DESIGNING INDUSTRIAL DSM PROGRAMS THAT WORK

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INTRODUCTION

Traditionally, electric and gas utilities have done little to influence customer decisions about the energy efficiency of customer facilities. Instead, utilities reacted to rising demand for energy by building more power plants and pipelines. However, this situation has changed in the past decade; under the title *demand-side management* (DSM), many utilities are trying to influence decisions on "the customer side of the meter" including programs to promote energy efficiency (reducing energy use), load management (shifting demand from one time period to another, typically in an effort to reduce peak demand), and load building (increasing demand in order to help meet a utility's strategic objectives). To date, over 600 utilities have sponsored over 2000 DSM programs (Blevins and Miller 1993). Total expenditures on electric utility DSM programs were nearly $2 billion in 1991 and this figure is expected to increase significantly during the 1990s (Hirst 1993). Expenditures by gas utilities are much lower, but are also expected to increase significantly over the next decade.

Why Industrial DSM?

From the utility perspective, the primary rationale to offer DSM programs is to save utilities and consumers money. Utilities have spent many decades searching for inexpensive sources of power and optimizing power plant designs. Efforts to optimize energy efficiency in customer facilities have rarely received the same level of attention. As a result, there are many efficiency opportunities available in customer facilities that cost substantially less per kWh saved than the cost to generate a kWh from a new power plant. For example, the New York State Energy Plan (NYSEO et al. 1991) estimates that power from new power plants ranges in cost from $0.05/kWh to more than $0.10/kWh, depending on the type of plant, but that DSM programs generally range in cost from $0.014-0.050/kWh.

Furthermore, due to large construction-cost disallowances during the 1980s (more than $13 billion of power plant capital investments were denied cost recovery by state and federal regulators), many utilities are fearful that construction costs for new plants may also be disallowed (NERC 1990). Cost disallowances raise the cost of new power plants to stockholders, thereby making the economics of DSM programs even more enticing to utility managements.

In addition, in today's political climate, new power plants can be difficult to site and permit. Furthermore, air and water pollution and hazardous waste disposal problems are often associated with power plants. DSM programs reduce these problems by reducing the amount of power that is needed. In fact, under the Clean Air Act Amendments of 1991, utilities are encouraged to implement DSM programs as part of their compliance strategies (Markey and Moorhead 1991). Several studies have found that DSM programs can be less expensive per ton of sulphur dioxide removed than scrubbers (Geller et al. 1987).

Due in large part to the three factors described above, many state regulatory commissions are very supportive of DSM programs. As a result, commissions have employed a variety of inducements to encourage utilities to implement DSM programs. Inducements include: direct orders to implement DSM programs; financial penalties for not implementing DSM programs;

"least-cost planning" requirements under which utilities must implement DSM programs if they are less costly than supply-side alternatives; requirements that environmental externalities be included in analyses underpinning resource acquisition decisions; and financial incentives for implementing DSM programs (i.e. providing shareholders with a share of the financial benefits attributable to DSM programs).

From the industrial customer perspective, there are extensive cost-effective energy efficiency opportunities remaining in factories. The large efficiency gains that are still available in the industrial sector have been extensively documented by many studies including work by Fuller (1992); Jaccard, Nyboer and Fogwill (1993); and Newman (1993). These studies have found that if all cost-effective efficiency measures are implemented, industrial energy use can be reduced by 13-40%.

There are a number of reasons why many industrial firms have not implemented all cost-effective energy efficiency measures. Energy costs are generally a small fraction of total industrial costs, which means that the typical firm pays only limited attention to their energy bills. Additionally, for most firms, capital is scarce. Because the links between improvement in energy efficiency and higher priority goals such as improvements in plant productivity, product quality, environmental emission requirements, and labor and materials efficiency are generally not understood, energy-efficiency projects are considered non-strategic and take low priority when industrial firms allocate capital. A one- to three-year payback is often required for cost-saving investments such as energy-efficiency projects. Capital rationing, a common budgeting approach, further hinders energy-efficiency investments, since fewer investments are undertaken than would be justified by more conventional budgeting analysis. Many industrial firms also have concerns about the long-term persistence of savings of energy-efficiency measures, the amount of downtime that will result from measure installation and maintenance, and the effect of process changes on productivity and ongoing operations. For some firms, there are doubts as to whether the technologies even save energy. The lack of easily accessible information on the availability and/or economic and technical viability of energy-efficiency measures under full-scale, actual usage conditions amplifies the skepticism. Smaller-sized firms in particular often do not even know about the specific technologies that are available. In addition, many small- to medium-sized industrial firms do not have the expertise on their staff nor the time to address energy efficiency in isolation from more strategic concerns.

DSM programs can help overcome some of these informational and financial constraints, allowing industrial customers to reduce energy use and energy bills.

Concerns About Industrial DSM

As utility DSM programs have rapidly spread, some large industrial customers have expressed concern. These concerns stem primarily from the impact energy efficiency programs can have on the bills of program nonparticipants (ELCON 1990). As energy efficiency programs reduce energy use, revenues from energy sales decline. A portion of these revenues are needed to cover utility fixed costs; in order to make up for these lost revenues, rates often must be increased. For energy efficiency program participants, bill reductions resulting from the efficiency improvements generally more than compensate for the rate increase. But for nonparticipants, rates increase and there are no offsetting reductions in consumption. The impact of DSM programs on nonparticipants is also affected by the need to not only recover lost revenues, but to also recover the costs of DSM programs themselves. The impacts on nonparticipants can be further exacerbated by program offerings which favor some customer classes over others: the less favored customer classes are likely to be dominated by nonparticipants. Some large industrial customers are concerned that current utility DSM offerings have little to offer large industrial customers, and thus most large industrial customers will be nonparticipants who must subsidize DSM programs for other customer classes, such as residential and commercial customers, or even other groups of industrial customers.

In addition, some large industrial customers have concerns that utility DSM programs needlessly meddle in industrial customer affairs and the activities of the free market (ELCON 1990). Other concerns relate to DSM program evaluation. When DSM programs are not properly evaluated, there is a possibility of overstating energy savings and understating program costs (Joskow and Marron 1993). Ways to address these concerns are discussed later in this paper.

EXPERIENCE WITH UTILITY INDUSTRIAL DSM PROGRAMS

A recent study by Jordan and Nadel (1993) summarized the experience of over 70 utility industrial DSM programs. This study supports some of the arguments of both DSM supporters and detractors. The study found that the majority of industrial DSM programs were not especially successful. The majority of the programs studied had participation rates of less than 10% of eligible customers and savings of less than 1% of utility industrial sales (see Table 1). Many of these programs were combined commercial and industrial programs that emphasized basic lighting, HVAC, and motor improvements, and devoted little attention to industrial processes. On the other hand, some programs had much higher participation rates and savings, including participation rates of 10-100% and savings of up to 3% of industrial electricity sales.

Industrial DSM programs are generally among the least expensive types of DSM programs. A 1990 review (Nadel) of over 200 commercial and industrial DSM programs found that motor rebate and other industrial programs had the lowest cost to the utility of all of the program categories studied. The 1993 program review discussed above found that industrial DSM programs ranged in cost to the utility from $0.003-0.045 per kWh saved, with an average of $0.019. Particularly successful programs (those with high participation rates and/or savings) were slightly less expensive, with average costs to the utility of $0.014/kWh saved (Jordan and Nadel 1993).

Table 1. Average Cumulative Results for Industrial DSM Programs.

	Participation rate	Savings as % of 1989 industrial sales	Number of programs in category
All programs	9.4%	0.65%	31
Prescriptive - Motors	n/a	0.16%	6
Prescriptive - Other	n/a	0.06%	3
Custom	8.0%	1.34%	16
Custom & Prescriptive	14.2%	0.31%	6
"Successful" Programs	20.3%	1.33%	12

Source: Jordan and Nadel 1993.

Attributes of Successful Programs

In the Jordan and Nadel study, four factors were identified as contributing to successful industrial DSM programs:

1. Understanding the customers perspective. Industrial customers are different from other customer classes and to be successful, industrial DSM programs must be designed with industrial needs in mind. To provide just one example, in the industrial sector the majority of potential energy savings lie in industrial process improvements, not in the lighting measures that are the "bread and butter" of commercial DSM programs. Thus, lighting-oriented programs have limited appeal to industrial customers. Furthermore, identifying energy-saving opportunities in industrial processes requires detailed knowledge of specific industrial processes. Walk-through energy audits by junior-level utility staff cannot identify these measures, and may leave the industrial customer questioning whether the program is really worth the bother. To address this problem, some of the more successful programs feature technical assistance by experts in a particular industrial sector.

2. Marketing that is personal and user-friendly. Industrial programs cannot be run out of an office. Bill stuffers and other direct mail alone will rarely succeed in marketing a program to the appropriate people in a large industrial facility. The utility needs to make regular personal contact with appropriate decision-makers at each facility. Through this contact trust and rapport can be developed that will eventually lead to participation. Similarly, since "time is money" for an industrial customer, programs must be user friendly. This requires a well

administered program that minimizes paperwork, bureaucracy and customer time requirements.

3. Program flexibility. Generally the more flexibility offered the industrial customer, the more likely customers are to participate. Flexibility involves two concepts. To be most effective, a utility's industrial DSM effort must address both concepts in a complementary fashion. First, programs should allow customers to propose their own efficiency measures. Many customers know of conservation opportunities unique to their situation. Utility programs should encourage and be able to handle these custom measures because these measures often produce very large energy savings. Second, programs should not be limited to custom measures because custom measure application requirements will be perceived as burdensome by many customers. Simple prescriptive lists of common measures, with specified incentives and other services, make it easy for customers to participate. These measures can achieve high participation rates. Furthermore, implementation of simple, prescriptive measures build trust between the utility and the customer, making it more likely that custom measures will be proposed in the future.

4. Financial incentives. All of the programs with high participation rates and savings offered financial incentives to customers. In many cases the incentives are large, meaning they cover a large proportion of measure cost for those measures customers are unlikely to do on their own. For example, the Bonneville Power Administration had low participation in its Energy Savings Plan program until incentives were raised by a factor of three and program marketing improved. As a result of these changes, the annual participation rate increased approximately four-fold (Tawney 1992).

Successful Programs

Based on these findings, we recommend that utility industrial DSM efforts include both prescriptive and custom components. Prescriptive programs are easy for customers to participate in because they do not require special engineering analyses or complex paperwork. Examples of successful prescriptive DSM programs for industrial customers include British Columbia Hydro's motor, compressed air, and fan/pump programs, Niagara Mohawk's motors and adjustable speed drive program, and the Clark County Public Utility District industrial lighting program.

Custom programs provide an opportunity to address the unique attributes of each factory. Thus, custom programs are the primary way to promote industrial process improvements -- improvements that account for the majority of industrial energy-saving opportunities. Custom programs should address two different types of markets -- retrofit and new construction. Retrofits involve improving existing industrial processes. New construction involves working with process line designers to design state-of-the-art energy-saving measures into new facilities, so they do not need to undergo retrofit later. Examples of successful custom retrofit programs include Bonneville Power Administration's Energy Savings Plan and Aluminum Smelter Conservation/Modernization programs, B.C. Hydro's Power Plays and Power Partners programs, Central Maine Power's Power Partners program, and Puget Sound Power & Lights' Industrial Conservation Incentive Program.

