# SERVING THE INDUSTRIAL CUSTOMER: EMERGING DIRECTIONS FOR UTILITY-RELATED ENERGY EFFICIENCY SERVICES

Steven Nadel, Neal Elliott and Miriam Pye
American Council for an Energy-Efficient Economy

## INTRODUCTION

As of 1998, restructuring of the electric industry will begin in several states, including California, Massachusetts, New York and Rhode Island. Montana, Pennsylvania and Vermont have already committed to implement restructuring shortly thereafter, and many additional states are expected to follow in the steps of these leaders. Furthermore, the U.S. Congress is now considering national restructuring legislation; many of the proposed bills call for restructuring in all states by the early years of the next century.

The primary motive for restructuring is lowering the price of electricity. These rate reductions are expected to come primarily by allowing distribution companies and retail customers to choose from among many electricity suppliers, and not necessarily the local monopoly utility. In this manner, competition will be instituted in the electricity industry, and as a result of this competition, price reductions are expected. Experience in other countries that have restructured their electricity industries, such as the United Kingdom and Norway, indicate that price reductions of a few percent, to as much as 25% can result. Cost reductions have been in the upper half of this range for large industrial customers who by virtue of their large loads and sophisticated purchasing abilities are often in a good position to get the best deals.[1]

In the U.S., in preparation for restructuring, many utilities have instituted cost-cutting efforts and announced rate freezes. Early experiments in New Hampshire, Massachusetts and Illinois in which customers can choose their electricity providers from a wide range of competitors have resulted in rate reductions of 10-20%.[2] However, it is unclear whether these substantial rate reductions in pilot programs are representative of what will happen with full retail competition or whether these pilot programs exaggerate the impact of retail competition as the small size of the pilots and their widespread publicity prompt power suppliers to offer uneconomic discounts in order to gain market share, publicity, and experience serving retail access customers. Also, most of these pilots have been in areas with high electricity prices; it is unclear whether the opportunities for savings will be as great in lower cost areas.

While restructuring is primarily intended to reduce electricity prices, restructuring is also likely to have a profound impact on many other aspects of the electricity industry, including the provision of energy-efficiency services.

Historically, energy efficiency services were procured by individual customers, working with individual vendors, such as engineering firms and equipment suppliers. In the 1970s, following the first oil embargo, government agencies became increasingly involved in encouraging end-users to implement energy-saving measures, In the 1980s, electric utilities began implementing demand-side management (DSM) programs as a way to reduce the need for new generating resources, reduce emissions save money (since a kWh saved was often less expensive than a kWh generated) and satisfy regulators' demands for "least-cost planning." In recent years, government programs have been scaled back, due to budget cutting pressures at the state and federal levels, as well as to historically low energy prices which have replaced the crises of the 1970s. In many cases, utility programs have also been scaled back, as DSM expenditures became a frequent target of cost-cutting efforts instituted to prepare for restructuring and the increased competition that will result.

In this climate. energy efficiency efforts are also being substantially restructured. This paper discusses the emerging nature of the new programs, based on experience to date in the U.S. and overseas, as well as informed projections by many industry observers. Of course, since restructuring has yet to take place in the U.S., there is still a substantial degree of uncertainty as to the future and impacts of restructuring. Still, the decisions and actions to date provide strong indications of future trends, and these indications provide the foundation for this paper.

## EMERGING UTILITY-RELATED ENERGY EFFICIENCY SERVICES

In recent years, as noted above, many utilities have offered energy-efficiency services, commonly under the DSM heading. In addition many energy service companies and other private companies have marketed energy-efficient products and services, sometimes in conjunction or association with utility DSM programs. With utilities preparing for restructuring, traditional DSM programs are being scaled back. On the other hand, many utilities are initiating or expanding unregulated ventures, many of which offer energy-efficiency services. In addition, energy service companies are starting to get into the power marketing business, and new power marketing firms are being formed to sell power, and sometimes, energy-efficiency services as well. In this climate, the line between utility and non-utility energy-efficiency services is becoming increasingly blurred. In this paper we use the term "utility-related" energy-efficiency services to include the many utility and non-utility entities that are now offering these services. In the evolving utility industry, these services appear to be taking three primary forms — as a marketing and profit center, as a means to defer distribution investments, and as a means to provide important public benefits. Each of these forms are discussed in the sections below.

### Energy-Efficiency as a Marketing and Profit Center

As utilities prepare for increased competition, retaining important customers is a key objective. There is a growing body of work that indicates that energy-efficiency services can increase customer loyalty. Likewise, many rival utilities or independent power providers and power marketers may offer energy-efficiency services as part of a package of inducements to lock-in power purchase contracts with attractive customers. At times, these energy efficiency services can even be a profit center, providing added value that customers are willing to pay for, either directly as fees for service, or indirectly in the form of slightly higher power costs.

Many utilities are doing survey and statistical research on the factors that are likely to affect individual customers' choice of an electricity supplier. In general, this information is considered proprietary and is not published. However, discussions with several experts familiar with this body of research indicates that price is a primary determinant of customer loyalty, but that several other factors are also important, and that when these other factors are combined, they can contribute as much to customer loyalty as price. For example, one confidential national study on loyalty of industrial customers to their electric utility found that five major factors contribute to customer loyalty, including, in order from most to least important, satisfaction with price, complaint handling, energy conservation, account representatives, and reliability.

