RC EXHIBIT D (PHM)

STATE OF INDIANA

INDIANA UTILITIES AND REGULATORY COMMISSION

JOINT PETITION AND APPLICATION OF PSI ENERGY, INC. , D/B/A DUKE ENERGY INDIANA, INC., AND SOUTHERN INDIANA GAS AND ELECTRIC COMPANY, D/B/A VECTREN ENERGY DELIVERY OF INDIANA, INC., PURSUANT TO INDIANA CODE CHAPTERS 8-1-8.5, 8-1-8.7, 8-1-8.8, AND SECTIONS 8-1-2-6.8, 8-1-2-6.7, 8-1-2-42 (A) REQUESTING THAT THE COMMISSION: (1) ISSUE APPLICABLE CERTIFICATES OF PUBLIC CONVENIENCE AND NECESSITY AND APPLICABLE CERTIFICATES OF CLEAN COAL TECHNOLOGY TO EACH JOINT PETITIONER FOR THE CONSTRUCTION OF AN INTEGRATED GASIFICATION COMBINED CYCLE GENERATING FACILITY ("IGCC PROJECT") TO BE USED IN THE PROVISION OF ELECTRIC UTILITY SERVICE TO THE PUBLIC; (2) APPROVE THE ESTIMATED COSTS AND SCHEDULE OF THE IGCC PROJECT; (3) AUTHORIZE EACH JOINT PETITIONER TO RECOVER ITS CONSTRUCTION AND OPERATING COSTS ASSOCIATED WITH THE IGCC PROJECT ON A TIMELY BASIS VIA APPLICABLE RATE ADJUSTMENT MECHANISMS; (4) AUTHORIZE EACH JOINT PETITIONER TO USE ACCELERATED DEPRECIATION FOR THE IGCC PROJECT; (5) APPROVE CERTAIN OTHER FINANCIAL INCENTIVES FOR EACH JOINT PETITIONER ASSOCIATED WITH THE IGCC PROJECT; (6) GRANT EACH JOINT PETITIONER THE AUTHORITY TO DEFER ITS PROPERTY TAX EXPENSE, POST-IN-SERVICE CARRYING COSTS, DEPRECIATION COSTS, AND OPERATION AND MAINTENANCE COSTS ASSOCIATED WITH THE IGCC PROJECT ON AN INTERIM BASIS UNTIL THE APPLICABLE COSTS ARE REFLECTED IN EACH JOINT PETITIONER'S RESPECTIVE RETAIL ELECTRIC RATES; (7) AUTHORIZE EACH JOINT PETITIONER TO RECOVER ITS OTHER RELATED COSTS ASSOCIATED WITH THE IGCC PROJECT; AND (8) CONDUCT AN ONGOING REVIEW OF THE CONSTRUCTION OF THE IGCC PROJECT	)	**CAUSE NO. 43114**
VERIFIED PETITION OF DUKE ENERGY INDIANA, INC. FOR AUTHORITY PURSUANT TO AN ALTERNATIVE REGULATORY PLAN AUTHORIZED UNDER I.C. 8-1-2.5 ET SEQ. AND I.C. 8-1-6.1,8-1-8.7, AND 8-1-8.8 TO DEFER AND SUBSEQUENTLY RECOVER ENGINEERING AND PRECONSTRUCTION COSTS ASSOCIATED WITH THE CONTINUED INVESTIGATION AND ANALYSIS OF CONSTRUCTING AN INTEGRATED COAL GASIFICATION COMBINED CYCLE ELECTRIC GENERATING FACILITY	)	**CAUSE NO. 43114 S1**

Direct Testimony of

Philip Mosenthal

On Behalf of

Citizens Action Coalition Of Indiana

Save The Valley

Valley Watch

Sierra Club

May 15, 2007

Direct Testimony of
Philip Mosenthal
On Behalf of
Citizens Action Coalition Of Indiana
Save The Valley
Valley Watch
Sierra Club
May 15, 2007

I. IDENTIFICATION AND QUALIFICATIONS

Q. State your name and business address.

A. Philip Mosenthal, 14 School Street, Bristol, VT 05443.

Q. On whose behalf are you testifying?

A. I am testifying on behalf of the Citizen's Action Coalition of Indiana, Save the Valley, Valley Watch and the Sierra Club.

Q. Mr. Mosenthal, by whom are you employed and in what capacity?

A. I am a partner in Optimal Energy, Inc., a consultancy specializing in energy efficiency and utility planning.

Q. **Summarize your qualifications.**

A. I have 24 years of experience in all aspects of energy efficiency, including facility energy management, policy development and research, integrated resource planning, cost-benefit analysis, and efficiency and renewable program design, implementation and evaluation. I have developed numerous utility efficiency plans, and designed and evaluated utility and non-utility residential, commercial and industrial energy efficiency programs throughout North America, in Europe and China.

I have also completed numerous studies of efficiency potential and economics, including ones in China, Maine, Massachusetts, Michigan, New

England, New Jersey, New York, Quebec, Texas, and Vermont. Most recently, I led the analysis of electric and natural gas efficiency and renewable potential and development of suggested programs for New York State, on behalf of the New York State Energy Research and Development Authority (NYSERDA).

Beginning in 1998, I led development of commercial and industrial programs for the Long Island Power Authority. I continue to advise LIPA on program design, planning and implementation issues, and have recently been involved in assessment of the achievable electric potential from a portfolio of ramped up electric and gas efficiency programs on Long Island.

I was the chief architect of the nation's first and only "efficiency utility" in Vermont in the late 1990's, and led the development of the EEU, including all planning, program design and analysis, and testimony. I am currently a lead advisor for business energy services at Efficiency Vermont, which operates as the EEU. I also currently advise non-utility parties in the Massachusetts Collaborative on C&I efficiency planning, program design and evaluation issues, working closely with the utility program administrators in that state.

Prior to co-founding Optimal Energy in 1996, I was the Chief Consultant for the Mid-Atlantic Region for XENERGY, INC. (now KEMA). I have a *B.A.* in Architecture and an *M.S.* in Energy Management and Policy, both from the University of Pennsylvania. My resume is provided as Exhibit PHM-1.

Q. Have you previously testified before the Indiana Utilities and Regulatory Commission ("the Commission" or "IURC")?

A. No.

II. INTRODUCTION AND SUMMARY

Q. What is the purpose of your testimony in this proceeding?

A. My testimony addresses two issues: (1) appropriate efficiency resource investment funding and savings goals for Duke Energy and Vectren, and (2) the need to remove the conflict between the public's interest in acquiring cost-effective efficiency resources and the Companies' shareholders' interest in maximizing profit.

Q. Summarize your testimony.

A. The cost-effective achievable electric efficiency potential in Duke Energy and Vectren's territories are large and sufficient to *meet all electric load growth* at least thru 2020. Pursuit of this efficiency resource would result in dramatically lower energy costs for ratepayers and avoid the need to build a new IGCC plant in the near future. Further, efficiency resources can be captured at a fraction of the cost of new IGCC supply. The IURC should direct Duke Energy and Vectren to pursue all cost-effective efficiency opportunities through a portfolio of cost-effective programs, available to all electric customers.

Second, I address limited aspects relating to incentives and the administration of efficiency programs, since these can affect their efficacy. Efficiency programs can be effectively administered by either the utilities directly, or by third party administration.[1] Studies have shown that both models, or hybrid approaches, can be equally effective, and the optimal solution will vary depending

[1] Third party administration can take a number of forms. Government could directly serve as the administrator — as is done in NY— or contract to a single entity (like a non-profit organization) to serve as an "energy efficiency utility" — as is done in VT. Hybrid approaches also exist, for example, the NJ BPU

on things like: existing infrastructure and capability, willingness and commitment of utilities to aggressively pursue efficiency; the types of markets and goals established for the portfolio; and political and other goals.[2] If the IURC determines that utility administration and delivery of efficiency programs is the appropriate path for Indiana, then the Commission may wish to adopt a performance incentive mechanism for Duke Energy and Vectren that removes current economic disincentives toward investing in and supporting energy efficiency. However, such mechanisms must be chosen and implemented carefully.

III. THE COMMISSION SHOULD ADOPT SIGNIFICANT EFFICIENCY PROGRAMS FOR DUKE ENERGY AND VECTREN.

Q. Why is it important that the Commission adopt significant efficiency programs for Duke Energy and Vectren in these proceedings?

A. There are many important economic, consumer and environmental reasons for the Commission to adopt significant efficiency programs for Duke Energy and Vectren in these proceedings.

Q. Please describe the economic and consumer benefits of adoption of efficiency programs for Duke Energy and Vectren ratepayers.

Cost-effective electric efficiency programs help consumers and the economy because the costs of investing in efficiency are lower than the costs of generating and delivering the electricity for an equivalent level of service. This

retains overall responsibility for administering programs in NJ, but delivers them through multiple contractors that must meet various performance criteria.

[2] See for example, Blumstein, C., *et. al., Who Should Administer Energy efficiency Programs?,* Center for the Study of Energy Markets, August 2003, and Regulatory Assistance Project, *Who Should Deliver Ratepayer Funded Energy Efficiency?,* May 2003. Stratton*, et.al., Indiana DSM Investigation Report: Report on Current Programs and Future Direction,* April 16, 2006.

means that cost-effective efficiency programs produce a number of economic and consumer benefits including the following.

First, efficiency investments will lower total costs and electric bills for consumers in the Duke Energy and Vectren service territories. Second, these investments will boost the state and local economy. By reducing total energy bills consumers are left with more disposable income (the "income effect"). Third, efficiency investments, by reducing electricity demand, will reduce upward pressure on prices to cover significant new investments in generation, transmission and distribution infrastructure.

Q. Please describe the environmental benefits of adoption of efficiency programs for Duke Energy and Vectren.

A. More efficient end-use electricity use will result in reduced air pollution, particularly sulfur dioxide (the primary cause of acid rain), nitrogen oxides (a key component of urban smog), particulates (a key contributor to respiratory diseases), and carbon dioxide (a key greenhouse gas pollutant). This not only improves environmental health, but has the result of lowering risk to utility shareholders and ratepayers from future emissions regulations, taxes or cap and trade schemes.