Several programs combine both prescriptive and custom features. Successful examples include Wisconsin Electric's Smart Money for Business program, Southern California Gas' Equipment Replacement/Heat Recovery program, and United Illuminating's Energy Blueprint program. The Southern California Gas program is one of the few industrial gas DSM program's that have been offered while the United Illuminating is one of the few programs to focuses on industrial new construction projects including new facilities and changes to process lines in existing facilities.

Summary information on each of these programs is contained in Table 2. Additional descriptive information on each successful program is discussed in the sections below. Detailed data on each program are contained in the Appendix.

Prescriptive Programs

BC Hydro's Industrial Power Smart: Efficient Compressed Air Systems Component

BC Hydro has estimated that up to 50% of the energy used in an industrial compressed air system can be lost through leaks. These losses are particularly great in pulp and paper mills, whose facilities often occupy acres of land and have an extensive network of distribution piping. During the first few years of the program, BC Hydro performed free leak tests on the compressed air systems of its industrial customers. As of 1993, more general financial assistance is available for both mini- and full-scale audits of compressed air systems. Leak tests identify the location of leaks, estimate how much they are costing the customer, and suggest a leak reduction target (generally down to 15% leakage of air volume). Either the customer repairs its own leaks (generally at very low cost) and the utility performs a follow-up leakage test three to six months later, or -- if the customer agrees to do quarterly leak testing for 2 years -- the customer and the utility split the cost of leak testing equipment. If the leak reduction targets are met, the utility refunds the customer's payment for the leak testing unit. As of 1993, incentives and financing are also available for implementing other measures, such as installation of sequencers, dryer purge controls, and other system improvements. Sequencers and dryer purge controls allow for dryer operation only when needed. The program is largely marketed through site visits by BC Hydro representatives to industrial facilities. Seminars on the program are offered in local areas.

Some of the reasons for the program's success in recruiting participants were noted by program staff: (1) the utility set an internal mandate to achieve 100% participation over a three-year time span; (2) an extensive marketing effort was made, including seminars and computer software packages; and (3) little time and effort is required by the customer to participate in the program (Merrill 1992).

Table 2. Cumulative Results from Several Successful Industrial DSM Programs.

Utility	Program	Participation rate*	Savings as % of industrial sales**	Levelized utility cost ($/kWh saved)***
BPA	ESP	28%	0.68%	$0.008
BPA	Con/Mod	100%	2.53%	$0.006
BC Hydro	Bonus Partners	49%	0.48%	$0.003
BC Hydro	Compressed Air Program	37%	0.32%	$0.015
BC Hydro	Fans & Blowers Program	38%	0.11%	$0.011
BC Hydro	Motors Program	80%	0.43%	$0.008
BC Hydro	Power Plays	2%	0.34%	$0.001
CMP	Power Partners	7%	1.57%	$0.039
Clark PUD	Ind'l Lighting Pilot	10%	0.54%	$0.020
Niagara Mohawk	Motors & Drives Program	13%	0.25%	$0.007
Puget Power	Industrial Conservation Program	3%	2.02%	$0.020
Southern California Gas	Equipment Replacement/ Heat Recovery Program	3%	7.15%	$0.053/therm saved
UI	Energy Blueprint	47%	0.20%	$0.020
WEPCo	Smart Money	72%	3.17%	$0.019

* Number of participating customers divided by number of eligible customers. For BC Hydro motors program, participation rate is horsepower of participating motors in most recent year divided by total motor horsepower sold in service area during that year. For UI's program, participation rate is floor area (square feet) of participating facilities in most recent year divided by floor area of all new/remodeled facilities built during that year.

** Southern California Gas' sales are to core industrial customers only.

***Average cost (in 1992 $) per kWh saved over a measure's lifetime, where future energy savings are discounted at the rate of 5% per year (real discount rate). For the WEPCo and Puget Power programs, indirect costs were not available; indirect costs for these programs were assumed to be 30% of direct costs, based on Berry 1989.

The measure life of leak repairs is uncertain. An estimated measure life of three years was made by the program's former administrator and an outside expert on energy use in air compressor systems (McLelland 1993, Parfomak 1993). Although it was noted that without regular leak monitoring by the customer leaks can deteriorate within one year, this program emphasizes regular leak testing. BC Hydro is presently studying the persistence of these measures.

BC Hydro's Industrial Power Smart: Efficient Fan & Blowers Component

This program was introduced in the spring of 1990. Prior to the program, a utility-sponsored market survey was conducted to pinpoint the industrial application with the largest fan-related energy-savings potential. Lumber-drying kilns in the region's sawmills were noted as having the largest savings potential (50-60 GWh), and thus the program initially targeted the 400 lumber-drying kilns.

Free energy audits are offered to eligible customers to identify energy savings from installing fan speed controls (ASDs) and a few other fan-related efficiency measures. Approximately 85% of the region's lumber-drying kilns have been audited under the program. The marketing strategy for the program has emphasized multi-level contacts with the customer (i.e., marketing to both industrial financial executives and plant managers), and seminars are given to personnel at lumber drying plants. ASD software and literature on case studies of electricity-saving fan-related projects are made available to interested customers. The program manager emphasized the importance of marketing the program first to the plant manager (in order to get the initial "buy-in") and then to the person running or managing the facility for final approval (Donnelly 1992).

Financial incentives are either $100/hp or are negotiated with the customer based on energy savings and are designed to provide the customer with a one-year simple payback. Generally, the incentives cover between 65-75% of the project costs. ASDs are the primary measures installed. Since early 1992, the utility has begun marketing the program to other industrial customers besides sawmills, although the incentive to these customers is capped at a two-year rather than a one-year payback. The program manager noted that industrial customers are very cautious when it comes to changing a process, since the potential financial repercussions are perceived to be great if something goes wrong. Installing fan speed controls in lumber drying-kilns is a process-related measure, whereas in most other industrial applications it is not, and this is why the utility offers a payback buydown to one year with the kilns and not with other customers.

A savings verification evaluation performed in early 1992 indicated that the savings have been slightly less than projected, and in a few isolated cases no savings are being achieved because the energy-saving equipment has not been used. The no-savings cases were in situations where the project had only been "sold" at the management level and not at the plant level.

In 1990, BC Hydro also began a similar program targeting industrial pumping systems. Incentives and free audits are offered for identifying and implementing cost-effective measures which improve the efficiency of pumping systems. Pulp mills and refineries are targeted, since these two industries were noted as having large pumping systems in BC Hydro's service territory. As with the fan program, this program emphasizes the installation of ASDs. Modifications to existing pump systems are also frequently performed to improve efficiency.

BC Hydro's Industrial Power Smart: Motor Rebate Component

This program offers industrial customers an incentive of $300/kW deferred for new and replacement motors. Utility staff personally visit large customers to apprise them of the program, provide customers with information about high-efficiency motors, and provide calculational tools to allow customers to estimate the benefits of upgrading their motor purchases. Free software packages, educational booklets, and a motor database are made available to customers and vendors. A complementary vendor incentive is offered and is equivalent to 25% of the customer incentive. Also, direct one-on-one contact between the utility and motor vendors allows for distribution of important information on the program. As a result, vendors now routinely stock and recommend efficient motors. In addition, an estimated 22% of motors sales in the province are direct from manufacturers to customers. BC Hydro staff regularly visit motor dealers and repair shops to promote the program and to provide information and promotional material motor dealers can use to sell high-efficiency motors to their customers.

Before the program began, high-efficiency motors accounted for only 5% of the motor horsepower sold in BC Hydro's service territory; as of 1993 this figure has increased to 70%. Largely due to the motor rebate program, many dealers have begun routinely stocking and selling high-efficiency motors; thus the program has been successful in transforming the motor market in British Columbia (Kabel 1993).

Utility staff cited a number of reasons for the program's success including the active involvement of motor dealers and an intensive, multi-faceted marketing effort contributes to the success. The vendor incentive has also increased participation and savings in the program (McLelland 1992). In addition, the program is part of a widely promoted Power Smart package of programs to industries. The ultimate objective of the program is to have minimum efficiency standards enacted by the provincial government, which is expected to be accomplished by 1995 (Kabel 1993).

Clark Public Utility District (PUD) Industrial Lighting Incentive Pilot Program

From 1985 through 1988, the Bonneville Power Administration (BPA) funded a lighting efficiency pilot program which served industrial and warehousing facilities in the Clark PUD service territory of Washington State. Energy-efficient lighting systems were installed in participating facilities, and participants paid only the cost of the new system's first year energy savings. The remaining costs were paid by BPA. Clark PUD and participating lighting manufacturers marketed the program. Initially, Clark PUD mailed a customer information packet to potential participants and issued a press release. Lighting manufacturers took the lead on marketing and largely emphasized "cold calls" (representatives drove into industrial areas and contacted owners of facilities that seemed eligible). Representatives of lighting manufacturers performed the audits and designed the lighting systems, while local contractors performed the installations. High-pressure sodium lighting systems were the most commonly installed system under the program. On average, lighting electricity use was reduced 50% in participating facilities. When customers were interested in increasing overall lighting levels, which was often the case, customers paid in full for the extra costs to do so (Wolfe and McAllister 1989).

Some of the strengths of the program, as noted in the process evaluation, are as follows: (1) *easy implementation*: the program had clear goals, the audit did not require much time, and the paperwork was small; (2) *limited overhead costs*: administrative costs were limited to 10% of the program expenses; and (3) *lighting manufacturer marketing*: manufacturer representatives strongly marketed the program.

It is important to note that savings for similar programs offered today may be somewhat lower than with the Clark PUD program. Some industries may have upgraded their lighting systems in recent years, even without incentives.

Niagara Mohawk's High-Efficiency Motors and ASD Program

Niagara Mohawk Power Corporation has offered its C&I High-Efficiency Motors and ASD Program since 1991. Under this program, financial incentives are offered for the installation of energy-efficient motors and drives. Both the ASD and the motor incentives are fixed and are based on the nominal motor efficiency and horsepower. Generally, the ASD incentives pay for 50-75% of the drive equipment costs. In 1993, ASD rebates ranged from $550 for 5 hp motors to $18,000 for 400 hp motors. Due primarily to the large incentive, the ASD portion of the program has experienced high participation. Approximately 90% of the program's energy savings have come from ASDs. To date, among industrial participants, drive installations have been typically performed in blower, fan, HVAC, water pumping, and process applications. As of 1993, only motors operating pumps and fans are eligible for ASD installations. According to the program manager, marketing efforts have been largely targeted at equipment vendors. For example, the utility has organized numerous breakfast meetings with trade allies and assisted them in marketing the program at industrial shows. Niagara Mohawk's energy utilization specialists and customer contact personnel also market the program (DePaull 1993).

In its first year, this program exceeded the utility's savings goal by 500%. Niagara Mohawk credits its marketing approach and the large ASD incentive for the program's success (Stapleton 1992). In addition, the utility notes its efforts to keep the program elements simple as aiding in the program's success (DePaull 1993). In 1992, a customer survey estimated that 21% of participants were free riders (Research Triangle Institute 1993).

Custom Programs

Bonneville Power Administration's Energy Savings Plan

Bonneville Power Administration (BPA), a federal wholesaler of electricity in the Northwest, initiated their Energy Savings Plan (ESP) in 1988 as a custom pilot program to promote energy efficiency in industries. In designing the full-scale version of ESP in 1990, BPA decentralized the program and altered the marketing techniques. Whereas the earlier version of ESP was designed, administered, and marketed only by BPA, the revised program gives utilities who distribute BPA's power the opportunity to administer and market ESP. Vendors, contractors, utility customers, industrial customers, and others help plan, design, and participate in the ongoing evaluation of the full-scale ESP. These parties contribute to the annual modification of a list of flexible "program principles" which BPA's area offices use as the basis for designing their ESP program. The on-going revision of the principles allows BPA to incorporate lessons learned and changing conditions into the program design in a timely manner (Rose 1993).

