, I have specific recommendations for what should be done in the meantime.

First, the Company's *existing* funding for low-income weatherization services (via the CAAs) should be continued as is and at current or higher funding levels until the IA is up and running. I recommend that an interim funding level from the Company for these services be set after inquiry into the rate at which the CAAs could efficiently and

effectively ramp up their current program. It would not be in the public interest to forego the savings that can be achieved by those programs during the startup of an IA, especially the savings that could be delivered by implementing the improvements recommended above.

Second, when the IA is fully functional, funding should be 2% of revenues.

Third, I would expect that, as part of a well designed package of DSM services, a major increase in funding for Low Income Weatherization would be found to make sense, and that it would also be quite likely that the CAAs would be the most appropriate vehicles to continue delivering that part of the DSM program in close coordination with the IA. The Vermont third party delivery administrator, for example, very closely coordinates program delivery with the CAAs and has the CAAs deliver some of the low income programs. Because the CAAs also administer the state, DOE, and other utility-sponsored low-income programs, both weatherization and LIHEAP, their involvement would be reasonable and likely beneficial.

Fourth, to achieve the maximum cost effective level of savings and equitable delivery, it is critical that renters also be eligible for DSM services, especially in connection with low-income DSM programs, since low-income families tend to be renters more often than homeowners. [30] Nor should customers be excluded because they do not have gas space or water heat.[31] Doing so excludes another group of customers who could greatly benefit from weatherization service. It is interesting to note that a third-party administrator would not be expected to discriminate against and exclude customers because of fuel source.

Fifth, the Commission should order a set of independent studies of resource potential, market research studies, and program design projects to begin immediately under its supervision and to be funded by, but completely independent of the Company.

[30] In Indiana, 21.7% (144,787 households) of renter households are below the poverty line, while only 4.7% (78,447 households) of home-owner households are below the poverty line. National Low Income Housing Coalition, Local Area Low Income Housing Database, www.nlihc.org/research/lalihd/Indiana.pdf.

[31] Low-income weatherization programs typically provide certain non-heating measures, such as CFLs, refrigerator replacements, and some air conditioning measures, which could be cost-effective for customers, regardless of heating

These studies would be done to enable the IA to implement fully functioning programs as soon as it is selected and organized. The studies would also provide important market data that would enable potential bidders for the IA job to have more certainty about the challenges and opportunities in Indiana, making the competition among potential IA bidders more efficient and robust. Study specifications, RFP content and process, and necessary funding level for these interim activities should be determined by the Commission, and the Commission should require the Parties to submit recommendations (by some date certain) that are consistent with above points.

In connection with this proposal, I wish to emphasize that market assessment and studies of potential program enhancements are an essential part of DSM program design, but are an inherently iterative process, not done once for all time. Hence, the proposed studies are of a type that would normally be performed in parallel with ongoing program delivery by a fully functioning DSM deliverer. Thus, Indiana should not delay organization and implementation of DSM programs, especially via an IA, pending the studies I recommend or any other studies. Rather, such studies would merely be the first round of ongoing research by or for any future DSM deliverers. (Indeed, in my experience, a good IA craves good evaluation and potential assessment.) Good market assessment and related studies examine programs already delivered or in place, but also expand the universe of opportunities by understanding markets and building procedures better, even as core programs are being implemented. Under a comprehensive market characterization and assessment process, DSM deliverers and stakeholders learn about how well key players know the programs, the potential for delivery of new or innovative products or programs, how many customers are using them, why or why not, and many other key questions important to maximizing the benefits and efficiency of DSM programs.