Q. Why can't we just let the market take care of electric efficiency?

A. Electricity customers face a number of classic market barriers which prevent them from pursuing efficiency measures and investments, even when it would be in their own economic interest to do so. The resulting market failure leaves economically achievable efficiency savings unrealized, resulting in an <u>over</u>-commitment to more expensive electric supply. Energy-efficiency market barriers require policy intervention with proven program designs to overcome multiple, interacting market barriers. Among the most widely-recognized efficiency market barriers are limited access to low-cost capital to cover the higher first cost of efficiency; scarcity of reliable information on the costs and performance of efficiency technologies; limited availability of high-efficiency products, equipment, and/or services; and split incentives between those who pay for energy-using equipment and those who pay energy bills (e.g., landlords and tenants).[3]

Q. Do customers in Duke Energy and Vectren service territories currently have access to efficiency programs?

A. Yes. However, they are fairly limited at this point. The "Indiana DSM Investigation Report: Report on Current Programs and Future Direction" submitted to IURC Staff April 16, 2007 found "the current combination of programs places Indiana below average in spending for energy efficiency and in savings attained both nationally and within the Midwest region."[4] In addition, they do not address large commercial and industrial customers (>500 kW average peak demand) at all.

Q. Why do you recommend that the Commission increase the budgets for the Duke Energy and Vectren efficiency programs?

A. The current and planned budgets and savings established for Duke Energy's and Vectren's programs do not even come close to capturing the full consumer and environmental benefits of investment in efficiency programs in their service territories, resulting in significant lost opportunities. Faced with potential reliability shortfalls in the near future, Duke Energy and Vectren must either invest more

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[3] See, for example: Lawrence Berkeley Laboratories, *Market Barriers to Energy Efficiency: A Critical Reappraisal of the Rationale for Public Policies to Promote Energy Efficiency,* Berkeley, CA, 1996), pp. 20, 35–41, available on the DOE Information Bridge Web site at <www.osti.gov/bridge/home.html>.

significantly in efficiency, or alternatively in a more expensive, higher risk and polluting supply option.

Q. Have you examined the potential for cost-effective efficiency in the Duke Energy and Vectren service territory?

A. Yes. I have not performed a detailed potential analysis for Duke Energy and Vectren. However, I have reviewed available Indiana data. Based on this and extensive experience having both completed numerous efficiency potential studies and reviewing those done by others, I estimate the cost-effective achievable potential over the next 15 years is approximately 20% of forecast electric load. I conservatively recommend here an increased efficiency effort that falls significantly short of the maximum cost-effectively achievable potential, but would bring Duke Energy and Vectren up to levels similar to leaders in efficiency programs throughout the nation. As a result, I focus here on proven levels of effort and accomplishments. Exhibit PHM-2 shows recommended efficiency targets and forecast loads net of efficiency for Duke Energy and Vectren.[5] CAC witness Biewald provides more detailed analysis of the effects of these efficiency resources on the need for future supply resources.

Q. Please describe the economic benefits of adoption of aggressive efficiency programs for Duke Energy and Vectren.

A. Electric energy efficiency programs are typically very cost-effective. While the levelized cost per kWh has ranged significantly among individual programs,

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[4] Stratton, *et.al., Indiana DSM Investigation Report: Report on Current Programs and Future Direction,* April 16, 2006, p. 2.

[5] Reference case forecasts for Duke and Vectren are from Joint Petitioners' Exhibit No. 8-B and CAC 4.6, respectively.

typical total costs have been in the 2-4 cents/kWh range.[6] Many DSM efforts are capturing savings below this level.[7] The Western Governors' Association found:

> *"DSM programs typically save electricity at a total cost of $0.02 – 0.03/per kWh (utility plus participant costs), meaning that improving end-use efficiency is the least expensive electricity resource…Also, many DSM programs reduce peak power demand more than they reduce electricity consumption in percentage terms, meaning the programs also improve the load factor for the utility system and improve system reliability."*[8]

Q. How does this compare to the costs of supply-side alternatives to meet future load growth?

A. CAC Witness Biewald testimony addresses costs for supply-side options. He estimates a cost for the IGCC plant proposed by Duke Energy and Vectren of *at least* 7 cents/kWh, or roughly 2 to 3 times the cost of efficiency resources. As a point of reference, in 1995 Vectren captured significantly larger savings than its current plans, at a cost of approximately 2.3 cents/kWh.[9]

Q. What did you base your estimate of the cost-effective achievable efficiency potential on?

A. I considered a variety of data. First, I reviewed the recent efficiency potential study commissioned by Vectren.[10] I also considered the range of typical

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[6] See for example: U.S. Department of Energy, *State and Regional Policies that Promote Energy Efficiency Programs Carried Out by Electric and Gas Utilities, A Report to the United States Congress Pursuant to Section 139 of the Energy Policy Act of 2005,* March 2007, p. 11 and Western States Governors' Assocaiation, *Clean and Diversified Energy Initiative,* Energy Efficiency Task Force Report, January 2006, pp. 55-56.

[7] For example, the Texas investor owned utilities exceeded the Texas Energy Efficiency Resource Standard requirements in 2005 by 27% at a cost of only 1.36 cents/kWh. A recent study, Optimal Energy Inc., *Power to Save: An Alternative Path to Meet Electric Needs in Texas,* prepared for Natural Resources Defense Council and Ceres, January 2007, estimates that Texas can reduce loads by an annual average of 1.4% at a cost of 1.8 cents/kWh.

[8] WGA, *on. cit.,* pp. 55-56.

[9] Southern Indiana Gas and Electric Company (SIGECO), *1995 Demand-Side Management Annual Report and Evaluation,* May 6, 1996, p. 4. Levelized cost calculation assumes an average weighted measure life of 13 years and a real discount rate of 3%.

[10] Forefront Economics and Gil Peach, *Vectren South Electric DSM Action Plan Final Draft Report,* prepared for Vectren, April 24, 2007.

efficiency estimates from other studies conducted in the North America for different utility territories, states, or regions. Finally, I relied on my extensive experience having led or been directly involved in numerous efficiency potential studies in the past. Exhibit PHM-3 shows a range of electric efficiency potential found from a number of different studies by sector.[11] The range of technical potential is 17% to 48%. Economic potential ranges from 6.2% to 35%. The range for achievable potential is about 2-22%. However, I note that these ranges are not exhaustive, and a number of studies, including one by ACEEE for Illinois in 1998, estimated achievable potential at 43%.[12]

Q. Why is there such a large range of findings?

A. The biggest determinant is the range and scope of analysis conducted. For example, many studies will only look at limited sectors or markets, or limited technologies. In the case of achievable potential, the range is further broadened because many "achievable" potential studies are not intended to be *maximum* achievable, but rather the achievable potential from a particular portfolio of programs, limited funding levels, limited program designs, or other constraints. Typically, the high end of the range is most closely associated with maximum achievable potential. As mentioned above, numerous studies have found substantially higher achievable potential than the high end of the range listed in this table. For example, studies by ACEEE for Illinois and the MidAtlantic States found

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[11] ICF, *Electricity Demand in Ontario – Assessing the Conservation and Demand Management (CDM) Potential,* Prepared for the Ontario Power Authority, November 2005.
[12] ACEEE, *Energy Efficiency and Economic Development in Illinois,* 1998.

43% and about 40% respectively. Optimal Energy found 31% achievable potential in Vermont.

Q. Given the Vectren Study estimates only 18% economic potential, how can the achievable potential exceed this?

A. While the Vectren study is most relevant to Indiana, I found a number of flaws that cause it to be fairly conservative, particularly in terms of economic potential. First, it considered a fairly limited number of technologies. Of particular importance, it completely ignored fuel switching measures. For Vectren, fuel switching is likely to represent the largest cost-effective opportunities for residential and small commercial efficiency because of its relatively high saturation of electric space and water heating. Based on a 2005 Vectren market research survey, 24% of residential customers have primary electric space heat with another 9% using electric heat as a secondary source.[13] The same study estimates 40% of homes use electric domestic hot water.[14] These are high levels, and fuel switching to fossil fuel sources is likely to be cost-effective in a number of instances.

In addition to omitting fuel switching, the limited technologies analyzed is especially troublesome for C&I facilities. The only measures the Study finds economic and recommends for programs tend to be very specific, "prescriptive" type measures. Most leading C&I efficiency programs capture the majority of savings from "custom" measures. These site-specific opportunities are typically screened for cost-effectiveness based on individual circumstances and promoted

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[13] Forefront Economics, *op. cit.,* p. 9.
[14] *Ibid.*

only when cost-effective. As a result, eliminating all these opportunities just because the study believes that *on average* they are not cost-effective dramatically understates the opportunities. In addition, many potential technologies were not even considered as part of the technical potential. For example, the study does not consider any industrial process opportunities. Certainly, there are cost-effective industrial process efficiency measures available in Duke Energy and Vectren territories.

The Vectren study estimated total technical potential of 36%, which is fairly consistent with other studies. However, it eliminated only half of this as non-cost-effective.

Q: Do you have concerns with the way the Vectren Study estimated the economic cost-effectiveness of efficiency measures?

A: Yes. Rather than performing a full analysis of the costs and benefits, the study used a simplified method for determining cost-effectiveness. It calculated a levelized cost per kWh saved for each measure and simply screened out everything that cost more than 6 cents/kWh.

Q: If 6 cents is roughly comparable to forecast avoided costs, why isn't this an appropriate approach?

A: It could be, if the levelized cost were calculated properly considering all the pertinent costs and benefits. However, this was not done. For example, the study ignored all non-electric benefits from such things as gas and oil savings.[15] Second, it ignored the electric generation, transmission and distribution capacity benefits

[15] Note, the study did include these for cost-effectiveness analysis of programs, but only after eliminating all measures deemed not cost-effective based on its initial screening.

from reducing summer and winter peak demand. A proper levelized cost per kWh analysis should compare *net* levelized costs per kWh after accounting for all other costs and benefits.

Q: What level of efficiency do you recommend for Duke Energy and Vectren service territory?