Several utilities are now conducting more direct research on the likelihood customers will switch electricity suppliers and the impact of energy efficiency programs on this decision. For example, in a confidential study by one large utility on its small- to medium-sized business customers, likelihood to switch suppliers was compared across a range of possible price discounts and as a function of customer ratings of their utility on a range of factors. In general, likelihood to switch was found to be approximately 20% higher among customers who rated their current utility's energy efficiency programs poor than among customers who rated such services excellent. Energy efficiency services were among only three non-price factors that had a statistically significant relationship to customers' expressed likelihood of switching suppliers.

In Sweden, which instituted restructuring beginning January 1, 1996, initial experience is that some utilities and power marketers are offering a variety of services as part of a package used to sign-up customers to power supply contracts or as additional profit-making opportunities. The larger utilities generally offer a

range of services or packaged products and have experts in energy efficiency and other areas on their staff. In an interview, one utility representative estimated that about half of the customers were interested in additional services. Another interviewee noted that interest was highest in administrative services, such as electronic or simplified billings, not energy efficiency. Nearly all efforts to market energy services so far have targeted relatively large customers, with utility representatives noting that the consumption and efficiency potential among small customers is too small to carry the cost of energy efficiency efforts.[3]

In the U.S., several utilities have begun to introduce customer retention more directly into their energy-efficiency programs. In many of these efforts utilities are seeking to develop partnerships with their large industrial customers -- partnerships which serve industrial customer needs and thereby help keep key industrial accounts as local utility customers. For example, Northeast Utilities (NU) has a special program named PRIME which they target at "at-risk" customers. PRIME offers a process audit that examines manufacturing productivity improvements including energy cost savings, improvements in raw material utilization, labor productivity gains, improvements in product quality, increased production capacity, reduced costs for emissions/hazardous waste abandonment, and other potential direct customer benefits. Financing and energy-efficiency incentives are offered to help customers implement productivity improvements identified in the PRIME audit.

In addition, NU's commercial and industrial DSM programs, particularly the flagship Energy Action program, address customer retention. Under Energy Action, NU provides energy assessments and financial and technical assistance to implement comprehensive energy-efficiency packages. As part of the Energy Action contract, customers must commit to use NU as their sole electricity supplier for a three-year period or refund the incentive payments they received.[4]

An example of a PRIME and Energy Action success was a joint PRIME/Energy Action project implemented at a battery manufacturing company. As a result of this project the customer has successfully consolidated plant operations, reducing required square footage by more than 45% while increasing manufacturing capabilities by 25%. In addition to this substantial improvement in manufacturing productivity, overall energy use was reduced by 30%.[5]

Similarly, New England Electric offers the Energy Fit program, primarily to its largest customers, particularly to customers who may be vulnerable to leaving the utility system. The general approach is to identify problems facing the customer, and then to provide targeted services that address these problems. Overall, the attitude is to do what is best for the customer, because this approach builds and maintains trust and contributes to satisfied customers. Among the services available include: energy efficiency, power quality and reliability analyses, cogeneration analyses, and rate studies.[6]

Virginia Power (VEPCo) has also begun to use efficiency services as an inducement to retain existing customers and attract new business outside their serve territory. While efficiency services are not currently marketed alone, the company views them as important way to differentiate themselves from potential competitors. Recent power purchase agreements between VEPCo and several of their large industrial users have all included a significant efficiency component.[7] Services, such as those available from the North Carolina Alternative Energy Corporation's Industrial Electrotechnology Laboratory (IEL), of which VEPCo is a sponsor, are made available to any at-risk industrial customer. VEPCo's new unregulated subsidiary, Evantage, also offers the efficiency services as a "relationship building opportunity" including services provided by IEL, a growing group of contracted efficiency experts, and VEPCo's wholly owned energy consulting company, A&C Enercom. These services are often delivered at or below cost as an enticement for developing a future relationship[8]. In one case Evantage has contracted with Chesapeake Paper Products to design and build a $42 million, 38 MW combined-cycle cogeneration facility at Chesapeake's West Point, Virginia facility. The plant will serve current and projected electricity and steam needs and replace several oil-fired steam boilers at the mill. The contract also calls for Evantage to become Chesapeake's energy supplier of choice for the next 25 years and to help with rebuilding another boiler at the plant.[9]

Other utilities with analogous approaches to customer retention include Bonneville Power Administration,

Carolina Power & Light, Cinergy, Duke Power, Georgia Power, and Southern California Edison.

Energy-efficiency services can also play a role in longer-term power supply agreements. For example, Detroit Edison recently signed agreements with the "Big 3" auto makers in which the manufacturers agreed to purchase power from Detroit Ed for a ten year period, securing electricity sales that totaled $332 million in 1994. In exchange, the utility has agreed to rate reductions to the three automakers worth a total of $30-50 million annually. In addition the utility is providing power quality upgrades and on-going evaluation, on-site utility energy efficiency analysts to work in customer facilities, and creation of a customer-directed efficiency fund. An initial two year pilot, in which the utility provided each automaker with one utility efficiency analyst, has saved the automakers over $1 million annually.[10] Similarly, the New York Power Authority, in recently negotiated long-term power contracts with key customers, promised to make specified energy efficiency investments in customer facilities.