Sixth, the Commission should order implementation of a limited number of demonstration efficiency projects targeted at end uses and customer groups or markets that have seen successful results in other states. Such demonstrations should be funded by, but

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source.

not under the control of, the Company and be designed and implemented consistent with above principles, but targeted at customer groups and end uses now underserved and likely to be major DSM resources in the future, and with careful process and an impact evaluation component. The demonstrations should target end uses and customer groups with high potential for large savings and significant research benefits. Also, such demonstrations should be implemented by independent entity selected by Commission and not affiliated with any Indiana energy utility. To the extent feasible, these demonstration projects should be "fast tracked" so they are in operation within 4 months and measure installation is completed within 12 months so that at least preliminary evaluation results can be available by the final stages of IA program design.

Q. DOES THAT COMPLETE YOUR TESTIMONY AT THIS TIME?

A. Yes.

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PROFESSIONAL EXPERIENCE

Work Experience

Synapse Energy Economics Inc., Cambridge, MA.
Senior Consultant, July 2003 to Present
Provided consulting services to consumer advocates, environmental organizations, and utility regultors on power supply procurement, electric industry restructuring, green marketing, portfolio management, rate design, economic impacts of efficiency and renewable generation programs, and other utility and energy topics. Expert witness services and litigtation advice. Co-authored reports, journal articles and conference presentations on portfolio management, energy efficiency programs, and electric reliability.

Vermont Department of Public Service, Montpelier, VT.
Director for Regulated Utility Planning, 1986-2003
Responsible for preparation of Vermont's long range policy plans in the areas of electric utilities, energy and telecommunications, including oversight of research, modeling, public input processes, policy analysis and writing. Development of policy positions and drafting of legislation and rules concerning utility resource planning, least cost provision of service, power supply acquisition, generation and transmission permitting, environmental costing, energy efficiency and alternative generation, utility restructuring and retail choice, distributed utility planning, rate setting and rate design, mergers, financing and acquisitions, decision analysis, power contract restructuring, Qualifying Facility contracts and permits, net metering, and other critical regulatory issues. Extensive expert testimony on those matters, as well as utility bankruptcy, prudence reviews, and critical utility policy matters. Extensive legislative testimony.

Planning Econometrician, 1981-1986
Energy demand forecasting, economic and demographic projections, economic and policy impact analysis, avoided cost estimates, and other quantitative analysis for utility and energy policy making. Development of State's basic policies regarding least cost planning and resource selection, including methodologies for evaluation of and program design for generation, transmission and demand-side options. Implementation of utility energy efficiency program requirements.

Vermont Agency of Human Services, Montpelier, VT.
Director of Planning, 1979-1981

Vermont Department of Social and Rehabilitation Services, Waterbury, VT.
Director of Planning and Evaluation, 1977-1979

Acting Deputy Commissioner, 1977

Vermont Department of Corrections, Montpelier, VT.
Director of Planning and Research, 1974-1977
Chief of Research and Statistics, 1973-1974

Pre-2004 Energy Consulting

Ill. Energy Office, 1986.
Mass. Exec. Office of Energy Resources, 1986.
Northern Technology, Inc., Gorham, NH, 1983-1985.
James River Corporation, Green Bay, WI, 1985.
Newfoundland Department of Natural Resources, 1995

Teaching

University of Vermont, Burlington, Vt., 1977 to 1989
Adelphi University, Garden City, N.Y., 1980 to 1988
University of N. H., Complex Systems Ctr., Grad. Studies Comm., 1992-1994
Institute of International Education, Least Cost Planning Seminar, 1999
Community College of Vermont, 2002