Under the ESP, either industrial customers propose energy-efficiency projects to their utility or, if the customer needs assistance in identifying conservation opportunities, BPA will provide an Energy Review Service for identifying, analyzing, and proposing a package of energy-efficiency measures. This Service includes short walk-through audits, more detailed energy audits when necessary, and proposal preparation. Measures commonly installed include energy-efficient refrigeration, motors, energy management systems, air compressors, and waste heat recovery equipment (Rose 1993).

BPA and the utilities administering ESP generally negotiate incentives with industrial participants based on the individual customer's needs; other benefits, such as changes in labor requirements and/or non-electric savings, are taken into account. When the program first began, participants received -- upon completion of a project -- approximately $0.05/kWh saved in the first year. In an effort to increase participation, this has since been raised and, on average, the customer now receives the lesser of $0.15/kWh saved in the first year or 80% of the project costs. Staff reported that as long as a project's payback can be reduced to less than three years, most industrial firms are interested in participating (Aho 1989, Tawney 1992).

Increased emphasis has been placed on equipment vendors since the re-design of ESP. Utility marketing staff attend trade shows and offer vendor seminars in order to educate vendors on how ESP works and on effective methods for marketing their products by marketing the ESP program. Vendors have since played a central role in "selling" the program to industrial customers, and BPA staff cite this as largely contributing to the increased success of the program in attracting participants and savings (Peters 1992, Tawney 1992).

BPA's Aluminum Smelter Conservation/Modernization Program

BPA has been administering its Aluminum Smelter Conservation/Modernization (Con/Mod) program since 1987. The program was introduced at a time when BPA had an electricity surplus and when the aluminum industry was just emerging from one of the longest economic slumps in recent history. Aluminum production is a highly electricity-intensive industry with electricity purchases responsible for approximately 25% of production costs. The short-term goal of this program was to retain load through improving the energy efficiency of the aluminum smelters in the region, thus making the smelters more economically viable in the highly-competitive world aluminum market. The long-term objective of the program from BPA's perspective was to purchase low-cost power from the smelters through efficiency improvements (Mortensen 1992). The ten primary smelters in BPA's service territory purchase approximately one-third of all BPA's power.

All of the primary aluminum smelters participated in the planning and design of the program. Initial measurements of the baseline efficiency of the smelters, in kWh per pound of aluminum produced, were made in 1987. Since then, the smelters have reported their electricity use per pound to BPA on a quarterly basis. The incentive payment to the smelters is linked to improvements in this baseline efficiency and equals $0.005/kWh (1987$) saved over a ten-year period, or roughly one-third of the costs of efficiency improvements. Although the deadline for completion of modernization projects was mid-1991, BPA will continue making incentive payments to the smelters over the life of the measures. The customers are under no obligation to explain to the utility how they reduce their electricity consumption due to proprietary concerns. According to utility staff, as a result of this stipulation and the fact that many of the smelters need to make some of the improvements in order to survive, the financial incentive offered to the customer is fairly small (Kusaka 1992).

Since the start of the program, Con/Mod has achieved electricity savings of 2.5% of total industrial sales and a 100% participation rate (Mortensen 1992; Reiwer 1992). Although BPA has not estimated the free-ridership of this program, staff notes that some of the measures would have been installed regardless of the program due to the smelters' need to remain competitive and electricity's high contribution to total aluminum production costs (Johnson 1992; Kusaka 1992). The levelized cost to the utility has been $0.006/kWh saved. According to the utility, the low cost of the program is partly due to the minimal administrative requirements of the program, since the smelters do not allow utility staff to enter their facilities. The smelters keep all the recorded data and report results to BPA.

BPA suspects that some smelters have made "real" energy savings as a result of the program, and others have made less genuine savings, meaning that the methods for reducing the kWh usage per unit of aluminum produced were not necessarily due to pure energy-efficiency improvements but rather to more questionable methods. For example, the amount of savings achieved in the smelter projects depended on the assumed baseline efficiency, which was negotiated jointly by BPA and the smelters. Since the program was initiated during an economic slump in the U.S. aluminum industry, the efficiency of many of the smelters was lower than normal, according to utility staff. Soon after the program began, the industry began to recover as aluminum prices escalated. Smelters resumed their "normal" operations, the efficiencies of the plants improved, and BPA has reason to believe that the resulting reductions in kWh per pound of aluminum were claimed as savings under the Con/Mod program. Staff noted that, although this suspicion can not be proved, estimated savings based on metered data are only 50% of the savings claimed by manufacturers, and increases in aluminum production do not fully account for the discrepancy (Kusaka 1992). "Real" energy savings generally came from installing process control measures and measures controlling the magnetic field of the pot within which aluminum is produced.

BC Hydro's Power Smart: Bonus Partners Program

BC Hydro's Bonus Partners program, a custom program for BC Hydro's industrial customers, was initiated in mid-1990. Under Bonus Partners, industrial customers propose energy-conserving, process-related projects to BC Hydro; either financing options or cash grants are offered for qualifying projects. If an approved project yields savings of less than 200 MWh per year, the participant generally receives an incentive which brings the project's payback period down to two years. For larger projects, the utility meets with the customer and negotiates the investment criteria that the industrial customer would need in order to proceed with the project. In determining the incentive payment for projects of any size, other factors beyond the energy savings are considered; the utility works with the customer in determining the effects the project will have on maintenance costs, productivity, product quality, equipment reliability and other important industrial concerns. The utility and the participant jointly assign monetary values to these effects and factor these values into the incentive calculation.

Pointing out the other benefits of the efficiency projects generally enhances participation in the program. Staff note that although this approach takes longer than a more traditional incentive arrangement, it is worth the effort. Incentives generally cover between 15-30% of the project costs; with BC Hydro's incentive design, the utility noted that an incentive covering 80-100% of project costs is not needed (Hessen 1993). It is important to note, however, that customers participating in the larger Bonus Partners projects are generally energy-intensive industries, such as paper and pulp, mining, and food processing industries, and are more interested in improving the energy efficiency of their facilities than the average industrial firm. It is therefore unclear whether lower negotiated incentives would work for the typical industrial customer in other utility service territories.

In marketing Bonus Partners, BC Hydro makes available to prospective participants a variety of literature on efficient technologies and case studies. The utility also co-sponsors energy forums for particular industries. The utility offers materials, partial financing, and marketing for a forum on an energy efficiency-related topic of interest to particular industry associations. To date, the utility has held a forum on industrial refrigeration, a forum for the foundry industry, and a forum for the pulp and paper industry on distribution control systems. The key to the success, according to BC Hydro, is that industry associations, and not the utility, are "up front" leading the forum.

BC Hydro's Industrial Power Smart: Power Plays/ Employee Involvement Component

British Columbia Hydro (BC Hydro) ran the Power Plays pilot program in 1991 as a test for a new and innovative approach to achieving industrial energy savings. The utility's aim in offering this program was to acquire low-cost savings by offering an incentive to employees who operate equipment in industrial customers' facilities. Employees at seven industrial facilities were encouraged to submit suggestions on electricity-saving measures. Employees whose ideas were finally implemented received $0.005/kWh saved from BC Hydro. Most of the viable ideas fall within the guidelines of another Power Smart program, and therefore the customer is also eligible for an incentive. According to the program manager, the industrial customers implemented and paid for more than two-thirds of the proposed projects themselves without applying for additional incentives (Venneman 1992). Within each participating facility, BC Hydro promoted the program for six months; workshops were held and ideas were solicited. The pilot program had a good response, according to the program manager, and 2.5 GW of load reduction were achieved. The retrofit most commonly performed was the installation of sensors and timers for motors, lights, fans, and pumps.

In 1993, a full-scale version of the program was presented to customers. An evaluation of the pilot program indicated that the six-month promotional period within each industrial facility was unnecessarily long, so the new version of the program promotes the program for only two months. After the two-month period is over, the utility does an initial survey of the technical feasibility of the proposed projects. A meeting is then held with the key decision-makers in the industrial firm to decide which of the options are the most viable based on a number of factors, including the project's effect on safety and production. The utility is offering a "two-tiered" incentive. With this approach, the utility offers a $250 reward to the employee whose idea is deemed "viable" by both BC Hydro and the participating company. Upon implementation of the idea, the employee receives an additional award of $0.0025/kWh saved, up to a maximum of $2,500. Team submissions collect 20% more incentive. Utility staff noted that the program is no longer actively promoted, since the program is currently oversubscribed (Kabel 1993).

CMP's Power Partners Program

CMP's Power Partners program is an all-source bidding program in which DSM projects compete among themselves and with supply-side options such as cogeneration. C&I customers or energy service companies (ESCOs) submit energy management project bids in response to RFPs issued by the utility for specific blocks of power. The applicants propose a payment level for a projected amount of electricity savings. Projects are selected based on their price, dispatchability, and other factors. Contracts are developed between participants and CMP to address completion targets, financial arrangements, and savings verification. The utility monitors all projects within this program to determine if the savings are persisting over time. Incentive payments are made over the lifetime of the measures, with the sum of the payments made over the years generally covering more than 100% of the initial project costs (Carter 1992).

To date, ESCOs have generally managed the industrial projects in the program, although 20% of the projects were directly submitted by industrial customers. Although bids have not been solicited for almost three years due to adequate power availability, savings from existing projects are still coming in, including savings from industrial projects. Measures often installed in the industrial projects include process-related improvements, ASD installations, and lighting and motor retrofits.

Staff noted the program's flexibility as a key component contributing to its success (Linn 1992). No estimates of the number of free riders have been made for this program.

Puget Power's Industrial Conservation Incentive Program

Puget Power, located in Washington State, has administered its Industrial Conservation Incentive program since 1981. Utility staff work with program participants and consultants to perform analyses of entire industrial systems, identify where the electricity savings and greatest overall customer benefits lie, oversee project bidding, assist in project design, and perform savings verification tests. Seminars on commonly-applied measures, such as ASDs or compressed air-system measures, are available to customers. Energy audits are performed by both utility staff as well as consultants chosen by either the utility or the customer. Three-to-five-year plans are developed with participants to coordinate which measures will be installed and when. Initially, although the program was open to all industrial customers, Puget targeted its marketing toward its largest industrial customers. In the last few years they have begun to market to small- and medium-sized customers as well. The customer incentive usually covers approximately 50-75% of materials and installation costs of a project. Puget staff noted that due to the intensive labor requirements of this program, the availability of staff to broadly market the program is limited. The program is marketed by word-of-mouth, through the trade ally network, and through direct customer contact. Seminars and slide shows are also available (Banister 1993).

According to the program manager, 80% of the measures performed are either energy-efficient pumping, motor/ASD, lighting, compressed air, refrigeration, or process-related measures. Of these, lighting, ASD, and process modification measures are currently the most commonly installed measures (Banister 1993).

The utility now performs savings verification on every project about one year after project completion, including metering and monitoring of installed equipment. In addition, for some of the projects, the utility will return to the facility in later years to see if the equipment is still on-line. The percent of participants who are free riders is estimated at 10% (Puget Power 1993).