A: I recommend at a minimum that Duke Energy and Vectren ramp up to savings of approximately 1% of load per year. This is likely well below the maximum achievable potential, but would bring these utilities programs up to levels similar to some of the leading efforts around the country, although still less aggressive than some. At this rate, considering the ramp-up, savings by 2020 would be 12.3% of forecast load. Exhibit PHM-2 shows annual savings for such a strategy, as well as its impact on forecast load.

Q: Given that you believe maximum achievable potential is higher, why are you only recommending a goal of 1% savings per year?

A: For two reasons. First, I have not had the opportunity to fully analyze the full potential for Duke Energy and Vectren territories, and the associated costs involved. Second, even capturing 1% per year of efficiency — a level proven to be achievable at costs of typically about 3 cents/kWh — is sufficient to roughly meet load growth for both Duke Energy and Vectren by 2020. While I believe Duke Energy and Vectren can do much more cost-effectively, this proven level of efficiency can meet the load needs in the near future and does not require more detailed analysis or speculation about the ultimate level of potential. I recommend the IURC direct Duke Energy and Vectren to pursue at least this level of efficiency immediately. The IURC should also engage in a detailed study of the cost-effective opportunities for ramping this level of efficiency up higher over time.

Q: What would be the effect on the need for new power supply if your recommended efficiency effort is pursued?

A: As shown in Exhibit PHM-2, virtually all electric load growth by 2020 can be met with efficiency. For Duke, loads would actually *decrease,* with a resultant average annual load growth from 2007-2020 of -0.03%. For Vectren load would grow slightly, with average annual growth of just 0.11%. Taken together, Duke Energy and Vectren's total load would *decrease* with average annual growth of -0.01%. CAC Witness Biewald more fully discusses the impact of efficiency and other resources on the need for a new IGCC plant.

Q. Aren't achievable potential studies theoretical? How can we be sure Duke Energy and Vectren can achieve the levels of efficiency you estimate?

A. As mentioned above, my recommendations call for a conservative level of effort ramping up to 1% per year savings. This level of savings is currently being met in a number of jurisdictions, including CA, CT, MA and VT. Further, these jurisdictions have a long history of efficiency programs, and therefore likely already have a much more efficient building stock in place than Indiana. In fact, a recent report to the IURC staff noted that Indiana ranks highest among Midwestern states, and sixth highest nationally in per capita energy consumption.[16]

In addition, plans are either in place or contemplated to significantly surpass these historic levels. For example, MA and CT are both considering dramatic ramp-

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[16] Prefiled Verified Testimony of Susan E. Stratton and Submission of Staff Report on Behalf of Designated Testimonial of the Indiana Utility Regulatory Commission, Cause No. 42693, Exhibit 1, pp. 10-11.

up of existing efficiency efforts that would bring savings up to over 2% of load each year.[17] Vermont's new goals established by the Public Service Board call for approximately 2% statewide incremental savings in 2008, and about 10% savings over 2 years in geographically targeted areas. Long Island Power Authority is currently working on a plan to achieve 15% savings by 2015, consistent with Governor Spitzer's goals for New York, starting in 2008. These represent dramatically greater efficiency efforts than Duke Energy and Vectren need to meet all new load growth with efficiency.

Q: Is there any Indiana experience that indicates this is achievable?

A: Yes. In fact, Duke's original 2005 DSM plans called for achievement of goals by 2010 not very different from those I estimate. Duke Witness Stevie noted in testimony for Cause No. 42612 (provided as response CAC 4.6-A) that "The total cost of program measures and implementation over the next five years is projected to be just over $50 million. This is intended to reduce energy consumption by over 1 billion kWh and peak demand by over 120 MW."[18] This is greater than the recommended savings for 2010, and not dramatically less than the savings of 1.47 billion kWh I estimate from the first 5 years of program implementation under my recommendations, which ramp up to 1% per year savings by year 3 (see Exhibit PHM-2).

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[17] Massachusetts Department of Telecommunications and Energy, *Petition of the Massachusetts Division of Energy Resources For An Investigation into Establishing an Electric Efficiency Performance Standard as a Component of the Supply of Basic Service Electricity,* December 21, 2006, p.4. and *Conservation and Load Management Portfolio Plan, Docket 06-10-02, Scenario 2 Supplemental Filing,* January 24, 2007, submitted to the DPUC jointly by Connecticut Light and Power Company and United Illuminating Company.
[18] Response to discovery CAC 4.6, Exhibit A, p. 18.

In addition, the Duke 2005 DSM Plan only proposed programs for customers under 500 kW peak demand. Large C&I customers generally participate in programs in disproportionately high numbers, and often account for a large portion of other efficiency portfolio's savings. Cause No. 42693 Staff witness Stratton noted "the presence of large, energy-intensive industry in the state contributes to this high ranking [6th highest per capita energy consumption in the U.S.] — accounting for half of Indiana's consumption."[19] Therefore, if Duke had expanded its efforts envisioned in its 2005 IRP to address all electric customers its estimated savings would likely have exceeded the savings I recommend.

Q: What were the costs associated with Duke's 2005 DSM plan?

A: Duke estimated a cost of $50 million over 5 years. At that rate, spending *for all five years* would be less than 3% of current annual revenue and would have captured savings of 3% of forecast 2010 load. Had Duke met its original goals, I estimate it would have captured savings at approximately 0.5 cents/kWh levelized.[20] This is far cheaper than my estimate of 2-4 cents/kWh, indicating Duke anticipated it would capture the savings with relative ease. This low cost seems to indicate Duke anticipated a great deal of "low hanging fruit" and did not anticipate highly comprehensive efforts. In contrast, Duke's current DSM Plan of June 15, 2006 calls for savings in year 5 (2012) of only about 60 million kWh, or just 6% of the prior proposed savings. Even its "Ultra High" DSM case only anticipates savings by 2012 of 441 million kWh, or approximately 40% of its original plans.

Q: What about Vectren?

[19] Prefiled Verified Testimony of Susan E. Stratton and Submission of Staff Report on Behalf of Designated Testimonial of the Indiana Utility Regulatory Commission, Cause No. 42693, Exhibit 1, pp. 11.

A: Vectren has a similar story. In 1995 Vectren spent $8.7 million on DSM and captured energy savings of 25.5 GWh.[21] This is equivalent to about 0.4% of today's load. Not counting demand response efforts, Vectren's spending was about $6 million, providing efficiency savings at a levelized cost of approximately 2.3 cents/kWh.[22] This is in contrast to Vectren's current recommended programs with an average annual budget of only $3.8 million per year.[23] In fact, Vectren's Study only estimates achievable potential for all programs with a spending of 5.8 million per year. Even without considering inflation this is only 67% of what Vectren cost-effectively spent in 1995.

Q: What spending levels do you recommend for Duke Energy and Vectren?

A: Other jurisdictions are capturing savings of around 1% of load each year with budgets of around 3% of electric revenue. I believe this would be a good initial target, with adjustments over time based on more detailed analysis of the opportunities and costs. For Duke, this would represent average annual spending of approximately $60 million.

Q. Do you have any recommendations on the types of programs and portfolio that Duke Energy and Vectren should pursue given your suggested investment in efficiency resources?

A. Yes. The Commission should direct Duke Energy and Vectren to develop a comprehensive portfolio of programs based on careful analysis of the markets in their territories, and best practices throughout North America. However, below I

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[20] Assuming average weighted measure life of 13 years, using a real discount rate of 3%.
[21] SIGECO, *op. cit.,* p.2
[22] Estimated based on average weighted measure life of 13 years and 3% real discount rate.
[23] Forefront Economics, *op. cit.,* p. 2.

list promising programs based on best practices. Any portfolio should rely on a small number of comprehensive programs that address multiple end-uses and opportunities with-in the targeted market. This provides improved customer service through one-stop-shopping, and allows for more comprehensiveness treatment within each facility. In contrast, Duke Energy and Vectren's current proposals are for very limited programs designed around specific technologies. While promotion of each technology does require a full understanding of its unique market and customized strategies, isolating them in separate programs creates barriers to customers that inhibit comprehensively addressing their energy needs and results in balkanized services that customers find frustrating.

Further, as is recommended in the Vectren Study and proposed in Duke's original 2005 DSM Plan filed in Cause No. 42612, integration of gas and electric services within a single portfolio of programs should be pursued. This again allows for better customer service and comprehensiveness. It also potentially expands the depth of efficiency adoption because both electric and gas economics can be considered when offering customers financial incentives.[24] Duke seems to agree with this, as it noted "focusing on dual fuel opportunities in areas where our [Duke Energy Indiana, Citizens Gas and Coke Utility (Citizens Gas), Vectren Energy Delivery, and IPL] service territories overlap creates efficiencies in administration,

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[24] For example, better insulation or windows may not be cost-effective based only on electric cooling savings or only on gas heating savings, but when considered together may be cost-effective. Separate electric and gas programs, even if they use total resource cost-effectiveness criteria, will generally limit any financial incentives based on the value to the particular energy system. As a result, many measures may not be considered or sufficiently promoted that are cost-effective.

marketing and delivery of a broader set of energy efficiency measures to customers."[25]

Finally, Duke Energy and Vectren programs should be funded by and available to *all* electric consumers. The largest C&I customers are more directly able to participate in efficiency programs and have greater resources to invest in efficiency and technical expertise. However, many of the same barriers exist for these customers, who typically do not implement many cost-effective efficiency measures on their own. This large customer market is especially important in Indiana, given its relatively large proportion of energy usage, as noted above.

Programs I recommend include:

- Residential new construction program (e.g., Energy Star New Homes)
- Residential lighting and appliances (promotion of compact fluorescent lighting and efficient appliances through upstream promotions such as manufacturers buy-downs, point of sale marketing, vendor services, etc.; note this program could be combined with the C&I Products)
- Residential Low Income program (whole house treatment of gas and electric opportunities in existing Low Income homes)
- Residential Existing Home Improvements (e.g., Energy Star Home Performance; should include aggressive strategies to capture electric space and water heating fuel switching opportunities)

[25] Duke IRP, June 15 2006, p. 4-18.