Miscellaneous

National Science Foundation Undergraduate Research Grant, 1965.
Wesleyan University Astronomy Prize, 1967.
Association for Criminal Justice Research (Northeast/Canada), Director, 1973 to 1981, Secretary/Treas., 1973 to 1980.
University of Vermont Graduate Award in Statistics, May, 1980.
Contributing Editor, Current Index to Statistics, 1976-1985.
Chair, Session on Energy Economics, New England Business and Economics Association Annual Meeting, 1983.
Member, Intl. System Dynamics Soc., Tau Beta Pi.
Northeast International Committee on Energy, New England Governors' Conference/Eastern Canadian Premieres, various periods, 1986 to 2003
Director, Vermont Girl Scout Council, 1989-1991; Secy., 1991-1997
Editor, Intl. System Dynamics Soc. Bibliography, 1990-
Advisory Group Member, New England Project, MIT Analysis Group for Regional Electricity Alternatives, 1991-1995.
Chair, Steering Committee & Modeling Subcommittee, New England Governors Conf. Regional Energy Planning Project, 1991-1995.
Member, Montpelier School System Technology Steering Committee and Montpelier High School Technology Committee, 1992-1993.
Reviewer, Vermont Experimental Program to Stimulate Competitive Research, 1993-
Invited Speaker, 3rd Intl. Conf. on Externality Costs, Ladenburg, FDR, 1995.
Member, Steering Committee, New England Governors Conference, Restructuring/ Environmentally Sustainable Technolgies Project, 1996-1997
U. S. DOE Distributed Generation Collaborative, 2000-2

EDUCATION

Degrees

B.A., Physics, Wesleyan University, Middletown, CT, 1970
M.S., Statistics, University of Vermont, Burlington, VT, 1980
Ph.D., Mechanical Engineering , University of Vermont, Burlington, VT, 1988

Continuing Education

Seminar in Electricity and Telecommunications Demand, 1981
Advanced Workshop in Regulation and Public Utility Economics, June, 1982 and
June, 1983, Rutgers University
Transmission Reliability Assessment, Power Technologies, Inc., 1986
Regional Forecasting and Simulation Modeling, January, 1991, U. Massachusetts-Amherst

TESTIMONY

Vermont Public Service Board

Docket 4661 - Green Mountain Power Rate Increase

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Dockets 5108/5109 - Vt. Marble Co. Small Power Rate

Docket 5133 - Moretown Hydro Energy Co. Small Power Rate

Docket 5202 - VPPSA Refinancing

Docket 5248 - DPS Ontario Hydro Power Purchase

Docket 5270 - Least Cost Planning and Demand-Side Management

Docket 5270-GMP-1 - Highgate Apartments Fuel Switching

Docket 5270-CV-1&3 - Demand-Side Management Preapproval and
Ratemaking Principles

Docket 5270-CV-4 - IRP

Docket 5270-VGS-1 - Demand-Side Management Preapproval

Docket 5270-WEC-1 - Demand-Side Management Preapproval

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5270-LDLW-1, 5270-LYND-1, 5270-MRSV-1, 5270-ORLN-1, 5270-RDSB-1,
5270-ROCH-1, 5270-STOW-1, 5270-SWNT-1, 5270-VMC-1 - IRP's

Docket 5270-VGS-2 - Demand-Side Management Preapproval

Docket 5277 - DPS Ontario Hydro Transactions Agreement

Docket 5330A - Hydro Quebec Power Purchase

Docket 5330E - Hydro Quebec Power Purchase, Waiver and Amendment

Vermont Public Service Board (cont.)

Docket 5372 - CVPSC Rate Increase

Docket 5491 - CVPSC Rate Increase

Docket 5630/32 - VEC Debt Restructuring & Rate Increase

Docket 5634 - NET Toll Dialing Plan

Docket 5638 - CVPSC Mack Molding*

Docket 5664 - EPACT Standards

Docket 5810/11/12 - VEC Debt Restructuring & Rate Increase

Docket 5825 - Ludlow IRP*

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Docket 5859 - Citizens Utilities Prudence Review & Revocation Petition

Docket 5971 - VEC Bankruptcy Reorganization*

Docket 5980 - Proposal for Statewide Efficiency Utility

Docket 5983 - GMP Rate Increase (HQ Issues)

Docket 6018 - CVPSC Rate Increase (HQ Issues)

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Docket 6300 - Sale of Vermont Yankee

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Docket 6495 - Vermont Gas Systems Rate Increase (Deferral Account and Hedging)

Docket 6565 - Various station service contracts

Docket 6596 - CUC rate Increase (HQ Issues)