According to the utility, low electric rates reduced participation in the earlier years (Banister 1993). The utility's goal is to save 1% of industrial sales annually through this program.

The utility attributes the program's success to a number of factors, including: (1) the program is part of a package of energy services, and is marketed as such (industrial customers generally do not want to be part of a *program*, according to the utility, but would rather receive *energy services*); (2) contractors involved in the projects generally have extensive technical expertise in the participating industries; and (3) the audits and recommendations target process-related improvements.

Joint Custom/Prescriptive Programs

Southern California Gas' Industrial Equipment Replacement/Heat Recovery Program

Since 1990, Southern California Gas has offered incentives to industrial customers to install high-efficiency equipment and heat recovery devices through its High Efficiency Industrial Equipment Replacement and Industrial Heat Recovery programs. Incentives are also available for consultant studies to determine cost-effective conservation measures. The utility pays for 50% of the study costs. Both prescriptive and custom incentives are offered. Incentives are based on rated input and/or therm savings, up to 30% for the installed cost of equipment replacement and up to 50% for heat recovery, whichever is less. Measures most commonly installed are high-efficiency gas boilers, dryers, kilns, ovens, process cooking equipment, economizers, and recuperators.

According to utility staff, some customers are meeting new air quality standards in California by participating in the program. Customers who operate industrial process waste heat boilers can receive a rebate for adding "super-efficient" heat recovery devices to these boilers. The devices can increase the efficiency of the boilers to at least 92.5%, according to the utility, and this helps participants meet air quality regulations (Spasaro 1993).

United Illuminating Energy Blueprint Program

United Illuminating (UI) has offered its Energy Blueprint program to eligible commercial and industrial customers since 1990. The program offers incentives and design assistance for incorporating energy-efficiency measures in new construction and major renovation projects. Both prescriptive and custom rebates as well as design grants are offered under this program.

Prescriptive rebates are available for installation of high-efficiency motors, lighting, building envelope, HVAC, and heat recovery equipment. Custom rebates are offered for other site-specific and/or process-related measures. Design grants are offered to architects and engineers to defray the additional design and analysis costs needed to consider energy-efficiency opportunities. When appropriate, industrial specialists are hired by the utility to provide assistance in industrial projects.

The baseline efficiency of the design plan for a new or expanded facility is determined on a case-by-case basis by the utility and is generally based upon both quantitative and qualitative information collected from the participant. Utility staff noted that third-party engineering firms are often hired to assist in determining the baseline for facilities in which custom projects are being considered.

Thus far under the Energy Blueprint program, lighting, motor, ASD, compressed air system, and waste water projects predominate. Incentives to industrial customers generally cover roughly 50-75% of a project's equipment and installation costs. Energy savings of 20-30% relative to baseline energy consumption are typically being achieved in industrial projects (Balinskas 1993; United Illuminating 1992).

The program is marketed by direct customer contact. Utility representatives and engineers utilize leads from the customer service section. According to the program manager, it is important to have experienced and "well-versed" utility representatives market the program, so that the initial contact with a potential participant is clear and direct. Representatives should know the industry and the program well enough to pinpoint energy-saving opportunities early on in the marketing effort (Balinskas 1993).

Wisconsin Electric's Smart Money for Business Program

Wisconsin Electric's (WEPCo) C&I Smart Money for Business program is a combination custom and prescriptive program offering commercial and industrial customers zero-to-low interest loans or cash rebates for installing qualifying energy-efficient measures. Special incentives are also provided to encourage energy-efficient design and new construction. Prescriptive rebates are available for lighting, motor, HVAC, and refrigeration measures. Custom incentives are available for process-related improvements and are negotiated with each participant. Between 15-30% of a custom project's total costs are typically covered by the incentive, or low-interest/no-interest financing is provided. If a project requires a feasibility study, WEPCo will pay up to 50% of the costs of a comprehensive study. WEPCo has focused on securing the technical expertise necessary to do a thorough job; engineering consultants having particular expertise with relevant industrial processes are available to participants to perform feasibility studies.

After administering the program for over three years and studying the managerial structure of its industrial customers, WEPCo refined its marketing approach to reflect what had been learned.

A two-pronged strategy is now taken: utility sales executives (typically engineers) communicate with and market the program to process-level plant personnel, such as plant engineers and maintenance operators. Simultaneously, utility account executives interact with and market the program to industrial vice presidents. Generally, smaller projects can be handled by the process-level employees, whereas larger projects require interaction at a senior management level.

To date, it is estimated that more than half of all WEPCo's industrial customers have received rebates or loans through the Smart Money program. The majority of participants have focused on prescriptive measures, with approximately two-thirds of rebates being prescriptive. A little more than half of the industrial energy savings have been due to lighting measures, while process-oriented measures are responsible for approximately 30% of the savings. The program manager noted that it has taken time to gain the trust of the industrial customers with regard to DSM, especially in moving from lighting and HVAC measures to process measures. According to the utility, industrial customers have shown great concern and caution in altering their processes (Hawley 1992).

The program manager noted that the program's success in recruiting a large proportion of the eligible industrial customer base and acquiring significant savings as a percent of sales is primarily due to the utility's focus on understanding the customer's perspective, making personal one-on-one customer contact, utilizing effective marketing techniques, simplifying the program while still offering a comprehensive package, and securing technical expertise necessary to do a good job (Hawley 1993).

Program Approaches that Have Not Been Successful

A review of program experience to date indicates that some types of programs have not generally been very successful in achieving significant energy savings including information-only, loan, and shared savings programs. However, it is possible that new improved variations on these program types may be more successful in the future. Each of these program types is discussed below.

Information-Only Programs

Information-only programs can range from simple educational brochures to detailed energy audits. Hundreds of information programs have been run by utilities, but information on program results is rarely compiled or published. However, the limited data that are available indicate that information programs can have a positive impact, but that participation rates and savings are usually very limited. For example, Orange and Rockland mailed an informational brochure on lighting efficiency improvements to 18,000 customers. Less than 1% responded by sending in a tear-out card to request additional program information (Orange and Rockland, 1988). Similarly, Niagara Mohawk mailed an informational brochure on energy-saving fluorescent lamps to a targeted group of lighting decision-makers at customer facilities. In a survey conducted at the end of the six month experiment, 3% of these customers reported they had switched to high efficiency fluorescent lamps in the last six months while 5.6% of customers who received the same brochure combined with a rebate offer reported the same switch. By way of comparison, among a control group of customers who received neither information nor incentives, 2.5% switched to high efficiency lamps. Thus, relative to the control group, information alone increased use of efficient lamps by 20% while information plus rebates increased efficient lamp use by more than 100% (Clinton and Goett 1989).

With regard to audit programs, industrial audit programs have been offered by many utilities and state governments. Some of the more successful programs have achieved participation rates in excess of 60% of eligible customers. Several studies have examined savings achieved by audited customers. Some of these studies are based on engineering estimates, and some are based on a comparison of participant bills to a control group of non-participants. These studies, which are discussed by Nadel (1990), have found that participants reduce their kWh use by an average of 2-8%. While these savings are significant, these programs generally capture only a minority of the cost-effective savings opportunities that are available. Furthermore, most of the programs with savings in the upper half of this range also include financial incentives which help pay the cost of measure installation. Without financial incentives, savings are commonly near the lower end of this range.

Loan Programs

Industrial loan programs have only been offered by a few utilities. These programs have achieved some energy savings, but side-by-side comparisons with rebate programs offered by the same utilities show that most customers prefer rebates. However, loans can be useful for the minority of customers who lack cash to finance energy-saving investments. For example, both Wisconsin Electric and Puget Sound Power & Light offer customers a choice between a zero interest loan or a rebate that is approximately equivalent to the interest subsidy on the loan. In both programs over 90% of the participating customers have chosen rebates instead of loans (Clippert 1989 and France 1989). These utilities also found that loans tend to be more complex to administer than rebates, which raises program administrative costs.

Shared Savings

In a shared savings approach, a utility or energy service company helps identify and finance energy efficiency measures in customer facilities. As energy savings accrue, the customer then pays the utility or energy service company a portion of the money saved. In some programs, all program costs are recouped from participating customers; in other programs, only a portion of program costs are recouped -- the remaining portion of costs is a utility-financed subsidy. While the shared savings concept appears very attractive on paper, and these programs can be effective for some market niches such as government buildings, in the industrial sector they have not generally been very successful. In the late 1980s several utilities offered industrial shared savings programs including Central Maine Power (CMP), Northeast Utilities (NU), and Wisconsin Power & Light (WP&L). Most of these programs included some utility subsidies. Participation rates were disappointingly low: for example, 1 out of 45 targeted customers participated in the CMP program while only 3 out of 179 participated in NU's program (Nadel 1990). These programs were generally marked by complex negotiations on how savings would be measured and the energy service provider paid. Many of these discussions never reached completion.

More recently, several utilities, including PacifiCorp and Bangor Hydro, have used utility staff and utility financing to operate industrial shared savings programs. These programs have also not done very well. The Bangor Hydro program had no participants in its first year and was discontinued. Utility staff attribute the failure of the program to limited marketing and to lack of significant financial incentive for the customer to participate (Tyler 1993). PacifiCorp's program, which includes utility subsidies, has been slightly more successful -- after a little over one year of operation, ten customers have signed commitments to participate and one installation was completed. Still, with approximately 400-700 eligible customers, this participation rate must be considered disappointing. Also energy savings from this program have been limited -- program staff estimate that the average participant will reduce energy use by only 3% (Van Kempena 1993).

Program Approaches that May Merit Some Additional Experimentation

In addition to the program approaches discussed above, several other program approaches have been proposed for which too little actual experience is available to reach conclusions about their likely impacts. Some of these approaches are very different from typical industrial DSM programs; others are variations on program approaches that have not worked thus far. In either case, a limited number of pilot programs are needed to assess the effectiveness of each approach. Among these program options are bidding, shared savings with a bonus, leasing, comprehensive one-stop services, subscription service programs, dedicated allocation of DSM funds, incentives to encourage firms to hire energy managers, and market-pull programs.

Bidding

In the past few years there has been considerable interest in bidding programs where utilities request proposals from outside parties to supply demand-side and/or supply-side resources. Successful bidders are selected on the basis of price and other factors. The purpose of bidding programs is to let the market determine the price of new resources and the proper mix of program efforts, including the mix between demand- and supply-side resources and/or the mix of utility sponsored programs relative to the efforts of non-utility parties. In some bidding programs, bids are limited to specific sectors (e.g. industrial) or end-uses (e.g. lighting), in other programs, bids for any sector or end-use can be submitted.

Actual experience with demand-side bidding programs is limited, although the number of DSM bidding programs are growing each year (Goldman and Busch 1992). Indications thus far are that these programs can achieve significant energy savings. For example, by the end of 1991, Central Maine Power had signed savings contracts totaling 4.6% of its peak demand through its Power Partners and Efficiency Buyback programs (Linn 1992). 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, a review of nine bidding programs found utility costs per kWh of $0.027-0.067, with an average of $0.051 (Goldman and Busch 1992). As discussed above, a 1993 review of utility-operated industrial DSM programs (Jordan and Nadel 1993) found utility costs ranged from $0.003-0.045/kWh (average of $0.019), implying that utility-operated programs may be less expensive. Still, bidding programs may be appropriate in some situations; for example, for utilities who are not interested in running their own programs and for utilities who have not been able to design and deliver effective industrial DSM programs. Further work is needed to better define the situations where bidding programs may be appropriate.