- C&I New Construction (addresses all cost-effective opportunities for new buildings, expansions and major renovations; works closely with design community)
- C&I Existing Construction (addresses all cost-effective opportunities for existing buildings and industrial processes, both at the time of planned investment in equipment and systems and for early retirement; for small commercial where electric space and water heating is prevalent, consider fuel switching)
- C&I Products (similar to residential lighting and appliances, this would promote efficient commercial plug load equipment using upstream strategies; note this program could be combined with the residential lighting and appliances program)

IV. THIRD PARTY ADMINISTRATIVE MECHANISM OR ALTERNATIVE TO REMOVE DUKE ENERGY AND VECTREN DISINCENTIVES TO INVESTMENT IN EFFICIENCY RESOURCES AND PLACE EFFICIENCY ON AN EQUAL FOOTING WITH POWER SUPPLY ALTERNATIVES.

Q: Do Duke Energy and Vectren have any disincentives to pursue efficiency instead of traditional supply-side resources?

A: Yes. Under current regulation, once base rates are set Duke Energy and Vectren have incentives to increase sales until the next rate case to increase profits. This inherently conflicts with the broader societal goal of providing energy services to ratepayers at the least total cost.

Q: Are there ways to overcome these disincentives?

A: The IURC has two options. One option is to establish non-utility administration of efficiency programs, ideally Statewide. If this option is pursued, then overcoming the utility disincentives and providing incentives becomes less important. While utility customer relationships are important, and utilities should still be encouraged to market efficiency efforts and support the programs, the overall success of program delivery would not be under direct utility control.

A second option is to allow utility administration of programs, but to carefully develop financial mechanisms that reward utilities for exemplary performance but do not provide a windfall to shareholders for programs that do not show results.

Q: Please discuss the option of third party administrative models for efficiency delivery in Indiana.

A: The IURC recently commissioned a study that assessed different administrative models for Indiana.[26] It discusses the benefits and drawbacks of different options. It notes "fundamentally, it is more important for Indiana to initiate an effective statewide effort with explicit goals and objectives than to debate over how the effort is structured. States have had proven success under all versions of the models reviewed in this paper."[27] I agree with this advice. Indiana should consider the different options, and pursue a path that allows for effective and cost-efficient delivery to all electric consumers, consistency across utility territories and effective integration of gas and electric programs. It is likely that use of a statewide administrative model may be more effective at doing this by

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[26] Stratton*, et.al., Indiana DSM Investigation Report: Report on Current Programs and Future Direction,* April 16, 2006.

avoiding duplicative administration efforts and balkanized services. However, I believe adoption of a new structure will take some time. In the absence of a new structure, IURC should direct Duke Energy and Vectren to deliver aggressive efficiency programs and provide some level of incentive to encourage exemplary performance.

Q: If the IURC elects to continue utility administration of efficiency programs, what do you recommend to overcome inherent disincentives?

A: The Commission could create a mechanism to make investment in the least cost solutions for energy services profitable for Duke Energy and Vectren. This should include a performance incentive for shareholders for exemplary performance. A number of models exist to do this. Massachusetts, Connecticut and Vermont can be looked to for good models. The key components of a good performance incentive mechanism should be:

- Award of incentives based on *actual verified performance* (e.g., not for spending money on efficiency, but for getting results)
- Incentives should be scaled, with higher incentives for higher achievement. The target award level should based on aggressive but achievable goals, with the opportunity to earn greater incentives for exemplary performance beyond these base goals. This avoids the desire for utilities to stop pursuing more cost-effective efficiency once they reach the base target.

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[27] Stratton, *op. cit.,* p. 2.

- Threshold levels that are less than the base goals should be established where Duke Energy and Vectren can earn a portion of the target incentive for reaching the threshold level (say 75% of the base goal and incentive level), with additional earnings scaled up to the exemplary level. This is important because if it is clear prior to the end of the period that a utility will not reach the target, they should still have incentive for pursuing as much cost effective efficiency as possible.
- The largest portion of incentives should be based on achieving actual benefits, ideally based on total resource net benefits, but could be based on kWh and peak kW savings as well, or a combination of the three. However, additional goals tied to other criteria should exist. These goals can be used as countervailing influences, to avoid utilities simply focusing on savings at the potential detriment of things like equity, comprehensiveness, etc. Examples could include: targets for low income participation; geographic or demographic equity goals; comprehensive treatment goals (e.g., at least X% savings among new construction participants), etc.
- Incentives can be annual or multi-year. Multi-year goals have the advantage of allowing utilities more flexibility to modify designs over time to make most efficient and effective use of resources. It also allows for goals focused on things like market transformation that may take multiple years to show results.

Q: Didn't Duke propose a shareholder incentive as part of its last request for DSM programs in Cause No. 42612?

A: Yes. However, Duke's combination of lost revenue recovery and shareholder incentive were designed to overcompensate the Shareholders, at significant expense to the ratepayers. Given the relatively low risks involved in investment in DSM, the levels of incentive were not necessary to encourage exemplary performance.

Q: What level of incentive is reasonable?

A. The Commission should develop incentive levels that are enough to motivate Duke Energy and Vectren, but no more. This will depend on consideration of other financial aspects of the company. However, in general, incentives in the range of 5-10% of program spending have proved sufficient in other jurisdictions. Exhibit PHM-4 shows performance incentive levels at various jurisdictions. Note that while incentives should be based on performance, not spending, considering the level of base incentives as a fraction of utility investment is a convenient way to consider appropriate levels. Also note that at least some jurisdictions scale these target levels up for corporate taxes, so the percents may reflect after-tax earnings.[28]

Q. Does this conclude your testimony?

A. Yes.

[28] MA does this. Others may as well.

RESUME

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Mr. Mosenthal has 24 years experience in energy efficiency consulting, including facility energy management, utility and state planning, program design, implementation, evaluation and research. He has particular expertise in the commercial, industrial and institutional sectors. Mr. Mosenthal has developed numerous utility, state and regional integrated resource and DSM plans, and designed and evaluated residential, commercial and industrial energy efficiency programs throughout North America and in Europe and China. He has also been the lead analyst on numerous energy efficiency potential assessments. Mr. Mosenthal has played key roles in utility collaboratives and has successfully worked to build consensus among diverse parties in various assignments. Mr. Mosenthal also has designed program implementation procedures, managed implementation contracts, trained efficiency program and planning staff, and performed over 400 commercial and industrial facility energy efficiency analyses for end users.

PROFESSIONAL EXPERIENCE

1996 – present
Founding Partner, **Optimal Energy, Inc**., Bristol, VT.
Consult with electric and gas utilities, governments and other non-utility parties on energy efficiency, resource planning and regulatory issues. Develop strategies for achieving energy efficiency and least-cost resources, including administrator funding and incentive mechanisms, and program and market design and analysis. Projects include lead work on utility DSM collaboratives; development of utility, state and regional IRP and DSM filings; expert testimony in contested regulatory proceedings; program design, implementation, planning, monitoring and evaluation; energy efficiency resource assessment; and advisory roles on the development of energy policy. Current or recent projects include: Lead researcher on energy efficiency issues for EPA's Clean Energy Partnerships with State and Local Government to advance State Clean Energy Action Plans; Manager of electric and natural gas efficiency and renewable potential assessments for New York State Energy Research and Development Authority; Lead consultant for C&I gas program design, development and analysis for NYSERDA; Chief architect of Efficiency Vermont, the nation's first and only state efficiency utility, as well as advisor on C&I planning and program design to Efficiency Vermont; Advising two provincial governments in China on development of efficiency efforts that would serve as a model for long term national efforts; and Team Leader for Commercial and Industrial sectors in the NSTAR Collaborative.

1995 – 1996
Senior Research Associate, **Resource Insight, Inc**., Middlebury, VT.

Consulted on DSM planning, program design, monitoring and evaluation, and resource characterization, specializing in the commercial and industrial sectors. Projects performed on behalf of utility and non-utility parties, in both cooperative settings and in contested regulatory proceedings.

1990 – 1995
Chief Consultant, **Xenergy, Inc**. **(now Kema)**, Allendale, NJ.
Managed the consulting division for Xenergy's (now Kema's) Research, Planning and Evaluation Group (RP&E) in its Mid-Atlantic Region. Responsibilities included direct utility consulting, as well as marketing, administration and staff management for RP&E. Consulting activities focused on assessment of DSM technology potential, DSM planning, program design and development, and process and impact evaluation for electric and gas utilities.

1990
Research Associate, **Center for Energy and the Environment**, **University of Pennsylvania**, Philadelphia, PA.
Supported design and analysis of a performance-based hook-up fee program for the New York Power Pool. Activities included modeling building energy use and peak loads; identifying residential and commercial new construction baseline practices; identifying barriers to efficiency in residential, commercial and industrial new construction and analyzing the economic, energy efficiency and legal impacts of the potential program.

1989
Independent Researcher, **Natural Resources Defense Council**, New York, NY.
Developed report on potential incentives for commercial energy efficiency improvements in New York City. Analyzed technical lighting efficiency potential in New York City commercial buildings; identified existing regulatory, institutional and market barriers to improved efficiency; and proposed potential regulatory, legislative and market incentives at the state, city and utility levels to encourage increased efficiency.

1988 – 1990
Private Consultant, Philadelphia, PA.
Clients included non-profit, governmental and private entities. Performed energy-related research, developed and analyzed potential energy efficiency programs, wrote reports and proposals, aided in contract negotiations and performed building energy audits.

1986 – 1988
Acting Executive Director, **Community Energy Development Corp. (CEDC)** with simultaneous positions as *General Manager*, **Citizens Coalition for Energy Efficiency (C2E2)** and *General Manager*, **Community Energy Consumers (CEC)**, Philadelphia, PA.
Managed all aspects of CEDC, C2E2 and CEC operations including: program design and development; program implementation; provision of energy efficiency consulting services for multifamily and institutional building owners; and delivery of a fuel oil cooperative program. CEDC and C2E2 were non-profit organizations providing direct energy efficiency services and energy policy research, respectively. CEC was a for-profit CEDC subsidiary that brokered fuel oil for commercial and residential customers.