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Vermont State Environmental Board

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Ohio Public Utilities Commission

Restructuring Roundtable – System Benefit Charges*

Federal Energy Regulatory Commission

Docket Nos. ER95-1586-000 and EL96-17-000 - Citizens Utilities Company

Connecticut Department of Public Utility Control

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* No prefiled testimony

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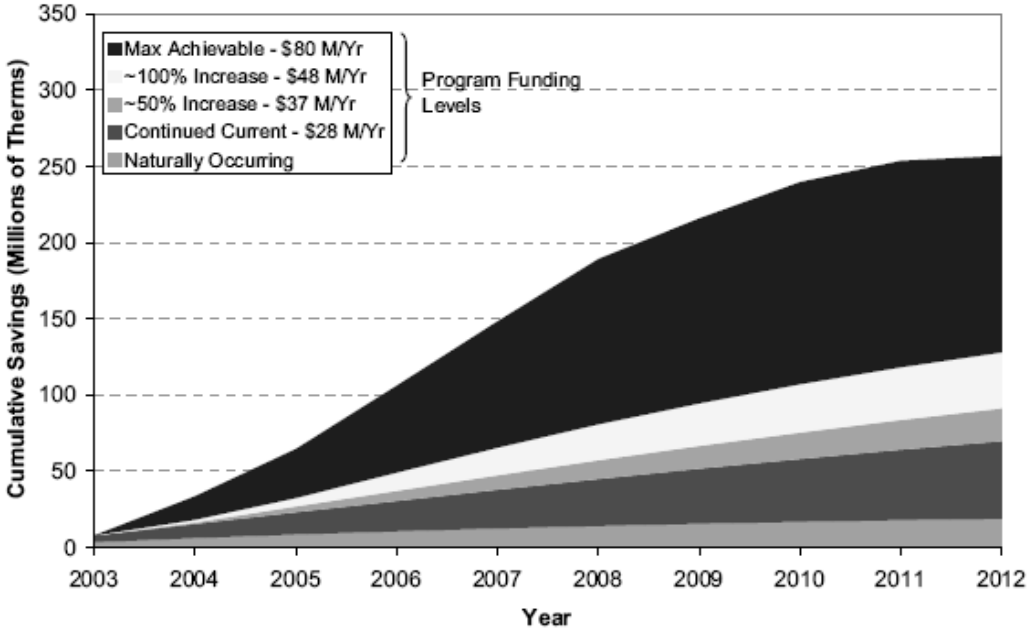
Attachment 3 Performance of Natural Gas DSM programs in the U.S.

	Minimum	Maximum	Mean	Median	Total
Annual program spending: all programs* (n = 32)	$79,036	$35,835,000	$3,733,428	$953,640	$131,222,815
Annualized 1st year savings: all programs* (therms)	24,910	10,000,000	1,345,081	567,824	44,767,409
• Savings: residential programs (n = 20)	24,910	7,004,880	824,862	267,353	16,497,247
• Savings: C/I programs (n = 10)	25,384	10,000,000	2,385,518	1,337,382	23,855,180
Cost-effectiveness					
• Cost of conserved energy: 1st year $/therm (n = 8)	1.53	6.70	3.63	2.59	
• Cost of conserved energy: lifetime $/therm (n = 7)	0.07	0.80	0.38	0.28	
• Benefit/cost ratio (n = 9)	1.08	5.05	1.98	1.42	