Another novel approach is to revive Thomas Edison's original idea that utilities should sell energy services, not kWh. Under this concept, which is sometimes called end-use pricing, utilities would own or lease energy-using equipment such as lights and motors and charge customers for the energy services delivered, such as lumen-hours of lighting or BTU's of heating or cooling. With utilities responsible for the equipment and being paid for services not kWh, utilities have an incentive to invest in efficiency improvements that provide the same or more energy services for less kWh. A recent experiment with the concept was Wisconsin Electric's End-Use Pricing program, which began in 1993. Under the program, the utility provided equipment specification, purchase, ownership, maintenance, repair, and warranty and the customer paid a monthly fee for end-use services. By the spring of 1994, the program had three participants and four more were close to being finalized. The participants included refrigeration services provided to two supermarkets, and air conditioning provided to a school district. In marketing the program, the utility found that end-use services were attractive to some customers and not to others. However, the program was abruptly canceled by Wisconsin Electric after local contractors complained that the utility was taking away business from them. The utility canceled the program rather than risk a big fight with local contractors; avoiding a fight was important because Wisconsin Electric was seeking regulatory approval for a merger with neighboring Northern States Power.[11] In the future, such programs are likely to be run by unregulated utility subsidiaries or through private companies not affiliated with the utility. In these cases, contractor complaints to the utility commission are less of a concern. Also, future ventures are likely to include other end-use services such as compressed-air or refrigeration services for industrial customers.

Energy service companies (ESCo's) and power marketers will also figure prominently in the emerging market for efficiency services. Energy service companies have been in existence for more than a decade and typically offer comprehensive services to identify, install and finance energy-saving improvements. ESCo's are often paid on the basis of verified energy savings, although in some cases they are paid on a fee-for-service basis. Many electric utilities have established or acquired unregulated energy service companies; a March 1997 compilation of utility energy service affiliates includes 31 utilities in 24 states.[12] Recently, many ESCo's have begun moving into the power and gas marketing business, acting as a broker between power and energy producers and end-use customers. For example, Xenergy, an energy efficiency consulting firm, teamed with Freedom Energy, a power marketer, in the New Hampshire retail wheeling pilot. Frequently these companies offer a package of services including power and energy supply, energy efficiency implementation and financing, and other related services. Likewise, power and marketing companies are starting to enter the energy efficiency business. For example, in New Hampshire Louis Dreyfus, Enron, and Working Assets all marketed power and other services, in conjunction with partner generating and energy service companies. The term "Energy Service Business" is frequently used to describe these combined ventures. Thus, the lines between ESCo's and power marketers are increasingly blurring, and this trend is likely to continue.

### Energy Efficiency to Defer Distribution Utility Investments

Most utilities need to improve the transmission and distribution systems in several portions of their service

area each year. The cost of some of these improvements can be substantial. By offering intensive energy efficiency programs in a district a few years before the T&D improvements are needed, loads can be reduced and the need for these T&D improvements can be postponed for several years, thereby saving money and improving the cost-effectiveness of energy efficiency programs. In order to have a significant impact on loads in just a few years, intensive retrofit programs are usually needed in which customers are encouraged and assisted to improve the efficiency of existing equipment and plants.

Several utilities have targeted retrofit programs to T&D constrained areas including Central Maine Power, Consolidated Edison, Idaho Power, Niagara Mohawk, PG&E, and Portland General Electric. For example, in 1990, Idaho Power determined that a T&D upgrade in one area would cost $3 million, but that energy efficiency programs to defer the upgrade would cost less. The energy efficiency programs were run in 1991 and 1992 and achieved 78% of the planned reductions (participation rates were lower than planned) but this was still sufficient to postpone the upgrade. The final cost of the programs was less than the $3 million upgrade cost.[13]

Similarly, a 1993 pilot program run by Portland General Electric offered intensive energy efficiency services in four areas in an attempt to delay T&D upgrades. As a result, one of the upgrades was delayed, another upgrade proceeded (because T&D staff did not trust energy efficiency programs to deliver the energy efficiency savings, and implemented the upgrade anyway, even though subsequent program results showed that the upgrade could have been deferred), and decisions on the other two upgrades were deferred until later.[14]

In the United Kingdom several regional electric companies have used shareholder funds to pursue DSM programs that defer investment in distribution upgrades. Under the price cap regulatory system in place for distribution, capital costs are not passed directly to customers, and thus deferring distribution upgrades can sometimes increase profits, even accounting for the cost of the energy efficiency programs and the foregone profits of additional distribution revenue.[15]