1983 – 1986

Director of Technical Services, **Pennsylvania Energy Center**, Philadelphia, PA.
Managed, designed and developed energy services for the Southeast Regional branch of the Pennsylvania State Energy Office. Designed and developed technical energy services for commercial, industrial and institutional building owners; supervised staff of energy auditors and subcontractors; performed over 400 commercial and industrial energy audits; and taught energy management workshops.

EDUCATION

M.S., Energy Management and Policy, University of Pennsylvania, Philadelphia, PA, 1990, 4.0 GPA.
B.A., Design of the Environment, University of Pennsylvania, Philadelphia, PA, 1982.

Certificate in Electrical Engineering, Pennsylvania State University, Ambler, PA, 1984.

HIGHLIGHTS OF PROJECT EXPERIENCE

EFFICIENCY PROGRAM DESIGN AND PLANNING

- Lead advisor to the Ohio Office of Energy Efficiency on planning and program design on behalf of U.S. EPA's Clean Energy Partnerships with State and Local Government's to advance State Clean Energy Action Plans. Project includes reviewing past performance and current plans and funding, and advising on new programs and funding commitments. (2006 – present)

- Manager of program design, development and planning for Efficiency Vermont, the world's first Energy Efficiency Utility, as part of multi-organizational enterprise operating under a $27 million contract with the Vermont Public Service Board to deliver statewide energy-efficiency programs for the customers of Vermont's twenty-one electric utilities. Includes design, development and start-up of programs to serve the commercial, industrial, institutional and agricultural sectors in Vermont. (2000 – present)

- Team Leader for the commercial and industrial programs for the NSTAR Energy Efficiency Collaborative, on behalf of the Massachusetts Collaborative Non-Utility Parties. Responsible for leading a team of consultants representing non-utility parties interests on the design, development, implementation and evaluation of NSTAR's portfolio of C&I programs. This project involves supporting the utility in developing and implementing a set of SBC-funded C&I programs. Took a lead role in the technology assessment of NSTAR C&I achievable potential and its 1999, 2000 and 2001 Energy Efficiency Plan filings to the MA DTE. (1999 – present)

- Manager of NY statewide gas resource assessment and program design and analysis for all gas territories in NY. Responsible for coordinating a large multidisciplinary team to assess residential, commercial and industrial gas efficiency potential, and design and analyze a portfolio of efficiency programs to be delivered statewide. For NYSERDA (2005 – present)

- Managed redesign and development of new incentive offerings and forms for Cape Light Compacts C&I efficiency programs. Included promotion of Energy Star products and new emerging technologies. For Cape Light Compact (2005 — 2006)

- C&I consultant for the MECO, WMECO, and NSTAR Collaboratives, representing the Massachusetts Collaborative Non-Utility Parties, on the regional CoolChoice and MotorUp programs. Lead planning, program design and goal setting negotiations related to MA participation in these programs. Also provide consulting on cross-utility program and planning and policy issues. (1999 – present)

- Consulting team C&I leader on development and assessment of demand-side management investment portfolios for China, for the Natural Resources Defense Council. This project includes developing and analyzing the potential for a portfolio of efficiency programs to serve as model programs for China. It includes addressing political and regulatory barriers, long term funding mechanisms and development of an administrative organizational structure. (July 2003 – present)

- Designing a portfolio of C&I program incentive forms for Cape Light Compact. Revising current offerings to improve and expand, and to bring greater consistency with other MA utility programs. (2005)

- Assist the Connecticut Municipal Electric Consortium to design and develop a portfolio of municipal efficiency programs. This project includes analysis of opportunities and design and development of program designs, and implementation services including development of tracking systems and provision of technical services directly to C&I customers. (2005 – present)

- Assist the Vermont Electric Power Company to analyze and propose resource solutions to address a T&D constrained area in southern VT. Analyzed the efficiency potential in the region and proposed and designed a portfolio of efficiency programs to avoid or defer the need for substantial T&D upgrades. (2005 – present)

- Report and testimony on performance of DSM initiatives and proposed shareholder performance incentives for administrators of conservation and load management programs in Connecticut, on behalf of Connecticut Office of Consumer Counsel. Led C&I analysis. (2003 – 2004)

- Led the development and analysis of a portfolio of C&I market transformation and retrofit programs for the Long Island Power Authority. Currently advising the project team on implementation issues related to the development and delivery of these initiatives. This project includes program design of utility and regional market transformation programs targeting new and replacement building and equipment markets, and the estimation of the achievable potential for selected markets on Long Island. (1998 – 2000)

- Economic advisor to Northeast Energy Efficiency Partnerships, a not-for-profit regional consortium of utilities pursuing market transformation in efficiency markets. Economic analysis and report on cost-effectiveness of NEEP initiatives involving high-efficiency motors, CoolChoice unitary HVAC, clothes washers, and residential lighting. (On and off 1998 – 2004)

- Commercial programs consultant for the Cape Light Compact energy efficiency programs. Advised on planning, program design, measures, cost-effectiveness, implementation issues and goal setting. (2003 – 2004)

- Commercial and industrial analysis and report on gas energy efficiency programs for Consolidated Edison of New York, on behalf of New York City Economic Development Corporation, NRDC, Pace Energy Project, Association for Energy Affordability and Public Utility Law Project. (April – May 2004)

- Commercial advisor on program planning and implementation of multi-year statewide energy-efficiency programs in the New Jersey Clean Energy Collaborative involving all the state's electric and gas utilities and the Natural Resources Defense Council. (April 2000 – June 2003, on behalf of NRDC). Co-directed collaborative work on program development, planning, and implementation for Conectiv. (November 1996 – 2000)

- Consultant to Citizens Utilities Corporation's Arizona Electric Division, developing a program strategy to capture maximum achievable potential among targeted sectors to effect immediate load reductions in response to energy shortages and rate shock from the California electric market. This project included assessing the efficiency and load reducing opportunities, and developing implementation strategies to capture them, among food processing and storage, wastewater treatment and school facilities. (2000 – 2001)

- Led the design and analysis of a portfolio of commercial, industrial and residential core DSM programs for the Vermont Department of Public Service to create the first ever efficiency utility. The project involved program design and development; measure characterizations; analysis of program impacts and costs; assessment of achievable market-driven and retrofit potential; modeling of program participation; economic screening; and development of monitoring and evaluation guidelines. In addition, developed criteria for the delivery of the core programs during a transition to the efficiency utility and electric utility restructuring, and established the proposed structure and role of the efficiency utility. (1995 – 2000)

- Consultant to the California Board for Energy Efficiency in development of a portfolio of statewide non-residential programs and program elements. These programs, designed around markets and market players, rather than intervention strategies, would target a comprehensive package of C&I opportunities among all market segments. They include strategies to transform equipment markets and to enhance and spur the creation of independent energy service providers. (1998 – 1999)

- Analyst energy and business strategy and planning for Energy Cooperative Association of Pennsylvania, a buyers' cooperative offering electricity, fuel oil, energy-efficiency and renewable energy to residential and non-profit consumers in eastern and western Pennsylvania. Collaborated on a feasibility analysis and preliminary business plan. (1997 – 1998)

- Technical and market support for Energy Co-op of Vermont *(ECVT)* in developing competitive energy efficiency products and services for residential and small commercial markets. ECVT will deliver a full range of energy services to its members, including electricity, fossil fuels, efficiency and on-site renewable energy. Activities included identifying potential products and services; developing appropriate and cost effective marketing and delivery strategies; analyzing the economics and likely market adoption of products and services, including solar systems; and support in the development of a detailed business plan. (1998)

- Program support to the Citizens Utilities Company Vermont Electric Division in developing strategies for regulated and unregulated energy service offerings during a transition to, and after electric utility restructuring. Services included supporting DSM planning, characterization of efficiency resources, program design, evaluation of program design and implementation procedures, and detailed implementation planning. Programs included both remedial DSM programs and potential new DSM programs targeted to CUC's total territory and also specifically designed to target areas undergoing transmission and distribution constraints. (1998 – 2000)

- Program support for the Burlington (VT) Electric Department in development of its 1997 Energy Efficiency Plan. Services included developing strategies for new programs to complement statewide core programs and to develop transition strategies for modifying existing programs under both existing and restructured utility environments. Services included program planning, measure characterization and program design. (1998 – present)

- Performed a critical review of Jersey Central Power and Light DSM plans and recommended program modifications to key C&I programs, on behalf of the Mid-Atlantic Energy Project and NJ Public Interest Research Group. This project involved negotiations with the utility and non-utility parties on program design details, culminating in formal testimony before the New Jersey Board of Public Utilities, in which most recommendations were ultimately adopted in BPU decision. (1995)

- Developed program designs, resource planning assessments, detailed implementation manuals and guidelines, and monitoring and evaluation plans for Maryland utilities in DSM collaboratives, primarily for Potomac Electric Power and Maryland Office of People's Counsel. Separate projects included work on behalf of both utilities and the Maryland Office of Peoples' Counsel. Programs designed included direct installation and financial incentive programs targeted for residential, commercial and industrial customers. Detailed implementation plans and guidelines were developed for small commercial and residential direct installation programs and a residential point of sale program. Utilities worked with included Potomac Electric Power Company, Baltimore Gas and Electric, Delmarva Power Company, and Potomac Edison. (1990 – 1997)

- Worked with Florida Power Corporation to develop alternative DSM program design strategies meeting its multiple rate impact, cost-effectiveness and budgetary constraints. (1996)

- Negotiated with Interstate Power, MidAmerican Energy Company, and Iowa Electric Systems on IRP and DSM program design issues, on behalf of the Iowa Office of Consumer

Advocate. Successfully developed, and obtained agreement to implement, an innovative Comprehensive Early HVAC Retirement programs for the C&I market with IP and MEC. Completed program designs, developed financial and marketing strategies, and quantified all program impacts and costs, and performed economic analysis of the program. (1995)

- Designed, developed and planned a portfolio of energy efficiency programs for the nationalized wholesale electric utility in Spain and its retail utility companies, for Grupo Endesa. This project included development of Spain's first ever DSM programs. Consensus was built among diverse utility parties, including representatives from separate retail companies. (1995)