**All programs* data include two portfolios of multiple programs

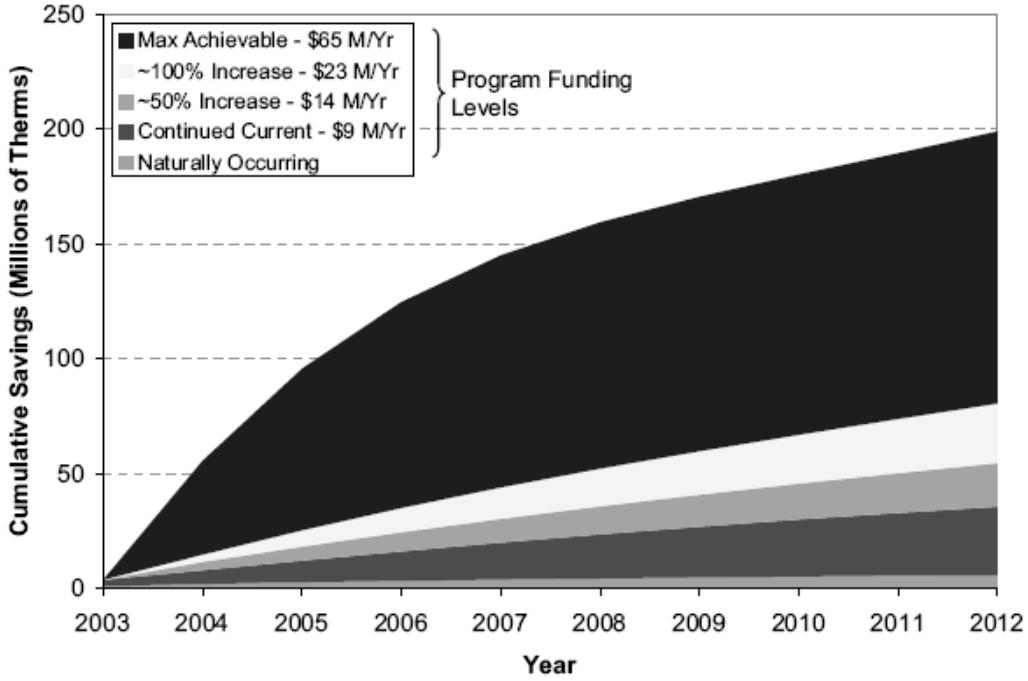
Source: York and M. Kushler, 2004, *Tapping Our Hidden Reserves: America's Exemplary Natural Gas Energy Efficiency Programs*, a Report presented at the 2004 ACEEE Summer Study on Energy Efficiency in Buildings, page 5-275

Attachment 4 Natural Gas Savings Potential by the Residential Sector under Base Energy Costs Case



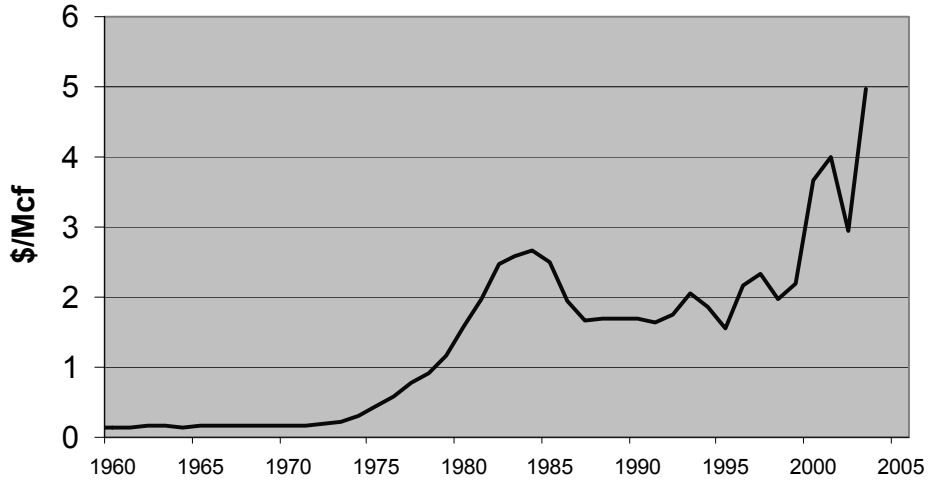
Source: F. Coito and M. Rufo, 2003a, *California Statewide Residential sector Energy Efficiency Potential Study, Final Report, Volume 1 of 2 Main Report*: KEMA-XENERGY Inc., page 9-6