### Public Benefit Programs

Traditionally, regulated monopoly utilities have provided a variety of services that benefit the public and are funded through rates. Among these services are special programs for low-income customers (e.g. moratoria on shutoffs during the heating season and discount "lifeline" rates), energy efficiency and renewable energy programs (whose purposes are to lower customer bills and help protect the environment) and research and development activities on new technologies and practices that are in the broad public interest. Under restructuring, these public benefit programs are at risk of being shutdown or substantially curtailed due to pressures on utilities to reduce prices in order to compete with low-cost power providers. To address this problem, several states are setting up special public benefit programs, funded by a small transmission or distribution surcharge ("wires charge") paid by all customers, regardless of who they purchase their power from. For example, in California, the public benefit fund will begin operation in January 1998 and will finance low-income, energy efficiency, renewable energy and research and development programs. The surcharge for all of these services will total approximately $0.003 per kWh. Similar programs have been set up in Massachusetts and Rhode Island and are being set up in Maine, Montana, New Jersey, New York, Vermont, and Wisconsin.

Similarly, when the electricity industry was restructured in the United Kingdom, Norway, Australia and New Zealand, public benefit funds were established.

In the United Kingdom, originally the regulator believed that market forces would meet demands for efficiency services that arose and hence that no special provisions for energy efficiency were needed. By 1992, three years after restructuring began, it was apparent that the marketplace was not yielding either demand for or investments in energy efficiency. To address this problem, the Energy Savings Trust was established by the government to advise the regulator on matters relating to energy efficiency and to design

and oversee energy efficiency programs. The Trust helped the regulator set a mandatory efficiency target for each Regional Electric Company (REC) and developed three different approaches REC's can use to meet these targets including: (1) participating in national programs planned by EST: (2) offering regional programs based on EST concepts and guidelines; and (3) offering programs developed and implemented by the RECs. These programs are funded by a small wires charge of $1.60 per year for small customers served directly by RECs.[16]

Similarly, in Norway, following restructuring in 1991, utility energy efficiency programs withered. In order to compensate for the reduced energy efficiency activity, the government initiated two related programs: (1) a small transmission tax earmarked for energy conservation information; and (2) the creation and partial funding of independent regional energy conservation centers to provide energy efficiency services.[17]

In Australia, restructuring is now proceeding in the two most populous Australian states — New South Wales (containing Sydney) and Victoria (containing Melbourne). In New South Wales, as part of restructuring legislation, a Sustainable Development Authority was set up to administer a Sustainable Energy Fund whose purpose is to promote energy efficiency and renewable energy in the state. The state government has allocated $39 million (Australian) to the fund for the 1996-98 period. In addition, restructuring legislation directed local electricity distributors to develop strategies to reduce greenhouse gas emissions associated with the electricity they supply, to develop demand management plans, and to investigate energy conservation and other alternatives before expanding the distribution network. In Victoria, the government believes in a let the market rule approach to restructuring and even some existing energy efficiency programs have been dismantled. It is too early to say what impact this policy will have on energy efficiency efforts in Victoria.[18]
19

In New Zealand, an Energy Saver Fund was established as part of restructuring, to fund residential sector programs. Local utilities, government agencies, and others compete for the funds in a series of bid cycles. The program is funded by an $18 million (New Zealand) appropriation from the federal government for an initial three year period. The restructuring plan also initially included an energy efficiency revolving loan fund for larger commercial and industrial facilities but this was never implemented.[20]

For industrial customers in the U.S., at least four types of public benefit programs are likely to be important — market transformation programs, bidding and standard offers, special services for small customers, and co-funded research, development and demonstrations.

*Market Transformation Programs*

Market transformation is a process whereby energy-efficiency innovations are introduced into the marketplace and over time penetrate a large portion of the eligible market. Market transformation also implies lasting change such that the market does not regress to lower levels of efficiency at some later time. In the past few years, many program planners and policy makers have begun discussing program and policy initiatives to encourage and accelerate the market transformation process. Market transformation programs seek to achieve these objectives by first understanding the barriers inhibiting certain energy-saving measures (e.g. lack of customer and vendor familiarity with the measure, high measure costs, etc.), and developing strategies to overcome these barriers over time. Instead of saving energy building-by-building, a market transformation approach seeks to change the entire market for particular products or services so that efficient products or services are the norm and do not need to be promoted with incentives. Relative to conventional program approaches, market transformation programs can potentially increase the amount of energy that is saved (because participation rates approach 100%) while lowering long- term program costs per unit of energy saved (because transformed markets do not require incentives).

There are several recent examples of how utilities have influenced the transformation of an end-use market. An example of industrial market transformation is B.C. Hydro's effort to transform the provincial motor market since 1988. The B.C. effort consists of four components: (1) educational efforts to provide customers and dealers with information on high efficiency motors -- their economics and availability; (2) customer

incentives to pay part of the incremental cost of high efficiency motors; (3) vendor incentives, to encourage vendors to routinely stock and promote high efficiency motors; and (4) support for efforts to enact provincial and national minimum efficiency standards. As a result of the first three components, high efficiency motors had a 70% share of the new motor market in 1993, up from approximately 5% in 1987. In 1992 and again in 1993, the utility reduced the incentives by just over 10%; still market penetration held as dealers now routinely stock and customers routinely request high efficiency motors. In fact, in a reversal of the pre-program situation, in some areas standard efficiency motors were no longer stocked and must be special-ordered, resulting in delivery times of six to eight weeks. In 1993, the utility was finally successful with its lobbying efforts and provincial and national legislation was passed setting motor efficiency standards. The new standards took effect in 1995, thereby completing the transformation of the market. Costs of this program to the utility have averaged less than $0.01 per kWh saved from the beginning of the program through 1993. Once the impacts of the new standard are factored into the calculations, the cost of energy savings will be significantly lower.[21]