- Designed, and developed detailed implementation and evaluation plans for, American Electric Power C&I programs providing detailed technical assistance and financial strategies to promote energy efficiency. This project included development of marketing strategies and materials; identification of resource requirements; and development of delivery, tracking and evaluation strategies. (1994)

- Designed a portfolio of commercial and residential DSM programs for the Southern Minnesota Municipal Power Agency (SMMPA). Characterized and screened extensive efficiency measures covering lighting, motors and HVAC end uses for the commercial and industrial classes and lighting, hot water, HVAC and shell measures for the residential class. Developed program concepts and detailed implementation plans by building consensus among SMMPA's 18 member retail utilities, serving a variety of communities -- from small, rural farming towns to a city of approximately 40,000 people. Final deliverables included customized implementation plans and staff training to ensure that each retail utility would be able to easily implement the programs. Programs included residential lighting and water heating, and commercial and industrial HVAC, lighting and motors programs. (1993)

- Designed a high-efficiency lighting program for Public Service of New Mexico. This direct-installation program was designed to support state and federal facilities throughout New Mexico with compliance of an executive energy conservation order. The program included a turn-key service, including auditing, detailed lighting design, construction management and installation services, and low-interest financing. Developed a pilot project implementation. In addition to program-design services, supported the formulation of a strategy for lost revenue and cost-recovery for PSNM, and developed a cost-recovery proposal presented to Commission staff. (1992)

- Managed the design of a dual-fuel heat pump program for Georgia Power Company. Directed modeling of commercial building energy consumption, and customer and trade ally market research; designed marketing, incentive and program delivery approaches; quantified program costs and impacts; and developed a program plan. (1992)

- Designed, and produced a detailed implementation procedures manual for a residential direct installation program for Ontario Hydro. This $100 million program was at the time the largest and most aggressive residential DSM program in the world. It included offering audits to all residential households in the Ontario Province, with follow-up direct installation of measures for customers identified as high use. The procedures manual developed detailed implementation plans for all aspects of program delivery, including marketing, audit completion and mailing, crew dispatch and installations, measure procurement and warehousing, and development and maintenance of an MIS system to track and report program data. (1991)

- Designed portfolio of commercial and residential DSM programs for Omaha Public Power District, including complete development of program plans and implementation requirements. Program plans were based upon a comprehensive DSM technology assessment that included estimating the technical and economic potential of cost-effective DSM measures in the residential, commercial and industrial market segments. Technologies were screened and identified to match Omaha Public Power District's goals and customer service objectives. Programs and plans were eventually developed for residential new construction, audit and direct load control programs, and for a commercial and industrial lighting program. (1991)

RESOURCE PLANNING AND POLICY

- Lead energy efficiency analysis, research and product develoment for EPA's Clean Energy Partnership with State and Local Governments to advance State Clean Energy Action Plans. Current projects include development of a Clean Energy Fund Manual to guide state planners in development of Clean Energy Action Plans; development of an energy efficiency potential assessment white paper on the use, value and performance of efficiency and renewable potential assessments; and development of multi-year plans for efficiency programs for Ohio Office of Energy Efficiency. For EPA (2006 — present)

- Principal investigator and author of an assessment of electric efficiency potential for Texas. Analyzed the residential, commercial and industrial potential for electric load reductions from efficiency programs, appliance standards, enhanced building codes, demand response and combined heat and power programs as an alternative to coal plants to meet reliability constraints. Also recommended policy and programatic changes to advance efficiency in Texas. For NRDC and Ceres (2006 –- present)

- Manager of NY statewide gas resource assessment and program design and analysis for all gas territories in NY. Responsible for coordinating a large multidisciplinary team to assess residential, commercial and industrial gas efficiency potential, and design and analyze a portfolio of efficiency programs to be delivered statewide. For NYSERDA (2005 – present)

- Developed an innovative "efficiency rate tariff" designed to benchmark commercial facilities energy efficiency and price electricity to them based on their efficiency levels. This electric rate would develop threshold efficiency levels by facility type with increasing block rates that remove current disincentives to efficiency that exist with traditional electric rate design. For Wal-Mart™ (2005 — 2006)

- Consulting team C&I leader providing technical assistance supporting rulemaking to implement energy-efficiency provision of renewable portfolio standard for Pennsylvania, on behalf of Citizens for Pennsylvania's Future (PennFuture). Developed mechanisms and sample verification protocols for inclusion of efficiency resources to meet RPS standards. (February 2005 – present)

- Assist the Vermont Electric Power Company to analyze and propose resource solutions to address a T&D constrained area in southern VT. Analyzed the efficiency potential in the region and proposed and designed a portfolio of efficiency programs to avoid or defer the need for substantial T&D upgrades. (2005 – present)

- Commercial analysis project lead for consulting team assessing technical, achievable and economic potential for energy-efficiency and renewable resources in New York State and five sub regions over 5, 10 and 20 years, on behalf of New York State Research and Development Authority. This project set the standard for national efficiency potential efforts, analyzing over 2000 commercial measures throughout NY. (January 2002 – August 2003)

- C&I project lead, including report and testimony, for consulting team projecting potential for demand-side resources to defer the need for major transmission upgrades, on behalf of Vermont Electric Power Company. This project included analyzing the economic and achievable potential in a transmission-constrained area to determine the least cost solution to reliability problems. (November 2001 – December 2004)

- C&I project lead for consulting team updating statewide projection of economically achievable efficiency potential for state of Vermont, on behalf of the Vermont Department of Public Service. (October 2001 – 2003)

- C&I project lead for consulting team supporting utilities in targeting demand-side resources to optimize distribution investment planning in statewide distributed utility planning collaborative, on behalf of the Vermont Department of Public Service. This project included developing a unique "distributed utility screening tool" that allowed small municipal and cooperative utilities to easily estimate rough achievable potential in their jurisdiction as a first step in least cost distributed utility planning. (September 2001 – December 2002)

- Analyzed the C&I electric efficiency achievable potential for the State of Maine, on behalf of the Office of Consumer Advocate. This project included estimated economic and achievable opportunities over 10 years, in support of development of a statewide efficiency administration model. (2002)

- Analyzed the C&I electric efficiency achievable potential for the State of Michigan, on behalf of the American Council for an Energy Efficient Economy (ACEEE). This project included estimated economic and achievable opportunities over 10 years, in support of potential development of a statewide efficiency administration model. (2002 - 2003)

- Consultant to the Northeast Energy Efficiency Partnerships, a non-for-profit regional consortium of utilities pursuing market transformation in efficiency markets. Conduct technology assessments and economic analysis of the effects of codes and standards in the Northeast, and of NEEP initiatives involving high-efficiency motors, and C&I Unitary HVAC. (1998 – present)

- Consultant on commercial and industrial technology protocols and cost-effectiveness for the New Jersey Statewide Utility Collaborative, for the Natural Resources Defense Council. This project included developing engineering algorithms and baseline assumptions for all prescriptive gas and electric technologies promoted in the statewide C&I Construction program. In addition, participated in the cost-effectiveness analysis of the C&I programs supporting the New Jersey July 2001 Compliance Filing to the NJ BPU. (2000 – present).

- Modeled carbon output from end use energy consumption in Vermont, and identified potential revenue resulting from a "carbon/Btu tax" imposed on all fossil fuels and on hydro and nuclear electricity. Presented findings to a committee of Vermont legislators and other interested parties. (1996, for Friends of the Earth)

- Performed a critical review of Centra and Union Gas Company's joint DSM resource plan. This project involved assessing the appropriateness and completeness of the methods and data used, and the resulting outcomes, for the Green Energy Coalition. It focused on the development, analysis and screening of its proposed commercial and industrial DSM programs. The project included formal testimony before the Ontario Energy Board (EBRO 493/494), which included proposed improvements to the planning process, and recommended regulatory mechanisms to encourage the improvement of future plans. (1996)

- Performed a cogeneration penetration and potential study for Consolidated Edison of New York. Modeled the costs and benefits of cogeneration among five commercial building types and numerous equipment and operating scenarios to assess the likelihood of large existing customers self-generating. Supported the utility in analyzing the likely prime motivators for decisions to self-generate, and strategies to develop value-added services customer would prefer. (1995)

- Completed separate electric and gas DSM resource assessments for Public Service Electric and Gas Company. Studies identified the technical, economic and market potential for electric and gas energy efficiency and fuel switching measures, for residential, commercial and industrial customers, and for both new and existing construction. Projections of likely free market activity were also made. (1995)

- Performed a study of the forest products industry. Identified the impact on different sectors of the forest products industry of energy pricing and tax policy, by geographic region. Identified energy efficiency opportunities for paper, lumber, and furniture manufacturers and the typical cost effectiveness of these opportunities, for the New York State Energy Office. Focus groups and other market research techniques, along with a literature search, were used to identify the efficiency potential of the industry, as well as likely forest products industries' response to changes in energy, employment and tax policy in New York State including likely probability of companies' relocation. (1995)

- Performed a gas DSM resource assessment for Orange and Rockland Utilities. This project identified the technical, economic and market potential for gas energy efficiency and for electric-to-gas fuel-switching measures. These potentials were estimated separately for residential, commercial and industrial customers, and for both new and existing construction. Projections of likely free market activity, by sector, were also made. (1993)

- Performed DSM planning services in support of Consolidated Edison Company's 1991 and 1993 biennial DSM Plan filings with the NY Public Service Commission. These projects included estimating the technical, economic and market potential of energy efficiency, program design and development, and modeling of program participation, costs and impacts for a portfolio of residential, commercial and industrial programs with an annual combined budget of approximately $130 million. (1991 and 1993)

- Developed long-range DSM Plan. Project included development of measure costs and impacts, program designs, integration of demand-side plans with supply resource costs, training utility staff in the use of a proprietary demand-side resource planning model, and regulatory filing support, for the New York Power Authority. The project resulted in development of a portfolio of commercial, industrial, and municipal DSM programs. (1993)