Shared Savings with Upfront Incentive

As discussed above, participation in shared savings programs has generally been limited, in part because the need to share savings with the program sponsor reduces the benefit to the customer. To address this problem, Blank (1993) has proposed that shared savings program participants receive both full financing of efficiency measures and a large up-front incentive payment designed to entice participation. Over time, this incentive payment, along with the cost of efficiency measures, is recovered through shared savings charges. The reasoning behind this program approach is that customers have high implicit discount rates, and thus are not motivated by benefits spread over many years. The upfront incentive provides customers with the near-term benefit they desire. Utilities, on the other hand, are much more willing to see benefits spread over time, as is the case with energy service payments spread over many years. To our knowledge this approach has yet to be tried in practice. Some pilot programs may be appropriate. However, given customer's reluctance to participate in traditional shared savings programs, convincing customers to participate in this variation on shared savings is likely to be a hard sell.

Leasing

One option that has been suggested, but is largely untried in the industrial sector, is for utilities to purchase high efficiency equipment and lease it to customers. Leasing eliminates the upfront capital cost of an efficiency investment and converts it to an annual expense. Municipal utilities in Burlington, VT, Taunton, MA, and Gainesville, FL have had some success leasing efficient lighting equipment to commercial customers (BED 1993, Love 1993, Nadel 1990). Alberta Power has discussed this option for industrial equipment but has not yet implemented this idea (Nadel et al. 1991). Leasing faces several unanswered questions. For example, will industrial customers respond to leasing? Many industrial firms are reluctant to let outsiders own a piece of their plant (Gordon 1993). Also, leases will probably require approval by financial and legal staff who may be reluctant to take on debt that appears on a company's balance sheet. On the other hand, there may be ways to structure a lease (e.g. as a tariff with an energy service charge) so it does not appear on balance sheets (Chernick 1993). Another question is can the administrative costs of a large-scale leasing program (e.g. larger scale than the municipal utility operated programs discussed above) be kept to reasonable levels?

Comprehensive One-Stop Services

One utility -- Southern California Edison (SCE) -- has recently postulated that they can overcome industrial customer reluctance to invest in energy efficiency measures by providing a comprehensive package of services to identify, install and finance efficiency measures. SCE has just proposed a new program -- ENVEST -- which is designed to provide hassle-free energy efficiency services to customers. Under the ENVEST program, SCE will provide energy audits, volume purchasing (to reduce measure costs), arranging of measure installation, measure financing, performance reporting, and performance warranties. Services will be provided by energy service companies and other third parties under contract with SCE. Financing is either via loans or a service charge (somewhat analogous to a lease). The utility will pay program administrative costs and approximately one sixth of direct program costs. Remaining program costs will be paid over time by participating customers through loan payments or service charges. Essentially, this is a variation on loan programs, but with much more extensive technical assistance than previous loan programs have provided. Given customer reluctance to participate in traditional loan programs, this program approach may also be a hard sell. The program is initially being proposed as a pilot program to be offered through the end of 1995. Periodic evaluations are planned (SCE 1993).

Subscription Service Program

In a recent settlement, a group of large industrial customers and Niagara Mohawk Power Corp. (NMPC) negotiated a deal in which Niagara Mohawk agreed to offer large industrial customers a choice of two DSM options: NMPC's conventional DSM programs or a "subscription service" program which combines customer-financed energy audits, customer-financed efficiency improvements, and an unsubsidized shared savings program. Under the arrangement, customers who choose the subscription option are not eligible to receive utility DSM subsidies, but are excused from paying a portion of DSM-related costs. The rate reductions amount to approximately 1.4-2.4 mills/kWh (a mill is a tenth of a cent) (Robinson 1992). Subscription service customers must conduct a detailed energy audit of their facilities and submit the results to the utility. Niagara Mohawk and the group of large industrial customers who negotiated the program argued that the subscription service program would lower the cost to ratepayers of each kW and kWh saved. As part of the proposal, Niagara Mohawk agreed to increase its industrial DSM savings goal by 20%. The New York Public Service Commission approved the deal as a three-year experiment. To be judged successful, the utility must show that subscription service customers have done at least as good a job installing energy efficiency measures as customers who remain eligible for NMPC's regular DSM programs (Bradford 1993). This experiment has received extensive attention and has been allocated a large evaluation budget. Given the disappointing track record of shared savings programs (discussed above), it is premature for other utilities to replicate the NMPC experiment until the NMPC project is completed in 1996.

Dedicated Allocation of DSM Funds

Some large industrial customers are concerned that they are not getting their "fair share" of DSM funds, and therefore, they are subsidizing DSM services for other customers. To address this issue, Rochester Gas & Electric (RG&E) has negotiated a program with many of its large industrial customers under which the industrial DSM budget for its custom incentives program is allocated to each customer based on each customers share of RG&E industrial electric sales. Each customer may use its share of DSM incentives for projects which meet the program's guidelines. If a customer elects not to use their share of funds, the funds are allocated to other customers who have already exhausted their share of the incentive pot. This program approach addresses the inter-customer subsidy issue and provides a strong marketing message to eligible customers -- "use your allocation of incentive funds, before your share is given to other customers." The program is scheduled to run in 1993 and 1994 (RG&E 1993).

Incentives to Encourage Firms to Hire Energy Managers

In the 1970s many industrial firms hired Energy Managers to help them reduce energy use. These energy managers helped firms improve operations and maintenance practices, and they also planned capital programs to reduce plant energy use. Most of these energy managers were very successful in their efforts (see for example Perkins and Flanigan 1992). However, most of these Energy Managers were hired by large companies -- Energy Managers are rare in small and medium-sized companies. Furthermore, even many large companies have cut back on energy managers during recent "downsizing" efforts (Elliott 1993). Several studies have found large opportunities for low-cost energy savings in small- to medium-sized industrial firms (see for example Ross 1992). In order to encourage these firms to hire full- or part-time energy managers, a program offered in North Carolina to local governments could be adapted to the industrial sector. The North Carolina program encourages facilities to hire energy managers. The program sponsor (a utility-funded organization named the North Carolina Alternative Energy Corp. -- NCAEC) guarantees that after two years, the energy manager will save enough money to pay his salary. The sponsor also helps train the energy managers. If the value of the energy savings are less than salary costs, the sponsor pays the difference. Thus, organizations hire energy managers at no financial risk for the first two years. NCAEC found that over two years, the average energy manager saved twice his or her salary. NCAEC had to pay less than 3% of the total salaries covered by the program (Emmett and Gee 1986).

Market-Pull Programs

Market-pull programs attempt to create a demand for specific high efficiency equipment by coordinating DSM programs on a national or regional basis. The targeted equipment may be an existing product that is slow to penetrate the market, or it may be a new piece of equipment that equipment manufacturers develop in response to the program. Thus far, the market-pull approach has been primarily used in the residential and commercial sectors. For example, in the Super Efficient Refrigerator Program (SERP), 25 utilities from throughout the U.S. pooled $30 million in incentives and offered these incentives as a prize in a competition among refrigerator manufacturers to see who could design and commercialize the most efficient refrigerator. The winning model is at least 30% more efficient than current models and is expected to reach market in early 1994 (SERP 1993). Similarly, a group of utilities have coordinated on eligibility levels for commercial air conditioner rebate programs. As a result, manufacturers are introducing many new models that meet these standards (CEE 1993). Initial research for a possible industrial sector market-pull program is now underway. For this project a group of utilities from throughout the U.S. are investigating how original equipment manufacturers (OEMs) use motors in their equipment, and are exploring ways to encourage OEMs to increase the efficiency of motor systems in their equipment (Easton Consultants 1993).

BUILDING INDUSTRY/UTILITY PARTNERSHIPS

Both utilities and industrial customers agree that it is in everyone's interest for industrial customers to implement energy efficiency improvements where it is cost-effective to do so. In order to advance this goal on a broad scale, we have four recommendations:

First, utilities need to do a better job designing industrial DSM programs including involving industrial customers in the design process. As discussed above, many industrial DSM programs have suffered from low participation and low savings because they do not meet industrial customer needs. All too often programs are developed by utilities and presented as a *fait accompli* to industrial customers. Instead customers need to be consulted and involved throughout the program planning process. As part of this process, utilities should be open to new program ideas proposed by customers. Where ideas may have merit, small pilot programs should be planned to test untried approaches. In this manner, all parties can learn what works and what does not. Industrial DSM is still in its early stages -- no one knows for sure which approaches are best.

Second, utilities should learn from the substantial experience with industrial DSM that has already occurred throughout North America. Successful program designs should be replicated by other utilities. For example, if B.C. Hydro can succeed in transforming the market for high efficiency motors or if BPA, Puget Power, and Wisconsin Electric can offer successful custom measure programs that help finance energy-saving ideas proposed by customers, then other utilities can follow suit. By learning from successful programs developed elsewhere, utilities can reduce program costs, increase program effectiveness, and begin to bring some commonality to programs offered by different utilities (large industrial firms with operations in many states have often suggested that by increasing commonality between programs offered by different utilities, customer confusion will be reduced and more projects will be implemented).

Third, ways need to be found to diffuse the rate impact issue. While solutions will not be easy, and may be controversial in some quarters, it is in all parties interest to reach sensible compromises because the current contentious debate often results in resolutions that serve none of the parties' best interests. Where rate impacts are large and DSM costs are treated as an expense, utilities should consider spreading the costs over several years, just as the cost of power plant investments are spread over the expected life of the plant. Where large industrial customers are concerned that they are subsidizing DSM expenses by other customer classes, utilities should consider allocating costs by customer class or sub-class. Where rate impacts are still considered excessive, utilities should be given a financial incentive to reduce DSM expenditures per unit of energy savings, while maintaining aggregate savings levels. Utilities and regulators might also consider placing caps on DSM-caused rate increases. Most DSM programs have caused only very modest rate increases. For example, a study by Faruqui and Chamberlin (1993) found DSM programs at eight utilities caused rates to increase by an average of 0.6 mills/kWh (i.e. an average increase of approximately 1%). By limiting future DSM-caused rate increases to 1-2% per year, DSM programs should not be significantly constrained. Such rate caps should only be set prospectively and not retrospectively. Retrospective caps would be unfair to utilities and their shareholders who have implemented DSM programs in good faith.

Fourth, utilities need to do a better job evaluating their DSM programs. Some utilities have done an exemplary job evaluating their industrial DSM programs, but the vast majority of industrial DSM programs have yet to be properly evaluated. An example of a well-evaluated industrial DSM program is BPA's Energy Savings Plan program. BPA conducts periodic process (Peters 1989) and impact evaluations (Spanner 1993) on the program. Process evaluations assess program operations by reviewing and analyzing program records and conducting interviews with program managers, trade allies, participants and nonparticipants. Impact evaluations assess the energy savings achieved by a program by analyzing the energy use of program participants before and after measure installation, while controlling for non-program-related effects. Impact evaluations also compare program costs to program benefits. Utilities need to emulate BPA and make good evaluation the norm, not the exception.

CONCLUSIONS

There are many reasons why industrial customers do not implement all cost-effective efficiency measures on their own. Utility DSM programs can help overcome some of these barriers. DSM programs provide an opportunity for utilities to reduce the cost of providing energy services while helping customers to reduce their energy bills and thereby increase profit margins and competitiveness. Still, large industrial customers have concerns about the impacts of DSM programs on the rates of program nonparticipants and about the quality of DSM programs.