Currently several market transformation programs of interest to industrial customers are either beginning or are being planned, including efforts promoting use of premium efficiency motors, improved motor repair practices, improvements to compressed air systems, and use of higher-efficiency distribution transformers. "Premium efficiency" motors are motors even more efficient than the "high-efficiency" motors that will predominate once the motor efficiency standards contained in the U.S. Energy Policy Act of 1992 take effect in October, 1997. The premium efficiency motor initiative was developed by the Consortium for Energy Efficiency (CEE -- a consortium of utilities, government agencies, and public interest organizations) and includes a common efficiency specification for utility rebates and educational materials on the advantages and limitations of premium efficiency motors. The program is now being offered by utilities and other organizations in the northeast, northwest, California and Wisconsin, in coordination with many major motor manufacturers.[22]

Improper motor repairs can reduce the efficiency of a motor by approximately 1% on average, and up to 4% in some cases.[23] To address this problem, CEE, DOE's Motor Challenge program and regional organizations in the northwest, northeast and Wisconsin are developing an initiative to provide industrial customers with tools so they can better understand the need for, and how to obtain, quality motor repairs. As part of this initiative some utilities will probably assist repair shops in their areas with training and equipment to improve the quality of their repairs.

Compressed air systems offer a particularly large opportunity for energy savings; energy savings opportunities include reduction of air leaks and other energy waste through on-going maintenance programs; use of higher-efficiency compressors; and improved equipment selection, control and system optimization. To promote these opportunities, DOE Motor Challenge, the Compressed Air and Gas Institute (CAGI) and CEE are considering a variety of program components including compressed air system management recommendations, standard testing and labeling, a national educational initiative on compressed air system efficiency, and a technician training and certification program (McKane 1996).

Distribution transformers are owned by many industrial customers in order to purchase economical high voltage power and step the voltage down to lower levels for in-plant use. Distribution transformers and generally energized continuously, so small differences in efficiency can result in substantial energy savings, particularly considering that the typical transformer is used for approximately 30 years before replacement. Improved efficiency transformers are marketed by many manufacturers, but these products probably account for the minority of purchases, in part because many customers lack the time or expertise to prepare economic analyses on each transformer purchase.[24] To address this problem, the National Electrical Manufacturers Association (NEMA) recently developed a voluntary standard which specifies recommended minimum efficiency levels for different transformer types and ratings. These recommended levels are based on a three year payback to the customer, a very attractive return given the long-life of the product.[25] CEE, working with DOE Motor Challenge, regional utility organizations, and several individual utilities, is now developing a market transformation program based on the NEMA standard. The program is likely to include a variety of educational efforts and analysis tools to help purchasers and distributors understand appropriate

applications for improved efficiency transformers and may include optional incentives or financing for improved efficiency transformers..

*Bidding and Standard Offers*

Bidding programs have been offered by a number of utilities over the past decade. Bidding programs are solicitations in which the energy service companies, individual customers, and other service providers compete to supply saved kWh to the utility. Successful bidders are selected on the basis of price and other factors. Bidding programs let the market determine the price of energy efficiency resources. Standard offers are a type of program pioneered by Public Service Electric & Gas (PSE&G, serving northern New Jersey) in which the utility offers to purchase delivered energy savings under specified terms and conditions. Standard offer prices are set below the utility's marginal cost of power on the basis of previous bidding results, analyses, and other factors. Relative to bidding, standard offers are easier to administer, but may not get the very lowest price. With both bidding and standard offers, payments are generally made for verified energy savings, although in some cases savings are verified only for the initial or a few years, and then estimated for the remainder of the contract.

Bidding and standard offer programs are being touted by energy service companies and some other service providers as a way to expand the private energy services industry during the transition to a fully restructured utility industry. They may be seen as a type of market transformation program, helping to establish private energy services as a major industry that is viable in the long term. These programs may be particularly useful in customer segments where the energy services industry is not presently strong but has the potential to be strong in the future. For example, estimates for 1990-1994 indicate that institutional sector projects account for approximately 60%, commercial sector projects for approximately one-third, and industrial sector projects for less than 10% of ESCo investments.[26] Thus, the industrial sector may be a target for some of these programs.