- Performed a critical review of Florida Power and Light's integrated resource plan, for the Legal Environmental Assistance Fund. This project involved assessing the completeness and appropriateness of FPL's IRP process and outcomes, focusing on the development, analysis and screening of its proposed commercial and industrial DSM programs. (1995)

- Developed an integrated resource plan (IRP) approach for Midwest Energy. This "scoping study" involved devising a method for this small cooperative utility to meet the Kansas Corporation Commission IRP requirements in a cost effective and appropriate way, given their limited resources. The project included design of sampling and date collection strategies, development of analytical methods to address both supply and demand resources, identification of staffing and economic requirements, and support in the development of testimony to the Kansas Corporation Commission on appropriate alternatives to IRP rules. (1994)

- Performed a critical review of the Tennessee Valley Authority's integrated resource plan, for the Tennessee Valley Public Power Agency. This project involved assessing the completeness and appropriateness of TVA's IRP process and outcome, as well as its likely impact on TVA's 160 full-requirements retail distribution utilities. Areas addressed included residential, commercial and industrial DSM planning and design, forecasting, and integration of demand and supply resources. (1994)

- Established a method, and developed a scoping plan, for estimation of technical, economic and market energy efficiency potential for Wisconsin Gas Company. This project specified innovative methods to leverage secondary data, while maintaining precision, thereby reducing the costs of formal data collection. (1994)

- Researched and estimated typical energy demand and consumption for a comprehensive list of residential electrical equipment and appliances, for Atlantic Electric. (1993)

- Analyzed the economic, legal, regulatory, utility and institutional barriers to energy efficiency in New York City, for the Natural Resources Defense Council. Quantified economic potential for commercial energy efficiency in New York City, and determined the primary reasons this potential was not being captured. The report identified appropriate market, legal and regulatory solutions to these barriers at the local, state and federal levels. These included restructuring commercial leasing laws in New York City, developing a lost revenue, cost recovery and savings incentive mechanism for utility DSM, and changes to tax codes. (1989)

- Analyzed the economic, environmental and efficiency impacts of implementing a fee-based capacity charge on all new construction to obtain electric service in New York State, for the New York Power Pool. Identified cost-effective efficiency opportunities in the commercial and residential sectors and their likely adoption under different "hook-up" fee scenarios. Project also identified then-current baseline practices in new construction, the likely economic impact on both builders/developers and building occupants/purchasers, as well as the likely impact on building activity throughout the state. (1989)

EVALUATION, MONITORING AND ASSESSMENT

- Development of M&V protocols and mechanisms for two Chinese provinces to sell energy efficiency portfolio carbon dioxide savings into the Clean Development Mechanism (CDM) established under the Kyoto Protocol. For Natural Resources Defense Council (2004 — present)

- Market assessment support to the NYSERDA Small C&I Lighting Program. This project included advising on scope of analysis and interpretation of interview and survey data, and review and recommendations on program design and implementation. (2003 - present)

- Lead advisor to Efficiency Vermont on C&I evaluation planning and coordination with Department of Public Service on evaluation and savings estimation and verification. Lead negotiator for Efficiency Vermont with the VT DPS on C&I savings estimates and verification. (2000 – present)

- Lead advisor to Long Island Power Authority on its C&I baseline analysis and market assessment. Project included support in developing program and market theory, evaluation plans and RFP, review of proposals, and ongoing advise and critique on third party analysis. (1999 - 2001)

- Assessment of Citizens Utilities Company's Vermont Electric Division's small C&I retrofit program. Process and market evaluation of the effectiveness of CUC's design and delivery strategies. This project included detailed quantitative analysis of program implementation data on measures recommended and installed, measure costs and savings, participant demographics and electric loads, and program services and features. This implementation data was supplemented with on-site data collection and interviews with participants and utility staff and contractors. Statistical relationships were identified allowing inferences about the likely success of alternative program designs and implementation strategies. (1998)

- Separate reviews and analyses of the C&I DSM performance of Green Mountain Power and Central Vermont Public Service. These projects included review of utility databases and paper records, assessment of the level and quality of utility implementation performance, and review of planning, design, monitoring and evaluation efforts. These projects have culminated in formal testimony filed (in Docket Nos. 5983, 6018 and 6107) on behalf of the

Vermont Department of Public Service, criticizing GMP and CVPS for specific implementation and planning failures. Testimony has also offered detailed cost-effectiveness analyses of additional, specific C&I efforts GMP and CVPS could and should have performed. (1997 – 1998)

- Assessment of the energy and peak demand impacts, lost revenue and program costs of Baltimore Gas and Electric's 1996 DSM programs, for Maryland Office of Peoples Counsel. This includes review of all calculations and engineering algorithms, and assumptions used. (1997)

- Reviewed and revised Potomac Electric Power Company's monitoring and assessment of 1994 and 1995 DSM impacts and net benefit determinations, for Maryland Office of Peoples Counsel. This project involved developing and negotiating engineering algorithms to estimate program impacts for all Pepco DSM initiatives, and review of Pepco data collection processes, and impact and net benefit calculations, ultimately resulting in the establishment of cost recovery surcharges. (1995 – 1996)

- Jointly developed monitoring and evaluation strategies for assessing residential, commercial and industrial utility DSM programs, for the Vermont Department of Public Service. This project involved negotiations with utilities to develop joint evaluation methods for Green Mountain Power, Central Vermont Public Service, and other Vermont utilities to evaluate similar programs offered in each territory. (1995)

- Evaluated design of all ten residential and commercial programs offered by Dayton Power and Light, for the Dayton Power & Light Collaborative Evaluation Working Group. Project included a critical assessment of current approaches and implementation results, as well as detailed recommendations on program design modifications. Presented results to the full collaborative. (1994)

- Researched and analyzed the electronic fluorescent ballast lighting market and North American lighting DSM activity from 1988 to 1994, for Fried Frank, et. al. In support of civil litigation, identified typical costs and savings from adoption of electronic ballasts for different sectors and time periods, projected expected free market penetration of electronic and dimmable ballasts both with and without utility DSM programs, identified the likelihood for continued utility DSM subsidies, and projected sales of high efficiency lighting products given current utility regulatory climate. (1994)

- Completed both process and impact evaluations for all of Orange and Rockland Utilities' six commercial and industrial DSM programs. Project included development of engineering algorithms and parameter values to estimate program impacts. Default parameter values were estimated through detailed analysis of over 1,000 C&I energy audits. It also incorporated the first practical use of an innovative technique, "error propagation analysis," to estimate the contribution of each parameter to overall impact uncertainty. Process evaluations included design and implementation review, staff interviews, and market research including customer and trade ally surveys. Presented results before Public Service Commission Staff and intervenor groups. (1993)

- Process evaluation of Pennsylvania Power & Light's low income weatherization program. Project included development of participant survey instruments, completion of participant surveys, and interviews with utility and contractor staff. (1991

PERFORMANCE CONTRACTING AND FACILITY ENERGY MANAGEMENT

- Advising on development of business plan, financial model, and monitoring and verification needs for start-up private energy service company (ESCO) in Jiangsu Province, China. Project includes development of performance contracting offers, development of marketing and implementation procedures and materials, staff training, development of M&V protocols, and project marketing and analysis. (2004 – present)

- Managed development of a shared energy savings program for the Philadelphia Housing Authority. This project to install energy conservation measures in over four million square feet of inner-city public housing was the largest and most innovative public housing energy program in the U. S. at the time. It established precedents at the U. S. Department of Housing and Urban Development (HUD) for the provision of performance contracting in all HUD capitalized public housing projects. Tasks included project strategy development and planning, development of an RFP, and review and selection of energy service companies (1988)

- Provided technical engineering, construction management and financial services to commercial, non-profit and multifamily building owners, for Community Energy Development Corporation. Services included identification of cost effective energy efficiency opportunities, estimation of measure savings and installation costs, support in identifying and procuring financial assistance including grants and low interest loans, and construction management oversight of installation of energy efficiency measures. (1986 – 1988)

- Performed over 400 detailed commercial and industrial energy audits, for the Pennsylvania Energy Center. These audits identified cost effective energy efficiency opportunities in all types of C&I facilities, addressing all end uses and fuels. Audits included identification of project costs, savings, and equipment needs. Clients ranged from small commercial facilities to large office buildings and industrial facilities over 1,000,000 square feet. In addition to directly performing audits, managed and trained a staff of in-house and subcontract auditors, and developed and implemented marketing strategies to increase audit demand. (1983 – 1986)

- Performed approximately 25 site reviews of potential solar energy applications, for the Pennsylvania Governor's Energy Council. Included feasibility assessment of cost-effectively operating residential solar hot water systems, and verification of eligibility for state and federal tax credits. (1985)

EDUCATION AND TRAINING

- Instructor, Gas Efficiency Programs, National Best Practices, Association of Energy Service Professionals On-Line Seminars, Forthcoming, April 2006.

- Instructor and lead presenter, China State Grid Corporation DSM Instruction Center. Produced 2 instructional videos for utility staff throughout China on DSM. "Introduction To Demand-Side Management: The Usa Experience" and "Long-Term Energy-Efficiency Dsm Investment In The Northeastern U.S.", November 2004.

- Instructor, "On Target" DSM Workshops. Taught course sessions on DSM planning, program design, implementation and evaluation to utility personnel and other parties. (1994 – 1995, for Association for Demand-Side Management Professionals).

- Trained international team of utility personnel in DSM program planning and implementation. Training included identifying implementation needs among five different retail utilities in Spain. (1995, for Grupo Endesa)

- Designed and taught DSM and energy management workshops targeted to architects, engineers and building owners. Topics have included efficient lighting, multifamily building submetering; boiler efficiency improvements and weatherization techniques. (1983 – 1986, for the Pennsylvania Energy Center)

- Trained community action agencies to perform small commercial energy audits. This project to provide efficiency information to inner city neighborhoods included training addressing energy end-uses and fuels. (1985, for the Pennsylvania Energy Center)

PROFESSIONAL AFFILIATIONS

Co-Chair, Association of Energy Service Professionals, Marketing and Program Development Committee, 1996.
Project Leader, Association for Demand-Side Management Professionals, Committee on Program Design, Marketing and Implementation, 1995.
Chair, Association for Demand-Side Management Professionals, Innovative Program Design Committee, 1994.
Instructor, Association for Demand-Side Management Professionals, "On Target" DSM Workshops, 1994.
Member, Southeast Pennsylvania Regional Energy Advisory Board, 1986 - 1989.
Member, Mayor's Committee on Energy and Housing, Philadelphia, PA, 1986 - 1988.
Member, American Institute of Architects, Research and Technology Committee, 1984 - 1987.