A review of utility experience with industrial DSM programs shows that some types of programs work much better than other types. Successful efforts include both custom and prescriptive components that show an understanding of the customers perspective, use marketing that is personal and user-friendly, provide flexibility, and include financial incentives. Among the less successful programs are programs that do not address customer needs, including information-only, loan, and shared savings programs. A number of other program approaches are largely untested and merit further experimentation.

In order to advance towards the goal of maximum cost-effective efficiency improvements in the industrial sector, it is time for utilities and their industrial customers to work more closely together in order to design programs that serve the needs of industrial customers and to develop procedures to ensure that the rate impacts of DSM programs are kept to modest levels and that programs are properly evaluated. By working together, utilities and industrial customers can put the contentious debates of the past behind, and turn their attention away from generating legal briefs and towards generating energy savings and healthier businesses.

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APPENDIX

Detailed Data Sheets on Successful Programs

EXPLANATION OF DATA SHEET VARIABLES

VARIABLE	DATA/INFORMATION
Start year	Year program began.
End year	Year program ended.
TECHNOLOGY:	
Program type	Audits, rebates, shared savings, bidding, etc.
Marketing approach	Description of marketing techniques (seminars, field reps, bill stuffers, etc.)
Technology description	Description of measures most commonly performed.
Average incremental equipment cost/participant	Average cost/project since start of program, or for most recent year. Includes utility & customer share.
Average incremental installation cost/participant	Average cost/project since start of program, or for most recent year. Includes utility & customer share.
Average incremental annual O&M cost/participant	Average cost/project since start of program, or for most recent year. Includes utility & customer share.
Incremental program savings	Annualized savings for measures installed in designated year only.
1992 utility sales to industrial customers	
Coincident kW deferred	
Estimated average measure life	Average for all measures.
# eligible customers	Average since start of program.
# of participants	Number of participating customers (not number of rebates unless noted otherwise).
Estimated free rider proportion	
Total utility rebate costs/ year	Total direct costs to participating customers (i.e. rebates, audits, etc.).
Total utility marketing costs/year	
Average administrative costs/year	
Staffing — number (professional, FT equiv.)	
Utility contact & phone number	

UTILITY NAME:	Bonneville Power Administration	
PROGRAM NAME:	Energy Savings Plan	
VARIABLE	DATA/INFORMATION	NOTES
Start year	1988	
End year	—	
Program type	The program aim is to increase the energy efficiency of industrial facilities. Custom incentives are available for qualifying projects. Incentives average $0.15/1st year kWh savings or 80% of the project costs, whichever is smaller. BPA's utility customers may administer the program. BPA will operate the program in those territories not choosing to run the program.	
Marketing approach	Most marketing is through one-on-one contact between vendors and customers. Utility marketing staff attend trade shows and offer vendor seminars to educate vendors on marketing strategies. Vendors generally "sell" the program to customers.	
Technology description	Energy-efficient refrigeration systems, motors, energy management systems, air compressors, and waste heat recovery equipment are often installed.	
Average incremental equipment + installation cost/participant	$78,000	Most projects cost less than $100,000. The second largest cost category is $100,000 - $300,000. A few projects cost over $1 million.
Average incremental annual O&M cost/participant	n/a	
Incremental program savings		
1987	— MWh	
1988	— MWh	
1989	25,259 MWh	
1990	22,828 MWh	
1991	47,323 MWh	
1992	50,582 MWh	
cumulative	145,992 MWh	
1992 utility sales to industrial customers	17,730,240 MWh	Rose 1993 (does not include sales to aluminum smelters).
Coincident kW deferred	n/a	
Estimated average measure life	15 years	
# eligible customers	300	
# of participants		
1987	—	

1988	—	
1989	9	
1990	8	
1991	18	
1992	50	
cumulative	85	
Estimated free rider proportion	30%	Spanner, et. al 1993.
Total utility rebate costs/ year		
1987	—	
1988	—	
1989	$705,000	
1990	$974,000	
1991	$1,520,000	
1992	$4,334,000	
cumulative	$7,533,000	
Total utility marketing & administrative costs/ year		Based on BPA estimate that indirect costs have been generally 30-50% of rebate costs. The midpoint of 40% was used here.
1987	—	
1988	—	
1989	$282,000	
1990	$389,600	
1991	$608,000	
1992	$1,733,600	
cumulative	$3,013,200	
Staffing — number (professional, FT equiv.)		
1987	—	
1988	—	
1989	n/a	
1990	n/a	
1991	n/a	
1992	n/a	
Utility contact & phone number	Mike Rose, 503 230 3601	

UTILITY NAME: BC Hydro

PROGRAM NAME: Industrial Power Smart: Compressed Air component

VARIABLE	DATA/INFORMATION	NOTES
Start year	1988	
End year	—	
Program type	Financial assistance available for both mini- and full-scale audits of compressed air systems. BC Hydro splits the cost of leak testing equipment with participants. If savings targets are met, the utility reimburses customer their portion. Incentives and financing available for implementing measures that need a buydown to a 2 year simple payback.	
Marketing approach	Seminars in local areas. Site visits by BC Hydro representatives. Awareness of program increased through vendor visits, give aways of hats, etc. Pulp and paper mills are targeted, since these customers generally have the most extensive air distribution systems.	
Technology description	Air compressor system leak repair & monitoring equipment. Sequencers, dryer purge controls, other.	
Average incremental equipment cost/participant	$2,200	Average leak tester cost.
Average incremental installation cost/participant	$5,000 to $100,000	Utility estimate.
Average incremental annual O&M cost/participant	-$5,000 to -$10,000	Utility estimate. Customer's O&M costs are reduced.
Incremental program savings		
1987	— MWh	
1988	1,700 MWh	
1989	7,500 MWh	
1990	19,000 MWh	
1991	15,200 MWh	
1992	7,200 MWh	
cumulative	50,600 MWh	
1992 utility sales to industrial customers	16,000,000 MWh	
Coincident kW deferred	n/a	
Estimated average measure life	3 years	Rough estimate (McLelland 1993, Parfomak 1993).
# eligible customers	500	Large industries. Originally program targeted 200 paper mills
# of participants		

1987	—	
1988	n/a	
1989	n/a	
1990	n/a	
1991	133	
1992	50	
cumulative	183	
Estimated free rider proportion	0%	Utility estimate.
Total utility rebate costs/ year		Costs are in Canadian dollars.
1987	—	
1988	$0	
1989	$0	
1990	$22,000	
1991	$238,000	
1992	$134,200	
cumulative	$394,200	
Total utility marketing costs/ year		Administrative costs are not included here.
1987	—	Costs are in Canadian dollars.
1988	$32,400	
1989	$112,900	
1990	$262,400	
1991	$281,100	
1992	$427,100	
cumulative	$1,115,900	
Average labor costs/ year		Costs are in Canadian dollars.
1987	—	
1988	$4,100	
1989	$44,800	
1990	$192,400	
1991	$178,400	
1992	$190,300	
cumulative	$610,000	
Staffing — number (professional, FT equiv.)		
1987	—	
1988	1	
1989	1	
1990	2	
1991	2	
1992	3	
Utility contact & phone number	Caroline Kabel, 604 891 6063	

UTILITY NAME: BC Hydro

PROGRAM NAME: Industrial Power Smart: Efficient Fans & Blowers component

VARIABLE	DATA/INFORMATION	NOTES
Start year	1990	
End year	—	
Program type	Incentives are either $100/hp or are negotiated with the customer and are designed to provide the customer with a 1-year simple payback. An ASD software package is also available.	
Marketing approach	Seminars are given to personnel at lumber drying plants, which are the target of the program. The utility first markets the program to the plant manager to get the initial "buy-in" and then to the person running or managing the facility for final approval.	
Technology description	ASDs often installed on fans in lumber drying kilns. Also, vacuum drying, air bags for baffling, and other technologies are being explored in the kilns.	
Average incremental equipment & installation cost/kiln	$25,000	Cost per kiln to purchase and install ASDs.
Average incremental annual O&M cost/participant	$0	Incremental O&M costs generally negligible (Ahad 1993).
Incremental program savings		
1987	— MWh	
1988	— MWh	
1989	— MWh	
1990	180 MWh	
1991	6,230 MWh	
1992	11,110 MWh	
cumulative	17,520 MWh	
1992 utility sales to industrial customers	16,000,000 MWh	
Coincident kW deferred	n/a	
Estimated average measure life	15 years	Average for ASDs
# eligible customers	300	Approximate number of lumber-drying plants in territory.
# of participants		To date, all participants have been lumber-drying plants.
1987	—	
1988	—	
1989	—	
1990	35	

1991	26	
1992	54	
cumulative	115	
Estimated free rider proportion	6%	
Basis for free rider estimate	Utility estimate. A small percentage of projects are done without any utility assistance.	
Total utility rebate costs/ year		Costs are in Canadian dollars.
1987	—	
1988	—	
1989	—	
1990	$665,300	
1991	$119,700	
1992	$321,700	
cumulative	$1,106,700	
Total utility marketing costs/ year		This does not include administrative costs. 1989 costs are marketing costs related to program development. Costs are in Canadian dollars.
1987	—	
1988	—	
1989	$4,900	
1990	$167,900	
1991	$242,300	
1992	$165,100	
cumulative	$580,200	
Average labor costs/ year		1989 costs are labor-related program development costs. Costs are in Canadian dollars.
1987	—	
1988	—	
1989	—	
1990	$124,500	
1991	$120,100	
1992	$152,800	
cumulative	$397,400	
Staffing — number (professional, FT equiv.)		
1987	—	
1988	—	
1989	1	
1990	3	
1991	3	
1992	3	
Utility contact & phone number	Caroline Kabel, 604 891 6063	

UTILITY NAME: BC Hydro

PROGRAM NAME: Industrial Power Smart: Motors component

VARIABLE	DATA/INFORMATION	NOTES
Start year	1988	
End year	—	
Program type	Incentives are offered for motor replacement with high-efficiency motors or for installing new high-efficiency motors. 1-500 hp motors qualify. The incentive is $300/kW deferred. Free software packages, educational booklets, and a motor database are available. Vendors receive a separate rebate equivalent to 25% of the value of the customer's incentive.	
Marketing approach	Extensive trade ally contact to ensure HEMs are in stock and available. Field representatives keep customers informed.	
Technology description	High-efficiency motors	
Average incremental equipment cost/participant	Utility cost: $8/hp Customer cost: $4/hp	
Average incremental installation cost/participant	negligible	
Average incremental annual O&M cost/participant	n/a	
Incremental program savings		Note: 1988 savings assumed to be 100% free riders. For all other years, savings are adjusted for free riders.
1987	— MWh	
1988	2,700 MWh	
1989	12,000 MWh	
1990	16,900 MWh	
1991	19,900 MWh	
1992	16,800 MWh	
cumulative	68,300 MWh	
1992 utility sales to industrial customers	16,000,000 MWh	
Coincident kW deferred	n/a	
Estimated average measure life	20 years	
Estimated hp sold/year	1991: 346,445 hp 1992: 266,000 hp	The drop in 1992 was attributed by the utility to the economic recession.
# of participants		Horsepower rebated under program.