Attachment 5 Natural Gas Savings Potential by the Commercial Sector under Base Energy Costs Case



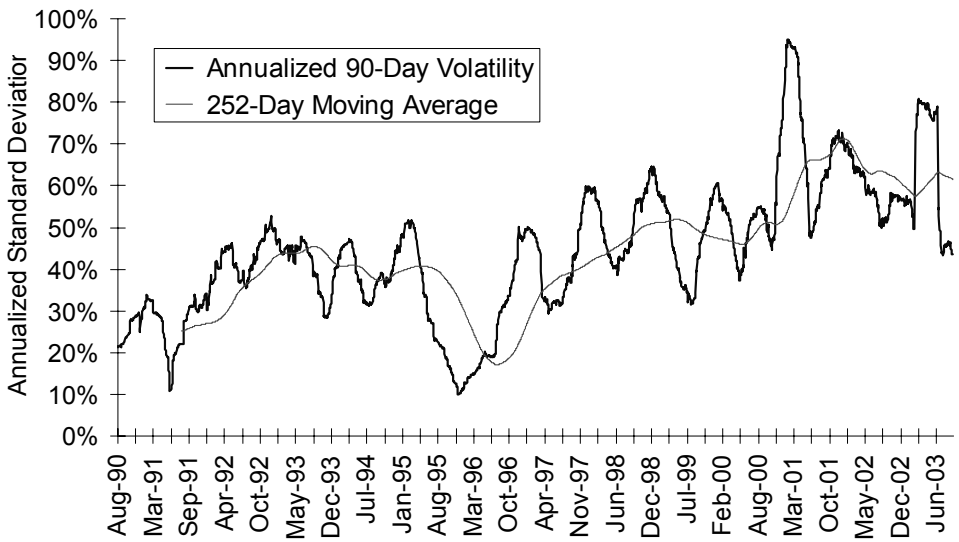
Source: Coito and M. Rufo, 2003b, *California Statewide Commercial Sector Natural Gas Energy Efficiency Potential Study, Final Report, Volume 1 of 2 Main Report*: KEMA-XENERGY Inc.,page 7-5

Attachment 6 U.S. Natural Gas Wellhead Price ($/Mcf)



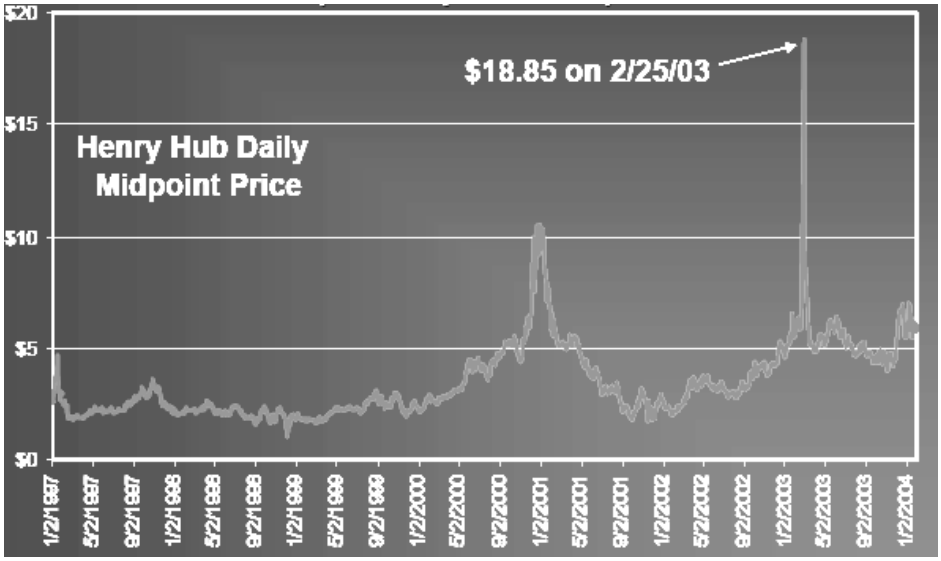
Data source: EIA, http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_nus_a.htm