Goldman and Kito examined 18 bidding and standard offer programs and found that bids are primarily for large C&I projects — residential and small C&I bids have been limited. The vast majority of demand-side bids (87%) have been submitted by ESCOs. Most bidding programs receive bids for far more capacity than they need, allowing utilities to be very selective and only choose the best bids. Most bidding programs have emphasized lighting measures; even programs that encourage comprehensive packages of measures have found that lighting measures account for 70-100% of savings. Overall, as of October 1993, utilities contracted for approximately 425 MW of DSM resources through bidding programs, including several utilities who have each awarded more than 40 MW of contracts through bidding. Bidding programs, by definition, cost less than utility avoided costs (because bid prices are capped at avoided costs), although there is a tendency for bids to approach utility avoided costs. For example, Goldman and Kito found total costs (including utility and customer payments) of $0.054-0.08 per kWh saved (based on an 11% nominal discount rate), which is more than most other types of DSM programs. However, payment is often dependent on savings over time, and thus savings with bidding programs can be more persistent than with program approaches that lack good measure monitoring and maintenance mechanisms.[27]

*Services for Small Customers*

Many states and utilities operate economic development programs to encourage new industrial facilities to locate in their regions and to assist existing plants to prosper and expand. Energy efficiency programs are often a significant component of these efforts. Where energy-efficiency services are offered, they generally target small- to medium-sized plants, since these plants sometimes lack the time and expertise to pursue cost-effective efficiency investments on their own. As public benefit programs are put into place, we expect that the number of states offering such programs will expand.

Services offered by these programs vary, but may include opportunity identification, technical, design and operations assistance, financing, and advanced technology promotions. For example, New York State's Flexible Technical Assistance Program (FlexTech) provides audit, design assistance, procurement, and

implementation services for small- and medium-sized industries. Costs are shared between the state and the industrial customer. In 1996 FlexTech worked on 94 projects, with an annual budget of about $1.2 million. Follow-up surveys indicate that 63% of recommended measures are being implemented, with customers indicating that they have future plans to implement an additional 19% of measure recommendations. For each dollar spent by the state, the program is leveraging $17 in capital investment and achieving $5 in annual savings. Due to limited funding, the program is not actively marketed, since funds are barely sufficient to serve customers who learn of the program through word of mouth. With expanded funding and marketing, it is likely many more customers could be served.[28]

In addition to expanded use of traditional energy efficiency services for small customers, more innovative approaches are likely to be tried as well. Examples of such innovations might include encouraging and assisting companies to hire energy managers, and using large industrial firms to assist and mentor energy-efficiency initiatives at smaller companies, including companies that act as suppliers to the larger companies. These potential innovations are discussed more extensively elsewhere.[29]

*Research, Development and Demonstrations*

Research, development and demonstration programs (RD&D) help to develop and demonstrate new energy-saving technologies. Such programs are traditionally operated by the federal government (primarily through the U.S. Department of Energy -- DOE), utility consortia such as the Electric Power Research Institute (EPRI) and the Gas Research Institute (GRI), individual utilities, and state R&D organizations such as the New York State Energy Research and Development Authority (NYSERDA), the California Institute for Energy Efficiency (CIEE), the Energy Center of Wisconsin (ECW), and the North Carolina Alternative Energy Corp. (NCAEC). All but the DOE programs have been fully or partially supported through electric and gas rates; this rate-based funding will continue in many states through a public benefits program.

Research, development and demonstration programs generally serve all major sectors of the economy, including the industrial sector. To mention just a few examples of past programs, which illustrate the types of projects that are likely to be undertaken in the future, we briefly describe the ECW biopulping project and the NCAEC Industrial Electrotechnology Laboratory.

Biopulping is a new technology that could reduce the energy and cost required to make high quality paper. Letting a certain fungus grow on wood chips reduces the amount of mechanical grinding required to produce a high-quality pulp with extra-long cellulose fibers, which makes the paper stronger. After nine years of research on biopulping by various parties, ECW became involved to move the technology to the next step of development, larger-scale pilots. Completed pilots show energy savings of 25 to 30 percent and increased chip throughput of 25 percent, indicating a recovery of capital costs in four to ten months. ECW is also co-sponsoring a biopulping workshop and has produced a video to educate potential end users on the technological and economic aspects of biopulping. Based on pilot testing thus far, biopulping has the potential to save orders of magnitude more than the investment in its development.[30]

The NCAEC established the Industrial Electrotechnology Laboratory (IEL), in cooperation with the North Carolina State University College of Textiles in 1989 to provide industrial customers, principally textiles, access to state-of-the-art production equipment. Initial focus was on radio frequency and infrared drying, which offered demonstrated product quality, productivity and energy efficiency benefits. By providing near-production class facilities, with well equipped testing laboratories, companies could bring samples of their products to IEL to evaluate these alternative technologies without disrupting production at their plants. Some of the trials have eliminated technologies from consideration as inappropriate for a customer's unique needs. Many adopters have realized real and substantial benefits. In general, non-energy benefits have motivated implementation, with the energy savings viewed as an added benefit.[31]

In addition to promoting energy saving innovations, RD&D programs can also serve as an initial stage of a more comprehensive market transformation initiative.

## SERVICES FOR SMALL VERSUS LARGE INDUSTRIAL CUSTOMERS

A key issue in the development of energy efficiency services for industrial customers will be the impact of customer size on the services that are offered. Of the services discussed above, many will not serve all industrial customers equally, but instead will tend to serve small or large customers disproportionately. Ventures that seek to retain customers and/or make a profit from energy services will primarily serve large customers, just as ESCo's have traditionally focused on large companies and large contracts are of special interest to power marketers. Marketing and providing energy services involves substantial fixed costs, including a significant portion of marketing, legal, and engineering costs. It is much easier to recoup these costs and make a profit on large jobs than on small jobs. As noted above, to the extent energy efficiency services are marketed in Sweden's restructured industry, these services are nearly all targeted at large customers.