1987	—	
1988	0 hp	
1989	123,506 hp	
1990	150,092 hp	
1991	180,200 hp	
1992	143,800 hp	
Estimated free rider proportion	9%	Based on customer survey.
Total utility rebate costs/ year		Customer and vendor rebates. Costs are in Canadian dollars.
1987	—	
1988	$0	
1989	$1,030,300	
1990	$863,000	
1991	$1,769,100	
1992	$1,050,000	
cumulative	$4,712,400	
Total indirect utility costs/year		This is total program costs minus rebate and labor costs. Costs are in Canadian dollars.
1987	—	
1988	$133,100	
1989	$53,900	
1990	$314,500	
1991	$275,300	
1992	$347,000	
cumulative	$1,123,800	
Total utility labor costs/year		Costs are in Canadian dollars. Does not include consultant costs.
1987	—	
1988	$70,300	
1989	$96,500	
1990	$248,400	
1991	$254,100	
1992	$249,300	
cumulative	$918,600	
Staffing — number (professional, FT equiv.)		Program staff only. This does not include field representatives.
1987	—	
1988	2	
1989	2	
1990	2	
1991	2 utility staff + 2 consultants	
1992	2 utility staff + 2 consultants	
Utility contact & phone number	Caroline Kabel, 604 891 6063	

UTILITY NAME:	BC Hydro	
PROGRAM NAME:	Industrial Power Smart: Bonus Partners component	

VARIABLE	DATA/INFORMATION	NOTES
Start year	1990	
End year	—	
Program type	Custom rebate program. Participants propose energy-saving projects. If a project saves less than 200 MWh/yr, the utility buys payback down to 2 years. Otherwise, rebates are negotiated with the participant.	
Marketing approach	Utility marketing representatives visit customers and market the program. Ideas are stimulated through seminars and trade shows. Utility sponsors engineering assistance to help develop ideas into potential projects. The utility's largest customers are targeted.	
Technology description	Refrigeration systems upgrades, process control upgrades, efficient transformers, conversion of hydraulic debarkers to mechanical debarkers, replacement of electric resistance heating with gas immersion heating.	
Average incremental equipment & installation cost/participant	$0.10/1st year kWh savings	
Average incremental annual O&M cost/participant	$0	Negligible. For some projects, the more efficient option costs less to operate and maintain. For others, the O&M costs have been higher. Overall, it averages out as negligible.
Incremental program savings		
1987	— MWh	
1988	— MWh	
1989	— MWh	
1990	422 MWh	
1991	39,645 MWh	
1992	37,466 MWh	
cumulative	77,533 MWh	
1992 utility sales to industrial customers	16,000,000 MWh	
Coincident kW deferred		
1987	—	
1988	—	
1989	—	
1990	57	
1991	5,431	
1992	5,132	

cumulative	10,620	
Estimated average measure life	20 years	
# eligible customers	400	BC Hydro's largest customers with more than 1 MW peak demand are targeted.
# of participants		1990 & 1992 data are utility estimate (Willis 1993).
1987	—	
1988	—	
1989	—	
1990	10	
1991	84	
1992	100	
cumulative	194	
Estimated free rider proportion	5-10%	Based on Bonus Partners impact evaluation, 1993.
Total utility rebate costs/ year		Costs are in Canadian dollars.
1987	—	
1988	—	
1989	—	
1990	$20,200	
1991	$812,000	
1992	$503,000	
cumulative	$1,335,200	
Total utility marketing & administrative costs/ year		Costs are in Canadian dollars.
1987	—	
1988	—	
1989	—	
1990	$249,000	
1991	$528,000	
1992	$566,000	
cumulative	$1,343,000	
Staffing — number (professional, FT equiv.)		
1987	—	
1988	—	
1989	—	
1990	3	
1991	5	
1992	5	
Utility contact & phone number	Caroline Kabel, 604 891 6063	

UTILITY NAME:	BC Hydro	
PROGRAM NAME:	Industrial Power Smart: Employee Involvement/ Power Plays component	

VARIABLE	DATA/INFORMATION	NOTES
Start year	1991	
End year	—	
Program type	The program aim is to acquire low-cost savings by offering an incentive to industrial facility employees who identify energy-efficiency measures which are subsequently implemented. Industrial employees can receive $250 for presenting a "viable" conservation measure, followed by $0.0025/kWh upon implementation of the idea, up to a maximum of $2,500. Team submissions collect 20% more incentive.	
Marketing approach	Utility marketing representatives visit customers and market the program. Seminars are offered. Utility staff attend trade shows. Presentations by staff are also made to the employees of potential industrial participants.	
Technology description	During the first two years of the program, the most commonly performed measures were the installation of sensors and timers for motor, light, fan, and pump systems.	
Average incremental equipment + installation costs/participant	n/a	
Average incremental annual O&M cost/participant	n/a	
Incremental program savings		
1987	— MWh	
1988	— MWh	
1989	— MWh	
1990	— MWh	
1991	1,189 MWh	
1992	538 MWh	
cumulative	1,727 MWh	
1992 utility sales to industrial customers	16,000,000 MWh	
Coincident kW deferred	n/a	
Estimated average measure life	n/a	Measure life varies too widely to make estimate.
# eligible customers	1991: 7 (pilot) 1992: 500	Eligible number of customers for 1992 is utility estimate (Kabel 1993). Large industrial customers.
# of participants		

1987	—	
1988	—	
1989	—	
1990	—	
1991	2	
1992	6	
cumulative	8	
Estimated free rider proportion	n/a	
Total utility rebate costs/ year		Projects in 1992 were generally smaller in size than in 1991 (Kabel 1993). Costs are in Canadian dollars.
1987	—	
1988	—	
1989	—	
1990	—	
1991	$12,318	
1992	$2,100	
cumulative	$14,418	
Total utility marketing costs/year		Costs are in Canadian dollars.
1987	—	
1988	—	
1989	—	
1990	—	
1991	$30,704	
1992	$57,700	
cumulative	$88,404	
Average labor costs/ year		Costs are in Canadian dollars.
1987	—	
1988	—	
1989	—	
1990	—	
1991	$49,227	
1992	$84,300	
cumulative	$133,527	
Staffing — number (professional, FT equiv.)		
1987	—	
1988	—	
1989	—	
1990	—	
1991	1	
1992	1.75	
Utility contact & phone number	Caroline Kabel, 604 891 6063	

UTILITY NAME:	Central Maine Power	
PROGRAM NAME:	Power Partners	

VARIABLE	DATA/INFORMATION	NOTES
Start year	1987	
End year	—	
Program type	The program is designed to provide CMP with least-cost resources through a competitive bidding process. DSM projects compete among themselves and with supply-side options such as cogeneration. The program is implemented as an RFP process marketed to CMP's large customers and ESCOs. Interested parties submit proposals for demand and supply side resources. A project is selected based on price, dispatchability, and other factors. Contracts are developed between participants and CMP to address completion targets, financial arrangements, and savings verification. Payments are made over the lifetime of the measures. Two RFPs have been issued thus far. CMP monitors all projects to determine savings persistence.	
Marketing approach	CMP has adveritised in trade and business journals. Two pre-bid conferences have been held. ESCO's market their services to industrial customers via direct mail and one-on-one contacts.	
Technology description	Process improvements, motors, ASDs, and lighting retrofits are common projects.	
Incremental equipment & installation cost/participant	between $50,000- $2,000,000	
Average incremental annual O&M cost/participant	n/a	
Incremental program savings (1987 - 1992)	57,427 MWh	
1991 utility sales to industrial customers	3,651,175 MWh	
Coincident kW deferred	n/a	
Estimated average measure life	15 years	
# eligible customers	339	CMP's largest customers.
# of participants (1987 - 1992)	25	Utility estimate of industrial participants.
Estimated free rider proportion	n/a	No estimate has yet been made by the utility.
Total utility rebate costs/ year		In addition, there are obligated payments for present industrial projects in future years. The projected budget ranges up to $12 million/year for current contracts,
1987-1990	$7,748,000	
1991	$5,295,340	

1992	$9,348,488	for up to 15 additional years (growing for the next 5-6 years, then trailing off), depending on success of projects in achieving savings.
cumulative	$22,391,828	
Total utility marketing & administrative costs/ year		
1987-1990	$399,214	
1991	$177,200	
1992	$226,042	
cumulative	$802,456	
Staffing — number (professional, FT equiv.)		Staffing is for entire program, not just industrial portion of the program. In 1991 and 1992, 4 engineers and 1 part-time staffperson carried out the program.
1987	1	
1988	2	
1989	2	
1990	4	
1991	4.5	
1992	4.5	
Utility contact & phone number	Jon Linn, 207 623 3521	

UTILITY NAME:	Clark Public Utility District	
PROGRAM NAME:	Industrial Lighting Incentive Program	
VARIABLE	**DATA/INFORMATION**	**NOTES**
Start year	11/85	
End year	1/88	
Program type	Energy-efficient lighting systems were installed in participating facilities, and participants paid only the cost of the new system's 1st year energy savings. BPA paid the remaining costs. Lighting manufacturers performed the audits and designed the lighting systems. Local contractors installed the systems.	
Marketing approach	Initially, a customer information packet was mailed to potential participants, a press release was sent to the local newspaper, and an article on the program was published in the utility newsletter. Thereafter, the lighting manufacturers' representatives and contractors were the primary marketers. Manufacturer marketing was largely based on "cold calls", i.e. driving into industrial areas and contacting owners of facilities that seemed eligible.	
Technology description	High-efficiency, high intensity discharge (HID) lighting systems. On average, lighting electricity use was reduced 50% in participating facilities.	
Average incremental equipment & installation cost/participant	$33,000	
Average incremental annual O&M cost/participant	---	Not noted in program evaluation, but most likely negative, since lights will need replacing less frequently.
Annual savings for all installed projects	3,273 MWh	
1988 utility sales to industrial customers	605,539 MWh	
Non-coincident kW deferred for all installed projects	752 kW	
Estimated average measure life	20 years	Gordon, et al. 1988.
# eligible customers	245	Clark PUD marketed to 207 customers, and manufacturers marketed to approx. 38 additional customers.
# of participants		Number of facility installations completed in a particular year.
1985	0	
1986	11	
1987	7	
1988	6	

cumulative	24
Estimated free rider proportion	n/a
Basis for free rider estimate	n/a
Total rebate costs (1985 - 1988)	$690,518
Total marketing, administrative, & program planning costs (1985 - 1988)	$118,550
Staffing — number (professional, FT equiv.) 1985 - 1988	n/a
Contact & phone number	Patrick Wolfe (PECI), 503 248 4636

UTILITY NAME:	Niagara Mohawk	
PROGRAM NAME:	High-Efficiency Motors and ASD Program	