Attachment 7 Increased Natural Gas Volatility 1



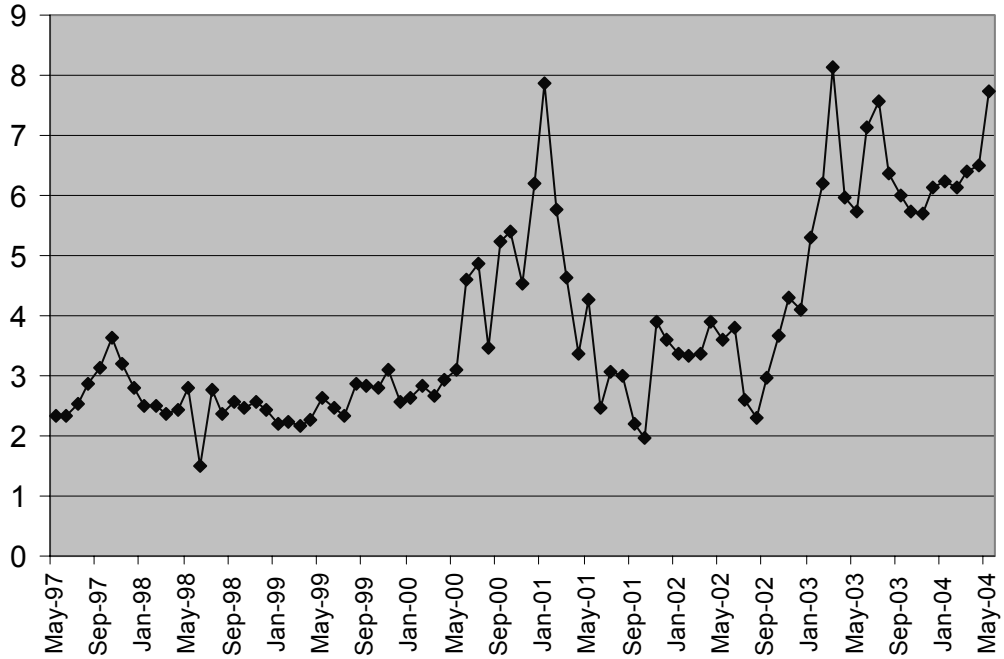
Source: Mark Bolinger at Lawrence Berkeley National Laboratory , *Potential Benefits of an RPS in Vermont*, a presentation to VT RPS Collaborative Meeting, October 1, 2003, available at http://www.state.vt.us/psb/LBNL_RPS_Benefits.ppt

Attachment 8 Increased Natural Gas Volatility 2



Source: Mark Rodekohr at EIA, *U.S. Natural Gas Supply Forecast*, a presentation to APGA gas Supply Conference, February 10, 2004, available at http://www.apga.org/pdfs/Rodekohr.pdf

Attachment 9 Monthly Natural Gas City Gate Prices in Indiana ($/Mcf)



Source: EIA, available at http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm

Attachment 10 Energy Burden on Low-Income Customers in Indiana

Poverty Level	Home Energy Burden
Below 50%	37.3%
50 – 74%	15.1%
75 – 100%	10.7%
101 – 124%	8.4%
125 – 150%	6.8%
150% - 185%	5.6%

Source: Fisher, Sheehan & Colton, available at http://www.fsconline.com/work/heag/04/in.pdf

Attachment 11 Natural Gas Affordability Gap for Indiana Consumers

Poverty Level	Total 2003 Affordability Gap
Below 50%	$107,374,165
50 – 74%	$44,103,424
75 – 100%	$37,655,062
101 – 124%	$30,214,341
125 – 150%	$14,962,999
150% - 185%	$348,606
Total statewide	$234,658,596