Public benefit programs, on the other hand, are likely to emphasize small- and medium-sized customers. In many states, public benefit programs are being set up to provide services that will not be provided by the private market. Thus, if the private market concentrates on large plants, public benefit programs must concentrate on smaller plants. Furthermore, relative to small industrial plants, large plants generally have larger staffs and are more likely to be knowledgeable about and to implement energy-saving measures. Energy efficiency opportunities (on a percent reduction basis), and the need for energy efficiency services, will often be greater for smaller firms.[32] On the other hand, public benefit programs will also serve larger customers to a considerable extent. Market transformation initiatives for premium efficiency motors, quality motor repair practices, air compressor system improvements, and distribution transformers will benefit large customers as well as smaller customers. Research, development and demonstration projects generally serve and benefit many customers, regardless of size. And bidding and standard offer programs, if past experience is a guide, will serve large customers more than small customers.

Energy efficiency services to defer distribution investments are likely to be more limited than either market-based or public-benefit programs. At any given time, only limited geographic areas will be candidates for distribution upgrades and programs to defer these upgrades. Such programs will generally target rapidly growing areas where rising electricity demand makes existing distribution infrastructure inadequate. Where large industrial plants are in these areas, they will be primary targets of these programs, because of the potential to reduce loads by hundreds of kilowatts through a single project. However, in many rapidly growing areas, smaller customers predominate, including residential and commercial customers, as well as smaller industrial customers.

Overall, while every customer, regardless of size, may be served or benefit from each type of program, the tendency will be that large customers will be primarily served by market-based programs, and smaller customers by public benefit programs.

## DISCUSSION AND CONCLUSION

The electric utility industry, and utility energy efficiency services, are going through a radical transformation. Traditional regulated monopoly utilities and traditional utility DSM programs will soon be history. In their place will emerge a much more dynamic market. The market is likely to be dominated by price considerations, but quality of service, and providing extra value to the customer will also be important. It is in these latter areas that energy efficiency services will play a significant role. In this market, many new services are starting to emerge including customized packages of services (combining energy efficiency, power quality, pollution prevention, and/or productivity enhancement), engineering assistance, cogeneration and power house management, end-use pricing, and motor and compressed air system management. The variety of these services are likely to grow as boundaries between utilities, power marketers, and energy service companies blur, and all of these players seek to offer power as well as other value-added services.

However, market-based efficiency services are unlikely to serve all customers, or to address many barriers

inhibiting investments in cost-effective energy saving technologies and practices. In particular, the market is unlikely to adequately serve small customers, including small industrial customers. And the market-alone is unlikely to be able to transform highly diffuse markets, such as electric motors and distribution transformers, where the actions of thousands of customers are needed to prompt significant change. To fill this gap, some but not all states are likely to offer a variety of programs including market transformation programs (primarily targeting generic equipment such as motors, compressors and transformers that are used by many customers), bidding and standard offer programs, technical and financing assistance (primarily for small- and medium-sized customers), and research, development and demonstrations. The dominant theme of these programs will be market transformation -- reducing the barriers inhibiting efficient goods and services, so that in the long term these efficient goods and services become normal practice without continued intervention in the market. In this market transformation context, R&D, education, financing, and other initiatives will all play a role. These public benefit programs will be funded with small "public benefit charges" on distribution service, just as similar programs are funded through electric and gas rates today.

In addition, in some limited geographic areas where distribution capacity is tight, energy efficiency services will be offered to all customers to reduce energy use and demand and defer the need for distribution upgrades. Such programs will be offered where the cost of the programs are less than the cost of distribution upgrades that can be deferred.

Overall, while many different types of services and programs will prosper, it is unclear what their impact will be in the aggregate, and whether these aggregate impacts are sufficient to meet societal environmental and other goals. Thus, time will tell whether this emerging industry structure is robust, or whether further tinkering will be needed. In the meantime, it is clear that the next few years will be highly dynamic and interesting.

## ACKNOWLEDGMENTS

Funding for this work was provided by the Joyce Mertz-Gilmore Foundation and the Energy Foundation. This paper also draws extensively from previous ACEEE projects funded by the Office of Utility Technologies, U.S. Department of Energy and the Pew Charitable Trusts.

## REFERENCES

1. Nadel, Steven, 1996, "The Impact of Energy Sector Restructuring on Energy Consumption and the Environment: International Experiences," American Council for an Energy-Efficient Economy, Washington, DC.

2. Fryer, Lynn, "The New Hampshire Retail Wheeling Pilot Program: Learning Experience, Chaos, or Price War?," *Strategic Memo*, E-Source, Boulder, CO. Also, Xenergy, 1997, "Reactions to Retail Competition," *Xentrends*, Winter, p. 6.