VARIABLE	DATA/INFORMATION	NOTES
Start year	1991	
End year	—	
Program type	The program encourages C&I customers to replace standard-efficiency motors in their facilities with high-efficiency motors and to install ASDs on motors with varying loads. 1-400 hp motors operating more than 2,000 hours per year are eligible. ASDs require motors ranging from 5-400 hp. The 1993 rebates for HEMs ranged from $35 for 1 hp motors to $3,200 for 400 hp motors. Rebates for ASDs ranged from $550 for 5 hp motors to $18,000 for 400 hp motors. The ASD incentive generally covers 50-75% of drive equipment costs. In 1993, only motors operating pumps and fans are eligible for ASD installation	
Marketing approach	Initially, utility marketed to and worked with equipment vendors. Breakfast meetings with trade allies to assist them in marketing program. Direct mailing, trade shows, and media advertisements.	
Technology description	Motors & Adjustable Speed Drives.	
Average incremental equipment + installation cost/unit	$5,238 per ASD	ASD costs from Annual Evaluation Report 1993, p. C-3. Information on motors was not available.
Average incremental annual O&M cost/unit	negligible	Drives should reduce maintenance and extend life of motor. HEMs are designed to last longer.
Incremental program savings		Based on IRT Report #41 and estimate by program administrator that 90% of total program savings come from drives + 10% from motors. 35% of drive savings are from industrial participants, and 65% of motor savings are from industrial participants.
1987	— MWh	
1988	— MWh	
1989	— MWh	
1990	— MWh	
1991	3,208 MWh	
1992	25,689 MWh	
cumulative	28,897 MWh	
1991 utility sales to industrial customers	11,609,607 MWh	
Coincident kW deferred		Winter coincident peak capacity savings. See program savings note above. Similar assumptions made here.
1987	—	
1988	—	
1989	—	
1990	—	
1991	179	
1992	380	

cumulative	559	
Estimated average measure life	15 years	IRT Report #41.
# of eligible industrial customers	2,400	Estimate made by the utility (DePaull 1993).
# of rebates paid to industrial participants		Number of participating industrial customers was not available. Data here were calculated from estimates of C&I participants based on assumptions noted under program savings, as suggested by utility (see above).
1987	—	
1988	—	
1989	—	
1990	—	
1991	44	
1992	262	
cumulative	306	
Estimated free rider proportion	34% 1991; 21% 1992	Based on customer survey, Annual Evaluation Report 1993.
Total utility rebate costs/ year		Estimate made by utility (DePaull 1993).
1987	—	
1988	—	
1989	—	
1990	—	
1991	$357,870	
1992	$1,099,646	
cumulative	$1,457,516	
Total utility marketing & administrative costs/ year		Estimate made by utility (DePaull 1993).
1987	—	
1988	—	
1989	—	
1990	—	
1991	$312,000	
1992	$438,000	
cumulative	$750,000	
Staffing — number (professional, FT equiv.)		Estimate made by utility (DePaull 1993).
1987	—	
1988	—	
1989	—	
1990	—	
1991	n/a	
1992	7	
Utility contact & phone number	Tom DePaull, 315 428 6216	

UTILITY NAME: Puget Power

PROGRAM NAME: Industrial Conservation Program

VARIABLE	DATA/INFORMATION	NOTES
Start year	1989	
End year	—	
Program type	Utility works with participants and consultants to perform audits of facilities, identify savings, oversee project bidding, assist in project design, and perform savings verification tests. The energy analysis is free to the customer and includes a written report. Incentives to implement energy-efficiency measures are either billing credits, cash grants of up to 70% of the full avoided cost for retrofits, or 90% of the full avoided costs for new construction. The incentives generally cover approximately 50-75% of materials and installation costs.	
Marketing approach	Program is largely marketed by word-of-mouth, through the trade ally network, and through direct customer contact. Seminars and slide shows are offered. Marketing materials include fliers and brochures.	
Technology description	Lighting, pumping, process modifications, and motor/ASD installations primarily.	
Average incremental equipment & installation cost/participant	$90,000	Based on simple average made by utility for all industrial projects, which have a wide range in sizes and costs.
Average incremental annual O&M cost/participant	n/a	
Incremental program savings		Data were not disaggregated by industrial class prior to 1989.
1987	– MWh	
1988	– MWh	
1989	1,736 MWh	
1990	13,094 MWh	
1991	24,213 MWh	
1992	37,653 MWh	
cumulative	76,696 MWh	
1992 utility sales to industrial customers	3,704,450 MWh	
Coincident kW deferred	n/a	Up until 1993, the program focused only on energy savings
Estimated average measure life	12 years	
# eligible customers	3,659	
# of participants		
1987	–	

1988	–	
1989	1	
1990	9	
1991	30	
1992	80	
cumulative	120	
Estimated free rider proportion	< 10%	
Basis for free rider estimate	1993 Industrial Conservation program evaluation plan. Based on over 90 customer/ trade ally surveys and interviews.	
Total utility rebate costs/ year		
1987	–	
1988	–	
1989	$21,700	
1990	$353,089	
1991	$3,505,722	
1992	$6,120,497	
cumulative	$10,001,008	
Total utility marketing & administrative costs/ year		Industrial costs are not available separately from the utility.
1987	–	
1988	–	
1989	n/a	
1990	n/a	
1991	n/a	
1992	n/a	
Staffing — number (professional, FT equiv.)		
1987	–	
1988	–	
1989	1	
1990	3	
1991	5	
1992	5	
Utility contact & phone number	Bob Banister, 206 462 3726	

UTILITY NAME:	Southern California Gas Company
PROGRAM NAME:	Industrial Equipment Replacement/Heat Recovery Program

VARIABLE	DATA/INFORMATION		NOTES
Start year	1990		
End year	—		
Program type	The program provides incentives to encourage customers to install high-efficiency equipment and heat recovery equipment or devices. Incentives are offered for consultant studies. The utility pays up to 50% of audit costs. Prescriptive & custom rebates are offered. The custom rebate equals $2.65/MBtu saved. The incentive for heat recovery measures is 50% of installation costs or $0.50/ therm saved, whichever is less. The program is available to "core" customers using under approximately 250,000 therms/year. Typically, audit recommendations are the basis for customers pursuing incentives in the program.		
Marketing approach	Targeted mailings and seminars support direct customer contact efforts.		
Technology description	Measures most commonly installed are high-efficiency gas dryers, boilers, furnaces, kilns, ovens, process cooking equipment, economizers, and recuperators.		
Average equipment & installation costs/participant	$2,400 - $16,000		
Average consultant study costs/participant	$1,800 - $5,350		
Incremental program savings			
1987	—	Therms	
1988	—	Therms	
1989	—	Therms	
1990	5,655,936	Therms	
1991	7,677,630	Therms	
1992	5,854,246	Therms	
cumulative	19,187,812	Therms	
1992 utility sales to industrial customers	268,400,000	Therms	Sales to core industrial customers only.
Estimated average measure life	15	years	1993 DSM Report: Technical Appendix, page TA II-9
# eligible customers	26,950		
# of participants			
1987	—		
1988	—		

1989	–
1990-1991	500
1992	377
cumulative	877
Estimated free rider proportion	n/a
Total utility rebate costs/ year	
1987	–
1988	–
1989	–
1990	$1,256,119
1991	$2,894,753
1992	$2,354,538
cumulative	$6,505,410
Average administrative + marketing costs/year	
1987	–
1988	–
1989	–
1990	$1,014,000
1991	$1,274,000
1992	$1,781,000
cumulative	$4,069,000
Staffing --- number (professional, FT equiv.)	
1987	–
1988	–
1989	–
1990	9.3
1991	9.3
1992	15

Utility contact & phone number Frank Spasaro, 213 244 3648

UTILITY NAME:	United Illuminating	
PROGRAM NAME:	Energy Blueprint	

VARIABLE	DATA/INFORMATION	NOTES
Start year	1990	
End year	—	
Program type	Custom and prescriptive rebates offered for conservation measures in new construction and renovation projects as well as for equipment replacement. Incentives usually cover 50-75% of incremental equipment costs. Design Grants are available to building and process-line designers who incorporate conservation into construction plans. Prescriptive rebates are available for lighting, HVAC, and envelope-related technologies. Other measures, including industrial process measures, are handled on a custom basis.	
Marketing approach	Utility representatives and engineers deliver program to customers utilizing leads from customer service section. Program is marketed mostly by word-of-mouth with strong emphasis on customer/utility relationships.	
Technology description	Motors, ASD's, process measures, lighting, and HVAC.	
Average incremental equipment & installation cost/participant	roughly $0.15 to $0.20/1st year kWh savings	
Average incremental annual O&M cost/participant	$0	
Incremental program savings		
1987	— MWh	Data are for new construction & renovation projects; equipment replacement savings are not included.
1988	— MWh	
1989	— MWh	
1/90 - 8/93	1,982 MWh	
1992 utility sales to industrial customers	980,071 MWh	
Coincident kW deferred	n/a	
Estimated average measure life	15 years	
# eligible customers	30 per year	Utility estimates 24-36 customers are eligible/year. The average was taken.
# of participants		
1987	—	
1988	—	
1989	—	

1990	6		
1991	14		
1992	14		
cumulative	34	participants	
cumulative (1/90 - 8/93)	3,381,178	square feet	Data are for new construction & renovation projects; equipment replacement savings are not included.
Estimated free rider proportion	n/a		
Basis for free rider estimate	n/a		
Total utility rebate costs/ year			
1987	—		
1988	—		
1989	—		
1990	$59,300		
1991	$138,099		
1992	$113,194		
cumulative	$310,593		
Total utility marketing & administrative costs/ year			Estimate based on assumption that 1/5 of total Energy Blueprint costs have been for industrial projects, based on fraction of participants and savings that have been industrial.
1987	—		
1988	—		
1989	—		
1990	$30,420		
1991	$29,840		
1992	$45,940		
cumulative	$106,200		
Staffing — number (professional, FT equiv.)			For industrial portion of program.
1987	—		
1988	—		
1989	—		
1990	0.5		
1991	0.5		
1992	1		
Utility contact & phone number	Mike Balinskas, 203 499 2042		

UTILITY NAME:	Wisconsin Electric Power Company
PROGRAM NAME:	Smart Money for Business: Industrial

VARIABLE	DATA/INFORMATION	NOTES
Start year	1987	
End year	—	
Program type	Combination custom and prescriptive program that offers zero-to-low interest loans or cash rebates for installing qualifying energy-efficiency measures in C&I facilities. Special incentives are also available to encourage energy-efficient design in new construction. Prescriptive rebates available for lighting, motor, HVAC, and refrigeration measures. Custom incentives are negotiated with each participant. Between 15-30% of a custom project's total costs are typically covered by the incentive. Utility pays up to 50% of cost for feasibility study if needed.	
Marketing approach	Sales executives market program to plant-level personnel. Account executives market to industrial VPs.	
Technology description	Process-related measures are most commonly performed, with lighting measures also common.	
Average incremental equipment + installation cost/project	$4,300	Labor & material costs.
Incremental program savings		
1987	12,100 MWh	Net of free riders.
1988	64,400 MWh	
1989	49,600 MWh	
1990	74,100 MWh	
1991	39,200 MWh	
1992	60,800 MWh	
1993 (through 10/93)	57,400 MWh	
cumulative	357,600 MWh	
1991 utility sales to industrial customers	9,462,065 MWh	
Coincident kW deferred		
1987	2,500 kW	
1988	12,600 kW	
1989	10,800 kW	
1990	16,600 kW	
1991	7,900 kW	
1992	11,100 kW	
1993 (through 10/93)	10,200 kW	
cumulative	71,700 kW	
Estimated average measure life	10 years	

# eligible customers	5,000	
# of participants		
1987	142	
1988	544	
1989	509	
1990	653	
1991	599	
1992	1,135	
cumulative	3,582	
Estimated free rider proportion	15%	Weighted average for all measures; estimated by utility. Based on formal & informal market research; sales force feedback.
Total utility rebate costs/ year		
1987	n/a	
1988	$8,400,000	
1989	$5,800,000	
1990	$9,900,000	
1991	$3,914,000	
1992	$5,900,000	
cumulative	33,914,000	
Total utility marketing + administrative costs/year	n/a	
Staffing — number (professional, FT equiv.)		
1987	n/a	
1988	n/a	
1989	n/a	
1990	n/a	
1991	n/a	
1992	35	Utility estimate for industrial portion of program only.
Utility contact & phone number	Tom Hawley, 414 221 2195	