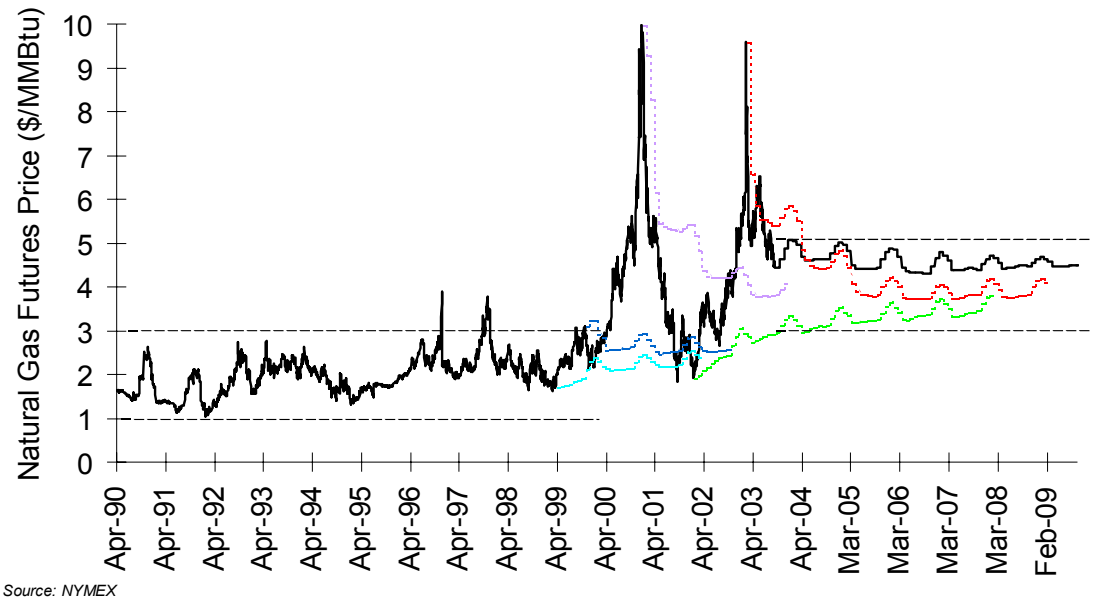
Source: Fisher, Sheehan & Colton, available at http://www.fsconline.com/work/heag/04/in.pdf: Note that households above 150% of the federal poverty level are not often regarded as low-income customers, and yet the total of affordability gap in this table includes the households with poverty level between 150% and 185%. However, exclusion of this category does not make much difference to the total gap.

Attachment 12 DSM Spending as Percent of Revenue by Utility or Jurisdiction in North America

Utility and/or Jurisdiction	DSM spending share in revenues
British Columbia: Teresan Inc.	0.2%
California	0.7%
Connecticut: Connecticut Natural Gas	0.2%
Connecticut: Southern Connecticut Gas	0.7%
Iowa	1.0%
Massachusetts: Keyspan	1.0%
Minnesota: Xcel Energy	0.5%
New Hampshire	1.5%-2.0%
Oregon: NW Natural	1.5%
Vermont: Vermont Gas	2.1%
Washington: Puget Sound Energy	0.7%
Wisconsin (electric and gas DSM combined)	0.8%

Source: IndEco and Navigant Consulting, 2004, *DSM in North American Gas Utilities*; M. Kushler, D. York, & P. Wite, 2003, *Responding to the Natural Gas Crisis: America's Best Natural Gas Energy Efficiency Programs*, ACEEE

Attachment 13 NYMEX Natural Gas Futures Prices ($/MMBTU)



Source: NYMEX

Source: Mark Bolinger at Lawrence Berkeley National Laboratory , *Potential Benefits of an RPS in Vermont*, a presentation to VT RPS Collaborative Meeting, October 1, 2003, available at http://www.state.vt.us/psb/LBNL_RPS_Benefits.ppt