3. Nilson, Lars, 1996, "Services Instead of Products — Experience from Energy Markets — Examples from Sweden," Dept. of Environmental and Energy Systems Studies, Lund University, Lund, Sweden.

4. Morante, Peter, 1996, personal communication, Northeast Utilities, Hartford, CT.

5. Ogurick, Richard, 1995, personal communication, Northeast Utilities, Hartford, CT.

6. Davis, Alan, 1996, personal communication, New England Electric, Westborough, MA.

7. Elliott, R. Neal, Miriam Pye, and Steven Nadel, 1996, *Partnerships: A Path for the Design of Utility/Industrial Energy Efficiency Programs*, American Council for an Energy-Efficient Economy,

Washington, DC.

8. Web, Mark, 1996, personal communication, Virginia Power, Richmond, VA.

9. Elliott et al., see note 7.

10. *Ibid.*

11. Results Center, 1996, "Program Snapshot — Wisconsin Electric: End-Use Pricing Program," *Energy Efficiency News & Views* 1(10):7-8.

12. Barakat & Chamberlin Inc., 1997, "Utilities with Energy-Service Affiliates," *Electrical World*, March, pp. 37-39.

13. Sparks, Scott, Andrew Goett, Lorna Stucky, and Scott Dimetrosky, 1994, "Producing More with Less: Evaluating the Impact of a T&D Agricultural DSM Program," in *Proceedings of the ACEEE 1994 Summer Study on Energy Efficiency in Buildings*, American Council for an Energy-Efficient Economy, Washington, DC, pp. 2.249-2.256.

14. Weijo, Richard and Linda Ecker, 1994, "Acquiring T&D Benefits from DSM: A Utility Case Study" in *Proceedings of the ACEEE 1994 Summer Study on Energy Efficiency in Buildings*, American Council for an Energy-Efficient Economy, Washington, DC, pp. 2.269-2.275.

15. King, Michael, Stale Johansen, J. Brian Kick, and Grayson Heffner, 1994, "DSM in Restructured Markets," in *Charting the Future: Proceedings Third International Energy Efficiency and DSM Conference*, Synergic Resources Corp., Bala Cynwyd, PA, pp. 53-68. Also, Swinden, D.J., 1994, "Energy Efficiency and DSM in a Fully Competitive Energy Market," in *Charting the Future: Proceedings Third International Energy Efficiency and DSM Conference*, Synergic Resources Corp., Bala Cynwyd, PA, pp. 27-36.

16. Nadel, see note 1.

17. *Ibid.*

18. Hoch, Lance, 1997, Electronic mail message dated June 6, SRC International, Melbourne, Australia.

19. Dunstan, Chris, 1997, Electronic mail message dated June 6, Sustainable Energy Development Authority, New South Wales, Australia.

20. Hoch, see note 18.

21. Nadel, Steven, 1996, *Providing Utility Energy Efficiency Services in an Era of Tight Budgets: Maximizing Long-Term Energy Savings While Minimizing Utility Costs*, American Council for an Energy-Efficient Economy, Washington, DC.

22. Delaski, Andrew, 1997, personal communication, Consortium for Energy Efficiency, Boston, MA.

23. Schueler, Vince, Paul Leistner and Johnny Douglass, 1995, *Industrial Motor Repair in the United States: Current Practice and Opportunities for Improving Customer Productivity and Energy Efficiency*, Bonneville Power Administration, Portland, OR.

24. Barnes, P.R., J.W. Van Dyke, B.W. McConnell, and S. Das, 1996, *Determination Analysis of Energy Conservation Standards for Distribution Transformers*, ORNL-6847, Oak Ridge National Laboratory, Oak Ridge, TN.

25. NEMA, 1996, "Guide for Determining Energy Efficiency for Distribution Transformers, TP 1-1996, National Electrical Manufacturers Association, Arlington, VA. Also, Phil Hopkinson, 1996, personal communication, Square D Corp., Monroe, NC and Chairman, NEMA TP-1 Committee.

26. Cudahy, Richard, 1995, personal communication, National Association of Energy Service Companies, Washington, DC.

27. Goldman, C A and Kito, M S (1994) *Review of Demand-Side Bidding Programs: Impacts, Costs, and Cost-Effectiveness* LBL-35021 Lawrence Berkeley Laboratory, Berkeley, CA.

28. Nadel, Laitner, Goldberg, Elliott, DeCicco, Geller and Mowris, 1997, *Energy Efficiency and Economic Development in New York, New Jersey, and Pennsylvania*, American Council for an Energy-Efficient Economy, Washington, DC.

29. Elliott et al., see note 7.

30. Kohler, Jeremy, 1996, "Fungus Invades Wisconsin Paper Mill, *E2* 1(3), Energy Center of Wisconsin, Madison, WI. Also, Shipley, David, 1996, personal communication, Energy Center of Wisconsin, Madison, WI.

31. Thomason, Cynthia, 1997, personal communication, North Carolina Alternative Energy Corp., Raleigh, NC.

32. Nadel et al., see note 28. Also, DOE, 1996, *Analysis of Energy-Efficiency Investment Decisions by Small and Medium-Sized Manufacturers*, DOE/PO-0043, U.S. Department of Energy, Washington, DC.