PUBLICATIONS

"Removing Disincentives for Efficiency from Electric Rate Design," (with Galura, J., Gupta, A., Loiter, J.), *17th National Energy Services Conference Proceedings,* Las Vegas, NV, February 2007.

Power to Save: An Alternative Path to Meet Electric Needs in Texas, published by Natural Resources Defense Council and Ceres, New York, NY, January 2007.

"Gas Efficiency Potential and a Portfolio of Integrated Gas and Electric Statewide Programs for New York," (with Hogan, E.), *American Council for an Energy Efficiency Economy 2006 Summer Study Proceedings,* Pacific Grove, California, Forthcoming August 2006.

"Demand-Side Management Strategic Plan for Jiangsu Province, China: Economic, Electric and Environmental Returns from an End-Use Efficiency Investment Portfolio in the Jiangsu Power Sector," (with Finamore, B., Plunkett, J., Moscowitz, D., Slote, S., Wyatt, F.), *American Council for an Energy Efficiency Economy 2006 Summer Study Proceedings,* Pacific Grove, California, Forthcoming August 2006.

"Purchasing Efficiency Power Plants in Jiangsu," (with Finamore, B., Plunkett, J., Moscowitz, D., Slote, S., Wyatt, F.), *Greener Management International,* Forthcoming August 2006.

"Purchasing Efficiency Power Plants in Jiangsu and Shanghai" with (Song, H., Chen, R., and B. Finamore), *Rightlight 6 International Energy Efficiency Lighting Conference,* Shanghai, China, Forthcoming May 2005.

"Transmission System Integrated Resource Planning: Leveling the Playing Field" (with S. Slote), *ACEEE 2002 Summer Study on Energy Efficiency in Buildings,* Pacific Grove, California, August 2004.

"Long-Term Energy-Efficiency and DSM Investment in the Northeast United States," (with J. Plunkett), presented at the *China-US Workshop on DSM Policy Research,* sponsored by the China State Grid Corporation, Beijing, China, March 2004.

"The Big Picture: An Overview of Energy Savings Opportunities," *PACE University Energy Law Center*, presented as plenary session at PACE Recharge Energy Conference, September 2003.

"Energy Efficiency and Renewable Energy Resource Development Potential in New York State" (with C. Donovan, N. Elliott, D. Hill, S. Nadel, C. Neme, J. Plunkett), *New York State Energy Research and Development Authority*, August 2003.

"Documentation of the Northwest Energy Efficiency Alliance Efforts to Support Energy Codes and Participate in the Federal Standards Setting Process" (with S. Slote and D. Baston), *Northwest Energy Efficiency Alliance*, 2003.

"Efficiency And Renewable Electricity Potential Studies: Approaches, Results, Uses And Implications," *ACEEE 2003 Electricity Reliability Conference,* Berkeley, California, June 2003.

"The Technical and Economic Potential for Energy-Efficient Products and Services," *ACEEE 2003 National Symposium On Market Transformation*, Washington DC, April 2003.

"Light-Years Ahead: A New Approach to Transform Commercial Lighting" (with P. Richards and S. Lacey) *ACEEE 2002 Summer Study on Energy Efficiency in Buildings,* Pacific Grove, California, August 2002.

"A Modified Delphi Approach to Predict Market Transformation Program Effects" (with R. Prahl, C. Neme and R. Cuomo) *ACEEE 2000 Summer Study on Energy Efficiency in Buildings,* Pacific Grove, California, August 2000.

"A Systematic Application of Theory-Based Implementation and Evaluation of Market Transformation Programs," (with S. Hastie and R. Prahl), *ACEEE 2000 Summer Study on Energy Efficiency in Buildings,* Pacific Grove, California, August 2000.

"The Link Between Program Participation and Financial Incentives in the Small Commercial Retrofit Market," (with M. Wickenden), *1999 International Energy Program Evaluation Conference,* Denver, Colorado, August 1999.

"Delivering Statewide Efficiency Programs In a Competitive Environment — Vermont's Model," *1997 Annual Conference of the Association of Energy Service Professionals,* Boca Raton, Florida, December 1997.

"Marketing with Community Involvement," (with Shel Feldman, Jane Peters, Lynn Goldfarb and Bill Stieglemen), Panel presentation and discussion at the *Association of Energy Service Professionals 1997 Annual Conference,* Boca Raton, Florida, December 1997.

"Vermont 'Efficiency Utility' to Deliver Core Efficiency Programs," (with S. Parker), *Strategies, Vol. 8, No. 3, Association of Energy Service Professionals,* Summer 1997.

"The Power to Save: A Plan to Transform Vermont's Energy-Efficiency Markets" (with J. Plunkett), *Vermont Department of Public Service*, May 1997.

"Capturing Comprehensive Benefits from Commercial Customers: A Comparative Analysis of HVAC Retirement Alternatives" (with J. Plunkett and M. Kumm). *1996 ACEEE Summer Study on Energy Efficiency in Buildings*, Pacific Grove, CA, August 1996.

"Achieving Market Transformation with Pepco's Save and Save Again Program" (with A. Flinchum). *Association of Energy Service Professionals' 1995 Implementation Conference,* Dallas, TX, March, 1995.

"Potomac Electric Power Company's Early Chiller Retirement Option" (with G. Simpson), *1994 Annual Member Meeting of the Association for Demand Side Management Professionals*, San Diego, CA, December 1994.

"Innovative DSM Programs," Moderator of presentation session at the *1994 Annual Member Meeting of the Association for Demand Side Management Professionals*, San Diego, CA, December 1994.

"Home Energy Rating Systems," Moderator of presentation session at the *1994 Affordable Comfort Conference*, Philadelphia, PA, March 1994.

Demand-Side Management Planning and Implementation Guide, Association of Demand-Side Management Professionals, Boca Raton, FL, December 1991.

Performance Based Hook-Up Fees: Issues and Options (with R. Wirtshafter, et al.). New York Power Pool and Staff of the New York Public Service Commission, Schnectady and Albany, NY, August 1990.

Buyer's Guide to Energy Efficient Gas Furnaces. Citizens Coalition for Energy Efficiency, Philadelphia, PA, 1987.

"Hot Water Heating Energy Savings", *Pennsylvania Energy Report,* Citizens Coalition for Energy Efficiency, Philadelphia, PA, Summer 1986.

"Lighting: Sorting Through the Options", *Pennsylvania Energy Bulletin,* Pennsylvania Energy Center, Philadelphia, PA, January 1985.

Duke and Vectren Recommended Efficiency Savings as Compared to Electric Forecast

	Cumulative Annual Savings (GWh)			Load Forecast net of efficiency Savings (GWh)			Efficiency as % of base forecast
Year	Duke	Vectren	Total	Duke	Vectren	Total	Duke & Vectren
2007	0	0	0	33,169	6,210	39,379	
2008	161	30	191	32,061	6,011	38,072	0.5%
2009	411	77	488	32,450	6,069	38,519	1.3%
2010	748	140	889	32,505	6,104	38,608	2.3%
2011	1,096	206	1,302	32,626	6,136	38,762	3.3%
2012	1,453	274	1,727	32,725	6,172	38,897	4.3%
2013	1,819	344	2,162	32,823	6,202	39,025	5.3%
2014	2,193	415	2,608	32,895	6,224	39,119	6.3%
2015	2,575	488	3,063	32,945	6,239	39,184	7.3%
2016	2,966	562	3,528	32,988	6,247	39,236	8.3%
2017	3,366	638	4,005	33,028	6,260	39,287	9.3%
2018	3,773	716	4,490	33,040	6,273	39,313	10.3%
2019	4,187	797	4,984	33,034	6,288	39,322	11.3%
2020	4,610	879	5,489	33,021	6,297	39,318	12.3%
Average Annual Load Growth after efficiency:				**-0.03%**	**0.11%**	**-0.01%**	

Range of Electric Efficiency Potential by Sector			
	Technical Potential	**Economic Potential**	**Achievable Potential**
Residential Sector	21%-36%	10.6%-30%	5.3%-21.7%
Commercial Sector	18%-41%	12.7%-35%	5.1%-17%
Industrial Sector	17%-48%	6.2%-32%	2%-19%

Source: *Electricity Demand in Ontario – Assessing the Conservation and Demand Management (CDM) Potential.* Prepared by ICF Consulting for the Ontario Power Authority, November 2005.

DSM Incentives as % of Budget (at 100% of performance targets)

Jurisdiction	Annual DSM Budget	Annual Performance Incentive	Incentive as % of DSM Budget	Comments
Masschusetts (KeySpan)	$11,700,000	$585,000	5.0%	Calculated from 2005 expenditures
Massachusetts (Mass. Electric)	$49,596,839	$2,479,842	5.0%	From 2005 EE Plan.
Rhode Island (Narragansett)	$17,606,570	$774,689	4.4%	Budget based on June 11, 2005 true-up filing. Target calcuated from 2005 year end budget.
Connecticut (CL&P)	$55,562,000	$2,778,100	5.0%	Budget exclusive of ECMB, audit and incentive
New Hampshire (Granite State)	$1,450,563	$116,046	8.0%	Budget includes implementation and evaluation expenditures
Vermont (EVT)	$14,653,567	$460,333	3.1%	Contract values for 2006 through 2008 divided by three to get average annual values
Quebec (Gaz Metro)	$6,598,929	$659,893	10.0%	Calculated from 2005 (2005-2006) EE budget

Source: Testimony of Chris Neme & Glenn Reed, VEIC, Before the Ontario Energy Board, EB-2006-0021, *An Effective Policy Framework for Gas DSM in Ontario, Exhibit L, Tab 5,* June 2, 2006, p. 30.